YEAE Falcon Data Logger

General Description

The YEAE Falcon Data Logger is a standalone system designed for flexible automotive testing. It is battery-powered, allowing completely independent operation without external power sources or cables during logging runs.

The system is highly customizable, featuring a modular 8-slot configuration. This design supports a variety of signal-acquisition and communication modules, enabling users to tailor the data-logging setup to their specific requirements. Besides the modular 8-slot configuration, non-enclosed NI C Series modules can be integrated to provide additional functionality. In multi-logger deployments, a C Series GNSS module can be used to provide precise synchronization across the entire system.

Built for high-speed data logging, the device delivers reliable throughput for standard automotive analog and digital signals and includes robust internal storage to securely retain recording sessions.

To achieve this performance, the controller integrates an FPGA alongside a real-time processor. The FPGA handles high-speed, deterministic tasks, interfacing directly with the module slots to capture data with hardware-level synchronization. The real-time processor runs the operating system and manages TCP/IP networking, file storage, and configuration of all slots.

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Connectivity can be controlled either through our GUI application for end-to-end management or via TCP/IP for network-based operation. This supports integration into custom setups using a standardized command set (provided separately). The system is also scalable: multiple loggers can be synchronized to function as a larger, unified data-acquisition system.

Key Features

- The device ensures comprehensive data recording through multi-protocol support for CAN and LIN networks.
- Versatile signal capture capabilities allow the system to read Analog Voltage (AIV) and Current (AIC) from various sources.
- The system delivers accurate, calibrated temperature measurements even in extreme conditions when using compatible sensors.
- Simultaneous logging records physical sensor data and network traffic together, allowing you to verify if physical sensors react correctly to network commands.
- Integrated GNSS positioning tracks essential metrics including vehicle location, speed, and absolute time.
- Flexible synchronization allows multiple logger units to align data perfectly across distributed systems using GNSS or Hardware Triggering.
- An IP67 rugged enclosure and an average 12-hour battery life facilitate reliable, independent operation in harsh environments.
- By connecting microphones and vibration sensors to the Analog Input modules, the system enables comprehensive Noise, Vibration, and Harshness (NVH) analysis.

Applications

- **Long-Term Logging:** Continuous, independent data recording for extended periods, supported by the 12-hour battery life and high-capacity storage.
- **Vehicle Durability:** Monitoring stress and conditions during road tests.
- **Thermal Analysis:** Tracking engine, battery, and cabin temperatures.
- **Distributed System Monitoring:** Synchronizing data capture across multiple logger units in complex test setups.
- **NVH Analysis:** Conducting detailed noise and vibration studies by utilizing acoustic and vibration sensors connected via the analog inputs.

Specifications

- **Enclosure:** IP67 Rugged Case

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- **Operating Temp:** -40°C to +70°C
- **Internal Battery:** LiFePO4, 4500 mAh, BMS
- **Battery Life:** Average 12 hours of continuous operation
- **Vibration:** Random vibration, 10 Hz to 2000 Hz, 3 G RMS
- **PC Interface:** Ethernet connection for system configuration and data transfer.

Software

The system includes a comprehensive GUI for configuration, monitoring, and data management.

General Configuration & Hardware Panels

The General Configuration Panel (located on the left) displays a list of connected loggers and a logger status field. It includes buttons to open the calibration and file transfer windows. The file transfer window is used for exporting log files located on the SD card to the host PC. Logging options allow the user to specify settings such as log time and storage device, while averaging options are used for specifying the data averaging type.

The Hardware Configurations Panel contains a button for adding another logger and provides access to specific settings for each channel, including triggering configuration, formula configuration, and alarm configuration.

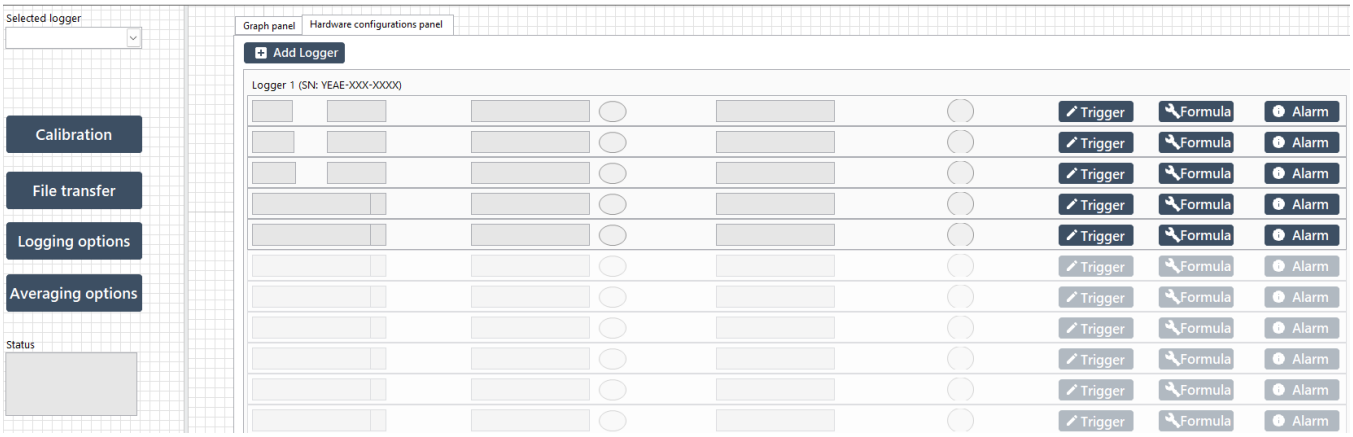
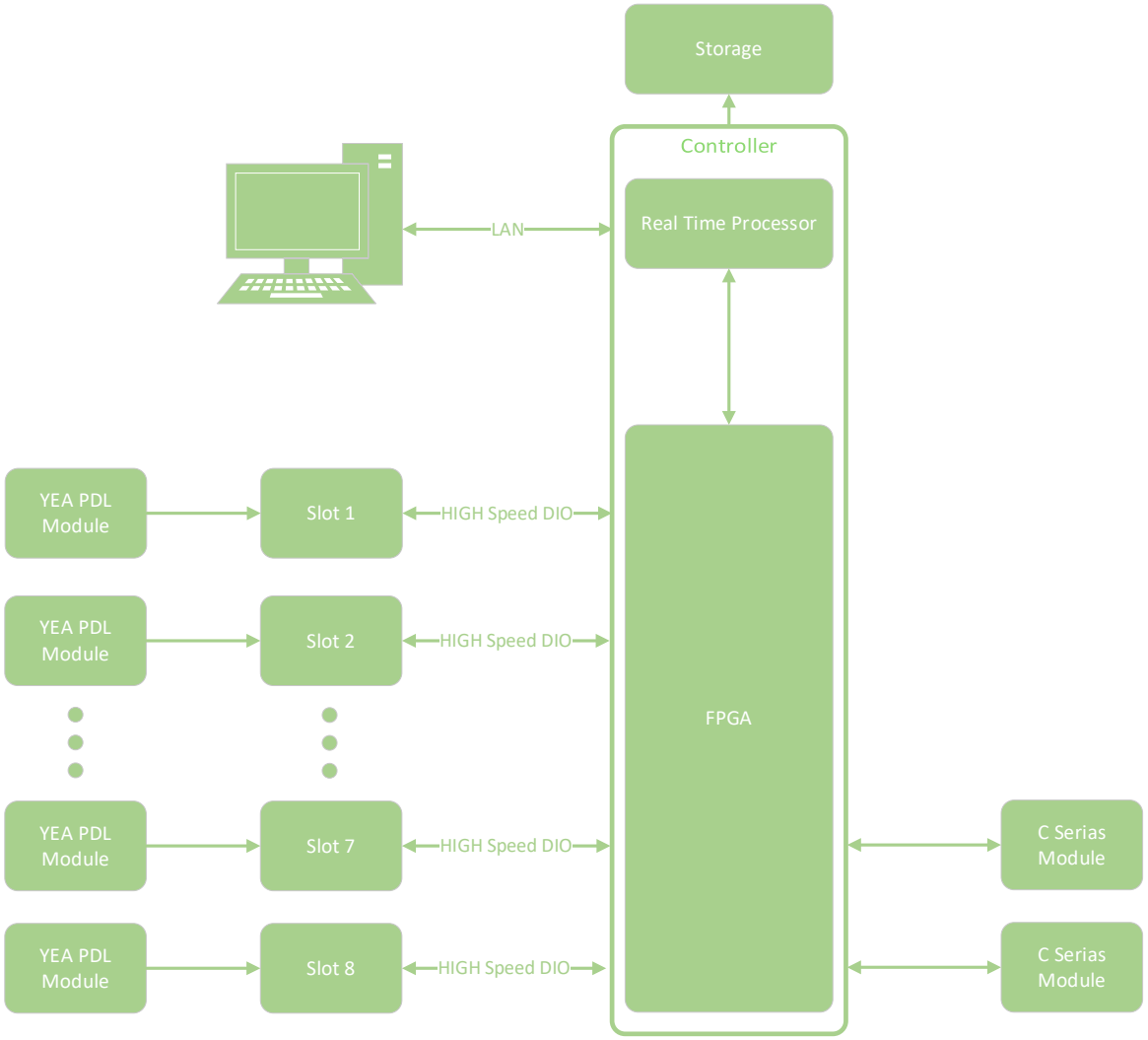


Figure 14: General Configuration Panel with Hardware Configuration

Graph Panel

The Graph Panel features three tabs dedicated to different module types (ADCs, Temperature, and CAN-FD), allowing for real-time visualization of data.

High Level Architecture



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NVH Analysis

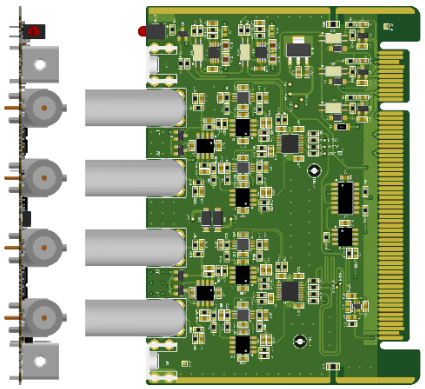
The system supports advanced processing for detailed Noise, Vibration, and Harshness (NVH) studies:

- **Time Domain Analysis:** Acquires and visualizes data in time and amplitude for immediate signal verification.
- **Frequency Domain Analysis:** Transforms time-domain data to display frequency components clearly.
- **Spectrum Analysis:** Performs detailed spectral analysis including Power Spectrum, Frequency Response, and Octave Analysis (1/1, 1/3, 1/6, 1/12, 1/24).
- **Time-Frequency Analysis (Spectrogram):** Maps signal intensity over time and frequency using color coding for variables like RPM.
- **Order Analysis & Campbell Diagrams:** Visualizes response spectrum vs. oscillation regime (2D/3D).
- **Run-Up/Coast-Down Analysis:** Rotational order tracking for stable spectral results during speed variations.
- **Peak Detection:** Calculations in frequency and order domains to indicate worst-case scenarios.

Technical Specifications of YEA PDL Modules

YEA PDL Analog Voltage Inputs Module

YEA PDL Analog Voltage Inputs Module provides a four-channel interface designed for accurate signal processing. This unit utilizes standard BNC connectors to establish reliable connections. It delivers data with 12-bit resolution and maintains sampling speed of 5 MSPS. The hardware supports an input voltage range extending from 0 V to 15 V, ensuring compatibility with standard signal levels.



Parameter	Specification
Analog Input	4 channels
Input Configuration	Supports parallel operation and differential input modes
Resolution	12-bit
Sampling Rate	5 MSPS per channel
Voltage Range	0-15V
Connector	BNC

Analog Input Interface (BNC Connector)

This standard BNC female connector is used for connecting analog signal sources. It acts as the input interface for the module's four voltage channels.

	Pin No.	Signal
	1	ADC INPUT

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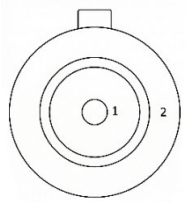
	2	GND

NVH Application: Noise Measurement

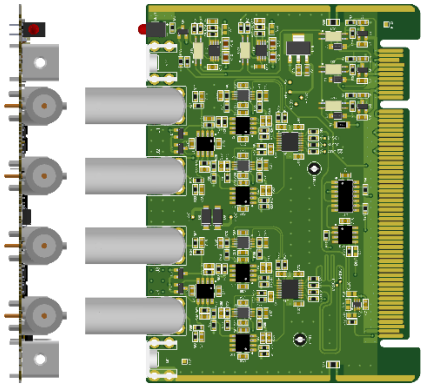
The system provides an integrated solution for noise measurement by combining sensors, hardware, and software. High-performance microphones capture acoustic data across various testing environments, such as vehicle cabins or engine bays. This signal is digitized by the YEA PDL Analog Voltage Input Module, which utilizes a 12-bit resolution and standard BNC interfaces for data acquisition. The software then processes this raw data to perform analysis, providing real-time visualization of noise levels and spectral characteristics.

Supported Microphones

Microphone Type	Frequency Range (± 2/3 dB)	Dynamic Range	Sensitivity
1/4" Array Microphone	10 Hz - 20 kHz	32 dBA - 135 dB	50 mV / Pa
1/2" Free-field	3.15 Hz - 20 kHz	17 dBA - 135 dB	50 mV / Pa
1/4" Free-field	4 Hz - 80 kHz	36 dBA - 157 dB	4 mV / Pa
1/2" Pressure	3.15 Hz - 20 kHz	27 dBA - 147 dB	12.5 mV / Pa
1/4" Pressure	4 Hz - 70 kHz	44 dBA - 165 dB	1.6 mV / Pa

YEA PDL Analog Current Inputs Module

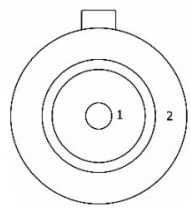
YEA PDL Analog Current Inputs Module provides a four-channel interface designed for accurate signal processing. This unit utilizes standard BNC connectors to establish reliable connections. It delivers data with 12-bit resolution and maintains a sampling speed of 200 kSPS. The hardware supports an input current range extending from 0 mA to 20 mA, ensuring compatibility with standard industrial current loop signals.



Parameter	Specification
Analog Input	4 channels
Input Configuration	Supports parallel operation and differential input modes
Resolution	12-bit
Sampling Rate	5 MSPS per channel
Current Range	0-20mA
Connector	BNC

Analog Input Interface (BNC Connector)

This standard BNC female connector is used for connecting analog signal sources. It acts as the input interface for the module's four current channels.



Pin No.	Signal
1	ADC INPUT
2	GND

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NVH Application: Vibration Analysis

The system provides an integrated solution for vibration measurement by combining sensors, hardware, and software. Industrial MEMS accelerometers detect physical vibrations and convert them into a robust 4-20 mA current signal, ensuring noise-immune transmission. This signal is digitized by the YEA PDL Analog Current Inputs Module, which utilizes 12-bit resolution and standard BNC interfaces for reliable data acquisition. The software then processes this raw data to perform detailed analysis, visualizing the system's response spectrum and oscillation regimes.

Supported Accelerometers

Series	Axes Available	Range	Max. Bandwidth (-3dB)
IAC-CM-I (Condition Monitoring)	1, 2, 3	±25 g to ±500 g	0 - 24 kHz
IAC-I (Standard)	1, 2, 3	±2 g to ±6 g	0 - 1000 Hz
IAC-MR-I (Medium Resolution)	1, 2, 3	±2 g to ±8 g	0 - 1000 Hz
IAC-HiRes-I (High Resolution)	1, 2, 3	±2 g to ±400 g	0 - 4000 Hz

Mounting Types

To ensure secure installation on various surfaces during testing, the system supports a range of mounting interfaces compatible with the vibration sensors.

Accessory Name	Function
Seismic Support	Heavy metallic disk with feet and handles (DIN 45669-2 compliant).
Magnet Interface	Mechanical interface for installation on magnetic metallic supports.
Glueing Interface	Mechanical interface for glued installation on any support.
Threaded Hole Interface	Mechanical interface for M5 screwed installation.
Threaded Stud Interface	Mechanical interface for M5 bolted installation.
Wall Mounting Interface	Mechanical interface for installation on a flat surface.
Pipe Interface	Mechanical interface for installation with hose clamps on pipes.

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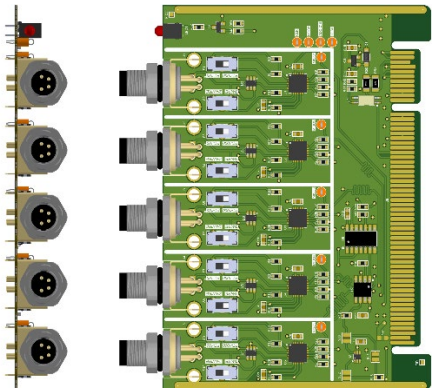
YEA PDL Temperature Inputs Module

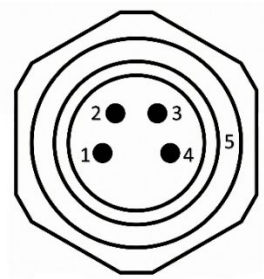
YEA PDL Temperature Inputs Module serves as a dedicated interface for monitoring temperature using Resistance Temperature Detectors (RTDs). This unit provides five independent channels to accommodate multiple sensors simultaneously. It is fully compatible with standard PT100 and PT1000 sensor types. To ensure flexible installation, the module supports 2, 3, or 4-wire wiring configurations connected via reliable M12 4-pin ports. The measurable temperature range is defined by the specific capabilities of the external sensor being used.



Parameter	Specification
Temperature Input	5 channels
Sensor Compatibility	PT100, PT1000
Wiring Support	2, 3, or 4-wire configurations
Temperature Range	Depend on RTD
Connector Type	M8 4-pin

Temperature Sensor Interface (M8 Connector)

This 4-pin M8 connector is used to connect PT100 or PT1000 RTD sensors. It supports 2, 3, and 4-wire configurations for temperature measurement.



Pin No.	Signal
1	**FORCE+**
2	**RTDIN+**
3	**FORCE-**
4	**RTDIN-**
5	**GND**

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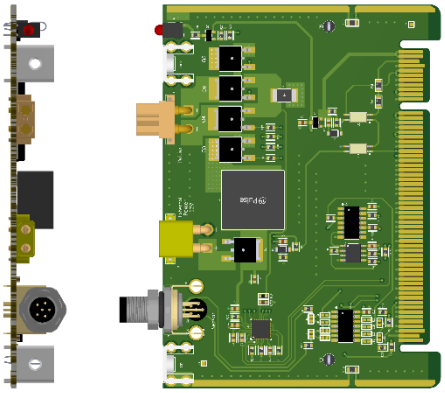
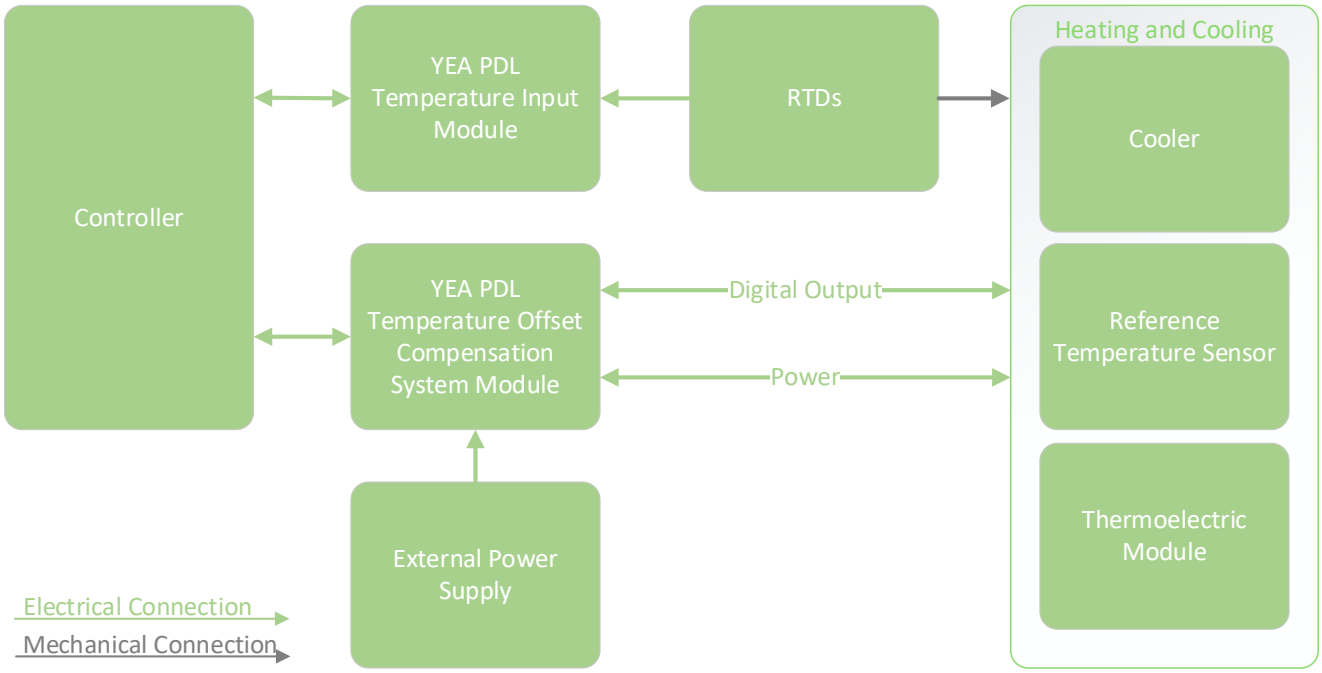
YEA PDL Temperature Offset Compensation System Modules

YEA PDL Temperature Offset Compensation System Module functions as an independent unit for thermal adjustment. It utilizes a Thermoelectric element to actively heat or cool the cooler assembly. An external power supply connects to the module to provide the necessary power for the element. A Reference Temperature Sensor measures the resulting temperature of the cooler. This reading is processed to calculate static errors and apply temperature offset compensation to the connected RTDs. The module provides 16-bit resolution with a specified accuracy of ± 0.25 C.





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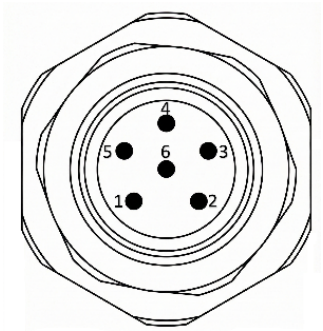
Reference Sensor Interface (M12 Connector)

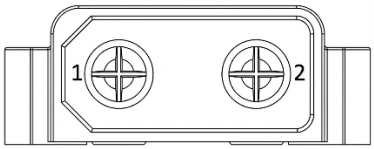
This M12 connector is used to connect the Reference Temperature Sensor. It enables the module to read the temperature required for offset compensation.



Pin No.	Signal
1	+3.3V
2	CLK
3	MOSI
4	MISO
5	CS
6	GND

External Power Input (Male XT30 Connector)

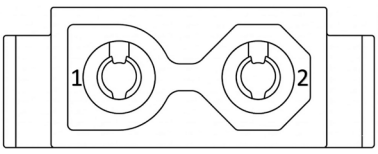
This male XT30 connector is used for connecting the external power supply. It provides the necessary power to the thermoelectric element.



Pin No.	Signal
1	GND
2	VCC

Thermoelectric Module Interface (Female XT30 Connector)

This female XT30 connector connects to the Thermoelectric Module. It supplies power to the cooler assembly.



Pin No.	Signal
1	P+
2	P-

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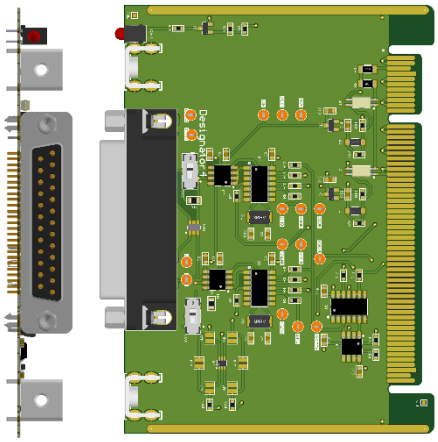
Digital Interfaces

YEA PDL Digital I/O (DIO)

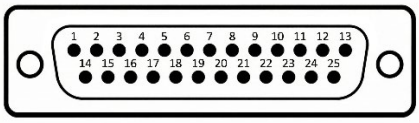
YEA PDL Digital I/O Module provides a multi-voltage interface for digital signal processing. The unit supports three operational voltage ranges: 3.3V, 5V, and 12V. This allows the module to interface with various digital automotive protocols, such as SENT. Physical connections are established using a standard 25-pin D-SUB connector.



Parameter	Specification
Input/Output Voltage	3.3V, 5V, 12V
Max Input Current	500 mA
Max Output Current	200 mA
Connector	25 D-SUB

Digital I/O Interface (25-pin D-SUB Connector)

This 25-pin D-SUB male connector is used to connect the module to external digital sources and actuators. It acts as the input/output interface for the module's eight digital channels, supporting signal levels of 3.3 V, 5 V, and 12 V.



Pin No.	Signal
1, 2, 3, 4, 5, 6, 7	12V DIO
8, 9, 10, 11, 12, 13, 14	5V DIO
15, 16, 17, 18, 19, 20, 21	3.3V DIO
22, 23, 24, 25	GND

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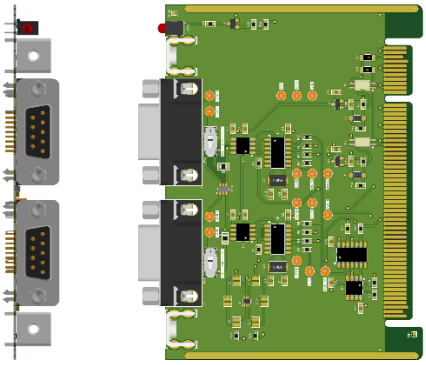
YEA PDL CAN Bus

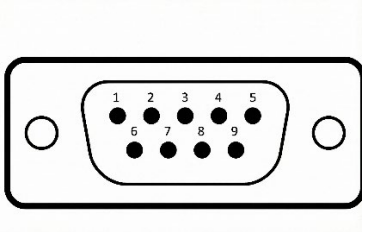
YEA PDL CAN Bus Module facilitates data communication using the Controller Area Network interface. This unit is compatible with both standard High-Speed CAN and the CAN FD (Flexible Data-rate) protocols. It utilizes industry-standard 9-pin D-SUB connectors to establish physical connections with external networks. The module allows for data transmission speeds of up to 8 Mbps, depending on the specific configuration and protocol in use.



Parameter	Specification
Protocol Support	CAN, CAN FD
Max Data Rate	Up to 8 Mbps
Connector	9 D-SUB

CAN Bus Interface (9-pin D-SUB Connector)

This 9-pin D-SUB male connector is used to connect the module to the CAN network. It supports physical connections for both High-Speed CAN and CAN FD protocols.



Pin No.	Signal
2	CAN L
7	CAN H
3, 6	GND
1, 4, 5, 8, 9	NC

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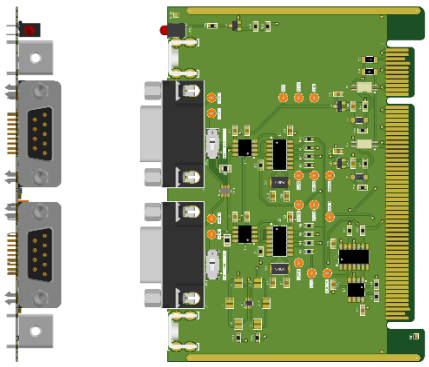
YEA PDL LIN Bus

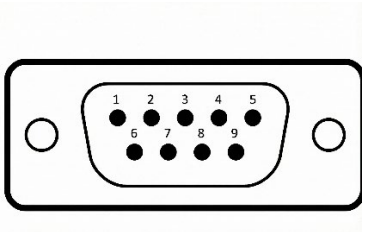
YEA PDL LIN Bus Module provides an interface for the Local Interconnect Network (LIN) protocol. This unit is intended for low-speed serial communication, typically utilized within automotive sub-systems. It supports master-slave operation modes to facilitate organized data exchange. The module complies with established standards, including LIN 2.1, LIN 2.2, and SAE J2602. Data transmission is supported at speeds up to a maximum of 20 kbps, and physical connections are established using standard 9-pin D-SUB connectors.



Parameter	Specification
Compliance	LIN 2.1, LIN 2.2, SAE J2602
Max Baud Rate	20 kbps
Connector	9 D-SUB

LIN Bus Interface (9-pin D-SUB Connector)

This 9-pin D-SUB male connector is used to connect the module to the LIN network. It supports physical connections for LIN 2.1, 2.2, and SAE J2602 protocol standards.



Pin No.	Signal
7	LIN
3, 6	GND / GND
1, 2, 4, 5, 8, 9	NC / NC

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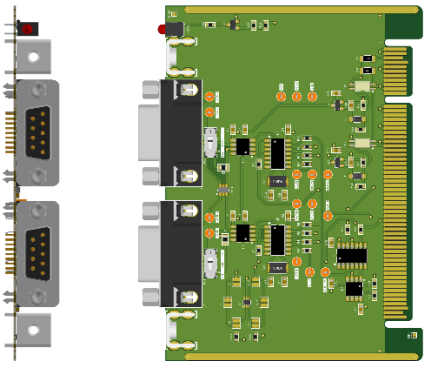
YEA PDL PSI5 Interface

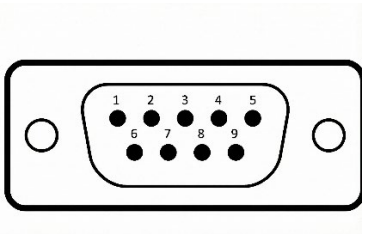
YEA PDL PSI5 Interface Module provides an interface for the Peripheral Sensor Interface 5 (PSI5) protocol. This unit is designed for high-reliability communication with automotive peripheral sensors. It supports both asynchronous and synchronous data transmission modes to facilitate robust sensor data exchange. The module complies with established PSI5 standards, ensuring compatibility with a wide range of automotive sensor applications. Data transmission is supported at speeds up to a maximum of 125 kbps, and physical connections are established using standard 9-pin D-SUB connectors.



Parameter	Specification
Compliance	PSI5 V2.1, PSI5 V1.3
Max Baud Rate	125 kbps
Connector	9 D-SUB

PSI5 Interface (9-pin D-SUB Connector)

This 9-pin D-SUB male connector is used to connect the module to the PSI5 network. It supports physical connections for standard PSI5 protocol sensor configurations.



Pin No.	Signal
2,7	PSI1 / PSI2
3, 6	GND / GND
1, 4, 5, 8, 9	NC / NC

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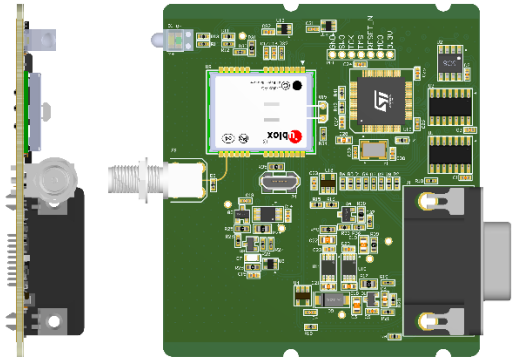
GNSS Specification

The YEAE 9417 GNSS Module provides an interface for positioning and timing operations. It enables standard global positioning and generates a time pulse to synchronize data logging across multiple devices. The unit supports major satellite constellations, including GPS, GLONASS, BeiDou, Galileo, and QZSS. It utilizes 72 channels for signal processing and connects via an SMA female connector. Additionally, the module supplies a +3.3 V DC output to support active antennas



Category	Parameter	Specification
Constellations & Signals	**Supported Constellations**	GPS, GLONASS, BeiDou, Galileo, QZSS
	Signal Types	L1C/A, L1OF, B1, E1B/C, GPS L1C/A²
	Number of Channels	72 channels
Timing & Performance	**Time Pulse Frequency**	1 Hz
RF Electrical	**Input Impedance**	50 Ω, nominal
	Max RF Power at Input	15 dBm
Antenna Interface	**Connector Type**	SMA female
	Active Antenna Output	+3.3 V DC ±5 %

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