Wireless 3-Phase Current Meter

R718N3 Series User Manual

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1. Introduction

The R718N3 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. R718N3 series have different measuring range for different variety of CT.

It is divided into:

R718N3 Wireless 3-Phase Current Meter with 3 x 50A Solid Core CT (Range:100mA-50A , Accuracy: ±1% (300mA-50A))

R718N37 Wireless 3-Phase Current Meter with 3 x 75A Clamp-On CT (Range:100mA-75A , Accuracy: ±1% (300mA-75A))

R718N315 Wireless 3-Phase Current Meter with 3 x 150A Clamp-On CT (Range:1A-150A ±1%)

R718N325 Wireless 3-Phase Current Meter with 3 x 250A Clamp-On CT (Range:1A-250A ±1%)

R718N363 Wireless 3-Phase Current Meter with 3 x 630A Clamp-On CT (Range:10A-630A ±1%)

R718N3300 Wireless 3-Phase Current Meter with 3 x 3000A Clamp-On CT (Range:150A-3000A ±1%)

* When the current of the device that is 75A or below is less than 100mA, the current is reported as 0.

When the current of the device that is above 75A is less than 1A, the current is reported as 0.

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.

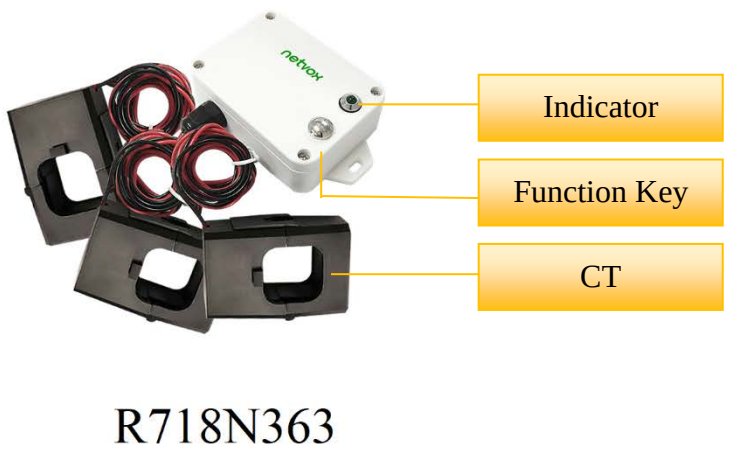
2. Appearance

R718N3

R718N37

R718N315

R718N325



R718N363

3. Main Features

- Adopt SX1276 wireless communication module.
- 2 x ER14505 lithium battery in parallel (3.6V/section)
- 3-phase current meter detection.
- The base is attached with a magnet that can be attached to a ferromagnetic material object.
- IP rating: Main body - IP53, CT - 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
- Battery Life: Please refer to web: http://www.netvox.com.tw/electric/electric_calc.html

  At this website, users can find battery life time for variety models at different configurations.

  *1. Actual range may vary depending on 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 till the green indicator flashes once.
Turn off (Restore to factory setting)	Press and hold the function key for 5 seconds till 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 at least 10 seconds between turning the device on and off. 3.At 1st -5th second after power on, the device will be in engineering test mode.

Network Joining

Never joined the network	Turn on the device, and it will search for the network to join. The green indicator light stays on for 5 seconds: joins the network successfully The green indicator light remains off: fail to join the network
Had joined the network (not restore to factory setting)	Turn on the device, and it will search for the previous network to join. The green indicator light stays on for 5 seconds: joins the network successfully The green indicator light remains off: fail to join the network
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 the pressing 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: send a data report according to 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 current, 3 multiplier and battery voltage.

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

Default setting:

Max Interval = 0x0E10 (3600 s)

Min Interval = 0x0E10 (3600 s)

CurrentChange = 0x0064 (100 mA)

*The interval between min time and max time must be the greater than 20 seconds.

Note:

(1) The device report interval will be programmed based on the default firmware which may vary.

(2) If MinTime configuration less than 20 seconds, it will configure 20 seconds.

(3) R718N3 series would take about 3 seconds for the CT to sample and process the collected value. If the current changes frequently, the sampling result might be wrong.

Please refer Netvox *LoRaWAN Application Command document* and *Netvox Lora Command Resolver* http://cmddoc.netvoxcloud.com/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 20~65535	Any number between Min.~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

The devicetype is listed in Netvox LoRaWAN Application Devicetype .doc

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 014A000A0B202005200000, the firmware version is 2020.05.20

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	DeviceType	Report Type	NetvoxPayLoadData				
R718N3	0x4A	0x00	SoftwareVersion (1Byte) Eg.0x0A—V1.0	Hardware Version (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* Multiplier
		0x02	Battery (1Byte, unit:0.1V)	Mulitplier2(1Byte), the real current2 should convert with Current* Multiplier	Mulitplier3(1Byte), the real current3 should convert with Current* Multiplier	Reserved (5Bytes,fixed 0x00)	

Uplink: Data # 1: 014A0124006400C81B5801

Data # 2: 014A0224010A0000000000

1st byte (01): Version

2nd byte(4A): DeviceType 0x4A – R718N3 Series

3rd byte (01): ReportType

4th byte(24): Battery – 3.6V, 24 (H_{ex})= 36 (D_{ec}), 36x0.1=3.6 V

5th 6th byte(0064): Current 1 – 100mA , 0064(H_{ex})= 100 (D_{ec})

7th 8th byte(00C8): Current 2 – 200mA , 0064(H_{ex})= 200 (D_{ec})

9th 10th byte(1B58): Current 3 − 70000mA , 1B58(H_{ex})= 7000 (D_{ec}),7000* Multiplier 10=70000

11th byte(01): Multiplier − 1

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	R718N3	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, MaxTime = 1min, CurrentChange = 100mA

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)

Note:

Press and hold the function key for 5 seconds, and the device will turn off and restore the original factory mode.

If you want to change the value of MinTime/MaxTime and want to keep the changed value when the device is power off, please remove the battery directly without long pressing the function key.

5.3 Example of SetRportType

The R718N3 series defaults to return two packets, which can be changed to one by the following command.

(Supported after firmware 2022.8.XX)

Description	Device	CmdID	Device Type	NetvoxPayLoadData	
SetRportTypeReq	R718N3	0x03	0x4A	ReportTypeSet (1Byte,0x00_reporttype1&2, 0x01_reporttype3)	Reserved (8Bytes,Fixed 0x00)
SetRportTypeRsp		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_reporttype3

Downlink: 034A010000000000000000 // 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)

The format of one packet:

Device	Device Type	Report Type	NetvoxPayLoadData				
R718N3 Series	0x4A	0x03	Battery (1Byte) Unit:0.1V	Current1 (2Bytes) Unit:1mA	Current2 (2Bytes) Unit:1mA	Current3 (2Bytes) Unit:1mA	Multiplier(1Byte) BIT0-1: 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

Uplink: 014A032405DC36B080E824

1st byte (01): Version

2nd byte(4A): DeviceType 0x4A − R718N3 Series

3rd byte (03): ReportType

4th byte(24): Battery − 3.6V, 24 (H_{ex})= 36 (D_{ec}), 36x0.1=3.6 V

5th 6th byte(05DC): Current 1 − 05DC Hex=1500 Dec, 1500*1=1500mA (1.5A)

7th 8th byte (36B0): Current 2 − Current 2 − 36B0 Hex=14000 Dec , 14000*5=70000mA (70A)

9th 10th byte (80E8): Current 3 − Current 3 − 80E8 Hex=33000 Dec , 33000*10=330000mA (330A)

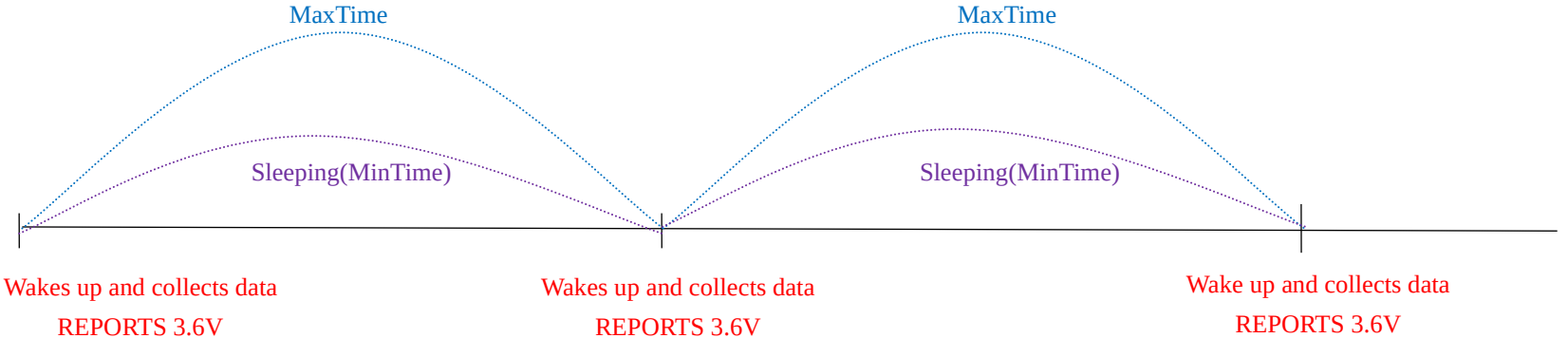
11th byte (24): Multiplier1=1, Multiplier2=5, Multiplier3=10

// 0x24 = 00 10 01 00 (bin)

Bit4-5 Bit2-3 Bit0-1

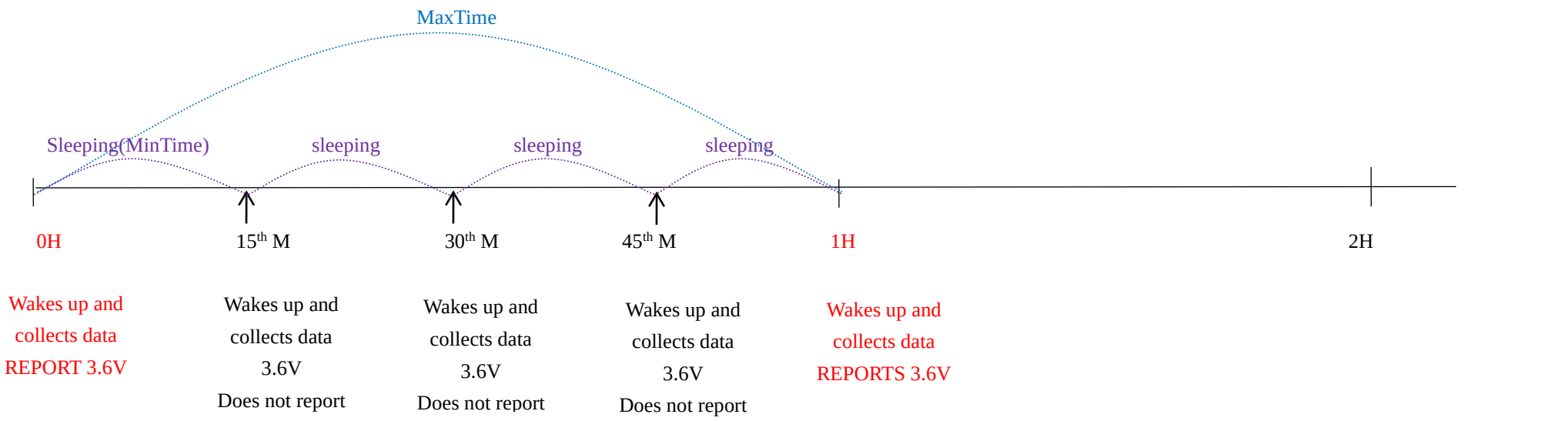
5.4 Example for MinTime/MaxTime logic

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

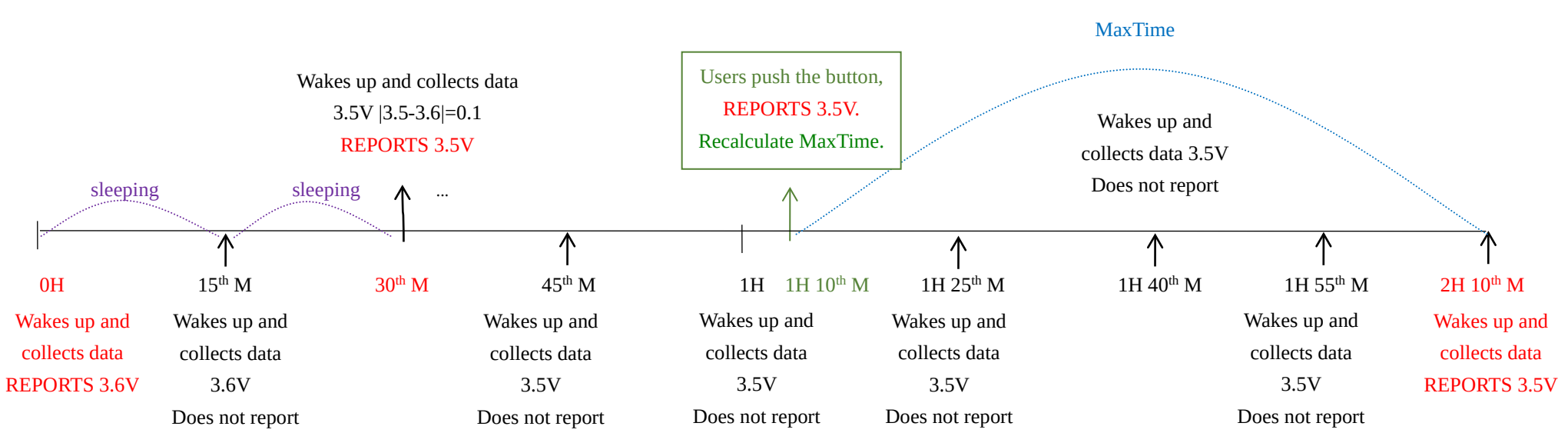


Note: MaxTime=MinTime. Data will only be report according to MaxTime (MinTime) duration regardless BatteryVoltageChange value.

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.

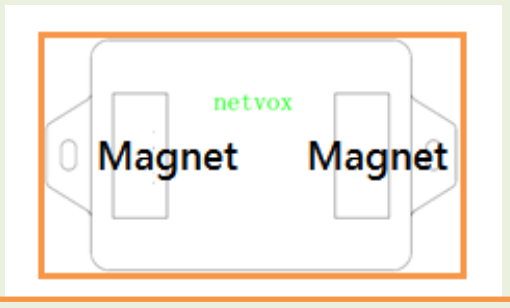
2) The data collected is compared with the last data reported. If the data variation is greater than the ReportableChange value, the device reports according to MinTime interval. If the data variation is not greater than the last data reported, the device reports according to MaxTime interval.
3) We 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 (R718N3) 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 (R718N3) 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.

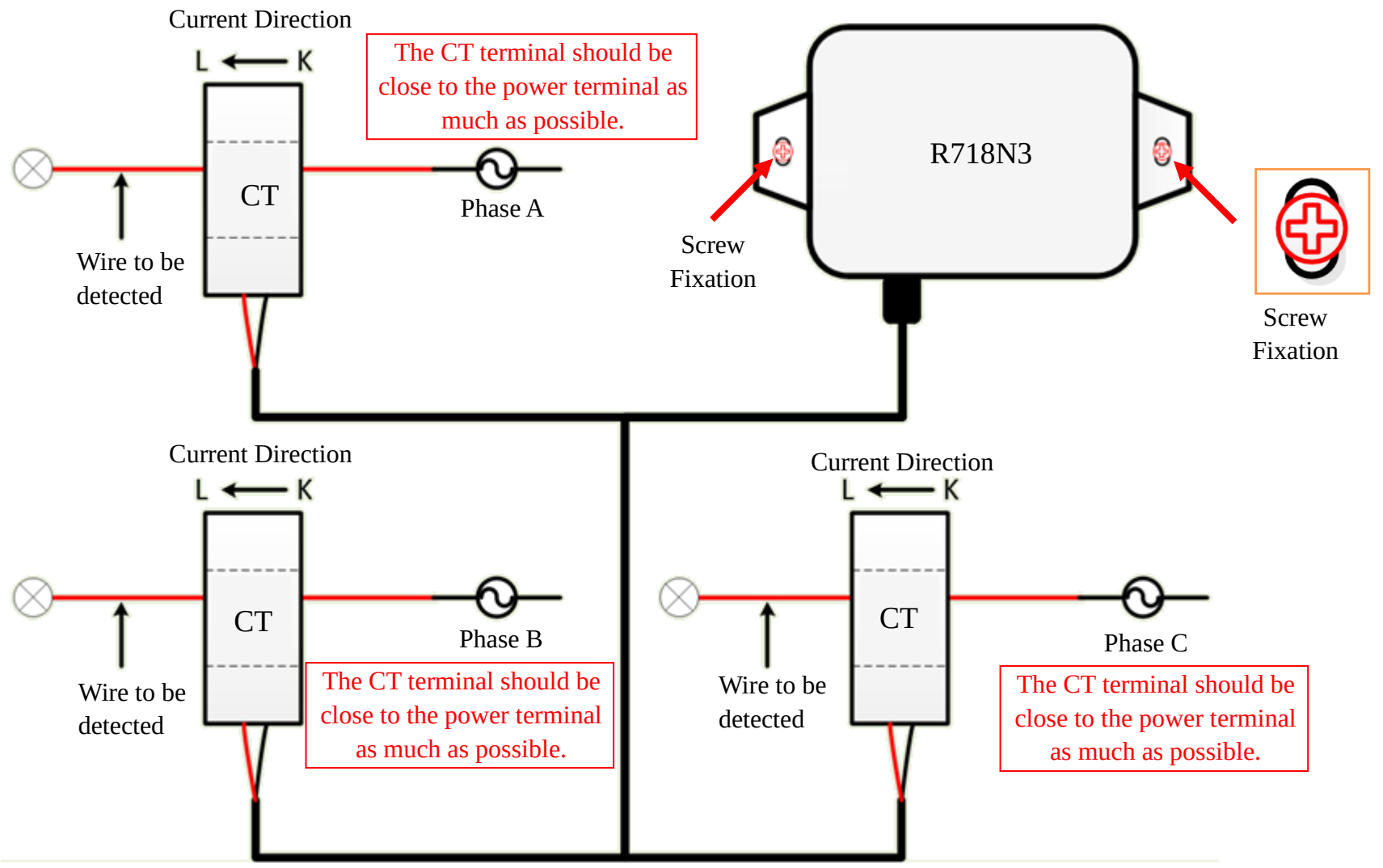
3. Precautions:

- 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 (R718N3) is suitable for the following scenarios:

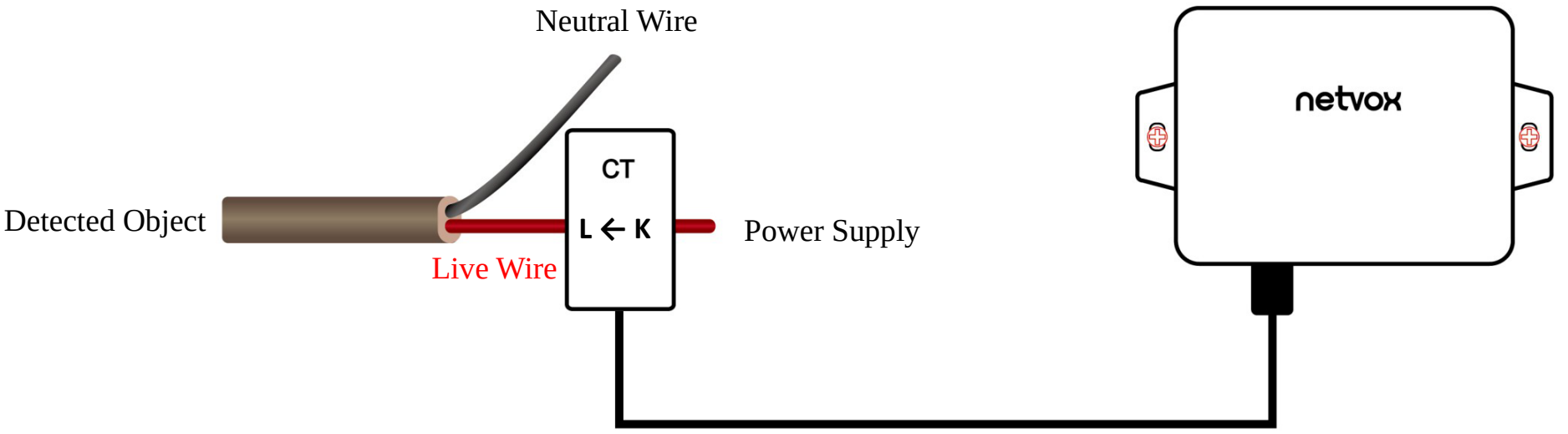
- School
- Factory
- Shopping mall
- Office building
- Smart building

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

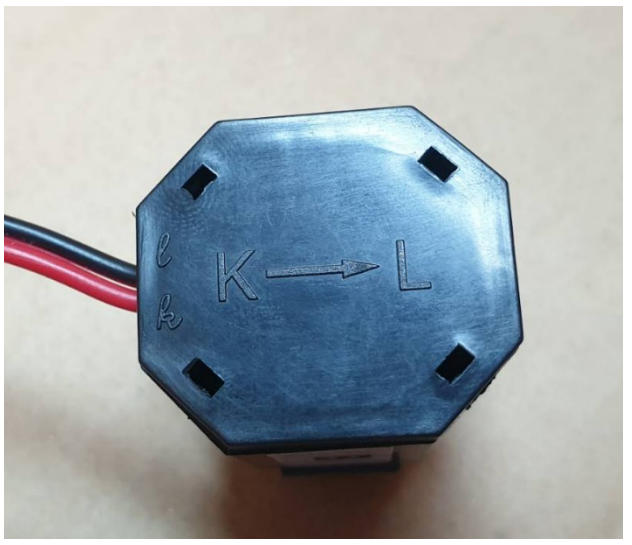


Installation Diagram

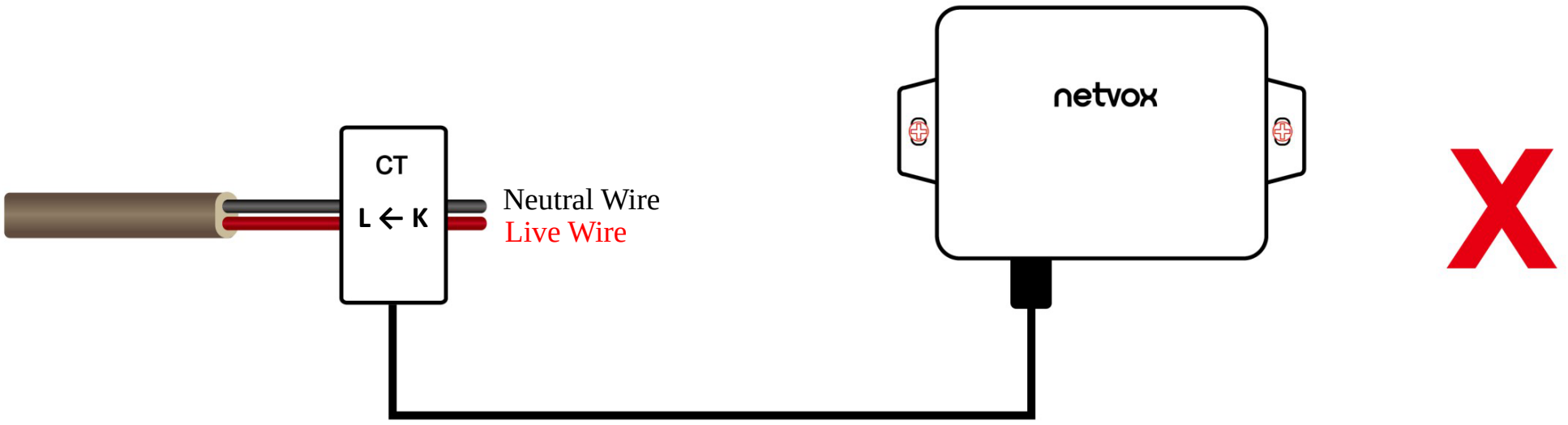
1. When using it, the back of it can be adsorbed on the iron surface, or the two ends can be fixed to the wall with screws.
2. When installing the R718N3 series current transformer, please separate the live and neutral wires of the wire to be detected, and only take the live wire through current transformer 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:

Please do not disassemble the device unless it is required to replace the batteries.

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:

- Keep the device dry. Rain, moisture, or any liquid might contain minerals and thus corrode electronic circuits. If the device gets wet, please dry it completely.
- Do not use or store the device in dusty or dirty environment. It might damage its detachable parts and electronic components.
- Do not store the device under excessive hot condition. High temperature can shorten the life of electronic devices, destroy batteries, and deform or melt some plastic parts.
- Do not store the device in places that are too cold. Otherwise, when the temperature rises to normal temperature, moisture will form inside, which will destroy the board.
- Do not throw, knock or shake the device. Rough handling of device can destroy internal circuit boards and delicate structures.
- Do not clean the device with strong chemicals, detergents or strong detergents.
- Do not apply the device with paint. Smudges might block in the device and affect the operation.
- Do not throw the battery into the fire, or the battery will explode. Damaged batteries may also explode.

All of the above applies to your device, battery and accessories.

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