EAT4A02 Datasheet

V 1.0.0

Revision History

Date	Version	Detail	Reviewer
May 2024	V1.0	First Version	Terry Xu Chris Xu

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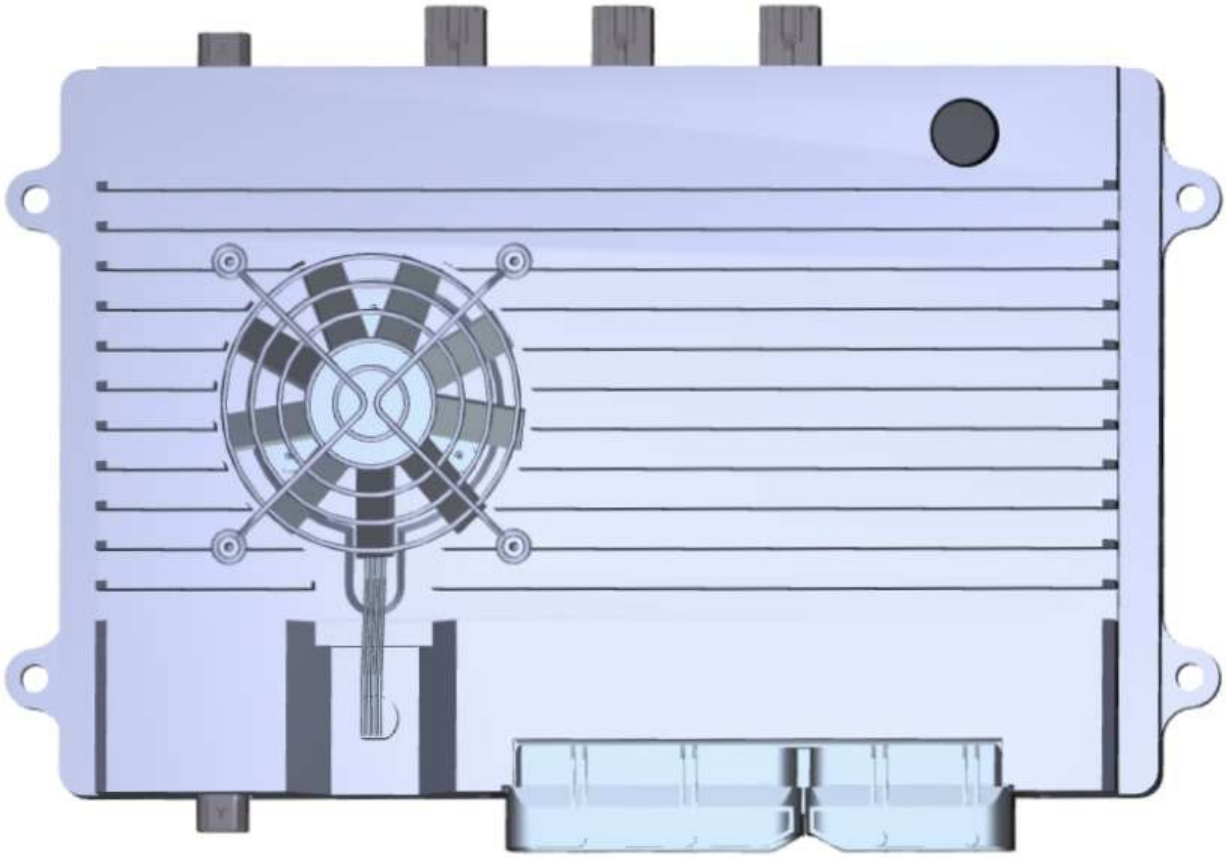
Contents

1. Overview

The EAT4A02 automotive intelligent driving computing platform integrates one TI TDA4 VH chip and one Infineon TC397 chip internally to meet automotive grade applications. It covers the application requirements of passenger car L2/L2.5/L2.9, L4 AVP automatic valet parking and scenario-specific L4 application.



2. Interface

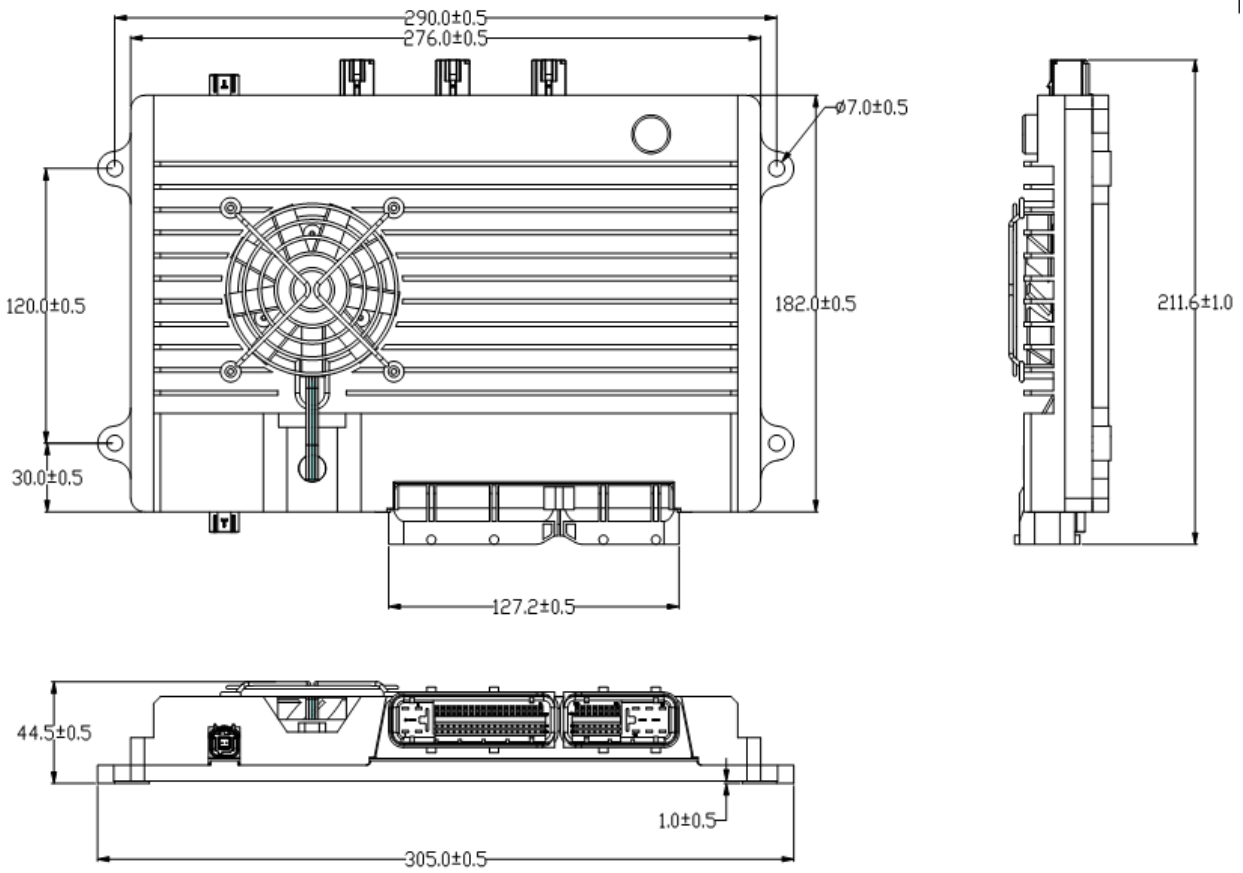
Interface Type	Quantity	Function	Internal Chip	Connector
Camera	11	GMSL	SOC	TE Waterproof Connector
Video Output	1	GMSL	SOC	TE Waterproof Connector
Gigabit Automotive Grade Ethernet	2	1000BASE-T1	SOC	Waterproof Connector
M.2 KEY M	1	Optional		
IMU	1	Optional		
RS232	2	One of the channels is used for Debug	SOC	121PIN-CMC
CANFD	7	2 with Specific frame wake up	SOC	
PPS_IN	1		SOC	
CAN/CANFD	8	1 channel with specific frame wake-up	MCU	
USS	12	Ultrasonic Radar	MCU	
KEYON	3	1 channel for SOC, 2 channels for MCU		
Digital Inputs	4	Default configuration: 2 channel active-high. 2 channel active-low	MCU	
Analog Inputs	6	Default configuration: 2 channel 5V voltage type, 2 channel resistance type, 2 channel 36V voltage type	MCU	
5V sensor power supply	2	Maximum current 100mA	SBC	
Power supply positive terminal	6			
Power Ground	7			
Signal Ground	9			

3. Mechanical

3.1 Dimensions

No special treatment or plating etc. on the outside of the housing shell of the controller, no sharp burrs and sharp edges.

Size: 305mm*211.6mm*44.5mm



3.2 Connector

The connector products of EAT4A02 are qualified products in accordance with the automotive safety class, and the connector models are listed below.

Serial number	Connectors	Name	Category	Suppliers	Link
1	121P	PCB Pin Headers	1746979-1	TE	--
2		81P Sheath	1473244-1	TE	http://www.digikey.com/products/en?keywords=1473244-1
3		40P Sheath	1473252-1	TE	http://www.digikey.com/products/en?keywords=1473252-1
4		Large Terminals	964273-2	TE	http://www.digikey.com/products/en?keywords=964273-2%20
5		Small Terminals	968220-1	TE	http://www.digikey.com/products/en?keywords=968220-1
6		81P Back cover	1473247-1	TE	http://www.digikey.com/products/en?keywords=1473247-1
7		40P Back cover	1473255-1	TE	http://www.digikey.com/products/en?keywords=1473255-1
8		81P Snap	368382-1	TE	http://www.digikey.com/products/en?keywords=368382-1
9		40P Snap	368388-1	TE	http://www.digikey.com/products/en?keywords=368388-1
10	Waterproof Connector	Board End	2415723_1	TE	
11	4-Chamber Waterproof Connector	Board End	2404815_1	TE	

4. Quick Start

4.1 Preparation in Advance

Before using this device, please prepare the following items:

- Stable power supply, 12V DC/ 10A min or 24V DC/ 5A min
- USB to RS-232 adapter
- Laptop

4.2 Basic Knowledge

If you are a Linux beginner, it is helpful to learn how to use Linux command line tools. Here is a good Linux tutorial: tutorial.

4.3 Equipment

1. Connections

Connect the positive and negative terminals of the device to the DC power supply and connect the RS232-1 of the device to the computer via USB to RS-232 to ensure that the computer can use the serial device normally.

2. Configuration

Configure serial port: baud rate 115200, 8 data bits, no parity check, 1 stop bit.

Using Putty or MobaXterm under Windows or using Minicom, etc under Linux to turn on the serial port window.

3. Start

Turn on the Keyon switch of the device and power on the device. The device will first run U-Boot and then run the Linux system, and through the serial terminal window it can be shown that the system boots normally, after which you can log in with the default username: root and password: eco123.

5. Hardware

The hardware circuit of this computing platform is designed according to the application requirements of the autonomous driving system. The electrical parameters meet the requirements of automotive grade, with a variety of data transmission interfaces to meet the needs of multi-sensor fusion of the autonomous driving system, and the main chip contains a variety of high-performance computing units to fulfill the computing characteristics of sequential and parallel computing for autonomous driving.

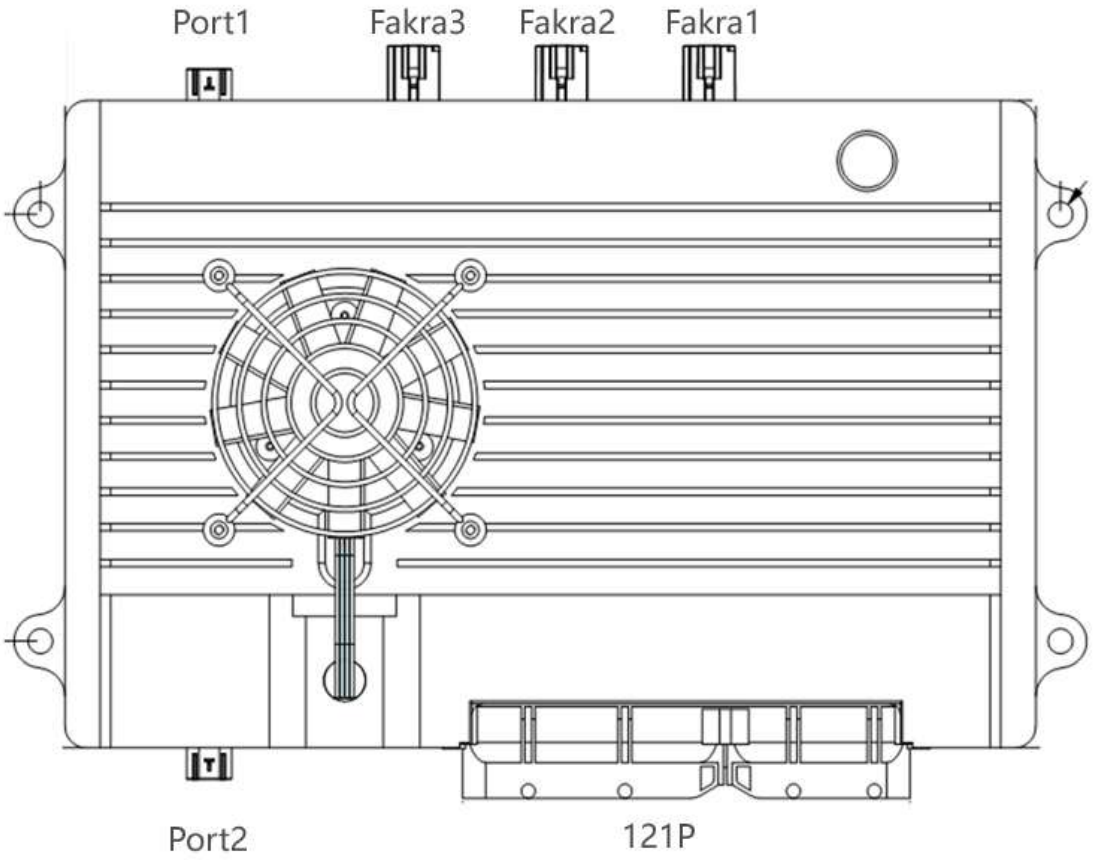
5.1 Specifications

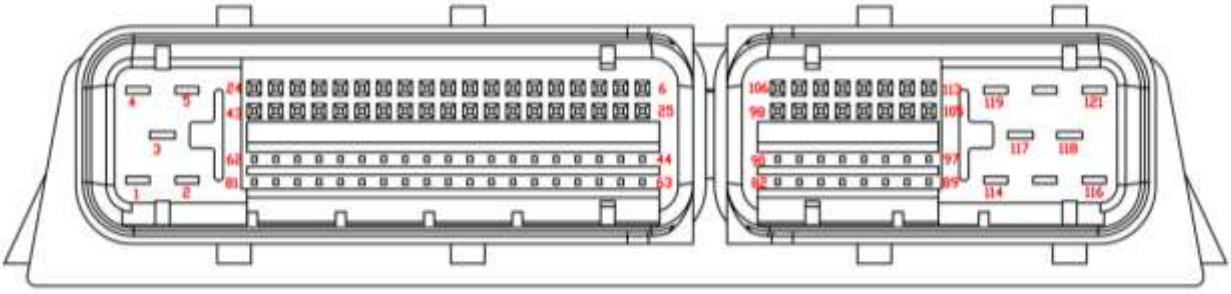
Items	Design Metrics
Operating Voltage	DC 9 ~ 36V
RAM	32GB
ROM	32GB
Operating temperature	-40 ~ 85℃
Working humidity	0 ~ 95%, no condensation
Storage temperature	-40 ~ 105℃
Size	305mm*211.6mm*44.5mm
Protection level	IP67
Heat Dissipation	Air Fan Cooling

5.2 Device Ports

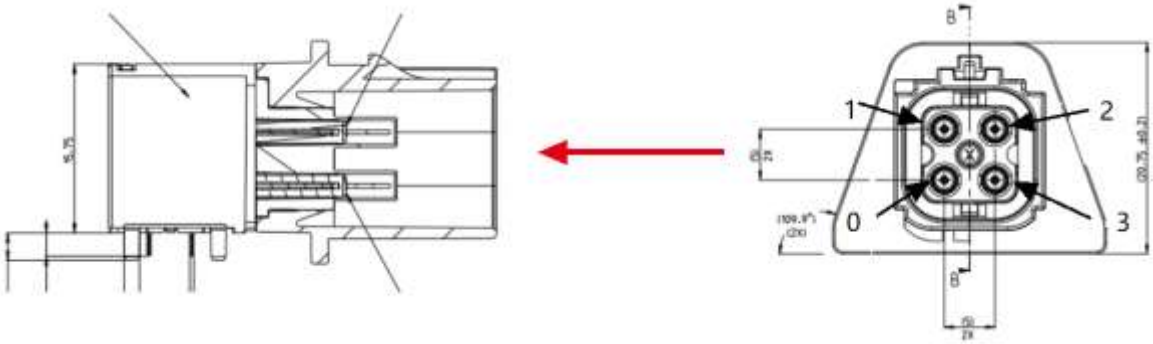
5.2.1 Port Map

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

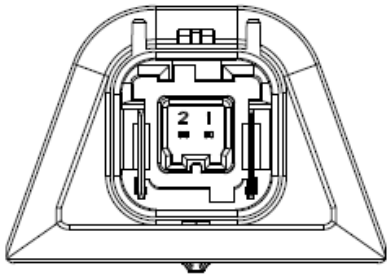




Connector



Camera Interface



Automotive Ethernet

6. SoC Basic Software

The TI TDA4 provides two separate SDK installation packages and documentation, namely the Linux SDK and RTOS SDK. These packages include numerous practical demos, such as binocular vision, dense optical flow, AVP deep learning, and object detection applications. During SOC development, the A-core utilizes the Linux SDK, while the other cores utilize the RTOS SDK. The SDK development environment is Ubuntu 18.04 64-bit.

The Linux SDK is a software development kit (SDK) tailored for the TI platform's TDA4 chip, primarily used for booting, operating systems, and file systems on the A72 core. It also provides several modules, including:

- Multimedia: Supports video stream processing and encoding/decoding.

- Graphics: Supports graphics computation based on OpenGL ES and OpenCL, including GPU drivers and EGL libraries.

- Networking: Supports various network protocols and interfaces, including Ethernet, CAN bus, etc.

- Tools: Offers various tools, including cross-compilation toolchains, debugging tools, and performance analysis tools, to help developers expedite the development process.

The RTOS SDK is the primary SDK developed on the TDA4 Platform. The most significant feature of the TDA4VH chip is its heterogeneous multi-core architecture, with the R5F core, C66x core, and C7x deep learning core-related software packages all residing within the RTOS SDK.

- Vision App: The vision application package includes demos/applications for ADAS, vision, perception, and deep learning on the Jacinto 7 platform.

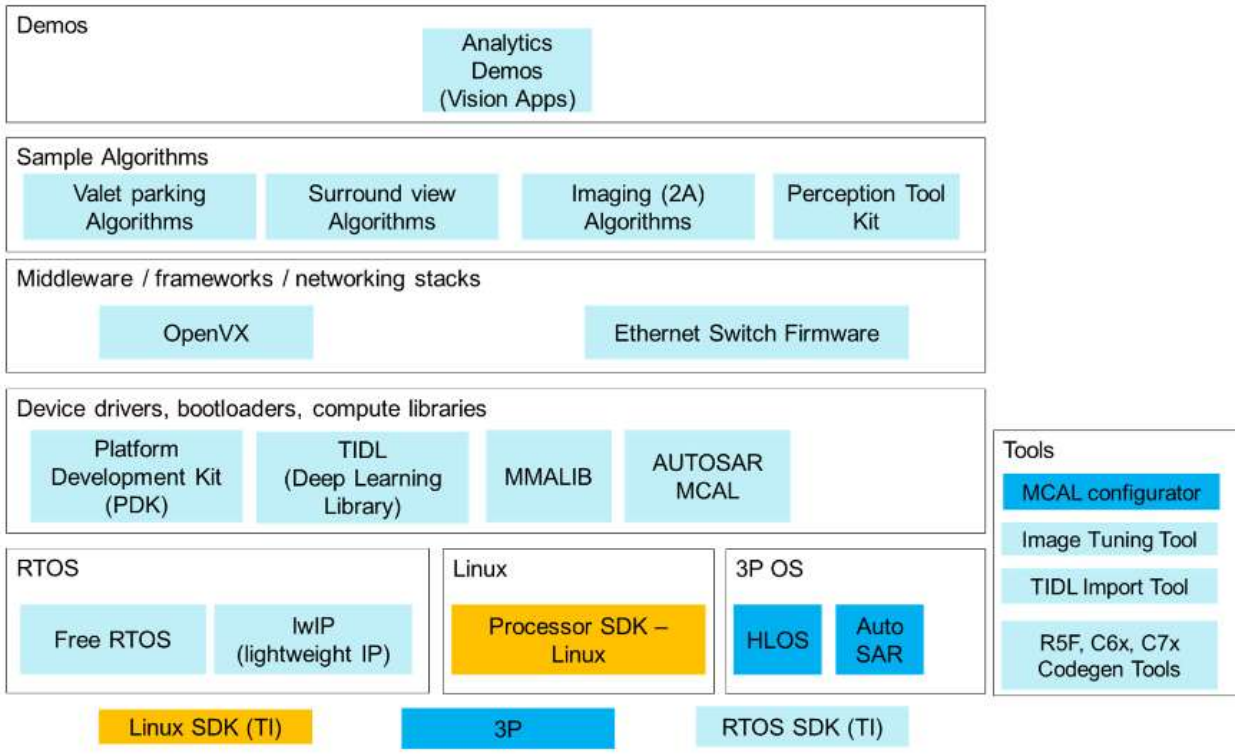
- PDK/SW: Contains device drivers, bootloaders, CSL for bare-metal/RTOS, MCU demos, and MCAL for AutoSAR.

- TIDL: Includes TI's deep learning inference solution, with widely-used open-source runtime environments on ARM MPU (such as TFLite Runtime, ONNX Runtime, and TVM-based runtime) and optimized TIDL runtime back-ends on C7x and MMA. It also includes necessary tools for DNN compilation and provides numerous Python and C language examples to exercise the tools and inference solutions.

- MMA/FFT lib: MMA computation libraries and C7x/MMA FFT computation libraries. TI's platform also provides a variety of debugging ways: TF card, serial port, CCS JTAG, Lauterbach, etc.

- TIOVX: This includes the implementation of OpenVX, which comprises OpenVX nodes for VPAC, DMPAC, CSI2RX, Display, TIDL, and Video decode.

In the RTOS SDK, the code compilation is maintained using the open-source compilation framework Concerto. It is a collection of make rules and macros that enables streamlined compilation and linking across multiple code generation tools, CPU architectures, operating systems, and SoCs. Together with the Linux SDK, the RTOS SDK forms the multi-processor software development package for the J721E platform. This SDK offers a comprehensive set of software tools and components to assist users in developing and deploying their applications on supported SoCs.



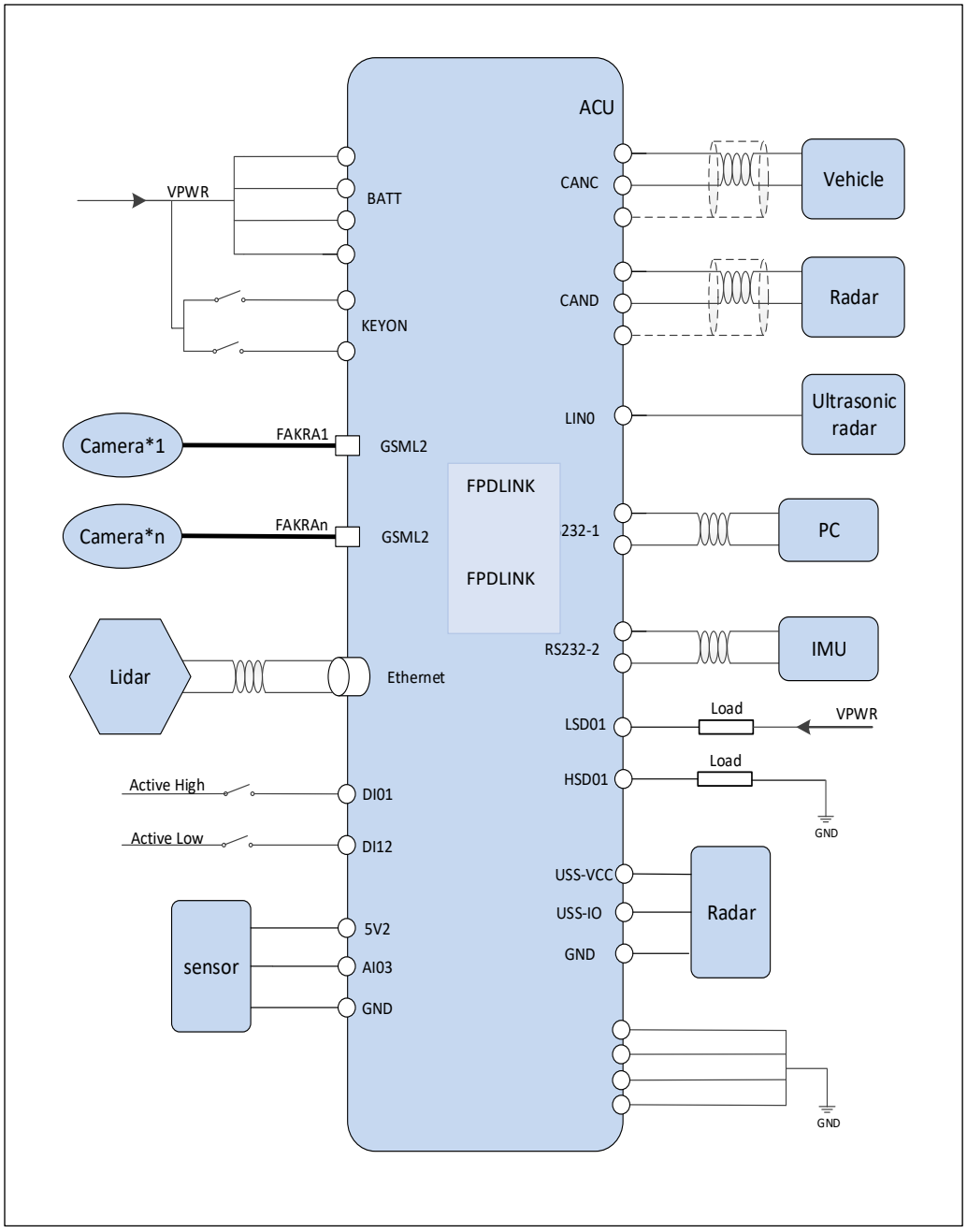
Serial port: the most classic debugging method is to add printing, TDA4 has multiple serial ports, by default A72 will print out the debugging information of each core through the serial port.

The software architecture of the MCU inside the TDA4 computing platform is designed with reference to the AUTOSAR architecture standard and is divided into an application software layer and basic software layer. The basic software layer is further divided into microcontroller abstraction layer, ECU abstraction layer, service layer and complex drivers. The application layer software and the base software are integrated through EcoCoder, which uses the s-function in Simulink to encapsulate the underlying interface into the Simulink module library, so that application developers can use Simulink to build the application layer model. Developers can use Simulink to build application layer models and generate executable program files adapted to TC397 by Simulink with one click.

The EcoCoder encapsulated underlying interface enables reading digital input signals, analog signal status, controlling high and low side outputs, supporting DBC file parsing, protocols such as CCP, UDS, etc., and enabling the definition of observables, calibration variables, NVM variables, etc. The MCU application development is achieved with the calibration software EcoCAL and the flash software EcoFlash.

7. Demo Application

The EAT4A02 is used in the field of autonomous driving and forms the hardware platform of the autonomous driving system with sensors. The common connection methods are shown in the figure below.


ACU
VPWR
BATT
KEYON
Camera*1
FAKRA1
GSML2
Camera*n
FAKRAn
GSML2
FPDLINK
FPDLINK
Lidar
Ethernet
Active High
DI01
Active Low
DI12
sensor
5V2
AI03
GND
CANC
CAND
LIN0
232-1
RS232-2
LSD01
HSD01
USS-VCC
USS-IO
GND
Vehicle
Radar
Ultrasonic radar
PC
IMU
Load
VPWR
Load
GND
Radar
GND

8. Development Tool

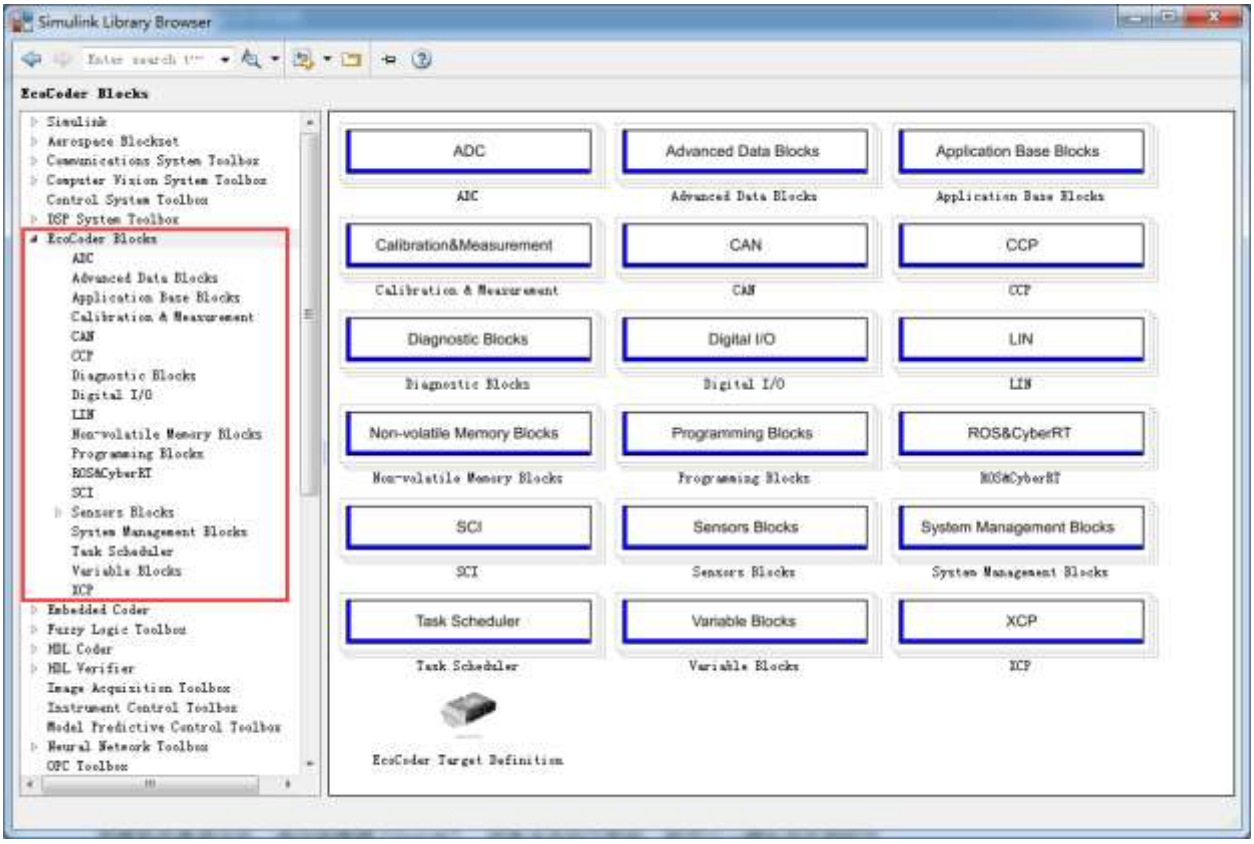
A combination of hardware, operating system stacks, and runtime environments are not capable enough to achieve autonomous driving, therefore, users need to develop software that can perform specific functionality and deploy them to EAT4A02. For MCU Infineon TC397, three development tools are provided: EcoCoder, EcoCAL, and EcoFlash. Developers can select the tools they need.

8.1 EcoCoder

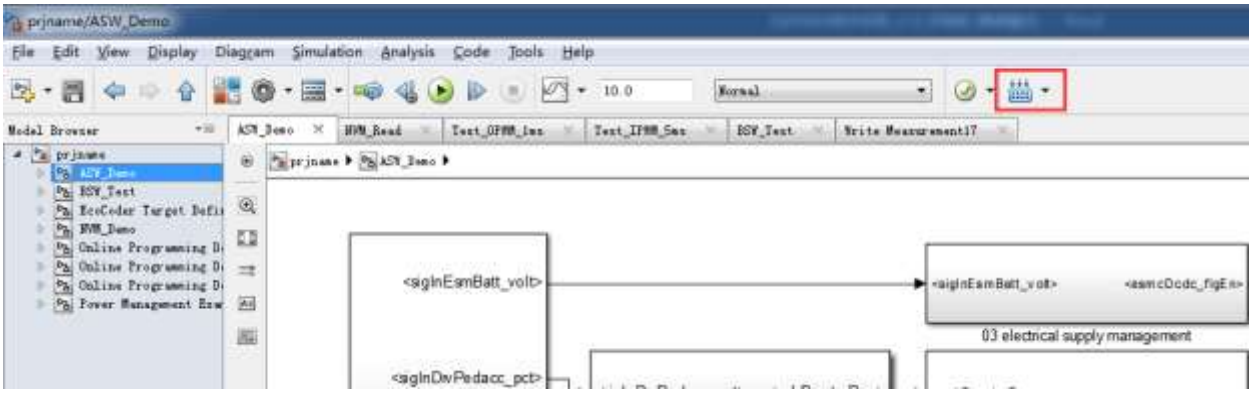
EcoCoder is an application development tool for the control system, which makes it easier for users to develop embedded application software in the Simulink environment. It expands the resources of Simulink and Real-Time Workshop embedded encoders to generate the necessary code module and automatically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



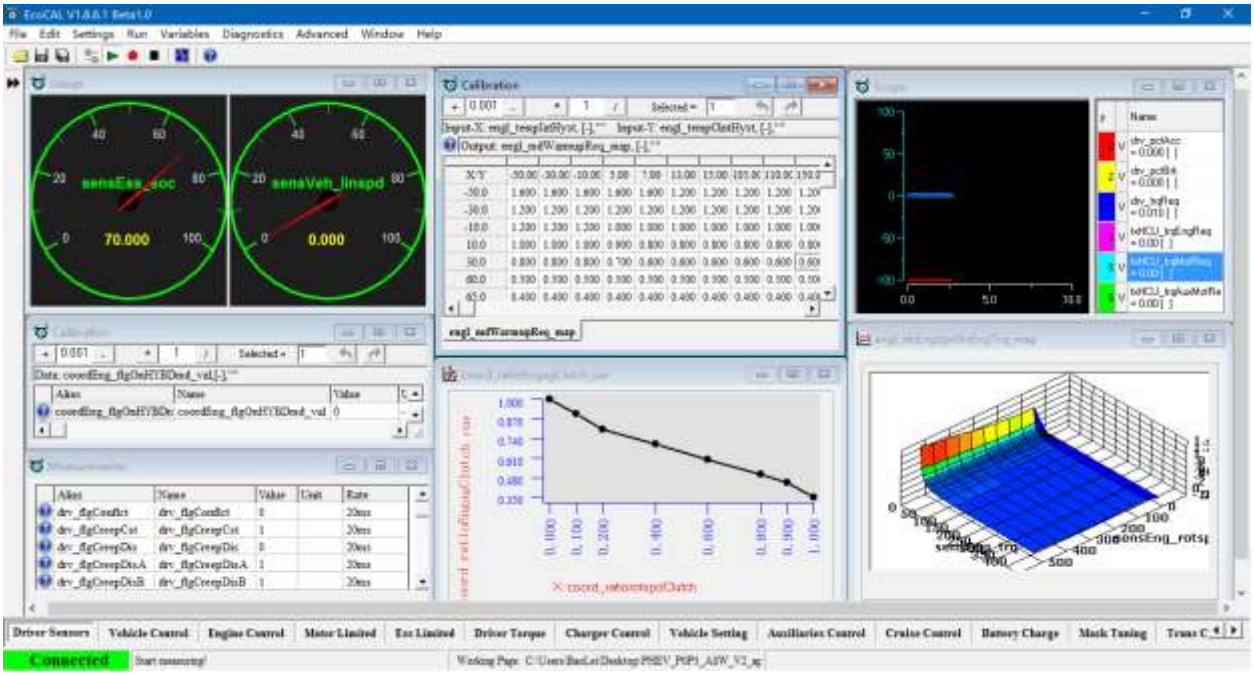
After compilation of the model, use the shortcut “Ctrl + B” or click the button shown below, the flash-able file will be generated.



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

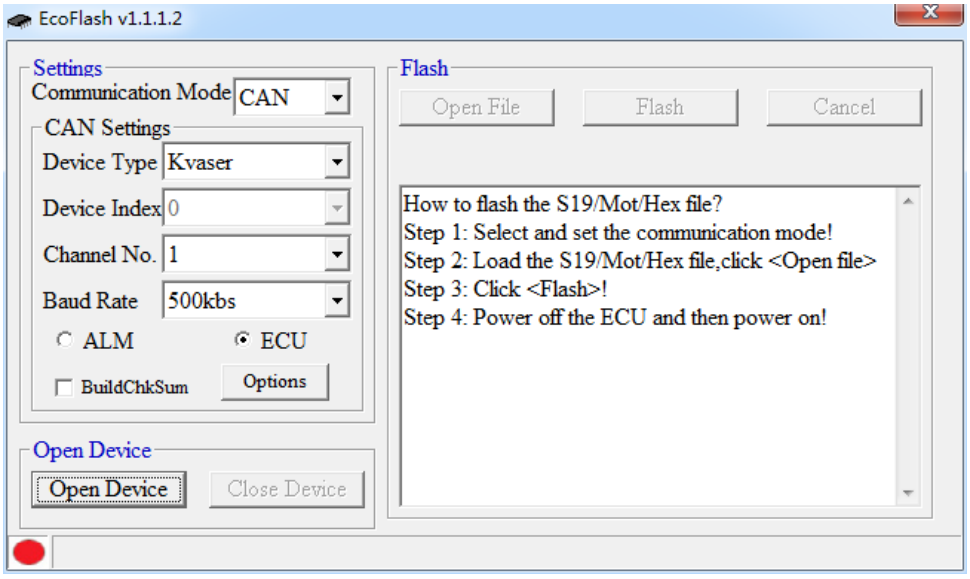
8.2 EcoCAL

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.



8.3 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.

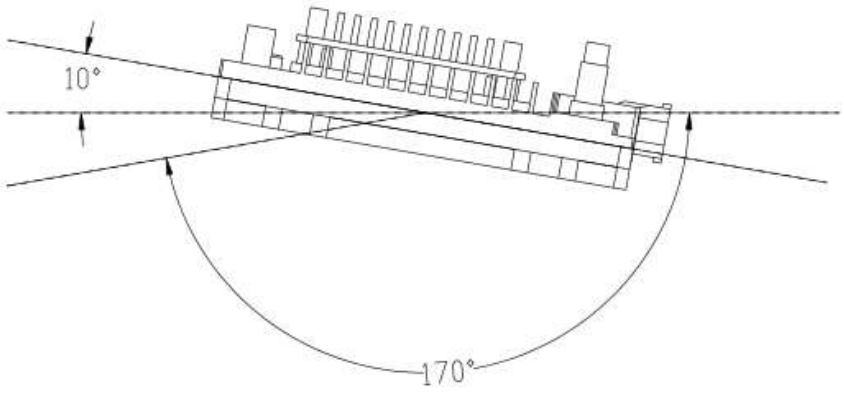


9. Installation Requirements

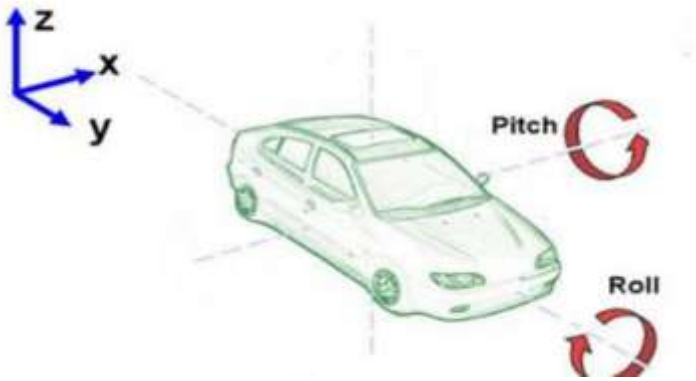
It is recommended to install the ADCU in the cabin. If the OEM wants to assemble the ADCU in another location, the corresponding installation location should be evaluated by Ecotron's engineers and the OEM's engineers.

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 shell 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

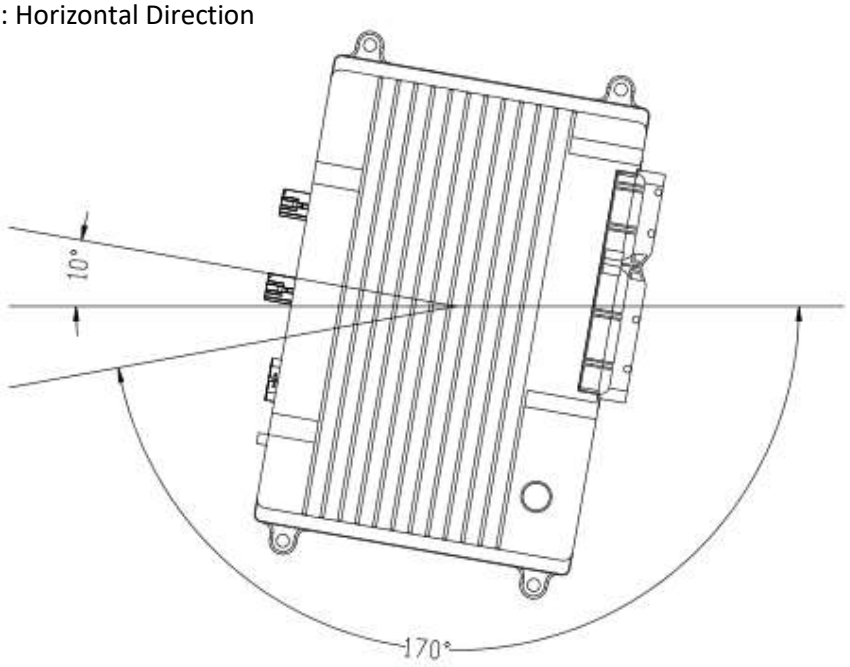


Figure: Vertical Installation Angle

Ecotron recommends using the 4 installation points on the ADCU for installation and fixation. It is recommended to use metal materials such as aluminum alloy for the mounting bracket, and the housing should have a reliable electrical connection with the vehicle body 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 far as possible.