Wireless 3-Phase Current Meter

R718N3xxx(E) Series User Manual

Table of Contents

1. Introduction 2

2. Appearance 3

3. Features 3

4. Set up Instruction 4

5. Data Report 5

5.1 Example of ReportDataCmd 6

5.2 Example of ConfigureCmd 9

5.3 Example of SetRportType 10

5.4 Set/GetSensorAlarmThresholdCmd 11

5.5 Example for MinTime/MaxTime logic 12

6. Installation 14

7. Information about Battery Passivation 17

7.1 To determine whether a battery requires activation 17

7.2 How to activate the battery 17

8. Important Maintenance Instruction 18

1. Introduction

The R718N3xxx(E) series is 3-Phase Current Meter device for Netvox Class A type devices based on the LoRaWAN open protocol and is compatible with the LoRaWAN protocol. R718N3xxx(E) series have different measuring range for different variety of CT. It is divided into:

Model	Name	CT cables
R718N3	Wireless 3-Phase Current Meter with 3 x 50A Solid Core CT	-
R718N3E		Detachable cables
R718N33	Wireless 3-Phase Current Meter with 3 x 75A Clamp-On CT	-
R718N33E		Detachable cables
R718N37	Wireless 3-Phase Current Meter with 3 x 75A Clamp-On CT	-
R718N37E		Detachable cables
R718N315	Wireless 3-Phase Current Meter with 3 x 150A Clamp-On CT	-
R718N315E		Detachable cables
R718N325	Wireless 3-Phase Current Meter with 3 x 250A Clamp-On CT	-
R718N325E		Detachable cables
R718N363	Wireless 3-Phase Current Meter with 3 x 630A Clamp-On CT	-
R718N363E		Detachable cables
R718N3100	Wireless 3-Phase Current Meter with 3 x 1000A Clamp-On CT	-
R718N3100E		Detachable cables

LoRa Wireless Technology

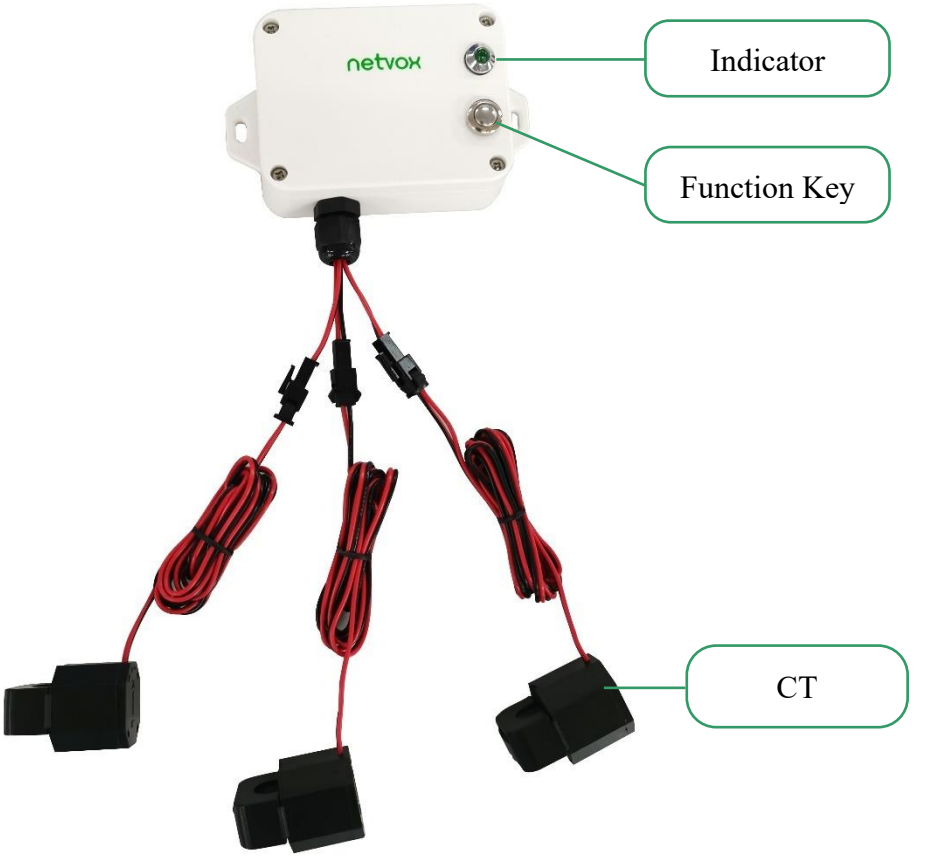
LoRa is a wireless communication technology famous for its long-distance transmission and low power consumption. Compared with other communication methods, LoRa spread spectrum modulation technique greatly extend the communication distance. It can be widely used in any use case that requires long-distance and low-data wireless communications. For example, automatic meter reading, building automation equipment, wireless security systems, industrial monitoring. It has features like small size, low power consumption, long transmission distance, strong anti-interference ability and so on.

LoRaWAN

LoRaWAN uses LoRa technology to define end-to-end standard specifications to ensure interoperability between devices and gateways from different manufacturers.

2. Appearance

R718N37 (non-detachable cables)



R718N37E (detachable cables)

3. Features

- SX1276 wireless communication module.
- 2 x ER14505 lithium battery in parallel (3.6V/section)
- 3-phase current meter detection.
- Magnetic base
- Main body: IP53; Current transformer: IP30
- LoRaWAN™ Class A compatible
- Frequency Hopping Spread Spectrum (FHSS)
- Available third-party platform: Actility/ThingPark, TTN, MyDevices/Cayenne
- Low power consumption and long battery life

Note: Please refer to web: http://www.netvox.com.tw/electric/electric_calc.html. Users can find battery lifetime for various models at different configurations on this website.

1. The actual range may vary depending on the environment.
2. Battery life is determined by sensor reporting frequency and other variables.

4. Set up Instruction

On/Off

Power on	Insert batteries. (Users may need a screwdriver to open the battery cover.)
Turn on	Press and hold the function key for 3 seconds until the green indicator flashes once.
Turn off (Reset to factory setting)	Press and hold the function key for 5 seconds until green indicator flashes 20 times.
Power off	Remove Batteries.
Note	1.The device will be off in default after removing the battery and insert it again. 2.It is suggested to wait for 10 seconds between turning on and off the device. 3. 5 seconds after power on, the device will be in engineering test mode.

Network Joining

Never joined the network	Turn on the device and search for the network to join. The green indicator light stays on for 5 seconds: Success The green indicator light remains off: Fail
Had joined the network (without factory resetting)	Turn on the device, and it will search for the previous network to join. The green indicator light stays on for 5 seconds: Success The green indicator light remains off: Fail
Fail to Join the Network	Suggest to check the device verification information on the gateway or consult your platform server provider.

Function Key

Press the function key and hold for 5 seconds	The device will be set to default and turned off The green indicator light flashes 20 times: success The green indicator light remains off: fail
Press the function key once	The device is in the network: green indicator light flashes once and sends a report The device is not in the network: green indicator light remains off

Sleeping Mode

The device is turned on and in the network	Sleep period: Min Interval. When the reportchange exceeds setting value or the state changes, the device would send a data report based on Min Interval.

Low Voltage Warning

Low Voltage	3.2V

5. Data Report

The device will immediately send a version packet report along with two uplink packets including 3-phase current value and battery voltage.

The device sends data in the default configuration before any configuration is done.

Default setting:

Max Interval = 0x384 (900s)

Min Interval = 0x384 (900s)

CurrentChange = 0x0064 (100 mA)

Three-phase current detection:

The device would detect and send report of the current value as the function key is triggered or in configuration.

Measurement Range and Accuracy:

	CT	Measurement Range	Accuracy
R718N3(E)	Solid-core	100mA to 50A	±1% (measurement range: 300mA to 50A)
R718N37(E)	Clamp-on	100mA to 75A	±1% (measurement range: 300mA to 50A)
R718N315(E)	Clamp-on	1A to 150A	±1%
R718N325(E)	Clamp-on	1A to 250A	±1%
R718N363(E)	Clamp-on	10A to 630A	±1%
R718N3100(E)	Clamp-on	10A to 1000A	±1%

Note: Current transformer (measurement range ≤ 75A): report data as 0 when the current < 100mA .

Current transformer (measurement range > 75A): report data as 0 when the current < 1A.

Please refer to Netvox *LoRaWAN Application Command document* and *Netvox Lora Command Resolver* http://www.netvox.com.cn:8888/cmddoc to resolve uplink data.

Data report configuration and sending period are as following:

Min. Interval (Unit:second)	Max. Interval (Unit:second)	Reportable Change	Current Change≥ Reportable Change	Current Change＜ Reportable Change
Any number between 1 to 65535	Any number between 1 to 65535	Can not be 0	Report per Min. Interval	Report per Max. Interval

5.1 Example of ReportDataCmd

FPort：0x06

Bytes	1	1	1	Var (Fix=8 Bytes)
	Version	DeviceType	ReportType	NetvoxPayLoadData

Version– 1 byte –0x01——the Version of NetvoxLoRaWAN Application Command Version

DeviceType– 1 byte – Device Type of Device

ReportType – 1 byte –the presentation of the NetvoxPayLoadData, according the devicetype

NetvoxPayLoadData– Fixed bytes (Fixed =8bytes)

Tips

1. **Battery Voltage:**

   The voltage value is bit 0 ~ bit 6, bit 7=0 is normal voltage, and bit 7=1 is low voltage.

   Battery=0xA0, binary=1010 0000, if bit 7= 1, it means low voltage.

   The actual voltage is 0010 0000 = 0x20 = 32, 32*0.1v =3.2v

2. **Version Packet:**

   When Report Type=0x00 is the version packet, such as 014A000A02202207080000, the firmware version is 2022.07.08.

3. **Data Packet:**

   When Report Type=0x01 is data packet; If the device data exceeds 11 bytes or there are shared data packets, the Report Type will have different values.

Device	**Device Type**	**Report Type**	**NetvoxPayLoadData**			
R718N3xxx(E) Series	0x4A	0x00	SoftwareVersion (1Byte) Eg.0x0A—V1.0	HardwareVersion (1Byte)	DateCode (4Bytes, eg 0x20170503)	Reserved (2Bytes,fixed 0x00)
		0x01	Battery (1Byte, unit:0.1V)	Current1 (2Bytes, unit:1mA)	Current2 (2Bytes, unit:1mA)	Current3 (2Bytes, unit:1mA)	Mulitplier1(1Byte), the real current1 should convert with Current* Mulitplier
		0x02	Battery (1Byte, unit:0.1V)	Mulitplier2 (1Byte), the real current2 should convert with Current* Mulitplier	Mulitplier3 (1Byte), the real current3 should convert with Current* Mulitplier	Reserved (5Bytes,fixed 0x00)
		0x03	Battery (1Byte,	Current1 (2Bytes,	Current2 (2Bytes,	Current3 (2Bytes,	Multiplier (1Byte), BIT0-1:

			unit:0.1V)	Unit:1ma)	Unit:1ma)	Unit:1ma)	Multiplier1(0b00_1,0b01_5,0b10_10,0b11_100) BIT2-3: Multiplier2(0b00_1,0b01_5,0b10_10,0b11_100) BIT4-5: Multiplier3(0b00_1,0b01_5,0b10_10,0b11_100) BIT6-7: Reserved
		0x04	Battery(1Byte, unit:0.1V)	ThresholdAlarm(1Byte, Bit0_LowCurrent1Alarm, Bit1_HighCurrent1Alarm, Bit2_ LowCurrent2Alarm, Bit3_ HighCurrent2Alarm, Bit4_ LowCurrent3Alarm, Bit5_ HighCurrent3Alarm, Bit6-7:Reserved)			Reserved(5Bytes,fixed 0x00)

Uplink:

Data # 1: 014A019F05DD05D405DE01

1st byte (01): Version

2nd byte (4A): DeviceType - R718N3xxx(E) Series

3rd byte (01): ReportType

4th byte (9F): Battery – 3.1V (low voltage) 9F (Hex) = 31 (Dec), 31* 0.1V = 3.1V

5th-6th byte (05DD): Current1 – 1501mA 05DD (Hex) = 1501 (Dec), 1501* 1mA = 1501mA

7th-8th byte (05D4): Current2 – 1492mA 05D4 (Hex) = 1492 (Dec), 1492* 1mA = 1492mA

9th-10th byte (05DE): Current3 – 1502mA 05DE (Hex) = 1502 (Dec), 1502* 1mA = 1502mA

11th byte (01): Multiplier1

Note:

The real Current1=Current1*Mulitplier1

The real Current2=Current2*Mulitplier2

The real Current3=Current3*Mulitplier3

Data # 2: 014A029F01010000000000

1st byte (01): Version

2nd byte(4A): DeviceType − R718N3xxx(E) Series

3rd byte (02): ReportType

4th byte(9F): Battery − 3.1V (low voltage) 9F (Hex) = 31 (Dec), 31* 0.1V = 3.1V

5th byte (01): Multiplier2

6th byte (01): Multiplier3

7th-11th byte (0000000000): Reserved

Data # 3: 014A039F05C705D405F000

1st byte (01): Version

2nd byte(4A): DeviceType − R718N3xxx(E) Series

3rd byte (03): ReportType

4th byte(9F): Battery − 3.1V (low voltage) 9F (Hex) = 31 (Dec), 31* 0.1V = 3.1V

5th-6th byte (05C7): Current1 − 1479mA 05C7 (Hex) = 1479 (Dec),1479*1mA=1479mA

7th-8th byte (05D4): Current2 – 1492mA 05D4 (Hex) = 1492 (Dec),1492*1mA=1492mA

9th-10th byte (05F0): Current3 – 1520mA 05F0 (Hex) = 1520 (Dec),1520*1mA=1520mA

11th byte (00): Multiplier1 = Multiplier2 = Multiplier3 = 1

//0x00 = 00 00 00 00 (bin)

Bit4-5 Bit2-3 Bit0-1

Data # 4: 014A049F01000000000000

1st byte (01): Version

2nd byte(4A): DeviceType − R718N3xxx(E) Series

3rd byte (04): ReportType

4th byte(9F): Battery − 3.1V (low voltage) 9F (Hex) = 31 (Dec), 31* 0.1V = 3.1V

5th byte (01): ThresholdAlarm – LowCurrent1Alarm

6th-11th byte (000000000000): Reserved

5.2 Example of ConfigureCmd

FPort：0x07

Bytes	1	1	Var(Fix =9 Bytes)
	CmdID	DeviceType	NetvoxPayLoadData

CmdID– 1 byte

DeviceType– 1 byte – Device Type of Device

NetvoxPayLoadData– var bytes (Max=9bytes)

Description	**Device**	**CmdID**	**Device Type**	**NetvoxPayLoadData**			
Config ReportReq	R718N3xxx(E) Series	0x01	0x4A	MinTime (2bytes Unit:s)	MaxTime (2bytes Unit:s)	CurrentChange (2byte Unit:1mA)	Reserved (3Bytes,Fixed 0x00)
Config ReportRsp		0x81		Status (0x00_success)		Reserved (8Bytes,Fixed 0x00)	
ReadConfig ReportReq		0x02		Reserved (9Bytes,Fixed 0x00)			
ReadConfig ReportRsp		0x82		MinTime (2bytes Unit:s)	MaxTime (2bytes Unit:s)	CurrentChange (2byte Unit:1mA)	Reserved (3Bytes,Fixed 0x00)

(1) Configure device parameters MinTime = 1min (0x003C), MaxTime = 1min (0x003C), CurrentChange = 100mA (0x0064)

Downlink: 014A003C003C0064000000

The device returns:

814A000000000000000000 (Configuration successful)

814A010000000000000000 (Configuration failed)

(2) Read device configuration parameters

Downlink: 024A000000000000000000

The device returns:

824A003C003C0064000000 (Current device configuration parameters)

5.3 Example of SetRportType

Description	Device	CmdID	Device Type	NetvoxPayLoadData	
SetRportTypeReq (REMAIN Lastconfig when resettofac)	R718N3xxx(E) Series	0x03	0x4A	ReportTypeSet (1Byte,0x00_reporttype1&2, 0x01_reporttype3)	Reserved (8Bytes,Fixed 0x00)
SetRportTypeRsp (REMAIN Lastconfig when resettofac)		0x83		Status (0x00_success)	Reserved (8Bytes,Fixed 0x00)
GetRportTypeReq		0x04		Reserved (9Bytes,Fixed 0x00)	
GetRportTypeRsp		0x84		ReportTypeSet (1Byte,0x00_reporttype1&2, 0x01_reporttype3)	Reserved (2Bytes,Fixed 0x00)

(3) Configure ReportTypeSet =0x01

Downlink: 014A010000000000000000 // 0x01 Uplink return one packet.

The device returns:

834A000000000000000000 (Configuration successful)

834A010000000000000000 (Configuration failed)

(4) Read device configuration parameters.

Downlink: 044A000000000000000000

The device returns:

844A010000000000000000 (Current device configuration parameters)

5.4 Set/GetSensorAlarmThresholdCmd

Fport:0x10

CmdDescriptor	CmdID (1Byte)	Payload (10Bytes)			
SetSensorAlarmThresholdReq	0x01	Channel(1Byte, 0x00_Channel1, 0x01_Chanel2, 0x02_Channel3,etc)	SensorType(1Byte, 0x00_Disable ALL SensorthresholdSet 0x27_Current,	SensorHighThreshold (4Bytes,Unit:same as reportdata in fport6, 0Xffffffff_DISALBLE HighThreshold)	SensorLowThreshold (4Bytes,Unit:same as reportdata in fport6, 0Xffffffff_DISALBLE HighThreshold)
SetSensorAlarmThresholdRsp	0x81	Status (0x00_success)		Reserved (9Bytes,Fixed 0x00)	
GetSensorAlarmThresholdReq	0x02	Channel(1Byte, 0x00_Channel1, 0x01_Chanel2, 0x02_Channel3,etc)	SensorType (1Byte,Same as the SetSensorAlarmThresholdReq's SensorType)	Reserved (8Bytes,Fixed 0x00)	
GetSensorAlarmThresholdRsp	0x82	Channel(1Byte, 0x00_Channel1, 0x01_Chanel2, 0x02_Channel3,etc)	SensorType (1Byte,Same as the SetSensorAlarmThresholdReq's SensorType)	SensorHighThreshold (4Bytes,Unit:same as reportdata in fport6, 0Xffffffff_DISALBLE HighThreshold)	SensorLowThreshold (4Bytes,Unit:same as reportdata in fport6, 0Xffffffff_DISALBLE HighThreshold)

Channel - 1byte

0x00_ Current1, 0x01_ Current2, 0x02_ Current3 // When restoring factory settings, the last set value will be retained.

(1) SetSensorAlarmThresholdReq: (Set Current HighThresholdt to 500mA; LowThreshold to100mA)

Downlink: 0100270000001F400000064 //1F4 (Hex) = 500 (Dec), 500* 1mA = 500mA;

64 (Hex) = 100 (Dec), 64* 1mA = 64mA

Response: 810000000000000000000

(2) GetSensorAlarmThresholdReq：

Downlink: 020027000000000000000

Response: 820027000001F400000064

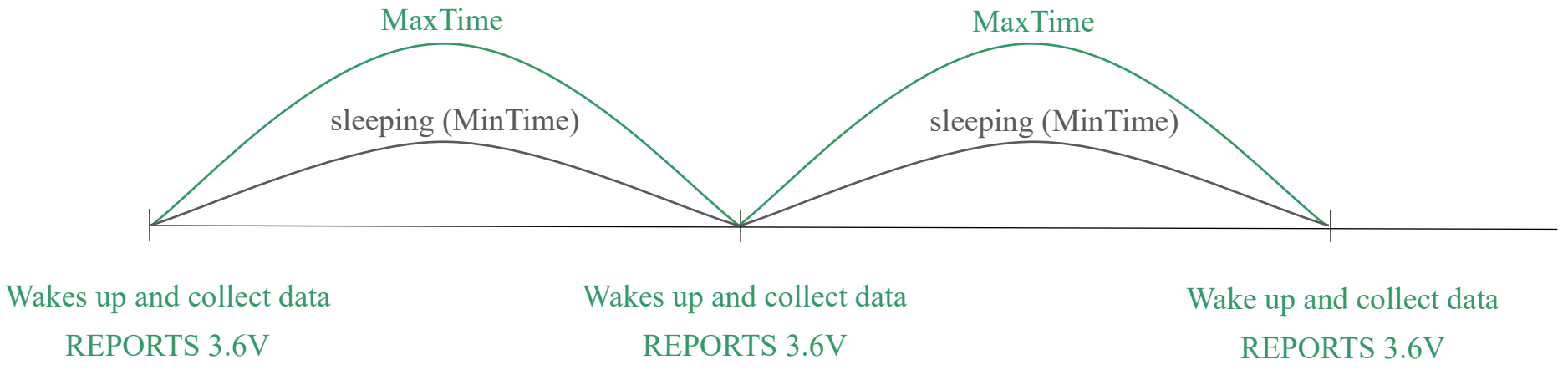
(3) Disable all sensor thresholds. (Configure the Sensor Type to 0)

Downlink: 010000000000000000000

Response: 810000000000000000000

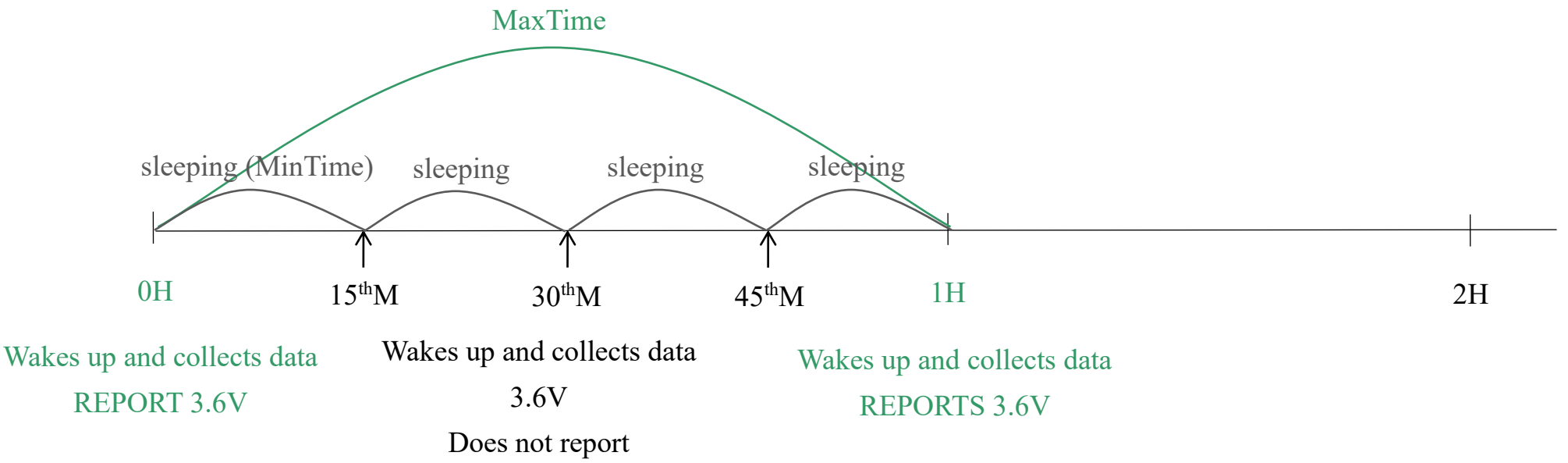
5.5 Example for MinTime/MaxTime logic

Example#1 based on MinTime = 1 Hour, MaxTime= 1 Hour, Reportable Change i.e. BatteryVoltageChange=0.1V

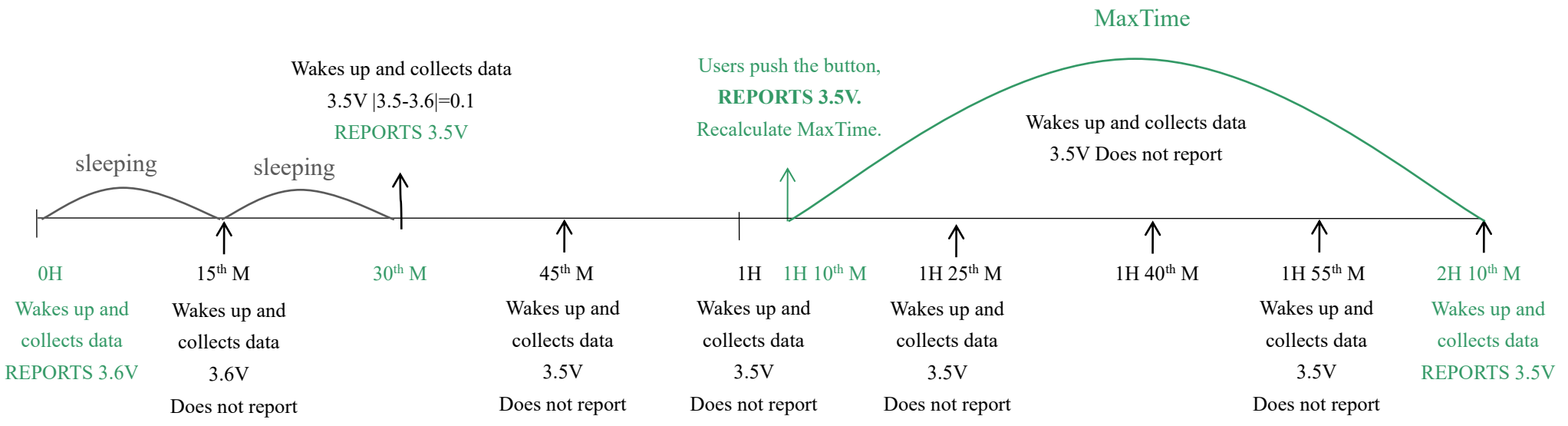


Note: MaxTime=MinTime. Data will only be report according to MaxTime (MinTime) duration regardless BatteryVoltageChange value.

Example#2 based on MinTime = 15 Minutes, MaxTime= 1 Hour, Reportable Change i.e. BatteryVoltageChange= 0.1V.



Example#3 based on MinTime = 15 Minutes, MaxTime= 1 Hour, Reportable Change i.e. BatteryVoltageChange= 0.1V.



Notes :

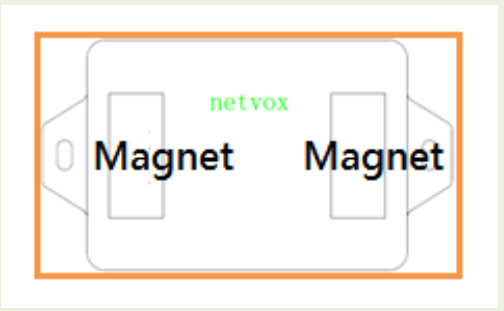
1) The device only wakes up and performs data sampling according to MinTime Interval. When it is sleeping, it does not collect data.
2) The data collected is compared with the last data reported. If the data variation is greater than the ReportableChange value, the device reports according to MinTime interval. If the data variation is not greater than the last data reported, the device reports according to MaxTime interval.
3) We do not recommend to set the MinTime Interval value too low. If the MinTime Interval is too low, the device wakes up frequently and the battery will be drained soon.
4) Whenever the device sends a report, no matter resulting from data variation, button pushed or MaxTime interval, another cycle of MinTime/MaxTime calculation is started.

6. Installation

1. The 3-phase current meter R718N3xxx(E) series has a built-in magnet (see Figure 1 below). It can be attached to the surface of an object with iron during installation, which is convenient and quick.

   To make the installation more secure, please use screws (purchased separately) to fix the device to the wall or other objects (such as the installation diagram).

Note: Do not install the device in a metal shielded box or in an environment surrounded by other electrical equipment to avoid affecting the wireless transmission of the device.



4. The 3-phase current meter samples the current according to MinTime. If the current value sampled this time relatively exceeds the set value (the default is 100mA) more than the current value reported last time, the device will immediately report the current value sampled this time. If the current variation does not exceed the default value, the data will be reported regularly according to MaxTime.
5. Press the [Key] of the device to start sampling data and report the data after 3 to 5 seconds.

   Note: MaxTime must be set greater than Min Time.

2. Open the clamp-on current transformer, and then pass the live wire through the current transformer according to the installation.

   Note: "L←K" is marked on the bottom of the CT.

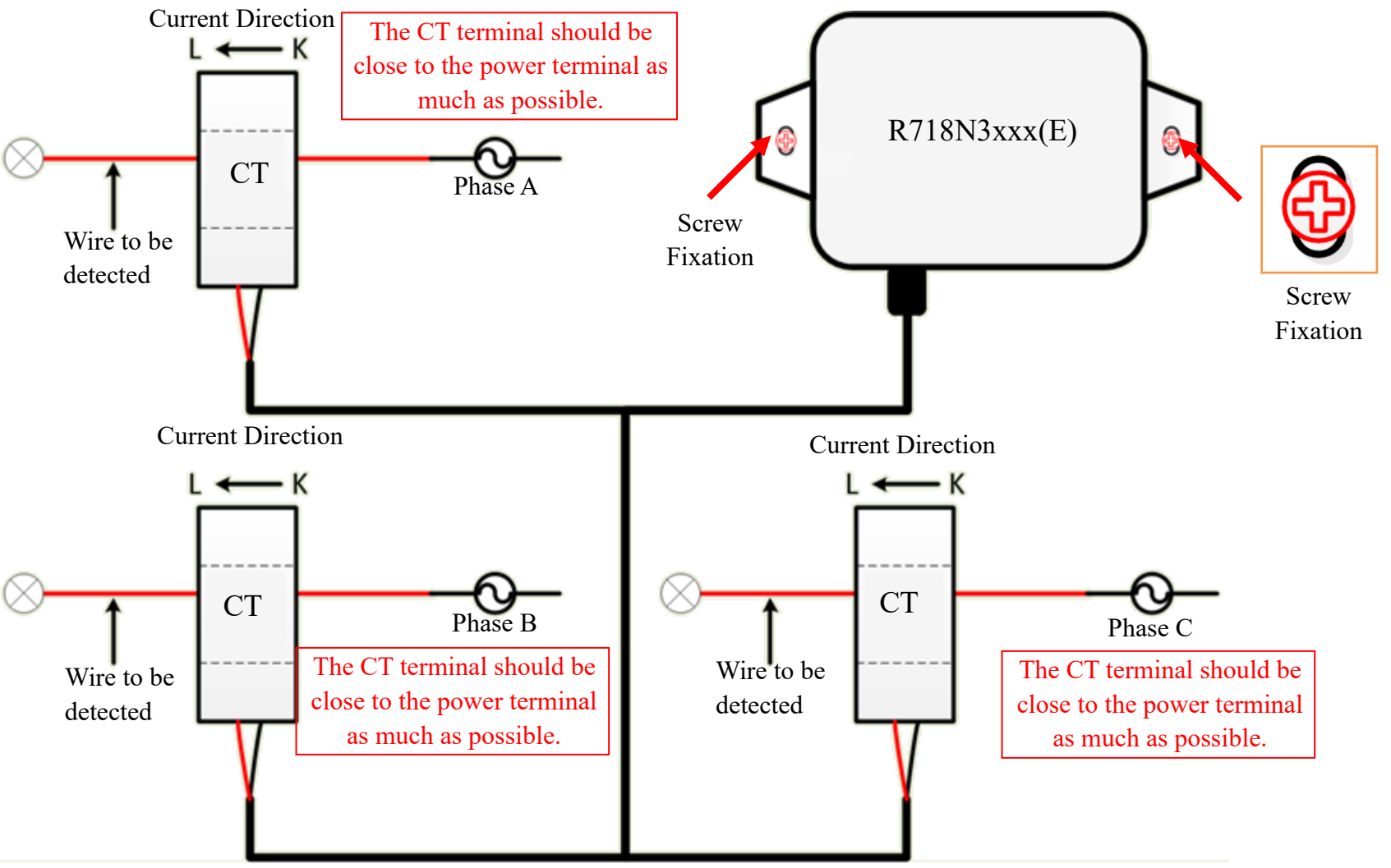
3. Precautions:

- Before using, user must check whether the appearance is deformed; otherwise, the test accuracy will be affected.
- The using environment should be kept away from strong magnetic fields, so as not to affect the test accuracy. It is strictly forbidden to use in humid and corrosive gas environments.
- Before installation, please confirm the current value of the load. If the current value of the load is higher than the measurement range, select a model with a higher measurement range.

The three-phase current detector R718N3xxx(E) is suitable for the following scenarios:

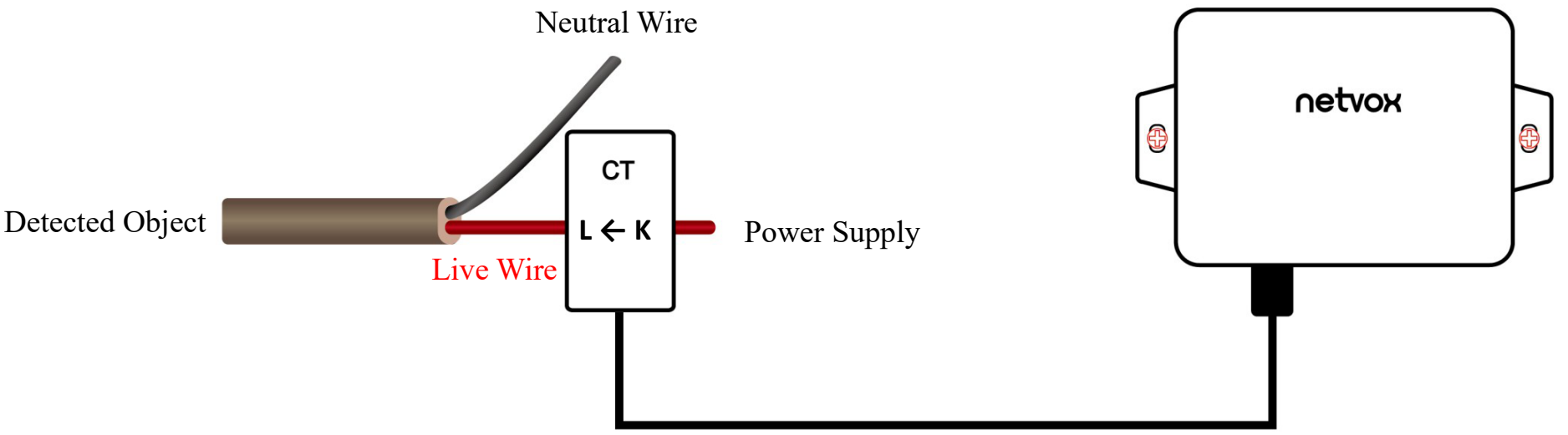
- School
- Factory
- Shopping mall
- Office building
- Smart building

Where the electrical data of the device with the three-phase electricity needs to be detected.

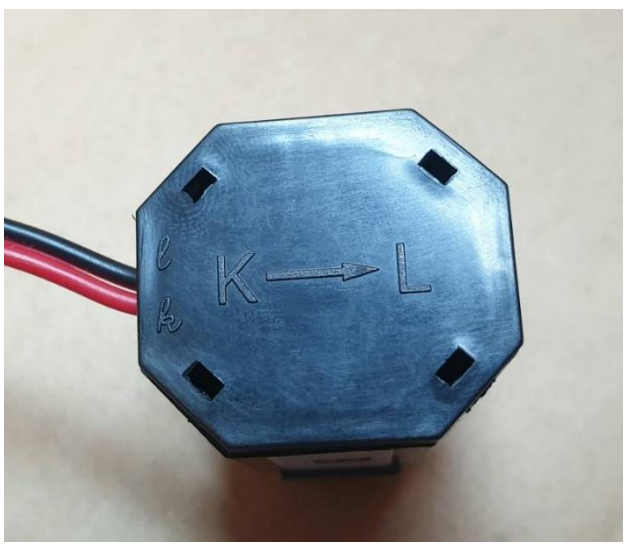


Installation Diagram

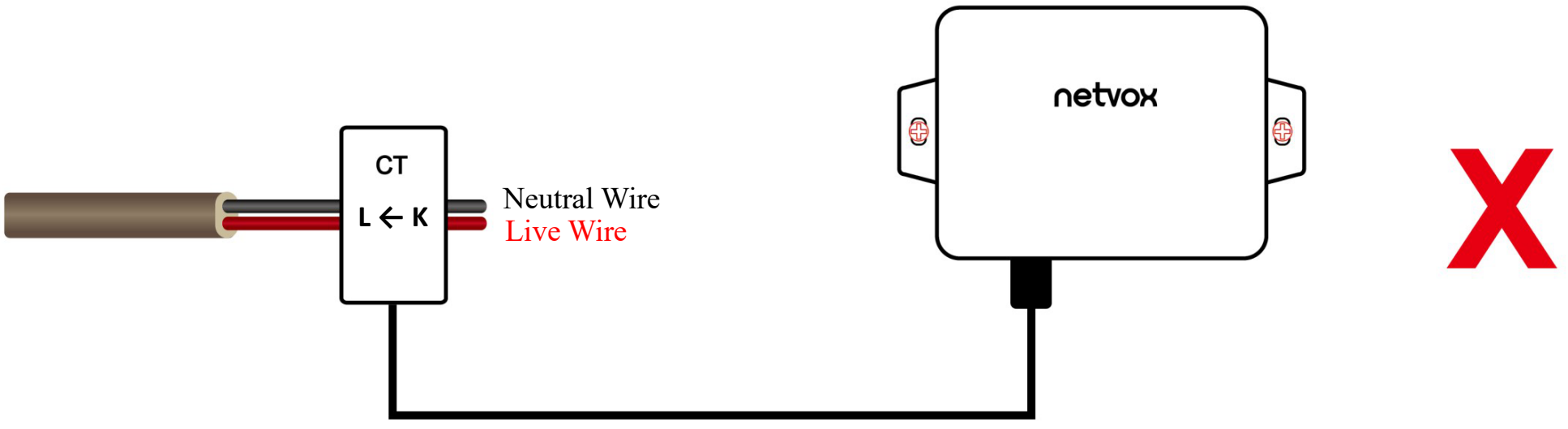
1. When using it, the back of it can be adsorbed on the iron surface, or the two ends can be fixed to the wall with screws.
2. When installing the R718N3xxx(E) series current transformer, please separate the live and neutral wires of the wire to be detected, and only take the live wire through current transformer and start the measurement according to the wiring below:



CT Wiring Schematic Diagram (Current direction K→L)



If the live wire and the neutral wire are connected together at the same time, they will offset each other and the measurement is 0.



Note:

1. Please do not disassemble the device unless it is required to replace the batteries.
2. Do not touch the waterproof gasket, LED indicator light, function keys when replacing the batteries. Please use suitable screwdriver to tighten the screws (if using an electric screwdriver, it is recommended to set the torque as 4kgf) to ensure the device is impermeable.

7. Information about Battery Passivation

Many of Netvox devices are powered by 3.6V ER14505 Li-SOCl2 (lithium-thionyl chloride) batteries that offer many advantages including low self-discharge rate and high energy density. However, primary lithium batteries like Li-SOCl2 batteries will form a passivation layer as a reaction between the lithium anode and thionyl chloride if they are in storage for a long time or if the storage temperature is too high. This lithium chloride layer prevents rapid self-discharge caused by continuous reaction between lithium and thionyl chloride, but battery passivation may also lead to voltage delay when the batteries are put into operation, and our devices may not work correctly in this situation.

As a result, please make sure to source batteries from reliable vendors, and it is suggested that if the storage period is more than one month from the date of battery production, all the batteries should be activated. If encountering the situation of battery passivation, users can activate the battery to eliminate the battery hysteresis.

ER14505 Battery Passivation

7.1 To determine whether a battery requires activation

Connect a new ER14505 battery to a resistor in parallel, and check the voltage of the circuit.

If the voltage is below 3.3V, it means the battery requires activation.

7.2 How to activate the battery

a. Connect a battery to a resistor in parallel

b. Keep the connection for 5~8 minutes

c. The voltage of the circuit should be ≧3.3, indicating successful activation.

Brand	Load Resistance	Activation Time	Activation Current
NHTONE	165 Ω	5 minutes	20mA
RAMWAY	67 Ω	8 minutes	50mA
EVE	67 Ω	8 minutes	50mA
SAFT	67 Ω	8 minutes	50mA

Note:

If you buy batteries from other than the above four manufacturers, then the battery activation time, activation current, and required load resistance shall be mainly subject to the announcement of each manufacturer.

8. Important Maintenance Instruction

Kindly pay attention to the following in order to achieve the best maintenance of the product:

- Do not put the device near or submerge into water. Minerals in rain, moisture, and other liquids could cause corrosion of electronic components. Please dry the device, if it gets wet.
- Do not use or store the device in dusty or dirty environments to prevent damage to parts and electronic components.
- Do not store the device in high temperatures. This may shorten the lifespan of electronic components, damage batteries, and deform plastic parts.
- Do not store the device in cold temperatures. Moisture may damage circuit boards as the temperatures rise.
- Do not throw or cause other unnecessary shocks to the device. This may damage internal circuits and delicate components.
- Do not clean the device with strong chemicals, detergents, or strong detergents.
- Do not apply the device with paint. This may block detachable parts and cause malfunction.
- Do not dispose of batteries in fire to prevent explosion.

The instructions are applied to your device, battery, and accessories.

If any device is not working properly, please bring it to the nearest authorized service provider for repair.