

LoRa Interface Converter & DI/DO Controller LR-201-E(Modbus) LR-201-S LR-201-U LR-201-DIO

User Manual



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<http://www.tcpipweb.com>

*** this document subject to change without prior notice.

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1. Introduction

Thank you for using LoRa interface gateway in your system work. These LoRa gateways provide the way of connecting IoT remote units to a Local Area Network (LAN) or Host Computer from long distance. The data transmission via LoRa gateways mainly intended for the ISM (Industrial, Scientific, and Medical) frequency bands at 862-932 MHz.

The gateway has been built with the module integrated many RF functions and PA to make the maximum output power up to +20dBm.

LoRa Interface Gateways are packaged in a plastic case well suited for industrial environments. LoRa Interface devices have different models for converting to Ethernet, USB, Serial ports (RS-232, RS-422/485) and DI/DO controller. Configuration is easy to set up via web page and utility tool.

The following topics are covered in this chapter:

- ☐ **Applications**
- ☐ **Packaging**
- ☐ **Specifications**

1.1 Applications

- Automation and safety alarm in the community.
- Various automated smart meters, such as water meter, gas meter and electricity meter.
- Long range communication data collection and integration.
- Outdoor information monitoring and collection, such as temperature, humidity and air quality information.
- Electricity facilities measurement and management, such as smart street lighting.
- Agriculture and animal husbandry monitoring and management.

1.2 Packaging

LoRa Interface Gateway attached with the following items:

- ☐ 1 unit of Gateway device.
- ☐ 1 unit of Power Adaptor, 9V or 12V DC, 500mA (option)
- ☐ 1 unit of Antenna
- ☐ Documentation & Utility CD

NOTE: Inform your sales representative if any of the above items missing or damaged.

1.3 Product Specifications

1.3.1 LR-201-E : Ethernet To LoRa

- CPU : 32 bits MCU ,40 MHz , 16KB SRAM, 128KB Flash ROM
- **Support Modbus or Transparent (to be assigned on order)**

- **LoRa : Semtech SX1272**
 - Freq. : ISM band 862 ~ 936MHz
 - Receiver Sensitivity : -137 dBm
 - Transmit Output Power : 20 dBm
 - Sleep Current : 3uA (at power down state)
 - TX current < 140 mA@20 dbm , RX current < 10 mA
 - Security processor (128/192/256 bits AES)
 - Packet engine up to 256 bytes with CRC
 - Antenna : SMA Type , 2 dBi , changeable
 - Distance : Up To 1500~7500 Meters in free space
 - Data Rate : 0.244 ~ 18.2K bps (LoRa) / 300 K bps (FSK)
 - Application mode : Star

- **Ethernet Port**
 - Port Type : RJ-45 Connector
 - Speed : 10 / 100 Mbps (Auto Detect)
 - Protocol : ARP , IP , ICMP , UDP , TCP , HTTP , DHCP
 - Mode : TCP Server / TCP Client / UDP / Virtual Com / Pairing
 - Setup : HTTP Browser Setup (IE)
 - Security : Login Password
 - Protection : Built-in 1.5KV Magnetic Isolation
 - Modbus TCP To RTU Slave & Modbus TCP To ASCII Slave Mode
 - Modbus RTU To TCP Slave & Modbus ASCII To TCP Slave Mode

- Setup Tool : Windows Utility
- Power : DC 9 ~ 24V / 150mA@ 9V , 60mA@ 24V
- Led Lamp : SYS (green) , Rx(red) , Tx(green)
- Environment: Operating Temperature: -10°C ~ 70°C
Storage Temperature: -20°C ~ 80°C
- Dimensions : 100 * 90 * 25 mm (W * D * H)
- Weight : 150 gm (not include power)

1.3.2 LR-201-S : RS-232/422/485 To LoRa

- CPU : 32 bits MCU ,40 MHz , 16KB SRAM, 128KB Flash ROM
- Support Modbus & Transparent

- **LoRa** : Semtech SX1272
 - Freq. : ISM band 862 ~ 936MHz
 - Receiver Sensitivity : -137 dBm
 - Transmit Output Power : 20 dBm
 - Sleep Current : 3uA (at power down state)
 - TX current < 140 mA@20 dbm , RX current < 10 mA
 - Security processor (128/192/256 bits AES)
 - Packet engine up to 256 bytes with CRC
 - Antenna : SMA Type , 2 dBi , changeable
 - Distance : Up To 5000 Meters in free space
 - Data Rate : 0.244 ~ 18.2K bps (LoRa) / 300 K bps (FSK)
 - Application mode : Star

- **Serial Port**
 - No.of Port : RS-232/422/485 * 1 port (auto Detect)
 - RS-232 : Rx , Tx , GND , RTS , CTS (DB9 female)
 - RS-422 : Tx+ , Tx- , Rx+ , Rx- (Surge Protect)
 - RS-485 : Data+ , Data- (Surge Protect)
 - Built –in RS-422/RS-485 Terminal Resistor
 - Speed : 9600 bps~115.2K bps
 - Parity : None , Odd , Even
 - Data Bit : 7, 8 / Stop Bit : 1 , 2
 - Setup Tool : Windows Utility
 - Power : DC 9 ~ 24V / 150ma @ 9V , 60ma @ 24V
 - Led Lamp : SYS (green) , Rx(red) , Tx(green)
 - Environment: Operating Temperature: -10°C ~ 70°C
Storage Temperature: -20°C ~ 80°C

- Dimensions : 100 * 90 * 25 mm (W * D * H)
- Weight : 150 gm (not include power)

1.3.3 LR-201-U : USB To LoRa

- CPU : 32 bits MCU ,40 MHz , 16KB SRAM, 128KB Flash ROM
- Support Modbus & transparent

- **LoRa** : Semtech SX1272
 - Freq. : ISM band 862 ~ 936MHz
 - Receiver Sensitivity : -137 dBm
 - Transmit Output Power : 20 dBm
 - Sleep Current : 3uA (at power down state)
 - TX current < 140 mA@20 dbm , RX current < 10 mA
 - Security processor (128/192/256 bits AES)
 - Packet engine up to 256 bytes with CRC
 - Antenna : SMA Type , 2 dBi , changeable
 - Distance : Up To 5000 Meters in free space
 - Data Rate : 0.244 ~ 18.2K bps (LoRa) / 300 K bps (FSK)
 - Application mode : Star

- **USB Port**
 - No.of Port : USB * 1 port, Connector : USB type B
 - Chipset : Silicon Laboratories CP2102
 - Compliant : US1.0 , 1.1 , 2.0
 - Baud Rates : Full speed 12 M bps
 - Driver Support : Windows-98/ 2000/ XP/ 2003/ Vista /Win-7/Win-10
Mac Osx / Os9 / Linux2.4 / 2.6
- Provide : USB driver
- Setup Tool : Windows Utility
- Power : DC 5V / 150mA @ 5V
- Led Lamp : SYS (red) , Pairing (green) , Rx(red) , Tx(green)
- Environment: Operating Temperature: -10°C ~ 70°C
Storage Temperature: -20°C ~ 80°C
- Dimensions : 100 * 90 * 25 mm (W * D * H)
- Weight : 150 gm (not include power)

1.3.4 LR-201-DIO : LoRa Digital I/O Controller

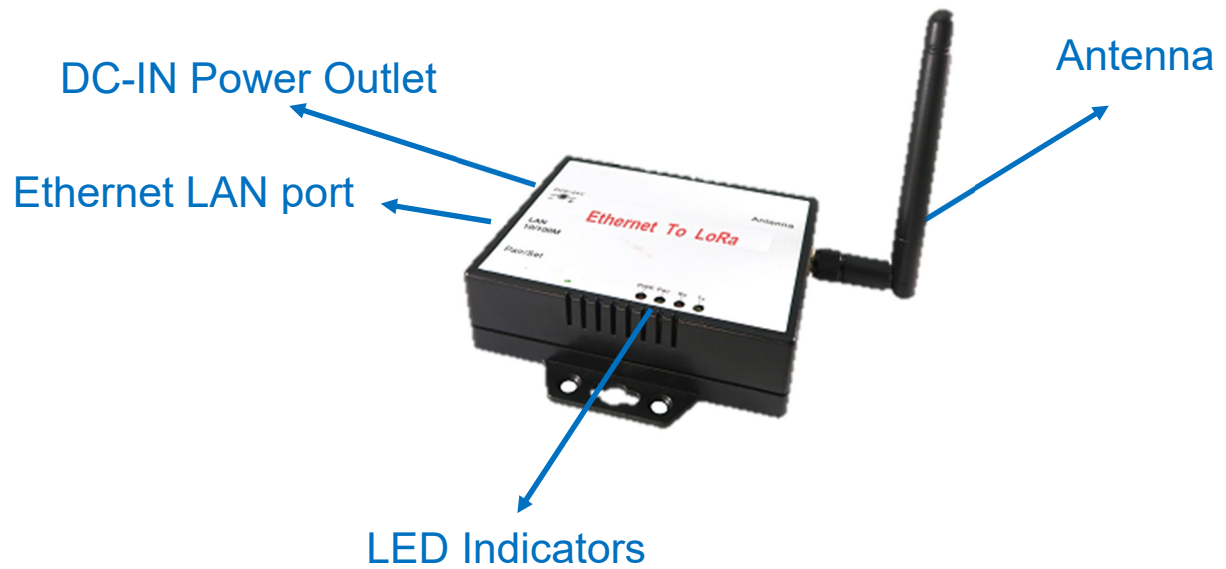
- CPU : 32 bits MCU ,40 MHz , 16KB SRAM, 128KB Flash ROM
- Support Modbus Protocol

- **LoRa** : Semtech SX1272
 - Freq. : ISM band 862 ~ 936MHz
 - Receiver Sensitivity : -137 dBm
 - Transmit Output Power : 20 dBm
 - Sleep Current : 3uA (at power down state)
 - TX current < 140 mA@20 dbm , RX current < 10 mA
 - Security processor (128/192/256 bits AES)
 - Packet engine up to 256 bytes with CRC
 - Antenna : SMA Type , 2 dBi , changeable
 - Distance : Up To 5000 Meters in free space
 - Data Rate : 0.244 ~ 18.2K bps (LoRa) / 300 K bps (FSK)
 - Application mode : Star

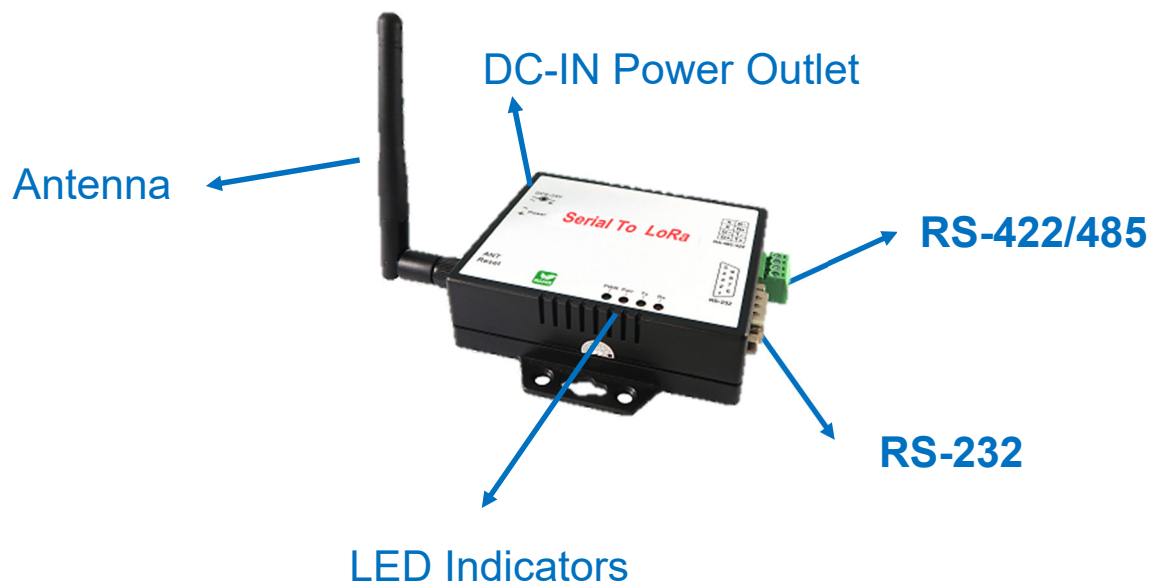
- **Digital I/O**
 - Digital Input * 2
3000VDC Isolation Protect (Active High /Active Low Selectable)
Dry contact : Logic level 0 : close to GND , Logic level 1 : open
Wet contact : Logic level 0 : 0~3 V , Logic level 1 : 10 ~ 30 V
 - Digital Output * 2
Relay (Active High /Active Low Selectable)
120V AC@10A , 240V AC@7A , 24V DC@10A
- Setup Tool : Windows Utility
- Power : DC 9 ~ 24V / 150ma @ 9V , 60ma @ 24V
- Led Lamp : SYS (red) , Pairing (green) , Rx(red) , Tx(green)
- Environment: Operating Temperature:-10°C ~70°C
Storage Temperature:-20°C ~85°C
- Dimensions : 160 * 90 * 25 mm (W * D * H)
- Weight : 350 gm (not include power)

2. Product Views

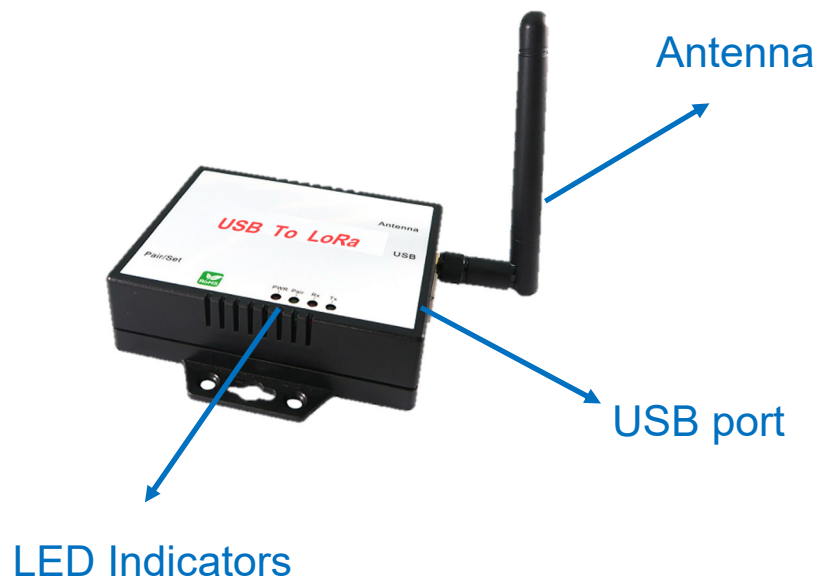
2.1 LR-201-E : Ethernet To LoRa



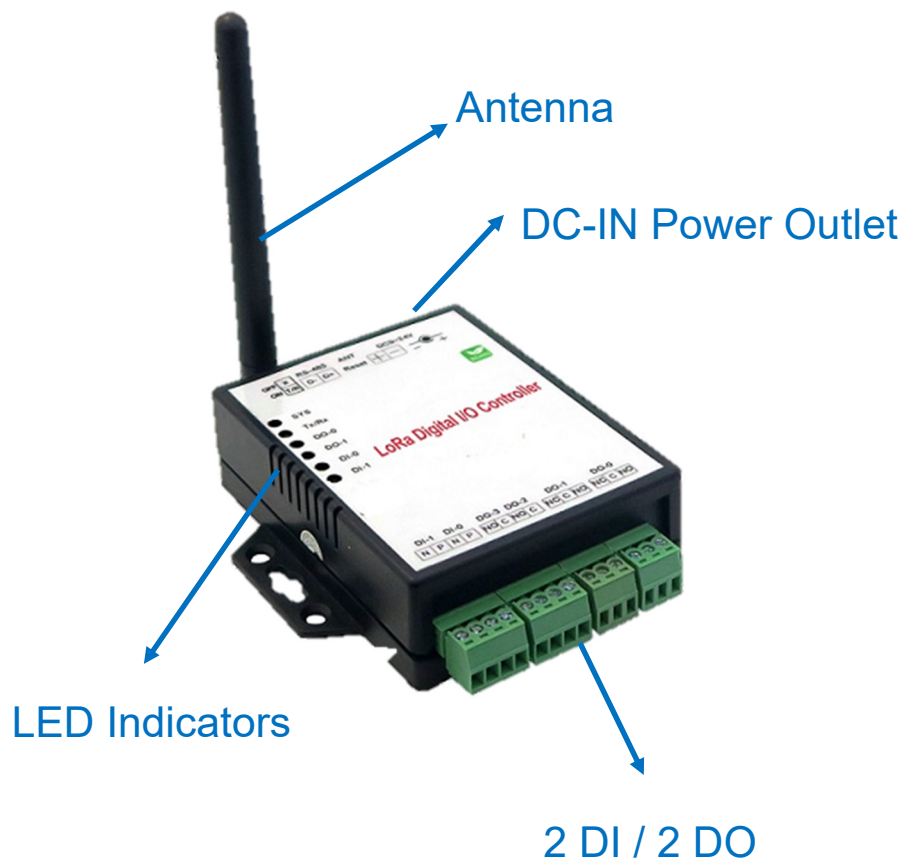
2.2 LR-201-S : RS-232/422/485 To LoRa



2.3 LR-201-U : USB To LoRa



2.4 LR-201-DIO : LoRa to Digital I/O Controller



2.5 Outlined Components

2.5.1 DC-IN Power Outlet

LoRa Gateways are powered by a 12V DC (Inner positive, outer negative) power supply and 1.0A current. Connecting the AC plug to the AC power socket and put the DC Jack plug into the outlet of device. The “SYS” (or “PWR”) red color LED will be ON when power properly supplied. Terminal Block (2 wires) power supply is alternative.

2.5.2 Ethernet LAN Port

The connector for LAN connection is a general RJ45 socket. Simply connect it to network Switch Hub. When the connection is made, the LAN LED indicator light on. When data start transmission, Tx/Rx LED indicator will blink during data transferring or receiving.

2.5.3 Serial Port (RS-232, RS-422/485)

Connecting the Serial Port Cable from the LoRa Gateway to the Serial Interface device. Follow the parameter setup procedures to configure the converter (see the following chapters).

2.5.4 2 DI / 2 DO port

Please refer the specs sheet of LR-201-DIO.

2.6 LED Indicators



PWR (Red):

Power indicator. When the power is on, the LED will be on.

Tx (Green):

Data sending indicator. When data sending to the network, this LED will blink.

Rx (Red):

Data received indicator. When data receiving from the network, this LED will blink.

Pair (Green):

No function.

3. Wiring Architecture

3.1 Ethernet + LoRa --- air ---- LoRa + Serial Interface ----- Machine



3.2 USB Interface + LoRa --- air ---- LoRa + Serial Interface ----- Machine



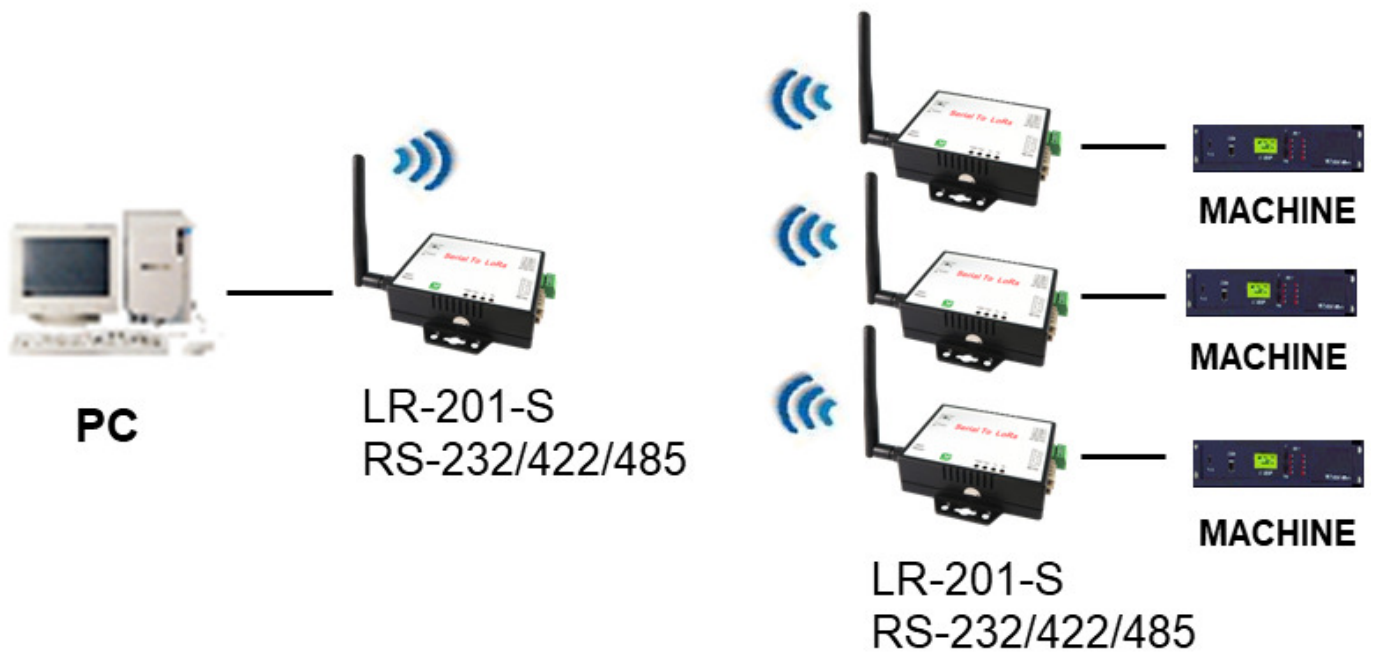
3.3 Ethernet + LoRa --- air ---- LoRa + Serial DI/DO Interface ----- DI/DO



3.4 Serial Interface + LoRa --- air ---- LoRa + Serial Interface ----- Machine



3.5 Star topology



4. LoRa module Setting Utility

4.1 LoRa Setting Tool factory default

Setting Tool - ver1.0.0.0

Refresh

Read

Write

Uart

Baud Rate[bps]

9600

▼

Parity

None

▼

Data Bit

8

▼

Stop Bit

1

▼

LoRa

Frequency[Hz]

915500000

Spreading Factor

9

▼

Bandwidth[kHz]

125

▼

Tx Power[dBm]

20

▼

Function

Pass Mode

0

▼

Device ID

0

Encryption

☐

Key

30313233343536373839414243444546

Interface

☒ RS232

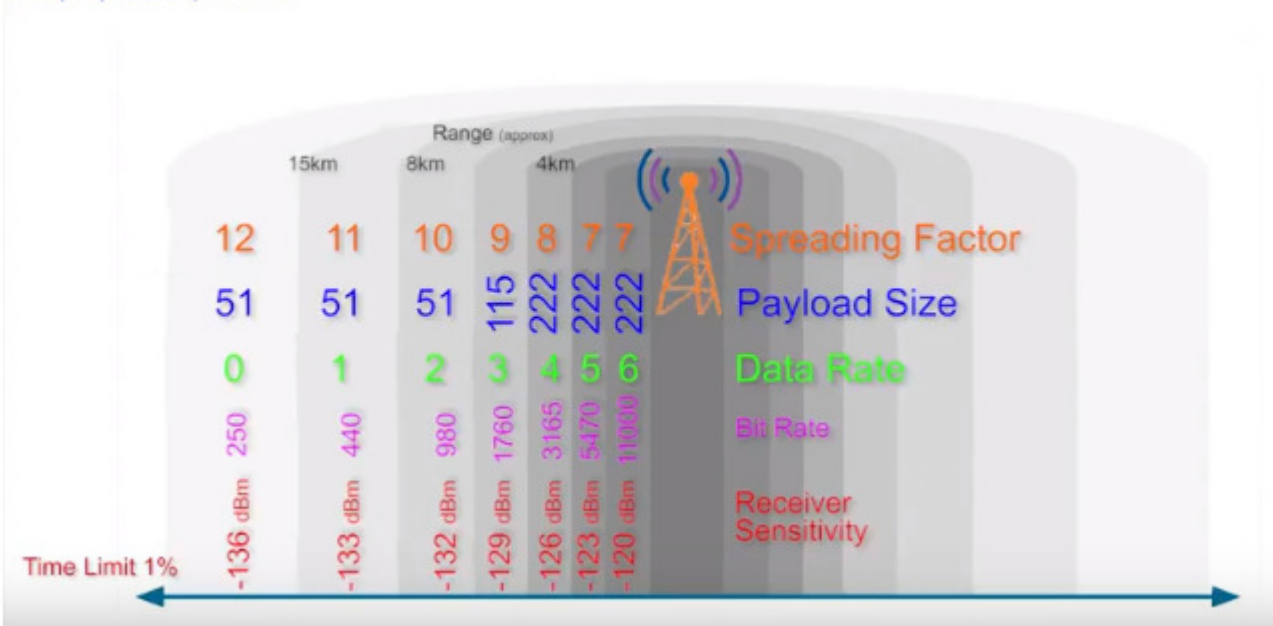
☐ RS485

Uart			
Baud Rate [bps]	9600	Parity	None
Date Bit	8	Stop Bit	1
Lora			
Frequency [Hz]	915500000	Spreading Factor	9 **
Bandwidth [kHz]	125	Tx Power [dBm]	20
Encryption	30313233343536373839414243444546		

*** For setting multi-groups by different Frequency in same area, the frequencies must be at least 0.5Mhz far from each other such as 9155 and 9160Mhz in order to prevent interference.

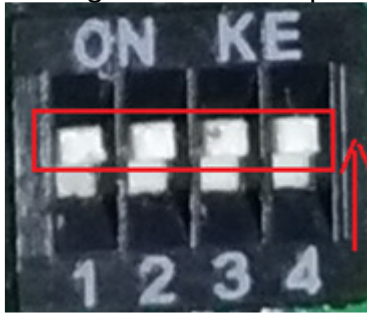
** Spreading Factory (for reference only, not exactly to real device):

Chirp Spread Spectrum

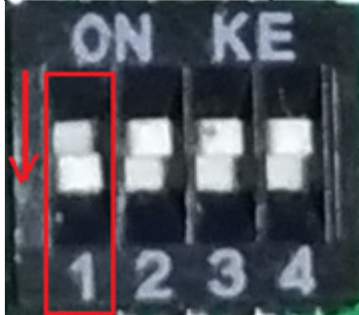


4.2 Dip Switch

- 1) Setting mode: #1~#4 pins all at up position enable to modify LoRa settings.



- 2) Operation mode: only #1 at down position enable to run data transmission.



5. LoRa setting process

5.1 Pull power off

- 5.1.1 For Ethernet to LoRa model: [not able to modify the setting unless the upper level module adapt to our bottom board with a RS-232 or USB port.](#)
- 5.1.2 For Serial to LoRa model: pull off power plug, use a USB to RS-232 Converter to connect with the RS-232 port. A crossover RS-232 adaptor is necessary.
- 5.1.3 For USB to LoRa model: pull off USB plug from NB/PC USB host.
- 5.1.4 For DI/DO to LoRa model: pull off power plug.

5.2 Poke the Dip Switch #1 to down position as setting mode.

5.3 Plug in the power plug or USB plug to turn power ON.

5.4 Recognize LoRa device's COM port

5.5 Running the Setting Tool:

COM5	Refresh	Read	Write
------	---------	------	-------

- 1) Press "Refresh" button, select right COM port number.
- 2) Press "Read" button to read existing parameters out.
- 3) Modify parameters as follows.

5.6 Setting UART parameters

Uart			
Baud Rate[bps]	9600	Parity	None
Data Bit	8	Stop Bit	1

5.7 Setting LoRa parameters

LoRa			
Frequency[Hz]	925500000	Spreading Factor	9
Bandwidth[kHz]	250	Tx Power[dBm]	20

5.8 Function Pass Mode and Device ID: **discard this function temporarily because DI/DO model is not available.**

Device ID: set ID# for LoRa device unless Modbus RTU device on the back end not with ID#.

Function			
Pass Mode	0	Device ID	0

5.9 Encryption value should be same on pairing devices. Encryption is optional for security purpose.

Encryption	☐	Key	30313233343536373839414243444546
------------	--------------------------	-----	----------------------------------

5.10 Interface: discard this function temporarily.

Interface	☒ RS232 ☐ RS485
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5.11 Press “Write” button to write parameters back to device.

COM5	Refresh	Read	Write
------	---------	------	-------

5.12 Pull off power plug or USB plug to turn power off.

5.13 Poke Dip Switch #1 back to down position enable operation mode.

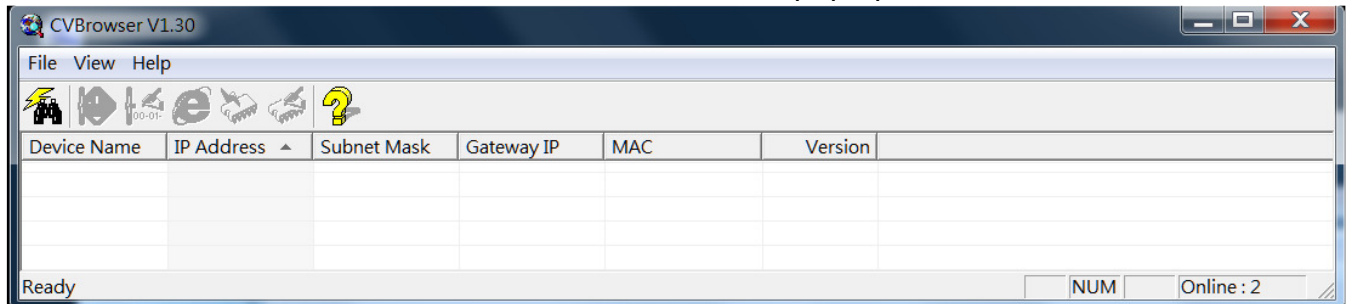
5.14 Plug into the power plug or USB plug to turn power on.

6. Ethernet to LoRa settings

6.1 Installation of IP Search Tool

6.1.1 Find out “CVBrowser.EXE” in the CD ROM, copy the file to your host computer.

6.1.2 Double click to run “CVBrowser.EXE”, a window will pop up as below.

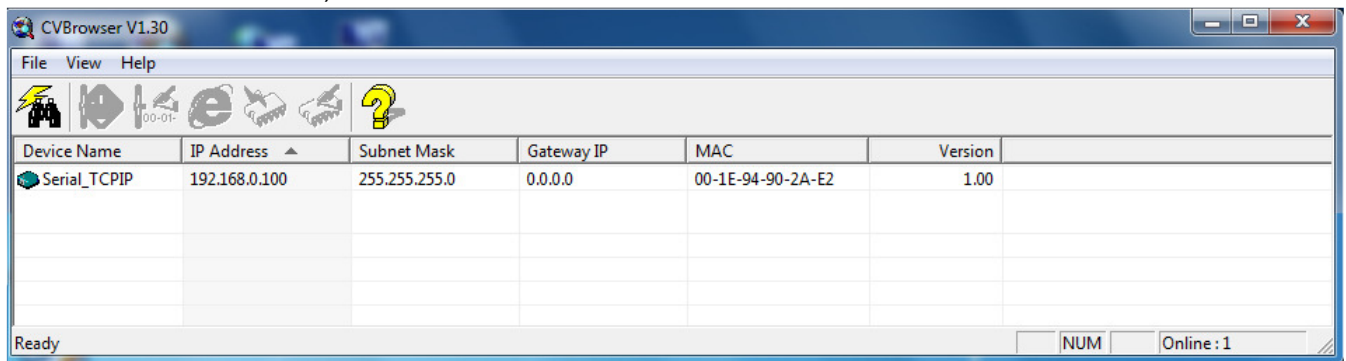


6.2 Hardware Connection

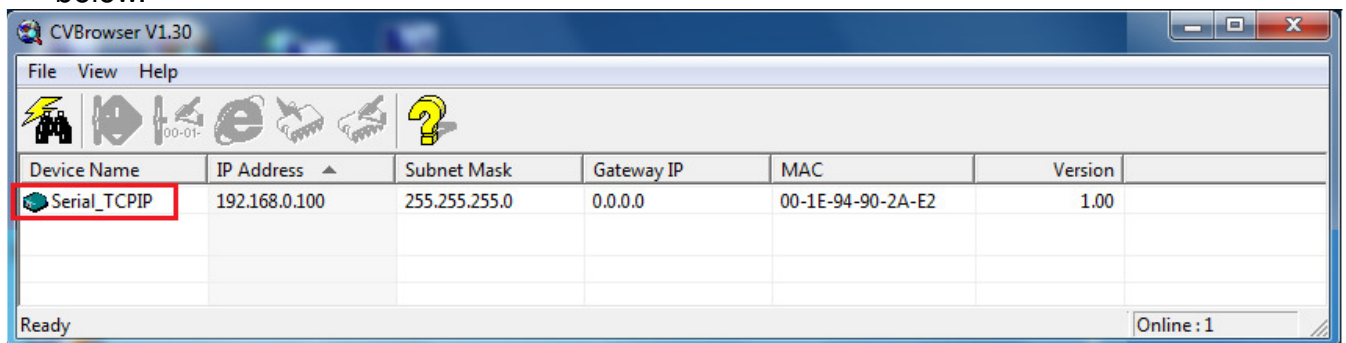
6.2.1 Connect host computer and LR-201-E to Switch Hub with RJ45 Ethernet cable.

6.2.2 Power on LR-201-E.

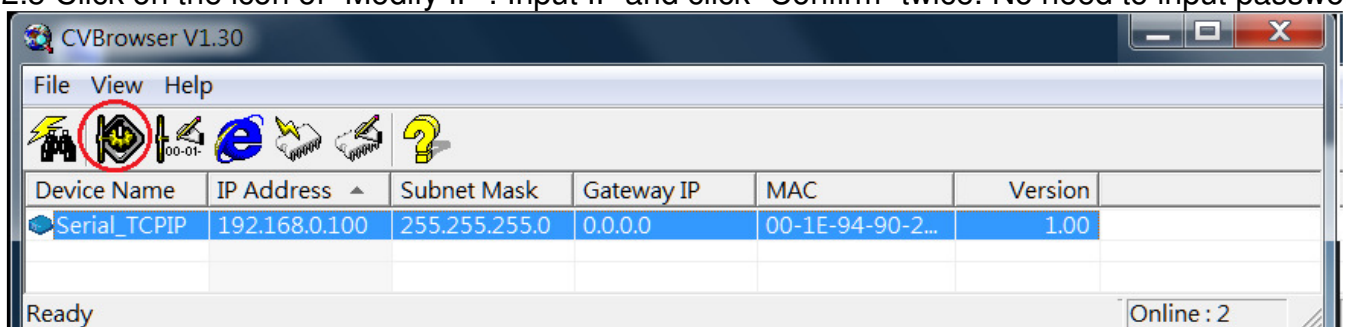
6.2.3 Click the icon of Binocular as “Refresh”, it will search and show up the IP of Converter (Default IP: 192.168.0.100).



6.2.4 IP of Converter changing subnet to match with host PC/NB. Clicking “Serial_TCPIP” per below.



6.2.5 Click on the icon of “Modify IP”. Input IP and click “Confirm” twice. No need to input password.



Dialog Frame

Input IP Address

192 . 168 . 0 . 100

Input Subnet Mask

255 . 255 . 255 . 0

Input Gateway IP

0 . 0 . 0 . 0

Confirm

Cancel

Dialog Frame

Input Password

Confirm

Cancel

6.3 Input Converter's IP to Web browser. Configuration page will show up. Click "Login" without password.

Modbus TCP To RTU/ASCII Gateway

Login setting

System time elapsed (Day:Hour:Min:Sec)	0:0:5:55
Firmware version	Nov 25 2015 07:25:58
Serial number	LM6911-M21
Ethernet MAC address	00-01-02-03-04-05

Password
Login

6.4 LoRa module only use port #1 with default socket 501. Please don't change the parameters inside the red square. Port #2 is not used. Packet collect time of Port #1 should be initially set "Rx 100". Modbus Master query interval time should be longer than 2000ms.

Modbus TCP To RTU/ASCII Gateway

Parameter setting

IP address	192.168.1.162
Subnet mask	255.255.255.0
Gateway IP	0.0.0.0
Link Modes	Auto detect ▼
DHCP Client	Disable ▼
Auto Reset (No data input)	0 (1 ~ 255 Minute)
Device Name	Serial_TCPIP
Login password	
Serial I/O Port 1	0
Local port,Socket mode	501 TCP Server ▼
Remote IP,Port (TCP Client)	0.0.0.0 0
Interface	RS232 ▼
Baudrate	9600 ▼
Parity,Data bit,Stop bit	None ▼ 8 ▼ 1 ▼
Force off-line time (No data input)	10 (1 ~ 255 Minute)
Packet collect time	Tx 0 Rx 100 (mSec)
Modbus type	TCP To RTU Slave ▼
Serial I/O Port 2	0

6.5 LR-201-E or LR-201-E-Modbus **must not set same socket number at Port 1 and Port 2 otherwise will cause the device down and not able to reboot or reset.**

Please set 2nd port to 999 in advance ensure 1st port not to be set same number in the future.

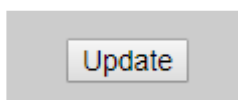
Serial I/O Port 1 0

Local port, Socket mode	501	TCP Server ▾
Remote IP, Port (TCP client)	0.0.0.0	0
Interface	RS232 ▾	
Baudrate	9600 ▾	
Parity, Data bit, Stop bit	None ▾ 8 ▾ 1 ▾	
Force off-line time (No data input)	10 (1 ~ 255 Minute)	
Packet collect time	Tx 0 Rx 100 (mSec)	
Modbus type	TCP To RTU Slave ▾	

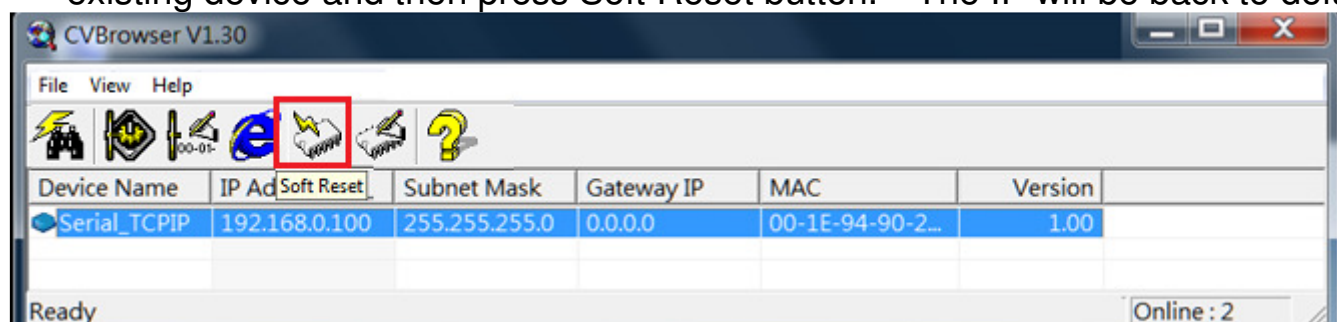
Serial I/O Port 2 0

Local port, Socket mode	999	TCP Server ▾
Remote IP, Port (TCP client)	0.0.0.0	0
Interface	Auto Detect ▾	
Baudrate	9600 ▾	
Parity, Data bit, Stop bit	None ▾ 8 ▾ 1 ▾	
Force off-line time (No data input)	10 (1 ~ 255 Minute)	
Packet collect time	Tx 0 Rx 100 (mSec)	
Modbus type	TCP To RTU Slave ▾	

6.6 Press “Update” to save new parameters and reboot.



6.7 Reset: in case of anything must to reset the device. Run the CVBrowser, find the existing device and then press Soft Reset button. The IP will be back to default.



7. Serial Interface to LoRa Settings

Just follow above LoRa setting procedure. This device without WEB interface settings.

8. USB to LoRa Settings

Just follow above LoRa setting procedure. This device without WEB interface settings.

9. LoRa to DI/DO Modbus command (this section is temporarily stop)

9.1 Digital Output port #1

9.1.1 port #1 ON : 01 05 00 00 00 01 (write)

9.1.2 port #1 OFF: 01 05 00 00 00 00 (write)

9.2 Digital Output port #2

9.2.1 port #2 ON : 01 05 00 01 00 01 (write)

9.2.2 port #2 OFF: 01 05 00 01 00 00 (write)

9.3 Digital Input (read only)

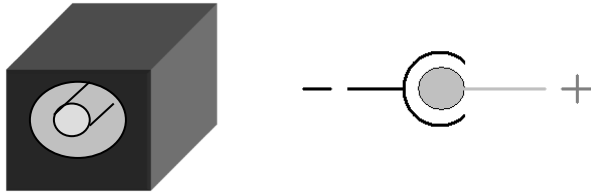
9.3.1 port #1 : 01 04 00 00 00 01

9.3.2 port #2 : 01 04 00 01 00 01

Appendix A

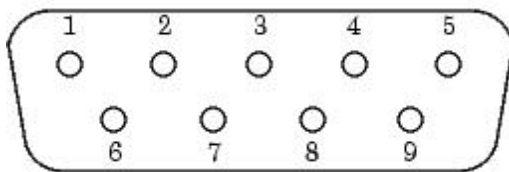
Pin Assignment

□ DC Power outlet



□ RS-232 Pin Assignment

The pin assignment scheme for a 9-pin male connector on a DTE is given below.



PIN 1 : DCD
PIN 5 : GND
PIN 9 : X

PIN 2 : RXD
PIN 6 : DSR

PIN 3 : TXD
PIN 7 : RTS

PIN 4 : DTR
PIN 8 : CTS

□ RS-232 Wiring Diagram

Serial Device	Converter
<u>2 RX</u>	<u>3 TX</u>
<u>3 TX</u>	<u>2 RX</u>
<u>5 GND</u>	<u>5 GND</u>
<u>7 RTS</u>	<u>8 CTS</u>
<u>8 CTS</u>	<u>7 RTS</u>

□ RS-422/485 Pin Assignment

The pin assignment scheme for a 4-pin RS-422 and 2-pin RS-485 as given below.

□ RS-422 Wiring Diagram

Serial Device	Converter
<u>R-</u>	<u>T-</u>
<u>R+</u>	<u>T+</u>
<u>T-</u>	<u>R-</u>
<u>T+</u>	<u>R+</u>

□ RS-485 Wiring Diagram

Serial Device	Converter
<u>D+</u>	<u>D+</u>
<u>D-</u>	<u>D-</u>