ZWGW01/02 LoRa Modbus Transceiver Datasheet

Rev D

XI'AN ZenlyTech Electronic Technology Co., Ltd

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1 Overview

The ZWGW01/02 LoRa Modbus transceiver serves as a wireless bridge for Modbus RTU/TCP devices, enabling seamless connections between diverse serial devices and Modbus TCP devices. It revolutionizes network connectivity by substituting traditional wired links with wireless ones, all while maintaining the integrity of the original network configuration.

Within a single network environment, the ZWGW01/02 has the remarkable ability to interface with both RS485 serial devices and Modbus TCP devices. This dual - compatibility feature significantly simplifies the process of network deployment and connection establishment for users, offering them greater flexibility and convenience in setting up and managing their networks.

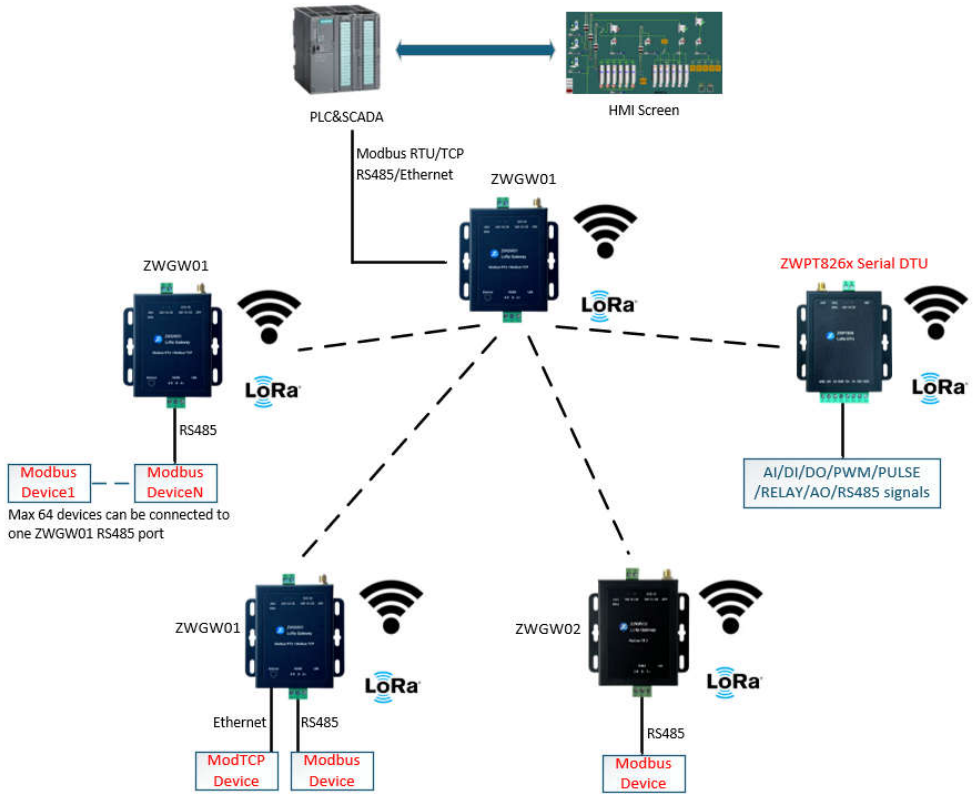
Connecting RS485 devices to this network is highly convenient. For users who need to integrate AI/DI/DO/PWM/PULSE/RELAY/AO/LATCH devices, simply add the ZWPT826x serial DTU to the network. From the standpoint of PLCs (Programmable Logic Controllers) and SCADA (Supervisory Control and Data Acquisition) systems, the ZWPT826 functions as a Modbus - compliant device, ensuring seamless integration and communication.

The key distinction between ZWGW01 and ZWGW02 lies in their connectivity options. ZWGW01 is equipped with both an RS485 port and an RJ45 network port, while ZWGW02 features only an RS485 port. Notably, both ZWGW01 and ZWGW02 can coexist and be deployed within the same network environment, offering users flexibility in system configuration based on their specific connectivity requirements.

The ZWGW01 internet connection supports five operation modes: TCP Client, TCP Server, UDP Client, UDP Server, and Httpd Client. Specifically, both the TCP Client and TCP Server modes are compatible with the Modbus TCP protocol. It can function as a gateway for both MQTT and Modbus protocols. Configuration can be achieved via either a web - based interface or dedicated configuration software. Moreover, the port supports the functions of heartbeat packets and registration packets.

Features:

- ✓ Configurable channels
- ✓ USB-based parameter configuration
- ✓ USB-enabled MCU program upgrades
- ✓ Long-range and low power consumption
- ✓ Transparent data transmission
- ✓ Support Modbus RTU/TCP and private protocol
- ✓ Support serial device and Modbus TCP device in one network
- ✓ Both RS485 and network port are electrically isolated
- ✓ AES128 encryption support
- ✓ Low-rate long-range wireless transmission
- ✓ TCP Client/TCP Server/UDP Client/UDP Server/Httpd Client/Modbus/MQTT



Wireless modbus network system

The network system built around the ZWGW01 can be employed in RS485 networks, Modbus TCP networks, or hybrid setups, effectively replacing the original wired networks. With straightforward configuration, it can establish a wireless transparent transmission network.
RS485 sensors or devices can be linked to the ZWGW01 to bridge RS485 data. For AI/DI/DO/PWM/PULSE/RELAY/AO connections, the ZWPT826X serial DTU can be used. It functions as a wireless converter that transforms AI/DI/DO/PWM/PULSE/RELAY/AO signals into Modbus - compatible data.
From the perspective of PLC or SCADA systems, all the objects marked in red are Modbus devices. As such, each of these devices must have a unique Modbus address to ensure proper communication and identification within the network.
A key difference between the ZWGW01 and ZWGW02 lies in their port configurations. The ZWGW01 is equipped with both an RS485 serial port and an RJ45 network port, while the ZWGW02 only has an RS485 serial port. Despite this difference, both the ZWGW01 and ZWGW02 can be co - deployed within the same network, providing users with flexibility in network design and implementation.
When the Ethernet port of ZWGW01 is connected to the master device, the RS485 port can be connected to slave devices to realize conversion from Modbus TCP to Modbus RTU.

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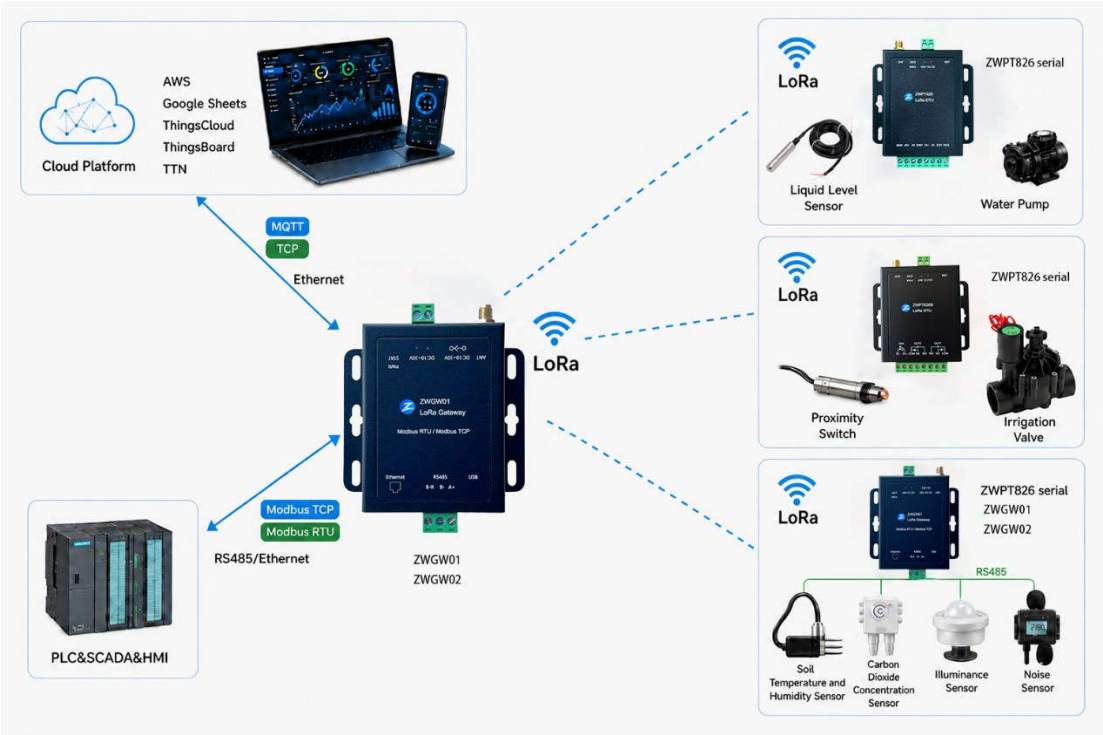
providing users with flexibility in network design and implementation.

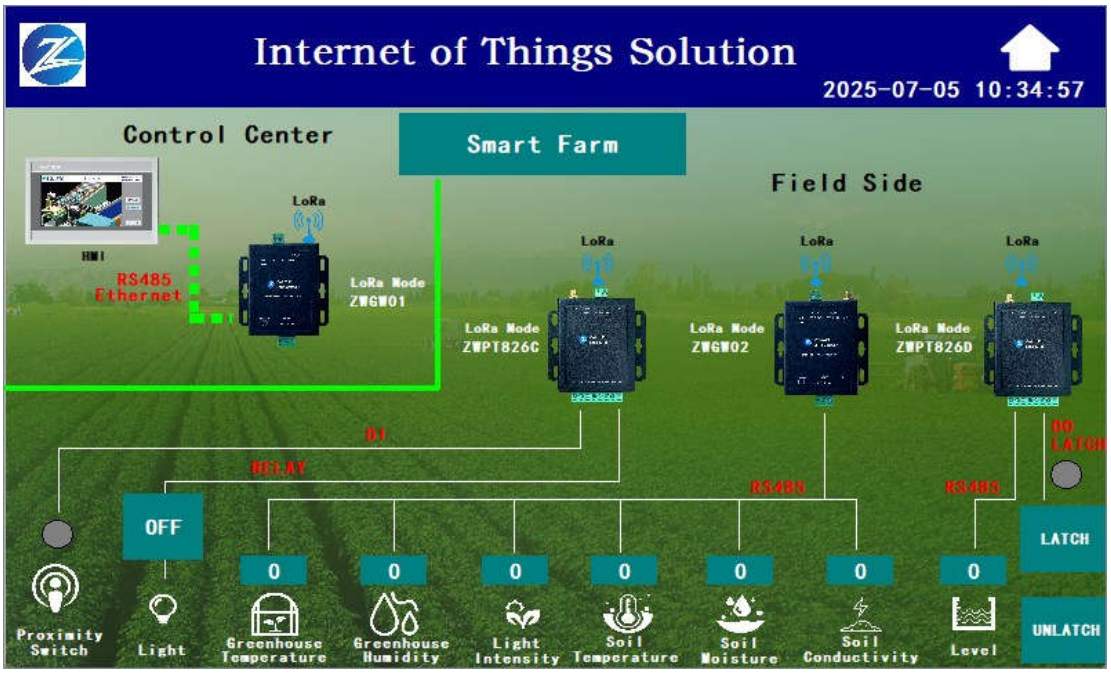
Equipped with dual ports—Ethernet and RS485—the ZWGW01 allows one port to connect to a master device while the other interfaces with slave devices. This realizes conversion from Modbus TCP to Modbus RTU.

ZWGW01 physical photo

ZWGW02 physical photo



LoRa Network Diagram



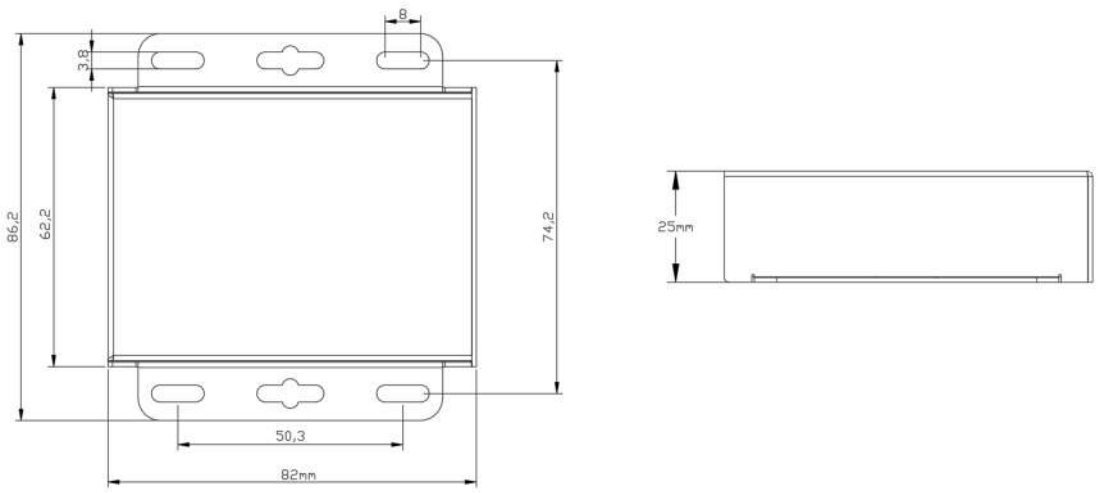
Smart Farm Application Example

2 Product parameters

Name	Content	Remark
Frequency bands	433//470/868/915	MHZ
Antenna	External rod antenna	Optional FRP antenna

Transmit power	20dbm	
Power supply	10-30VDC	
Power adapter	Input 100~240VAC 50/60HZ Output 12VDC/1A	
Maximum current	<300mA	AVG. 120mA@12VDC AVG. 60mA@24VDC
Operating temperature	(-40 ~ +85)℃	
RS485 devices supported for one ZWGW01/02 on slave side	64	
Maximum recommended Poll Rate	5/s@125KHZ_BANDWIDTH 10/s@500KHZ_BANDWIDTH	
Transmission distance	1-10KM	Sunny weather, visual barrier-free up to 10KM
Protection	IP65	
Weight	Approx. 200g	Power adapter not included
Housing material	Galvanized steel	
Size	86X82X25	mm

3 Outline



Outline

4 Description

4.1 Power on the device

The power supply can be connected using a power adapter or cables. *The power supply must not be connected using both a power adapter and cables simultaneously.*

When powered by a power adapter, the power terminal can connect to external

devices to supply power to them, with the supply voltage equal to the output voltage of the power adapter(12VDC).

4.2 LED indicator

PWR Power Indicator (Green)	Lights up when powered on; Flashes when transmitting/receiving LoRa data
STAT status Indicator (Red)	It is always on when there is an error state. This LED remains lit during the device power-on initialization process.
The PWR/STAT LEDs blink simultaneously in upgrade mode.	

LED Indicator Status

4.3 Communication

In addition to supporting the standard Modbus protocol, the ZWGW01/02 also supports user-defined private protocols.

Since LoRa is a low-rate, long-distance wireless communication technology, the Poll Rate of PLC/SCADA should not be too high; otherwise, communication failure will occur. The recommended maximum Poll Rate is 5/s@125KHZ_BANDWIDTH and 10/s@500KHZ_BANDWIDTH.

For the same LoRa network, consistent spread factor (SF) and frequency(channel) must be maintained. A larger spread factor enhances communication distance, yet it simultaneously reduces data transmission rate and increases latency.

Make sure all nodes in one network use the same spread factor (SF) and frequency(channel). Nodes cannot communicate with each other with different spread factors (SF) and frequency(channel). Spread factor (SF) and frequency(channel) can be seen in LOG after reset and can be set with IoT_Test_Tool.

Communication port default parameters

Name	Content	Remark
RS485 default	9600,n,8,1	9600/19200/38400/57600/115200 available
IP address	192.168.0.7	
Ethernet TCP port	502	
Max data length	232bytes	
Built-in web page user/password	admin/admin	

IP/port can be configured via built-in web page.

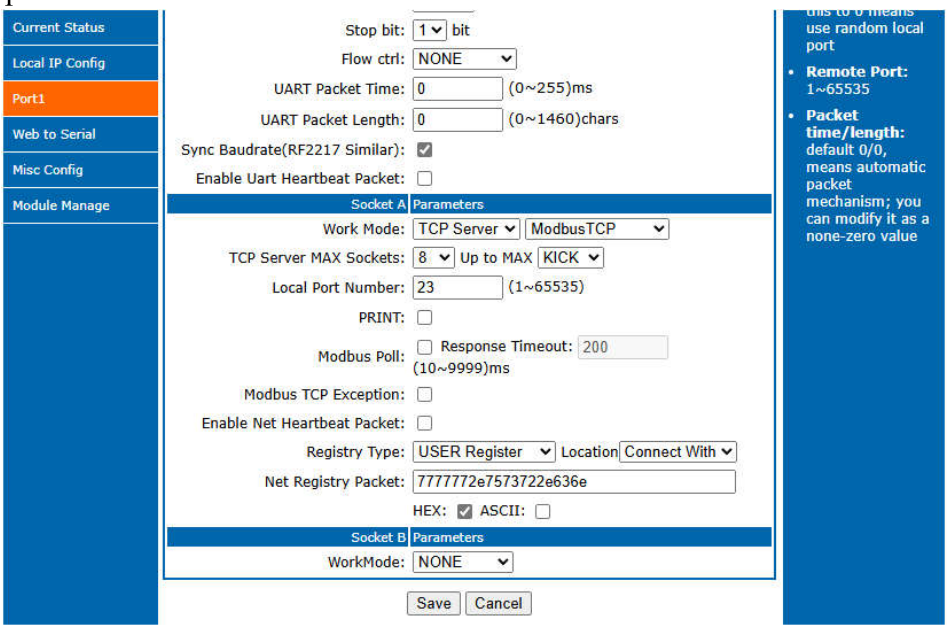
4.4 Web connection

The ZWGW01 network port supports five operational modes: TCP Client, TCP Server, UDP Client, UDP Server, and Httpd Client. Notably, both the TCP Client and TCP Server modes are fully compatible with the Modbus TCP protocol, enabling seamless industrial communication. Configuration can be easily performed via either a web -

based interface or dedicated configuration software, offering flexible setup options for users. Additionally, the port incorporates support for heartbeat packets and registration packets, enhancing network stability and device management capabilities.

The network port supports static and DHCP IP address settings, as well as DNS configuration.

The ZWGW01 can be integrated into various IoT platforms via the TCP registration packet mechanism, allowing seamless access to wireless network data through these platforms. This capability ensures flexible connectivity and efficient data retrieval for IoT applications.



4.5 Terminal definition

10~30VDC +	Power supply positive
10~30VDC -	Power supply negative
A+	RS485 A+
B-	RS485 B-
B-R	Short B- and B-R using an internal 120ohm termination resistor

4.6 Extend Transmission Distance

For scenarios requiring ultra-long-distance transmission, the method of using hopping stations can be adopted to extend the communication distance.

Two sets of ZWGW01/02 form a hopping station. During the hopping process, the frequency is switched to a different channel.

Using the hopping method can significantly extend the transmission distance, but it will introduce additional time delay.

4.7 Antenna

The modbus transceiver uses a rod antenna by default, and in order to achieve a longer communication distance, users can choose to use a fiberglass (FRP) antenna.

Rob antennas(default)

FRP antenna

Magnetic Suction Antenna with Feeder Cable(1m default)

The communication distance is substantially affected by multiple factors, including antenna type, mounting technique, presence of obstacles (e.g., buildings, trees), and weather conditions (rainy days will attenuate the signal and reduce the communication distance). To maximize transmission range, the following strategies are recommended:

- Select high-gain FRP antennas engineered for extended coverage; RG58 is adopted as the default antenna feeder. LMR200 and LMR400 provide lower attenuation.
- Mount antennas at elevated positions to optimize line-of-sight propagation.
- It is best to ensure unobstructed clear line-of-sight between antennas to minimize signal degradation.
- Select higher spread factor by PC setting tool IoT_Test_Tool .

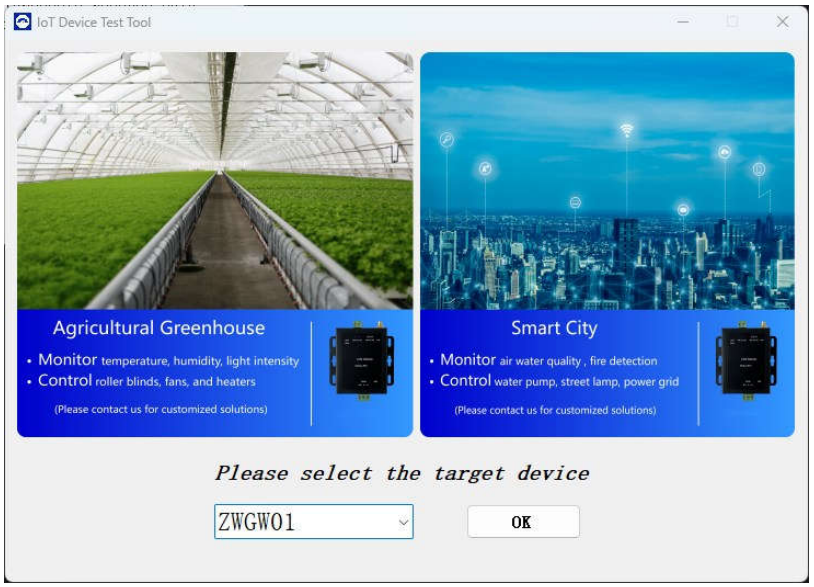
4.8 Device automatically rebooting

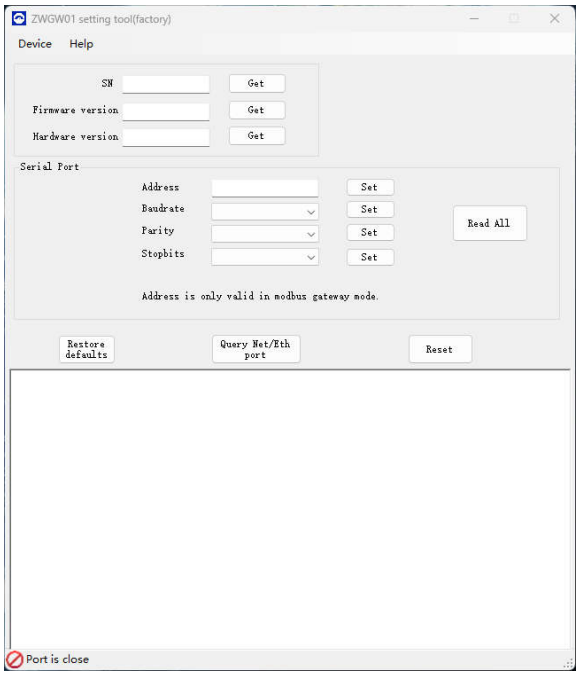
To prevent TCP dead links, the device will automatically reboot if no data is received within 5 minutes from either the RS485 port or the RJ45 network port.

4.9 Configuration via USB & RJ45

Through USB, parameters related to LoRa(Spread factor/frequency/transmit power) and the RS485 serial port can be configured, along with device firmware upgrades. Users can view device log information via USB. The manufacturer provides PC configuration software tools.

Network-related parameters can be configured by accessing the built-in web page through the RJ45 port. The default IP address is 192.168.0.7. Built-in web page user/password is admin/admin. Only ZWGW01 supports RJ45 net port.





ZWGW01/02 Configuration Tool IoT_Test_Tool

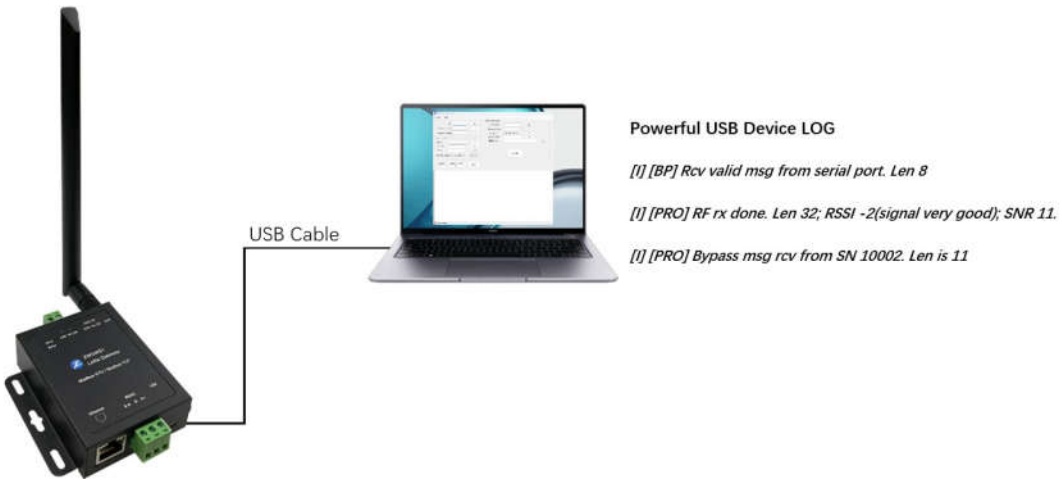
4.10 Device logs

Logs that output via USB port play a critical role in problem troubleshooting. Such logs contain essential information including device parameters and communication status: all user-configured parameters (such as spreading factor SF values, frequency values, transmission power, IP addresses, baud rates, etc.) are fully output during device startup; real-time statuses like LoRa data transceiving, serial port data interaction, and RSSI/SNR signal strength are also clearly recorded in the logs. By analyzing log contents, various operational anomalies can be accurately identified, making the mastery of log analysis skills of great practical significance.

Logs are automatically stored in files. Users are advised to first perform self-diagnosis via log analysis. In case further assistance is required, log files can be submitted to the manufacturer's technical support team for review.

```
----Enter application----
[I] [DEV] Hardware version is A
There is no valid data in factory storage
[I] [DEV] Firmware version: V1.0.3
[I] [DEV] Hardware version: A
[I] [DEV] Device model: ZWGW01 Bypass version
[I] [DEV] Description: LoRa gateway BYPASS version. IoT expert. Built at Jul  9 2025 16:29:20
[I] [DEV] Device ID: 1; SN:10000
[I] [DEV] CodingRate is LORA_CR_4_5
[I] [DEV] PreambleLength is 8
[I] [DEV] LowDatarateOptimize is 1
[I] [DEV] Spread factor is SF7
[I] [DEV] Tx power is 22dbm
[I] [RTC] RTC initialization done
[I] [485] RS485 modbus baudrate is 9600;8 bit data length
[I] [485] RS485 modbus parity NONE
[I] [485] RS485 modbus 1 stop bit
[I] [USRNET] Usr net module intialization done
[16:31:12:022]
[I] [BP] Rcv valid msg from serial port. Len 8
[16:31:14:061]
[I] [BP] Rcv valid msg from serial port. Len 8
[16:31:15:094]
[I] [USRNET] Enter config mode done
[I] [USRNET] Echo off
[I] [USRNET] Version: V8.0.08.000000.0000
[16:31:15:160]
[I] [USRNET] Mode: STATIC; address: 192.168.0.7; mask: 255.255.255.0; gateway:192.168.0.1
[16:31:15:210]
[I] [USRNET] MODTCP: ON
[I] [USRNET] Sock: TCPS,192.168.0.201,502
[I] [USRNET] Sock link: LISTEN
[I] [USRNET] No data reset time(S): 0
[16:31:15:231]
[I] [USRNET] Enter transparent mode done
[16:31:15:333]
[I] [PRO] Frequency is 1, 902500000
[I] [PRO] BW is 125K
[I] [PRO] Time on air for 16bytes is 52ms
[16:31:15:367]
[I] [PRO] CAD parameters: symb 2 min 10 peak 22
[I] [PRO] Get random number: 2147525979
[16:31:15:407]
[I] [BP] LoRa send out
[I] [PRO] Encrypt data
[16:31:15:501]
[I] [RTC] MCU wakeup time: 0ms
[16:31:16:118]
[I] [BP] Rcv valid msg from serial port. Len 8
[I] [BP] LoRa send out
[I] [PRO] Encrypt data
[16:31:18:310]
[I] [PRO] RF rx done. Len 16; RSSI -19(signal very good); SNR 12. [I] [PRO] Descrypt. [I] [PRO] Bypass msg rcv from SN 10003. Len is 7
[16:31:19:901]
[I] [BP] Rcv valid msg from serial port. Len 8
[I] [BP] LoRa send out
[I] [PRO] Encrypt data
```

ZWGW01 log example



Easy Network Diagnosis With IoT_Test_Tool

4.11 LoRa signal probe

Users can leverage the Probe tool for network troubleshooting. Connected to a computer via USB, the tool enables the PC-based software IoT_Test_Tool to receive data from all nodes within the LoRa network—including real-time visibility of each

node signal strength and data payload—after the corresponding wireless parameters are configured. By deploying the Probe tool at different locations across the network, users can conduct comprehensive analysis of node signal strength and data to facilitate accurate network diagnosis.

Probe Tool

[10:03:52:121]
[I] [PRO] RF RX Size 32; RSSI -11(signal very good); SNR 12 ->{
[I] [PRO] LoRa message from SN 10000. FuncCode 7, Payload Len 9. Type 17
Payload: 06 03 04 00 00 00 E1 4C BB }

[10:03:52:210]
[I] [PRO] RF RX Size 16; RSSI -14(signal very good); SNR 12 ->{
[I] [PRO] LoRa message from SN 10000. FuncCode 7, Payload Len 8. Type 17
Payload: 02 03 01 02 00 01 24 05 }

[10:03:56:302]
[I] [PRO] RF RX Size 16; RSSI -14(signal very good); SNR 12 ->{
[I] [PRO] LoRa message from SN 10000. FuncCode 7, Payload Len 8. Type 17
Payload: 02 03 01 02 00 01 24 05 }

[10:03:58:493]
[I] [PRO] RF RX Size 16; RSSI -14(signal very good); SNR 12 ->{
[I] [PRO] LoRa message from SN 10000. FuncCode 7, Payload Len 8. Type 17
Payload: 0B 01 00 02 00 0C 9D 65 }

Log example from Probe Tool

5 Cautions

5.1 Transmit range

To increase the range of a LoRa communication system, several factors can be adjusted, including the spreading factor, transmit power, antenna setup, and environmental factors. Here's a breakdown of how to optimize for longer distances:

1. Spreading Factor (SF)

- ✓ Higher SF, Longer Range

Increasing the spreading factor (e.g., from SF7 to SF12) increases the range but also decreases the data rate and increases transmission time.

- ✓ Consider Trade-offs

While a higher SF offers more range, it also means slower data transmission and potentially increased power consumption.

2. Transmit Power

- ✓ Increase the transmit power to the maximum allowed by local regulations. Be mindful that higher power also increases energy consumption.

3. Antenna Optimization

- ✓ High Gain Antennas

Use high-gain antennas (e.g., 8dBi or higher) on the receiving device to improve signal reception.

- ✓ Antenna Height

Mount antennas as high as possible, preferably on rooftops, to minimize obstructions and maximize line-of-sight.

- ✓ Line of Sight

Ensure a clear line of sight between antennas to minimize signal interference from obstacles.

- ✓ Antenna Type

Vertical antennas are generally recommended.

- ✓ Antenna Cable

Keep antenna cables as short as possible and ensure the device is close to the antenna.

4. Environmental Factors

- ✓ Obstacles

Buildings, trees, and other obstacles can significantly impact signal strength. Minimize obstructions in the signal path.

- ✓ Gateway Placement

For LoRa, proper gateway placement is crucial. Consider installing gateways on rooftops or elevated positions.

5.2 SMA antenna mount

The device's antenna mount is an SMA connector with external threads and an internal hole. When users purchase their own antennas or antenna feeder cables, it is crucial to ensure proper matching between the pin and the hole. If the pin diameter is larger than that of the hole, screwing the threads may damage the SMA mount. This will severely affect communication distance. This point requires special attention during use.

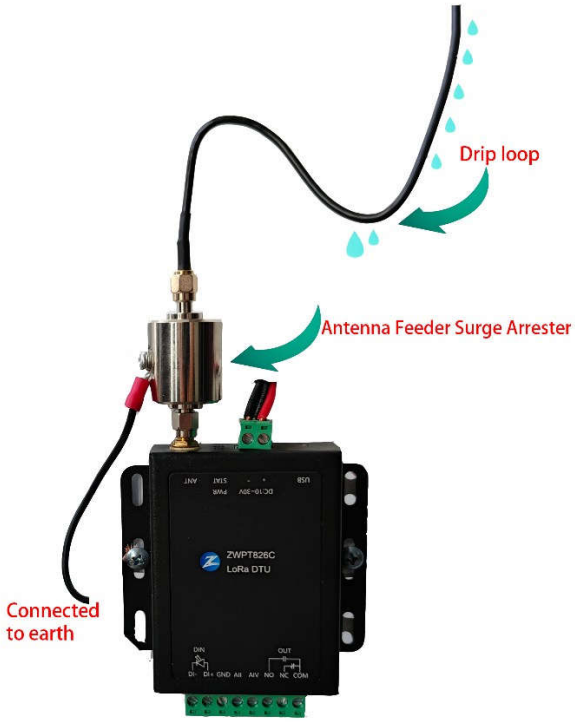
5.3 Water drip loop

A drip loop is a U-shaped bend made in the coaxial cable of a LoRa antenna, just below the antenna connector or wall feed-through. Rainwater runs down the cable, collects at

the loop's lowest point, and drips off, preventing water intrusion into the connector, equipment, or enclosure.

5.4 Antenna Feeder Surge Arrester

An antenna feeder surge arrester protects LoRa radio equipment by diverting lightning-induced surges and static electricity from the coaxial cable to a grounded metal body, such as a metal cabinet, equipment chassis, or dedicated grounding bar. This prevents high-voltage transients from damaging sensitive RF circuits.



Wiring Diagram with Drip Loop and Surge Arrester

5.5 System-level risk consideration

During the system design and deployment phase, it is necessary to fully consider the system response mechanisms under abnormal operating conditions such as wireless communication link interruption, including but not limited to pre-set schemes for key links like system output logic and actuator action strategies, so as to ensure the controllability of the overall system operation.

ZenlyTech shall only assume quality assurance obligations that are in line with statutory and agreed standards for the products themselves it provides. ZenlyTech shall not be liable for system-level risks and related losses caused by factors such as system integration schemes, scenario adaptation strategies, external environmental interference, or failure to fully pre-set response mechanisms for abnormal operating conditions.

6 Order consideration

Factors to Consider When Placing an Order

- ✓ Model selection between ZWGW01 and ZWGW02; ZWGW01 is equipped with an Ethernet port.
- ✓ Antenna type: Choose an FRP antenna for longer communication distance; the length of the antenna feeder cable shall also be taken into consideration.
- ✓ Confirm whether an antenna feeder surge arrester is required.
- ✓ Whether a LoRa signal probe is required for network commissioning and debugging.

Revision History

Document revision history

Date	Version	Revise
2021/01/15	Rev A	Initial release
2022/02/01	Rev B	Update for web
2025/05/01	Rev C	Update for cautions
2025/12/01	Rev D	Update for probe tool

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FCC Warnning:

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection againstharmful interference in a residential installation. This equipment generates, uses and can radiateradio frequency energy and, if not installed and used in accordance with the instructions, maycause harmful interference to radio communications. However, there is no guarantee thatinterference will not occur in a particular installation. If this equipment does cause harmfulinterference to radio or television reception, which can be determined by turning the equipmentoff and on, the user is encouraged to try to correct the interference by one or more of thefollowing measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Caution: Any changes or modifications to this device not explicitly approved by manufacturer could void your authority to operate this equipment.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1)This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body.