



EAXVA04 Datasheet

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Chapter 1 Summary

Ecotron’s ADCU, EAXVA04, is an intelligent computing platform designed specifically for autonomous driving systems. EVXVA04 is equipped with 1 NVIDIA AGX Xavier chip and 1 Infineon TC297 chip. With basic software and development tools, developers can safely, conveniently, and efficiently build low-speed L4-level autonomous driving systems in confined areas.

NVIDIA designs Xavier particularly for embedded intelligent systems. Xavier supports autonomous driving functions such as sensor fusion, environment perception, and path planning. Infineon TC297 has a TriCore™ architecture and has an operating frequency of 300MHz. - Moreover, it has 728KB + 8MB capacity and ECC (error correction coding) RAM protection. Ecotron's ADCU is designed based on the ISO26262 standard and supports ASIL-D safety level requirements. Engineers can develop vehicle control and functional safety-related strategies based on this MCU.

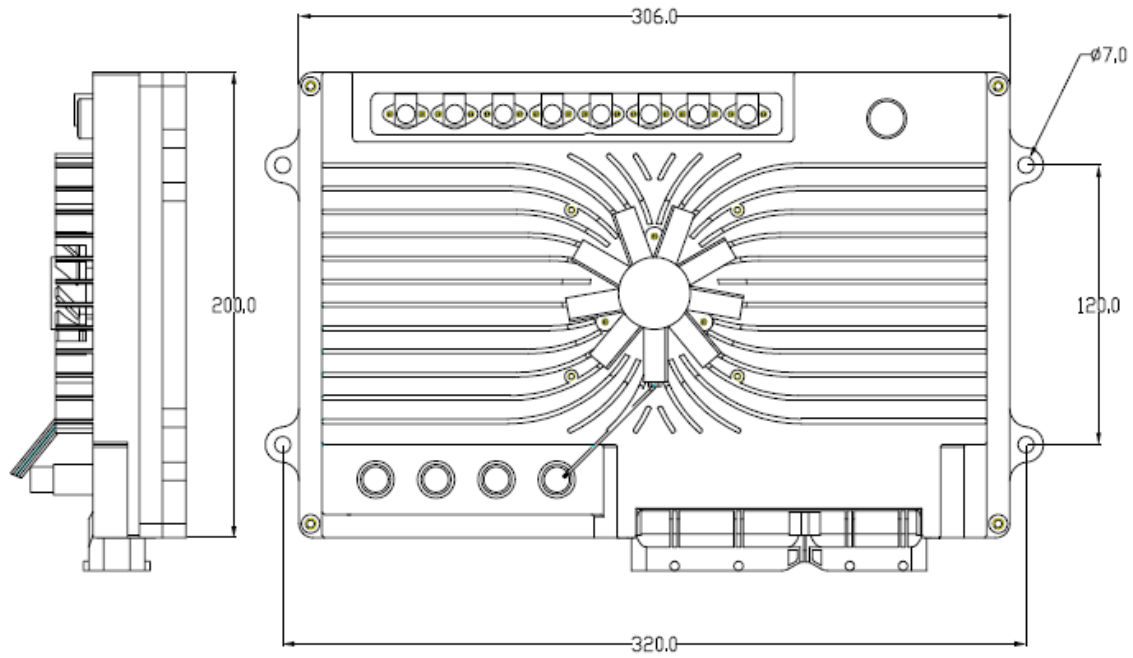


Chapter 2 Interface Configuration

| Interface type | Number | Function | Chip | Connector |
|-----------------------------|--------|---|--------|------------------|
| M.2 KEY M | 1 | Extended storage | SOC | Internal |
| Camera interface | 8 | FPDlink III/GMSL II | 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 | 4 | 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, 2 channels 12V output | SOC | |
| CANFD | 4 | | MCU | |
| CAN | 2 | 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 | | | |

Chapter 3 Mechanical Properties

3.1 Dimensions



Chapter 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 the requirements of the automotive industry regulations and have a variety of data transmission interfaces to meet the needs of multi-sensor fusion of the autonomous driving system. 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

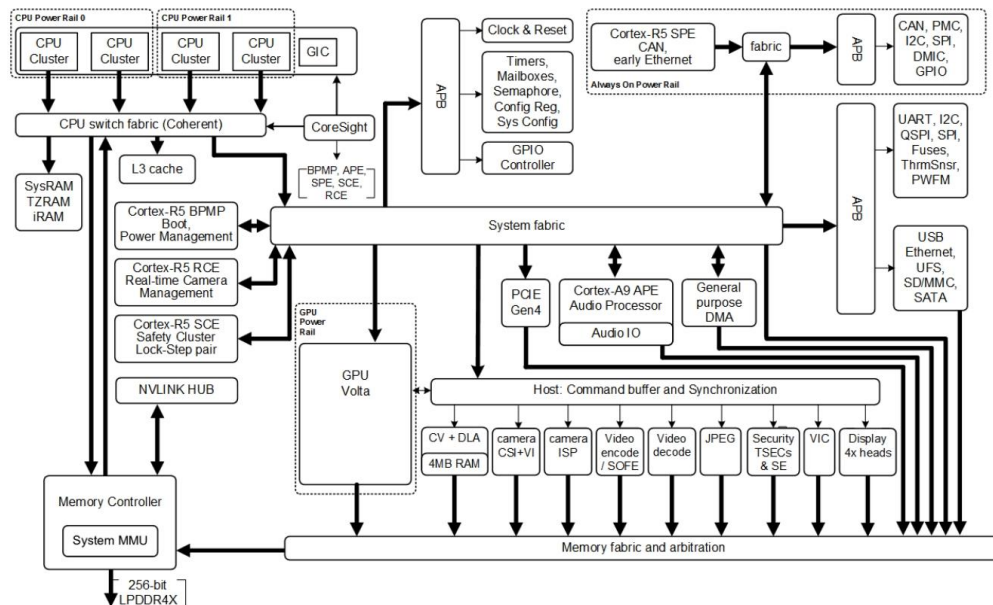
| Item | Parameter |
|-----------------------|-----------------------------|
| Operating voltage | DC 9-32V |
| Operation memory | 32GB |
| Storage memory | 32GB, optional expanded SSD |
| Operating temperature | -20 to 70 °C |
| Operating humidity | 0 - 95%, no condensation |
| Storage temperature | -40 to 85 °C |
| Dimensions | 335mm*214mm*60mm |
| Weight | ≤3700g |
| Protection level | IP67 |

4.2 System Main Chip

The main chip of EAXVA04 is NVIDIA Jetson AGX Xavier which is designed for embedded autonomous driving control systems. The computing performance of different internal processors is listed below.

- 8-Core CPU: 8-Core Carmel CPU based on ARMv8 ISA
- Deep Learning Accelerator (DLA): 5 TFLOPS (FP16) | 10 TOPS (INT8)
- Volta GPU: 512 CUDA cores | 20 TOPS (INT8) | 1.3 TFLOPS (FP32)
- Vision Processor: 1.6 TOPS
- Stereo and Optical Flow Engine (SOFE): 6 TOPS
- Image Signal Processor (ISP): 1.5 Giga Pixels/s
- Video Encoder: 1.2 GPix/s
- Video Decoder: 1.8 GPix/s

The internal structure of the chip is shown below:



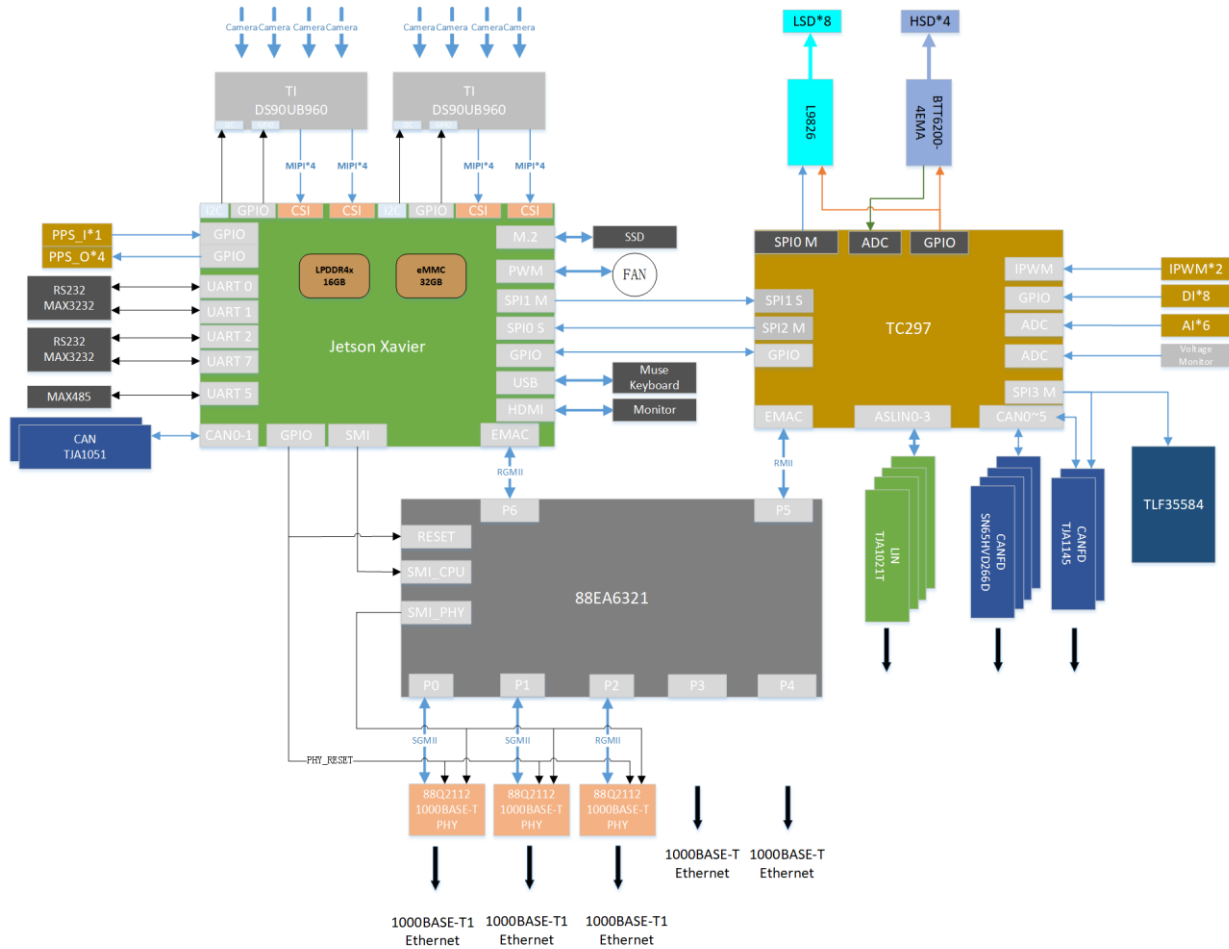
The microcontroller used in EAXVA04 is Infineon TC297 which has a TriCore™ architecture, working at 300MHz and has an ECC (Error Correction Code) protected RAM with a capacity of up to 728KB + 8MB, designed based on ISO26262, supporting up to ASIL-D. By working with a system

basic chip (SBC), a hardware core security architecture design is realized. 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 EAXVA04 is shown below:

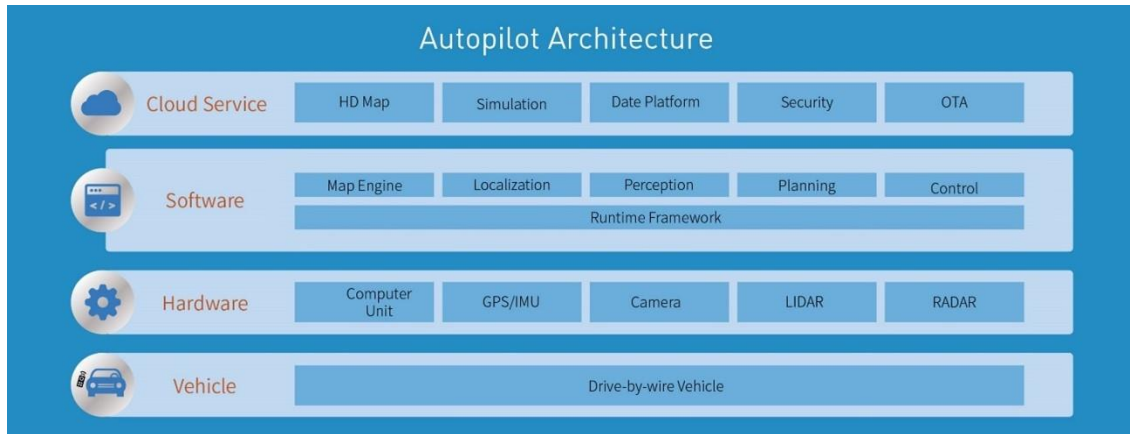


Chapter 5 SoC Basic Software

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 EAXVA04 consists of Runtime Framework and other components. The Runtime Framework is ROS (Robot Operating System) Melodic.

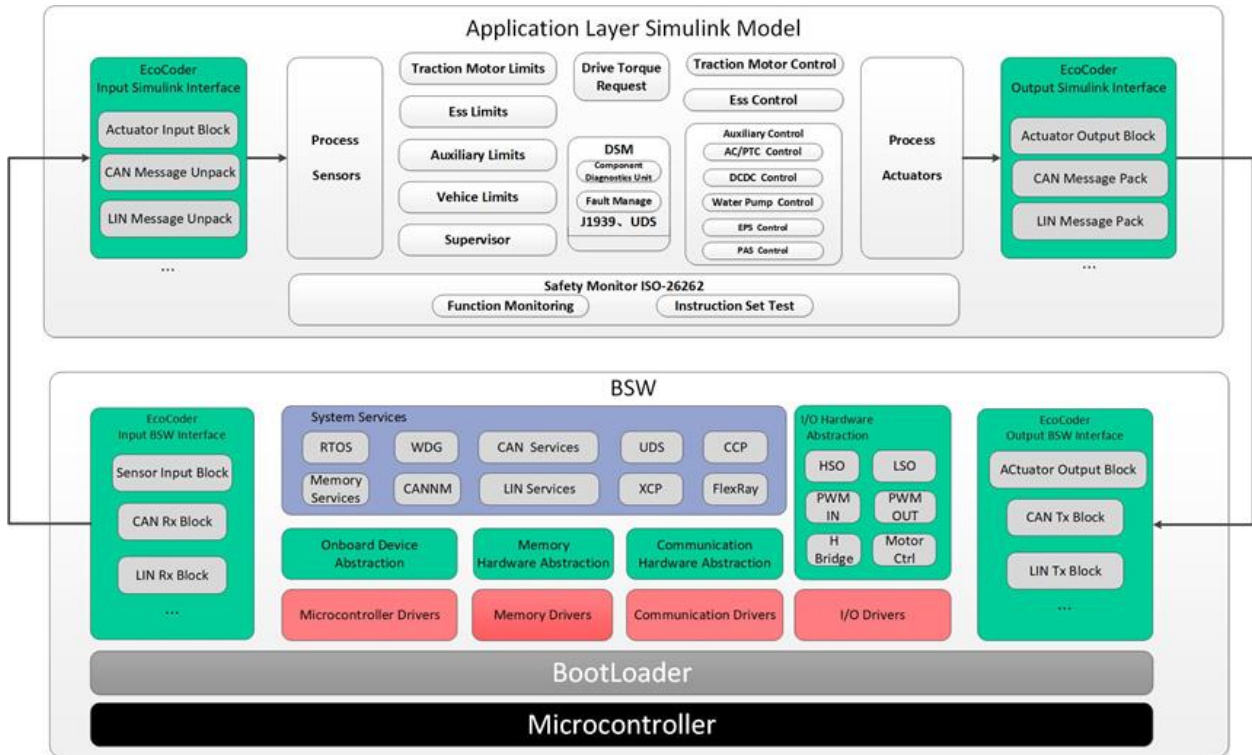
Linux is a bridge connecting the hardware and the users, providing functions such as Process Management, Memory Management, File System, Network, Security, User Interface, and Device

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.



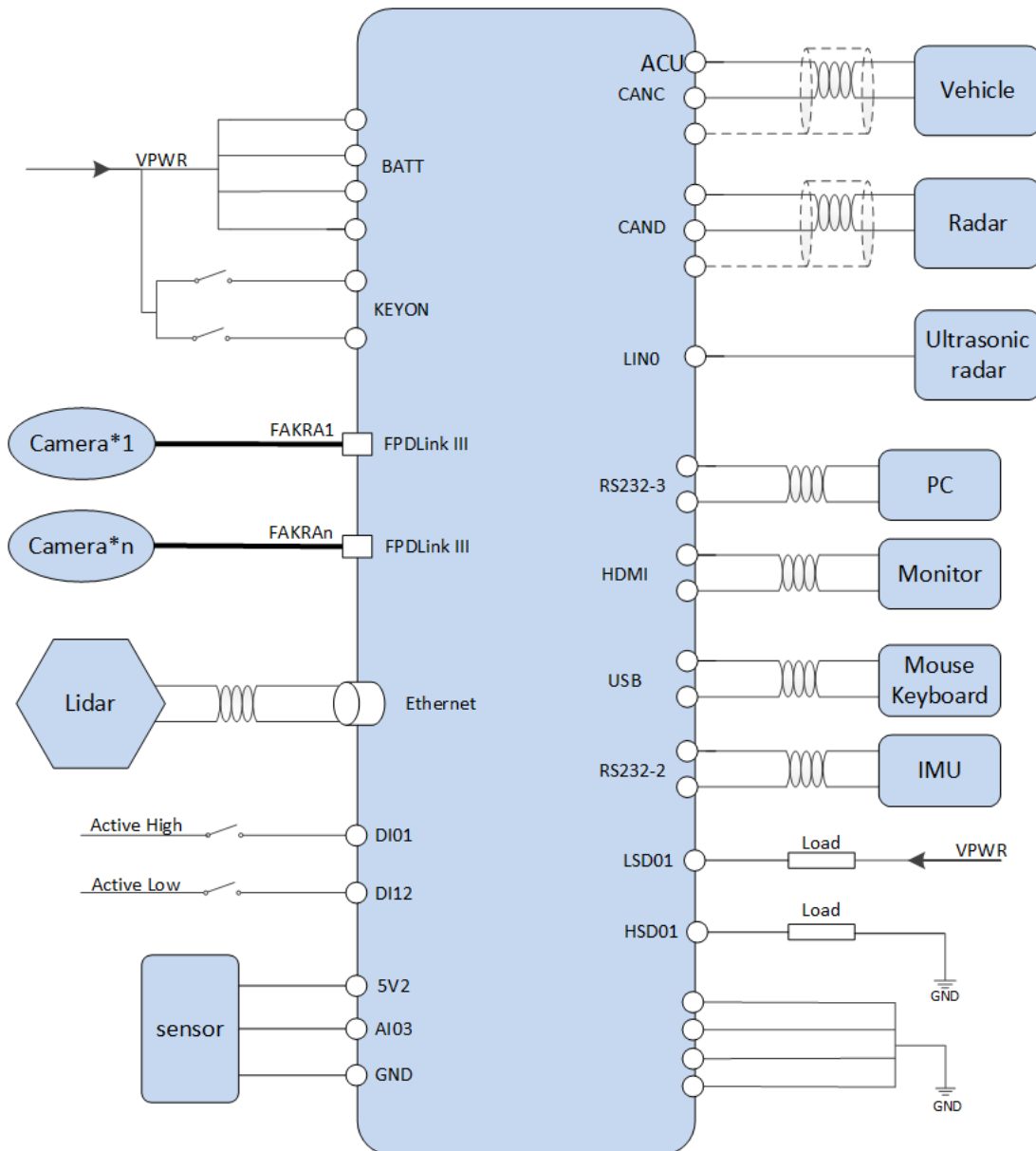
The software architecture of the MCU inside EAXVA04 is designed according to AUTOSAR, which is divided into Application Software Layer and Basic Software Layer. Basic Software Layer consists of a microcontroller abstraction layer, an ECU abstraction layer, a service layer, and a complex driver. Application 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 with 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.



Chapter 6 Demo Application

A demo for an autonomous driving hardware platform is shown below, which consists of EAXVA04 and sensors.

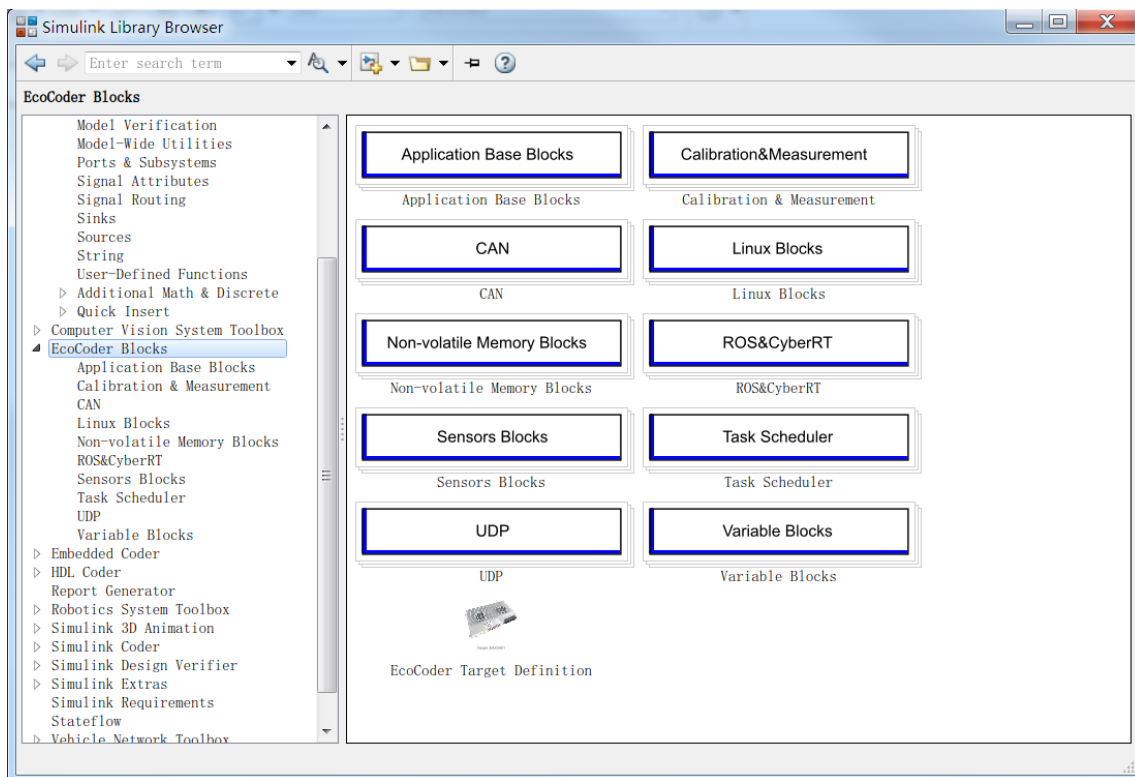


Chapter 7 Development Tool

A combination of hardware, operating system stacks, and runtime environments are not capable enough to realize autonomous driving, therefore, users need to develop software that can perform specific functionality and deploy them to EAXVA04. For autonomous driving processor Xavier, 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.

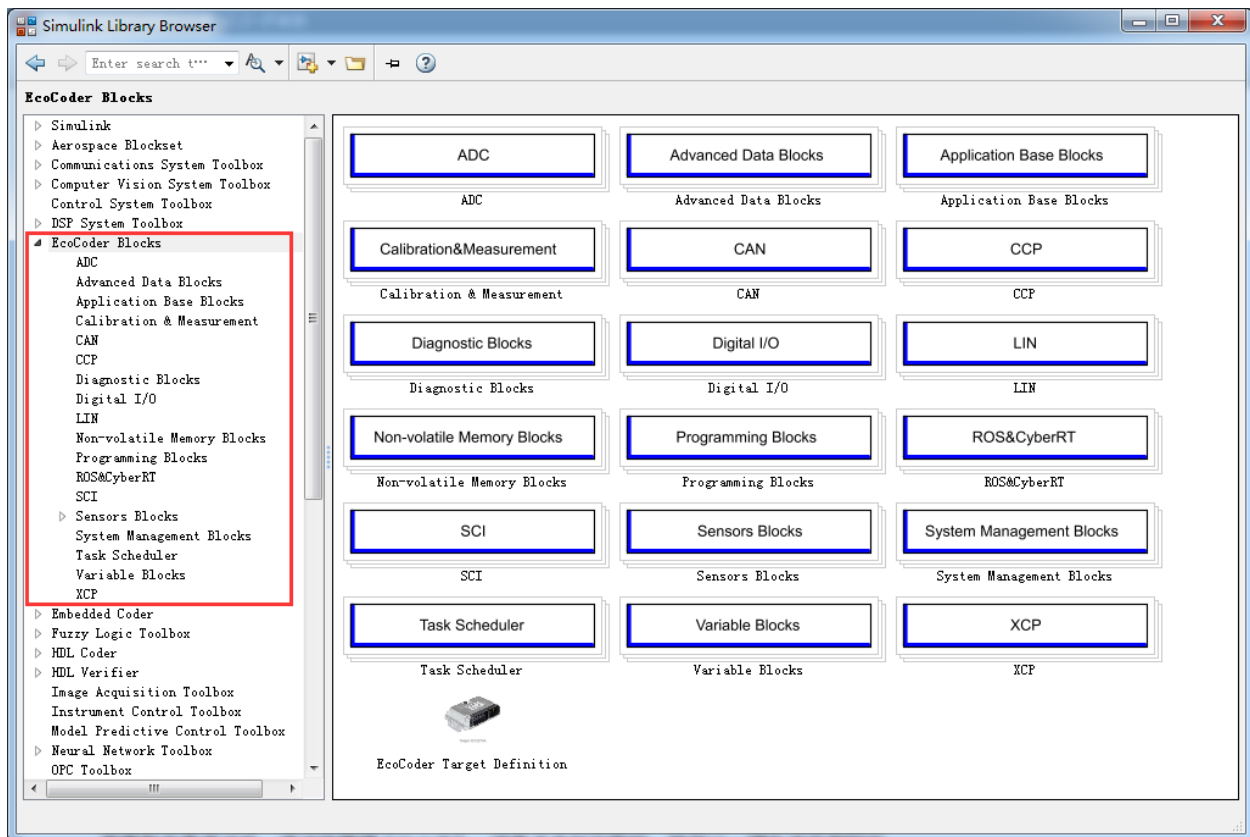


7.2 EcoCoder

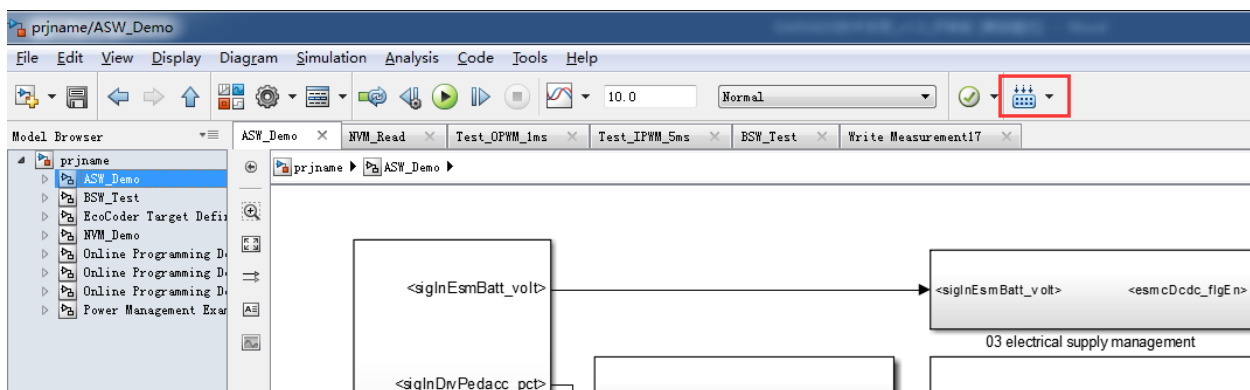
EcoCoder is an application development tool for the control system, which makes it easier for users to develop embedded application software in the Simulink environment. It expands the resources of Simulink and Real-Time Workshop embedded encoders to generate the necessary code module and automatically 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.



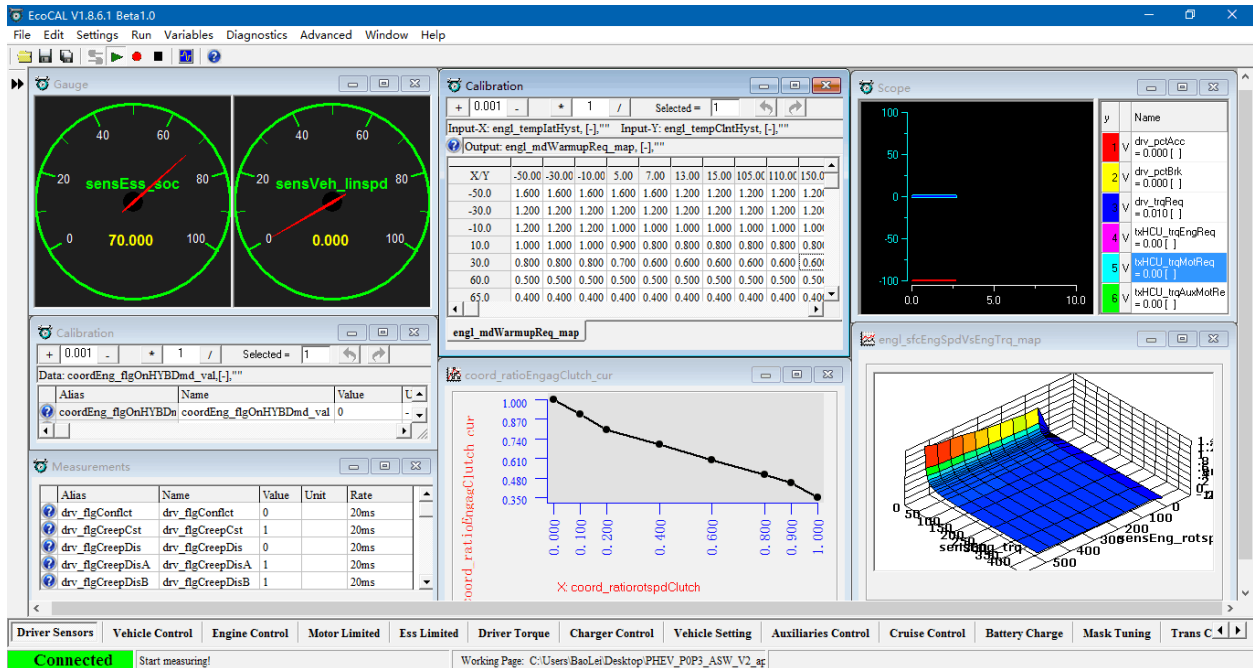
After compilation of the model, use the shortcut “Ctrl + B” or click the button shown below, the executable (ready-to-flash) files will be generated.



Developers can use EcoCoder to develop application software for MCU in EAXVA04. Please refer to EcoCoder User Manual for details.

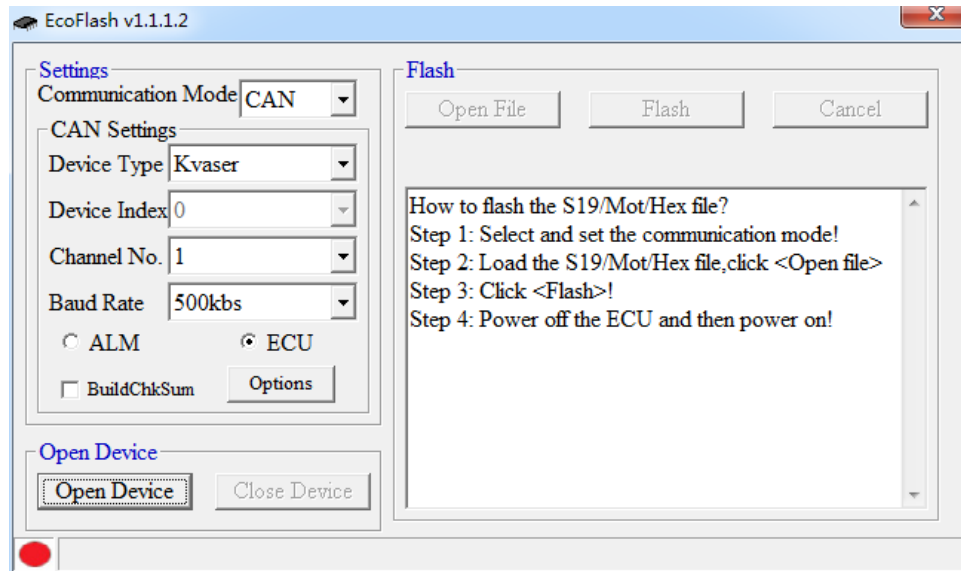
7.3 EcoCAL

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.



Chapter 8 Installation Requirements

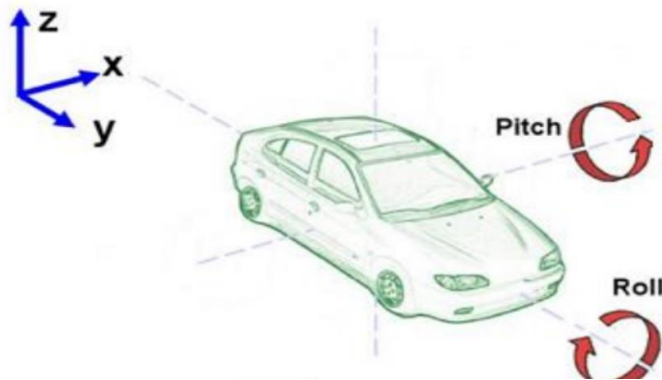
It is recommended to install the ADCU in the cabin. If the OEM wants to install the ADCU at another location, the corresponding installation location should be evaluated by Ecotron's engineers and the OEM's engineers.

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. Avoid installing in places where dust is prone to gather, a large amount of dust accumulation will affect the reliability of ADCU functionality.
3. ADCU should keep away from location where the temperature of the shell may be out of the $-15^{\circ}\text{C}\sim 70^{\circ}\text{C}$ operating temperature. It is necessary to prevent the surrounding parts from releasing heat to the ADCU. ADCU should be installed in places that allow for air circulation to aid in heat dissipation.
4. Avoid installing the ADCU in locations where it may be subject to oil, moisture, and water

splashes.

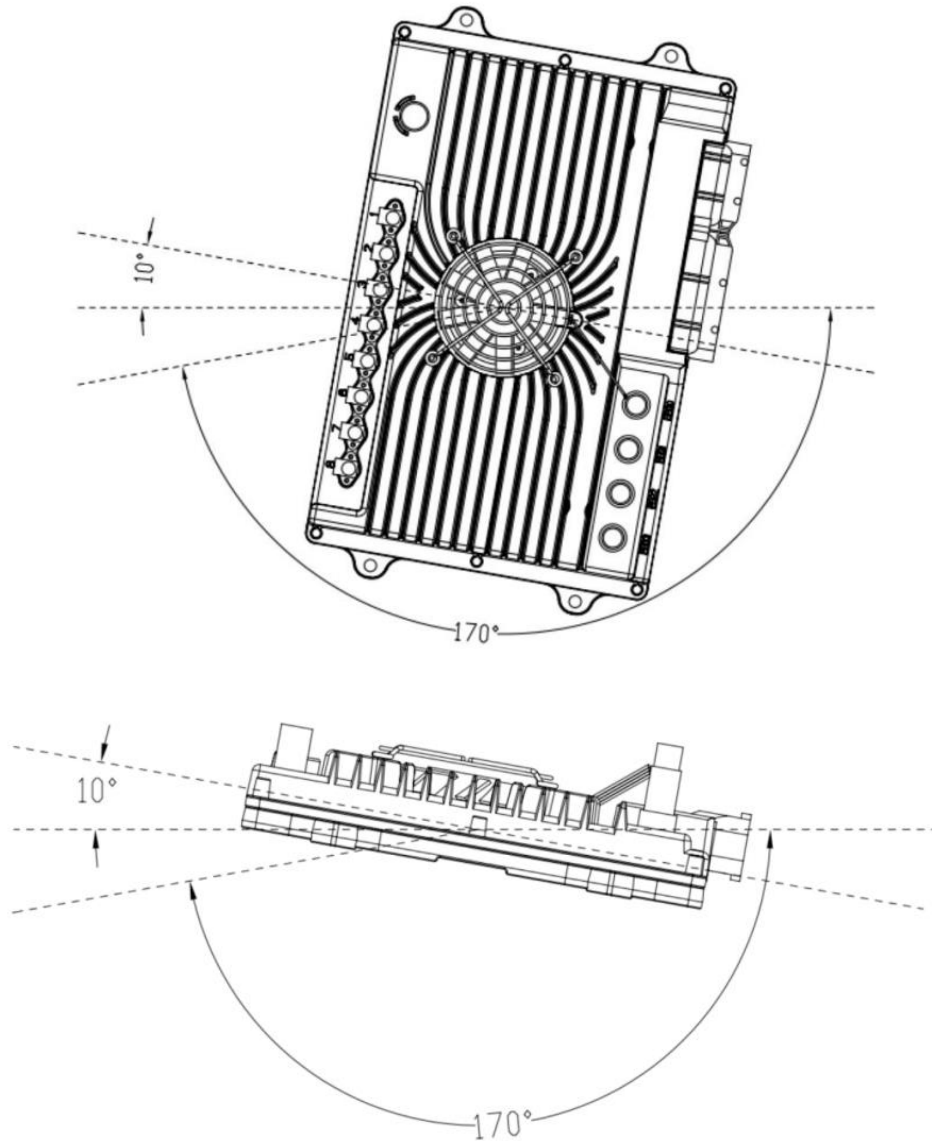
5. Avoid installing the ADCU in locations where it may be subject to the additional mechanical shock and external impact due to the installation position and mounting method of the ADCU and avoid installing the ADCU at the resonance point of the car body.
6. Avoid installing the ADCU in locations where it may come into contact with the battery or other parts that are prone to seepage of acid and alkaline solutions, and where it may be subject to corrosion.
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 orientation, the recommended installation angle is -170° to -10° , as shown in Figure below. In the vertical orientation, the recommended installation angle is -170° ~ -10° , as shown in Figure below.



α

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 harnesses, network cables, video cables, etc. should keep away from areas of high voltage, radiation interference such as motors, battery packs, DCDCs as far as possible.