VCARSYSTEM

MAKE R&D EASIER

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VCARSYSTEM



MAIN PRODUCT INTRODUCTION

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MAKE R&D EASIER

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VCARSYSTEM

COMPANY PROFILE

We support clients around the world by offering premium products and high-quality solutions.

Founded in 2011, VCARSYSTEM specializes in developing R&D testing toolchains for embedded systems, serving key sectors such as automotive, education, and rail transit, among others.

Our current portfolio of R&D tools encompasses rapid prototyping, virtual simulation testing, hardware-in-the-loop (HIL) testing, real-vehicle testing, data acquisition & analysis, and network simulation testing. These solutions are engineered to build an efficient R&D testing ecosystem, empowering clients to accelerate product innovation.

Looking ahead, VCARSYSTEM remains customer-centric, upholding the principle of “MAKE R&D EASIER." By focusing on virtual simulation testing, software R&D tools, and real-vehicle testing frameworks, we strive to enhance R&D efficiency, shorten development cycles, optimize costs, drive industry advancement, and fuel client success.

75%
R&D Personnel

400+
Global Customers

RELIABLE PARTNER

ISO 9001:2015
REGISTRATION NO.: 00924Q10061R1M

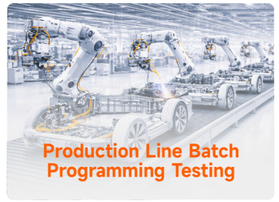
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APPLICATION OF OUR PRODUCTS AND SERVICES


Vehicle Bus Development and Testing Services

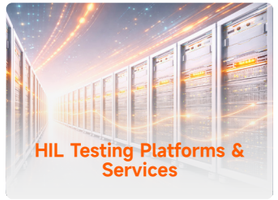

HIL Simulation Testing


ECU Calibration, Measurement & Diagnostics


Production Line Batch Programming Testing

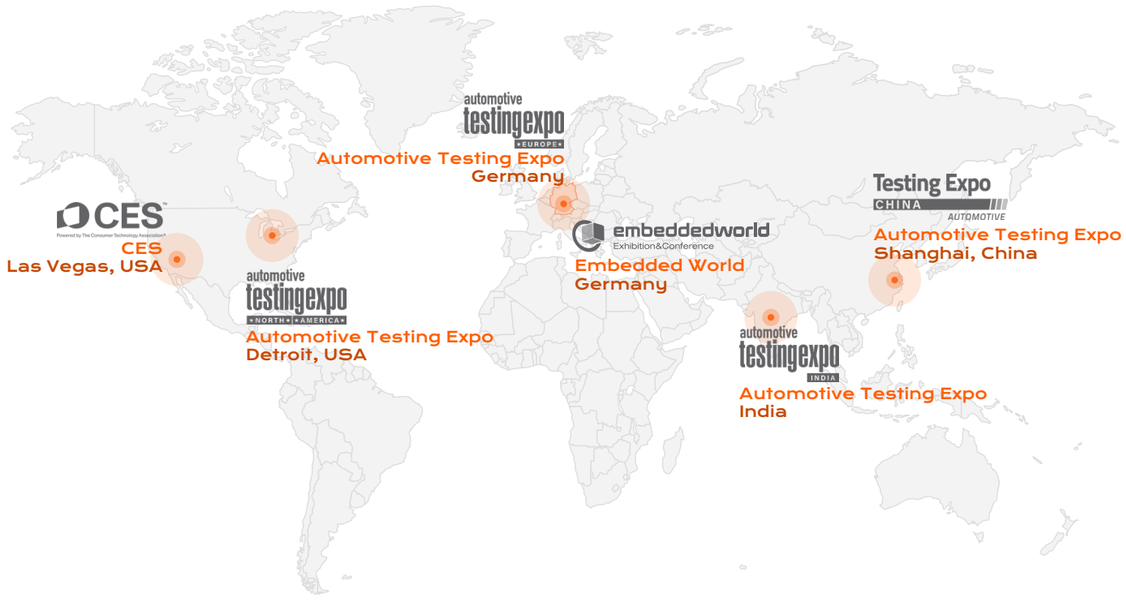

Vehicle Data Logging


Software Testing


HIL Testing Platforms & Services


ADAS Testing Solutions

MEET US AT GLOBAL INDUSTRY EXPOS



01

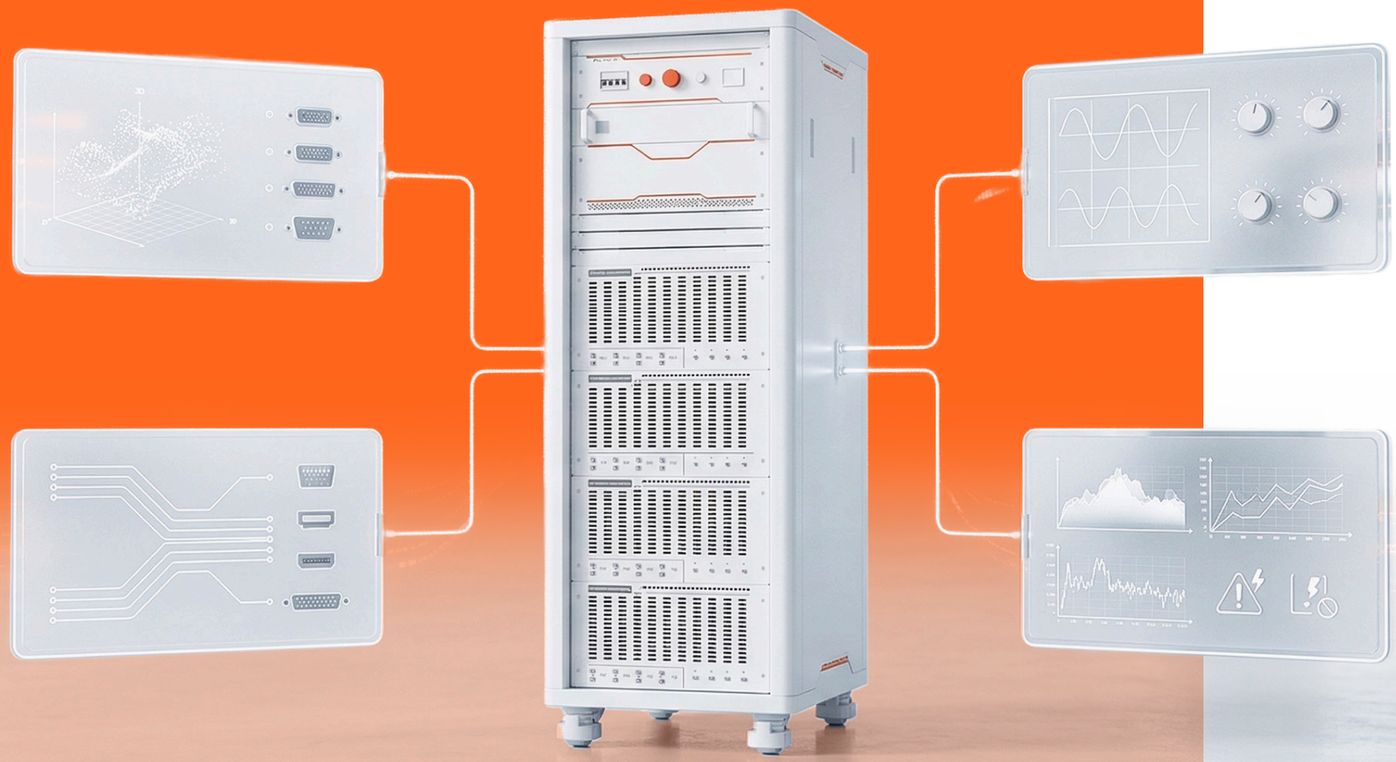
Integrated Testing Platform



CubeStack HIL

Hardware-in-the-Loop Testing for Complex Embedded System
Make HIL as Soft & Flexible as SIL— Accelerate Your SDV.







Where Cluster HIL Meets SDV
Accelerate Agile, Secure, Scalable Validation

The global automotive industry is transforming, driven by four key trends: electrification, intelligentization, connectivity, and shared mobility. At the heart of this change is the rise of Software-Defined Vehicles (SDVs), where software controls more vehicle functions.

This shift has led to a major evolution in vehicle electrical/electronic (E/E) architectures—from traditional setups to integrated, domain-centric or zonal systems that support SDV needs.As SDVs grow in complexity, with more powerful computing and data bandwidth, legacy testing systems struggle to keep up, creating bottlenecks for OEMs working to launch next-gen SDVs.

Core Testing Pain Points

- **Cross-Domain Testing Challenges**
  In SDVs, functions like powertrain control, ADAS (Advanced Driver Assistance System/Automated Driving), and infotainment are highly interconnected. Legacy systems can't validate these interactions, leaving risks undetected in real-world performance.

- **Inefficient Testing for Fast Software Iterations**
  SDV development relies on frequent software updates via Over-the-Air (OTA) updates. Traditional test systems can't keep up with these fast updates, causing delays and longer time-to-market for new vehicles.

- **Inflexible Hardware Resource Allocation**
  Traditional HIL systems are rigid and can't quickly switch between different tests (e.g., battery management vs. autonomous sensor testing). This limits resource use, increases test times, and hinders adaptation to shifting project needs.



CubeStack HIL

Cluster Hardware-in-the-Loop Testing for Complex Embedded System

Make HIL as Soft & Flexible as SIL— Accelerate Your SDV.

For automotive R&D and validation engineers, VCARSYSTEM's CubeStack HIL solution is designed to validate software-centric, connected systems. It's a streamlined, all-in-one platform packed with on-demand resources, global multi-user access, parallel testing, sub-ms synchronization, centralized management, and CI/CD integration. It replaces legacy HIL systems and fragmented test workflows with agile, unified testing, which helps cut manual work, shorten SDV validation cycles, and keep global teams aligned.

Main Functions

- **Flexible Resource Allocation**
  Configurable, scalable architecture enables on-demand, agile allocation of test resources—adapting dynamically to evolving SDV validation workflows.

- **Multi-User Remote Access**
  Supports flexible cross-team access models: single-user/single-node, multi-user/single-node, multi-user/multi-node, and single-user/multi-node—enabling global development teams to collaborate seamlessly.

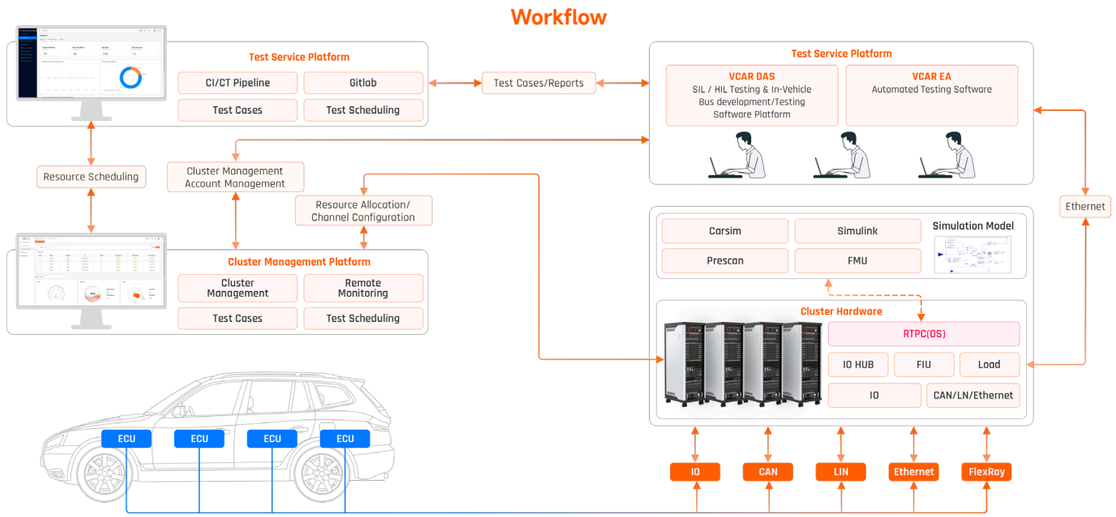
- **Multi-Environment Concurrent Execution**
  Enables parallel test execution across multiple user sessions and heterogeneous test environments—cutting down validation cycles for complex SDV software stacks.

- **Synchronization Capability**
  Guarantees sub-millisecond time and data synchronization across distributed real-time processing nodes—critical for validating interconnected zonal E/E architectures.

- **Digitalized Cluster Management**
  Unified management suite covering user account administration, cluster orchestration, remote real-time monitoring, and automated digital reporting—centralizing visibility into large-scale test operations.

- **Automated Testing Integration**
  Facilitates end-to-end automated test script execution, with native integration into CI/CD pipelines—aligning with agile SDV software development rhythms.

Workflow



Paired with the Integrated CubeStack HIL Management Platform

Empowering Seamless Control, Maximizing Resource Efficiency

Virtual Bench Management

Create and release virtual benches based on user applications. Allocate and release RTPC resources, IO resources, CAN bus resources, etc.

Device Resource Management

Add, delete, and maintain RTPC nodes, bus boards, and IO resource boards for the cluster HIL.

Device Monitoring Center

Real-time monitoring of the running status of each RTPC node, including CPU resource usage, temperature information, and the running status of the IO and bus resource pools. Report any abnormal information.

User Management

Create, delete, and maintain user accounts, group management, and user permission configurations.

Big Data Visualization

Real-time display of virtual bench running status, node information, device status statistics, resource usage, and early warning information.



Work Steps

1. **Admin Setup**
   Administrators create and manage user accounts with assigned permissions.
2. **Resource Provisioning**
   Admin approves virtual bench applications and configures IO/CAN resources.
3. **Resource Allocation**
   Assign RTPC, IO, and CAN resources to designated user accounts.
4. **User Application**
   Users log in and submit requests to claim the allocated virtual bench.
5. **Environment Deployment**
   Users retrieve the bench via host software and deploy resources to RTPC.
6. **Real-Time Monitoring**
   Monitor system status continuously and report exceptions / alarms.

Advantages

Maximize Resource Utilization
Leverage flexible test resource pooling to eliminate idle hardware and resource bottlenecks. Enables on-demand, agile allocation of test resources. Driving higher ROI on your test infrastructure investments.

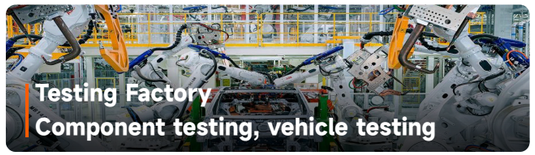
Minimize Total Investment
Eliminate redundant hardware purchases through shared resource pooling and lower operational costs via centralized management. Its open architecture also reduces second-development costs by supporting third-party software/model integration—delivering more value with less investment.

Shorten Validation Cycles
Accelerate end-to-end development with parallel multi-environment testing and rapid virtual testbed deployment. Enable multi-user remote access for distributed teams. Reduce queuing and wait times to speed up time-to-market for your SDV programs.

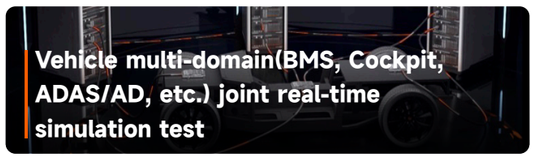
Deliver Trusted Results
Ensure test accuracy with high-fidelity real-time simulation and low-latency time/data synchronization. Results mirror real-world performance, eliminating discrepancies between lab testing and on-road validation.

Improve Testing Efficiency
One-click resource configuration, real-time monitoring, and streamlined scheduling reduce operational complexity and lower training barriers. Integrate seamlessly with CI/CD pipelines and automate test execution. Eliminate repetitive manual tasks and free up engineers for high-value work.

Application Areas











Get More Information

02

HIL Testing System





HIL System





MINI HIL
(Modular All-in-One Bus Acquisition
& HIL Simulation Platform)





ADAS / AD HIL





Replay HIL





Automotive Camera Injection Box/Board



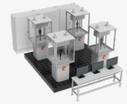
Intelligent Cockpit HIL





Powertrain HIL Testing Solution
BMS / VCU / TCU / MCU HIL



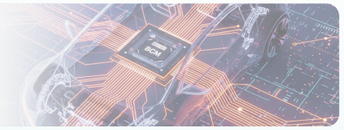


Chassis HIL Solutions
Steering / Braking / Suspension HIL





Body HIL



HIL Testing Bottlenecks: The Silent Threat to Automotive Project Timelines

Against the backdrop of automotive electrification and intelligence, Hardware-in-the-Loop (HIL) testing has become critical for validation—but it's increasingly plagued by bottlenecks (e.g., real-time/simulation trade-offs, high costs) that delay project timelines.

Real-Time Performance vs. Simulation Fidelity Imbalance

Engineering teams must navigate a high-stakes trade-off between supporting high-fidelity, physics-based simulation of real-world driving scenarios (critical for ADAS/AD validation) and meeting HIL's strict deterministic real-time response requirements; subpar simulation environments force compromises to test rigor or over-reliance on costly physical vehicle testing—slowing validation cycles and driving up material, labor, and rework costs.

Prohibitive Deployment & Maintenance Cost Burdens

Excessive upfront capital expenditure (CAPEX) for monolithic HIL hardware, coupled with inflexible architectures that require full-system overhauls for upgrades, leads to system incompatibility with evolving automotive standards, delayed capability expansion, and constrained workflows—directly reducing testing throughput and compromising the quality of validation data.

Platform Obsolescence & Skill Gap Constraints

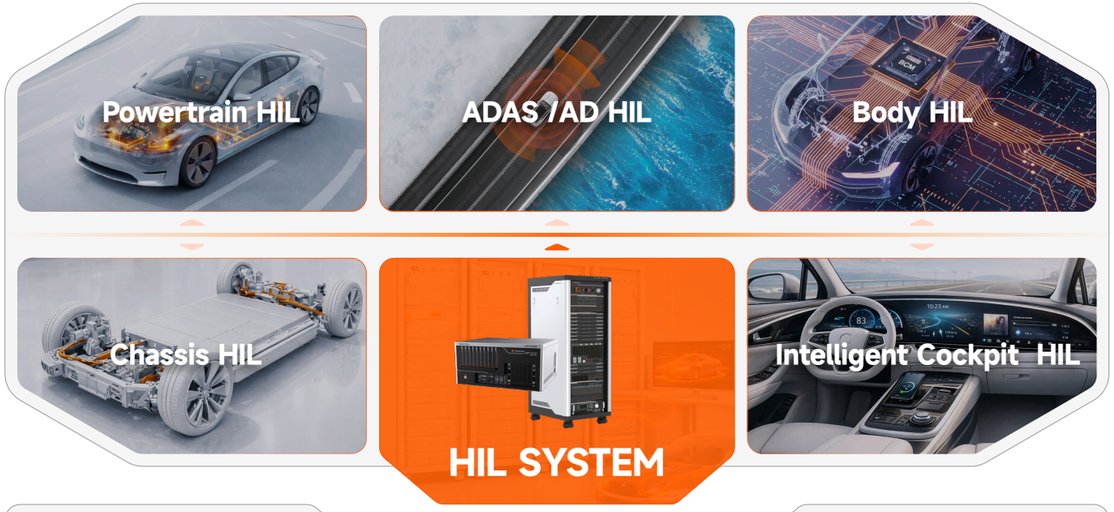
Rapid advancements in vehicle electrification, connected car technology, and autonomous driving demand agile, future-proof HIL platforms—but legacy systems lack modularity to integrate new I/O protocols and testing features, while limited upskilling budgets leave teams ill-equipped to leverage modern HIL automation tools. This dual challenge slows engineer onboarding, delays validation of next-generation vehicle systems, and locks teams into inefficient, manual testing workflows.

Fragmented Toolchain & Interface Compatibility Issues

To date, very few HIL vendors can deliver a truly unified, natively integrated solution covering HIL testing, network testing, calibration testing, and diagnostic testing tools. To unlock this full suite of test capabilities, engineering teams typically need to integrate disparate platforms and software from multiple vendors, which introduces system redundancy, unnecessary complexity, and a range of compatibility issues. These disparate multi-vendor HIL hardware and software stacks create rigid integration silos; even minor system updates require custom protocol development and manual data conversion to enable interoperability between sensors, ECUs, and analysis tools. This drives avoidable project delays, inflated operational expenditure (OPEX), and exposes validation workflows to data integrity risks and unnecessary engineering strain.

VCARSYSTEM HIL Systems: Resolve HIL Testing Bottlenecks, Accelerate Automotive Project Timelines

VCARSYSTEM launches a multi-form, cross-domain HIL solution tailored to resolve these core pain points, helping teams streamline workflows and boost validation efficiency.



CubeStack HIL

Cluster HIL simulation platform for complex systems R&D in SDV programs—making HIL as soft & flexible as SIL



- **Flexible and scalable HIL resources**
- **Multi-user & remote parallel testing**
- **Deterministic time & data synchronization**
- **CI / CD-ready automated validation**

DV Design Validation

PV Product Validation

EoL End-of-Line

Ultra Accuracy & Real-time Response

Drive Automotive Testing Efficiency



HIL SYSTEM

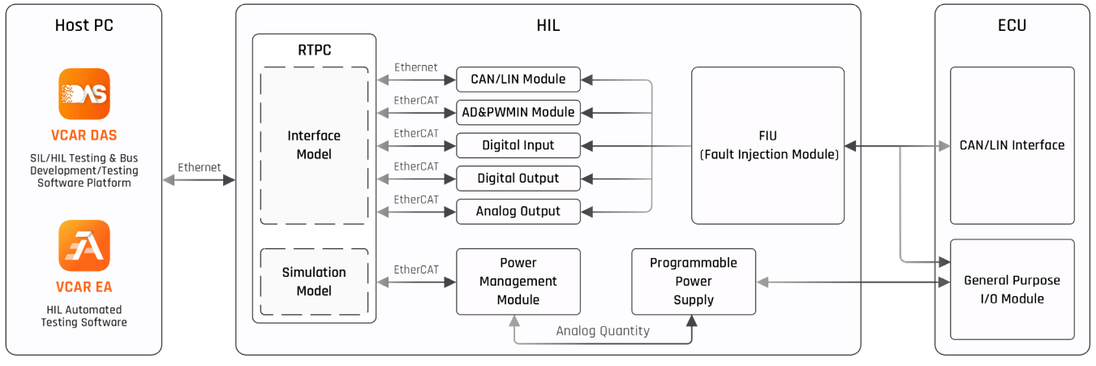
Versatile Hardware-in-the-loop(HIL) Test Platform for Multi-Domain System Validation

All-Domain, Agile, Future-Proof — Accelerate R&D, Lower Costs.

VCARSYSTEM's HIL System is a robust, configurable hardware-in-the-loop testing platform built exclusively for automotive system validation. It supports verification for core vehicle ECUs (BMS, VCU, MCU), ADAS functions (ACC, LKA, AEB) and other critical automotive system applications. Its flexible architecture and dependable performance are engineered to meet diverse validation needs across all automotive development workflows.

Main Functions

- **Functional Compliance Validation**
  Validates that controller functionality aligns precisely with original design intent, mitigating costly late-stage design reworks and reducing compliance risks in production validation.
- **Precision Fault Injection**
  Delivers non-intrusive injection of predefined electrical faults (e.g., open circuits, short-to-power) to controller pins via a dedicated FIU board—enabling repeatable, safe reliability testing without physical device damage.
- **Scripted Automated Testing**
  Enables script-driven automated fault injection and controller diagnostic data retrieval, eliminating manual effort, accelerating test cycle times, and ensuring consistent, repeatable validation outcomes.
- **Multi-Protocol Bus Compatibility**
  Supports CAN/CAN FD, LIN, FlexRay, Automotive Ethernet, SENT/SPC, PSI5, AK, DSI3 and other mainstream automotive protocols for industrial and automotive network communication validation, covering diverse interface needs for multi-domain automotive controller testing.
- **Component-Level Modular Expansion**
  Enables on-demand scaling of I/O channels, communication modules, and high-precision signal components—optimizing capital expenditure (CAPEX) by avoiding over-investment in unused capacity.



Advantages

Modular Deployment Cost Optimization

- **Optimizes capital and operational expenditure**
- On-demand modular scaling eliminates over-investment in unused hardware capacity, while avoiding costly full-system replacements during upgrades.

Streamlined Testing Efficiency

- **Accelerates validation with minimal manual effort**
- Script-driven automation enables unattended testing and data retrieval, shortening test cycle while improving result consistency—critical for faster time-to-market.

Multi-Domain Application Versatility

- **Adapts to diverse testing scenarios**
- Multi-protocol support and flexible signal interfaces address controller test needs across automotive, industrial control, and adjacent high-tech sectors.

Scalable Future-Proofing

- **Evolves with emerging automotive standards**
- Modular hardware and protocol-agnostic interfaces ensure your HIL setup remains compatible with next-gen technologies without full-system overhauls.

End-to-End R&D Support

- **Covers the full product development lifecycle**
- Supports testing from early-stage concept verification and mid-stage debugging to late-stage compliance validation—ensuring testing continuity across R&D phases.



Get More Information



Driven by the rise of intelligent transportation, industrial automation, and Software-Defined Vehicles (SDV), modern E/E architectures are becoming increasingly complex. Systems now rely on heterogeneous communication networks—CAN/CAN FD, LIN, FlexRay, and automotive Ethernet—alongside diverse signal types including GPIO, analog, resistance, and sensor-specific protocols.

At the same time, validation workflows are shifting from isolated lab testing to continuous, agile, and full lifecycle verification. Traditional tools, however, struggle to keep up—limited by rigid configurations, fragmented workflows, and insufficient integration across bus communication, signal acquisition, and HIL simulation.



Key Challenges in Traditional Testing

- **Rigid Channel Configuration with Limited Adaptability**

  Traditional tools provide fixed channel types and quantities (e.g., 8 CAN FD + 4 LIN). Mixed-signal testing or HIL simulation often requires multiple devices, resulting in resource waste, compatibility issues, and delays when requirements change.

- **Isolated Signal Processing & Low Efficiency**

  Most legacy tools focus only on bus communication and lack support for general-purpose signals and sensor protocols. Engineers must combine separate tools, leading to fragmented datasets, synchronization errors, and increased deployment time.

- **Limited Offline Capability for Long-Term Testing**

  Dependence on PCs or limited storage makes these tools unsuitable for long-duration, remote, or no-network testing scenarios. Slow data transfer further reduces post-analysis efficiency.

- **Complex Integration Workflows**

  Separate tools for configuration, logging, simulation, and analysis create siloed workflows. Lack of standard format support increases conversion effort and risks data inconsistency.



MINI HIL

Modular All-in-One Bus Acquisition & HIL Simulation Platform

Enabling Agile and Reliable Validation for the Automotive and Industrial Ecosystems

For engineering teams tackling the complexity of modern E/E systems, MINI HIL provides a flexible and scalable alternative to rigid, siloed tools.Designed to unify bus communication (CAN/CAN FD, LIN, FlexRay), multi-type signal acquisition (DIO、AIO、RO), high-speed data logging, offline operation and desktop-grade HIL simulation into a scalable end-to-end validation solution, precisely adapting to dynamic testing requirements and full development-cycle ECU validation scenarios.

Main Functions

- **Modular Channels & Board-Level Expansion**

  Supports multiple interchangeable multifunction base cards. The modular board architecture, combining base cards with various functional daughter cards, enables flexible channel-level configuration and switching. The system can provide up to 80 bus communication channels or more than 120 conventional I/O channels, while external 2.5G high-speed Ethernet ports allow further Ethernet interface expansion. It precisely meets a wide range of requirements, from bench testing to system-level HIL simulation.

- **Broad Compatibility for Buses & Signals**

  Supports CAN/CAN FD (up to 8 Mbit/s), LIN (≤19.2 kbps, protocol 1.3–2.2), and dual-channel FlexRay, while extending to automotive Ethernet T1 (100/1000 Mbps) and sensor protocols such as SENT, SPC, and PSI5. It integrates bus communication with general-purpose signals—including 0–60V analog input, ±100 mA digital output, and resistance simulation—as well as dedicated sensor signals, enabling true “bus + sensor/actuator + ECU + HIL” synchronized testing in a single platform.

- **High-Performance HIL Computing & Parallel Testing**

  Powered by 12th Gen Intel® Core™ processors, the platform delivers high-performance computing capability to meet the development and validation requirements of Rapid Control Prototyping (RCP) and Hardware-in-the-Loop (HIL) testing. It supports parallel multitasking, hybrid bus communication, and functional testing, while the 6-core processor ensures reliable low-latency operation under concurrent workloads, making it ideal for multi-user parallel testing and complex system-level validation scenarios.

- **Compact Deployment & Flexible Offline Operation**

  With a compact chassis (455 × 330 × 144 mm), CubeBox can be deployed on desktops, lab benches, or directly in vehicles without dedicated infrastructure. It operates independently without a PC and supports a wide 9–36V DC input (28V typical), making it ideal for remote testing, long-duration durability validation, and field deployment where network access is limited or unavailable.

- **High-Speed & Reliable Data Logging**

  Optional dual hot-swappable U.2 SSDs (1TB–8TB each), delivering up to 2.8 GB/s read/write performance and total storage up to 16TB. It supports industry-standard formats including DAT, MDF, MF4, ASC, and BLF, ensuring direct compatibility with 3rd party tools. A 1 µs timestamp resolution guarantees precise synchronization across all bus, signal, and HIL data.

- **Node Simulation, Fault Injection & Full Lifecycle Validation**

  The platform supports simulation of master/slave nodes across CAN/CAN FD, LIN, FlexRay, and automotive Ethernet, with configurable baud rates, sampling points, and termination resistors. Built-in fault injection capabilities—including node disconnection, termination faults, and signal interference—along with OBD diagnostic testing, enable comprehensive validation of system robustness and compliance across the entire development lifecycle.

- **Open Automation Ecosystem & Seamless Software Integration**

  MINI HIL provides native support for Python scripting and a real-time SDK, enabling integration with custom automation and test management systems. In combination with VCAR DAS, it delivers unified configuration, real-time visualization, signal parsing, HIL scheduling, and automated execution. Support for OTA updates and open interfaces ensures long-term scalability and seamless integration with existing development and calibration toolchains.

Paired with the VCAR DAS Software Platform: All-in-One Configuration, Control & Analysis

The integrated VCAR DAS software elevates CubeBox to a full testing and HIL simulation ecosystem, resolving the fragmentation pain points of traditional tools entirely:

Intuitive Bus & Signal Configuration

A graphical user interface enables setup of bus attributes (baud rate, sampling point, terminal resistor), signal physical value mapping, and GPIO/AI/AO channel configuration without complex coding, lowering operational barriers.

Real-Time Monitoring & Visualization

Real-time dashboards display bus load, signal waveforms, HIL simulation status, and key metrics (e.g., CANFD frame error rate). Custom threshold alerts (e.g., signal loss, abnormal bus load) enable timely detection of test anomalies.

Data Management & Analysis

Centralized storage of logged data and HIL simulation results, with built-in filtering, trend analysis, and report generation tools. Direct export to industry-standard formats ensures seamless integration with third-party analysis software, boosting data processing efficiency.

Automated Test Scripting

Custom test sequences and HIL simulation scenarios can be created for repeatable validation, with support for CI/CD pipeline integration to match agile development rhythms.

Device & User Management

Role-based access control facilitates team collaboration. Real-time monitoring of CubeBox hardware status (SSD health, power status, module temperature) and remote diagnostic capabilities enable rapid troubleshooting.

One Software for All



Bus Communication Analysis



HIL Testing Platform



VCAR SIL



3rd Party Software
Support via API

Multi-device compatible, Lower your software costs
Effortlessly streamline your workflow across functions

Advantages

Maximize Flexibility with Modular Design
Adapts to dynamic testing needs and scales from small setups to full HIL systems without hardware waste.

All-in-One Integration for Higher Efficiency
Unifies bus, signal, HIL, and fault injection in one platform—reducing setup time, improve efficiency.

High-Speed Long-Duration Logging
Supports continuous high-load acquisition (e.g., CAN FD + automotive Ethernet) for 72+ hours, far exceeding SD-based solutions.

Agile Deployment & Lower Investment
Compact design eliminates need for dedicated labs. Modular expansion avoids upfront overinvestment.

Open Ecosystem & Workflow Integration
Python automation, open SDK, and standard formats enable seamless integration without workflow disruption.

Stable Performance & Industry Compatibility
Reliable under high-load, multi-user scenarios. Fully compatible with mainstream 3rd paryt tools.

Application Areas

MINI HIL delivers core value to the automotive, industrial, and R&D sectors, adapting to diverse modern engineering needs and full development-cycle validation:



Automotive ECU Validation & HIL Simulation
Full lifecycle validation—from concept to compliance—supporting agile SDV development.



In-Vehicle Network & Diagnostics
CAN/LIN/Ethernet validation, signal integrity testing, and OBD fault diagnostics.



Automotive E/E System Validation
Domain controllers, ADAS, and complex network validation, including cross-domain interaction.



Industrial Automation & IoT
Validation of industrial communication systems in manufacturing, energy, and smart factories.



Component & Product Testing
End-of-line validation for ECUs and communication modules, ensuring quality and reliability.



R&D & Field Troubleshooting
Portable deployment for on-site diagnostics, intermittent issue logging, and prototype validation.



Education & Research
Scalable platform for teaching and research—from basic communication to advanced HIL systems.

Main Specifications

CubeBox Chassis		
Core Function	Provides an integrated installation platform, power management, device integration, and supports multi-card expansion	
Supply Voltage	9-36 VDC	Typical: 28 VDC
Rated Power Consumption	⩽ 200 W	
Startup Power Consumption	⩽ 250 W	
Protection Features	Supports overvoltage, reverse polarity, and short-circuit protection.	
Operating Temperature	0°C to 60°C	
Operating Humidity	10%–90% (non-condensing)	
Storage Temperature	−40°C to 85°C	
Altitude	⩾ 2000 m	
Dimensions (L × W × H)	279 × 450 × 177 (mm)	
Weight	4 kg (Chassis w/ backplane) / 6 kg (Chassis w/ backplane, PSU & blade host)	
Device Features	Integrated modular design for flexible multi-card configuration	

Parameter	KY9211 Blade Host	KYA411 Logger Board	KY3582 Multi-Function Switchable Base Board
Core Function	System computing core, interface expansion, data processing, real-time control	High-speed data storage, recording / playback, hot-swap management	Daughter card carrier, channel expansion, bus communication transfer, power distribution
Hardware Configuration	CPU: Intel® Core™ i7-12700K Memory: 32 GB DDR4 2666 MHz Storage: 512 GB / 1 TB SSD (optional)	Dual U.2 SSD slots (supports 1 TB / 8 TB) Protocol: PCIe 3.0 ×4	8 piggy slots; supports EtherCAT / Ethernet / PCIe communication transfer
Key Performance	3 GHz base / 4.6 GHz boost OS: Linux-based real-time system	Single-channel write speed ⩾ 2.8 GB/s Supports 2.5″ HDD (7–9.5 mm height)	EtherCAT: 100 Mbps Ethernet: 1000 Mbps PCIe 3.0 ×1: 984.6 MB/s Overvoltage protection ⩾ 60 V
Communication Interfaces	11× IOCNET, 2× USB, 1× Type-C (LCD support), 1× delayed Gigabit Ethernet	EtherCAT, board-to-board connector	RJ50 port, 2× D84B, EtherCAT & SGMII
Dimensions (L × W × H)	380 × 100 × 60 (mm)	380 × 100 × 30 (mm)	380 × 100 × 30 (mm)
Weight	1.5 kg	-	0.6 kg
Power Consumption	Typical: 50 W Startup: 115 W	⩽ 30 W	⩽ 40 W

Main Specifications

KY3582 Bus Series boards				
Parameter	KY3582F1 (CAN / CAN FD)	KY3582F2 (LIN)	KY3582F3 (FlexRay)	KY3582F12 (PSI5)
Core Function	CAN / CAN FD bus communication, node simulation, data Tx / Rx / playback	LIN bus communication, master / slave node simulation, data acquisition & recording	FlexRay bus communication, A/B dual-channel interaction, data acquisition	PSI5 serial communication, data interaction, protocol adaptation
Single Piggy Slot Count	1	1	1	2
Channel Configuration	Single piggy: 2 channels Full card: 0–16 channels (configurable)	Single piggy: 2 channels Full card: 0–16 channels (configurable)	Single piggy: 2 channels (A/B) Full card: 0–16 channels (configurable)	Single piggy: 1 channel Full card: 0–4 channels (configurable)
Bus Speed	CAN: ⩽ 1 Mbit/s CAN FD: ⩽ 8 Mbit/s	⩽ 20 kbit/s (⩽ 19,200 bps typical)	⩽ 20 kbit/s (⩽ 19,200 bps typical)	125 / 189 kbps
Termination Resistor	0 / 60 Ω / 120 Ω (software configurable)	-	0 / 100 Ω (software configurable)	-
Supported Protocols	J1939, ISO 11898-1/2/5/6	LIN 1.3, 2.0, 2.1, 2.2	FlexRay bus standard	PSIS V1.2, V1.3
Key Features	1 µs time accuracy, high-voltage isolation, node simulation & fault injection	Software-configurable master / slave mode Bus voltage: 5.5–12 V High channel density	Dual-channel isolation, simultaneous A/B communication support	Calibration: P / CRC Slot count: 1–6 configurable Filler types configurable

KY3582 Bus Series boards					
Parameter	KY3582F7 (DIO)	KY3582F8 (AI)	KY3582F9 (AO)	KY3582F11 (RO)	KY3582F13 (GPIO)
Core Function	Digital I/O, PWM signal Tx/Rx/acquisition	Analog input acquisition, multi-range adaptation	Analog voltage output, waveform generation (sine/square)	Resistance output, resistance simulation	General-purpose I/O, AI/AO/DI/DO switching
Single Piggy Slot Count	2	2	2	2	2
Channel Configuration	Single Piggy: 4 channels Full card: 0–16 channels (configurable)	Single Piggy: 6 channels Full card: 0–24 channels (configurable)	Single Piggy: 6 channels Full card: 0–24 channels (configurable)	Single Piggy: 2 channels Full card: 0–2 channels (configurable)	Single Piggy: 4 channels Full card: 0–4 channels (configurable)
Input / Output Range	Input: −60 V to +60 V Output: ±100 mA	Input ranges: −60 V to +60 V −15 V to +15 V −5 V to +5 V	Output: −15 V to +15 V Max output current: 150 mA	Resistance: 17 Ω to 1 MΩ	Analog I/O: Input: 0 V to 30 V Output: 0 V to 18 V Digital I/O: −30 V to +30 V
Key Parameters	PWM frequency: 0.03 Hz to 1 MHz Drive: LSD / HSD / Push-Pull	Resolution: 16-bit Sampling rate: 250 KSPS/Ch Input impedance: 1 MΩ	Resolution: 16-bit Update rate: 20 µs Waveform output: Sine: 0.02 Hz to 20 kHz Square: 0.02 Hz to 30 kHz Differential supported	Accuracy: ±2 Ω (17 Ω–260 Ω) ±1% (260 Ω–1 MΩ) Step: 1 Ω	PWM frequency: 0.03 Hz to 200 kHz Sampling rate (AI): 50 KSPS
Supported Signal Types	Switching value, PWM, coded signal, pulse signal	Sustained voltage input	Resistance output signal	Switching value, PWM, sustained voltage signal	Switching value, PWM, sustained voltage signal

Daily Obstacles Slowing Your Path to Autonomous Driving Commercialization

With the rapid advancement of artificial intelligence, big data, and Internet of Vehicles (IoV) technologies, autonomous driving has evolved from a conceptual vision to a key strategic direction reshaping the global automotive industry. It not only represents a revolutionary upgrade in transportation methods but also bears profound implications for improving traffic safety, optimizing resource allocation, and promoting sustainable development.

However, the large-scale commercialization of autonomous driving cannot be separated from rigorous and comprehensive testing—testing serves as the core barrier to ensuring the reliability and safety of autonomous driving systems. Meanwhile, the complexity and uncertainty of real-world driving scenarios have given rise to a series of core pain points in the testing process, which need to be addressed urgently by the industry. For automotive engineers developing ADAS/AD systems, testing workflows are often hindered by persistent challenges that slow progress and introduce uncertainty:

Data Acquisition Hurdles

Real-world road testing requires precise synchronization (<1ms) across multi-sensor arrays, yet inconsistent timing undermines data correlation—compromising the reliability of subsequent algorithm validation. Additionally, rigid, costly data loggers delay deployment, making it difficult to capture critical edge-case data when needed.

Data Management Inefficiencies

The volume of raw road test data overwhelms manual processing. Curating scenario libraries, standardizing annotations, and converting formats (e.g., to OpenDrive/OpenScenario) become time-intensive bottlenecks, stalling the transition from data collection to actionable validation.

Unreliable Perception Testing

Replicating real-world sensor inputs (cameras, LiDAR, radar) in lab environments is often imprecise. Poorly simulated sensor data or cumbersome RestBus emulation fail to reflect on-road realities, leaving perception algorithms untested against actual environmental nuances.

Gaps in Functional Validation

Extreme corner cases and fault scenarios (e.g., sensor malfunctions, bus communication failures) are too high-risk for public road testing. Traditional HIL systems, however, lack seamless end-to-end simulation capabilities to address these gaps—creating critical blind spots in functional verification.

VCARSYSTEM Helps Get Your ADAS / AD Projects On The Road Faster

VCARSYSTEM's integrated, end-to-end ADAS/AD testing solution is engineered to alleviate these pain points, empowering engineers to work more efficiently and confidently.

Advanced Driver Assistance Systems (ADAS) and Autonomous Driving (AD) Closed-Loop solution



- **Road Testing & Data Logging**
  VCARSYSTEM's High-Bandwidth ADAS/AD Data Logger collects high-quality, 1ms-synchronized datasets during real-world tests, with plug-and-play deployment and cost efficiency ensuring reliable, scalable data acquisition.

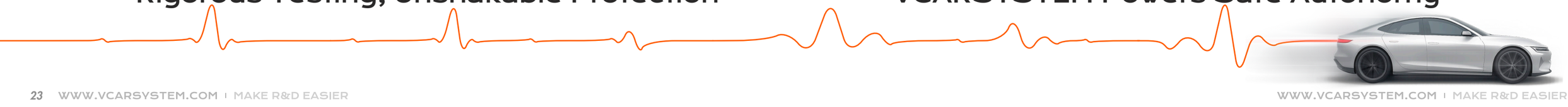
- **Data Management**
  VCARSYSTEM's integrated Data Management Platform handles scenario library curation, annotation, and OpenDrive / OpenScenario format conversion (industry standards), enabling structured perception testing and scenario-driven validation.

- **Perception Testing**
  VCARSYSTEM's Data Replay HIL facilitates sensor data injection, Rest Bus simulation, and cluster management — replicating real-world inputs to rigorously validate perception systems.

- **Functional Validation**
  VCARSYSTEM's ADAS/AD HIL supports end-to-end simulation (real/constructed scenarios) plus fault injection and corner-case testing, ensuring thorough verification of ADAS/AD functionalities.

By streamlining these workflows, VCARSYSTEM reduces rework, cuts time-to-validation, and minimizes uncertainty. For engineers, this means more time focused on innovating core ADAS/AD technologies—with the assurance that your systems are rigorously tested and ready for real-world deployment. In automated driving, rigorous testing isn't just a technical requirement—it's a commitment to saving lives.

Rigorous Testing, Unshakable Protection ———— VCARSYSTEM Powers Safe Autonomy





ADAS/AD HIL

Advanced Driver Assistance System/Autonomous Driving Hardware-in-the-Loop

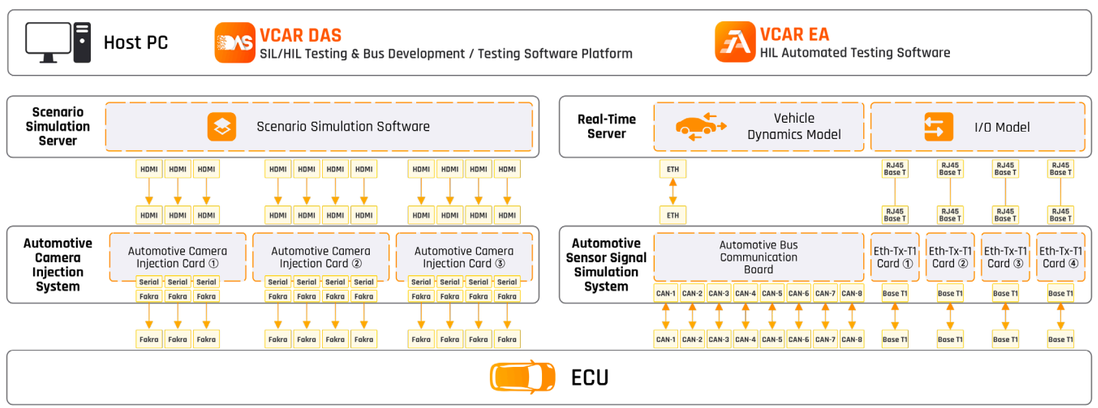
Hyper-Realistic Scenario & Sensor Fusion Simulation to Accelerate Safe, Scalable AD System Validation.

ADAS/AD HIL incorporates hardware into the test loop to emulate real-world scenarios, enabling rigorous testing of algorithms, domain controller within a safer, more controllable, and repeatable environment.
It further facilitates critical testing capabilities such as fault injection, corner case validation, scenario generalization, smoke testing, and stress testing, among others. These functionalities ensure autonomous driving systems undergo comprehensive validation across diverse operating conditions and potential failure modes prior to deployment.

Main Functions

- **Multi-Solutionreal vehicle sensor simulation Integration Support**
  Supports integration of diverse technical solutions, including scenario simulation software, vehicle dynamics models, and real vehicle sensor simulation with ground truth capabilities.
- **End-to-End Smart Driving Simulation Testing Support**
  Supports end-to-end simulation testing for autonomous driving, including measurement and analysis, use case design, environment simulation, test execution, and performance evaluation.
- **Closed-Loop Solution for Vehicle Simulation Testing**
  Enables development of closed-loop solutions for vehicle-level simulation testing, leveraging offline data replay and scenario simulation to support comprehensive validation across the entire R&D lifecycle.
- **Comprehensive AD HIL Equipment & Technical Solutions**
  Provides a full suite of AD HIL equipment and technical solutions, supporting extended development of scenario simulation and vehicle dynamics models—including adaptation of dynamics and sensor models.
- **Secondary Development Support for Open-Source Simulation Software**
  Supports extended development with open-source simulation software, delivering testing and validation services for domain controller perception, fusion, and control algorithms.
- **Legacy Simulation Environment Upgrades**
  Facilitates integration with legacy simulation environments, and provides hardware upgrade and middleware design services for existing vehicle-level or communication test simulation setups.

All these functions are available on our CubeStack(Cluster HIL Test Platform), enabling joint testing with other functional domains.



Advantages

Real-Time Closed-Loop

- **Ensures Reliable Validation of Time-Critical AD Algorithms.**
- Ultra-low latency closed-loop mirrors real-world dyamics, validating time-sensitive AD algorithms for ISO 26262 compliance.

High-Fidelity Sensor Data Injection

- **Reduces Dependence on Costly Field Testing.**
- High-fidelity sensor data (camera/LiDAR) with realism covers edge cases, cutting field test reliance.

Multi-Protocol Bus Simulation

- **Minimizes Integration Risks in Vehicle Networks.**
- Multi-protocol (CAN/LIN) bus simulation enables seamless node interaction, lowering integration risks.

Ethernet Node Simulation

- **Guarantees Stability for Next-Gen High-Speed E/E Architectures.**
- High-bandwidth Ethernet simulation validates peak-load performance, securing next-gen E/E stability.

Flexible Fault Injection

- **Validates Fault Tolerance & Compliance with Safety Standards.**
- Granular fault injection tests system resilience, supporting ISO 26262 compliance.

Efficient, Cost-Safe Testing

- **Accelerates R&D Cycles While Covering High-Risk Scenarios.**
- 24/7 automated testing covers high-risk scenarios, enabling cost-effective, safe R&D acceleration.



Get More Information



Replay HIL

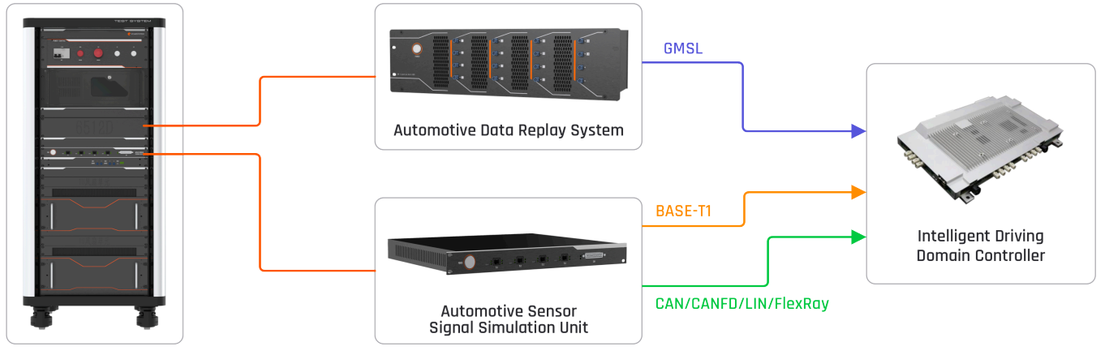
Automotive Sensor Data Replay Hardware in-the-Loop Solution

Replay Real-World Sensor Data, Accelerate AD Testing with Pinpoint Precision.

REPLAY HIL enables seamless scenario replication, accelerated perception algorithm R&D, and rigorous DMS (Driver Monitoring System)/OMS (Occupant Monitoring System) testing via fault injection.It delivers real-world driving scenarios directly to your lab, slashing reliance on costly field tests—supercharging R&D efficiency through pinpoint environment reproduction, supporting multi-protocol compatibility (CAN/-CANFD, LIN, FlexRay) and ultra-precise 1ms channel synchronization, and validating system resilience under abnormal conditions, all fully aligned with global automotive safety standards.

Main Functions

- **High-Fidelity Sensor Data Replay**
  Supports RAW/YUV video injection formats, MIPI/DVP protocols, and serializer model customization, with single-channel resolution up to 8MP at 30fps and 1ms inter-channel synchronization accuracy.
- **Multi-Protocol Bus & Ethernet Simulation**
  Features 8-channel CAN/CANFD (ISO 11898 compliant), 8-channel LIN (1.3/2.0/2.1/2.2), 1-channel FlexRay, and 4-channel automotive Ethernet conversion, enabling seamless ECU connectivity and 100/1000BASE-T1 standard Ethernet mutual conversion.
- **End-to-End Testing Integration**
  Supporting test stages from MIL/SIL to HIL/VIL/DIL for full-lifecycle R&D validation.
- **Customizable & Open Integration**
  Offers custom I2C handshake protocol support, DBC file import/parsing, and compatibility with legacy simulation environments, as well as secondary development for open-source simulation tools.
- **Fault Injection & Robustness Testing**
  Enables targeted fault injection to simulate abnormal sensor or communication conditions, validating system fault tolerance and compliance with safety standards.



Module Functions

Automotive Data Replay System

- Video link forwarding: Forwards video content to camera serial links (e.g., GMSL1/2, FPDLINK)
- ECU connection adaptation: Provides serial data output for connecting to ECU under test
- Customization support: Supports serializer model customization & custom I2C handshake protocol
- Video capabilities:
  - Max single-channel resolution: 8MP @ 30fps
  - Supports dedicated video injection formats for RAW/YUV products
  - Compatible with MIPI/DVP protocols
- Synchronization accuracy: 1ms across all channels

Automotive Sensor Signal Simulation Unit

Hardware Channel Overview (Can be customized as needed)

- 8-channel CAN/CANFD
- 8-channel LIN1-channel FlexRay
- 4-channel in-vehicle Ethernet protocol conversion channel

Bus Functions

- CAN/CANFD:
  - Supported protocols: ISO 11898-1, ISO 11898-6, ISO 11898-2 (for high-speed CAN)
  - Configurable baud rate: 40kbps–1Mbps (CAN); 40kbps–8Mbps (CANFD)
  - Supports DBC file import & parsing
- LIN:
  - Supported versions: 1.3, 2.0, 2.1, 2.2
  - Baud rate range: 0–20kbps
  - FlexRay protocol support

Ethernet Functions

- **Interface support:** 1-channel 100/1000BASE-T1 interface
- **Protocol conversion:** Supports bidirectional conversion between 100/1000BASE-T1 and standard Ethernet
- **Status monitoring:** Supports reading link status (LINK UP/LINK DOWN)

Advantages

Accelerated R&D Cycles

Reduces field test dependency by replicating complex scenarios in the lab, cutting down algorithm iteration time and overall development costs.

Ultra-Reliable Validation

Delivers consistent, repeatable testing conditions to ensure perception algorithms and AD systems perform reliably across diverse real-world scenarios.

Enhanced Safety & Risk Mitigation

Enables safe testing of high-risk edge cases and fault conditions that are difficult to replicate in the field, aligning with ISO 26262 functional safety requirements.

Flexible & Scalable Deployment

Supports customization of serializers, protocols, and simulation workflows, adapting to diverse AD sensor configurations and evolving testing needs.

Cost-Efficient & Controllable

Enables 24/7 automated testing in a controlled lab environment, minimizing resource waste associated with field tests while maximizing test coverage.

Get More Information



Automotive Camera Injection Box/Board

Accelerating ADAS/AD Validation with Simulated Camera Inputs

High-Fidelity, Millisecond-Synchronous Multi-Channel Video Injection to Fill the Gaps in Traditional Validation

Automotive Camera Injection Box/Board replaces physical cameras by simulating high-fidelity, multi-channel video output. It enables millisecond-level synchronous injection of these video streams within a controlled, repeatable testing environment.

It supports critical validation capabilities—including full-stack testing from low-level to high-level, fault simulation, and edge-case verification. These integrated functionalities break through the bottlenecks of traditional verification systems, accelerating the development and deployment of autonomous driving system

Main Functions

- **Video Injection Capability**
  - Supports forwarding HDMI video content into camera serial data (such as GMSL1/2, FPDLINK, etc.), enabling access to simulation software videos, data acquisition recorded videos, and videos in other data formats.
  - Supports 4-channel HDMI input with customizable resolution and frame rate, paired with 4-channel serial data output for connection to the ECU under test.
  - Supports customization of serializer models (e.g., Maxim/TI/THine/RHOM) and mixed use of multiple serializers on a single board, along with customizable I^2C handshake protocol.
  - Enables single-channel resolution up to 8M pixels at 30 frames, supporting video injection formats such as RAW/YUV and MIPI/DVP protocol.
  - Ensures 1ms synchronization accuracy across all channels, and supports video unit expansion via Ethernet cascading with synchronized cascading boards.
  - Supports converting images intoserial signals via the PCIe interface
- **Ethernet Management Function**
  Supports 100/1000M Base TX interface and enables remote firmware upgrade through the Ethernet interface.
- **Debugging Support**
  Provides debugging capabilities via the dedicated Debug interface.
- **Dual Form Factors, Flexible Integration**
  Automotive Camera Video Injection Box converts HDMI to GMSL for direct integration into existing cabinets; Automotive Camera Video Injection Board installs via PCIe on server motherboards and outputs GMSL.

Core Functional Specifications	
Parameter	**Specification**
FAKRA Output Ports	4 ports
HDMI Input Ports	4 ports (Box Only)
RJ45 Ethernet Interface	1 port (Box Only)
Video Injection Capability	GMSL1 / GMSL2 / FPD-Link; 8 MP @ 30 FPS
Protocol Support	MIPI / DVP
SerDes Support	Maxim / TI / THine / RHOM
Ethernet Management	Remote upgrade & cascading (Box Only)
Debug Interface	1 port (JTAG)

Physical & Environmental Specifications	
Parameter	**Specification**
Power Supply Mode	12 VDC (Box)
Operating Current	Max. 1.5 A
Size	255.3 × 150 × 60 (mm)
Weight	Approx. 1.7 kg
Operating Temperature	0°C to 40°C
Operating Humidity	10%–90% (non-condensing)
Dust & Waterproof Rating	IP20 (Box Only)

Advantages

High-precision Channel Synchronization

- **Mitigates Multi-Camera Timing Deviations for Accurate Fusion**
- Achieves 1ms cross-channel sync accuracy to coordinate multi-channel signals, alleviating timing mismatches that undermine autonomous driving decision-making.

Comprehensive & Customized Protocol Compatibility

- **Resolves Fragmented Protocol & Hardware Compatibility Issues**
- Supports mainstream protocols (MIPI, DVP) and custom I2C handshake protocols to enable seamless integration with diverse devices.

Diverse Video Format & Access Support

- **Expands Fault Simulation & Scenario Coverage**
- Accommodates formats (RAW, YUV) and diverse video sources (simulation, data acquisition) to cover long-tail test scenarios.

High-Definition Resolution Support

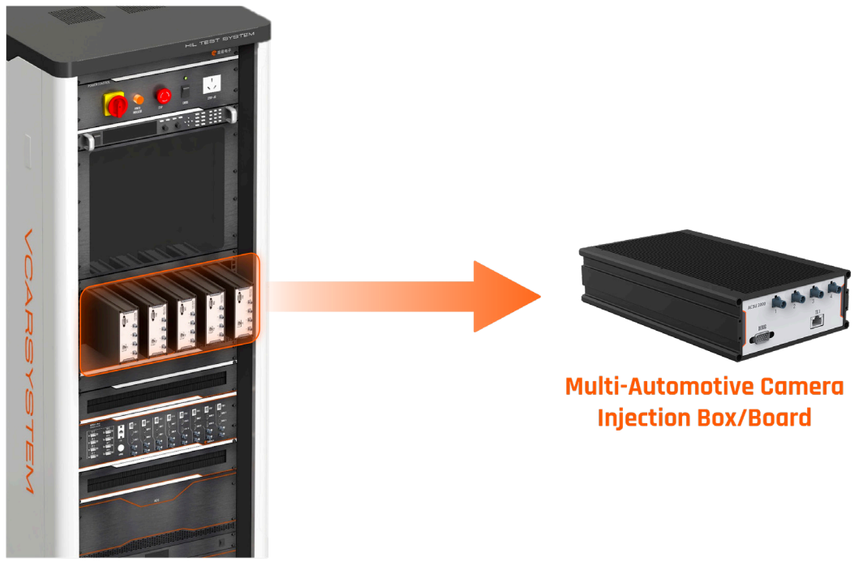
- **Enhances Signal Integrity in Complex Testing Scenarios**
- Supports single-channel 8M-pixel 30fps resolution to ensure smooth HD video transmission amid extreme conditions.

Ethernet Cascade Expansion

- **Scales Testing Capability for Large-Scale Validation**
- Enables Ethernet cascading of video units (with synchronized boards) to meet large-scale autonomous driving test needs.

Seamless HIL System Integration, Complete Workflow

Seamlessly integrates into existing AD or Replay HIL setups to refine test workflows, end road-test reliance, and achieve significant R&D savings



Get More Information



Intelligent Cockpit HIL

Multi-Domain Synergy Solution for User-Centric Cockpit Validation

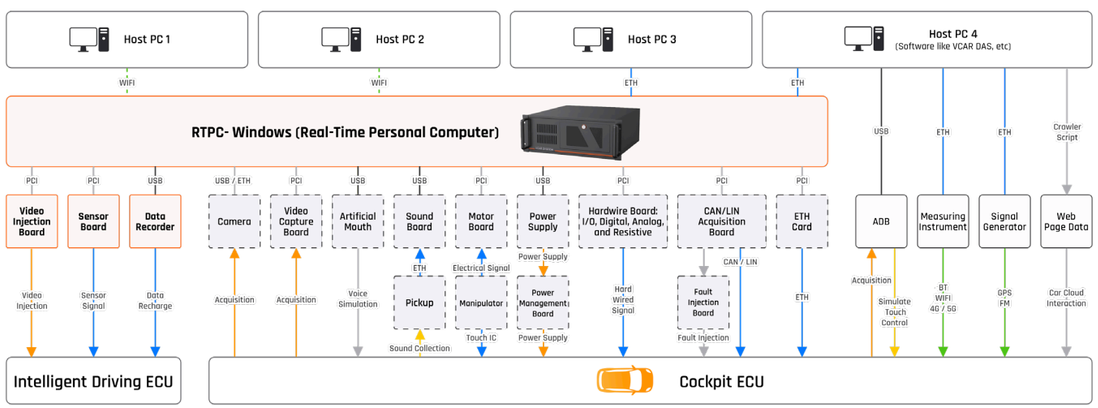
Multi-Domain Synergy & Realistic Interaction Simulation to Expedite Reliable Intelligent Cockpit Validation

Intelligent Cockpit HIL incorporates real intelligent cockpit hardware into the virtual test loop to replicate the in-vehicle ecosystem, enabling thorough validation of interfaces, connectivity, and intelligent interactions within a highly controllable, repeatable, and cost-effective environment.
It delivers comprehensive testing capabilities to break through the limitations of traditional discrete verification methods, ensuring next-generation intelligent cockpit systems achieve seamless cross-domain synergy and pass rigorous validation across all operational scenarios and potential edge cases before mass production

Main Functions

- **Bus Simulation Support**
  Supports core bus simulation requirements for intelligent cockpit testing, including mainstream bus types such as CAN/-CAN FD and Ethernet, laying a foundation for reliable data transmission verification between in-vehicle components.
- **Intelligent Human-Machine Interface (HMI) Interaction Automated Testing**
  Integrates AI algorithms, covering image/audio/touch testing and screen anomaly detection to ensure interaction reliability.
- **Performance Validation & Anomaly Detection**
  Covers comprehensive performance validation of intelligent cockpit systems, combined with targeted anomaly detection capabilities to ensure both operational performance and reliability, accurately identifying potential issues.
- **Radio Frequency (RF) Functionality Comprehensive Testing**
  Supports testing of multiple RF communication modules including Bluetooth/Wi-Fi, GPS, radio, 4G/5G, and satellite communication to fully verify wireless connectivity performance and compatibility.
- **Vehicle-Cloud Integration & Fusion Perception Testing**
  Facilitates testing of vehicle-cloud integration functionality and fusion perception systems, enabling scenario emulations for 360° surround view, Driver Monitoring System (DMS), and streaming rearview mirror.
- **Automated Test Software with User-Centric Features**
  Features graphical test case editing, customizable interfaces, and integrated engineering management, ensuring flexible and user-friendly operation to reduce the threshold for test teams.

All these functions are available on our CubeStack(Cluster HIL Test Platform), enabling joint testing with other functional domains.



Advantages

Compatible & Customizable Fixtures

- **Enables Flexible Adaptation to Diverse Cockpit Configurations**
- Customizable hardware fixtures support multi-screen installation and compatibility with various screen sizes, adapting to different intelligent cockpit hardware layouts and testing scenarios .

Compact Cockpit HIL Cabinet

- **Optimizes Laboratory Space Utilization**
- Features a space-saving compact design that reduces floor area occupancy while maintaining full hardware integration capabilities and test functionality .

Platform-Based Solutions

- **Combines Standardization and Customization for Swift Deployment**
- Built on a standardized hardware-software platform, it offers personalized customization options, short lead times, and scalable multi-unit replication to support batch testing.

Real-Time Processing System

- **Guarantees High Performance & Stable Test Operation**
- The Real-Time Processing System (RTPC) delivers high real-time computing capabilities, ensuring reliable performance and long-term stability for complex simulation scenarios.

Remote & Multi-Host Concurrent Control

- **Enhances Collaborative Testing**
- Supports remote operation and simultaneous control by multiple upper computers, enabling real-time data synchronization and collaborative test management across teams .

Scalable Integrated HIL Extension

- **Adapts to Evolving Test Requirements**
- Supports flexible function expansion, including extension to integrated cockpit-vehicle HIL solutions, compatible with advanced testing scenarios such as cockpit-driving integration .



Get More Information

Powertrain HIL Testing: Smash NEV's Core ECUs (VCU/BMS/MCU/TCU) Testing Pain Points

As the four core electronic control units (ECUs) of new energy vehicles (NEVs), the Battery Management System (BMS), Vehicle Control Unit (VCU), Motor Control Unit (MCU), and Transmission Control Unit (TCU) determine the vehicle's safety, reliability, energy efficiency, and connectivity performance. Yet, despite their foundational role in underpinning NEV performance, verifying these core components through conventional testing approaches—such as isolated bench testing or on-road prototype trials—presents a host of formidable challenges that impede efficient, comprehensive, and safety-aligned validation.

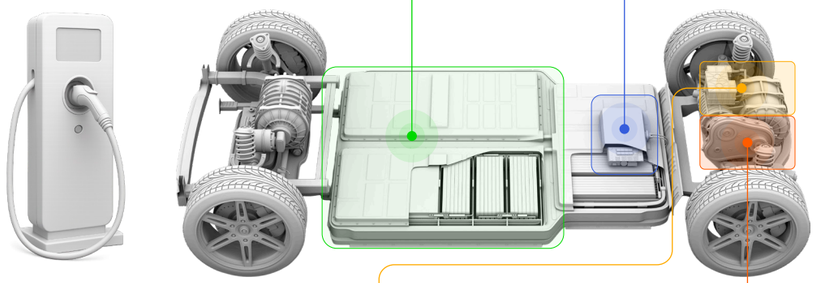
Critical Pain Points in BMS, VCU, MCU, and TCU Verification

Battery Management System (BMS)

- Difficult to replicate extreme temperatures and complex charge/discharge scenarios.
- High cost and long validation cycles due to battery wear and road testing.
- Safety risks in extreme condition testing (e.g., thermal runaway).
- Poor repeatability as battery performance changes with aging and temperature.
- Limited real-time integration testing with VCU, MCU, and other systems.

Vehicle Control Unit (VCU)

- High upfront investment in simulators, I/O hardware, and software licenses.
- Simulation latency and heavy bus load reduce test accuracy.
- Poor time synchronization between devices affects closed-loop reliability.
- Limited real-time integration with BMS, MCU, and other subsystems.
- Low automation and lack of a unified multi-domain platform.



Motor Control Unit (MCU)

- Tradeoff between real-time performance and accuracy (μs-level timing impact).
- Risk of equipment damage during fault injection.
- High system complexity and hardware cost (e.g., FPGA-based platforms).
- Dependence on third-party tools limits efficiency and collaboration.
- Complex multi-domain coordination and heavy regression workload.

Transmission Control Unit (TCU)

- Hydraulic systems are difficult to model accurately.
- Strong real-time coupling with powertrain increases validation complexity.
- Critical faults are difficult to safely reproduce.
- Large number of test cases and low automation efficiency.
- Complex I/O and multi-protocol communication extend debugging cycles.

Hardware-in-the-Loop (HIL) testing has emerged as an irreplaceable solution, directly targeting these core pain points while ensuring alignment with ISO 26262 functional safety standards.

BMS HIL: Full-operating-condition & multi-protocol compatibility that enhances BMS reliability verification efficiency

- Covers full-operating-condition simulation (e.g., low-temperature operation, overcharging, fault injection, and balancing strategy testing), mitigating risks associated with real-vehicle testing
- Supports European, American, and latest Chinese charging protocols (CCS / ISO 15118, etc.), aligning with global market requirements
- Integrates high-fidelity battery models and real-time simulation engines to accurately replicate battery characteristics

MCU HIL: Multi-hardware compatibility + full-dimensional fault simulation, reducing hardware adaptation costs and expanding fault verification coverage

- Compatible with mainstream motor types (PMSM, AC, BLDC) and common sensors (resolvers, eddy current sensors, encoders, SPI), reducing hardware replacement costs
- Replicates multi-type faults (inverter, motor, sensor, etc.) to cover anomaly verification needs in real operating conditions
- Adapts to controllers for water pumps, oil pumps, EPS steering motors, and traction motors, expanding test scenario boundaries

VCU HIL: Full-architecture + full-operating-condition validation to ensure precise deployment of VCU control logic and safety strategies

- Supports mainstream powertrain architectures (BEV, hybrid (PHEV/HEV), range-extended), compatible with VCU hardware and control strategies across vehicle models
- Covers full operating conditions (startup, idle, acceleration, braking, charging, energy recovery) to validate power distribution and mode switching
- Simulates faults (battery overcharge/discharge, motor malfunctions, communication anomalies) to verify VCU safety protection and diagnostic capabilities, ensuring vehicle operational safety

TCU HIL: Multi-transmission compatibility + full-scenario validation, improving shift performance testing efficiency

- Compatible with mainstream transmission types (AT, DCT, CVT, AMT) and various gear layouts/logics, reducing adaptation costs
- Covers scenarios (hill start, high-speed shifting, low-speed creep, shift jerk suppression) to test shift response, smoothness, and reliability
- Supports precision validation (shift pressure control, clutch engagement logic) and injects faults (sensor/hydraulic system anomalies) to enhance functional safety testing coverage

Net-Zero Goals, Zero Testing Headaches

VCARSYSTEM Paves the Way for Eco-Drive, Accelerates Sustainable Mobility



BMS HIL

Battery Management System Hardware-in-the-Loop

Hyper-Realistic Battery Dynamics Simulation to Accelerate Reliable BMS Controller Development & Validation.

VCARSYSTEM's BMS HIL critical for new energy BMS development—uses high-fidelity battery models and real-time kernels to replicate full operational scenarios: low-temp performance, over-charge protection, fault injection, cell balancing.

It rigorously validates BMS core algorithms, communication, and fault diagnostics, while simulating extreme regimes and full-lifecycle aging. Critical to mitigating deployment risks, it ensures BMS reliability and safety while accelerating development—streamlining lab-to-road transition with unmatched efficiency.

Main Functions

- **Battery Pack Core State Monitoring**

  Enables real-time, high-precision monitoring of key battery pack parameters (total voltage, loop current, cell/module temperatures) to support BMS real-time operational decisions.
- **Battery Cell State Estimation**

  Delivers accurate real-time Battery State of Charge (SOC) and State of Health (SOH) calculation via advanced algorithms for performance evaluation and lifecycle prediction.
- **High-Voltage Circuit Control & Protection**

  Manages high-voltage circuit pre-charging to mitigate inrush current, ensuring safe, stable system startup and component protection.
- **Insulation & Cell Balancing Management**

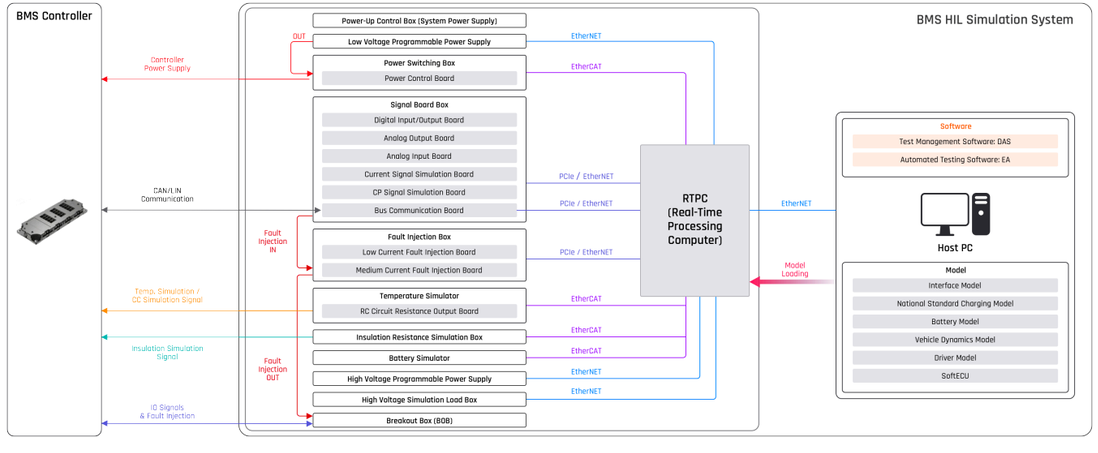
  Provides real-time high-voltage system insulation monitoring for electrical safety; enables active cell balancing to enhance pack consistency and cycle life.
- **Dual-Mode Charging Control Validation**

  Validates AC/DC charging control logics, aligning with protocol specs and power strategies for diverse charging scenarios.
- **Battery Thermal Management Validation**

  Simulates thermal conditions to validate BMS cooling/heating strategies, keeping the battery within optimal temperature ranges for safety and performance.
- **Scalable 4-Electric HIL Integration Testing**

  Expands to a 4-Electric HIL System for integrated testing of Vehicle Control Unit (VCU), BMS(Battery Management System), Motor Control Unit (MCU),Fuel Cell Control Unit (FCU)—validating multi-controller collaborative logic across the powertrain.

All these functions are available on our CubeStack(Cluster HIL Test Platform), enabling joint testing with other functional domains.



Advantages

Eliminate Compatibility Issues: In-House Hardware for Seamless BMS Signal Testing

Third-party hardware often causes BMS signal compatibility gaps—such as unrecognized cell voltage data or unstable CAN communication. Our in-house developed circuit boards cover digital I/O, CAN/LIN communication, and core modules, directly resolving these issues. They seamlessly adapt to diverse BMS signal needs, avoiding adaptation delays and ensuring reliable testing across all scenarios.

End Cumbersome Deployment: Integrated & Portable Design for Cross-Scenario BMS Testing

BMS testing across labs, production lines, and field sites is often hindered by bulky equipment and complex setup. Our highly integrated, compact system is plug-and-play—easy to transport and ready for immediate use. It eliminates the hassle of on-site configuration, cutting cross-scenario deployment costs and saving valuable testing time.

Solve Complex Testing & Remote Collaboration Gaps: Scalable Resource Pooling for BMS

Modern BMS testing requires complex scenarios like 4-electric system linkage, while remote teams face limited hardware access. Our scalable architecture supports multi-system integration for complex validation, and resource pooling enables multiple engineers to access remotely. This enhances hardware utilization and breaks geographical barriers for seamless collaboration.

Overcome Rigid Configurations: Customizable Solutions for Multi-Type BMS Adaptation

Modern BMS testing requires complex scenarios like 4-electric system linkage, while remote teams face limited hardware access. Our scalable architecture supports multi-system integration for complex validation, and resource pooling enables multiple engineers to access remotely. This enhances hardware utilization and breaks geographical barriers for seamless collaboration.

Cut Hidden Software Costs: One-Stop Toolchain for BMS Fault Injection & Calibration

BMS testing often incurs unexpected costs for separate fault injection tools, calibration software, and licenses. Our system integrates built-in fault injection (no extra tools) and a pre-loaded calibration library, eliminating additional software expenses. It streamlines the full testing workflow, from fault simulation to calibration, with minimal operational hassle.

Break License & Parallel Testing Limits: License-Free Modeling for Faster BMS Validation

Software licensing fees and single-device constraints slow BMS model development and parallel testing. Our license-free model ecosystem removes these barriers, allowing multiple computers to simultaneously develop models and run physical simulations. It accelerates validation cycles and eliminates recurring license costs, supporting efficient parallel workflow.

Eradicate Manual Interface Errors: Automated IO Generation for BMS Communication Adaptation

Manual configuration of BMS communication (dbc/ldf) and hardwired interfaces is time-consuming and prone to errors. Our M script-driven automated interface generation solves this pain point, replacing manual input with fast, accurate file creation. It avoids interface-related test failures, saves adaptation time, and ensures compatibility with diverse BMS protocols.

Get More Information



VCU HIL

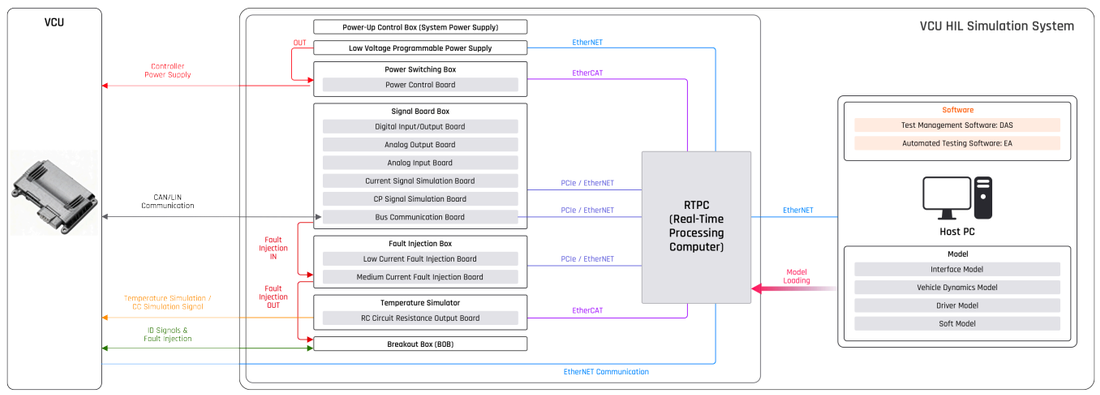
Vehicle Control Unit Hardware-in-the-Loop Validation Platform

Hyper-Realistic Vehicle Dynamics Simulation to Accelerate Reliable VCU Development & Validation.

VCARSYSTEM's VCU HIL leverages high-fidelity vehicle models and real-time emulation to replicate full operational scenarios—from normal driving to fault injection and edge-case conditions. It rigorously validates VCU control algorithms, communication protocols, and fault diagnostics, while mitigating deployment risks, improving reliability, and streamlining lab-to-road transition with unmatched efficiency.

Main Functions

- **Full Vehicle Dynamic Simulation**
  Verify functions such as torque control, vehicle energy management, vehicle power-on/off, network management and communication, vehicle status detection and display, and fault diagnosis and protection through high-fidelity models, while simulating real driving conditions and load curves.
- **Extreme Condition & Fault Injection Testing**
  Simulate edge cases (e.g., low-temperature cold start, sensor faults, high-voltage faults) and inject faults to verify the fault detection and response mechanisms of the Vehicle Control Unit (VCU).
- **Multi-Component Integration Validation**
  Integrates with BMS, MCU, and FCU emulators to test cross-subsystem communication and coordination, ensuring seamless interoperability in production vehicles.
- **I/O & Communication Protocol Validation**
  Validates analog/digital I/O, PWM signals, and CAN/LIN communication performance under both normal and fault conditions, adhering to automotive standards.
- **Automated Test Execution & Reporting**
  Runs scripted test cases automatically, generating detailed reports to streamline validation workflows and ensure traceability.
- **Model-Based Development Support**
  Compatibility with Matlab/Simulink, CarSim, and other modeling tools enables seamless model import, rapid iteration, and hardware-in-the-loop validation of control algorithms.



Advantages

Eliminate Subsystem Compatibility Issues: Multi-System Integration for Seamless Powertrain Validation

During powertrain integration, traditional HILs often create compatibility gaps in cross-subsystem communication—such as unrecognized CAN FD messages, mismatched fault response timing, or inconsistent torque coordination between VCU and MCU. Our in-house developed interface boards and automotive-grade protocol stacks provide native support for OEM communication standards. They enable closed-loop validation of VCU interactions with BMS, MCU, and TCU, avoiding integration delays and ensuring reliable multi-system performance across all driving scenarios.

End Cumbersome Deployment: All-in-One Portable HIL Chassis for Cross-Scenario VCU Testing

BMS testing across labs, production lines, and field sites is often hindered by bulky equipment and complex setup. Our highly integrated, compact system is plug-and-play—easy to transport and ready for immediate use. It eliminates the hassle of on-site configuration, cutting cross-scenario deployment costs and saving valuable testing time.

Solve Complex Testing & Remote Collaboration Gaps: Scalable Powertrain Emulation for Distributed Teams

Modern VCU testing demands complex scenarios while global engineering teams face limited hardware access. Our scalable HIL architecture supports multi-subsystem emulation for complete powertrain validation, and cloud-enabled resource pooling allows simultaneous remote access for distributed teams. This maximizes hardware utilization, breaks geographical barriers, and enables seamless collaborative debugging of VCU control logic.

Overcome Rigid Configurations: Modular, Reconfigurable Platform for Multi-Type VCU Adaptation

VCU designs vary widely across OEM platforms (passenger vehicles, commercial trucks, hybrid EVs) with unique I/O layouts, communication protocols, and fault logic. Our modular HiL platform features swappable I/O banks, reconfigurable fault injection matrices, and protocol-agnostic communication ports. It adapts to any VCU variant without requiring dedicated test benches, reducing capital expenditure and accelerating platform migration.

Cut Hidden Software Costs: One-Stop Toolchain for VCU Fault Injection & Calibration

VCU testing often incurs unexpected costs for standalone fault injection tools, third-party calibration software, and model licensing. Our HIL system integrates a built-in fault injection engine (for simulating sensor failures, overcurrent events, and bus faults) and a pre-loaded calibration workbench. This eliminates additional software expenses, streamlining the full workflow—from fault simulation to torque map calibration—with minimal operational hassle.

Break License & Parallel Testing Limits: License-Free Modeling for Parallel VCU Validation

Proprietary software licenses and single-device constraints slow VCU model development and parallel testing. Our HiL platform supports license-free import of models from Matlab/Simulink, CarSim, and other tools, and enables parallel test execution across multiple virtual nodes. This accelerates validation cycles, eliminates recurring licensing costs, and supports efficient parallel testing of control algorithm variants.

Eradicate Manual Interface Errors: Automated I/O & Communication Generation for VCU Protocol Adaptation

Manual configuration of VCU communication (dbc/dbf files) and hardwired I/O interfaces is time-consuming and prone to human error. Our M script-driven automated interface generation tool auto-generates dbc/dbf files and maps I/O signals to VCU pins. This replaces manual input with fast, accurate file creation, avoiding interface-related test failures, cutting adaptation time, and ensuring compatibility with diverse protocols (CAN FD, Ethernet, LIN).

Get More Information



TCU HIL

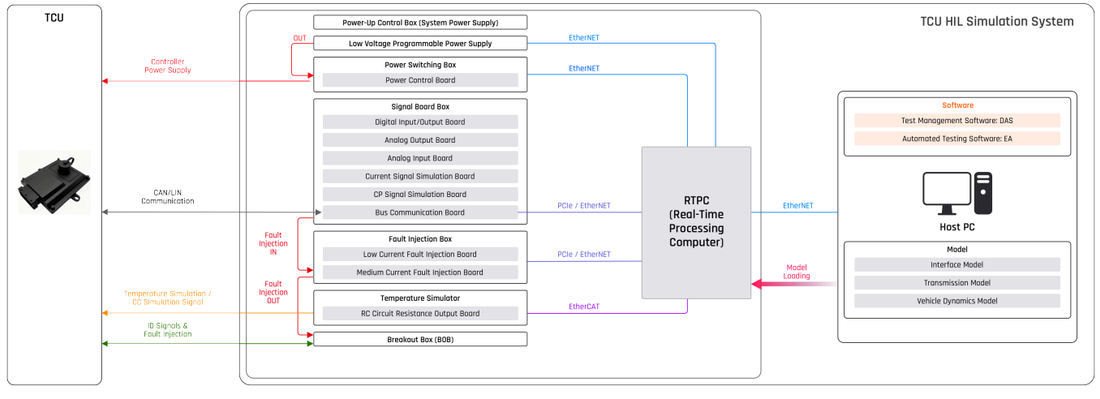
Transmission Control Unit Hardware-in-the-Loop Validation Platform

Hyper-Realistic Transmission Dynamics Simulation to Accelerate Reliable TCU Development & Validation.

VCARSYSTEM's TCU HIL leverages high-fidelity transmission dynamics models and real-time emulation to replicate full operational scenarios—from smooth city driving to extreme fault conditions. It rigorously validates TCU shift logic, clutch control, communication protocols, and fault diagnostics, while mitigating deployment risks, improving reliability, and streamlining lab-to-road transition with unmatched efficiency.

Main Functions

- **Shift Logic & Clutch Control Validation**
  Emulates real-time transmission dynamics to test shift quality, clutch engagement smoothness, and torque management across driving scenarios, ensuring optimal performance and comfort.
- **Hardware-Based Fault Injection**
  Injects faults (e.g., sensor signal loss, solenoid failures, bus communication errors) directly via hardware, eliminating the need for external tools and enabling safe validation of TCU fault response.
- **Measurement Calibration & Diagnostics**
  Provides built-in calibration compliant with automotive standards, eliminating reliance on third-party tools (e.g., INCA, CANape) and enabling automated diagnostic trouble code (DTC) validation.
- **License-Free Model Support**
  Enables secondary development without proprietary licenses, supporting concurrent access to physical models by multiple engineers and compatibility with Matlab/Simulink, CarSim, and other tools.
- **Automated I/O Interface Generation**
  The M-script-based automated interface generation tool can quickly and accurately generate configuration files, replacing manual input, preventing interface-related test failures, and significantly reducing integration time.
- **Multi-Subsystem Integration Testing**
  Integrates with HCU, MCU, and EMS emulators to validate cross-system communication and torque coordination, ensuring seamless interoperability in production vehicles.



Advantages

Eliminate Subsystem Compatibility Issues: In-House Hardware & Protocol Stack for Seamless TCU Integration

Our in-house developed multi-function I/O and communication boards natively support CAN, LIN, and FlexRay, eliminating compatibility gaps in TCU-subsystem communication. This ensures reliable validation of cross-system interactions without integration delays.

End Cumbersome Deployment: Highly Integrated, Portable Design for Cross-Scenario Testing

Our compact, plug-and-play HIL system requires zero on-site configuration, making it easy to transport and deploy across labs, production lines, and field sites. It eliminates the hassle of multi-component assembly and cuts cross-scenario deployment costs.

Solve Complex Testing & Remote Collaboration Gaps: Scalable Resource Pooling for Distributed Teams

Our scalable architecture supports multi-user remote access, enabling global engineering teams to collaborate on complex TCU validation scenarios. This maximizes hardware utilization and breaks geographical barriers to accelerate development.

Cut Hidden Software Costs: One-Stop Toolchain for TCU Validation

Our integrated platform eliminates the need for standalone fault injection tools, third-party calibration software, and proprietary model licenses. This reduces operational expenses and streamlines the full validation workflow.

Break License & Parallel Testing Limits: License-Free Modeling for Faster Validation

Our platform supports license-free model import and parallel test execution, enabling multiple engineers to validate shift algorithm variants simultaneously. This accelerates validation cycles and eliminates recurring licensing costs.

Eradicate Manual Interface Errors: Automated I/O & Communication Generation

Our M-script-driven automated interface generation replaces manual configuration with fast, accurate file creation, avoiding interface-related test failures and ensuring compatibility with diverse protocols.

Get More Information



MCU HIL

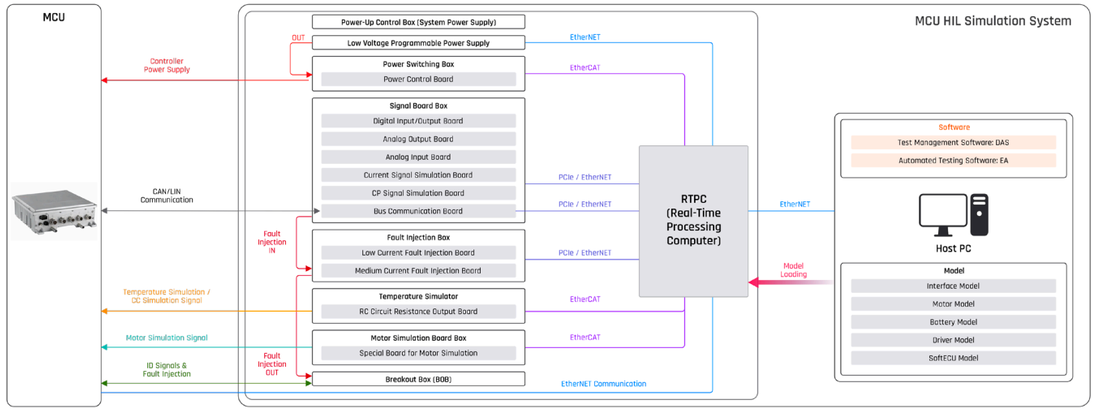
Motor Control Unit Hardware-in-the-Loop

High-Fidelity Real-Time Simulation to Streamline Reliable MCU Development & Verification.

VCARSYSTEM's MCU HIL simulation testing system integrates core components including a real-time host, FPGA motor simulation board, and CAN communication board. Via the host computer, motor models are downloaded to the FPGA for direct data output. The system supports closed-loop control, enabling seamless data interaction through the CAN board. Relying on test management software and automated testing software, tasks such as test execution, fault injection, test case editing, and report generation can be completed to achieve comprehensive verification of MCU performance.

Main Functions

- **Signal-Level and Power-Level Simulation**
  - Supports both signal-level and power-level simulation. Applicable to steering, braking, thermal management, electric drive systems, and two-wheeled EV drive systems.
- **Dynamometer Integration**
  - Can be extended for joint debugging with dynamometer systems and combined with real battery packs for integrated "three-electric" system testing.
- **Motor and Sensor Simulation**
  - Supports simulation of PMSM, AC induction motors, BLDC motors, and multiple motor instances simultaneously.
  - Simulates position sensors including resolvers, encoders, and eddy current sensors.
- **Integrated Fault Injection and Calibration**
  - Supports motor, sensor, and inverter fault simulation without additional fault injection software.
  - Provides built-in measurement and calibration libraries, eliminating the need for external tools such as INCA or CANape.
- **Software and Automation**
  - Includes engineering configuration tools, test management, and automated testing software.
  - Supports multi-user license sharing and Simulink model import with hierarchical viewing, without requiring additional Simulink licenses.
- **Customizable Configuration**
  - Offers rich optional configurations and customization to meet diverse testing needs and shorten procurement cycles.



Advantages

Highly Integrated & Deployment Portability: Maximize space efficiency, enable flexible deployment

Featuring a highly integrated hardware architecture and lightweight design, our MCU HIL solution is easy to move and deploy across diverse scenarios—including bench testing, field validation, and even on-vehicle applications—without sacrificing testing precision and real-time performance.

Hardware Efficiency & Cost Optimization: Cut upfront investment, reduce long-term maintenance

We consolidate analog/digital/communication signal acquisition onto a single board, shrinking hardware footprint while simplifying inventory management to lower ongoing operational overhead.

Agile Procurement & Configuration: Avoid over-specs, shorten lead times

Our fully customizable hardware/software configurations align precisely with your unique testing needs—eliminating redundant components and streamlining procurement timelines.

Software License & Compatibility Savings: Reduce license costs, skip extra tool fees

Concurrent multi-user license sharing lets teams collaborate without per-seat charges; native compatibility with mainstream tools removes the need for costly third-party software.

Integrated Toolchain: Skip tool purchases, cut integration work

Built-in fault injection, calibration, and diagnostic functions eliminate separate tool buys; pre-validated compatibility ensures seamless setup with no extra software dependency.

Collaborative Testing Efficiency: Sync cross-team work, speed up testing

Simultaneous multi-workstation model deployment (no siloed licenses) and centralized shareable repositories let teams align tests faster and avoid synchronization delays.

Get More Information



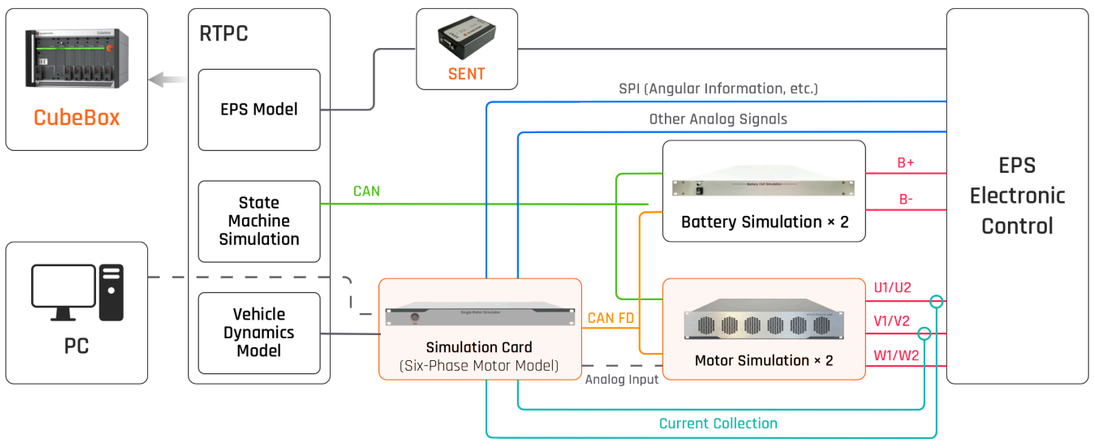
Digitally-Driven Intelligent Motor Simulator

Mechanical-free, full-spectrum fault injection, seamless HIL integration, all-scenario motor testing

Boasting mechanical-free electrical signal simulation, customizable complex working condition replication, full-spectrum active fault injection, and seamless HIL system integration. It precisely addresses the testing requirements of on-vehicle motors—from routine performance evaluations to extreme scenario validations—and stands as an indispensable high-efficiency core tool for motor testing in the automotive electrification era.

Main Functions

- **Electrical Signal Simulation**
  - Provides power signal simulation for various automotive motors, including permanent magnet synchronous motors (PMSM) and brushed DC motors, covering voltage/current output, speed/torque/position signal simulation, and dynamic performance curve reproduction.
- **Operating Condition Test Simulation**
  Customizable complex working condition parameters & test sequences; support storage and reuse of parameters to ensure test consistency and avoid data deviation.
- **Multi-scenario Motor Test Adaptation**
  Covers multiple motor types (surface-mounted PMSM, 3-phase BLDC, DC); adapts to automotive MCU/EPS/EMB/body controller power-level tests; supports multi-power scenarios (tens of watts to tens of kilowatts) for functional and durability testing.
- **Rapid HIL System Adaptation**
  Standardized interfaces (CAN, Ethernet) for direct HIL test bench integration; customizable test logic to fit automated processes and boost system construction efficiency.
- **Fault and Limit Testing**
  Electronic injection of various motor faults/extreme conditions (current surge, voltage fluctuation, etc.); precise setting of fault trigger timing, duration and parameter fluctuation for accurate extreme scenario reproduction.



Advantages

No mechanical design: Eliminates noise and safety hazards
- Laboratory background noise level (<40dB), no need for additional sound insulation facilities.
- Compact size, saves space costs, makes the test environment safer and operation more convenient.

Operating Condition Simulation: Flexible adaptation + accurate reproduction
- Flexibly adapts to and accurately reproduces any complex operating conditions (e.g., start-stop cycles, dynamic load
- mutations, wide-range speed regulation).
  Supports repeated testing of the same test scenario to ensure consistent test data.

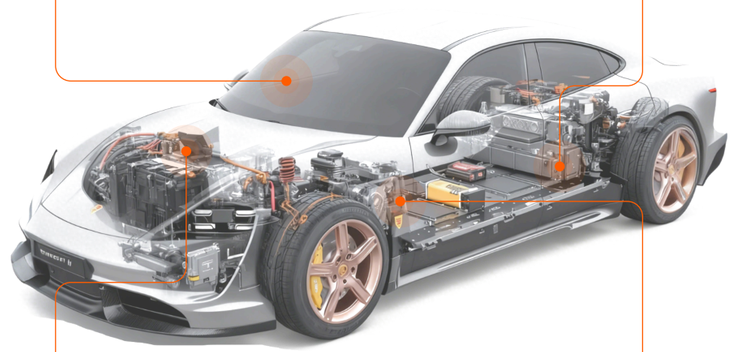
Fault Injection: Full-dimensional coverage extreme testing
- Supports extreme condition testing such as current surge, voltage fluctuation, sudden stall, and overload impact.
- Actively injects various faults/extreme conditions in an electronic way to break through the test boundaries of mechanical solutions.

HIL adaptation: Flexible definition & Rapid docking
- Simplified integration: Can be directly embedded into various automated test benches.
- Flexible expansion: Supports custom adjustment of test logic, greatly improving the construction efficiency and subsequent expansion capability of the test system.

Typical Applications

Thermal Management System (Approx. 15% of Total Vehicle Motors)
Temperature control center for stable operation of vehicle components. Motors precisely regulate the operating temperature of batteries and drive motors to avoid overheating or overcooling.

Body System (Approx. 45% of Total Vehicle Motors)
Motor supports automated comfort functions such as seat adjustment and window lifting;
it is a functional actuator that enhances the driving experience.



Power Train System (Approx. 30% of Total Vehicle Motors)
The core of vehicle power output. Motors determine acceleration and endurance performance.

Chassis Control System (Approx. 10% of Total Vehicle Motors)
The "braking guarantee for driving safety." Motors control steering force to improve handling convenience.

Daily Challenges Slowing Your Path to Chassis Control Validation

With the rapid advancement of intelligent chassis, drive-by-wire systems, and domain integration, the automotive industry is accelerating the transition to software-defined vehicles. As the core of vehicle motion control, the intelligent chassis has evolved from traditional mechanical systems to a highly integrated platform that unifies steering, braking, and suspension functions—laying a cornerstone for delivering enhanced safety, comfort, and agility.

However, the large-scale adoption of intelligent chassis relies on rigorous, comprehensive, and reliable testing as a critical prerequisite for ensuring the reliability, performance, and robustness of its control systems. Meanwhile, the increasing complexity of vehicle dynamics, the growing demand for scenario-driven validation, and the difficulty in replicating extreme operating conditions and fault scenarios in real-world settings have become critical pain points that the industry urgently needs to address. For engineering teams developing chassis control systems, testing workflows are frequently hampered by persistent challenges that slow progress and introduce uncertainty.

Steering System Testing & Validation Challenges

As steering systems evolve towards electrification and steer-by-wire, testing focus expands beyond precision and durability to functional safety, fault tolerance and driving experience. Specifically, steer-by-wire eliminates the mechanical steering linkage, so comprehensive fault simulation testing is mandatory to meet strict functional safety mandates.

Brake System Testing & Validation Challenge

Automotive brake system testing is likewise facing the challenges of a full-scale transformation—shifting from traditional mechanical performance validation to intelligent control, safety redundancy, and electrification integration. With the widespread adoption of brake-by-wire technology, the core focus of testing has deepened to address the unique hurdles inherent to functional safety validation, quantifiable driving experience assessment, and regenerative braking. In addition, simulating the full spectrum of extreme operating conditions presents a further critical challenge to comprehensive test and validation.

Suspension System Testing & Validation Challenges

Suspension system testing is undergoing a profound transformation—from traditional mechanical performance validation to comprehensive evaluation of intelligent control, functional safety and quantifiable driving experience. With the widespread adoption of active suspension technologies, however, traditional test setups lack the capability to accurately simulate multi-sensor data, replicate complex driving scenarios, and achieve cross-system coordination with steering and brake systems, creating critical gaps in test and validation coverage.

Chassis Domain Control Testing Challenges

Validating chassis domain control performance requires addressing core challenges from deep multi-system integration, an exponential surge in software algorithm complexity, and mandatory validation of Safety of the Intended Functionality (SOTIF), as well as meeting stringent demands for the test system's real-time performance and determinism, system latency, displacement control accuracy (e.g., ±2mm), and high-fidelity simulation of sensor noise and environmental disturbances.

VCARSYSTEM Accelerates Your Chassis Control Projects From Lab to Road

VCARSYSTEM's integrated, end-to-end HIL validation solution for the entire chassis domain—encompassing Steering, Braking, and Suspension—is engineered to break down testing silos, empowering engineers to efficiently validate complex interactions across the full vehicle motion control system.



- **Steering System Testing & Validation**

  VCARSYSTEM provides a professional hardware-in-the-loop test solution for steering systems, covering full-scenario testing from component-level, system-level to vehicle-level. It accurately simulates and captures core torque and angle signals, achieves rigorous validation of functional safety and performance with comprehensive fault injection capabilities, and supports plug-and-play rapid deployment to fully guarantee the reliable operation of the steering system under dynamic working conditions.

- **Braking System Testing & Validation**

  VCARSYSTEM's Braking HIL Test Platform delivers full-tier braking system testing across component-level, system-level and vehicle-level tiers, with accurate wheel speed signal simulation and acquisition, paired with comprehensive wheel speed fault scenario simulation and injection capabilities. This platform enables rigorous validation of the braking system's functional safety logic and performance, with plug-and-play rapid deployment to ensure reliable braking operation under all dynamic driving conditions.

- **Suspension System Testing & Validation**

  VCARSYSTEM's Suspension HIL Test Platform supports dynamic testing of suspension systems at component-level, system-level and vehicle-level. It accurately simulates and captures height and acceleration signals, and integrates high-dynamic actuation with real-time scenario modeling to faithfully reproduce various dynamic road inputs such as potholes and load variations. The platform enables rigorous validation of functional safety logic and performance, supports plug-and-play rapid deployment, and helps engineers optimize and iterate damping algorithms to continuously improve vehicle ride comfort.

Comprehensive Chassis Validation, Full-Range Dynamic Safeguarding —— VCARSYSTEM Drives Dependable Vehicle Operation



Steering HIL Testing System

Electric Power Steering (EPS)/ Steer-by-Wire Steering (SBW) Hardware-in-the-Loop (HIL) Testing System

Multi-Level Testing & High-Fidelity Vehicle Dynamics Simulation to Ensure Reliable EPS/SBW System Validation

VCARSYSTEM Full-Function Steering Hardware-in-the-Loop (HIL) Test System delivers full-dimensional simulation across signal-level, power-level and mechanical-level, enabling comprehensive testing and validation of motor control boards, inverters, motor components, as well as steering control algorithms and functional safety diagnostics, with full compatibility for both Electric Power Steering (EPS) and Steer-by-Wire (SBW) systems; capable of reproducing real-world steering scenarios including vehicle dynamics characteristics, road conditions and driver maneuvers to complete full functional and performance evaluation of the steering system, this controllable, highly repeatable test environment provides reliable verification evidence for steering system components and control strategies, and facilitates the engineering readiness and implementation of relevant R&D achievements prior to real-vehicle testing.

Main Functions

- **Steering Wheel Simulation Input**

  For mechanical-level testing, the integrated steering robot delivers a high-dynamic input torque of ≥100 Nm with angle control accuracy of <0.1°, enabling precise simulation of real-world steering maneuvers for reliable validation testing.

- **Linear Motor Load Simulation**

  Delivers a maximum simulated output force of 20 kN (force measurement accuracy: 0.25% FS), a linear motion speed of 1 m/s, and 0.1 mm positioning accuracy via direct drive technology (zero backlash), enabling high-precision load and motion simulation across real-world operating conditions.

- **Adaptive Mechanism Design**

  Enables left-right and hand-drive adjustment with 0.25 mm positioning accuracy and a maximum positional tolerance of <5 mm, adapting to diverse steering gear installation orientations.

- **High-Dynamic Performance (Speed & Acceleration)**

  Delivers exceptional dynamic performance with high speed and rapid acceleration, enabling simulation of extreme steering maneuvers to meet complex testing requirements.

- **High-Speed & High-Resolution Acquisition**

  Incorporates VCARSYSTEM's proprietary high-speed measurement system (max. sampling rate ≥2 MHz, resolution ≥ 16-bit) to acquire accurate, high-quality test data.

- **Complete Automatic Calibration Function**

  Integrates a fully automated calibration function for ADAS-enabled power steering systems, streamlining test preparation workflows and ensuring consistent accuracy.

- **Comprehensive Steering Verification & Simulation**

  Encompasses all full-spectrum key steering functions, simulates diverse driving conditions, road characteristics, and vehicle operating states, and injects a comprehensive suite of fault scenarios to thoroughly validate steering system performance, reliability, and adaptability across all operating conditions.

Signal-Level Testing	Power-Level Testing	Mechanical-Level Testing
Focuses on steering system control logic & signal integrity. Validates MCU software algorithms, sensor processing, CAN/SPI buses, and PWM drive accuracy under no-load or simulated-load conditions.	Focuses on steering system energy efficiency & operational reliability. Validates drive circuit switching performance, thermal behavior, and overcurrent/overvoltage/overheat protection effectiveness under real or high-power simulated load.	Focuses on overall steering system performance & electromechanical integration. Validates torque, speed, positioning accuracy, vibration, noise, and service life under real actuator (e.g., motor) operating conditions.
• **Safe & Low-Cost:** Low-voltage, low-current operation eliminates damage risk and cuts test costs • **High Efficiency & Coverage:** Easily replicates all working conditions/faults, supports automated testing, and delivers high software logic coverage • **Fast Troubleshooting:** Separates control logic issues from power/mechanical faults to speed up problem localization	• **Real Stress Validation:** Uncovers overshoot, oscillation and hidden risks in power devices under real electrical stress • **Protection Verification:** The only effective method to validate overcurrent, short-circuit and overheat protection functions • **Quantifiable Performance:** Directly measures efficiency and temperature rise to boost product competitiveness & reliability	• **Real-World System Validation:** Delivers real-vehicle aligned results, reflecting full cross-tier integrated performance • **Hidden Fault Detection:** Identifies electro-mechanical coupling issues (e.g., vibration-induced connector loosening) undetectable by electrical-only testing • **Ride Comfort Optimization:** Quantifies noise, vibration and smoothness to enhance vehicle driving experience

Advantages

Signal-Level Full-Parameter Simulation & Control Strategy Pre-validation

- **Enables pre-validation of steering control strategies, significantly shortening your R&D cycle and reducing hardware trial-and-error costs.**
- Supports convenient full-parameter configuration of motors and inverters (pole pairs, phase resistance, inductance, flux linkage, initial state, inertia, friction coefficient, etc.), accurately simulates PWM-controlled DC-AC conversion characteristics, IGBT/diode switching characteristics, and enables rapid simulation of various inverter and motor fault conditions.

Power-Level Wide-Range Adaptation & Hardware-Level Fault Simulation

- **Covers full testing requirements of all steering power units with one single system, eliminating multi-equipment switching and reducing test investment.**
- Adapts to 300W-20KW power range, 12V/24V/48V platform voltage, compatible with Surface-mounted Permanent Magnet Synchronous Motors (SPMSM), supports peak single-motor current ≥150A, and accurately simulates motor hardware faults including inter-phase short circuit, phase offset and phase loss.

High Reliability Long-Term Operation & Lifecycle Cost Reduction

- **Delivers maintenance-free continuous stable operation, greatly reducing equipment downtime and full-lifecycle operational costs.**
- Adopts a wear-free component design with fire resistance, supports uninterrupted long-duration testing in harsh environments, and meets all long-cycle test requirements.

High-Efficiency Force Transmission & Compact Structure Optimization

- **Reduces test site footprint, deployment costs and equipment failure rate, while improving load simulation accuracy.**
- Adopts direct force generation technology and simplified mechanical structure, eliminates intermediate transmission parts to reduce mechanical loss and failure points, simultaneously cuts equipment weight and installation space, and improves force transmission efficiency and load simulation accuracy.

High-Stiffness Drive & Ultra-High Precision Testing

- **Ensures test accuracy and repeatability under all working conditions, achieving 1:1 matching with real-vehicle operating conditions.**
- The drive unit features high static and dynamic stiffness, delivers stable output under high load and high speed conditions, realizes ultra-precise motion control with positioning accuracy <1μm, and meets the most stringent accuracy requirements of steering testing.

Robust Environmental Adaptability & Superior Shock/Vibration Resistance

- **Greatly improves equipment durability and service life, enabling stable and reliable operation in complex and harsh environments.**
- Features excellent shock and vibration resistance, maintains stable operation in complex and harsh test environments, and adapts to long-term testing requirements in all scenarios.

Multi-Platform Rapid Adaptation & Ultra-Fast Real-Time Response

- **Seamlessly adapts to various autonomous driving test platforms, ensuring the accuracy and reliability of high-speed real-time testing.**
- Seamlessly adapts to power steering systems of various autonomous driving platforms, enables rapid switching without extensive software and hardware reconstruction, features millisecond-level system response and microsecond-level component update capability, eliminates system hysteresis error, and meets high-speed real-time testing requirements.

Get More Information



Braking HIL Testing System

Electronic Parking Brake (EPB) / Electronic Hydraulic Brake (EHB) / Electric Mechanical Brake (EMB) Hardware-in-the-Loop (HIL) Testing System

Comprehensive Testing & High-Fidelity Condition Simulation to Ensure Reliable Braking System Validation

VCARSYSTEM's comprehensive Braking HIL Testing System supports three mainstream braking systems (EPB/EHB/EMB), integrating high-fidelity test bench hardware with real-time simulation models to create a closed-loop validation platform. It accurately replicates real-world braking scenarios, validates braking system functions via precise closed-loop control, and supports Simulink physical model import, hierarchical visualization, and customizable test management controls. This unified, scalable test environment accelerates the development, verification, and optimization of braking systems, ensuring reliability and safety prior to real-vehicle deployment.

Main Functions

- **Brake Caliper Motor Rotational Speed & Stroke Performance Testing**
  Monitors and verifies the rotational speed stability of the brake caliper drive motor, performs high-precision measurement of piston stroke, and ensures the responsiveness, reliability and stable operational performance of mechanical brake actuation under dynamic braking conditions.

- **Clamping Current Testing**
  Real-time tracks clamping current fluctuations to ensure stable output of brake clamping force and avoid performance degradation under variable load conditions.

- **Motor Fault Simulation & Injection**
  Supports injection of typical faults for brake caliper motors, including jamming, increased mechanical resistance, extended no-load operation, open circuit and other scenarios, to verify the system's fault tolerance and diagnostic capabilities.

- **Wheel Speed Signal Emulation & Fault Simulation**
  Supports mainstream wheel speed protocols including PWM and AK, enables full-range wheel speed fault simulation in conjunction with the fault injection board, covers fault scenarios specific to directional wheel speed sensors, and verifies the system's signal fault tolerance and diagnostic response performance.

- **ABS/ESP/TCS/VDC Brake Controller Development & Testing**
  Supports modular development and full-scenario verification of multi-system brake control functions, improves the dynamic response performance of the controller, and builds a solid technical foundation for vehicle active safety.

- **Brake System Performance Testing**
  Combines bench simulation testing with real-vehicle road validation to conduct a comprehensive, high-fidelity evaluation of the overall brake system performance.

- **Brake System Durability Analysis**
  Performs systematic durability testing and comprehensive data analysis to provide critical reference data for the reliability design of the brake system.

- **Automated Testing**
  Supports automatic interface module generation via M-script, Simulink physical model import, layered visualization, and customization of test management software. This function simplifies automated test workflows, reduces manual intervention, and improves test consistency across the entire test process.

Advantages

Highly Integrated

- **Simplifies test setup and improves workflow efficiency, shortening the braking system validation cycle.**
- The Braking HIL system seamlessly integrates purpose-built hardware and validated software into an all-in-one testing solution, minimizing potential faults and ensuring high test result accuracy.

Accurate Real-Time Simulation

- **Reduces reliance on costly physical vehicle testing in the early development stage and speeds up the R&D lifecycle.**
- Features powerful real-time simulation capabilities that accurately replicate various real-world driving conditions and fault scenarios, ensuring reliable and valid test results before real-vehicle deployment.

Flexible Scalability

- **Adapts to evolving test requirements across project phases and preserves your R&D investment.**
- The system supports flexible expansion of test functions and scaling to user needs, addressing diverse application scenarios from component-level validation to full-system integration.

High-Precision Data Acquisition

- **Captures critical data in real time to identify performance bottlenecks early and avoid field failures.**
- It leverages advanced high-precision data acquisition technology to acquire and analyze key system data in real time, providing robust support for fault diagnosis and performance optimization of braking systems.

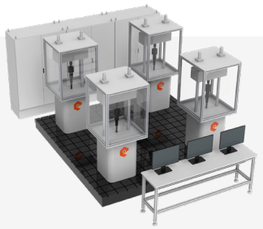
Powerful Development Capability

- **Empowers customized test workflows and accelerates project delivery and R&D advancement.**
- The system provides a comprehensive suite of development tools and open interfaces to facilitate customized development and system integration, enabling tailored test environments to meet specific user requirements.

Safe & Reliable Operation

- **Complies with industry safety standards and mitigates operational risks throughout the entire test process.**
- Designed with an emphasis on safety and reliability, it integrates advanced fault diagnosis and safety protection mechanisms to ensure safe, controlled testing even when simulating extreme fault conditions.





Suspension HIL Testing System

Semi-Active & Active Suspension Hardware-in-the-Loop (HIL) Testing System

Comprehensive Testing & High-Fidelity Condition Simulation to Ensure Reliable Suspension System Validation

VCARSYSTEM's comprehensive Suspension HIL testing system supports a full range of active and semi-active suspension systems—including air suspension, CDC dampers, electromagnetic damping, hydraulic suspension, and linear motor suspension—and supports a flexible range of testing modes, such as standalone HIL mode and system integration mode (full-vehicle four-post test bench, suspension four-post test setup). It accurately replicates complex real-world operating conditions, enabling thorough validation of suspension system performance via precise closed-loop control. This delivers robust technical support for the research, development, verification, and optimization of active and semi-active suspension systems, ensuring a seamless transition to real-vehicle testing.

Main Functions

- **Full-Dimensional Suspension System Function Validation**
  Covers full-dimensional performance validation of the suspension system, including pitch control during braking/acceleration, height adjustment, automatic leveling, vehicle body vertical control, and lateral/longitudinal cooperative control, enabling comprehensive verification of suspension performance under real working conditions.
- **Real Road Condition & Dynamic Scenario Emulation**
  Accurately reproduces various road excitation inputs and dynamic vehicle loads, providing high-fidelity operating conditions for the verification of suspension dynamic response characteristics and durability.
- **Signal Acquisition & Multi-Protocol Communication**
  Implements multi-type signal acquisition and multi-protocol communication via self-developed hardware boards, supports automatic configuration of signal and interface model mapping, and fully adapts to signal interaction requirements in all suspension test scenarios.
- **Height Sensor PSI5/PWM Signal Emulation**
  Supports full-parameter emulation of height sensor PSI5 (covering all versions 1.3/2.1/2.3) and PWM protocols, with flexible configuration of baud rate, cycle period, check modes, operating voltage, synchronization signals, multi-operation modes, current and initialization parameters to meet suspension height sensing test requirements.
- **Acceleration & IMU Signal Emulation**
  Supports emulation of multiple types of vehicle body attitude signals, including acceleration signals via CAN/PSI5 protocol and IMU signals via CAN/SPI protocol. It also supports signal emulation of preview sensors including camera, mmWave radar and LiDAR, fully matching the test requirements for attitude sensing and preview control of suspension control systems.
- **Full-Scenario Fault Injection Testing**
  Enables injection of a full range of fault scenarios into the suspension test system to verify the operational safety and fault tolerance of active/semi-active suspension systems under fault conditions.
- **M-Script Driven Automated Testing & Interface Configuration**
  Supports multiple test modes, automatically generates communication interface modules via M-script based on dbc/ldf bus files and hardwire interface definitions, with built-in Override function, to simplify the automated test workflow and improve test consistency.
- **Software & Model Lifecycle Management**
  Integrates host configuration, test management and automated test software, supports Simulink physical model import and secondary development without additional authorization restrictions.
- **Integrated Measurement, Calibration & Diagnosis**
  Has a built-in measurement and calibration library, enabling direct measurement, calibration and full-function diagnosis of the suspension controller without relying on external professional software.

Advantages

High-Precision Simulation Capability

- **Ensures suspension performance validation is highly consistent with real-world operating conditions, enhancing the credibility of test results.**
- A high-bandwidth real-time computing platform delivers millimeter-level road surface input simulation and dynamic load control accuracy, supported by comprehensive built-in vehicle models for high-precision hardware-in-the-loop simulation.

Self-Developed Board Capability

- **Reduces equipment cost and improves compatibility, with robust customizability to meet diverse test needs quickly.**
- All boards are proprietary designs, with voltage/PWM input boards integrating multiple acquisition functions, CAN communication boards supporting three protocols (CAN, LIN, FlexRay) with abundant channels, and single boards enabling multi-type signal acquisition.

Built-In High-Speed Data Acquisition

- **Provides accurate, real-time test data to support precise suspension performance analysis and optimization.**
- A proprietary VCARSYSTEM high-speed measurement system (max. sampling rate ≥2 MHz, resolution ≥16-bit) captures high-fidelity suspension dynamic parameters, with a custom PSI5 signal board supporting multiple different communication protocols for high-speed, stable data transmission.

Multi-Suspension Type Compatibility

- **Eliminates the need for extensive reconfiguration across test setups to reduce test preparation time and costs.**
- Flexible, configurable interfaces accommodate all types of active and semi-active suspension architectures.

Highly Integrated & Portability

- **Expands application scenarios and improves operational efficiency, lowering the barrier to equipment adoption.**
- The system features high integration and a lightweight design, allowing for easy movement and on-vehicle installation.

Cost-Effective Software & Customization

- **Reduces procurement and operational costs, shortens delivery cycles, and meets personalized test needs of different customers.**
- It offers abundant optional configurations with short procurement cycles, a single software license for multi-user access, and secondary development support without additional licenses or external software purchases.

Efficient Model & Test Management

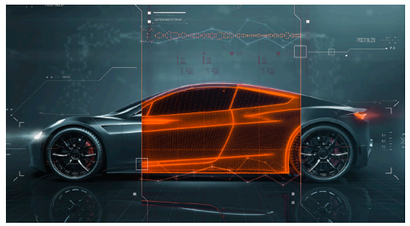
- **Dramatically reduces test preparation time and manual configuration effort, minimizing reliance on specialized technical personnel.**
- By automating interface generation and supporting flexible workflow customization, it accelerates test iteration cycles and ensures consistent, repeatable test execution across projects.

Get More Information



Accelerate BCM development:

Shorten test cycles by automating complex validation



Driven by the next-generation electronic and electrical (E/E) architecture, the Body Control Module (BCM)—the core "brain" of a vehicle's electrical system—is undergoing unprecedented transformation. As automotive intelligence, connectivity, and electrification advance rapidly, the BCM has moved beyond traditional body equipment coordination to integrate new functional modules and control nodes, taking on more complex system collaboration tasks.

Traditional testing can no longer match BCM's growing complexity, bottlenecking R&D cycles and product stability. They present the following core pain points in real-world application.

Core Pain Points

- **Incomplete Function Verification**

  Traditional testing cannot fully cover multi-subsystem and multi-signal interactions in BCMs, leading to missed defects and insufficient validation of intelligent functions.

- **Limited High-Power Load Simulation**

  Realistic simulation of motor loads (window, tailgate, sunroof, wiper, seat) and behaviors such as current inrush and stall protection is difficult. Real-vehicle-level benches are expensive and pose safety risks.

- **Limited Fault Injection Coverage**

  BCM testing must cover numerous faults (open/short circuits, signal drift, communication loss, sensor failures). Manual injection is inefficient, and automated systems struggle with complex combined fault scenarios.

- **Inefficient Diagnostic Verification**

  Reliance on third-party tools (e.g., INCA, CANape, CANoe) increases software cost and limits multi-user access. Complex system architecture makes fault isolation difficult and extends root cause analysis time.

- **Low Test Equipment Reusability**

  BCM variants differ in pins, protocols, and logic, reducing hardware reuse and increasing test migration effort. Scripts are tightly hardware-coupled, requiring major rework after upgrades.

- **High Cost and Low Efficiency**

  High-end processors, precision I/O, and fault injection hardware are expensive. Parallel testing requires multiple benches, increasing investment. Manual setup and long-term durability testing further raise labor and time costs.



Body HIL

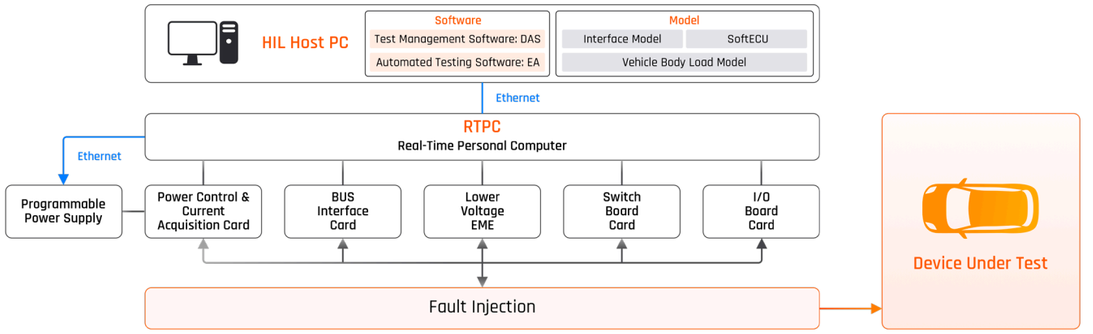
Body Control Module Hardware-in-the-Loop Test Solution

Full-stack BCM HIL testing: Precision, flexibility, and multi-protocol compatibility

A hardware-in-the-loop test system for automotive body domain controllers. It uses real-time simulation to replicate sensor, actuator, and bus communication environments for closed-loop functional validation of body ECUs, supporting traditional bus/SOA testing, real/virtual load switching, custom fixture development, and expandable to other domains like cockpits.

Main Functions

- **Software-Defined Hardwaret**
  - The modular hardware platform allows I/O channel attributes to be configured via software. Each channel can be configured as AI, AO, DI, DO, PWM In, or PWM Out.
- **Multi-Scenario Adaptation**
  - Supports simulated load benches, yellow board benches, and LabCar benches. Compatible with traditional buses, hardwired I/O, and Service-Oriented Architecture (SOA).
  - Supports automatic switching between physical and virtual loads and integration with third-party equipment (e.g., Remote Keyless Entry simulation).
- **Low-Voltage Motor Simulator**
  - Provides a low-voltage motor simulator capable of accurately simulating tailgate, window, sunroof, and seat motors. Supports self-learning calibration, normal operation, and fault simulation (e.g., stall).



Advantages

High Relevance

Designed specifically for complex body domain controller testing, covering communication, load behavior, and functional interaction verification.

Flexibility & Efficiency

Software-defined hardware, channel switching, motor simulation, and automatic configuration significantly improve test efficiency. Reserved interfaces and customization options support diverse project needs.

Strong Scalability

Supports fast reuse across new platforms, independent body domain testing, and extension to other domains. Integrates with third-party equipment to expand test coverage.

Get More Information

03

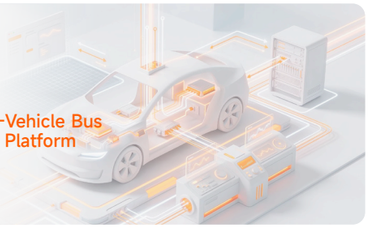
VCAR Software Platform





VCAR DAS

Integrated SIL/HIL Testing & In-Vehicle Bus Development/Testing Software Platform

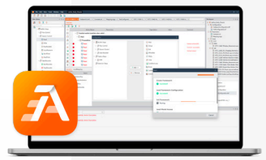




VCAR SIL

Unified, Scalable Simulation Platform for Automotive R&D & Validation





VCAR EA

Comprehensive Automated Testing Software for Automotive Control Unit Validation



Vehicle Testing Software Snags Delaying Your Project Timelines

With the rapid electrification and intelligence of automobiles, software has become the core of automotive innovation, bringing unprecedented complexity to automotive testing. As a key tool to address these challenges, software platforms are irreplaceable in automotive testing but also face urgent pain points in practice. This article outlines their importance and existing pain points to provide references for the global automotive testing industry. While software platforms serve as pivotal tools to tackle these challenges, they remain plagued by pressing practical pain points.

Difficulties in Balancing Real-Time Performance and Simulation Accuracy

When testing real-time systems (e.g., powertrain, ADAS), engineers face challenges with the platform's real-time performance—data delays often occur in complex, data-heavy scenarios, undermining result reliability. Meanwhile, virtual environments cannot fully replicate real-world physical phenomena or human-computer interactions, limiting simulation accuracy. This forces engineers to conduct extensive real-vehicle tests for verification, increasing workload and test costs from repeated trials.

Restrictions from High Construction and Maintenance Costs

Cost constraints hinder engineers' work significantly. Insufficient initial investment results in incomplete hardware configurations and software functions (e.g., low-performance servers causing slow operation, missing advanced simulation modules limiting test scenarios). Tight maintenance budgets delay platform updates and technical support for failures, forcing engineers to find workarounds with limited resources—impacting testing efficiency and quality.

High Learning Costs and Lagging Platform Functions

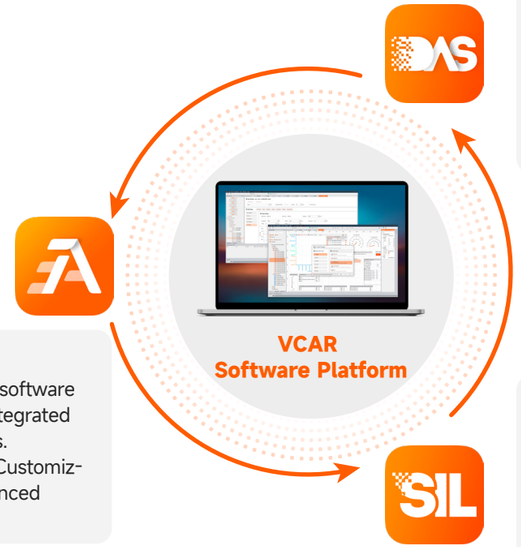
Rapid automotive tech advancements (e.g., autonomous driving, V2X) demand new testing methods, but software platforms often lag functionally. When testing new technologies, missing platform modules force engineers to build test scripts from scratch. Cost constraints often mean no systematic training for platform upgrades, forcing engineers to self-learn new features in their spare time—adding workload and delaying new technology testing.

Tedious Interface Adaptation and Tool Connection Issues

Engineers frequently grapple with tedious interface adaptation when using software platforms. Test tools from different manufacturers use incompatible protocols and data formats, requiring engineers to invest significant time in custom interface development and protocol conversion. Frequent automotive software/hardware upgrades often cause interface failures, forcing repeated debugging and delaying progress. Additionally, cost constraints prevent SMEs from affording professional adaptation services, adding extra workload for engineers.

VCARSYSTEM Helps Get Your Projects On The Road Faster

Based on these pain points, VCARSYSTEM has developed a complete set of software platforms tailored to automotive testing scenarios. This suite of solutions is designed to specifically address engineers' core challenges, providing targeted support to streamline their testing workflows and enhance overall efficiency.



VCAR DAS

- Integrated SIL/HIL Testing & In-Vehicle Bus Development/Testing Software Platform
- All-in-one simulation, fault injection, diagnostics & scripting — Maximum Efficiency, Seamless Convenience.

VCAR EA

- Customizable HIL test software with data logging & integrated calibration/ diagnostics.
- Simplify HIL Testing—Customizable, Intuitive, Data-Synced Excellence.

VCAR SIL

- Unified, Scalable Simulation Platform for Automotive R&D & Validation.
- All-in-one co-simulation, automation & collaboration — Accelerate R&D, Cut Costs, Ensure Consistency.

- **End-to-End Test Automation to Cut Manual Work & Hidden Software Costs**
  Automate test case management, reporting, and UDS diagnostics with a fully connected workflow. It removes repetitive tasks, shortens test cycles, and delivers instant results to boost testing efficiency.

- **Seamless HIL Environment Adaptability**
  Simplifies HIL setup with support for multi-protocol buses, hardware, models, and multi-device cascading. With built-in logging, calibration, and diagnostics, it eliminates interface adaptation hassles and enables smooth, synced testing.

- **All-In-One In-Vehicle Bus Testing**
  A single platform for bus simulation, diagnostic flashing, and automated testing. It removes tool compatibility issues and streamlines all bus-related workflows.

- **Balanced Customization & Data Synergy**
  Combines customizable functions with unified data management, connecting logging, calibration, and diagnostics to support tailored testing without scattered data handling.

Ease Engineers' Testing Burdens
Empower Engineering Innovation



VCAR DAS

Integrated SIL/HIL Testing & In-Vehicle Bus Development/Testing Software Platform

All-in-one simulation, fault injection, diagnostics & scripting — Maximum Efficiency, Seamless Convenience.

For automotive HIL test engineers and bus developers,VCAR DAS is your all-in-one automotive development, testing, and analysis platform: it unites VCAR DAS consolidates HIL test execution, engineering configuration, in-vehicle bus simulation, diagnostics, and automated testing capabilities into a unified solution. Swap fragmented toolchains for automated end-to-end workflows to cut manual busywork, speed up cycles, and boost testing accuracy. Focus on building robust automotive systems—not fighting disjointed tools.

Main Functions

- **Centralized Management of HIL and SIL Resources**
  Configure and manage multiple HIL test benches/ SIL operating environments simultaneously; support manual addition and remote auto-retrieval of board card information, single interface for configuration, execution, and monitoring. Centralized control of HIL I/O, loads, and power.

- **In Vehicle Network Configuration**
  Enable communication setup for buses (CAN, LIN, ETH, etc.); create Ethernet virtual topologies (switches, ports, MAC addresses, VLANs, etc.) to implement simulation and fault injection across all bus layers (physical, data link, application).

- **Model & Node Simulation**
  Load diverse model types (e.g., Simulink, CarSim); create virtual nodes (e.g., CAPL, network, DDS); import protocol files (e.g., arxml, dbc) to enable bus encoding/decoding, SOA node simulation, and closed-loop testing.

- **Test & Signal Management**
  Run multiple test environments concurrently on a single device; build test interfaces via GUI drag-and-drop editing; define stimulus signals graphically (e.g., constant, sine, random) and support signal monitoring, recording, and playback (compatible with ASAM MDF format).

- **Fault Injection & ECU Flashing**
  Support controller fault injection and bus fault injection (electrical, link, application layers); enable ECU flashing via XCP/Ccp protocols.

- **Diagnostics & Automation**
  Implement UDS diagnostics (over CAN FD/Ethernet) and custom execution of diagnostic services; support CAPL/Python script editing for automated test case execution and custom interface development.

Advantages

Streamline Workflows Across Platforms
Consolidates full-lifecycle capabilities (HIL test execution, engineering configuration, in-vehicle bus testing) into one platform. It replaces fragmented toolchains, reduces cross-tool manual collaboration, and lets teams focus on core testing tasks.

High Flexibility & Compatibility
Supports GUI drag-and-drop configuration, custom models/nodes/signals, and compatibility with industry standards (e.g., ASAM) and diverse model/protocol file types—adapting to varied testing scenario requirements.

Efficient, Cost-Saving
Enables parallel management of multiple test benches/test environments; pairs with CAPL/Python automation scripts to shorten project cycles, cut on-site collaboration costs, and reduce tool operation and maintenance expenses.

Robust Functionality & Standard Compliance
Covers fault injection across all bus layers and multi-protocol closed-loop testing; aligns with industry standards while accommodating custom needs, ensuring test compliance and product adaptability.

Fully In-House Developed
Leverages a self-developed software architecture to eliminate reliance on third-party tools, safeguard system data security, and support flexible expansion and iteration of business scenarios.

One Software for All



Bus Communication Analysis



HIL Testing Platform



VCAR SIL



3rd Party Software
Support via API

Multi-device compatible, Lower your software costs
Effortlessly streamline your workflow across functions

Get More Information



VCAR SIL

Unified, Scalable Simulation Platform for Automotive R&D & Validation

All-in-one co-simulation, automation & collaboration — Accelerate R&D, Cut Costs, Ensure Consistency.

For automotive R&D and validation engineers, SIL Simulation Solution is your all-in-one platform for vehicle system simulation, test automation, and cross-environment collaboration. It consolidates multi-model co-simulation, SIL-HIL unified toolchains, open ecosystem integration, and seamless deployment capabilities into a single solution. Replace fragmented simulation tools and redundant cross-platform work with automated, end-to-end workflows to reduce manual effort, shorten validation cycles, and ensure consistency across early-stage development to late-stage verification. Focus on delivering reliable automotive systems—not navigating disjointed simulation environments.

Main Functions

- **Multi-Model Co-Simulation**
  Supports standard formats (Simulink, FMU, C code etc.) and enables multi-model co-simulation for complex scenario validation.

- **Client-Server Architecture**
  Windows GUI suite (DAS for bus test/configuration, EA for ASAM XIL-compliant automation); server enables multi-user access, cluster scaling, and ASAM XIL/proprietary API compatibility.

- **Unified SIL-HIL Toolchain**
  Identical host software; 1:1 test case/experiment portability and cross-platform resource reuse

- **Open API & Customization**
  CI/CT-ready, Python/C++ APIs/SDKs, ASAM XIL compliance, and tailored development services.

- **Open Ecosystem**
  Co-simulates with 3rd-party tools (CarSim, CarMaker, AMESim and other FMU-exportable third-party models) and integrates with test automation suites (PROVETech:TA, NI-LabVIEW).

- **Seamless Deployment & Maintenance**
  WSL Docker-supported (no extra hardware); in-use automatic updates (zero downtime, no license reactivation).

- **Cloud Deployment**
  Supports cloud deployment especially on AWS (Amazon Web Services) and enables flexible scaling, on-demand access, and cross-team collaboration.

Advantages

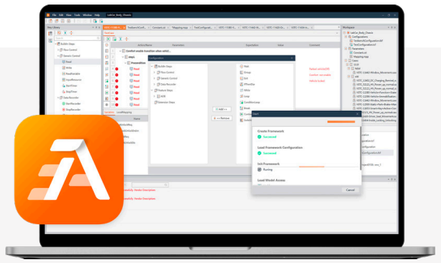
Boost R&D Efficiency & Shorten Validation Cycles
Break down cross-team collaboration silos with multi-user concurrent access, enabling parallel work across powertrain, ADAS, and chassis teams. The client-server architecture and cluster scaling boost simulation throughput, cutting weeks of validation work into days. CI/CT integration and flexible APIs automate end-to-end workflows, freeing engineers from repetitive tasks to focus on innovation.

Reduce Total R&D Costs Significantly
Eliminate redundant hardware investments via WSL Docker deployment, leveraging existing IT infrastructure. The unified SIL-HIL toolchain eliminates 30%+ of engineering rework by enabling 1:1 test case/experiment portability—no more rewriting tests for cross-platform use. Protect legacy tool investments with open ecosystem support, avoiding costly tool replacements or team retraining.

Seamless SIL-HIL Alignment, No Platform Barriers
Unified host software ensures a consistent user experience across SIL and HIL, reducing training time and operational errors. End-to-end asset reuse (test cases, configurations, analysis templates) spans the entire development cycle—from early-stage MIL to late-stage HIL—ensuring validation consistency and avoiding misalignment between phases.

Flexible Operation & Maintenance, Minimal Overhead
Deploy quickly via WSL Docker (on-premises or cloud) with no extra hardware required. In-use automatic updates deliver new capabilities without downtime or license reactivation, keeping workflows on track. ASAM XIL compliance and proprietary API support ensure interoperability with your existing toolchain (PLM, data management systems), eliminating vendor lock-in.

Tailored to Your Unique Workflows
Avoid compromising on specialized needs (custom bus protocols, ADAS scenario logic, proprietary ECU diagnostics). Our tailored development services—including custom API extensions, bespoke automation logic, and dedicated technical support—ensure the solution adapts to your workflows, not the other way around. Maximize efficiency for your unique R&D processes.



VCAR EA

Comprehensive Automated Testing Software for Automotive Control Unit Validation

All-in-one Test Authoring, Execution & Reporting – Streamline Validation, Enhance Compliance, Adapt to Your Workflows.

For automotive control unit (ECU) testing and validation engineers, VCAR EA is your turnkey automated testing solution – eliminating disjointed tools, manual repetitions, and customization limitations. It unifies test case management, execution, and analysis in a user-centric platform, tailored to the dynamic demands of automotive R&D and production validation.

Main Functions

- **Graphical Test Sequence Building**
  Built-in core action steps (read/write operations, conditional judgment) with drag-and-drop visualization; supports ADB tool integration and image recognition for end-to-end test flow construction.

- **Customizable & Extensible Workflows**
  Enables user-defined action steps via Python scripting; supports nested and serialized editing of test sequences to adapt to specialized testing logic (e.g., ADAS scenarios, proprietary protocols).

- **ISO-Standard Compliant Testing**
  Delivers automated validation for diagnostic functions and ECU flashing, fully aligned with ISO standards to ensure regulatory compliance and test reliability.

- **Intelligent Test Case Generation**
  Automatically converts Excel-based test plans into executable cases, reducing manual transcription errors and accelerating test deployment.

- **Open Ecosystem**
  Co-simulates with 3rd-party tools (CarSim, CarMaker, AMESim and other FMU-exportable third-party models) and integrates with test automation suites (PROVETech:TA, NI-LabVIEW).

- **Comprehensive Reporting & Customization**
  Generates test reports in HTML/PDF formats out-of-the-box; supports full customization of layout, format, and content to meet internal auditing and stakeholder communication needs.

- **Open Toolchain Compatibility**
  Seamlessly integrates with automotive testing ecosystems, including SIL/HIL systems, simulation, configuration and management software platform (VCAR DAS),ensuring end-to-end workflow continuity.

Advantages

Boost Validation Efficiency & Shorten Cycles

Graphical drag-and-drop operation and Excel-driven test case generation cut test setup time by 40%+. Automation of repetitive tasks (execution, reporting) frees engineers to focus on critical scenario design and result analysis, slashing validation timelines from weeks to days.

Ensure Compliance & Test Consistency

ISO-standard alignment eliminates compliance risks for diagnostic and flashing tests. Unified test authoring and execution frameworks ensure consistent processes across teams (powertrain, chassis, body control), avoiding discrepancies in validation results.

Reduce Operational Overhead

Eliminates the need for multiple disjointed tools by integrating test editing, management, execution, and reporting in one platform. Reusable test sequences and user-defined steps reduce redundant work by 30%+, while seamless integration with existing HIL/configuration tools protects legacy investments.

Flexibility for Specialized Requirements

Python-based customization and support for proprietary protocols/scenarios adapt to unique ECU testing needs (e.g., smart cockpit interactions, V2X communication). No forced workflow adjustments – the software bends to your specialized processes, not the other way around.

Streamlined Collaboration & Auditing

Structured test case management and customizable reporting facilitate cross-team collaboration and simplify audit trails. Stakeholders gain clear, actionable insights into test progress and results, enhancing decision-making efficiency.

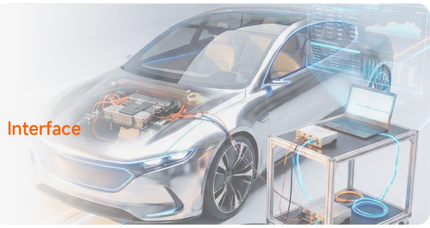
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In-Vehicle Network Test Solution



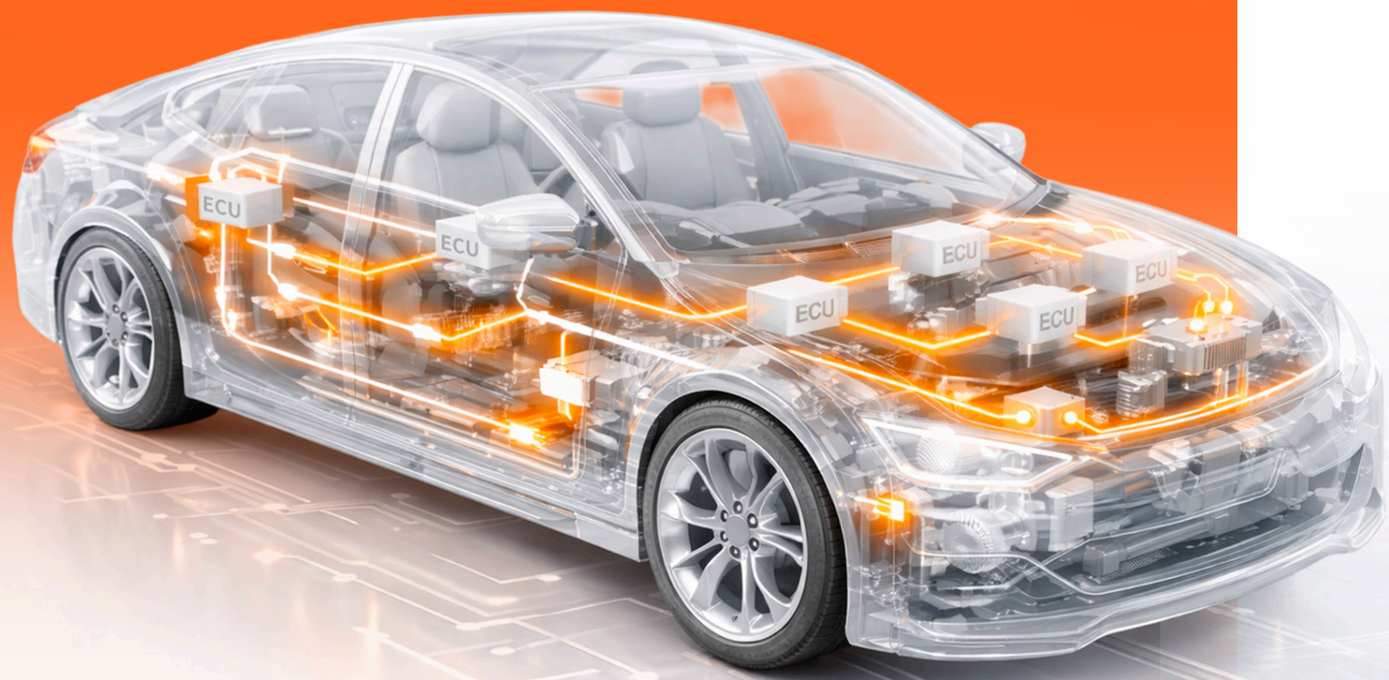
VCI Series
Vehicle Communication Interface





VBE Series
Vehicle Bypass Ethernet Interface

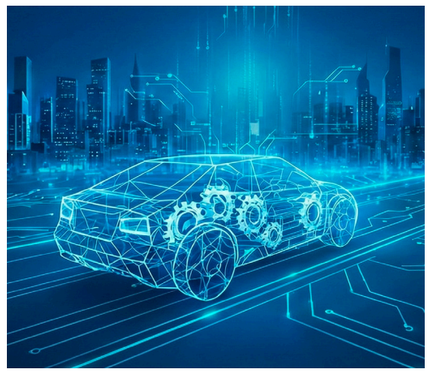






Multi-Channel IVN Testing, Zero Lag—
Accelerate Your Vehicle Development Timelines

As automotive electrification and connected mobility redefine vehicle design, in-vehicle networking (IVN) architectures have grown exponentially complex. Today's vehicles integrate a mosaic of bus protocols—CAN, CAN FD, LIN, FlexRay, and Automotive Ethernet—each powering critical systems (e.g., CAN FD for powertrain control, Ethernet for ADAS and infotainment). This heterogeneity has created a fragmented testing landscape: legacy tools often support only one protocol, forcing engineering teams to juggle disjointed hardware, inflate costs, and slow development cycles.



The Pain Points Plaguing IVN Engineering Teams

- **Fragmented, Siloed Test Infrastructure**
  Legacy single-protocol tools require teams to switch between devices for CAN, LIN, or Ethernet testing. This fragmentation raises capital expenditures, introduces inconsistencies in data collection, and wastes hours on setup/teardown.
- **Lack of Synchronized Multi-Channel Testing**
  Complex IVN topologies (e.g., coordinating signals across 4+ ECUs) demand simultaneous access to multiple bus channels. Single-channel tools cannot support parallel testing, delaying validation of inter-ECU communication.
- **Hardware Vulnerability & Signal Corruption**
  Direct connections between test equipment and vehicle ECUs expose both systems to voltage spikes or electrical noise—risking costly hardware damage or distorted data that invalidates test results.
- **Inflexible Tools for Diverse Environments**
  R&D lab testing, vehicle-in-the-loop (VIL) validation, and field diagnostics require tools that balance lab-grade performance and field portability. Most solutions prioritize one over the other, limiting operational flexibility.
- **Inadequate Robustness Validation**
  Verifying IVN resilience (e.g., handling bus drops or signal interference) requires controlled fault injection—a feature missing from many basic test interfaces, leaving teams unable to validate real-world reliability.



VCI Series

Vehicle Communication Interface equipment for In-Vehicle Networking testing

Multi-Channel IVN Testing, Zero Lag—Accelerate Your Vehicle Development Timelines.

VCARSYSTEM's VCI Series (VCI2200 & VCI4422) is the all-in-one solution for complex IVN testing, supporting CAN, CAN FD, LIN, FlexRay and Automotive Ethernet protocols. The compact VCI2200 handles mid-scale CAN/LIN testing, while the full-featured VCI4422 delivers multi-channel synchronized validation for large-scale ECU networks. Equipped with electrical isolation, lab-grade precision and IP5K durability, these portable interfaces work seamlessly across R&D labs, field diagnostics and production lines, cutting costs and streamlining workflows.

Main Functions

- **Full IVN Protocol Support**
  Covers CAN, CAN FD, LIN, FlexRay and 100/1000BASE-T1 Automotive Ethernet, for testing from body control to ADAS and intelligent cockpits.
- **Isolated Multi-Channel Testing**
  Independent isolated channels enable parallel synchronized testing; high-precision timestamps ensure accuracy and protect ECUs/test equipment.
- **One-Stop Testing Capabilities**
  Integrates bus monitoring, ECU diagnostics/flashing, network simulation, fault injection and conformance testing—no extra tools needed.
- **All-Scenario Hardware Adaptability**
  IP5K dust/water resistance, portable design and independent power supply fit lab bench, on-vehicle and EOL testing; select models offer USB 3.0 high-speed transmission and Ethernet switch mode.
- **Mainstream Software Compatibility**
  Works seamlessly with mainstream industry tools; supports standardized APIs to cut integration costs and boost efficiency.

Specifications	VCI 4422	VCI 4222	VCI 4202	VCI 2200
CAN/CANFD	4	4	4	2
LIN	4	2	2	2
Automotive Ethernet	2 × 100/1000BASE-T1	2 × 100/1000BASE-T1	-	-
FlexRay	2 × (A)	2 × (A	2 × (A+B)	-
Standard Ethernet	2 × 10/100/1000BASE-TX	2 × 10/100/1000BASE-TX	2 × 10/100/1000BASE-TX	-
USB-A	1	1	1	-
Cascaded Synchronization	Supported	Supported	Supported	-
Operating Voltage	6–36 VDC	6–36 VDC	6–36 VDC	6–36 VDC
Power Consumption	< 17 W	< 15 W	< 15 W	< 7 W
Dimensions	150 × 120 × 59 mm	150 × 120 × 59 mm	150 × 120 × 59 mm	100 × 79 × 53 mm
Weight	Approx. 1.1 kg	Approx. 1.1 kg	Approx. 1.1 kg	Approx. 450 g
Working Environment	Operating Temperature: −20 °C-75 °C Operating Humidity: 5% to 95% RH, non-condensing		Storage Temperature: −40 °C to +85 °C	
Main Features	Features metal housing, natural convection cooling, Type-C PC connection & power supply; supports CAN / CAN FD bus disturbance, IP4X protection rating, overload and reverse polarity protection.			

Solutions

Traditional In-Vehicle Bus Test Solutions

Vehicle CAN/CAN FD Bus Testing Solution

Covers physical layer, data link layer, interaction layer, and fault tolerance testing. Provides tailored test tools for each testing dimension to ensure comprehensive validation of CAN/CAN FD bus systems.

Vehicle LIN Bus Testing Solution

Focuses on physical layer and communication layer testing. Offers a complete solution with finely matched test tools to meet complex and dynamic testing requirements in LIN bus applications.

Vehicle FlexRay Communication Testing Solution

Delivers advanced, efficient tools for comprehensive validation of FlexRay bus systems (a high-speed, reliable automotive network protocol). The solution connects the ECU under test to the VCI4422 device, enabling real-time bus monitoring and analysis via VCAR DAS software. Supports functional, performance, fault tolerance, safety, timing/synchronization, integration, load, and stability testing.

Automotive Ethernet Test Soltions

Automotive Ethernet Development and Simulation Analysis Solution

Integrates VCAR DAS software and VCI4422 bus interface card to address the rapid development of automotive Ethernet. Enables easy creation of automotive Ethernet database files (ARXML) and diagnostic database files (CDD, ODX, PDX), supporting in-depth simulation analysis to optimize bus design schemes.

DoIP-Based Automotive Ethernet Diagnostics and Flashing Solution

Addresses the high cost of DoIP diagnostic flashing testing caused by tool chain monopolies. Tailored for the widespread adoption of Ethernet-based diagnostics/flashing, leveraging automotive Ethernet's high bandwidth, speed, rich upper-layer protocols, and scalability to meet market growth and competitive pressures.

Customized Content-Based Automotive Ethernet Testing Solution

Solves challenges from the rapid expansion of automotive Ethernet applications. Maximizes Ethernet's high performance and scalability to reduce testing costs. Fully supports UDPNM, DDS protocol testing, and fault injection testing, ensuring system stability in complex network environments.

OPEN TC8-Based Automotive Ethernet Testing Solution

Designed for the fast evolution of automotive Ethernet technology. Covers physical layer (IOP, PMA, TCP/IP) and data link layer testing to ensure stable, high-performance automotive communication networks. Provides comprehensive, reliable validation for automakers and suppliers to drive Ethernet technology advancement.

Advantages

All-in-One Multi-Protocol Coverage, Eliminating Device Fragmentation

Covers all mainstream IVN protocols in a single device: VCI2200 supports CAN/CAN FD and LIN; VCI4422 adds FlexRay and 100/1000BASE-T1 Automotive Ethernet. This unified design meets testing needs across applications from body control to ADAS, reducing initial equipment investment and ongoing management costs by eliminating the need for multiple specialized tools.

Independent Isolated Multi-Channel Design, Ensuring Accuracy & Safety

Features independent electrical isolation across all bus channels, preventing signal interference and voltage surges to protect both vehicle ECUs and test equipment. VCI2200 offers 4 independent channels (2 CAN/CAN FD + 2 LIN), while VCI4422 provides 14 channels for parallel synchronized testing. High-precision hardware timestamps ensure accurate bus event timing analysis, supporting reliable validation of complex bus topologies.

Full-Scenario Adaptability: Lab Performance & Field Durability

Combines lab-grade performance with field durability: IP5K dust and water resistance, portable lightweight design, and independent power supply enable seamless deployment across lab automation, on-vehicle field diagnostics, and production line EOL testing. VCI4422 further integrates USB 3.0 high-speed transmission and Ethernet switch mode, supporting versatile deployment for both automated testing and complex on-vehicle scenarios.

Integrated Hardware-Software Solution, Reducing Integration Costs

Delivers a seamless integrated hardware-software solution with in-house VCAR DAS software, which natively supports full VCI functionality including real-time bus monitoring, database creation, simulation analysis, fault injection, and ECU diagnostics/flashing. It also supports 3rd party tools via standardized APIs, reducing software procurement and system integration costs while improving testing efficiency

Targeted Cost Reduction for Core Pain Points

Provides cost-effective solutions for high-value IVN testing scenarios such as DoIP-based Ethernet diagnostics and flashing. For customized testing needs, it natively supports UDPNM, DDS protocol testing, and fault injection—enabling targeted validation of complex network environments without additional customization costs.

Scalable Performance for Full-Stage Needs

Offers two performance-graded models to match diverse testing requirements: VCI2200 provides a cost-effective configuration for mid-scale testing (e.g., body control systems); VCI4422 caters to complex high-end architectures (e.g., ADAS, intelligent cockpits) with support for multi-device cascade clock synchronization and large-scale network integration testing. This scalable design allows seamless upgrades as testing needs expand, optimizing long-term investment value.

Get More Information



VBE Series

VCAR Bypass Ethernet Series

High-speed, low-latency communication for next-gen vehicle systems

VCARSYSTEM's VCAR BYPASS ETH Series enables physical layer conversion between automotive Ethernet and standard Ethernet networks, facilitating development and testing for engineers. It can decode and analyze Ethernet data streams for comprehensive protocol analysis.

Boasting a diverse product lineup to meet varied industry needs, the VCAR Bypass Ethernet Series excels at adapting to different in-vehicle testing scenarios, covering a wide range of application requirements, including bypass forwarding collection, device configuration management, and online firmware upgrades, to perfectly align with the distinct demands of each client.

Technical parameters

Specification/Model	VBE1200	VBE1010	VBE1001
Appearance			
Automotive Ethernet (T1) Channels	2× 100 / 1000BASE-T1	1× 2.5G / 5G / 10GBASE-T1	1× 100 / 1000BASE-T1
Bidirectional Conversion	100 / 1000BASE-T1 ↔ Standard Ethernet	2.5G / 5G / 10GBASE-T1 ↔ 2.5G / 5G / 10GBASE-T	100 / 1000BASE-T1 ↔ Standard Ethernet
Link Status Reading (Link Up / Link Down)	Supported	Supported	Supported
Port Mirroring Function	Supported	-	-
Supply Voltage	9–36 VDC	9–36 VDC	9–36 VDC
Operating Temperature	−40°C to 65°C	−40°C to 65°C	−40°C to 65°C
Power	6 W	8 W (Full Load)	8 W (Full Load)
Size	134.6 × 82.8 × 28.8 (mm)	100 × 50 × 28.8 (mm)	100 × 50 × 28.8 (mm)
Weight	300 g	300 g	300 g
Protection Grade	IP42	IP42	IP42
Ethernet (RJ45) Channels	2	1	1
Master–Slave Mode	Configurable		

Advantages

Ultra-Reliable Ethernet Redundancy & Real-Time Performance

Reliable Bypass Protection

Delivers seamless failover between primary and backup Ethernet links, ensuring dependable packet delivery and uninterrupted data transmission for mission-critical in-vehicle communication.

Deterministic Low-Latency Transmission

Optimized for automotive Ethernet, providing ultra-low latency and jitter-free transmission to meet the strict real-time requirements of ADAS and autonomous driving systems.

Seamless In-Vehicle Integration & Plug-and-Play Deployment

Native Automotive Protocol Support

Enabling out-of-the-box compatibility with modern vehicle ECUs and communication architectures.

Non-Disruptive Retrofit & Scalable Deployment

Compact form factor fits standard automotive ECU enclosures; hot-swappable functionality allows field upgrades without disrupting vehicle operation.

Ecosystem Compatibility

Compatibility with Validation Tools

Works with mainstream development tools, enabling automated test workflows and reducing validation overhead.

Application Areas



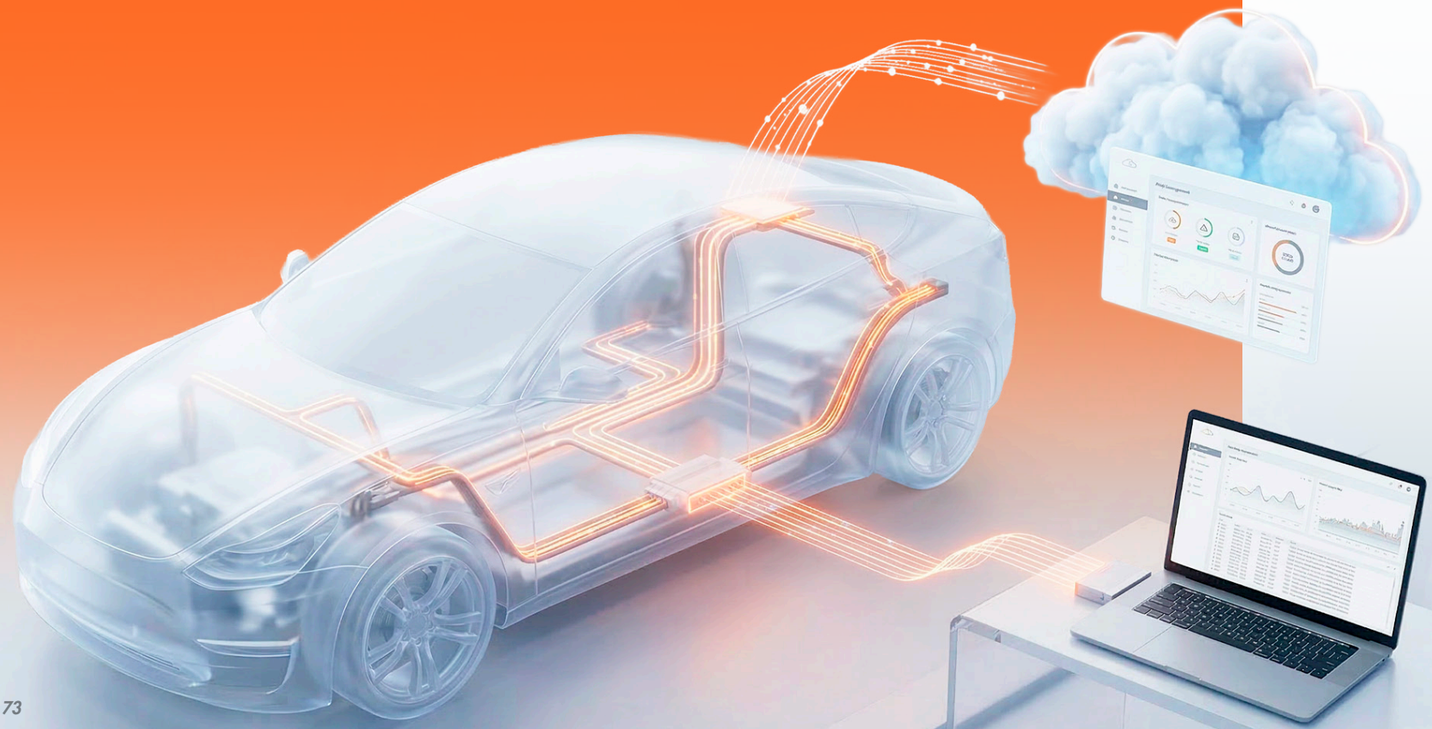




Get More Information

05

Data Logging and Bus Test Solution





AD Station
Autonomous Driving
Data Acquisition Solution





VGB
VCAR Gigabit Multimedia Serial Link(GMSL)
Camera Bypass Data Logging Device





Video Box
Video data acquisition Module





HSMI
Hyper Stream Measurement Interface
Data Acquisition Module



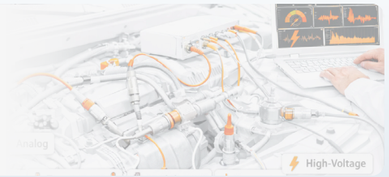


VGATE Series
Vehicle Bus Data Acquisition Solution





C-module
Data Acquisition Modules





Unlock the full potential of autonomous driving with comprehensive, high-fidelity data acquisition

Data is key to advancing autonomous driving technology, and data collection spans algorithm R&D, function testing, scenario library building, safety compliance, and commercialization. It provides real-scenario data for core algorithms like perception and decision-making, ensures precise multi-sensor collaboration, and is essential for verifying functional safety, covering high-risk scenarios, tracing accidents, and meeting compliance rules.

Without proper data collection and recording, algorithms can't be optimized, functional safety can't be validated, faults/accidents can't be investigated clearly, and test scenarios are incomplete. Researchers will also face difficulties in quantifying results, locating problems, reproducing scenarios, and achieving efficient R&D—ultimately hindering tech progress and commercialization, and creating many industry pain points.



Pain points of traditional data collection

- **Asynchronous Multi-Sensor Data**
  In autonomous driving testing, the time benchmarks of data from multiple devices (such as cameras, LiDAR, and inertial navigation systems) are inconsistent, leading to data deviations during algorithm verification and affecting the accuracy of test results.

- **High Sensor Adaptation Costs**
  Testing requires compatibility with automotive-grade sensors of different brands and specifications. Substantial R&D resources need to be invested in adapting to each type of device individually, driving up testing costs.

- **High-Bandwidth Data Storage and Transmission Packet Loss**
  When collecting raw video data such as RAW/YUV, the large data volume makes it difficult for existing equipment to meet high-bandwidth storage requirements. Additionally, packet loss often occurs during transmission, resulting in incomplete data.

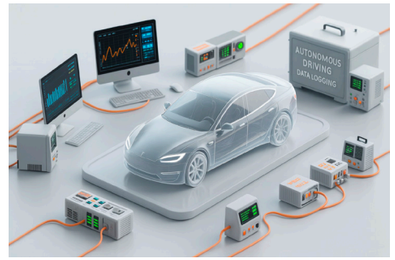
- **Insufficient Testing Equipment Stability**
  During the long-term operation of 100+ vehicle test fleets, the annual failure rate of equipment is relatively high, and frequent hardware failures interrupt the testing process and delay R&D progress.

- **Difficulty in Meeting Customized Acquisition Needs**
  Different testing scenarios (e.g., urban road, highway testing) have varying requirements for the number of sensors and interface types. The fixed configurations of existing equipment cannot be flexibly adjusted, making it hard to adapt to personalized acquisition needs.

Solutions

To tackle these critical industry pain points head-on, VCARSYSTEM has developed a comprehensive product ecosystem centered on data acquisition and recording, featuring core offerings such as the AD STATION (ADS) series, VGB video bypass modules, and Adsoft ADAS function evaluation software.

Building on the complementary strengths of these products. VCARSYSTEM has also rolled out tailored integrated solutions. These end-to-end offerings directly address the core demands of the autonomous driving sector, providing reliable, efficient, and holistic support to overcome key challenges in data collection, processing, and functional testing.



ADAS/AD Testing and Evaluation System Solution

VCARSYSTEM has launched an ADAS feature evaluation solution for comprehensive, accurate, and fast testing. It offers data support and analysis reports to enhance feature algorithms or sensor configurations, fostering rapid growth in the intelligent automotive and smart transportation sectors.

RAW Camera ISP Processing and Acquisition Solution

VCARSYSTEM launches a collection solution using ADS 3010 RAW camera ISP processing. It compresses raw data after ISP processing, preserving key information to save hardware resources and improve algorithm performance.

RAW Camera Compression Processing and Acquisition Solution

VCARSYSTEM has launched a collection solution using ADS 3020 RAW camera compression processing. Their proprietary technology balances compression costs and image quality, reducing storage costs by 80% while maintaining lossless compression, marking a breakthrough in industry technology.

High-Bandwidth Raw Data Acquisition Solution

VCARSYSTEM unveils a high-bandwidth raw data collection solution, tackling image data transmission bottlenecks in autonomous driving. This advancement enhances customer value across technical R&D and market competitiveness, serving as vital infrastructure for advancing and commercializing autonomous driving technology.

Camera Bypass Acquisition Solution

Different testing scenarios (e.g., urban road, highway testing) have varying requirements for the number of sensors and interface types. The fixed configurations of existing equipment cannot be flexibly adjusted, making it hard to adapt to personalized acquisition needs.



AD STATION

Autonomous Driving Data Recorder

High-precision data recorders supporting multiple ADAS sensors and AD functionality validation.

AD STATION series crushes traditional autonomous driving data acquisition pain points—sub-millisecond sensor sync, broad compatibility, and integrated ADAS validation—fueling reliable data integration, accelerated algorithm iteration, and scalable, efficient autonomous driving development.

Boasting a diverse product lineup to meet varied industry needs, the AD STATION series excels at capturing multiple data types and covers a wide range of data acquisition, including multi-type sensor data and scenario-specific core data, such as visual data, LiDAR data, Inertial Navigation System (INS) data, parallel data from 16+ sensors, ADAS function evaluation-related data, and scenario ground truth data.

This device is fully compatible with all mainstream camera sensors available on the market.

- **SONY:** IMX623, IMX728, ISX031
- **OV:** 0X03 Series, 0x08 Series
- **ON:** AR0231, AR0233, AR0820
- **SerDes:** Full series of Maxim GMSL, full series of TI FPD-LINK, ROHM, Thine, etc.

ADS 3000 Series (Including ADS 3200/3110/3020/3010/3000)



ADS 3000



ADS 3110



ADS 3200

- **Processing Power:** Supports 2 NVIDIA RTX 30/40 Series, RTXA6000/A4500 GPUs (up to 97 TFLOPS FP32); options include Intel 9th Gen Core i9 (LGA1151) or R680E chipset.
- **Memory:** Up to 128GB ECC/non-ECC DDR4 2133 (4 SO-DIMM slots) or 96GB DDR5.
- **Interfaces:** Up to 16-channel CAN/CANFD, 16-channel LIN, 2-channel FlexRay; Support 2-channel Gigabit Ethernet (expandable)
- **Synchronization:** Up to 1ms synchronization accuracy, supporting gPTP/PTP synchronization.
- **Expansion & Storage:** 5 PCIe slots (2×16+3×8), 2 hot-swappable 2.5" HDD bays + 1 M.2 NVMe slot; 8-48V wide DC input.

ADS 1000 Series (Including ADS 1686/1281/1280)



ADS 1280



ADS 1281



ADS 1686

- **Processing & Memory:** Intel 9th/11th Gen Core i9 (LGA1151/LGA1200); 32GB/64GB/128GB DDR4 2133.
- **Interfaces:** Up to 16-channel CAN/CANFD, 16-channel LIN, 2-channel FlexRay; 2-channel Gigabit Ethernet
- **Synchronization:** Up to 1ms accuracy, supporting PTP, GPS (PPS).
- **Storage & Expansion:** 2 hot-swappable 2.5" HDD bays; support for 2 NVIDIA RTX 30 Series GPUs.

Advantages

Full-category Compatibility

Compatible with automotive-grade cameras from leading brands including Sony, ON Semiconductor, and all types of sensors such as LiDAR, with extensive support for multiple communication protocols.

Ultra-precise Synchronization

Delivers <1ms high-accuracy clock synchronization via a hardware-software co-design, supports multi-camera synchronized exposure, and ensures perfect temporal alignment of multi-sensor data.

High-performance Processing

Hardware-accelerated encoding and compression frees up system resources; self-developed ISP optimizes image quality, featuring low latency, high bandwidth, and accurate, reliable data acquisition.

Highly Stable Operation

Enables 24/7 uninterrupted data collection for high-mileage testing, with built-in self-check and fault-tolerance mechanisms. Zero packet loss, low-latency bypass transmission guarantees complete, intact data.

High Flexibility

Integrated hardware-software architecture delivers excellent scalability and flexibility, with rich software functions to adapt to diverse data acquisition scenarios.

AD STATION & adSoft Integration: Enabling Visualized Data Management

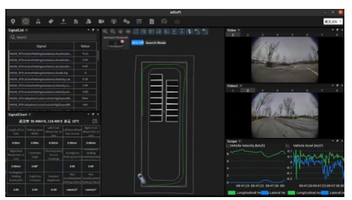


adSoft

Powered by ADS series hardware, adSoft Data Acquisition Software delivers comprehensive performance advantages to accelerate R&D, optimize ADAS algorithms, and unlock maximum data value.

AD STATION hardware and adSoft data acquisition software synergize to form an "acquisition-verification-analysis-optimization" closed loop, with core value in 4 dimensions:





- **Precise Hard-Soft Matching:** adSoft can directly use the high-fidelity multi-source data provided by ADS for the evaluation of core ADAS functions (such as AEB/FCW), without the need for additional conversion.
- **Real-Time Loop for Faster Iteration:** adSoft's online visualization (targets, waveforms) supports real-time test monitoring. Linked with hardware's ADAS module, software alerts and multi-mode marking quickly capture key scenarios, shortening algorithm iteration cycles.
- **Full-Scenario Stability & Adaptability:** adSoft offers a flexible interface (with custom label and drag-and-drop features), and multi-dimensional reports for diverse requirements. Its combination with ADS enables coverage of all processes from lab debugging to road testing.
- **Maximized Data Value** ADS's efficient RAW/YUV processing (lossless compression, ISP optimization) provides high-quality data for adSoft. adSoft turns massive data into actionable insights (algorithm optimization, sensor configuration) via targeted reports, transforming data from "storage" to "value output".

Get More Information

ADS 3000 Seires

Specification / Model	ADS 3110	ADS 3000	ADS 3200	ADS 3020	ADS 3010
Product Picture					
CPU	Intel® i9-13900K CPU	Intel® i9-9900K CPU			
Chipset	Intel® 680E Platform Controller	Intel® C246 Platform Controller			
Memory	2× SO-DIMM, up to 96GB DDR5-4800 (ECC / non-ECC)	4× SO-DIMM, up to 128GB DDR4-2133 (ECC / non-ECC)			
Ethernet	2× 2.5 Gigabit Ethernet, 1× Gigabit Ethernet (Expandable)	2× Gigabit Ethernet (Expandable)			
Display Interface	1× VGA, 1× DP	1× VGA, 1× DVI-D, 1× DP			
Serial Port	2× COM RS-232/422/485			2× Serial Port	
USB	6× Gen 2(10 Gbps) USB 3.2	4× Gen 1 (5 Gbps) & 4×Gen 2 (10 Gbps)	4× Gen2 (10 Gbps) & 4× Gen1 (5 Gbps) USB 3.1	4× Gen 1(5 Gbps) & 4× Gen 2(10 Gbps) USB 3.1	4× Gen 1 (5 Gbps) & 4× Gen 2 (10 Gbps)
CAN / CAN FD	16	16	16	16	16
LIN	16	15	15	15	15
FlexRay	2	2	2	2	2
Audio interface	1× 3.5mm interface, microphone input & speaker output				
SATA	2× hot-swappable drive bays, support 2.5" HDD / SSD				
PCI Express	2× PCIe x16 slots (Gen3, x8) 2× PCIe x8 slots (Gen3, x4) 1× PCIe x4 slot (Gen3, x4)	2× PCIe x16 slots (Gen3, x8) 2× PCIe x8 slots (Gen3, x4) 1× PCIe x4 slot (Gen3, x1)			
mini-PCIe	2× Full-length mini-PCIe slots				
DC Input	3× 4-Pin Plug-in terminal blocks, 8–48V DC input	2× 4-Pin Plug-in terminal blocks, 8–35V DC input			
Size	432 x 400 x 243(mm)	381 x 360 x 235(mm)			
Operating Temperature	–25 °C to 70 °C				
Storage Temperature	–40°C to 85 °C				
Humidity	10%–90% RH (non-condensing)				

ADS 1000 Series

Specification / Model	ADS 1686	ADS 1284	ADS 1281	ADS 1280
Product Picture				
CPU	Intel ® i9-9900K CPU	Intel® i9-11900 CPU	Intel® i9-9900K CPU	Intel® i9-9900K CPU
Chipset	Intel® H310	Intel® W580	Intel® C246	Intel® H310
Memory	1× SO-DIMM slot, up to 32GB DDR4-2133	4× SO-DIMM slots, up to 128GB DDR4-2133 (ECC / non-ECC)	4× SO-DIMM slots, up to 128GB DDR4-2133 (ECC / non-ECC)	1× SO-DIMM slot, up to 32GB DDR4-2133
Ethernet	2× Gigabit Ethernet (Expandable)	1× Gigabit Ethernet 1× 2.5 Gigabit Ethernet (Expandable)	2× Gigabit Ethernet (Expandable)	2× Gigabit Ethernet (Expandable)
Display Interface	2× DVI-D	3× DP	1× VGA, 1× DVI-D, 1× DP	2× DVI-D
Serial Port	3× RS-232/422/485 (COM1/COM2/COM3)	4× RS-232/422/485	2× RS-232/422/485 (COM1/COM2)	3× RS-232/422/485 (COM1/COM2/COM3)
USB	4× USB 3.1 Gen1 (5Gbps)	6× USB 3.2 Gen2 (10Gbps)	4× USB 3.2 Gen1 (5Gbps) 4× USB 3.2 Gen2 (10Gbps)	4× USB 3.2 Gen1 (5Gbps)
CAN / CAN FD	6	16	16	16
LIN	1	16	16	16
FlexRay	-	2	2	2
Audio interface	1× 3.5mm interface, microphone input & speaker output			
SATA	2× 2.5" hot-swappable drive bays (HDD / SSD)	4× 2.5" hot-swappable drive bays (SSD)	2× 2.5" hot-swappable drive bays (SSD)	2× 2.5" hot-swappable drive bays (HDD)
PCI Express	1× PCIe x16 (Gen3, x16) 1× PCIe x8 (Gen3, x4) 1× PCIe x4 (Gen3, x1)	2× PCIe x16 (Gen3, x8) 3× PCIe x16 (Gen3, x4)	2× PCIe x16 (Gen3, x8) 2× PCIe x8 (Gen3, x4) 1× PCIe x4 (Gen3, x1)	1× PCIe x16 (Gen3, x16) 1× PCIe x8 (Gen3, x4) 1× PCIe x4 (Gen3, x1)
mini-PCIe	1× Full-length mini-PCIe slots	2× Full-length mini-PCIe slots	2× Full-length mini-PCIe slots	1× Full-length mini-PCIe slots
M.2	-	1× M.2 2280 M-Key (Gen3, PCIe x4) 1× M.2 2242 B-Key	1× M.2 2280 M-Key (Gen3, PCIe x4)	-
DC Input	1× 3-pin plug-in terminal block, 8–35V DC	1× 4-pin plug-in terminal block, 9–55V DC	2× 4-pin plug-in terminal blocks, 8–35V DC	1× 3-pin plug-in terminal block, 8–35V DC
Size	313 × 331 × 235 (mm)	253 × 375 × 208 (mm)	318 × 360 × 235 (mm)	264 × 331 × 235 (mm)
Operating Temperature	–25°C to 70°C			
Storage Temperature	–40°C to 85°C			
Humidity	10%–90% RH (non-condensing)			



VGB

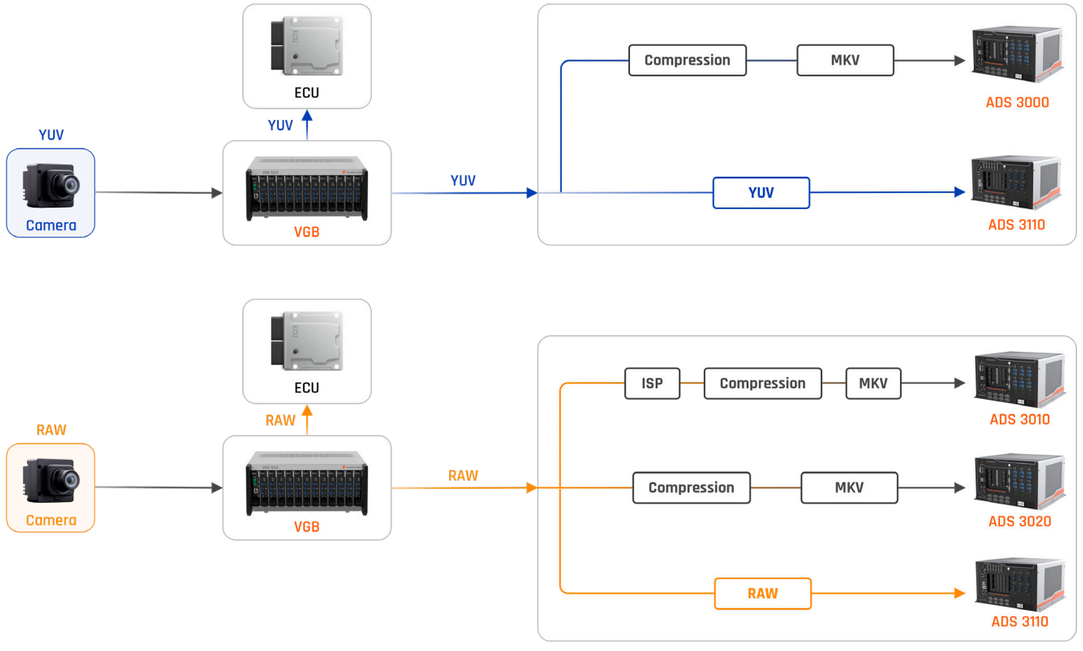
VCAR Gigabit Multimedia Serial Link(GMSL) Camera Bypass Data Logging Device

Microsecond-level synchronization and multi-camera compatibility

VCAR Gigabit Multimedia Serial Link(GMSL) Camera Bypass Data Logging Device supports microsecond - level synchronized replication and diversion of camera data. Equipped with a customizable deserializer, it can adapt to cameras from various manufacturers. VGB optimizes sensor data links for intelligent driving and industrial vision scenarios, and supports domain controller development as well as multi - algorithm validation.

Main Functions

- **Camera Data Bypass Acquisition**
  Enables efficient replication and distribution of video streams without disrupting the original data link.
- **Flexible I/O Configuration**
  Supports up to 12-channel GMSL1/2 camera input and 24-channel GMSL1/2 camera output, facilitating versatile multi-camera setups.
- **High-Resolution Compatibility**
  Works seamlessly with high-resolution cameras to capture detailed images for advanced intelligent driving and industrial vision applications.
- **High-Bandwidth & Synchronization**
  Features PPS signal synchronization and high transmission bandwidth, meeting the requirements for bypass acquisition of RAW/YUV format videos.
- **High-Performance Processing**
  Single-channel supports 8MP 30FPS camera data input, enabling multi-link parallel processing with a maximum of 12 inputs and 24 outputs.



Advantages

High-Compatibility Acquisition
The device supports camera data bypass acquisition, adapting to 12-channel GMSL1/2 camera inputs and connecting to high-resolution cameras.

Flexible Transmission
It provides 24-channel GMSL1/2 camera outputs, covering RAW/YUV video acquisition requirements.

Low Latency Synchronization
The system offers μs-level transmission latency with high synchronization accuracy, ensuring that data acquisition does not interfere with the normal operation of the domain controller.

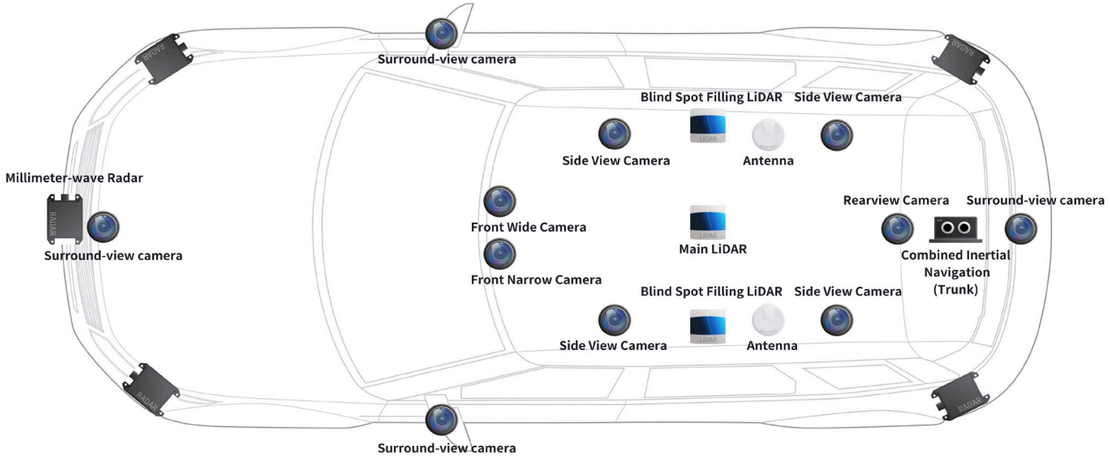
High-Performance Processing
A single channel supports 8MP 30FPS camera data input, and the system can achieve multi-link parallel processing with up to 12 inputs and 24 outputs.

Related Solution

Data Logging Closed-loop Solution For 4D-BEV*

To meet 4D-BEV annotation's core need for high-quality basic data, VCARSYSTEM has launched a global perception data acquisition system integrated with the VGB video bypass module.
Leveraging VGB's microsecond-level synchronization and high-bandwidth transmission, plus the "spatiotemporal sync - lossless acquisition - intelligent processing" full-link innovation, VGB enables efficient bypass replication and stable distribution of GMSL camera data (adapting to multi-vendor high-res cameras) to ensure latency-free, lossless sensor data.
It ultimately delivers high-fidelity, low-latency datasets for 4D-BEV annotation, satisfying 4D perception model training needs in intelligent driving.

*BEV: Bird's Eye View



Get More Information



HSMI Data Acquisition Module

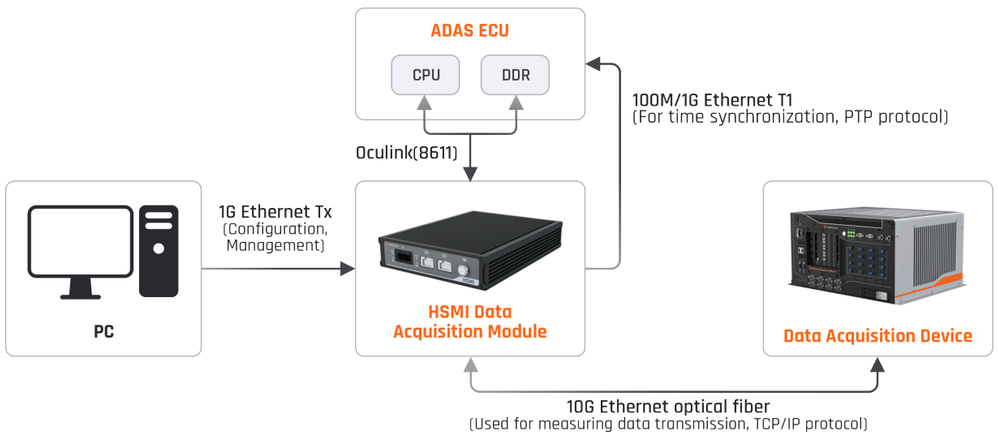
Hyper Stream Measurement Interface Data Acquisition Module

High-Performance, Low-Latency Data Acquisition Solution for Autonomous Driving and ADAS Development

Engineered to solve the core pain points of lossless, low-interference, high-precision raw ECU data acquisition, it supports synchronous collection and real-time transmission of multi-sensor data, and acts as a core tool for algorithm iteration and functional validation.

Main Functions

- **Unified Direct Acquisition of Full-Dimension ECU Data**
  - Integrated into ADAS ECUs as a standard PCIe device via the OcuLink (8611) interface
  - Adopts Direct Memory Access (DMA) technology to bypass the ECU CPU and retrieve raw observation data from DDR memory in real time
  - Zero occupation of ECU computing resources, with no impact on the normal operation of ADAS functions
- **Synchronous Acquisition of Multi-Source Sensor Data**
  - Synchronously collects multi-source data including cameras (RAW YUV), LiDAR (point cloud), and millimeter-wave radar (target list)
  - Built-in Precision Time Protocol (PTP) enables sub-microsecond time synchronization, ensuring precise timestamp alignment of multi-sensor data
- **Protocol Conversion and High-Speed Transmission**
  - Encapsulates raw PCIe data into TCP/IP Ethernet streams for high-speed transmission via the 10G Ethernet optical fiber interface
  - Data transmission bandwidth of no less than 8 Gb and latency ≤ 10 μs, meeting the large data volume requirements of autonomous driving scenarios
- **Flexible Software Control and Triggering**
  - The accompanying SDK supports user-defined acquisition rules, allowing registration of variables to be observed and configuration of sampling cycles
  - Provides an active trigger interface, supporting external CPUs to initiate DMA sampling and transmission of target variables by the acquisition card
- **Security Isolation and Low Interference**
  - Access permissions are strictly governed by the ECU security domain, with only non-sensitive observation data retrieved, complying with the ISO 26262 functional safety standard
  - No access to the core security domain code of the ECU; non-intrusive design safeguards driving safety



Advantages

Low-interference Acquisition
DMA direct memory access eliminates ECU CPU resource occupation and avoids impacting ADAS real-time performance

High-precision Synchronization
Sub-microsecond time synchronization enables accurate timestamp alignment of multi-sensor data

High-bandwidth Transmission
10Gbps optical fiber interface easily addresses the large data volume demands of autonomous driving

Highly Flexible Configuration
SDK-enabled custom acquisition rules and active trigger support for seamless adaptation to multiple scenarios

Automotive-grade Reliability
Wide temperature and wide voltage design, suitable for real-vehicle road tests and extreme operating environments

Easy Scalability & Integration
Standalone operation without additional supporting equipment for rapid deployment

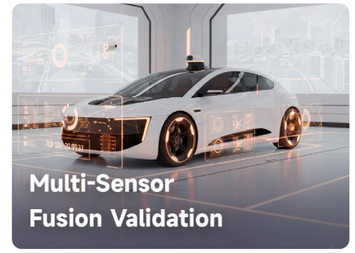
Application Areas



Acquire raw ECU data to verify the logical correctness of algorithms and provide real-world data support for algorithm iteration.



Continuously record real road condition data on mass-produced vehicles for the training and optimization of autonomous driving algorithms.



Synchronously collect multi-source sensor data to verify the accuracy and robustness of fusion algorithms.



Run algorithms in parallel on real vehicles to collect real-scenario data and validate algorithm performance under complex operating conditions.



Reconstruct the vehicle's status at the time of an incident with high-precision timestamped data to assist in identifying the root cause of faults.



Video Box

Video Data Acquisition Module

GMSL* Synchronization, Multi-Brand Camera Compatibility, Efficient Output

A 4-channel GMSL video data capture module with broad compatibility, efficient data handling and reliable hardware, ideal for intelligent driving testing and data collection.

*GMSL: Gigabit Multimedia Serial Link

Main Specifications

Specifications	Details
Connector	4× Amphenol 2FA1-NZSP-PCBD3 automotive coaxial connectors
Bus Protocol Standard	1000BASE-T
Channel	Channel 1 (IX to RJ45)
Interface	GMSL1 / GMSL2; 1× HDMI; 1× USB; 1× CAN & Trigger
Power	PoC power supply; Max. 1.8 A @ 12 V; Power consumption < 20 W
Cameras	4× channels (1 Gb/s physical bandwidth per channel)
Size	150 × 44.5 × 186.4 (mm)
Working Temperature	Operating: −20 °C to 70 °C; Storage: −40 °C to 80 °C

Advantages

Multi-channel Acquisition Capability

The system supports the synchronous input and acquisition of 4-channel GMSL 1/2 cameras, comprehensively covering the visual information of the test scenario.

Flexible Compatibility and Adaptation

It adapts to well-known brand cameras such as Senyun, Leopard, Sunny, Hikvision, and Lianchuang. It is compatible with MAX9296A, TI FPDLinkIII (DS90UB954) deserializer chips and cameras with various resolutions to meet the needs of different hardware configurations.

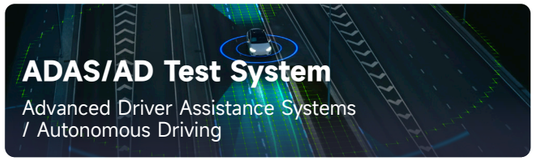
Efficient Data Processing

Supports simultaneous multi-channel video capture, features H.264/H.265 and JPEG/MJPEG encoding capabilities, and enables HDMI and RTSP output for multi-format data processing and real-time video transmission.

Highly Reliable Hardware Design

Equipped with an Amphenol vehicle coaxial connector (2FA1-NZSP-PCBD3), it ensures stable camera connection under complex working conditions such as vibration and electromagnetic interference, guaranteeing the reliability of data transmission.

Application Scenarios





Vehicle Bus Data Acquisition Solution

Efficient Data Capture | Full-scenario Adaptability

Seamless Integration | Compliance & Traceability



VGATE Series

Vehicle Bus Data Acquisition Solution



C-module

Data Acquisition Modules





Multi-Protocol Compatibility, High-Precision Acquisition – VGATE Delivers Reliable Bus Data for Automotive Excellence.

Against the backdrop of the rapid advancement of automotive intelligence and electrification, in-vehicle bus systems including CAN, LIN, FlexRay and Ethernet have evolved into the core nerve center linking the vehicle's powertrain, chassis, body control and intelligent driving subsystems.



As a specialized device dedicated to the full-cycle collection, secure storage and professional analysis of bus data, the automotive bus data logger assumes an irreplaceable pivotal role in guaranteeing the authenticity and integrity of vehicle test data, accelerating the efficiency of fault diagnosis and localization, satisfying the stringent requirements of industry compliance certification, and shortening the R&D and mass production cycles. It is an indispensable core tool that underpins the smooth implementation of vehicle R&D, verification testing and mass production processes.

Nevertheless, in the absence of such professional automotive bus data loggers, the automotive testing industry will be confronted with the following prominent pain points.

Pain Points

- **Data Reliability Deficiency**
  Incomplete data collection and insufficient standardization lead to a lack of reliable basis for test conclusions.
- **Time-Consuming Fault Localization**
  Intermittent faults are hard to reproduce and communication issues are difficult to quantify, making fault localization time-consuming and labor-intensive and prolonging the R&D cycle.
- **Uncontrolled Test Processes**
  Inability to monitor bus status in real time and lack of an automatic alarm mechanism result in out-of-control test processes and easy omission of abnormal risks.
- **Compliance & Mass Production Hurdles**
  Lack of traceable standardized data leads to failure to meet compliance certification requirements, hindered mass production progress, low efficiency in batch quality inspection, and high after-sales risks.
- **High Labor Costs & Low R&D Efficiency**
  Manual data recording and sorting involve heavy workload and high errors; data requires secondary processing, leading to high labor costs and low R&D efficiency.

Solutions

To address the core pain points plaguing the automotive R&D and testing sector, VCARSYSTEM leverages its solid R&D expertise in in-vehicle bus technologies and launches a full range of high-performance automotive bus data logger products, along with a set of targeted, systematic solutions.



VG 8000 Series



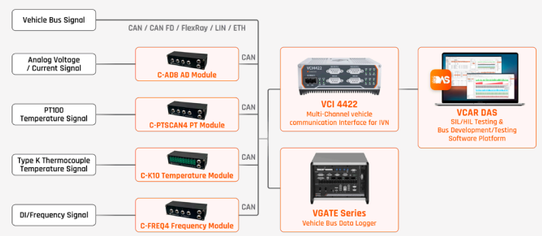
VG 4000 / 5000 Series

The product series fully supports mainstream protocols including CAN, CAN FD, LIN, FlexRay and Automotive Ethernet, featuring high-density long-duration synchronous data acquisition and high-precision timestamping. Combined with integrated solutions covering real-time monitoring, standardized storage and analysis tool docking, they effectively cut R&D cycles, reduce costs and meet strict compliance and quality inspection requirements.

Bus Data Acquisition Solution

Centered on the VGATE Series and C Module, it enables multi-dimensional and precise data acquisition.

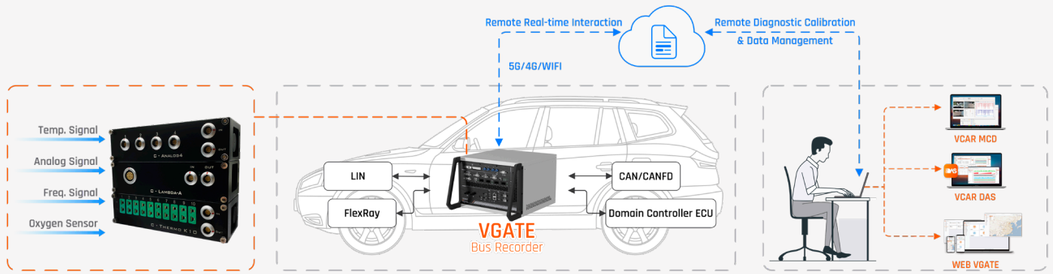
The Bus Data Acquisition solution launched by VCARSYSTEM, centered around automotive bus recorders and C modules, can cover multi-dimensional data acquisition scenarios such as temperature, voltage, current, mechanical stress, rotational speed, and air-fuel ratio. This solution supports modular flexible cascading expansion and, with its excellent stability and compatibility, has achieved large-scale application in the global automotive R&D and production fields.



Remote Measurement and Calibration Solution

Integrated with VCARSYSTEM's self-developed software, it enables remote calibration management.

The remote calibration solution provided by VCARSYSTEM integrates the calibration software VCAR MCD and the bus recorder VGATE SERIES, enabling the remote calibration function. This solution supports the XCP/CCP ON CAN and XCP ON CANFD protocols. Users can perform calibration and measurement operations on the experimental vehicle through the VCAR MCD and VGATE SERIES devices, and receive the calibration results and the measured variable values of the application.





VG8000 Series Bus Data Logger

Flagship Vehicle Bus Data Acquisition Solution — Coverage, Full-Scenario Support, Reliable Data Capture

Amid the dual momentum of automotive electrification and intelligentization, in-vehicle electronic architectures now feature more bus nodes and increasingly complex multi-system interactions. Traditional bus data acquisition solutions struggle with limited channel counts, incomplete interface coverage for diverse bus types, and single-source data capture that cannot support scenario replication .

Built to address these challenges, the VG8000 delivers full-scenario, full-interface, and highly reliable data acquisition to support vehicle-level verification, system integration, and root-cause analysis throughout the development lifecycle.

Main Functions

- **Comprehensive Vehicle Bus Acquisition**
  Native support for all mainstream in-vehicle networks:CAN / CAN FD/LIN/FlexRay/Ethernet T1, 99% high load without frame drops, Flexible channel configurations (up to 32 CAN, 26 LIN, and 32 Ethernet T1) scale from early platform bring-up to complex zonal and centralized E/E architectures.

- **Synchronized Video, Audio & Bus Data Capture**
  Standard configuration includes four 1080p@30 FPS cameras, audio interfaces, and HDMI output. Bus data is precisely synchronized with audio and video, enabling full-dimensional “data + context” scenario reproduction.

- **Signal Interaction & Expansion**
  Built-in DI/DO/AI interfaces allow direct interaction with test benches and external systems. Multiple USB 3.2 and COM ports enable easy expansion for specific instruments or sensors—without custom hardware redesign.

- **High-Capacity, Long-Duration Storage**
  Built-in 500 GB SSD with expandable 2.5-inch SATA storage (up to 4 TB), Supports the cyclic storage function with automatic overwrite when full, meeting massive data storage requirements for long-cycle tests such as road trials and durability testing.

- **Vehicle-Specific Scenario Compatibility**
  Supports a wide 9–36 VDC power input range. Select models feature ultra-low sleep current (<10 mA) to prevent vehicle battery drain, along with fast startup capability—ideal for temporary installations and long-duration road testing. Built-in GPS module, capable of synchronously collecting location data.

- **Extreme Environment Resilience**
  Operates reliably in temperatures from -40°C to 75°C and humidity from 10% to 90% (non-condensing). Designed for extreme environments such as high-altitude, high-temperature durability tests and off-road conditions—no additional protective equipment required.

- **Full-Lifecycle Data Processing & Intelligent Management**
  - Custom data file labels + multi-format time config; 6-channel button/signal-threshold dual triggers for single-end logging (multi-packet pre/post retention + parallel multi-task recording).
  - Web-based remote management/config/measurement; 4G/WiFi cloud transmission + USB (time-segment/real-time) copy; NTP/PTP + RTK-PPS for high-precision sync.

Advantages

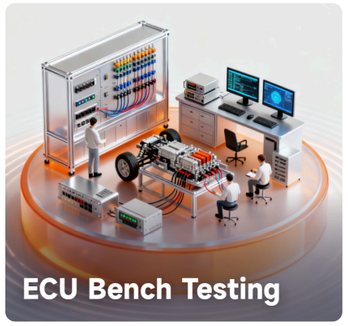
Reduced Test Complexity, Faster Root-Cause Analysis
Unified capture of all bus traffic and video/audio context eliminates tool fragmentation and synchronization issues—shortening issue localization and reducing re-test cycles.

One Platform Across the Validation Lifecycle
From ECU bench testing to full-vehicle and durability validation, VG8000 supports multiple test stages with a single hardware platform—lowering procurement, training, and maintenance costs.

Extreme Environmental Resilience & High Capacity, Worry-Free Testing
The wide operating temperature range (-40°C to 75°C) supports all test environments without extra protection. Large onboard storage eliminates mid-test data offloading, ensuring uninterrupted long-duration testing.

Lower Operational Overhead
Simple deployment, minimal configuration, and user-friendly operation allow standard validation engineers to operate the system—reducing reliance on specialized resources.

Typical Applications



Supports data acquisition for single-ECU and multi-ECU co-simulation bench environments.



On-board deployment enables high-speed, multi-bus data capture across multi-road conditions.



Wide temperature tolerance supports extreme high- and low-temperature durability testing.



Captures cross-system bus interaction data to verify communication stability and system interoperability.



Reproduces bus signals and physical scenarios at the moment of failure to support efficient root-cause analysis.

Get More Information

Product Specifications

Specifications	VG8820	VG8831	VG8832
Product Picture			
CAN / CAN FD①	20		
LIN②	14	20	20
FlexRay③	1		
ETH-T1④	8	12	20
ETH-RJ45	2	2	-
4G & GPS	1		
Trigger Button / DI	5 × IO + 1 Wake-up		
Audio IN / OUT	1		
Camera	4 × 1080p @ 30 FPS		
HDMI	1		
RS232	2		
2.5″ SATA HDD Slot	1		
Data Storage	1 / 2 / 4 TB		
USB 3.2-A	8		
Buzzer	1		
Quick Start	Supported		
Sleep Current⑤	< 10 mA (Single Wake-up Source)		
Operating Voltage	9–36 VDC		
Dimensions	300 × 373 × 210 mm	360 × 372 × 240 mm	360 × 372 × 240 mm
Operating Temperature	−40°C to 75°C		
Storage Temperature	−40°C to 85°C		
Humidity (Non-Condensing)	10%–90%		

① **CAN / CAN FD:** Supports message ID filtering for logging; CANFD supports a maximum 8 Mbps baud rate.

② **LIN:** Supports a maximum 20 Kbps baud rate.

③ **FlexRay:** Supports a maximum 10 Mbps baud rate.

④ **Automotive Ethernet:** Configurable in bypass or transparent mode.

⑤ **Sleep / Wake Function:**

- Triggers configurable sleep countdown after bus inactivity.
- Configurable sleep sources: CAN/CANFD, LIN, 4G/WiFi transmission, automotive Ethernet host connection.
- Configurable wake sources: CAN/CANFD, LIN, I/O buttons; fast startup post wake-up.

Product Specifications

Specifications	VG8833	VG8834
Product Picture		
CAN / CAN FD	32	
LIN	26	
FlexRay	1	
ETH-T1	24	32
ETH-RJ45	2	
4G & GPS	1	
Trigger Button / DI	5 × IO + 1 Wake-up	
Audio IN / OUT	1	
Camera	4 × 1080p @ 30 FPS	
HDMI	1	
RS232	2	
2.5″ SATA HDD Slot	1	
Data Storage	1 / 2 / 4 TB	
USB 3.2-A	8	
Buzzer	1	
Quick Start	Supported	
Sleep Current	< 10 mA (Single Wake-up Source)	
Operating Voltage	9–36 VDC	
Dimensions	360 × 372 × 240 mm	
Operating Temperature	−40°C to 75°C	
Storage Temperature	−40°C to 85°C	
Humidity (Non-Condensing)	10%–90%	



VG4000/5000 Series Bus Data Logger

High-Performance Bus Recorders for Automotive R&D & Production

Comprehensive Data Acquisition · Intelligent Remote Management · Global Industry Validation

The VGATE Series is a line of high-performance bus recorders engineered for automotive R&D, testing, and production. Boasting versatile models, it features flexible channel configurations, broad protocol compatibility, and seamless integration with industry solutions—delivering reliable, efficient data capture, storage, and analysis to empower automotive professionals worldwide across diverse use cases.

Main Functions

- **Multi-Type Data Acquisition**
  Supports CAN/CANFD, LIN, Ethernet, Automotive Ethernet, and FlexRay buses, paired with 3-channel 1080P@30fps or 4-channel 720P@30fps video input. Offers flexible channel combinations (8-20 channels for CAN/CANFD, 4-12 channels for LIN, 2-8 channels for Ethernet) to adapt to diverse application scenarios.
- **Full Protocol & Format Compatibility**
  Covers mainstream automotive protocols including XCP/CCP, J1939, UDS, DoIP, and FlexRay monitor. Compatible with parsing libraries (DBC/A2L/LDF/XML/ARXML) and storage formats (DAT/MF4, BLF, MP4, PCAP), seamlessly working with mainstream data analysis software.
- **Flexible Recording & Management**
  Features button/signal threshold triggering, enabling packetized recording of multi-type data before and after the time point. 4G-enabled remote management allows device control, data viewing, real-time monitoring, and remote calibration anytime, anywhere.
- **Industry Solution Adaptability**
  Seamlessly integrates with remote measurement and calibration solutions, as well as lightweight data acquisition solutions. Supports modular scalable expansion, covering multi-dimensional data collection scenarios (temperature, voltage, current, mechanical stress, etc.).

Advantages

Comprehensive Configuration Options

A full product matrix of many models caters to all scenarios from lightweight to high-density data collection, meeting needs in automotive R&D and production.

High Compatibility, Low Integration Cost

Complies with global automotive industry standards, enabling seamless integration with existing test equipment, software, and on-board systems without additional adaptation.

Efficient Operation

Remote management reduces on-site workload; targeted triggering avoids redundant data; modular design adapts to project-specific requirements, boosting overall workflow efficiency.

Stable & Proven Performance

Globally validated in large-scale automotive R&D and production, with excellent stability and adaptability to complex on-board environments.

Comprehensive Software & Hardware Ecosystem

Comes with supporting tools (vgConfig, VCAR MCD/DAS software, WEB Management Platform) and compatible modules, delivering a one-stop data collection, analysis, and calibration solution.

Product Specifications(VG58XX Series)

Specifications	VG5820	VG5812	VG5808
Product Picture			
CAN / CAN FD	20	12	8
LIN	12	6	4
FlexRay	1		
ETH-T1	8		
RJ45	1		
USB3.0	2		
WIFI	The WiFi module can be expanded externally （support AP/STATION）		
LTE	The default is 4G and it can be upgraded to 5G		
GPS	Supported		
Audioport	1× 3.5 mm two-in-one audio interfaceT		
Disk	1 TB		
Consumption	< 18 W (no peripheral load)		
Operating Voltage	8–36 VDC		
Operating Temperature	−40°C to 80°C		
Storage Temperature	−40°C to 85°C		
Humidity (Non-Condensing)	10%–90%		

Get More Information

Product Specifications(VG54XX Series)

Specifications	VG5420	VG5412	VG5408
Product Picture			
CAN / CAN FD	20	12	8
LIN	12	6	4
FlexRay	1		
ETH-T1	8		
Camera	3× 1080p + 4× 720p @ 30 FPS		
RJ45	1		
USB3.0	2		
WIFI	The WiFi module can be expanded externally （support AP/STATION）		
LTE	The default is 4G and it can be upgraded to 5G		
GPS	Supported		
Audioport	1× 3.5 mm two-in-one audio interfaceT		
Disk	500 G / 1 TB		
Consumption	< 18 W (no peripheral load)		
Size	212 × 60 × 215 (mm)		
Operating Voltage	8–36 VDC		
Operating Temperature	-40°C to 80°C		
Storage Temperature	-40°C to 85°C		

Product Specifications(VG52XX Series)

Specifications	VG5220	VG5212	VG5208
Product Picture			
CAN / CAN FD	20	12	8
LIN	12	6	4
FlexRay	1		
ETH-T1	2		
Camera	3× 1080p + 4× 720p @ 30 FPS		
RJ45	1		
USB3.0	2		
WIFI	The WiFi module can be expanded externally （support AP/STATION）		
LTE	The default is 4G and it can be upgraded to 5G		
GPS	Supported		
Audioport	1× 3.5 mm two-in-one audio interfaceT		
Disk	500 G / 1 TB		
Consumption	< 18 W (no peripheral load)		
Size	212 × 60 × 215 (mm)		
Operating Voltage	8–36 VDC		
Operating Temperature	-40°C to 80°C		
Storage Temperature	-40°C to 85°C		

Product Specifications(VG50XX Series)

Specifications	VG5020	VG5012	VG5008
Product Picture			
CAN / CAN FD	20	12	8
LIN	12	6	4
FlexRay	1		
ETH-T1	-		
Camera	3× 1080p + 4× 720p @ 30 FPS		
RJ45	1		
USB3.0	2		
WIFI	The WiFi module can be expanded externally （support AP/STATION）		
LTE	The default is 4G and it can be upgraded to 5G		
GPS	Supported		
Audioport	1× 3.5 mm two-in-one audio interfaceT		
Disk	500 G / 1 TB		
Consumption	< 18 W (no peripheral load)		
Size	212 × 60 × 215 (mm)		
Operating Voltage	8–36 VDC		
Operating Temperature	−40°C to 80°C		
Storage Temperature	−40°C to 85°C		

Product Specifications(VG4XXX Series)

Specifications	VG4206	VG4006	VG4002
Product Picture			
CAN / CAN FD	6	6	2
LIN	2	2	-
FlexRay	1	1	-
ETH-T1	2	-	-
RJ45	1		
USB3.0	1		
WIFI	The WiFi module can be expanded externally （support AP/STATION）		
LTE	4G		
GPS	Supported		
Disk	128 GB / 500 GB / 1 TB		
Consumption	< 18 W (no peripheral load)		
Size	138 × 144 × 55 (mm)		
Operating Voltage	8–36 VDC		
Operating Temperature	−40°C to 80°C		
Storage Temperature	−40°C to 85°C		



Data Acquisition Module - C Module Series

Portable high-precision sensor data acquisition unit

Full-Scenario Precision Capture, Robust Protection for Demanding Tests – Stable, Accurate, Flexible Data Acquisition!

The C Module series is an all-in-one data acquisition solution for automotive and industrial use. It covers analog, temperature, lambda, frequency, high-voltage, and high-speed vibration signals, with 24-bit resolution, up to 1 kHz sampling, ±0.1°C temperature accuracy, and ±0.005 lambda precision. Built for harsh environments (-40°C~85°C, IP65/67, full electrical isolation), it supports multi-module daisy-chaining and CAN output. Seamlessly integrating with mainstream test systems, it's ideal for vehicle data acquisition, new energy tests, and engine monitoring – reliable, efficient industrial-grade precision.

Main Specifications

Specifications	Aggregate Module-C-Multi LTK10		
Product Picture			
Data Acquisition Type	Temperature	Turbocharger Speed	Air-Fuel Ratio
Channel Configuration	10-channel temperature input	1 speed sensor interface	1 linear oxygen sensor interface
Measurement Accuracy	±1°C (Ambient Temperature: -40 °C to 105 °C)	(30 blades): ±0.25%	AFR: IP accuracy ±0.1% + 0.007 mA λ accuracy: ±0.005 (when λ ≈ 1)
Measurement Range	−100°C to +1250°C	10 blades: 0–320,000 RPM 30 blades: 0–100,000 RPM	LS4U.2: 0.55–32.767 LS4U.9: 0.650–15.990
Sampling Rate / Resolution	Sampling frequency: 0.2–10 Hz (Adjustable) Data transmission period: 100–5000 ms (Adjustable)	Resolution: 12 RPM (10 blades) 4 RPM (30 blades)	Sampling frequency: 100 Hz
Output Interface	CAN communication interface		
Protection Rating	High waterproof and dustproof rating, suitable for harsh environments		
Supported Features	Supports multi-module cascading for signal expansion; full electrical isolation (input, CAN, power supply, housing)		
Application Scenarios	Vehicle data acquisition, vehicle energy flow management, high-voltage applications		

Main Specifications

Specifications	Analog Acquisition	Temperature Acquisition		Lambda Acquisition
	C-AD4/8	C-Thermo-K/T 10/20	C-PT100	C-Lambda
Product Picture				
Channel Configuration	4 / 8-channel voltage input	10 / 20-channel K-type thermocouple input	4-channel PT sensor interface (compatible with 2-, 3-, and 4-wire systems)	1-channel linear oxygen sensor interface
Measurement Range	±60 V / ±10 V (adjustable)	−100°C to 1250°C	−200°C to 850°C	AFR (compatible with LSU4.2 / LSU4.9)
Measurement Accuracy	±10 mV / ±5 mV	±1°C (Ambient Temperature: −40°C to +85°C)	±0.1°C (Ambient Temperature: −40°C to +85°C)	AFR: ±0.1% + 0.007 mA λ accuracy: ±0.005 (λ ≈ 1)
Sampling Resolution	24-bit (Adjustable)	16-bit	24-bit	16-bit
Sampling Rate / Response Speed	1 Hz to 1 kHz (Adjustable)	0.2 Hz to 10 Hz (Adjustable)	0.1 Hz to 10 Hz (Adjustable)	100 Hz
Output Interface	CAN Output	CAN Output	CAN Output	CAN Output
Protection Rating	High water and dust resistance	Harsh environment resistance	Harsh environment resistance	Full electrical isolation
Insulation Performance	Full electrical isolation			
Supported Features	Supports multi-module cascaded expansion for signal acquisition			
Data Transmission Cycle	1 ms to 1 s (Adjustable)	100 ms to 5000 ms (Adjustable)	100 ms to 5000 ms (Adjustable)	10 ms
Application Scenarios	Vehicle data acquisition, vehicle energy flow management	Vehicle data acquisition	Vehicle data acquisition	Automotive exhaust measurement, vehicle data acquisition

Main Specifications

Specifications	Frequency Acquisition	High-Voltage Acquisition
	C-FREQ	HV-MODULE
Product Picture		
Channel Configuration	4-channel frequency input	1× high-voltage measurement channel Input cutoff frequency: 2 kHz Input impedance: 21 MΩ
Measurement Accuracy	Input voltage: ±60 V High / low level thresholds (Adjustable)	±2 V (−40°C to 85°C)
Measurement Range	0.1 kHz to 300 kHz	±1100 V
Sampling Rate / Resolution	Sampling rate: 1 ms to 1 s (Adjustable) Resolution: 16-bit	Sampling rate: 1 Hz to 1 kHz Resolution: 24-bit
Output Interface	CAN Output	Standard CAN Output
Protection Rating	High-voltage resistant, harsh-environment resistant	
Supported Features	Supports multi-module cascaded expansion for signal acquisition	
Application Scenarios	Vehicle data acquisition, vehicle energy flow management, high-voltage scenarios	Vehicle data acquisition, vehicle energy flow management

Advantages



Analog Acquisition
(C-AD4/8)

Adjustable precision + concatenation flexibility – stable analog capture in harsh industrial environments

Reduce equipment procurement costs; ensure 99.9% data integrity in extreme industrial scenarios; simplify test setup with flexible parameter adjustment.



Temperature Acquisition
(C-Thermo-K10/20, C-PT100)

High-channel density + ±0.1°C accuracy – master -100 °C ~ + 1250 °C temperature monitoring effortlessly.

Improve writing efficiency; lower maintenance costs; guarantee reliable data in extreme cold/hot test environments (e.g., vehicle winter testing)



Lambda Acquisition
(C-lambda)

Full electrical isolation + 100Hz response – capture lab-grade lambda data plug-and-play.

Ensure compliance with automotive EMC standards; save testing time; provide trustworthy data for emission control system optimization.



Frequency Acquisition
(C-FREQ)

±60V wide input + adjustable thresholds – scale frequency testing with multi-module expansion.

Eliminate extra adapter costs; improve test efficiency ; support integrated testing of multiple frequency-based components (e.g., motors, sensors).



Combined Acquisition
(C-Multi LTK10)

All-in-one temp/lambda/turbine speed – cut wiring chaos, thrive in high-voltage harsh conditions.

Reduce wiring complexity; avoid data asynchrony risks; adapt to high-voltage/extreme condition testing (e.g., off-road vehicle trials).



High-Voltage Acquisition
(HV-MODULE)

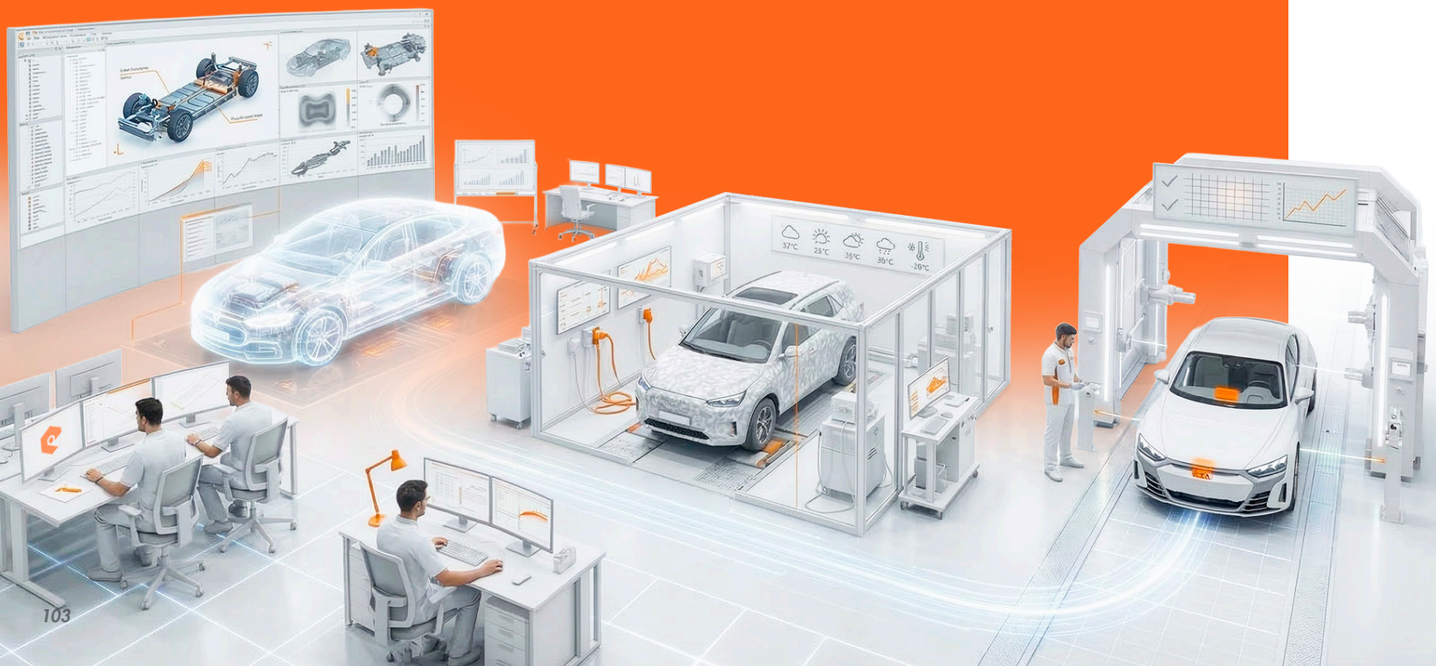
Triple insulation + voltage-temp integration – safe, stable ±1500V high-voltage testing.

Ensure operator safety in high-voltage tests; cut equipment investment; simplify new energy vehicle power train testing.

Get More Information

06

Full Life Cycle Validation: DV/PV/EoL



DV
Design Validation



PV
Product Validation

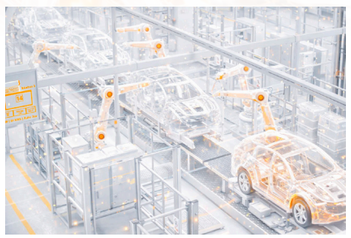


EoL
End-of-Line





Empowering Efficiency, Compliance and Reliability in the Era of Smart Mobility



The global automotive and embedded electronics industry is undergoing an unprecedented transformation, with the waves of electrification, autonomous driving and Industry 4.0 driving rapid technological iteration. For Tier 1 suppliers, OEMs and embedded system developers, delivering high-performance, safe and compliant products is no longer a competitive edge, but a prerequisite for survival. At the core of this mission lies a rigorous end-to-end test process: Design Validation (DV), Product Validation (PV) and End-of-Line (EoL) testing.

In the automotive embedded domain, DV, PV and EoL are not isolated phases, but form a closed-loop quality assurance lifecycle that directly determines product success, cost efficiency and brand reputation. Gaps or silos in any phase can lead to severe consequences:

Design Validation (DV) phase: If defects are overlooked and the accuracy of product design cannot be validated, it will lead to subsequent hardware rework, prototype delivery delays and missed market windows.

Product Validation (PV): If conducted inadequately, it fails to verify the reliability of production—especially manufacturing processes—thereby triggering after-sales recalls, safety incidents and compliance penalties.

End-of-Line (EoL) testing: If not properly executed, defective products will enter the supply chain, eroding customer trust and increasing warranty costs.

A unified PV/DV/EoL process ensures seamless data flow from design to production, reusable test cases across phases, and quality embedded in every step rather than added as an afterthought.

Core Pain Points for Customers

- **Data and tool silos**
  DV, PV and EoL teams use disjointed platforms, leading to repetitive test script development and manual data transfer, which wastes engineering time.
- **Escalating compliance burdens**
  Meeting ISO 26262/ASIL-D compliance requires extensive documentation and traceability, a process that is error-prone and time-consuming with fragmented tools.
- **Trade-off between production efficiency and quality**
  EoL testing bottlenecks slow down production lines, while hasty testing allows defective products to enter the market.
- **Lack of scalability**
  Fixed test configurations cannot adapt to dynamically changing product portfolios (e.g., all-new EV models, ADAS sensors) or production capacity fluctuations

VCARSYSTEM Full-Process DV/PV/EoL Testing Ecosystem: From Lab to Production Line

Targeting these challenges, VCARSYSTEM has launched a unified automotive-grade testing ecosystem perfectly adapted to the full DV→PV→EoL workflow. Exclusively designed for the automotive embedded industry, this solution eliminates data silos, streamlines compliance processes, accelerates time-to-market, and ensures the highest level of product reliability. The following is a detailed breakdown of the solution, including core testing equipment for each phase:

Full Cycle Validation
From Lab to Production: One Unified Platform

DV — Design Validation
Early Defect Interception to Reduce Costs

VCAR SIL
Unified, Scalable Simulation Platform for Automotive R&D & Validation

Hardware-in-the-Loop Test System
Real-time simulation to verify the logical functions, fault injection and diagnostic capabilities of ECUs

EMC Test Load Box
A shielded I/O simulation device for controllers, supporting EMC testing of controllers in corresponding environments to verify their electromagnetic radiation and anti-interference capabilities

Durability Test Equipment
Simulates controller input signals and load output signals; combines with environmental chambers, vibration test stands and other lab equipment to verify the environmental reliability performance indicators of products

PV — Product Validation
Compliance and Reliability to Ensure Real-World Performance

EoL — End-of-Line
Dual Assurance of Mass Production Quality and Efficiency

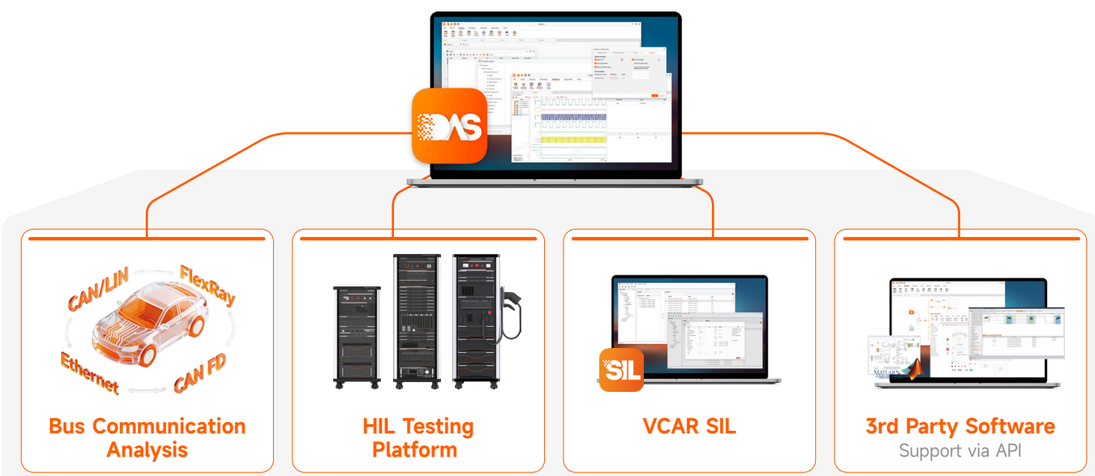
EoLTest Bench
100% full inspection: verify the basic functions, software version, and configuration correctness of mass-produced parts, and eliminate production defects

Controller Refresh Solution
Flashes and configures automotive electronic controllers before EoL, enabling rapid firmware/calibration programming, self-test and data writing to ensure uniform versions and qualified performance, plus fault diagnosis and data traceability for improved EoL efficiency and quality.

Manufacturing Execution System
Records EoL test data, firmware versions and production time for each unit to meet IATF 16949 requirements

VCAR DAS: One Software for All

At the core of the VCARSYSTEM solution is VCAR DAS, a single unified software hub that powers all DV, PV and EoL testing equipment. This means test scripts developed for SIL/HIL in the lab can be directly reused for EoL mass production testing—eliminating redundant work and ensuring consistency across the entire product lifecycle.



Multi-device compatible, Lower your software costs
Effortlessly streamline your workflow across functions

Why VCARSYSTEM?

True "Single Ecosystem, Zero Data Silos" Integration

VCARSYSTEM solution shares a single unified software platform across all phases, enabling:

- Direct reuse of HIL-developed test scripts from the DV phase for EoL testing, reducing engineering workload.
- Automatic synchronization of reliability test data from the PV phase to EoL production line systems, ensuring full-link traceability from design to delivery.
- A unified user interface for the entire testing process, lowering training costs and human error.
- Modular Design for Flexible Production

Modular Design for Flexible Production

Customers operate in dynamic markets with continuously evolving product portfolios. VCARSYSTEM testing equipment features a modular design that:

- Allows lab-grade HIL systems to be upgraded to production-line grade testing to adapt to capacity growth.
- Enables EoL workstations to be reconfigured within hours to support testing of new ECU models, aligning with the "flexible manufacturing" strategy of modern automotive factories.

Localized Technical Support

VCARSYSTEM provides localized technical support to minimize customer downtime. Our engineering teams have an in-depth understanding of customer scenarios (e.g., EV powertrains, ADAS sensors) and deliver customized solutions, on-site training and maintenance services.

Related VCARSYSTEM HIL Testing Solutions

Resolve HIL Testing Bottlenecks, Accelerate Automotive Project Timelines

VCARSYSTEM launches a multi-form, cross-domain HIL solution tailored to resolve these core pain points, helping teams streamline workflows and boost validation efficiency.

CubeStack HIL

Cluster HIL simulation platform for complex systems R&D in SDV programs—making HIL as soft & flexible as SIL



- **Elastic, scalable HIL resources**
- **Multi-user & remote parallel testing**
- **Deterministic time & data synchronization**
- **CI/CD-ready automated validation**

CubeBox

Modular All-in-One Bus Acquisition & HIL Simulation Platform



- **Maximize Flexibility with Modular Design**
- **All-in-One Integration for Higher Efficiency**
- **Open Automation Ecosystem & Seamless Software Integration**
- **Node Simulation, Fault Injection & Full Lifecycle Validation**

Intelligent Cockpit HIL



Multi-Domain Synergy & Realistic Interaction Simulation to Expedite Reliable Intelligent Cockpit Validation

Powertrain HIL



Net-Zero Goals, Zero Testing Headaches

- **Battery Management System (BMS)**
- **Vehicle Control Unit (VCU)**
- **Motor Control Unit (MCU)**
- **Transmission Control Unit (TCU)**

ADAS/AD HIL



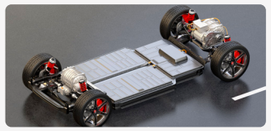
Accelerate Safe, Scalable AD System Validation

Replay HIL



Replay Real-World Sensor Data

Chassis HIL



Body HIL



Get More Information

From Design to Mass Production

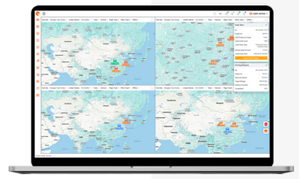
Build Quality with Testing

07

Cloud Management



WEB HIL



WEB VGATE





WEB HIL

HIL Management Platform

HIL management platform is an efficient and fast visual management platform with cool 3D vehicle models that dynamically display the testing process, provide visual charts, and display the operating status and results of equipment in real time.

Main Functions

- **Supports unified management of users, projects, equipment, personnel, announcements, and other resources.**
- **Supports decoupling of controlled object models and interfaces, enabling rapid signal configuration and modification.**
- **Provides visual dashboards to display equipment and project operation status, abnormal alarms, and real-time monitoring. A 3D vehicle model can demonstrate real-time testing actions and simulate real-world scenarios.**

Application Scenarios

- Addresses the complexity of managing multiple types and quantities of customer platforms.
- Large-screen visualization displays testing status and alarm information, helping users quickly identify and locate equipment issues.
- Decoupling of controlled object models and interfaces enables flexible adaptation to changing testing environments.



WEB VGATE

VGATE Management Platform

The VGATE series management platform is a remote management platform based on the network cloud as a service, which can be used as a comprehensive management platform integrating functions such as logger management, data management, signal detection, and remote services.

Main Functions

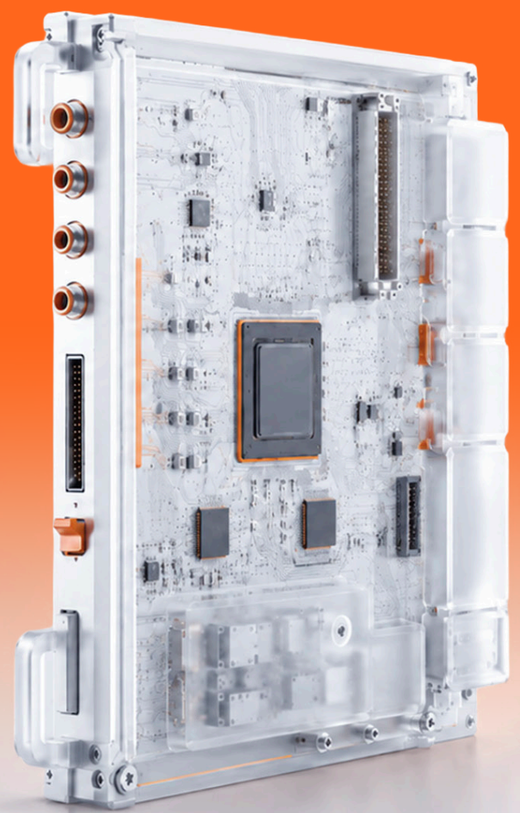
- **Data Management**
  Can be integrated with vehicles to enable centralized data management, ensuring high data security and maximizing the value of data mining.
- **Access Control**
  A mature permission management system supporting hierarchical management of users, devices, and related information.
- **Monitoring Information**
  Provides real-time monitoring of logger details, location information, and device status.
- **Remote Management**
  Supports remote data acquisition, real-time signal monitoring, remote firmware updates, diagnostics and calibration, version configuration, as well as device maintenance and upgrades.
- **Data Storage**
  Utilizes distributed storage architecture to ensure high data security and stability, allowing recorder data to be accessed anytime and anywhere through the platform.
- **Reduced Labor Costs**
  An intuitive visual interface with a low learning threshold enables quick deployment and improves engineering efficiency.
- **Customization**
  Supports function customization and platform deployment tailored to specific customer requirements.

Application Scenarios

- Vehicle Road Test Data Acquisition
- Three-High Environmental Test Data Acquisition (High Temperature, High Cold, High Altitude)
- Vehicle Remote Diagnostics and Updates
- Controller Bench Data Acquisition

08

ABC/TBC Board Overview



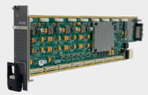
ABC Board



TBC Board



ABC Board

Board Name	Board Appearance	Functions & Advantages
KY9211 Blade Computer Board		12 resistor channels and 20 relay-matrix channels with 32 GB onboard memory; low latency and high I/O bandwidth. • Supports EtherCAT, Ethernet, PCIe and USB high-speed communication. Rugged blade-card architecture compatible with Windows 10/11 and 9-56 V wide-voltage input. • Ideal for automotive testing, HIL systems, data acquisition, sensor/actuator simulation and industrial control.
KY3582 Multifunction Switchable Base Board (PCIe)		Modular baseboard plus Piggy daughter-board design with 8 slots; supports flexible sub-board replacement. • High-speed PCIe communication, excellent EMC performance, and integration of simulation, digital, analog and switching functions. • Open architecture for vehicle signal simulation, bus acquisition and multi-scenario test systems.
KY3584 Multifunction Switchable Base Board (TCP)		Distributed baseboard plus Piggy daughter-board design with 8 slots and replaceable sub-boards. • Supports TCP remote connectivity and automated test-system integration, with modular I/O expansion and online firmware upgrades. • Suitable for vehicle wiring-harness acquisition, sensor/actuator signal simulation and HIL platforms.
KY4751 Fault Injection Board		20 channels with five common fault modes, including open circuit, short circuit, short-to-ground and bus/power fault simulation. • High-speed relay switching, programmable routing and up to 36 V operating capability. • Designed for ECU troubleshooting, abnormal power-supply testing and in-vehicle network fault simulation
KY1741 Multifunction Matrix I/O Board		10 x 10 differential matrix, 4 x 10 power matrix and 10 relay switching outputs. • Supports current, voltage and power monitoring; 40 V high-voltage capability and up to 20 A current measurement. • Switch control enables battery, ground and floating states for automotive I/O and power-distribution tests.
KY6122 Signal-Level Load Simulation Board		30 standard 1 kOhm load channels for simulating vehicle actuators and testing ECU outputs. • Supports high-side, low-side and full-bridge load modes, channel-state switching and configurable load routing. • 9-36 V wide supply range with current-collection circuitry for reliable load simulation.
KY6431 Battery Self-Discharge Analysis Board		High-precision 0.5-4.5 V voltage measurement, +/-10 mA current detection and temperature measurement. • Efficient 1-2 hour charge/discharge current testing; 30-minute cell balancing and 16-channel parallel testing. • Low-latency, low-interference design for cell self-discharge analysis and charge/discharge performance evaluation.

TBC Board

Board Name	Board Appearance	Functions & Advantages
KY1221 PWMOUT		24-channel digital PWM output with dual-channel architecture; 1 Hz-100 kHz frequency range and 0-100% adjustable duty cycle. • Programmable channel isolation, internal channel isolation and reverse-power protection. • EtherCAT plus 500k high-speed CAN communication for controller, motor-drive and HIL system tsts.
KY1313 Multi_Digital I/O		12 isolated digital channels with configurable acquisition and output functions. • Supports three independent digital-signal modes, channel-status indicators, relay/MOS control, digital and PWM signal collection. • EtherCAT and CAN communication for automotive electronics, controller interfaces and HIL simulation.
KY1421 VTI_60A*6		6 isolated current-acquisition channels with up to 60 A per channel; suitable for load-current measurement. • Seven measurement ranges with automatic matching, fault indicators and range adjustment. • EtherCAT and high-speed CAN communication for real-time current monitoring in battery and controller applications
KY1451 H_AD		12 high-speed analog acquisition channels supporting single-ended and differential measurement. • Peak-Hold voltage capture for transient signals and low-frequency sensor measurement. • Ethernet communication for vehicle controllers, actuators, sensor acquisition and HIL monitoring.
KY1511 AnalogOut_12V		24 isolated analog voltage outputs with 0-12 V output range and 0-10 mA drive capability. • Channel isolation, 3 mV output accuracy and PID-based over-voltage/current protection • Ethernet/CAN communication for sensor simulation, low-frequency signals and HIL applications.
KY1521 H_Precision_DA		4 isolated analog output channels with differential output; voltage range -500 mV to +500 mV and current range -100 mA to +100 mA. • High precision up to +/-0.1 mV, channel isolation and software-configurable voltage/current outputs. • 100M EtherCAT and CAN communication for BMS cell simulation, vehicle controllers and high-accuracy signal sources.
KY1541 Analog_Out_15V		24 isolated analog voltage outputs with 0-12 V output range and 0-10 mA drive capability. • Channel isolation, 3 mV output accuracy and PID-based over-voltage/current protection • Ethernet/CAN communication for sensor simulation, low-frequency signals and HIL applications.
KY1711 Analog/PWM_IN		24 isolated channels for analog, PWM and digital-signal acquisition. • High reliability, low-latency sampling and flexible signal acquisition across multiple scenarios. • Ethernet, 500k high-speed CAN and IO communication for HIL sensor measurement and controller testing.
KY2421 Resistance_Out_12		12 programmable resistance-output channels with 50 Ohm-8 MOhm range and 1 Ohm minimum step; each channel independently configurable. • Designed for HIL sensor-resistance simulation and resistance/temperature systems. • EtherCAT and CAN communication with firmware version 1.0 support.
KY2442 Wheel_Speed _Simulation_Module		4 wheel-speed signal outputs plus 4 tooth/missing-tooth signal channels with channel isolation. • Simulates wheel-speed sensors; supports S/I/V speed outputs and external interface circuits. • EtherCAT and CAN communication for ABS, ASR, EBR, CBC and ESP system tests.
KY2451 Insulation Resistance Simulation		Two insulation-resistance channels with 100 Ohm-50 MOhm per-channel adjustment and 150.1 kOhm-100.15 MOhm combined output range. • Simulates Pack+ and Pack- insulation to ground, with 100 Ohm steps, auxiliary 9-12 V supply and millisecond-level detection. • 100M EtherCAT and CAN communication for EV, BMS and battery-pack insulation monitoring tests.

TBC Board

Board Name	Board Appearance	Functions & Advantages
KY2713 H_DA (Engine_Speed_Sim)		24-channel digital PWM output with dual-channel architecture; 1 Hz-100 kHz frequency range and 0-100% adjustable duty cycle. • Programmable channel isolation, internal channel isolation and reverse-power protection. • EtherCAT plus 500k high-speed CAN communication for controller, motor-drive and HIL system tests.
KY3141 SENT		1 SENT communication circuit for SENT frame receiving and transmitting, with 500 kbps high-speed CAN interface. • Configurable SENT ID, tick count, frame length and stop-pulse parameters; supports online/offline communication and SENT data configuration. • Used for SENT sensor simulation, SENT signal monitoring and EPS/controller test scenarios.
KY3151 PSI5		8 PSI5 channels with support for two groups of PSI5 signals output simultaneously; designed for multi-sensor simulation. • Supports PSI5 1.3 and 2.1 protocols, configurable voltage selection, checksum and sensor-simulation parameters. • CAN communication for vehicle PSI5 sensor simulation, signal acquisition and HIL testing.
KY3161 PCIe-4AE		PCIe 3.0 x2 interface with 5 automotive Ethernet channels (T1); Port 5 supports 100M and uses a MATEnet automotive Ethernet interface. • Supports real-time Ethernet packet receiving, routing, point-to-point communication and bus analysis. • Applicable to automotive Ethernet simulation, bus analysis, data recording and playback.
KY3162 PCIe-5AE		PCIe 3.0 x2 interface with 4 automotive Ethernet channels (T1) plus 1 SFP+ optical interface; MATEnet automotive Ethernet interface. • Supports real-time packet RX/TX, routing, point-to-point communication, data monitoring and bus analysis. • Designed for automotive Ethernet simulation, analysis, recording and replay.
KY3511 VCI8		8 CAN/CAN FD channels, 8 LIN channels and 1 FlexRay channel. • Supports CAN/LIN/FlexRay message transmit and receive; CAN up to 1 Mbps, CAN FD up to 4 Mbps and LIN slave mode. • 100 Mbps Ethernet, Bus-Off auto recovery and stable operation for HIL, bus simulation, recording and playback.
KY3512 VCI8_Pro		16 isolated bus channels, including 8 CAN/CAN FD and 8 LIN channels; CAN up to 1 Mbps, CAN FD up to 8 Mbps and LIN up to 19.2 kbps. • Supports CAN/CAN FD/LIN transmit/receive, BLF/ASC data logging, bus simulation and data replay. • 100M/1000M Ethernet for high-efficiency bus data exchange and controller road-test analysis.
KY3521_F1 KY3521F1_DSI3 DSI3		4 independent isolated bus channels using a daughter-card design; DSI3 application with KY3521F1 sub-card. • Supports DSI3, PSI5 and SENT communication; ECU/Sensor mode switching and differential output. • Ethernet plus CAN communication for sensor acquisition, simulation and automotive bus monitoring.
KY3521_F2 KY3521F2_SENT SENT		4 independent isolated bus channels using a daughter-card design; SENT application with KY3521F2 SENT sub-card. • Supports DSI3, PSI5 and SENT communication, ECU/Sensor operating modes and real-time data acquisition. • Ethernet plus CAN communication for SENT, DSI3 and PSI5 bus simulation and analysis.
KY3521_F3 KY3521F3_PSI5 PSI5		4 independent isolated bus channels using a daughter-card design; PSI5 application with KY3521F3 PSI5 sub-card. • Supports DSI3, PSI5 and SENT communication, ECU/Sensor mode switching and PSI5 four-wire A/P/U/D modes. • Ethernet plus CAN communication for sensor simulation, signal collection, fault diagnosis and bus analysis.

TBC Board

Board Name	Board Appearance	Functions & Advantages
KY3591 Smart Charging (PLC)		Simulates EV/EVSE charging communication, CP PWM output/measurement, 100 Hz-1.2 kHz frequency and -15 V to +15 V voltage range. • Compliant with IEC 61851; integrates Green PHY module and supports EV/EVSE two-state simulation and resistance-box switching. • TCP/IP and CAN FD communication for charger testing, charge-pile fault injection and test automation.
KY3613 IO_HUB		PCIe 3.0 x4 interface with dual 4 GB/s bandwidth and optical-fiber communication for high-speed data transfer. • Enables RTPC data/file streaming and host-collector data exchange, including request/response processing, shared-memory read/write, broadcast and multi-request arbitration. • Expands multi-HIL systems and can connect with KY3584 boards for large-scale system integration.
KY4111 Relay_IO		24 independent digital-output channels; each 6 channels share one power loop. Single-channel maximum output current is 1 A, with 9.6 A total for 24 channels and up to 30 V. • Supports signal-latency timing, short-to-ground and up to three operating states. • CAN communication for digital output, actuator drive, signal short/open tests and fault injection.
KY4411 Relay_2A		42 relay-control channels; each channel supports up to 30 V and 2 A. • Supports signal switching, PIN-to-PIN and PIN-to-ground connection modes. • CAN communication with extended CAN-controller support for signal disconnection/reconnection and related tests.
KY4421 Relay_10A		21 relay-control channels; each channel supports up to 30 V and 10 A. • Supports signal disconnection, PIN-to-PIN connection and PIN-to-ground switching. • CAN communication for signal interruption, reconnection and multi-scenario relay-control tests.
KY4431 Relay_30A		8 relay-control channels; each channel supports up to 30 V and 30 A. • Supports high-current signal disconnection/reconnection and DUT signal switching. • CAN communication for high-load switching, controller fault simulation and power-path testing.
KY4611 Channel_Switch		20 independent load-switching channels, including 12 x 10 A channels and 8 x 2 A channels; single-channel maximum voltage 40 V. • Independent double-throw switching enables ECU-to-real-load, ECU-to-simulated-load and sensor/signal switching. • CAN communication with extended CAN-controller support for real/simulated load switching tests.
KY4711 L_FIU		24 independent current fault-injection channels; single-channel maximum voltage 40 V and maximum current 2 A. • Supports six fault-state switching modes, including default connection and five fault states, with automatic protection at over-current thresholds. • CAN communication for controller signal input/output faults, power-supply open/short faults and general fault simulation.
KY4721 M_FIU		8 independent current fault-injection channels; single-channel maximum voltage 40 V and maximum current 10 A. • Supports six fault-state switching modes for DUT-side terminal-to-ground and terminal-to-terminal faults. • CAN communication for controller fault insertion, device power-supply faults and switching control tests.
KY4731 H_FIU		4 independent high-current fault-injection channels; single-channel maximum voltage 40 V and maximum current 30 A. • Supports multiple fault-state switching modes for high-current power and control lines. • CAN communication for high-load fault injection, power-path faults and controller signal fault simulation.