User's Manual

Sushi Sensor

XS770A Wireless Vibration Sensor Functions

IM 01W06E01-11EN

This manual has been integrated into the User's Manual "Sushi Sensor Series Software Edition" and will no longer be revised in the future.
Therefore, please read to the latest edition of the User's Manual "IM 01W06C01-01EN".

YOKOGAWA
Yokogawa Electric Corporation

IM 01W06E01-11EN
9th Edition

XS770A
Wireless Vibration Sensor
Functions

IM 01W06E01-11EN 9th Edition

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Revision Information

Introduction

This manual has been integrated into the User's Manual "Sushi Sensor Series Software Edition". For the functions, configurations, operations, and maintenance of XS770A, please read the latest edition of User's Manual "IM 01W06C01-01EN".

Table 1.1 shows the documents related to this manual.

Table 1.1 Related Document List

Title	Document No.
General Specification XS770A Wireless Vibration Sensor	GS 01W06E01-01EN
User's manual XS770A Wireless Vibration Sensor Startup Guide	IM 01W06E01-01EN
User's manual Sushi Sensor Series Software Edition	IM 01W06C01-01EN
Technical Information Sushi Sensor System Engineering Guide	TI 01W06A51-01EN
Technical Information Sushi Sensor System Key card Creation Guide	TI 01W06A51-41EN

Regarding This Manual

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- **Please note that changes in the specifications, construction, or component parts of the instrument may not immediately be reflected in this manual at the time of change, provided that postponement of revisions will not cause difficulty to the user from a functional or performance standpoint.**

Safety, Protection, and Modification of this Product

Safety precautions related to XS770A are described in "IM 01W06E01-01EN". Please be sure to read the manual.

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Trademarks

- Sushi Sensor is a registered trademark or trademarks of Yokogawa Electric Corporation.
- The name, LoRa, and related logo are registered trademarks or trademarks of Semtech Corporation and/or its subsidiaries.
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Documentation Conventions

Typographical Convention

The following typographical conventions are used throughout the user's manual.

Conventions commonly used throughout the manuals

Character string to be entered

The characters to be entered are shown in one-byte characters as follows:

Example:

FIC100.SV=50.0

"△" mark

Indicates a space between character strings to be entered.

Example:

AL△PIC010△-SC

Character string enclosed in curly brackets ({ })

Indicates an optional character that can be omitted.

Example:

PR△TAG {△. Sheet name}

Conventions used to show key or button operations:

Characters enclosed in square brackets ([ ])

Characters enclosed in square brackets show the names of buttons used during the explanation of software operation.

Example:

To execute the command, click [OK].

Characters enclosed in angled brackets (< >)

Characters enclosed in angled brackets show the title of the screen during the explanation of software operation.

Characters enclosed in double quotation marks (" ")

Characters enclosed in double quotation marks show a tab or an item of the screen during the explanation of software operation.

Symbols

The symbols used in the manual are described in "IM 01W06E01-01EN". Refer to the document for details.

Drawing Conventions

Some drawings may be partially emphasized, simplified, or omitted for the convenience of description.

Some screen images depicted in the user's manual may have different display positions or character types (e.g., the upper/lower case). Also, note that some of the images contained in this user's manual are display examples.

1. Sushi Sensor System Overview

The Sushi Sensor system consists of Sushi Sensor, LoRaWAN gateway, the Application, and Sushi Sensor App. Sushi Sensor is an Industrial IoT intended for the trend monitoring of production equipment and instruments. The Application collects and utilizes the measurement values. Sushi Sensor App navigates settings and displays the status of Sushi Sensor. The Application is compatible with both cloud-based and on-premises environments.

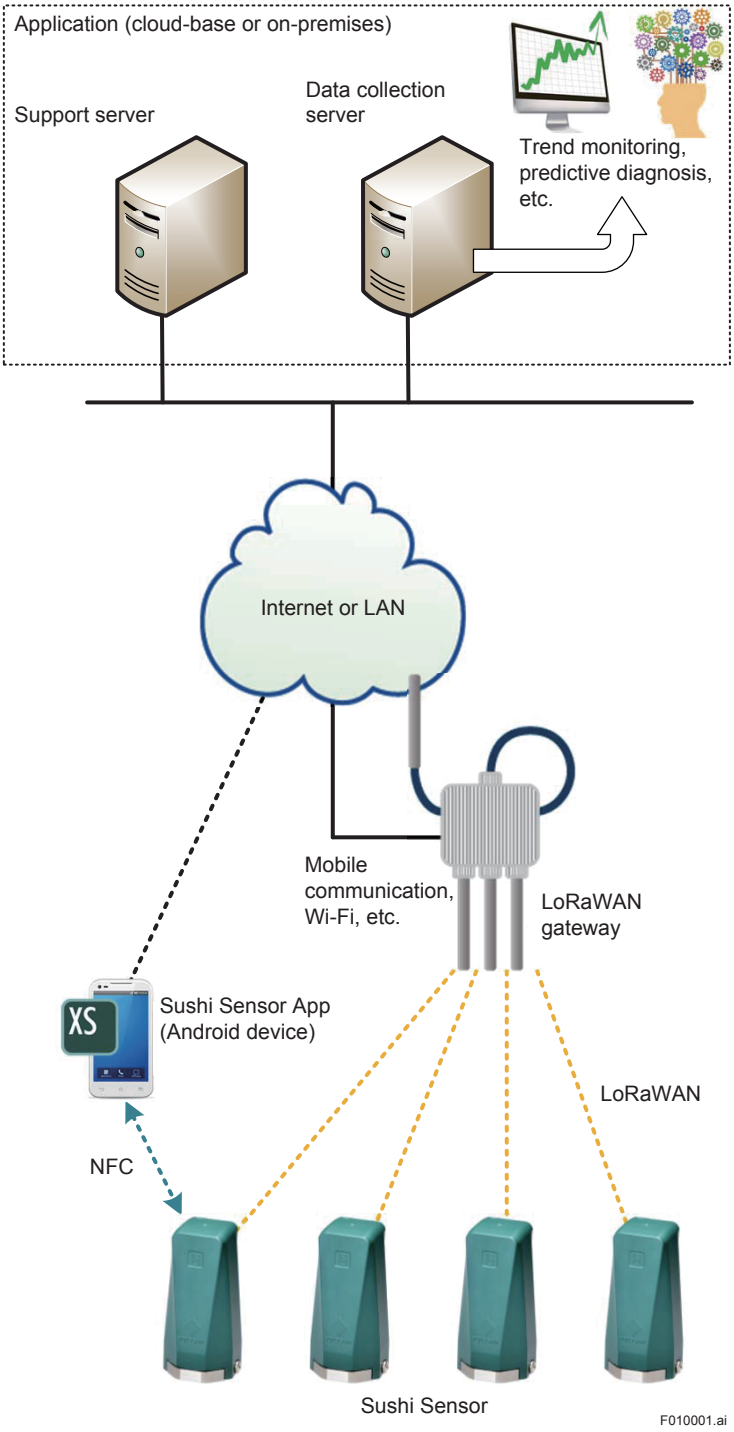


Figure 1-1 Sushi Sensor System Configuration

Sushi Sensor

Sushi Sensor is a sensor for Industrial IoT, intended for trend monitoring of production equipment and instruments. This sensor adopts LoRaWAN communication which actualizes long-distance communication. Setting and status check of the sensor is supported by the NFC function of Android devices.

This manual explains XS770A, one of Sushi Sensor.

LoRaWAN gateway

LoRaWAN gateway relays Sushi Sensor sending data to the Application and manages the LoRaWAN network.

By installing multiple units of the gateways, the communication route between Sushi sensor and the gateway can be made redundant.

Application

The Application consists of a Data collection server and a Support server. These servers can be installed in a single hardware host.

- Data collection server

  This server collects data such as measurement data and device status sent from Sushi Sensor to monitor equipment and devices online. Maintenance timing can be determined by monitoring Sushi Sensor data. Data stored in this server can be output to other applications, and can be used for trend monitoring and predictive maintenance of measurement targets.

- Support server

  This server helps users configure and import/export the network setting for Sushi Sensor by interacting with Sushi Sensor App. This server is not indispensable to operate the Sushi Sensor system.

This manual explains installation, setting, operation of XS770A and how to use of Sushi Sensor App.

For information about the LoRaWAN gateway and the Application, refer to "TI 01W06A51-01EN".

2. Engineering Flow

This section explains the engineering flow and its operations required for constructing the Sushi Sensor system.

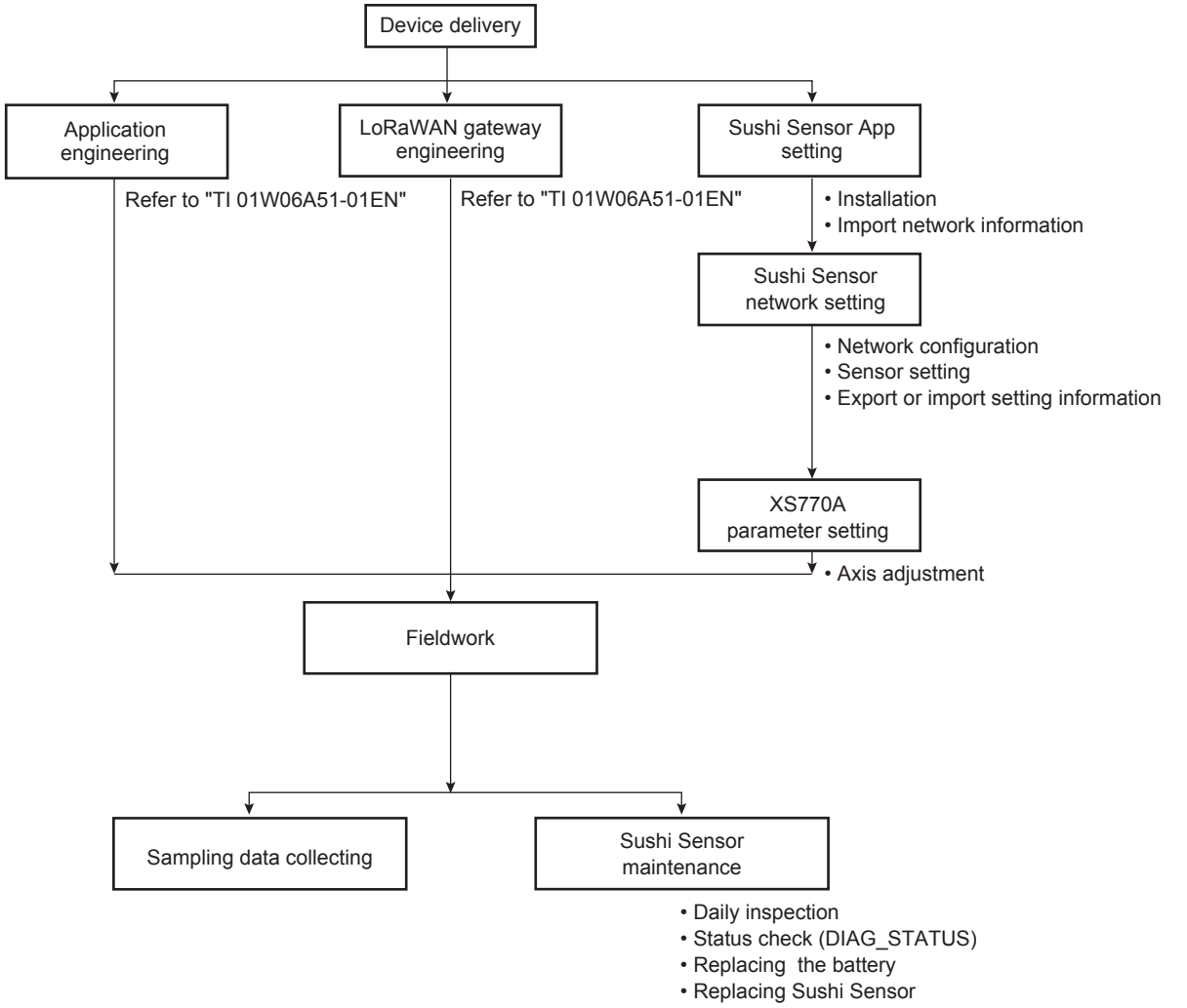


Figure 2-1 Engineering Flow for Constructing the Sushi Sensor System

Constructing the Sushi Sensor system requires the following four engineering processes.

(1) Installation of Sushi Sensor, network configuration, and sensor setting
(2) LoRaWAN gateway engineering
(3) Application engineering
(4) Start up and maintenance Sushi Sensor

This manual explains (1) Installation of XS770A. network configuration, and sensor setting, and (4) start up and maintain XS770A.

NOTE

The default key label included in this product package is not used for the XS770A setting. Store it with the bundled manual.

3. Installation

3.1 Precautions

- **For information about ambient conditions of the installation location, refer to Section 2.4 in "IM 01W06E01-01EN".**
- **Make sure that there are no damages, deformations, or stains adhering to the surface of the Base. Any deformations or stain may affect measurements.**
- **To align the X-axis or Y-axis to the desired orientation, make appropriate adjustments using Sushi Sensor App after mounting. For details, refer to Section 5.3.**

3.2 Installation Procedure

XS770A can be installed using two methods: directly mounting to the measurement target by the attached screw, or using the magnetic holder (F9096DA) which is an accessory of XS770A.

To install XS770A, follow the procedure described below.

1. Determine the mounting position of XS770A. Find a plain surface with a diameter of 40 mm (1.57 inch) or more and a thickness of 7 mm (0.28 inch) or more.
2. Mounting this product.
   - 2a. Direct mounting of XS770A
     - 2a.1 Follow the procedure below, make a vertical installation hole.
       - In case using the hexagon socket set screw, make a screw hole (more than 7 mm deep at M6 P-1) in the mounting position.
       - In case using the conversion screw, make a vertical screw hole (more than 0.28 inch deep at UNF1/4-28) in the mounting position.
     - 2a.2 Attach the screw (provided hexagon socket set screw or provided conversion screw) to the base. If using the conversion screw, screw the M6 side (with no notch) into the base.
     - 2a.3 Mount XS770A to the installation hole made on the measurement target, and tighten the screw using a tool such as a 46 mm wrench. (Recommended tightening torque: 5.1 N·m)
   - 2b. Using the magnetic holder
     - 2b.1 Attach the provided hexagon socket set screw to the Base.
     - 2b.2 Attach XS770A to the magnetic holder and tighten the screw using a tool such as a 46 mm wrench or strap wrench. (Recommended tightening torque: 5.1 N·m)
     - 2b.3 Mount XS770A to the installation surface. The magnetic holder has a strong magnetic force. Place the edge of the magnetic holder on the installation surface once, then carefully install it without moving your hand.
3. Make sure that there is no loose space in the connection surface between this sensor and the measurement target, and that no abnormal vibration occurs.
4. Tie the strap hole of this product to a structural object nearby using a string as needed.

Removing procedures are the reverse of the above.

CAUTION

- Tighten the screw and use the proper tool for all operations, and ensure that the tool is applied to the Base (metallic part).
- Install XS770A with extremely careful not to injure your hand or finger.
- Note that, when installing XS770A using the magnetic holder, the vibration measurement frequency band drops.
- In case the earthing of the Base (metallic part of the enclosure) is not ensured by installation, use the screw at the side of the Base for bonding the Base to the earth point or the equipotential bonding system.

4. Sushi Sensor App

Sushi Sensor App communicates with XS770A via NFC and sets the following items.

- Import network information
- XS770A network configuration
- XS770A sensor setting
- Export and import setting
- Fieldwork

When you write an XS770A sensor setting with NFC, the setting information is saved in Sushi Sensor App automatically.

4.1 Sushi Sensor App Installation

Sushi Sensor App is a tool dedicated to the Android device. Install it from Google Play.

(1) Install Sushi Sensor App

(1)-1 Install "Sushi Sensor App" from the Google Play store.

(1)-2 Check that Sushi Sensor App icon is shown on the Android home screen.

Figure 4-1 Sushi Sensor App Installation

Sushi Sensor App can be updated from Google Play manually or automatically. For details of application update, refer to the Google Play help or the manual for your Android device.

4.2 NFC Communication Procedure

This subsection explains the procedure of NFC communication between the Android device and XS770A.

(1) Check the NFC detection area of the Android device and XS770A. For that of Android device, refer to the device's manual.

(2) Follow the instructions on the Sushi Sensor App, move the NFC detection area of Android device closer to XS770A.

(3) When NFC communication starts, and Android device notifies with sounds and vibrations once. Do not move Android device and XS770A until Sushi Sensor App notifies that the communication is completed or data updating indication is disappeared.

(4) After NFC communication is completed, Android device notifies with sounds and vibrations three times.*1

*1: If NFC communication is failed, Android device notifies with sounds and vibrations twice.

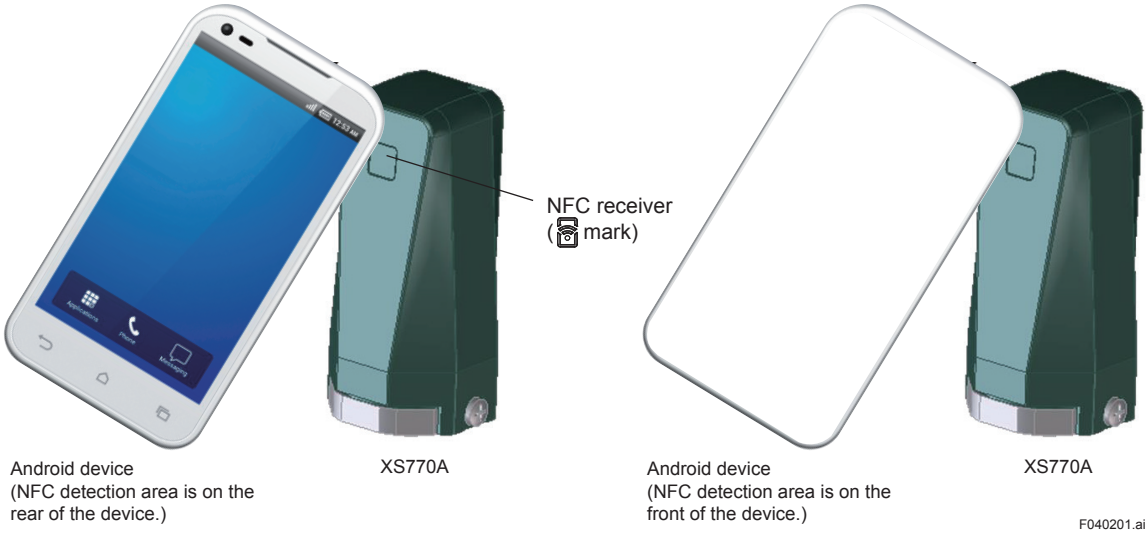


Figure 4-2 The Way of NFC Communication

IMPORTANT

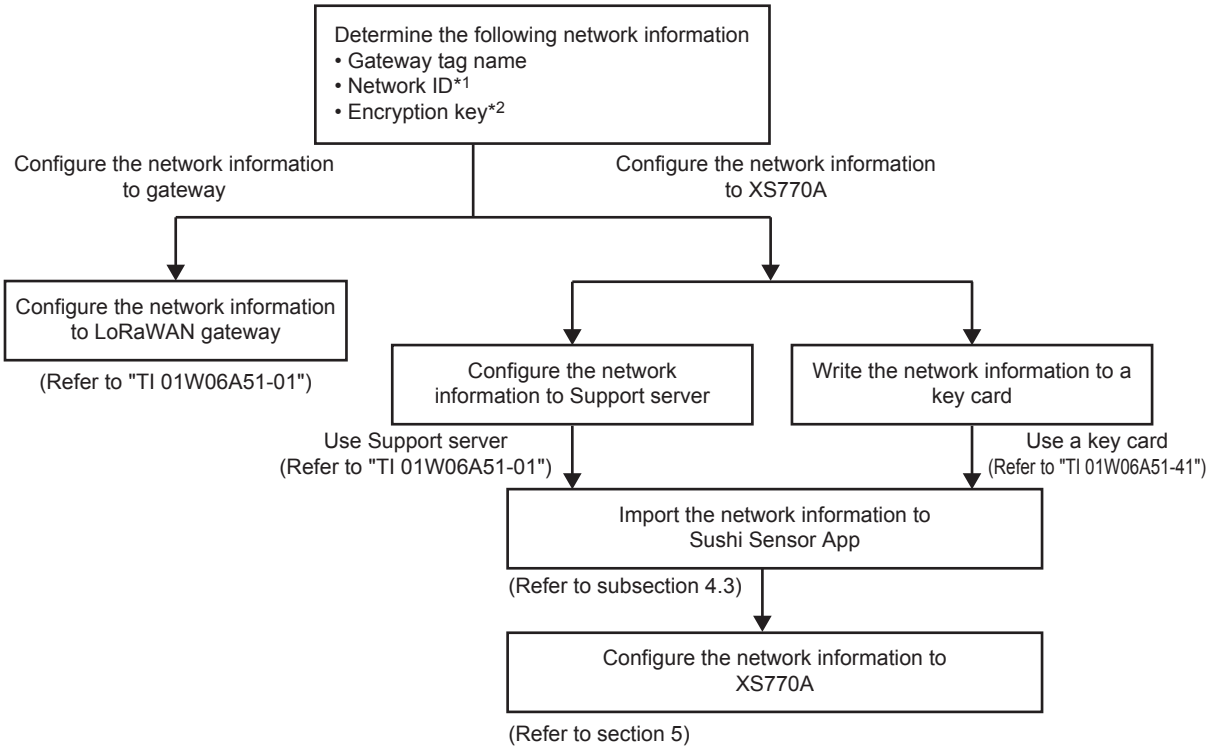
If NFC communication is not available, perform a hardware reset of the XS770A.
Remove the battery from the XS770A and wait 30 seconds. Then, install the battery.
Refer to Section 6.7.2 on how to install and remove the battery.

NOTE

Enable NFC reader/writer of Android device before using Sushi Sensor App.

4.3 Import Network Information

Network information is required for configuring network for XS770A. The same information must be specified for both of XS770A and LoRaWAN gateway to be connected. This subsection explains "Import network information to Sushi Sensor App" in Figure 4-2. "Write network information to XS770A" is explained in section 5.



*1: Network ID is defined as App EUI in LoRaWAN specification. It represents the Application identifier to which Sushi Sensor is connected.
*2: Encryption key is defined as App Key in LoRaWAN specification.

F040301.ai

Figure 4-3 Distribution of Network Information

To import network information to Sushi Sensor App, there are two ways to import the key: "Use a key card" and "Use Support server".

4.3.1 Use a Key Card

This subsection explains how to import the network information from a key card.

(1) Select the source of the network information.

(1)-1 On the start screen of the Sushi Sensor App, press [Network Configuration] button.

(1)-2 Press [Use Key Card] button.

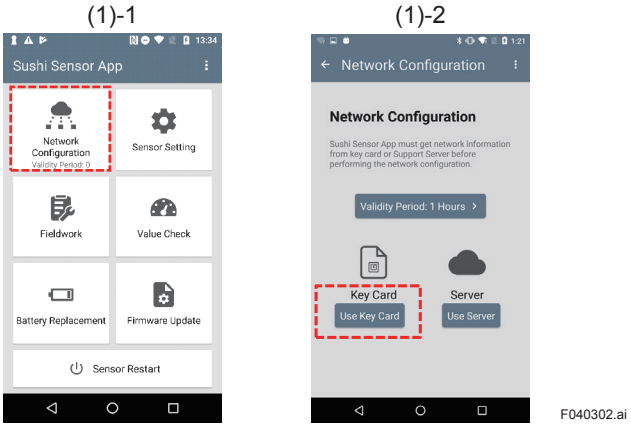


Figure 4-4 Select Key Card as Source of Network Information

(2) Import network information

(2)-1 Move Android device and a key card closer.
"Network info. Acquisition Completed" message appears after reading the card successfully.

(2)-2 Press [Done] button.

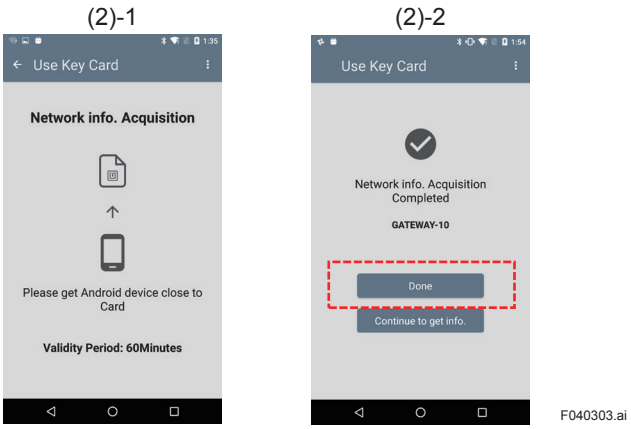


Figure 4-5 Import of Network Information Using a Key Card

4.3.2 Use Support Server

This section explains how to import network information from the Support server.

(1) Select the source of the network information.

(1)-1 On the start screen of the Sushi Sensor App, press [Network Configuration] button.

(1)-2 Press [Use Server] button.

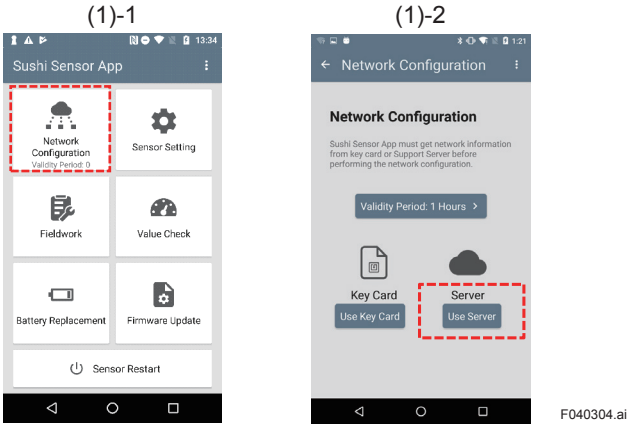


Figure 4-6 Select Support Server as Source of Network Information

(2) Import network information

(2)-1 Enter the host name or IP address, user name and password of the Support server, and press the [Network info Acquisition] button.
"Network info. Acquisition Completed" message appears after downloading.

(2)-2 Press [Done] button.

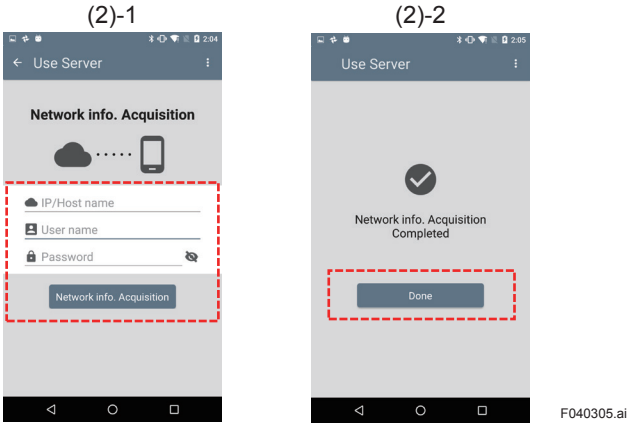


Figure 4-7 Import of Network Information Using Support Server

5. XS770A Setting

5.1 XS770A Network Configuration

Configure the network information to XS770A using Sushi Sensor App.

When [Location Information] of the Android device is set to ON, the location information (latitude and longitude) of the Android device records in XS770A.

By configuring at the actual installation point, XS770A can notify appropriate location information.

(1) Check the validity period of the network information.

(1)-1 On the start screen of the Sushi Sensor App, check the validity period displayed on the [Network Configuration] button.

(1)-2 If validity period is not 0, press [Network Configuration] button*1.

*1: When the validity period is 0, follow the procedure in Section 4.3 and import network information in Sushi Sensor App.

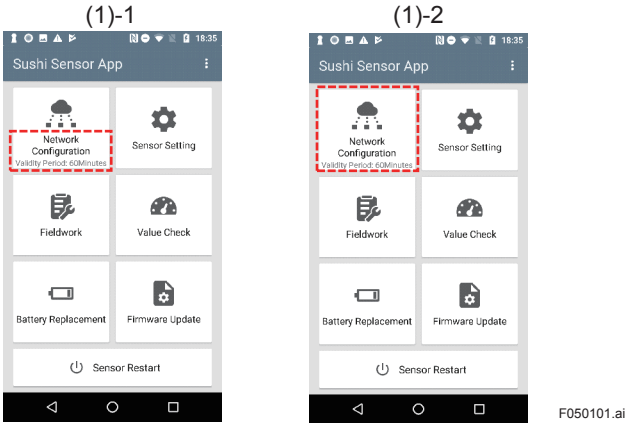


Figure 5-1 Check Validity Period

(2) Select the destination gateway.

(2)-1 Press [Change] button.
A list of connectable gateway tag names appears.

(2)-2 Select destination gateway tag name from the list and press [OK] button.

(2)-3 Check selected gateway tag name is shown on the screen.

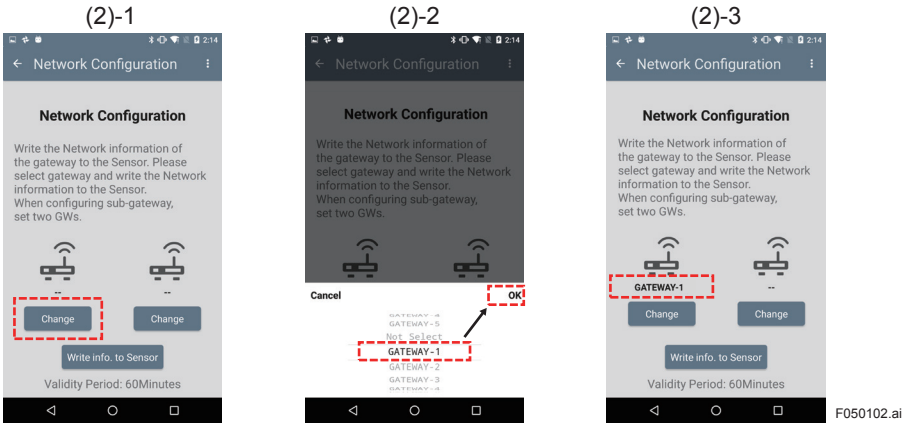


Figure 5-2 Select Destination Gateway

(3) Write the network configuration to XS770A.

(3)-1 Press [Wirte info. to Sensor] button.

(3)-2 Move the Android device closer to XS770A.
"Network Configuration Completed" message appears after writing the configuration.
And press[Done] button.

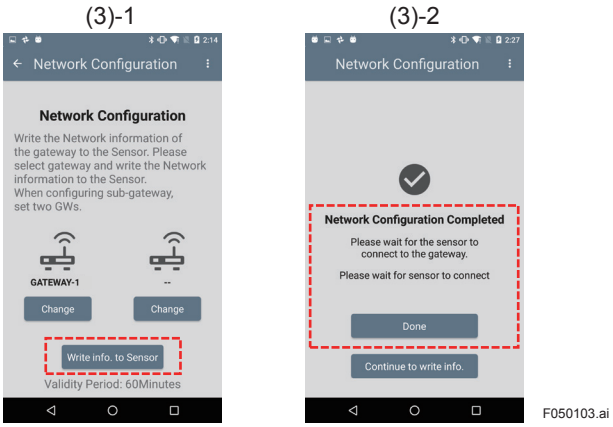


Figure 5-3 Write Network Configuration

5.2 XS770A Sensor Setting

Specify sensor tag name, sampling data, sending period and transmission mode for XS770A. Possible and the default value of each item is shown below.

Table 5-1 XS770A Sensor Setting Items

Item			Description	Default	Possible Setting
General Setting	Sensor Tag Name		This is the tag name of Sushi Sensor. Setting this item is mandatory.	blank	-
	Sending Period		This is the sending cycle of sampling data.	2[Hours]	1,10,30[Minutes] 1,2,3,4,5,6,12,18,24,48,72[Hours]
	Sampling Data	Z-axis & temp	This sets Z-axis and temperature data are sent or not. Number of axes to be sent is 1 because these data are put in one packet. (Refer to Section 7.1)	ON	ON/OFF
More…		XYZ-axis & temp	This sets the composite value of XYZ-axis and temperature data are sent or not. Number of axes to be sent is 1 because these data are put in one packet. (Refer to Section 7.2)	OFF	ON/OFF
		X-axis	This sets X-axis data are sent or not. For the packet format, refer to Section 7.3.	OFF	ON/OFF
		Y-axis	This sets Y-axis data are sent or not. For the packet format, refer to Section 7.4.	OFF	ON/OFF
	Transmission Mode	High Speed Mode	For details of this setting, refer to Table 5-2. This setting is displayed in the Sushi Sensor App if the channel plan is EU868 or KR920.	ON	ON/OFF
	Axis Adjustment	XY Angle	This specifies the angle of the axis adjustment.	0	5 degrees increments in the range of -180 to 180 degrees
	Sub-band Setting		Specify the frequency band to be used when sending Sushi Sensor to LoRa Gateway. Set the same parameter as LoRa Gateway. For details of this setting, refer to Table 5-3. This setting is displayed in the Sushi Sensor App if the channel plan is US915 or AU915.	1	All, 1, 2, 3, 4, 5, 6, 7, 8
	Unit Setting*1	Acceleration Unit	Select the acceleration, velocity, and temperature unit to be displayed on the Sushi Sensor App. This setting is displayed in the Sushi Sensor App if the channel plan is US915.	g	m/s^2, g
		Velocity Unit		in/s	mm/s, in/s
		Temperature Unit		°F	°C, °F

*1: When the channel plan is other than US915, the units used are as follows.
- acceleration : m/s^2
- velocity : mm/s
- temperature : °C

Table 5-2 Transmission mode

Transmission mode	Description
High Speed mode is ON	The sending period can be set from 1 minute to 72 hours. However, if number of axes to be sent is multiple, please set the transmission cycle to 10 minutes or more.
High Speed mode is OFF	EU868: The sending period can be set from 4 hours to 72 hours. There is no limit on the sending period depending on number of axes to be sent. KR920: The sending period can be set from 1 hour to 72 hours. There is no limit on the sending period depending on number of axes to be sent.

The behavior when High Speed mode is OFF varies by country.

Table 5-3 Sub-band Setting Parameters

Sub-band Setting Parameter		US915 Frequency [MHz]	AU915 Frequency [MHz]
1	All*	902.3-903.7	915.2-916.6
2		903.9-905.3	916.8-918.2
3		905.5-906.9	918.4-919.8
4		907.1-908.5	920.0-921.4
5		908.7-910.1	921.6-923.0
6		910.3-911.7	923.2-924.6
7		911.9-913.3	924.8-926.2
8		913.5-914.9	926.4-927.8

*1: If you select “All” as the sub-band setting, it takes a long time to complete the network join sequence of Sushi sensor.

(1) Check Sensor list registration.

(1)-1 On the start screen of the Sushi Sensor App, press [Sensor Setting] button.

(1)-2 Check sensor tag name to be changed is registered on the list.
Detail of the Sensor list, refer to Table 5-4.

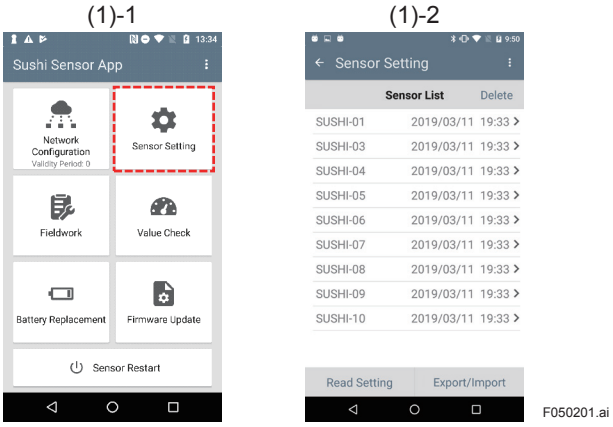


Figure 5-4 Check Sensor List Registration

(2) Display the <Sensor Setting> screen.

A:In the case of the sensor is not registered in the list

(2)-A-1 Press the [Read Setting] button.

(2)-A-2 Move the Android device closer to XS770A to be changed.
<Sensor Setting> screen appears after reading successfully.

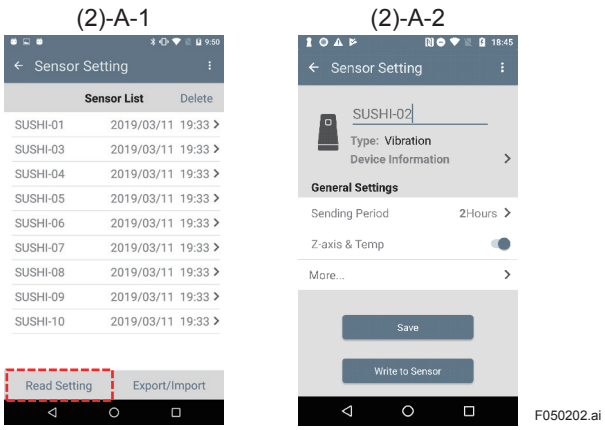


Figure 5-5 Read Sensor Setting with NFC

B:In the case of the sensor has been registered in the list

(2)-B-1 Tap XS770A tag name to be changed in the Sensor list.

(2)-B-2 <Sensor Setting> screen appears .

(2)-B-1 (2)-B-2

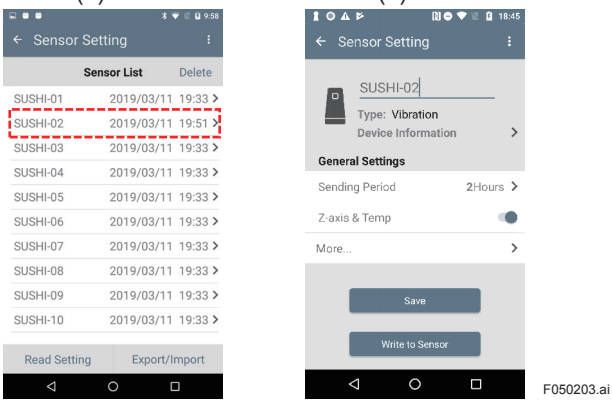


Figure 5-6 Select Sushi Sensor from List

(3) Specify the sensor setting items.

(3)-1 If the Sensor tag name is blank, be sure to set it. For other items, refer to Table 5-1 and set them as necessary.

(3)-1

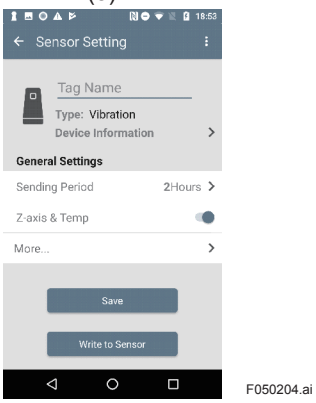


Figure 5-7 Specify the Sensor Setting Items

(4) Write setting information to XS770A.

(4) -1 After the setting is completed, press the [Write to Sensor] button.

(4) -2 Move the Android device closer to XS770A.
"Write Sensor Setting Completed" message appears after writing the setting. Press [Done] button.

(4) -3 Check XS770A tag name is registered in the Sensor list.

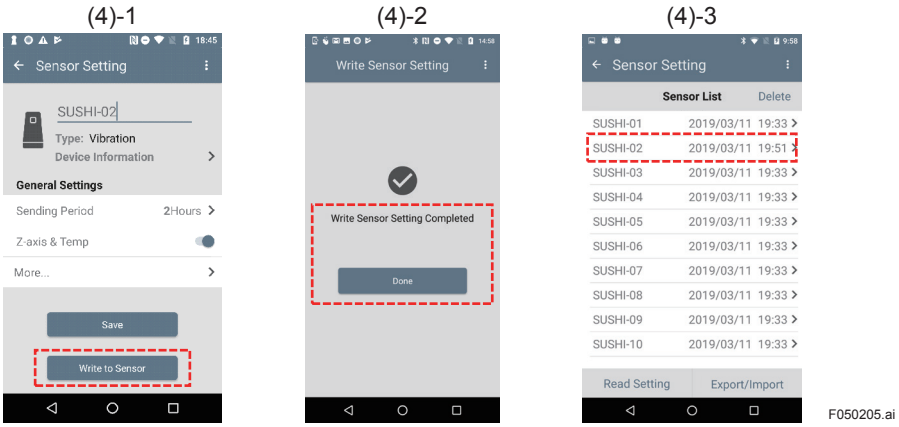


Figure 5-8 Write setting information to XS770A

Table 5-4 shows the items of <Sensor List> screen. After selecting a sensor from this list, <Sensor Setting> screen appears. The contents of <Sensor Setting> screen is shown in Table 5-5.

Table 5-4 Contents of Sensor List

Item	Description
Sensor Tag Name	Refer to Table 5-1
Date	Date saved in Sushi Sensor App

Table 5-5 Contents of Sensor Setting

Item		Description
Sensor Tag Name		Refer to Table 5-1
Sensor Type		Type of Sushi Sensor. For XS770A, the type is vibration.
EUI		Sushi Sensor EUI64
General Setting	Sending Period	Refer to Table 5-1
	Z-axis & temp	Refer to Table 5-1
	More...	Other Setting button. Refer to Table 5-1

NOTE

- Up to 10 characters can be set as a tag name. Upper-case alphanumeric characters (A to Z, and 0 to 9), hyphens ("-") and underscores ("_") can be used.
- The number of sending axes and its sending period affect battery life. See Section 6.4.
- Available data types are "Z-axis and temp", "XYZ axes and temp", "X-axis", and "Y-axis". Vibration measures acceleration (peak) and velocity (RMS) for each axis. XYZ axes is a composite value.
- When multiple axes data send, set the sending period to 10 minutes or more. If sending period is less than 10 minutes, the data may not reach the Application.

5.3 Measurement Axis Adjustment

After installing XS770A, the direction of measurement axes (X-axis and Y-axis) can be adjusted using Sushi Sensor App.

With the X-axis of XS770A as the reference point, the axes can be adjusted by specifying a positive angle for counterclockwise rotation and a negative angle for clock rotation.

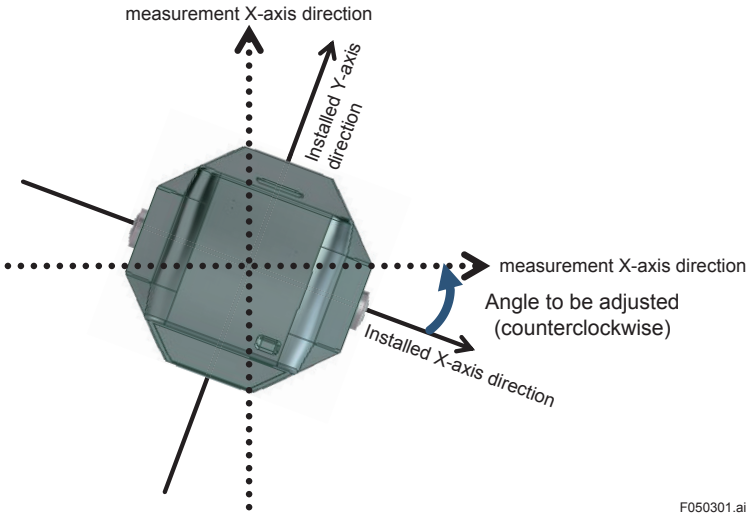


Figure 5-9 Measurement Axis Adjustment

(1) Display <Sensor Setting> screen of the sensor to be adjusted.

(1)-1 Follow the procedure in Section 5.2, display <Sensor Setting> screen.

(1)-1

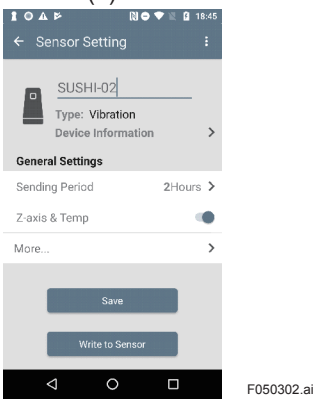


Figure 5-10 Display General Setting Screen

(2) Specify the X-Y angle to be adjusted.

(2)-1 Press the [More...] button.

(2)-2 Press the [X-Y Angle] button.
A list of selectable angles appears.

(2)-3 Select the angle from the list and press [OK] button.
For detail of the angle adjustment refer to Table 5-1.

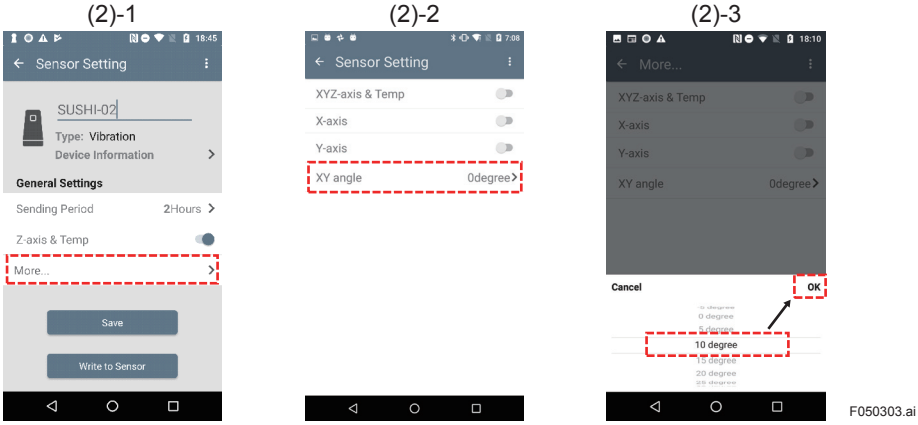


Figure 5-11 Specify X-Y Angle

(3) Write setting information to XS770A.

(3)-1 Return to <Sensor Setting> screen.

(3)-2 Follow the procedure in Section 5.2, write the setting to XS770A.

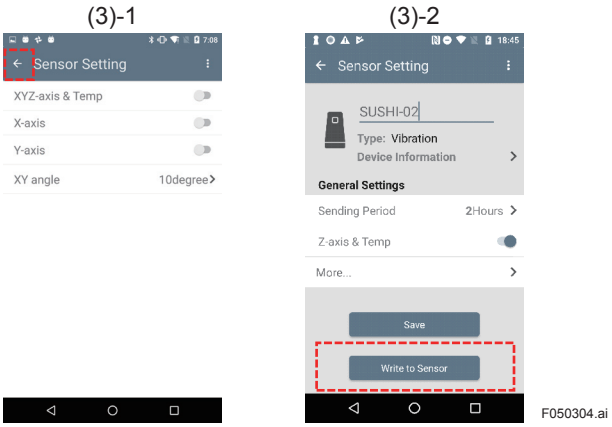


Figure 5-12 Write Adjustment to XS770A

NOTE

The adjustment value is valid after writing to Sushi Sensor. The setting is applied from the next measurement timing.

5.4 Fieldwork

Fieldwork verifies that XS770A sending data reaches Data collection server and this server output values correctly.

Fieldwork is executed by using the Sushi Sensor App.

(1) Check XS770A status.

(1)-1 On the start screen of the Sushi Sensor App, press [Fieldwork] button.

(1)-2 Move the Android device closer to XS770A.
Check sensor tag name and status.
When the status is "GOOD", fieldwork can be executed.

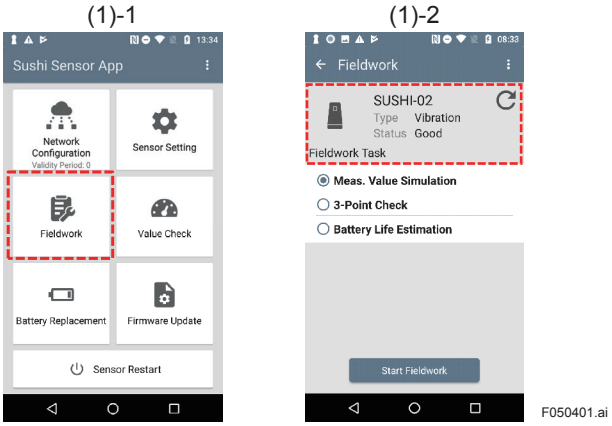


Figure 5-13 Check XS770A Status

(2) Execute Fieldwork

(2)-1 Select a task and press [Start Fieldwork] button.
For details of each task, refer to Table 5-6.

(2)-2 Move the Android device closer to XS770A.

(2)-3 Press [Done] button.

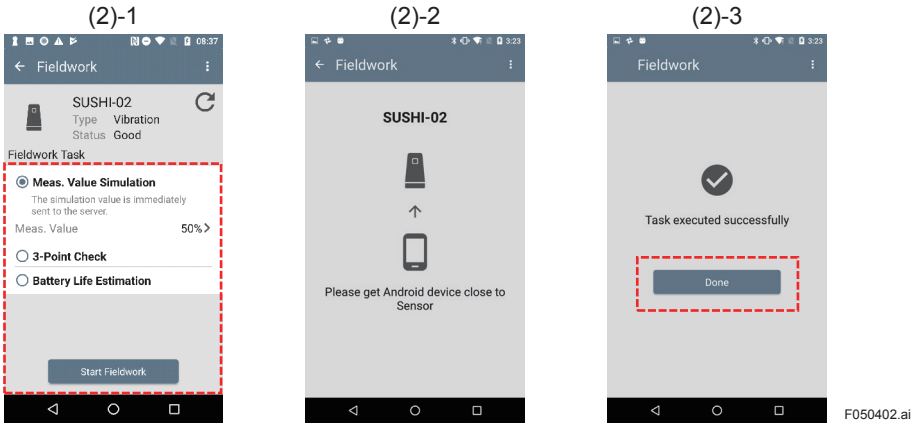


Figure 5-14 Execute Fieldwork

Fieldwork performs operations shown in Table 5-6.

Table 5-6 Fieldwork operation list

Item	Description
meas. Value Simulation	The sensor sends a specified value (selected from 0, 50, 75, or 100% of the measurement range) to the Data collection server once. Verify that the values are correct with this server.
3-point check	The sensor sends 0, 50 and 100% of the measurement range automatically every 10 minutes. Verify that the values are correct with this server.
Battery level check	Sushi Sensor App determines the communication quality between LoRaWAN gateway and Sushi Sensor and calculates estimated XS770A battery life. Verify the battery life with Sushi Sensor App. The procedure takes about 20 seconds to get the result.

5.5 Gateway Redundancy Setting

The Sushi Sensor system supports gateway redundancy. When one gateway is out of service by failure, another gateway is used.

Registering network information of the two gateways in XS770A makes gateway redundancy. The registered XS770A automatically selects the connectable gateway and sends data.

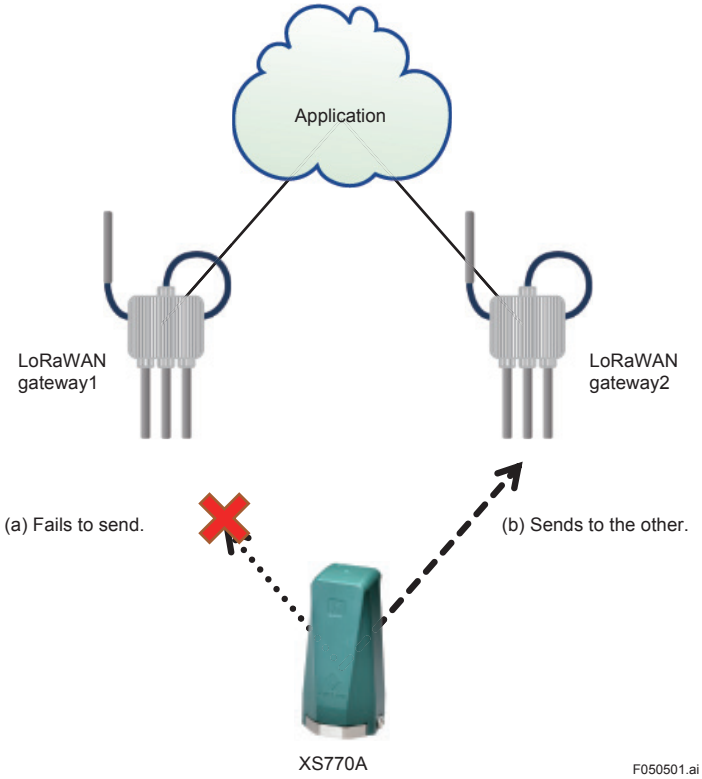


Figure 5-15 Gateway Redundancy Image

5.6 Import and Export Setting

XS770A setting data saved in Sushi Sensor App can be exported or import to/from Support server or PC.

5.6.1 Export Setting to PC

This section describes the procedure to export the XS770A setting to PC.

(1) Specify export destination

(1)-1 On the start screen of the Sushi Sensor App, press [Sensor Setting] button.

(1)-2 Press [Export/Import] button.

(1)-3 Press [Device] button.

(1)-4 <Sensor list> appears on the screen.
All the devices in this list (refer to Table 5-4) are subject to export.

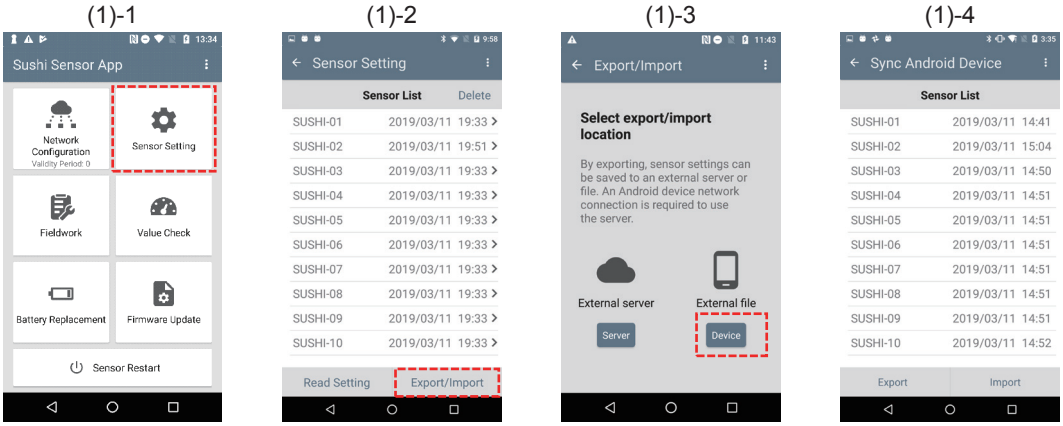


Figure 5-16 Specify Android Device as Export Destination

(2) Export setting of XS770A on Android Device.

(2)-1 Press the [Export] button.
Data export on the local storage is executed. After that, "Export Completed" message with data stored path is shown.

(2)-2 Press [Done] button.

(2)-3 Restart the Android device manually.

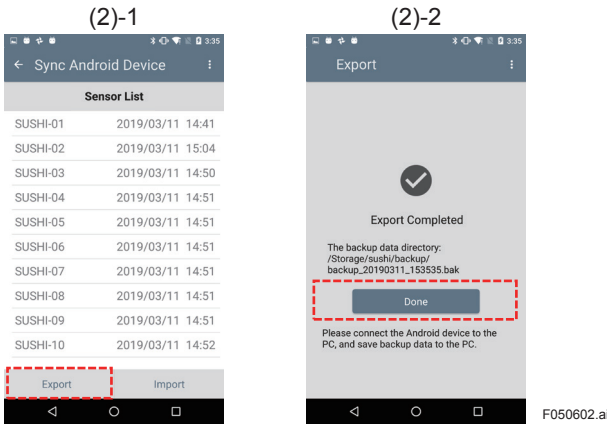


Figure 5-17 Export Setting on Android Device

NOTE

After restarting the android device, you can securely access the backup file from the PC.

(3) Save to PC

(3)-1 Connect Android device and PC.

(3)-2 Open "internal storage / sushi / backup" folder of the Android device.

(3)-3 Transfer the backup file (*.bak file) to PC.

(3)-2

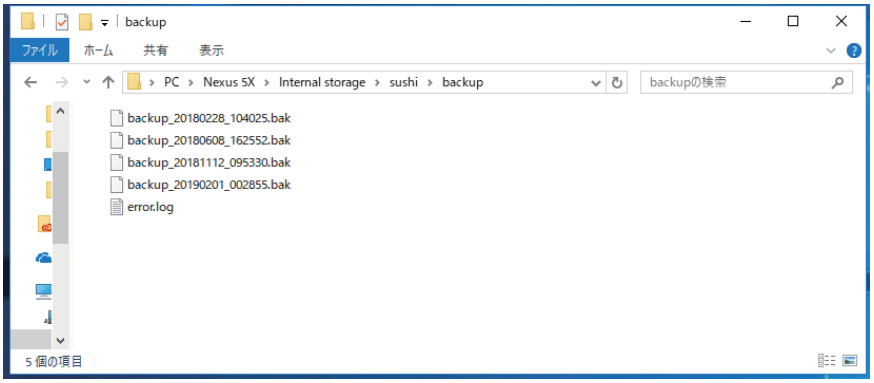


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Figure 5-18 Saving the backup file to PC

NOTE

- Have to change the USB configuration of the Android device to file transfer.
  Tap the "Charging this device via USB" notification. Under "Use USB for," select File Transfer.
- The "internal storage / sushi / backup" folder is created automatically after saving the setting of XS770A on Android device.(Section 5.6.1 (2))

Backup filename is "backup_YYYYMMDD_HHmmss.bak"

YYYMMDD_HHmmss is the timestamp of the saved date. YYYY is a year, MM is a month, DD is a day, HH is a 24-hour notation, mm is a minutes, and ss is second.

5.6.2 Import Setting from PC

This section describes the procedure to import XS770A setting from PC.

(1) Load backup file from PC to Android device

(1)-1 Connect PC and Android device.

(1)-2 Copy backup file (*.bak file) from PC to "internal storage / sushi / backup" folder of Android device.

(1)-2

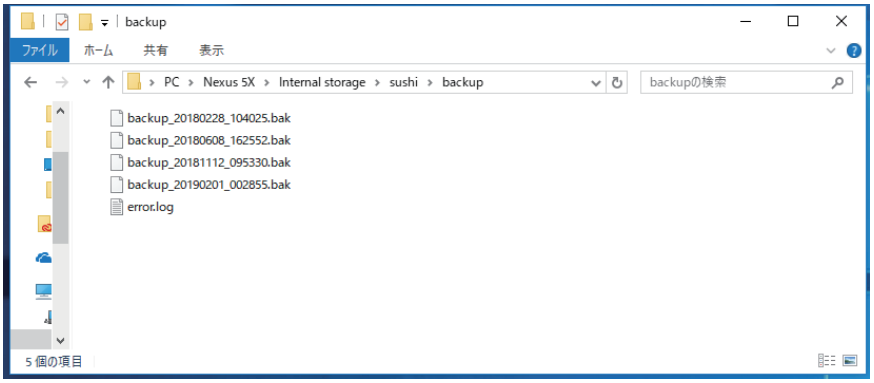

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Figure 5-19 Load Backup File From PC

NOTE

- Have to change USB configuration of Android device to file transfer.
  Tap the "Charging this device via USB" notification. Under "Use USB for," select File Transfer.
- The "internal storage / sushi / backup" folder of Android device is created automatically after saving setting of XS770A on the Android device.(Section 5.6.1 (2))

(2) Specify the import source.

(2)-1 On the start screen of the Sushi Sensor App, press [Sensor Setting] button.

(2)-2 Press [Export/Import] button.

(2)-3 Press [Device] button.

(2)-1 (2)-2 (2)-3

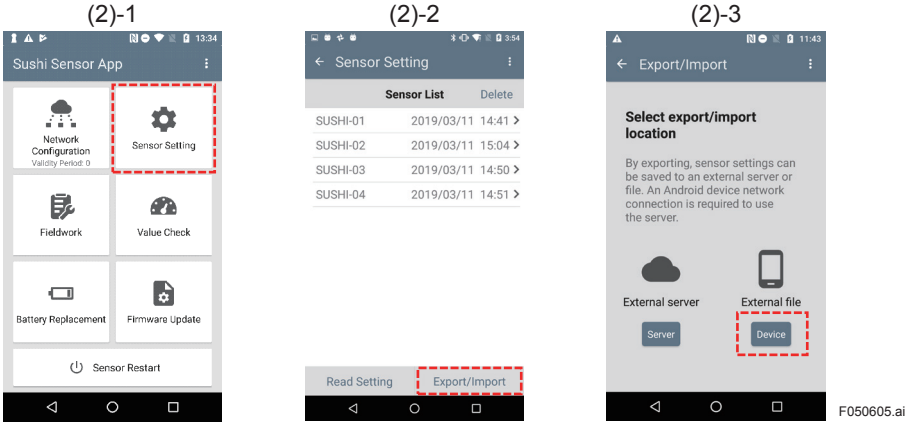

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Figure 5-20 Specify Android Device as Import Source

(3) Import to Sushi Sensor App

(3)-1 Press [Import] button. Sensor List (refer to Table 5-4) stored in backup file is listed on Sushi Sensor App.

(3)-2 Select XS770A to be imported from the list and press [Import] button.

(3)-3 Make sure that the selected sensor tag name is shown in <Sensor List>.

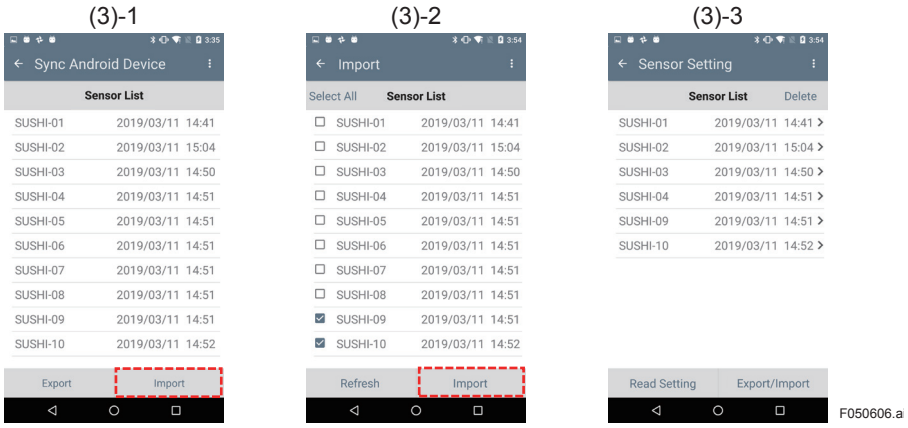

Figure 5-21 Import Setting to Sushi Sensor App

5.6.3 Export Setting to Support Server

This section describes the procedure to export the XS770A setting to the Support server.

(1) Specify export destination

(1)-1 On the start screen of the Sushi Sensor App, press [Sensor Setting] button.

(1)-2 Press [Export/Import] button.

(1)-3 Press [Server] button.

(1)-4 Enter the host name or IP address, user name and password of the Support server, and press the [Login] button.

(1)-5 <Sensor List> appears on the screen.
All the devices in this list (refer to Table 5-4) are subject to export.

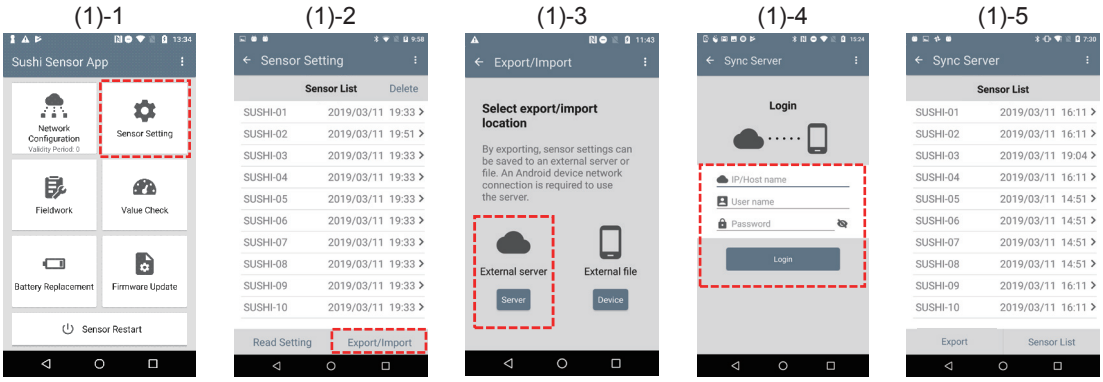

Figure 5-22 Specify Support Server as Export Destination

(2) Export to Support server

(2)-1 Press the [Export] button.
"Export Completed" message appears after uploading backup data.

(2)-2 Press [Done] button.

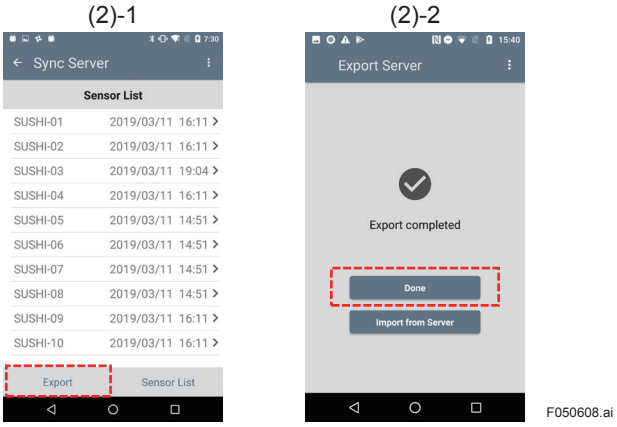

Figure 5-23 Export Setting to Support Server

5.6.4 Import Setting from Support Server

This section describes the procedure to import the XS770A setting from the Support server.

(1) Specify the import source.

(1)-1 On the start screen of the Sushi Sensor App, press [Sensor Setting] button.

(1)-2 Press [Export/Import] button.

(1)-3 Press [Server] button.

(1)-4 Enter the host name or IP address, user name and password of the Support server, and press the [Login] button.

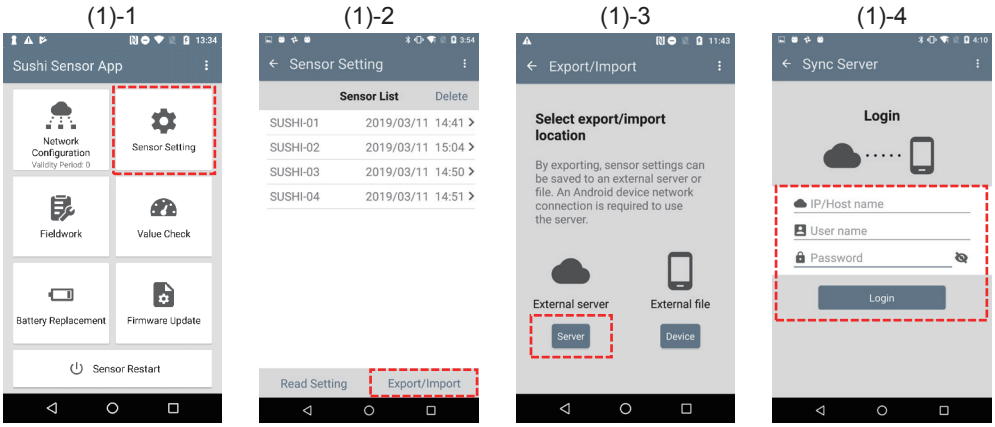

Figure 5-24 Specify Support Server as Import Source

(2) Import to Sushi Sensor App

(2)-1 Press [Sensor List] button. Sensor List (refer to Table 5-4) is listed on Sushi Sensor App.

(2)-2 Select XS770A to be imported from the list and press [Download] button.

(2)-3 Make sure that the selected sensor tag name is shown in <Sensor List>.

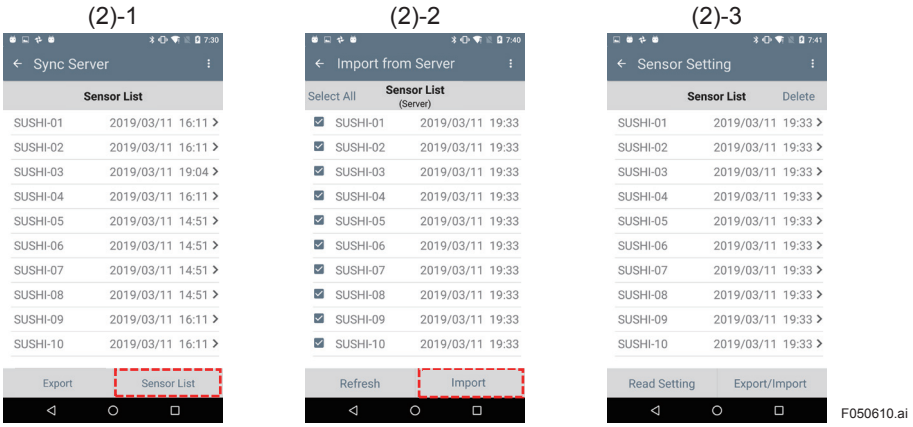

Figure 5-25 Import Setting from Support Server

6. Operation and Maintenance

This section describes how to carry out daily inspection, a sensor indicates warning or error status, and replace the battery or device of XS770A.

6.1 Hardware Maintenance

Check XS770A installation and stain condition. If XS770A becomes dirty or dusty, wipe with a soft cloth moistened with water or mild soap.

6.2 Daily Inspection Using Sushi Sensor App

This section explains the procedure of daily inspection of XS770A status by using Sushi Sensor App.

(1) Read the current status of XS770A

(1)-1 On the start screen of the Sushi Sensor App, press [Value Check] button.

(1)-2 Move the Android device closer to XS770A.
<Value Check> screen appears after reading status.

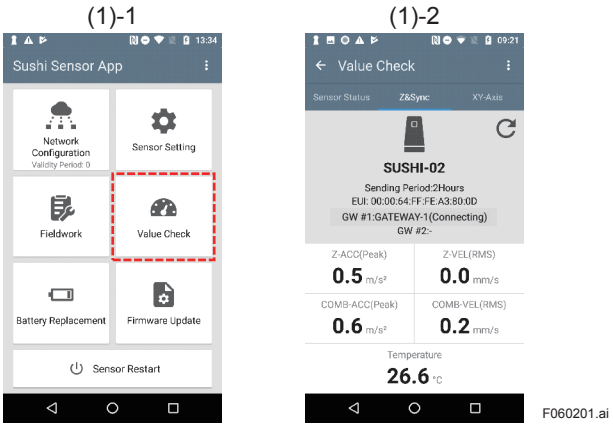

Figure 6-1 Read Current Status

(2) Check device status of XS770A

(2)-1 Click "Sensor Status" tab and check the following items.
- Check any alarms are notified in the "STATUS" area.
- Check that RSSI has not decreased significantly compared with startup.

(2)-1

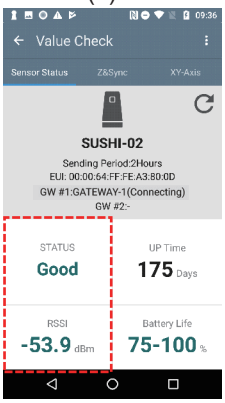

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Figure 6-2 Check Device Status

For details about sensor status, refer to Table 6-1.

Table 6-1 XS770A status and action strategies

Status Display	DIAG STATUS (Table 7-9)	DIAG STATUS DETAIL (Table 7-10)	DATA_ STATUS (Table 7-3)	Output Operation	Description	Action
No setting	Bit25	Bit23	-		Network is not configured for XS770A.	Configure the network for XS770A. Refer to Section 5.1.
Unconnected	Bit25	Bit22	-		XS770A is not connected to the gateway.	Check whether there is any shielding object between XS770A and the gateway, or any object that interferes with radio waves.
OFF	Bit24	Bit16	-		XS770A is in OFF mode.	Perform the procedure to change ON mode (refer to Section 6.9.2).
Low power	Bit20	Bit31	-	Normal measurement	Power is low.	Replace the battery. Refer to Section 6.7 for the battery replacement procedure.
	Bit19	Bit30	-	Normal measurement	The battery life has dropped to 25% or less.	
Temperature error	Bit22	Bit28	-	Normal measurement	CPU temperature goes outside the specified range.	The XS770A operating environment is outside the specified range. A failure may occur if you keep using it without taking corrective actions. Use it in a location with an environment that meets the relevant specifications.
		Bit29		Normal measurement		
In failure	Bit27	Bit19	-	Normal measurement	A memory error has occurred.	Replace the device. Back up the XS770A setting if necessary.
	Bit26	Bit25	Bit15	Previous value	An error has occurred during acceleration measurement.	
			Bit14	Previous value	An error has occurred during velocity measurement.	
		Bit24	Bit13	Previous value	An error has occurred during temperature measurement.	
Sim	Bit17	Bit17	Bit8	Simulation value	Task check is running for XS770A.	The simulation value is being sent. Wait until the task check is completed.
Threshold error	Bit23	Bit21	Bit12	Normal measurement	The vibration value measured by XS770A is outside the measurable range.	Check the installation status of XS770A.
			Bit11	Normal measurement		
		Bit20	Bit10	Normal measurement	The temperature measured by XS770A is outside the measurable range.	
Good					XS770A is in a normal state.	None in particular

6.3 Self-diagnosis Data Output by XS770A

XS770A sends the device status to the Data collection server once a day. Monitor the device status by using this server if necessary. For details of health report information (HRI) and self-diagnosis information (DIAG) refer to Section 7.

6.4 Estimated Battery Life

The XS770A battery life is affected by the sending period and the ambient environment. The following shows the estimated battery life of XS770A at an ambient temperature of 25±10°C. The actual battery life varies depending on the ambient temperature, temperature variation, and radio wave environment.

Table 6-2 Battery life vs. sending period and data count

Sending Period	Number of axes to be sent	Battery Life
1 day	1	10 years
1 hour	1	4 years
1 hour	4	3 years
1 minute	1	2 months

For information about the sending period and number of axes to be sent, refer to Section 5.2.

6.5 Handling a Device in the Warning Status

If there is a device that indicates some warnings, a communication error may occur even if the data sending is continued. If a warning message appears due to the remaining battery life of XS770A, immediately replace the battery regardless of the displayed number of days. For the replacement procedure, refer to Section 6.7.

When some warnings regarding a degradation of wireless communication are notified by monitoring Health Report Information(HRI), check whether there are any obstructs or interference sources around the communication path.

6.6 Device Replacement

The section explains the procedure to replace devices.

(1) Prepare setting information of the XS770A to be replaced.

(1)-1 Follow the procedures in Section 5.2, check the XS770A to be replaced is registered in Sensor List.

(1)-1

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Figure 6-3 Check Sensor List

A:In the case of the sensor is not registered in the list

(1)-A-1 Follow the procedure in Section 5.6, import setting information the XS770A to be replaced from the Support server or PC.
Display the <Sensor Setting> screen (refer to Table 5-5).

B:In the case of the sensor has been registered in the list

(1)-B-1 After selecting the sensor, <Sensor Setting> screen appears.
Display the <Sensor Setting> screen (refer to Table 5-5).

(1)-A-1, (1)-B-1

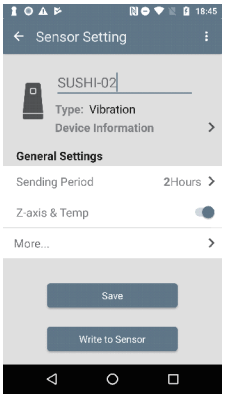

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Figure 6-4 Display The General Setting Screen

(2) Write setting information to the new XS770A.

(2)-1 Prepare a new XS770A.

(2)-2 Follow the procedure in Section5.2, write setting information to the new XS770A. The warning message appears because the network ID is different, but press [Done] button.

(2)-3 Follow the procedure in Section5.1, configure the network for the new XS770A.

When the network configuration is completed, the new XS770A connects to the gateway.

(2)-2

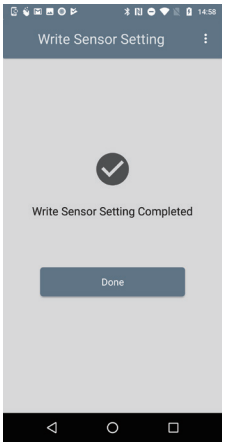

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Figure 6-5 Write Setting to New XS770A

(3) Check the connection with the gateway

(3)-1 Follow the procedure in Section 6.2, confirm the status of the new XS770A.

(3)-1

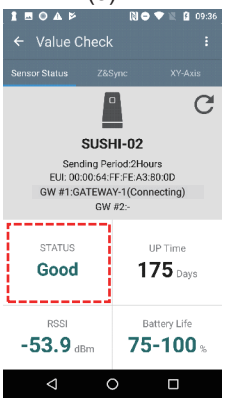


Figure 6-6 Check the Connection

6.7 Battery Replacement

6.7.1 Preparation

Only the dedicated battery specified by Yokogawa should be used with this product. When a replacement battery is needed, please order the XS70BT. The XS70BT is a dedicated product (model: LS14500 C5SY) that uses a specified quantity of SAFT batteries with a battery connector incorporated to the batteries.

6.7.2 Battery Replacement

To replace a battery, follow the procedure described below.

IMPORTANT

- This product contains parts that can be damaged by static electricity. When replacing a battery, take precautions such as using a grounded wrist strap to avoid handling electronic parts or touching the board circuit patterns.
- When putting on or removing the Case, pay great attention to the environmental conditions to prevent dust and water droplets entering the product.
- When replacing the battery, check that the product has sufficiently cooled because of the built-in battery or internal components may still be hot.
- Be extremely careful not to apply excessive force to the circuit board, hit it with a tool or allow any foreign materials or stains to adhere to it.
- Be extremely careful not to forcibly pull the cable in a way that may lead to damage or disconnection.
- Be extremely careful to ensure that no foreign materials get into or become adhered to the battery connector of the product when the battery is being removed."

(1) Remove two M4 screws fixing the case.

(2) Remove the Case by inserting a flathead screwdriver into the slit.

(3) Disconnect the battery connector from the battery holder.

(4) Remove the used battery from the battery holder.

(5) Put a new battery into the battery holder with the negative side facing down.

(6) Connect the battery connector to the board.

(7) Put the case onto the base with directing the nameplate to the battery side.

(8) Tighten the M4 screw to fix the case. (Recommended tightening torque: 1.37 N·m)

(9) Initialize the battery life using Sushi Sensor App.

NOTE

- If the battery and Case are not placed in the correct orientation, the Case will not be able to be closed.
- When attaching the cover, make sure the EUI of XS770A displayed by executing [Value Chack] in Sushi Sensor App matches EUI64 described on the nameplate.

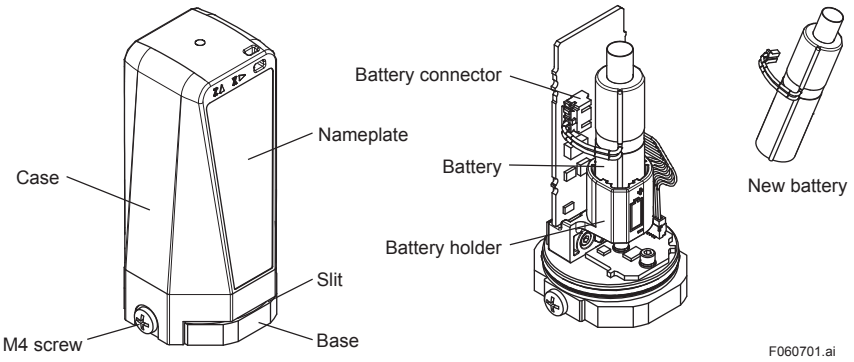


Figure 6-7 Battery Replacement Procedure

6.7.3 Initializing the Battery Life

After replacing the battery, the battery life will have to be initialized. The battery life will not be calculated correctly if it is not initialized.

The procedure for initializing the battery life using Sushi Sensor App is shown below.

(1) Replace XS770A battery

(1)-1 Follow the procedure in Section 6.7.2, replace the XS770A battery.

(2) Initialize battery life.

(2)-1 On the start screen of the Sushi Sensor App, press [Battery Replacement] button.

(2)-2 Press [Start] button.

(2)-3 Move the Android device closer to XS770A.
"Battery Replacement Completed" message appears after initializing battery life.

(2)-4 Press [Done] button.

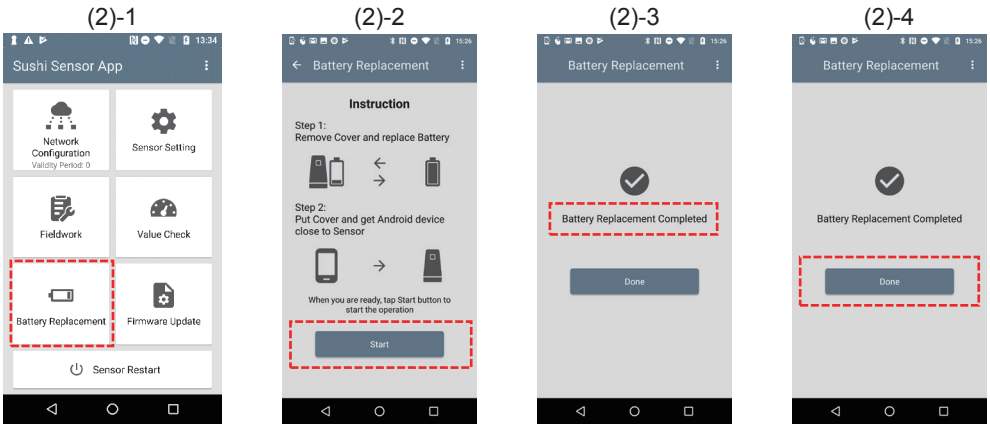


Figure 6-8 Initializing the Battery Life

6.7.4 Handling the Battery

This product uses one lithium thionyl chloride primary battery. The battery contains approximately 0.7 g of lithium.

Under normal conditions, the battery materials are self-contained and are not reactive as long as the battery integrity is maintained. Care should be taken to prevent thermal, electrical or mechanical damage. Battery should be stored in a clean and dry area. For maximum battery life, storage temperature should not exceed 40°C.

Use the dedicated battery shown in section 6.7.2.

WARNING

Handling the battery
The following precautions must be observed to safely and effectively use a battery pack. Improper use may lead to fluid leakage,excessive heat, ignition, or explosion.

- Never charge it.
- Do not short-circuit it.
- Do not disassemble, transform, or modify it.
- Do not heat it or throw it into a fire.
- Do not soak it in fresh water or seawater.

CAUTION

Observe the following precautions for the safe disposal of battery.

- Do not incinerate the battery, and do not expose it to a high temperature of 100°C or more. This may lead to fluid leakage or explosion.
- Dispose of the battery according to laws and regulations.

Transportation of products containing a lithium battery:

This product contains a lithium battery. When transporting this product with the battery installed, set this product to OFF mode to prevent the battery from draining. For the procedure to enable OFF mode, refer to Section 6.9. Transportation of primary lithium batteries is restricted by regulations issued by the U.S. Department of Transportation, the International Air Transport Association (IATA), the International Civil Aviation Organization (ICAO), and the European Ground Transportation of Dangerous Goods (ARD). It is the responsibility of the shipper to ensure compliance with these and any other local requirements. Consult current regulations and requirements before shipping.

6.8 Firmware Update

The XS770A firmware can be updated by using Sushi Sensor App. A new version of the XS770A firmware is provided through Sushi Sensor App.

IMPORTANT

It takes a few minutes to upgrade the firmware. Before upgrading the firmware, the Android device should set so that it does not enter sleep mode. If the Android device enters sleep mode during the update process, the firmware updating fails.

(1) Check the current firmware version.

(1)-1 On the start screen of the Sushi Sensor App, press [Firmware Update] button.

(1)-2 Move the Android device closer to XS770A.
Check current and new firmware versions.

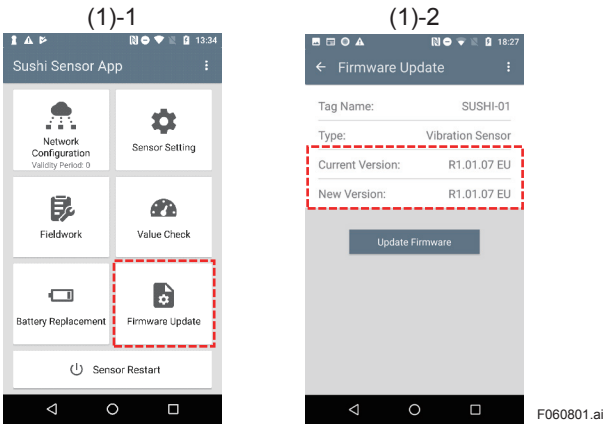


Figure 6-9 Check Current Firmware Version

(2) Update the new firmware.

(2)-1 Press [Update Firmware] button.

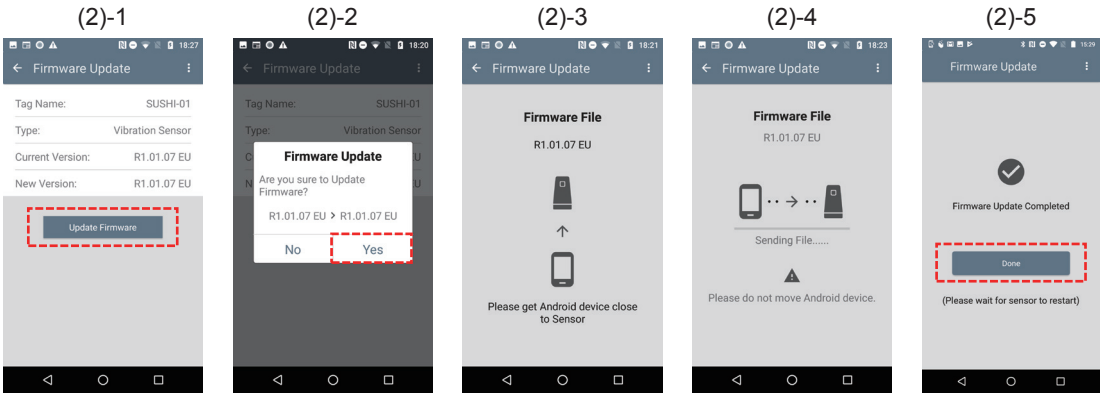
(2)-2 Check the new firmware version. And press [Yes] button.

(2)-3 Check the new firmware version and move the Android device closer to XS770A.

(2)-4 Do not move the Android device and XS770A until firmware writing is completed.
It takes about 2 or 3 minutes.
"Firmware Update Completed" message appears after finishing it.*1

(2)-5 Press [Done] button.

*1: After firmware writing to XS770A ,XS770A restarts automatically. It takes about 1 minute for the restart to complete.



F060802.ai

Figure 6-10 Firmware Update

6.9 Device Storage

When you store an XS770A or do not use it for a long period for transportation or other reasons, set the XS770A to OFF mode. OFF mode minimizes battery power consumption.

6.9.1 Change to OFF Mode

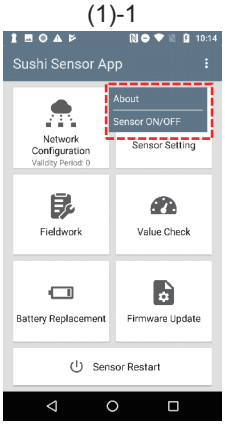
This section explains the procedure to change XS770A to OFF mode. After shifting to OFF mode, XS770A can be used only for NFC communication function.

(1) Check the current mode

(1)-1 Press [menu] icon and [Sensor ON/OFF] button.

(1)-2 Move the Android device closer to XS770A.

(1)-1



F060901.ai

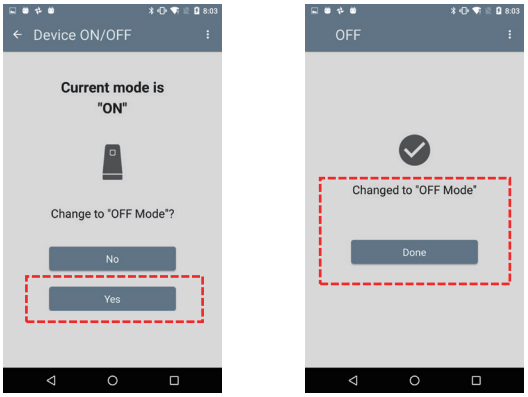
Figure 6-11 Select Sensor ON/OFF Menu

(2) Change to OFF mode

(2)-1 Check "Current mode is "ON" " message appears on the screen, press [Yes] button.

(2)-2 Move the Android device closer to XS770A.
After changing OFF mode, "Changed to "OFF Mode" " message appears and press [Done] button.

(2)-1 (2)-2



F060902.ai

Figure 6-12 Shifting XS770A to OFF Mode

6.9.2 Change to ON Mode

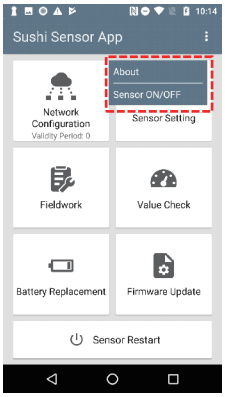
This section explains the procedure to return XS770A from OFF mode to ON mode.

(1) Check current mode.

(1)-1 Press [menu] icon and [Sensor ON/OFF] button.

(1)-2 Move the Android device closer to XS770A.

(1)-1



F060903.ai

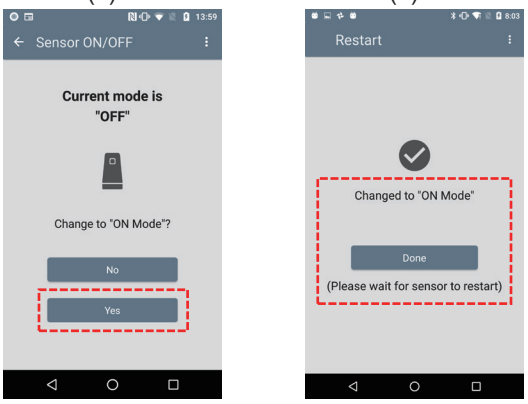
Figure 6-13 Select Sensor ON/OFF Mode

(2) Change to ON mode

(2)-1 Check "Current mode is "OFF" " message appears on the screen, press [Yes] button.

(2)-2 Move the Android device closer to XS770A.
After changing ON mode, Changed to "ON Mode" message appears. And press [Done] button.

(2)-1 (2)-2



F060904.ai

Figure 6-14 Changing XS770A to ON Mode

NOTE

After executing network configuration, device setting, or run firmware update during OFF mode, XS770A changes to ON mode automatically.

7. XS770A Sending Data

This section describes the data sent by XS770A.

XS770A sends data according to the format described in Table 7-1.

The Data_Type field shows the formats of the sending data. The sending period varies depending on Data_Type.

Table 7-1 Sending data format

Parameter Name	Size (Byte)	Description
Data_Type	1	0x10 Sushi Sensor vibration (Z-axis) 0x11 Sushi Sensor vibration (XYZ composite axes) 0x12 Sushi Sensor vibration (X-axis) 0x13 Sushi Sensor vibration (Y-axis) 0x40 Health report information (HRI) 0x41 Self-diagnosis information (DIAG) 0x42 Initialization information (INI) 0x43 GPS information (GPS)
Data	Variable length	Varies depending on Data_Type.

Table 7-2 Data_Type and sending period

Data_Type	Sending period
0x10 Sushi Sensor vibration (Z-axis) 0x11 Sushi Sensor vibration (XYZ composite axes) 0x12 Sushi Sensor vibration (X-axis) 0x13 Sushi Sensor vibration (Y-axis)	Depends on the sensor setting
0x42 Initialization information (INI) 0x43 GPS information	Transmit data after joining the network, and every hour, up to three times.
0x40 Health report information (HRI) 0x41 Self-diagnosis information (DIAG)	Once every 24 hours. 15 minutes after network connection.

7.1 Sushi Sensor Vibration (Z-axis) Data_Type=0x10

Table 7-3 Sushi Sensor vibration (Z-axis) data format

Parameter Name	Type	Size (Byte)	Description
Data_Type	UINT8	1	0x10
Data_Status	UINT16	2	Shows the status of the measured value. All 0: Good Bit15: Acceleration error Bit14: Velocity error Bit13: Temperature error Bit12: Acceleration overrange Bit11: Velocity overrange Bit10: Temperature overrange Bit9: (Reserved) Bit8: Simulation mode Bit0 to 7: (Reserved)
PV_Acceleration	FLOAT16	2	Z-axis acceleration peak value (m/s^2)
PV_Velocity	FLOAT16	2	Z-axis velocity RMS value (mm/s)
PV_Temperature	FLOAT16	2	Temperature measured value (°C)

7.2 Sushi Sensor Vibration (XYZ axes) Data_Type=0x11

Table 7-4 Sushi Sensor vibration (XYZ axes) data format

Parameter Name	Type	Size (Byte)	Description
Data_Type	UINT8	1	0x11
Data_Status	UINT16	2	Shows the status of the measured value. All 0: Good Bit15: Acceleration error Bit14: Velocity error Bit13: Temperature error Bit12: Acceleration overrange Bit11: Velocity overrange Bit10: Temperature overrange Bit9: (Reserved) Bit8: Simulation mode Bit0 to 7: (Reserved)
PV_Acceleration	FLOAT16	2	XYZ composite axes acceleration peak value (m/s^2)
PV_Velocity	FLOAT16	2	XYZ composite axes velocity RMS value (mm/s)
PV_Temperature	FLOAT16	2	Temperature measured value (°C)

7.3 Sushi Sensor Vibration (X-axis) Data_Type=0x12

Table 7-5 Sushi Sensor vibration (X-axis) data format

Parameter Name	Type	Size (Byte)	Description
Data_Type	UINT8	1	0x12
Data_Status	UINT16	2	Shows the status of the measured value. All 0: Good Bit15: Acceleration error Bit14: Velocity error Bit13: (Reserved) Bit12: Acceleration overrange Bit11: Velocity overrange Bit10: (Reserved) Bit9: (Reserved) Bit8: Simulation mode Bit0 to 7: (Reserved)
PV_Acceleration	FLOAT16	2	X-axis acceleration peak value (m/s^2)
PV_Velocity	FLOAT16	2	X-axis velocity RMS value (mm/s)

7.4 Sushi Sensor Vibration (Y-axis) Data_Type=0x13

Table 7-6 Sushi Sensor vibration (Y-axis) data format

Parameter Name	Type	Size (Byte)	Description
Data_Type	UINT8	1	0x13
Data_Status	UINT16	2	Shows the status of the measured value. All 0: Good Bit15: Acceleration error Bit14: Velocity error Bit13: (Reserved) Bit12: Acceleration overrange Bit11: Velocity overrange Bit10: (Reserved) Bit9: (Reserved) Bit8: Simulation mode Bit0 to 7: (Reserved)
PV_Acceleration	FLOAT16	2	Y-axis acceleration peak value (m/s^2)
PV_Velocity	FLOAT16	2	Y-axis velocity RMS value (mm/s)

7.5 Health Report Information (HRI) Data_Type=0x40

Table 7-7 Health report information sending data format

Parameter Name	Type	Size (Byte)	Description
Data_Type	UINT8	1	0x40
UpTime	UINT24	3	Time elapsed after power-on Up to approximately 31 years. Unit: minute
BatteryLeft	UINT8	1	A value obtained by doubling the remaining battery level. Unit: % (Example: When 150, 150 ÷ 2 = 75%)
RSSI	UINT8	1	Receiving strength. Handled as a negative number. Unit: dBm
PER	UINT8	1	Packet error rate detected by the device. Unit: %
SNR	INT8	1	A value obtained by multiplying the device-detected SN ratio by 4. Unit: dB (Example: When 27, 27 ÷ 4 = 6.75 dB)

7.6 Self-diagnosis Information (DIAG) Data_Type=0x41

DIAG_STATUS is classified into four categories complying with NE107* of NAMUR (F: Failure,C: Function Check,O: Out of specification,M: Maintenance required), and each category is assigned to Bit27-1. When any Bit in each category is 1, the representative value of the category defined in Bit31-28 turns to 1. Also when any Bit of DIAG_STATUS_DETAIL is ON, Bit0 of DIAG_STATUS turns to 1. Each Bit turns to 1 when the status is detected.

* NAMUR NE107 "Self-Monitoring and Diagnosis of Field Devices"

Table 7-8 LoRaPayload format of self-diagnosis information

Parameter Name	Type	Size (Byte)	Description
DATA_TYPE_CODE	UINT8	1	0x41
DIAG_STATUS	UINT32	4	Diagnosis information (outline)
DIAG_STATUS_ DETAIL	UINT32	4	Diagnosis information (detail)

Table 7-9 DIAG_STATUS

Bits	Contents	NAMUR category
Bit31(MSB)	F: Failure status	---
Bit30	C: Function check status	---
Bit29	O: Out of specification status	---
Bit28	M: Maintenance required status	---
Bit27	Faults in electronics	F
Bit26	Faults in sensor or actuator element	F
Bit25	Installation,calibration problem	C
Bit24	Out of service	C
Bit23	Outside sensor limits	O
Bit22	Environmental conditions out of device specification	O
Bit21	Fault prediction: Maintenance required	M
Bit20	Power is critical low: maintenance need short-term	M
Bit19	Power is low: maintenance need mid-term	M
Bit18	Not used	---
Bit17	Simulation is active	C
Bit16	Not used	---
Bit15-1	Not used	---
Bit0	Detail information available	---

Table 7-10 DIAG_STATUS_DETAIL

Bits	Contents	DIAG_STATUS
Bit31(MSB)	Voltage is low	Bit 20
Bit30	Battery Left is low	Bit 19
Bit29	Temp Hi	Bit 22
Bit28	Temp Low	Bit 22
Bit27	(Reserved)	Bit 27
Bit26	(Reserved)	Bit 27
Bit25	Electrical Failure: Vibration Sensor	Bit 26
Bit24	Electrical Failure: Temperature Sensor	Bit 26
Bit23	Sensor is not provisioned	Bit 25
Bit22	Sensor is not joined	Bit 25
Bit21	Sensor Over flow : Vibration Sensor	Bit 23
Bit20	Sensor Over flow : Temperature Sensor	Bit 23
Bit19	Memory Failure	Bit 27
Bit18	Out of service (Reserved for future use)	Bit 24
Bit17	Simulation Mode	Bit 17
Bit16	OFF Mode	Bit 24
Bit15-0	Not used	---

7.7 Initialization Information Data_Type=0x42

Table 7-11 Initialization information sending data format

Parameter Name	Type	Size (Byte)	Description
Data_Type	UINT8	1	0x42
Tag_Name	STRING	10	Tag name defined in the device (up to ten ASCII characters)

7.8 GPS Information Data_Type=0x43

Table 7-12 GPS information sending data format

Parameter Name	Type	Size (Byte)	Description
Data_Type	UINT8	1	0x43
Longitude	FLOAT32	4	Longitude. Positive value for east longitude. Negative for west longitude.
Latitude	FLOAT32	4	Latitude. Positive value for north latitude. Negative for south latitude.

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(End)

9. General Specifications

Please refer to GS 01W06E01-01EN for the latest information.

9.1 Standard Specifications

WIRELESS SPECIFICATIONS

Communication Protocol:

LoRaWAN class A

For detail on channel plan, refer to Table 9-1.

Modulation Method:

LoRa modulation

Data Rate:

250 to 21900 bps*

*: Available data rate vary depending on the country.

Frequency:

Refer to Table 9-1.

Radio Security:

AES 128 bit encryption

RF Transmitter Power:

Max. 7 dBm

Antenna:

Built-in Omni-directional antenna

POWER SUPPLY SPECIFICATIONS

Battery:

Lithium thionyl chloride battery: 1 unit (dedicated product)

Rated voltage: 3.6 V

Rated capacity: 2.6 Ah

PERFORMANCE SPECIFICATIONS

Measurement:

Item		Specifications
Vibration	Measurement	Acceleration (peak), Velocity (RMS)
	Axis	X, Y, Z axes and 3-axis composite
	Range *1	Acceleration: 0 to 130 m/s^2 (0 to 13.26 g) Velocity *2: 0 to 20 mm/s (0 to 0.79 in/s)
	Frequency range	10 to 1,000 Hz (± 3 dB)
	Accuracy (100 Hz)	X, Y, Z axes : ±10% FS 3-axis composite : ±20% FS
Temperature	Measurement	Temperature
	Range	–20 to 85°C (–4 to 185°F)
	Resolution	0.1°C
	Measurement part	Base

*1: Peak value of the input vibration. For the relationship between the frequency band and range, refer to the following figure.
*2: The 20 mm/s pk value is equivalent to 14 mm/s RMS when input is based on a sine wave.

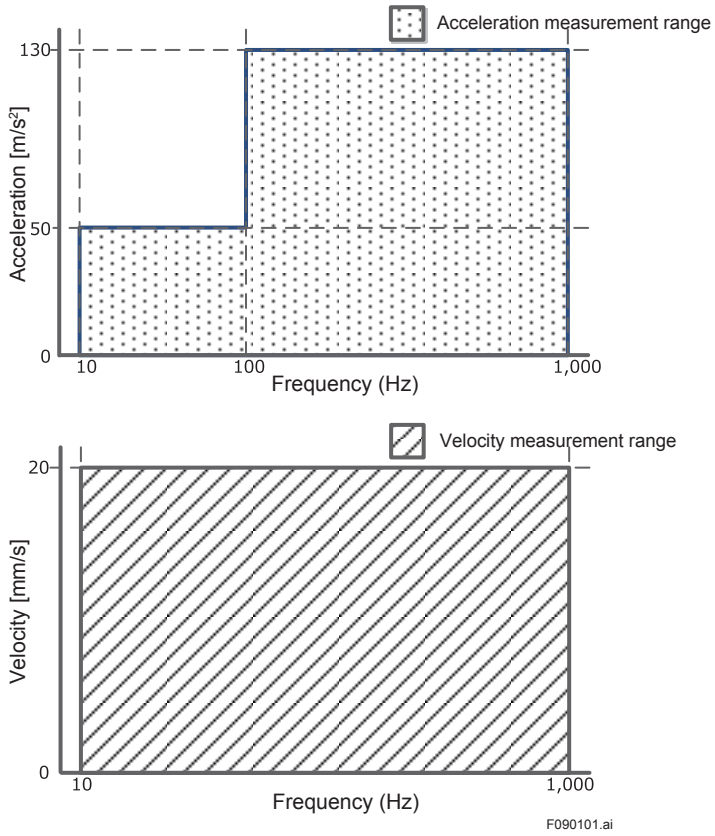


Figure 9-1 Measurable Range

Battery Characteristics:

The typical battery life is 4 years in the following conditions*.

- Update period: 1 hour
- Ambient temperature: 23±2°C (73.4±3.6°F)

*: Environmental condition such as vibration and the type of the connected device may affect battery life.

Update Period:

1 minute to 3 days

FUNCTIONAL SPECIFICATIONS

Output:

LoRaWAN

For detail on channel plan and available countries and regions, refer to Table 9-1.

NFC Interface:

NFC Forum Type 2 Tag

Diagnosis Function:

Battery alarm, internal temperature, wireless communication failures, sensor over-range, sensor failures, memory failures

Software Download Function:

Allows the user to update the software of the sensor via the NFC interface.

INSTALLATION ENVIRONMENT

Ambient Temperature Limits:

Operating: –20 to 85°C (–4 to 185°F)

Ambient Humidity Limits:

Operating: 0 to 100% RH (non-condensation)

Altitude (Atmospheric pressure):

[Type Code: 00] Up to 3000 m

[Type Code: K2,S2,F1,P1,U1] 80 to 110 kPa (Up to 2000 m*)

*: Ambient Temperature: over 10 °C

Shock Resistance:

100 G

Table 9-1 Area code, frequency and LoRaWAN regional parameter

Area Code	Frequency	Channel Plan	Countries and Regions
2	863 to 870 MHz *1	EU868	Europe
3	902 to 928 MHz *2	US915	North America
4	919 to 925 MHz *2	AS923-1	Malaysia, Singapore, Thailand
5	915 to 928 MHz	AU915	Australia, Chile
6	915 to 928 MHz	AS923-1	New Zealand
7	920.9 to 923.3 MHz	KR920	South Korea
9	915 to 928 MHz	AU915	Brasil
C	920 to 923 MHz	AS923-2	Indonesia
G	915 to 928 MHz	AU915	Argentina
H	863 to 870 MHz	EU868	Saudi Arabia, UAE

*1: This wireless frequency can be used throughout Europe, although there are some restrictions in Sweden and Greece.
*2: Available frequency bands vary depending on the country.

REGULATORY COMPLIANCE STATEMENTS

This device satisfies the following standards.

*: Please confirm that an installation region fulfills an applicable standard. If additional regulatory information and approvals are required, contact a Yokogawa representative.

Telecommunication Compliance:

RE Directive (EEA and EFTA Countries),

FCC Approval (United States),

ISED Approval (Canada),

KC Marking (South Korea)

RCM (Australia and New Zealand)

CE Conformity:

EU RoHS Directive compliant

RE Directive: Safety: EN61010-1 (Indoor/Outdoor use), EN62479

EMC: EN 301 489-1, EN 301 489-3, EN61326-1 Class A Table 2, EN61326-2-3, EN55011 Class A Group1

Radio Spectrum: EN 300 220-2 (Band h1.3 in the tale 1 of CEPT ERC Rec. 70-03), EN 300 330

ATEX Intrinsically safe declaration:

Applicable standard: EN IEC 60079-0:2018, EN 60079-11:2012

Ex Marking: II 3 G Ex ic IIB T4 Gc

Enclosure: IP66/IP67 in accordance with EN 60529

Ambient temperature: –20 to 80°C (–4 to 176°F)

Canadian Safety Standards:

CAN/CSA-C22.2 No.61010-1

CSA-C22.2 No.94.2

IEC 60529

Degrees of protection:

[Housing material Code: 1] IP66/IP67

[Housing material Code: 2] IP66/IP67 and Type 4X

KC Marking:

Trade Name: Yokogawa Electric Corp.

Equipment Name: Wireless Vibration Sensor

Manufacturer: Yokogawa Electric Corp.

IECEx Intrinsically safe Approval

Application Standard: EN IEC 60079-0:2018, IEC 60079-11:2011,

Certificate number: IECEx DEK 19.0072

Ex Marking: Ex ic IIB T4 Gc

Ambient temperature: –20 to 80°C (–4 to 176°F)

FM Nonincendive Approval (United States)

Applicable Standards: FM 3600:2018, FM 3611:2018, FM 3810:2018,
ANSI/UL 121201 Ed.9 (2017), ANSI/UL 61010-1 Ed.3 (2012),
NEMA 250:1991
Certificate number: FM19US0205
Nonincendive for Class I, Division 2, Groups A, B, C, D; Class II, Division 2, Groups F, G;
Class III, Division 1; Class I, Zone 2, Group IIC
Temperature Class: T4
Ambient temperature: –20 to 85°C (–4 to 185°F)
Enclosure: Type 4X

■ PHYSICAL SPECIFICATION

Housing Material:

For detail, refer to "MODEL AND SUFFIX CODES."

Weight:

260 g (0.57 lb)

Mounting:

Mounting on the measurement target using the screw *

*: Can also be mount using the magnetic holder supplied as an accessory. Note that, when using the magnetic holder, the vibration measurement frequency band drops.

9.2 Software Specifications

■ SUSHI SENSOR APP

This software is used to perform the setting and status check of this product via the NFC interface.

Operating Environment:

Item	Recommended System Requirements
OS	Android 5.1.1 or higher
CPU	Snapdragon 800 or equivalent or higher
Resolution	1280x720 dots or more
NFC	Reader, writer
GPS	Optional

Note of Available Android Device:

When using Sushi Sensor App to intrinsically safe explosion devices, the Android device must comply with the following.

- When using an NFC link in a non-hazardous area, the maximum magnetic field strength generated by the Android device is 18 A/m (r.m.s.) or less (Compliant with ISO / IEC 14443).
- When using an NFC link in a hazardous area, only an Android device confirmed by Yokogawa Electric Corporation can be used.
- If additional information and approvals for Android devices are required, contact a Yokogawa representative.

9.3 Model and Suffix Codes

Model	Suffix Codes	Description
XS770A[*1]	.....	Wireless Vibration Sensor
---	**-A**.....	Always A
Area	**2**	Europe EU868
	3	North America US915[*2]
	4	Malaysia, Singapore, Thailand AS923-1
	5	Australita AU915
	6	New Zealand AS923-1
	7	South Korea KR920
	9	Brazil AU915
	C.....	Indonesia AS923-2
	G.....	Argentina AU915
	H.....	Saudi Arabia, UAE EU868
Type	**00**	General Purpose[*3]
	K2.....	ATEX Intrinsic safety[*4]
	S2.....	IECEx Intrinsic safety[*5]
	F1	FM Nonincendive [*6]
	P1	Korea Energy-limited safety[*7]
	U1.....	INMETRO Intrinsic safety[*8]
---	**-A**.....	Always A
Housing material	**1**	Plastic (PBT), Stainless steel[*9]
	2	Plastic (PC), Stainless steel[*10]
Power supply	**C**.....	Battery powered (battery included)
---	**A**.....	Always A

*1: A hexagon socket set screw is attached.
*2: Conversion screw is included when area code is 3.
*3: Applicable when area code is 2 or 3.
*4: Applicable when area code is 2, 4, C or H. Area code H is Saudi Arabia only.
*5: Applicable when area code is 4, 5, 6, G or H.
*6: Applicable when area code is 3 and sales country is United States.
*7: Applicable when area code is 7.
*8: Applicable when area code is 9.
*9: Applicable when area code is 2, 4 or C.
*10: Applicable when area code is 3, 5, 6, 7, 9, G or H.

9.4 Optional Accessories

Item	Part Number	Description
Magnetic holder	F9096DA	Magnet for mounting (M6 female screw)
Hexagon socket set screw	B1137BS	Screw for mounting (M6)
Conversion screw	F9096CM	Screw for mounting (M6 to 1/4 28UNF) [*1]

*1: Conversion screw is attached when area code is 3.

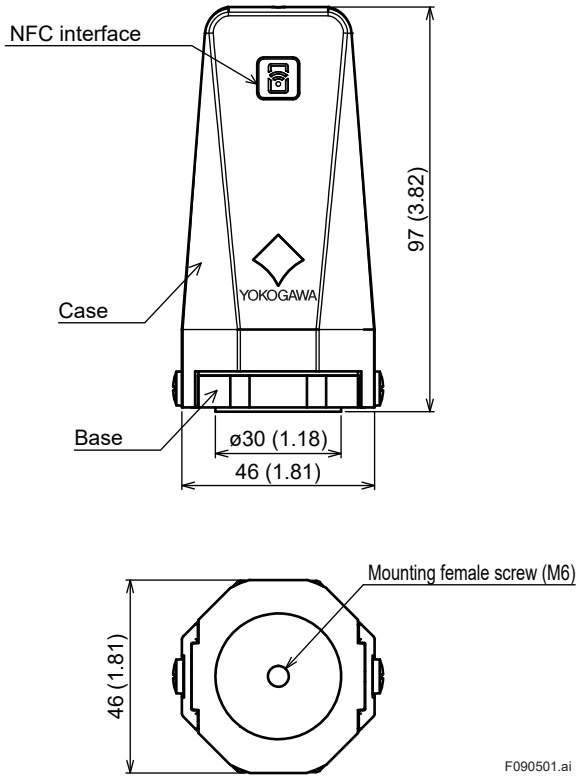
Model	Suffix Codes	Description
XS70BT[*1]	.....	Lithium battery
Battery type	**-A**.....	Dedicated battery for XS770A
---	**A**.....	Always A
Number of Unit	**-C004**	4 units
	-C012	12 units

*1: The XS70BT is a dedicated product (model: LS14500 C5SY) with a battery connector incorporated to SAFT battery.

9.5 Dimensions

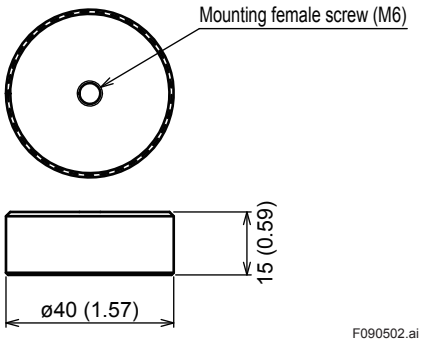
Main unit

Unit: mm (approx. inch)

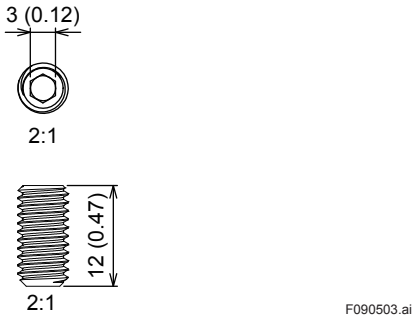


- **Magnetic holder**
  Parts No.: F9096DA

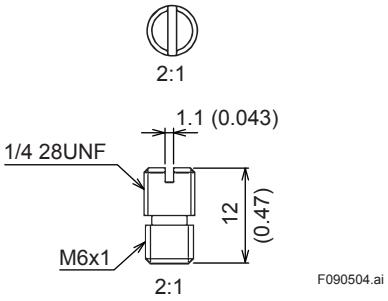
Unit: mm (approx. inch)



- **Hexagon socket set screw (M6)**
  Parts No.: B1137BS



- **Conversion screw*1 (M6 to 1/4 28UNF)**
  Parts No.: F9096CM



*1: Conversion screw is attached when area code is 3

Revision Information

Title : XS770A Wireless Vibration Sensor Functions
Manual No. : IM 01W06E01-11EN

Edition	Date	Page	Revised Item
1st	March, 2019	—	New issue
2nd	Aug. 2019	—	Add "Area code: 4" to Chapter 9
3rd	Nov. 2019	—	Add Item of Optional setting for North America Add Area code 3 to Chapter 9 Add Canadian Safety Standards
4th	Mar. 2020	— 64 66 —	The terms of "backup" and "restore" change to "export" and "import" 9.1 Révise altitude description 9.2 Fix MS Code description for type Add general Type at Kore and EU
5th	Jun. 2020	All	Add IECEx and FM Type Code
6th	Aug. 2020	16 49	Add transmission mode for KR Revised the license of Liblzg
7th	Oct. 2020	62, 64, 67	Add Indonesia
8th	Dec. 2020	62, 64, 67	Add Brazil, Chile and Argentina
9th	May 2021	Cover, 1 16, 17 62, 64, 67	Add manual revision policy Changed the description from region to channel plan. Add Saudi Arabia and UAE.