



## ***LAS-603V1/LAS-603V2 User Manual***

V.1.0.1



 **LoRa Alliance Member™**



# Table of Contents

<b>1. Introduction</b> .....	<b>1</b>
<b>2. Installation</b> .....	<b>2</b>
<b>3. Report and Data Format</b> .....	<b>3</b>
<b>3.1. Data Format</b> .....	<b>4</b>
3.1.1. Temperature Report.....	4
3.1.2. Status Report.....	4
3.1.3. Temperature Alarm .....	4
3.1.4. Downlink Setting Command.....	5
<b>4. Example</b> .....	<b>6</b>
<b>5. Firmware Upgrade</b> .....	<b>8</b>

# 1. Introduction

LAS-603 is a temperature sensor that utilizes LoRaWAN to periodically report temperature. LAS-603 can also send an abnormal temperature alarm once environment temperature is out of predefined allowable range. The periodically report will be sent on each clock. Therefore, LAS-603 will retrieve date time from server at boot up. In addition, there are 3 magnets at bottom side of LAS-603 for easily mounting on metal surface.



Figure 1 LAS-603



Figure 2 Magnets at Bottom of LAS-603

## Technical Characteristics

Power	
Operating Voltage	DC 3V
Battery	CR-AG Battery, 2400mAh x 2
Radio Frequency	
Frequency	902.3 MHz to 914.9 MHz
Antenna	Embedded 2.5dBi
Certification	FCC
LoRaWAN	
Device Class	Class A
Activation	ABP
Temperature Sensor	
Measurement Range	-55~125°C
Abnormal Detection	Every 5 minutes
Report Interval	1~24 Hour, Default: 4 Hours Generate 1 record each hour.
Environmental	
Operating Temperature	-30~70°C
Storage Temperature	-40~85°C
Mechanism	
Dimension	64 x 75 x 37mm
Weight	150g

## 2. Installation

To start to use LAS-603, the battery should be installed well and power switch should be ON position. Please loosen two screws at bottom of LAS-603 and open the back cover, as Figure 3. Then make sure the battery is connected to connector and power switch is ON position.

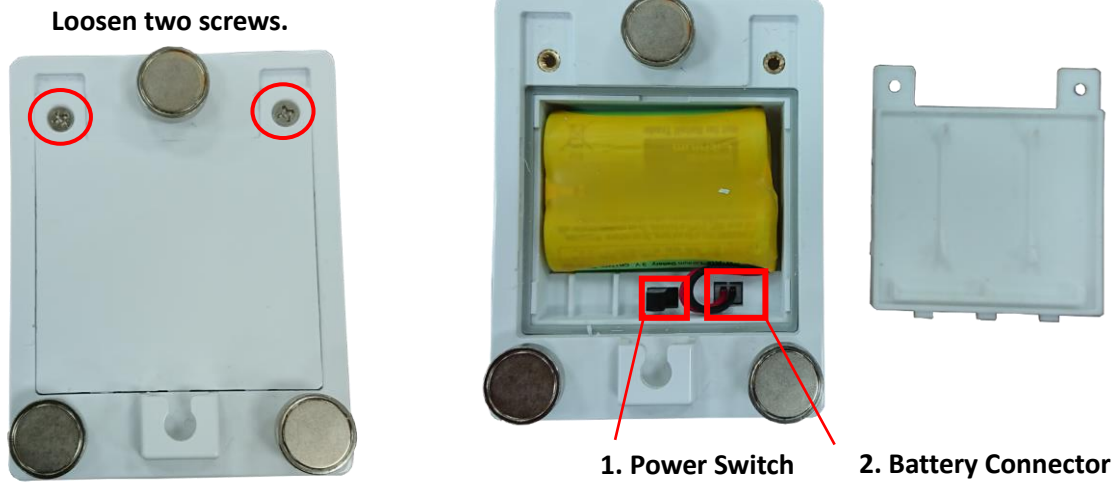


Figure 3 Installation of LAS-603

LAS-603 has two mounting methods. As shown on Figure 4, magnet can be used to mount on metal surface and hanging hole can be used to hook on any surface having object.

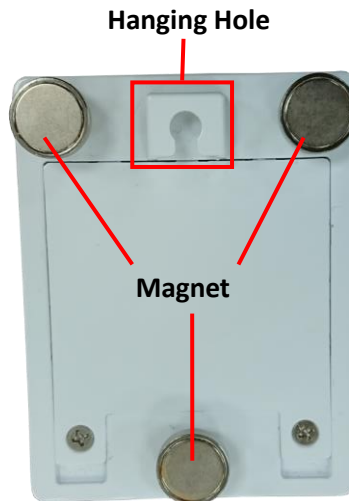


Figure 4 Mount of LAS-603

### 3. Report and Data Format

LAS-603 reports temperature and alarm through LoRaWAN’s uplink. By default, LAS-603 will send a temperature report every 4 hours and the report contains 4 temperature records at each clock. In another words, LAS-603 will read temperature every hour and keep in memory. Then, LAS-603 sends the temperatures readings in memory at predefined period, default is 4 hours.

In addition to temperature report, LAS-603 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-603 to server for time synchronization. Figure 5 depicts the entire sequence from power on.

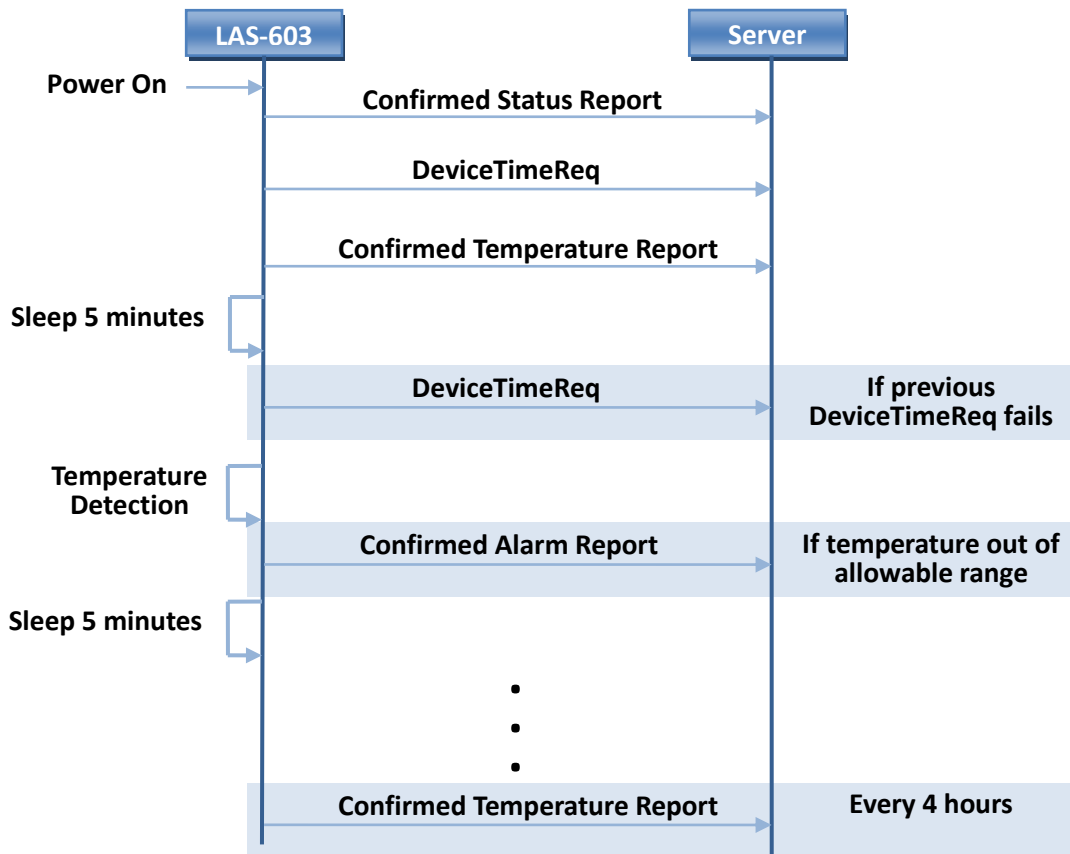


Figure 5 LAS-603 Sequence Diagram

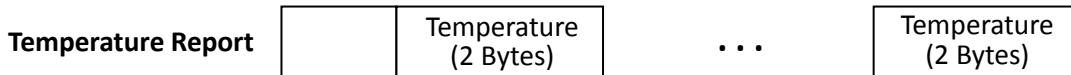
### 3.1. Data Format

There are 3 uplink will be sent by LAS-603, temperate report, status report and temperature alarm. The format of these 3 reports are described at following.

#### 3.1.1. Temperature Report

Temperature report is sent by LAS-603 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**



**Battery:** The most significant bit indicates low voltage.

The least significant 7 bits is battery voltage multiplying 10.

EX: 0x98 (1001 1000) → low voltage and 2.4v

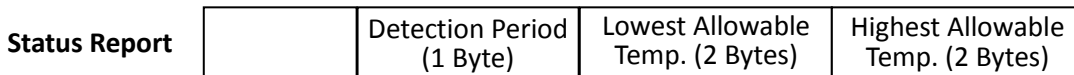
**Temperature:** Signed integer, big-endian, multiplies 10.

EX: 0x00 0xEC → 23.6°C

#### 3.1.2. Status Report

Status report is sent by LAS-603 at power-on and when LAS-603 getting downlink command.

**FPort: 201**



**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

#### 3.1.3. Temperature Alarm

Temperature alarm is sent by Las-603 when the read temperature is out of allowable range.

**FPort: 202**



**Temperature:** Signed integer, big-endian, multiplies 10.

EX: 0x00 0xEC → 23.6°C

### 3.1.4. Downlink Setting Command

Downlink setting command is sent by server to LAS-603 for changing period of temperature report and detection. Once LAS-603 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. Example

This section gives an example of setting LAS-603, gateway and Kiwi-tec's LoRaWAN Network server.

### Setting of Gateway

Gateway's receiving frequencies must be same as LAS-603. And, the address of packet forwarder must be set correctly to LoRaWAN network server.

chan_Lora_std	enable	radio_1	SF7	250K	-200000	922800000
chan_multisf_0	enable	radio_0	-400000	922000000		
chan_multisf_1	enable	radio_0	-200000	922200000		
chan_multisf_2	enable	radio_0	0	922400000		
chan_multisf_3	enable	radio_0	200000	922600000		
chan_multisf_4	enable	radio_0	400000	922800000		
chan_multisf_5	enable	radio_1	0	923000000		
chan_multisf_6	enable	radio_1	200000	923200000		
chan_multisf_7	enable	radio_1	400000	923400000		

Figure 6 Gateway Setting

### Setting of LoRaWAN Network Server

Final step is create a node on network server as Figure 7 shows. The Device EUI, Application EUI, and Application Key is get from above operation. **Application** must set to LAS603 and Activation and **LoRaWAN Class** should be set to **ABP** and **Class A** separately.

**Note: Due to LAS-603 sending periodically report at each clock, the downlink window is recommended to set to RX2 for preventing from data collision.**

Device EUI	000b78ffffe060335
Device Address	fe060335
Device Name	Device Name (Optional)
Location	Latitude Longitude
Application	LAS603 (LAS603)
Activation	ABP
Relax Counter Check	TRUE
LoRaWAN Class	Class A
Owner	kiwird (Kiwi R&D)
Channel Plan	AS923
Application Session Key	Application Session Key
Network Session Key	Network Session Key

Figure 7 Create Node on Network Server

# Temperature Report

The temperature report is under application of LAS603, as following figure shows.

⚡ LAS603 Data List Baidu Map Google Map Chart Data Format + ↺ ↻ ⬇ 📄

Show  entries

Time	DevAddr	DevEUI	Gateway	Name	Owner	Type	Temperature	Battery (V)	Low Voltage	TX Period	Det Period	Low Det Temp.
2019/03/31 23:27:44	fe060338	000b78fffe060338	🟢000b78fffeb00147	LAS603_Test-38	kiwird	Temp	0.60 °C	2.8 V	0			
2019/03/31 23:26:44	fe060338	000b78fffe060338	🟢000b78fffeb00147	LAS603_Test-38	kiwird	Temp	0.60 °C	2.8 V	0			
2019/03/31 23:25:44	fe060338	000b78fffe060338	🟢000b78fffeb00147	LAS603_Test-38	kiwird	Temp	0.60 °C	2.8 V	0			
2019/03/31 23:24:44	fe060338	000b78fffe060338	🟢000b78fffeb00147	LAS603_Test-38	kiwird	Temp	0.60 °C	2.8 V	0			
2019/03/31 23:23:44	fe060338	000b78fffe060338	🟢000b78ffec01229	LAS603_Test-38	kiwird	Temp	0.60 °C	2.8 V	0			
2019/03/31 23:22:44	fe060338	000b78fffe060338	🟢000b78ffec01229	LAS603_Test-38	kiwird	Temp	0.60 °C	2.8 V	0			
2019/03/31 23:21:43	fe060338	000b78fffe060338	🟢000b78fffeb00147	LAS603_Test-38	kiwird	Temp	0.60 °C	2.8 V	0			
2019/03/31 23:20:43	fe060338	000b78fffe060338	🟢000b78fffeb00147	LAS603_Test-38	kiwird	Temp	0.60 °C	2.8 V	0			
2019/03/31 23:19:43	fe060338	000b78fffe060338	🟢000b78ffec01229	LAS603_Test-38	kiwird	Temp	0.60 °C	2.8 V	0			
2019/03/31 23:18:43	fe060338	000b78fffe060338	🟢000b78fffeb00147	LAS603_Test-38	kiwird	Temp	0.60 °C	2.8 V	0			

Showing 1 to 10 of 63 entries Previous 1 2 3 4 5 6 7 Next

Figure 8 LAS-603 Report

## 5. Firmware Upgrade

LAS-603'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-603.

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-603.

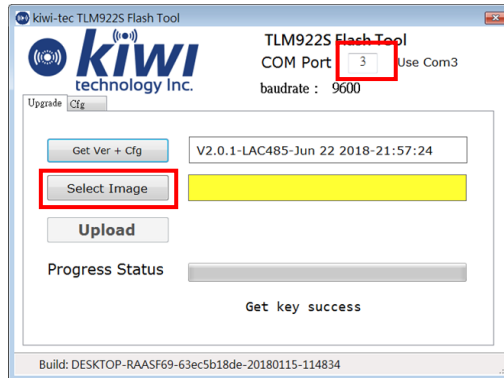


Figure 9 Setup COM Port and Connection

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

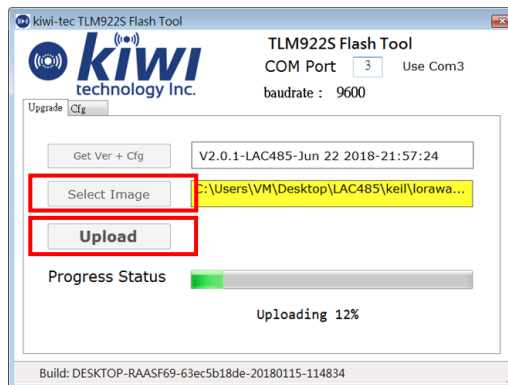


Figure 10 Select Firmware and Upgrade

If the upgrade is going well as following figure, the upgrade process is success and the new firmware is programmed to LAS-603.

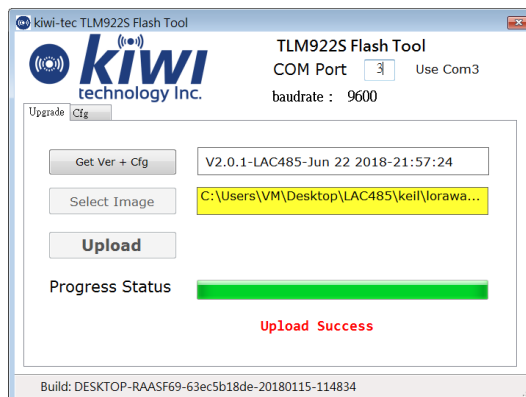


Figure 11 Firmware Upgrade Success

## 6. Certification

Thank you for purchasing this product.

### 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.

## 7. 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.



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.



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



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 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.