LAS-604V2 User Manual

V.1.0.2

History

Date	Version	Revision Description	Writer
2019/08/05	V.1.0.0	First release	Liu Ken
2019/08/23	V1.0.1	Update report period	Chris Chuang
2019/9/12	V1.0.2	Adding new chapter - Warning	Chris Chuang
2020/01/06	V1.0.1	Add Certification and safety information	Lin Eden

Table of Contents

1. Introduction

LAS-604V2 is a temperature sensor that utilizes LoRaWAN to periodically report temperature. The temperature measurement is through PT100 probe. For forcing various requests of demand, LAS-604V2 supports two operation modes, mode A and mode B. Mode A is hourly report that temperature is reported or recorded every hour. Mode B supports temperature measurement every 30 seconds, 1 minute or 2 minutes, depending on setting. In addition, LAS-604V2 will retrieve date time for synchronous from server at boot up which make sure the accuracy of report time period.

Technical Characteristics

Power	
Operating Voltage	DC 3V
Battery Type	CR-AG Battery, 2400mAh x 2
Radio Frequency	
Frequency	902.3 MHz to 914.9 MHz
Sensitivity	-137 dBm
Antenna	Embedded
Certification	FCC
LoRaWAN	
Device Class	Class A
Activation	ABP
Temperature Sensor	
Measurement Range	-60 ~ 200°C
Report Interval with Measure Period	Mode A: Detect every 5 minutes, hourly report, reporting period can be 1~24 hour, default is 1 hour. Mode B: Report every 10 min(20 records)/30 min(30 records)/60 min(30 records)
Environmental	
Operating Temperature	-20℃ ~ +70℃
Storage Temperature	-30℃ ~ +70℃
Mechanism	
Dimension	66.3 x 84.5 x 32 mm
Weight	120 g ± 15g

2. Installation

The first step to start to use LAS-604V2 is installing battery. LAS-604V2 can be opened by simultaneously holding and pressing two places in red circle of following figure. A battery holder is inside LAS-604V2, as Figure 2. The supply voltage of battery is 3V.

Figure 1 Open LAS-604V2

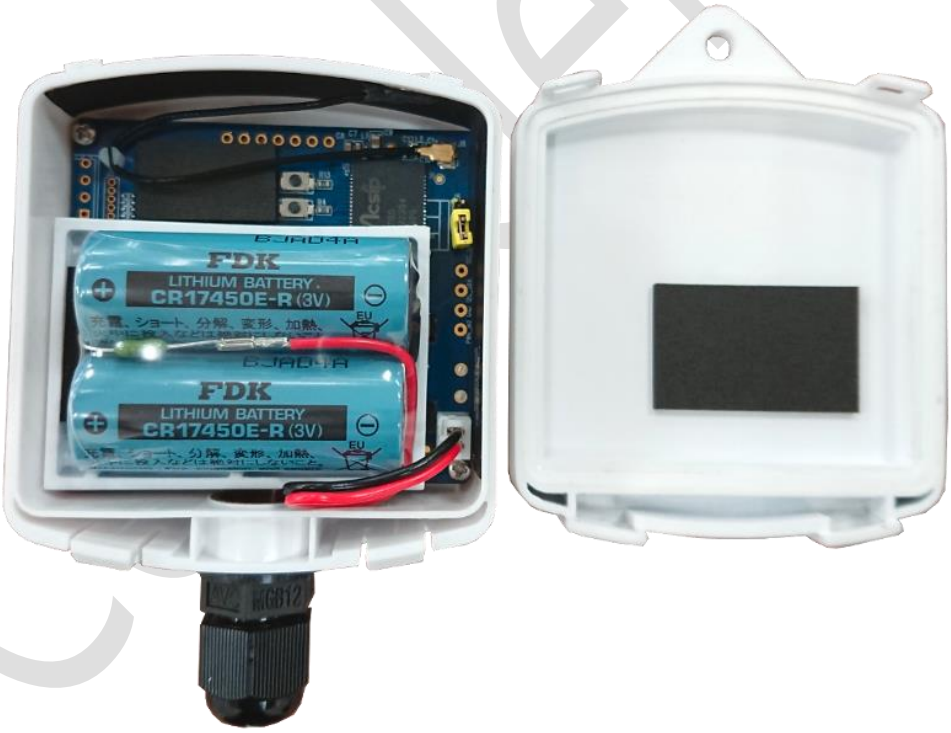


Figure 2 Battery Holder

There is a wakeup button, SW1, which is used to wakeup LAS-604V2 when it enters deep sleep mode.

Figure 3 Wakeup Button

There is a jumper inside LAS-604V2 for selecting operation mode of LAS-604V2. Figure 4 is an example which sets LAS-604V2 to Mode B.

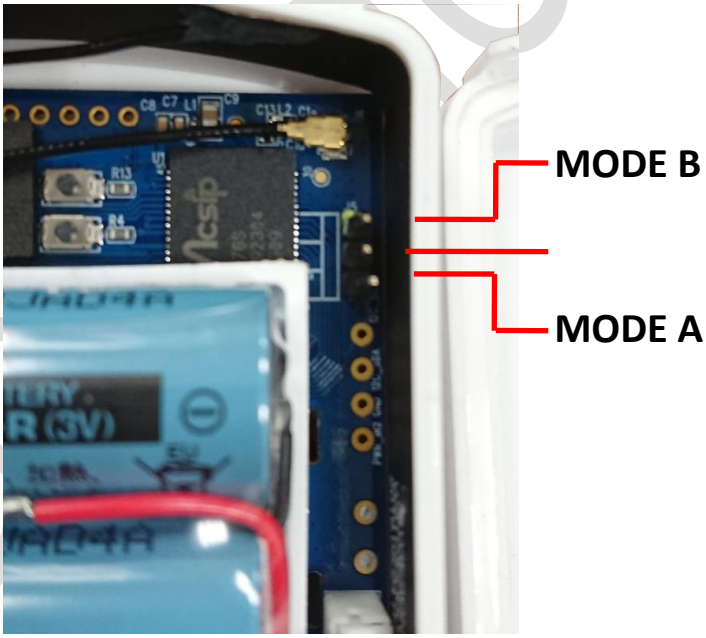


Figure 4 Mode Selection Jumper

3. Device Setup

Device Activation:

First step is created a node on LoRaWAN Network Server. The ***Device EUI***, ***Application Session Key***, and ***Network Session Key*** will get from product supplier. **Application** must set to **LAS-602/4** and Activation and LoRaWAN Class should be set to **ABP** and **Class A** separately.

Note: Due to LAS-602/4 sending periodically report at each clock, the downlink window is recommended to set to RX2 for preventing from data collision.

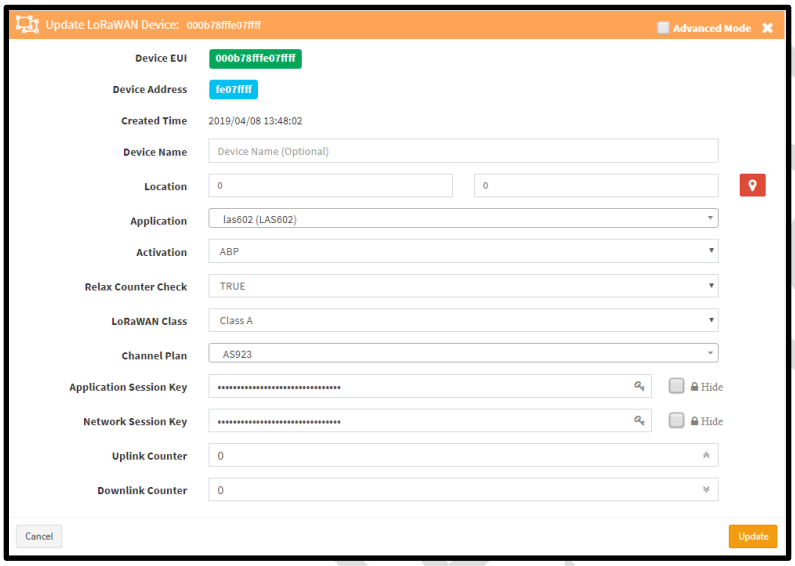


Figure 5 Device Activation

Gateway Notice:

Another notice is that make sure the Gateway frequencies setting is same as LAS-604V2. And the address of packet forwarder setting must be set to LoRaWAN network server correctly.

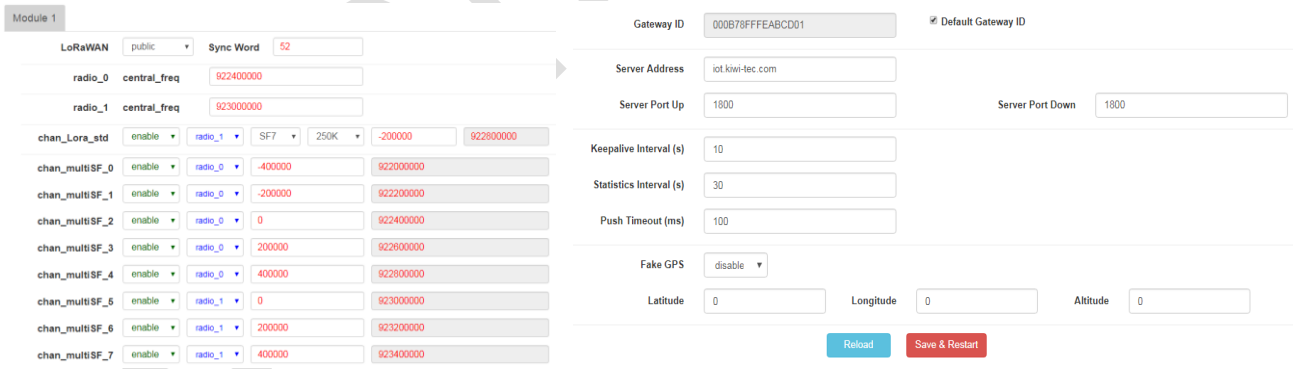


Figure 6 Gateway Setting

Temperature Report in Platform:

The temperature report is under application of LAS-602/4, as following figure shows.

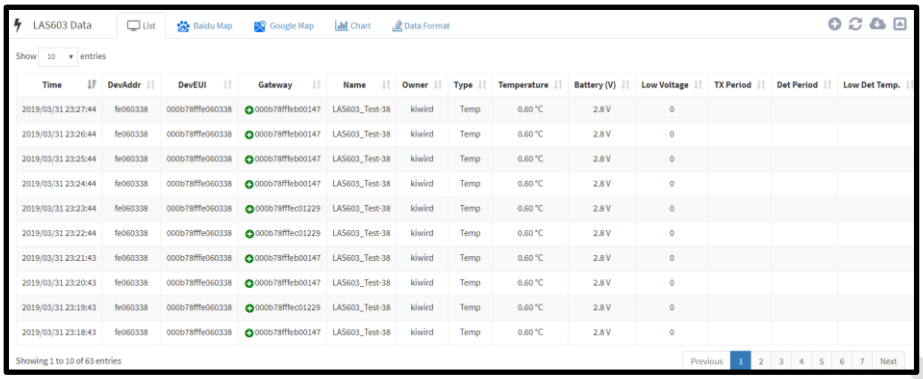


Figure 7 LAS-602/4 Report

4. Report and Data Format

4.1. Mode A

LAS-604V2 reports temperature and alarm through LoRaWAN's uplink. By default, LAS-604V2 will send a temperature report every hours. In addition to temperature report, LAS-604V2 will read temperature **every 5 minutes** by default and compare read value with allowable temperature range. If read temperature is out of allowable temperature range, an alarm will be sent. Besides, the allowable temperature range can be set by downlink command.

Except temperature and status report, a LoRaWAN MAC command, **`DeviceTimeReq`**, is sent from LAS-604V2 to server for time synchronization. Figure 8 depicts the entire sequence from power on.

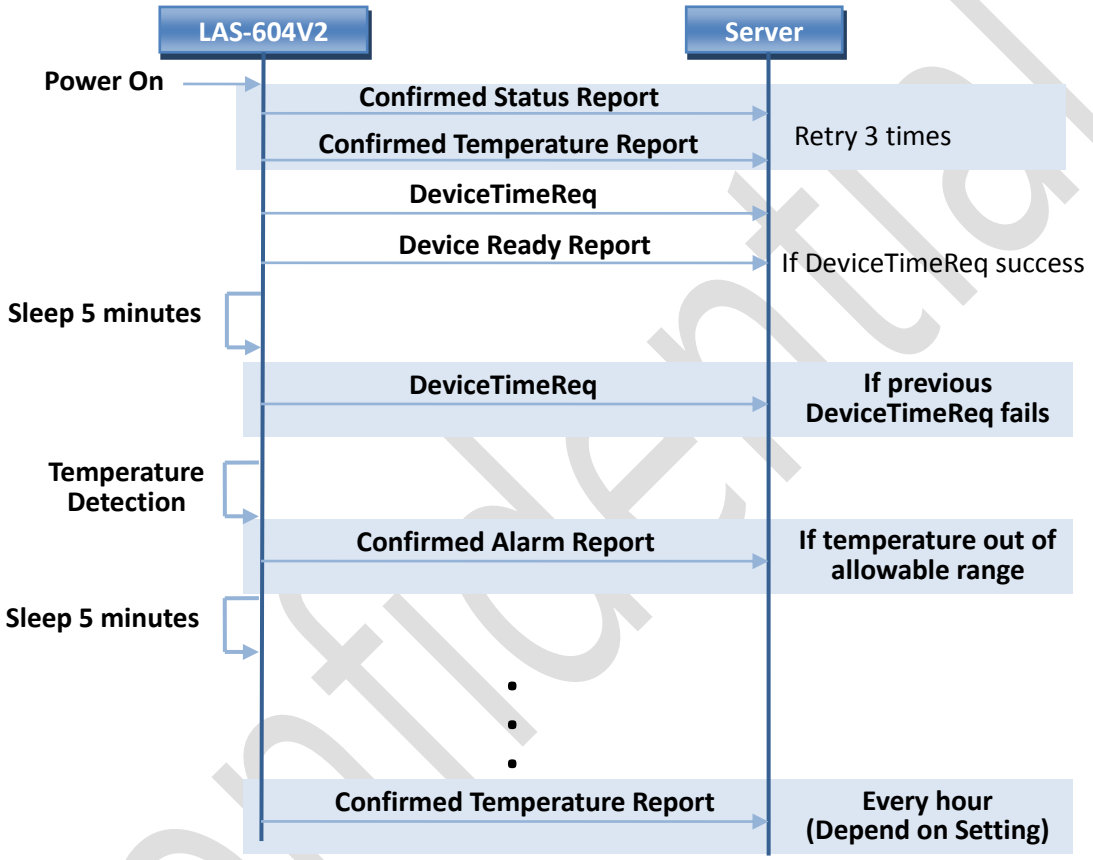


Figure 8 LAS-604V2 Sequence Diagram

There are 3 uplink will be sent by LAS-604V2, temperate report, status report and temperature alarm. The format of these 3 reports are described at following.

4.1.1. Temperature Report

Temperature report is sent by LAS-604V2 at every predefined period. The period can be changed by downlink command. The length of temperature report depends on how many temperature records in a single report.

FPort: 200

Temperature Report			Temperature (2 Bytes)	. . .	Temperature (2 Bytes)

Battery: The most significant bit indicates low voltage.
The least significant 7 bits is battery voltage multiplying 10.
EX: 0x98 (**1**001 1000)→ low voltage and 2.4v

Temperature: Signed integer, big-endian, multiplies 10.
EX: 0x00 0xEC → 23.6°C

4.1.2. Status Report

Status report is sent by LAS-604V2 at power-on and when LAS-604V2 getting downlink command.

FPort: 201

Status Report		Detection Period (1 Byte)	Lowest Allowable Temp. (2 Bytes)	Highest Allowable Temp. (2 Bytes)

TX Period: Unsigned integer presents period of temperature report in hour, can be 1 to 24.
Detection Period: Unsigned integer presents period of temperature detection in minute, can be 1 to 30.
Temperature: Signed integer, big-endian, multiplies 10.
EX: 0x00 0xEC → 23.6°C

4.1.3. Temperature Alarm

Temperature alarm is sent by LAS-604V2 when the read temperature is out of allowable range.

FPort: 202

Temperature Alarm	Temperature (2 Bytes)

Temperature: Signed integer, big-endian, multiplies 10.
EX: 0x00 0xEC → 23.6°C

4.1.4. Downlink Setting Command

Downlink setting command is sent by server to LAS-604V2 for changing period of temperature report and detection. Once LAS-604V2 getting a downlink command, it should send back a status report for confirmation.

FPort: 201

Setting Command		Detection Period (1 Byte)	Lowest Allowable Temp. (2 Bytes)	Highest Allowable Temp. (2 Bytes)

TX Period: Unsigned integer presents period of temperature report in hour, can be 1 to 24.
Detection Period: Unsigned integer presents period of temperature detection in minute, can be 1 to 30.
Temperature: Signed integer, big-endian, multiplies 10.
EX: 0x00 0xEC → 23.6°C

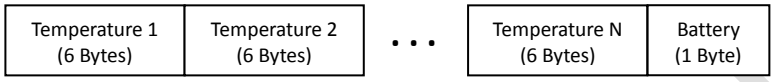
4.2. Mode B

There is one uplink data type of LAS-604V2 for reporting temperature records and 3 downlink data type for remote settings whose are manually offset setting, interval time/record period, and single mode (Mode 1) setup. The formats of these data types are described at following section.

4.2.1. Temperature Report (Uplink)

Temperature report is sent by LAS-604V2 at every predefined period. The period can be changed by downlink command. The length of temperature report depends on how many temperature records in a single report.

Temperature Report:



Temperature: Composed with Time (4 Bytes) and Temperature (2 Byte).

Example: 0x5C 0x85 0xC5 0x46 0x00 0xEE

Time: 0x5C 0x85 0xC5 0x46 → $5C85C546_{hex}$ → 1552270662_{dec} Unix Timestamp

→ 2019/03/11 Monday 02:17:42

Temp.: 0x00 0xEE → EE_{hex} → 238_{dec} → 23.8°C

Battery: The Least Byte (Battery byte) indicates the power percentage of battery.

Example: 0x64 → 64_{hex} → 100_{dec} → 100%

Temperature report record amount and total payload bytes for different mode are shown below:

Mode	Report Interval	Measure Period	Record Amount	Total Payload Bytes
1	10 minutes	30 sec.	20	121
2	30 minutes	60 sec.	30	181
3	60 minutes	120 sec.	30	181

4.2.2. Remote Setting Command (Downlink)

Remote setting command is sent by server to LAS-604V2 for changing offset by manually, interval time and record period, and single mode activate. Once LAS-604V2 getting a downlink command, it should send back a status report for confirmation.

In Server downlink page, selecting the specific device and port 15 for setting. The Downlink Payload rules and examples are shown below:

Figure 9 LAS-604V2 Downlink Page

Setting Command	OP Code (1 Byte)	Operation (2 Bytes)

OP Code	Operation	Payload Range
0x01	Manually Offset Setting	-100 ~ 100 (0xFF9C ~0x0064)
0x02	Measure Period	3/6/12 (0x0003/0x0006/0x000C)

Example OP 1: The report temp. is 28.0°C, and need to adjust to 25.0°C for calibration.

The offset value setting is calculated as: **(25.0-28.0) * 10 = -30**, then transfer **-30_{dec}** to Hexadecimal data type, **0xFFE2**. Finally, the downlink payload is **01FFE2**

Example OP 2: The measure time is need to adjust to 60 sec (Mode 3).

The offset value setting is calculated as: **60/ 10 = 6**, then transfer 6_{dec} to Hexadecimal data type, **0x0006**. Finally, the downlink payload is **020006. Therefore, the report period will also set to the mode 3 behavior.**

5. Firmware Upgrade

LAS-604V2's firmware can be upgraded through UART by using TLM922S Flash Tool. Please make sure the COM port number is the interface connected between PC and LAS-604V2.

The first step is setting COM port number and click "Get Ver+Cfg" button. If the version name does not appear, there might be problems on connection between PC and LAS-604V2.

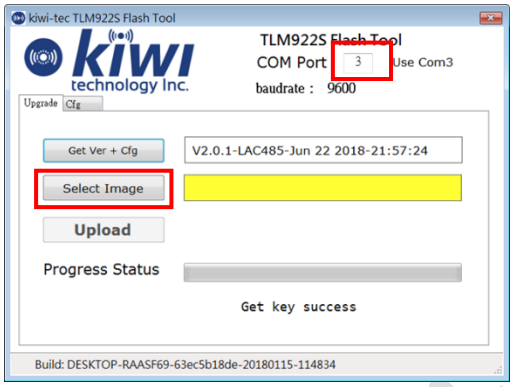


Figure 10 Setup COM Port and Connection

Next step is clicking "Select Image" to choose firmware file and clicking "Upload" to start the upgrade procedure.

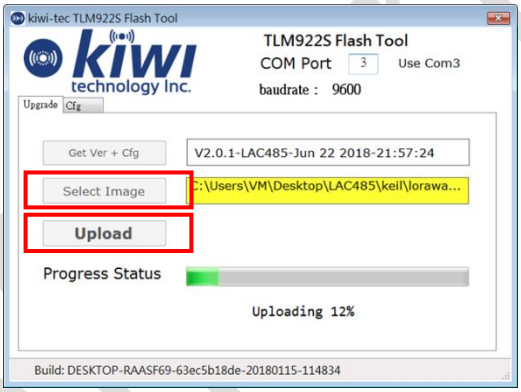


Figure 11 Select Firmware and Upgrade

If the upgrade is going well as following figure, the upgrade process is success and the new firmware is programmed to LAS-604V2.

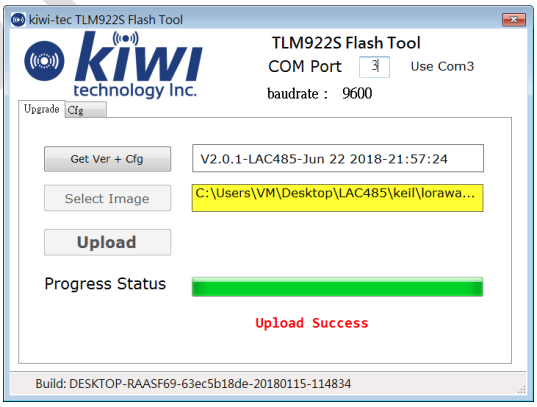


Figure 12 Firmware Upgrade Success

6. Warning

LAS-604V2 guarantees IP rating level IP64, which means it against splashes of water from all directions, with limited ingress permitted. NOT allow to submerse the device into liquid to avoid any issue caused.

7. Certification

FCC warning

Federal Communications Commission Statement

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

• This device may not cause harmful interference.

• This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a class B digital device, pursuant to Part 15 of the Federal Communications Commission (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 causes 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 doing 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.

FCC Caution

Any changes or modifications not expressly approved by the party responsible for compliance could void the user‘s authority to operate the equipment.

The antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Radiation Exposure Statement:

This equipment must be installed and operated in accordance with provided instructions and the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

8. Safety information

Thank you for purchasing this product.

Safety Precautions and Instructions

The following items should be strictly obeyed for the safe usage of this product, and for protecting yourself and other people from bodily harm and/or damage to property.

Explanation of Symbols

DANGER	These entries are actions that absolutely under no circumstance should be taken. The taking of such an action may cause serious personal physical damage or death.
CAUTION	These entries are actions that if taken may lead to physical injury or damage to persons or things.

DANGER To Prevent Serious Accidents

Do not disassemble, repair or modify the unit and/or accessories.

Do not use the unit in any environment that is exposed to chemicals and harmful gases. Doing so may cause corrosion and/or other danger to the unit. Also, coming in contact with hazardous substances may cause bodily harm to the user or people nearby.

Do not handle the unit, remove batteries or cables with wet hands.

This product has been designed for private and/or industrial use only. It should not be used in situations where strict safety precautions are necessary such as with medical equipment, or in systems directly or indirectly connected with human life or well-being.

Do not drop or expose the unit to a strong impact.

Do not cut or process the cords for the communication cables. Also, do not twist, pull on or swing any of the cords.

To prevent damage to the unit from static electricity, remove static electricity from your body by touching metal around you (such as a door knob and window frame) before touching the unit.

Place and store the unit and accessories out of the reach of children.

We are not responsible for any damage, malfunction or trouble, whether direct or indirect, caused by the use of our product.

Do not use any battery, sensor, or cable other than those specified by Kiwi technology Inc.

Do not put anything on top of the cable or the unit. This may cause overheating.

Make sure that sensor and cable plugs are all inserted fully, so as not to cause an improper connection. Also, when unplugging the cable from the unit, do not pull the cord, but hold the connector to disconnect.


If the unit produces heat, emits smoke or a strange smell, or makes unusual noise, immediately remove the batteries and stop using it.


If the unit is not to be used for a long period of time, remove batteries. Leaving batteries inside the unit may cause battery leakage and malfunction. Install new batteries when starting or re-starting to use a unit.

Do not attach non-isolated thermocouple sensors to objects connected to a live voltage. This may cause a short circuit or an electrical shock.

CAUTION Do not place or store in the following areas:

» Areas exposed to direct sunlight

» Areas subject to direct flames or heaters, as well as areas in which hot air accumulates and creates extremely high temperatures

» Areas exposed to static electricity

» Areas exposed to strong magnetic fields

» Areas exposed to water leakage

» Areas subject to condensation or wet areas

» Areas exposed to excessive vibration » Areas exposed to excessive smoke, dust or dirt.

CAUTION Other Precautions:

» Use the unit in the specified operating environment. Do not use it for any purpose other than for which it was designed.

» Condensation may occur inside the case when a unit is moved from one environment to another where there is a great difference in temperature.

» Do not use the unit in wet areas or places exposed to water such as bathroom.

» Do not insert any foreign objects into any of the units' jacks.

» If the unit gets dirty, wipe it with a clean cloth.

» Make sure to remove dust and dirt from plugs of any cables.

» Battery terminals may provide insufficient contact due to age or vibration. This may lead to data loss.

» Please note that this document has been written based on the presupposition that details about contracts with an Internet provider, specific network environments and the set-up of any other necessary equipment to enable network connection has already been taken care of by the User and that connection has been confirmed as workable. Kiwi technology Inc. shall not be responsible for any damages which a contractor, a user or a third party may suffer, whether direct or indirect, due to the inability to communicate or use communication devices.

CAUTION Notices about Sensors:

» Do not connect any sensor to the unit other than those specified by Kiwi technology Inc.

» Make sure to use sensors within the measurement range indicated in the specifications for that sensor.

» Do not connect the sensor to any data logger other than those specified by Kiwi technology Inc.

» Do not expose the sensor to a strong impact. This may adversely affect measurement accuracy and cause damage or malfunction.

» When the sensor is not to be used for a long period of time, please store it at normal temperature and

humidity.

» The included sensor is not water resistant. If the sensor gets wet, immediately remove the sensor from the unit and wipe it with a clean cloth as soon as possible. Then allow the sensor to dry in normal room temperature before using it again.

» Do not use the sensor on the human body.

Temperature-Humidity Sensor

» If extremely severe temperature changes occur, it may result in large errors in humidity measurement. Once the sensor's temperature becomes stable, the measurements will return to normal.

» The temperature-humidity sensors will with normal use experience losses in precision and sensitivity over time due to degradation. If the sensor is being used in an unsuitable environment (smoky or dusty places) it may be necessary to change the sensor sooner.

» Do not expose to condensation, dampness, corrosive gases, or organic solvents.