OPERATING MANUAL

WIRELESS GATEWAY **(Modbus/TCP (Ethernet), Modbus-RTU Transparent 920MHz Band Wireless Device (Parent device))**	MODEL	**WL40EW2TW, WL40EW2TH, WL40EW2VN, WL40EW2KR**

CONTENTS

FUNCTION OUTLINE

■ COMMUNICATION

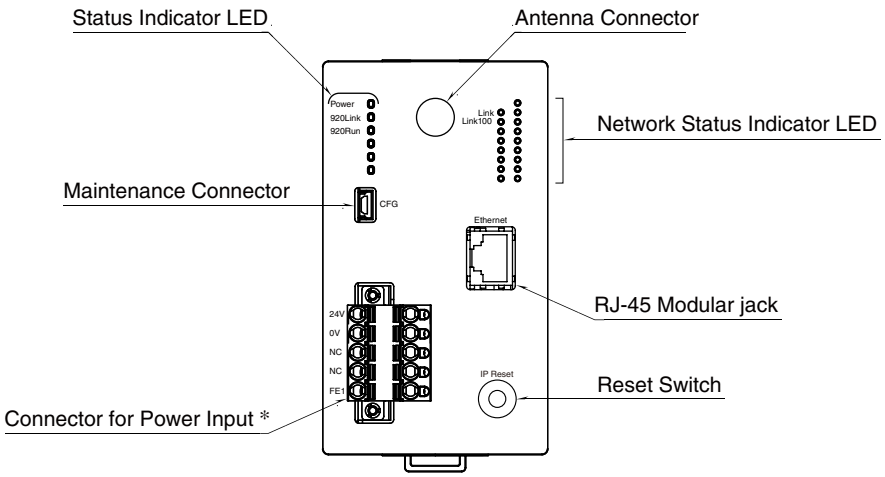
920MHz band wireless function is equipped, which can communicate with our 920MHz band wireless devices (child devices) by Modbus.
Ethernet (100BASE-TX) is equipped.

■ MODEL NO.

Web server for settings is equipped, which allows to connect from PC, tablet and smart phone and to change settings.
Access to the setting screen is protected by requiring user name and password.

COMPONENT IDENTIFICATION

■ FRONT VIEW



■ STATUS INDICATOR LED

ID	STATUS	COLOR	FUNCTION
Power	ON	Green	Power is on.
	Blinking		Reset switch is on.
	OFF		Power is off, or device error occurring.
920Link	ON	Green	920MHz band wireless: operating
	0.5 Hz blinking		920MHz band Wireless: starting up
	2 Hz blinking		920MHz band Wireless: stopping due to 1% duty cycle restriction
	OFF		920MHz band Wireless: stopping
920Run	ON	Green	920MHz band Wireless: normal communication with child device

■ NETWORK STATUS INDICATOR LED

ID	STATUS	COLOR	FUNCTION
Link	ON	Green	Linking via 10BASE or 100BASE
	Blinking		Sending / Receiving data
	OFF		No link
Link100	ON	Green	Linking via 100BASE
	OFF		Linking via 10BASE or no link

■ RESET SW

To reset the unit's current settings to the factory default values, press and hold the Reset SW for two seconds or more until Power LED starts blinking, then release the SW. The initialization starts and the unit reboots.

MODBUS FUNCTION CODE

Modbus function codes are shown below.

■ DATA AND CONTROL FUNCTIONS

CODE	NAME	
01	Read Coil Status	Digital output from the slave (read/write)
02	Read Input Status	Status of digital inputs to the slave (read only)
03	Read Holding Registers	General purpose register within the slave (read/write)
04	Read Input Registers	Collected data from the field by the slave (read only)
05	Force Single Coil	Digital output from the slave (read/write)
06	Preset Single Register	General purpose register within the slave (read/write)
15	Force Multiple Coils	Digital output from the slave (read/write)
16	Preset Multiple Registers	General purpose register within the slave (read/write)

■ EXCEPTION CODES

CODE	NAME	
06	Slave Device Busy	Device's Modbus/TCP request queue is full.
11	Gateway Target Device Failed To Respond	Response from 920MHz band wireless device (child) is error, or response timeout occurred.

Note: When 920MHz band wireless device (child) returns an exception code other than the above, the exception code is directly transmitted to the upper device.

COMMUNICATION CONNECTION

■ CONNECTION VIA WEB BROWSER

After the device is installed, it needs to be initialized from a web browser on PC, tablet, or smart phone through Ethernet. In the initial settings, configure TCP/IP settings, such as IP address, and other settings relating to the device's functions such as 920MHz band wireless setting according to your usage.

The web server function on the device is designed to be used in various web browser environments where HTML5 is supported. However, we cannot guarantee operations with all web browsers, in all environments.
Please note that even though the web browser operation has been checked by us, there are possibilities of errors, such as that a distorted screen is displayed or a specific function does not work, caused due to the web browser setting or the security software installed.

Web browsers checked by us for those operations are shown in the table below.

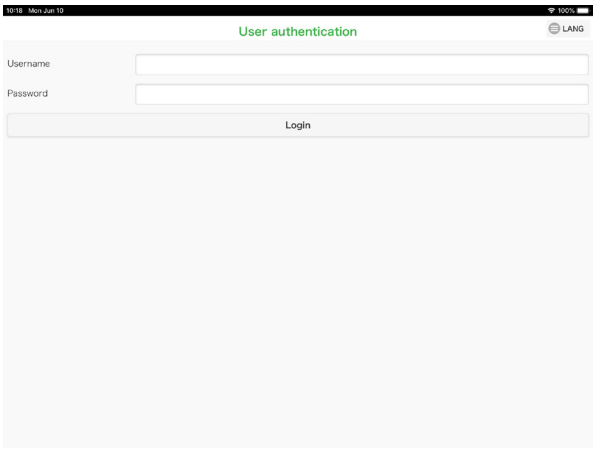
DEVICE FOR OPERATION	WEB BROWSER
PC supporting Windows7, Windows8.1 or Windows10	Internet Explorer 11.608.15063.0 Microsoft Edge 40.15063.0.0 Firefox 56.0 Chrome 61.0.3163.100
iPhone or iPad supporting iOS 11.0.1	Safari *1 *2
Smart phone or tablet supporting Android 6.0.1	Chrome 61.0.3163.98

*1. For iOS10.x, when saving maintenance settings to a file, they cannot be saved in a local drive due to iOS restrictions. In this case, install a network storage application (such as Google drive), so that the file can be stored in the network storage. For iOS11.x, the file can be stored in a local drive without iOS restrictions.
*2. For iOS Safari, a setting file is given "Unknown" as a file name when saved.

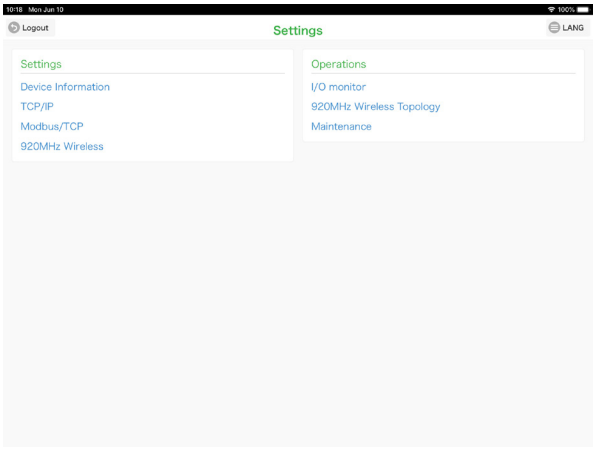
The device's IP address is factory-set to "192.168.0.1".
As PC's IP address or other devices', set numbers such as 192.168.0.5 that can communicate with 192.168.0.1, and connect the devices with Ethernet cable.

Then, access http://192.168.0.1/ through Web browser.

When they are connected successfully, 'User authentication' screen shown on the right appears on web browser.
The display differs depending on your OS, web browser type and version.



The device's user name and password is factory-set to "admin". Enter 'admin' to both 'Username' and 'Password' fields and then click "Log in" button, so that 'Settings' menu screen shown on the right below appears.



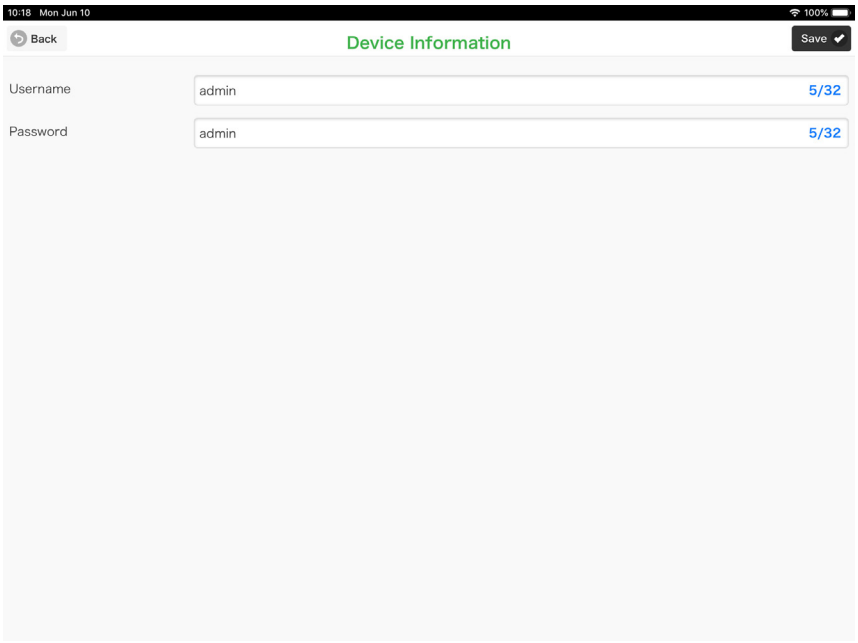
■ SETTING MENU

To return to the 'User authentication' screen, click "Logout" button at the top left of screen.

To change the language setting, click "LANG" button at the top right of screen and manipulate the setting.

DEVICE INFORMATION

Selecting “Device Information” on the ‘Settings’ menu leads to the following screen where the items in the table below can be set.



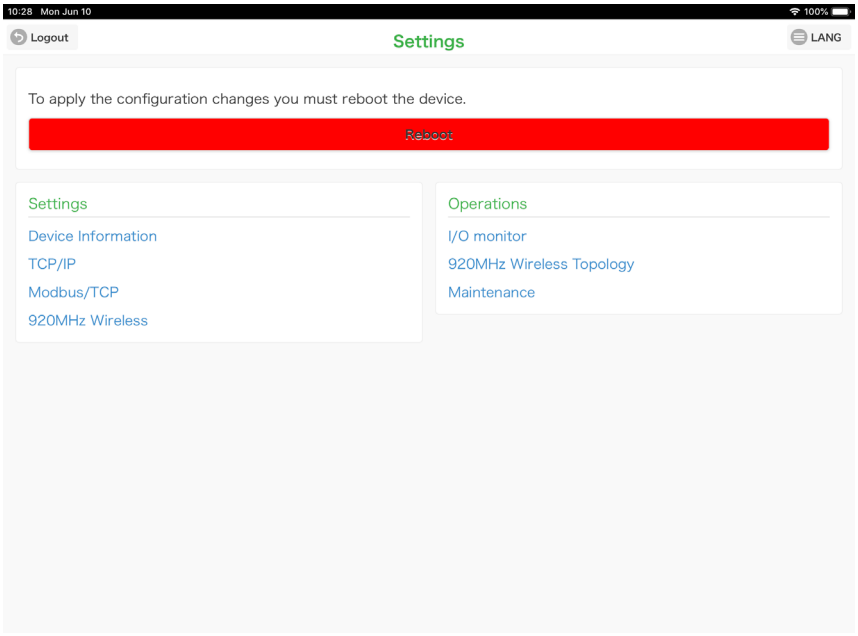
■ SETTING ITEMS

ITEM	DESCRIPTION	DEFAULT
Username/Password	Username and Password with which to log in to the ‘Settings’ menu can be changed. It is highly recommended to change the factory setting to new one. Up to 32 optional characters are settable.	admin/admin

■ SAVING SETTINGS

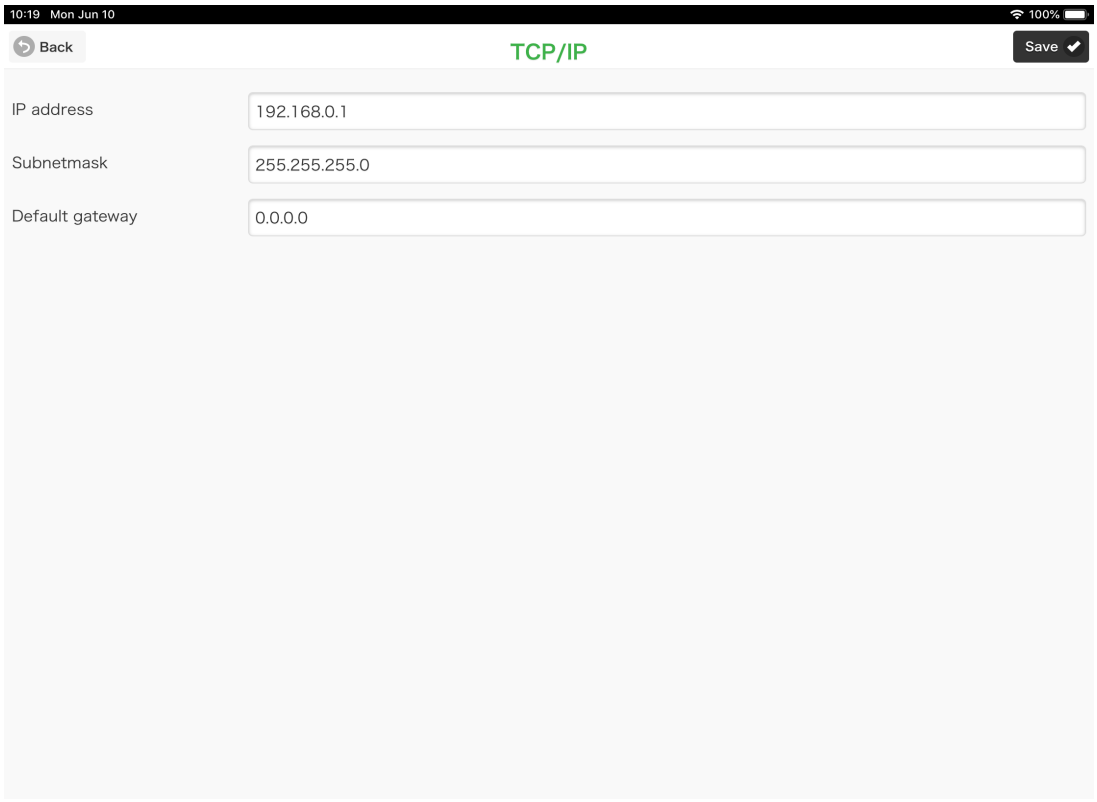
After entering new settings, click “Save” button at the top right of screen, so that the settings are saved on the device and the screen returns to the ‘Settings’ menu.
Clicking “Back” button, the screen returns to the ‘Settings’ menu without saving changes.
This procedure is applied not only to the ‘Device Information’ but also to the other settings on the ‘Settings’ menu.

When the screen returns to the ‘Settings’ menu after saving the setting, “Reboot” button shown below appears.
If you want to change other settings as well, perform continuously setting changes.
When the setting changes are all complete, click “Reboot” button to reboot the device and apply the changed settings to the device.



TCP/IP SETTING

Selecting “TCP/IP” on the ‘Settings’ menu leads to the following screen where the items in the table below can be set.



■ SETTING ITEMS

ITEM	DESCRIPTION	DEFAULT
IP address/ Subnet mask	Set IP address and Subnet mask of the device.	192.168.0.1 / 255.255.255.0
Default gateway	Set IP address of the router that connects to external networks. For use within the local network that does not communicate with external networks, leave the Default gateway setting ‘0.0.0.0’ (which means “unused”).	0.0.0.0

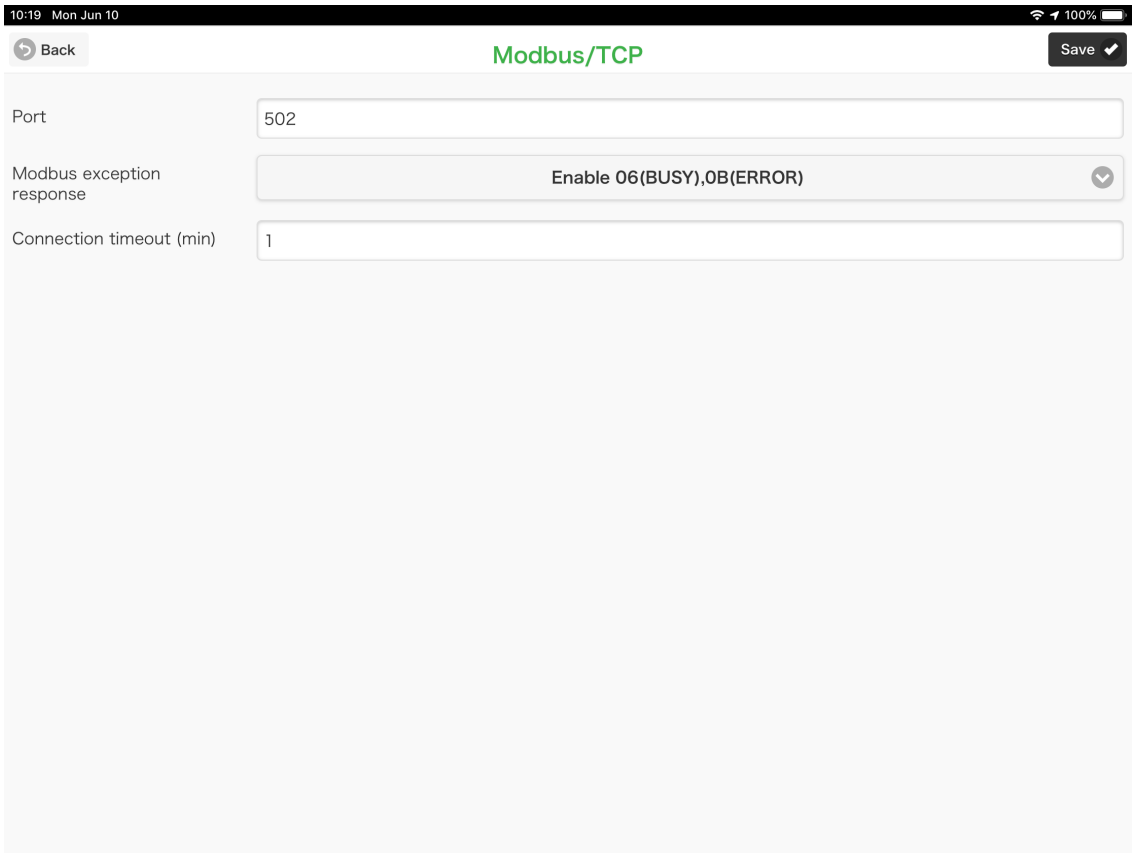
Set the applicable setting for installation place.
If you are not sure of the setting content, contact your network administrator or network installation provider.

NOTE

If you are not sure of the device’s TCP/IP setting and cannot connect via network from other devices, refer to ‘Reset SW’ on page 2 and initialize the settings.

MODBUS/TCP SETTING

Selecting “Modbus/TCP” on the ‘Settings’ menu leads to the following screen where the items in the table below can be set.

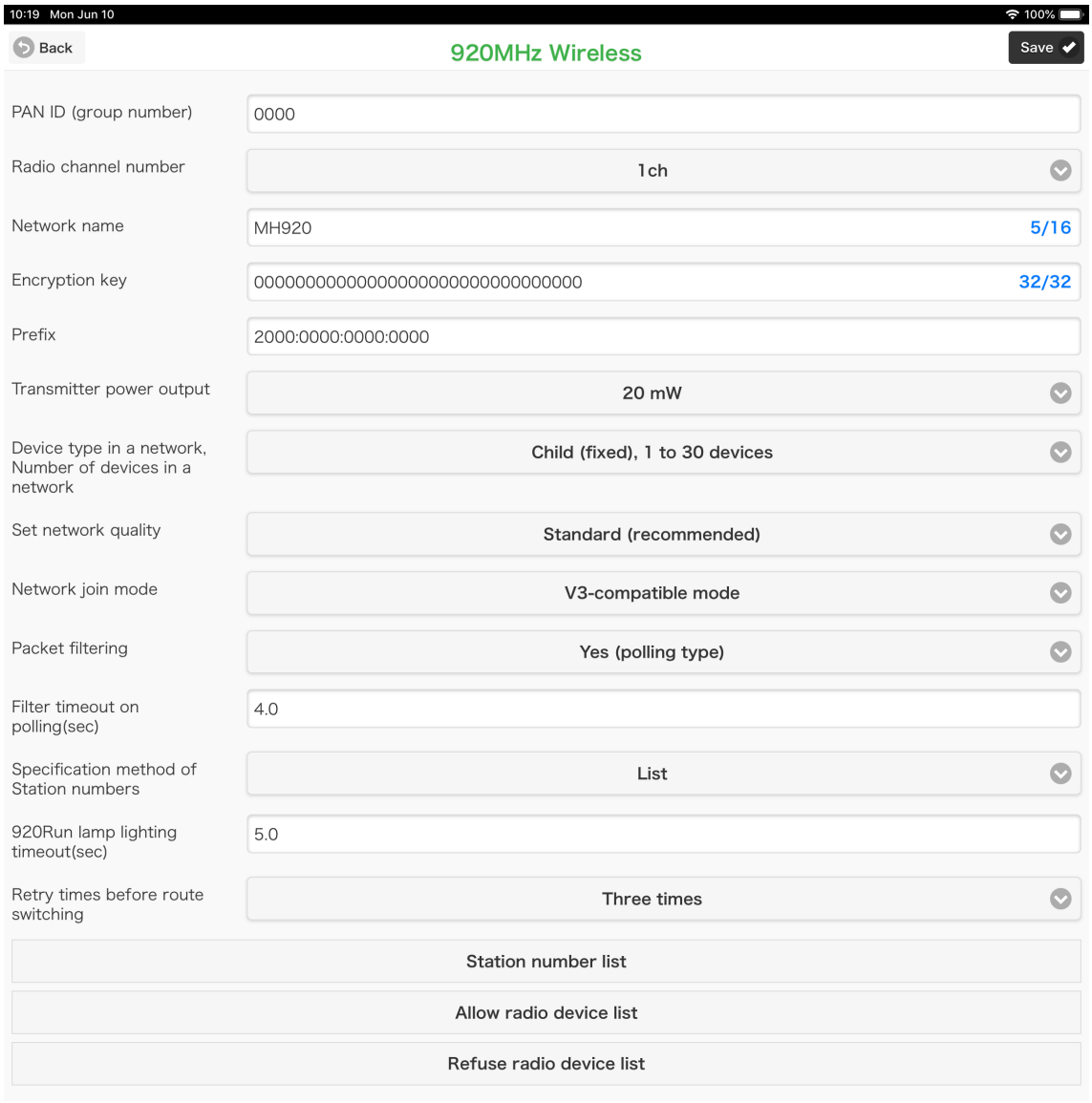


■ SETTING ITEMS

ITEM	DESCRIPTION	DEFAULT
Port	Set TCP port number ranging from 1 to 65535 used in Modbus/TCP communication. The port number generally used in Modbus/TCP communication is 502. If there is no need to change, leave this number.	502
Modbus exception response	Select whether to return Modbus exception code to Modbus master when the device detects Modbus timeout or error. • Enable 06 (BUSY), 0B (ERROR): Returns Modbus exception code. • Disable 06 (BUSY), 0B (ERROR): Does not return Modbus exception code.	Enable 06 (BUSY), 0B (ERROR)
Connection timeout	Set the waiting time ranging from 1 to 60 (min) till when TCP in no connection state is cut off.	1 min.

920MHZ BAND WIRELESS SETTING

Selecting “920MHz Wireless” on the ‘Settings’ menu leads to the following screen where the items in the table below can be set.

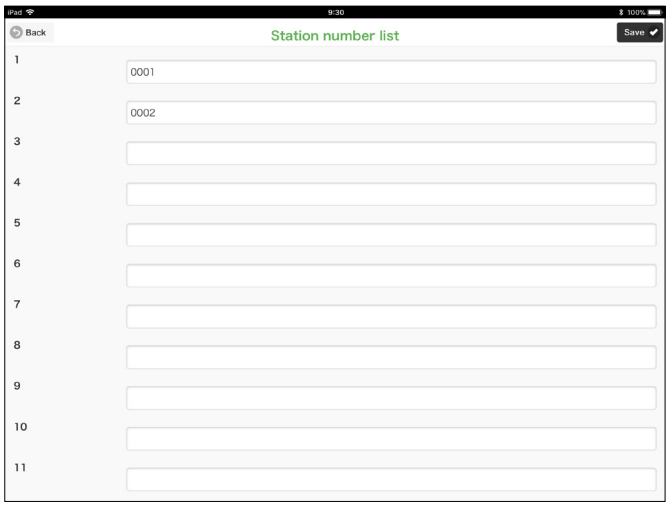


■ SETTING ITEMS

<table>
<tr><th>ITEM</th><th>DESCRIPTION</th><th>DEFAULT</th></tr>
<tr><td>PAN ID
(group number)</td><td>Set the hexadecimal number ranging from 0000 to FFFF as ID to identify 920MHz band wireless.
When multiple 920MHz band wireless devices form two or more networks, a different PAN ID must be set for each parent device.
Setting ‘0000’ disables the 920MHz band wireless operation.</td><td>0000</td></tr>
<tr><td>Channel number</td><td>Select which channel of 920MHz band to use from the table below.
<table>
<tr><th>Model</th><th>Channels</th></tr>
<tr><td>WL40EW2TW</td><td>1 ch to 8 ch</td></tr>
<tr><td>WL40EW2TH</td><td>1 ch to 8 ch</td></tr>
<tr><td>WL40EW2VN</td><td>2 ch to 7 ch</td></tr>
<tr><td>WL40EW2KR</td><td>1 ch to 14 ch</td></tr>
</table></td><td>WL40EW2TW, WL40EW2TH and WL40EW2KR
1 ch

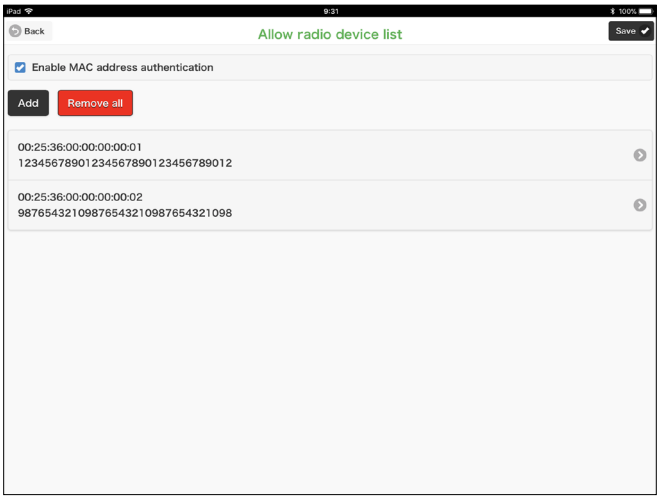
WL40EW2VN
2 ch</td></tr>
<tr><td>Network name</td><td>To identify 920MHz band wireless, set the ID using up to any 16 one-byte alphanumeric characters and some symbols (one-byte space, “-“, “_”, “.”,”@”).
On the child device side, as the network name, designate the name of the 920MHz band wireless network to which the child device is to connect.</td><td>MH920</td></tr>
<tr><td>Encryption key</td><td>Set the encryption key with a 32-digit hexadecimal number for allowing the connection of 920MHz band wireless device (child device).</td><td>ALL 0</td></tr>
<tr><td>Prefix</td><td>In 920MHz band wireless, IPv6 network is adopted. IPv6 addresses of the parent and child device connected to the network are automatically determined based on the prefix specified here.</td><td>2000:0000:
0000:0000</td></tr>
<tr><td>Monitoring unit time of 1% duty (sec)</td><td>To observe the regulation on transmission time restriction (1% duty restriction) stipulated by law, set the unit time for monitoring radio transmission time.
Setting range: 10 to 3600 sec.
This parameter is applicable only to WL40EW2TH and WL40EW2VN.
No such restriction is applied to WL40EW2TW and WL40EW2KR.</td><td>1800 sec.</td></tr>
<tr><td>Transmitter power output</td><td>Select the transmitter power output for 920MHz band wireless from the table below.
<table>
<tr><th>Model</th><th>Transmitter power output</th></tr>
<tr><td>WL40EW2TW
WL40EW2TH
WL40EW2VN</td><td>• 0.16mW
• 1mW
• 20mW</td></tr>
<tr><td>WL40EW2KR</td><td>• 0.16mW
• 1mW
• 5mW
• 12.5mW *1</td></tr>
</table>
*1 Not available when 1 ch to 7 ch is selected.</td><td>WL40EW2TW, WL40EW2TH, WL40EW2VN:
20 mW

WL40EW2KR:
5mW</td></tr>
<tr><td>Device type in a network, Number of devices in a network</td><td>Select the set content and number of child devices connected in 920MHz band wireless form among the followings.
• Child (fixed), 1 to 30 devices
• Child (fixed), 31 to 60 devices
• Child (fixed), 61 to 100 devices
• Child (fixed) + child (moving)</td><td>Child (fixed), 1 to 30 devices</td></tr>
<tr><td>Set network quality</td><td>Select the quality setting for 920MHz band wireless from among the followings.
• Standard (recommended)
• Frequency of route switching and delay (higher)
• Frequency of route switching and delay (highest)</td><td>Standard (recommended)</td></tr>
<tr><td>Network join mode</td><td>Set the network join mode for 920MHz band wireless.
For the setting of ‘Device type in a network, Number of devices in a network’, when ‘child (fixed), 1 to 30 devices’ is chosen, this setting is automatically fixed to ‘V3-compatible mode’.
• V3-compatible mode
• Fast join mode</td><td>V3-compatible mode</td></tr>
<tr><td>Packet filtering</td><td>Set whether to perform timeout processing for the request from Modbus/TCP master in 920MHz band wireless network.
• None
• Yes (polling type)</td><td>Yes (polling type)</td></tr>
<tr><td>Filter timeout on polling (sec)</td><td>Set the timeout value ranging from 2.0 to 60.0 sec. for Modbus request from Modbus/TCP master.</td><td>4.0 sec.</td></tr>
</table>

ITEM	DESCRIPTION	DEFAULT
Specification method of Station numbers	Select how to connect the short addresses of 920MHz band wireless devices (child device) and Modbus device addresses. • Range: 1 device (max. multi drop number) • Range: 1 to 4 devices (max. multi drop number) • Range: 1 to 8 devices (max. multi drop number) • Range: 1 to 16 devices (max. multi drop number) • Range: 1 to 31 devices (max. multi drop number) • List 'Range' is a method to connect the short addresses in order from 0001 with the addresses of Modbus devices of the max. drop number specified in 'Range'. For example of 'Range: 1 to 4 devices (max. drop number)', Modbus device addresses 1 to 4 and 5 to 8 are connected to short addresses 001 and 002, respectively. 'List' is a method to connect freely. Clicking the "Station number list" button leads to the following screen where you can edit the connection. Set the short addresses of 920MHz band wireless devices (child device) to be connected. 	List
920Run lamp lighting timeout (sec)	When a readout/write request from Modbus master is transmitted to / received by 920MHz band wireless device (child device) through the parent device, 920Run lamp lights up. If a set timeout period has elapsed before next request, 920Run lamp turns off and the error is indicated. The timeout period is settable ranging from 0.0 to 3200.0 (sec.).	5.0 sec.
Retry times before route switching	Select how many times to retry the transmission before switching the route when the communication from the parent to the child of 920MHz band wireless devices is failed. Once / Twice / Three times	Three times

■ ALLOW RADIO DEVICE LIST SETTING

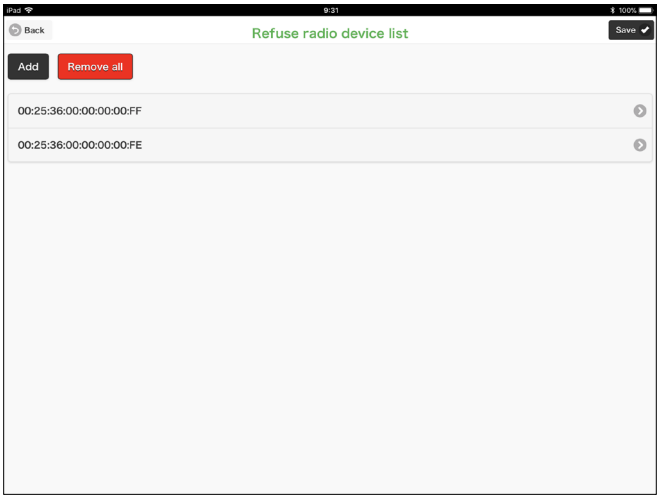
For the connection authentication and encryption of 920MHz band wireless, the same encryption key is normally used.
However, a dedicated encryption key can be assinged to a MAC address of each child device to be connected.
Up to 200 pairs of encryption keys and MAC addresses can be created.



To register these pairs, click “Allow radio device list” button on the ‘920MHz Wireless’ screen to display the screen shown on the left.
Check the checkbox of ‘Enable MAC address authentication’, and then register pairs of MAC address and encryption key for necessary devices by clicking “Add” button.

■ REFUSE RADIO DEVICE LIST SETTING

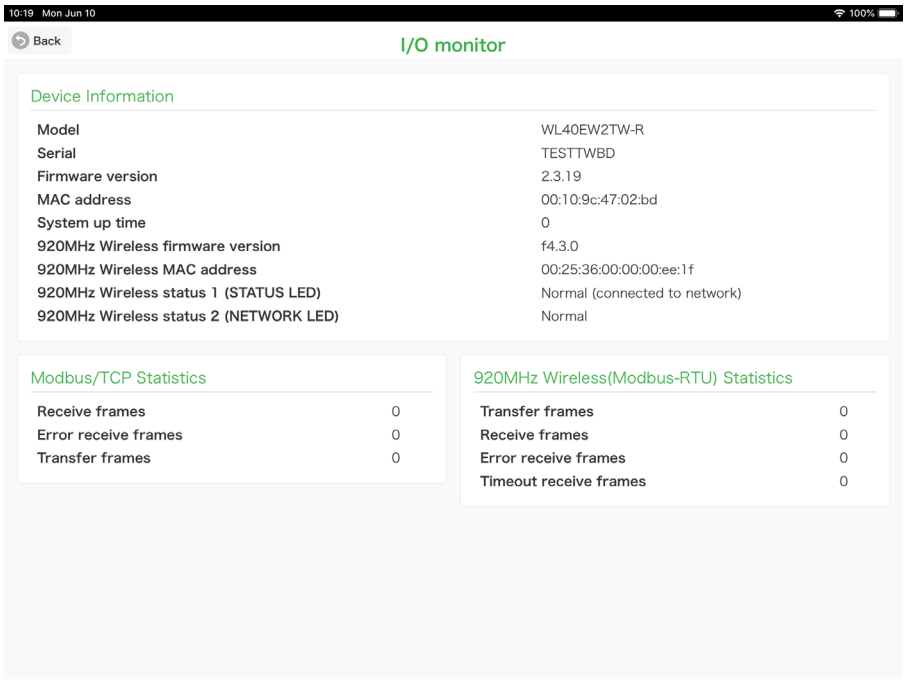
When encryption keys for child devices are registered in ‘Allow radio device list’, it is possible to refuse certain child devices explicitly by registering the MAC addresses of such devices.
UP to 50 MAC addresses can be registered.



For registering child devices to refuse, click “Refuse radio device list” button on the ‘920MHz Wireless’ screen to display the screen shown on the left.
Register the MAC address by clicking “Add” button.

I/O MONITOR

Selecting “I/O monitor” on the ‘Settings’ menu leads to the following screen where you can perform operation checks for the device.



■ DISPLAYED ITEMS

• Device Information

Model	Model of the unit
Serial	Serial number of the unit
Firmware version	Firmware version of the unit
MAC address	Ethernet MAC address of the unit
System up time	Operating time since power on *The count returns to 0 when the power is turned off
920MHz Wireless firmware version	Firmware version of 920 MHz band wireless module
920MHz Wireless MAC address	MAC address of 920 MHz band wireless module
920MHz Wireless status 1 (STATUS LED)	Status of 920 MHz band wireless module
Normal (no network connection)	Normal; but not connected to network
Normal (connected to network)	Normal; connected to network
Alarm issued	Failure is occurring in 920 MHz band wireless module. If not recovering after restarting and resetting, the wireless module might be damaged.
920MHz Wireless status 2 (NETWORK LED)	Network status of 920 MHz band wireless module
No network connection	Not connected to network
Normal	Connected to network
Radio transmission stopped	Wireless connection is disconnected
Sending serial data	Sending serial data to 920 MHz band wireless devices (child)

• Modbus/TCP Statistics

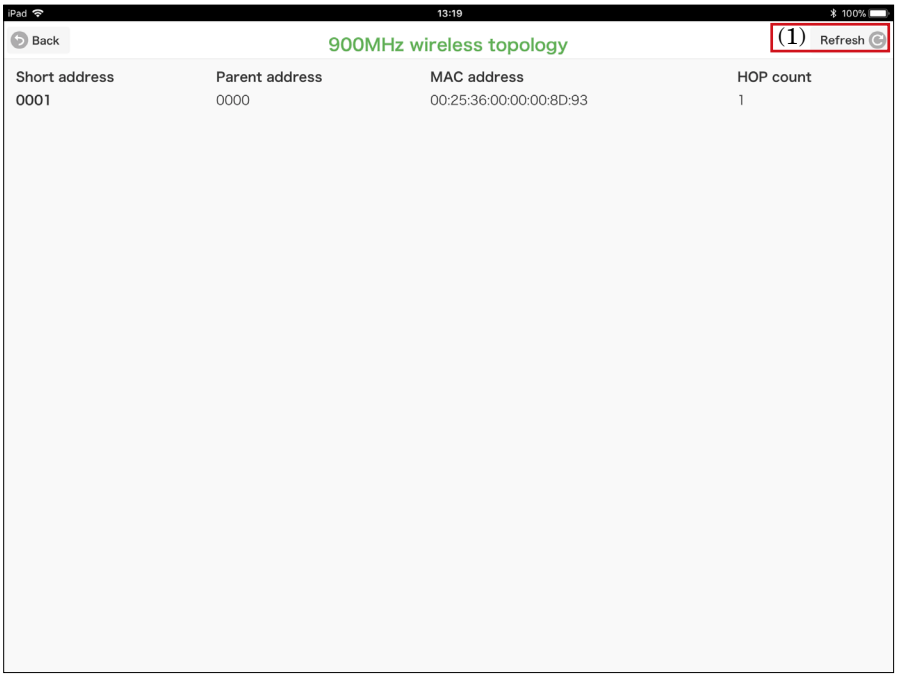
Receive frames	The total number of normal requests received via Modbus/TCP
Error receive frames	The total number of erroneous requests received via Modbus/TCP
Send frames	The total number of responses sent via Modbus/TCP

• 920MHz wireless (Modbus-RTU) Statistics

Send frames	The total number of requests sent to 920 MHz band wireless devices (child)
Receive frames	The total number of normal responses received from 920 MHz band wireless devices (child)
Error receive frames	The total number of erroneous responses received from 920 MHz band wireless devices (child)
Timeout receive frames	The total number of timeouts due to reception failure of requests from 920 MHz band wireless devices (child).

920MHZ WIRELESS TOPOLOGY

Selecting “920MHz Wireless Topology” on the ‘Settings’ menu leads to the following screen that shows 920MHz wireless device (s) (child device) connecting to the device (parent device).

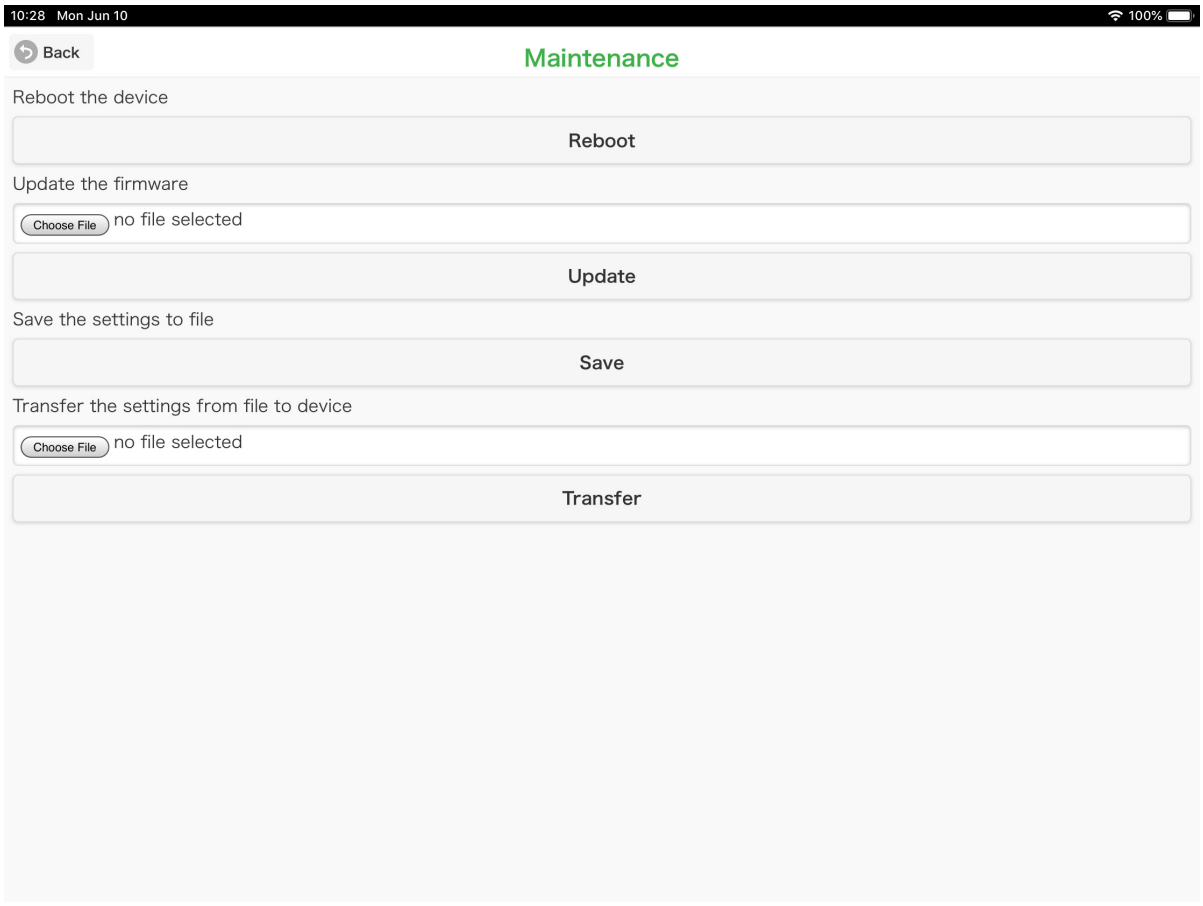


■ OPERATION ITEM

(1) Refresh	Updates a list of 920MHz band wireless devices (child device).

MAINTENANCE

Selecting “Maintenance” on the ‘Settings’ menu leads to the following screen where you can perform maintenance operations in the table below.



■ OPERATION ITEM

Reboot the device	Clicking “Reboot” button reboots the unit.
Update the firmware	Click “Choose File” button (there might be a different name such as “reference”, depending on your web browser) and select the firmware file. Click “Update” button to transfer the firmware to the device. Reboot the device after the transfer is complete, so that the firmware update is performed and the device reboots with new firmware version.
Save the settings to file	Click “Save” button so that the saved settings are read out from the device and saved to a file.
Transfer the settings from file to device	Click “Choose File” button (there might be a different name such as “reference”, depending on your web browser). Select a saved file and click “Transfer” button so that it is transferred and written to the device. After the transfer is complete, reboot the device to apply the changed setting to the device.