EAORA10

Datasheet

V1.0.0

ECOTRON CORPORATION

www.ecotron.ai

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1. Overview

The EAORA10 product is an intelligent computing platform developed by ***Ecotron Corporation*** for autonomous driving systems, aimed at L3-L4 level integrated driving and parking solutions. It integrates an NVIDIA ORIN NX 16G / NVIDIA ORIN NX 8G / NVIDIA ORIN Nano 8G / NVIDIA ORIN Nano 4G chip and an Infineon TC377 chip, combining high-precision maps and positioning navigation. For driving, it can achieve L3-level highway pilot (HWP), traffic jam pilot (TJP), and automatic navigation driving (NOP) functions. For parking, it can reach L4-level memory parking (HPA) and valet parking (AVP) functions.

2. Interface Configuration

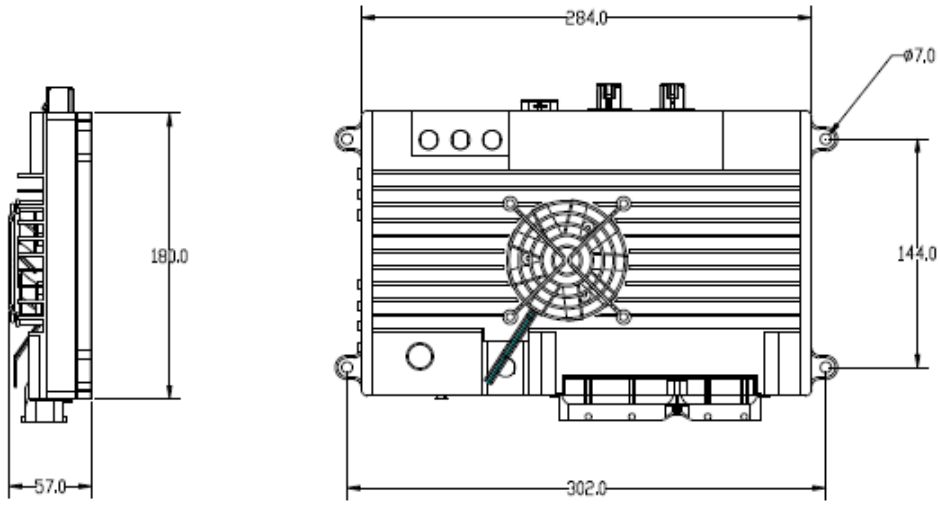
Interface Type	Quantity	Function	Internal Chip	Connector
Camera Interface	8	GMSL/GMSL2	SOC	2*4 Cavity Connector
100M Automotive Ethernet	1	100Base-T1	Switch	1*4 Cavity Connector
1G Automotive Ethernet	3	1000Base-T1	Switch	
Standard 1G Automotive Ethernet	3	100BASE-T/1000BASE-T Standard	Switch	3*Aviation Plugs
HDMI	1		SOC	
USB	1	1 USB Host supports USB 2.0, USB 3.0, USB 3.1	SOC	
M.2 KEY M	1	Expandable Storage	SOC	Internal
GNSS	1	Optional	SOC	
WIFI	1	Optional	SOC	
4G	1	Optional	SOC	
5G	1	Optional	SOC	
Audio Interface	1	Optional	SOC	
CANFD	2		SOC	121PIN-CMC
RS232	2	One of the ports is used for Debugging	SOC	
PPS_IN	1	Supports 5V-16V	SOC	
PPM	1		SOC	
Wheel Speed	1		GNSS	
Steering	1		GNSS	
CANFD	8	2 Channels with Specific Frame Wakeup	MCU	
KEYON	3	1 Channel for SoC, 2 Channels for MCU	MCU	
Digital Acquisition	6	Default configuration, 4 High-Active Channels, 2 Low-Active Channels	MCU	
Analog Acquisition	6	Default configuration, 2 Channels with 5V voltage type, 2 Channels with 36V voltage type, 2 Channels with resistor type	MCU	
Low-Side Drive	8	8 Channels @ 250mA	MCU	
High-Side Drive	4	4 Channels @ 1A	MCU	

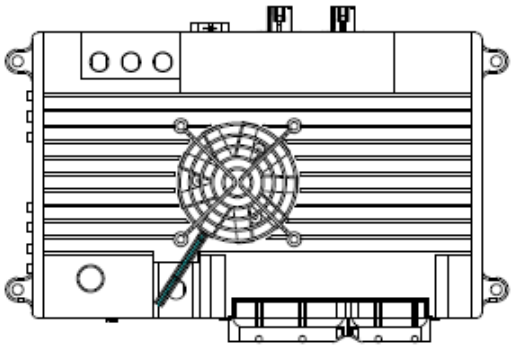
5V Sensor Power Supply	2	Maximum Current 100mA	MCU	
Power Positive	6			
Power Ground	7			
Signal Ground	9			

3. Mechanical Structure

3.1 Dimensional Drawing

The exterior of the controller's housing has no special treatment or coatings and is free of sharp burrs or edges.





4. Hardware Description

The hardware circuitry of this computing platform is designed based on the application requirements of autonomous driving systems. The electrical parameters meet automotive-grade standards and the platform is equipped with various data transmission interfaces to meet the demands of multi-sensor fusion in autonomous driving systems. The main chip includes multiple high-performance computing units, suitable for both sequential and parallel computing characteristics of autonomous driving.

4.1 Specifications and Parameters

Item	Design Specifications
Working Voltage	DC 9～36V
Operating Memory	8GB
Storage Space	512GB SSD
Operating Temperature	-25～70℃
Operating Humidity	0～95%，no condensation
Storage Temperature	-40～85℃
Dimensions	317*180*57mm
Waterproof Rating	IP67
Cooling Method	Air Cooling

4.2 Device Ports

4.2.1 Port Distribution

The distribution of input and output ports on this computing platform is shown in the figure below. All the views shown are front views.

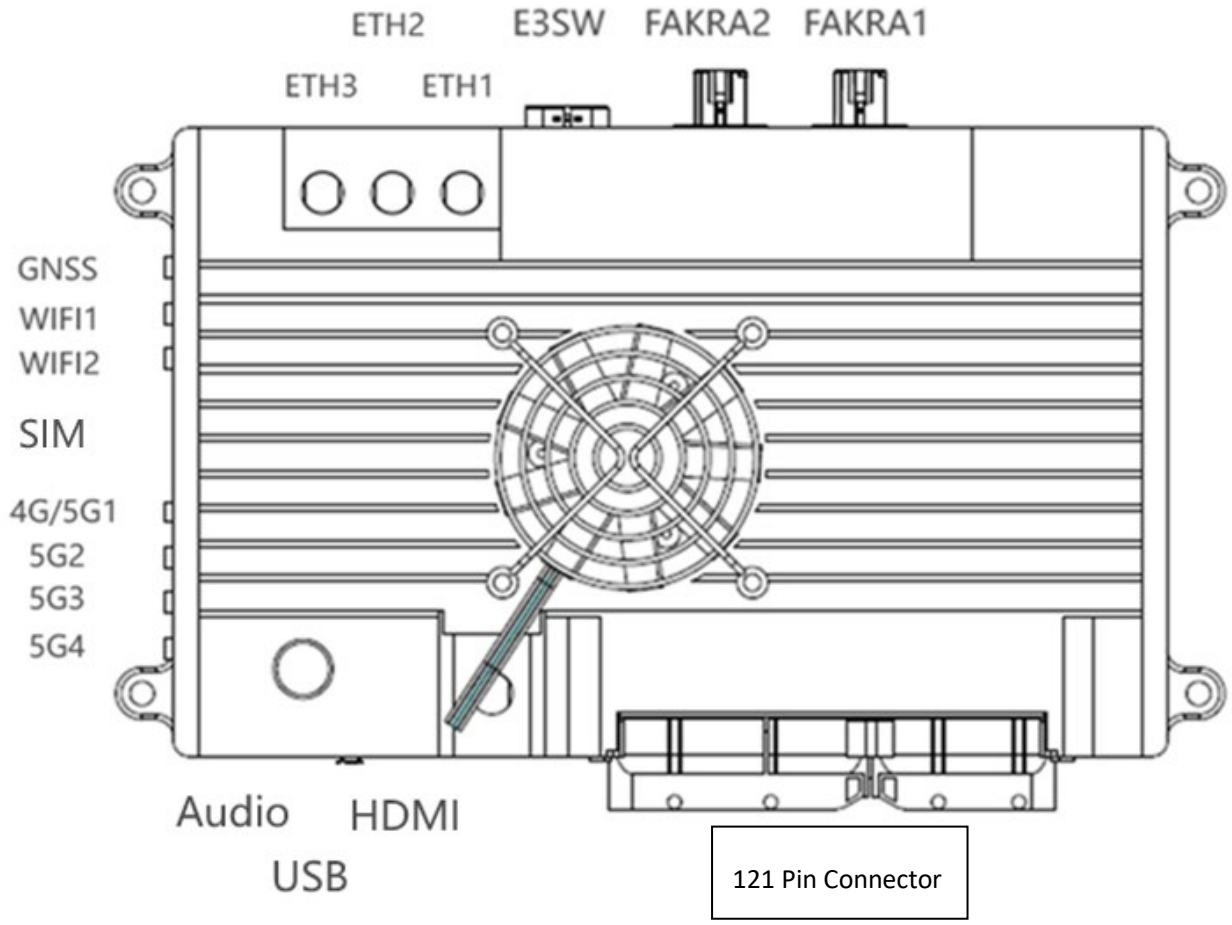


Figure 1: Top View of the Controller

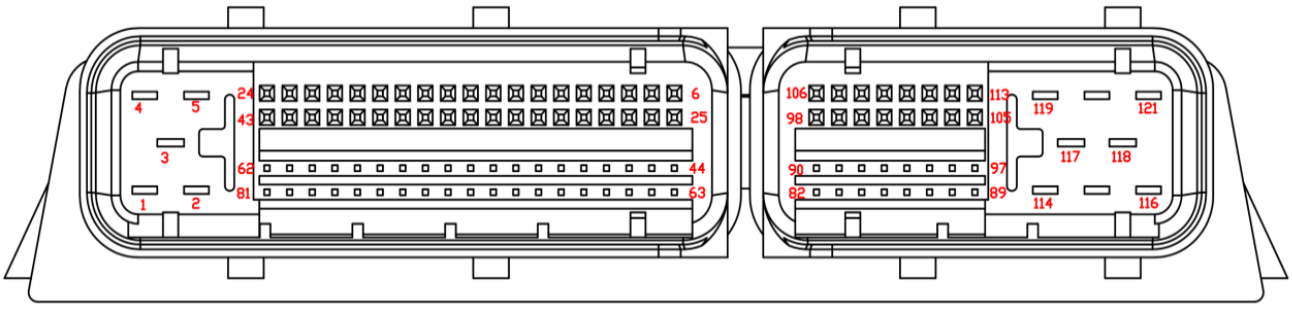


Figure 2: 121 Pin Connector

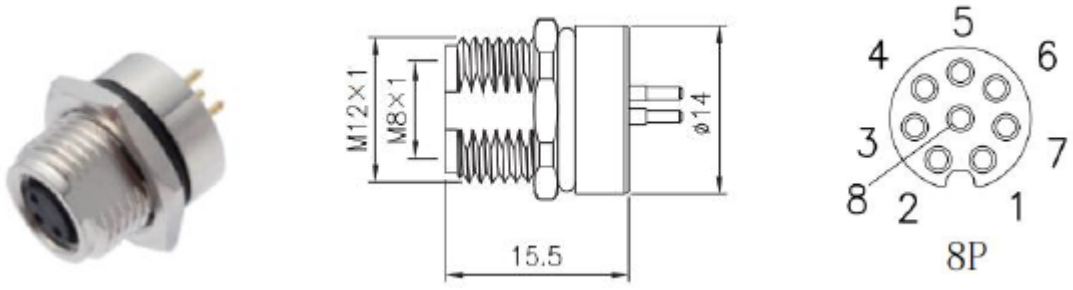


Figure 3: Standard Ethernet Connector

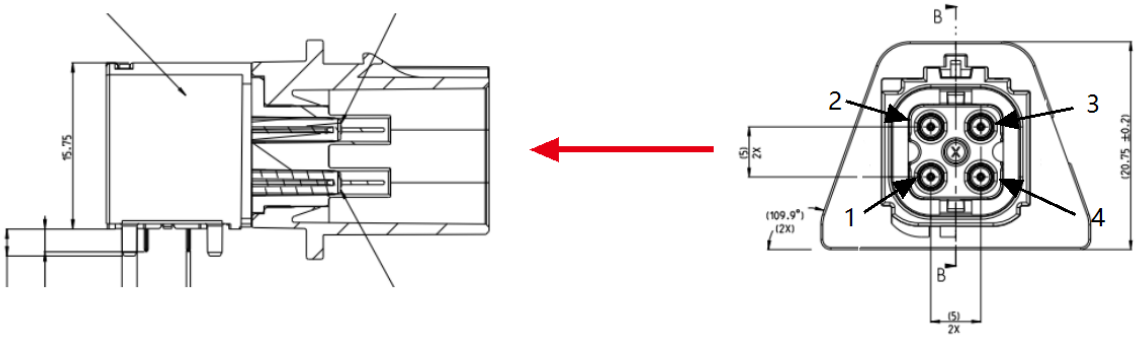


Figure 4: Camera Connector

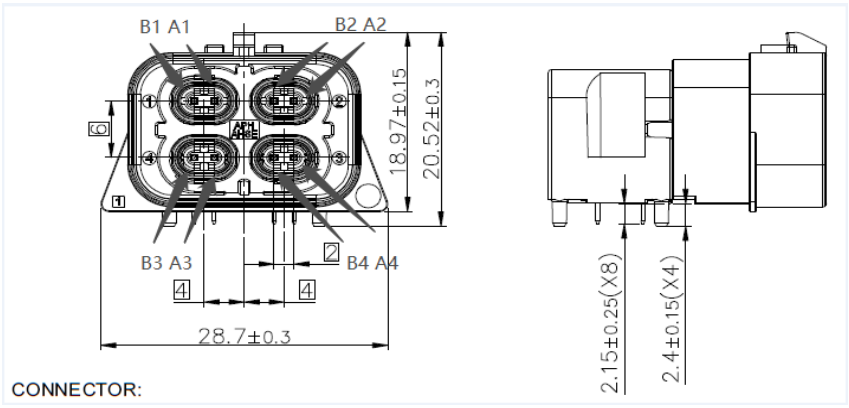


Figure 5: Automotive Ethernet Connector

Figure 6: Antenna Connector

4.3 System Main Chip

The autonomous driving processor inside the EAORA10 is the ORIN NX/NANO chip, which is designed by NVIDIA for embedded intelligent systems, including autonomous driving systems. The computational performance of the different processors is listed below:

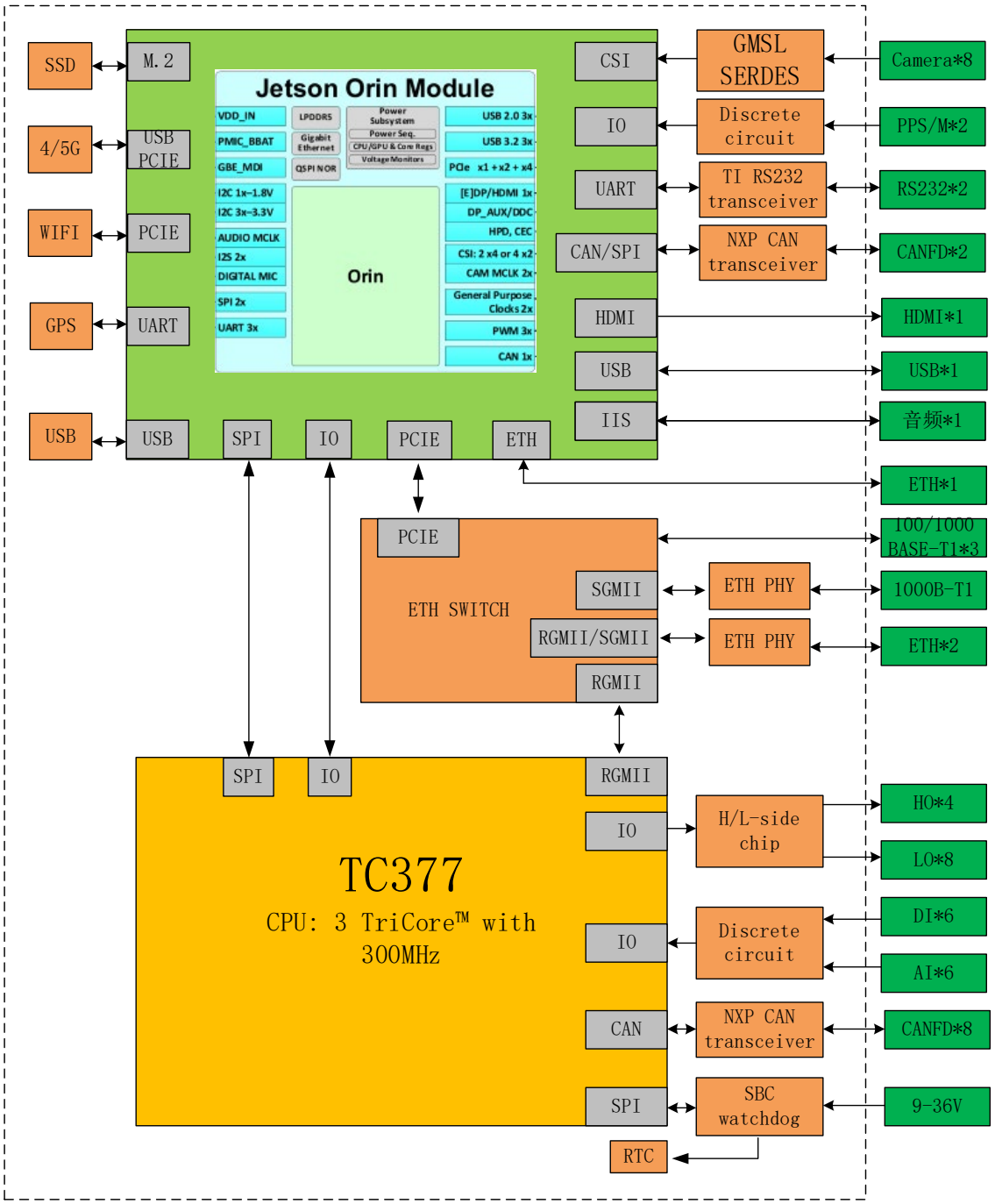
	Jetson Orin NX Series		**Jetson Orin Nano Series**	
SOM	Jetson Orin NX 16GB	Jetson Orin NX 8GB	Jetson Orin Nano 8GB	Jetson Orin Nano 4GB
AI Performance	157 TOPS	117 TOPS	67 TOPS	34 TOPS
GPU	1024-core NVIDIA Ampere architecture GPU with 32 Tensor Cores		1024-core NVIDIA Ampere architecture GPU with 32 Tensor Cores	512-core NVIDIA Ampere architecture GPU with 16 Tensor Cores
Max GPU Frequency	1173 MHz	1173 MHz	1020 MHz	1020 MHz
CPU	8-core Arm® Cortex®-A78AE v8.2 64-bit CPU 2MB L2 + 4MB L3	6-core Arm® Cortex® A78AE v8.2 64-bit CPU 1.5MB L2 + 4MB L3	6-core Arm® Cortex® A78AE v8.2 64-bit CPU 1.5MB L2 + 4MB L3	
Max CPU Frequency	2 GHz		1.7 GHz	
	16GB 128-bit LPDDR5 102.4GB/s	8GB 128-bit LPDDR5 102.4GB/s	8GB 128-bit LPDDR5 68 GB/s	4GB 64-bit LPDDR5 34 GB/s
Video Encoding	1x 4K60 (H.265) 3x 4K30 (H.265) 6x 1080p60 (H.265) 12x 1080p30 (H.265)		1080p30, supported by 1-2 CPU cores	
Video Decoding	1x 8K30 (H.265) 2x 4K60 (H.265) 4x 4K30 (H.265) 9x 1080p60 (H.265) 18x 1080p30 (H.265)		1x 4K60 (H.265) 2x 4K30 (H.265) 5x 1080p60 (H.265) 11x 1080p30 (H.265)	

The microcontroller inside the EAORA10 uses Infineon's TC377 series chip, which features a 3-core TriCore™ architecture with a working frequency of 300 MHz. It includes up to 1.1MB + 6MB of RAM with ECC (Error Correction Code) protection. The chip supports ASIL-D, the highest safety level requirement. Together with the basic chip, it enables the design of a hardware core safety architecture. The chip resources are as follows:

Feature	Detail
Micro Control Core	32-bit Infineon TC377TP
Maximum Frequency	300MHz
Flash	6MB
SRAM	1.1MB
EEPROM	256K
Float Point Capability	Yes
SBC	TLF35584

4.4 Circuit Diagram

The internal hardware circuit structure of the EAORA10 is shown in the figure below.

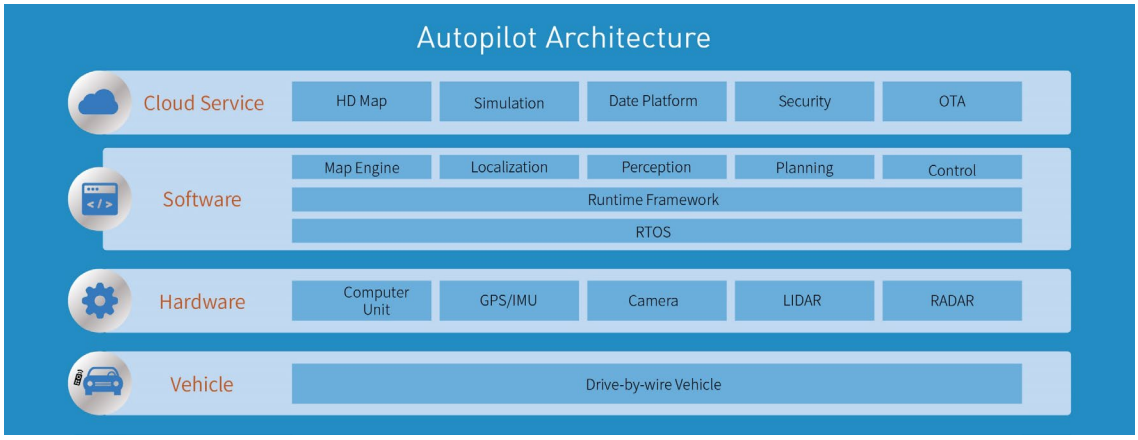

Jetson Orin Module
VDD_IN
PMIC_BBAT
GBE_MDI
I2C 1x-1.8V
I2C 3x-3.3V
AUDIO MCLK
I2S 2x
DIGITAL MIC
SPI 2x
UART 3x
LPDDR5
Gigabit Ethernet
QSPI NOR
Power Subsystem
Power Seq.
CPU/GPU & Core Regs
Voltage Monitors
USB 2.0 3x
USB 3.2 3x
PCIe x1 + x2 + x4
[E]DP/HDMI 1x
DP_AUX/DDC
HPD, CEC
CSI: 2 x4 or 4 x2
CAM MCLK 2x
General Purpose Clocks 2x
PWM 3x
CAN 1x
Orin
SSD
M.2
4/5G
USB PCIE
WIFI
PCIE
GPS
UART
USB
USB
SPI
IO
PCIE
ETH
CSI
IO
UART
CAN/SPI
HDMI
USB
IIS
GMSL SERDES
Discrete circuit
TI RS232 transceiver
NXP CAN transceiver
Camera*8
PPS/M*2
RS232*2
CANFD*2
HDMI*1
USB*1
音频*1
ETH*1
PCIE
ETH SWITCH
SGMII
RGMII/SGMII
RGMII
ETH PHY
ETH PHY
100/1000 BASE-T1*3
1000B-T1
ETH*2
SPI
IO
RGMII
IO
IO
CAN
SPI
TC377
CPU: 3 TriCore™ with 300MHz
H/L-side chip
Discrete circuit
NXP CAN transceiver
SBC watchdog
RTC
HO*4
LO*8
DI*6
AI*6
CANFD*8
9-36V

5. Basic Software

The SOC software system of this computing platform is custom-developed for autonomous driving systems. The figure below shows a typical block diagram of an autonomous driving system. The software system of this platform includes components such as RTOS and the Runtime Framework. The RTOS is the Linux operating system, and the Runtime Framework is the melodic version of ROS (Robot Operating System).

The Linux operating system bridges the gap between the underlying hardware and the user. Users can input commands through the system's user interface, and the operating system interprets the commands, drives the hardware, and fulfills the user's requests. The Linux operating system provides the following functionalities: process management, memory management, file system, networking, security mechanisms, user interface, and device drivers.

ROS offers standard operating system services such as hardware abstraction, low-level device control, common functionalities, inter-process communication, and data packet management. ROS is based on a graph architecture, allowing processes from different nodes to receive, publish, and aggregate various types of information (such as sensing, control, status, planning, etc.).



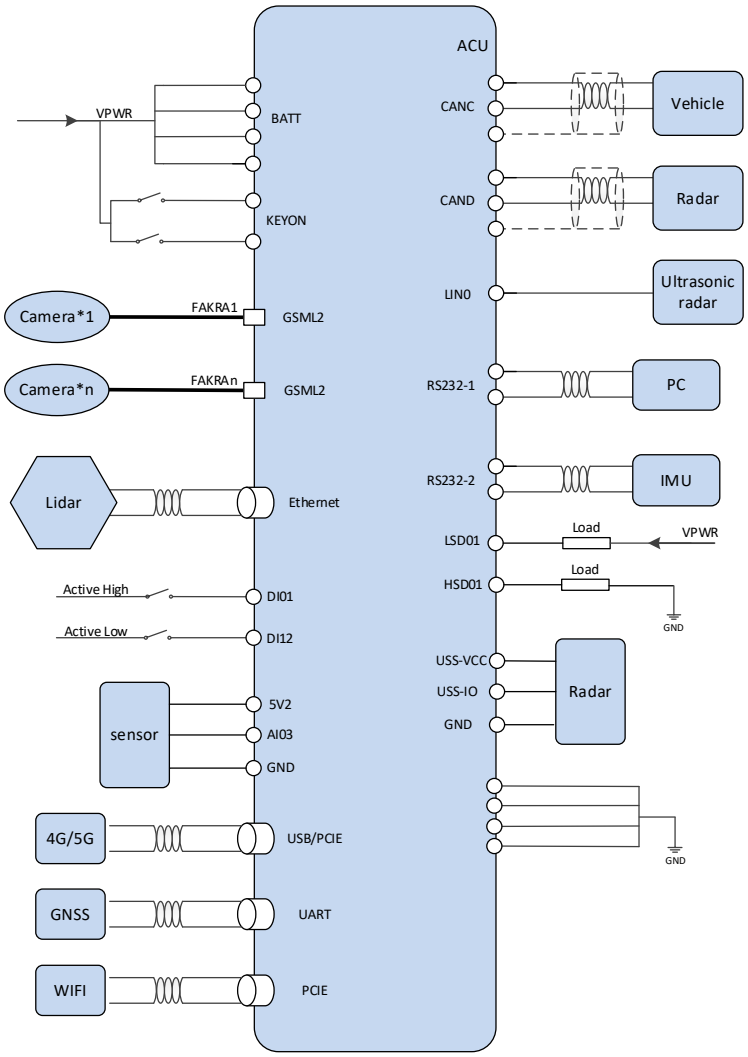
The MCU software architecture inside the ORIN computing platform is designed with reference to the AUTOSAR architecture standard, divided into the application software layer and the basic software layer. The basic software layer is further divided into the microcontroller abstraction layer, ECU

abstraction layer, service layer, and complex drivers.

The application software and basic software are integrated through EcoCoder. EcoCoder uses the s-function in Simulink to encapsulate the underlying interfaces into the Simulink block library. Application developers can use Simulink to build application-layer models and generate executable program files adapted for the TC377 with a single click in Simulink.

6. Application Scenarios

The EAORA10 is used in the field of autonomous driving, forming the hardware platform of an autonomous driving system in conjunction with sensors. The common connection methods are shown in the figure below.



7. Development Tools

The MCU software architecture inside the ORIN computing platform is designed with reference to the AUTOSAR architecture standard, divided into the application software layer and the basic software layer. The basic software layer is further divided into the microcontroller abstraction layer, ECU abstraction layer, service layer, and complex drivers.

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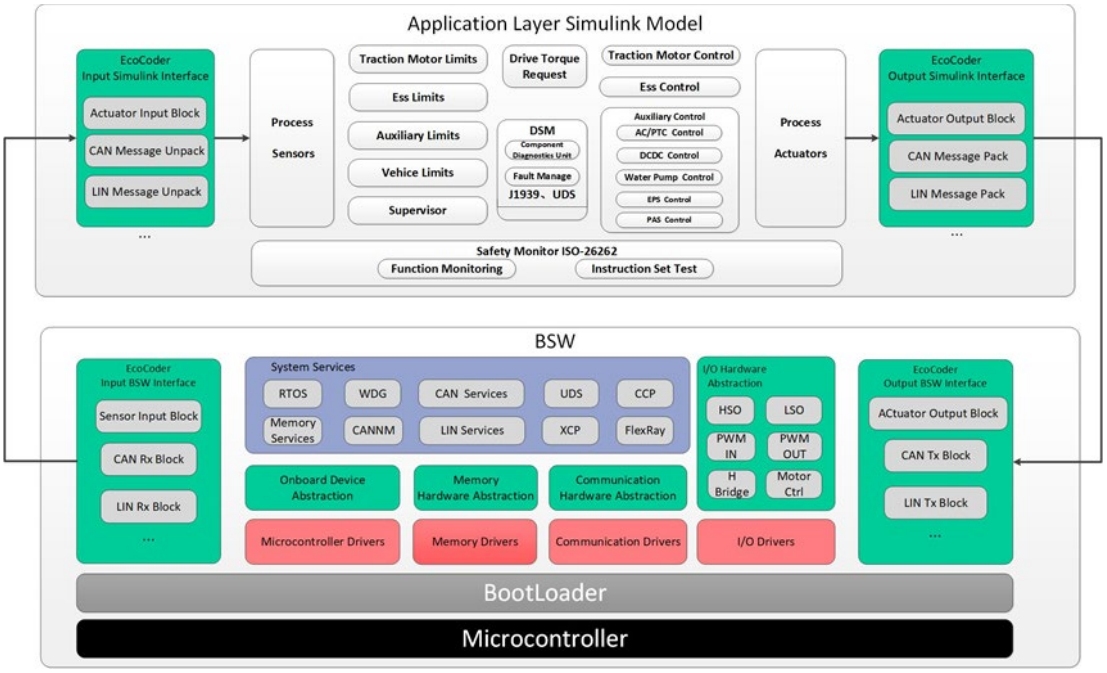
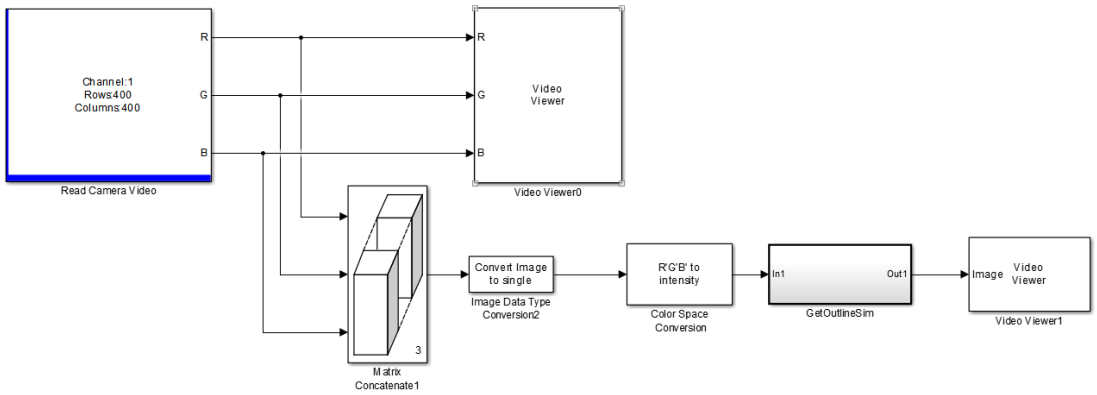


7.1 EcoCoder-AI

EcoCoder-AI is a powerful automatic code generation library based on Matlab/Simulink, directly linked to the target controller, enabling the import of image data and LiDAR data into the Simulink

environment. EcoCoder-AI integrates code generation, compilation, and one-click executable file generation. It allows control models built in Simulink to be directly converted into ROS-based executable programs suitable for the target controller, and then downloaded to the target controller. Additionally, it can accelerate GPU data processing. For more details, please refer to the document *"EcoCoder-AI User Manual."*



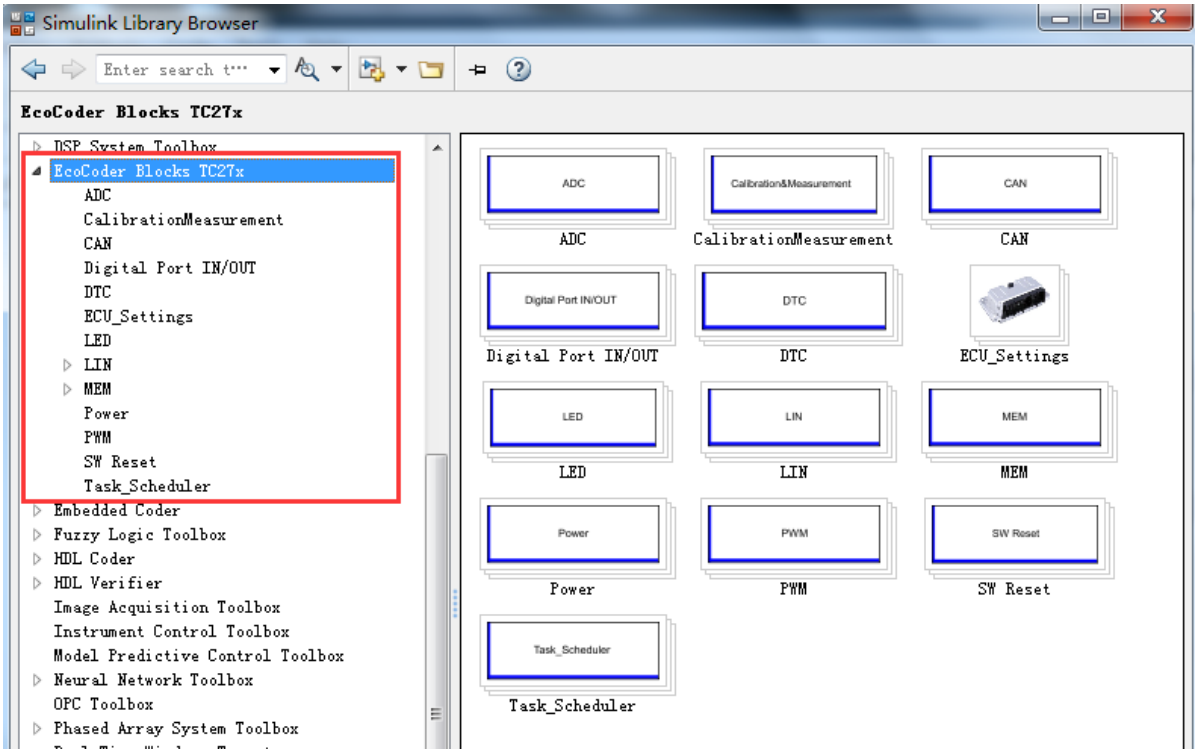
7.2 EcoCoder

EcoCoder is an application development tool for control systems that allows users to develop embedded application-layer programs more conveniently in the Simulink environment. It extends Simulink and Real-Time Workshop by providing the necessary code module resources for embedded coder generation, enabling automatic configuration and optimization of code generation. The basic software library is encapsulated as an s-function, allowing developers to use basic software interfaces and perform some basic parameter configurations in a graphical manner. It enables one-click generation of executable files and data description files, and provides an A2L address update tool.

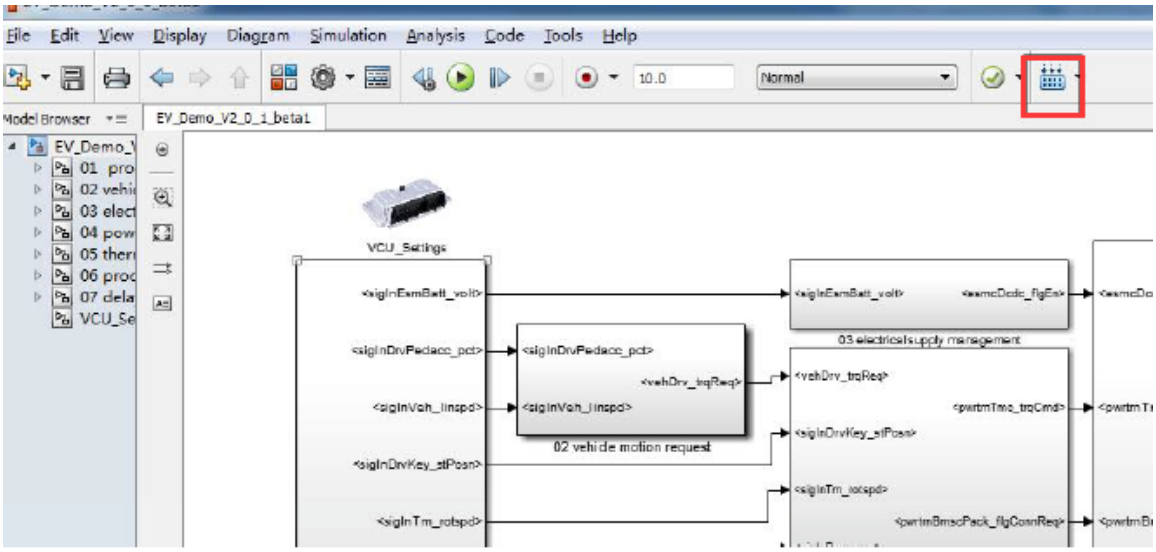
Features:

- Users can develop embedded application-layer programs in the Simulink environment.
- Application developers can focus on control strategy development without needing to worry too much about microcontroller and hardware platform aspects, thus reducing the cost of involving low-level software and hardware engineers.

- The basic software library is encapsulated as an s-function, allowing developers to use basic software interfaces and configure parameters in a graphical way, making it easier for application developers to use low-level software.
- From the application layer model, executable files and data description files can be generated with a single click, and an A2L address update tool is provided. Automatic integration is used to automatically integrate the code generated from the application layer model with the underlying software in the background, and the makefile method is used to automatically invoke the compiler to compile and generate executable files. This eliminates the need for manual integration of application and low-level software, reducing the cost of involving software integration engineers.



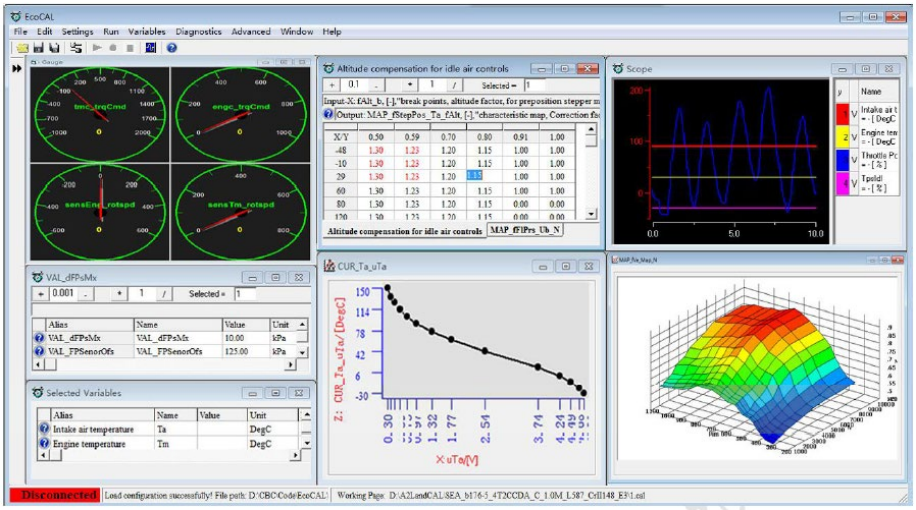
Once the model simulation passes, you can generate the flashable file with a single click by using the shortcut "Ctrl+B" or by clicking the icon shown below.



Application developers can use this tool to develop applications based on the MCU inside the autonomous driving domain controller. For more details, please refer to the document *"EcoCoder User Manual."*

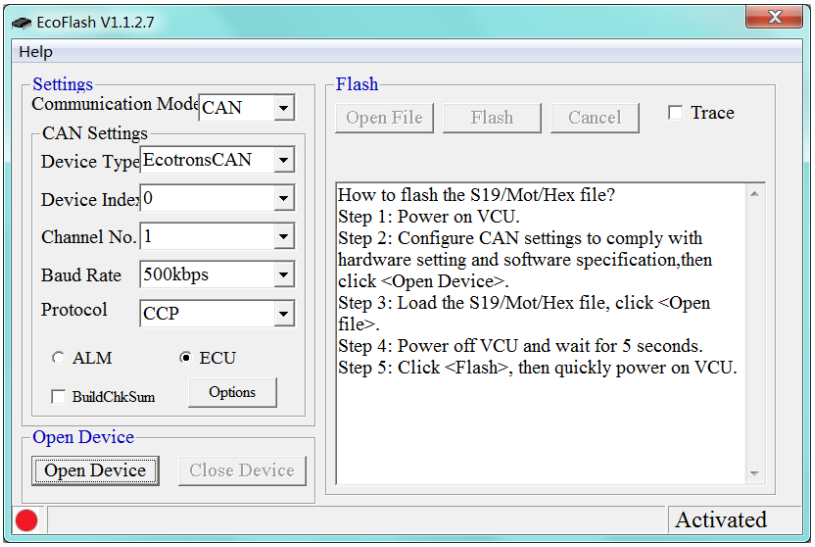
7.3 EcoCAL

EcoCAL is a PC-based calibration software using the CCP protocol. By loading A2L and hex files, it enables real-time observation of measured values and online calibration of calibration values. It assists control strategy developers in debugging and calibrating application software. For more details, please refer to the document *"EcoCAL User Manual."*



7.4 EcoFlash

EcoFlash is an upper computer software developed in-house, used in conjunction with BootLoader for online flashing of target program files. The CAN communication protocol uses CCP/UDS, and the supported target files for flashing include S19, mot, and hex formats.

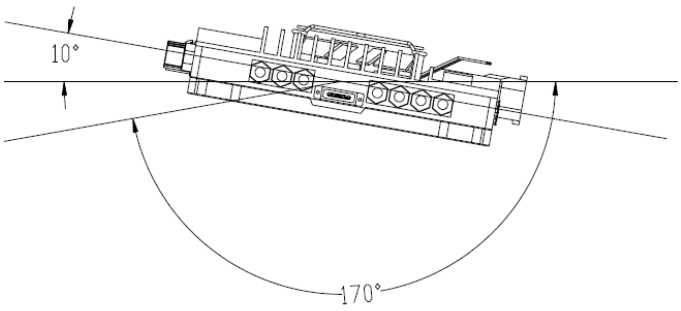


8. Installation Guidelines

Ecotron recommends installing the ADCU (Autonomous Driving Control Unit) inside the cockpit. If the vehicle manufacturer wishes to install the ADCU in another location, the installation position should be evaluated jointly by engineers from Ecotron and the vehicle manufacturer.

The following points should be noted when installing the ADCU:

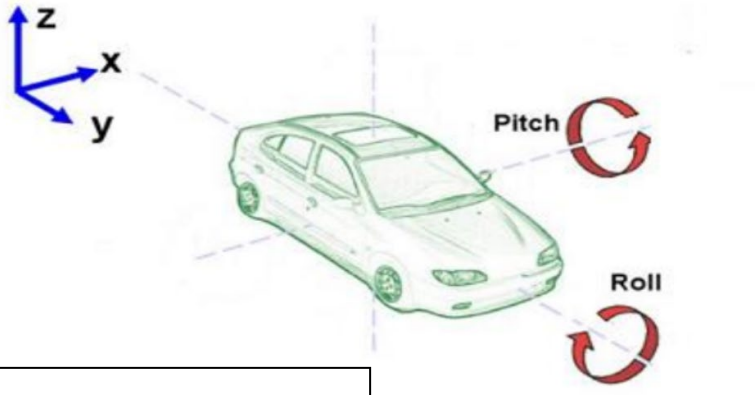
1. The ADCU and wiring harness must be securely and reliably installed, with no looseness. The ADCU should not be used to support the harness, and the layout of the ADCU wiring harness should protect all wires from damage caused by wear and overheating.
2. Installation in areas where dust can easily accumulate should be avoided, as large amounts of dust accumulation may affect the reliability of the ADCU's operation.
3. The ADCU should be installed away from locations where its casing temperature may exceed the range of -15°C to 70°C, and care should be taken to prevent heat radiation from surrounding parts from impacting the ADCU. It is recommended to install the ADCU in an area with good airflow to facilitate cooling.



4. The ADCU should be installed in areas where oil, moisture, or water splashes are unlikely to reach.
5. The installation location and method of securing the ADCU should prevent it from being subjected to additional mechanical vibration and external impact. Avoid installing the ADCU at

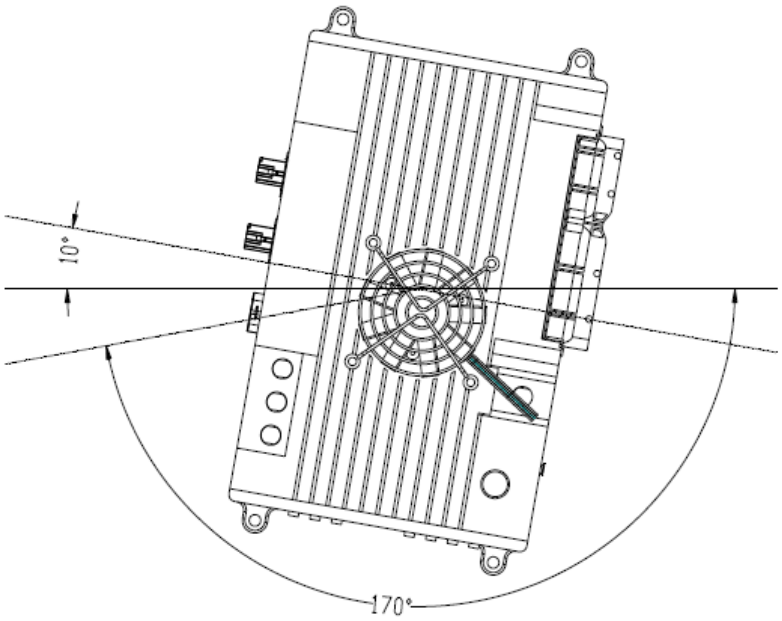
resonance points of the vehicle body.

6. The ADCU should not be installed in areas where it may come into contact with the battery or where acidic or alkaline solutions might leak, as well as in areas prone to corrosion.
7. The ADCU should be installed away from places where it might come into contact with the positive battery terminal or ignition power terminal.
8. When installing the ADCU, the connectors should be oriented at a downward angle both horizontally and vertically to prevent water from entering the connectors. The recommended horizontal installation angle is between -170° and -10°, and the recommended vertical installation angle is between -170° and -10°, as shown in the figure.



Z-axis: Vertical direction of the vehicle

X, Y-axis: Horizontal direction of the vehicle



Ecotron recommends using the four mounting points on the ADCU itself for installation and securing. It is recommended to use metal materials, such as aluminum alloy, for the mounting bracket, and the casing should be reliably electrically connected to the vehicle body through the bracket. If other materials are used, the customer must ensure that the ADCU's requirements for vibration, heat dissipation, temperature, and EMC (Electromagnetic Compatibility) are met. If there are any deviations, they must be confirmed with Ecotron.

9. During the installation of the wiring harness, ensure that high-speed signal cables, such as Ethernet cables and video cables, are kept as far away as possible from high-voltage and radiated interference areas like motors, battery packs, and DC-DC converters.