

TOSUN



In-Vehicle Network Toolchain Provider
 LIN / CAN / CAN FD / CAN XL / FlexRay / Ethernet

TSMMASTER

Engineer Everything

Shanghai TOSUN Technology Ltd.

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About TOSUN

TOSUN Technology was founded by over a decade of experience in the automotive industry. With deep expertise in automotive electronics and system integration, we are committed to delivering innovative, reliable, and cost-effective solutions that help engineers streamline their workflows and enhance productivity.

Our goal is to empower engineers worldwide by providing a robust and intuitive toolchain that meets the evolving demands of modern automotive technology. Through continuous research and development, we strive to set new industry standards and drive technological advancements in the field.



TSMaster Software Feature List

Functional Capabilities	Function Description
Supported Protocols	CAN FD / CAN / LIN / FlexRay / Automotive Ethernet / ARINC-825
Number of Supported-channels	64
Message Transmission	Supports sending messages in raw format or in DBC / LDF / ARXML / FIBEX formats; configurable signal generator with C / Python scripting and sequential transmission
Message Monitoring	Real-time display of raw frames; signal values available after loading DBC / LDF / XML / ARXML
Message Filtering	Filter messages by ID, CAN channel, signal name, and signal value ranges; supports complex filter expressions
Data Logging	Stores data locally in BLF; supports auto-export to ASC and offline conversion to other file formats
Database Management	Supports loading and parsing of DBC / LDF / ARXML / XML files
Simulation	Residual bus simulation for CAN / LIN/ J1939 / FlexRay / Ethernet; nodes selectable from databases or combined with panels and C programming; supports static / dynamic PDUs, E2E, SecOC
Graphical Programming	Workflow-based graphical programming modules, including signal read / write, API calls, expressions; and intuitive toolchain
Message Playback	Supports online and offline playback of BLF / ASC / PCAP / PCAPNG formats
Statistical Analysis	Bus load, frame rate, error count, and error frame rate
Graphical Visualization	Supports graphical curves, dashboards, and numerical signal display
Dashboard Panel	Rich UI components: gauges, buttons, indicators, progress bars, input / output fields, etc.
Script Editing	Supports C language, Python, TAC
Database Editing	Integrated DBC / LDF / A2L / ODX / PDX database editor
Test System	Users can define complete test systems; supports automated testing and report generation; supports test cases in C / Python / graphical programming

Code Generation	Supports UDS generation; includes CAN / LIN drivers, Bootloader, CCP / XCP stacks
Format Conversion	Supports conversion between multiple file formats: DBC / ARXML / XLSX / XLS / DBF / YAML / SYM / CSV / JSON / FIBEX
Signal Processing	Signal mapping, testing, and comparison
Security Management*	Supports configuration of E2E / MACsec / SecOC
Model-Based Design (MBD)*	Model diagrams for modeling, simulation, and analysis of dynamic systems; supports direct execution of Simulink models in TSMaster; includes model manager and data repository
SOME / IP*	Supports Ethernet communication simulation, SOME / IP simulation, and parsing
DDS Simulation*	Supports Ethernet simulation and testing based on OMG-DDS standards
UDS Diagnostics*	Some basic diagnostic functions are available free of charge, including diagnostic parameter and service configuration, multi-frame transmission, and configuration of UDS-based Flash Bootloaders; Paid features include loading diagnostic database files such as ODX / PDX / CDD to generate test cases, automated diagnostics, and more
CCP / XCP Calibration*	Supports A2L files; online / offline calibration, flashing, calibration data management; characteristic curves, signal stimulation, automated calibration via system variables
Co-simulation*	RPC Remote Procedure Call controller, FMI / FMU, MATLAB automation, TSMaster Web Server, etc.
Encrypted Deployment*	Encrypt internal modules within engineering configurations, such as DBC files and script modules
Application Deployment*	Customize and publish form interfaces in TSMaster, with selectable display of execution modules and forms
Instrumentation Support*	Support controlling and integrating various instruments within TSMaster, such as oscilloscopes, programmable power supplies, and multimeters
Toolkit Development Environment*	Support custom interface development through Python

*Indicates features that require a license for activation

Hardware Product Quick Selection Table

XIL Cube Desktop Real-Time Simulation System

Type	Model	Function
Desktop Host	TOSUN XIL Cube	Real-time simulation test desktop host
TOSUN Dev and Testing Software	RTTSMaster Suite	High-precision real-time simulation module
Dedicated Multi-Bus Expansion Card	TA1038	12× CAN FD, 12× LIN, 4× DI / DO, 3× AI / AO
	TA1101	30× AI / AO, 30× DI / DO

TTS8000 Series

Communication and Control via EtherCAT / Industrial Ethernet

Type	Model	Function
Basic Hardware	TTS0002	12-slot board chassis with sliding rails
	TTS8012	Hardware system backplane module
	TTS8920	Power supply boards
Digital I / O Boards	TTS8011	12-channel DI / DO (supports PWM and standard I / O acquisition), supports FIU
	TTS8516	16-channel DI / DO (supports PWM / Bitstream / Voltage signals), supports FIU
	TTS8848	16-channel PWM transceivers, 48-channel DI, Bitstream transceiver control
	TTS8849	16-channel PWM transceivers, 48-channel DI, Bitstream transceiver control, supports FIU and-channel isolation
Analog I / O Boards	TTS8004	4-channel AO (supports PWM / Square / Sine / Arbitrary waves), DO output and resistance matrix control
	TTS8015	16-channel AI / AO (Voltage output and acquisition), supports FIU
	TTS8016	16-channel AO (with Voltage feedback), supports FIU
	TTS8018	Multi-channel single-ended / differential AI and voltage / current AO, supports FIU, short-circuit protection, and accuracy testing

Type	Model	Function
Analog I / O Boards	TTS8301	Current AO / AI, supports FIU
	TTS8808	8-channel AI, direct connection to ECU or load for V / I measurement
	TTS8812	12-channel AO simulation (16-bit precision), output range -10V to +28V, max current 200 mA
	TTS8816	12-channel AI, 4-channel AO (supports PWM / Arbitrary waves), supports V / I measurement
	TTS8817	12-channel AI, 4-channel AO (supports PWM / Arbitrary waves), supports V / I measurement, FIU and-channel isolation
Simulation / Fault Injection Boards	TTS8025	Shunt current simulation: output range ± 300 mV (50 μ V precision), supports open-circuit and positive / negative short-circuit simulation, -channels independently isolated
	TTS8027	Programmable insulation resistance board, simulates DC bus (HV+ / HV-) insulation resistance to vehicle body
	TTS8029	Capacitance simulation: range 2 nF – 2.6 μ F, step 0.1 nF
	TTS8031	6-channel programmable resistor, Ethernet-based communication, supports open-circuit, short-circuit (to power / ground / COM) FIU modes
	TTS8036	6-channel programmable resistor, EtherCAT-based communication, supports open-circuit, short-circuit (to power / ground / COM) FIU modes
	TTS8517	5-channel FIU, supports open-circuit and short-circuit (to power / ground / COM) modes
Relay / Switching Boards	TTS8051	High-voltage relay: HV-channel on / off control, max switching voltage per channel 1,500 V, overload current ≥ 6 A
	TTS8820	20-channel relay control

(continued)

Type	Model	Function
Power Supply / Load Boards	TTS8832	Matrix, PWM and Bitstream Switch Control; supports V / I measurement
	TTS8101	External Power Input and Internal Voltage Output; V / I detection and reporting; 3 integrated UART-channels
	TTS8104A	Electronic Load Simulation (CC / CR modes); voltage and PWM measurement
Bus Communication Boards	TTS1017pro -C	5-channel CAN; independent termination resistors (54 / 66 / 98 / 147 Ω); supports FIU, CoE protocol and Distributed Clock (DC)

TTS9000 Series

Communication and Control Based on CAN / CAN FD Bus

Type	Model	Function
Basic Hardware	TTS0001	12 Slot Board Chassis
Digital I / O Boards	TTS9011	12 DI / DO-channels; PWM output (0.03-200 kHz) and acquisition (0.03-250 kHz)
Analog I / O Boards	TTS9015	8 AI / AO-channels; Voltage ± 60 V (20-bit sampling / 0-60 V (16-bit output); Current 0-25 mA (20-bit sampling) / 0-25 mA (16-bit output)
Simulation / Fault Injection Boards	TTS9021	6 General-purpose-channels; support short / open-circuit injection
	TTS9036	5 Programmable resistors; 1 Ω -4,194,303 Ω , ± 0.5 Ω (1-500 Ω) / $\pm 0.1\%$ (500 Ω -4.19 M Ω)
Relay / Switch Boards	TTS9045	16 General-purpose relays; DC 36 V / 2.5 A or DC 40 V / 2 A max
Bus Communication Boards	TTS1016Pro	4 CAN FD, 2 LIN-channels bus analysis
	TTS1018*	12 CAN FD-channels bus analysis
	TTS1026P*	1 CAN FD, 6 LIN-channels bus analysis
	TTS1034*	2 CAN FD, 2 FlexRay-channels bus analysis; FlexRay supports cold start and auxiliary communication

* One CAN FD channel is reserved for sliding-rail system-level control

TIO Modules

Model	Function
TIO9011	12-channel DI / DO; supports PWM output (0.03 Hz – 200 kHz) and PWM acquisition (0.03 Hz – 250 kHz)
TIO9015	8-channel AI / AO; Voltage ± 60 V (20-bit sampling), 0–60 V (16-bit output); Current 0–25 mA (20-bit sampling), 0–25 mA (16-bit resolution)
TIO9036	6-channel Programmable Resistor; Range 1 Ω –4,194,303 Ω , Accuracy ± 0.5 Ω (1–500 Ω) / $\pm 0.1\%$ (500 Ω –4.19 M Ω)
TIO9045	18-channel Relay Switches; COM / NO / NC fully routed, overcurrent capability up to 1.8 A at 40 V

Single / Dual-channel Bus

Communication Interface Card

Model	LIN	CAN FD	PC Interface
TL1001	1		USB
TL1011	1 *Fast LIN		USB
TC1001		1 *CAN	USB
TC1011		1	USB
TC1012P	1	1	USB
TC1013		2	USB
TC1013HV *DC 4,500 V isolation		2	USB
TP1013		2	PCIe
MP1013		2	Mini PCIe

*Fast LIN: 1-channel fast LIN Bus to USB Interface

*CAN: 1-channel CAN Bus to USB Interface

SocketCAN Interface Card

Model	CAN FD	PC Interface
TC111	1	USB
TC113	2	USB
TC114	4	USB
TC3014	4	Mini PCIe

Multi-channel Bus Communication Interface Card

Model	LIN	CAN FD	Ethernet	FlexRay	PC Interface
TCI014		4			USB
TCI015	2	2			USB
TLI016P	2	4			USB
TCI017		8			USB
TCI018		12			USB
TCI026P	6	1			USB
TCI034		2		2	USB
TCI052		2	1 *10BASE-TIS		USB
TPI014		4			PCIe
TPI018		12			PCIe
TPI026P	6	1			PCIe
TPI034		2		2	PCIe

High-Performance Bus Analyzer

Model	LIN	CAN FD	Ethernet	I / O Interface	PC Interface
TCI013Pro		2		4 × DI / DO, 3 × AI / AO	USB
TCI014Pro		4		4 × DI / DO, 3 × AI / AO	USB
TCI017Pro		8		4 × DI / DO, 3 × AI / AO	USB
TCI018Pro		12		4 × DI / DO, 3 × AI / AO	USB
TCI038Pro	12	12		4 × DI / DO, 3 × AI / AO	Ethernet
TCI055Pro	2	4	4 × 100 / 1000BASE-T1	4 × DI / DO, 3 × AI / AO	USB 3.0
			2 × 100 / 1000BASE-T(x)		Gigabit / 10 Gigabit Ethernet
TCI055Pro+	2	4 *CAN XL	4 × 100 / 1000BASE-T1	4 × DI / DO, 3 × AI / AO	USB 3.0
			2 × 100 / 1000BASE-T(x)		Gigabit / 10 Gigabit Ethernet

*CAN XL: 4-channel CAN XL Bus to USB Interface

Model	CAN FD	FlexRay	I / O Interface	PC Interface
TCI034Pro	2	2	4 × DI / DO, 3 × AI / AO	USB

Automotive Data Acquisition / Logger

Model	LIN	CAN FD	Ethernet	I / O Interface	eMMC	PC Interface
Tlog1002	2	2		2 × DI / DO, 1 × AI	64 GB	Ethernet
Tlog1004	2	4		2 × DI / DO, 1 × AI	64 GB	Ethernet
Tlog1039	10	12	3 × 100 / 1000Base-T1 (switch)	4 × DI / DO, 3 × AI / AO	128 GB (Default) – 1 TB	Ethernet / 4G / BT / Wi-Fi

Model	Bus	I / O Interface	Storage	PC Interface
Tlog1057	8 × GMSL 8 × 1000BASE-T1 20 × CAN XL 1 × FlexRay 4 × FastLIN 8 × LIN	2 × DIDO / AIAO	Standard eMMC: 32 GB Optional: SATA / NVMe	Ethernet / 4G / BT / Wi-Fi

Automotive Ethernet Test Series

Model	Function
TE1021	1 port 100 / 1000BASE-T1 to 100 / 1000BASE-Tx Media Converter
TE1024	4 port 100 / 1000BASE-T1 and 100 / 1000BASE-Tx media converter with integrated native NIC technology
TE1105	5 port Ethernet Switch, supports 100 / 1000BASE-T1 and 100 / 1000BASE-T
TE1051	1 port Ethernet to USB Interface Tool

Bus Test Instruments / Specialized Tools

Model	Function
TX1000	High-Speed ECU Calibration and Debugging Device
TH7011	CAN / CAN FD Bus Disturbance Injector
TH7012	CAN / CAN FD / LIN Bus Disturbance Injector, supports ISO 16845 testing
TO1013	2 channel CAN FD to Fiber-Optic and USB Communication Tool
TC201	CAN Trigger Device
TL1021	UART-over-LIN Transparent Transmission Device
TC1021	UART-over-CAN Transparent Transmission Device
TC4016	SENT and PSI5 Sensor Signal Acquisition and Analysis Device
TS3004	8-channel Thermocouple Temperature Acquisition Device
TM2101	CAN / CAN FD-based GNSS and IMU Integrated Navigation Sensing Terminal
TSync01	High-Precision Time Synchronization Device
TF1011	Handheld Offline ECU Flashing Tool

Gateway Series

Model	LIN	CAN FD	I / O Interface	Industrial Interface	PC Interface
GW1040	8	8	4 × DI / DO	1 × EtherCAT, 1 × RS485	Ethernet
GW2112		2			USB
GW2202*		2	4 × DI / 2 × DO		Ethernet
GW2204*		4	4 × DI / 2 × DO		Ethernet
GW2208*		8	4 × DI / 2 × DO		Ethernet
GW2212*		12	4 × DI / 2 × DO		Ethernet
GW2208+	2	8	4 × DI / 2 × DO		Ethernet

*Supports full-channel independent electrical isolation

A comprehensive tool for automotive electronics simulation and testing

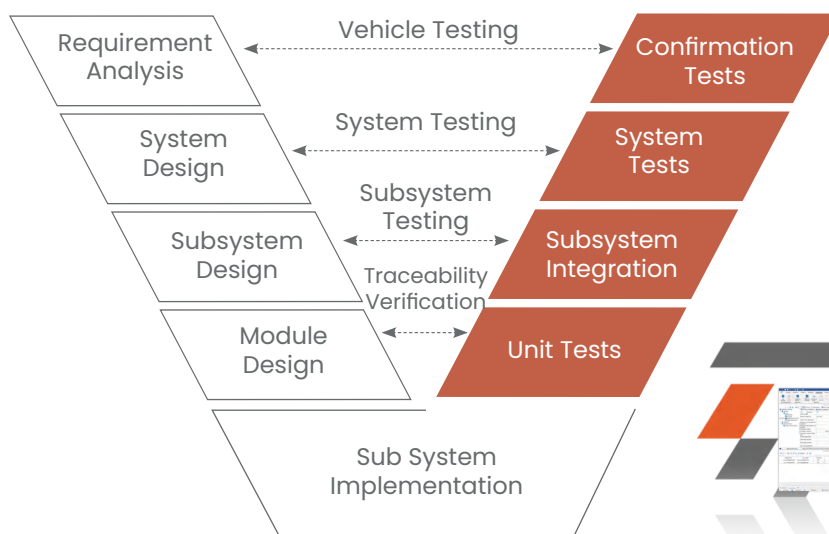
TSMaster is a powerful virtual instrument software platform that connects and controls all TOSUN hardware to enable automotive bus embedded code generation, monitoring, simulation, development, diagnosis, calibration, bootloader, I / O control, test and measurement, EOL, and other functions.

TSMaster supports ECU algorithm simulation testing (soft real-time HIL) for MATLAB Simulink joint simulation and CarSim dynamic models.

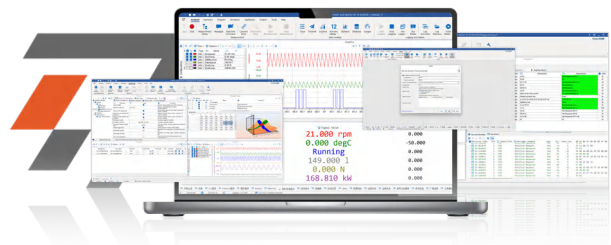
- Provides a range of convenient features and editors to execute ECU code directly in TSMaster, and supports C and Python script editing
- Support mini program function to customize simulation test panels, test processes, test logic and even the entire test system, and automatically generate reports
- Code is hardware-agnostic, easy to share, reference, and apply across different hardware platforms

TSMaster has a wide range of compatibility and can be perfectly integrated with test systems to achieve multi-hardware, multi-channel joint simulation and testing, which can meet the needs of PV / DV testing and verification of various automotive electronic components and assemblies, as well as off-line inspection.

- Compatible with Vector, Kvaser, PEAK, IXXAT, ICS and other bus tools
- Compatible with mainstream instruments (such as oscilloscopes, waveform generators, digital multimeters, etc.) and boards (such as AI, DI, DO, etc.)



Try TSMaster for
30 days!

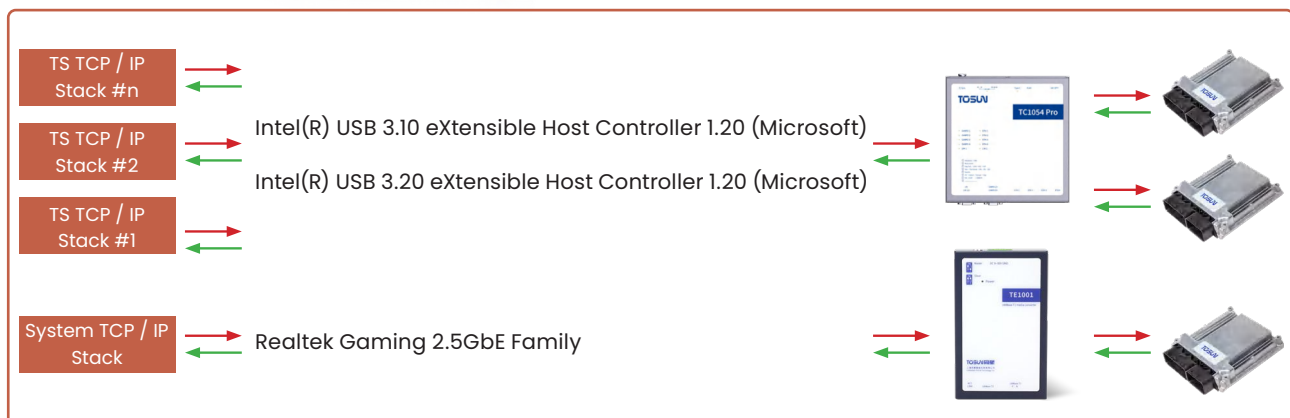
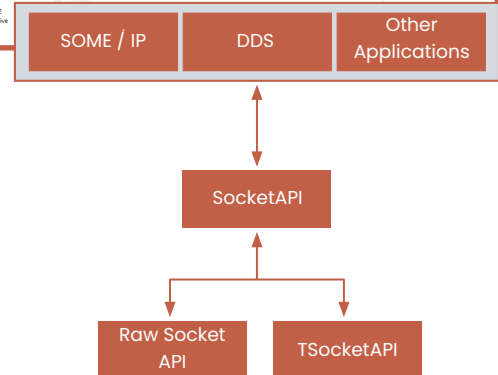
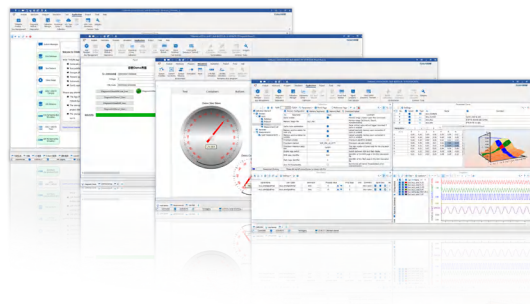
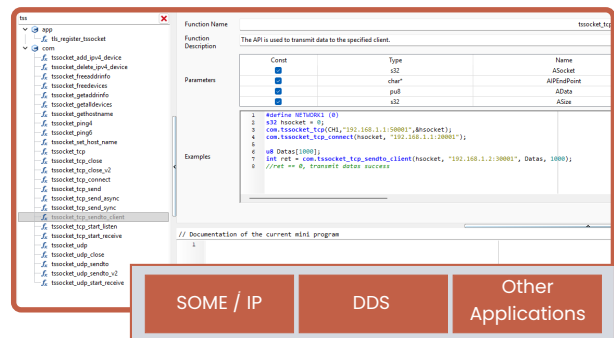
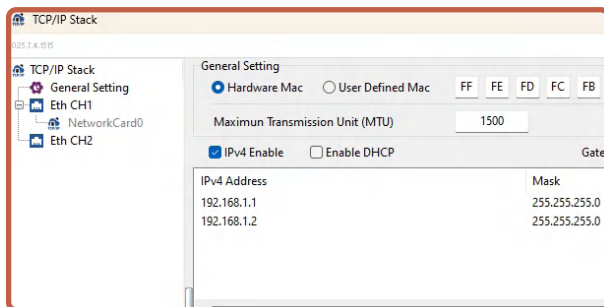


Ethernet

TSSocket and TSSocket API

The TSSocket protocol stack is developed by TOSUN and is independent of the TCP/IP stack provided by the operating system.

- Each individual hardware interface can be configured with a separate TCP / IP protocol stack
- It does not automatically send Ethernet frames related to the Windows / Linux operating systems
- Supports flexible MAC and IP configuration, including multiple virtual MACs per device and multiple IPs / VLANs per interface
- With TSSocket, any MAC device can be freely simulated. Each MAC device can have different IP addresses, and each IP address can have multiple ports



- Raw socket interface: Complies with the socket interface definitions provided by Linux. Suitable for developers familiar with network programming and can be integrated into existing application-layer code
- TSSocket interface: Designed for simple TCP / UDP transmission and reception. The API handles blocking and thread termination internally, so developers do not need to manage threads manually. It is ideal for developers new to socket programming

```
void on_startNewOn_Start1(void) { try { // 程序启动事件
1  #define NETWORK1 (0)
2  int hsocket = 0;
3  if(0 == com.tssocket_tcp(
4  NETWORK1,
5  "192.168.1.1:20001",
6  &serverSocket
7  )){
8  app.log_text("Create tcp socket1 success", lv10K);
9  log("serverSocket: %d", serverSocket);
10 if(0 == com.tssocket_tcp(
11 NETWORK1,
12 "192.168.1.2:30001",
13 &clientSocket
14 )){
15 app.log_text("Create tcp socket2 success", lv10K);
16 log("clientSocket: %d", clientSocket);
17 if(0 == com.tssocket_tcp_start_listen(serverSocket)){
18 app.log_text("serverSocket start listen success", lv10K);
19 if(0== com.tssocket_tcp_connect(clientSocket, "192.168.1.1:20001")){
20 app.log_text("connect to server success", lv10K);
21 com.tssocket_tcp_start_receive(serverSocket);
22 com.tssocket_tcp_start_receive(clientSocket);
23 }
}
```

TSMaster supports the parsing of basic Ethernet protocols. For SOME / IP and similar application-layer protocols, a database must be imported before parsing can be triggered. Once the database is loaded, playback can directly display the parsed results of protocols and signals.

[illegible]

TSMaster supports filtering of frame information based on Ethernet fields.

In the example shown, the filter string “someip && !someipsd” means filtering messages based on the SOME / IP protocol while excluding SOME / IP-SD protocol messages.

The screenshot shows the 'Settings - Filter Settings' window in WinBox. The 'Filter Settings' tab is selected, and the 'Date Time' filter is highlighted in red. The 'Filter Settings' tab is also highlighted in red.

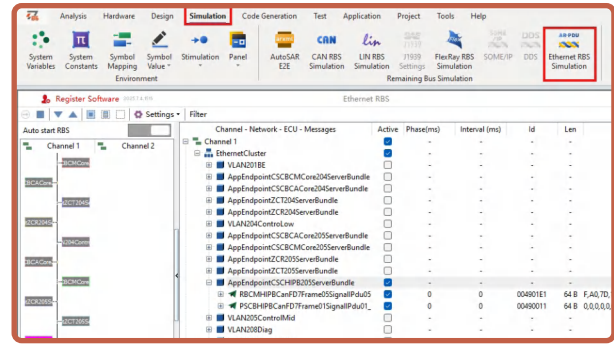
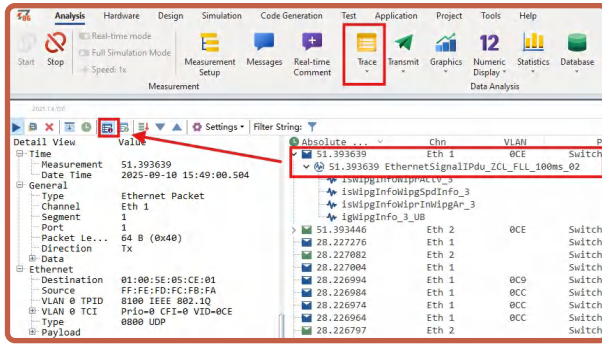
Filter Name	Chain	Port	Source IP	Destination IP	Protocol	Port	Time	Filter Action	Type
W1.00000000	ETH 1	Switch 11 Port 100	Tx	192.168.0.1	192.168.0.1	UDP	192.168.0.1	Count	Ethernet II [Ethernet]
W2.00000000	ETH 1	Switch 3 Port 0	Tx	192.168.0.1	192.168.0.1	UDP	192.168.0.1	Count	Ethernet II [Ethernet]
W3.00000000	ETH 1	Switch 3 Port 0	Tx	192.168.0.1	192.168.0.1	UDP	192.168.0.1	Count	Ethernet II [Ethernet]
W4.00000000	ETH 1	Switch 3 Port 0	Tx	192.168.0.1	192.168.0.1	UDP	192.168.0.1	Count	Ethernet II [Ethernet]
W5.00000000	ETH 2	Switch 0 Port 0	Rx	192.168.0.1	192.168.0.1	UDP	192.168.0.1	Count	Ethernet II [Ethernet]
W6.00000000	ETH 2	Switch 0 Port 0	Rx	192.168.0.1	192.168.0.1	UDP	192.168.0.1	Count	Ethernet II [Ethernet]

The 'Date Time' filter is highlighted in red. The 'Filter Settings' tab is also highlighted in red.

Ethernet Simulation

The Ethernet communication simulation module simulates ECU frame transmission and reception to verify software correctness and stability under different types of frames. It also supports network impairment simulation, such as latency, packet loss, and erroneous frame injection, for robustness testing.

Once the Ethernet communication simulation is started, parsed AUTOSAR PDUs can be viewed under [Analysis] → [Ethernet Frame Information].

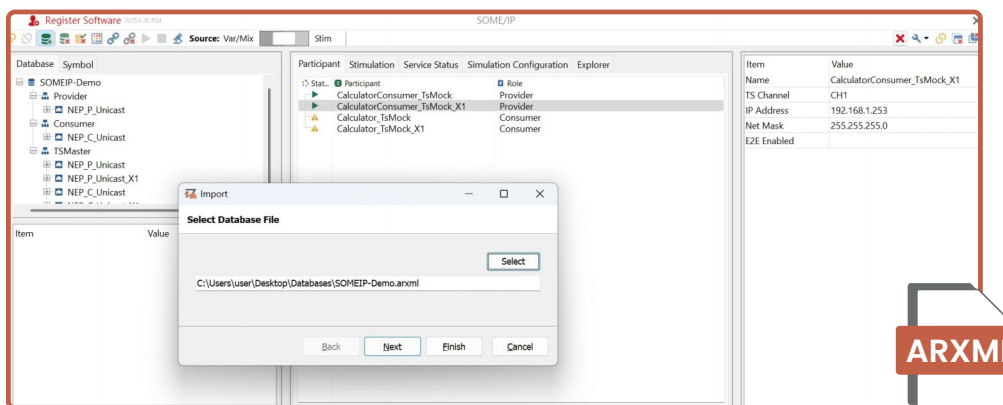


SOME / IP Basic Features:

- Supports importing AUTOSAR ARXML files
- Enables serialization / deserialization based on ARXML information
- Supports automatic generation of simulation participants and multi-participant simulation
- Supports automatic generation of data types and symbolic variables from the database
- Supports scripting / programming interfaces
- Supports manual modification of IP and port information in ARXML

Key Features:

- The simulation mode supports simultaneous generation of counterpart participants for rapid simulation
- Supports modification of basic information (such as IP / MAC) for simulation, avoiding the inconvenience of editing the ARXML file
- Seamlessly integrates with panel and image modules, allowing quick access to serialization results via user variables



The serialized results of Ethernet-SOME / IP generated by TSMaster can be directly applied in the Trace interface, supporting the import of recording files such as BLF, PCAP, and PCAPNG for online playback and offline simulation.

Port	VLAN	Sim	Dir	Source MAC	Destination MAC	Source IP	Destination IP	Source Port	Destination Port	Type	Packet Len
S...		Rx		SA:45:45:00:0...	SA:45:45:00:0...	10.205.0.2	10.205.0.3	C739	CABC	ETHER...	73
S...		Rx		SA:45:45:00:0...	SA:45:45:00:0...	10.205.0.2	10.205.0.4	C739	CABC	UDP...	95
S...		Rx		SA:45:45:00:0...	SA:45:45:00:0...	10.205.0.2	10.205.0.2	E300	E301	UDP[A...	68

Detail View

- Ethernet II: From FF:FE:FD:FC:FB:FA to FF:FE:FD:FC:FB:FA
 - Destination MAC: FF:FE:FD:FC:FB:FA (multicast)
 - Source MAC: FF:FE:FD:FC:FB:FA (multicast)
 - Ethernet type next: 0x8100
- Virtual LAN tag, id = 3, priority = 0
- Internet Protocol Version 4: From 192.168.1.13 to 192.168.1.13
 - Protocol version: 1
 - User Datagram Protocol: From 40000 to 40000
- Service-oriented Middleware: out: IP: Service
 - Service ID: 0x00AA
 - Method ID: 0x9F41
 - Length: 26
 - Client ID: 0x0000
 - Session ID: 0x0007
 - Interface version: 0
 - Message type: 2 (NOTIFICATION)
 - Return code: 0 (No error)

SOME / IP: File Import and Information Generation Functionality

- Supports ARXML files from AUTOSAR CP / AP
- Generates type data from ARXML for user programming in C mini-program applications
- Generates serialization metadata from ARXML to enable data serialization and deserialization
- Automatically generates simulation code for participants in the file, which can be executed directly
- Automatically generates simulation code for the counterpart of the participant, facilitating quick environment setup and testing

SOME / IP: Simulation Functionality

- The simulation mode supports simultaneous generation of counterpart participants, enabling rapid simulation and testing
- Supports modification of basic information (IP / MAC address) for simulation purposes, avoiding the inconvenience of modifying the ARXML file
- Simulation code (C / C++) for participants and their counterparts defined in the ARXML can be executed directly, enabling users to implement custom business logic based on the generated code

Database

- SOMEIP_Demo
 - Provider
 - network_endpoint
 - Consumer
 - network_endpoint
 - TSMaster

Calculator

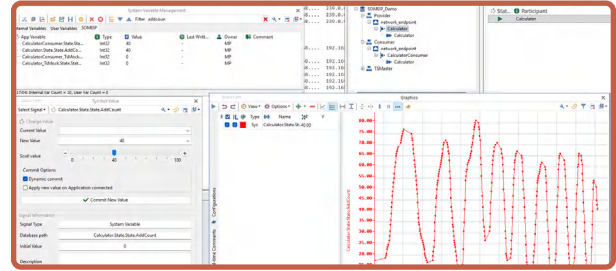
Variable	Type	Value
CalculatorConsumerData...	IP	0.0.0.0
CalculatorConsumerData...	IP	0.0.0.0
CalculatorConsumerData...	IP	0.0.0.0
CalculatorConsumerData...	IP	0.0.0.0
CalculatorConsumerData...	IP	0.0.0.0



SOME / IP DEMO

Integration with Other Modules

- Enables modification of service-type data via signal value modules and similar components
- Provides panel-based management of service variables to facilitate efficient data interaction and user input
- Supports integration with graphical applications and related tools to implement comprehensive testing functionalities



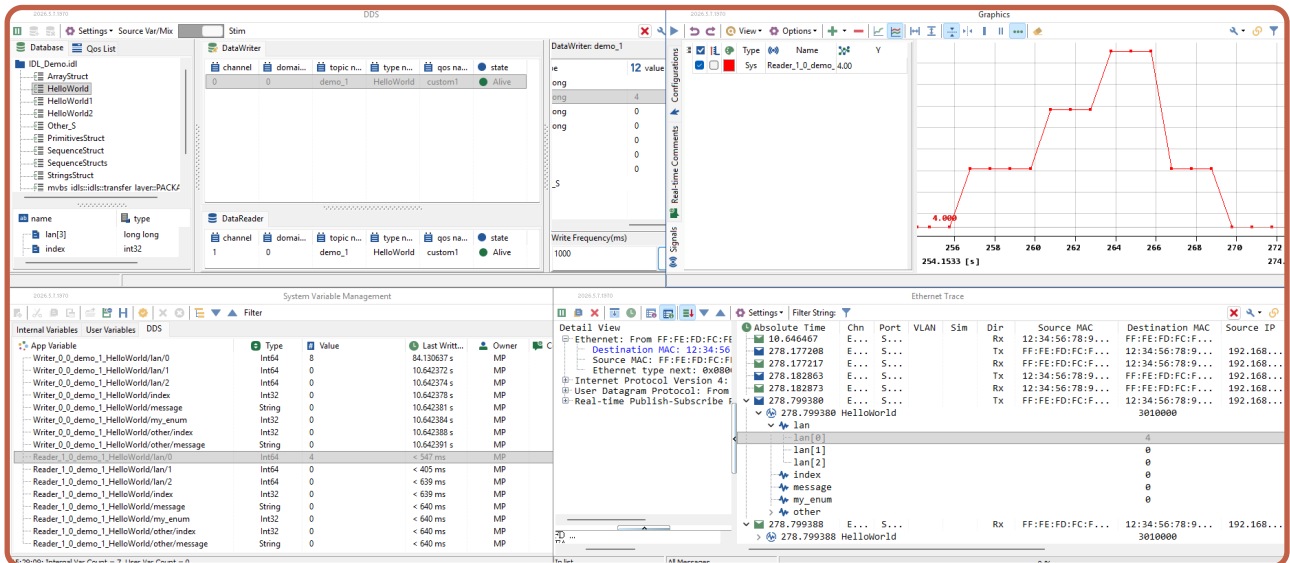
DDS Simulation

Basic Functions

- Supports importing IDL files
- Enables serialization and deserialization based on IDL structure definitions
- Supports creation of publishers and subscribers, with multi-participant simulation capabilities
- Automatically generates dynamic data types and database signal variables
- Provides scripting interfaces for lightweight application development
- Allows manual configuration of QoS parameters and port gain settings

Key Features

- Simulation mode supports simultaneous generation of publishers and subscribers for rapid prototyping
- Enables quick modification of data variables and basic configurations (e.g., QoS, ports) for simulation
- Seamlessly integrates with panels and visualization modules, allowing fast access to serialized data via user-defined variables



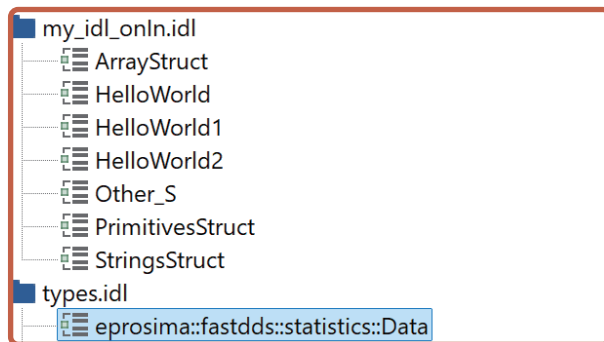
The serialization results generated by TSMaster Ethernet DDS can be directly applied in the Trace interface, and support importing recording files such as BLF, PCAP, and PCAPNG for online playback and offline simulation.

绝对时间	通道	端口	VLAN	源MAC地址	目的MAC地址	源IP	目的IP	源端口	目的端口	报文类型
694.926369	Eth 2	Sw...		FF:FE:FD:FC:FB:FA	12:34:56:78:9A:BC	192.168.10.55	192.168.10.66	55548	7411	UDP[DDS RTPS]
695.422513	Eth 1	Sw...		FF:FE:FD:FC:FB:FA	12:34:56:78:9A:BC	192.168.10.55	192.168.10.66	55548	7411	UDP[DDS RTPS]
695.427013	Eth 2	Sw...		FF:FE:FD:FC:FB:FA	12:34:56:78:9A:BC	192.168.10.55	192.168.10.66	55548	7411	UDP[DDS RTPS]
695.927774	Eth 2	Sw...		FF:FE:FD:FC:FB:FA	12:34:56:78:9A:BC	192.168.10.55	192.168.10.66	55548	7411	UDP[DDS RTPS]
695.923273	Eth 1	Sw...		FF:FE:FD:FC:FB:FA	12:34:56:78:9A:BC	192.168.10.55	192.168.10.66	55548	7411	UDP[DDS RTPS]
696.423910	Eth 1	Sw...		FF:FE:FD:FC:FB:FA	12:34:56:78:9A:BC	192.168.10.55	192.168.10.66	55548	7411	UDP[DDS RTPS]
696.423910 HelloWorld					3010000					
lan										
lan[0]					12					
lan[1]					34					
lan[2]					56					

DDS-

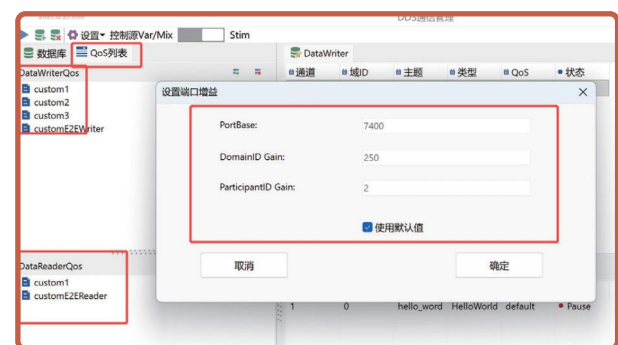
File Import and Data Generation

- Supports importing IDL files
- Generates dynamic type data based on IDL, along with the serialization information needed to implement data serialization / deserialization



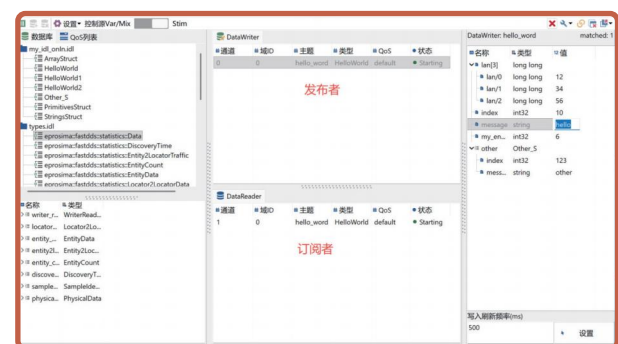
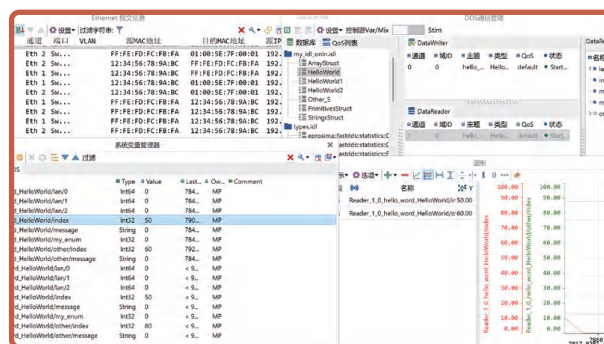
DDS Simulation Functions

- Supports creating publishers and subscribers, enabling multi-participant simulation and rapid simulation
- Supports fast modification of data variables and basic information (such as QoS / ports, etc.)



DDS Integration with Other Modules

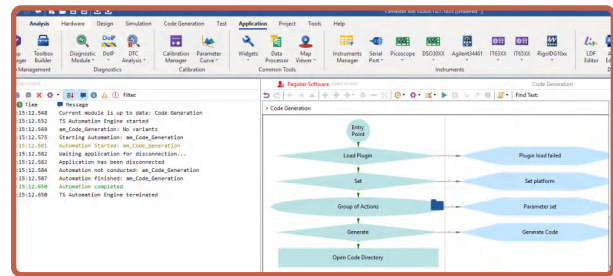
- Uses user variables to modify publisher variable data
- Manages data variables through Panel components for streamlined interaction and input
- Works with graphical programs and other functions to achieve testing capabilities



Code Generation

TSMaster can generate embedded code, including CAN / LIN drivers, UDS diagnostic stacks, Bootloader components, and CCP / XCP calibration stacks.

In the graphical module, users can configure chip type, protocol selection, and diagnostic / calibration settings, then click Run to generate the code automatically.



Simulation

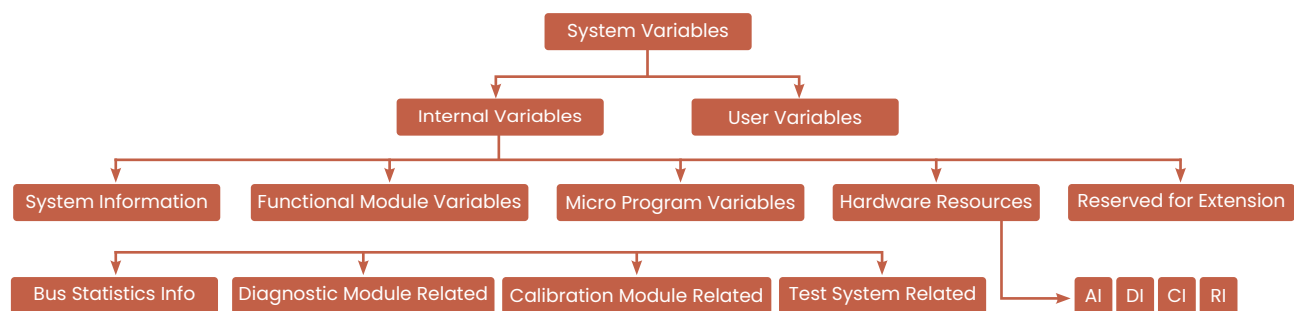
System Variables

To facilitate data interaction both within and outside the software, TSMaster provides a system variable mechanism. Based on how they are generated, system variables fall into two categories: Internal Variables and User Variables.

The key differences are as follows:

- Internal Variables are automatically created and released by the system. Users cannot add or delete them manually.
- User Variables are created and managed by users themselves

The architecture of the system variable mechanism is illustrated below:



Internal Variables	User Variables					
User Variable	Type	#	Value	Last Writt...	Owner	Comment
Var0	Int32	50		-	User	
Var1	Int32	0		-	User	
Var2	Int32	0		-	User	
Var3	Int32	0		-	User	

In addition to common data types such as int and string, this mechanism also digitizes internal hardware and software module resources. For example, in the case of digital input (DI) interfaces, if the connected hardware device includes two physical DI ports, the software will automatically generate two corresponding DI system variables internally, as shown in the following figure:

Internal Variable	Type	Value
Digital.DI01	Int32	0
Digital.DI00	Int32	0

User read / write operations on the “Digital.Dix” system variables are internally translated into read and write operations on the hardware digital input interfaces.

Taking the built-in system variables of the diagnostic module as an example, as shown in the figure below:

Internal Variable	Type	Value	Last Val...	Owner	Comment
Diagnostic.ExportProject	String			n.a.	Diagnostic Export project file
Diagnostic.ImportProject	String			n.a.	Diagnostic Import project file
Diagnostic.TesterSoftware	Int32	0		n.a.	Diagnostic Whether start tester present command
Diagnostic.SI	Int32	0		n.a.	Diagnostic Max H/L of every PD frame, this parameter is valid only in PD mode
Diagnostic.SIHL	Int32	0		n.a.	Diagnostic SIHL0 value defined manually
Diagnostic.SIHL1	Int32	0		n.a.	Diagnostic SIHL1 value defined manually
Diagnostic.SIHL2	Int32	0		n.a.	Diagnostic SIHL2 value defined manually
Diagnostic.SIHL3	Int32	0		n.a.	Diagnostic SIHL3 value defined manually
Diagnostic.SIHL4	Int32	0		n.a.	Diagnostic SIHL4 value defined manually
Diagnostic.SIHL5	Int32	0		n.a.	Diagnostic SIHL5 value defined manually
Diagnostic.SIHL6	Int32	0		n.a.	Diagnostic SIHL6 value defined manually
Diagnostic.SIHL7	Int32	0		n.a.	Diagnostic SIHL7 value defined manually
Diagnostic.SIHL8	Int32	0		n.a.	Diagnostic SIHL8 value defined manually
Diagnostic.SIHL9	Int32	0		n.a.	Diagnostic SIHL9 value defined manually
Diagnostic.SIHL10	Int32	0		n.a.	Diagnostic SIHL10 value defined manually
Diagnostic.SIHL11	Int32	0		n.a.	Diagnostic SIHL11 value defined manually
Diagnostic.SIHL12	Int32	0		n.a.	Diagnostic SIHL12 value defined manually
Diagnostic.SIHL13	Int32	0		n.a.	Diagnostic SIHL13 value defined manually
Diagnostic.SIHL14	Int32	0		n.a.	Diagnostic SIHL14 value defined manually
Diagnostic.SIHL15	Int32	0		n.a.	Diagnostic SIHL15 value defined manually
Diagnostic.SIHL16	Int32	0		n.a.	Diagnostic SIHL16 value defined manually
Diagnostic.SIHL17	Int32	0		n.a.	Diagnostic SIHL17 value defined manually
Diagnostic.SIHL18	Int32	0		n.a.	Diagnostic SIHL18 value defined manually
Diagnostic.SIHL19	Int32	0		n.a.	Diagnostic SIHL19 value defined manually
Diagnostic.SIHL20	Int32	0		n.a.	Diagnostic SIHL20 value defined manually
Diagnostic.SIHL21	Int32	0		n.a.	Diagnostic SIHL21 value defined manually
Diagnostic.SIHL22	Int32	0		n.a.	Diagnostic SIHL22 value defined manually
Diagnostic.SIHL23	Int32	0		n.a.	Diagnostic SIHL23 value defined manually
Diagnostic.SIHL24	Int32	0		n.a.	Diagnostic SIHL24 value defined manually
Diagnostic.SIHL25	Int32	0		n.a.	Diagnostic SIHL25 value defined manually
Diagnostic.SIHL26	Int32	0		n.a.	Diagnostic SIHL26 value defined manually
Diagnostic.SIHL27	Int32	0		n.a.	Diagnostic SIHL27 value defined manually
Diagnostic.SIHL28	Int32	0		n.a.	Diagnostic SIHL28 value defined manually
Diagnostic.SIHL29	Int32	0		n.a.	Diagnostic SIHL29 value defined manually
Diagnostic.SIHL30	Int32	0		n.a.	Diagnostic SIHL30 value defined manually
Diagnostic.SIHL31	Int32	0		n.a.	Diagnostic SIHL31 value defined manually
Diagnostic.SIHL32	Int32	0		n.a.	Diagnostic SIHL32 value defined manually
Diagnostic.SIHL33	Int32	0		n.a.	Diagnostic SIHL33 value defined manually
Diagnostic.SIHL34	Int32	0		n.a.	Diagnostic SIHL34 value defined manually
Diagnostic.SIHL35	Int32	0		n.a.	Diagnostic SIHL35 value defined manually
Diagnostic.SIHL36	Int32	0		n.a.	Diagnostic SIHL36 value defined manually
Diagnostic.SIHL37	Int32	0		n.a.	Diagnostic SIHL37 value defined manually
Diagnostic.SIHL38	Int32	0		n.a.	Diagnostic SIHL38 value defined manually
Diagnostic.SIHL39	Int32	0		n.a.	Diagnostic SIHL39 value defined manually
Diagnostic.SIHL40	Int32	0		n.a.	Diagnostic SIHL40 value defined manually
Diagnostic.SIHL41	Int32	0		n.a.	Diagnostic SIHL41 value defined manually
Diagnostic.SIHL42	Int32	0		n.a.	Diagnostic SIHL42 value defined manually
Diagnostic.SIHL43	Int32	0		n.a.	Diagnostic SIHL43 value defined manually
Diagnostic.SIHL44	Int32	0		n.a.	Diagnostic SIHL44 value defined manually
Diagnostic.SIHL45	Int32	0		n.a.	Diagnostic SIHL45 value defined manually
Diagnostic.SIHL46	Int32	0		n.a.	Diagnostic SIHL46 value defined manually
Diagnostic.SIHL47	Int32	0		n.a.	Diagnostic SIHL47 value defined manually
Diagnostic.SIHL48	Int32	0		n.a.	Diagnostic SIHL48 value defined manually
Diagnostic.SIHL49	Int32	0		n.a.	Diagnostic SIHL49 value defined manually
Diagnostic.SIHL50	Int32	0		n.a.	Diagnostic SIHL50 value defined manually
Diagnostic.SIHL51	Int32	0		n.a.	Diagnostic SIHL51 value defined manually
Diagnostic.SIHL52	Int32	0		n.a.	Diagnostic SIHL52 value defined manually
Diagnostic.SIHL53	Int32	0		n.a.	Diagnostic SIHL53 value defined manually
Diagnostic.SIHL54	Int32	0		n.a.	Diagnostic SIHL54 value defined manually
Diagnostic.SIHL55	Int32	0		n.a.	Diagnostic SIHL55 value defined manually
Diagnostic.SIHL56	Int32	0		n.a.	Diagnostic SIHL56 value defined manually
Diagnostic.SIHL57	Int32	0		n.a.	Diagnostic SIHL57 value defined manually
Diagnostic.SIHL58	Int32	0		n.a.	Diagnostic SIHL58 value defined manually
Diagnostic.SIHL59	Int32	0		n.a.	Diagnostic SIHL59 value defined manually
Diagnostic.SIHL60	Int32	0		n.a.	Diagnostic SIHL60 value defined manually
Diagnostic.SIHL61	Int32	0		n.a.	Diagnostic SIHL61 value defined manually
Diagnostic.SIHL62	Int32	0		n.a.	Diagnostic SIHL62 value defined manually
Diagnostic.SIHL63	Int32	0		n.a.	Diagnostic SIHL63 value defined manually
Diagnostic.SIHL64	Int32	0		n.a.	Diagnostic SIHL64 value defined manually
Diagnostic.SIHL65	Int32	0		n.a.	Diagnostic SIHL65 value defined manually
Diagnostic.SIHL66	Int32	0		n.a.	Diagnostic SIHL66 value defined manually
Diagnostic.SIHL67	Int32	0		n.a.	Diagnostic SIHL67 value defined manually
Diagnostic.SIHL68	Int32	0		n.a.	Diagnostic SIHL68 value defined manually
Diagnostic.SIHL69	Int32	0		n.a.	Diagnostic SIHL69 value defined manually
Diagnostic.SIHL70	Int32	0		n.a.	Diagnostic SIHL70 value defined manually
Diagnostic.SIHL71	Int32	0		n.a.	Diagnostic SIHL71 value defined manually
Diagnostic.SIHL72	Int32	0		n.a.	Diagnostic SIHL72 value defined manually
Diagnostic.SIHL73	Int32	0		n.a.	Diagnostic SIHL73 value defined manually
Diagnostic.SIHL74	Int32	0		n.a.	Diagnostic SIHL74 value defined manually
Diagnostic.SIHL75	Int32	0		n.a.	Diagnostic SIHL75 value defined manually
Diagnostic.SIHL76	Int32	0		n.a.	Diagnostic SIHL76 value defined manually
Diagnostic.SIHL77	Int32	0		n.a.	Diagnostic SIHL77 value defined manually
Diagnostic.SIHL78	Int32	0		n.a.	Diagnostic SIHL78 value defined manually
Diagnostic.SIHL79	Int32	0		n.a.	Diagnostic SIHL79 value defined manually
Diagnostic.SIHL80	Int32	0		n.a.	Diagnostic SIHL80 value defined manually
Diagnostic.SIHL81	Int32	0		n.a.	Diagnostic SIHL81 value defined manually
Diagnostic.SIHL82	Int32	0		n.a.	Diagnostic SIHL82 value defined manually
Diagnostic.SIHL83	Int32	0		n.a.	Diagnostic SIHL83 value defined manually
Diagnostic.SIHL84	Int32	0		n.a.	Diagnostic SIHL84 value defined manually
Diagnostic.SIHL85	Int32	0		n.a.	Diagnostic SIHL85 value defined manually
Diagnostic.SIHL86	Int32	0		n.a.	Diagnostic SIHL86 value defined manually
Diagnostic.SIHL87	Int32	0		n.a.	Diagnostic SIHL87 value defined manually
Diagnostic.SIHL88	Int32	0		n.a.	Diagnostic SIHL88 value defined manually
Diagnostic.SIHL89	Int32	0		n.a.	Diagnostic SIHL89 value defined manually
Diagnostic.SIHL90	Int32	0		n.a.	Diagnostic SIHL90 value defined manually
Diagnostic.SIHL91	Int32	0		n.a.	Diagnostic SIHL91 value defined manually
Diagnostic.SIHL92	Int32	0		n.a.	Diagnostic SIHL92 value defined manually
Diagnostic.SIHL93	Int32	0		n.a.	Diagnostic SIHL93 value defined manually
Diagnostic.SIHL94	Int32	0		n.a.	Diagnostic SIHL94 value defined manually
Diagnostic.SIHL95	Int32	0		n.a.	Diagnostic SIHL95 value defined manually
Diagnostic.SIHL96	Int32	0		n.a.	Diagnostic SIHL96 value defined manually
Diagnostic.SIHL97	Int32	0		n.a.	Diagnostic SIHL97 value defined manually
Diagnostic.SIHL98	Int32	0		n.a.	Diagnostic SIHL98 value defined manually
Diagnostic.SIHL99	Int32	0		n.a.	Diagnostic SIHL99 value defined manually
Diagnostic.SIHL100	Int32	0		n.a.	Diagnostic SIHL100 value defined manually

Developers can perform the following operations on the diagnostic module:

- Read and configure parameters at the transport and service layers
- Start or stop the diagnostic process
- Import / export diagnostic module projects

System constants

TSMaster includes a built-in System Constants Manager that maintains all constant parameters defined within the software.

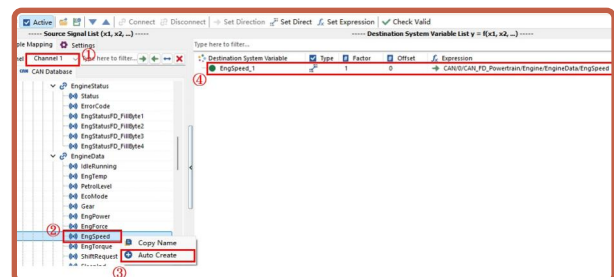
Examples include: hardware-channel identifiers, API return error codes, device type definitions, BLF function return values, signal tester return values, system variable types, and more, as illustrated in the following figure:

Code	Name	Description
1	CONST_LOG_ERROR	error message will be displayed with red color
2	CONST_LOG_WARNING	warning message will be displayed with blue color
3	CONST_LOG_OK	OK message will be displayed with green color
4	CONST_LOG_HINT	hint message will be displayed with yellow color
5	CONST_LOG_INFO	info. message will be displayed with black color
6	CONST_LOG_VERBOSE	verbose message will be displayed with gray color
0	CONST_CH1	Channel 1 index

Signal Mapping

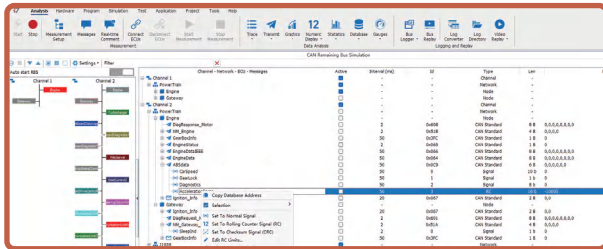
The Signal Mapping module decouples upper-layer application logic from lower-layer database variables. Directly manipulating database variables creates tight coupling between the application layer and the database, so any change in database structure forces updates across all dependent components such as panels and test scripts. This is highly undesirable in large-scale engineering projects.

By using the Signal Mapping module, the upper layer no longer interacts directly with database variables. Instead, it accesses mapped system variables. When changes occur in the underlying database, developers only need to re-map the updated database variables to the existing system variables—without modifying the upper-layer application logic.



Remaining Bus Simulation

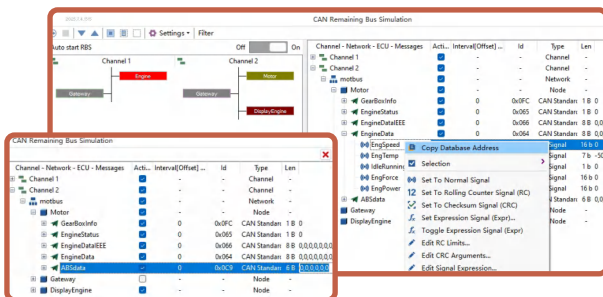
TSMaster's Remaining Bus Simulation (RBS) supports CAN / CAN FD / LIN / FlexRay / J1939, and enables simulation of all or selected ECU nodes in a vehicle network. Combined with signal generators, C scripts, and graphical programming modules, it allows flexible simulation of in-vehicle communication behavior.



Developers can implement checksum algorithms via C / Python scripts or configure CRC and Rolling Counter signals directly through the GUI. In addition, E2E signals can be automatically extracted from DBC / ARXML / FIBEX files to generate scheduling logic, greatly reducing simulation development effort.

CAN Bus Simulation

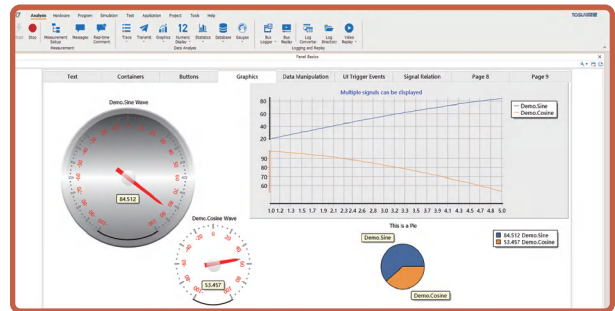
- The CAN RBS module can simulate multiple virtual ECU nodes, including their associated-channels, networks, nodes, messages, and signal attributes
- The CAN RBS module supports CRC, Rolling Counter, and E2E (End-to-End) validation mechanisms
- Built-in E2E algorithms can automatically extract E2E information directly from DBC, ARXML, or FIBEX files, significantly reducing development time and complexity



Graphical Panel

TSMaster's Panel function allows users to design independent software interfaces. It acts as an IDE (Integrated Development Environment), enabling users to build customized user interfaces that function as standalone applications.

Although these applications rely on the TSMaster core engine, they can operate independently and are virtually indistinguishable from traditional applications developed through standard IDEs.



Within the panel, users can bind bus signals for graphical display. When combined with residual bus simulation (RBS), it also enables control over signal and message transmission. Together with system variables, more advanced automation features can be implemented.

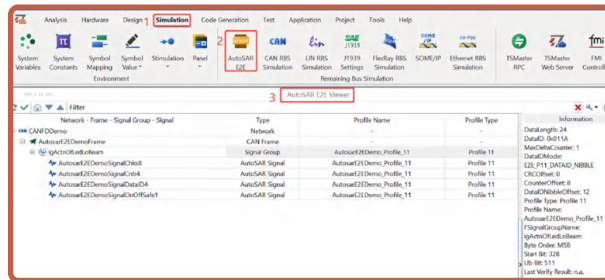
- A rich set of UI components, including various gauges, buttons, indicators, progress bars, and input / output fields
- Support for associating C scripts with the panel to implement testing logic
- Integration with system variables to link diagnostics and calibration, enabling fast customization of diagnostic / calibration panels

AUTOSAR E2E

The AUTOSAR E2E simulation module in TSMaster enables the transmission of AUTOSAR E2E messages, as well as the detection and validation of received E2E information. The user interface clearly displays whether the transmitted and received E2E data are correct.

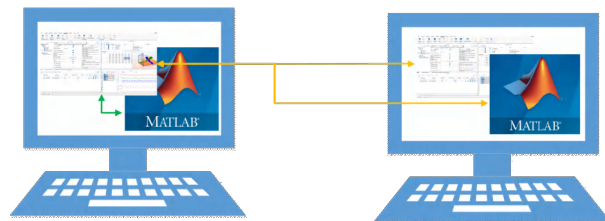
Key features include:

- E2E message transmission
- E2E message checking
- E2E fault injection



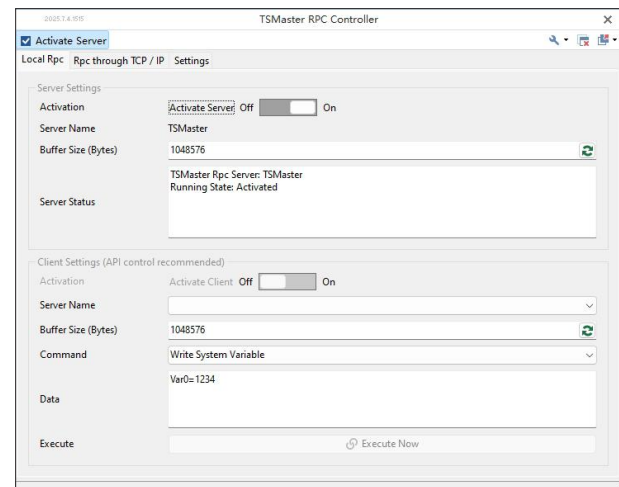
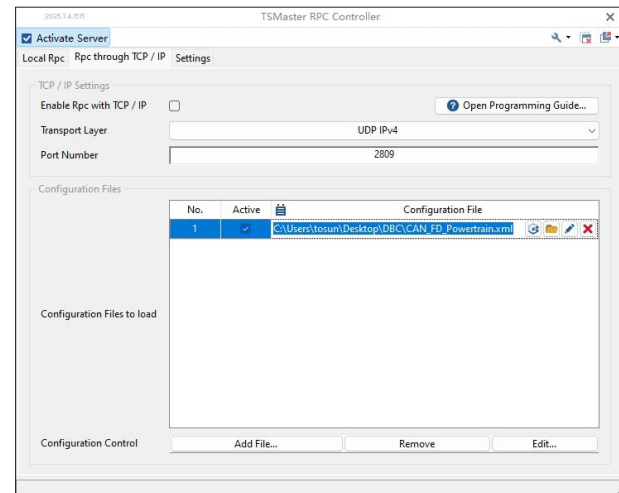
Co-Simulation — TSRPC

TSMaster RPC is a protocol designed for simple, fast, and real-time data exchange between TSMaster and other systems through Ethernet connections. The protocol allows external systems, typically HIL simulation software such as Simulink and CarMaker, to read and write TSMaster system variables and bus messages.



Supports UDP over IPv4. After importing an XML file containing data information, corresponding UDP packets can be sent according to protocol rules to achieve direct data exchange between TSMaster and other systems.

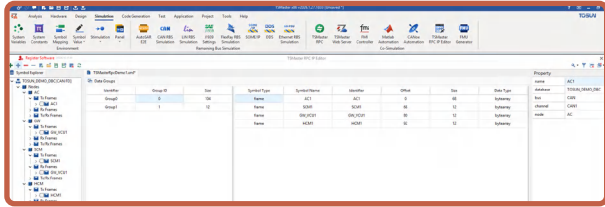
This protocol supports not only one-to-one communication between clients and servers, but also complex communication topologies such as one-to-many, many-to-one, and many-to-many.



In HIL testing systems, higher real-time performance is required for data exchange. Therefore, we have defined a method for fast data communication, allowing users to directly add configuration XML files within the interface. It should be noted that UDP communication between different computers is carried out through their network interfaces.

Co-Simulation – RPC IP Editor

The TSMaster RPC IP Editor is a tool used to configure RPC IP-based data exchange, and also supports importing FDX XML description files.

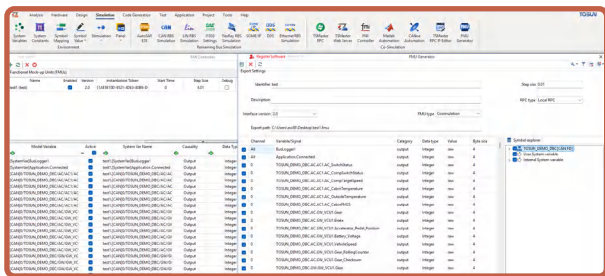


Co-Simulation – FMI / FMU

FMI is a widely used standard interface in co-simulation. It is software-independent, and the models used can originate from different tools or software. Models packaged according to the FMI standard are called Functional Mock-up Units (FMUs).

With the capability of TSRPC, FMU packages can be exported for co-simulation. TSMaster's FMI controller supports loading FMUs of version 2.0 and 3.0, enabling co-simulation between MATLAB and TSMaster.

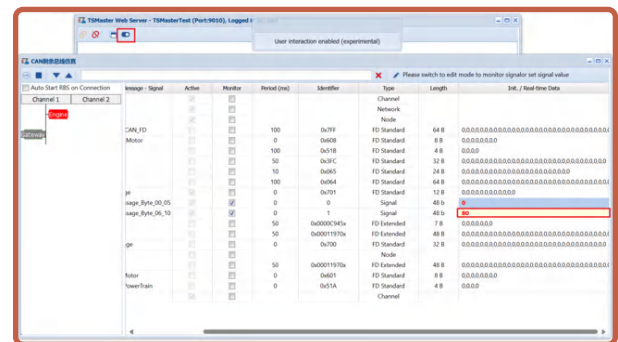
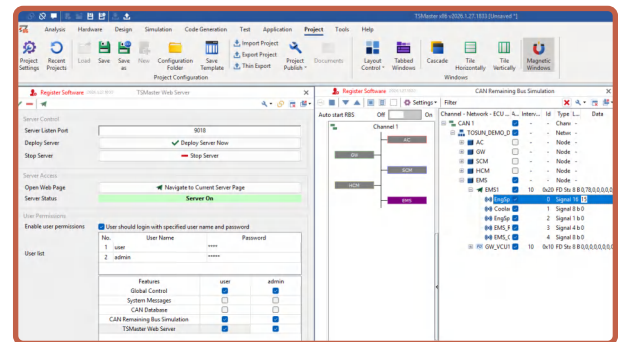
TSMaster can import FMUs generated by other software, and it also supports exporting FMU files, facilitating integration with other systems. Since FMI primarily handles signal interactions for model import and co-simulation, it is necessary to import a database or create user-defined variables.



Web Server

The TSMaster Web Server module allows users to interact with TSMaster through a web browser.

Users can create panels within the TSMaster software and define all business logic, then publish them as a TSMaster Web interface. Once published, users can remotely log in to the Web Server to program and control TSMaster using the published panels, or use other programming methods to control TSMaster.



Example: Simulation signals can be configured via the web interface, and the updated message data can be viewed on the TSMaster server.

This module also enables features such as remote calibration, remote diagnostics, and remote panel control.

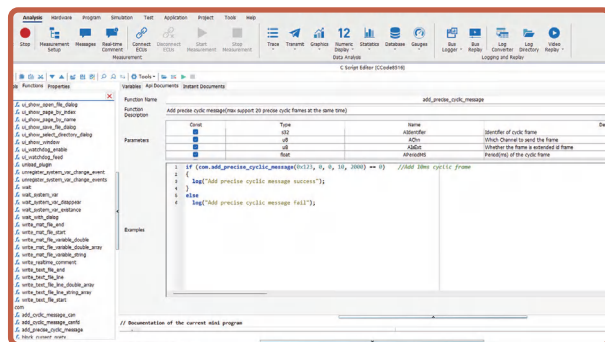
Scripting

C / Python Mini-Programs

TSMaster uses a pure C and Python scripting framework with a front-end / back-end runtime architecture similar to that of an ECU, making it convenient to directly integrate and validate embedded code.

It provides hundreds of API functions related to system management (app), communication management (com), database interaction, and test management (test). The scripts can directly access hardware, system variables, and the RBS module.

TSMaster includes a built-in mini-program engine that allows users to execute any custom logic within an independent environment, referred to as a mini-program. These mini-programs invoke the TSMaster API framework, enabling users to efficiently develop their own applications. Users can choose to publish their mini-programs with or without encryption on other computers.



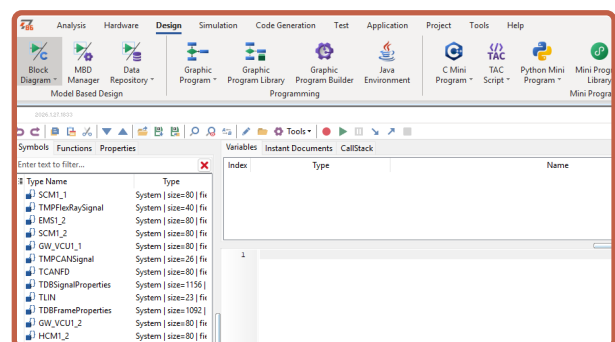
Python scripting: Compared with traditional C scripting, it further lowers the entry barrier for hiring and training test engineers.

TAC Scripting

TAC (TOSUN Automation C) is a lightweight scripting language designed for test automation and embedded use cases. Based on C-like syntax, it retains the simplicity of C while being optimized for test automation and embedded applications, providing an efficient and reliable scripting solution.

Key Features of TAC:

- User-Friendly Syntax: Easy to learn for users with a C background; readable and maintainable
- Efficient Debugging: Built-in debugging tools enable fast issue identification
- Flexible Integration: Deep integration with TSMaster for complex testing scenarios
- Rich Data Types: Supports static types and dynamic structure registration
- AI-Flow Visualization: Converts code into flowcharts for better understanding and collaboration
- Memory Safety: Built-in mechanisms ensure stable and reliable execution
- Seamless Connectivity: Supports integration with C mini-programs and ECU code.



Mini-Program Library

Based on TSMaster's mini-program architecture, users can integrate the functionalities of their own mini-programs into the TSMaster software platform, providing API support for other user mini-programs. Mini-programs merged into the TSMaster software platform become part of the mini-program library. Through this library, users can continuously iterate and expand their self-developed software modules.

Since extensions can be built on existing TSMaster mini-programs, the development threshold is lowered. Secondary development enables rapid construction of new features or optimization of existing ones, facilitating quick iteration and timely response to market demands. These secondarily developed mini-programs have access to both the TSMaster platform APIs and existing mini-program APIs, improving development efficiency and reducing costs.

Common use cases include:

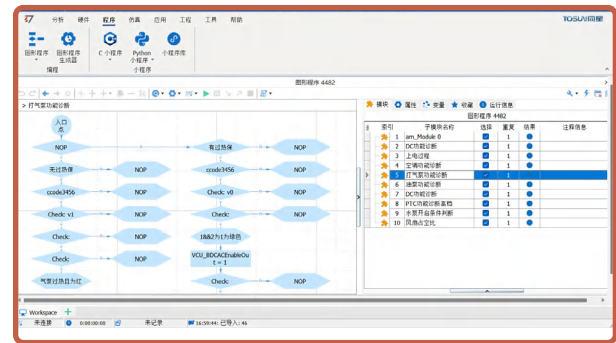
- Algorithm libraries
- Support for general instrumentation devices
- Custom functional modules

Index	Function Name	Function Arguments	Description
1	tsdiag_can_create	ps32 pDiagModuleIndex...	create uds diagnostic module
2	tsdiag_can_delete	s32 ADiagModuleIndex	delete uds diagnostic module, It is recommended to replace tsdiag_delete
3	tsdiag_can_delete_all		delete all uds diagnostic modules, It is recommended to replace tsdiag_delete
4	tsdiag_delete	s32 ADiagModuleIndex	delete uds diagnostic module
5	tsdiag_delete_all		delete all uds diagnostic modules
6	tsdiag_set_p2_timeout	s32 ADiagModuleIndex, ...	set p2 timeout value
7	tsdiag_set_p2_extended	s32 ADiagModuleIndex, ...	set p2 extended value
8	tsdiag_set_s3_server_time	s32 ADiagModuleIndex, ...	set s3 server time
9	tsdiag_set_s3_client_time	s32 ADiagModuleIndex, ...	set s3 client time
10	tsdiag_set_filled_byte	s32 ADiagModuleIndex, ...	set filled byte value
11	tsdiag_set_fc_delay	s32 ADiagModuleIndex, ...	set the delay time between FC frame and first CF frame

Graphical Programming

TSMaster includes a built-in graphical programming language that supports users in writing arbitrary logic. It supports subsystems, breakpoints, single-step debugging, and allows calls to any C / C++ functions. It is a versatile graphical programming language.

Using TSMaster's graphical programming module, users can access built-in features such as RBS (Residual Bus Simulation), CAN / CAN FD / LIN / FlexRay / Ethernet bus signals, system variables, and mini-program APIs. This enables process-oriented and graphical programming, greatly enhancing work efficiency.



Graphical Program Generator

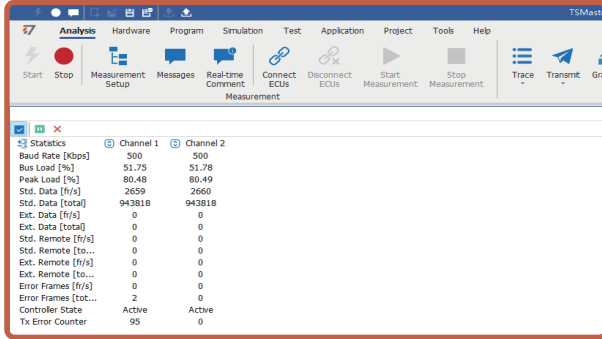
Developers can write test procedures in Excel and import them to automatically generate flowchart-based test cases.

Def	Name	Comment	Configuration
Program	am_Module 1		1.0.am_Module 1.Graphic Program 8021
A2	NOP Action Add		0.1.0
A3	NOP		0.1.0
A4	jump from		0.1.0
A5	Group of Actions		0.1.0
C3	NOP		0.1.0
E3	NOP		0.1.0
E4	Group		0.1.0
E5	go back		0.1.0



Bus Statistics

The CAN bus statistics feature includes: bus load rate, peak load rate, data frame rate, data frame count, error frame rate, error frame count, controller status, transmit error count, etc. These statistics can also be displayed on panels or charts through system variables.

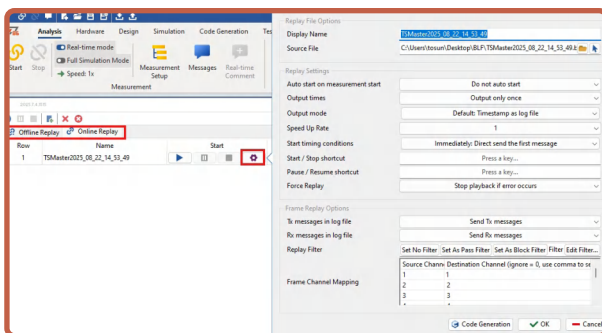


	Channel 1	Channel 2
Baud Rate [Kbps]	500	500
Bus Load [%]	51.75	51.78
Peak Load [%]	80.48	80.49
Std. Data [fr/s]	2659	2660
Std. Data [total]	943818	943818
Ext. Data [fr/s]	0	0
Ext. Data [total]	0	0
Std. Remote [fr/s]	0	0
Std. Remote [to...]	0	0
Ext. Remote [fr/s]	0	0
Ext. Remote [to...]	0	0
Error Frames [fr/s]	0	0
Error Frames [tot...]	2	0
Controller State	Active	Active
Tx Error Counter	95	0

Message Replay

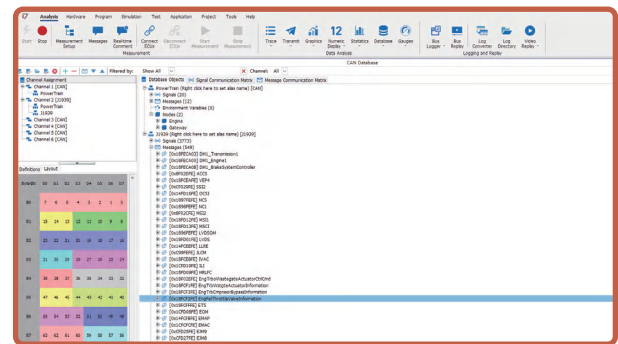
Message playback supports BLF and ASC formats, with both online and offline playback modes. Offline playback is equivalent to opening a recorded file directly, with options for post-processing functions and playback range selection. Online playback sends messages through hardware according to defined rules and supports:

- Playback count and mode
- Start timing conditions
- Shortcut keys for start, stop, pause, and resume
- Pass / block filters
- -channel mapping



Database

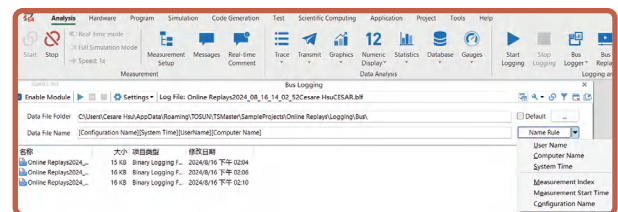
Supports loading DBC / ARXML / LDF / XML database files. It also provides a structural view of the database, a signal communication matrix view, and a message communication matrix view. For ARXML databases, multiplexed signal parsing is supported. In addition to traditional button-based importing, drag-and-drop of database files into the workspace is also supported.



Bus Logging

By default, logs are saved as BLF files, and can later be converted to ASC / CSV / MAT formats.

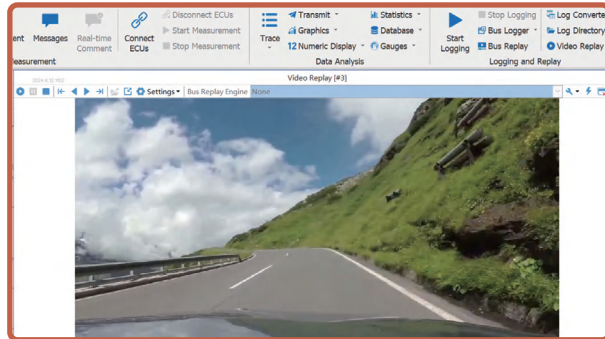
- Can be configured to start logging automatically when analysis begins
- Supports unlimited logging
- Can be set to automatically create a new file after logging 5 million messages per file
- Automatically creates a new file when the current one reaches 500 MB
- File naming rules are configurable; filenames can include: username, system time, start time, project name, etc.



Video Replay

Supports common video formats such as MP4, AVI, and WMV.

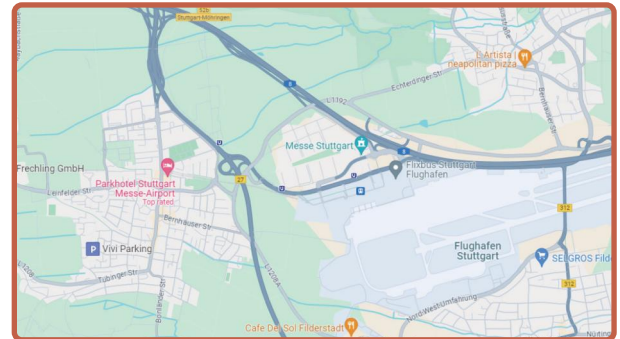
Can be synchronized with the bus playback engine using a configurable time offset.



GPS Replay

TSMaster includes a built-in GPS data playback and analysis module.

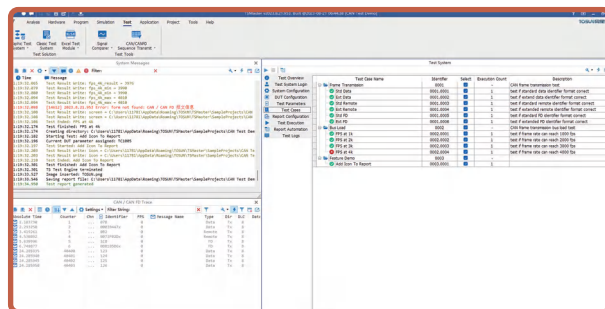
It can be linked with bus message data to perform synchronized analysis of GPS and bus data.



Test System

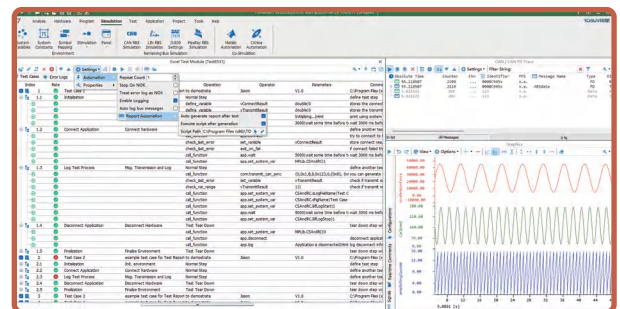
Test System

The TSMaster software features an open architecture. In addition to supporting TOSUN hardware, it can integrate a wide range of external instruments and automotive sensor simulators via mini-programs. Combined with C scripts for test case development, users can easily build automated testing systems and export test reports in user-defined formats.



Excel Test Module

With the dedicated Excel testing module and its related functions, users can import test cases written in Excel to perform testing. After execution, test results are displayed directly and can also be used to generate test reports.

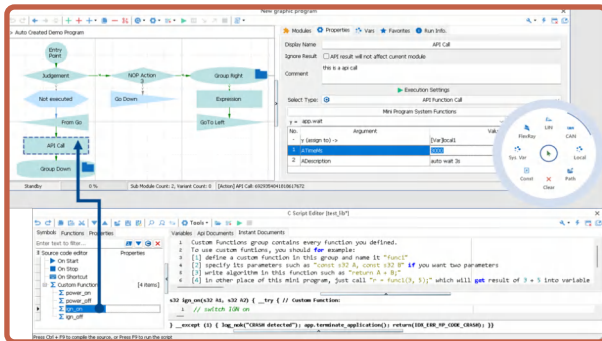


Graphical Programming Testing System

The Flowchart-Based Testing System is fundamentally similar to the graphical programming module and can also be used as a testing system with support for automatic test report generation.

Its advantages include:

- Visualized execution flow
- Flowchart-based test logic
- Similar to Stateflow
- Supports breakpoints
- Supports step-by-step execution
- Editable from PC
- Logs each execution step
- Easy API integration

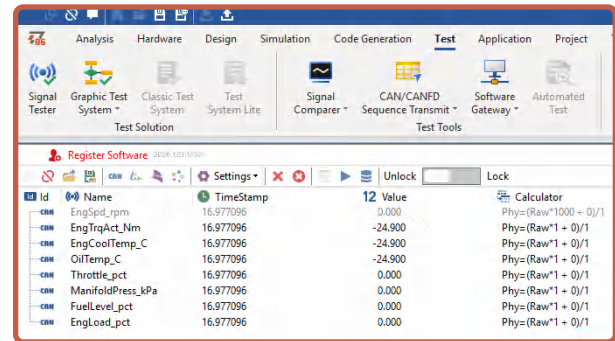


Signal Comparison Module

Supports real-time monitoring and analysis of thousands of signals simultaneously with smooth performance and low CPU usage. Built-in signal value calculation and judgment features allow users to intuitively observe whether signals remain within the expected range.

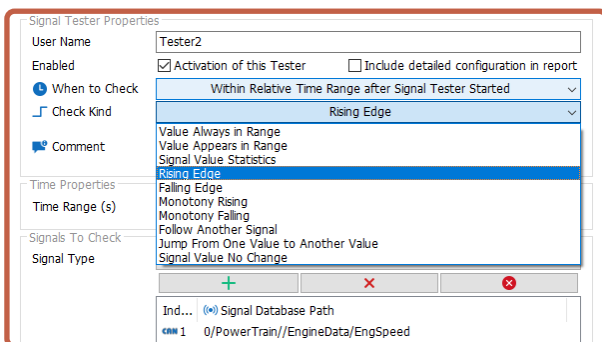
Includes built-in parsers for CAN FD / CAN / LIN and sensor variables, and is compatible with DBC, LDF, FIBEX, and ARXML databases.

Signals can be freely dragged and dropped across the same or different panels.



Signal Testing System

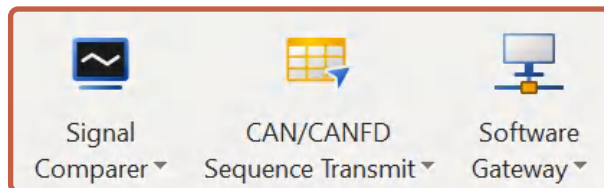
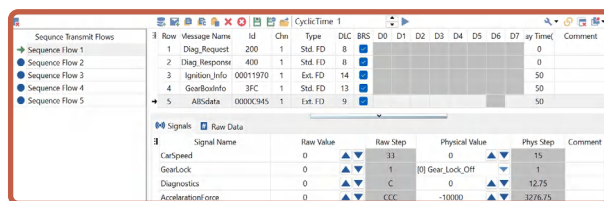
The Signal Testing System is used to analyze signal characteristics. Supported signal types include system variable signals, bus signals, and test signals. It can detect features such as rising / falling edges, level holding, and signal changes. The configuration UI is shown as follows:



Sequence Transmission Function

The Sequence Transmission module enables predefined message sequences to be sent without scripting. This module is commonly used for sending control messages in a specific order or loop to verify product functionality.

It supports the creation of multiple transmission sequences. Each sequence can include both raw messages and database messages, and the number of loops can be configured. The sequence transmission process can be registered as a system variable, allowing it to be called and controlled by other modules, such as C mini-programs.

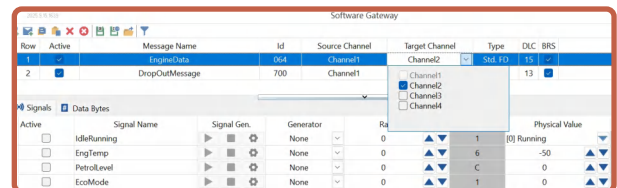
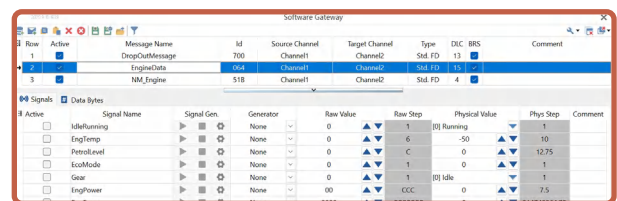


Software Gateway

The Software Gateway module provides a graphical, code-free interface for configuring message mapping and forwarding.

Users can create forwarding lists and configure source and target-channels for gateway messages, enabling real-time forwarding of received messages from the source-channel to the target-channel.

Gateway messages can be forwarded one-to-one or modified through a signal generator. The signal generator supports sine wave, ramp, pulse, range, toggle, random, custom, and system variable signals. This module can be used to inject fault data during message forwarding or to add and transmit changing signals such as a Rolling Counter.



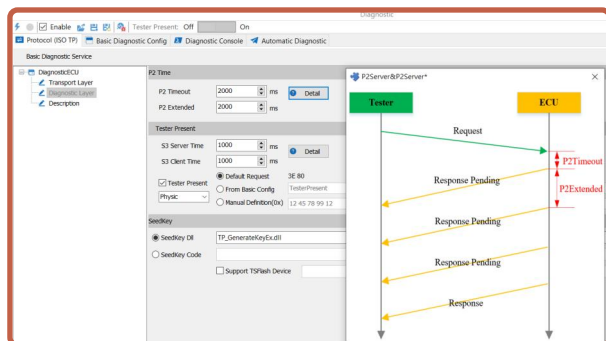
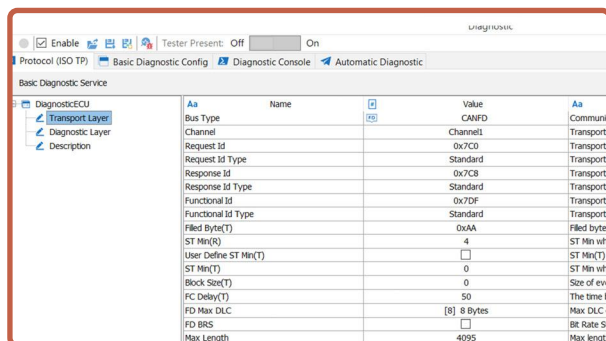
Diagnostic

TSMaster diagnostic functions support flexible configuration of diagnostic services and parameters, UDS-based Flash Bootloader flashing setup, and automated diagnostic workflows.

It is compatible with standard diagnostic database formats such as ODX and CDD, enabling low-code / no-code diagnostic process development. Developers only need to understand the diagnostic workflow itself, making it applicable across the full lifecycle of R&D, production, and after-sales service.

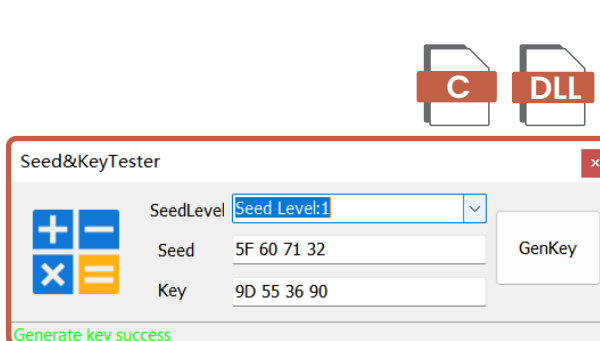
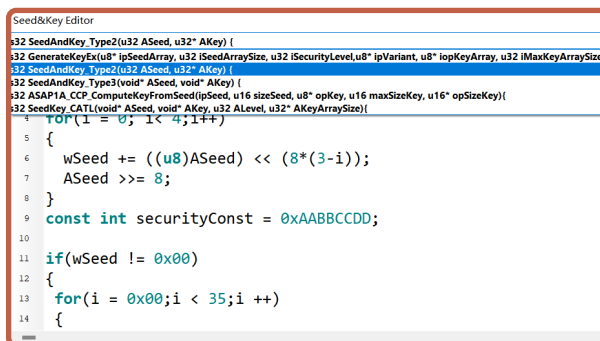
Diagnostic Parameter Configuration

Transport Layer Parameters: Configure bus type, various IDs, -channel DLC, intervals, etc.
Service Layer Parameters: Configure P2 timing parameters, tester online settings, seed and key, etc.



Diagnostic Seed and Key

TSMaster supports direct import of Seed and Key DLLs and includes a built-in SeedKey algorithm editor, allowing users to implement SeedKey algorithms without relying on external development tools.



Database-Based Diagnostics

Supports importing diagnostic database files such as ODX, PDX, and CDD, with options to select different MCU variable objects.



Users can manually edit diagnostic databases, including settings for individual services, request / response parameters, and more.

Session Control (0x10): Switch between default session and programming session

Security Access (0x27): Seed and Key algorithm integration module

Data Transfer (0x34 / 0x36 / 0x37): supports dynamic addressing and block checksum

Memory Operation (0x31): Erase / verification commands

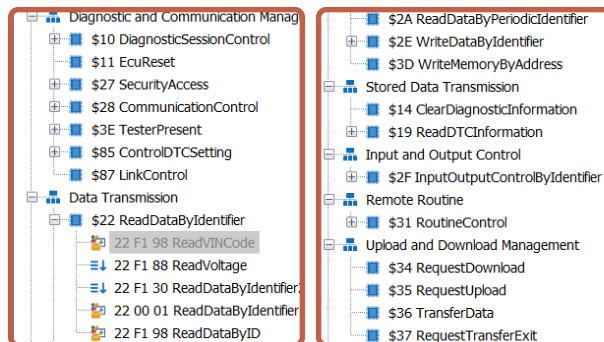
ECU Reset (0x11): Reset the ECU according to restart type

Communication Control (0x28): Disable non-diagnostic messages

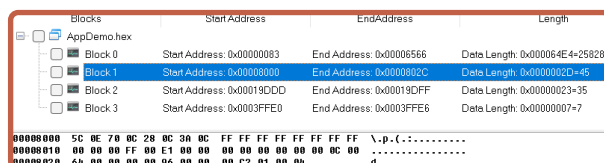
Control DTC Setting (0x85): Disable DTC recording

Write DID (0x2E): Write dataTester Present

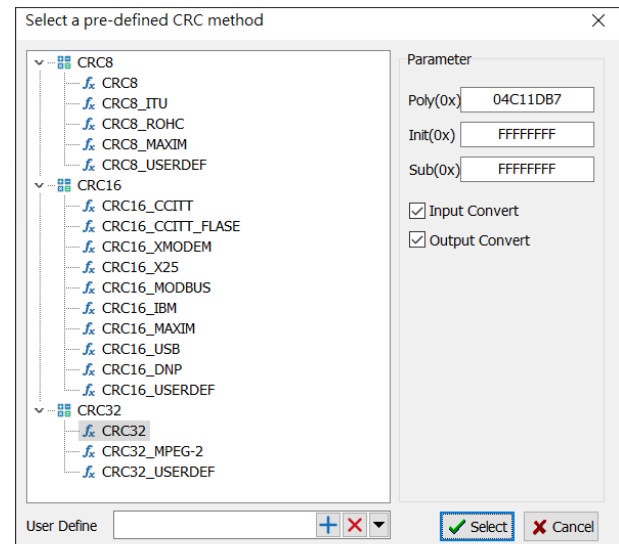
Tester Present (0x3E): Used for executing individual diagnostic services Diagnostic tester keep-alive



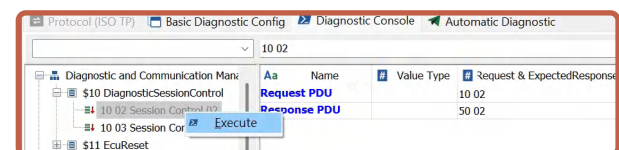
Supported formats: hex / bin / s19 / mot / source
Modifiable byte count for start address and data length.



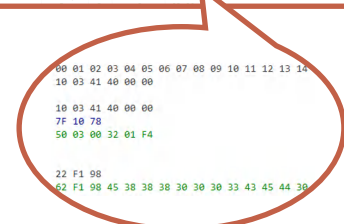
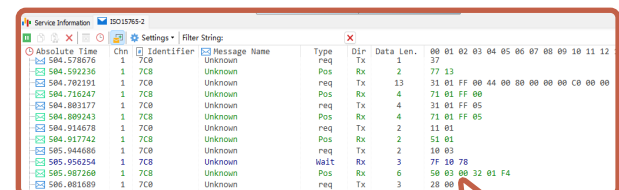
- Byte order: Intel or Motorola
- Import and modify CRC tables
- Support custom CRC verification algorithms



Used for executing individual diagnostic services and comparing actual responses. Users can choose whether to synchronize system variables from the diagnostic parameters.



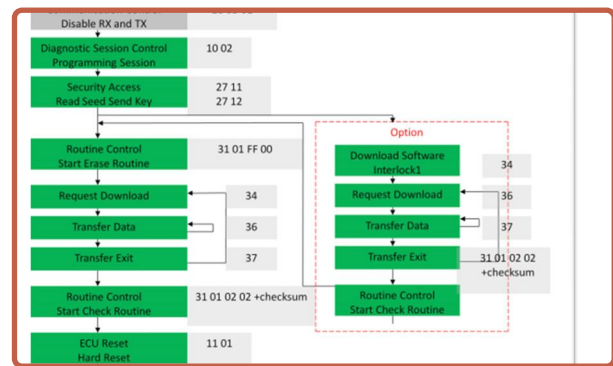
The ISO15765-2 window displays the transmission packet process and parameter parsing.



Automated Diagnostic Workflow

TSMaster allows users to customize workflows and arrange configured services. This makes it easy to build various Flash Bootloader flashing processes.

Id	Type	ServiceName	Address	Request(D)	Response(D)	Delay	Property
1	Normal	ExtendedSession	Physic: 10 02		Has Response: 10 02	50	Priority: 0 (High)
2	Normal	Close DTC	Physic: 05 02		Has Response: 05 02	50	Priority: 0 (High)
3	Normal	DisableRx	Physic: 28 03 01		Has Response: 28 03 01	50	Priority: 0 (High)
4	Normal	ReadDataByDF100	Physic: 22 F1 00		Has Response: 22 F1 00	50	Priority: 0 (High)
5	Normal	SessionV2	Physic: 10 02		Has Response: 10 02	50	Priority: 0 (High)
6	SecurityKey	Service2	Physic: Send Level 3 Key Level 4		Has Response: 31 01 00	50	Priority: 0 (High)
7	Normal	WriteDataByP200	Physic: 22 F1 90 35 34 32 31 4E 53		Has Response: 22 F1 90 35 34 32 31 4E 53	50	Priority: 0 (High)
8	DownloadFile	ReadDriver	Physic: 5, sec 1, hex		Has Response: 31 01 00	50	Priority: 0 (High)
9	Normal	Close	Physic: 21 02 F1 04 03 00 00 00 00 C0 00 00		Has Response: 21 02 F1 04 03 00 00 00 00 C0 00 00	50	Priority: 0 (High)
10	Normal	ReadDataByP200	Physic: 22 F1 90 35 34 32 31 4E 53		Has Response: 22 F1 90 35 34 32 31 4E 53	50	Priority: 0 (High)
11	Normal	ECU Reset	Physic: 11 01		Has Response: 11 01	1000	Priority: 0 (High)
12	Normal	ExtendedSession	Physic: 10 02		Has Response: 10 02	50	Priority: 0 (High)
13	Normal	EnableRx	Physic: 28 03 01		Has Response: 28 03 01	50	Priority: 0 (High)



Typical Application

UDS-based Flash Bootloader flashing. Combined with modules such as Panel, users can create Flash Bootloader flashing interfaces within the software without writing scripts, enabling flexible applications for different use cases.

- Diagnostics + Panel PC-Flashing Software
- Diagnostics + Panel + COM
- Production-line flashing software
- Diagnostics + Panel + COM + Application Deployment → After-sales flashing software
- Diagnostics + TFI011 → Handheld Flashing Device
- Diagnostics + CAN Device with Wireless Module
- Remote Flashing Device



Configure the flashing process in TSMaster



Perform online flashing via connected CAN / LIN tools



Download the configuration to a handheld flashing device for offline flashing

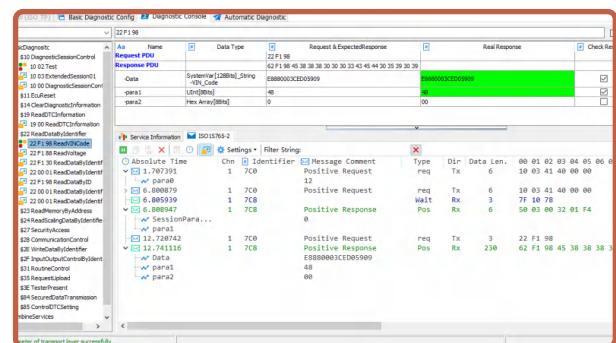
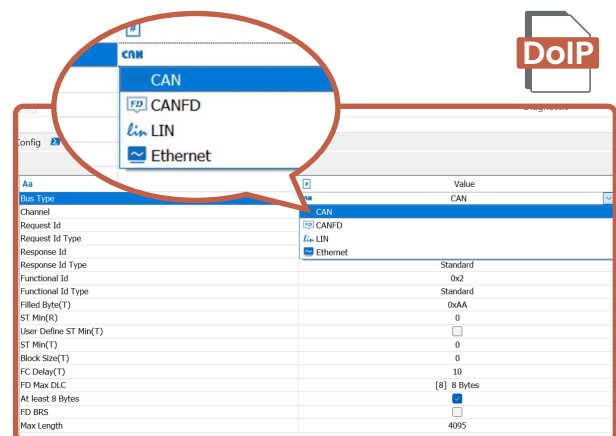


Use a tablet with TSMaster to connect to the CAN tool via WiFi for flashing

Vehicle / ECU

DoIP Functionality and Flashing

TSMaster's DoIP function supports both standard Ethernet (100/1000BASE-T) and Automotive Ethernet (100/1000BASE-T1). The configuration and usage are largely consistent with UDS diagnostic functions over CAN.



Calibration

Calibration Environment and Measurement Functions

- TSMaster supports XCP and CCP calibration
- Supports A2L file import and variable parsing
- Supports simultaneous calibration and measurement across up to 64 channels
- Supports loading BIN / S19 / HEX / MOT files
- Supports Polling, dynamic DAQ, and static DAQ measurement modes
- Supports numerical display, graphical curves, and panel controls for signal observation
- Supports MDF / MF4 format recording and playback
- Supports unified timestamp recording and playback for calibration signals and bus signals

Calibration Functions and Data Management

- Supports both online and offline calibration
- Supports parameter, array, curve, and map signal types for calibration
- Supports characteristic parameter curves and 3D views of maps
- Supports importing and exporting calibration parameters in PAR, DCM, and HEX formats
- Supports automated calibration via COM service components
- Supports calibration data management, including comparison and analysis of multiple calibration datasets
- Supports XCP program protocol downloads
- Supports uploading calibration data from the working page or reference page
- Supports merging calibration data areas with application program areas

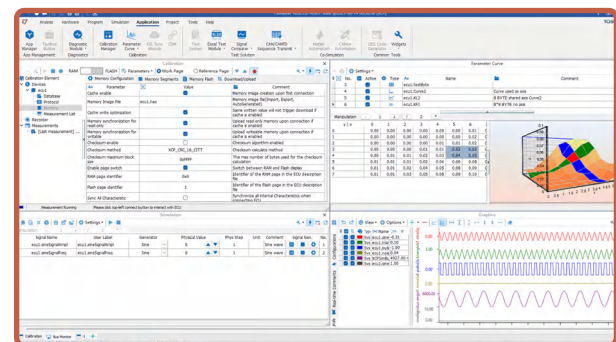
Automated Calibration

- TSMaster integrates message analysis, diagnostics, calibration, and system variable data into a single platform, enabling synchronized data analysis
- Automated calibration can also be achieved via COM component calls
- Typical applications include production lines, laboratories, and other automation scenarios
- User-developed applications can invoke TSMaster through COM component interfaces to perform automated calibration and flashing

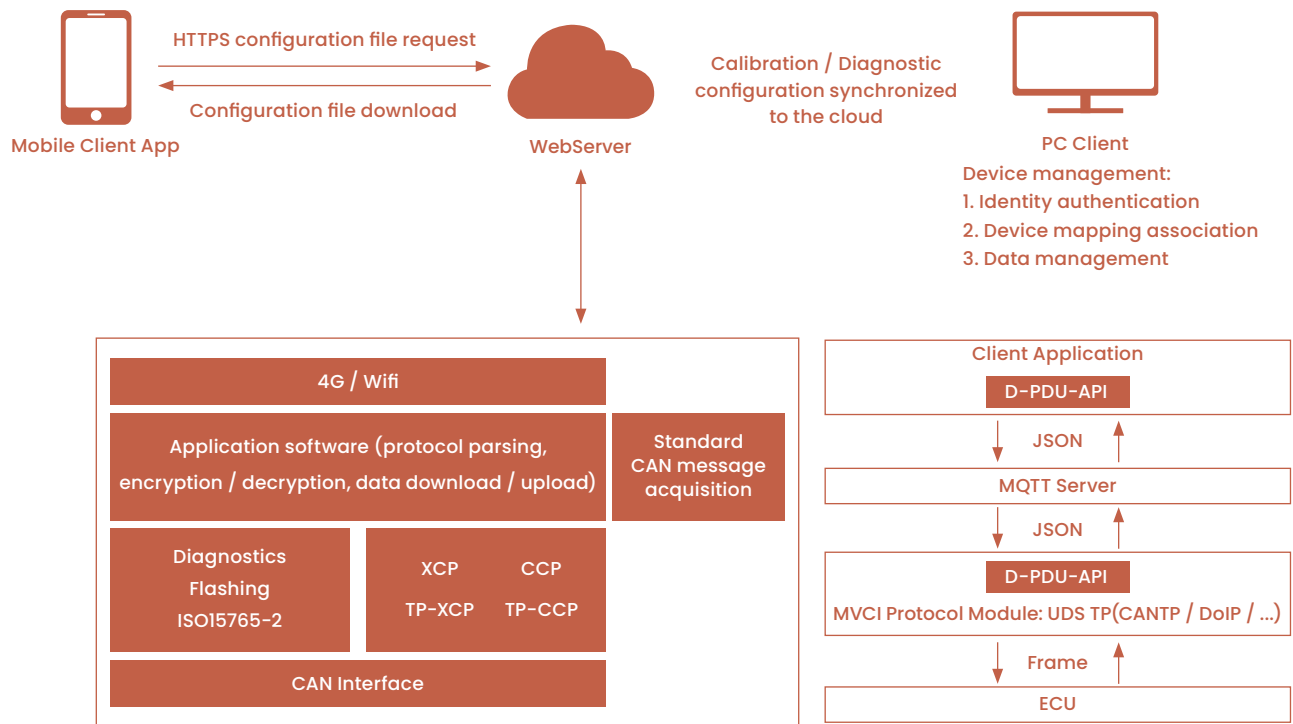
User-developed applications



Invoke via COM components to achieve automated calibration



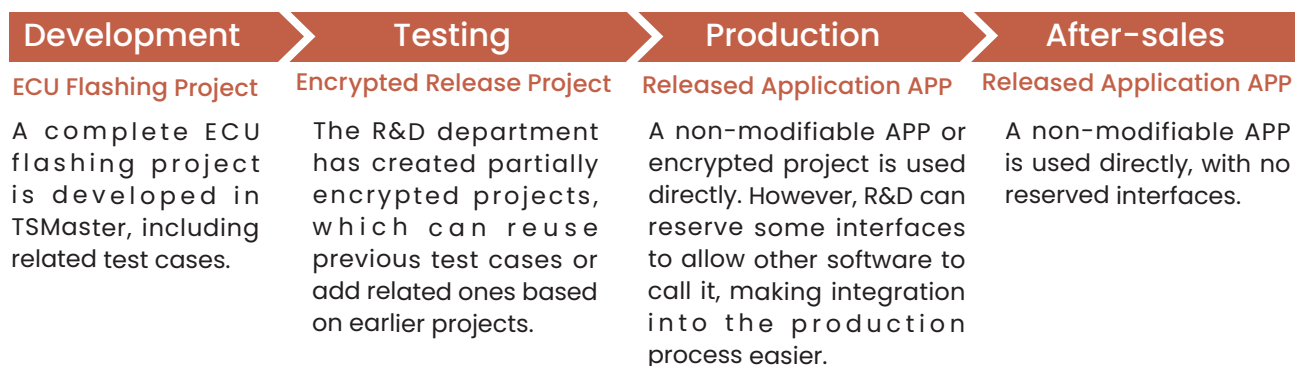
Remote Calibration



Seamless Engineering Lifecycle

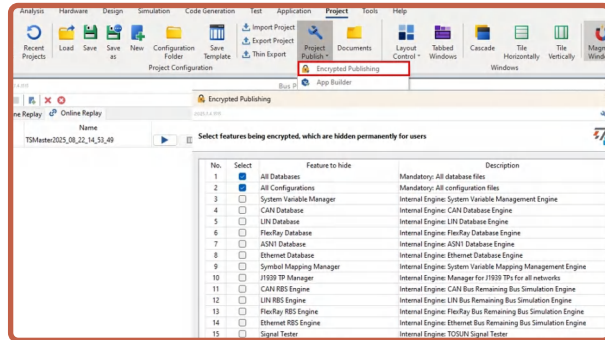
The configuration file suffix for TSMaster engineering files is .T7z, which supports compressed and encrypted configuration files. A T7z file contains all the contents of the current configuration: forms, information on the forms, database, panels, C scripts, etc.

Encrypted release and application release are mainly used to streamline the entire process flow including development, testing, production, and after-sales. After development and configuration are completed, there is no need for customized non-standard software. The encrypted release and application release functions can be used to publish and provide the files for subsequent stages.



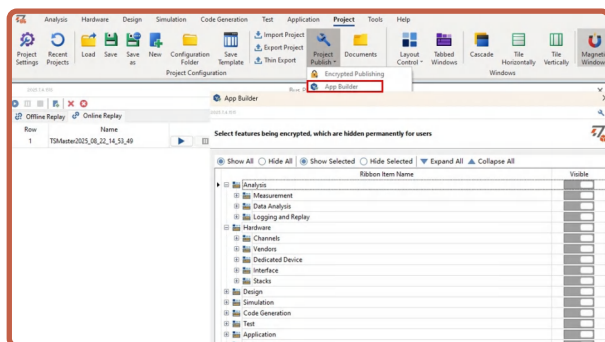
Encrypted Release

Encrypts internal modules of the engineering configuration, such as DBC and script modules. The released engineering file can only be opened and used on the corresponding hardware with the correct password.



App Builder

Customizes the released application interface based on TSMaster, allowing users to select which modules and forms to display and execute. Users can only use the obtained engineering files but cannot edit them, providing a usage experience similar to customized software interfaces. By using TSMaster's encrypted release and application release, product development personnel only need to develop a diagnostic-related program during the product development phase. Then, according to requirements, different licenses can be used to release software modules to the production line or after-sales, completing the full-process diagnostic development. This approach reduces labor costs, shortens the development cycle, makes timelines more predictable, and ensures security.



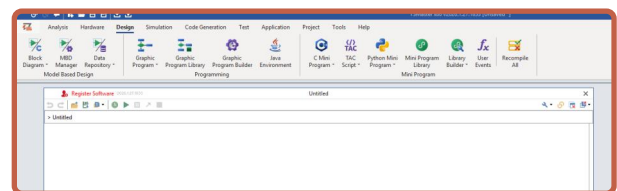
Additional Features

Model Block Diagram

The TSMaster Model Block Diagram module is a Simulink-like modeling module designed to support Model-Based Development (MBD). It allows users to build system models by dragging and dropping modules and connecting signal lines. It supports simulation of continuous-time, discrete-time, and hybrid systems.

Module Features

- **Rich Module Library:** Includes predefined modules in areas such as mathematical operations, signal processing, control systems, and communication systems
- **Hierarchical Modeling:** Supports creating hierarchical models through subsystems; multiple modules can be combined into subsystems; supports multi-level nested subsystems; enables creation of conditional execution subsystems (such as enable, trigger, etc.)
- **Simulation Capabilities:** Supports parallel running of subsystems with different sampling rates; automatically handles signal transmission between modules operating at different rates
- **Deep Integration:** Can directly read data from TSMaster system variables; simulation results can be exported as mbd files for analysis; related functions within the model block diagram can be called to operate TSMaster



Real Vehicle Data Acquisition Mode

When Vehicle Measurement Mode is enabled, all channels automatically switch to listen-only mode. This mode is designed for monitoring a real vehicle bus without causing interference. In addition to TOSUN hardware, TSMaster also supports a wide range of well-known tool brands, including Vector, PEAK, Kvaser, and ICS.

TSMaster will not actively transmit any messages.

When enabled in the hardware settings, Vehicle Measurement Mode has the highest priority and overrides the current hardware settings.

CAN / CAN FD:

- Termination resistors are disabled to avoid affecting bus impedance
- Supports-channels are set to listen-only mode to ensure no messages are sent, even if simulation modules are active

LIN:

- Termination is configured as a slave node
- Operates in monitor mode rather than master / slave mode

Support for Third-Party Hardware

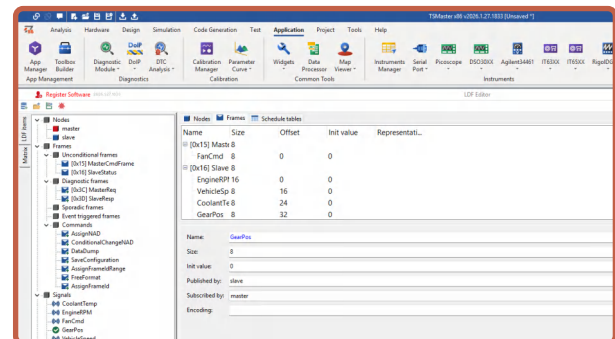
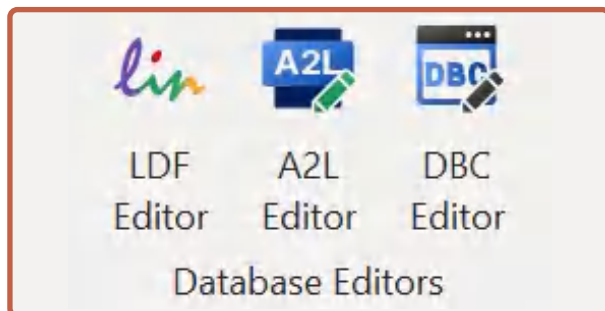
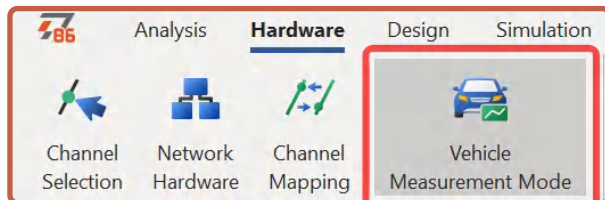
TSMaster highly abstracts the measurement behavior of measurement tools, enabling the software to support a wide range of well-known bus tool brands—such as Vector, PEAK, Kvaser, ICS, and ZLG—without any modification to the software itself. It also supports oscilloscopes, waveform generators, digital multimeters, programmable power supplies, and other measurement and testing instruments from major manufacturers such as Tektronix, Keysight, and LeCroy.

Even if new measurement and testing instruments appear on the market, TSMaster can integrate them into the software platform without changing the core software.

LDF Editor

The main functions of the LDF Editor include viewing, creating, and modifying LDF files.

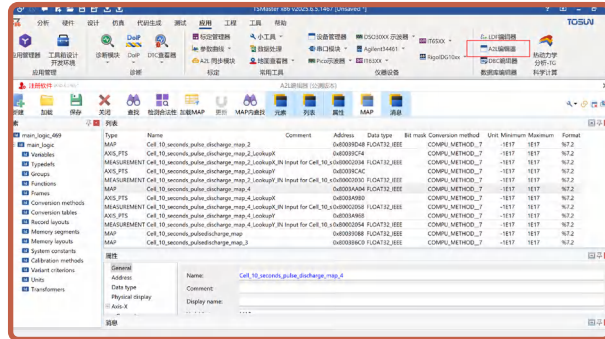
The “Create New LDF File” function covers nodes, frames (supporting unconditional frames, diagnostic frames, etc.), signals, schedule tables, system variables, and more.



A2L Editor

The main functions of the A2L Editor include viewing, creating, and modifying A2L files.

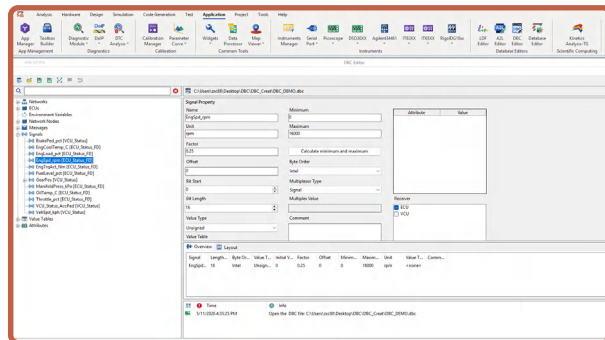
It supports importing ELF files and then exporting new A2L files.



DBC Editor

The main functions of the DBC Editor include viewing, creating, and modifying DBC files.

The “Create New DBC File” function covers nodes, messages, signals, system variables, and more.



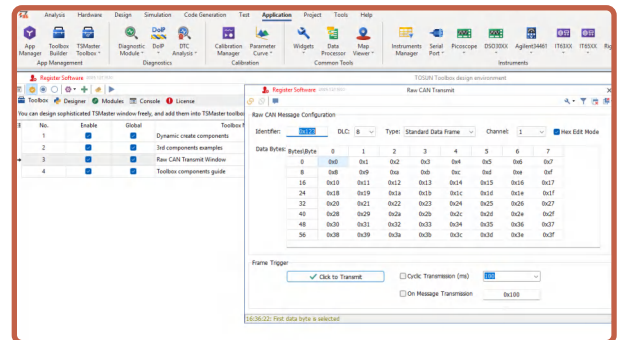
Toolbox Design and Development Environment

The TSMaster software architecture supports dynamic loading of toolboxes and provides framework-level functional support for their operation, making toolbox design based on TSMaster’s architecture simple and efficient. Key functions such as the calibration module, diagnostic module, and testing system module are all implemented in the form of toolboxes.

Users can develop their own software systems to run within TSMaster based on the toolbox architecture, enabling TSMaster to support not only in-vehicle networks but also industrial, medical, and other fields.

Any developer can use Python to design a professional TSMaster user interface and integrate it into their own projects to meet specific application needs.

The DBC Editor supports editing messages, signals, system variables, and more.



Comparison Between Toolbox and Panel:

Item	Panel	Toolbox
Features	Panels are mainly composed of buttons, labels, and selection boxes. They are linked to system variables, RBS modules, and scripts through association information	Built-in Python-based graphical Integrated Development Environment (IDE) that allows users to develop window modules and call TSMaster's built-in API functions
Use Cases	Pair with RBS simulation or scripting tools	Used when more complex logic is required and the interface needs to present more elements
Target Users	Suitable for testers without coding background	Requires developers with Python knowledge

TSMaster COM API

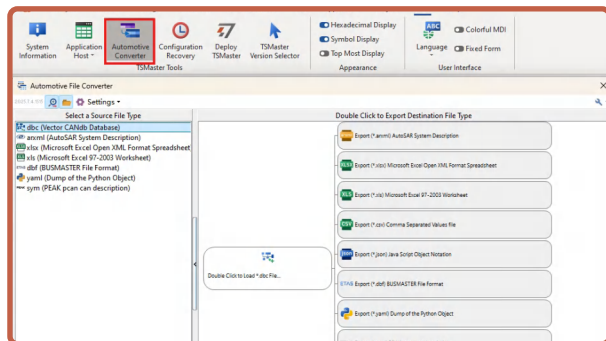
Calling TSMaster through COM components means it can be invoked from software written in other programming languages on Windows, thereby extending more application scenarios.

Typical Applications

In production lines, laboratories, and similar environments, users can use their own applications to call TSMaster via the COM interface, enabling automated diagnostics and calibration.

Automotive File Conversion Function

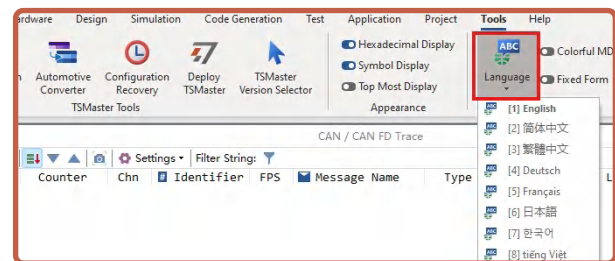
TSMaster supports conversion between multiple commonly used file formats: DBC / ARXML / XLSX / XLS / DBF / YAML / SYM / CSV / BLF / ASC / JSON / FIBEX / MAT ...



Multi-Language Support

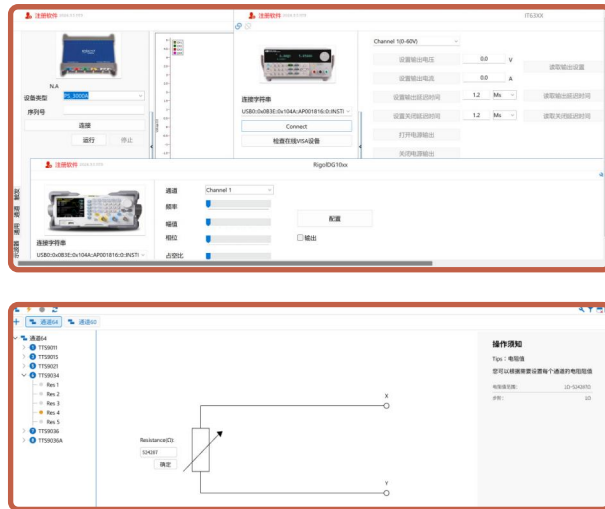
The TSMaster software interface, built-in panels, and toolbox modules all support multiple languages, facilitating collaborative development among engineers worldwide.

Supported languages include Simplified Chinese, Supported languages include Traditional Chinese, English, Spanish, French, Japanese, Korean, Vietnamese, and more.



Instrument Management

- Default integration of recommended models for mainstream testing instruments such as serial ports, oscilloscopes, programmable multimeters, programmable power supplies, and signal generators
- In addition to a user-friendly operation UI, a rich set of programmable API interfaces is provided for each type of programmable device
- A MiniSDK development environment is provided, allowing users to integrate their own devices



Data Processing Tool

The data processing module focuses on parsing and provides extensive data transformation and extraction capabilities.

Features:

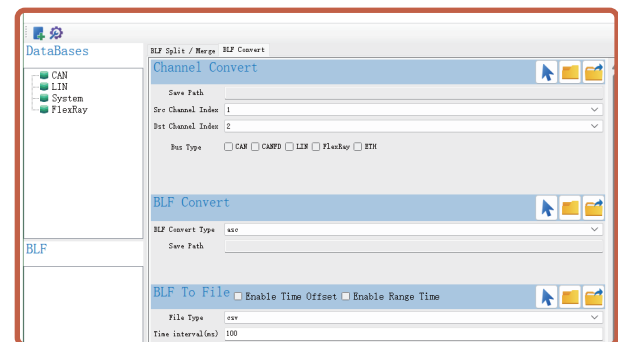
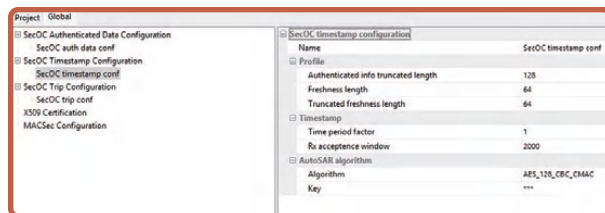
- Multi-format support: Supports reading and conversion of various bus log formats, including BLF, MAT, MDF, and others
- Flexible splitting: Supports splitting BLF files by time, data volume, file size, or specified time ranges
- File merging: Allows multiple BLF files to be merged into a single file in chronological order
- Data extraction: Enables extraction of messages from specified-channels or message IDs within BLF files
- Format conversion: Supports conversion between common formats such as BLF, ASC, CSV, and MAT

This module provides comprehensive capabilities for efficient bus data extraction, splitting, merging, and format conversion, making it suitable for a wide range of data analysis scenarios.

Security Management

The Security Management module is used to configure and activate security-related protocols. In addition to standard protocols, custom security plugins are also supported.

Currently, the module primarily supports AUTOSAR SecOC and Ethernet MACsec. The SecOC module requires an ARXML database for configuration and operational use.



Hardware



XIL Cube Real-Time Simulator

Type	Model	Function
Desktop Host	TOSUN XIL Cube	Real-time simulation test desktop host
TOSUN Dev and Testing Software	RTTSMaster Suite	High-precision real-time simulation module
Dedicated Multi-Bus Expansion Card	TA1038	12× CAN FD, 12× LIN, 4× DI / DO, 3× AI / AO
	TA1101	30× AI / AO, 30× DI / DO

Real-Time and Performance

- Dedicated CPU core real-time execution for deterministic performance
- 20 kHz high-precision real-time timer

Communication and Integration

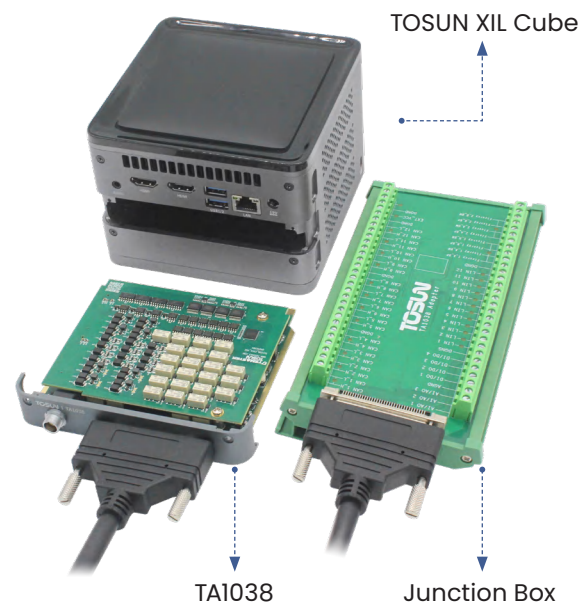
- EtherCAT master support
- Seamless integration with TSMaster

Simulation and Testing

- Real-time bus simulation with RTTSMaster
- Supports DBC / LDF / XML / ARXML databases

Advanced Functions

- UDS diagnostics and ECU flashing
- CCP / XCP calibration support
- Message tracing and error frame statistics



TTS Test System

TTS Series – Modular Test Boards

TTS is a series of modular test boards designed for automotive electronics development and testing. Each module integrates all required circuitry for I / O-channels, simplifying test bench and HIL system setup while reducing wiring complexity and deployment time.



► TTS8000 Chassis



► TTS9000 Chassis

System Integration and Coverage

- Unified control of TTS chassis and external instruments
- Supports diagnostics, calibration, and ECU testing workflows
- Covers full testing requirements across the ECU development lifecycle



Automated Testing

- Supports graphical programming, C scripting, and Excel-based workflows
- No-code testing via Excel

Key Features:

- Define test steps directly in Excel and import into the system
- Run tests without writing additional code
- Automatic report generation with customizable templates
- Closed-loop workflow from test design to result output

TTS8000 Series

Communication and Control via EtherCAT / Industrial Ethernet

Type	Model	Function
Basic Hardware	TTS0002	12 slot board chassis with sliding rails
	TTS8012	Hardware system backplane module
	TTS8920	Power supply boards
Digital I / O Boards	TTS8011	12-channel DI / DO (supports PWM and standard I / O acquisition), supports FIU
	TTS8516	16-channel DI / DO (supports PWM / Bitstream / Voltage signals), supports FIU
	TTS8848	16-channel PWM transceivers, 48-channel DI, Bitstream transceiver control
	TTS8849	16-channel PWM transceivers, 48-channel DI, Bitstream transceiver control, supports FIU and-channel isolation
Analog I / O Boards	TTS8004	4-channel AO (supports PWM / Square / Sine / Arbitrary waves), DO output and resistance matrix control
	TTS8015	16-channel AI / AO (Voltage output and acquisition), supports FIU
	TTS8016	16-channel AO (with Voltage feedback), supports FIU
	TTS8018	Multi-channel single-ended / differential AI and voltage / current AO, supports FIU, short-circuit protection, and accuracy testing

Type	Model	Function
Analog I / O Boards	TTS8301	Current AO / AI, supports FIU
	TTS8808	8-channel AI, direct connection to ECU or load for V / I measurement
	TTS8812	12-channel AO simulation (16-bit precision), output range -10V-+28V, max current 200 mA
	TTS8816	12-channel AI, 4-channel AO (supports PWM / Arbitrary waves), supports V / I measurement
	TTS8817	12-channel AI, 4-channel AO (supports PWM / Arbitrary waves), supports V / I measurement, FIU and-channel isolation
Simulation / Fault Injection Boards	TTS8025	Shunt current simulation: output range ± 300 mV (50 μ V precision), supports open-circuit and positive / negative short-circuit simulation, -channels independently isolated
	TTS8027	Programmable insulation resistance board, simulates DC bus (HV+ / HV-) insulation resistance to vehicle body
	TTS8029	Capacitance simulation: range 2 nF - 2.6 μ F, step 0.1 nF
	TTS8031	6-channel programmable resistor, Ethernet-based communication, supports open-circuit, short-circuit (to power / ground / COM) FIU modes
	TTS8036	6-channel programmable resistor, EtherCAT-based communication, supports open-circuit, short-circuit (to power / ground / COM) FIU modes
	TTS8517	5-channel FIU, supports open-circuit and short-circuit (to power / ground / COM) modes
Relay / Switching Boards	TTS8051	High-voltage relay: HV-channel on / off control, max switching voltage per-channel 1500 V, overload current ≥ 6 A
	TTS8820	20-channel relay control

Type	Model	Function
Power Supply / Load Boards	TTS8832	Matrix, PWM and Bitstream Switch Control; supports V / I measurement
	TTS8101	External Power Input and Internal Voltage Output; V / I detection and reporting; 3 integrated UART-channels
	TTS8104A	Electronic Load Simulation (CC / CR modes); voltage and PWM measurement
Bus Communication Boards	TTS1017pro -C	5-channel CAN; independent termination resistors (54 / 66 / 98 / 147 Ω); supports FIU, CoE protocol and Distributed Clock (DC)

TTS9000 Series

Communication and Control Based on CAN / CAN FD Bus

Type	Model	Function
Basic Hardware	TTS0001	12 Slot Board Chassis
Digital I / O Boards	TTS9011	12 DI / DO-channels; PWM output (0.03-200 kHz) and acquisition (0.03-250 kHz)
Analog I / O Boards	TTS9015	8 AI / AO-channels; Voltage ± 60 V (20-bit sampling), 0-60 V (16-bit output); Current 0-25 mA (20-bit sampling), 0-25 mA (16-bit)
Simulation / Fault Injection Boards	TTS9021	6 General-purpose-channels; support short / open-circuit injection
	TTS9036	5 Programmable resistors; 1 Ω -4,194,303 Ω , ± 0.5 Ω (1-500 Ω) / $\pm 0.1\%$ (500 Ω -4.19 M Ω)
Relay / Switch Boards	TTS9045	16 General-purpose relays; DC 36 V / 2.5 A or DC 40 V / 2 A max
Bus Communication Boards	TTS1016Pro	4 CAN FD, 2 LIN-channels bus analysis
	TTS1018*	12 CAN FD-channels bus analysis
	TTS1026P*	1 CAN FD, 6 LIN-channels bus analysis
	TTS1034*	2 CAN FD, 2 FlexRay-channels bus analysis; FlexRay supports cold start and auxiliary communication

*Indicates one CAN FD-channel must connect to the sliding rail for system-level control

TIO Test Module

TIO Series – Modular I / O Test Modules

The TIO series is designed for automotive ECU simulation and testing. It integrates key functions including relay control, resistor simulation, digital I / O, and analog I / O within a modular platform, providing high-precision signal processing for voltage, current, and PWM applications.

Key Features

Modular Design:

High-reliability LEMO connectors enable power and CAN transmission over a single cable
Supports fast module cascading for flexible system configuration

High-Precision Signal Processing:

Resistor simulation, wide-range voltage / current measurement, and PWM signal handling

Robust and Wide Temperature Range:

Compact aluminum housing with strong EMI immunity
Operating range: -40°C to +80°C

Seamless Software Integration:

Fully compatible with TSMaster
Supports auto hardware detection, DBC loading, and API integration for automation

Applications

Vehicle Data Acquisition:

Distributed modules for multi-node signal collection in limited space

Energy Flow Management:

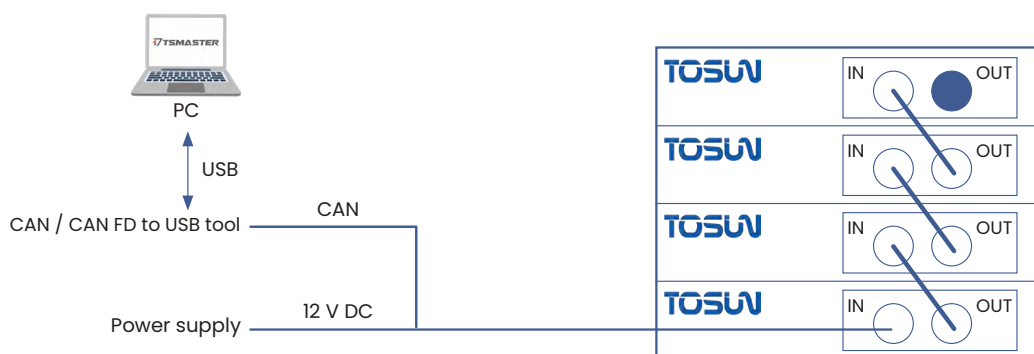
Monitoring and analysis of vehicle electrical power distribution

Road Testing:

Portable design with wide temperature support for durability and calibration tests



Connection Diagram



Bus Analysis Tools

TSMaster Hardware Definition

CAN XL / CAN FD / CAN:

Built-in software-configurable 120 Ω termination resistor

LIN:

Free transmission mode, eliminating the need for LDF files and schedule table configuration required in traditional LIN systems

FlexRay:

Independent cold start capability, allowing a single device to directly wake up and drive the entire FlexRay network; built-in software-configurable 100 Ω termination resistor

Automotive Ethernet

- 10BASE-T1S: Supports flexible configuration Configurable PLCA parameters (node ID, number of nodes, timeout) for easy multidrop network setup. built-in software-configurable 120 Ω termination resistor
- 100 / 1000BASE-T1: Flexible speed switching via TSMaster software or DIP switch. Provides comprehensive API interfaces to support flexible customization and secondary development
- Cross-platform, driver-free, plug-and-play operation



Single / Dual-Channel Interfaces

Compact, high-integration interface cards supporting CAN / CAN FD and LIN / FastLIN. When used with TSMaster, they enable database parsing, real-time bus monitoring, UDS diagnostics and flashing, CCP / XCP calibration, and script-based automation, providing an efficient and portable solution for ECU development, validation, and diagnostics.



TL1001

1-channel LIN to USB Interface



TL1011

1-channel fast LIN Bus to USB Interface



TC1001

1-channel CAN to USB Interface



TC1011

1-channel CAN FD Bus Interface



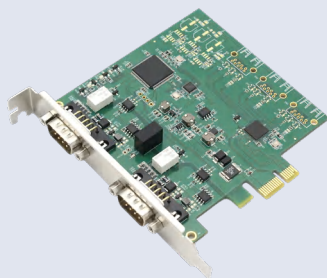
TC1013

2-channel CAN FD Bus Interface



TC1012P

1-channel CAN FD / LIN Bus Interface



TP1013

2-channel CAN FD to PCIe Interface



MP1013

2-channel CAN FD to Mini PCIe Interface

TC1013HV

2-channel CAN / CAN FD to USB Interface

(DC 4,500 V Isolation)



Multi-channel Bus Interface

Designed for complex multi-node network topologies in automotive and industrial applications. Integrates multiple-channels supporting CAN, CAN FD, LIN, FlexRay, and Automotive Ethernet, with high data throughput and microsecond-level synchronization.

Paired with TSMaster software, it enables high-fidelity data acquisition and monitoring, multi-node synchronized simulation, gateway analysis, and vehicle-level UDS diagnostics and flashing.

Acts as a robust bridge between physical bus networks and digital analysis platforms, delivering a stable, efficient, and scalable testing solution.



TC1014

4-channel CAN FD Bus Interface



TC1015

2-channel LIN,
2-channel CAN FD to USB Interface



TC1017

8-channel CAN FD to USB Interface



TC1018

12-channel CAN FD to USB Interface



TC1016P

2-channel LIN,
4-channel CAN FD to USB Interface



TC1026P

1-channel CAN FD,
6-channel LIN to USB Interface



TC1034

2-channels CAN FD
2-channels FlexRay to USB Interface



TC1052

2-channel CAN / CAN FD,
1-channel 10BASE-T1S to USB Interface



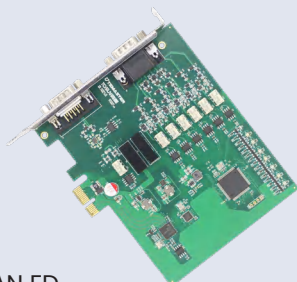
TP1014

4-channel CAN FD to PCIe Interface



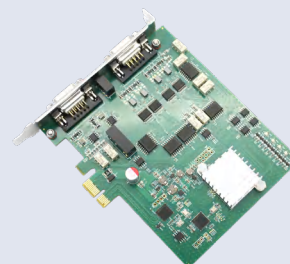
TP1018

12-channel CAN FD to PCIe Interface



TP1026

1-channel CAN FD,
6-channel LIN to PCIe Interface



TC1034

2-channel FlexRay,
2-channel CAN FD bus device

TC1052

10BASE-T1S

10BASE-T1S and CAN FD USB Interface

- 1× 10BASE-T1S + 2× CAN FD in one device
- Synchronized multi-channel analysis
- Supports DoIP and SOME/IP
- Integrated solution for in-vehicle network testing and diagnostics



High-Performance Bus Analyzer

The TC Pro series is an upgraded version of the TC series, maintaining high reliability and stability while integrating 4-channel DI / DO and 3-channel AI / AO in a compact form factor. A single device supports both bus communication and signal control, significantly simplifying test bench setup.

Key Features

- Integrated 4× DI / DO + 3× AI / AO for combined communication and signal control
- Self-ACK mechanism enables standalone ECU driving for offline flashing and bench testing
- Supports active error frame injection to validate fault tolerance and system robustness
- FPGA-based high-precision timing control for low-jitter cyclic messaging
- ACK error reporting and Spy Mode for full bus monitoring and anomaly detection
- Supports TSync01 hardware synchronization for multi-device μ s-level time alignment



TC1013Pro

2-channel CAN FD to USB Interface



TC1014Pro

4-channel CAN FD to USB Interface



TC1017Pro

8-channel CAN FD to USB Interface



TC1018Pro

12-channel CAN FD to USB Interface



TC1034Pro

2-channels CAN FD
2-channels FlexRay to USB Interface



TC1038Pro

12-channels CAN/CAN FD,
12-channels LIN to Ethernet Interfaces



TC1055Pro

2-channels LIN, 4-channels CAN/CAN FD,
4-channels 100/1000BASE-T1
2-channels 100/1000BASE-T(x) to USB or
Gigabit/10 Gigabit Ethernet Interfaces



TC1055Pro+

2-channel LIN, 4-channel CAN XL,
4-channel 100/1000BASE-T1
2-channel 100/1000BASE-T(x) to USB or
Gigabit/10 Gigabit Ethernet Interfaces

TC1055Pro / TC1055Pro+ CAN XL

High-Performance Multi-Protocol Vehicle Network Interface

TC1055Pro series is a high-performance in-vehicle network interface supporting USB or Gigabit / 10Gigabit Ethernet connection.

TC1055Pro integrates 2 × LIN, 4 × CAN / CAN FD, 4 × 100 / 1000BASE-T1, and 2 × 100 / 1000BASE-T(x).

TC1055Pro+ additionally supports 4 × CAN XL-channels.

CAN XL / CAN FD-channels feature configurable 120 Ω termination via TSMaster, while Ethernet speeds can be flexibly adjusted for heterogeneous network environments.

A built-in bypass mode ensures physical link continuity during power-off or special conditions, improving system reliability.

Fully integrated with TSMaster, it supports synchronized monitoring, simulation, playback, and advanced protocols such as DoIP and SOME / IP, enabling efficient development and testing of complex vehicle networks.

SocketCAN Interface

Designed for CAN / CAN FD development and system integration in Linux environments, this series is fully compatible with the SocketCAN framework. It enables CAN communication as simple and efficient as standard network programming, while reducing cross-platform development complexity and system integration costs.

System Compatibility

- Linux: Fully compatible with native SocketCAN, with complete driver support
- Windows: Driver-free, plug-and-play with fast communication via Windows API

Communication Performance

Supports CAN FD with up to 5 Mbps (customizable up to 8 Mbps)

Supply Chain Reliability

supply-chain-resilient controller chips

Model	CAN FD	PC Interface
TC111	1	USB
TC113	2	USB
TC114	4	USB
TC3014	4	Mini PCIe



Data Logger

The Tlog series is designed for complex in-vehicle network environments, providing reliable data acquisition and logging from node-level monitoring to full-vehicle recording. With hardware-level precise timestamping, it ensures accurate cross-channel synchronization.

Dual-Mode Operation

- Standalone logging with built-in storage and GPS
- Interface mode (via TSMaster license) for simulation, UDS diagnostics, CCP / XCP calibration, and UDS-based Flash Bootloader

High-Precision Timing

- μ s-level hardware timestamps for accurate multi-channel synchronization

Multi-Bus Integration

- Multi-protocol bus-channels with integrated digital / analog I / O
- Enables synchronized acquisition of mixed signals without additional devices

License Options	Activated Features
TSMaster / Bus Analysis	Bus simulation and analysis functions
TSMaster / UDS	UDS diagnostics (supports ODX file import)
TSMaster / CCP / XCP	CCP / XCP calibration functions



	Tlog1002	Tlog1004
LIN-channels	2	2
CAN FD-channels	2	4
Digital I / O	2× DI / DO	2× DI / DO
Analog I / O	1× AI	1× AI
PC Interface	Ethernet	Ethernet
Timestamp Accuracy	1 μ s	
Onboard Storage	64 GB eMMC	
Positioning (GPS)	GPS supported	
Protection / Expansion	External TCA0001I surge protection module	

Tlog1039

High-Density Heterogeneous Network Integration

12-channels CAN / CAN FD

- Supports 5 Mbps high-speed communication (optional 8 Mbps)
- Supports Self-ACK self-response configuration

10-channels LIN

All nodes can be software-configured as slave nodes. LIN1-LIN4 support software configuration as master nodes, enabling flexible master / slave test modes without hardware jumpers.

3-channels 100 / 1000BASE-T1

Supports Switch mode operation, facilitating integration into complex in-vehicle Ethernet topologies

I / O-channels

Integrated 4-channel DI / DO and 3-channel AI / AO to meet synchronized acquisition requirements of vehicle hardwired signals

- Supports upgrade expansion of FlexRay communication capability

TB-Level Storage and Wireless Ecosystem

- Expandable storage: standard 128 GB industrial-grade eMMC, expandable up to 1 TB, meeting long-duration and full-scale offline recording requirements
- Full-scenario connectivity: supports wired connection to host PC via RJ45 Ethernet, and also supports wireless 4G / Wi-Fi connections

Professional Timing and Interaction Experience

- Microsecond-level synchronization: μ s-level hardware timestamps, supports high-precision hardware clock synchronization across multiple devices with TSync01
- Convenient event marking: supports connection with TCB001 button box for one-click key event tagging during road testing, greatly improving data review and analysis efficiency



Tlog1057

High-Density Heterogeneous Network Integration

20-channel CAN XL

- Supports high-speed communication up to 20 Mbps
- Built-in error detection ensures accurate bus monitoring

Full GMSL2 protocol compatibility

- Fully compatible with GMSL2 protocol
- Maximum transmission rate up to 6 Gbps

8-channel Automotive Ethernet

- Supports 100 / 1000BASE-T1 standards
- Flexible master / slave mode switching via TSMaster software for enhanced network continuity and reliability in testing scenarios

12-channel Hybrid LIN Bus

- 4-channels FastLIN supporting up to 200 Kbps high-speed communication
- Master/slave node configuration adjustable via TSMaster software
- 8-channels LIN-channels

I / O-channels and FlexRay

- Integrated 2-channel DIDO / AIAO
- Integrated 1-channel FlexRay interface

Local Storage and Network Connectivity

- Standard 32 GB eMMC storage, with optional high-capacity SATA / NVMe expansion
- Gigabit Ethernet interface for connection to host PC, avoiding bandwidth bottlenecks under extreme load conditions
- Supports remote access via 4G / Wi-Fi wireless connectivity

Ready-to-use across multiple operating systems



Model	Bus	I / O Interface	Storage	PC Interface
Tlog1057	8 × GMSL 8 × 1000BASE-T1 20 × CAN XL 1 × FlexRay 4 × FastLIN 8 × LIN	2 × DIDO / AIAO	Standard eMMC: 32 GB Optional: SATA / NVMe	Ethernet / 4G / BT / Wi-Fi

Automotive Ethernet

This series is developed by TOSUN for next-generation vehicle E / E architectures, delivering a one-stop solution from physical layer media conversion and network switching to protocol-level simulation and analysis.

Fully compatible with both Automotive Ethernet and standard Ethernet, the series supports advanced protocols such as DoIP and SOME / IP. It is designed to eliminate the physical barriers between traditional Ethernet and in-vehicle networks, enabling engineers to efficiently build domain controller test benches and automotive backbone network simulation environments.

Physical Layer Conversion and Network Switching Devices

TE1021 / TE1024 are high-performance physical layer media converters specifically designed for automotive Ethernet testing environments.

They enable bidirectional signal conversion between 100 / 1000BASE-T1 (Automotive Ethernet) and 100 / 1000BASE-Tx (Standard Ethernet), serving as a critical physical interface between ECUs and PC-based test systems.

The TE1024 integrates native NIC functionality, allowing it to be recognized directly as a standard network adapter by Windows / Linux systems. This enables full protocol stack communication without requiring a dedicated physical NIC port, significantly reducing test system topology complexity.

Key Features

Dual-Rate Compatibility

- Supports both 100BASE-T1 and 1000BASE-T1 standards
- Configurable data rates (100 Mbps / 1000 Mbps) via DIP switch

Physical Layer Transparency

- Performs signal conversion strictly at the physical layer
- Fully transparent to upper-layer protocols
- Ensures low latency and high data integrity

Flexible Hardware Configuration

- Multi parameter DIP switch configuration
- Supports Master / Slave mode, data rate, and auto-negotiation settings
- Enables fast switching between different network topologies

Plug-and-Play Design

- Driver-free operation
- Ready to use out of the box

Model	Function
TE1021	1 port 100 / 1000BASE-T1 to 100 / 1000BASE-Tx Media Converter
TE1024	4 port 100 / 1000BASE-T1 to 100 / 1000BASE-Tx Media Converter, integrated native NIC technology

TE1105

5-port switch that enables seamless hybrid connectivity between automotive Ethernet (T1) and standard Ethernet (Tx)



Flexible Hybrid Networking Architecture

Integrates automotive and standard Ethernet interfaces, enabling seamless cross-communication without external converters, with 100 / 1000 Mbps auto-negotiation.

Layer 2 Management and Monitoring

- VLAN Segmentation: Supports IEEE 802.1Q for flexible network segmentation and improved security
- Intelligent Filtering: MAC-based whitelist filtering for precise traffic control
- Port Mirroring: Supports flexible port mirroring for traffic monitoring and troubleshooting

Automotive Ethernet Interface

TE1051

Single-channel Ethernet-to-USB interface for monitoring and analyzing both standard and Automotive Ethernet via PC.



Portable and Easy to Use

- USB-powered, no external adapter required
- Driver-free plug-and-play with broad OS compatibility (driver required for Windows 7)

TSMaster-Defined Hardware

- Integrated standard and automotive Ethernet, switchable via TSMaster without hardware replacement

Interface Options

- Supports TE MATEnet or Rosenberger H-MTD automotive Ethernet connectors

Protocol and Development Support

- Supports DoIP and SOME / IP protocols
- High-precision hardware timestamping
- Windows API for automated test development

High-Speed Calibration

TX1000 is a high-speed calibration and debugging tool designed for high-performance ECU development. It leverages Gigabit Ethernet for high-bandwidth data communication and integrates DAP / JTAG / SWD debugging with CAN FD communication, enabling deep ECU control and monitoring via TSMaster.

High-Speed Communication Architecture

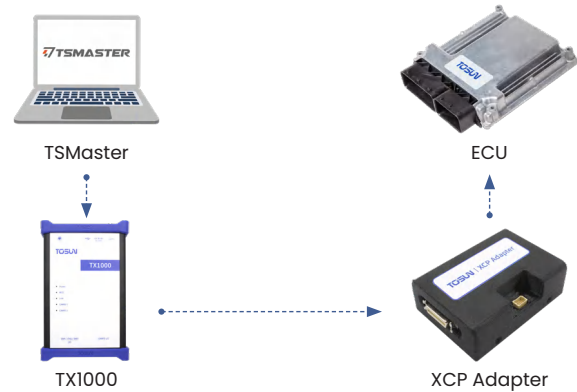
- Gigabit Ethernet uplink for high-throughput data transfer
- 2× CAN FD, up to 8 Mbps

Chip-Level Debugging

- Supports DAP, JTAG, and SWD protocols
- Compatible with major automotive MCUs

Core Control

- Supports halt, resume, and step execution
- Program counter modification for code control



Non-Intrusive Access

Direct memory access without CPU load or code modification

XCP Calibration

Supports high-speed calibration and data acquisition (DAQ)

Multi-Device Synchronization

μs-level hardware synchronization via sync interface

Bus Disturbance Generator

The TH Series is a professional toolset for deep protocol validation and stress testing of ECUs and chips. It supports fault injection at both physical and data link layers for CAN / CAN FD and LIN, and complies with ISO 16845 protocol conformance testing. It is essential for verifying ECU error handling and bus-off recovery behavior under extreme conditions.

High-Precision Disturbance

It provides 5 ns minimum injection resolution with a 200 MHz clock, enabling bit-level signal manipulation for fault detection under critical conditions.

Extended Disturbance Sequencing

With up to 65,536 programmable disturbance points, the TH series enables highly reproducible, complex fault scenarios.

Multi-Dimensional Triggering and Sampling

It supports frame, error frame, and software triggering, and includes built-in sampling point testing for ECU sampling accuracy verification.

Plug-and-Play Deployment

It supports RJ45 Ethernet or USB connectivity, features a driver-free plug-and-play design, and enables rapid automated test bench setup via TSMaster.

TH7011

CAN / CAN FD Bus Disturbance Analyzer

High-precision fault injection for CAN / CAN FD communication stability validation and fault reproduction.



Bit-level fault injection

Precise disturbance on arbitration, control, data, and CRC fields of CAN / CAN FD frames for bit-level error reproduction.

Multiple disturbance modes

Supports forced dominant, forced recessive, and signal inversion to reproduce intermittent faults.

Automated robustness testing

Triggers error frames via scripts to validate ECU TEC accumulation and Bus-off detection / recovery logic.

Bus-off behavior validation

Continuous fault injection to evaluate ECU recovery capability and behavioral consistency after Bus-off.

Physical layer tolerance testing

Adjustable bit width and phase offset to assess decoding stability under sampling deviation.

Quantified analysis

Error frame statistics and TEC tracking with disturbance counts and test reports.

TH7012

CAN / CAN FD / LIN Bus Disturbance and Testing Device

Multi-bus disturbance and validation platform for automotive network controllers and transceiver chips, supporting CAN FD, LIN, and UART interfaces for full-stack testing from physical to protocol layer.



LIN Bus Fault Tolerance and Boundary Testing

- Disturbance on sync break, sync field, and checksum to validate node error detection logic
- Frame header fault injection to test slave state machine reset capability
- Baud rate drift up to $\pm 14\%$ for clock mismatch tolerance evaluation

ISO 16845 Protocol Conformance Validation

- Built-in ISO 16845 test suite (based on ISO11898-1) for CAN controllers
- Supports standard, extended, and CAN FD frame handling validation
- Verifies response to Bit, CRC, stuffing, and format errors
- Error sequence injection to validate IUT state machine transitions between error states

CAN / CAN FD to Fiber Optic

TO1013

Optical Isolation and Relay

TO1013 delivers EMI / EMC-immune optical isolation for stable, long-distance CAN/CAN FD communication in harsh environments.



Simplified Architecture with Direct USB Connection

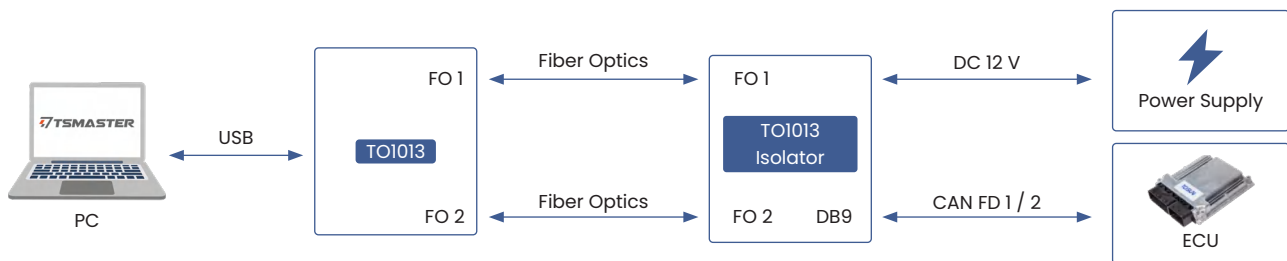
- Integrates the CAN FD controller into the fiber transceiver, eliminating the need for external CAN interface cards
- PC-side unit connects via USB for both power and data through a single cable
- Isolator-side unit is powered by 12V DC and connects directly to the DUT for test setup

Hardware Reliability and Flexible Configuration

- Configurable termination and filtering via DIP switches (60 / 120 Ω , 22 / 470 pF)
- Built-in ESD and surge protection with optical isolation for stable operation in harsh environments
- μ s-level hardware timestamping for high-precision analysis

Software and Development Support

- Fully compatible with TSMaster for CAN / CAN FD monitoring, simulation, UDS diagnostics, and CCP / XCP calibration
- Supports mainstream formats including BLF, ASC, DBC, ARXML, and A2L
- Driver-free on Windows / Linux with plug-and-play functionality
- Provides comprehensive APIs for rapid integration into automated test systems



TC201

Signal Triggering and Conditioning

TC201 is a CAN / CAN FD bus trigger device that converts differential signals into a single-ended BNC trigger output, improving oscilloscope measurement stability.



Electrical isolation

Built-in 2500V DC isolation module eliminates ground loop disturbance and protects both oscilloscope and ECU.

Cost-effective probe replacement

Converts CAN High / Low differential signals into standard logic waveforms with direct BNC output, reducing testing cost.

Stable triggering

The DB9-to-BNC design provides clean trigger signals and reliable waveform capture.

CAN FD support

Fully compatible with CAN and CAN FD for high-speed automotive bus testing.

TC1021 / TL1021

UART Physical Layer Transparent Transmission

UART-to-CAN / LIN physical layer converter enabling long-distance, high-EMI-resistant serial data transmission without changing the original data format.



Transparent Transmission Mechanism

End-to-end data format remains unchanged
Only the physical transmission medium is converted (no protocol conversion required)
No additional software or protocol adaptation needed.

Physical Layer Enhancement

- Uses CAN differential signaling or LIN physical layer for strong EMI immunity in harsh environments
- Ensures stable long-distance transmission over hundreds of meters (CAN mode)

TL1021 (UART over LIN): Converts UART data into LIN physical-layer signals.

Suitable for K-Line or LIN based physical layer applications and compliance testing scenarios.

TC1021 (UART over CAN): Converts UART data into CAN physical-layer signals (CAN_H / CAN_L).

Designed for high EMI immunity and long-distance transmission, supporting up to 1 Mbps UART baud rate.

Sensor Signal Acquisition

TC4016

SENT / PSI5 Signal Acquisition

TC4016 is a SENT / PSI5 sensor acquisition device enabling real-time decoding and protocol validation via Gigabit Ethernet.



High-Density Acquisition-channels

- 20 SENT-channels (first 10 support SPC mode)
- 16 PSI5-channels
- 4 DI / DO-channels and 3 AI / AO-channels
- Supports high-density multi-sensor parallel data acquisition

CAN / CAN FD Integration

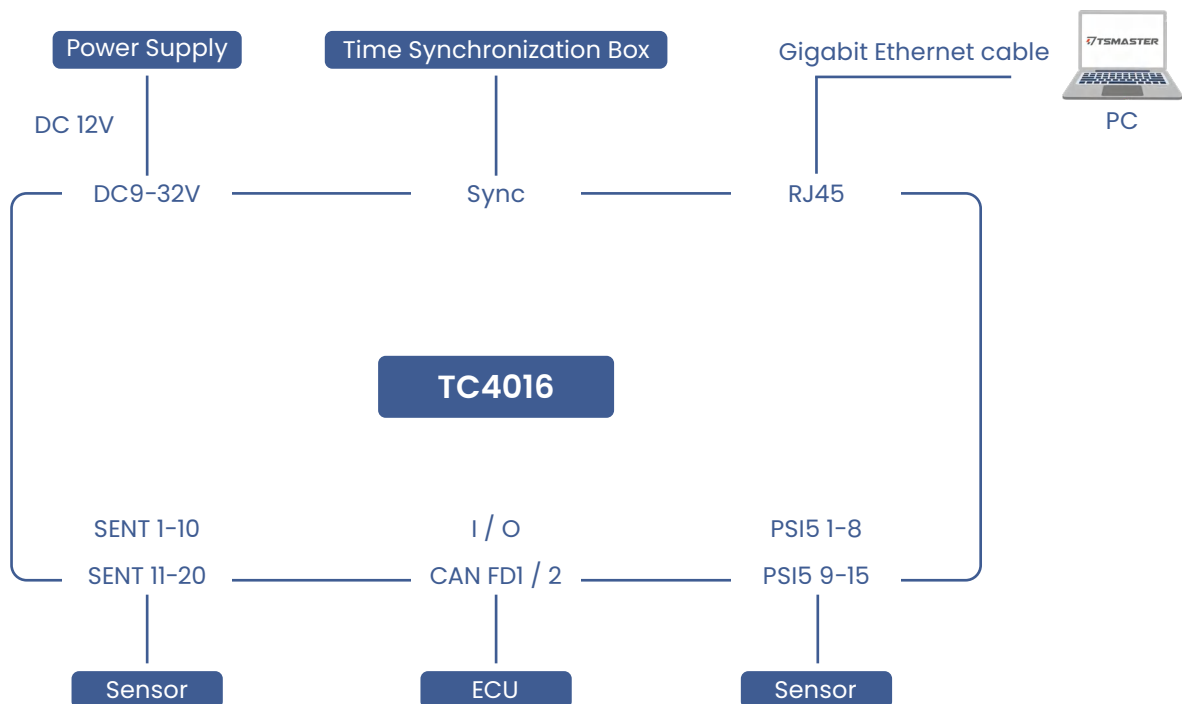
- 2 CAN / CAN FD-channels, up to 8 Mbps
- Software-configurable 120 Ω termination
- Supports Self-ACK mode for flexible network simulation

Multi-Device Time Synchronization

- μ s-level hardware timestamping
- Supports TSync01 for multi-device synchronization
- Ensures precise time alignment across distributed acquisition systems

Open Development Ecosystem

- API-based development support with sample projects
- Easily integrates into HIL systems, automation test platforms, and data logging systems



TS3004

Thermocouple Temperature Acquisition Device

8-channel thermocouple acquisition device that outputs high-precision temperature data via CAN / CAN FD.



Excellent Measurement Performance

- 8-channel parallel acquisition with K-type thermocouples by default (J/N/R/S/T/E/B types optional)
- Wide temperature range: -200°C to +1370°C for multi-scenario testing
- Built-in cold-junction compensation and linearization deliver calibrated °C output directly

High-Speed CAN FD Communication

- 1 CAN FD-channel, up to 8 Mbps with BRS support for low-latency 8-channel data transmission
- Built-in 120 Ω termination via hardware switch for flexible network configuration



Industrial-Grade Electrical Reliability

- $\pm 45V$ input protection against wiring faults and voltage leakage
- 2500V DC isolated CAN interface to eliminate ground loop disturbance
- 50 Hz noise filtering (60 Hz optional) for industrial EMI suppression
- Real-time diagnostics for open circuit, over / under-voltage, over-temperature, and sensor faults

Flexible Dual-Mode Configuration

- Default mode: fixed 1 Mbps with online configuration support
- Custom mode: automatic loading of user-defined parameters (sensor type, reporting cycle, CAN settings, message format, etc.)

TM2101

Integrated Navigation & Positioning Sensor

GNSS+IMU navigation device that outputs real-time positioning and motion data via CAN / CAN FD.



Multi-Dimensional Sensing

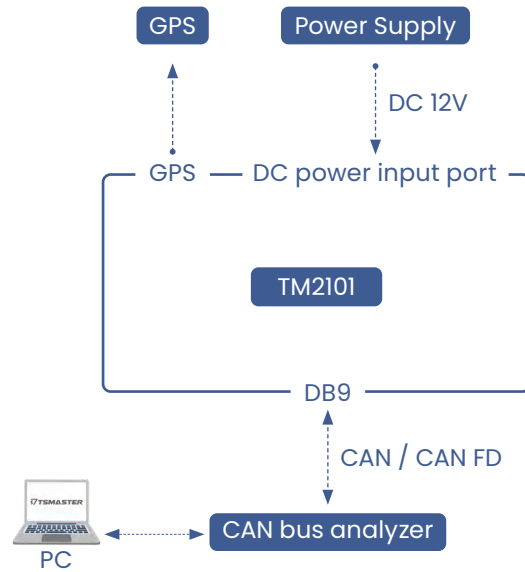
- Multi-constellation GNSS (BDS / GPS / GLONASS) for reliable positioning in complex environments
- Built-in IMU for real-time acceleration, angular velocity, and full motion capture

High Protocol Flexibility

- Fully configurable CAN/CAN FD frames, including ID, cycle time, and STD/EXT frame format
- Adjustable data length (DLC=8 or DLC=15) for different bandwidth requirements

Automatic DBC Generation

- Auto-generates DBC files via TSMaster based on configuration
- Enables instant signal decoding and visualization without manual database setup



Time Synchronization Unit

TSync01

High-precision time synchronization device that provides a unified satellite-based time reference and eliminates clock drift in distributed systems.



Multi-Constellation Time Synchronization

Supports BDS (BeiDou), GPS, and GLONASS for reliable global timing sources in all environments.

Microsecond-Level Precision

Provides μ s-level synchronization accuracy for time-sensitive applications and multi-source data alignment.

Flexible Synchronization Modes

Supports absolute time sync (UTC based) and relative internal alignment modes for different engineering scenarios.

Multi-Device Distribution

Supports up to 6 slave devices in a synchronized network for system-level time coordination.

ECU Flashing Tool

TF1011

1-channel CAN / CAN FD, enabling standalone updates and diagnostics without a PC



Classic Application:

- Offline UDS diagnostics and functional testing
- Flash Bootloader programming for OEM production lines or after-sales service offline firmware updates



No-Code Workflow Configuration

Deeply integrated with TSMaster, allowing users to configure UDS diagnostics and Flash Bootloader processes via a graphical interface without any coding, reducing development effort and debugging time.

One-Click Multi-Task Switching

Supports storage of up to 3 independent tasks. Easily switch between different vehicles or ECUs via hardware buttons to improve on-site efficiency.

Wide Protocol and Chip Support

- Supports standard UDS and custom SeedKey algorithms
- Supports Infineon UART on CAN and TLE989x BootRAM firmware download

Intelligent Hardware Control

- Power: DB9 interface, powered directly through OBD-II or harness
- Auxiliary Control: Supports periodic messaging (session keep-alive) and DUT power control, with built-in configurable 120 Ω termination and DC 2,500 V isolation for stable operation
- Security (Optional): Access control with remote configuration updates to prevent firmware leakage and misuse

Gateway Series

The GW series is an intelligent gateway lineup designed for multi-bus interconnection, protocol conversion, and remote access in in-vehicle networks. It covers a wide range from dual-channel to multi-channel gateways, supporting CAN / CAN FD / LIN / Ethernet / RS485 / EtherCAT communication.

Intelligent Bridging and Protocol Conversion

- **Baud Rate Adaptation:** Enables seamless communication between networks with different bit rates (e.g., 500 kbps to 2 Mbps)
- **Protocol Bridging:** Supports bidirectional conversion (e.g., CAN to CAN FD), allowing legacy devices to connect to high-speed networks
- **Signal Extension:** Acts as a physical repeater to extend bus distance, modify topology, and provide electrical isolation

Message Filtering

Supports ID-based filtering for intelligent forwarding, reducing redundant traffic and improving efficiency.

Comprehensive Protocol Integration

- **High-Density-channels:** Integrates CAN / CAN FD / LIN / RS485 / EtherCAT slave interfaces for automotive and industrial applications
- **Hybrid Routing:** User-defined routing and signal-level mapping via TSMaster, enabling CAN-to-CAN, LIN-to-CAN, and I/O linkage logic

Offline Operation

(GW2112 / GW2202 / GW2204 / GW2208)

support standalone gateway operation. Configured logic can be stored in the device and executed automatically after power-on without a host PC-ideal for in-vehicle testing and unattended scenarios.

GW1040

Integrating CAN FD, LIN, DI / DO, and EtherCAT / RS485 for unified automotive and industrial testing and connectivity.



Automotive and Industrial Cross-Domain Integration

- **EtherCAT Slave Support:** Integrates 1 EtherCAT interface, enabling seamless connection as a slave device to industrial automation systems. Achieves μ s-level synchronization and data exchange between industrial systems (e.g., test benches) and automotive ECUs (e.g., MCU control)
- **RS485 Serial Communication:** Integrates 1 RS485 interface for connecting industrial sensors or legacy instrumentation.
- **I / O Interface:** Includes 4-channel DI / DO. Supports logical mapping between external trigger signals (e.g., emergency stop, ignition) and bus messages, or direct control of external relays via bus commands, enabling integrated communication and control testing.

Cross-Platform Plug-and-Play

GW2112

High-performance offline CAN / CAN FD gateway with dual-channel routing for bridging, protocol conversion, and load optimization across heterogeneous networks.



Multi-channel CAN FD and DI/DO control

Integrates 2 high-performance-channels to enable automatic bidirectional data forwarding based on preset filtering and mapping rules, ensuring seamless cross-network communication.

Millisecond-Level Fast Forwarding

With latency below 0.5 ms, ensures strict real-time performance and timing accuracy even under high CAN FD bus load.

Offline Persistent Operation

Routing rules are stored in hardware memory and retained after power loss. The device automatically loads the latest configuration at startup, enabling standalone operation without a PC.

Multi-Protocol and Baud Rate Adaptation

Supports baud rate matching between different networks and enables hardware-level bidirectional conversion between CAN and CAN FD.

Bus Performance Enhancement and Relay

Acts as a gateway repeater to increase bus load capacity, enhance signal quality, and extend communication distance in complex wiring environments.

Engineering-Friendly Deployment

USB plug-and-play design with driver-free cross-platform support. Configuration rules can be exported as local files for fast import and multi-device deployment.



GW2202 / GW2204 / GW2208 / GW2212

Multi-channel CAN FD and DI / DO control, designed for automated test benches, distributed data acquisition, and industrial control systems.



Full-channel Electrical Isolation

Provides complete DC 2,500 V isolation between-channels and between-channels and ground, effectively eliminating ground loops and signal disturbance caused by potential differences. Ideal for multi-ECU parallel testing, multi-power domain systems, and motor test benches, significantly improving system safety and signal integrity.

Integrated Digital I / O

Standard 4-channel DI and 2-channel DO support synchronization between external trigger signals (e.g., ignition, emergency stop) or control signals (e.g., relay switching) and CAN bus data, enabling integrated communication and control testing in a single device.

TSMaster-Defined Hardware

- Termination Resistor: Each CAN-channel includes a built-in 120 Ω termination resistor
- Operating Modes: Supports Normal, No-ACK, Restricted, Internal Loopback, External Loopback, and Self-ACK modes

Models and Interfaces

GW2202 / GW2204 / GW2208 / GW2212

- I / O configurations scale from 2 to 12-channels (including DI / DO variants)
- PC interface: Ethernet

Cross-Platform Plug-and-Play

Gateway Series

Model	CAN FD	I / O Interface	PC Interface
GW2202*	4	4 × DI / 2 × DO	Ethernet
GW2204*	8		
GW2208*	12		
GW2212*	8		

*Supports full-channel independent electrical isolation

GW2208+

Intelligent gateway integrating
8-channels CAN / CAN FD, 2 LIN-channels,
4-channels DI, and 2-channels DO.



Protocol Routing and Conversion

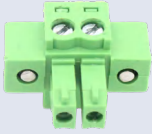
Supports bidirectional conversion across CAN ↔ CAN FD, CAN ↔ LIN, and LIN ↔ LIN networks.

TSMaster-Defined Hardware

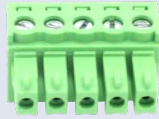
- Termination Resistor: Built-in 120 Ω CAN termination, configurable via software
- LIN Mode: 2 LIN-channels support software-configured Master / Slave modes, compatible with LIN 1.3 / 2.x protocols
- Test Assistance: Supports Self-ACK mode, enabling standalone single-node communication testing without external devices

Cross-platform, driver-free plug-and-play operation via RJ45 Ethernet connection to the host PC

Accessories



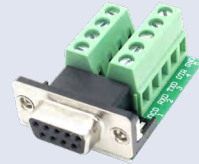
2-pin phoenix connector



5-pin phoenix connector



20-pin FPC press
fit connector



DB9 female connector



DB37 to 8 × DB9
adapter cable



DB37 to 12 × DB9
adapter cable



DB9 female connector
to 2 × banana



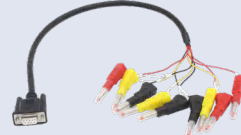
DB9 female connector
to 3 × banana



DB9 female connector
to 4 × banana



DB9 female connector
to 5 × banana



DB9 female connector
to 9 × banana



Banana-to-banana
connection cable



DB9 female to dual DB9
male signal cable (FlexRay)



DB9 female to dual DB9
male signal cable (CAN / LIN)



DB9 female to dual DB9
male signal cable (CAN)



MATenet Ethernet Cable



DB9 female with screws-
cigarette lighter cable



RJ45 Ethernet cable



DB9 to OBD adapter cable



KH-DB9 CAN cable (MPI013)



Rosenberger H-MTD Cable



GPS Antenna

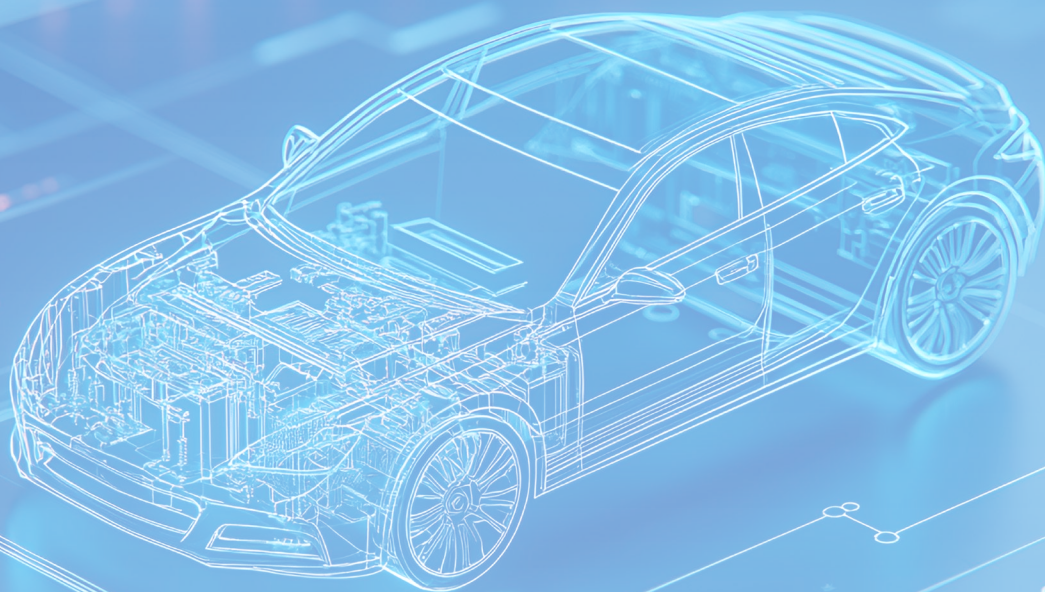


12 V / 2 A power adapter



Surge Protection Device

Solution

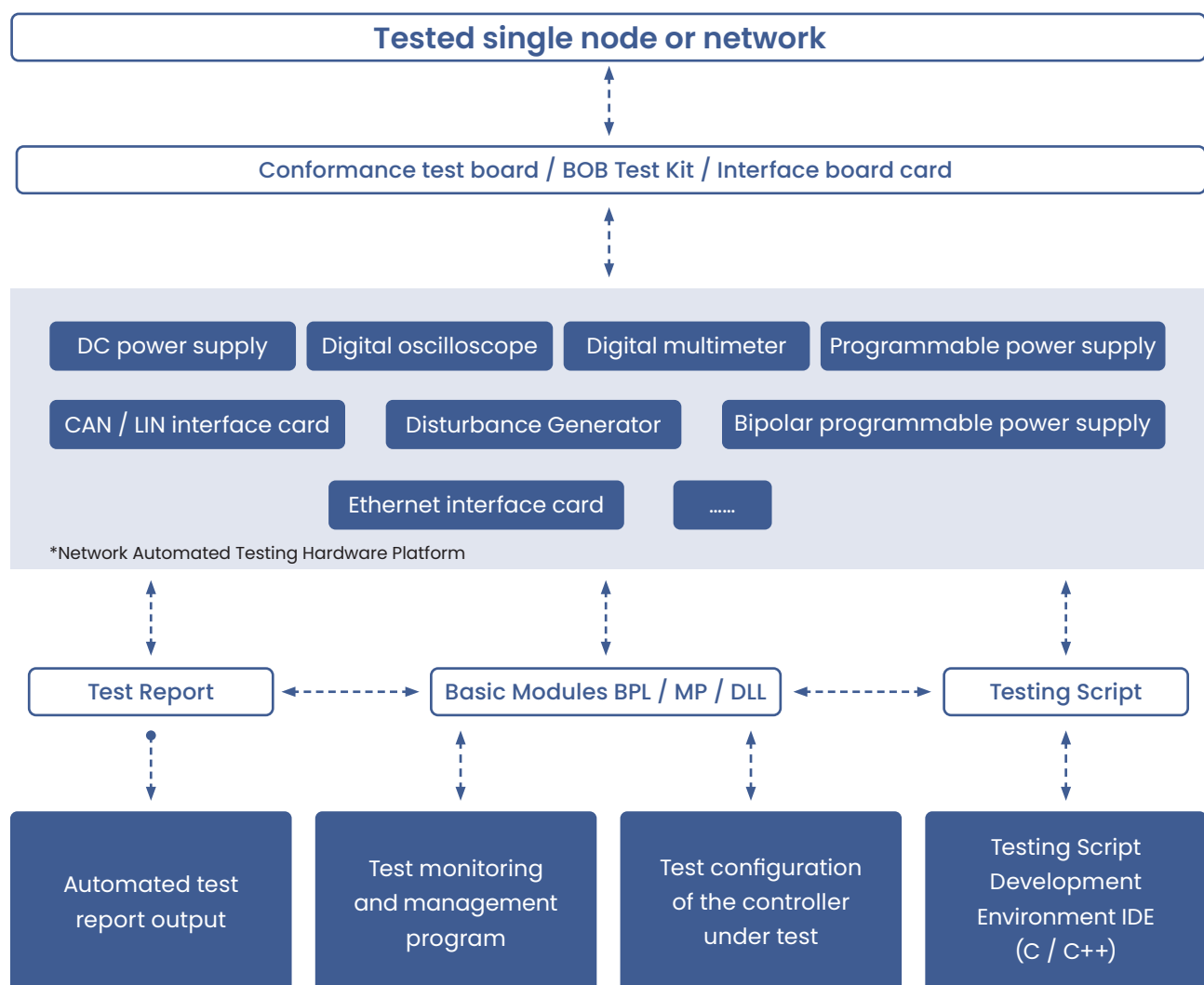


Bus Conformance Solution

A standardized compliance validation system designed for automotive OEMs and Tier-1 suppliers. Built around the powerful TSMaster platform, it integrates bus interface cards, bus disturbance tools, and dedicated conformance test modules, along with external instruments such as oscilloscopes, programmable power supplies, and digital multimeters.

With a hardware-standardized, software-driven, and modular test architecture, the system enables fully automated testing across all bus network layers—from physical and data link to application (network management, diagnostics, flashing, and routing)—and generates standards-compliant test reports.

CAN / LIN Conformance Testing System Architecture:



*Network Automation Testing Software Platform

Key Advantages

High Integration, One-Stop Delivery

Integrates communication simulation, disturbance injection, electrical measurement, and power control into a single platform. One system covers all dimensions of conformance testing, significantly reducing lab equipment redundancy and maintenance costs.

End-to-End Automation, One-Click Reporting

Supports one-click execution of automated test sequences with no manual intervention. Upon completion, the system automatically performs data analysis and evaluation, generating professional reports with waveform captures and detailed results—greatly improving validation efficiency and accuracy.

Open Ecosystem, Highly Scalable

Built on the TSMaster scripting engine with strong secondary development capabilities. Users can quickly develop or modify test cases, customize report templates, and extend to new application scenarios based on project needs.

Referenced Standards

The system's test case library strictly complies with international and OEM standards.

Testing Capabilities

The system provides full-layer test coverage, supporting ISO, SAE standards, and OEM-specific requirements:

Physical Layer Testing

Covers voltage levels, resistance and capacitance, rise / fall times, and fault tolerance under various error conditions.

Data Link Layer Testing

Includes bit timing accuracy, sample point position, DLC validation, and bus load stress testing.

Interaction Layer Testing

- CAN: message cycle stability, event-triggered mechanisms, signal default values
- LIN: schedule timing and sequence validation

Application Layer Testing

- Network Management: supports AUTOSAR NM, OSEK NM, sleep / wake logic, and direct / indirect NM testing
- Diagnostics and Flashing: supports UDS validation, flashing, and communication diagnostics
- Gateway Routing: supports cross-bus routing logic and latency testing

System-Level Testing

Covers end-to-end validation from physical to interaction layers, including network management and fault tolerance.

International and industry standards	OEM Standards
ISO Series ISO 11898, ISO 16845, ISO 14229, ISO 15765, ISO 17987, ...	BAIC, BYD, CHERY, GAC, GEELY 3.0 / 3.5, GMW 14241, JAC, SAIC, ...
SAE Series SAE J1939, SAE J2602, ...	
Others AUTOSAR, OSEK, LIN 2.x, GB / T 42691, ...	

ECU and Flashing Solution

Built on the TSMaster software ecosystem and TOSUN bus tools, this solution provides a comprehensive workflow from basic UDS diagnostics to advanced Flash Bootloader programming. With a fully graphical configuration approach, users can develop flashing processes without extensive programming expertise. It delivers a cost-effective, low-barrier solution for efficient and reliable ECU diagnostics and firmware updates, covering the entire lifecycle from R&D and production to after-sales service.

Key Features

- **UDS Diagnostics**
Configure diagnostic services and monitor request / response messages in real time for transparent interaction
- **Visual Flashing Configuration**
Build UDS-based Flash Bootloader workflows via GUI with zero coding required
- **ODX / PDX Support**
Load standard diagnostic databases with automatic parsing of services and parameters to reduce manual errors
- **Automated Testing and Reporting**
Enable regression testing and generate detailed reports automatically for validation compliance

Deployment Modes

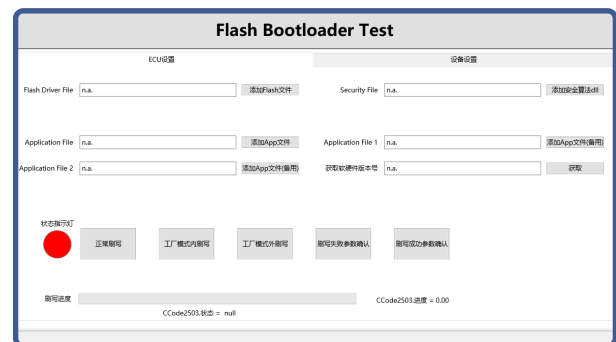
- **Desktop Development:** Diagnostic module + Panel (PC-based operation)
- **Production Integration:** Diagnostic module + Panel + RPC / COM (integration with MES or test systems)
- **Standalone After-Sales Tool:** Generate independent executable (.exe) without full TSMaster installation
- **Handheld Flashing:** Deploy workflows to TF1011 for offline operation without PC
- **Remote OTA:** Combine with wireless CAN (Bluetooth / Wi-Fi / 4G) for remote ECU updates
- **Cloud-Based Management:** Centralized control of user access, diagnostic databases, encrypted DLLs, and firmware files

Advantages

- **Low- / No-Code Development:** Configure workflows with minimal programming knowledge
- **High-Precision Timing Control:** 0.1 ms-level transport layer control ensures stability under high network load
- **Full Protocol Coverage:** Supports CAN / CAN FD / LIN / FlexRay / Ethernet
- **Broad File Format Support:** Compatible with Hex, S19, Bin, VBF, and more
- **Flexible Interaction and Control:** Supports both GUI-based operation and API-driven automation

Applications

- **R&D:** Rapid firmware iteration, Bootloader validation, diagnostic debugging
- **Manufacturing:** Flashing in FCT / EOL and automated production lines
- **After-Sales:** Vehicle upgrades at service centers and remote OTA diagnostics and flashing



SecOC Testing Solution

As automotive E / E architectures evolve, authentication and data integrity in in-vehicle communication are increasingly critical. Built on the TSMaster software platform and high-performance bus toolchain, TOSUN provides a full-stack cybersecurity testing solution covering SecOC (CAN / CAN FD) and MACsec (Automotive Ethernet), enabling protocol simulation and activation across the entire workflow—from R&D validation to production EOL.

Key Features

Unified Security Management Architecture

The solution separates global and project-level configurations to ensure both security and flexibility

- **Global Security Configuration:**
Centralized management of sensitive assets such as keys and X.509 certificates. Security files are decoupled from project files and stored locally in encrypted form, preventing leakage during project sharing
- **Project Configuration:**
Supports direct ARXML import with automatic mapping of PDUs and security policies. Users can flexibly assign key pairs to different messages based on Data IDs

MACsec Validation

Supports link-layer encryption and integrity verification based on IEEE 802.1AE

- **Multi-Mode Protection Testing:**
Validates integrity-only and confidentiality modes with configurable offsets (0 / 30 / 50 bytes)
- **MKA Protocol Simulation:**
Built-in MKA stack simulates key server behavior for dynamic key distribution and session timeout validation
- **Flexible Parameter Configuration:**
Supports stress testing of key parameters such as SCI port, replay window size, and packet number (PN) limits

Full-Stack SecOC Simulation

Provides in-depth protocol stack simulation for AUTOSAR-compliant CAN / CAN FD secure communication

- **Multi-Dimensional Freshness Value Management:**
Supports PDU-based, timestamp-based, and synchronized counter-based freshness mechanisms
- **High-Fidelity Truncation Logic:**
Strictly follows protocol specifications by combining truncated freshness values and partial MAC to generate standard secured I-PDUs
- **Custom Plugin Support:**
Enables compatibility testing for non-standard protocols by integrating third-party algorithm libraries via security plugins

Advantages

- **Multi-Protocol Coverage**

A single solution supports both SecOC and MACsec, covering mainstream in-vehicle security protocols and enabling hybrid network testing across CAN FD and automotive Ethernet

- **Compliance and Ease of Use**

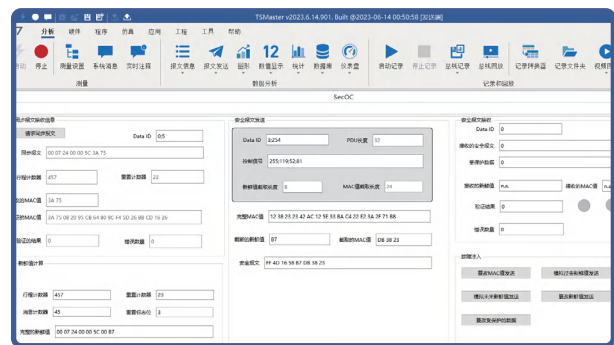
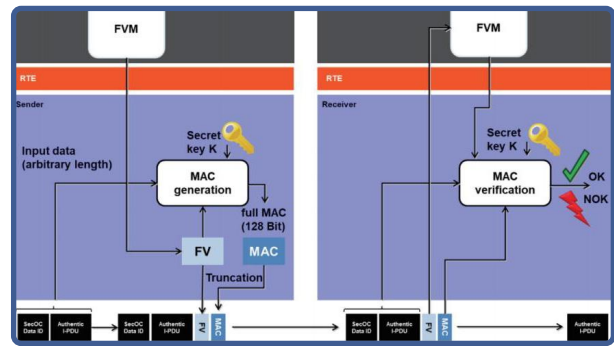
Deeply aligned with AUTOSAR standards, supporting batch import of ARXML databases and automatic Data ID mapping, significantly reducing manual configuration effort and improving test deployment efficiency.

- **Highly Scalable Algorithm Library**

In addition to built-in standard cryptographic algorithms, engineers can leverage TOSUN's security plugin framework to freely call basic security algorithm functions within scripting modules, enabling customized implementations.

- **Visual Monitoring and Analysis**

Supports secure message transmission within the RBS environment. The Trace window allows real-time inspection of secure frame structures, including raw payload, truncated freshness value, and authentication data fields, enabling intuitive communication validation.



EV Charging Test System

With the rapid development of high-power charging, plug-and-charge, and V2G technologies, EV charging systems are becoming increasingly complex, creating higher demands for protocol conformance and interoperability testing.

TSMaster-based EV charging protocol conformance test system is a modular and scalable automated platform designed for EV and EVSE communication testing. Built on a measurement-control and power separation architecture, the system integrates TSMaster software, bus tools, high-voltage interface modules, and programmable power supplies to support GB / T, ISO 15118, and DIN 70122 standards. It enables full-process charging simulation and advanced fault injection testing for comprehensive validation of charging systems.

Core Features

Full Voltage Range and High-Power Support

- **Wide-Range Simulation**

Supports AC 220 V charging simulation and high-power DC fast charging up to DC 1,000 V / 1,000 A, meeting the requirements of 800 V high-voltage platforms and next-generation ultra-fast charging technologies

- **Flexible Architecture**

Adopts a separated design for the power / load unit and simulation control cabinet, enabling flexible configuration to meet different power supply and load requirements across various application scenarios

Advanced Fault Injection and Boundary Testing

- **Signal-Level Fault Injection**

Equipped with dedicated fault injection modules, supporting various physical-layer fault simulations including PE pin disconnection, CP / CC circuit open faults, abnormal PWM frequency / duty cycle, and insulation resistance simulation

- **Protocol-Level Attack and Validation**

Supports error frame injection, timeout simulation, and data tampering at the communication message level to verify the DUT's safety protection mechanisms under extreme operating conditions

Comprehensive Standard

- **Comprehensive Standard Protocol Coverage**

Fully supports core standards including GB / T 27930, GB / T 34657.1 / 2, and GB / T 34658. Through continuous updates and dynamic iteration, the testing solution remains synchronized with the latest regulatory requirements.

- **European and International Standards Support**

Supports ISO 15118-4 / 5 (CCS Combined Charging System) and DIN SPEC 70122, meeting the Plug and Charge and V2G testing requirements for export vehicle platforms.

Highly Automated and Open Ecosystem

- **Excel and Script Dual-Mode Configuration**

Supports direct test case definition through Excel spreadsheets, while also enabling complex logic development using C / Python scripts, significantly lowering the barrier to automated testing

- **Automated Report Generation**

Automatically generates Word / PDF test reports after execution, including detailed waveform screenshots, data evaluation results, and pass-rate statistics

- **Source-Level Script Delivery**

Test scripts are delivered in source form, allowing users to adapt to evolving standards and perform deep customization.



Test Capabilities

The system covers the complete charging test process, from physical connection and communication handshake to charging termination.

Test Category	DC Charging Test (DC)	AC Charging Test (AC)	EU / US Standard / V2G Testing
Interoperability	Vehicle / charger connection, self-check and pre-charge testing, insulation fault simulation, PE disconnection, and communication interruption testing.	CC / CP signal interruption testing, S3 switch disconnection simulation, PWM duty cycle / frequency boundary testing.	SECC discovery protocol testing, TCP / IPv6 binding process, V2GTP message encapsulation testing.
Protocol Conformance	Handshake timing, parameter logic validation, state transitions, and error handling.	Charging readiness timing, start / stop logic, and maximum current limit verification.	TLS secure transmission testing, Plug and Charge (PnC) process, and External Identification Means (EIM) mode testing.

Application Domains

The system features excellent compatibility and is widely used in the development, testing, and maintenance of various motors and drive systems.

New Energy and Intelligent Vehicles

- New energy vehicle drive motors
- Autonomous driving actuator motors
- Starter motors

Industrial Automation and Robotics

- Robotic joint motors
- Permanent Magnet Synchronous Motors (PMSM) and servo variants
- Three-phase induction motors / inverter motors

Consumer and General Power Applications

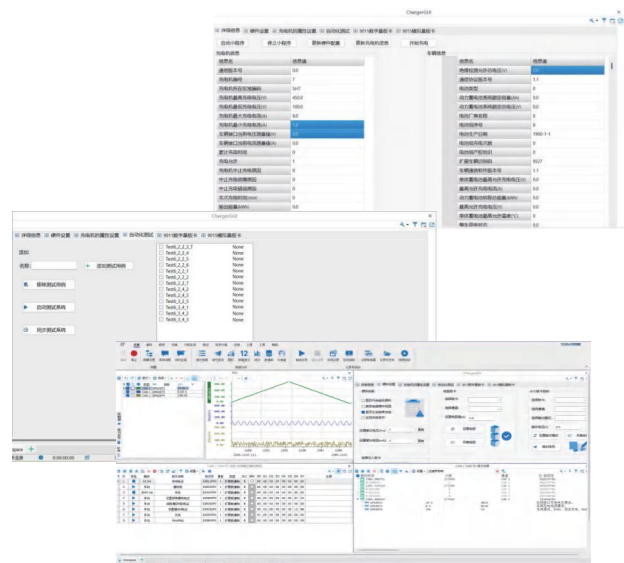
- Brushed and brushless DC motors (BLDC)
- Single-phase induction motors
- Electric motorcycle motors
- Power tool motors

Drivetrain Components

- Gear reducer performance testing

Application Scenarios

- **Vehicle and Charger Interoperability Testing**
Resolves charging failures caused by vehicle-charger incompatibility.
- **OBC / BMS Development Validation**
Supports the complete development and validation process from MIL (Model-in-the-Loop) to HIL (Hardware-in-the-Loop).
- **Export Vehicle Certification**
Provides ISO 15118 pre-conformance testing for CCS1 CCS2 standards to shorten certification cycles.
- **Production Line EOL Testing**
Used for rapid functional screening before charging modules leave the production line.



Motor Performance Test System

The Motor Performance Test System is designed for validating motor drive systems. With the growth of new energy vehicles and advanced manufacturing, it integrates performance evaluation and durability testing to improve motor quality and innovation.

Using high-precision torque and speed measurement, it calculates real-time power output and accurately assesses motor performance under various loads. This enhances safety, energy efficiency, and providing solid data support for engineering decisions and product competitiveness.

Core Functions

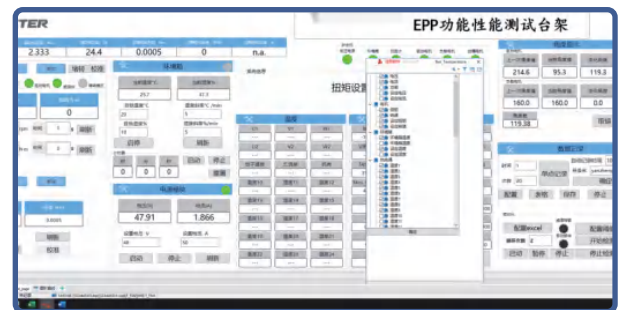
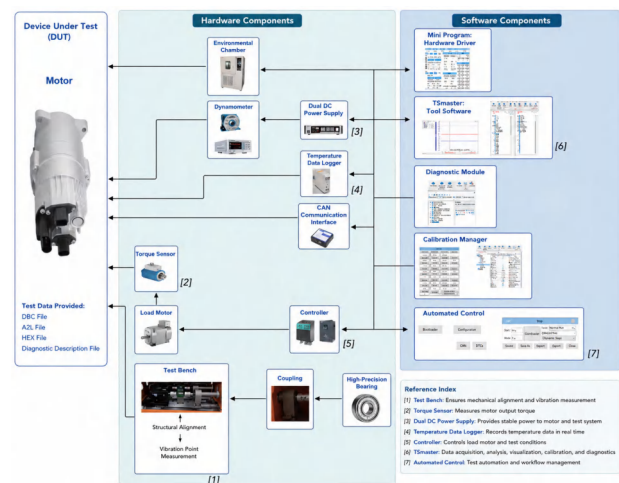
Leveraging the powerful data processing capabilities of TSMaster software, the system enables real-time acquisition, analysis, and visualization of test data.

Full Input and Output Parameter Measurement

- **Input Side (Electrical Parameters):**
Comprehensive monitoring of voltage, current, electrical power, and other input parameters to verify drive source stability.
- **Output Side (Mechanical Parameters):**
High-frequency acquisition of torque, rotational speed, and mechanical power to calculate real-time conversion efficiency.

Automatic Characteristic Curve Generation

The system automatically generates motor characteristic charts based on collected data, enabling visualization of motor performance across the full operating range and supporting targeted optimization.



Component Durability Solution

Durability testing verifies whether a product can reliably operate throughout its intended service life by simulating continuous or overstressed operating cycles for a defined number of repetitions. It follows industry-standard qualification criteria to ensure the product maintains functional, structural, electrical, and mechanical integrity without unacceptable degradation or safety risks after testing. This solution helps identify design weaknesses early, supports product optimization, and ensures long-term reliability in real-world applications.

Core Functions

The system provides comprehensive testing capabilities across four dimensions for full reliability evaluation.

Long-Term Continuous Operation Testing

Simulates real-world wear and aging through uninterrupted continuous operation, enabling rapid detection of potential failures caused by long-term use.

Load and Stress Testing

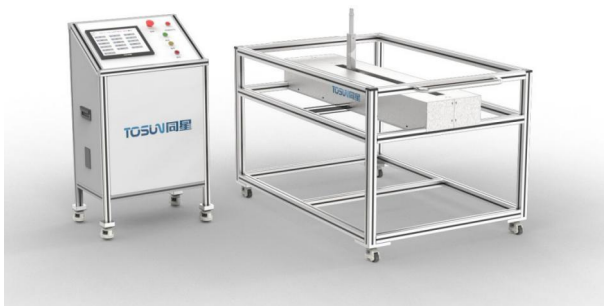
Applies different levels of mechanical loads and electrical stress to verify product performance stability and structural strength under full-load and overload conditions.

Extreme Environmental Testing

Integrated environmental chamber control enables operation testing under high / low temperature, high humidity, and thermal shock conditions to evaluate the tolerance of materials and electronic components to environmental changes.

Reliability and Fault-Tolerance Testing

Introduces fault injection (such as communication interruption and voltage drop) and operational error simulation during test cycles to evaluate system self-protection and automatic recovery capabilities under abnormal conditions.



Application Cases

This solution has been widely applied in durability validation for automotive electronics and electromechanical actuators, covering body systems, vision sensing systems, and power control systems.

Body Closure Systems

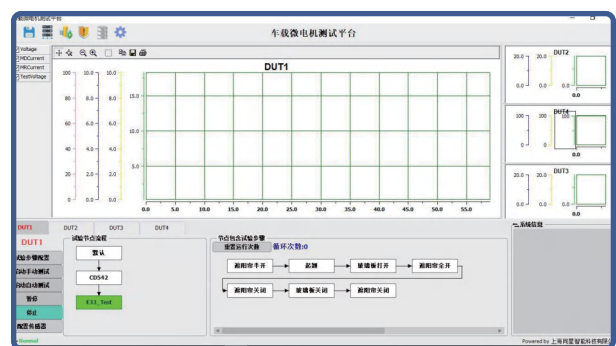
Includes durability testing of sunroof opening / closing mechanisms and structural strength, door lock and hinge endurance testing, window regulator aging tests, as well as cycling durability tests for electric sunshades and active rear spoilers.

Vision and Perception System

Used for long-term operational reliability testing of in-vehicle camera modules under vibration and temperature cycling conditions.

Motors and Actuators

Supports start-stop endurance testing, load aging tests, and thermal rise testing for both DC and brushless motors.

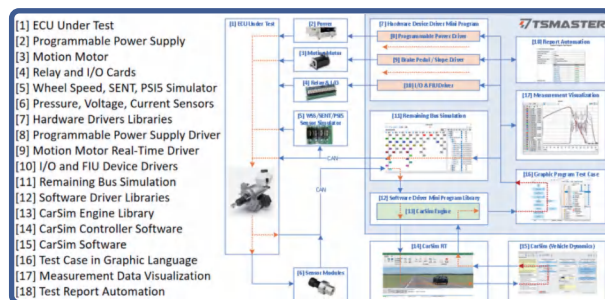


HIL Simulation Testing Solution

This solution is a lightweight and highly flexible Hardware-in-the-Loop (HIL) simulation platform built on TSMaster software, TTS systems, and bus interface hardware.

By integrating virtual simulation models such as Simulink and CarSim with real vehicle networks including CAN / CAN FD, LIN, FlexRay, and Ethernet, it enables efficient real-time simulation and testing.

Powered by TSMaster's open architecture and high-performance TTS hardware, users can quickly build environments ranging from Remaining Bus Simulation (RBS) to complex vehicle dynamics closed-loop testing, providing an efficient validation platform for ECU development.



Hardware Platform

TTS System and Bus Interface Hardware

The TTS platform and bus interface cards provide reliable real-time I / O and communication interfaces for HIL applications.

- Integrated CAN / CAN FD / LIN / FlexRay / Ethernet interfaces
- Built-in AI / AO, DI / DO, and PWM-channels for direct ECU connection
- Modular expansion for additional I / O and bus resources
- Optimized real-time performance with microsecond-level response and deterministic closed-loop control

Core Functions

This HIL solution provides comprehensive simulation and validation capabilities for ECU and vehicle network testing.

Vehicle Network Support

Supports CAN / CAN FD, LIN, FlexRay, and Ethernet with real-time signal analysis, database management, and online monitoring through TSMaster.

Simulation Integration

Supports Simulink C code execution, real-time co-simulation, direct .slx model loading, and CarSim integration for vehicle dynamics and controller validation.

Plant Model Library

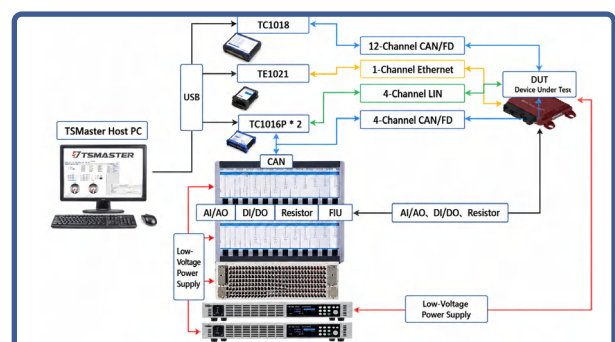
Includes high-fidelity engine, motor, battery, vehicle dynamics, and intelligent driver models for NEDC, CLTC, and custom driving cycles. Custom model development is also supported.

Remaining Bus Simulation (RBS)

Automatically simulates missing network nodes and maintains ECU communication for rapid test environment setup.

Graphical Automated Testing

Provides visual flowchart-based test programming with automated execution, parameter adjustment, signal transmission, and result evaluation to improve testing efficiency.



Key Advantages

Software-Defined Real-Time Performance

TSMaster delivers low-latency, real-time scheduling on Windows for synchronized model simulation and bus communication.

Simplified Workflow

Direct integration with Simulink and CarSim enables fast deployment to HIL environments with reduced development effort.

High Integration

Combines bus analysis and simulation control in a single platform for real-time monitoring and parameter adjustment.

Cost-Effective and Flexible

Supports rapid deployment, flexible expansion, and efficient development validation.

Advanced Protocol Analysis

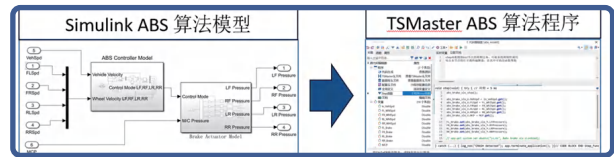
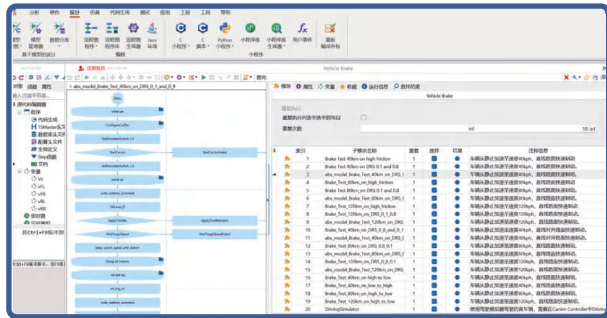
Native protocol stack support enables reliable handling of network management, diagnostics, and complex signal logic.

Seamless Toolchain Compatibility

Compatible with mainstream modeling tools such as Simulink and CarSim without requiring algorithm redesign.

Fast Iteration and Debugging

Supports online parameter tuning and real-time variable monitoring to accelerate development cycles.



Application Example

CarSim + TSMaster HIL Test Bench

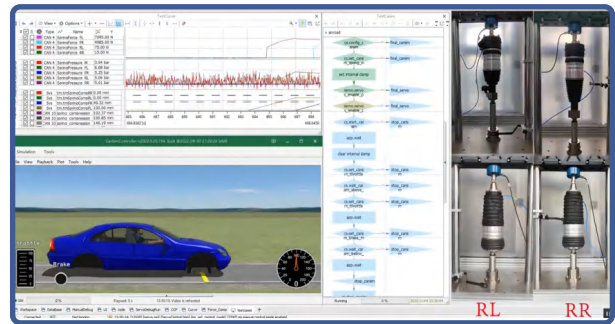
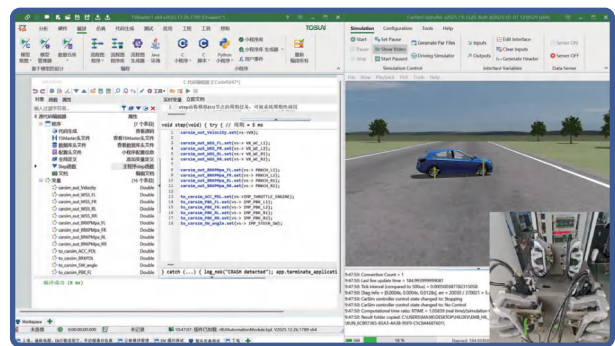
Using CarSim vehicle dynamics models together with TSMaster, the system enables real-time interaction with the DUT for closed-loop control and performance validation.

Automated Brake Testing

TSMaster flowchart automation supports brake testing across multiple road conditions and vehicle speeds with automatic result evaluation and report generation.

ABS Algorithm Validation

ABS control algorithms can be deployed directly in TSMaster for rapid prototyping, real-time brake pressure calculation, and parameter calibration.

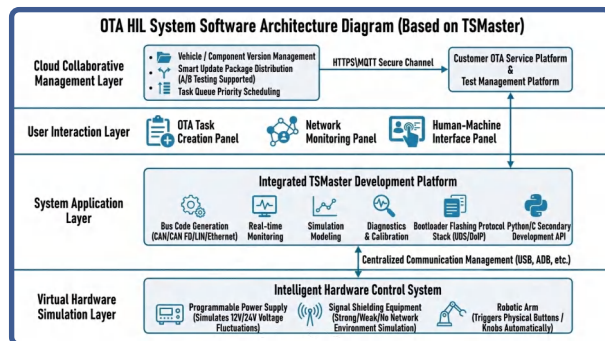


OTA Automated HIL Testing Solution

An end-to-end OTA HIL testing system for Software-Defined Vehicles (SDV), covering cloud-to-vehicle update workflows.

Supports full OTA lifecycle from cloud task deployment to ECU flashing, with compliance to GB 44496 and ISO 24089.

Integrates network impairment simulation and HMI automation to reproduce real-world and extreme conditions for safe OTA validation.



Core Functions

Cloud-Vehicle Integration

Direct connection with OTA backend to automate update task creation, target vehicle selection, and ECU list configuration, enabling a closed-loop workflow from backend setup to vehicle execution and result reporting.

Network Simulation

Simulates real-world communication conditions such as strong / weak / no network, latency, and packet loss to validate download stability and resume mechanisms.

Compliance and Security

Designed in accordance with ISO 24089, R155, and GB 44496 to ensure regulatory compliance and OTA security requirements.

Test Coverage

Regulatory Compliance

Verification against ISO 24089 and GB 44496 OTA update standards.

Functional Testing

Validates full OTA workflow including package download integrity, multi-ECU flashing, progress reporting, and interruption recovery.

Performance Testing

Evaluates ECU flashing speed, gateway load, and CAN FD bus utilization under parallel updates.

Security Testing

Based on ISO 21434 and GB 44495, including attack simulation (man-in-the-middle, replay, package tampering).

Reliability Testing

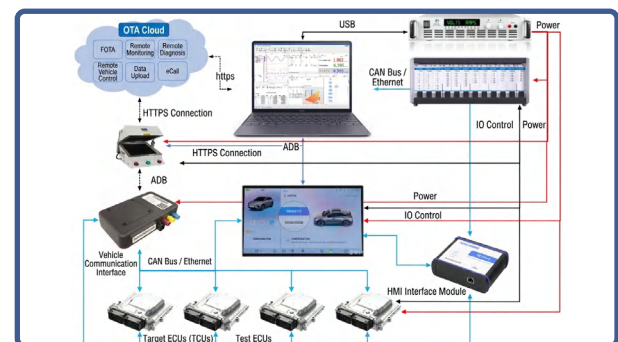
Simulates power loss recovery, weak network conditions, and multi-ECU stress scenarios.

Failure Scenarios

Tests abnormal conditions such as network interruption, power failure during flashing, and system faults.

User Experience

Evaluates update UI clarity, progress accuracy, and multi-channel status synchronization (vehicle, app, HMI).



Chassis-by-Wire HIL

An integrated HIL test platform for ADAS and chassis-by-wire systems, built on a unified TSMaster-based hardware and software architecture. It replaces fragmented traditional HIL setups and supports braking (EMB / ABS / ESC), steering (EPS), and suspension (ASU) systems for calibration, functional validation, and durability testing, while improving efficiency in large-scale HIL workflows.

Lightweight Hardware Platform

Replaces traditional PXI systems with high-performance Windows workstations and TS-IPC-RT real-time simulation hardware, reducing cost and maintenance complexity.

Unified Software Workflow

TSMaster enables a single-platform workflow covering test automation, bus simulation, UDS diagnostics, and CCP / XCP calibration, with compatible data export for mainstream analysis tools.

Vehicle Dynamics Integration

Native integration with CarSim Base for real-time vehicle dynamics simulation, enabling accurate chassis behavior modeling under various road and driving conditions at lower licensing cost.



EMB HIL Testing Solution

Provides a closed-loop validation environment for electro-mechanical braking (EMB) systems, integrating force sensors, data acquisition modules, real-time vehicle dynamics models, and TSMaster software for calibration, functional testing, fault injection, system-level simulation, and durability testing.

Core Functions

Closed-Loop Vehicle Dynamics Simulation

Integrated with CarSim for real-time vehicle dynamics simulation, supporting braking validation under different road friction and vehicle speed conditions.

Automated Testing and Graphical Development

- Unified workflow in TSMaster from script development to automated test execution
- Graphical and parameter-based test case configuration for rapid scenario generation
- Built-in monitoring logic including trigger, edge detection, signal tracking, and mathematical analysis
- One-click automated execution with data logging and report generation

Multi-Dimensional Fault Injection

Supports power, signal, and bus-level fault injection, including open circuit, short circuit, and communication fault simulation for EMB functional safety validation.

Calibration Protocol Support

Supports CCP / XCP protocols for parameter read / write and online calibration of EMB controllers, with customizable API support.

Signal Generation and Comparison

Built-in signal generator supporting sine, square, and pulse waveforms with real-time target and response comparison.

Automated Test Sequences

Supports scripted test execution for functional and durability testing with automatic data recording.

Data Storage and Replay Analysis

Stores test data in BLF format and supports multi-channel replay and waveform comparison through TSMaster.

Test Capabilities

Vehicle-Level Closed-Loop HIL Testing

Combines driving simulator hardware and virtual scenes for interactive braking evaluation and control algorithm validation

DUT Calibration and Performance Testing

Supports clamp force calibration, motor position calibration, PID tuning, and performance tests including maximum force, pressure response, and step response time

Functional Safety and Fault Tolerance Testing

Performs automated electrical and communication fault injection to verify DTC detection and fail-safe strategies under abnormal conditions.

Environmental Durability Testing

Supports automated power cycling and functional testing under extreme temperature, humidity, vibration, and salt spray conditions.

Hardware Features

High-Fidelity Caliper Fixture Design Custom fixtures simulate real vehicle installation conditions for accurate mechanical response validation.

- 25 kN version:
supports caliper inner width ≥ 20 mm
- 45 kN version:
supports caliper inner width ≥ 30 mm
- Customizable design based on customer-specific 3D caliper models

Integrated HIL Simulation Cabinet

Standard rack-based system integrating real-time simulator, programmable power supply, fault injection unit, force sensor conditioning modules, and multi-channel bus interfaces.

Provides dedicated HMI interfaces for servo control and power management.

Applications

R&D Centers

Supports chassis control algorithm validation, EMB software development, PID tuning, and ADAS closed-loop integration testing.

Laboratories

Used for performance evaluation, hardware-in-the-loop functional safety verification, and environmental reliability testing.

Manufacturing

Supports end-of-line (EOL) testing with automated test scripts for assembly consistency and functional verification.



Brake System HIL Testing Solution

A flexible HIL testing solution for hydraulic brake-by-wire systems, including OneBox, TwoBox, EPB, and ESC, supporting applications from Tier-1 desktop development to OEM bench-level validation.

Device Configuration	Applications	Key Features and System Configuration
Minimal Configuration	Basic Functional Validation (ABS / ESC / OneBox / EPB)	Supports manual pedal input with compact design for fast deployment
Compact Configuration	Rapid R&D Iteration (OneBox / TwoBox / EPB)	Supports automated testing and FIU; includes 4–8 wheel speed-channels and EPB signal simulation
Standard Configuration	OEM / Tier-1 Validation (Full Brake System Categories)	Supports manual / auto mode switching with full fault injection for vehicle-level HIL testing
Hydraulic Cabinet with Automated Pedal	High-Fidelity Hydraulic Validation (Full Brake System Categories)	Integrated hydraulic chamber with automated pedal control, supporting system-level integration with external test setups

*One-Box: Integrated hardware-software system

*Two-Box: Separated hardware and software system

Steering and Suspension HIL Testing Solution

A dedicated HIL platform for chassis integration testing, covering steering and air suspension systems.

EPS PPK Steering HIL System

- Focuses on steering assist algorithm validation and functional safety testing.
- Supports front-wheel steering and rear-wheel steering (RWS) logic verification, with integrated fault injection capability.

ASU Air Suspension HIL System

- Designed for air suspension software and valve block controller development under high load conditions.
- Uses high-precision pneumatic and hydraulic actuation systems to support extreme condition and fault injection testing.
- Built on a heavy-duty rig with high-power actuation for high-frequency dynamic response accuracy.



Powertrain HIL Testing Solution

An integrated HIL platform for electric vehicle core controllers, including VCU, MCU, and BMS. Built on TSMaster with real-time simulation and hardware integration, it enables a closed-loop workflow from simulation to ECU interaction and feedback, supporting pre-vehicle validation of control logic, fault handling, and driving conditions.

Real-Time Simulation Core

FPGA-Based Motor Simulation

Ultra-fast real-time solver with microsecond-level step size (down to 1 μ s). Models nonlinear magnetic behavior, inertia response, and inverter switching effects, including PWM-driven IGBT switching, dead-time, and shoot-through simulation for low-level MCU validation.

Multi-Resolution Battery and Thermal Model

Supports cell-level and pack-level modeling for the best balance between fidelity and real-time performance. Includes RC electrochemical modeling, SOH aging estimation, and electro-thermal coupling for voltage, current, and temperature interaction.

Native Charging Protocol Stack

Fully implements GB / T 27930 charging communication with complete state machine. Supports handshake, charging process, timeout logic, and fault injection (signal loss, CRC errors, CC / CP faults, insulation failures).

Test Coverage by Domain

VCU Testing

Validates vehicle startup / shutdown logic, torque distribution, energy management strategies, UDS diagnostics, network routing, and fault injection at both signal and bus levels.

BMS Testing

Tests cell voltage, temperature, and high-voltage current acquisition accuracy. Validates balancing strategies, HVIL behavior, relay fault simulation, and extreme condition handling.

MCU Testing

Simulates high-frequency phase current and rotor position signals (e.g., resolver). Evaluates torque / speed control transitions, response delay, steady-state accuracy, and full four-quadrant operation (drive, regen, reverse).

Cockpit and Vehicle Test

An automated testing platform for IVI and whole-vehicle interaction systems, built on the TSMaster ecosystem. It integrates AI vision, robotic control, and ADB communication to enable lightweight, unattended validation of smart cockpit and vehicle-level functions.

Smart Cockpit Automated Testing System

Focused on multi-screen interaction validation for infotainment systems, replacing manual operations with automated closed-loop testing

AI Vision and Multi-Modal Control

Uses image recognition, UI element detection, and coordinate-based control, combined with robotic arms and ADB to simulate touch, swipe, and input actions.

Integrated Hardware Test Bench

Includes a compact test box with power control (programmable ignition / ACC), steering button simulation, and USB relay switching.

Stress and Stability Testing

Supports CAN replay based on real driving data and automated scripts (Python-based APK and screen testing), enabling 24/7 continuous sleep / wake and functional regression testing.



Vehicle-Level Intelligent Testing System

Extends testing from bench to full vehicle, synchronizing physical states with CAN data in real time.

AI-Driven Test Generation and Analysis

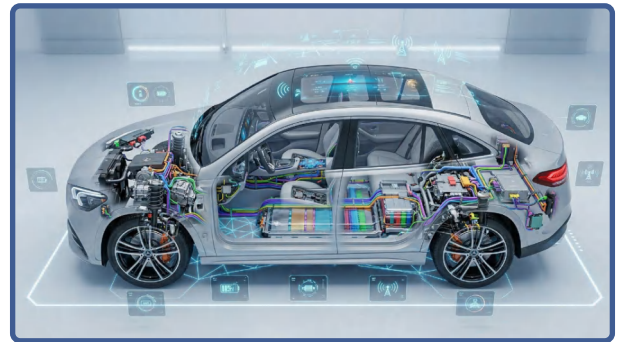
Automatically generates test cases using AI models and performs intelligent analysis of large-scale test results for faster issue localization.

Synchronized Audio / Video and Bus Data

Enables time-aligned recording and replay of camera streams, cockpit display output, and CAN bus signals for accurate system-level validation.

AI-Based Vehicle State Recognition

Uses computer vision to verify real-world vehicle states such as lighting status, door position, and window movement, enabling full closed-loop validation of physical and electronic behavior.



Smart Manufacturing and EOL

FCT is the first quality check in ECU PCBA mass production, used to verify electrical and functional performance under powered conditions, including bootloader programming.

Built on the TSMaster platform and a modular hardware system, it enables automated flashing, signal stimulation, and load testing to ensure each board meets electrical, communication, and control requirements, improving production yield and reliability.

System Architecture

Management Layer

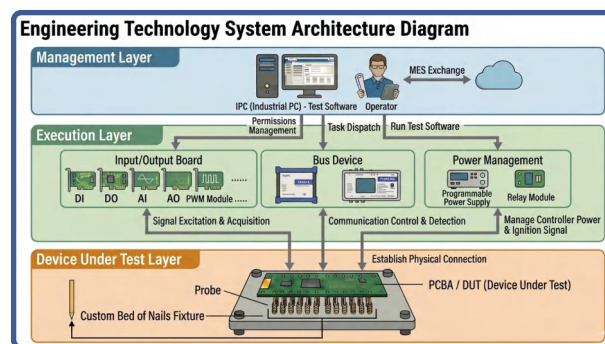
IPC-based control for test execution, user access, task scheduling, and MES integration.

Execution Layer

- I/O modules (DI / DO / AI / AO, PWM) for signal stimulation and acquisition
- CAN / CAN FD / LIN / FlexRay interface cards for communication testing
- Programmable power supply and relay modules for power and ignition control

DUT Layer

Custom test fixtures and probe bed establish physical connection with PCBA test points.



Test Capabilities

The system provides full-stack testing across electrical, communication, and logic validation.

Multi-Mode Programming and Flashing

- UDS Bootloader flashing via TSMaster diagnostic module
- Supports Infineon (TLE989x), NXP and other MCUs (Boot and App)

Mixed-Signal Simulation and I / O Testing

- Simulates sensor inputs (voltage, frequency, PWM) via I / O boards
- Real-time verification of output logic and driver states

Communication and Diagnostics

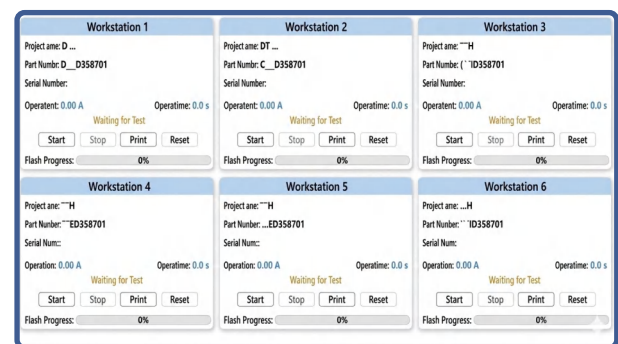
- Automated DID read, DTC clear, security access unlock
- Monitors bus timing and error frames

Power Load Testing

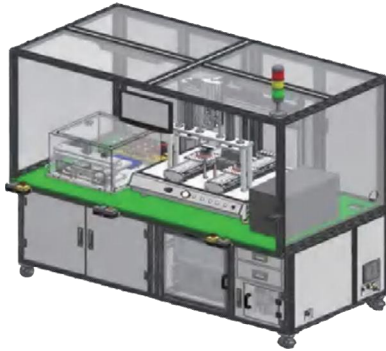
- Programmable electronic load for high-current validation
- Detects thermal issues and driver defects

Full Traceability

- MES integration with barcode scanning
- Auto upload of voltage, current, and Pass / Fail data



Application Cases



Case 1: Rotating Center Display Controller FCT Testing



Case 2: Reconfigurable Seat Controller FCT Equipment

EOL Testing Solution

EOL testing is the final quality inspection step in automotive component production, verifying ECU electrical, communication, and functional performance under simulated in-vehicle conditions.

Built on the TSMaster platform, this solution integrates IPC controllers, programmable instruments, and in-house bus interface cards to form an automated, traceable end-of-line test system, supporting both traditional testing and automotive Ethernet protocols such as SOME / IP and DoIP.

Software Management Layer

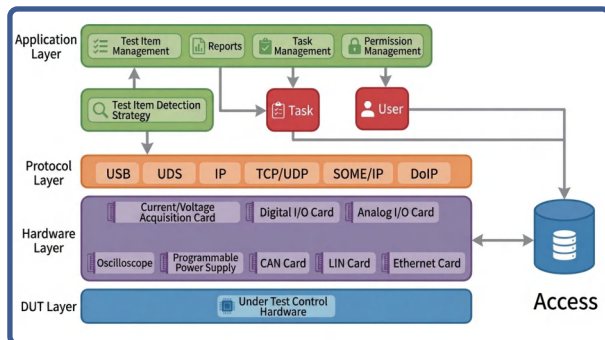
Built on TSMaster, including test item management (strategy configuration), task scheduling, user / role management, and reporting system.

Protocol Stack Support

Supports multiple protocols including USB, UDS, TCP / UDP, SOME / IP, and DoIP, meeting modern connected vehicle communication requirements.

Hardware Layer

- Core: industrial PC (IPC) as main controller
- Test Instruments: Programmable power supply, multimeter, oscilloscope, signal generator, and electronic load
- TSMaster Hardware: In-house CAN / CAN FD / LIN interface and I / O boards for high-precision voltage / current acquisition and bus communication
- Mechanical Fixtures: Customized EOL fixtures, probe modules, and barcode scanning system



Test Capabilities

The system provides full-stack testing across electrical, communication, and logic validation.

Electrical Performance and Static Testing

- Power-on / wake-up test with IGN signal control and current monitoring
- Voltage boundary test for over-voltage and under-voltage DTC detection and protection behavior

Communication and Program Management

- Automatic readout of software / hardware versions with MES comparison
- Writes production data including VIN and offline date

Functional Logic Testing (with Real Load)

- Simulates sensor inputs via I / O boards and drives real loads (motor, lighting, etc.)
- PWM duty-cycle analysis for functional validation (e.g., seat ventilation levels)

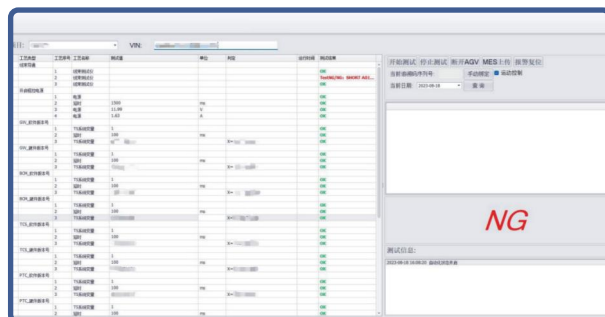
Digitalization and Error Prevention

MES Integration

- Barcode-based parameter retrieval before test
- Automatic upload of results to MES / database for full traceability

Intelligent Poka-Yoke (Error Proofing)

- I / O pin mapping checks and fixture position detection to prevent misoperation
- Automated Reporting
- Based on the PTS standard, the system generates test reports with waveform screenshots and failure analysis



Application Cases

Production Line EOL Testing

• Test Scope

Electrical safety inspection, ECU fault diagnosis, and system performance evaluation

• Key Benefits

Comprehensive safety coverage, improved maintenance decision accuracy, and reduced cost with higher efficiency



AR Smart Tailgate EOL Testing

• Test Scope

Optical module operating voltage check, logo projection position calibration, TOF (Time-of-Flight) function validation, and temperature sensor power supply testing

• Key Benefits

Integrates optical inspection and CAN communication testing to enable automated end-of-line validation for complex opto-mechanical systems



In-Vehicle Data Logger

With increasing OTA frequency and vehicle complexity, traditional offline data workflows can no longer meet development needs. A system is required to synchronize and remotely access vehicle bus data (CAN / CAN FD / Ethernet) and audio / video from real road tests.

Based on the TSMaster platform and TG3000 data acquisition devices, this solution enables synchronized collection of multi-channel data with cloud storage and remote access, forming a “vehicle-cloud-lab” data loop for efficient debugging and faster development iteration.

Core Functions

Full-Stack Bus Data Acquisition

- Supports CAN / CAN FD / LIN / FlexRay / Ethernet (100 / 1000Base-T1)
- Synchronized multi-bus recording with unified hardware timebase

Multi-channel Audio and Video Fusion

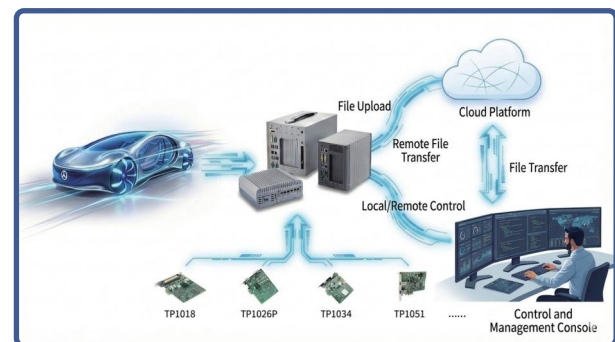
- Supports multi-camera and microphone input for road and driver monitoring
- Synchronized capture of video, audio, and bus data streams

Industrial-Grade Local Storage

- High-throughput recording for long-duration road tests without data loss
- Supports BLF / ASC / MDF formats for TSMaster or third-party analysis tools

Cloud Collaboration and Secure Transfer

- Supports automatic or scheduled cloud upload for data backup
- SSL / TLS encrypted transmission with access control and data protection
- Remote monitoring of vehicle location, signals, and device status



Intelligent Diagnostic Tool Solution

An EV battery diagnostic device developed for R&D and lifecycle maintenance, integrating high-precision data acquisition, fault diagnosis, state monitoring, and relay control. It offers broad compatibility with mainstream EV brands and BMS platforms, and is suitable for after-sales service, battery evaluation, and engineering development.

Core Functions

Battery State Monitoring

Provides real-time multi-parameter monitoring and visualization of battery operation.

- Multi-parameter monitoring: alarms, charge / discharge data, voltage / current sampling, system status, power output, and thermal / balancing states
- Cell-level resolution: supports individual cell voltage and temperature time-series data
- Data visualization: built-in charts for real-time trend analysis of key battery parameters

Fault Diagnosis and Closed-Loop Handling

Supports structured fault analysis and standardized troubleshooting workflows.

- Fault code and snapshot analysis: reads DTCs and related snapshots with root-cause classification
- System reset: supports fault clearing and state reset commands for efficient debugging
- Digital reporting: automatically generates standardized diagnostic reports for traceable maintenance records

High-Voltage Relay Control

Provides multi-level safety control for high-voltage system operations.

- Role-based access control: three-level permissions (normal / advanced / special control) with password authentication for critical commands to ensure safe operation
- Independent relay control: supports individual switching of main positive / negative, charge positive / negative, pre-charge, slow charge, heater, and water pump relays for detailed pack testing and fault simulation

CAN Bus Data Acquisition and Analysis

- Raw message capture: supports full CAN bus data logging with configurable baud rate and CAN ID filtering for targeted signal acquisition
- Data replay and traceability: supports local storage and playback for signal-level fault analysis and development validation

Platform Compatibility and HMI

- Cross-platform architecture: compatible with major battery technology platforms (v6.0 / v7.0 / v8.0), enabling multi-brand vehicle adaptation and reducing test asset fragmentation.
- Multi-language HMI: flat touch interface supporting Simplified Chinese, Traditional Chinese, English, and Japanese
- Modular scalability: supports remote control protocols and hardware expansion for customized and automated applications



Solution Advantages

- **High-Fidelity Parameter Analysis**
Deep integration with BMS low-level protocols ensures accurate and reliable monitoring and diagnostic data
- **High-Voltage Safety Control**
Software-based permission isolation with password authentication ensures safe and standardized high-voltage relay operations
- **Integrated Workflow**
Quality assurance: enables full traceability from requirements and test cases to execution results, improving process transparency, root-cause analysis, and delivery quality
- **Scalable Architecture**
Supports open bus configuration and modular hardware / software upgrades for evolving R&D and testing needs.

Application Scenarios

- **After-Sales Service**
Routine EV diagnostics, fault code reading / reset, and battery SOH evaluation
- **Battery Maintenance Facilities**
Deep battery pack inspection, repair, debugging, and professional health assessment
- **R&D Centers**
Battery performance calibration, BMS functional validation, and CAN bus road data acquisition
- **Fleet and Operations Platforms**
Large-scale battery health monitoring, early fault detection, and standardized maintenance data management

Cloud Platform Solution

Facing shorter development cycles and increasing cost pressure, traditional offline workflows are no longer sufficient. TOSUN Cloud is an industrial IoT platform for unified R&D data management and collaboration.

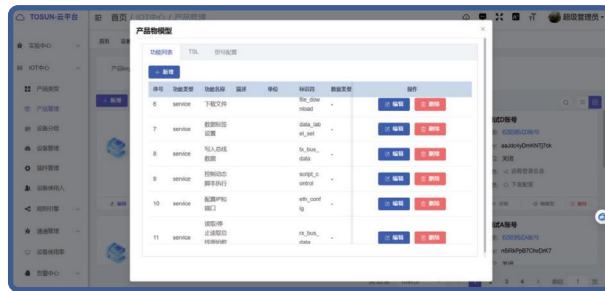
It integrates cloud computing, digital twin, AI, and distributed computing to enable end-to-end capabilities from data acquisition to analysis and remote collaboration, supporting a shift from experience-driven to data-driven development.

Platform Advantages

- **Improved R&D Efficiency**
Enables remote diagnostics, calibration, and automated testing, allowing engineers to manage multiple tasks simultaneously and improve resource utilization
- **Data Asset Utilization**
Provides end-to-end data management from acquisition to analysis, using AI to transform test data into traceable and reusable assets
- **Quality Assurance**
Ensures full lifecycle traceability from requirements to test results, improving transparency, issue tracking, and delivery quality
- **Enhanced Collaboration**
Multi-tenant architecture with fine-grained access control enables seamless cross-team and cross-region collaboration with unified data standards and workflows
- **Secure and Controllable**
TOSUN provides a fully self-developed hardware, software, and platform toolchain, ensuring data security and supply chain stability

Core Functions

- **Device Connectivity and IoT Hub**
Supports mainstream IoT protocols such as MQTT and HTTP
- **Full Lifecycle Device Management**
Includes device type definition, grouping, monitoring, and status tracking
- **Digital Twin (TSL Model)**
Standardizes device abstraction and interaction through a unified device modeling framework



Data Management and Analytics

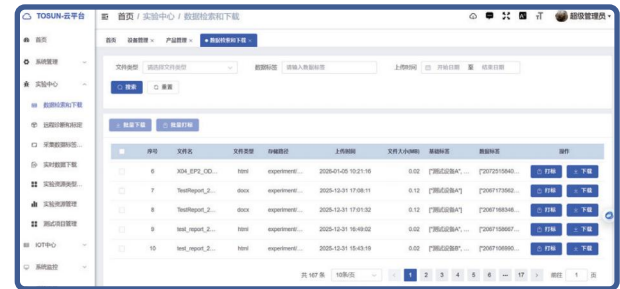
Unified Data Platform

- Integrated with distributed computing engine (Spark) for large-scale data processing
- Supports parallel processing and high-performance analysis of TB-level data



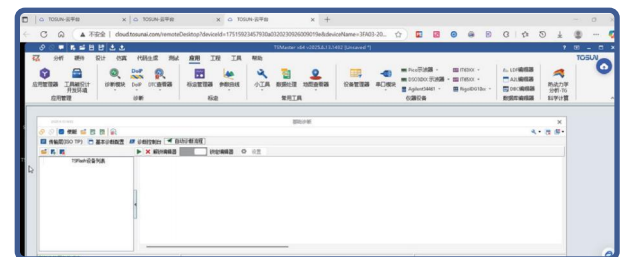
Data Tagging

- Uses tag-based classification for all data
- Supports multi-dimensional search and filtering by project, VIN, and scenario



Remote Calibration and Diagnostics

- **Seamless TSMaster Integration**
Deep integration with TSMaster enables low-latency remote flashing, diagnostics, and calibration with a local-like experience.
- **Flexible Access Modes**
Supports both browser-based remote desktop and local desktop mapping for different network and usage scenarios
- **Real-Time Synchronization**
Ensures stable and real-time synchronization of control commands and data feedback, enabling efficient collaborative calibration.



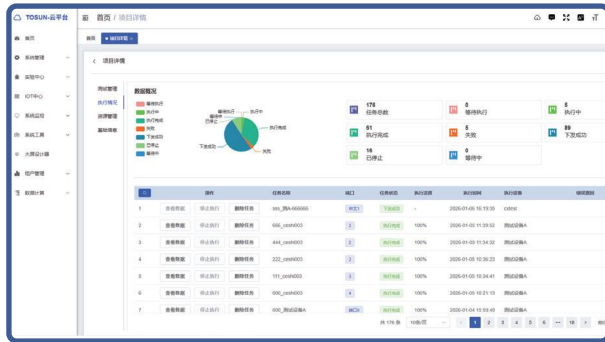
Automated Testing and ALM Integration

• ALM Integration and Test Execution

Integrates with ALM systems for automated test task distribution, execution, and result reporting

• Cross-Platform and Traceability

Enables “write once, run anywhere” test cases via intermediate translation, supporting multiple test environments, while ensuring full traceability between requirements, test cases, scripts, and results.



Visualization and Low-Code Development

• Drag-and-Drop Dashboard Builder

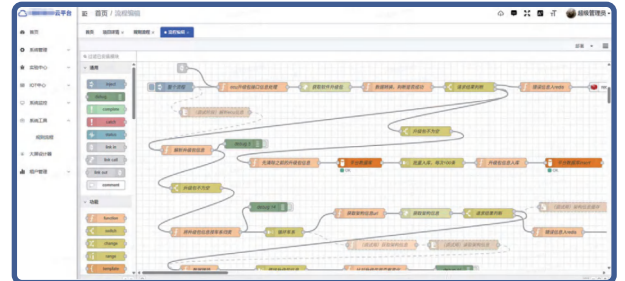
Provides rich chart components and templates for no-code creation of SCADA interfaces, data dashboards, and monitoring screens.



Rule Engine and Node-RED

• Visual Logic Configuration

Built-in visual workflow engine enables drag-and-drop configuration of data processing, business logic, and automated alert rules



API and System Integration

- Provides OpenAPI interfaces for customization and third-party system integration

System Management and Security

Multi-Tenant and RBAC

- Supports multi-tenant isolation with role-based access control (RBAC) for secure data management

Security Protection

- Uses AES-256 encryption and OAuth 2.0 authentication to ensure secure data transmission and storage

Operation and Monitoring

- Includes logs, service monitoring, and auto-restart functions to ensure stable platform operation

Technical Architecture

Microservices Architecture

- Decoupled front-end and back-end using microservices and micro-frontends, enabling fast iteration and scalable, loosely coupled systems

Cloud-Native Deployment

- Supports Docker and Kubernetes (K8s) containerization for high availability, scalability, and efficient operations

Openness and Integration

- Combines low-code and high-code development for seamless integration with existing enterprise IT systems

Use Cases

Smart Remote Road Testing

Engineers can remotely monitor, diagnose, and calibrate a nationwide fleet of test vehicles in real time from the office.

ECU Automated Testing

Automates test case execution, data acquisition, and report generation in both bench and vehicle environments, improving efficiency and coverage.

Centralized Test Data Platform

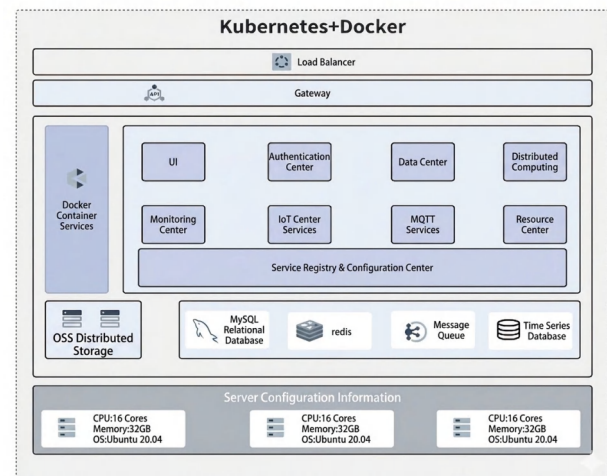
Builds an enterprise-level data platform to store and manage all test data, enabling data mining and intelligent analysis.

EOL / FCT Production Testing

Provides stable production-line solutions for device management, test deployment, and data collection.

Real-Time Monitoring and Digital Twin Visualization

Delivers real-time dashboards for control centers and labs, visualizing key metrics and alerts. Supports 3D digital twin models for intuitive vehicle test visualization.



Portable Diagnostic Solution

An industrial-grade tablet based on the TOSUN ecosystem that integrates TSMaster software with CAN / LIN / Ethernet interfaces into a single compact device, replacing the traditional laptop + interface + cable setup and providing an all-in-one solution for road testing, ECU flashing, and after-sales diagnostics in field environments.

Portable Production-Line Flashing System

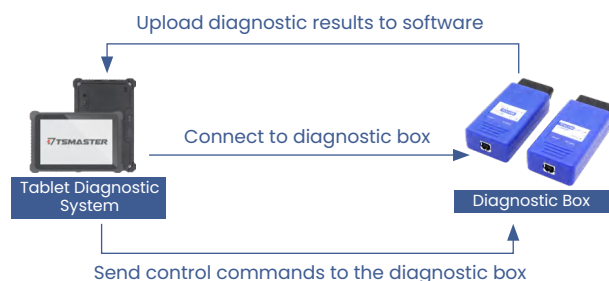
• Typical Configuration

TPAD1003 + TC1114B / TC1113B

Key Features

A professional diagnostic solution for the after-sales service market, supporting full-system DTC reading / clearing, freeze-frame analysis, live data monitoring, and active testing.

- Smart guidance: Built-in repair manuals and guided diagnostic logic to reduce technician complexity
- Lifecycle management: Supports ECU software version control, online updates, and remote diagnostics, enabling collaboration between on-site technicians and cloud experts
- Commercial vehicle optimized: Enhanced support for complex electrical architectures, including connection status detection and secure flashing capabilities



Portable Production-Line Flashing and Configuration System

• Typical Configuration

TPAD2002 (2× CAN FD + 1× Ethernet integrated)

Key Features

A mobile flashing station designed for manufacturing environments. The TPAD2002 features a rugged, industrial-grade design that is lightweight yet durable, suitable for harsh factory conditions.

- Multi-protocol support: Integrates CAN FD and Ethernet for both traditional bus flashing and high-speed DoIP programming
- Efficient operation: Plug-and-play setup, ideal for EOL stations and rework areas for mobile ECU programming tasks



Connected Vehicle Road Test System

• Typical Configuration

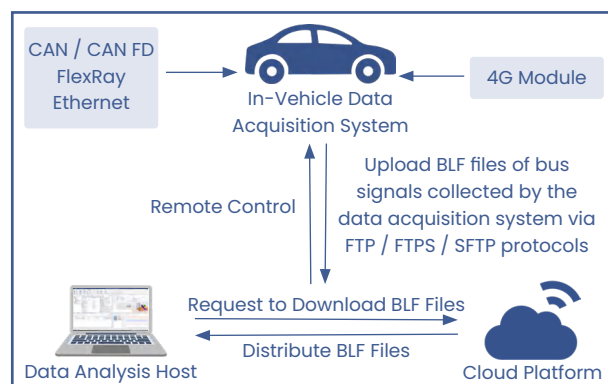
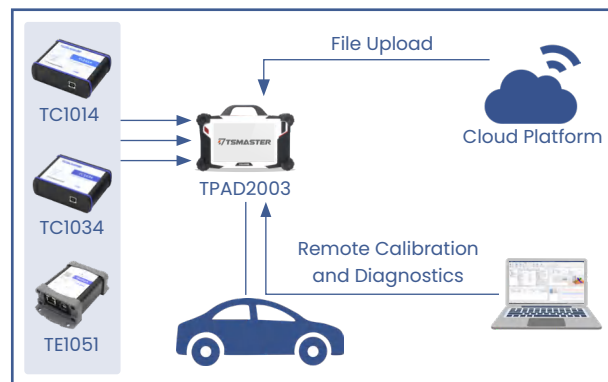
TPAD2003 + TOSUN Cloud Platform

Key Features

An end-to-cloud integrated solution enabling a closed-loop road testing data workflow. The system supports automatic power-on startup and unattended data logging.

- Cloud-enabled: Works with the TOSUN cloud platform for remote device management, cloud-based DBC / A2L file distribution, and automatic encrypted BLF data upload
- Access control: Provides a full permission management system and data APIs to ensure secure handling and efficient circulation of critical test assets

Bus Type	CAN / CAN FD	FlexRay	Ethernet	Resources
2.0 Platform	6	1	X	TC1014+TC1034
3.0 Platform	4	1	1	TC1014+TE1051



Connected Vehicle Road Test System

• Typical Configuration

TPAD3005 (Oscilloscope + 4× CAN acquisition)

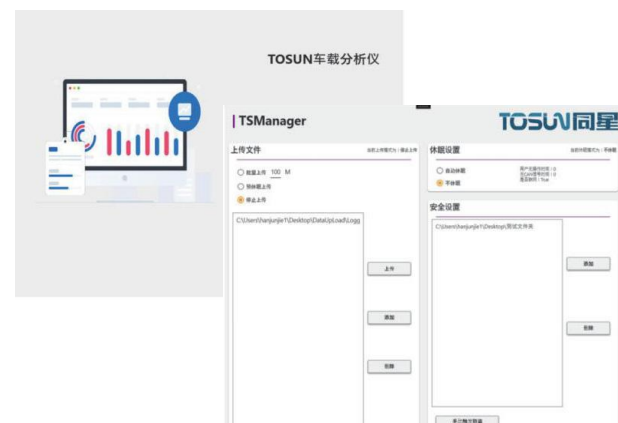
Key Features

A flagship all-in-one tool designed for advanced debugging, combining a bus analyzer and protocol oscilloscope.

- Hybrid analysis: Integrates an oscilloscope with protocol decoding, enabling PDU-based triggering for waveform capture and fast identification of physical-layer bus issues
- Advanced debugging: Supports 4--channel CAN replay, A2L variable loading, XCP calibration, and UDS diagnostics
- Remote interaction: Enables remote alarm message reporting and bidirectional control, ideal for expert-level debugging in complex scenarios

Use Cases

- Road Testing: Data logging and calibration in space-constrained vehicle environments
- Production-Line Flashing and Diagnostics: ECU programming and end-of-line testing in mobile stations or rework areas
- After-Sales Service: Fast diagnostics at dealerships or repair centers with remote expert support



TPAD Series Ordering Information

NO.	Product	Model	Specification
1	Tablet PC	TPAD1003	Rugged industrial tablet (water-, dust-, and shock-proof)
2	Tablet PC	TPAD2002-C	2-channel CAN FD
3	Tablet PC	TPAD2003-1634	6-channel CAN FD, 2-channel LIN, 2-channel FlexRay
4	Tablet PC	TPAD2003-1651	4-channel CAN FD, 2-channel LIN, 2-channel Automotive Ethernet
5	Tablet PC	TPAD2003-3451	2-channel CAN FD, 2-channel FlexRay, 2-channel Automotive Ethernet
6	Tablet PC	TPAD2005-12	1-channel CAN FD, 1-channel LIN
7	Tablet PC	TPAD2005-13	2-channel CAN FD
8	Tablet PC	TPAD2005-14	4-channel CAN FD
9	Tablet PC	TPAD2005-16	4-channel CAN FD, 2-channel LIN
10	Tablet PC	TPAD2005-26	1-channel CAN FD, 6-channel LIN
11	Tablet PC	TPAD2005-34	2-channel CAN FD, 2-channel FlexRay
12	Tablet PC	TPAD2005-51	1-channel Automotive Ethernet
13	Tablet PC	TPAD3007-1634	6-channel CAN FD, 2-channel LIN, 2-channel FlexRay, winter-enhanced version
14	Tablet PC	TPAD3007-1651	4-channel CAN FD, 2-channel LIN, 2-channel Automotive Ethernet, winter-enhanced version
15	Tablet PC	TPAD3007-3451	2-channel CAN FD, 2-channel FlexRay, 2-channel Automotive Ethernet, winter-enhanced version
16	Tablet PC	TPADScope	4-channel CAN FD + 4-channel analog input, up to 200 MHz bandwidth

Note: Other bus resources can be configured according to requirements





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