



TOSUN-TTS8015

User Manual

Product Features & Interface Overview

Product Name	Channel
TTS8015	AI/AO * 16 (Supports 0 V to 40 V voltage output with readback, and 0 V to 60 V voltage measurement.)

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Typical Application

- Testing and calibration of sensors and transmitters
- Hardware-in-the-loop (HIL) testing of controllers (PLC/DCS/ECU)
- Accuracy verification of data acquisition systems (SCADA/DAS)
- Durability and fault boundary testing of actuator drivers
- Dedicated testing for automotive electronics and new energy systems (BMS/VCU)
- Scientific research and reliability validation

Product Highlights

- Supports the EtherCAT real-time communication protocol, providing fast response and high control accuracy
- Supports multi-board cascading expansion for complex test scenarios
- Supports firmware updates via Ethernet, reducing maintenance costs

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1. Introduction

The TTS8015 is a highly integrated analog signal processing module specifically designed for the TTS system. It features 16 channels of analog input measurement with an effective measurement range of 0 V to 60 V, and 16 independent analog output channels with an effective output (and readback) range of 0 V to 40 V.

The module supports multiple fault injection modes, including high-side/low-side short circuits, and short circuits to ground/virtual ground/common terminals.

The board supports remote real-time control via the EtherCAT bus. Functional control signals defined through XML files allow flexible configuration of voltage output and acquisition states. It integrates multi-channel high-precision measurement and programmable analog signal output capabilities into a single compact unit, providing an all-in-one testing solution.

1.1. Technical Specifications

➤ Device Specifications

Parameter	Description
Communication Interface	100BASE EtherCAT
Management Interface	100BASE-T(X) Ethernet
Connector	Board-to-board connector, 60-pin
AI/AO Channels	AI/AO × 16
Functional Channels	3 fault injection channels: F_COM / F_GND / F_BAT
EtherCAT	100BASE-TX bus standard, full-duplex supported
Power Supply	DC 24 V
Power Consumption	2.9 W
Dimensions	380.6 × 35.56 × 172.85 mm
Operating Humidity	10% ~ 90% (non-condensing)
Environment	Keep away from corrosive gases

➤ Output/Measurement Voltage

Parameter	Description
Output Voltage	Effective output range 0 ~ 40 V
Measurement Voltage	Effective output range 0 ~ 60 V

➤ 100BASE EtherCAT

Parameter	Description
Protocol Support	IEC 61158, IEEE 802.3
Physical Layer	Standard Ethernet 100BASE
Signal Response Time	≤ 10 ms
Communication Mode	Full-duplex supported

➤ Fault Injection

Parameter	Description
Channels	16 AI/AO channels
Fault Types	Open circuit, short circuit

1.2. Electrical Specifications

➤ Power Characteristics

Parameter	Condition	Min	Typ.	Max	Unit
Operating Voltage	DC supply	--	24	--	V
Power Consumption	DC supply	--	7.1	--	W



Note: The typical power consumption of 7.1 W is measured under single-channel output conditions.

➤ Mechanical Dimensions

Unit: mm

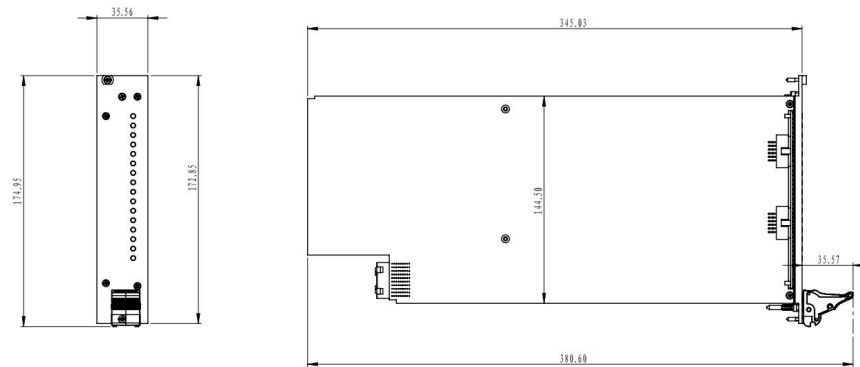


Figure 1-1 Mechanical Dimensions

1.3. Pin Definition

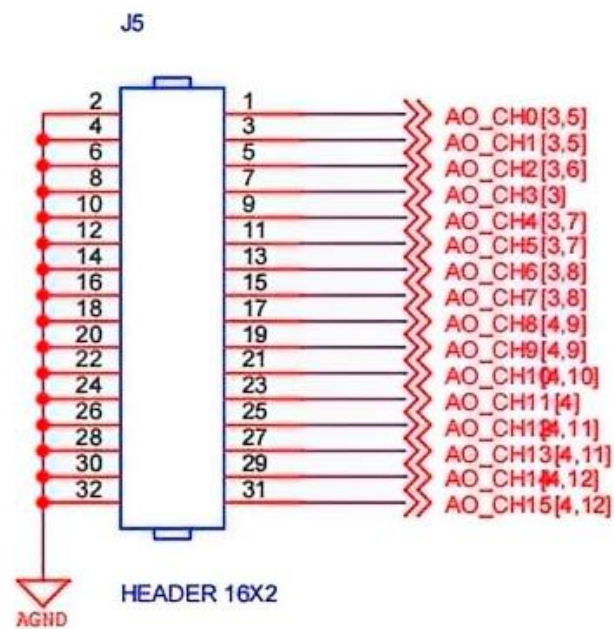


Figure 1-2 Pin Layout

1.4. LED Indicators

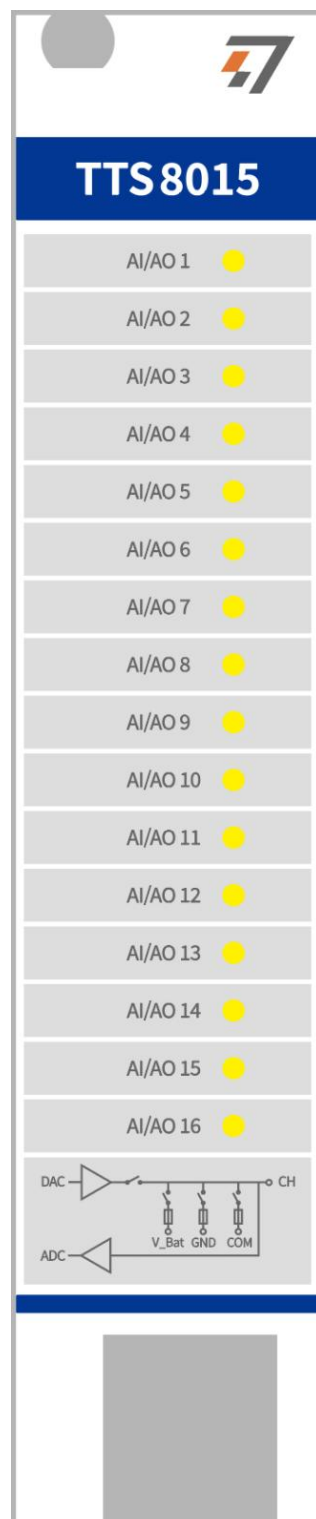


Figure 1-3 Product Front Label

➤ LED Definitions

Indicator	Description
AI/AO	Status of AI/AO channel 1 ~ 16

➤ LED Color Description

Indicator	Color	Description
AI/AO	Green	Blinking indicates analog voltage output is in progress
	Red	Fault injection is active on the channel

1.5. Internal Circuit

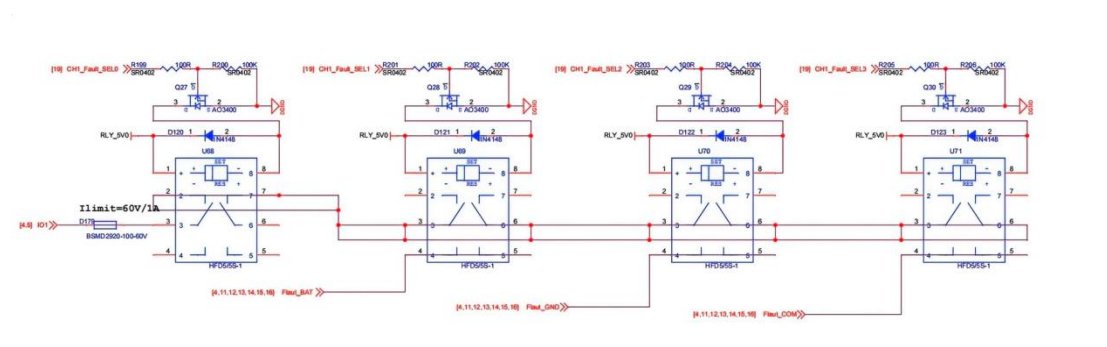


Figure 1-4 Internal Circuit Diagram

This product is an AI/AO board consisting of a core control board running the application program and a functional board responsible for voltage output and acquisition. Channels are enabled via switches after configuration.

EtherCAT control consists of 16 channels. The board includes two chips, which control channels 1 - 8 and 9 - 16 respectively.

Voltage output and acquisition are performed by enabling signals for the corresponding channels. External VREF/VBAT can be directly connected to control the threshold for voltage measurement/output.

Fault injection at the AI/AO interface is achieved by closing switches connected to VBAT, GND, and COM terminals via enable signals.

1.6. System Requirements

➤ PC Requirements

- PC with real-time environment
- Operating system: Windows 10

➤ Driver Installation

- Update to the latest network adapter driver



The download link is available on the official website of Shanghai TOSUN Technology Ltd.: <https://www.tosunai.com/>

1.7. Packing List

Item	Qty.	Illustration	Standard/Optional
TTS8015 Main Device	1		Standard
3-Pin Terminal Block	1		Standard
16-Pin Terminal Block	2		Standard

2. Usage

The Tx and Rx signals of the TTS8015 each contain 45 bytes (including reserved fields), among which 80 signals are valid Tx/Rx signals. Each Tx signal is mapped to a corresponding Rx signal for self-diagnostics.

The board supports configuration of two main functions via Tx signals:

- Voltage output
- Fault injection

2.1. Voltage Output

To configure voltage output, two signals must be set: `chX_ao_tx` and `chX_ao_enable_tx`, where X is the channel index ranging from 1 to 16.

- `chX_ao_tx`: Output value of the channel (occupies 2 bytes), unit: mV
- `chX_ao_enable_tx`: Enable signal (1 bit), indicating whether the relay at the final output and chip output is closed

Only when this enable signal is set can the output voltage be measured and read back.

- Value = 1: Enabled
- Value = 0: Disabled

After configuring the output and enabling the relay, `chX_ao_rx` will acquire the output value and report it via the PDO message.

- `chX_ao_rx`: 2 bytes
- The actual measured voltage (in mV) is obtained by multiplying this value by 2

2.2. Fault Injection

To perform fault injection, configure the following signals:

- `chX_di_com_tx`
- `chX_di_gnd_tx`
- `chX_di_bat_tx`

Where x is the channel index (1 - 16).

All these signals are 1 bit in size, with a default value of 0:

- Value = 0: Fault injection disabled
- Value = 1: Fault injection enabled

3. Inspection and Maintenance

The TTS8015 primarily contains semiconductor components, which typically have a long service life. However, adverse environmental conditions may accelerate aging and degrade performance. To ensure proper operation, regular inspections are recommended to maintain the required environmental conditions.

It is recommended to inspect the device at least once every 6 to 12 months. In harsher environments, inspections should be performed more frequently. Refer to the table below for inspection criteria and recommended actions. If issues persist, please contact Shanghai TOSUN Technology Ltd.

➤ Power Environment Inspection

Item	Check Content	Standard/ Range	Action/Measure
Power Supply	Check voltage fluctuation at supply input	DC60-pin backplane: $-24\text{ V} \pm 3\text{ V}$ DC	Use a power meter or voltmeter at the input; ensure voltage fluctuation is within range
Ambient Conditions	Check ambient temperature (including internal temperature within enclosures)	$-40^{\circ}\text{C} \sim +80^{\circ}\text{C}$	Use a thermometer to ensure temperature is within specified range
	Check the ambient humidity (including internal humidity within enclosures)	10% ~ 90% RH	Use a hygrometer to ensure humidity is within specified range

➤ Contamination & Protection Check

Item	Check Content	Standard/ Range	Action/Measure
Contamination	Check for accumulation of dust, powder, salt, and metal debris	None	Clean the device and prevent future contamination
	Check for exposure to water, oil, or chemicals	None	Clean and shield if necessary
Hazardous Gases	Check for corrosive or flammable gases	None	Use sensors or odor detection to verify

➤ Mechanical Stress & EMI Check

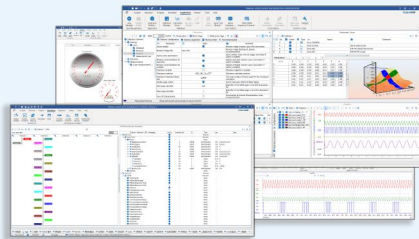
Item	Check Content	Standard/ Range	Action/Measure
Mechanical Stress	Check vibration and shock levels	Within specified limits	Install padding or vibration isolation measures if necessary
Electromagnetic Environment	Check for noise sources near the device	No significant noise sources	Isolate or shield the device from noise sources

➤ Installation & Wiring Check

Item	Check Content	Standard/ Range	Action/Measure
Wiring	Check crimped connectors in external wiring	Adequate clearance between connectors	Visually inspect and adjust as needed
	Check for damage to external wiring	No damage	Visually inspect and replace damaged cables if necessary

Software

Support CAN(FD)/LIN/FlexRay/SOME/IP and DoIP
 UDS diagnostics/ECU flashing/CCP/XCP calibration
 Embedded code generation/Application builder
 Encrypted release/Logging and bus replay
 Graphical programming/Residual bus simulation
 C and Python scripting
 Bus monitoring/Transmitting/Automated testing



TSMaster

Hardware

1/2/4/8/12-channel CAN FD/CAN to USB/PCIe device
 1/2/6-channel LIN to USB/PCIe device
 Multi channel FlexRay/CAN FD to USB/PCIe device
 Multi channel automotive Ethernet/CAN FD to USB/PCIe device
 Automotive Ethernet media conversion device (T1 to Tx)
 Multi-channel CAN FD/Ethernet/LIN datalogger



TTS test systems

- CAN FD/CAN/FlexRay/LIN communication boards
- Relay and fault injection boards
- Resistors for sensor simulation
- Digital I/O, Analog I/O boards available



Solutions

- Bus Conformance
- Network Automation Testing System
- Charging Testing System
- EMB Calibration Testing Equipment
- Information Security Solutions
- Steer-by-Wire Chassis Testing Solutions
- EOL Testing Equipment
- Motor Performance
- Durability Testing Solutions
- FCT



About TOSUN

The core product, TSMaster, is a comprehensive tool for automotive R&D, testing, production, and after-sales. It integrates essential functions with hardware support to streamline processes and ensure precision, making it ideal for automotive professionals.

International Organization



Quality Assurance
ISO9001:2015

CE Certification



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