Ettiksoft
Talent Innovation Solution

# ES_VCU

## Configurable Vehicle Control Unit for electric vechicles 12/24 V systems

- Reliable Control
- Flexible Configuration
- Built for Multiple Platforms




**SUPERVISORY CONTROL**
Drivetrain, battery charger and accessories

**VEHICLE FUNCTIONS**
Safety interlocks, fault handling and diagnostics

**SECURE PLATFORM**
Bootloader, UDS diagnostics and XCP calibration

**RUGGED DESIGN**
IP67 sealed enclosure

**WIDE APPLICATIONS**
2W, light EVs, commercial vehicles and special machines

# ES_VCU_04

Configurable Vehicle Control Unit
for electric vechicles 12/24 V systems




Reliable Control | Flexible Configuration | Built for Multiple Platforms

| 11 | 14 | 13 | 5 | 3 |
|---|---|---|---|---|
| Analog inputs | Digital inputs | Digital outputs | PWM channels | CAN 2.0B |

## Product overview

The ES_VCU_04 is the mid-range reference configuration of the Ettiksoft ES_VCU platform. It provides supervisory control of the drivetrain, battery, charger, instrument cluster and vehicle accessories, and manages driver commands, safety interlocks, fault handling and diagnostics. This configuration is laid out for 12 / 24 V vehicle systems, with dedicated I/O for pedal sensing, air-system monitoring, HVAC, PTO and thermal management.

## Key features

- 12 / 24 V nominal supply (9–36 V platform) with reverse-polarity and load-dump protection
- Automotive-grade 32-bit microcontroller
- 11 analog inputs, 14 digital inputs, 13 digital outputs and 5 PWM channels
- High-side drivers up to 1.5 A and an H-bridge output
- 3 × CAN 2.0B: Vehicle, Telematics and Debug
- Secure boot, UDS diagnostics, CAN bootloader and XCP calibration
- IP67 sealed enclosure

## Product overview

Any EV applications ranging from on road, off road and special machines.



Special machines



2W / light EVs



Light commercial vehicles

# Functional Architecture




Platform overview and block-level capabilities

**Analog inputs**
11 × 0-5 V;
2 x sensor supply

**Digital inputs**
14 × 12/24 V level

**PWM channels**
5 channels

**Analog outputs**
2 × 0-5 V

**High-side outputs**
3 × 1.5 A • 3 x 330 mA




**Lamp / tell-tale**
4 outputs to cluster

**Low-side & H-bridge**
1 x 330 mA LS,
1 x H-bridge 0.8 A

**Power supply & protection**
12/24 V nominal
reverse-polarity & load-dump

**Communication**
3 x CAN 2.0B

**Core control**
32-bit automotive MCU

**Software core**
Supervisory control, Diagnostics, Bootloader, Secure boot, Flash

**External interfaces**
B+ / B- 12/24 V supply, Vehicle CAN, Telematics CAN, Debug CAN, Service port, UART com

## Designed for supervisory vehicle control

The ES_VCU Advanced supervises the drivetrain, battery, charger, instrument cluster and vehicle accessories. It processes driver inputs, enforces safety interlocks, manages thermal and auxiliary functions, and provides diagnostics and update support through a robust 12/24 V vehicle platform.

## Typical deployment roles

- Drivetrain command and torque / speed supervision
- Battery, charger and accessory coordination
- Safety interlocks and fault handling
- Diagnostics, service and calibration support

# Electrical characteristics

Power, I/O channels and communication summary

## Designed for supervisory vehicle control

| Parameter | Value |
|---|---|
| Nominal system voltage | 12 / 24 V |
| Supply voltage range | 9 to 36 V DC (platform rating) |
| 1/0 operating level | 9 to 36 V |
| Maximum supply current | 3 A (B+ / B-) |
| Protection | Reverse-polarity and load-dump protection |
| Power modes | Key-on and CAN wake-up; low-power sleep mode |
| Supervision | Watchdog and brown-out detection |

## Input and output channels

| Channel class | Qty | Signal level | Max current | Notes |
|---|---|---|---|---|
| Analog inputs | 11 | 0 - 5 V | — | Single-ended or differential; 2 pedal channels also accept PWM |
| Analog outputs | 2 | 0 - 5 V | — | Reserved |
| Digital inputs | 14 | Low 0-5 V / High 18-28 V | — | Active high or active low per signal |
| High-side outputs, high-current | 3 | 9 - 36 V | 1.5 A | Drive enable, HVAC enable, PTO enable |
| High-side outputs | 3 | 9 - 36 V | 330 mA | Relay and wake-up drivers |
| Low-side output | 1 | Ground | 330 mA | Relay ground |
| H-bridge output | 1 | 0 - 36 V | 0.8 A | Rated loads |
| Lamp / tell-tale outputs | 4 | Low 0 - 5 V / High 9 - 36 V | — | ABS warning, Eco and Power mode tell-tales, 1 reserved |
| PWM channels | 5 | 0 - 36 V | 50 mA (fan output) | Radiator fan control, insulation status, 3 reserved |
| Sensor supply outputs | 2 | For 0-5 V sensors | — | With 2 sensor ground returns |

## Communication and connectivity

| Channel class | Channel class |
|---|---|
| CAN | 3 x CAN 2.0B: Vehicle CAN, Telematics CAN, Debug CAN (each with CAN_H, CAN_L, CAN_S) |
| CAN termination | 120 2 on Vehicle and Debug CAN |
| CAN protocols | ISO 15765 transport protocol (standard); SAE J1939, CANopen or customer-supplied DBC on request |
| Service interface | UART service port |



# Typical I/O allocation




## Reference signal mapping for the Advanced configuration

Signal-level allocation for the Advanced configuration. Channel IDs are for reference; the connector pin assignment is issued in the pinout document.

### Analog inputs

| ID | Signal / Function | Type | Range | Notes |
|---|---|---|---|---|
| AI - 01 | Accelerator pedal signal 1 | Analog / PWM input | 0-5 V | Redundant, ch. 1 |
| AI - 02 | Accelerator pedal signal 2 | Analog / PWM input | — | Redundant, ch. 1 |
| AI - 03 | Brake pedal position sensor 1 | Analog input, single-ended | 0-5 V | — |
| AI - 04 | Brake pedal position sensor 2 | Analog input, single-ended | 0-5 V | — |
| AI - 05 | Ambient temperature sensor | Analog input, differential | 0-5 V | — |
| AI - 06 | Cabin temperature sensor | Analog input, differential | 0-5 V | — |
| AI - 07 | Radiator inlet temperature | Analog input, differential | 0-5 V | — |
| AI - 08 | Radiator outlet temperature | Analog input, differential | 0-5 V | — |
| AI - 09 | System air pressure 1 | Analog input, differential | 0-5 V | — |
| AI - 10 | System air pressure 2 | Analog input | 0-5 V | — |
| AI - 11 | Reserved | Analog input | 0-5 V | — |

### Digital inputs

| ID | Signal / Function | Type | Range | Notes |
|---|---|---|---|---|
| DI-01 | Key ON signal | Digital input | 12/24 V logic | Active high |
| DI-02 | Brake pedal enable | Digital input | 12/24 V logic | Active high |
| DI-03 | Hand brake signal | Digital input | 12/24 V logic | Active high |
| DI-04 | Hill hold ON | Digital input | — | Active high |
| DI-05 | HVAC request | Digital input | 2.6 V | Active high |
| DI-06 | PTO request | Digital input | 12/24 V logic | Active high |
| DI-07 | Air pump - air pressure switch | Digital input | 12/24 V logic | Active high |
| DI-08 | Air pump - oil pressure switch | Digital input | 12/24 V logic | Active high |
| DI-09 | Low air pressure switch | Digital input | 12/24 V logic | Active high |
| DI-10 | Insulation failure detect | Digital input | 12/24 V logic | Active high |
| DI-11 | Emergency disconnect | Digital input | 12/24 V logic | — |
| DI-12 | Digital input (high-side, high-current) | Digital input | 9-36 V | DI HS HC channel |
| DI-13 | Reserved | Digital input | 12/24 V logic | Spare |
| DI-14 | Reserved | Digital input | 12/24 V logic | Spare |

### Digital outputs

| ID | Signal / Function | Type | Range | Notes |
|---|---|---|---|---|
| DO-01 | Drive enable signal | High-side, high-current | 9-36 V | 1.5 A |
| DO-02 | HVAC enable | High-side, high-current | 9-36 V | 1.5 A |
| DO-03 | PTO enable | High-side, high-current | 9-36 V | 1.5 A |
| DO-04 | Cluster wake-up | High-side | 9-36 V | 330 mA |
| DO-05 | Reverse ON - to relay | High-side | 9-36 V | 330 mA |
| DO-06 | Water pump ON - to relay | High-side | 9-36 V | 330 mA |
| DO-07 | Relay ground (24 V relay) | Low-side | Ground | 330 mA |
| DO-08 | Load1- Reserved | H-bridge, high-side | 0-36 V | 0.8 A |
| DO-09 | Load2-Reserved | H-bridge, high-side, high-current | 0-36 V | 0.8 A |
| DO-10 | ABS warning lamp | Digital output | 12/24 V logic | Active low |
| DO-11 | Eco mode | Digital output | 12/24 V logic | Tell-tale to cluster |
| DO-12 | Power mode | Digital output | 12/24 V logic | Tell-tale to cluster |
| DO-13 | Reserved | Digital output | 12/24 V logic | Spare |

### Digital outputs

| ID | Signal / Function | Type | Range | Notes |
|---|---|---|---|---|
| PWM-01 | Drive enable signal | PWM output | 9-36 V | 50 mA |
| PWM-02 | Insulation status | PWM | 0-36 V | From IMD |
| PWM-03 | Reserved | PWM | 0-36 V | Spare |
| PWM-04 | Reserved | PWM | 0-36 V | Spare |
| PWM-05 | Reserved | PWM | 0-36 V | Spare |

### Digital outputs

| ID | Signal / Function | Type | Notes |
|---|---|---|---|
| CAN-01 | Vehicle CAN - CAN H / CAN L/ CANS | CAN 2.0B | 120 Ohm termination |
| CAN-02 | Debug CAN - CAN_H/ CAN_L/ CAN_S | CAN 2.0B | 120 Ohm termination |
| CAN-03 | Telematics CAN - CAN_H/ CAN_L/CAN_S | CAN 2.0B | — |

### Power, sensor supply and grounds

| ID | Signal / Function | Type | Range | Notes |
|---|---|---|---|---|
| PWR-01 | B+ 12/24 V | Supply input | 9-36 V | 3 A |
| PWR-02 | B- 12/24 V | Supply return | Ground | 3 A |
| PWR-03 | Sensor supply ×2 | Sensor supply output | For 0-5 V sensors | — |
| PWR-04 | Sensor ground ×2 | Sensor return | 0V | Sensor return path |
| PWR-05 | Ground - cabin & ambient temperature | Ground output | Ground | — |
| PWR-06 | Ground - accelerator & brake pedal | Ground output | Ground | — |
| PWR-07 | Ground - 12/24 V relay ×2 | Power ground | Ground | — |

# Vehicle control, safety and support

Core functions, software capabilities and optional upgrades.

## Vehicle control functions

| | |
|---|---|
| **Core drive control** | Throttle processing, torque and speed request to the motor controller, reverse, speed limiting, regenerative braking request |
| **Drive modes** | Eco, Normal and Sport |
| **Motor support** | BLDC, PMSM or induction motor; single or dual motor |
| **Battery management** | BMS communication over CAN (charge and discharge limits, state of charge, faults); temperature-based power derating |
| **Charger integration** | On-board charger control, off-board charger communication |
| **Thermal management** | Cooling pump and fan control, battery heating control |
| **Driver assistance** | Cruise control, hill hold and anti-rollback, adjustable regeneration levels, creep mode |
| **Interlocks and anti-theft** | Brake interlock, tilt or crash cut-off, key or immobilizer authentication |
| **Instrument cluster** | CAN cluster interface with wake-up and tell-tale outputs |
| **Lighting and accessories** | Lamps, indicators and horn |

## Functional safety and cybersecurity

| | |
|---|---|
| **Safety level** | ASIL-B: watchdog, input plausibility checks, fault logging and limp-home mode |
| **Redundant inputs** | Dual accelerator-pedal and dual brake-pedal sensor channels |
| **Firmware authentication** | Secure boot |

## Software, diagnostics and updates

| | |
|---|---|
| **Diagnostics** | UDS (ISO 14229) over CAN with DTC storage |
| **Firmware update** | CAN bootloader for service and production updates |
| **Calibration** | XCP on CAN; PC configuration tool for parameters |
| **Data logging** | Fault and event logger |
| **Application software** | Ettiksoft standard application software, or customer control logic integrated with Ettiksoft Base software |

## Mechanical and environmental

| | |
|---|---|
| **Ingress protection** | IP67 |
| **Operating temperature** | -40 °C to +105 °C |
| **Connector** | 80-pin sealed automotive connector |
| **Housing material** | Plastic |
| **Mounting** | Bracket, flange or customer-specified |
| **Protective coating** | Standard conformal coating |
| **Harness** | Mating connector only, with pigtail harness, or custom harness to your drawing |

## Optional upgrades

| | |
|---|---|
| **Processing and storage** | Enhanced 32-bit multi-core microcontroller: extended storage (SD card or eMMC) for continuous logging |
| **Communication** | 4th CAN channel; CAN FD; LIN, RS-485, RS-232, Ethernet 10/100: 4G LTE: multi-constellation GNSS: Wi-Fi; cloud upload (MQTT or HTTPS) |
| **Vehicle functions** | Up to five customer-defined drive-mode maps; TFT display interface; wiper and accessory relays: charge-port lid or lock |
| **Safety and security** | Enhanced safety designed to support ISO 26262 ASIL B targets; signed firmware; HSM; encrypted configuration and logs; seed-key access control; debug port lock |
| **Software and updates** | Freeze-frame capture; remote diagnostics; Bluetooth service update; over-the-air update; continuous trip and usage logger |
| **Environmental** | Enhanced coating for high humidity |
| **Testing and compliance** | Extended burn-in; temperature and humidity tests; vibration and shock tests; pre-compliance EMC scan; homologation documentation support |
| **Documentation and support** | CAN database (DBC) file; integration manual; unit test reports; 24-month warranty, remote or on-site integration support |

## Contact


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