



OEM Board Datasheet

Hardware Version 5.0.0



This document contains the technical specifications and operating instructions for the OEM Board. Please review it carefully before using the device.

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As this document is continuously updated, its contents may change without prior notice. Please ensure that you are always referring to the latest version.

This document is intended to present the general installation and application guide for the OEM Board usage. For detailed information on the device configuration, please refer to the Interface Manual.

Visit www.nordian.com for more information.

CONTACT INFORMATION

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Version Log

Date	Version	Changes
06/2024	HW 4.0.0	HW Version 4.0 First Release
01/2025	HW 4.0.1	Additional electrical specifications
04/2025	HW 4.0.2	OEM New Auxiliary Dimensions
06/2025	HW 5.0.0	New Hardware Core Version

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1. Introduction

1.1. OEM Board Overview

OEM board is a high-precision navigation receiver. Designed for reliable geopositioning in daily applications, it offers fast setup, user-friendly configuration and compatibility across platforms. OEM Board receiver combines broad satellite signal support with an integrated IMU-based correction system to deliver accurate position, speed, altitude and timing for industrial applications.

Main Features:

- Full GNSS compatibility: GPS, GLONASS, BeiDou, Galileo, NavIC, QZSS, SBAS (including WAAS, EGNOS, GAGAN, MSAS, BDSBAS) and all-band L1, L2, L5 and L6.
- GNSS Signal Compatibility:
 - GPS: L1C/A, L2C, L5
 - GLONASS: L1OF, L2OF
 - Galileo: E1B/C, E5b, E6
 - BeiDou: B1I, B1C, B2a, B3I
 - QZSS: L1C/A, L1C/B, L2C, L5, L6
 - SBAS: WAAS, EGNOS, GAGAN, MSAS, BDSBAS
- Maximum Update Rate:
 - GNSS: 25 Hz
 - GNSS + IMU Sensor Fusion: 50 Hz
- Initialization Times
 - Cold start: 24s; Aided start: 2s; Reacquisition: 2s;
- Embedded high-grade IMU:
 - 6-axis;
 - Accuracy full-range 16 g;
 - Gyroscope full-range 2kdps;

- GNSS+IMU sensor fusion;
- Reduced start-stop offset;
- High robustness against interference;
- Terrain compensation;
- Communications:
 - Three (3) Serial UART COM ports;
 - One (1) CAN port;
 - Pulse Per Second (PPS) output;
 - Ground Speed Output (GSO/Radar) output;
 - Two (2) status LED indicators;
- Connectivity:
 - Cellular 5G/4G fallback;
 - Non Terrestrial Network (NTN) two-way satellite;

2. Technical Specifications

2.1. Electrical

Please see below the specified working voltage range. Applying voltage outside the specified range may result in permanent device damage.

Table 1: Electrical Requirements

Specification	Value
Voltage	+3.3 VDC $\pm$ 100 mV
Average Current	315 mA
Average Power	1 W
Peak Current	3.3 A
Duration of Peak Current	50 μ s

2.2. Accuracy

Table 2: Accuracy

Accuracy	Standalone	P1 Soft-Intelligence	P2 Soft-Intelligence
Horizontal Accuracy (RMS)*	1.2 m	0.40 m	0.03 m
Pass-to-Pass Accuracy	0.20 m	0.10 m	0.02 m

*Horizontal accuracy may vary based on satellites in view, clear sky and multipath.

2.3. GNSS Specifications

Table 3: Receiver Supported Signals

Constellation	Frequency
GPS	L1C/A, L2C, L5
GLO	L1OF, L2OF
GAL	E1B/C, E5a, E5b, E6
BDS	B1I, B1C, B2, B2a, B3I
QZSS	L1C/A, L1C/B, L2C, L5
SBAS	WAAS, EGNOS, GAGAN, MSAS, BDSBAS

Table 4: Convergence Time and Acquisition*

Time and Acquisition	
Convergence Time	< 40 s
Acquisition: Cold start	24 s
Acquisition: Aided start	2 s
Reacquisition	2 s

2.4. IMU Sensor

A high-end embedded Inertial Measurement Unit (IMU) is an integral part of the product's positioning calibration. The IMU operates continuously alongside the GNSS system.

The IMU has the following features:

- 6-axes
- Accelerometer full range: $\pm 16g$
- Gyroscope full range: ± 2000 degrees per second

2.5. Mechanical

This section presents the general mechanical characteristics and specifications.

Table 5: OEM Board Mechanical Specifications

Board Size	45.5 mm x 71.0 mm
Board Thickness	1.61 mm
Weight	25 g
Operating Temperature	-30 °C to 85 °C (-30 °F to 185 °F)

Table 6: OEM Connectors

OEM Connector	Name	Description
J1	Main Header	2x10 Pin Header 2 mm Pitch Part Number: TMM-110-03-G-D
J3	LTE Antenna	I-PEX MHFI 50 Ohm Part Number: 20279-001E-03
CN6	GNSS Antenna	Coaxial MCX 50 Ohm Part Number: 919-382J-51P

Figure 1: OEM Dimensions (millimeters)

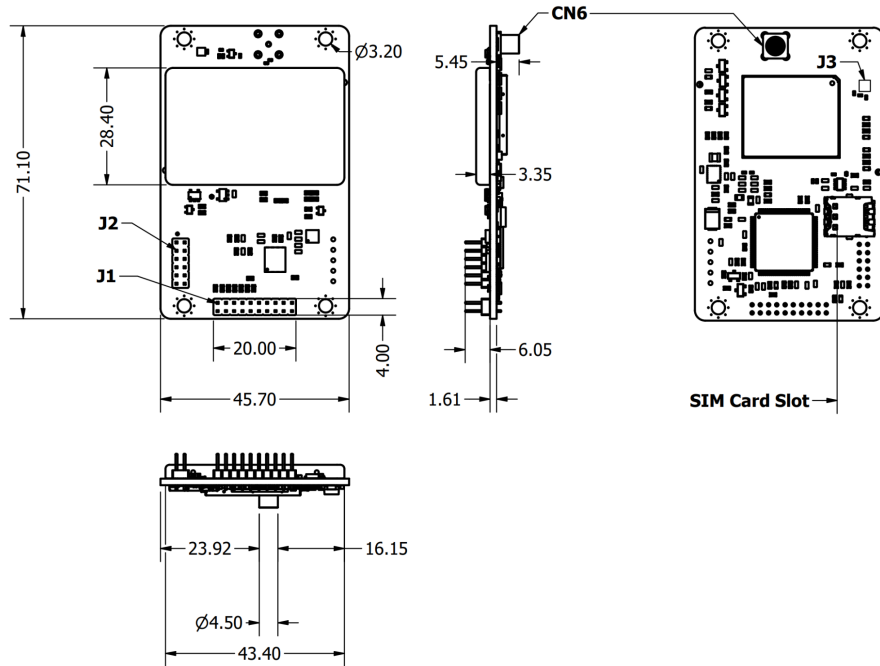
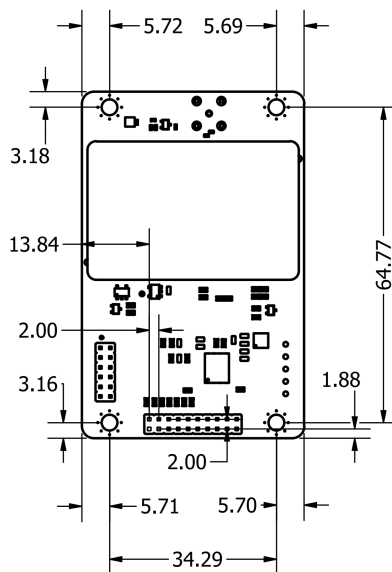


Figure 2: OEM Auxiliary Dimensions (millimeters)



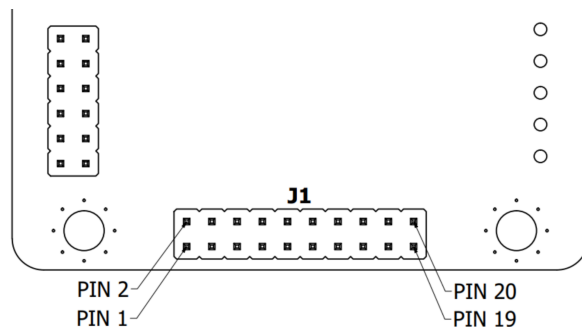
2.6. OEM Interface Connector

2.6.1. Main Header (J1)

Table 7: Physical Pinout Disposition of J1 Pin Header

PIN	Function	Direction
1	-	-
2	3V3	Power Input
3	-	-
4	COM3 RX	Input
5	RESET	Input
6	CAN_1_RX	Input
7	CAN_1_TX	Output
8	-	-
9	COM3 TX	Output
10	GND	Power Input
11	COM1 TX	Output
12	COM1 RX	Input
13	GND	Power Input
14	COM2 TX	Output
15	COM2 RX	Input
16	GND	Power Input
17	POSITION STATUS	Output
18	GND	Power Input
19	PPS	Output
20	-	-

Figure 3: Pin Connection of Main Header (J1)

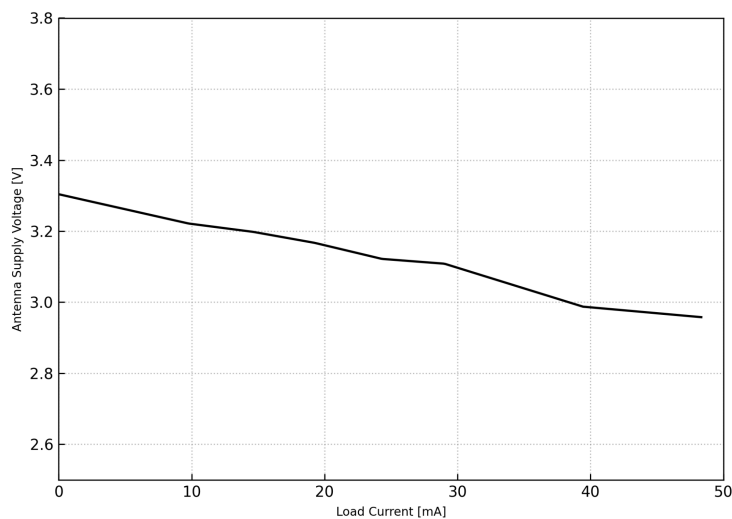


2.6.2. GNSS Antenna Connector (CN6)

The OEM Board receiver have a female MCX connector with a $50\ \Omega$ input impedance. To connect a GNSS antenna, use a male MCX plug.

This connector provides a nominal voltage of $3.303 \pm 0.012\ \text{V}$ under no-load conditions. This voltage is intended to power active GNSS antennas and its behavior under current load is detailed in the graph below.

Figure 4: Graph of Voltage [V] versus Load Current [mA] on GNSS Antenna Connector (CN6).



As the antenna's current draw increases, the output voltage correspondingly decreases. This voltage drop should be taken into account when selecting and operating an antenna, particularly for

models with higher current consumption, to ensure the supply remains within the specified voltage range.

The table below lists the antenna current levels that produce voltage drops of 1%, 5%, and 10% from the nominal 3.303 V. This data can be used to evaluate the impact of varying current loads on the supply voltage.

Table 8: GNSS Antenna - Current for Specified Voltage Drops.

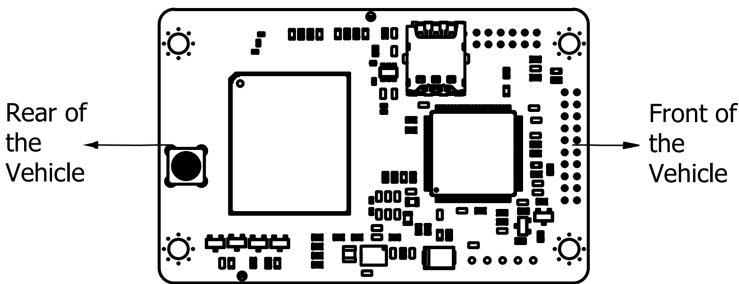
Voltage Drop (%)	Antenna Current (mA)
1 %	4.5 mA
5 %	22.5 mA
10 %	49 mA

3. Installation

3.1.1. Orientation

Device internal correction algorithms merge GNSS and IMU data. In order to achieve the best possible accuracy, OEM must be oriented towards the front of the vehicle. IMU acceleration compensation keeps track of the acceleration on all axis, thus the importance of the device orientation.

Figure 5: OEM Board Orientation



Any misalignment may result in decreased accuracy and localization offset. The OEM Board orientation must be parallel to the vehicle orientation. Ideally both vectors should overlap.

3.1.2. Inclination

Besides horizontal orientation, vertical inclination must also be considered. The two main sources of inclination are roof tilt and roof camber.

The OEM Board must be as flat as possible, any inclination may result in localization offset and accuracy degradation.

These two situations can be corrected by placing the OEM in a more suitable position, such that the correct vector (green) and OEM vector (red) overlap.

3.1.3. Terrain Compensation

OEM Board features a unique Terrain Compensation algorithm that increases the device's precision on uneven terrain. The algorithm minimizes errors related to rocky and rugged terrain that otherwise would result in dramatic loss in accuracy. Also, every inclination and elevation on hilly terrain is taken into account to guarantee that the board can be used in challenging terrain. For additional details, see the Product Configuration.

3.2. Communication

The OEM Board offers three configurable communication interfaces: Serial, CAN and PPS. Serial communication is available in 3 (three) UART ports and CAN communication is available in one (1) port. CAN and UART communication come without a transceiver.

3.2.1. UART Port

OEM Board configuration is done through serial or CAN communication, on either COM 1, COM 2, COM 3 or CAN FD. Each one of the ports can be independently configured.

- Available baudrates (kbps): 9600, 19200, 38400, 57600, 115200, 230400, 460800;
- No parity bit / 1 stop bit / 8 data bits / no handshaking;
- For messages configuration please refer to the Interface Manual;

3.2.2. CAN FD Port

The OEM Board's CAN interface does not incorporate an integrated physical layer. An external CAN transceiver is therefore required to complete the interface.

The device provides a single Controller Area Network (CAN) bus, which supports both data transmission and certain configuration commands via the CAN protocol, in addition to configuration through the serial interface.

- Available bitrates (kbps): 125000, 250000, 500000, 1000000, 2000000;
- CAN bus version: CAN 2.0B - extended;
- Max CAN FD port speed: 8 Mbps;
- J1939 protocol messages are sent exclusively via CAN bus;
- For messages configuration please refer to the Interface Manual;

3.2.3. PPS

- The Pulse Per Second (PPS) output generates pulses synchronized to the satellite's internal precision clock, providing a reliable reference for high-accuracy timing applications.
- The PPS signal transitions digitally between GND and 3.3 V. The pulse edge is synchronized with the satellite clock and can be configured for either rising-edge or falling-edge synchronization. Additionally, the pulse duty cycle and period are configurable.
- All PPS configuration parameters must be set via the serial communication interface. Refer to the *Interface Manual* for detailed instructions.

4. Communication Protocols

4.1. NMEA0183 (UART Port)

Protocol compatible with serial communication. NMEA0183 available output messages are shown in the table below:

Table 9: NMEA0183 Available Messages

Message	Description
DTM	Datum reference information
GGA	Time, position and fix related data
GLL	Latitude, longitude, time of position fix and status
GRS	Manages GNSS signal data, transmission timing, and system/signal IDs.

Message	Description
GSA	GPS DOP and active satellites
GST	UTC time, RMS value of pseudorange residuals and error ellipse
GSV	Satellites in view related data
HDT	Vessel Heading
RMC	Position, velocity and time
VTG	Course over ground and speed over ground related data
ZDA	UTC time related data

- For configuration details please refer to the Interface Manual.

4.2. CAN Messages

Protocol compatible with serial communication. NMEA2000 and J1939 available output messages are shown in the table below:

Table 10: NMEA2000 Available Messages

Message	Description
PGN126992	System Time
PGN127250	Vessel Heading
PGN127251	Rate of Turn
PGN127257	Attitude (pitch, roll, yaw)
PGN128001	Speed (through water)
PGN129025	GNSS position, rapid update
PGN129026	Course over ground and speed over ground, rapid upgrade
PGN129027	Position delta high precision rapid update
PGN129028	Altitude delta, rapid Update
PGN129029	GNSS position data
PGN129539	GNSS dilution of precision

Message	Description
PGN129540	GNSS satellites in view
PGN129542	GNSS Pseudorange Noise Statistics
PGN130312	Temperature
PGN130578	Longitudinal, transverse and stern speed

Table 11: J1939 Available Messages

Message	Description
PGN65254	Time and Date
PGN65256	Vehicle speed and direction
PGN65267	Vehicle position

*For configuration details please refer to the Nordian Interface Manual.

4.3. Diagnostics

This device has two (2) LEDs used for diagnostic status indication. Each LED blink pattern corresponds to a specific status, as shown in Table 11.

- LED 01: green
- LED 02: yellow

NOTE: Always contact Nordian support if a problem persists.

Figure 6: OEM Board LEDs Indication

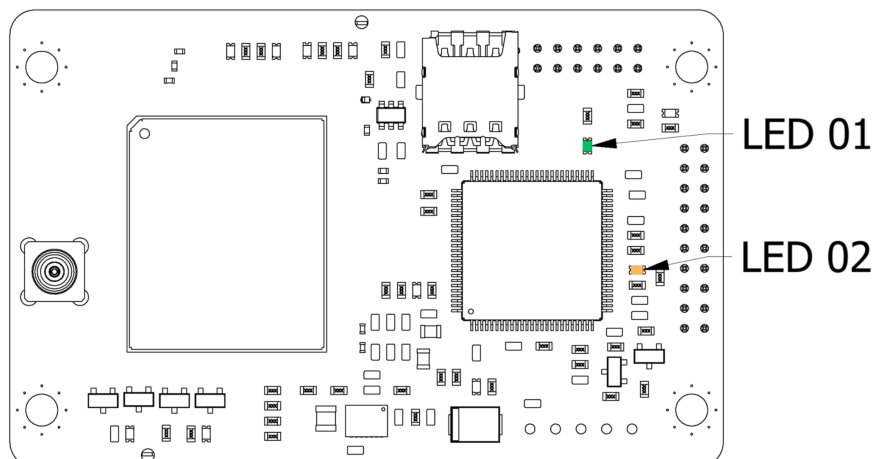


Table 12: Status LEDs Behavior

Group	LED 01		LED 02		Code	Meaning
	ON	OFF	ON	OFF		
Update	1 blink	1 s	Always	-	01	Update active
	2 blinks	1 s	Always	-	02	Update error
	3 blinks	1 s	Always	-	03	Previous update error
Firmware	4 blinks	1 s	Always	-	04	Firmware Fault
	5 blinks	1 s	Always	-	05	Firmware rollback
Hardware	0.5 s	0.5 s	0.5 s	0.5 s	06	Power Fault*
	0.25 s	0.25 s	0.25 s	0.25 s	07	Hardware Fault
Operation	0.5 s	0.5 s	0.5 s	0.5 s	08	Inactive State**
	Always	-	Always	-	09	Tracking Satellites
	Always	-	1 s	1 s	10	Position fixed
	Always	-	0.25 s	0.25 s	11	RTK fixed

*LEDs blink in sync; **LEDs blink alternately

Table 13: Status LEDs Description

Code	Description	Action
01	Firmware is being updated	Stand by
02	An error has occurred during update	Retry update
03	Non solved error occurred during last update	Retry update
04	Non valid firmware detected	Update firmware
05	Device is running on last functional firmware	Update firmware
06	Power is not within acceptable margin	Check power source, if error persists contact support
07	Hardware is defective	Contact support
08	Device is in inactive mode	Activate the device on Nordian Dashboard or send the keys via serial communication

Code	Description	Action
09	Device is working correctly and tracking satellites in view	Stand by, fixed position should soon be achieved
10	Device is working correctly and has converged to a fixed position	Device is ready to use
11	RTK is successfully receiving correction data	RTK correction is active

5. General

5.1. Default configurations

Table 14: Communications Default Configurations

Configuration	Default	Unit
\$COM SERIAL1 BAUDRATE _	115200	kbps
\$COM SERIAL2 BAUDRATE _	115200	kbps
\$COM SERIAL3 BAUDRATE _	115200	kbps
\$COM FDCAN1 BITRATE _	500000	kbps

Table 15: GNSS Receiver Default Configurations

Configuration	Default (command)	Default (value 1)	Unit
\$GNSS CONSTELLATIONS _ GPS	ENABLED	-	-
\$GNSS CONSTELLATIONS _ GALILEO	ENABLED	-	-
\$GNSS CONSTELLATIONS _ BEIDOU	ENABLED	-	-
\$GNSS CONSTELLATIONS _ GLONASS	ENABLED	-	-
\$GNSS ELEVATION SET _	-	20	deg.
\$GNSS TALKER_ID SET _	-	GN	-
\$GNSS CNO_SET	-	20	dBHz

Table 16: NMEA 0183 Default Configurations

	Configuration	Default Status (command)	Default Period (value 2)	Unit
COM1	\$NMEA0183 SERIAL1 _ DTM _	DISABLED	50	ms
	\$NMEA0183 SERIAL1 _ GGA _	ENABLED	50	ms

Configuration		Default Status (command)	Default Period (value 2)	Unit
	\$NMEA0183 SERIAL1 _ GLL _	DISABLED	50	ms
	\$NMEA0183 SERIAL1 _ GRS _	DISABLED	50	ms
	\$NMEA0183 SERIAL1 _ GSA _	DISABLED	50	ms
	\$NMEA0183 SERIAL1 _ GST _	DISABLED	50	ms
	\$NMEA0183 SERIAL1 _ GSV _	DISABLED	50	ms
	\$NMEA0183 SERIAL1 _ HDT _	DISABLED	50	ms
	\$NMEA0183 SERIAL1 _ RMC _	DISABLED	50	ms
	\$NMEA0183 SERIAL1 _ VTG _	ENABLED	50	ms
	\$NMEA0183 SERIAL1 _ ZDA _	DISABLED	50	ms
COM2	\$NMEA0183 SERIAL2 _ DTM _	DISABLED	50	ms
	\$NMEA0183 SERIAL2 _ GGA _	DISABLED	50	ms
	\$NMEA0183 SERIAL2 _ GLL _	DISABLED	50	ms
	\$NMEA0183 SERIAL2 _ GRS _	DISABLED	50	ms
	\$NMEA0183 SERIAL2 _ GSA _	DISABLED	50	ms
	\$NMEA0183 SERIAL2 _ GST _	DISABLED	50	ms
	\$NMEA0183 SERIAL2 _ GSV _	DISABLED	50	ms
	\$NMEA0183 SERIAL2 _ HDT _	DISABLED	50	ms
	\$NMEA0183 SERIAL2 _ RMC _	DISABLED	50	ms
	\$NMEA0183 SERIAL2 _ VTG _	DISABLED	50	ms
	\$NMEA0183 SERIAL2 _ ZDA _	DISABLED	50	ms
COM3	\$NMEA0183 SERIAL3 _ DTM _	DISABLED	50	ms
	\$NMEA0183 SERIAL3 _ GGA _	DISABLED	50	ms
	\$NMEA0183 SERIAL3 _ GLL _	DISABLED	50	ms
	\$NMEA0183 SERIAL3 _ GRS _	DISABLED	50	ms
	\$NMEA0183 SERIAL3 _ GSA _	DISABLED	50	ms
	\$NMEA0183 SERIAL3 _ GST _	DISABLED	50	ms
	\$NMEA0183 SERIAL3 _ GSV _	DISABLED	50	ms
	\$NMEA0183 SERIAL3 _ HDT _	DISABLED	50	ms
	\$NMEA0183 SERIAL3 _ RMC _	DISABLED	50	ms
	\$NMEA0183 SERIAL3 _ VTG _	DISABLED	50	ms
	\$NMEA0183 SERIAL3 _ ZDA _	DISABLED	50	ms

Table 17: NMEA 2000 Default Configurations

Configuration	Default Status (command)	Default Period (value 2)	Unit
\$NMEA2000 FDCAN1 _ PGN126992 _	DISABLED	50	ms
\$NMEA2000 FDCAN1 _ PGN127250 _	DISABLED	50	ms
\$NMEA2000 FDCAN1 _ PGN127251 _	DISABLED	100	ms
\$NMEA2000 FDCAN1 _ PGN127257 _	DISABLED	50	ms
\$NMEA2000 FDCAN1 _ PGN128001 _	DISABLED	100	ms
\$NMEA2000 FDCAN1 _ PGN129025 _	DISABLED	50	ms
\$NMEA2000 FDCAN1 _ PGN129026 _	ENABLED	50	ms
\$NMEA2000 FDCAN1 _ PGN129027 _	DISABLED	50	ms
\$NMEA2000 FDCAN1 _ PGN129028 _	DISABLED	50	ms
\$NMEA2000 FDCAN1 _ PGN129029 _	ENABLED	50	ms
\$NMEA2000 FDCAN1 _ PGN129539 _	DISABLED	50	ms
\$NMEA2000 FDCAN1 _ PGN129540 _	DISABLED	1000	ms
\$NMEA2000 FDCAN1 _ PGN129542 _	DISABLED	50	ms
\$NMEA2000 FDCAN1 _ PGN130312 _	DISABLED	2000	ms
\$NMEA2000 FDCAN1 _ PGN130578 _	DISABLED	250	ms

Table 18: J1939 Default Configurations

Configuration	Default Status (command)	Default Period (value 2)	Unit
\$J1939 FDCAN1 _ PGN65254 _	DISABLED	100	ms
\$J1939 FDCAN1 _ PGN65256 _	DISABLED	100	ms
\$J1939 FDCAN1 _ PGN65267 _	DISABLED	100	ms

Table 19: IO Default Configurations

Configuration	Default Status (command)	Default (value 1)	Unit
PPS	\$IO PPS _	ENABLED	-
	\$IO PPS POLARITY _	-	RISING
	\$IO PPS DUTY_CYCLE _	-	10
	\$IO PPS _ PERIOD_MS	-	1000
			ms

Table 20: Speed Filter Default Configurations

Configuration	Default (command)	Default (value 1)
\$SPEED_FILTER STATE _	ENABLED	-
\$SPEED_FILTER PRESET SET _	-	1

Table 21: Course Over Ground (Heading) Default Configurations

Configuration	Default (command)	Default (value 1)
\$COG_FILTER STATE _	ENABLED	-
\$COG_FILTER PRESET SET _	-	1

5.2. Warranty

OEM board comes with a standard 12-month warranty starting from the shipment date. Nordian Inc. will repair or replace — at no cost — any device proven to be defective within this warranty period.

The warranty does not apply if the OEM board has been subjected to negligence, misuse, improper storage, operation outside specified physical limits, improper application, physical damage, or unauthorized modifications or repairs by personnel other than Nordian Inc.

Please note that occasional, non-recurring errors or malfunctions that do not affect the device's continuous operation are not covered under this warranty.

5.3. Support

For specific support, doubts and warranty claim, contact Nordian Inc at:

Website: www.nordian.com

Customer Service: support@nordian.com

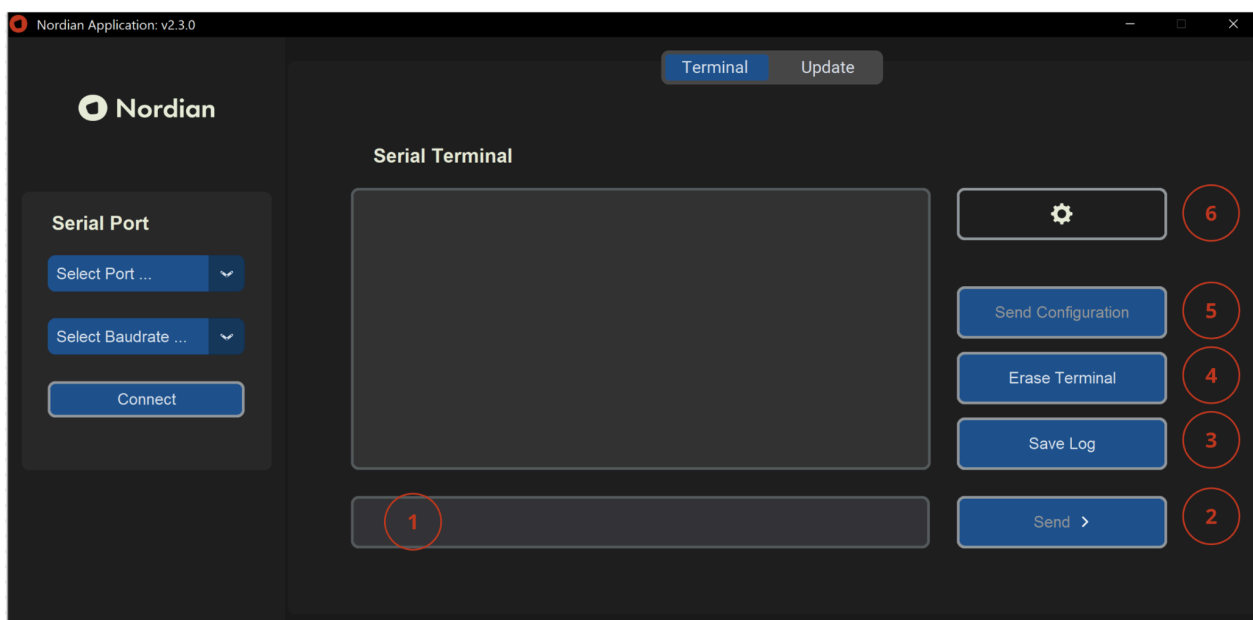
6. Software and Product Firmware Update

6.1. Nordian Application Platform

Nordian Inc. disposes of a proprietary software aimed for serial communication with all Nordian products, as well as for its firmware update. To proceed with the firmware update, please refer to the Nordian Inc. website www.nordian.com/support and download the software.

The software has a serial terminal interface that can be used to communicate with the OEM Board receiver. The figure below shows the software interface and its main communication functionalities.

Figure 7: Nordian Application Platform Interface



Legend:

- 1) Serial terminal command line: write here the commands according to the *Interface Manual*.
- 2) Send Command: after writing the command, click on this button to send it to the OEM board.
- 3) Save Log: If the user selects a file, the terminal data will be saved to that file until the user clicks at "Stop Logging".
- 4) Erase Terminal: click here to erase the Serial terminal for better visualization.
- 5) Send Configuration: after loading a command script click here to send it to the OEM board.
- 6) Load Command Script: a series of commands can be written in a text document and loaded using this button. This is useful if a series of Precisio devices shall be configured in the same way, thus the process can be done in a semi-automated way.

NOTE: remember to always connect the OEM board to the correct port and select the correct serial baudrate (default 115200).

NOTE: remember to always connect the OEM board to the right port and select the serial baudrate (default 115200).

6.2. Firmware Update Process

This device comes with a fully functional firmware already installed. Yet, due to Nordian's continuous improvement policy, new firmware versions may be made available online at www.nordian.com/support, without notification.

If this device presents an unexpected behavior and/or the diagnostic indicates a possible firmware issue, follow the instructions to update the firmware. Furthermore, if a new firmware version is available it is recommended to update the firmware.

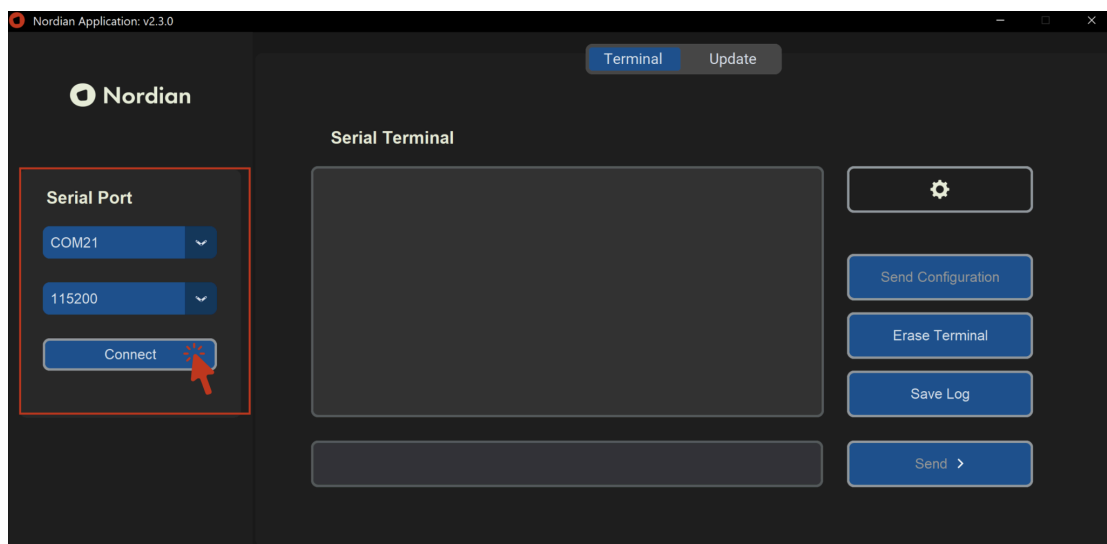
Follow the instructions below in order to update the firmware.

- 1) Connect the device: connect the product to the correct serial port with the correct baudrate. If the selected baud rate doesn't match the device's current setting, the software will not establish communication, without properly communicating, thus updating won't be possible.

In Figure 7 OEM board is being connected to the software via COM21 and with 115200 (default) baudrate. The software will automatically identify the available ports. Note that all peripheral devices will be identified as a possible connection port, it's up to the user to identify the correct one.

Once the port and baudrate are selected press "Connect", if the connection is successful the button will update to "Disconnect", which means that when pressed it will disconnect the device.

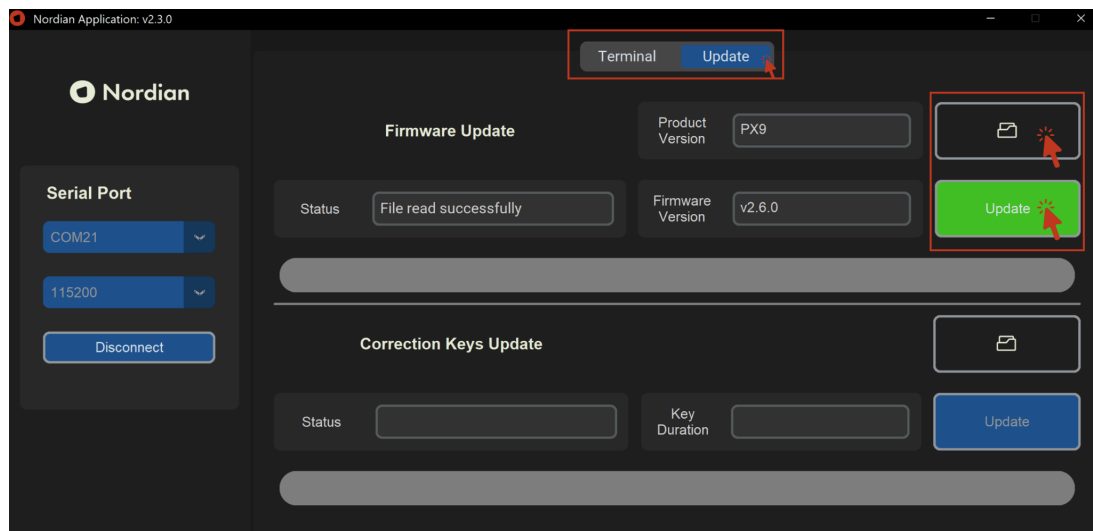
Figure 8: Product Interface



- 2) Load Firmware File: access www.nordian.com/support and download the firmware file (.ndn). Click on the folder icon and select the .ndn file. Once selected, the software will indicate that the firmware file corresponds to a valid firmware. It will show the version of the firmware and the corresponding product.

Once the firmware file has been read by the software the folder icon will turn green. If this product is correctly connected to the software the “Update” button will be enabled. Press the button to begin the firmware update, as shown in Figure 8.

Figure 9: Firmware Update Screen



- 3) Update Successful: if the update process is successful the “Update Successful!” message shall be displayed on the Update Status field, as shown in Figure 8. If any communication or power failure occurs during the firmware update process the software must be closed and the process must be restarted.

Once the process is finished disconnect and close the software. Now your device is ready to use!

NOTE: always check the LED status after the update process to verify if it has been successful. Restart the process if any issue is identified.

Figure 10: Firmware Update Successful

