



RAIBOX-AGX

USER MANUAL

UM-RBXAGX-01

Revision 1.0

18/05/2025

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Preface

Disclaimer

Forecr emphasizes that the information contained in this user manual is continuously updated in line with the technical modifications and enhancements made by Forecr to its RAIBOX-AGX. Therefore, this manual only represents the technical status of Forecr RAIBOX-AGX at the time of publishing.

Forecr shall not be held responsible for any damages that may occur directly or indirectly as a result of any technical or typographical errors or omissions found in this document or for any discrepancies between the product and the user's manual.

Customer Support

In case you encounter any challenges after reading the user manual and/or using the RAIBOX-AGX, please reach out to the Forecr reseller from which you purchased the RAIBOX-AGX.

See the contact information section below for more information on how to contact us directly.

Contact Information

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Limited Product Warranty

Forecr provides a 1-year Warranty for the RAIBOX-AGX. This warranty period is valid from the original purchase date of the RAIBOX-AGX. In order to maintain warranty, the RAIBOX-AGX must not be altered or modified in any way. Changes or modifications to the RAIBOX-AGX, that are not explicitly approved by Forecr and described in this user manual or received from Forecr Support as a special handling instruction, will void your warranty.

To receive warranty service, the RAIBOX-AGX must be delivered to Forecr within the warranty period together with the original invoice or proof of purchase.

Revision History

Revision No	Revision Date	Revision Description
rev 1.0	18.05.2025	Preliminary Release

1. Introduction

The RAIBOX-AGX Railway Grade AGX Orin Computer is a high-performance, ruggedized computing solution designed for railway, transportation, and industrial applications that demand real-time AI processing and edge computing. Powered by NVIDIA Jetson AGX Orin, it delivers exceptional AI inference capabilities for predictive maintenance, video analytics, and autonomous railway operations. Its compact yet durable design ensures reliable performance in environments with high shock, vibration, and temperature fluctuations. Operating within a wide temperature range of -40°C to +85°C, the RAIBOX-AGX thrives in extreme conditions, making it an ideal solution for mission-critical railway applications.

Equipped with high-speed connectivity options, including Gigabit Ethernet, 10G Ethernet, USB 3.0, CANBUS, RS232/RS422/RS485, and GMSL-2, the system enables seamless data exchange between train control systems, sensors, and cloud-based analytics. Its modular expansion capabilities allow for wireless communication via WiFi, Bluetooth, LTE, and 5G, while multiple M.2 slots for SSDs, SIM cards, and communication modules enhance flexibility. With its efficient 10-36V DC power input, the RAIBOX-AGX ensures stable power management across various railway infrastructures.

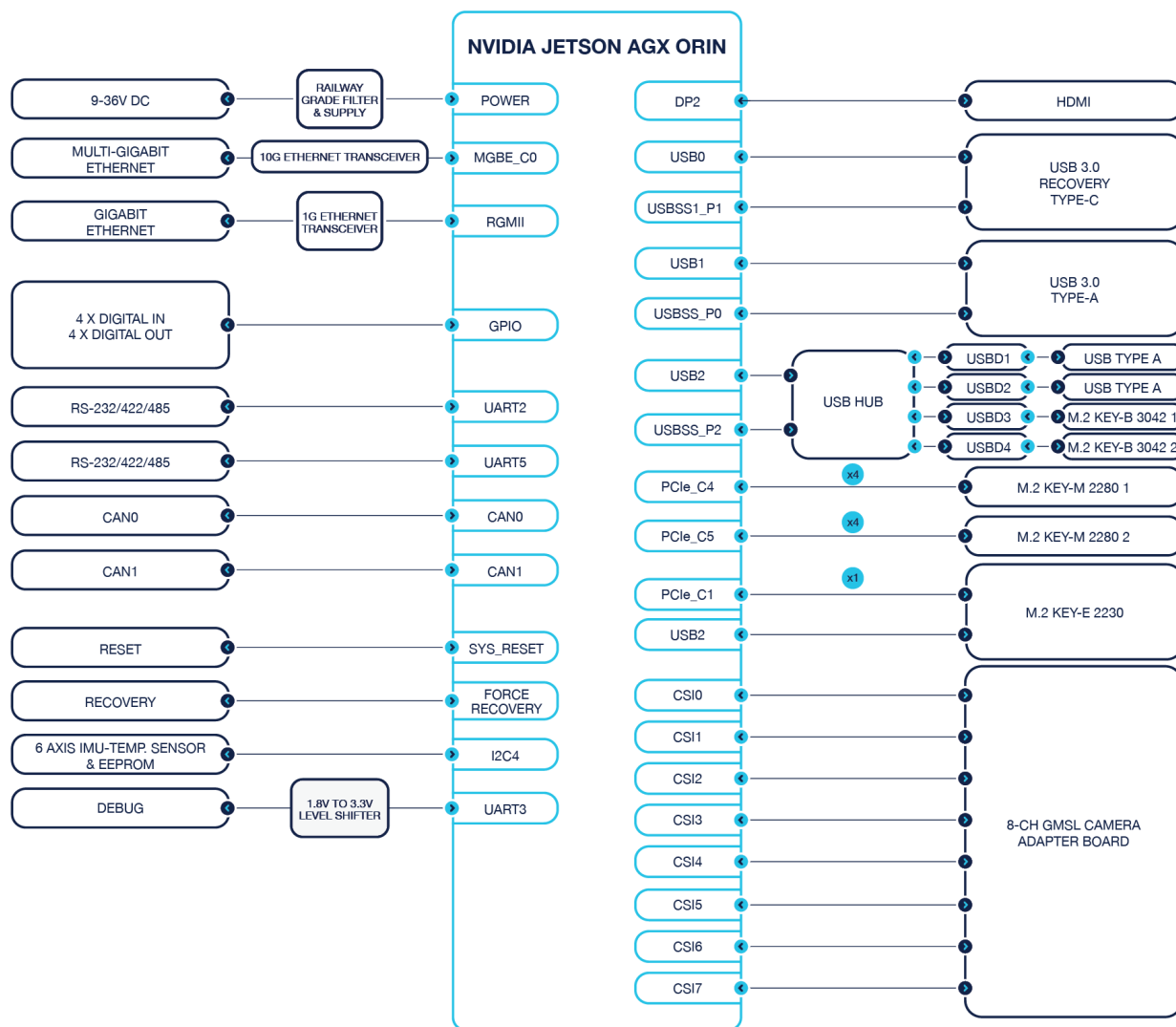
Latest revision of this user manual, datasheet, and 3D model can be downloaded from [Forecr Web Page](#).

2. Product Specification

2.1 Technical Specification

Supported Modules	Jetson AGX Orin Industrial Jetson AGX Orin 32GB/64GB
Memory	32 GB 256-bit LPDDR5x 64 GB 256-bit LPDDR5x
Graphics Interfaces	1x HDMI 2.0(max resolution 3840x2160)
Interfaces	1x Type-C USB3.0 3x Type-A USB3.0 1x Gigabit Ethernet 1x 10G Ethernet 2x CANBUS (Isolated) 2x RS232/RS422/RS485 (Isolated) 4x Digital In, 4x Digital Out (Isolated) 8x GMSL-2 (FAKRA Connector)
Wireless Communication	WiFi/Bluetooth/LTE/5G Connectivity by extension sockets
Power Supply	10V-36 VDC
Extension Sockets	2x M.2 Key-B 1x M.2 Key-E 2x SIM
Mass Storage	2x M.2 Key-M
Ambient Conditions	-40°C ... +85°C (with AGX Orin Industrial)
Form Factor / Dimensions	322mm x 222mm x 101 mm
Operating Systems	Ubuntu Linux 20.04 / 22.04
Standards	EN50155, EN45545-2 HL3, EN61373, EN60068, IP67 (Designed to meet)
JetPack Support	JetPack 5.x / 6.x

2.2 Block Diagram



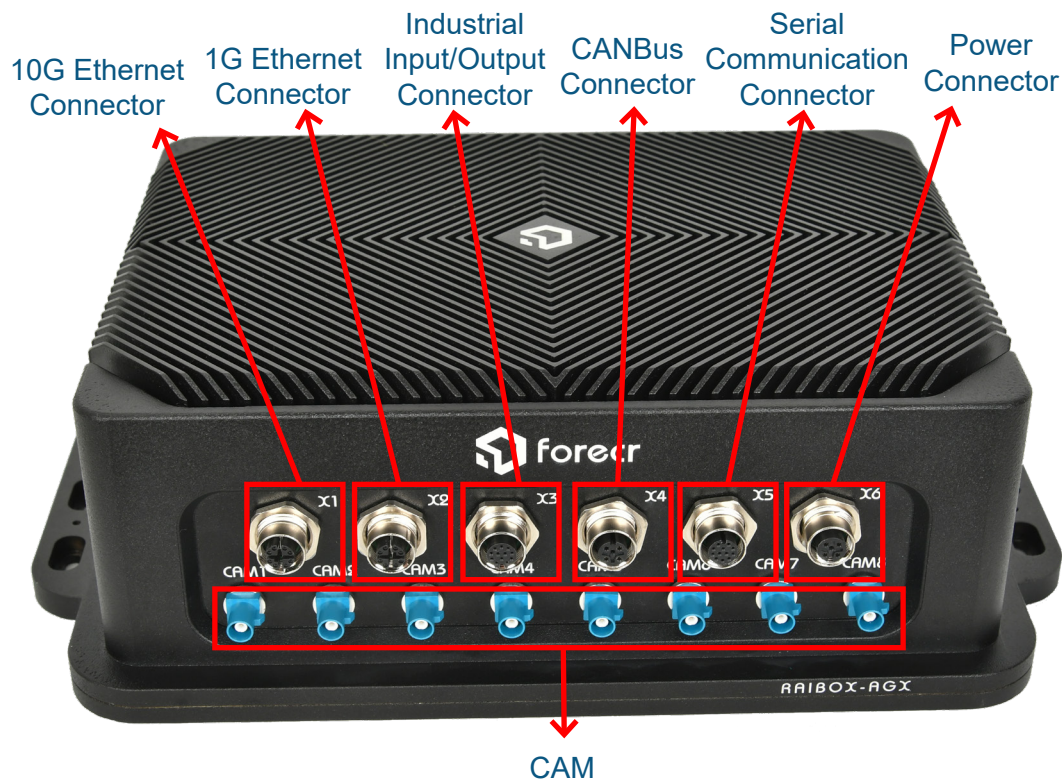
2.3 RAIBOX Visuals



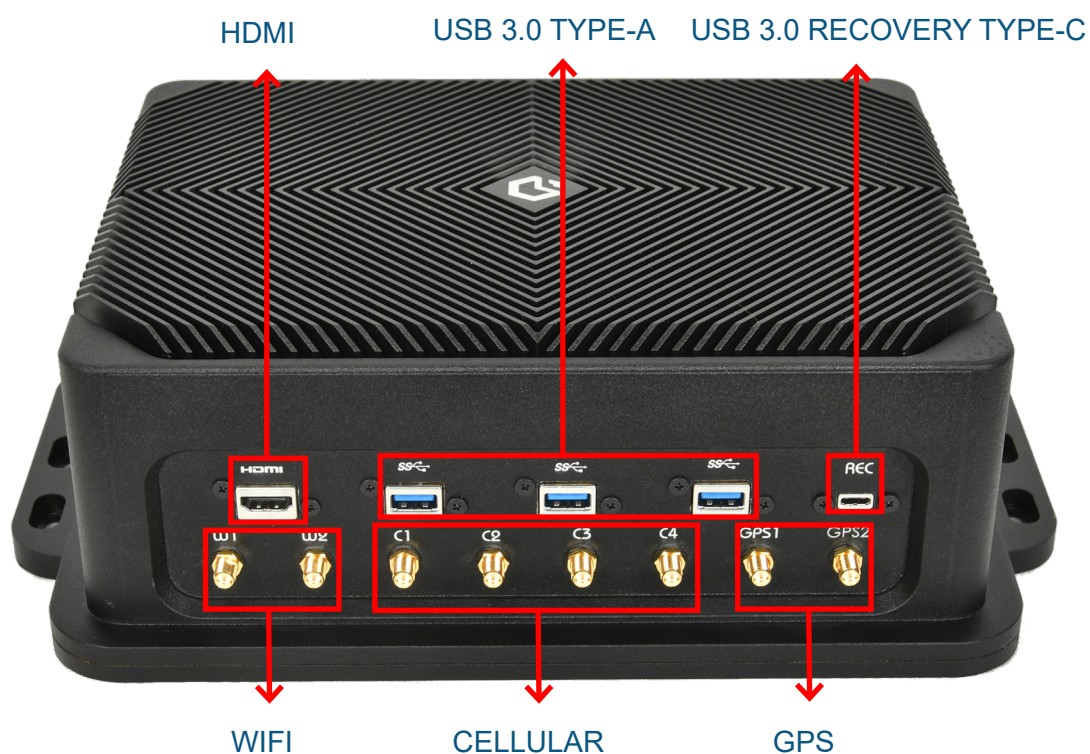
3. Hardware Information

3.1 Connector Location

3.1.1 Front Connectors Layout



3.1.2 Rear Connectors Layout



3.2 List of Connector

Connectors
RAIBOX-AGX Power Connector
RAIBOX-AGX Serial Communication Connector
RAIBOX-AGX CAN Bus Connector
RAIBOX-AGX Industrial Input Output Connector
RAIBOX-AGX 10G/1G Ethernet Connectors
RAIBOX-AGX GMSL-2 (FAKRA Connectors)
RAIBOX-AGX HDMI Connector
RAIBOX-AGX USB 3.0 Type-A Connectors
RAIBOX-AGX Recovery Mode USB 3.0 Type-C Connector
RAIBOX-AGX WIFI Antenna Connectors
RAIBOX-AGX Cellular Antenna Connectors
RAIBOX-AGX GPS Antenna Connectors

3.3 The Definition of Each Connector

3.3.1 Power Connector (X6)

Front View (X6)	Function	Description	
	Connector Type	1411584 from Phoenix Contact M12, 4-pos, A-coded	
	Minimum Input Voltage	+10V	
	Maximum Input Voltage	+36V	
	X6-Pinout	Pin	Description
		1	VDD
		2	VDD
		3	GND
4	GND		

3.3.2 Serial Communication Connector (X5)

The RAIBOX-AGX implements 12 pin serial communication connector which has 8 serial and 2 ground pins. Both serial communications can be configurable for RS232, RS422 or RS485 protocols independently.

Front View (X5)	Function	Description	
	Connector Type	1411589 from Phoenix Contact. M12, 12-pos, A-coded	
	X5-Pinout	Pin	Description
		1	SERIAL_CH0.TX_N
		2	SERIAL_CH1.TX_N
		3	SERIAL_CH1.TX_P
		4	SERIAL_CH1.RX_N
		5	SERIAL_CH1.RX_P
		6	RESET_ISO_N
		7	SERIAL_CH0.RX_P
		8	SERIAL_CH0.RX_N
		9	SERIAL_CH0.TX_P
		10	RECOVERY_ISO_N
		11	GND_ISO_SERIAL
		12	GND_ISO_SERIAL

3.3.3 CAN Bus Connector (X4)

Front View (X4)	Function	Description	
	Connector Type	1411586 from Phoenix Contact. M12, 5-pos, A-coded	
	X4-Pinout	Pin	Description
		1	CAN0_HI
		2	CAN1_HI
		3	CAN1_LO
		4	CAN0_LO
		5	GND

3.3.4 Industrial Input Output Connector (X3)

Front View (X3)	Function	Description	
	Connector Type	1411589 from Phoenix Contact. M12, 12-pos, A-coded	
	X3-Pinout	Pin	Description
		1	DIGITAL_OUT3
		2	DIGITAL_IN0
		3	DIGITAL_IN1
		4	DIGITAL_IN2
		5	DIGITAL_IN3
		6	GND_ISO
		7	DIGITAL_OUT0
		8	DIGITAL_OUT1
		9	DIGITAL_OUT2
		10	GND_ISO
		11	GND_ISO
		12	GND_ISO

3.3.5 10G/1G Ethernet Connectors (X1/X2)

Front View (X1-X2)	Function	Description			
	Connector Type	1424135 from Phoenix Contact. M12, 8-pos, X-coded			
	Pinout	X1-Pinout		X2-Pinout	
		Pin	Description	Pin	Description
		1	GBE2.X0_P	1	GBE.X0_P
		2	GBE2.X0_N	2	GBE.X0_N
		3	GBE2.X1_P	3	GBE.X1_P
		4	GBE2.X1_N	4	GBE.X1_N
		5	GBE2.X3_P	5	GBE.X3_P
		6	GBE2.X3_N	6	GBE.X3_N
		7	GBE2.X2_P	7	GBE.X2_P
		8	GBE2.X2_N	8	GBE.X2_N

3.3.6 GMSL-2 (FAKRA Connectors)

	Description
	The RAIBOX-AGX implements 8 FAKRA connectors for GMSL-2 camera connections.

3.3.7 HDMI Connector

	Description
	The NVIDIA® Jetson AGX Orin modules will output video via the RAIBOX-AGX's HDMI connector that is HDMI 2.0 capable.

3.3.8 USB 3.0 Type-A Connector

	Description
	The RAIBOX-AGX incorporates 3 USB 3.0 Type-A connectors with a 1.5A current limit per connector.

3.3.9 Recovery Mode USB 3.0 Type-C Connector

	Description
	The RAIBOX-AGX implements a USB 3.0 Type-C connector to allow to install or upgrade the operating system.

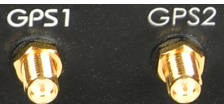
3.3.10 Wifi Antenna Connectors

	Description
	The RAIBOX-AGX incorporates 2 antenna connectors for WIFI connectivity.

3.3.11 Cellular Antenna Connectors

	Description
	The RAIBOX-AGX incorporates 4 antenna connectors for cellular connectivity.

3.3.12 GPS Antenna Connectors

	Description
	The RAIBOX-AGX incorporates 2 antenna connectors for GPS.

4. Software Information

4.1 Installation

JetPack-5.x Installation can be found here: <https://www.forecr.io/blogs/installation/jetpack-5-x-installation-for-raibox-agx>

JetPack-6.x Installation can be found here: <https://www.forecr.io/blogs/installation/jetpack-6-x-installation-for-raibox-agx>

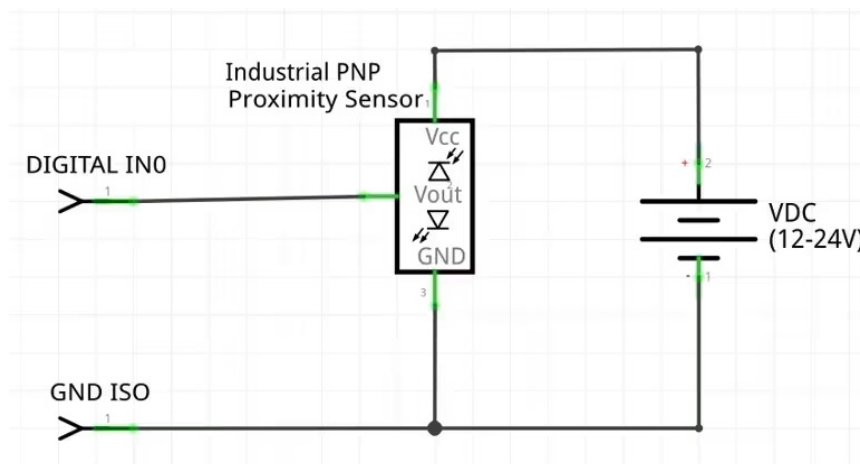
5. Connectivity

5.1 Industrial Input Output Interface

On the industrial input output connector, there are 4 ground, 4 digital input and 4 digital output pins. The pinout detail of the connector is given in section 3.3.4.

5.1.1 Setting and Reading Input Pin

Digital input side accepts signals between 12-24V (rated for 2.25mA). In our application, we used [Heschen M12 Inductive Proximity Sensor \(PNP & Normally Open\(NO\)\)](#) with 24V voltage source.



Find sysfs equivalent of the connected output pin from the table below. For this setup, it is DIGITAL_IN0. After proper hardware connection with industrial LED, we can continue with the software side.

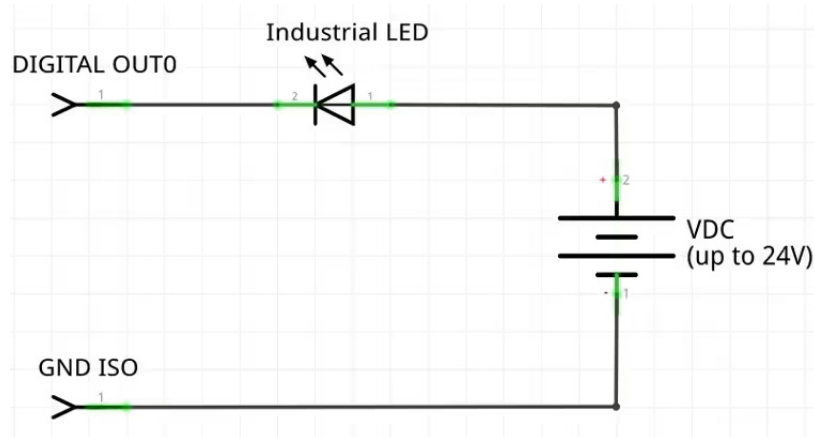
Pin Name	Sysfs Name
DIGITAL_IN0	gpio-398 (PH.07)
DIGITAL_IN1	gpio-399 (PI.00)
DIGITAL_IN2	gpio-400 (PI.01)
DIGITAL_IN3	gpio-401 (PI.02)
GROUND	GND_ISO

Set DIGITAL_IN0 as input and read sensor value. To do this, you should use the commands below.

```
sudo sh -c "echo 398 > /sys/class/gpio/export"
sudo sh -c "echo in > /sys/class/gpio/PH.07/direction"
sudo sh -c "cat /sys/class/gpio/PH.07/value"
```

5.1.2 Setting Digital Output as High and Low

Digital output side can drive loads up to 24V and has a current limit of 1A. They work as low side switches, open-close between them and GND. So, you should have a circuitry as in the schematic below. In our application, we used [GASH-ER 24V Indicator Light](#) with 24V voltage source.



Find sysfs equivalent of the connected output pin from the table below. For this setup, it is DIGITAL_OUT0. After proper hardware connection with industrial LED, we can continue with the software side.

Pin Name	Sysfs Name
DIGITAL_OUT0	gpio-444 (PP.04)
DIGITAL_OUT1	gpio-452 (PQ.04)
DIGITAL_OUT2	gpio-434 (PN.02)
DIGITAL_OUT3	gpio-446 (PP.06)
GROUND	GND_ISO

Then, set DIGITAL_OUT0 as output and control light state. To do this, you should use the commands below.

```
sudo sh -c "echo 444 > /sys/class/gpio/export"
sudo sh -c "echo out > /sys/class/gpio/PP.04/direction"
```

To short output:

```
sudo sh -c "echo 1 > /sys/class/gpio/PP.04/value"
```

To open output:

```
sudo sh -c "echo 0 > /sys/class/gpio/PP.04/value"
```

5.2 Serial Communication Interface

There are two serial communication channels on RAIBOX-AGX. On the serial communication connector, there are 8 serial communication, 2 ground pins. The pinout detail of the connector is given in section 3.3.2.

5.2.1 Serial Communication Interfaces Settings

Run the GtkTerm program with arguments. On the host side, you can use TeraTerm or Putty for Windows; GtkTerm for Ubuntu OS.

Job (1/0)	Sysfs Name	
	Channel-0	Channel-1
Half/Full#	gpio-470 (PY.00)	gpio-469 (PX.07)
RS485/RS232#	gpio-472 (PY.02)	gpio-480 (PZ.02)
Driver Enable	gpio-477 (PY.07)	gpio-474 (PY.04)
Receiverv Enable#	gpio-478 (PZ.00)	gpio-468 (PX.06)

5.2.1.1 RS-232 Settings

To set the serial communication interfaces in RS-232 mode:

Open new terminal then type these commands below for channel-0.

```
sudo sh -c "echo 470 > /sys/class/gpio/export"
sudo sh -c "echo 472 > /sys/class/gpio/export"
sudo sh -c "echo 477 > /sys/class/gpio/export"
sudo sh -c "echo 478 > /sys/class/gpio/export"
sudo sh -c "echo low > /sys/class/gpio/PY.00/direction"
sudo sh -c "echo low > /sys/class/gpio/PY.02/direction"
sudo sh -c "echo high > /sys/class/gpio/PY.07/direction"
sudo sh -c "echo low > /sys/class/gpio/PZ.00/direction"
```

Open new terminal then type these commands below for channel-1.

```
sudo sh -c "echo 469 > /sys/class/gpio/export"
sudo sh -c "echo 480 > /sys/class/gpio/export"
sudo sh -c "echo 474 > /sys/class/gpio/export"
sudo sh -c "echo 468 > /sys/class/gpio/export"
sudo sh -c "echo low > /sys/class/gpio/PX.07/direction"
sudo sh -c "echo low > /sys/class/gpio/PZ.02/direction"
sudo sh -c "echo high > /sys/class/gpio/PY.04/direction"
sudo sh -c "echo low > /sys/class/gpio/PX.06/direction"
```

5.2.1.2 RS-422 Settings

To set the serial communication interfaces in RS-422 mode:

Open new terminal then type these commands below for channel-0.

```
sudo sh -c "echo 470 > /sys/class/gpio/export"
sudo sh -c "echo 472 > /sys/class/gpio/export"
sudo sh -c "echo 477 > /sys/class/gpio/export"
sudo sh -c "echo 478 > /sys/class/gpio/export"
sudo sh -c "echo low > /sys/class/gpio/PY.00/direction"
sudo sh -c "echo high > /sys/class/gpio/PY.02/direction"
sudo sh -c "echo high > /sys/class/gpio/PY.07/direction"
sudo sh -c "echo low > /sys/class/gpio/PZ.00/direction"
```

Open new terminal then type these commands below for channel-1.

```
sudo sh -c "echo 469 > /sys/class/gpio/export"
sudo sh -c "echo 480 > /sys/class/gpio/export"
sudo sh -c "echo 474 > /sys/class/gpio/export"
sudo sh -c "echo 468 > /sys/class/gpio/export"
sudo sh -c "echo low > /sys/class/gpio/PX.07/direction"
sudo sh -c "echo high > /sys/class/gpio/PZ.02/direction"
sudo sh -c "echo high > /sys/class/gpio/PY.04/direction"
sudo sh -c "echo low > /sys/class/gpio/PX.06/direction"
```

5.2.1.3 RS-485 Settings

To set the serial communication interfaces in RS-485 mode:

Open new terminal then type these commands below for channel-0.

```
sudo echo 470 > /sys/class/gpio/export
sudo echo 472 > /sys/class/gpio/export
sudo echo 477 > /sys/class/gpio/export
sudo echo 478 > /sys/class/gpio/export
sudo echo high > /sys/class/gpio/PY.00/direction
sudo echo high > /sys/class/gpio/PY.02/direction
```

Open new terminal then type these commands below for channel-1.

```
sudo echo 469 > /sys/class/gpio/export
sudo echo 480 > /sys/class/gpio/export
sudo echo 474 > /sys/class/gpio/export
sudo echo 468 > /sys/class/gpio/export
sudo echo high > /sys/class/gpio/PX.07/direction
sudo echo high > /sys/class/gpio/PZ.02/direction
```

To write data for channel-0:

```
sudo echo high > /sys/class/gpio/PY.07/direction
sudo echo high > /sys/class/gpio/PZ.00/direction
```

To read data for channel-0:

```
sudo echo low > /sys/class/gpio/PY.07/direction
sudo echo low > /sys/class/gpio/PZ.00/direction
```

To write data for channel-1:

```
sudo echo high > /sys/class/gpio/PY.04/direction
sudo echo high > /sys/class/gpio/PX.06/direction
```

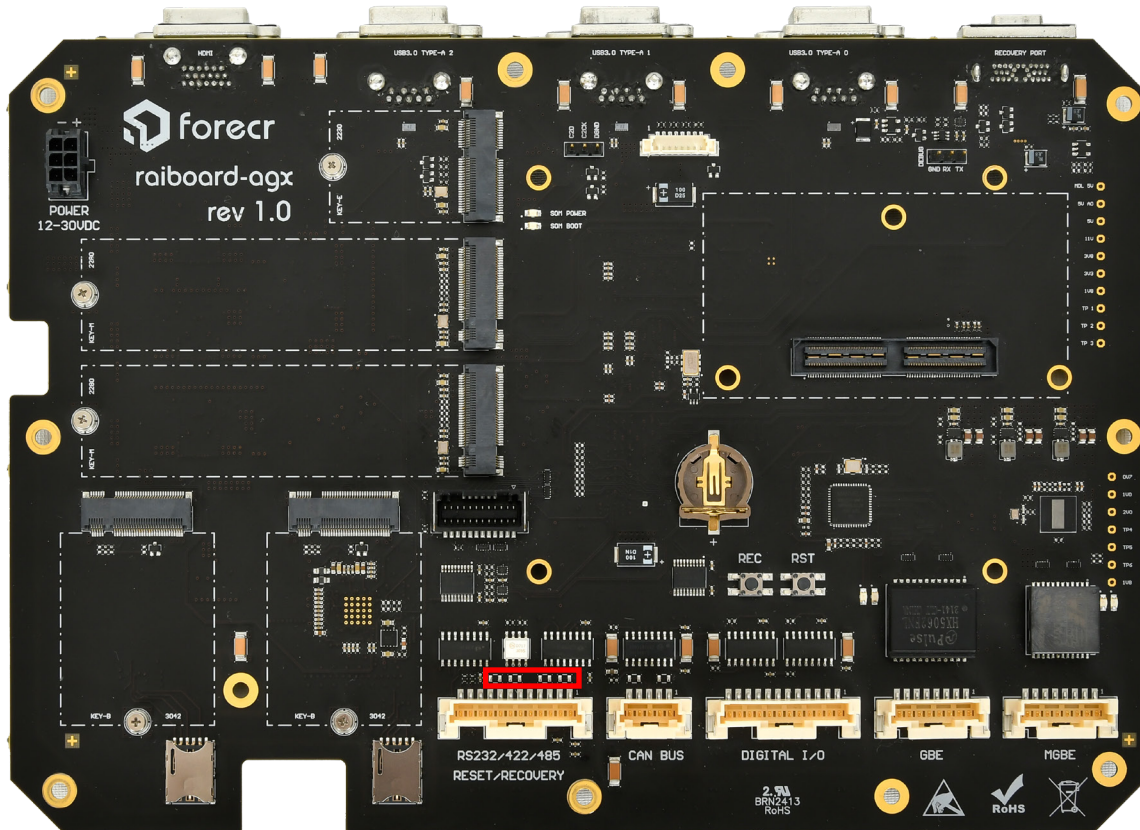
To read data for channel-1:

```
sudo echo low > /sys/class/gpio/PY.04/direction
sudo echo low > /sys/class/gpio/PX.06/direction
```

5.2.2 Serial Communication Termination Resistors

There are serial communication termination resistors on the RAIBOX-AGX. There are 0805 size 120R termination resistors between RS422 TX+/TX- and RX+/RX- pairs on the board, which are not populated by default. Standard resistors with above specs can be fitted if termination resistors are needed on the RAIBOX-AGX side.

Serial Communication Termination Resistors



5.3 CANBus Interface

There are two CANBus interfaces on the RAIBOX-AGX. On the CANBus connector, there are 4 CANBus pins and one ground pin. The pinout detail of the connector is given in section 3.3.3.

5.3.1 CANBus Testing

As an example CAN Bus testing application, we used a DSBOX-TX2NX as a test equipment (It has 120Ω termination resistor included). (If you use a USB-CAN adapter, connect that adapter to the USB port of the host PC and install its driver software if necessary.) To the other side of the connector, connect your device's CAN pins.

On host side, be sure that you are using same bitrate with your device.

On next step, activate CAN drivers and activate 2 CAN interfaces on RAIBOX-AGX with the following commands below:

```
sudo modprobe can
sudo modprobe can_raw
sudo modprobe mttcan
sudo ip link set can0 type can bitrate 500000 dbitrate 2000000 berr-reporting on fd on
sudo ip link set can1 type can bitrate 500000 dbitrate 2000000 berr-reporting on fd on
sudo ip link set up can0
sudo ip link set up can1
```

Now, you can use can-utils tools to communicate.

Use cangen to write random data from both CAN Bus interface:

```
cangen can0 -v
cangen can1 -v
```

Use cansend to write data from both CAN Bus interface:

```
cansend can0 123#1122334455667788
cansend can1 123#1122334455667788
```

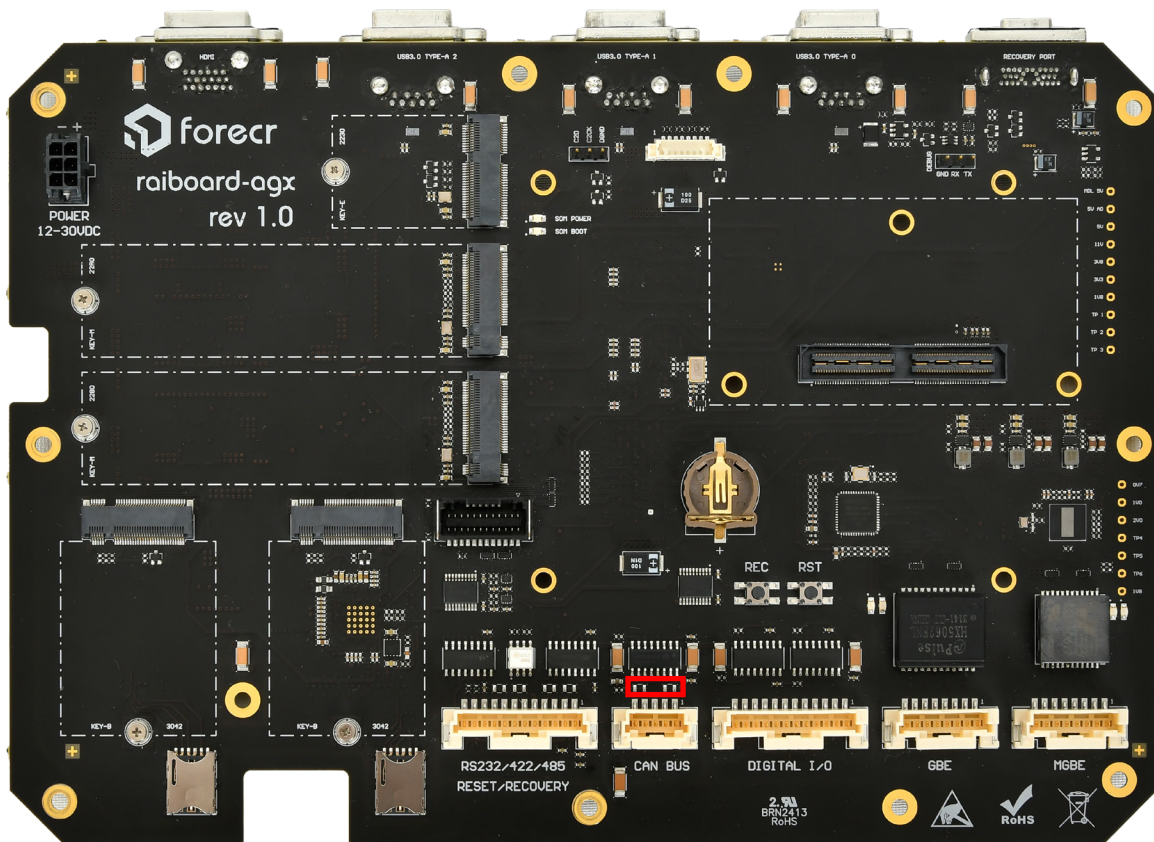
Use candump to listen bus from both CAN Bus interface:

```
candump can0
candump can1
```

5.3.2 CANBus Termination Resistors

There are 0805 size 120R termination resistors between CAN_H and CAN_L pins on the board, which are not populated by default. Standard resistors with above specs can be fitted if termination resistors are needed on the RAIBOX-AGX side.

CANBus Termination Resistors



5.4 I2C Devices

5.4.1 IMU / Temperature Sensor

RAIBOX-AGX contains a 6-AXIS IMU-Temperature sensor from Würth Elektronik (model: 2536030320001). It is accessible from I2C4 (i2c@c250000) and its I2C slave address is 0x6b.

5.4.2 EEPROM

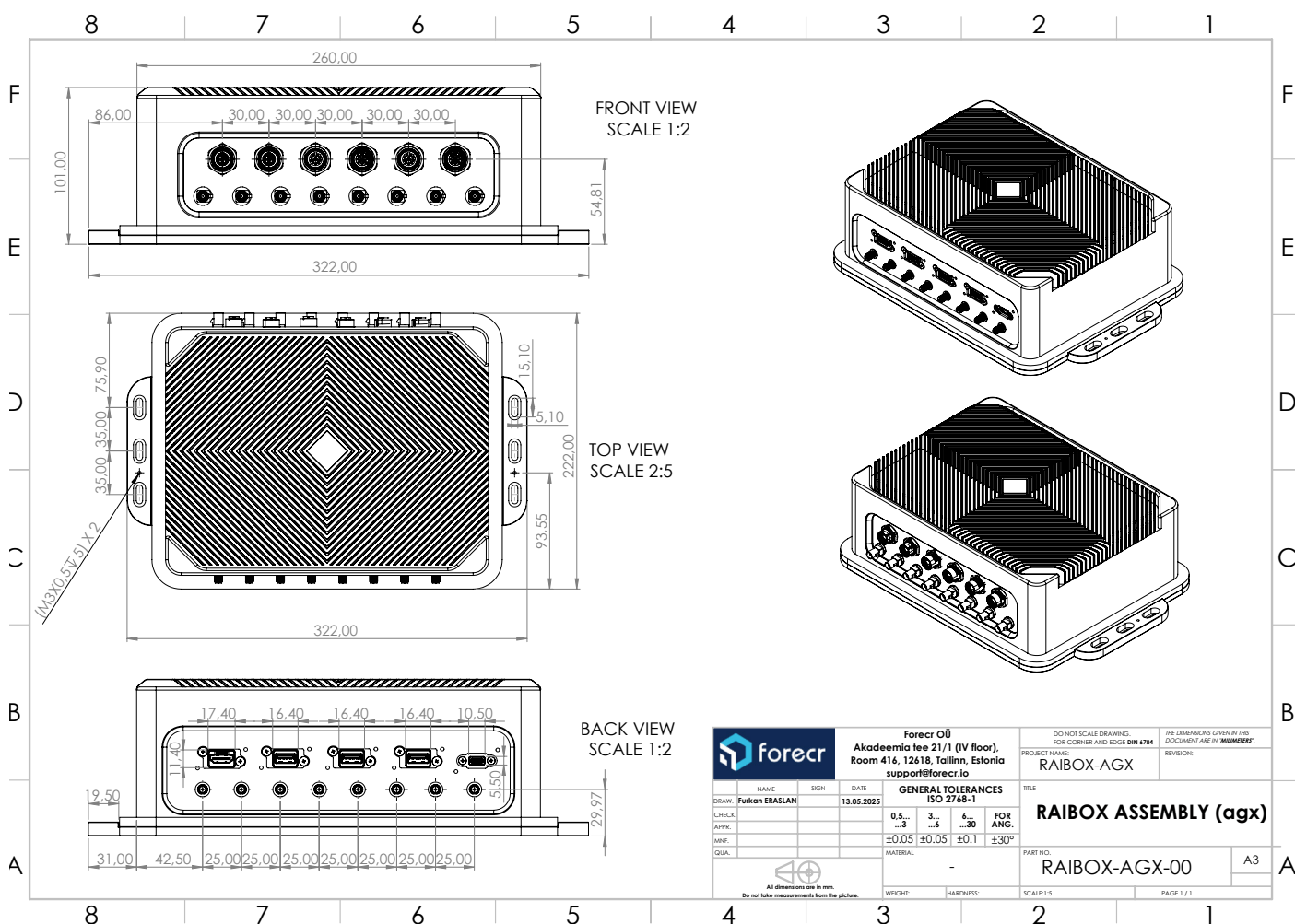
RAIBOX-AGX also contains an EEPROM from onsemi (model: CAT24C04WI-GT3). It is accessible from I2C4 (i2c@c250000) and its I2C slave address is 0x56.

5.5 General Purpose Input/Output (GPIO)

I/O Expander IC	PIN#	GPIO	TYPE	DESCRIPTION
Bus Name: I2C6 Module Pin Numbers: J53 / J52 P/N: PCA6416APW,118 Address: 0x20h	4	M2B_KEYB1.W_DISABLE1#	OUTPUT	LTE/5G module airplane mode control. Drive low to enable airplane mode. Drive high for normal operation.
	5	M2B_KEYB1.W_DISABLE2#	OUTPUT	GNSS disable control. Drive low to disable GNSS. Drive high for normal operation.
	6	M2B_KEYB1.FULLCARD_PWROFF#	OUTPUT	LTE/5G module power on/off control. Drive low to power off the module. Drive high for normal operation.
	7	M2B_KEYB1.RESET	OUTPUT	LTE/5G module reset control input. Drive low to put in reset state. Drive high for normal operation.
	8	M2B_KEYB2.W_DISABLE1#	OUTPUT	LTE/5G module airplane mode control. Drive low to enable airplane mode. Drive high for normal operation.
	9	M2B_KEYB2.W_DISABLE2#	OUTPUT	GNSS disable control. Drive low to disable GNSS. Drive high for normal operation.
	10	M2B_KEYB2.FULLCARD_PWROFF#	OUTPUT	LTE/5G module power on/off control. Drive low to power off the module. Drive high for normal operation.
	11	M2B_KEYB2.RESET	OUTPUT	LTE/5G module reset control input. Drive low to put in reset state. Drive high for normal operation.
	12	M2E_WDISABLE1	OUTPUT	WiFi/BT module full powerdown control for the WiFi/BT radio. Drive low to disable WiFi/BT. Drive high for normal operation.
	13	M2E_WDISABLE2	OUTPUT	Reset for Bluetooth. Active low by default.

6. 3D Model & Mechanical Information

Full 3D models of all RAIBOX-AGX can be found here: https://github.com/forecr/forecr_3d_models/tree/master/RAIBOX-AGX



7. Power Consumption

This section will be completed soon. It will be published on our website once completed. Please check our [Forecr](#) Web Page regularly.

8. MTBF Prediction

This section will be completed soon. It will be published on our website once completed. Please check our [Forecr](#) Web Page regularly.

9. Ordering Information

