



EAORA04
Datasheet

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1. General Information

EAORA04 is an intelligent computing platform developed by Ecotron, for autonomous driving systems using NVIDIA Jetson Orin chip and Infineon TC297. Along with the basic software and development tools, developers can build an L4 level low-speed autonomous driving system in a safe, convenient, and efficient manner.

NVIDIA Jetson Orin is designed for embedded intelligent systems, including autonomous driving systems with functions such as sensor fusion, environment perception, and path planning, etc.

Infineon TC297 is based on TriCore™ architecture with a 300MHz operating frequency and an

ECC (Error Correction Code) protected RAM with 728KB + 8MB capacity. It is designed based on the ISO26262 standard and supports ASIL-D safety level requirements. Developers can develop and deploy vehicle control and functional safety related strategies based on the MCU.

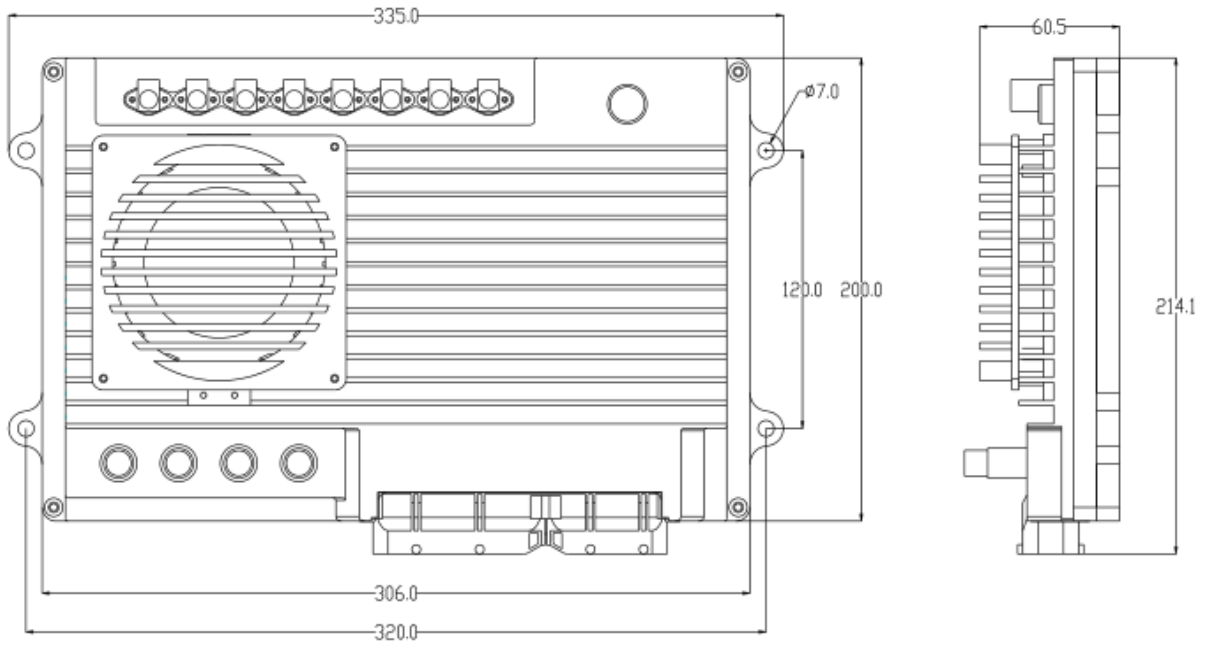


2. Interface

Interface type	Number	Function	Chip	Connector
M.2 KEY M	1	Extended storage	SOC	Internal
Camera interface	8	GMSL2/FPDLINK3	SOC	Waterproof FAKRA
Gigabit Standard Ethernet	2	100BASE-T/1000BASE-T standard	Switch	2* Aviation plug
Gigabit Automotive Ethernet	3	100Base-T1/1000Base-T1,	Switch	1* Aviation plug
Video Output	1	1 channel HDMI	SOC	
USB	1	1 channel USBHost supports USB2.0, US3.0, USB3.1	SOC	
RS232	3	1 channel used for debugging	SOC	121PIN-CMC
RS485	1		SOC	
CAN	2		SOC	
PPS_IN	1	Support 3.3V-16V, hardware configuration	SOC	
PPS_OUT	4	2 channels 5V or 3.3V output, 2 channels 12V output	SOC	
CANFD	6	2 channels support specific frame wake-up	MCU	
LIN	4	No wake-up function is required	MCU	
KEYON	3	1 channel for SOC; 2 channels for MCU		
Digital Input	6	Default configuration: 4 channels are active-high, 2 channels are active-low	MCU	
Analog Input	6	Default configuration: 2 channels are 5V voltage type, 2 channels are 36V voltage type and 2 channels are resistance type	MCU	
Digital Low-side output	8	8 channels @250mA	MCU	
Digital High-side output	4	4 channels @1A	MCU	
5V Sensor power	2	Maximum Current 100mA	MCU	
Power Positive	4			
Power Ground	4			
Signal Ground	8			

3. Mechanical Properties

3.1 Dimensions



4. Hardware Description

The hardware circuit of the computing platform is designed according to the application requirements of the autonomous driving system. The electrical parameters meet Automotive-grade requirements and have a variety of data transmission interfaces that can meet the needs of sensor fusion for autonomous driving systems. The main chip contains a variety of high-performance computing units to adapt to the computation-intensive characteristics of autonomous driving, including sequential and parallel computing.

4.1 Specifications

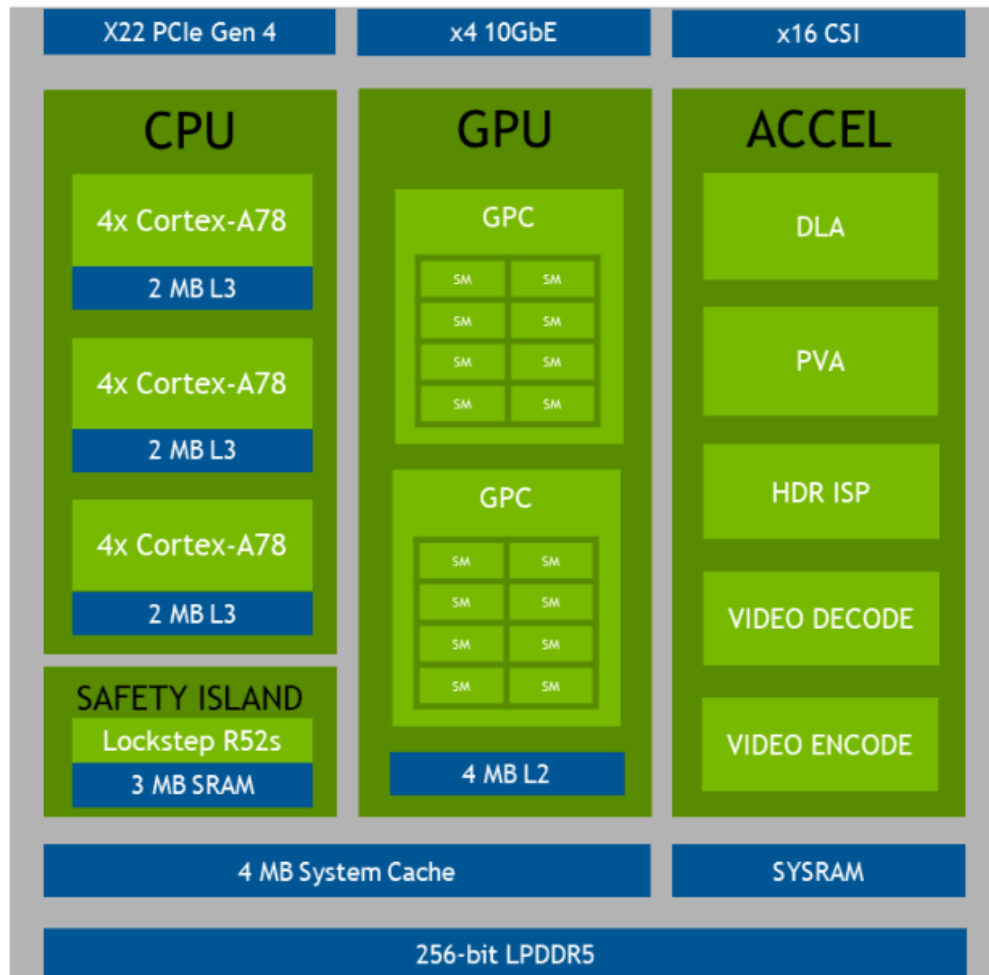
Item	Parameter
Operating voltage	DC 9-32V
Calculate performance	200 Tops
Operation memory	32GB
Storage memory	64GB, optional expanded SSD
Operating temperature	-25 to 70 °C
Operating humidity	0 - 95%, no condensation
Storage temperature	-40 to 85 °C
Dimensions	335mm*214mm*60mm
Weight	≤3000g
Protection level	IP5X

4.2 System Main Chip

The main chip of EAORA04 is NVIDIA Jetson AGX Orin, which is designed specifically for embedded autonomous driving control systems. The computing performance of different internal processors is listed below:

- AI performance: 200 INT8 Sparse TOPs
- CPU: 8 core Cortex A78 ARM 64-bit CPU, 2 clusters (4x 256KB L2 + 2MB L3) + 4MB L4

- Deep Learning Accelerator (DLA): 2x NVDLA 2.0 Engines (48 TOPs each)
- GPU: NVIDIA Ampere Architecture with 2048 NVIDIA[®] CUDA[®] cores and 64 Tensor Cores. (108 Sparse INT8 TOPs)
- Vision accelerator: 1x PVA v2
- Image Signal Processor (ISP): 1.85 Giga Pixels/s

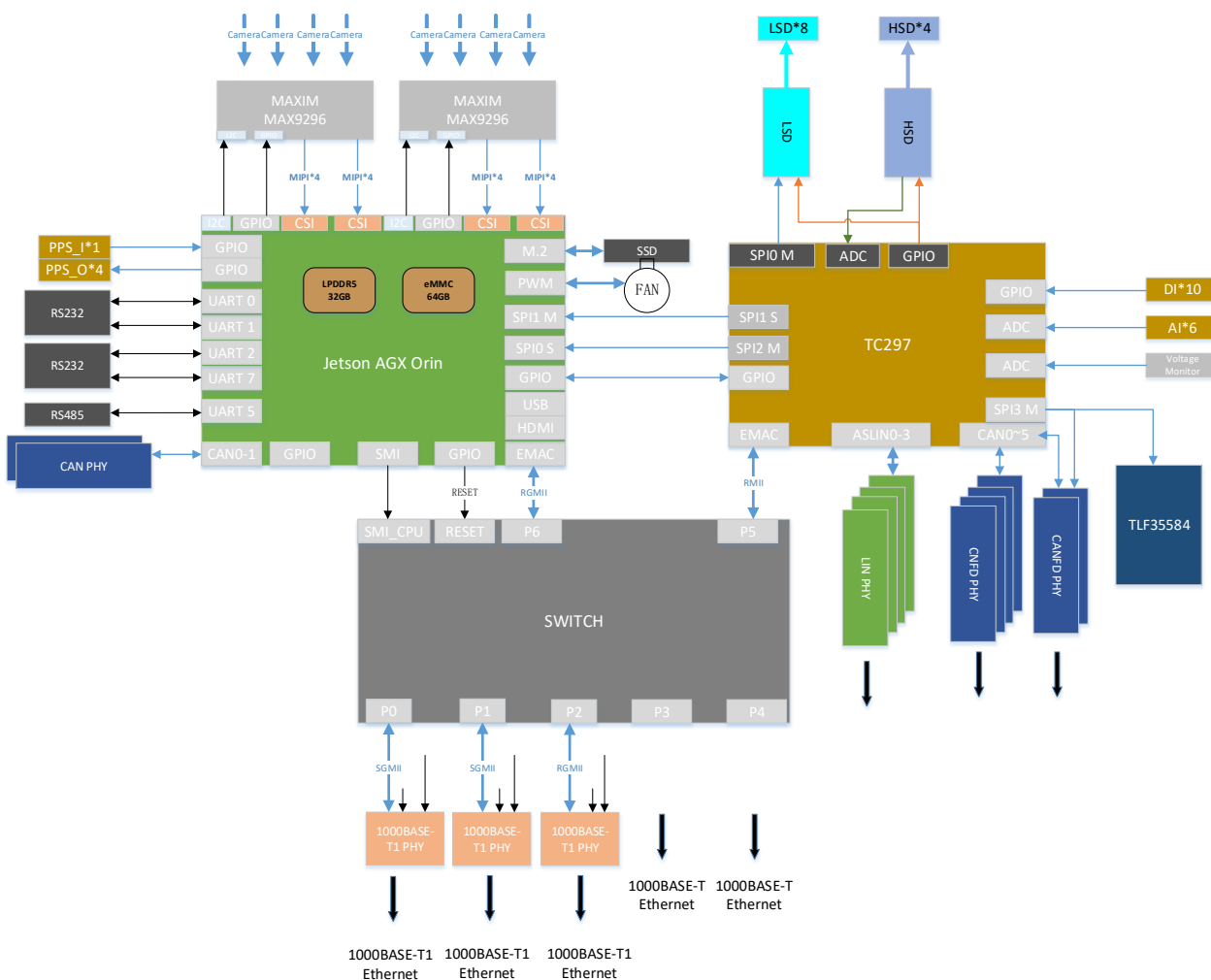


The microcontroller used in EAXORA04-D is Infineon TC297 which has a TriCore™ architecture, working at 300MHz and has an ECC (Error Correction Code) protected RAM with a capacity of up to 728KB + 8MB, designed based on ISO26262, supporting up to ASIL-D. By working with a system basic chip (SBC), it can achieve the hardware core safety architecture. The chip specs are shown below:

Feature	Detail
Micro Control Core	32-bit Infineon TC297TP
Maximum Frequency	300MHz
Flash	8M
SRAM	728K
EEPROM	128K
Float Point Capability	Yes
SBC	TLF35584

4.3 Circuit Structure

The internal circuit structure of EAORA04 is shown below:

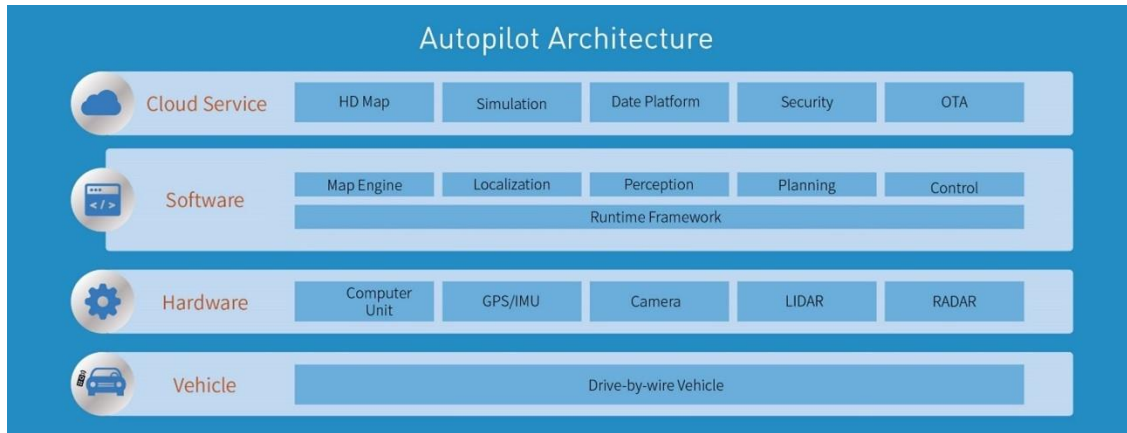


5. Soc Basic Software

The SOC software system of the computing platform is customized for the autonomous driving system. A typical framework of an autonomous driving system is shown below. The SoC software system of EAORA04 consists of Runtime Framework and other components. The Runtime Framework is ROS (Robot Operating System) Melodic.

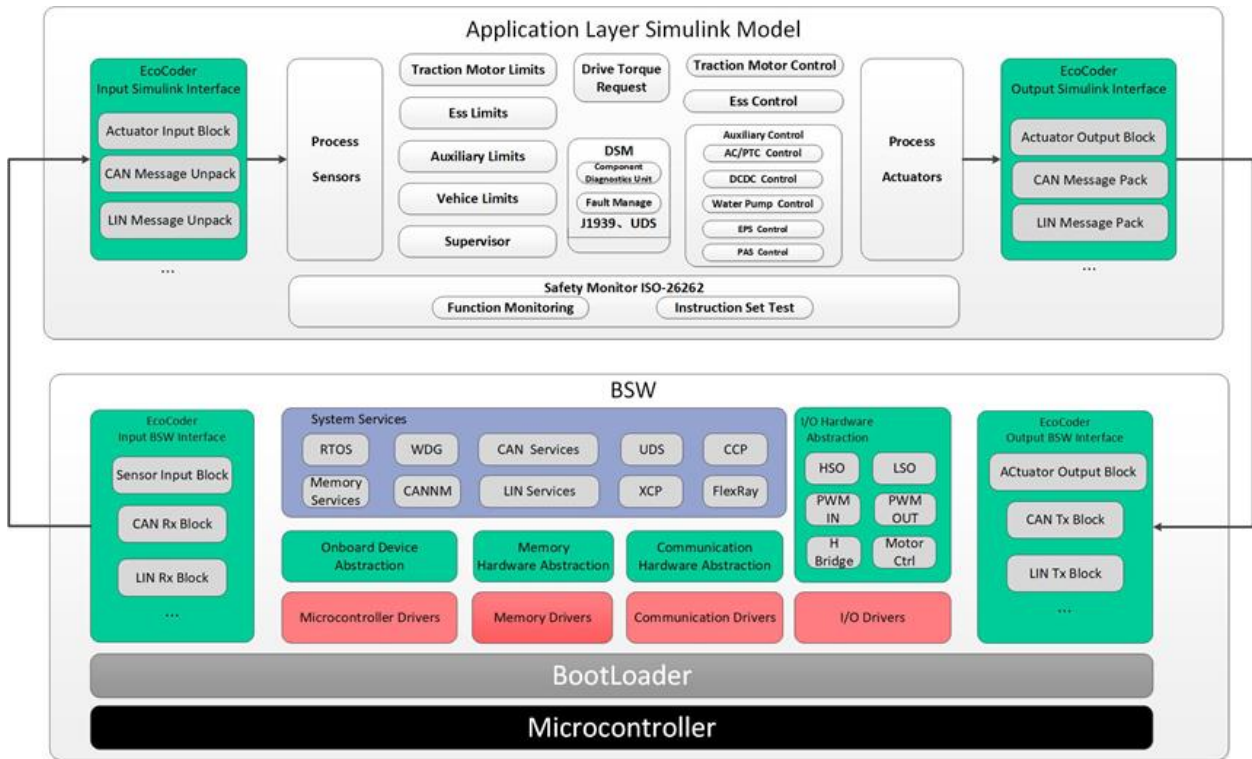
Linux is a bridge connecting the hardware and the users, providing functions such as Process Management, Memory Management, File System, Network, Security, User Interface, and Device Drivers. Users can enter commands through the user interface of the operating system. The operating system interprets the commands, drives the hardware devices, and implements user requirements. ROS provides some standard operating system services, such as Hardware

Abstraction, Low-Level Device Control, Inter-Process Messaging, and Message Packet Management. ROS is built on a graph architecture, various nodes can publish, subscribe and aggregate all kinds of information, e.g. sensing, control, status, planning.



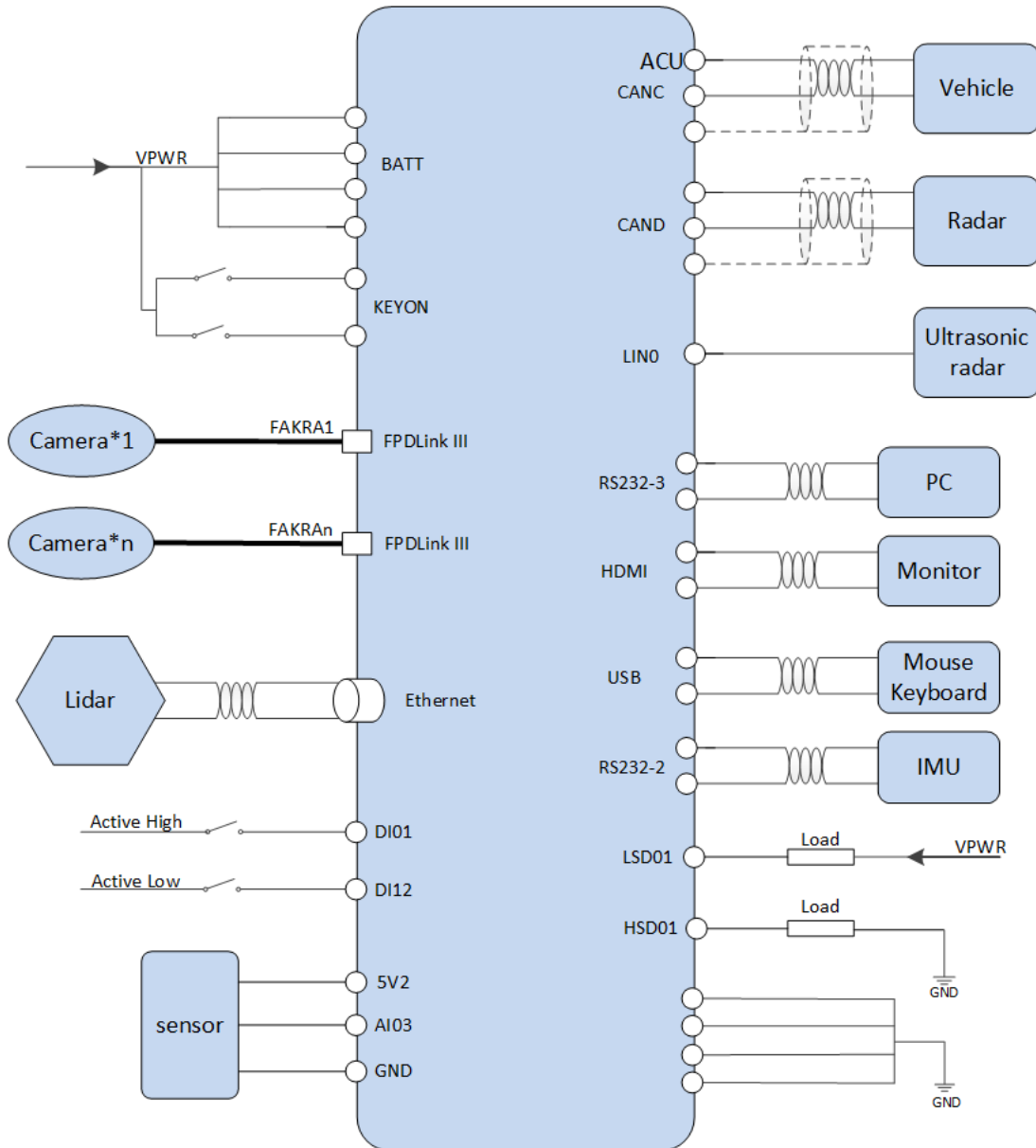
The software architecture of the MCU inside EAORA04 is designed according to AUTOSAR, which is divided into Application Software Layer and Basic Software Layer. Basic Software Layer consists of a microcontroller abstraction layer, an ECU abstraction layer, a service layer, and a complex driver. Application software and basic software are connected and integrated through EcoCoder. EcoCoder encapsulates the low-level software interfaces into the Simulink library via s-functions. Application developers can use Simulink to build the model and generate executable program files for TC297 via Simulink by just one click.

The basic software interfaces that EcoCoder encapsulates can read digital and analog input signals, control high and low side outputs, support .dbc file interpretation, implement CCP and UDS protocols, and define the measurement, calibration and NVM variables. MCU application development is implemented with the calibration software EcoCAL and the flashing software EcoFlash.



6. Demo Application

A demo for an autonomous driving hardware platform is shown below, which consists of EAORA04 and sensors.

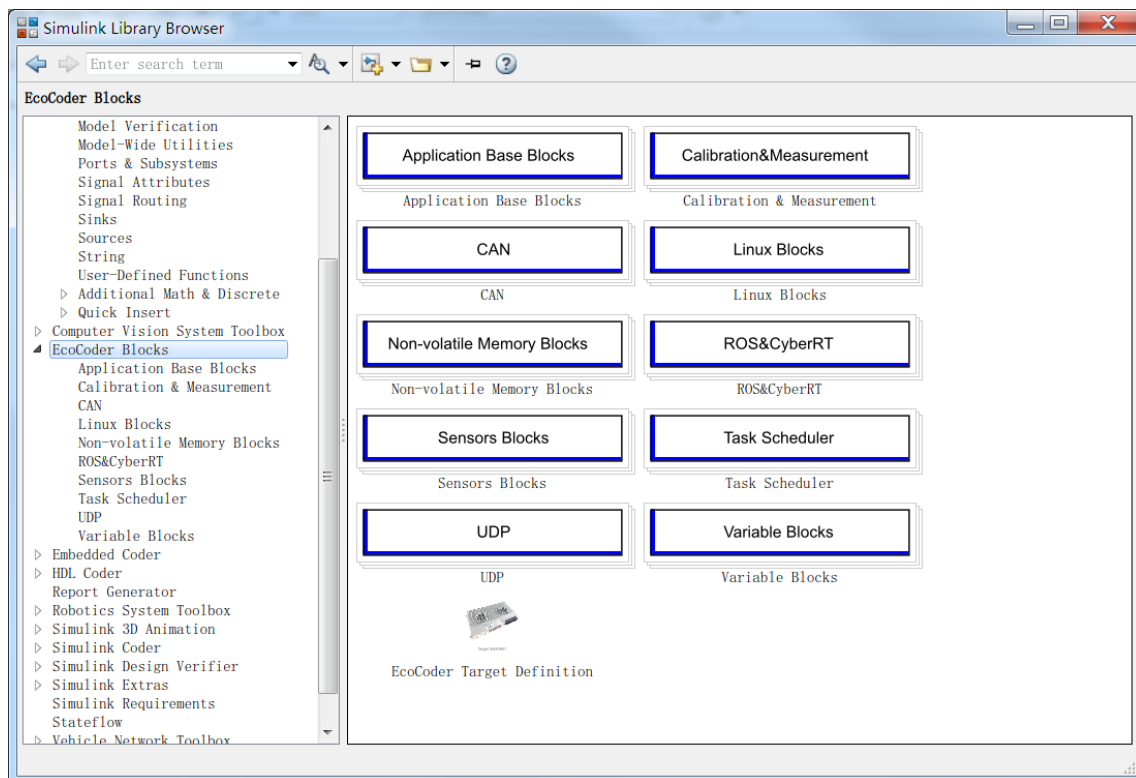


7. Development Tool

A combination of hardware, operating system stacks, and runtime environments are not capable enough to achieve autonomous driving, therefore, users need to develop software that can perform specific functionality and deploy them to EAORA04. For autonomous driving processor Orin, EcoCoder-AI is provided as a development tool. For MCU Infineon TC297, three development tools are provided: EcoCoder, EcoCAL, and EcoFlash. Developers can select the tools they need.

7.1 EcoCoder-AI

EcoCoder-AI is a powerful automatic code generation library based on Matlab / Simulink that links directly to the target controller. EcoCoder-AI integrates code generation, compilation and one-click generation of executable files. In addition, the control model based on Simulink can be directly converted into an ROS-based executable program suitable for the target controller and downloaded to the target controller. For details, please refer to EcoCoder-AI Manual for details.

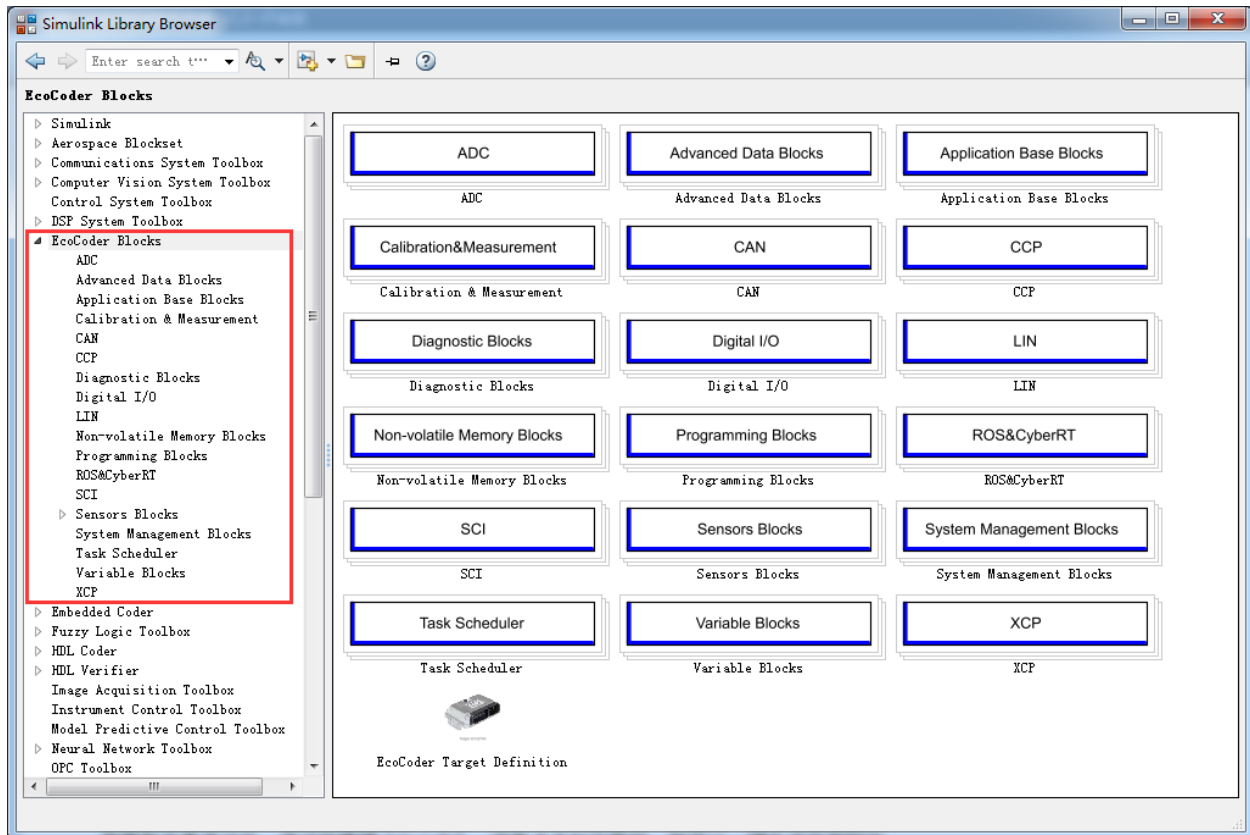


7.2 EcoCoder

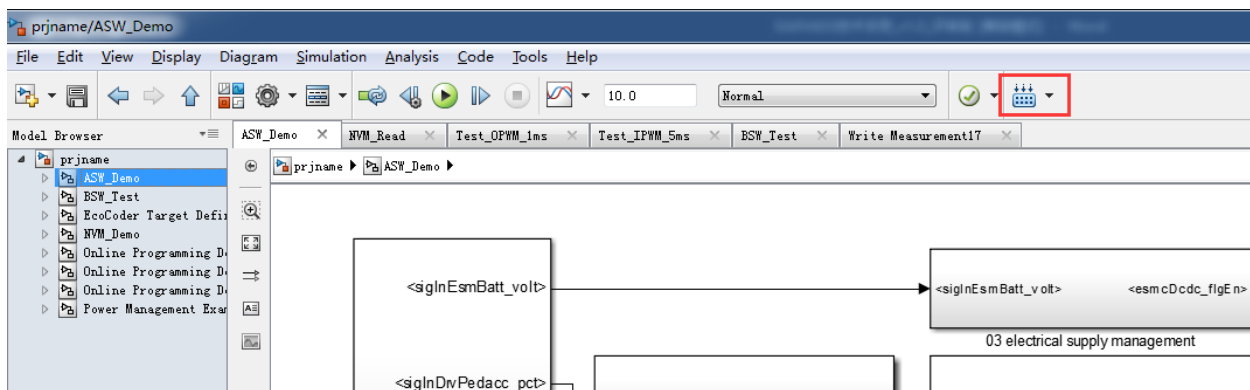
EcoCoder is an application development tool for the control system, which makes it easier for users to develop embedded application software in the Simulink environment. It expands the resources of Simulink and Real-Time Workshop embedded encoders to generate the necessary code module and automatically configures and optimizes code generation. By encapsulating the low-level software library to s-functions, EcoCoder allows developers to use low-level software interfaces by model-based-design method and configure basic parameters. It can generate executable files and data description files with one click and provide .a2l file address update tool.

Features:

- Users develop embedded application software in the Simulink environment.
- Application developers can focus on control strategy development without knowing all the information about hardware.
- By encapsulating the low-level software library to s-functions, EcoCoder enables developers to use the low-level software interfaces and configure parameters using the model-based-design method.
- Executable file and data description file can be generated by one click, and an .a2l file address update tool is provided. During the generation, the code generated by the model is integrated with the low-level software automatically in the background, then makefile is used to call the compiler to generate executables.



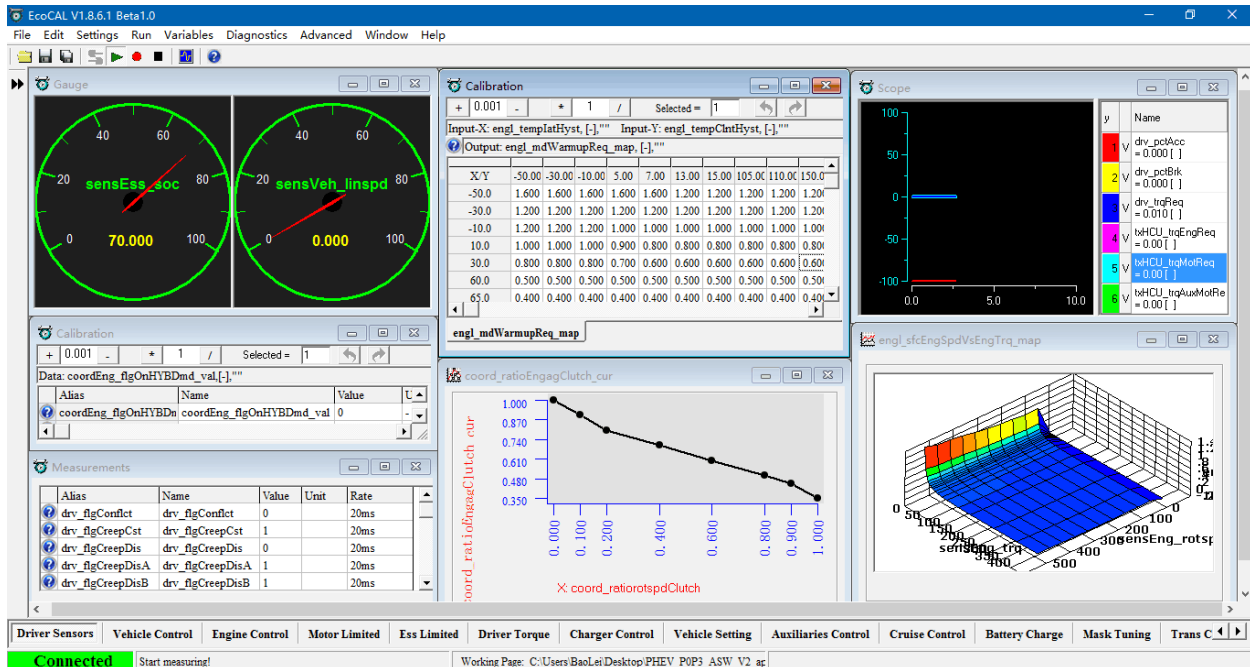
After compilation of the model, use the shortcut “Ctrl + B” or click the button shown below, the executable (ready-to-flash) files will be generated.



Developers can use EcoCoder to develop application software for MCU in EAORA04. Please refer to EcoCoder User Manual for details.

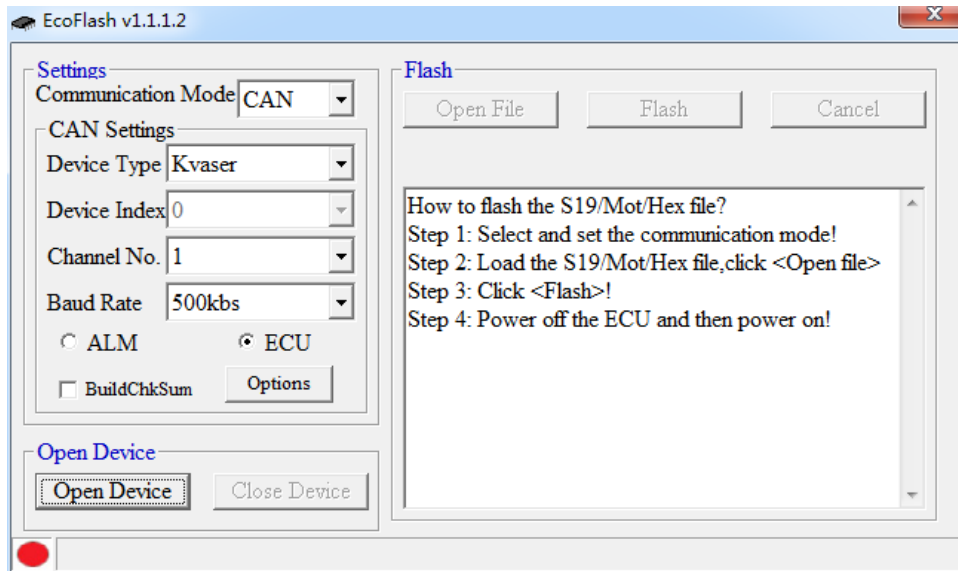
7.3 EcoCAL

EcoCAL is a PC-side calibration software based on the CCP protocol. By loading .a2l and .hex files, to achieve real-time observation and online calibration. It can assist control strategy development engineers to debug and calibrate application software. Please refer to EcoCAL User Manual for more details.



7.4 EcoFlash

EcoFlash is PC-side software working with BootLoader to flash target program files. It uses CAN communication protocol CCP/UDS, and support.s19, .mot and .hex files.



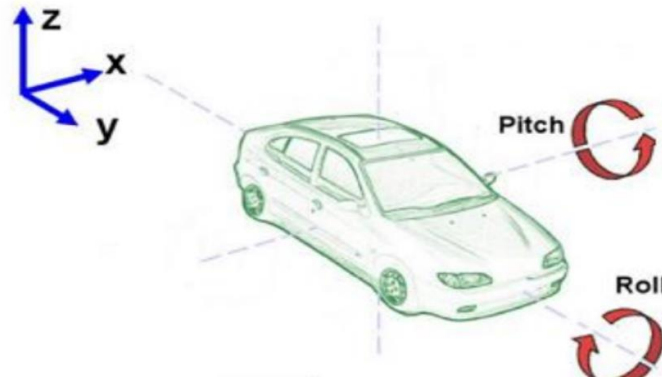
8. Installation Requirements

It is recommended to install the ADCU in the cockpit. If the OEM wants to assemble the ADCU in another location, the corresponding installation location should be evaluated by Ecotron's engineers and the OEM's engineers.

The precautions for ADCU installation are as follows :

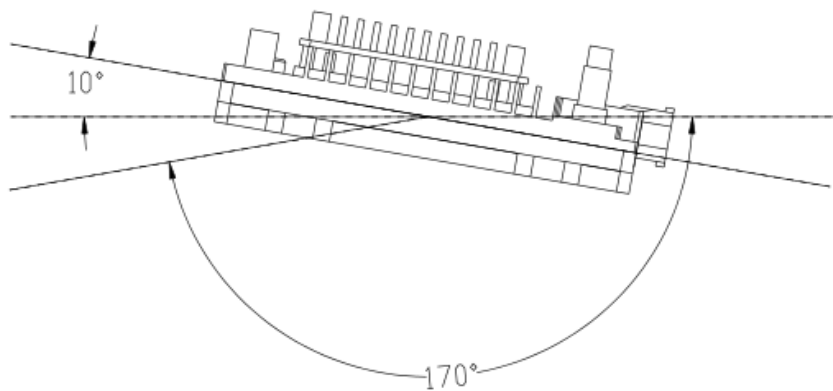
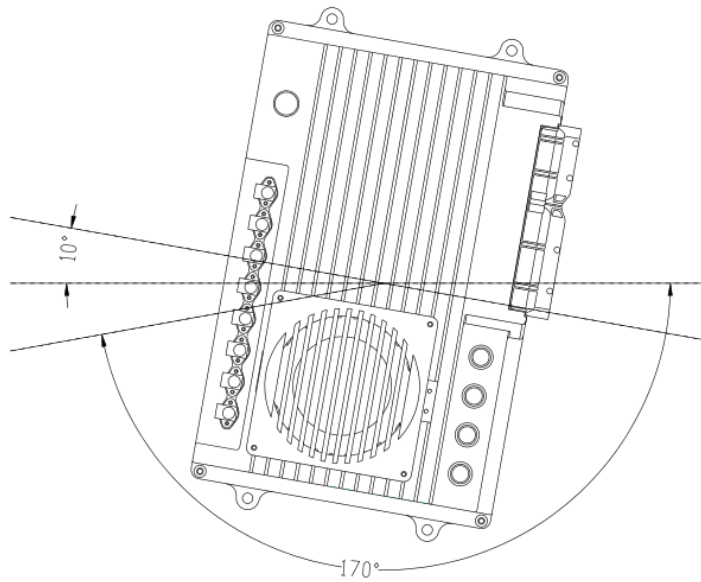
1. The installation of ADCU and wiring harness should be firm and reliable, and there should be no looseness. Avoid supporting the wiring harness by ADCU. At the same time, the arrangement of ADCU wiring harness should prevent and protect all wires in the wiring harness from damage due to wear and overheating.
2. Try to avoid installing in places where dust is easy to gather, a large amount of dust accumulation will affect the reliability of ADCU work.
3. ADCU should keep away from the location where the temperature of the housing itself may exceed 70°C. At the same time, it is necessary to prevent the surrounding parts from releasing heat to the ADCU.
4. Avoid installing the ADCU in locations where oil, moisture, and water droplets are likely to splash on it.
5. Avoid the possibility of additional mechanical shock and external impact due to the installation position and fixing method of the ADCU and avoid installing the ADCU at the resonance point of the car body.
6. Avoid installing the ADCU where it may come into contact with the battery or other parts that are prone to seepage of acid and alkaline solutions, and near the ADCU power terminal.
7. Avoid installing the ADCU where it may come into contact with the positive terminal of Battery and the ignition power terminal.
8. ADCU should be installed in the horizontal and vertical position according to the connector downwards and maintain a certain angle to prevent water from entering the connector. In the horizontal direction, the recommended installation angle is -170° to -10° , as shown in Figure below. In the vertical direction, the recommended installation angle is -170° ~ -10° , as

shown in Figure below.



Z Axis: Vertical Direction

X Y Axes: Horizontal Direction



Ecotron recommends using the 4 mounting holes on the ADCU for installation. It is recommended to manufacture the mounting bracket out of metal materials such as aluminum alloy, and the housing should have a reliable electrical connection with the vehicle GND through the bracket. If other materials are used, the customer must ensure that it can meet the requirements of ADCU for vibration, heat dissipation, temperature, EMC, etc. If there is any deviation, it needs to be confirmed with Ecotron.

9. High-speed signal lines such as harness installation, network cables, video cables, etc. should keep away from areas of high voltage, radiation interference such as motors, battery packs, DCDCs as much as possible.