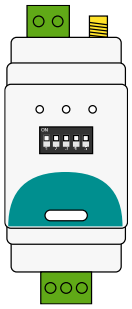
Radiocrafts
Embedded Wireless Solutions

Wireless Mesh Modbus Extender
Quick start installation guide

GENERAL
This manual applies for all three variants of the Wireless Mesh Modbus Extender. All relevant personnel must acquaint themselves with these instructions before installation. Warranty is voided if the product is not handled accordingly with the outlined instructions. Any damage to the product or parts due to improper handling will void the warranty. Do not use the product if damaged. For additional documentation visit www.radiocrafts.com.



WARRENTY
The warranty or service agreement will be deemed void if:
(1) The product is repaired, modified, or changed, unless such repair, modification or change has been approved by Radiocrafts AS; or
(2) The serial number on the product has been made ineligible or is missing

FCC ID: Y2NRC188X-IPM(RC2038-915)
Y2NRC189XHP-IPM(RC2038HP-915)

MET:E115504
UL: 62368-1
CSA: C22.2 No. 62368-1

TECHNICAL DATA
Casing DIN rail

Power supply AC:	24 VAC ±10%
Power supply DC:	12–24 VDC ± 15%
Max. power consumption:	2.5 W
Auto resettable fuse:	Yes
Solid cable rating, connector	0.2 - 1.5 mm2
Stranded cable rating, connector:	0.2 - 1.5 mm2
Conductor sizes (AWG:	24 - 16
Range per hop (Line-of-sight):	6000 m (max)
Range per hop (Indoor with walls):	250 m (max)
IP class:	40 X0
Dimensions (W x H x D):	36.5 x 93.0 x 58.7
Weight:	87 g

Casing DIN rail

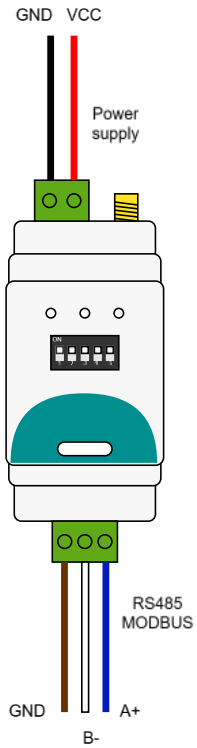
Power source restriction:	Only to be powered by a UL listed LPS power supply of max 15 W
Ambient operating temperature:	-20 to +55°C
Ambient storage temperature:	-30 to +80°C
Relative humidity:	10 - 95% non-condensing
Material:	ABS UL94-V0
Frequency band:	868/915 MHz, ISM band
Baud rate:	9600, 19200, 38400, 76800 bps
Number of Nodes:	32 servers in one wireless network
Max. number of hops:	10 hops in the meshing network

SAFETY
Only qualified electricians may perform interventions in connection with electrical installation. Always follow local/national rules when performing this type of electrical installation. If the extended is installed using an isolated AC or DC supply, this must be done in accordance with IEC 61558-1 and applicable part 2 of IEC 61558.

MANUFACTURER
Radiocrafts AS
Gullhaugveien 7
0484 Oslo
Norway

KIT PACKAGE CONTENT(other packet arrangements in volume):
1 pcs. Wireless Mesh Modbus Extender
1 pcs. 2 position terminal block for power connection
1 pcs. 3 position terminal block for RS485 connection
1 pcs. Antenna
1 pcs This Quick start installation guide

INSTALLATION
1. Confirm that the wireless Modbus extender has no visible damage.
2. The DIN rail has a clip-on mounting. Place it on the DIN rail.
3. Connect the antenna or the antenna cable to an external antenna.
4. Connect the power supply and the Modbus device(s) to the extender unit as shown
5. Power on the device. Verify that the leftmost LED is on or blinking.
6. The device is ready for commissioning.



POWER AND RS485 CONNECTION
The Wireless Mesh Modbus Extender uses a half-wave rectification. It must not share an AC transformer with other full-wave rectified devices. The extender box can be powered with the same transformer as other devices provided that:
- All other device(s) are half-wave rectified
- The transformer has a power rating sufficient for all the connected devices in total.
- All power connections are made with the same polarity(the "+" terminal on the extended must not be connected to the "-" terminal of another device.

The extender has a 12-24 VDC or 24 VAC connector at the top of the product and an RS485 connector at the bottom.

ANTENNA CONNECTION
The antenna connector is of type RP-SMA. The antenna supplied can be connected directly to the antenna connector. It is fitted with the correct connector. For installation purposes other antenna setups might be needed.

- Installation inside metal cabinet make it beneficial to use an antenna extension cable from the extender box and outside the metal cabinet. Some consideration is then required:
  - Use as short antenna cable as possible.
  - Use cable RP-SMA female to RP-SMA male cable.
  - If the antenna outside the metal cabinet is not grounded in cabinet, a dipole antenna is required.
- In space-restricted installation a smaller antenna could be used. This will typically reduce the range.

Antenna examples:

W5012	Pulse Electronics	Dipole
EW-915-5-RA	Embedded Works	Dipole
AR050WSG3019A	Wellshow	Dipole
ANT-868-CW	Linx	Quarter wave(NB ground plane)
OMNI	TE connectivity	Outdoor(Chose correct band)

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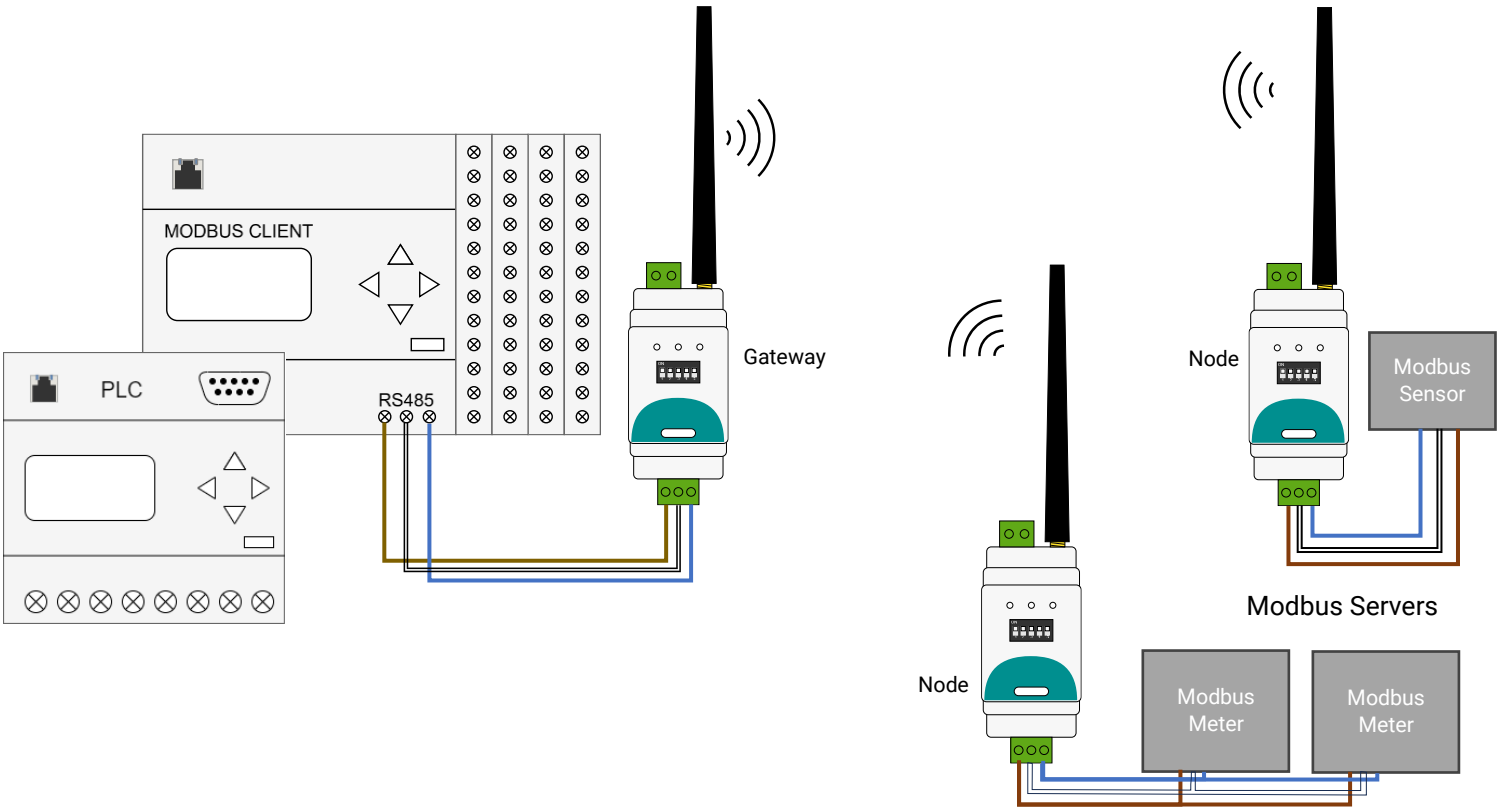
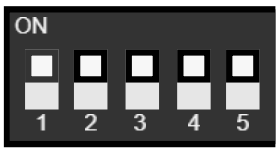
SYSTEM
The extender can be connected to both the Modbus client and servers. The software setup is different for the two devices. See section on setup.
The device connected to the Client is known as the network gateway. When powered on it creates a network.



ROLES
Each extender can be set up as a *radio gateway* to be connected to a Modbus client, or as a *radio node*, to be connected to one or more Modbus servers.

SETUP
DIP switches
Five DIP-switches control the setup of the device.



	1	2	3	4	5
BAUDRATE = 9600	Off	Off			
BAUDRATE = 19200	Off	On			
BAUDRATE = 38400	On	Off			
BAUDRATE = 76800	On	On			
No parity			Off		
Even parity			On		
1 stop bit				Off	
2 stop bits				On	
Start as Gateway					Off
Start as Node					On

Gateway MODBUS server
If the Modbus extender is set up as gateway, it also acts as a Modbus server with Modbus address 0xC9 (201). This means the Modbus client connected to this device can access its Modbus register and read out the following:

Register	0x10	Number of connected nodes.
Register	0x11	Beacon rate.
Register	0x20..0x3F	Modbus addresses of the connected nodes.

The following registers can be written:

Register	0x11	Modify beacon rate
Register	0x12	Modify Gateway Modbus address

USB-C connector
This USB port allows firmware upgrades. The USB-C connection also outputs debug/status information. A terminal program connected to this UART @ 115200 baud/second could be helpful during troubleshooting.

VARIANTS
The wireless Modbus mesh extender is supplied in four variants.

Ordering number	Description
• RC2038-868	Operate at 868 MHz, EU/CE
• RC2038-915	Operate at 915 MHz, US/FCC
• RC2038HP-868	Operate at 869.5 MHz. Extended range with 500 mW output power. EU/CE
RC2038HP-915	Operate at 915 MHz. Extended range with 500 mW output power. US/FCC

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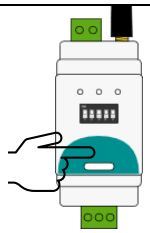
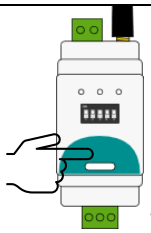
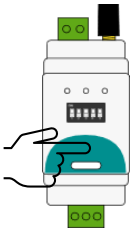
Wireless COMMISIONING Step-by-step

Step	Device	Action	Mode	LED blinking
1	Gateway	 Two short pushes	Enter commissioning mode	Blue led blinking
2	Node(s)	Wait(while green LED blinking)	Found commissioning network	Green LED continuously on
3	Gateway	 Two short pushes	Enter normal mode	Blue LED continuously on
4	Node(s)	Wait(Green led starts blinking after 5 seconds)	Found the new network	Green LED continuously on

If adding a new node to existing network, the steps are identical. The already installed nodes might lose connection temporarily
Both gateway and nodes will remember previously installed networks and devices after power off. To remove this from memory, perform a factory reset.

Modbus COMMISIONING Step-by-step
After the wireless commissioning is done and the Modbus devices is connected to the nodes –



Press two short pushes on the button on the Node.

This will initiate scanning after Modbus devices. This step is required for the mapping of Modbus addresses to wireless devices. This takes 9 minutes in total. During scanning the node will blink green at 2Hz. When finding a Modbus device, the Node will light up all 3 LEDs for 2 second. This confirms correct wiring and Modbus settings.

LEDS
3 LEDS indicate status

NET:

- BLUE — Gateway on normal mode
- BLUE BLINKING — Gateway commissioning mode
- GREEN BLINKING — Device is powered up as a Node and is searching for a network.
  4 Hz Searching for new
  0.5 Hz Searching for installed network
- GREEN — Device is powered up as Node and is connected to a Gateway
- Alternate BLUE and GREEN: 10 quick blinks for 0.5 seconds every time a valid Modbus is received on the RS485 bus.
- Alternate BLUE and GREEN: Slow blink for 2 second while scanning for Modbus devices(Only applies to Node)

STATUS:

- RED (1 BLINK) — Gateway: Too much traffic, reduce polling frequency
- RED off — Node: Radio link to node is good
- RED (1 BLINK per 5 sec) — Node: Radio link to node is weak
- RED (2 BLINK per 5 sec) — Node: Radio link is poor (consider antenna type and position)

DATA:

- YELLOW BLINKING — Blink for each radio transmission. This indicated active data traffic.

BUTTON

Push	Gateway	Node
One short push	Enable/Disable Net LED	
Two short pushes	Toggle commissioning mode (and back to normal node)	Scan for Modbus devices
Hold 1-5 second	Reset (Devices restarts)	
Hold 5-10 second	Factory reset All nodes forget previously installed networks	

- When holding down the button, the red LED will light up after 1 second and start blinking after 5 seconds to make is easy to control a long push