

RS-232/RS422/485 to LoRaWAN

EX-9212LoRa-S(WAN) User Manual



First Edition, Dec 2023

Introduction

EX9212LoRa-S(WAN) is a user-friendly radio transmitter featuring a MODBUS interface, tailored for seamless communication with EX9212LoRa-G-WAN LoRaWAN gateways. With versatile support for RS232/422/485 interfaces, it adapts to diverse connectivity requirements in industrial settings. Configuration becomes effortless through ExpertDAQ's LoRa utility, ensuring a streamlined experience.

This plug-and-play solution not only simplifies communication but also enhances operational efficiency across various industrial applications. EX9212LoRa-S(WAN)'s intuitive design empowers users to easily fine-tune parameters, addressing dynamic connectivity demands. Its reliability and adaptability make EX9212LoRa-S(WAN) a preferred choice, simplifying communication with LoRaWAN gateways and meeting the evolving connectivity needs of modern industries.

Features

- Auto polling Modbus RTU Data to LoRaWAN Server
- Windows Configuration Utility
- Support LoRaWAN 1.0.2
- Support Modbus RTU protocol
- Multi-interfaces (RS-232/422/485)
- High-gain Directional Antenna (9 dBi) (optional)

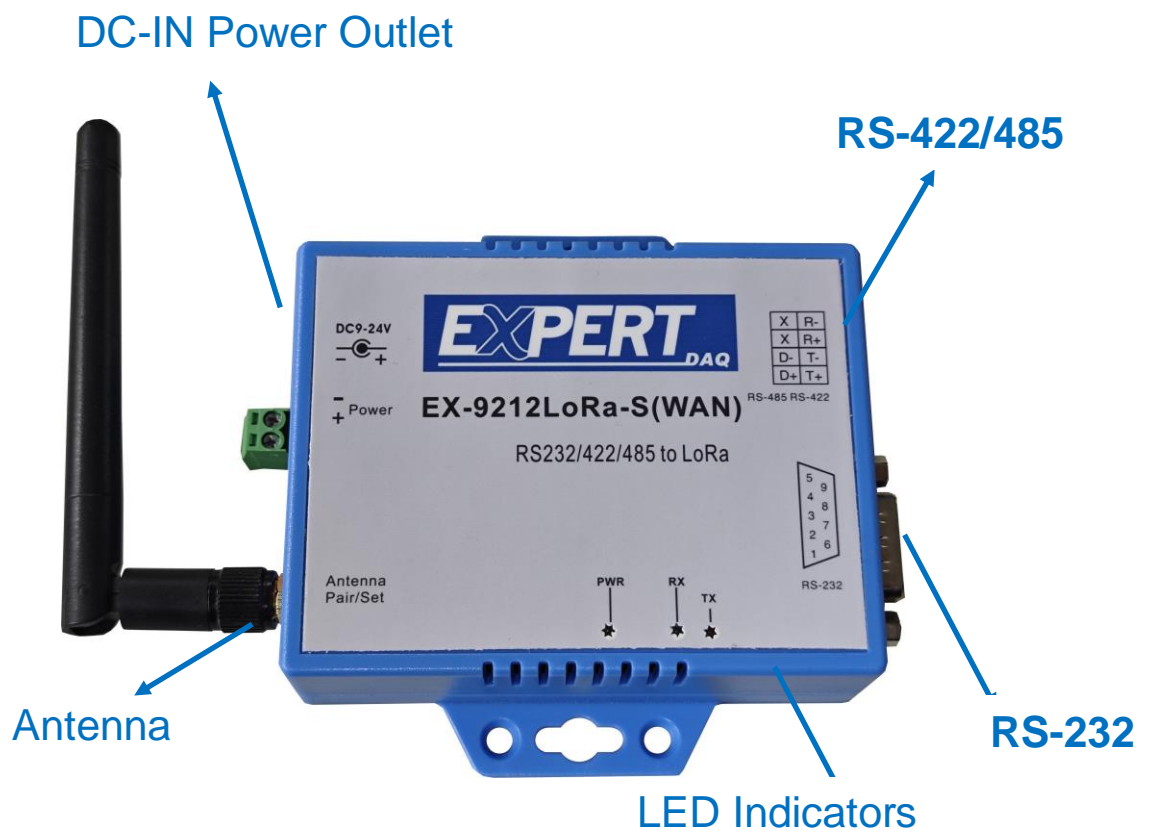
Specifications

System	Description
CPU	Xtensa® 32-bit LX6 microprocessors 160 MHz RAM 400K Bytes SRAM ROM 380K Bytes Flash ROM
LoRa Interfaces	
Frequency Bands	US915, AU915, AS923, KR920, EU868, IN865
Sensitivity	-124dBm@125K/SF7 -137dBm@125K/SF12
Distance	Up to 1 KM in free space (2 dBi) 3 ~ 4 KM (9 dBi directional antenna)
Data Rate	0.244 ~ 18.2K bps (LoRa)
TX Power	Max. 22dBm
TX Current	< 140 mA@20 dBm
Rx Current	< 10 mA
Deep Sleep	10 uA
Antenna Type	SMA, 2dBi, changeable
Serial Interfaces	
Interface	RS-232/422/485 *1 (Auto detection)
RS-232	Rx,Tx, GND (DB9 Female)
RS-422	Tx+, Tx-, Rx+, Rx- (Surge Protection) Built-in Terminal Resistor
RS-485	Data+, Data- (Surge Protection) Built-in Terminal Resistor
Data Rate	9600 bps ~ 115200 bps
Parity	None, Odd, Even
Data Bit	7,8
Stop Bit	1,2
Mechanical & Environment	
Input Power	DC-Jack 9 ~ 24V, 150 mA@ 9V, 60 mA@24V
Operating Temperature	-10 °C ~ +70 °C
Storage Temperature	-20 °C ~ +80 °C
Dimensions	100mm x 90mm x 25mm
LED	PWR (Green), Rx (Red), Tx (Green)

Table 1

Order Information

Model	LoRaWAN Gateway
EX9212LoRa-S(WAN)	LoRaWAN to Modbus RS-232/422/485

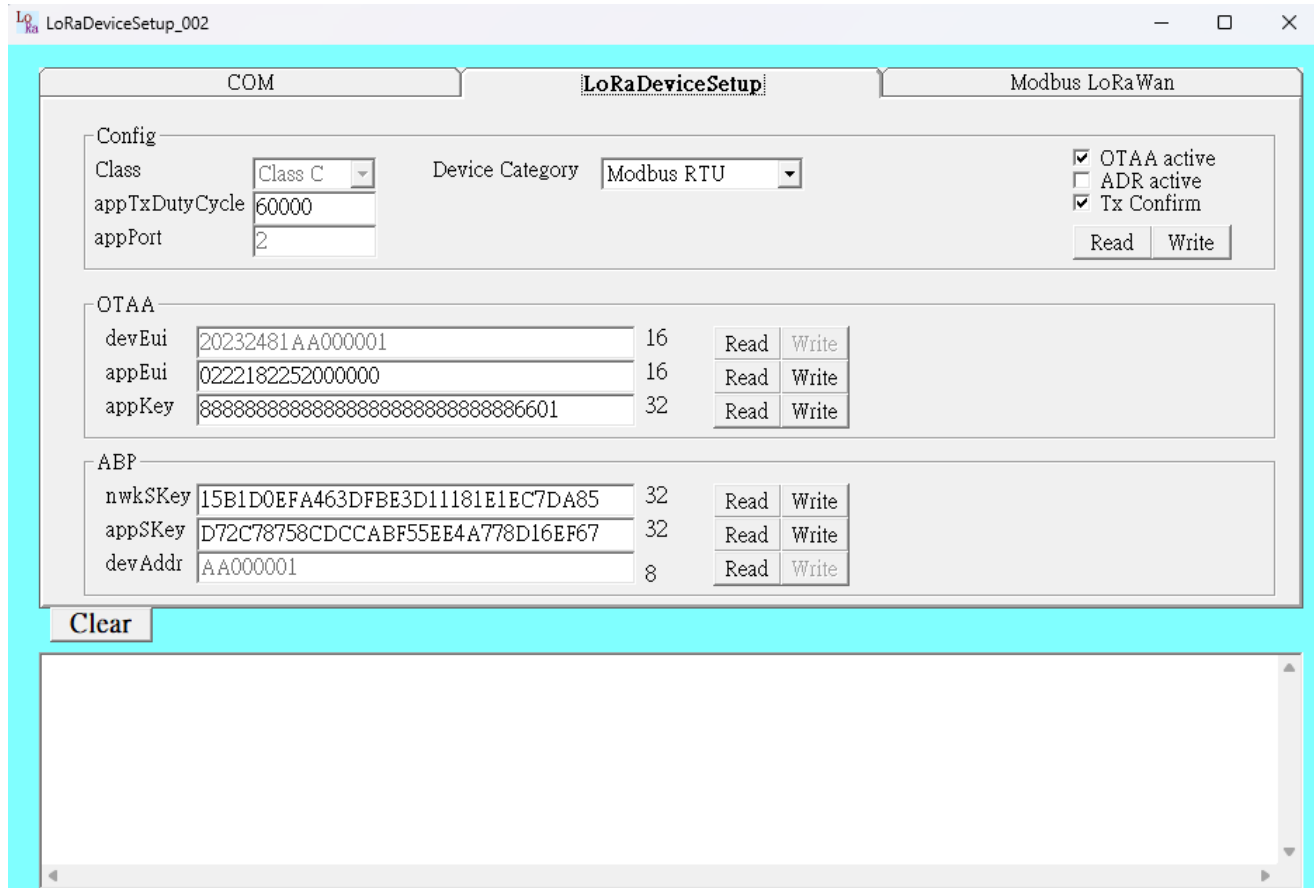
Table 2**1. Product View****Figure 1**

Reset Button has two functions.

- Program mode : Press and hold the reset button after powering on to enable program mode on EX9212LoRa-S(WAN).
- Reset COM port Baudrate : Press and hold the reset button for at least 7 seconds to reset the COM port baudrate to 115200.

2. LoRa Configuration Utility

LoRa configuration utility provides friendly interface and easily method for users to configure LoRa series devices.



The screenshot shows the 'LoRaDeviceSetup' window with three tabs: 'COM', 'LoRaDeviceSetup', and 'Modbus LoRaWan'. The 'LoRaDeviceSetup' tab is active. It contains the following sections:

- Config:**
 - Class: Class C (dropdown)
 - appTxDutyCycle: 60000
 - appPort: 2
 - Device Category: Modbus RTU (dropdown)
 - OTAA active: ☒
 - ADR active: ☐
 - Tx Confirm: ☒
 - Buttons: Read, Write
- OTAA:**

devEui	20232481AA000001	16	Read	Write
appEui	0222182252000000	16	Read	Write
appKey	888888888888888888888888888888601	32	Read	Write
- ABP:**

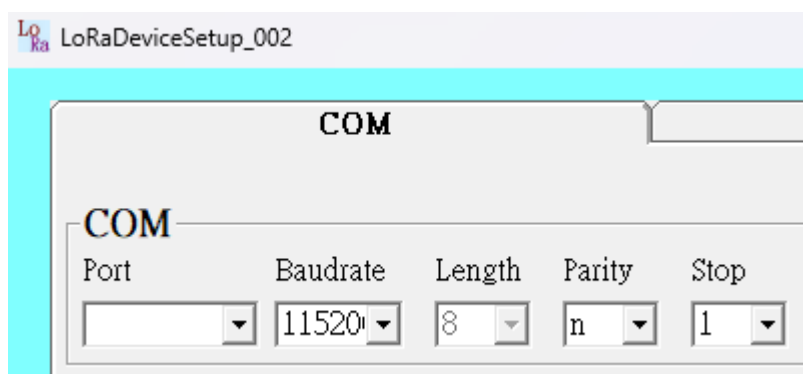
nwkSKey	15B1D0EFA463DFBE3D11181E1EC7DA85	32	Read	Write
appSKey	D72C78758CDCCABF55EE4A778D16EF67	32	Read	Write
devAddr	AA000001	8	Read	Write

At the bottom, there is a 'Clear' button and a large empty text area.

Figure 2

2.1 COM

The COM port settings are utilized to establish the connection between the laptop and EX9212LoRa-S(WAN). These settings are not intended for communication with external devices.



The screenshot shows the 'COM' tab of the 'LoRaDeviceSetup' window. It contains the following settings:

Port	Baudrate	Length	Parity	Stop
[Dropdown]	11520	8	n	1

- Port : Select the port to connect EX9212LoRa-S(WAN).
- Baudrate/Length/Parity/Stop : Serial parameters

2.2 LoRaDeviceSetup

All end devices joining a LoRaWAN network require activation. There are two activation methods available: Over-The-Air Activation (OTAA) and Activation By Personalization (ABP), and they implement either LoRaWAN specification version **1.0.x or 1.1.x**. Both OTAA and ABP activation methods involve generating secret session keys stored by both the end device and the network server. These keys are utilized to secure messages transmitted and received within the network."

Check the datasheet of LoRaWAN gateway or ask the manufacture which activation method and LoRaWAN specification version the device uses.

Device profile parameters.

- DevEUI (64 bits) :

The DevEUI is a 64-bit globally-unique Extended Unique Identifier (EUI-64) assigned by the manufacturer, or the owner, of the end-device.

- DevAddr (32 bits) :

The Device Address (DevAddr) is a 32-bit identifier assigned by the network server. Paired with the NwkSKey, DevAddr is utilized to uniquely identify the device within the current network.

- NwkSKey (128 bits) :

The Network Session Key (NwkSKey) serves to verify the integrity of all data frames. Additionally, the NwkSKey is utilized by both the network server and the end device for encrypting and decrypting MAC commands transmitted as MAC-only data frames."

- AppSKey (128 bits) :

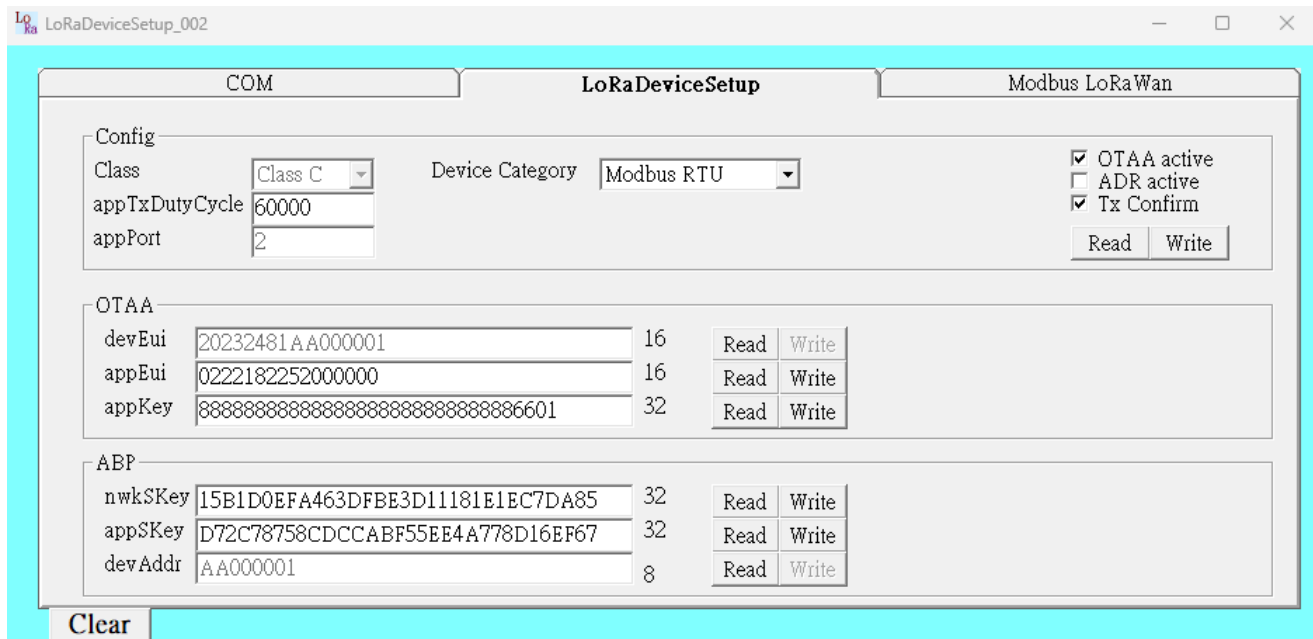
The application server and end device employ the AppSKey for encrypting and decrypting the Frame Payload (FRMPayload) field in application-specific data frames.

- AppEUI (64 bits) :

AppEUI is a 64-bit identifier serving as the unique ID of the application server and acting as the destination for messages sent by end-devices. It must be unique to ensure the end-device knows where to send its messages.

- AppKey (128 bits) :

The AppKey, a unique 128-bit AES root key for the end device, is utilized in the OTAA process. It helps derive NwkSKey and AppSKey session keys, ensuring message integrity during the join process.



LoRaDeviceSetup_002

COM | **LoRaDeviceSetup** | **Modbus LoRaWan**

Config

Class: Device Category:

appTxDutyCycle:

appPort:

☒ OTAA active
☐ ADR active
☒ Tx Confirm

OTAA

devEui	<input type="text" value="20232481AA000001"/>	16	<input type="button" value="Read"/>	<input type="button" value="Write"/>
appEui	<input type="text" value="0222182252000000"/>	16	<input type="button" value="Read"/>	<input type="button" value="Write"/>
appKey	<input type="text" value="8888888888888888888888888888886601"/>	32	<input type="button" value="Read"/>	<input type="button" value="Write"/>

ABP

nwkSKey	<input type="text" value="15B1D0EFA463DFBE3D11181E1EC7DA85"/>	32	<input type="button" value="Read"/>	<input type="button" value="Write"/>
appSKey	<input type="text" value="D72C78758CDCCABF55EE4A778D16EF67"/>	32	<input type="button" value="Read"/>	<input type="button" value="Write"/>
devAddr	<input type="text" value="AA000001"/>	8	<input type="button" value="Read"/>	<input type="button" value="Write"/>

Figure 3

2.2.1 Config

- Class : Enter LoRaWAN class level
- Device Category : Select Device type (Modbus RTU/AI-8/2DI2DO)
- AppTxDutyCycle (MS): Enter Duty cycle time interval
- appPort : Enter App port
- OTAA active : Check the checkbox for the active method for OTAA; otherwise, use the ABP method
- ADR active : Check for the ADR (Adaptive Data Rate) mechanism
- Tx Confirm : Check for TX confirmation

2.2.2 OTAA

Enter the required information for OTAA activation method.

- devEUI
- appEui
- appKey

2.2.3 ABP

Enter the required information for ABP activation method.

- nwkKey
- appSKey
- devAddr

2.3 Modbus LoRaWan

Configure COM port parameters for device connections. The system supports up to 4 devices; check the corresponding checkboxes (1-4) for individual devices. Enter the device ID and RTU data payload content to initiate communication with the devices.

LoRaDeviceSetup_002

COM

LoRaDeviceSetup

Modbus LoRaWan

Comport(RS485)

Baudrate

Length

Parity

Stop

9600

8

n

1

Command Enable

Device ID
(01~F7)

Function

Address

Length/Data

Command1

☒

01

04

0001

0002

Command2

☒

01

04

0001

0002

Command3

☐

01

04

0001

0002

Command4

☐

01

04

0001

0002

Read

Write

Clear

Figure 4

3. Revisions

Revision	Release Date	
V1.0.0	xx January 2024	

Appendix A : LoRaWAN Server Lite Package

ExpertDAQ EX9212LoRa-G-WAN is a cost effective gateway for LoRa communications. It bridges LoRa network to an IP network via Wi-Fi, Ethernet or 4G LTE. The EX9212LoRa-G-WAN gateway supports the open LoRaWAN® standard, designed to facilitate the development and prototyping of Internet of Things (IoT) solutions compatible with the LoRaWAN protocol.

The data format received from the EX9212LoRa-G-WAN follows the standard LoRaWAN payload structure, represented in hexadecimal form, conveying the actual data transmitted by the end device. However, direct interpretation of the data is not feasible. ExpertDAQ's LoRaWAN Server Lite package is utilized to interpret LoRaWAN format data into RAW data, encompassing parameters like Voltage, Current, AI/DIO status, etc.

EX9212LoRa-G-WAN can either publish RAW data to an MQTT broker or users can obtain RAW data by subscribing to the topic from EX9212LoRa-G-WAN's embedded MQTT broker.

LoRaWAN Node to EX9212LoRa-G-WAN + Server Lite (MQTT Publisher) Architecture

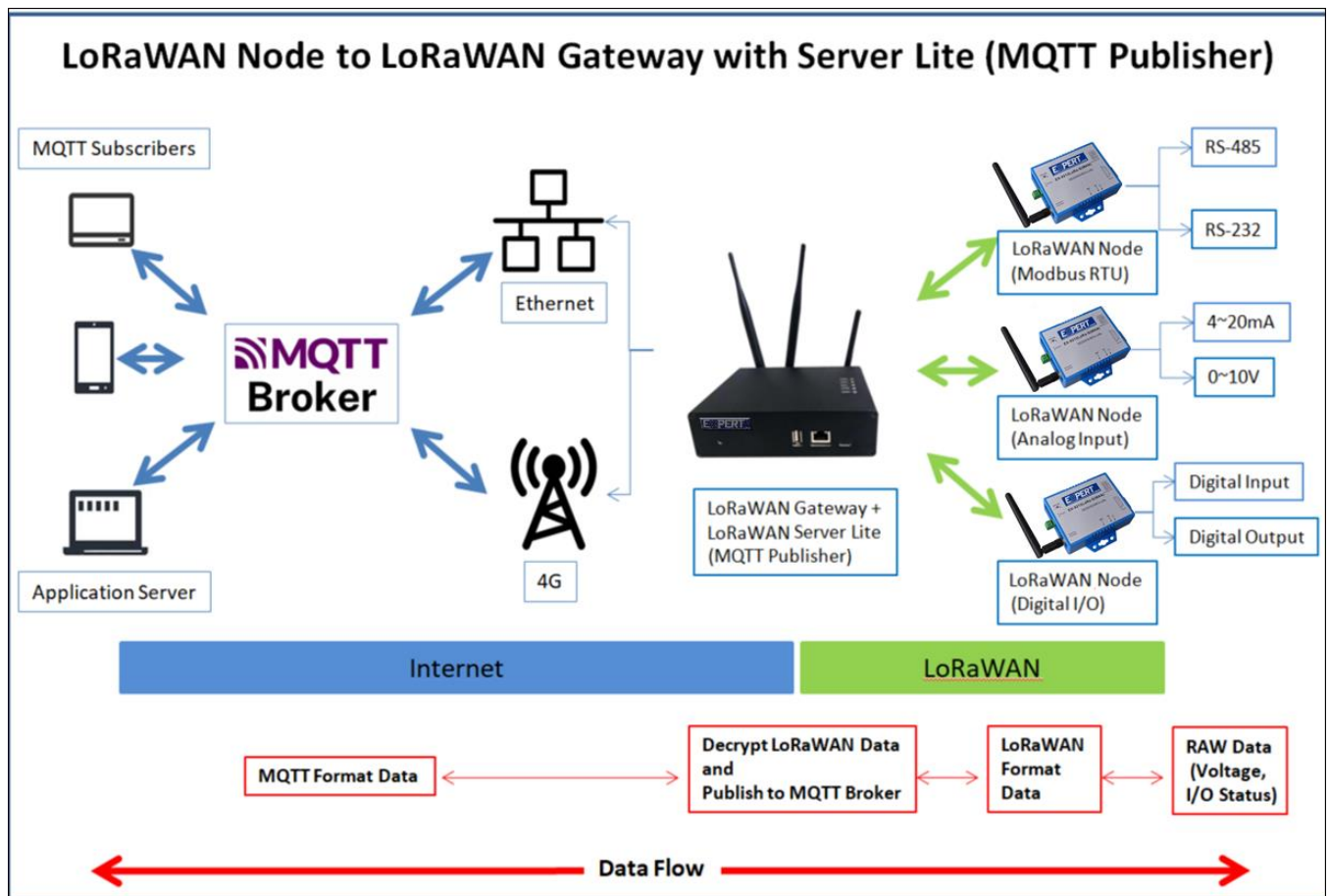


Figure 5