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# Introduction

This document describes how to set up a LoRaWAN gateway to be used in a Sushi Sensor system.

MultiConnect Conduit IP67 Base Station manufactured by Multi-Tech System is used as a LoRaWAN gateway. (hereinafter referred to as "gateway").

## ■ Notes Regarding this Document

- This document is based on gateway firmware version R5.0.1 and R5.3.0. When the version is upgraded, the screen layout and setup procedures may be changed. The contents of the LoRaWAN settings added by the version upgrade of the gateway firmware are described in the appendix. The gateway setting items described in this document are confirmed by Yokogawa when this document is created.
- The contents of this manual are subject to change without prior notice.
- All rights reserved. The information shown in this document cannot be reprinted without prior permission from Yokogawa.
- If any question arises or errors are found, or if any information is missing from this manual, please inform the nearest Yokogawa sales office.
- For the settings that comply with the latest radio laws and restrictions in each country or region, and the settings for the latest firmware version of the gateway, please contact to the nearest Yokogawa sales office.



### CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or physical damage. It may also be used to alert against unsafe practices.



### IMPORTANT

Indicates that operating the hardware or software in this manner may damage it or lead to system failure.



### NOTE

Draws attention to information essential for understanding the operation and features.

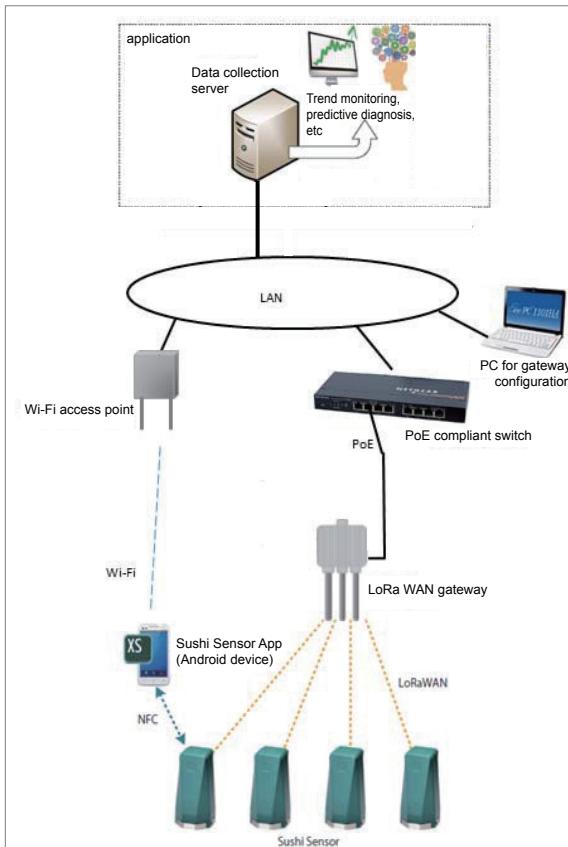
# 1. Overview of the LoRaWAN Gateway

As shown in Figures 1 and 2, the gateway receives data from Sushi Sensors through LoRaWAN and sends it to the application software via LAN or the Internet. The gateway establishes communications with the data collection server.

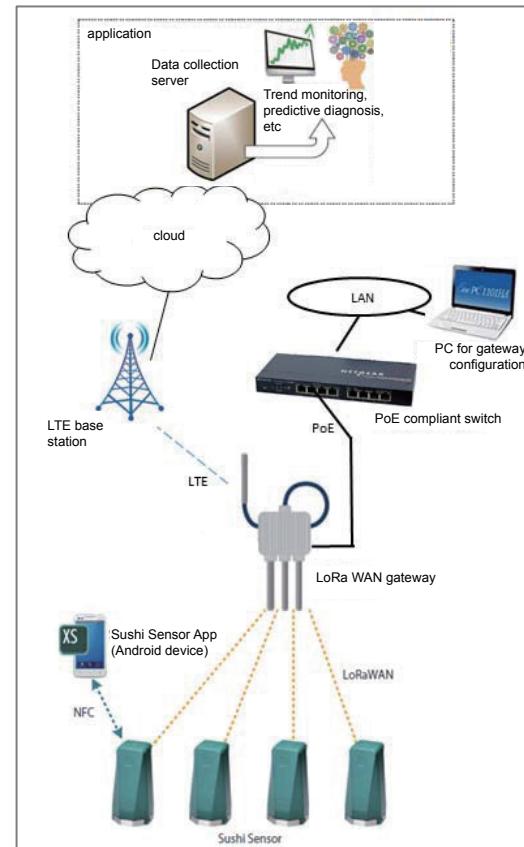
In order to configure the gateway, one PC installed with a web browser is necessary.

Encryption key for ensuring LoRaWAN communication security is determined by the Sushi Sensor system administrator.

For the procedures of the gateway and encryption key settings, refer to the following chapters.



**Figure 1** Sample: System architecture using LAN

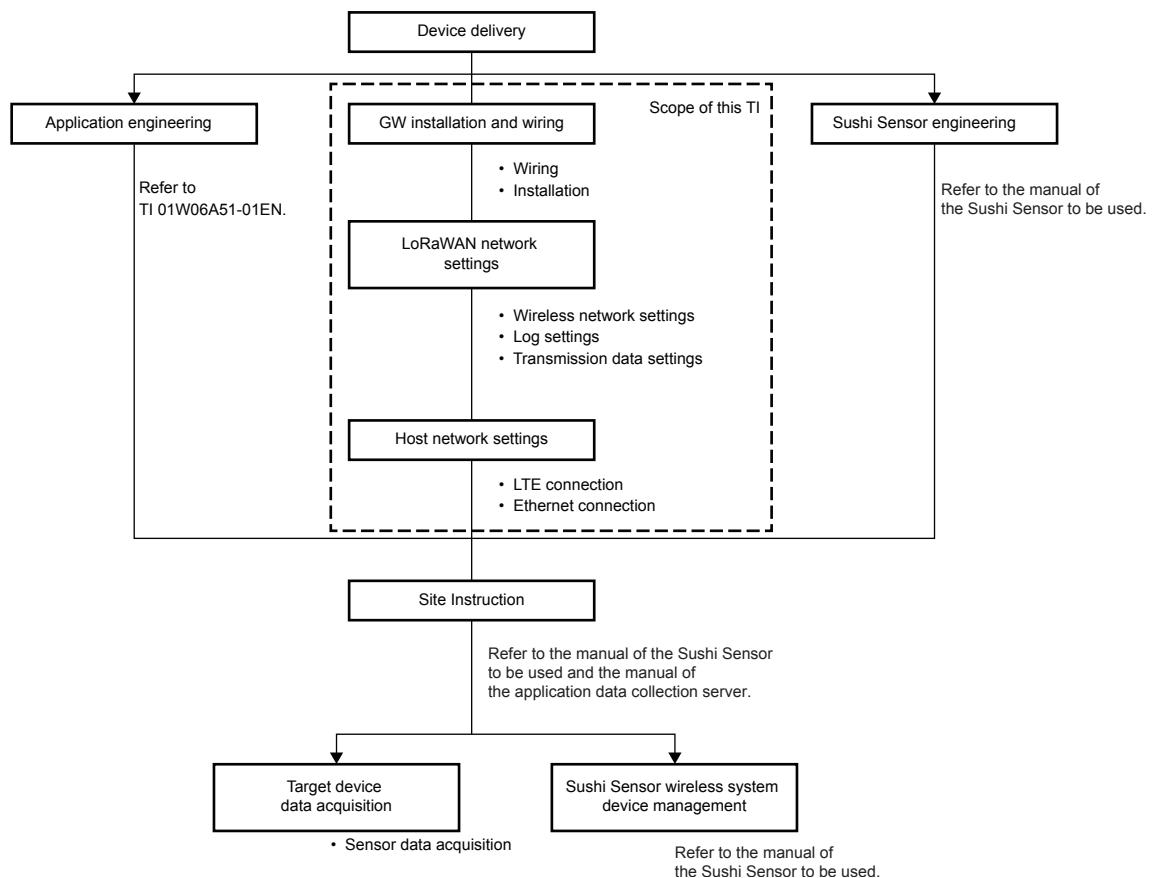


**Figure 2** Sample: System architecture using cloud network

This chapter describes the engineering workflow and tasks for building Sushi Sensor system.

This document covers only for scopes of the gateway. For details about Sushi Sensor engineering, refer to the manual of the Sushi Sensor.

## ● Engineering workflow



## 2. Preparation

Make sure that you have all following items available when you receive the gateway package.

- Gateway and accessories
  - Main unit
  - Hardware Installation Guide
  - Mounting bracket
  - Stainless hose band x 2
  - Cable gland
  - LTE antenna x 2
  - LoRa antenna x 1
  - GPS antenna x 1



Figure 2-1 External view of gateway

For setup the gateway, following peripherals are needed additionally.

- Peripherals
  - IEEE 802.3at-based PoE switch or PoE injector
  - Ethernet cable
 

Used to supply power to the gateway and connect to the gateway configuration PC.

    - Category: Category 5e or better
    - Environmental resistance: Outdoor use
    - Length: 100 m max.
  - Gateway configuration PC
 

Used to configure gateway settings and carry out maintenance.

    - Communication interface: Ethernet
    - Browser: Chrome, etc.



### NOTE

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"GW Custom App Generator for Sushi Sensor" used in "5.5.2 Use Custom App" has been confirmed to work on Windows 10 Professional 20H2 64 bit.

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- SIM card (when connecting to a cellular network)
  - Carrier: Refer to the gateway specifications issued by Multi-Tech Systems.
  - Size: MicroSIM



### NOTE

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Since the gateway models for South Korea, Brazil and South Africa are not compatible with LTE, LTE antennas are not enclosed as the accessories. The following description regarding LTE configuration can be skipped.

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## 3. Assembly and Wiring

### 3.1 Connecting the Ethernet Cable

The gateway is powered from the PoE switch/injector through the Ethernet cable. Therefore, the connection of Ethernet cable must be required even if LTE communications are used. The attached cable gland must be installed whether the gateway is used indoors or outdoors.

- (1) Remove the cable gland from the main unit.
- (2) Put the Ethernet cable through the outermost screwing part of the cable gland, and attach the waterproof rubber and rubber holding part.
- (3) Connect the Ethernet cable to the Ethernet connector of the gateway.
- (4) Attach the cable gland to the screwing part of the gateway. The standard tightening torque for the cable gland is 1.18 N·m.



Figure 3-1 Cable gland components

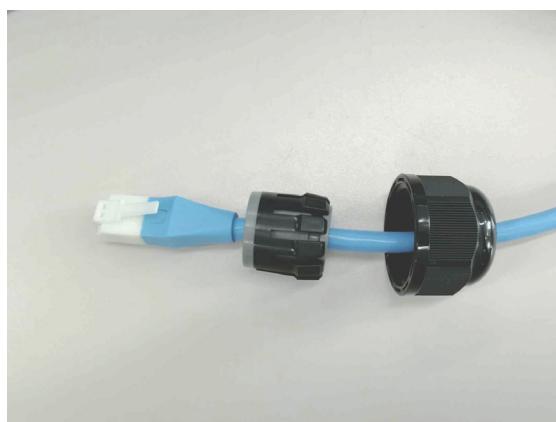


Figure 3-2 Attaching the cable gland to the Ethernet cable

## 3.2 Mounting the LTE Antennas

For direct access to the Internet via LTE network, install the SIM card into the gateway.

Even if the LTE network is not used, two of LTE antennas must be mounted to the connectors of the gateway for protection purpose.

- (1) Prepare the LTE antennas. "LTE" is indicated on the side of each antenna.
- (2) Connect either of the LTE antennas to antenna connector "5" at the bottom of the gateway.
- (3) Connect the other LTE antenna to antenna connector "6" at the bottom of the gateway.
- (4) Use a tightening torque of 2 to 3 N·m to mount the antennas.

## 3.3 Inserting a SIM Card

When using LTE communications, a SIM card is required to set into the gateway. If you do not use LTE communications, skip the procedure shown in this chapter.

- (1) Remove the SIM/USB cover at the bottom of the gateway. The SIM card slot is located on the top of the USB port.
- (2) Orient the SIM card so that the cut-off notch in the corner comes to the front left, and insert it into the slot. When the card clicks into place, it has been inserted correctly.
- (3) Mount the SIM/USB cover. The tightening torque for the SIM/USB cover is 1.18 N·m.



Figure 3-3 Gateway with a SIM card inserted

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## 3.4 Mounting the LoRa Antenna

Mount the LoRa antenna to establish LoRaWAN communications between Sushi Sensors and the gateway.

- (1) Prepare the LoRa antenna. “806-960 MHz” is indicated on the side of the antenna.
- (2) Connect the LoRa antenna to antenna connector “1” at the top of the gateway.
- (3) Use a tightening torque of 2 to 3 N·m to mount the antenna.

## 3.5 Mounting the GPS Antenna

The GPS function of the gateway is not used in the Sushi Sensor system; however, the GPS antenna must be mounted to protect the connector.

- (1) Connect the GPS antenna to antenna connector “3” at the top of the gateway.
- (2) Use a tightening torque of 2 to 3 N·m to mount the antenna.

## 4. Installation

This chapter describes how to install the gateway.

### 4.1 Precautions on Installation

- For information about the conditions of the installation location, refer to the gateway manual.
- For outdoor use, install the gateway at the location where there are less obstacles and higher level as long as possible.  
In the indoor use, carefully select the location not to be attenuate the radio by surrounding obstacles.
- Check that there are no anomaly at the installation points, such as material damage, deformation, adhesion of foreign objects and etc.
- Antennas of the gateway must be away from metallic objects sufficiently.

### 4.2 Mounting the Bracket on the Gateway

Follow the below procedure to install the mounting bracket.

- (1) Put the attached mounting bracket onto the back of the gateway. Make sure that the screw holes of the mounting bracket are correct positions.
- (2) Screw a M5 screw into each of the four mounting screw holes.



Figure 4-1 Gateway with the bracket mounted

## 4.3 Installing the Gateway

For installing the gateway, following items are needed.

- Flat blade screwdriver
- Stainless hose band (x 2)
- Gateway with the bracket mounted



- To mount the gateway, use a pipe with a diameter of 50 to 125 mm.
- The hose bands provided with the gateway can be used for a pipe with a diameter of 78 to 101 mm. When using a pipe that is wider or narrower than standard one, prepare appropriate hose bands separately.
- When installing the gateway in an elevated location, watch your step.

Follow the procedure below to carry out the work.

- (1) Use the two stainless hose bands that came with the gateway, and pass each of them through the gateway bracket.
- (2) Loop the hose band, and put the mounting pipe through the loop. Tighten the screw of the hose band using a flat blade screwdriver. As the screw of the hose band is tightened, the hose band is secured.
- (3) Be sure to use two hose bands to secure two sections of the mounting pipe.



Stainless hose band  
(accessory)



Diameter: 50 to 125 mm

## 4.4 Grounding

Directly connect the ground terminal to class D grounding (third class grounding) with a grounding resistance of  $100\ \Omega$  or less. The grounding screw is provided in the rear of the unit. For the grounding cable, use an electrical wire that has a conductor cross-sectional area of AWG14 or greater and that is based on outdoor specifications. Attach a round crimping terminal to the end of the cable. Pass the round crimping terminal through the grounding screw in the rear of the unit, and tighten it using a tightening torque of  $1.69\ N\cdot m$ .

## 4.5 PoE Power Supply and Connection with the Gateway Configuration PC

PoE switch or PoE injector is powered to the gateway through the Ethernet cable.



### CAUTION

The compatibility-confirmed PoE switches are based on indoor specifications. When installing the PoE switch outdoors, make sure that it will be enclosed in a waterproof box.

- (1) Connect the Ethernet cable of the gateway to the PoE port. The gateway configuration PC can be connected to any port.
- (2) Turn the PoE switch on.
- (3) Make sure that the power indicator LED (indicated by "PR") lights up among the indicator LEDs under the transparent cover at the bottom of the gateway.

## 5. Gateway Setup

This chapter describes how to set up the gateway.



### IMPORTANT

The DHCP server configuration is enabled on the default setting of the gateway. Before starting initial settings, ensure that this gateway is connected to the configuration PC only.



### NOTE

For reflecting the changed configuration, ensure to click the [Save and Restart] in the menu.

### 5.1 User Account Registration

Before setting the gateway, user account registration is required. Web browser is used to access the gateway configuration screen. The followings are the procedure of the registration.

- (1) Check IP address configuration of the PC is “Obtain an IP address automatically” or “Use the following IP address” with the IP address range shown in the below.
  - IP address: 192.168.2.2 – 192.168.2.99
  - Subnet mask: 255.255.255.0



### NOTE

For more detail of IP address configuration on the PC, please refer to manuals of PC.

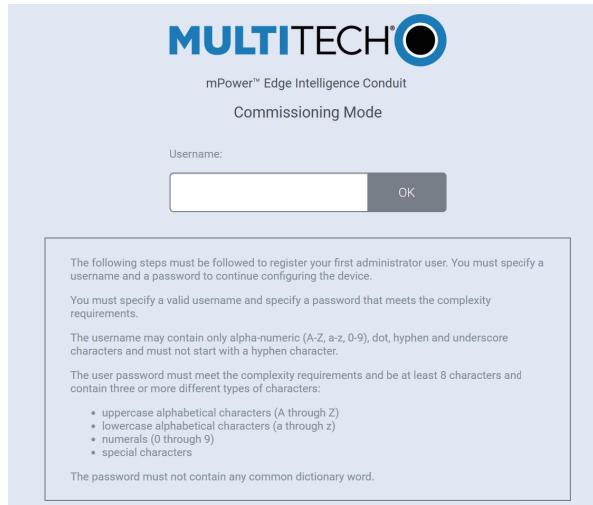
- (2) Connect the gateway and the PC through a PoE injector.
- (3) Access to <http://192.168.2.1/> by a web browser.



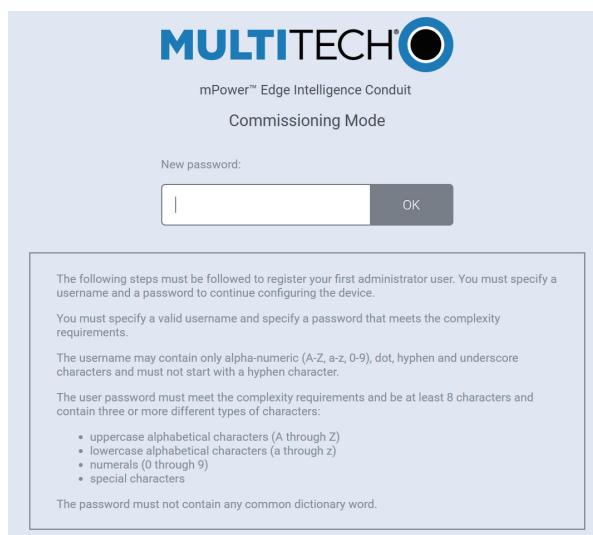
### NOTE

A security certification error window may be displayed when accessing the gateway. In the case, please continue web browsing by clicking “Continue to this website” or any same links.

- (4) The following screen is shown only for the first access. Enter the user name used to setting the gateway and click “OK”. Available characters as the user name are alphabets (case sensitive), numbers, dot (“.”) and hyphen (“-”).



- (5) Enter the password and click [OK]. The password must be at least 8 characters long and combine at least 3 of the following restrictions (Example: Admin123). After clicking [OK], the password re-enter screen will be shown. Enter the same password and click [OK].
- Uppercase alphabet (A-Z)
  - Lower case alphabet (a-z)
  - Number (0-9)
  - Symbol (@% + \ / ! # \$ ^?:, () {} [] ~ -\_)



- (6) User registration is completed when the login screen is shown.



If you forget the user name and the password, you need to reset the gateway to factory default and lose all configuration shown in the below.

## 5.2 Login

Gateway is configured through web interface. User name and password which are configured the previous section are used to login the gateway.

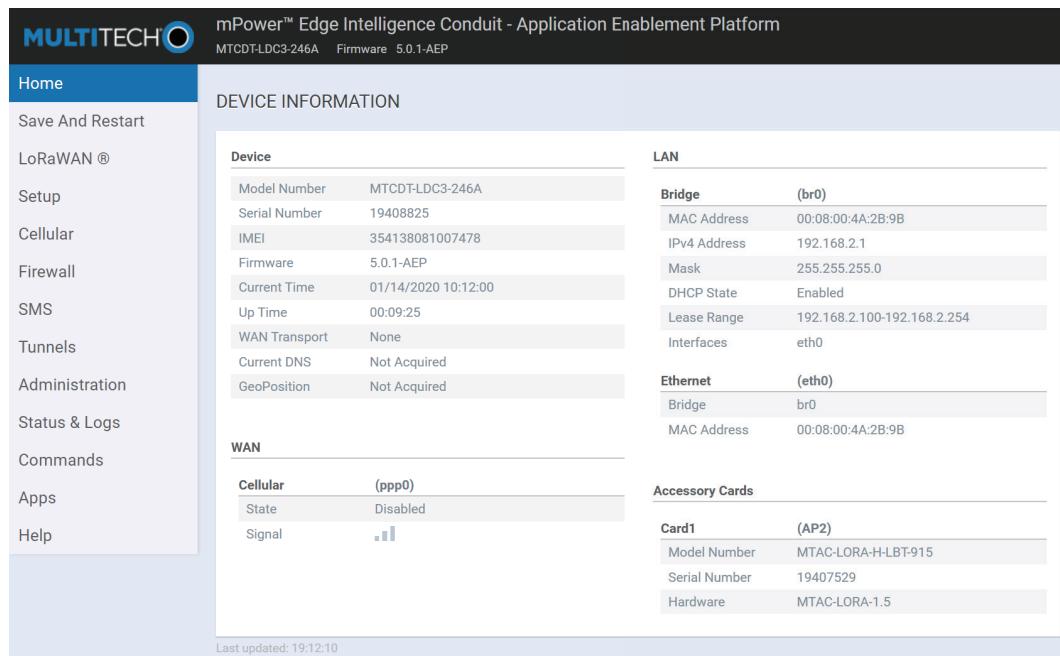
- (1) Access the gateway through a Web browser. Default IP address of the gateway is 192.168.2.1.
- (2) After showing login screen, enter the user name and the password and Click [Login].



- (3) The following screen (First Time Setup Wizard) is shown only for the first access. Since this wizard is not used in the configuration procedure shown in this document, please close by clicking "X" of the upper right corner.



(4) Confirm the home screen is shown.



The screenshot shows the 'DEVICE INFORMATION' section of the web interface. It includes tables for 'Device', 'LAN', 'WAN', and 'Accessory Cards' with the following data:

Device	
Model Number	MTCDT-LDC3-246A
Serial Number	19408825
IMEI	354138081007478
Firmware	5.0.1-AEP
Current Time	01/14/2020 10:12:00
Up Time	00:09:25
WAN Transport	None
Current DNS	Not Acquired
GeoPosition	Not Acquired

LAN	
<b>Bridge</b>	(br0)
MAC Address	00:08:00:4A:2B:9B
IPv4 Address	192.168.2.1
Mask	255.255.255.0
DHCP State	Enabled
Lease Range	192.168.2.100-192.168.2.254
Interfaces	eth0

WAN	
<b>Cellular</b>	(ppp0)
State	Disabled
Signal	■■■

Accessory Cards	
<b>Card1</b>	(AP2)
Model Number	MTAC-LORA-H-LBT-915
Serial Number	19407529
Hardware	MTAC-LORA-1.5

Last updated: 19:12:10



### NOTE

- A security certification error window may be displayed when accessing the gateway. In the case, please continue web browsing by clicking “Continue to this website” or any same links.
- Password can be changed by “Administration” – “User Accounts”.

## 5.3 Basic Setting of the Gateway

This section describes how to disable the DHCP server, set the gateway time, and configure LoRaWAN settings.



### NOTE

If there is not screen transition for a certain period while setting the gateway, the configuration screen is automatically logged out. This period is set to 5 minutes by default, but it can be changed to desired period. Please refer to “7.5 Changing automatic logout time” how to change the time.

### 5.3.1 Disabling the DHCP Server

The DHCP server function is enabled by default. In this section, disable the DHCP server. When using the DHCP server function of this gateway, proceed to the next section.

- (1) Access the gateway via the Web browser, and log in to the gateway.
- (2) Click [Setup] to display the sub menu. Click [DHCP].
- (3) Click [Pencil icon] in [Options].

Status	Interface	Gateway	Domain	Lease Range Start	Lease Range End	Options
Disabled	eth0	192.168.2.1		192.168.2.100	192.168.2.150	

- (4) Clear the [Enabled] check box, and click the [Submit] button.

DHCP	
<input type="checkbox"/> Enabled	
Interface	eth0
Gateway	192.168.2.1
Domain	
Lease Range Start	192.168.2.100
Subnet	192.168.2.0
Mask	255.255.255.0
Lease time (dd:hh:mm)	01:00:00
Lease Range End	192.168.2.150

## 5.3.2 Time Settings

Set the system time of the gateway.

- (1) Access the gateway via the Web browser, and log in to the gateway.
- (2) Click [Setup] to display the sub menu. Click [Time Configuration].
- (3) In [Date], pick up current date from the calendar shown in the screen. In [Time], type the time in 24-hour notation. As necessary, change [Time Zone] to the time zone of the region in which the gateway is to be used.

- (4) Click the [Submit] button.

## 5.3.3 LoRaWAN Settings

In this section, configure the LoRaWAN settings. Specify App key required to connect from Sushi Sensors, and configure wireless parameter settings to comply with the radio laws applicable in each country or region.



### IMPORTANT

For the settings that comply with the latest radio laws and restrictions in each country or region, and the settings for the latest firmware version of the gateway, please contact the nearest Yokogawa sales office.

- (1) Access the gateway via the Web browser, and log in to the gateway.
- (2) Logging in to the gateway opens the [Device Information] page. Check the information of [MAC Address] in [Ethernet (eth0)] shown in [LAN]. This MAC Address is used in the next section.

- (3) Click [LoRaWAN] to display the sub menu. Click [Network Settings].

- (4) Change [Mode] from [DISABLED] to [NETWORK SERVER]. Then, detailed items are displayed.
- (5) Set [Channel Plan] of [LoRaWAN Network Server Configuration] according to the region, and set [Network Mode] to [Public LoRaWAN]. Then, specify the items shown Appendix chapter to meet the regulations of the region in which the gateway is to be used. Items that can be set vary depending on the value selected in [Channel Plan] and [Country].

**LoRaWAN Network Server Configuration**

Channel Plan			
Channel Plan	AS923-1	Additional Channels 1 (MHz)	Max EIRP (dBm)
Channel Mask	<input type="text"/>	922.6	13
<input checked="" type="checkbox"/> Enable LBT	<input type="button" value="Edit"/>	Dwelltime Up	1 (400 ms)
Note: LBT requires FPGA v35 or v61		Dwelltime Down	1 (400 ms)
Country	JAPAN2	Country Summary	
		Frequency Range: 920.6-928.0 MHz Default Channels: 923.2, 923.4, 923.6 MHz Additional Channels Range: 921.1-922.6 or 924.1-927.5 MHz LBT: 128us, -80 dBm DutyCycle: 10% Max EIRP: +16 dBm <small>DwellTime: 400ms</small>	
<b>Network</b>			
Network Mode	Join Delay (sec)	Lease Time	Address Range Start
Public LoRaWAN	5	00:00-00	00:00:00:01
NetID	Rx1 Delay (sec)	Queue Size	Address Range End
000000	1	16	FF:FF:FF:FE
<b>Settings</b>			
Max Tx Power (dBm)	Rx 1 DR Offset	ADR Step (cB)	Min Datarate
13	0	30	2-SF10BW125
Antenna Gain (dBi)	Rx 2 Datarate	ACK Timeout	Max Datarate
3	2-SF10BW125	5000	5-SF7BW125
<input checked="" type="checkbox"/> Enable Duty-Cycle Limit	Duty-Cycle Period	Duty-Cycle Ratio	
	60	0.1	



## IMPORTANT

If you change the contents of [Country], there are items to return to the initial value. After setting, check that the settings are correct.

- (6) Specify the log-related items. Change [Log Level] of the Network Server Logging to [MAXIMUM].

- (7) Click the [Submit] button.

- (8) Click [Key Management] in the sub menu of the [LoRaWAN] menu, and set [Location] of [Join Server] to [Local Join Server].
- (9) Specify App EUI and App Key. Set the [Local Network Settings] items to the parameters shown below. These settings are required in the network settings of each Sushi Sensor. For details about the Sushi Sensor settings, refer to the relevant manual.

Item	Value
Enabled	Checked
Network ID (AppEUI)	EUI
EUI	Specify the EUI-64 address of the gateway. Hexadecimal notation. Delimit each byte using a colon (:).
Network Key (AppKey)	Key
Key	Sixteen arbitrary bytes. Hexadecimal notation. Delimit each byte using a colon (:).



## NOTE

App EUI is generated from the MAC address of the gateway. The MAC address is indicated as “NODE” on the [Device Information] page or the nameplate of the gateway. When the MAC address is set to “00:08:00:4A:3F:37”, the EUI-64 address is “00:08:00:FF:FE:4A:3F:37” (insert “FF:FE” in the middle of the MAC address).



Gateway nameplate sample

- (10) Click the [Submit] button.
- (11) Click [Save and Restart] to restart the gateway.

## 5.4 Data Collection Server Interface Settings

To transfer sensor data of a Sushi Sensor to the application, configure interface settings for connecting the gateway to the application. To transfer data to the application, use LTE or Ethernet.

### 5.4.1 LTE Settings

Configure LTE communication settings. If you do not use LTE communications, skip this procedure.



#### NOTE

- Configure the LTE settings with the SIM card inserted.
- (1) Access the gateway via the Web browser, and log in to the gateway.
  - (2) Click [Cellular] to display the sub menu. Click [Cellular Configuration].
  - (3) Configure APN information. Select the [Enabled] check box in [General Configuration], and specify [APN], [Authentication Type], [UserName], [Password], and other items according to the information you are notified of by the communication carrier.

- (4) Click the [Submit] button.
- (5) Click [Save and Restart] to restart the gateway.



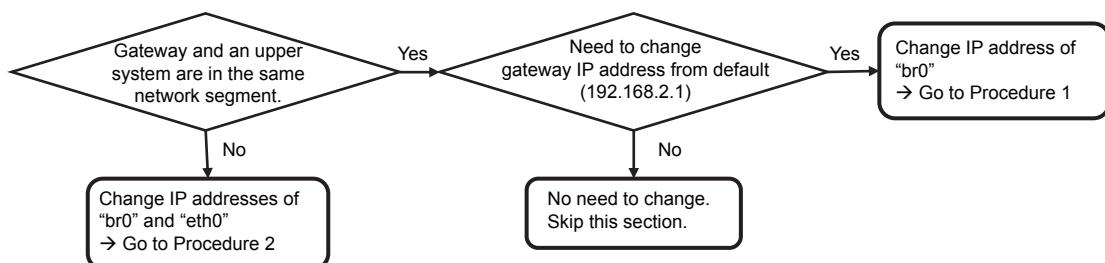
#### NOTE

Depending on the requirements of an application and/or a SIM card to be used, it is necessary to enable “Keep Alive” function of LTE communication. Before doing the procedure 4 and 5, the following procedure should be carried out.

- Enable “Enabled” check box at “ICMP/TCP Check”.
- Enable “Radio Reboot Enabled” check box at “ICMP/TCP Check”.
- Enter appropriate information provided by an application at “Interval (seconds)” and “Host Name”.

## 5.4.2 Ethernet Configuration

IP address of the Ethernet interface is 192.168.2.1 as a default. Necessity of the configuration shown in this section depends on the system design. Please follow the below chart and conduct required settings.



<Procedure 1: Changing “br0” interface>

- (1) Access the gateway through a web browser and log in to the gateway.
- (2) Click [Setup] to display sub menu and click “Network Interfaces”.
- (3) Change “br0” address. Click the [Pencil icon] in the “br0” line.

NETWORK INTERFACES CONFIGURATION ②							
Name	Direction	Type	IP Mode	IP Address	Bridge	Options	Reset To Default
eth0	LAN	ETHER	—	—	br0		
ppp0	WAN	PPP	PPP				
br0	LAN	BRIDGE	Static	192.168.2.1/24	br0		

- (4) Change IP address to desired address and click [Submit] button.

NETWORK INTERFACE CONFIGURATION - BR0 ②							
Direction	LAN	Mode	Static	IP Address	192.168.2.1	Mask	255.255.255.0
Submit	Cancel						

<Procedure 2: Change both “br0” and “eth0” IP address>

- (1) Access the gateway through a web browser and log in to the gateway.
- (2) Click [Setup] to display sub menu and click [Network Interfaces].
- (3) Change “br0” address. Click the [Pencil icon] in the “br0” line.

NETWORK INTERFACES CONFIGURATION ②							
Name	Direction	Type	IP Mode	IP Address	Bridge	Options	Reset To Default
eth0	LAN	ETHER	—	—	br0		
ppp0	WAN	PPP	PPP				
br0	LAN	BRIDGE	Static	192.168.2.1/24	br0		

- (4) Change IP address from 192.168.2.1 to an unused network address (Example: 169.254.0.1) and click [Submit].

NETWORK INTERFACE CONFIGURATION - BR0 ⓘ

Direction	LAN
Mode	Static
IP Address	169.254.0.1
Mask	255.255.255.0

**Submit** **Cancel**

- (5) Change “eth0” settings. Click [Pencil icon] in the “eth0” line.  
(6) Change IP address to a gateway address and related parameters as the following table and click [Submit] button.

Item	Value
Direction	LAN
Mode	Static
IP Address	IP address of the gateway
Mask	Subnet mask of the gateway
Bridge	-
Gateway	IP address of default route
Primary DNS Server	IP address of primary DNS server
Secondary DNS Server	IP address of secondary DNS server

NETWORK INTERFACE CONFIGURATION - ETH0 ⓘ

Direction	LAN
Mode	Static
IP Address	
Mask	
Bridge	-
Gateway	
Primary DNS Server	
Secondary DNS Server	

**Submit** **Cancel**

- (7) Restart the gateway by clicking [Save and Restart].

### NOTE

After changing the gateway IP address, the connection will lose from a configuration PC. Before reconnecting the gateway, IP address of the PC might have to be changed. The configuration of the DNS server addresses must be assigned if the data destination is specified by a host name.

## 5.5 Message Transfer Settings

This section describes the setting required to transfer Sushi Sensor data received by the gateway to the application.

The setting procedure differs depending on the firmware version of the gateway.

Firmware version of the gateway	Reference
Earlier than 5.3.0	Section 5.5.1 Use Node-RED
5.3.0 or later	Section 5.5.2 Use Custom App



### NOTE

- In order to configure the message transfer settings, configuration information (URL, user name, and password) of the application that is the connection destination is required. Before starting the gateway setting procedure, check the application setting.

### 5.5.1 Use Node-RED

To configure this setting, use the “Node-RED” software that runs on the Web browser. Node-RED, combined with functions called “nodes”, offers a visual programming environment. In this section, “nodes” are referred to as “blocks”.

- Access the gateway via the Web browser, and log in to the gateway.
- Click [Apps].
- Check the [Enabled] check box, and click the [Launch Node-RED] button. Then, the screen changes to another page.

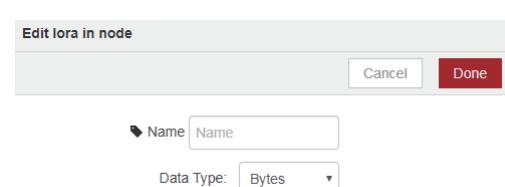


### NOTE

- Clicking the [Launch Node-RED] button may display a security certification error window. In such a case, continue to a site browsing.

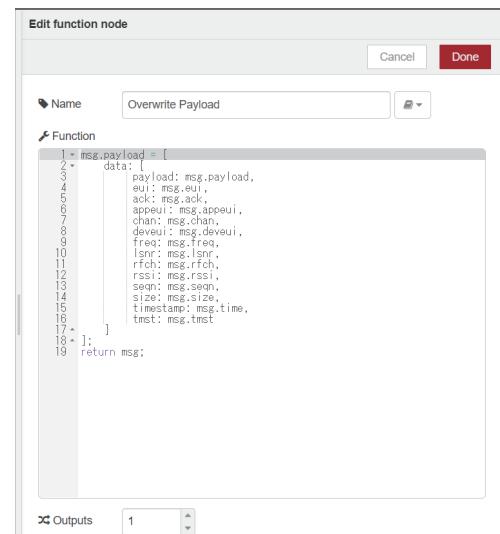
- The Node-RED login page opens. The login user name and password are the same as those required to log in to the gateway.
- Drag and drop the “lora” block from the left pane to the sheet in the center. Double-click the “lora” block you have placed.
- Configure the following settings in the [Edit lora in node] window. After configuring the settings, click the [Done] button.

Item	Value
Name	Arbitrary character string (Example: lora)
Data Type	Bytes

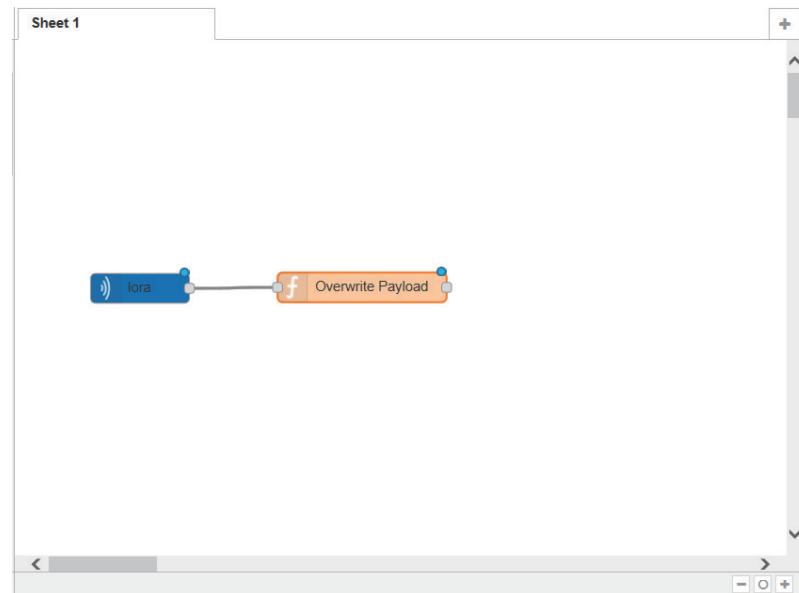


- (7) Drag and drop the “function” block from the left pane to the sheet in the center. Double-click the “function” block you have placed.
- (8) Configure the following settings in the [Edit function node] window. After configuring the settings, click the [Done] button.

Item	Value
Name	Overwrite Payload
Function	<pre>msg.payload = {     data: {          payload: msg.payload,         eui: msg.eui,         ack: msg.ack,         appeui: msg.appeui,         chan: msg.chan,         deveui: msg.deveui,         freq: msg.freq,         lsnr: msg.lsnr,         rfch: msg.rfch,         rssi: msg.rssi,         seqn: msg.seqn,         size: msg.size,         timestamp: msg.time,         tmst: msg.tmst     } };  return msg;</pre>

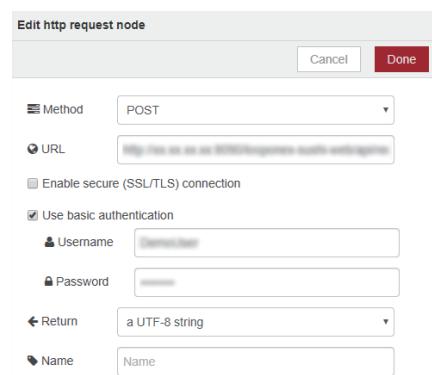


- (9) Drag the connection point of the “lora” block to connect it to the “function” block with a line.



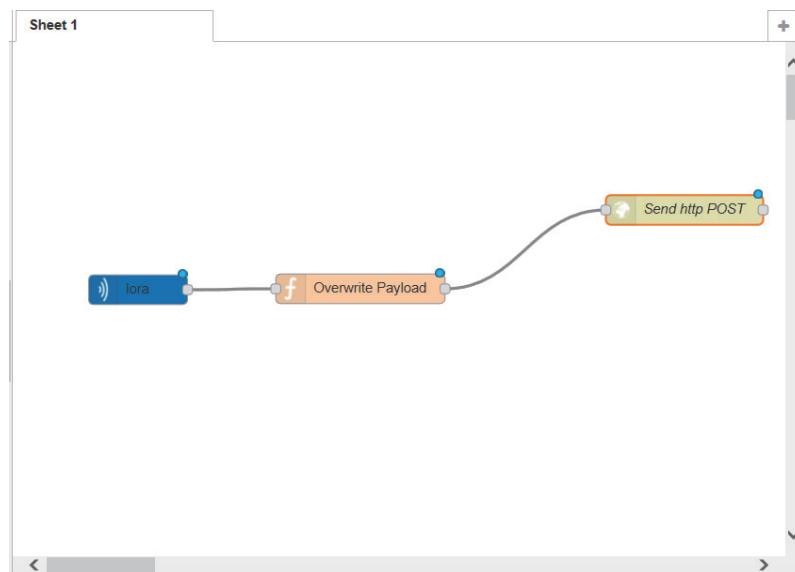
- (10) Drag and drop the “http request” block from the left pane to the sheet in the center. Double-click the “http request” block you have placed.
- (11) Configure the following settings in the [Edit http request node] window. After configuring the settings, click the [Done] button.

Item	Value
Method	POST
URL	*1
Use basic authentication?	Checked
Username	*1
Password	*1
Name	Arbitrary character string (Example: Send http POST)



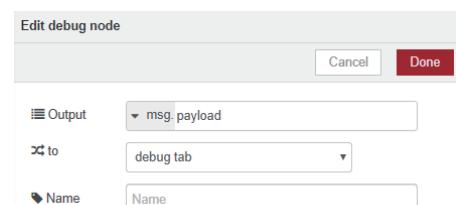
\*1: URL, Username, and Password are information required to transfer data to the application. These values must match the values specified for application engineering.

- (12) Drag the connection point of the “function” block to connect it to the “http request” block with a line.

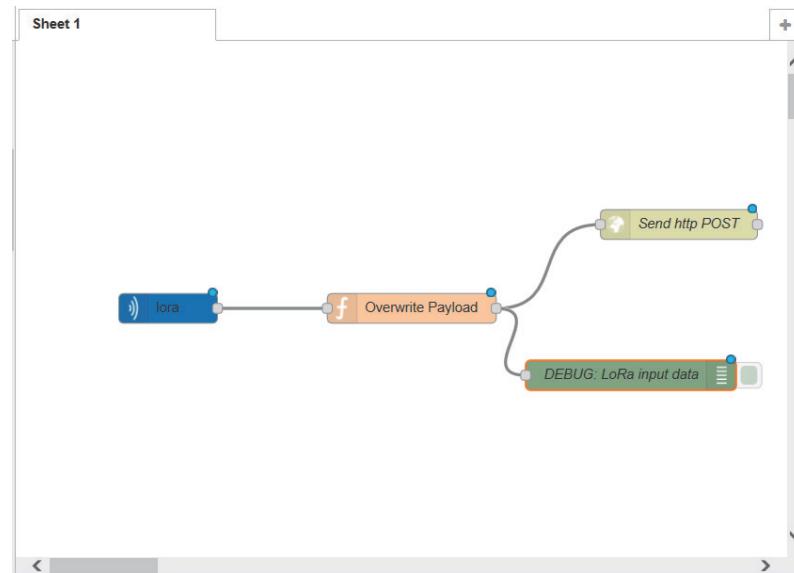


- (13) Drag and drop the “debug” block from the left pane to the sheet in the center. Double-click the “debug” block you have placed.  
 (14) Configure the following settings in the [Edit debug node] window. After configuring the settings, click the [Done] button.

Item	Value
Output	msg.payload
To	debug tab
Name	Arbitrary character string (Example: DEBUG: LoRa input data)



- (15) Drag the connection point of the “function” block to connect it to the “debug” block with a line.



- (16) Click the [Deploy] button. When “Successfully deploy” is displayed, the setting is completed.

## 5.5.2 Use Custom App

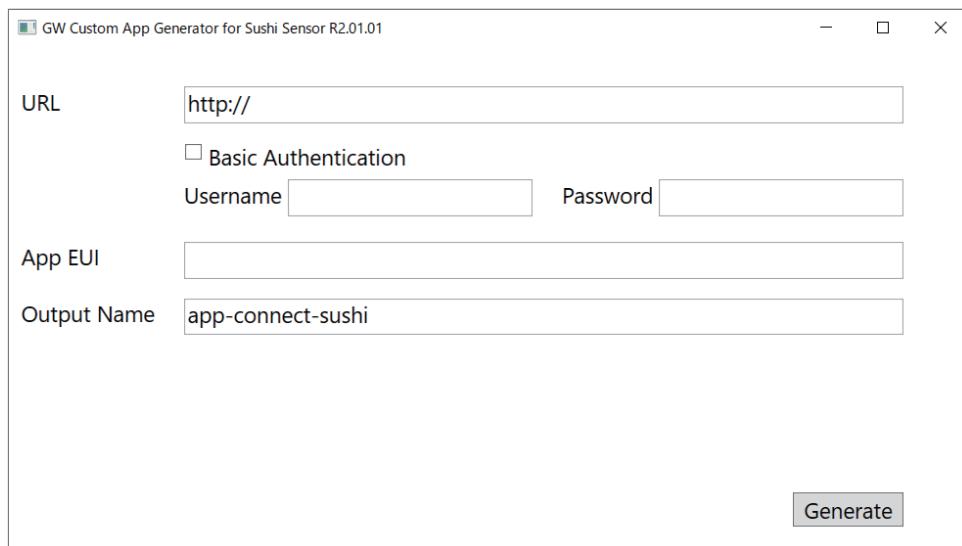
Create a Custom App containing configuration information by using the “GW Custom App Generator for Sushi Sensor” tool provided by YOKOGAWA, that supports the gateway message transfer settings on your PC and register the Custom Apps to the gateway. In order to obtain the tool, please contact the nearest Yokogawa sales office.

1. Extract the “GW Custom App Generator for Sushi Sensor” (zip file) to any location on your PC. Select the suitable version of “GW Custom App Generator for Sushi Sensor” depending on the firmware version of the gateway.

Firmware version of the gateway	GW Custom App Generator for Sushi Sensor version
5.3.0 to 5.3.8s-s1	R1.01.01
6.0.0 or later	R2.01.01

2. Run GWCUSTOMAPPGENERATORFORSUSHISENSOR.exe.

3. Enter the configuration information of the host system.



URL : Destination (host system) URL.

Basic Authentication : If user name and password are required, enable “Basic Authentication” check box and fill in the Username and Password.

App EUI : App EUI configured on the gateway.

Output Name : Prefix name of Custom App to be generated.



### NOTE

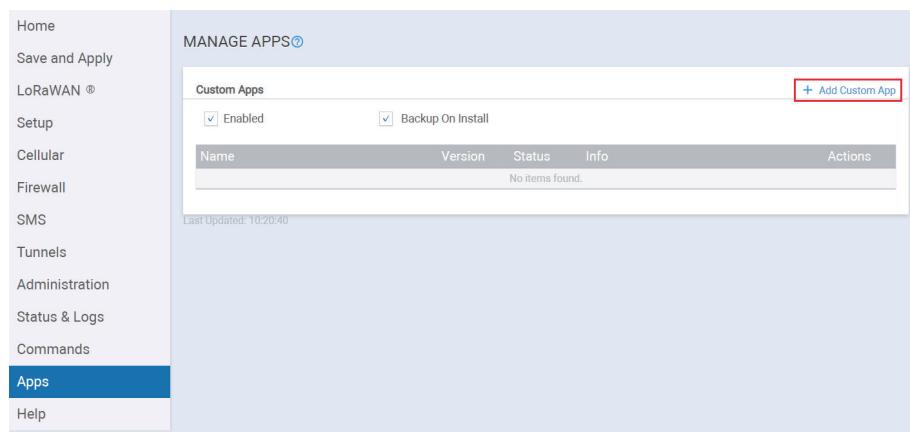
Refer to 5.3.3. LoRaWAN Setting how to set the App EUI.

4. Click the [Generate] button. The following Custom App will be generated in the folder of this tool. (File name format: [Output Name].tar.gz)



app-connect-sushi.gz

5. Access the gateway via the Web browser and log in to the gateway.
6. Click [Apps].
7. Click [Add Custom App].



8. Fill in App ID and App Name.

App ID: Identification number.

App Name: Identification name.

The screenshot shows a form for installing a custom app. It has fields for 'App ID' (containing '1') and 'App Name' (containing 'SushiSensor'). Below these is a 'Choose File' button with the text 'No file selected'. At the bottom are two buttons: a blue 'Install Custom App' button with a checkmark icon, and a grey 'Cancel' button with a cross icon.



### NOTE

Please set App ID to 1.

App Name is used in Custom App list in step 11.

9. Click [Choose File].

10. Choose the generated Custom App (\*.tar.gz).

The screenshot shows the same interface as before, but the 'Choose File' button now displays the path 'app-connect-sushi.gz'.

11. Click [Install Custom App]. Custom App will be registered and run automatically.

The screenshot shows the 'MANAGE APPS' screen. On the left is a sidebar with various tabs: Home, Save and Apply, LoRaWAN®, Setup, Cellular, Firewall, SMS, Tunnels, Administration, Status & Logs, Commands, Apps (which is highlighted in blue), and Help. The main area is titled 'MANAGE APPS' and shows a table for 'Custom Apps'. The table has columns: Name, Version, Status, Info, and Actions. One row is listed: 'SushiSensor' (Version 2.01.01, Status Started, Info: 'Custom App for Sushi Sensor'). The 'Actions' column for this row contains two icons: a pencil for edit and a trash can for delete. A note at the bottom says 'Last Updated: 10:26:31'.



### NOTE

The Custom App is registered in this procedure. No re-installation is required when the gateway is restarted.

To modify the AppEUI, Server Address (URL), User name, and Password, delete the previous Custom App by clicking trash icon in Actions and create new Custom App and install it again.

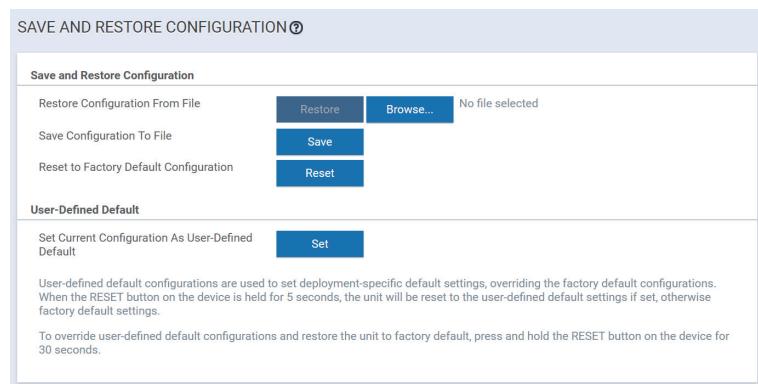
## 5.6 Backup and Restore

Gateway configuration can be backed up to the file and it can be restored by the backup file.

### 5.6.1 Backup

Configuration data can be backed up by the following procedure.

- (1) Access the gateway through a web browser and log in to the gateway.
- (2) Click [Administration] to display a sub menu and click [Save / Restore].
- (3) Click [Save] button at the right of “Save Configuration To File”.



- (4) Wait for a while until a download complete message is shown.
- (5) Save it to desired folder.

## 5.6.2 Restore

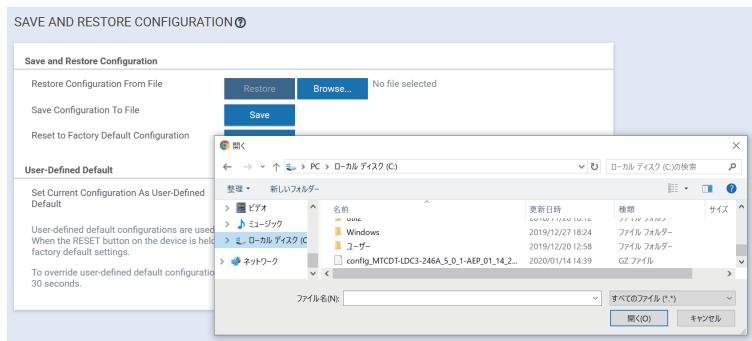
The configuration can be restored by using backup file which is stored in the previous section. All current configuration in the gateway will be overwritten by the backup file data.



### IMPORTANT

Gateway firmware version at the backup and the restore must be identical. If the version is unmatched, unexpected system troubles may occur.

- (1) Access the gateway through a web browser and log in to the gateway.
- (2) Click [Administration] to display sub menu and click [Save / Restore].
- (3) Click [Browse...] button at the right of “Restore Configuration From File”.



- (4) Specify a backup file.
- (5) Click [Restore] button at the right of “Restore Configuration From File”.
- (6) A message about overwrite configuration warning is shown and click [OK].
- (7) The gateway restarts automatically after restoring the configuration.

# 6. Operation and Maintenance

This chapter describes how to carry out daily check of the Sushi Sensor system, carry out maintenance when a warning or error occurs, and add and replace wireless system components.

## 6.1 Daily Check

To ensure that the wireless communication system continues to operate correctly, it is important to monitor the communication stability even after the setup work has been completed and the system has started to operate normally. Wireless communication may become unstable if radio waves are affected by obstacles in the communication path. Extra attention must be paid when a new building is constructed, additional equipment is installed, a temporary structure is built for installation or maintenance purposes, or a crane or other heavy vehicle enters the site.

### 6.1.1 Checking Wireless Communication Status

The application enables you to check the received signal strength indication (RSSI) and the packet error rate (PER) of Sushi Sensors. Based on these values, you can check the wireless communication status.

You can also use the Sushi Sensor configuration tool, "Sushi Sensor App", to check the RSSI value. For details, refer to the Sushi Sensor user's manual.

### 6.1.2 Gateway Inspection

During gateway inspections, check the installation of the gateway as well as its operation as a Sushi Sensor system component.

Check the installation, communication cable connection, and cleanliness of devices.

If any device is dirty or dusty, wipe off dirt or dust using a soft cloth moistened with water or mild soap.

### 6.1.3 Handling a Device in a Warning State

If any device has been judged to be in a warning state, a communication error may occur if the status deteriorates if the application is currently able to acquire sensor values and status information.

If a warning message appears due to a low battery level of a Sushi Sensor, replace the battery as soon as possible regardless of the displayed number of days. For details about the replacement procedure, refer to the Sushi Sensor user's manual.

If a warning message appears due to a problem related to Sushi Sensor communication quality, check whether any phenomena causing a radio propagation failure has occurred in the communication path. In addition, check whether any additional structures or vehicles are on the path or around the device, and whether any new wireless communication system using the same frequency band has begun to be used in the vicinity. For a certain period of time, monitor the device for which a warning message is displayed due to a problem related to communication quality. If there are no signs that the device may return to the normal state by itself, adjust the device arrangement. Adjusting the installation location may cause the device to return to the normal state. In addition, when another wireless system is used, improvements can be made by changing the radio frequency.

## 6.2 Gateway Addition and Replacement

### 6.2.1 Adding a Gateway (Providing Redundancy)

To add a gateway, follow the procedure described in this document to set up and install a new gateway. The new gateway App EUI and App Key values must be different from those of the gateway that has already been used.

The gateway configuration can be made redundant by additionally registering a new gateway in Sushi Sensors via an Android device. To register a gateway, access the network setting of each Sushi Sensor. For details, refer to the Sushi Sensor user's manual.

### 6.2.2 Replacing a Gateway

To replace a gateway, configure a new gateway using the same information as that which was configured for the old gateway. The new gateway App EUI and App Key settings must be the same as those of the previous gateway. Setting the same information allows you to replace a gateway without changing the Sushi Sensor settings.

## 7. Tips and Troubleshooting

### 7.1 Checking Sushi Sensor Connection Status

This section describes how to check the Sushi Sensor connection status via the gateway.

- (1) Access the gateway via the Web browser, and log in to the gateway.
- (2) Click [Status & Logs] to display the sub menu. Click [Statistics].
- (3) Click the [LoRa] tab to display the list of Sushi Sensors connected to the gateway.
- (4) Check whether the target Sushi Sensor is displayed in the list and whether data is received from the Sushi Sensor.

Item	Description
EUI	EUI-64 address of the Sushi Sensor connected to the gateway.
Join Time	Time at which the Sushi Sensor has connected to the gateway.
PktsUp, PktDown	Message sending/receiving counter for the Sushi Sensor.

If the target Sushi Sensor is not found in the list or the message sending/receiving counter is not incremented, it is assumed that the Sushi Sensor battery power has been empty, the network setting is not correct, the distance between the Sushi Sensor and the gateway is too long, or there is a problem with the communication environment.

## 7.2 Changing the Radio Frequency

This section describes how to change the frequency the Sushi Sensor system uses.

If many wireless devices using the same frequency band are provided in the gateway communication area, it may be difficult to connect the Sushi Sensor to the gateway. Such a problem may be improved by changing the frequency of the Sushi Sensor system.



### NOTE

In Australia, see 7.2.1 when using the AS923-1 channel plan and see 7.2.3 when using the AU915 channel plan.

#### 7.2.1 For Japan, EU, South Korea, ASEAN countries, Australia, New Zealand, UAE, Saudi Arabia, Serbia, India, Philippines, Vietnam and South Africa.

- (1) Access the gateway via the Web browser, and log in to the gateway.
- (2) Click [LoRaWAN] to display the sub menu. Click [Network Settings].

- (3) Change the value of [Additional Channels 1]. Select the appropriate setting value from the table shown below. Specify a value that is different from the frequency of the nearby wireless system if possible.

Region	Additional Channels (MHz)
EU	From 865.5 to 867.3 (0.2 MHz step), 867.5 (default), 869.5
UAE	From 865.5 to 867.3 (0.2 MHz step), 867.5 (default)
Japan	922.6 (default), 924.2, 925.2, 926.2, 927.2
Malaysia	From 919.6 to 922.4 (0.2 MHz step), 922.6 (default)
New Zealand, Australia	From 915.6 to 922.4 (0.2 MHz step), 922.6 (default), From 924.2 to 927.4 (0.2 MHz step)
Singapore	From 920.6 to 922.4 (0.2 MHz step), 922.6 (default), 924.2, 924.4
South Korea	921.3, 921.5, 922.9 (default)
Thailand	From 920.6 to 922.4 (0.2 MHz step), 922.6 (default), 924.2, 924.4
Indonesia	920.6, 920.8 (Recommendation), 922.4
Saudi Arabia	867.5 (default)
Philippines, South Africa	Empty
Serbia	869.4
India	866.385 (default)
Vietnam	920.6, 920.8 (Recommendation), 922.4

- (4) Click the [Submit] button.
- (5) Click [Save and Restart] to restart the gateway.

## 7.2.2 For United States and Canada

- (1) Access the gateway via the Web browser and log in to the gateway.
- (2) Click [LoRaWAN] to display the sub menu. Click [Network Settings].
- (3) Change the value of [Frequency Sub-Band 1]. Select a desired frequency range to be used in this system by specifying sub-band number.

LoRaWAN Network Server Configuration

---

Channel Plan

Channel Plan	Frequency Sub-Band 1
<input type="text" value="US915"/>	<input type="text" value="1"/>
Channel Mask	<input type="button" value="Edit"/>

Frequency Sub-Band 1	Frequency range (MHz)
1	902.3 - 903.7
2	903.9 - 905.3
3	905.5 - 906.9
4	907.1 - 908.5
5	908.7 - 910.1
6	910.3 - 911.7
7	911.9 - 913.3
8	913.5 - 914.9

- (4) Click the [Submit] Button.
- (5) Click the [Save and Restart] to restart the gateway.



### NOTE

The Sub-Band number must match sensor setting to be joined to the gateway. For the sensor configuration, please refer to sensor instruction manuals.

### 7.2.3 For Australia, Chile, Brazil, Argentina and Peru

- (1) Access the gateway via the Web browser and log in to the gateway.
- (2) Click [LoRaWAN] to display the sub menu. Click [Network Settings].
- (3) Change the value of [Frequency Sub-Band 1]. Select a desired frequency range to be used in this system by specifying sub-band number.

LoRaWAN Network Server Configuration

Channel Plan	
Channel Plan	AU915
Channel Mask	<input type="text"/> <input type="button" value="Edit"/>
Frequency Sub-Band 1	1
Max EIRP (dBm)	13
Dwelltime Up	1 (400 ms)
Dwelltime Down	1 (400 ms)

Frequency Sub-Band 1	Frequency Range (MHz)
1	915.2 – 916.6
2	916.8 – 918.2
3	918.4 – 919.8
4	920.0 – 921.4
5	921.6 – 923.0
6	923.2 – 924.6
7	924.8 – 926.2
8	926.4 – 927.8

- (4) Click the [Submit] Button.
- (5) Click the [Save and Restart] to restart the gateway.



#### NOTE

The Sub-Band number must match sensor setting to be joined to the gateway. For the sensor configuration, please refer to sensor instruction manuals.

## 7.3 Initializing the Gateway

When it is necessary to reset the gateway settings to their factory defaults because, for example, the gateway cannot be accessed from the gateway configuration PC, gateway initialization is required.

- (1) Remove the SIM/USB cover at the bottom of the gateway.
- (2) Hold down the RESET button under the USB port for 30 seconds or more using a sharp object such as a needle.



- (3) Mount the SIM/USB cover. The tightening torque for the SIM/USB cover is 1.18 N·m.
- (4) When approximately 10 minutes have elapsed, the gateway starts in the factory default state.

## 7.4 Collecting Gateway Logs

This section describes how to acquire gateway logs. Logs can be collected from the gateway if necessary. However, the amount of log data that can be stored in the gateway is small, so it may not be possible to store logs that have been collected for a long period. In order to store logs that have been accumulated over a long period, use a function that stores logs outside the gateway. The following example describes how to store logs using free software named “Visual Syslog Server”.

- (1) Download Visual Syslog Server from the following URL, and install it on the PC you want to store gateway logs on. <https://sourceforge.net/projects/syslogserverwindows/>
- (2) Launch Visual Syslog Server, and click the [Setup] button.
- (3) Configure the log storage settings on the [Setup] page.

Definition enclosed in {}	Meaning	Value
d	Day	1 to 31
dd	Day (Two digit)	01 to 31
ddd	Day of the week	Sun to Sat
dddd	Day of the week (Full)	Sunday to Saturday
m	Month	1 to 12
mm	Month (2-digit)	01 to 12
mmm	Month	Jan to Dec
mmmm	Month (Full)	January to December
yy	Year (2-digit)	00 to 99
yyyy	Year (4-digit)	0000 to 9999
h	Hour	0 to 23
hh	Hour (2-digit)	00 to 23
n	Minute	0 to 59
nn	Minute (2-digit)	00 to 59
s	Second	0 to 59
ss	Second (2-digit)	00 to 59

- (4) Click [OK].

Then, configure the log sending settings on the gateway.

- (5) Access the gateway from the Web browser, and log in to the gateway.
- (6) Click [Administration] to display the sub menu. Click [Debug Options].
- (7) In [Remote Syslog], configure settings to send logs to the outside of the gateway.

Item	Value
Enabled	Checked
IP Address	IP address of the logging PC



- (8) Click the [Submit] button.
- (9) Click the [Save and Restart] button to restart the gateway.

After the gateway is restarted, gateway logs are sent. Check in Visual Syslog Sever that gateway logs have been received.

## 7.5 Changing automatic logout time

A timeout period is set on the gateway configuration screen. If configuration screen transition does not occur for a certain period, the screen is forced to log out. The default time out is 5 minutes, but the time may be short when the gateway initial setup. The following procedure allows to change the time out period.

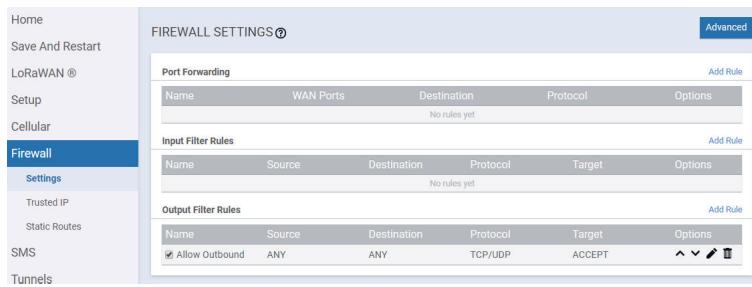
- (1) Access the gateway through a web browser and log in to the gateway.
- (2) Click [Administration] to display sub menu and click [Access Configuration].
- (3) Set desired timeout period at "Session Timeout (minutes)".

- (4) Click [Submit].
- (5) Click [Save and Restart] to restart the gateway.

## 7.6 Gateway access from LTE network

Build-in firewall in the gateway is enabled to prevent access from LTE network to the gateway as a factory default. To manage the gateway from the Internet, the firewall configuration must be changed by the following procedures.

- (1) Access the gateway through a web browser and log in to the gateway.
- (2) Click [Firewall] to display sub menu and click [Settings].
- (3) Click [Add Rule] in the line of "Input Filter Rules".



The screenshot shows the 'FIREWALL SETTINGS' page with the 'Input Filter Rules' tab selected. On the left, there's a sidebar with various navigation options like Home, Save And Restart, LoRaWAN®, Setup, Cellular, Firewall (which is selected and highlighted in blue), Settings, Trusted IP, Static Routes, SMS, and Tunnels. The main area has three tables:

- Port Forwarding:** No rules yet.
- Input Filter Rules:** A table with columns Name, Source, Destination, Protocol, Target, and Options. It contains one row: 'Allow Outbound' with ANY in all fields, set to ACCEPT.
- Output Filter Rules:** No rules yet.

- (4) After setting required configurations, click [Submit].



### NOTE

Configurations should be set here are specified by an application administrator and/or LTE network carrier.

## 8. Software License

### 8.1 GW Custom App Generator for Sushi Sensor License Agreement

GW Custom App Generator for Sushi Sensor Software License Agreement

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# Appendix: LoRaWAN Settings in each country or region.

In this appendix, configure the LoRaWAN settings to comply with the radio laws applicable in each country or region.



## IMPORTANT

For the settings that comply with the latest radio laws and restrictions in each country or region, and the settings for the latest firmware version of the gateway, please contact the nearest Yokogawa sales office.

Item	Region							
	Japan	EU UAE	Malaysia	Thailand	Singapore	New Zealand Australia*4	USA Canada	South Korea
Channel Plan	AS923-1	EU868	AS923-1	AS923-1	AS923-1	AS923-1	US915	KR920
Country*5	JAPAN2	N/A	MALAYSIA	THAILAND	MANUAL	MANUAL	N/A	N/A
Max EIRP	13	N/A	13	13	13	13	N/A	N/A
Duty Cycle Period(min)	N/A	60	N/A	N/A	N/A	N/A	N/A	N/A
Enable Duty-Cycle Limit*5	Checked	Unchecked	Unchecked	Checked	Checked	Unchecked	Unchecked	Unchecked
Duty-Cycle Period*5	60	60	60	60	60	60	60	60
Duty-Cycle Ratio*5	0.1	(empty)	0.01	0.01 or 0.*7	0.1	(empty)	(empty)	(empty)
Enable LBT	Checked	N/A	Checked	Checked*6	Checked	Checked*6	N/A	Checked
Dwelltime Up	1(400ms)	N/A	0 (no limit)	0 (no limit)	0 (no limit)	0 (no limit)	N/A	N/A
Dwelltime Down	1(400ms)	N/A	0 (no limit)	0 (no limit)	0 (no limit)	0 (no limit)	N/A	N/A
Network Mode	Public LoraWAN	Public LoraWAN	Public LoraWAN	Public LoraWAN	Public LoraWAN	Public LoraWAN	Public LoraWAN	Public LoraWAN
Join Delay (sec)	5	5	5	5	5	5	5	5
Rx Delay (sec)	1	1	1	1	1	1	1	1
Max Tx Power	13	13	13	13	13	13	13	13
Antenna Gain	3	3	3	3	3	3	3	3
Rx1 DR Offset	0	0	0	0	0	0	0	0
Rx2 Datarate	2-SF10BW125	2-SF10BW125 <sup>1</sup>	2-SF10BW125	2-SF10BW125	2-SF10BW125	2-SF10BW125	10-SF10BW500	2-SF10BW125 <sup>1</sup>
Min Datarate	2-SF10BW125	2-SF10BW125 <sup>1</sup>	2-SF10BW125 <sup>2</sup>	2-SF10BW125 <sup>2</sup>	2-SF10BW125 <sup>2</sup>	2-SF10BW125 <sup>2</sup>	0-SF10BW125	2-SF10BW125 <sup>2</sup>
Max Datarate	5-SF7BW125	6-SF7BW250	5-SF7BW125	5-SF7BW125	5-SF7BW125	5-SF7BW125	3-SF7BW125	5-SF7BW125

Item	Region						
	Australia*4 Peru	Chile	Brazil	Argentina	Indonesia Vietnam	Saudi Arabia Serbia Philippines South Africa	India
Channel Plan	AU915	AU915	AU915	AU915	AS923-2	EU868	IN865
Country*5	MANUAL	CHILE	MANUAL	MANUAL	MANUAL	N/A	N/A
Max EIRP	13	13	13	13	13	N/A	N/A
Duty Cycle Period(min)	N/A	N/A	N/A	N/A	N/A	60	N/A
Enable Duty-Cycle Limit*5	Unchecked	Unchecked	Unchecked	Unchecked	Checked	Unchecked	Unchecked
Duty-Cycle Period*5	60	60	60	60	60	60	60
Duty-Cycle Ratio*5	(empty)	(empty)	(empty)	(empty)	0.1	(empty)	(empty)
Enable LBT	N/A	N/A	N/A	N/A	Checked*6	N/A	N/A
Dwelltime Up	0 (no limit)	0 (no limit)	1(400ms)	1(400ms)	1(400ms)	N/A	N/A
Dwelltime Down	0 (no limit)	0 (no limit)	1(400ms)	1(400ms)	1(400ms)	N/A	N/A
Network Mode	Public LoraWAN	Public LoraWAN	Public LoraWAN	Public LoraWAN	Public LoraWAN	Public LoraWAN	Public LoraWAN
Join Delay (sec)	5	5	5	5	5	5	5
Rx Delay (sec)	1	1	1	1	1	1	1
Max Tx Power	13	13	13	13	13	13	13
Antenna Gain	3	3	3	3	3	3	3
Rx1 DR Offset	0	0	0	0	0	0	0
Rx2 Datarate	8-SF12BW500	8-SF12BW500	8-SF12BW500	8-SF12BW500	2-SF10BW125	2-SF10BW125 <sup>1</sup>	2-SF10BW125 <sup>1</sup>
Min Datarate	2-SF10BW125 <sup>2</sup>	2-SF10BW125 <sup>2</sup>	2-SF10BW125	2-SF10BW125	2-SF10BW125 <sup>3</sup>	2-SF10BW125 <sup>1</sup>	2-SF10BW125 <sup>1</sup>
Max Datarate	5-SF7BW125	5-SF7BW125	5-SF7BW125	3-SF9BW125	5-SF7BW125	5-SF7BW125	5-SF7BW125

\*1: When connected Sushi Sensors are configured as "High Speed Mode = OFF", "0 - SF12BW125" has to be selected instead.

\*2: When using DR0/1 as a data rate of LoRaWAN communication, "0 - SF12BW125" has to be selected instead. In the case, data sending period must be configured as 1 hour or longer.

\*3: When using DR0/1 as a data rate of LoRaWAN communication, "0 - SF12BW125" has to be selected instead. In the case, data sending period must be configured as 1 hour or longer. (And set Dwelltime Up and Dwelltime Down to 0(no-limit))

\*4: AS923-1 and AU915 channel plans are available in Australia. Set according to the specifications of the Sushi Sensor to be used.

\*5: These items are not displayed in gateway firmware version R5.3.0 or earlier.

\*6: "Unchecked" is also available.

\*7: This item depends on the gateway model to be used. 0.01 for MTCDTIP-LEU1-266A-915 , 0.1 for MTCDTIP-L4E1-266A-915.

# Revision Information

Title : LoRaWAN Gateway Setup Guide  
 Manual number : TI 01W06A51-50EN

Edition	Date	Revised Item
1st	March 2019	New issue
2nd	June 2019	Updated a description about gateway version. Corrected a description about SIM card installation. Added descriptions about SIM card. Added descriptions about Thailand.
3rd	November 2019	Updated a description about gateway version. Added descriptions about Singapore, Malaysia, USA and Canada.
4th	April 2020	Added description about LoRaWAN settings for South Korea. Update descriptions about gateway initial setup, IP address configuration, etc.
5th	September 2020	Added descriptions about LoRaWAN settings for Australia and New Zealand.
6th	December 2020	Added description about LoRaWAN settings for Chile, Brazil and Argentina
7th	June 2021	Added descriptions about "Gateway firmware version R5.3.0" and "GW Custom App Generator for Sushi Sensor" and LoRaWAN settings for Indonesia, UAE and Saudi Arabia.
8th	September 2021	Added description about LoRaWAN settings for India, Serbia and AS923-1 in Australia.
9th	July 2022	Added description about LoRaWAN settings for Philippines and Vietnam. Added "Appendix: LoRaWAN Settings in each country and region". Added a description of the gateway firmware version to the introduction chapter. Added descriptions about "Additional channels" in Chapter 7.2.1.
10th	August 2022	Added description about GW Custom App Generator for Sushi Sensor version. Added description about LoRaWAN settings and the radio frequency for South Africa.
11th	June 2023	Added description about LoRaWAN settings for Peru and Thailand.