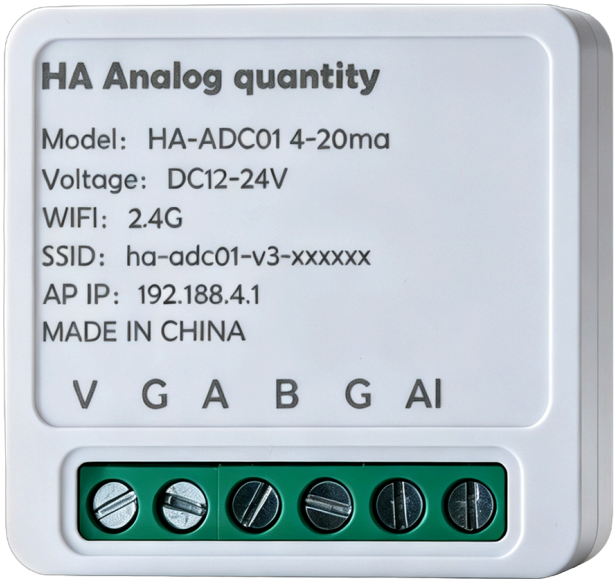
Product Manual

Analog AI Acquisition Module

Model · ADC01

Product version · V1.0



1. Product Overview

ADC01 is an industrial-grade analog AI acquisition module. It supports 4-20mA, 0-5V, and 0-10V signal inputs, adopts a 12-bit high-precision ADC, and features free range conversion. It supports the standard RS485 Modbus RTU protocol. An optional HA version (with built-in Wi-Fi and MQTT) is available for seamless integration into Home Assistant smart home or industrial systems, widely used in various data acquisition and monitoring scenarios.

2. Features

- Free range conversion: Can convert raw collected data (0-5000 / 0-10000 / 4000-20000) into actual engineering quantities (e.g., 0-1.5 meters, 0-100℃) as needed, supporting both direct and inverse proportional output.
- High precision and strong anti-interference: 12-bit ADC resolution (4096), with ±15KV ESD protection and 600W lightning surge protection. Data is stable without jumping, adapting to harsh industrial field environments.
- Standard Modbus RTU: RS485 interface, supporting 03/06/16 function codes. Can easily connect to PLC, HMI screens, and industrial control instruments, with a communication distance of up to 1200 meters.
- Native HA integration (optional): The HA version has built-in 2.4G Wi-Fi and supports native ESPHome integration, allowing automatic discovery and entity generation in Home Assistant; it also supports MQTT protocol connection to self-owned servers.
- Independent WEB page configuration: Built-in independent web backend on port 88, supporting online calibration (total range, dead zone value settings), MQTT configuration, as well as Chinese/English switching and light/dark theme switching, with flexible cloud/local deployment.

3. Application Scenarios

1. PLC/HMI screen data acquisition: Data acquisition and monitoring for industrial automation production lines.

2. HA integration and environmental monitoring: Connect to Home Assistant to achieve data linkage for environmental sensors such as temperature, humidity, and pressure.

3. Soil/water quality sensor acquisition: Analog signal conversion and upload in agricultural or environmental protection fields.

4. Current/Voltage Monitoring: Real-time analog monitoring of industrial equipment operating status.

4. Structural Interfaces

- Housing dimensions: 40 × 40 × 22 mm (white square housing).
- Product interface terminals:
- V: Power positive (DC 12-24V)
- G: Power negative / Analog signal ground
- A: RS485 A (+)
- B: RS485 B (-)
- AI: Analog signal input

Technical Specifications

Parameter	Parameter Value
Product Name	Analog AI Acquisition Module
Model	ADC01
Brand	LTCN
Supply Voltage	DC 12-24V
Input Voltage/Current	DC 12-24V
Interface Type/Quantity	RS485
Communication Protocol/Band/Rate	Standard Modbus RTU
Dimensions	40 × 40 × 22 mm
Weight	100 g
Operating Temperature	-40 ~ 80℃
Packing List	AI Acquisition Module ADC01 x 1

Free Range Conversion	Can convert the collected raw data (0-5000 / 0-10000 / 4000-20000) into actual engineering quantities (e.g., 0-1.5 meters, 0-100℃) as required, supporting direct and inverse proportional output.
High Precision and Strong Anti-Interference	12-bit ADC resolution (4096), equipped with ±15KV ESD protection and 600W lightning surge protection, ensuring stable data without jumping, suitable for harsh industrial field environments.
Standard Modbus RTU	RS485 interface, supports 03/06/16 function codes, can be easily connected to PLC, configuration screens, and industrial control instruments, with a maximum communication distance of 1200 meters.
HA Native Integration (Optional)	The HA version has built-in 2.4G Wi-Fi, supports ESPHome native integration, and can be automatically discovered in Home Assistant to generate entities; it also supports MQTT protocol connection to self-owned servers.
Independent WEB Page Configuration	Built-in independent web backend on port 88, supports online calibration (full range, dead zone value settings), MQTT configuration, as well as Chinese/English switching and light/dark theme switching, with flexible cloud/local deployment.
1. PLC/Configuration Screen Data Acquisition	Data acquisition and monitoring for industrial automation production lines.
2. HA Integration and Environmental Monitoring	Connect to Home Assistant to achieve data linkage for environmental sensors such as temperature, humidity, and pressure.
3. Soil/Water Quality Sensor Acquisition	Analog signal conversion and upload in agricultural or environmental protection fields.
4. Current/Voltage Monitoring	Real-time analog monitoring of industrial equipment operating status.
Enclosure Dimensions	40 × 40 × 22 mm (white square enclosure).
V	Power positive (DC 12-24V)
G	Power negative / Analog signal ground
A	RS485 A (+)

B	RS485 B (-)
AI	Analog signal input
Parameter Item	Specification Description
Power Consumption	<1000mW
Input Range	4-20mA / 0-5V / 0-10V (three versions available)
AD Resolution	12-bit (4096)
Default Baud Rate	9600, 8, N, 1
ESD Protection	±15KV
Surge Protection	600W 1000μs
HA Version Features	Independent WEB page + MQTT + HA auto-discovery
Power Connection	Connect the positive terminal of the DC 12-24V power supply to the V terminal, and the negative terminal to the G terminal.
Communication Wiring	Connect the RS485 A(+) of the host computer or controller to A, and B(-) to B.
Signal Acquisition	Connect the positive output of the sensor or signal source to the AI terminal, and the signal negative/ground wire to the G terminal (common ground with power).
1. Connect power and hotspot	After powering on, connect the phone/computer to the device hotspot starting with HA- (default password: 12345678).
2. Device network configuration	Automatically redirects to the network configuration backend (if not redirected, access 192.168.4.1), configure the device to connect to the 2.4G Wi-Fi network where the HA host is located.
3. HA auto-discovery	Open Home Assistant backend -> Devices & Services -> ESPHome integration, the system will automatically discover the device, click configure to add.
4. Start using	Add an entity card to the HA dashboard to monitor data remotely.
(Note	You can also access the device's port 88 via browser to enter the independent WEB backend for MQTT configuration or range calibration)*

Register Address	Content; Data Type; Operation; Description
:---	:---; :---; :---; :---
0x0000	Raw data; UINT16; Read-only; 0-5000 / 0-10000 / 4000-20000
0x0001	Temperature value; UINT16; Read-only; Module temperature (°C)
0x0002~0x0003	Range conversion value; Float32; Read-only; Converted value (Read value/100 = Actual value)
0x0004	Device address; UINT16; Read/Write; 1-247, default 1
0x0005	Baud rate; UINT16; Read/Write; 12=1200, 24=2400, 48=4800, 96=9600, 192=19200...
0x0008~0x0009	Range conversion upper limit; Float32; Read/Write; Communication format ABCD, high byte first
0x000A~0x000B	Range conversion lower limit; Float32; Read/Write; Communication format ABCD, high byte first
0x000C	ADC raw data; UINT16; Read-only; 0-4095 raw AD value
0x001D	Module restart; UINT16; Write-only; Write non-zero value to restart
Read raw data	Send 01 03 00 00 00 01 84 0A, return 01 03 02 13 88 B4 0E (0x1388=5000).
Read range conversion value	Send 01 03 00 02 00 02 65 CB, return 01 03 04 42 48 00 00... (0x42480000 float converted to 50.0).
Modify address to 2	Send 01 06 00 04 00 02 08 0B.
Independent WEB backend (IP	88) supports local calibration function, can modify "Total Range", "Total Range AD Value" and "Dead Zone Value" to correct data errors.
Product Version	V1.0

6. Installation and Wiring

- Power connection: Connect the positive terminal of the DC 12-24V power supply to the V terminal, and the negative terminal to the G terminal.
- Communication wiring: Connect the RS485 A(+) of the host or controller to A, and B(-) to B.

- Signal acquisition: Connect the positive output of the sensor or signal source to the AI terminal, and the signal negative/ground wire to the G terminal (common ground with the power supply).

7. Configuration and Usage

Modbus Mode Usage

After powering on the module, connect the PLC or computer via the RS485 interface. Use Modbus RTU commands to read register 0x0000 to obtain raw data. To display engineering quantities intuitively, write to registers 0x0008~0x0009 (range conversion upper limit) and 0x000A~0x000B (range conversion lower limit), then read 0x0002~0x0003 to obtain the converted actual values.

HA Version Network Configuration and Access

1. Connect power and hotspot: After powering on, connect the phone/computer to the device hotspot starting with HA- (default password: 12345678).

2. Device network configuration: Automatically redirects to the network configuration backend (if not redirected, access 192.168.4.1), configure the device to connect to the 2.4G Wi-Fi network where the HA host is located.

3. HA automatic discovery: Open the Home Assistant backend -> Devices & Services -> ESPHome integration, the system will automatically discover the device, click configure to add it.

4. Start using: Add an entity card to the HA dashboard to monitor data remotely.

(Note: You can also access the device's port 88 via a browser to enter the standalone WEB backend for MQTT configuration or range calibration)

8. Communication Protocol

This product uses the standard Modbus RTU communication protocol, with default parameters of 9600, 8, N, 1, CRC16 low byte first. Supports function codes 03H (read), 06H (write single), 10H (write multiple). The floating-point format uses ABCD (high byte first).

Register Address Table:

Register Address	Content	Data Type	Operation	Description
0x0000	Raw Data	UINT16	Read-only	0-5000 / 0-10000 / 4000-20000
0x0001	Temperature Value	UINT16	Read-only	Module temperature (°C)

0x0002~0x0003	Range Conversion Value	Float32	Read-only	Converted value (Read value/100 = Actual value)
0x0004	Device Address	UINT16	Read/Write	1-247, default 1
0x0005	Baud Rate	UINT16	Read/Write	12=1200, 24=2400, 48=4800, 96=9600, 192=19200...
0x0008~0x0009	Range Conversion Upper Limit	Float32	Read/Write	Communication format ABCD, high byte first
0x000A~0x000B	Range Conversion Lower Limit	Float32	Read/Write	Communication format ABCD, high byte first
0x000C	ADC Raw Data	UINT16	Read-only	0-4095 original AD value
0x001D	Module Restart	UINT16	Write-only	Write non-0 value to restart

Communication Command Examples:

- Read raw data: Send 01 03 00 00 00 01 84 0A, return 01 03 02 13 88 B4 0E (0x1388=5000).
- Read range conversion value: Send 01 03 00 02 00 02 65 CB, return 01 03 04 42 48 00 00... (0x42480000 floating point converted to 50.0).
- Modify address to 2: Send 01 06 00 04 00 02 08 0B.

9. Applicable Conditions and Limitations

- Must operate under the specified DC 12-24V voltage; exceeding the range may damage the device.
- Operating ambient temperature should be between -40 ~ 80°C.
- This module has three versions: 4-20mA, 0-5V, and 0-10V. Please select based on the actual sensor signal type; do not mix them.

10. Troubleshooting

[Not mentioned in the manual, please supplement later]

11. Safety and Maintenance

- Ensure the power is disconnected before wiring to avoid short circuits or electric shock.

- Strictly follow the terminal labels for wiring (V, G, A, B, AI). Do not connect high voltage (such as 220V) directly to signal or communication terminals.
- In environments with frequent lightning strikes or strong electromagnetic interference, it is recommended to take additional shielding or grounding measures.

12. Others

- The independent WEB backend (IP:88) supports local calibration functions, allowing modification of "Total Range", "Total Range AD Value", and "Dead Zone Value" to correct data errors.

13. Packing List

- AI Acquisition Module ADC01 x 1

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