

**User Manual**

# WISE-2410

## LoRaWAN Smart Condition Monitoring Sensor

**ADVANTECH**

*Enabling an Intelligent Planet*

---

## Copyright

The documentation and the software included with this product are copyrighted 2020 by Advantech Co., Ltd. All rights are reserved. Advantech Co., Ltd. also reserves the right to improve the products described in this manual at any time without notice. No part of this manual may be reproduced, copied, translated, or transmitted in any form or by any means without the prior written permission of Advantech Co., Ltd. The information provided in this manual is intended to be accurate and reliable. However, Advantech Co., Ltd. assumes no responsibility for its use, nor for any infringements of the rights of third parties that may result from its use.

## Acknowledgements

Intel and Pentium are trademarks of Intel Corporation.

Microsoft Windows and MS-DOS are registered trademarks of Microsoft Corp.

All other product names or trademarks are properties of their respective owners.

## Product Warranty (2 years)

Advantech warrants the original purchaser that each of its products will be free from defects in materials and workmanship for two years from the date of purchase.

This warranty does not apply to any products that have been repaired or altered by persons other than repair personnel authorized by Advantech, or products that have been subject to misuse, abuse, accident, or improper installation. Advantech assumes no liability under the terms of this warranty as a consequence of such events.

Because of Advantech's high quality-control standards and rigorous testing, most customers never need to use our repair service. If an Advantech product is defective, it will be repaired or replaced free of charge during the warranty period. For out-of-warranty repairs, customers are billed according to the cost of replacement materials, service time, and freight. Please consult your dealer for more details.

If you believe your product is defective, follow the steps outlined below.

1. Collect all the information about the problem encountered. (For example, CPU speed, Advantech products used, other hardware and software used, etc.) Note anything abnormal and list any onscreen messages displayed when the problem occurs.
2. Call your dealer and describe the problem. Please have your manual, product, and any helpful information readily available.
3. If your product is diagnosed as defective, obtain a return merchandise authorization (RMA) number from your dealer. This allows us to process your return more quickly.
4. Carefully pack the defective product, a completed Repair and Replacement Order Card, and proof of the purchase date (such as a photocopy of your sales receipt) into a shippable container. Products returned without a proof of purchase date are not eligible for warranty service.
5. Write the RMA number clearly on the outside of the package and ship the package prepaid to your dealer.

Part No. 2003240000

Printed in Taiwan

Edition 1

February 2020

# Declaration of Conformity

## FCC Class B

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

## Technical Support and Assistance

1. Visit the Advantech website at [www.advantech.com/support](http://www.advantech.com/support) to obtain the latest product information.
2. Contact your distributor, sales representative, or Advantech's customer service center for technical support if you need additional assistance. Please have the following information ready before calling:
  - Product name and serial number
  - Description of your peripheral attachments
  - Description of your software (operating system, version, application software, etc.)
  - A complete description of the problem
  - The exact wording of any error messages

### FCC WARNING STATEMENT

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

Radiation Exposure Statement:

This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body.

---

## Warnings, Cautions, and Notes

**Warning!** Warnings indicate conditions that if not observed may cause personal injury!



**Caution!** Cautions are included to help prevent hardware damage or data losses. For example, “Batteries are at risk of exploding if incorrectly installed. Do not attempt to recharge, force open, or heat the battery. Replace the battery only with the same or equivalent type as recommended by the manufacturer. Discard used batteries according to the manufacturer’s instructions.”



**Note!** Notes provide additional optional information.



## Document Feedback

To assist us with improving this manual, we welcome all comments and constructive criticism. Please send all feedback in writing to [support@advantech.com](mailto:support@advantech.com).

## Packing List

Before setting up the system, check that the items listed below are included and in good condition. If any item does not accord with the table, please contact your dealer immediately.

### **WISE-2410**

- 1 x WISE-2410 module
  - 1 x Mounting stud (1/4-28 UNF x 9.4Lmm)
  - 1 x Quick start manual
- \* 2 pcs AA 3.6VDC batteries should be ordered respectively.  
\* Built-in Antenna.

## Safety Instructions

1. Read these safety instructions carefully.
2. Retain this user manual for future reference.
3. For pluggable equipment, the power outlet socket must be located near the equipment and easily accessible.
4. Place the equipment on a reliable surface during installation. Dropping or letting the equipment fall may cause damage.
5. Ensure that the voltage of the power source is correct before connecting the equipment to a power outlet.
6. All cautions and warnings on the equipment should be noted.
7. If the equipment is not used for a long time, disconnect it from the power source to avoid damage from transient overvoltage.
8. Never pour liquid into an opening. This may cause fire or electrical shock.
9. Never open the equipment. For safety reasons, the equipment should be opened only by qualified service personnel.
10. If one of the following occurs, have the equipment checked by qualified service personnel:
  - The USB port is damaged.
  - Liquid has penetrated the equipment.
  - The equipment has been exposed to moisture.
  - The equipment is malfunctioning, or does not operate according to the user manual.
  - The equipment has been dropped and damaged.
  - The equipment shows obvious signs of breakage.
11. Do not leave the equipment in an environment with a storage temperature of below -20 °C (-4 °F) or above 85 °C (185 °F) USB powered/50 °C (122 °F)
12. Battery powered as this may cause damage. The equipment should be kept in a controlled environment.
13. CAUTION: Batteries are at risk of exploding if incorrectly replaced. Replace only with the same or equivalent type as recommended by the manufacturer. Discard used batteries according to the manufacturer's instructions.
14. According to IEC 704-1:1982 standards, the sound pressure level at the operator's position does not exceed 70 dB (A).

DISCLAIMER: These instructions are provided in accordance with IEC 704-1. Advantech disclaims all responsibility for the accuracy of any statements contained herein.

## Safety Precautions - Static Electricity

Follow these simple precautions to protect yourself from harm and the products from damage.

- Disconnect the power supply before making any configuration changes. The sudden rush of power after connecting a jumper or installing a card may damage sensitive electronic components.

## NCC 警语

第十二條 經型式認證合格之低功率射頻電機，非經許可，公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。

第十四條 低功率射頻電機之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。前項合法通信，指依電信法規定作業之無線電通信。低功率射頻電機須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。

## VCCI

この装置は、クラス B 機器です。この装置は、住宅環境で使用することを目的としていますが、この装置がラジオやテレビジョン受信機に近接して使用されると、受信障害を引き起こすことがあります。

使用説明書に従って正しい取り扱いをして下さい。

VCCI-B



# Contents

<b>Chapter 1</b>	<b>Product Overview .....</b>	<b>1</b>
1.1	Series Family and Specifications .....	2
1.2	Features .....	2
1.3	System Architecture .....	2
	Figure 1.1 System Architecture .....	2
1.4	Mechanical Design and Dimensions .....	3
	Figure 1.2 WISE-2410 Dimension .....	3
1.5	LED .....	3
	Figure 1.3 LED.....	3
<b>Chapter 2</b>	<b>Product Specification.....</b>	<b>5</b>
2.1	Wireless Interface .....	6
2.2	General .....	6
2.3	Power .....	7
2.4	Software .....	7
2.5	Configuration Interface.....	7
2.6	Sensor Specifications.....	7
<b>Chapter 3</b>	<b>Mechanical and Hardware Installation</b>	<b>9</b>
	<b>.....</b>	<b>9</b>
3.1	Interface Introduction .....	10
	Figure 3.1 WISE-2410 Interface Introduction .....	10
3.2	Tighten two chassis.....	10
	Figure 3.2 Tighten two chassis .....	10
3.3	Mounting .....	11
3.3.1	Installation Direction.....	11
	Figure 3.3 WISE-2410 Installation Direction on motor.....	11
	Figure 3.4 WISE-2410 Detail Installation Direction on motor ....	11
3.3.2	Stud mount.....	12
	Figure 3.5 Stud mount .....	12
	Figure 3.6 Stud mount .....	12
3.3.3	Magnetic bases.....	12
	Figure 3.7 Magnetic bases .....	12
3.3.4	Adhesive Mounting Pad.....	13
	Figure 3.8 Adhesive Mounting Pad.....	13
3.4	Battery Replacement.....	13
	Figure 3.9 Battery Replacement Step1.....	13
	Figure 3.10 Battery Replacement Step 2.....	13
	Figure 3.11 Battery Replacement Step 3.....	14
	Figure 3.12 Battery Replacement Step3.....	14
	Figure 3.13 Battery Replacement Step4.....	14
	Figure 3.14 Battery Replacement Step5.....	15
	Figure 3.15 Battery Replacement Step6.....	15
<b>Chapter 4</b>	<b>System Configuration .....</b>	<b>17</b>
4.1	Sensor and Gateway Connections.....	18
4.1.1	Sensor (WISE-2410) configuration .....	18
4.1.2	LoRaWAN gateway (WISE-6610) configuration .....	20

	4.1.3	Binding Process Between WISE-2410 and WISE-6610 .....	22
4.2		WISE-2410 Configuration .....	28
	4.2.1	Information Page .....	28
	4.2.2	Configuration .....	29
	4.2.3	IO Status.....	30
	4.2.4	Data Logger .....	32
	4.2.5	Diagnostician .....	34
4.3		Get Raw Data from WISE-2410 .....	34
	4.3.1	Standard operation mode .....	35
	4.3.2	Real-Time operation mode .....	36

## **Appendix A**      **WISE LPWAN Payload Format..... 37**

A.1		LoRaWAN - Frame Payload .....	38
	A.1.1	WHDR Header.....	38
	A.1.2	WPayload .....	39
	A.1.3	WCRC.....	39
	A.1.4	Sensor data (I/O Type: 0x5) .....	39
	A.1.5	Device data (I/O Type: 0x6).....	42
A.2		Packet Fragmentation and Reassembly .....	43

## **Appendix B**      **Modbus address ..... 45**

# Chapter 1

Product Overview

## 1.1 Series Family and Specifications

Function	Model	Description
LoRaWAN Smart Condition Monitoring Sensor	WISE-2410	Built-in 3 axis vibration and temperature sensor; Built-in antenna, support LoRaWAN

## 1.2 Features

### WISE-2410

- Built-in 3 axis vibration and temperature sensor
- Provide 3 axis vibration features(Velocity RMS, acceleration peak, etc.)
- Compliant with ISO 10816: WISE-2410 can directly provide vibration features. By simple setting, user can monitor machine motor for evaluation of vibration severity
- Built-in antenna, support LoRaWAN
- Powered by battery or USB port
- IP66 enclosure

## 1.3 System Architecture

WISE-2410 transmits sensor data to WISE-6610(via LoRaWAN) or 3rd party LoRaWAN gateway (via LoRaWAN). WISE-6610 provides Ethernet connectivity, and supports Modbus TCP, RESTful Web API for integration.

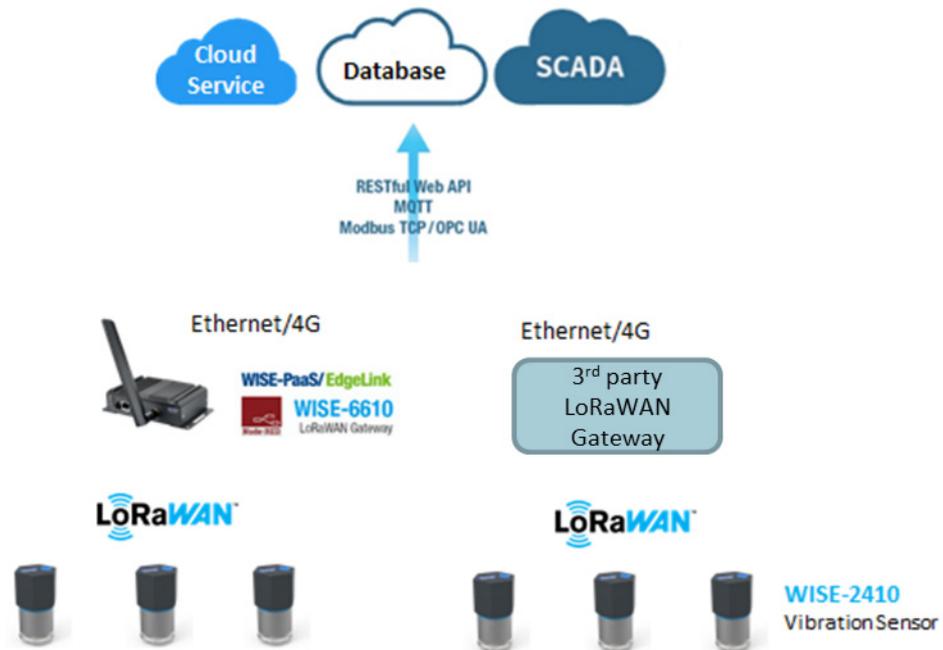


Figure 1.1 System Architecture

## 1.4 Mechanical Design and Dimensions

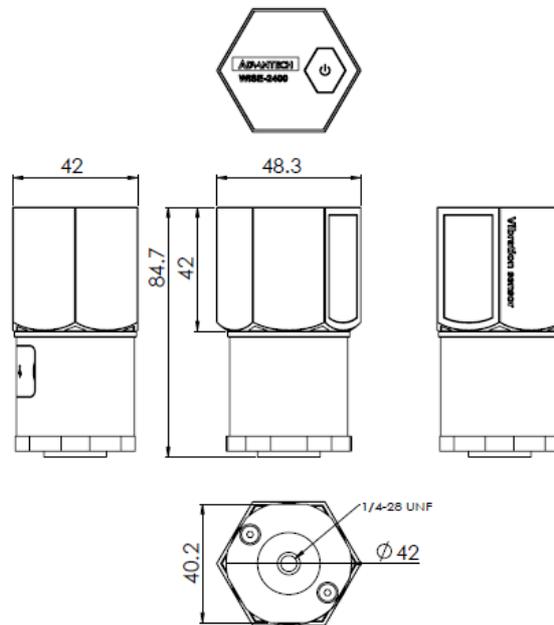


Figure 1.2 WISE-2410 Dimension

## 1.5 LED



Figure 1.3 LED

LED	Color	Indication	Behavior
Status	Green	ON	Turn on 2 sec when power on
			Turn on 1 ms when RF transmission completely
		OFF	Idle



# Chapter 2

Product Specification

## 2.1 Wireless Interface

1. Operating Frequency  
US 902-928 (MHz)  
EU 863-870 (MHz)
2. Data Rate:  
50 kbps at FSK mode EU  
21.9 kbps at SF7 mode US  
5.47 kbps at SF7 mode JP  
5.47 kbps at CCS mode TW
3. Antenna Gain  
- 902~928MHz: 1dBi  
- 863~870MHz: 1dBi
4. Transmit Power: Up to +20dBm
5. Receiver Sensitivity: -136 dBm at 125kHz bandwidth
6. Topology: Star

**Note!** *The transmitting distance is subject to the environment of application site. Please perform site survey to determine the set up range of the wireless network*



## 2.2 General

- Enclosure: PC
- Mounting: Stud mount, mounting pad and adhesives, magnetic base
- Dimensions (Height x Diameter): 84.7 x 48.3 mm
- Operation temperature:
  - Powered by batteries: -20~50°C
  - Powered by Micro-B USB cable: -20~85°C
- Storage temperature: -30~85°C(without battery)
- Operating humidity: 10~95% RH (non-condensing)
- Storage humidity: 5~95% RH (non-condensing)

**Note!** *Equipment will operate below 30% humidity. However, static electricity-problems occur much more frequently at lower humidity levels. Make sure you take adequate precautions when you touch the equipment. Consider using ground straps, anti-static floor coverings, etc. if you use the equipment in low humidity environments.*



## 2.3 Power

WISE-2410 is designed for two AA 3.6VDC batteries as an power source. Press the power switch on the top of chassis (see the Figure 1.3 led) and turn on WISE-2410.

**Note!** *Battery needs to order separately*  
1760002647-01 3.6V/2500mAh AA Cylindrical Battery (nonrechargeable)



## 2.4 Software

Utility: WISE Studio

## 2.5 Configuration Interface

### WISE-2410

- Interface: COM port through Micro-B USB interface
- Connector: Micro-B USB
- USB chipset: Silicon Labs CP210x
- Driver: CP210x USB to UART Bridge VCP Drivers (<https://www.silabs.com/products/development-tools/software/usb-to-uart-bridge-vcp-drivers>)

## 2.6 Sensor Specifications

### Vibration Sensor

- Axis: X-Y-Z
- Frequency Range: 10~1000Hz
- Amplitude Range:  $\pm 16g$
- Detection type: Velocity RMS, Acceleration (RMS & peak)  
Advanced: Kurtosis, Crest factor, Skewness, Standard deviation
- Resolution: 10 bit
- Sensitivity: 31.2mg/LSB (TYP.)
- Noise:  $\pm 150mg$  (MAX. TA = 25°C. 0g)

### Temperature Sensor

- Operation temperature range:  
Powered by batteries: -20~50°C  
Powered by Micro-B USB cable: -20~85°C
- Resolution: 12 bit
- Accuracy:  $\pm 2^\circ C$



# Chapter 3

Mechanical and  
Hardware Installation

## 3.1 Interface Introduction

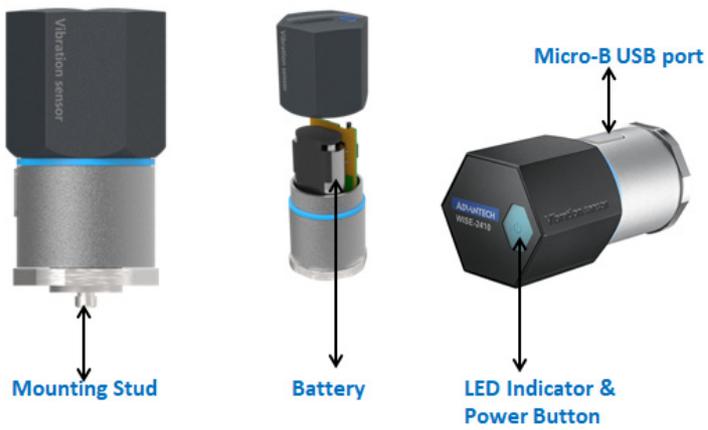


Figure 3.1 WISE-2410 Interface Introduction

## 3.2 Tighten two chassis

Turn clockwise the top chassis to locking point to tighten bottom chassis.

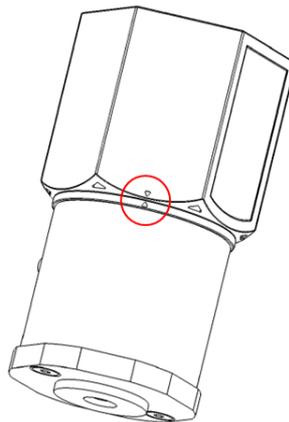


Figure 3.2 Tighten two chassis

## 3.3 Mounting

Applicable installation methods are briefly described in the following sections.

### 3.3.1 Installation Direction

WISE-2410 Builds-in 3-axis vibration sensor. Please follow the following installation guide to make sure the eigenvalues from your device are correct.

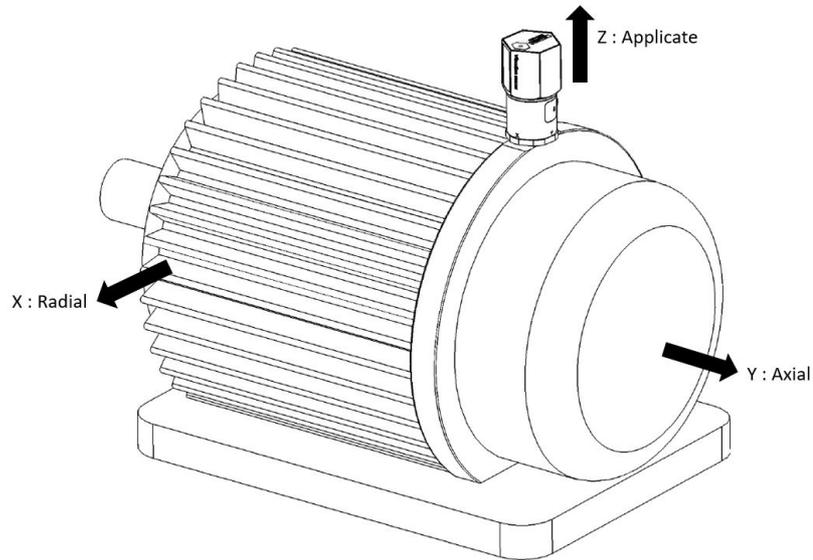


Figure 3.3 WISE-2410 Installation Direction on motor

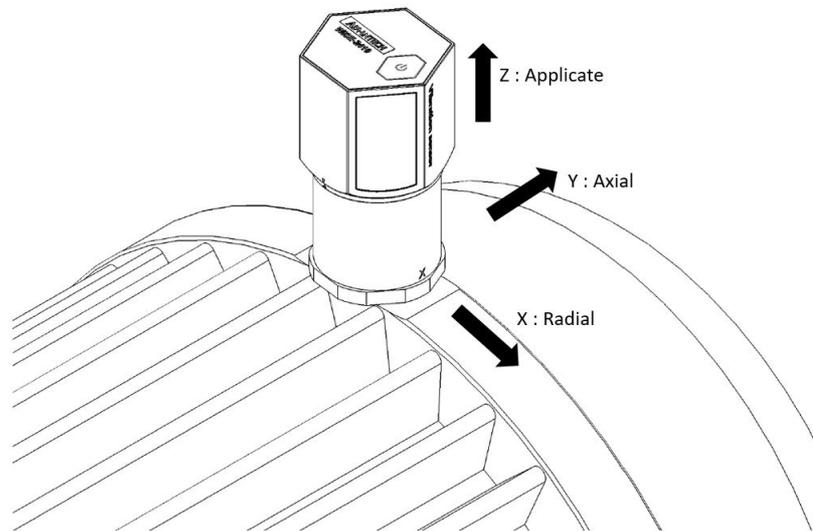
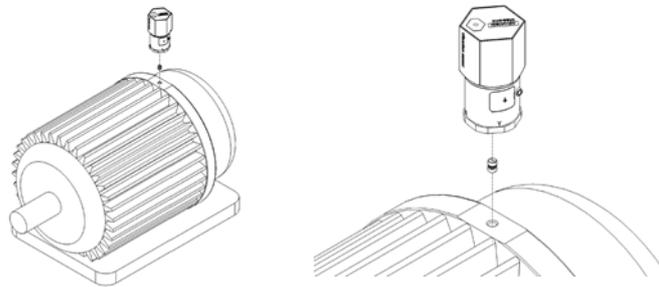


Figure 3.4 WISE-2410 Detail Installation Direction on motor

### 3.3.2 Stud mount

Dig a hole in motor surface(1/4-28).

Fasten WISE-2410 and stud(1/4-28 to 1/4-28).



**Figure 3.5 Stud mount**

Fasten WISE-2410(with stud) and hold of motor surface.

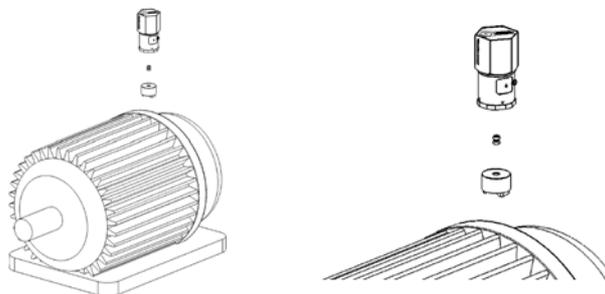
**Note!** Please Wrench need to hold base steel (not contact chassis) when you use Wrench to fasten WISE-2410(with stud) to hold of motor.



**Figure 3.6 Stud mount**

### 3.3.3 Magnetic bases

Fasten WISE-2410 and stud, and then fasten WISE-2410(with stud) and magnetic bases.



**Figure 3.7 Magnetic bases**

### 3.3.4 Adhesive Mounting Pad

Fasten WISE-2410 and stud, use adhesive epoxy glue(24hours) to stick on the motor surface.

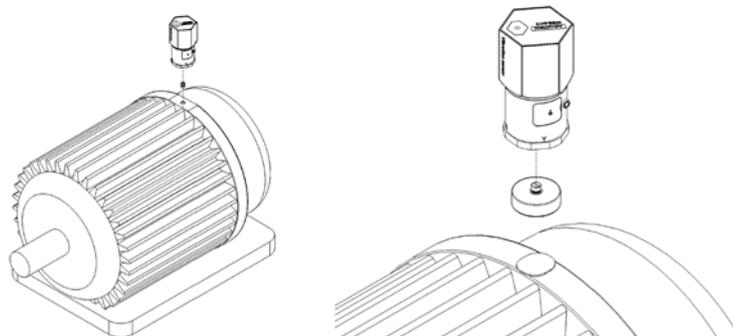


Figure 3.8 Adhesive Mounting Pad

## 3.4 Battery Replacement

1. Slowly remove top chassis



Figure 3.9 Battery Replacement Step 1

2. Unplug and remove battery pack and its connector



Figure 3.10 Battery Replacement Step 2

3. Plug in new battery and make sure the anode and cathod



**Figure 3.11 Battery Replacement Step 3**



**Figure 3.12 Battery Replacement Step3**

4. Plug in the connector of battery pack



**Figure 3.13 Battery Replacement Step4**

5. Plug in the battery pack, please be carefully the cables. You can arrange cable by inserting cable in the inner chassis seal(yellow square as below picture)



**Figure 3.14 Battery Replacement Step5**

6. Slowly and carefully close the top chassis, and avoid the cables.



**Figure 3.15 Battery Replacement Step6**

**Note!** Please be careful for inserting cables and close the top chassis.





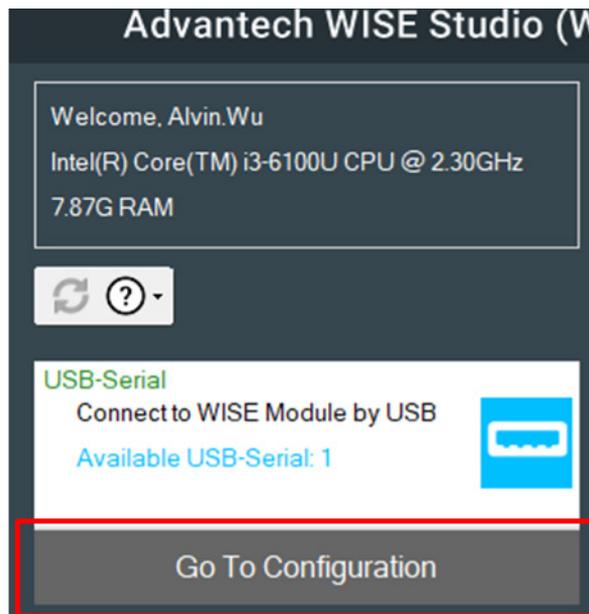
# Chapter 4

## System Configuration

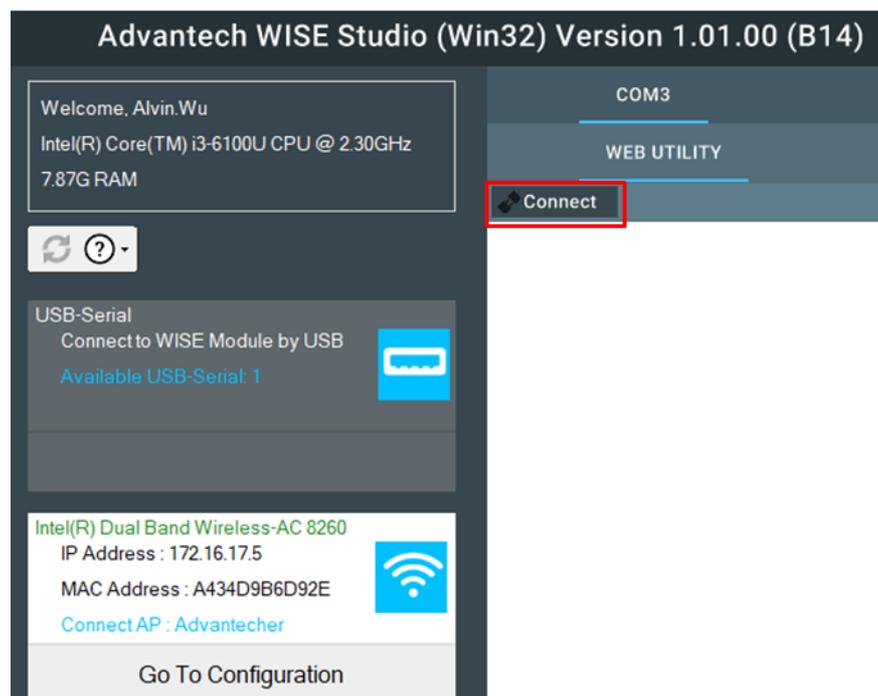
## 4.1 Sensor and Gateway Connections

### 4.1.1 Sensor (WISE-2410) configuration

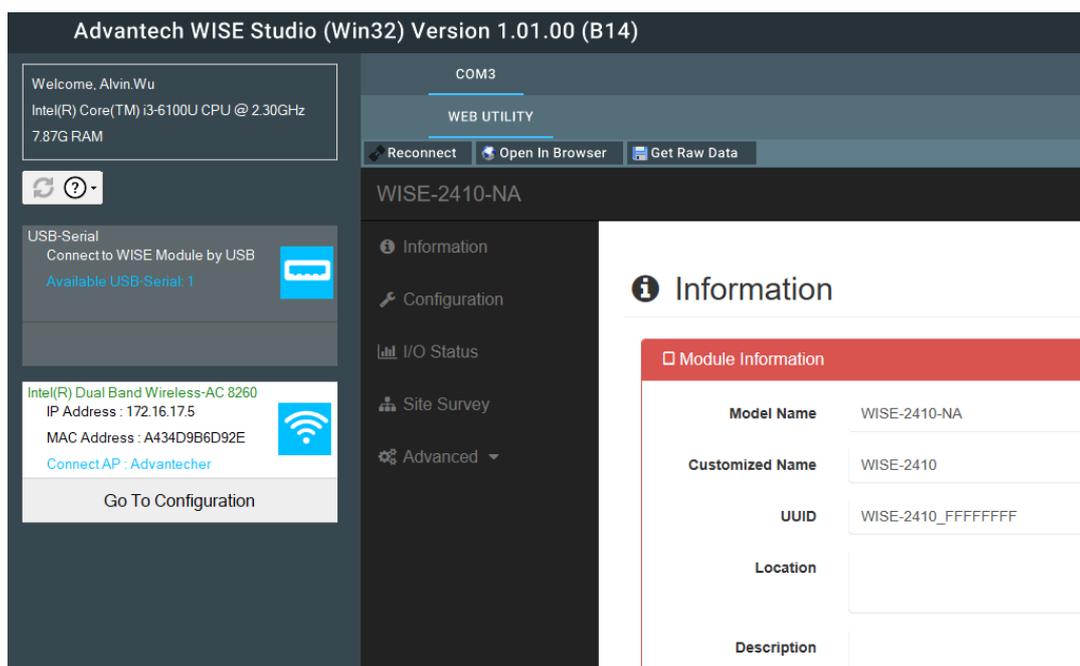
1. Download and install WISE Studio through [https://support.advantech.com/support/new\\_default.aspx](https://support.advantech.com/support/new_default.aspx).
2. Connect the module to your computer via the micro-USB port.
3. Execute WISE Studio.
4. Clicking **Go to Configuration** while it shows "available USB-Serial" in USB-Serial box, press Go To Configuration.



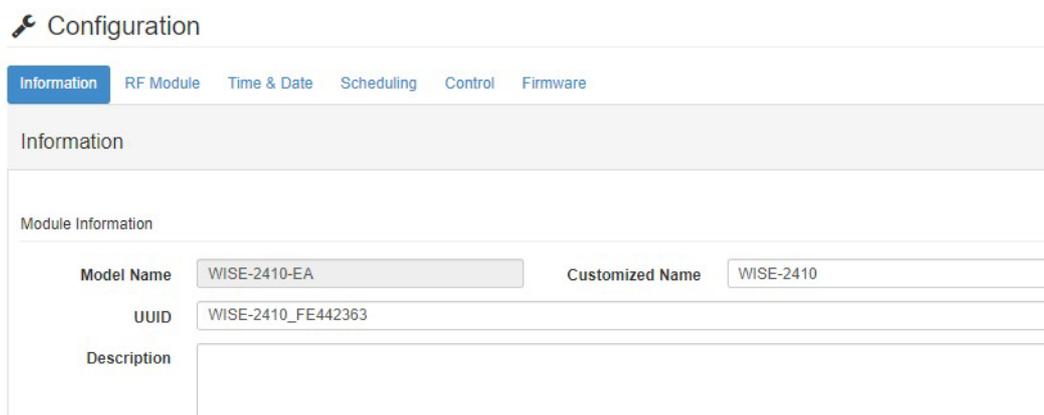
5. Click **Connect** to link the WISE-2410 and the web configuration page will appear.



- Use web configuration in WISE Utility or press Open In Browser to open the web configuration in any browser (Google Chrome is recommended).



- Click **Information** to check the basic information of the module.
- Click **Configuration** to use Information, RF Module, Time&Date, Scheduling, Control, Firmware settings.



- Click **IO Status** to check vibration and temperature data.

The screenshot shows the 'IO Status' page for the WISE-2410-EA device. The left sidebar has 'IO Status' selected. The main content area is titled 'IO Status' and has a 'Sensor' tab. The page displays a table of sensor metrics and a table of channel configurations.

Metric	Value
Velocity RMS (mm/s)	0.21
Acceleration Peak (g)	0.07
Acceleration RMS (g)	0.02
Kurtosis	0.00
Crest factor	0.00
Skewness	0.00
Standard deviation	0.00

Channel	Status	Range	Value	Unit
0	Enable	X Accelerometer	0.21,0.07,0.02,0.0,0.0,0	mm/s, g, g
1	Enable	Y Accelerometer	0.25,0.081,0.021,0,0,0,0	mm/s, g, g
2	Enable	Z Accelerometer	0.22,0.073,0.024,0,0,0,0	mm/s, g, g
3	Enable	Temperature	24.562	°C

#### 4.1.2 LoRaWAN gateway (WISE-6610) configuration

- Default ID of WISE-6610 is 192.168.1.1
- Login-  
Username: root  
Password: root

The screenshot shows the 'Login' page for the WISE-6610 gateway. The page has a blue header 'Login' and two input fields: 'Username' with 'root' and 'Password' with '\*\*\*\*'. A 'Login' button is at the bottom.

You can see the main page of Router; you can change IP in **LAN** if needed.

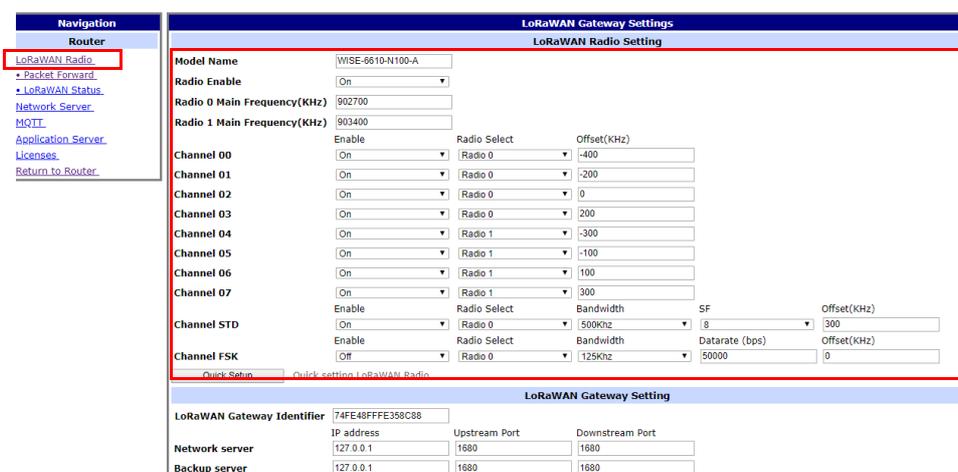
The screenshot shows the 'SmartStart LAN Router' configuration page. The page has a sidebar with 'LAN' selected under the 'Configuration' section. The main content area is titled 'Primary LAN Configuration' and shows various settings for IPv4 and IPv6.

Setting	IPv4	IPv6
DHCP Client	disabled	disabled
IP Address	192.168.1.1	
Subnet Mask / Prefix	255.255.255.0	
Default Gateway		
DNS Server		
Bridged	no	
Media Type	auto-negotiation	
<input checked="" type="checkbox"/> Enable dynamic DHCP leases		
IP Pool Start	192.168.1.10	
IP Pool End	192.168.1.254	
Lease Time	600	600 sec

3. LoRaWAN setting  
Step1: Choose **User Modules** and **LoRaWAN Gateway**.



You can see WISE-6610N100-A (Support NA frequency band), make sure all of these parameters are matching with the RF module setting on WISE-2410.



If you want to know any items' description, you can refer WISE-6610 user manual.

A new tab will pop-up after click on **Network Server (http)**.



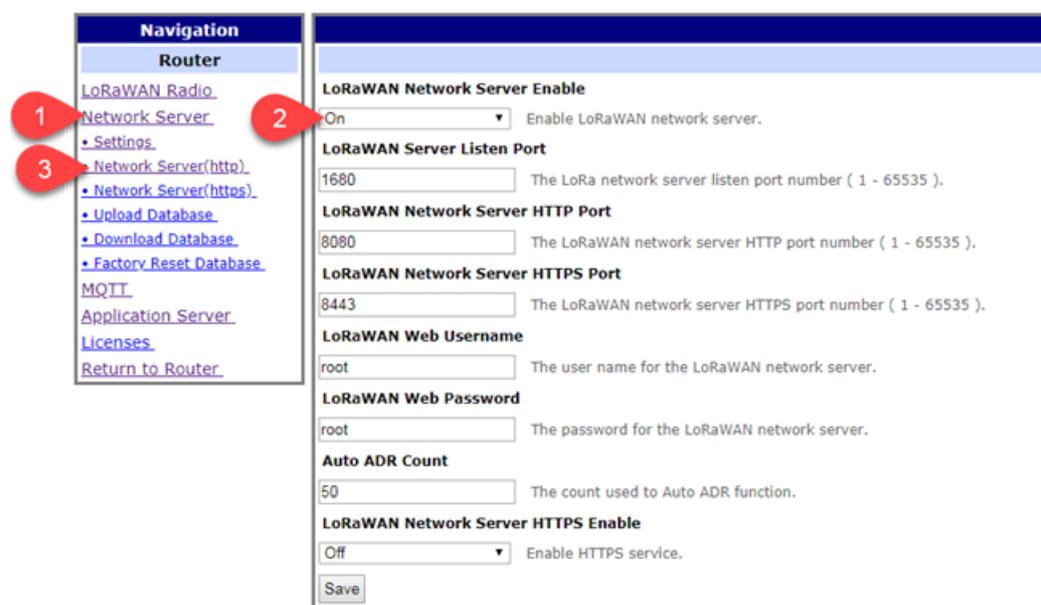
Account: root  
Password: root



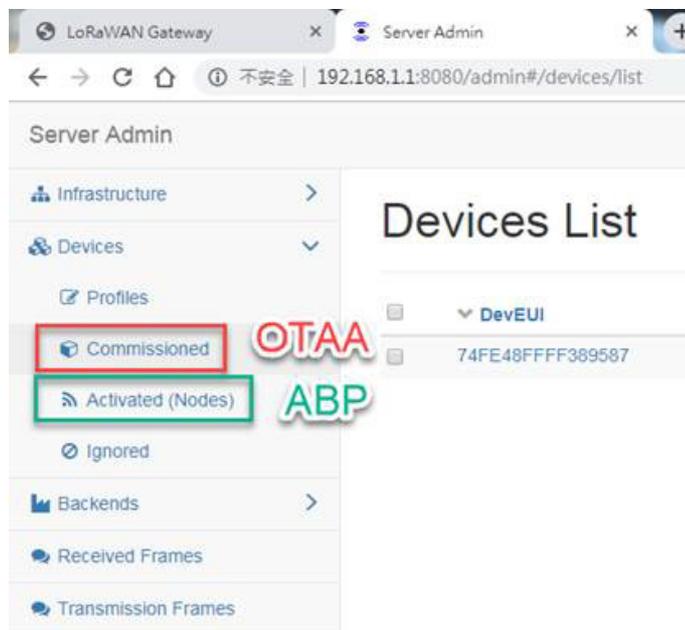
### 4.1.3 Binding Process Between WISE-2410 and WISE-6610

This section will guide you to setup the connection between WISE-2410 and WISE-6610.

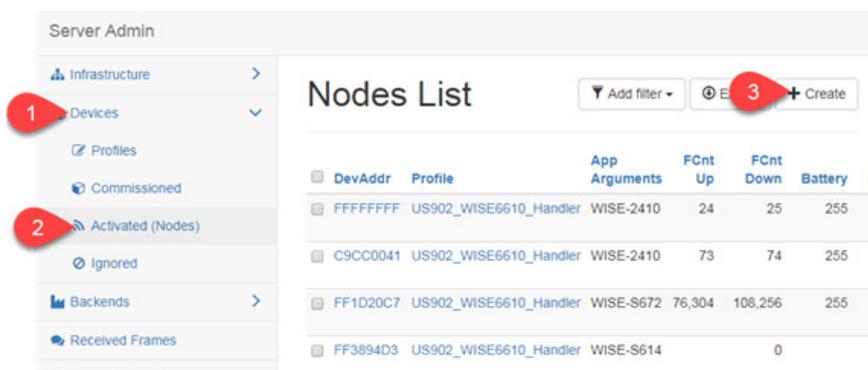
1. Enter the "Network Server (http)" in WISE-6610 gateway as follow.

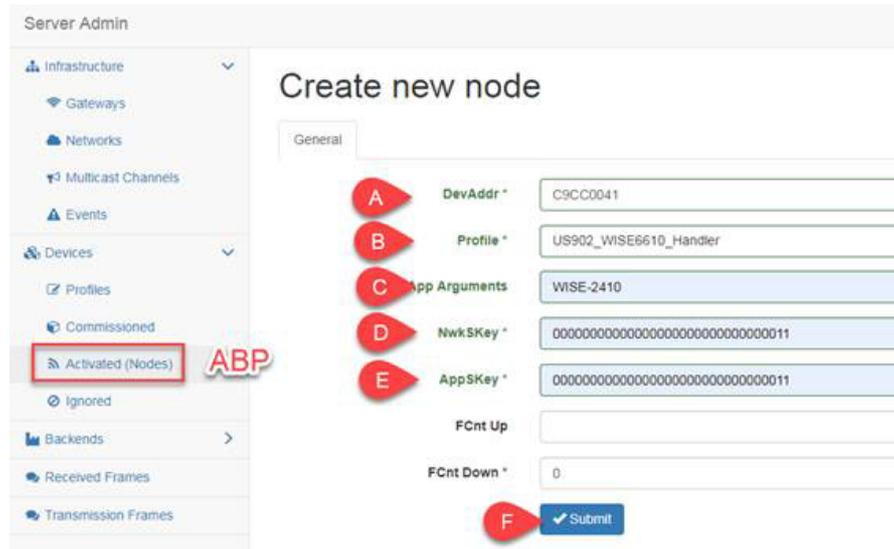


2. Create an end node device according the OTAA or ABP method. The following flow will use ABP mode for description the binding process.  
 Note: If select "Commissioned", which means the node will use OTAA mode for connecting with a gateway.  
 Note: If select "Active Nodes", which means the node will use ABP mode for connecting with a gateway.

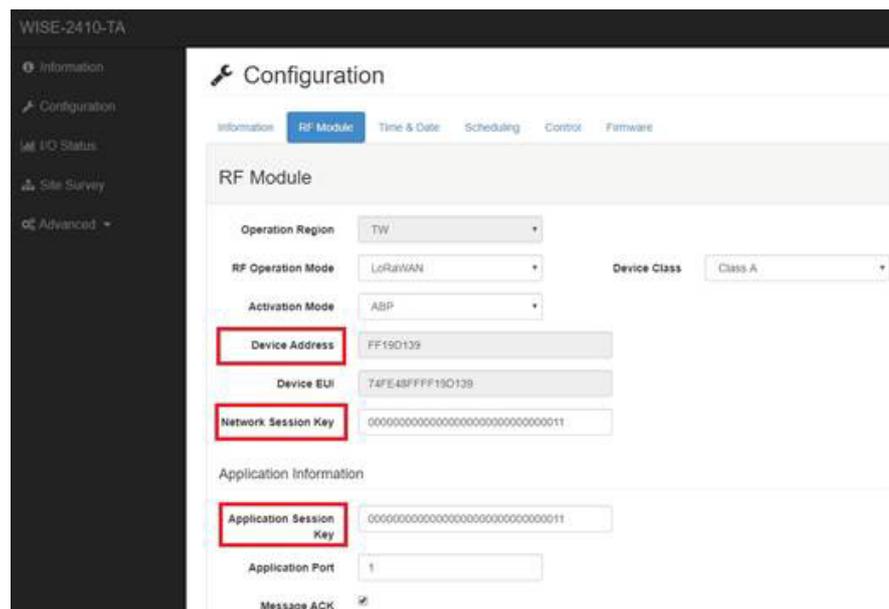


3. Click "Device" > "Activated (Nodes)" > "+ Create"

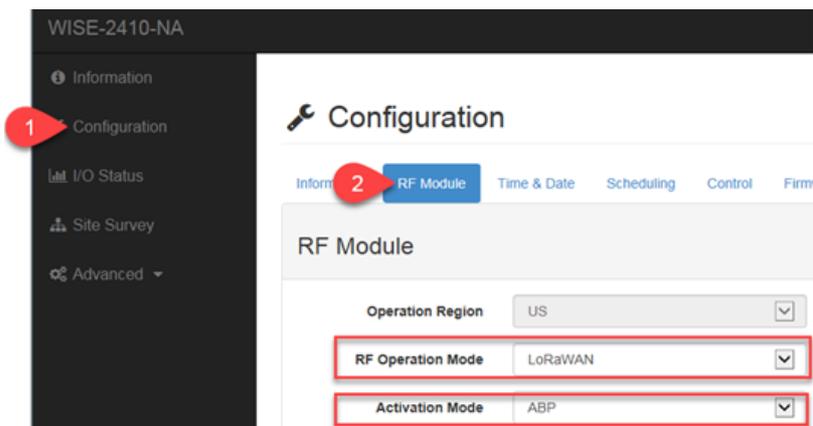




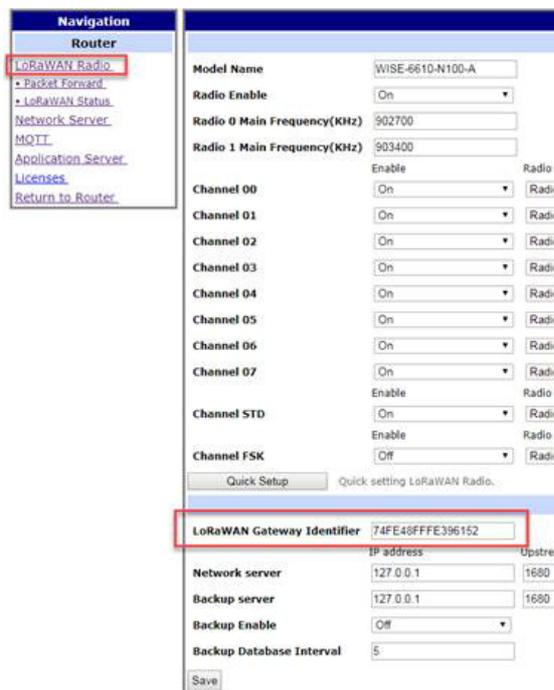
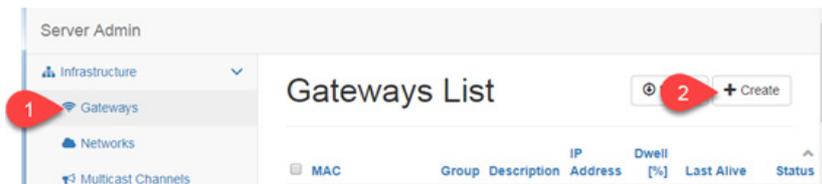
- A. DevAddr: the device address of an end node.  
Copy-pate "Device Address" from WISE-2410 "RF module" tab.
- B. Profile: select the model name of the WISE-6610 which used for Network Server role.  
In this demo, a US version is used to connect with WISE-2410NA version.
- C. App Arguments: the I/O board of the end node.  
In this demo, a WISE-2410 is used.
- D. NwkSKey: the network service key address of an end node.  
Copy-pate "Networks Session Key" from WISE-2410 "RF module" tab.
- E. AppSKey: the application service key of an end node.  
Copy-pate "Networks Session Key" from WISE-2410 "RF module" tab.
- F. Click on "save" to finish the setting.

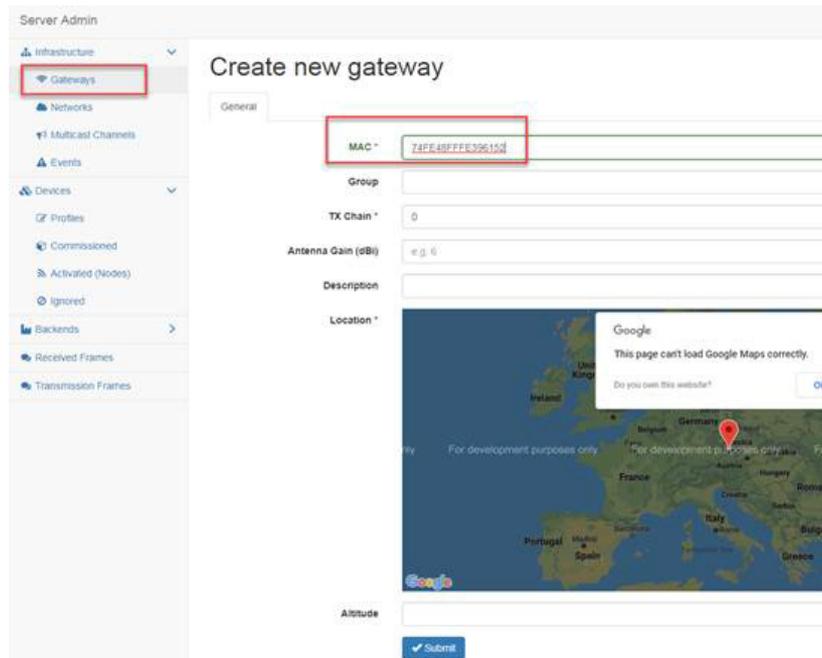


4. Back to WISE-2410 configuration setting page. Click "Configuration" > "RF Module" and choose "LoRaWAN" for RF operation mode setting on WISE-2410.



5. Create a "network server" gateway. Copy-paste the MAC address from "LoRaWAN radio" > "LoRaWAN Gateway Identifier". Then click on "submit".



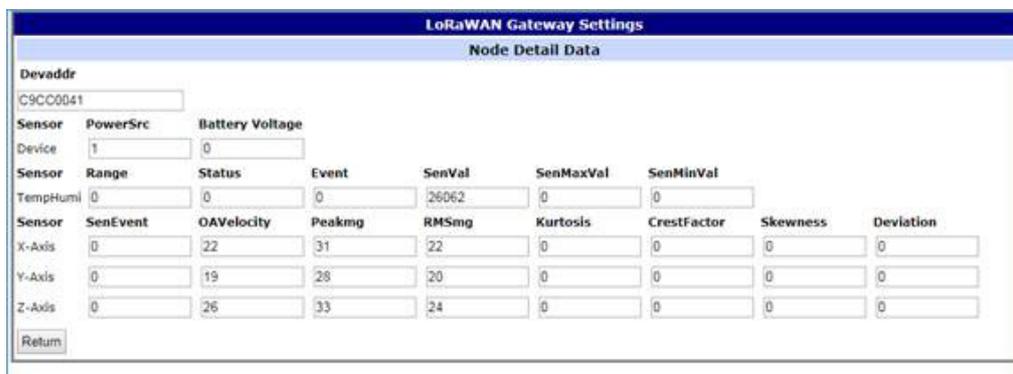


6. Connection Verify.

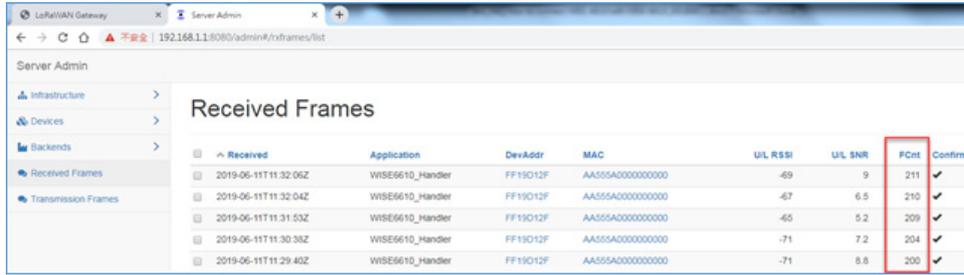
A. Click "Application Server" > "Status". Here shows the end nodes if packets are received by gateway from an end node.



B. Click "Detail". The gateway will help to pre-parsing the data payload if the "App Arguments" input correctly.



C. Users can also access into "Network Server (http)". The "Received frames" page shows the received results. The "FCnt" shows the frame sequence. If this sequence is in-continuously, means some of the packets were lost.



Received	Application	DevAddr	MAC	Upl RSSI	Upl SNR	FCnt	Confirm
2019-06-11T11:32:06Z	WISE610_Hander	FF19D12F	AA555A0000000000	-69	9	211	✓
2019-06-11T11:32:04Z	WISE610_Hander	FF19D12F	AA555A0000000000	-67	6.5	210	✓
2019-06-11T11:31:53Z	WISE610_Hander	FF19D12F	AA555A0000000000	-65	5.2	209	✓
2019-06-11T11:30:38Z	WISE610_Hander	FF19D12F	AA555A0000000000	-71	7.2	204	✓
2019-06-11T11:29:40Z	WISE610_Hander	FF19D12F	AA555A0000000000	-71	8.8	200	✓

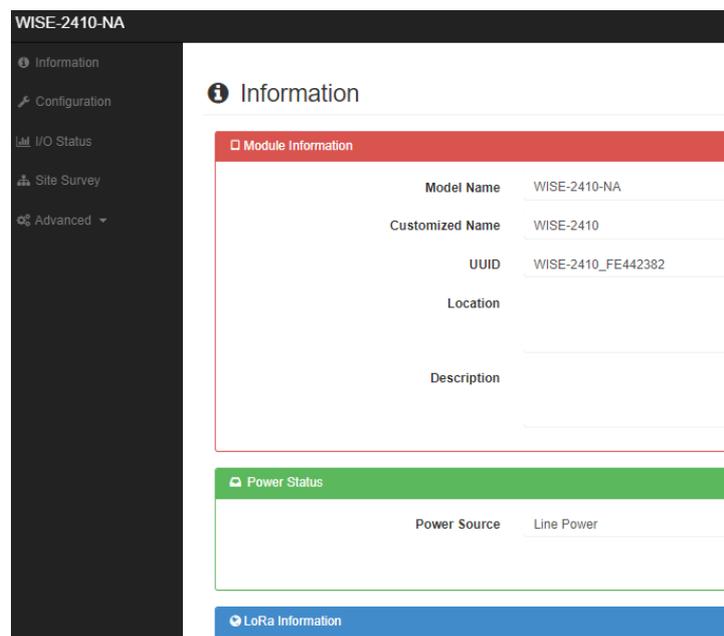
## 4.2 WISE-2410 Configuration

All functions of WISE Studio for WISE-2410 is below:

System	Function Item	Functional Description	
WISE Studio	Information	Display module name, Network status, Power status, Firmware version.	
	Configuration	<ul style="list-style-type: none"> <li>■ Module Information</li> <li>■ RF related setting</li> <li>■ Date/time, time zone settings</li> <li>■ Schedule of when sensor should start measurement</li> <li>■ System restart or reset to default</li> <li>■ Firmware download</li> </ul>	
		<ul style="list-style-type: none"> <li>■ Display values which is measured by sensors. Include following types:               <ul style="list-style-type: none"> <li>– X Accelerometer</li> <li>– Y Accelerometer</li> <li>– Z Accelerometer</li> <li>– Temperature</li> </ul> </li> <li>■ Sensor related settings</li> </ul>	
		Site Survey	Site Survey Tool for testing the communication quality between WISE-2410 wireless module with gateway.
		Data Logger	<ul style="list-style-type: none"> <li>■ Configurations of which channel, which type of sensor values to log data in module.</li> <li>■ Query log data stored in module.</li> </ul>
		Diagnostician	To display any errors detected by module
	Get Raw Data	Query raw data which is measured by vibration sensor.	

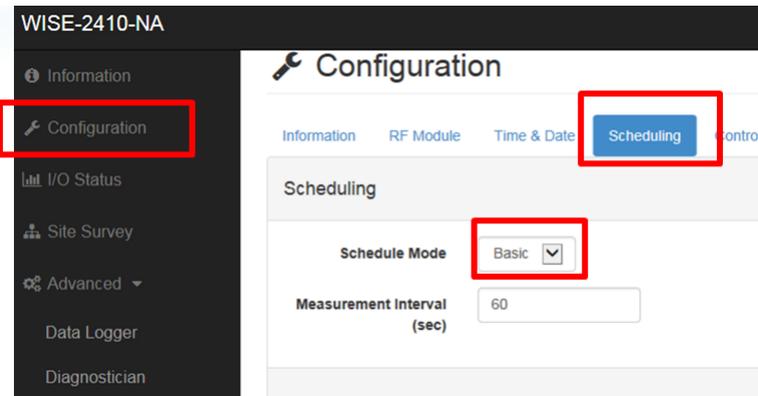
### 4.2.1 Information Page

Information page is displayed Module Information, Power Status, LoRa Information, Device Information.





- Scheduling: Data reports interval setting with optional weekly scheduling setting Based on application scenario, user can set scheduling of WISE-2410.
    - Mode: Basic/Advance
    - Day: Mask for Sunday ~ Saturday
    - Start time: 00: 00 ~ 23: 59
    - End time: 00: 00 ~ 23: 59
    - Periodic interval: 10 ~ 86400 (sec)
- Scenario A: Sensing target every minutes.

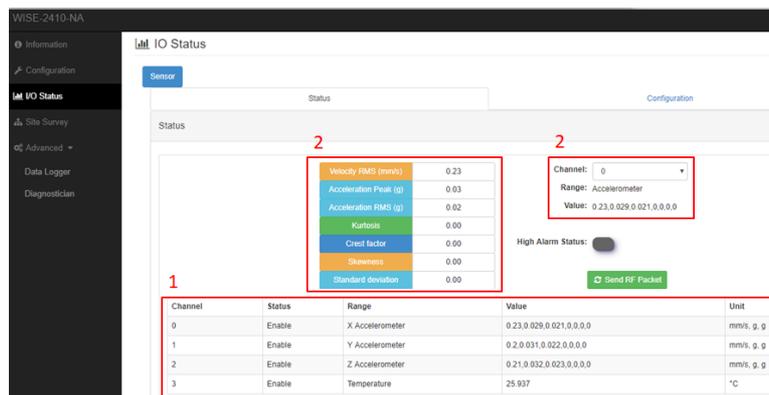


Scenario B: Sensing target on specific timing. In this example: Mon. 8:00am ~ Tue. 8:00 am.

### 4.2.3 IO Status

Click **IO Status** to check vibration and temperature data.

1. User can easily to see the detail data of all channels
2. User can choose channel 0, 1, 2 which means x, y, z axis to see the detailed vibration features (Velocity RMS, Acceleration Peak, and total seven features)



- Vibration alarm (for Velocity RMS)

- Please select the channel for correspondent settings with each axis. 0 means X-axis. 1 means Y-axis. 2 means Z-axis.
- If the sensing target vibrate abnormally and pass through a threshold, it can send alarm to LoRa gateway.

IO Status

Sensor

Status

Configuration

Channel

Channel Mask  Disable  Enable

Range

Enable High Alarm  Disable  Enable

High Alarm Value

Feature Enable  Kurtosis  Crest factor  Skewness  Standard deviation

#### ■ Temperature alarm

- Please select Channel 3 for Temperature sensor configuration.
- If the sensing target temperature raise and pass through a threshold, WISE will send alarm to a gateway.

IO Status

Sensor

Status

Configuration

Configuration

Channel

Channel Mask  Disable  Enable

Range

Enable High Alarm  Disable  Enable

High Alarm Value

Release Alarm Value

Sensor Offset Value  °C

## 4.2.4 Data Logger

Configure or query logs stored in module.

### 1. Data Configuration

- Log conditions:
  - By Period: Enable or Disable the periodical log
- General
  - Clear Log when Power Up: Enable or Disable to reset the Built-in log when the system powers on. (Not use for private server)
  - Circular Log when Memory Full: Enable or Disable the Circular Operation for Built-in Memory (Not use for private server)
- Log Data: User can choose the log by channel or by sensor
  - By Channel: 0 means X-axis. 1 means Y-axis, 2 means Z-axis, 3 means Temperature.
  - By Sensor: Data from sensors, including eigenvalues, alarm trigger, sensor status and raw data.

The screenshot shows the 'Data Logger' configuration interface. At the top, there are three tabs: 'Data Configuration' (selected), 'Logger Configuration', and 'Local Data Query'. Below the tabs, the 'I/O Configuration' section is visible. It contains three main sections: 'Log Conditions' with a radio button for 'By Period'; 'General' with checkboxes for 'Clear Log when Power Up' and 'Circular Log when Memory Full'; and 'Log Data' with two radio buttons for 'By Channel' and 'By Sensor'. Under 'By Channel', there is a table with columns 'Channel' and 'Log Enabled'. The table has four rows for channels 0, 1, 2, and 3, each with a checked checkbox in the 'Log Enabled' column.

Channel	Log Enabled
0	<input checked="" type="checkbox"/>
1	<input checked="" type="checkbox"/>
2	<input checked="" type="checkbox"/>
3	<input checked="" type="checkbox"/>

**Logger Configuration:** Enable or Disable the I/O log function

The screenshot shows the 'Data Logger' configuration interface with the 'Logger Configuration' tab selected. The 'Memory Storage' section is visible, containing a toggle switch for 'I/O Log' which is currently set to 'OFF'. A green 'Submit' button is located at the bottom right of the configuration area.

## Local Data Query

- Push Data Query Format
  - UUID: Enable or Disable the UUID
  - MAC ID: Enable or Disable the MAC ID
  - Timestamp: Local date and time (GMT) or Coordinated universal time (UTC)
- Query Filter
  - Filter Mode: User can choose No Filter Enable, Time Filter or Amount of Latest Data

Data Logger

Data Configuration   Logger Configuration   **Local Data Query**

Push Data Query

Push Data Query Format ▾

UUID  Enabled/Disabled      MAC ID  Enabled/Disabled

Timestamp

Query Filter ▾

Filter Mode

Current Total Amount

Total Amount

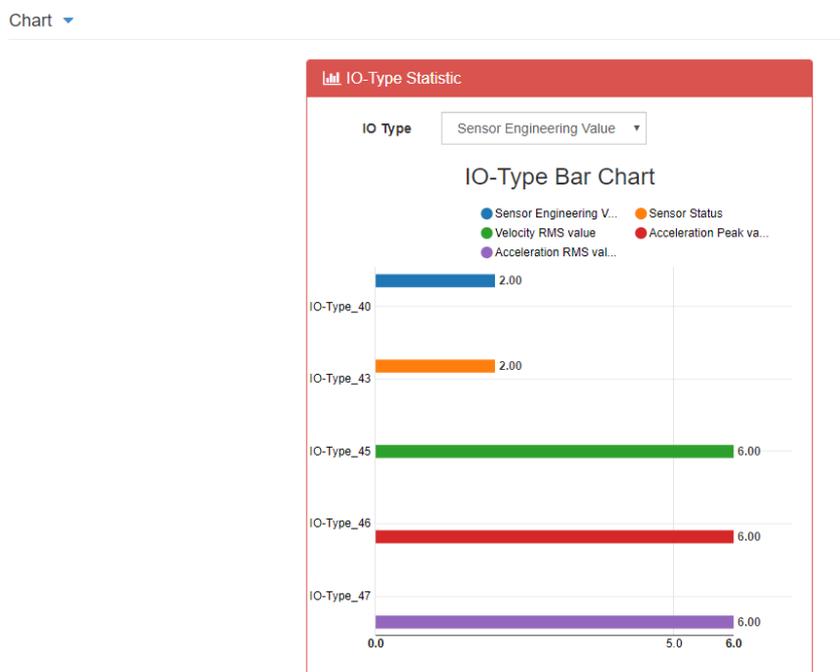
Timestamp of the Oldest

Start Time

Timestamp of the Latest

End Time

- Query result as follow



Data ▾

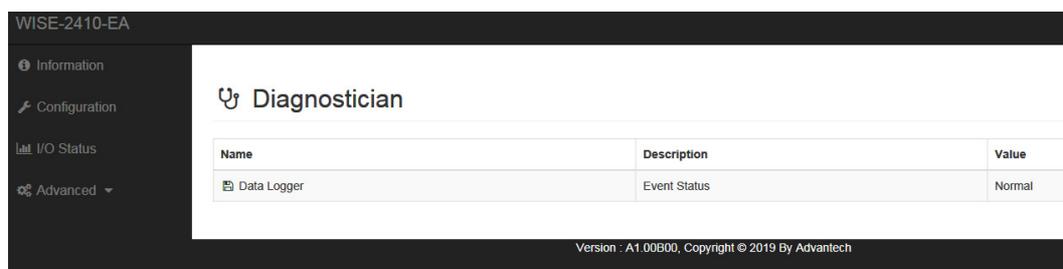
Show  entries Search:

Log Type	Timestamp	UUID	MAC	Slot	Channel	I/O-type	Value
64	2019-03-14T17:07:38+08:00	WISE-2410_C9CC0023	00-00-00-D0-C9-CC-00-23	0	3	43	0
64	2019-03-14T17:07:38+08:00	WISE-2410_C9CC0023	00-00-00-D0-C9-CC-00-23	0	3	40	24.062
64	2019-03-14T17:07:38+08:00	WISE-2410_C9CC0023	00-00-00-D0-C9-CC-00-23	0	0	45	0.2
64	2019-03-14T17:07:38+08:00	WISE-2410_C9CC0023	00-00-00-D0-C9-CC-00-23	0	0	46	0.035
64	2019-03-14T17:07:38+08:00	WISE-2410_C9CC0023	00-00-00-D0-C9-CC-00-23	0	0	47	0.025
64	2019-03-14T17:07:38+08:00	WISE-2410_C9CC0023	00-00-00-D0-C9-CC-00-23	0	1	45	0.23
64	2019-03-14T17:07:38+08:00	WISE-2410_C9CC0023	00-00-00-D0-C9-CC-00-23	0	1	46	0.032
64	2019-03-14T17:07:38+08:00	WISE-2410_C9CC0023	00-00-00-D0-C9-CC-00-23	0	1	47	0.022
64	2019-03-14T17:07:38+08:00	WISE-2410_C9CC0023	00-00-00-D0-C9-CC-00-23	0	2	45	0.35
64	2019-03-14T17:07:38+08:00	WISE-2410_C9CC0023	00-00-00-D0-C9-CC-00-23	0	2	46	0.042

Showing 1 to 10 of 22 entries Previous **1** 2 3 Next

## 4.2.5 Diagnostician

Display any errors detected by module.



## 4.3 Get Raw Data from WISE-2410

For WISE-2410 series, there are two operation modes for querying vibration raw data: Standard mode and Real Time mode.

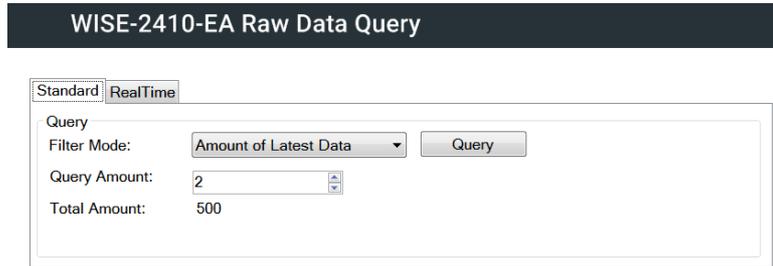
- Standard mode: User could query/get raw data which was previously measured and stored in WISE-2410.
- Real Time mode: User could query/get raw data which was measured by WISE-2410 in real time.

Press "Get Raw Data" button in WISE Studio.

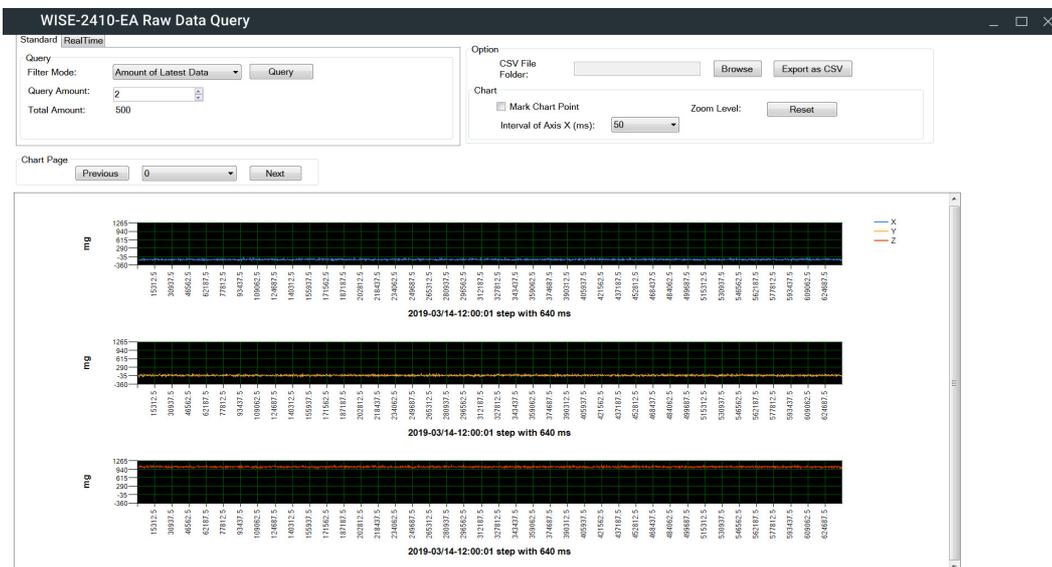


### 4.3.1 Standard operation mode

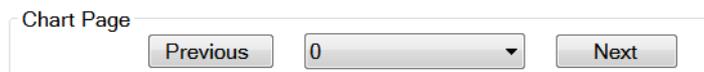
1. In Standard operation mode, user could use "Amount of Latest data" or "Time Filter" as query criteria to get raw data.



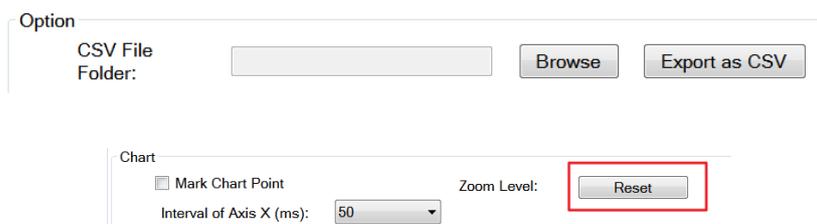
2. Press "Query button" and 3 charts (X, Y, Z axis) will display.



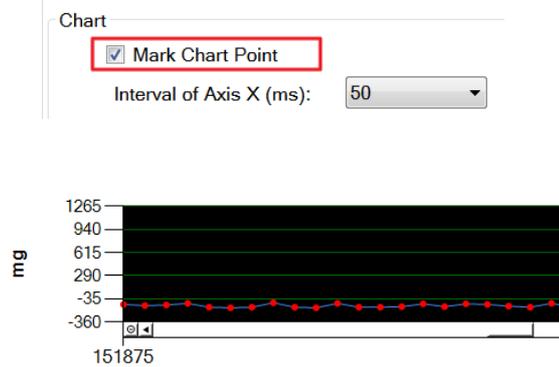
- If there are more than one record, user could press "Previous" or "Next" to display selected record.



- Record data could be exported as CSV file. Please select file folder and press "Export as CSV" to export records.

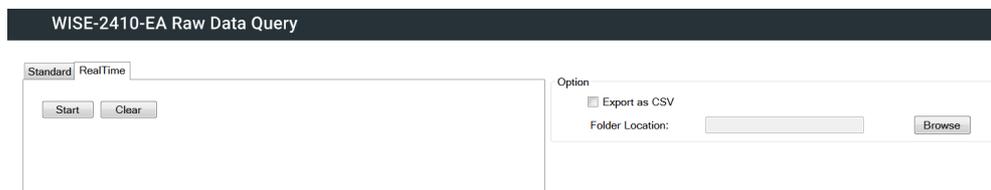


- Mark data: User could click "Mark Chart Point" to show real data as a "Red Dot" in the chart.

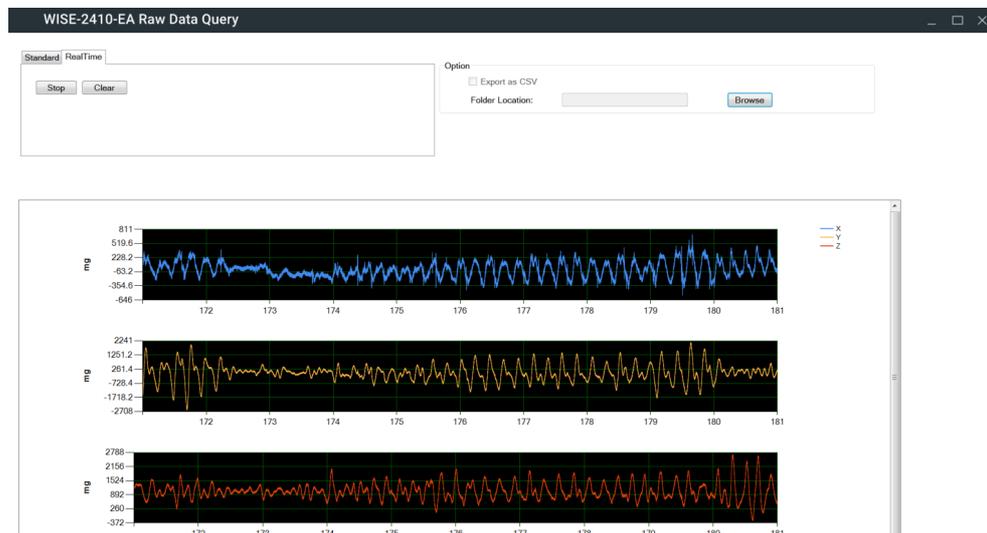


### 4.3.2 Real-Time operation mode

1. In Real-Time operation mode, user could get real time raw data. Please check "Export as CSV" to export records before pressing "Start" button.



2. Press "Start" button and there will be 3 charts (X, Y, Z axis) displayed in real time.



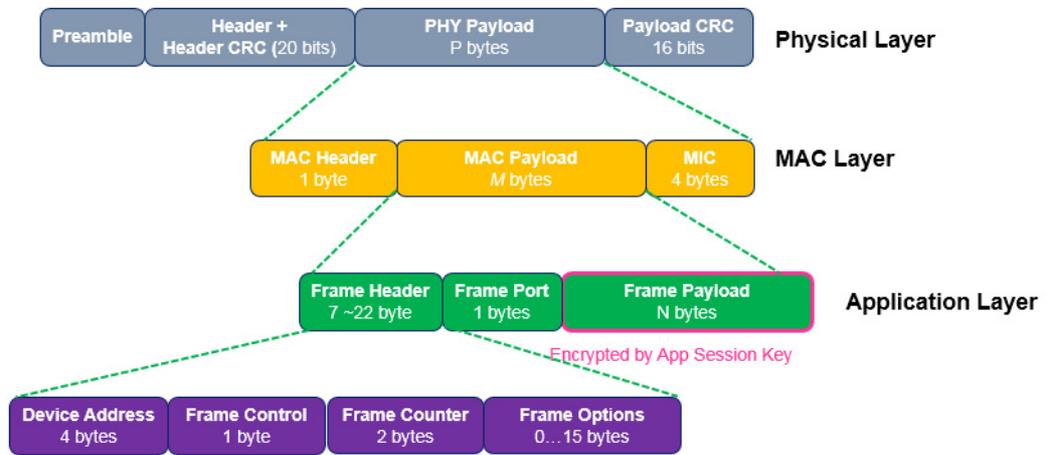
3. Press "Stop" button to terminate data query.

# Appendix **A**

WISE LPWAN Payload  
Format

## A.1 LoRaWAN - Frame Payload

### LoRa Frame Format



The message structure of LoRaWAN Frame Payload is detailed in this chapter. Each frame payload starting with a several-bytes WISE data header (WHDR), followed by a WISE LPWAN Payload (**WPayload**), and ending with a single-octet cyclic redundancy check (**CRC**) code. A WISE Payload (**WPayload**) contains I/O statuses, Device information, and so on.

Frame Payload (FRM Payload)					
Octet: 1	1	0/1	0/2/8	Variable	1
Frame Control	Frame Sequence Number	Total Length	Source Address	WISE LPWAN Payload	CRC
<b>WHDR</b>				<b>WPayload</b>	<b>WCRC</b>

#### A.1.1 WHDR Header

**Frame Control:** 1 byte

Frame Control					
bit 7	6	5	4	3, 2	1, 0
First Segment				Address Mode	Frame Version
0: not first one 1: first seg.	0 Reserved	0 Reserved	0 Reserved	00: No source address 01: the least LSB 2 octets of DevEUI 10: 8 octets DevEUI	00: initial version

– **First Segment bit**

Set the First Segment bit to inform the server that this is the beginning of a packet with Total Length information of WISE payload data.

- **Address Mode** 2-bits  
When the Address Mode bit is unset 00, it indicates no Source Address is encapsulated. If set 01 and 10, the Source Address is the least significant two bytes and eight bytes of DevEUI, respectively.
- **Frame Version** bit  
Two bits for frame structure version.

**Frame Sequence Number:** 1 byte, 0 ~ 255

The sequence number of data frame sent uplink to the gateway. Each time an uplink packet transmitted done, the sequence number is increased for the next new uplink.

**Total Length:** 1 byte (optional)

When the First Segment bit of Frame Control is set, the Total Length octet will be added to signal the server the total bytes of WISE payload data.

**Source Address:** 0/2/8 bytes (optional)

None, 2 LSB or 8 bytes of DevEUI according to the Address Mode bit of Frame Control.

If DevEUI is **74FE48FFFF19D121**, the sequential order of 2-bytes address starts with **D1 21**. For complete DevEUI address, the sequence will be **74 FE 48 FF FF 19 D1 21**.

### A.1.2 WPayload

The **WPayload** structure is detailed chapter 1.4

### A.1.3 WCRC

**CRC:** 1 byte

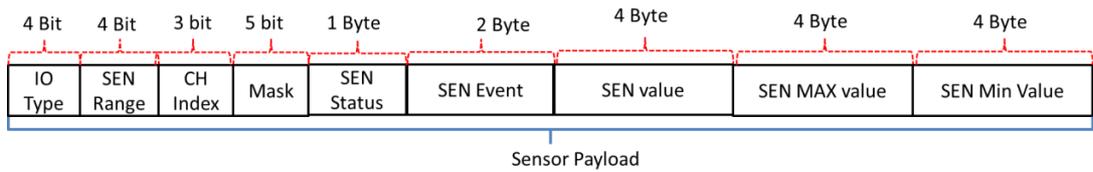
An 8-bit CRC-8-CCITT value calculated from WISE Payload data. It's a standard CRC-8, with polynomial  $x^8+x^2+x+1$  and initial value 0xFF.

### A.1.4 Sensor data (I/O Type: 0x5)

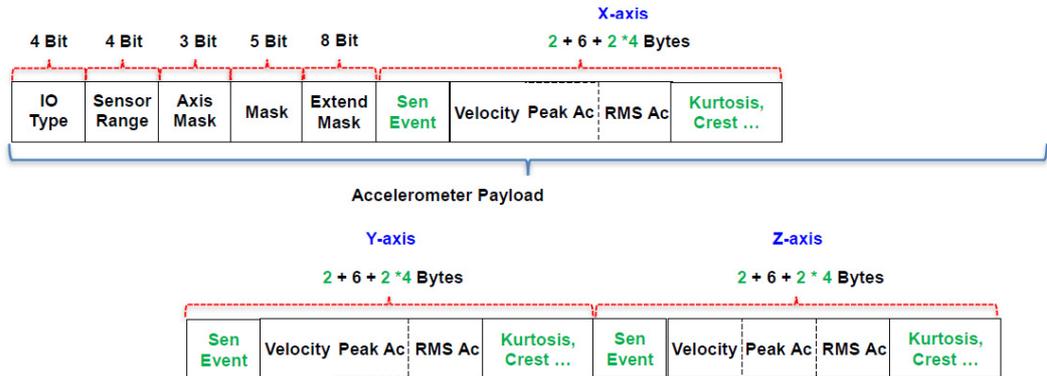
- IO Type (bit 7 - 4): 0x5
- Sensor Range (bit 3 - 0):

(4 bit)	Sensor Type
0x0	4096 - Temperature (°C)
0x4	4256 - Accelerometer
0x5 - 0xF	(RFU)

## Temperature:



## Accelerometer:



### ■ CH Index/Axis Mask (bit 7 - 5):

	Range: 0x0 - 0x3 Temp.	Range: 0x4 Accelerometer
Bit 0	0	X-axis
Bit 1	0	Y-axis
Bit 2	0	Z-axis

### ■ MASK (bit 4 - 0):

Bit	Range: 0x0 - 0x3 Temp.	Range: 0x4 Accelerometer
Bit 0	Sensor Status (1 Byte)	(Reserved)
Bit 1	Sensor Event (2 Bytes)	Sensor Event (2 Bytes)
Bit 2	Sensor Value (4 Bytes)	(Reserved)

■ Extend MASK (bit 7 - 0)

Bit	Range: 0x0 - 0x3 Temp.	Range: 0x4 Accelerometer
Bit 0	(No support)	OA Value of Vibration Velocity (0.01 mm/sec) (2 Bytes)
Bit 1		Peak Value of Acceleration (0.001g) (2 Bytes)
Bit 2		RMS of Acceleration (0.001g) (2 Bytes)
Bit 3		Kurtosis (2 Bytes)
Bit 4		Crest factor (2 Bytes)
Bit 5		Skewness (2 Bytes)
Bit 6		Standard deviation (2 Bytes)
Bit 7		(Reserved)

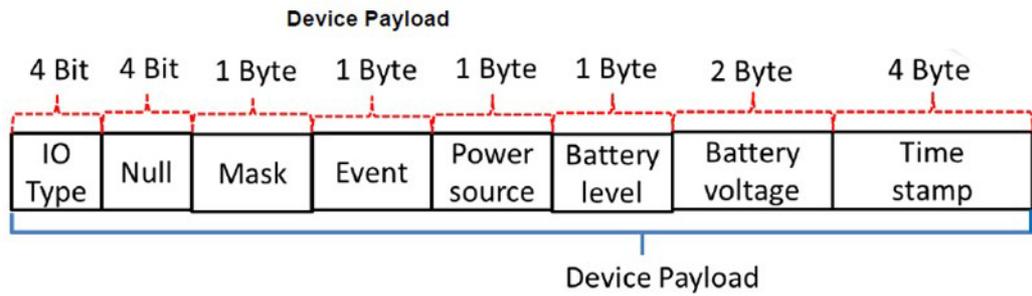
■ SEN Status (1 byte):

Bit	Range: 0x0 - 0x3 Temp./Humidity
Bit 0	Sensor fail
Bit 1 - 7	Reserved

■ SEN Event (2 bytes):

Bit	Range: 0x0 - 0x3 Temp.	Range: 0x4 Accelerometer
Bit 0	High alarm status 1: high alarm occurred. 0: not occurred	High alarm status of velocity RMS 1: high alarm occurred. 0: not occurred
Bit 1	Low Alarm Status 1: low alarm occurred. 0: not occurred	(Reserved)
Bit 2	(Reserved)	(Reserved)
Bit 3	(Reserved)	(Reserved)
Bit 4	Alarm update	(Reserved)
Bit 5 ~ 15	(Reserved)	(Reserved)

## A.1.5 Device data (I/O Type: 0x6)



- IO Type (bit 7 - 4): 0x6
- MASK (bit 7 - 0)

Bit 0	Device event
Bit 1	Power source
Bit 2	Battery level
Bit 3	Battery voltage
Bit 4	Timestamp
Bit 6~7	Reserved

- Device Event: 1 byte  
Device event status table is shown below.

Bit Order	Description
0	Battery low
2~7	Reserved

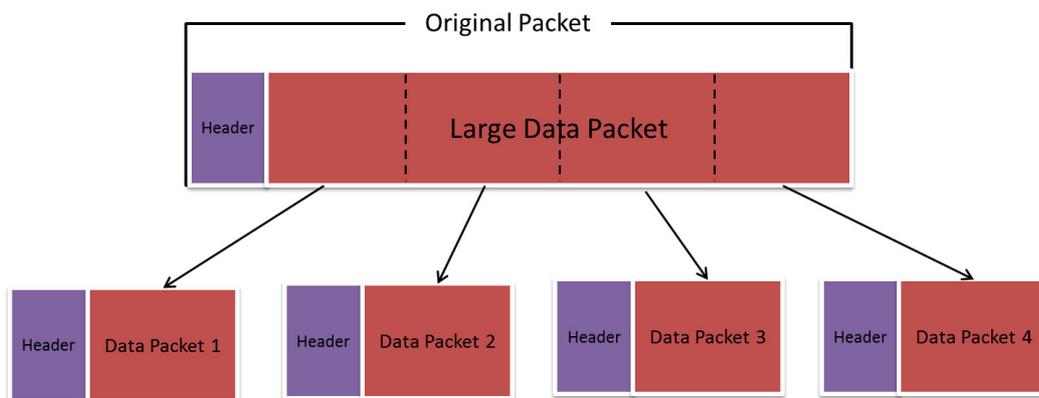
- Power Source: 1 byte  
Power source table is shown below.

Bit Order	Description
0	Power line
1	Battery
3~7	Reserved

- Battery voltage: 2 bytes  
The battery voltage with range 0 to 65.535V.
- Timestamp: 4 bytes

## A.2 Packet Fragmentation and Reassembly

Because the data rate is controlled by the network, the length of each uplink is not fixed. The Frame Payload (FRM Payload) will be split into multiple fragments.



A complete frame can be divided into several uplink messages.

Frame Payload (FRM Payload)		
WHDR	WPayload	WCRC

1<sup>st</sup> message:

		WHDR	WPayload*	
byte: 1	1	1	0	Variable
Frame Control	Frame Sequence Number	Total Length	Source Address	A partial of WISE Payload
0x80	S	M		

2<sup>nd</sup> ~ n<sup>th</sup> messages

		WHDR	WPayload*	
byte: 1	1	0	0	Variable
Frame Control	Frame Sequence Number	Total Length	Source Address	A partial of WISE Payload
0x00	(S+1)~			

The last message:

		WHDR	WPayload*		WCRC
byte: 1	1	0	0	Variable	1
Frame Control	Frame Sequence Number	Total Length	Source Address	The rest of WISE Payload	CRC
0x00	(S+n)				0x23



# Appendix **B**

Modbus address

WISE-2410 (for WISE-6610 LoRaWAN GW)			
Sensor	Temperature		1
Sensor	Acceleromter	Axis	3

Address 0X	Ch	Description	Attribute
00231	0 (X)		Read
00232	1 (Y)	Acceleromter High Alarm Flag	Read
00233	2 (Z)		Read
00234	3 (Temp)	Temperature High Alarm Flag	Read

Address 4X	Ch	Description	Attribute
40501	0 (X)	OA Value of Vibration	Read
40502	1 (Y)	Velocity	Read
40503	2 (Z)	(0.01 mm/sec)	Read
40504	3 (Temp)	Temperature Value	Read

40701	0 (X)		Read
40702	1 (Y)	Peak Value of Acceleration (0.001g)	Read
40703	2 (Z)		Read

40721	0 (X)	RMS of	Read
40722	1 (Y)	Acceleration	Read
40723	2 (Z)	(0.001g)	Read

40741	0 (X)		Read
40742	1 (Y)	Kurtosis(0.01)	Read
40743	2 (Z)		Read

40761	0 (X)		Read
40762	1 (Y)	Crest factor(0.01)	Read
40763	2 (Z)		Read

40781	0 (X)		Read
40782	1 (Y)	Skewness(0.01)	Read
40783	2 (Z)		Read

40801	0 (X)		Read
40802	1 (Y)	Standard deviation(0.01)	Read
40803	2 (Z)		Read



## [www.advantech.com](http://www.advantech.com)

Please verify specifications before quoting. This guide is intended for reference purposes only.

All product specifications are subject to change without notice.

No part of this publication may be reproduced in any form or by any means, such as electronically, by photocopying, recording, or otherwise, without prior written permission of the publisher.

All brand and product names are trademarks or registered trademarks of their respective companies.

© Advantech Co., Ltd. 2020