Wireless 2-Input 0-10V ADC Sampling and 2-Input 0-20mA Sensor Interface

R718KBC User Manual

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1. Introduction

R718KBC can connect with 4 devices, measuring 0 to 10V voltage and 0 to 20 mA current. With 24-bit ADC sampling and less than 1% error, the R718KB series gives users highly accurate measurement results. When connecting with sensors or instrumentation, the R718KB series automatically converts data with attributes set first so that users can read data easily. Precise results and convenient data conversion, the R718KB series makes measurements easier and more accurate than you ever imagined.

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 extends 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, and 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

3. Features

- 0–20mA and 0–10V detection with 4 external devices connected
- 24-bit ADC sampling
- <1% error for 1–20mA detection
- IP67
- 2* AA 3.6V ER14505 battery in parallel
- SX1262 wireless communication module
- Magnetic base
- Compatible with LoRaWAN™ Class A
- Frequency spread spectrum technology
- Applicable to third-party platforms: Actility / ThingPark, TTN, MyDevices / Cayenne
- Low power consumption and long battery life

Note: (1) R718KBC only takes input of 10V and 20mA DC signals.

(2) Please visit http://www.netvox.com.tw/electric/electric_calc.html for more information about battery lifespan.

4. Setup Instructions

On & Off

Power on	Insert batteries
Turn on	Press and hold the function key for 3 seconds until the green indicator flashes once.
Turn off	Press and hold the function key for 5 seconds until the green indicator flashes 20 times.
Power off (back to factory setting)	Remove batteries.
Note: (1) Users may need a screwdriver to open the battery cover. (2) The device will be off by default after removing the battery and inserting it again. (3) It is suggested to wait 10 seconds between turning on and off the device. (4) 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 search 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	(1) Please check the device verification information on the gateway or consult your platform server provider. (2) Please remove batteries when they are not in use.

Function Key

Press and hold the function key for 5 seconds	Back to factory setting and restart the device The green indicator flashes 20 times: Success The green indicator remains off: Fail
Short press the function key	The device is in the network The green indicator flashes once and sends a data packet. The device is not in the network The green indicator remains off.

Sleeping Mode

Device is on and in the network	Sleeping period: Min Interval When the reportchange exceeds setting value or the state changes: send a data report according to Min Interval
Device is on but not in the network	(1) Please check the device verification information on the gateway. (2) Please remove batteries when they are not in use.

Low Voltage Warning

Low voltage	3.2V

5. Data Report

After powered on, the device will immediately send a version packet report, 2 data of battery voltage and detected voltage from 4 connected devices.

The device sends data according to the default configuration before any other configuration.

Default Setting:

Max Interval: 0x0708 (1800s)
Min Interval: 0x0708 (1800s)
BatteryChange: 0x01 (0.1V)
VoltageChange: 0x0064 (100mV)
CurrentChange: 0x0064 (100μA)

RejoinCheckPeriod = 0x00001C20 (2 hr)
RejoinThreshold = 0x03 (3 times)
BalanceCheckPeriod = 0x0B40 (2880 minutes)
BalanceThreshold = 0xC8 (200mV)

Note:

(1) The cycle of the device sending the data report is according to the default.

(2) The interval between two reports must be the minimum time.

(3) 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 follows:

Min. Interval (Unit: second)	Max. Interval (Unit: second)	Reportable Change	Current Change≥ Reportable Change	Current Change＜ Reportable Change
Any number between 1–65535	Any number between 1–65535	Cannot 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 to 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 01DA000A01202311300000, the firmware version is 2023.11.30.

<table>
<tr><th>Device</th><th>Device Type</th><th>Report Type</th><th colspan="5">NetvoxPayLoadData</th></tr>
<tr><td rowspan="5">R718KBC</td><td rowspan="5">0xDA</td><td>0x01</td><td>Battery
(1 Byte,
unit: 0.1V)</td><td>Current1
(2 Bytes,
unit: 1 uA)</td><td>Current2
(2 Bytes,
unit: 1 uA)</td><td>voltage1
(2 Bytes,
unit: 1mv)</td><td>Reserved
(1 Byte,
fixed 0x00)</td></tr>
<tr><td>0x02</td><td>Battery
(1 Byte,
unit: 0.1V)</td><td>voltage2
(2 Bytes,
unit: 1mv)</td><td colspan="2">ThresholdAlarm (1Byte,
Bit0_LowCurrent1Alarm,
Bit1_HighCurrnet1Alarm,
Bit2_LowCurrent2Alarm,
Bit3_HighCurrent2Alarm,
Bit4_LowCurrent3Alarm,
Bit5_HighCurrent3Alarm,
Bit6_LowCurrent4Alarm,
Bit7_HighCurrent4Alarm)</td><td>Reserved
(4 Bytes,
fixed 0x00)</td></tr>
<tr><td>0x03</td><td>Battery
(1 Byte,
unit: 0.1V)</td><td>RawAttr1
(2 Bytes)</td><td>RawAttr2
(2 Bytes)</td><td>RawAttr3
(2 Bytes)</td><td>Reserved
(1 Byte,
fixed 0x00)</td></tr>
<tr><td>0x04</td><td>Battery
(1 Byte,
unit: 0.1V)</td><td>RawAttr4
(2 Bytes)</td><td colspan="2">ThresholdAlarm (1Byte,
Bit0_LowRawAttr1Alarm,
Bit1_HighRawAttr1Alarm,
Bit2_LowRawAttr2Alarm,
Bit3_HighRawAttr2Alarm,
Bit4_LowRawAttr3Alarm,
Bit5_HighRawAttr3Alarm,
Bit6_LowRawAttr4Alarm,
Bit7_HighRawAttr4Alarm)</td><td>Reserved
(4 Bytes,
fixed 0x00)</td></tr>
</table>

Uplink 1: 01DA0123173C173A26EE00

1st byte (01): Version

2nd byte (DA): DeviceType — R718KBC

3rd byte (01): ReportType

4th byte (23): Battery — 3.5v, 23 (Hex) = 35 (Dec) 35* 0.1v = 3.5v

5th–6th byte (173C): Current1 — 5948μA 173C (Hex) = 5948 (Dec), 5948*1μA = 5948μA

7th–8th byte (173A): Current2 — 5946μA 173A (Hex) = 5946 (Dec), 5946*1μA = 5946μA

9th–10th byte (26EE): Voltage1 — 9966mV 26EE (Hex) = 9966 (Dec), 9966*1mV = 9966mV

11th byte (00): Reserved

Uplink 2: 01DA022326F4A000000000

1st byte (01): Version

2nd byte (DA): DeviceType — R718KBC

3rd byte (02): Report Type

4th byte (23): Battery — 3.5v, 23 (Hex) = 35 (Dec) 35* 0.1v = 3.5v

5th–6th byte (26F4): Voltage2 — 9972mV 26F4 (Hex) = 9972 (Dec), 9972*1mV = 9972mV

7th (A0): ThresholdAlarm, 0x11 = 1010 0000 (Bin) Bit5, 7 = 1 (alarm)

Bit0: HighCurrent3Alarm

Bit4: HighCurrent4Alarm

8th–11th byte (00000000): Reserved

Uplink 3: 01DA03230064FFFFFFFF00

1st byte (01): Version

2nd byte (DA): DeviceType — R718KBC

3rd byte (03): Report Type

4th byte (23): Battery — 3.5v, 23 (Hex) = 35 (Dec) 35* 0.1v = 3.5v

5th–6th byte (0064): RawAttr1 — 100 100 (Hex) = 64 (Dec)

7th–8th byte (FFFF): RawAttr2— N/A

9th–10th byte (FFFF): RawAttr3—N/A

11th byte (00): Reserved

Uplink 4: 01DA0423FFFFA000000000

1st byte (01): Version

2nd byte (DA): DeviceType — R718KBC

3rd byte (04): Report Type

4th byte (23): Battery — 3.5v, 23 (Hex) = 35 (Dec) 35* 0.1v = 3.5v

5th–6th byte (FFFF): RawAttr4 — N/A

7th (A0): ThresholdAlarm, 0xA0 = 1010 0000 (Bin) Bit5, 7 = 1 (alarm)

Bit5: HighRawAttr3Alarm

Bit7: HighRawAttr4Alarm

8th–11th byte (00000000): Reserved

5.2 Example of Report Configuration

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)

5.2.1 MaxTime, MinTime, and Variation

Description	**Device**	**Cmd ID**	**Device Type**	**NetvoxPayLoadData**				
ConfigReportReq	R718KBC	0x01	0xDA	MinTime (2bytes Unit: s)	MaxTime (2 bytes Unit: s)	BatteryChange (1 byte Unit: 0.1v)	VoltageChange (Unit: 1mV, 2 Bytes)	CurrentChange (Unit: 1uA, 2 Bytes)
ConfigReportRsp		0x81		Status (0x00_success)		Reserved (8Bytes,Fixed 0x00)		
ReadConfigReportReq		0x02		Reserved (9Bytes,Fixed 0x00)				
ReadConfigReportRsp		0x82		MinTime (2bytes Unit: s)	MaxTime (2 bytes Unit: s)	BatteryChange (1 byte Unit: 0.1v)	VoltageChange (Unit: 1mV, 2 Bytes)	CurrentChange (Unit: 1uA, 2 Bytes)

(1) Command configuration

MinTime = 1min (0x003C), MaxTime = 1min (0x003C), BatteryChange = 0.1v (0x01), VoltageChange = 200mV (0x00C8), and CurrentChange = 200μA (0x00C8)

Downlink: 01DA003C003C0100C800C8

Response: 81DA000000000000000000 (configuration succeed)

81DA010000000000000000 (configuration fail)

(2) Read parameter

Downlink: 02DA000000000000000000

Response: 82DA003C003C0100C800C8 (current parameter)

5.2.2 Data Conversion

(When connecting the R718KBC with other devices, it would convert a current value into another value based on the configuration of RawAttrMin/Max and CurrentMin/Max.)

Description	Device	Cmd ID	Device Type	NetvoxPayLoadData				
SetRawAttrMapToVoltageCurrentReq	R718KBC	0x03	0xDA	Channel (1Byte, 0x00_RawAttr1, 0x01_RawAttr2, 0x02_RawAttr3, 0x03_RawAttr4)	RawAttr Min (2 bytes)	RawAttr Max (2 bytes)	Voltage/CurrentMin (Unit: 1mV/1μA, 2 Bytes)	Voltage/CurrentMax (Unit: 1mV/1μA, 2 Bytes)
SetRawAttrMapToVoltageCurrentRsp		0x83		Status (0x00_success)			Reserved (8 Bytes, Fixed 0x00)	
GetRawAttrMapToVoltageCurrentReq		0x04		Channel (1 Byte, 0x00_RawAttr1, 0x01_RawAttr2, 0x02_RawAttr3, 0x03_RawAttr4)			Reserved (8 Bytes, Fixed 0x00)	
GetRawAttrMapToVoltageCurrentRsp		0x84		Channel (1Byte, 0x00_RawAttr1, 0x01_RawAttr2, 0x02_RawAttr3, 0x03_RawAttr4)	RawAttr Min (2 bytes)	RawAttr Max (2 bytes)	Voltage/CurrentMin (Unit: 1mV/1μA, 2 Bytes)	Voltage/CurrentMax (Unit: 1mV/1μA, 2 Bytes)

(1) When connecting R718KBC with a 0–6V temperature transmitter that can measure 0–100 degrees, the Channel = RawAttr3 (0x02), RawAttrMin = 0, RawAttrMax = 100 (0x0064), VoltageMin = 0mV, VoltagetMax = 6000mV (0x1770)

Downlink: 03DA020000006400001770

Response: 83DA000000000000000000 (configuration succeed)

83DA010000000000000000 (configuration fail)

(2) Read Channel 0x02 parameter

Downlink: 04DA020000000000000000

Response: 84DA020000006400001770 (current parameter)

Note: a. Device reports ReportType 0x03 and 0x04 when the Min and Max of RawAttr and Current are configured; it reports ReportType 0x01 and 0x02 when the RawAttr and Current are off (0xFFFF).

b. Channel = 0x00 – 0x03 respectively refers to the 1st to the 4th connected devices.

5.3 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, 0x29_ Vol,)	SensorHighThreshold (4Bytes, unit: 1mV/μA)	SensorLowThreshold (4Bytes, unit: 1mV/μA)
SetSensorAlarmThresholdRsp	0x81	Status (0x00_success)	Reserved (9 Bytes, Fixed 0x00)		
GetSensorAlarmThresholdReq	0x02	Channel (1 Byte, 0x00_Channel1, 0x01_Chanel2, 0x02_Channel3, etc.)	SensorType (1Byte, 0x00_Disable ALL SensorthresholdSet 0x27_ Current, 0x29_ Vol,)	Reserved (8 Bytes, Fixed 0x00)	
GetSensorAlarmThresholdRsp	0x82	Channel (1 Byte, 0x00_Channel1, 0x01_Chanel2, 0x02_Channel3, etc.)	SensorType (1Byte, 0x00_Disable ALL SensorthresholdSet 0x27_ Current, 0x29_ Vol,)	SensorHighThreshold (4Bytes, unit: 1mV/μA)	SensorLowThreshold (4 Bytes, unit: 1mV/μA)
SetThresholdAlarmCheckCntReq	0x03	ThresholdAlarmCheckCn (1 Byte)	Reserved (9 Bytes, Fixed 0x00)		
SetThresholdAlarmCheckCntRsp	0x83	Status (0x00_success)	Reserved (9 Bytes, Fixed 0x00)		
GetThresholdAlarmCheckCntReq	0x04	Status (0x00_success)	Reserved (10 Bytes, Fixed 0x00)		
GetThresholdAlarmCheckCntRsp	0x84	ThresholdAlarmCheckCn (1Byte)	Reserved (9 Bytes, Fixed 0x00)		

(1) Configure Channel = 0x02_Channel3, SensorType = 0x29_Vol, SensorHighThreshold= 8V (0x00001F40), and SensorLowThreshold = 3V (0x00000BB8)

Downlink: 01002900001F4000000BB8

Response: 810000000000000000000

(2) Get configuration parameters

Downlink: 0202290000000000000000

Response: 82002900001F4000000BB8

Disable all Sensor thresholds (set SensorType = 0)

Downlink: 0100000000000000000000

Response: 8100000000000000000000

(3) Set detection time = 3 times (ThresholdAlarmCheckCn = 0x03)

Downlink: 0303000000000000000000

Response: 8300000000000000000000

(4) Read configuration

Downlink: 0400000000000000000000

Response: 8403000000000000000000

Note: a. The last configuration would be kept as user reset the device back to the factory setting.

b. Channel = 0x00 – 0x03 respectively refers to the 1st to the 4th connected devices.

c. Set SensorHigh/LowThreshold as 0xFFFFFFFF to disable threshold.

5.4 Example of NetvoxLoRaWANRejoin

(NetvoxLoRaWANRejoin command is to check if the device is still in the network. If the device is disconnected, it will automatically rejoin back to the network.)

Fport: 0x20

CmdDescriptor	CmdID (1 Byte)	Payload (5 Bytes)	
SetNetvoxLoRaWANRejoinReq	0x01	RejoinCheckPeriod (4Bytes, Unit: 1s 0XFFFFFFFF Disable NetvoxLoRaWANRejoinFunction)	RejoinThreshold (1 Byte)
SetNetvoxLoRaWANRejoinRsp	0x81	Status (1 Byte, 0x00_success)	Reserved (4 Bytes, Fixed 0x00)
GetNetvoxLoRaWANRejoinReq	0x02	Reserved (5 Bytes, Fixed 0x00)	
GetNetvoxLoRaWANRejoinRsp	0x82	RejoinCheckPeriod (4Bytes, Unit:1s)	RejoinThreshold (1Byte)

(1) Configure parameters

RejoinCheckPeriod = 60min (0x00000E10); RejoinThreshold = 3 times (0x03)

Downlink: 0100000E1003

Response: 810000000000 (configuration succeed)

810100000000 (configuration fail)

(2) Read configuration

Downlink: 020000000000

Response: 8200000E1003

Note: a. Set RejoinCheckThreshold as 0xFFFFFFFF to stop the device from rejoining the network.

b. The last configuration would be kept as user reset the device back to the factory setting.

c. Default setting: RejoinCheckPeriod = 2 (hr) and RejoinThreshold = 3 (times)

5.5 Set/GetNetvoxDSC100 charging and discharging's balance Check

Fport: 0x21

CmdDescriptor	CmdID (1 Byte)	Payload (3 Bytes)	
SetNetvoxDSC100BalanceCheckReq	0x01	BalanceCheckPeriod (2 Bytes, Unit: 1 min)	SetNetvoxDSC100BalanceCheckReq
SetNetvoxDSC100BalanceCheckRsp	0x81	Status (1 Byte, 0x00_success)	Reserved (2 Bytes, Fixed 0x00)
GetNetvoxDSC100BalanceCheckReq	0x02	Reserved (3 Bytes, Fixed 0x00)	
GetNetvoxDSC100BalanceCheckRsp	0x82	BalanceCheckPeriod (2 Bytes, Unit: 1 min)	BalanceThreshold (1 Byte, Unit: 100mV)

To check the balance between power generation and consumption, the voltage will be examined after the device successfully joins the network and after BalanceCeckPeriod. If the difference between the two examinations is higher or equal to BalanceThreshold, the voltage attribute =0xFF would be reported. After that, the voltage would be checked every BalanceCheckPeriod.

The initial values of BalanceCheckPeriod and BalanceThreshold could be programmed. After joining the network, they could be changed based on the above commands and reset back to the initial values when the device is reset to default.

(1) Configure BalanceCheckPeriod = 1 day (0x05A0); BalanceThreshold = 100mV (0x64)

Downlink: 0105A064

Response: 81000000 (configuration succeed)

81010000 (configuration fail)

(2) Read parameters

Downlink: 02000000

Response: 8205A064

Note: BalanceCheckPeriod = 0x0B40 (2880 minutes) and BalanceThreshold = 0xC8 (200mV) by default.

5.6 Example of GlobalCalibrateCmd

Fport: 0x0E

<table>
<tr><th>Description</th><th>CmdID</th><th>SensorType</th><th colspan="5">PayLoad (Fix =9 Bytes)</th></tr>
<tr><td>SetGlobalCalibrateReq</td><td>0x01</td><td rowspan="5">0x32_Current Sensor
0x42_Voltage Sensor</td><td>Channel
(1 Byte)
0_Channel1
1_Channel2, etc.</td><td>Multiplier
(2 bytes,
Unsigned)</td><td>Divisor
(2 bytes,
Unsigned)</td><td>DeltValue
(2 bytes,
Signed)</td><td>Reserved
(2 Bytes,
Fixed 0x00)</td></tr>
<tr><td>SetGlobalCalibrateRsp</td><td>0x81</td><td colspan="2">Channel
(1Byte)
0_Channel1
1_Channel2, etc.</td><td colspan="2">Status
(1 Byte, 0x00_success)</td><td>Reserved
(7 Bytes, Fixed 0x00)</td></tr>
<tr><td>GetGlobalCalibrateReq</td><td>0x02</td><td colspan="3">Channel
(1Byte)
0_Channel1
1_Channel2, etc.</td><td colspan="2">Reserved
(8 Bytes, Fixed 0x00)</td></tr>
<tr><td>GetGlobalCalibrateRsp</td><td>0x82</td><td>Channel
(1Byte)
0_Channel1
1_Channel2, etc.</td><td>Multiplier
(2 bytes,
Unsigned)</td><td>Divisor
(2 bytes,
Unsigned)</td><td>DeltValue
(2 bytes,
Signed)</td><td>Reserved
(2 Bytes,
Fixed 0x00)</td></tr>
<tr><td>ClearGlobalCalibrateReq</td><td>0x03</td><td colspan="6">Reserved (10 Bytes, Fixed 0x00)</td></tr>
<tr><td>ClearGlobalCalibrateRsp</td><td>0x83</td><td>Status
(1Byte,
0x00_success)</td><td colspan="5">Reserved (9 Bytes, Fixed 0x00)</td></tr>
</table>

(1) SetGlobalCalibrateReq

If Voltage is increased to 200μA from 100μA, the Multiplier = 0x0001, Divisor = 0x0001, and DeltValue = 0x0064.

Downlink: 0132000001000100640000

Response: 8132000000000000000000

(2) GetGlobalCalibrateReq

Downlink:0232000000000000000000

Response: 8232000001000100640000

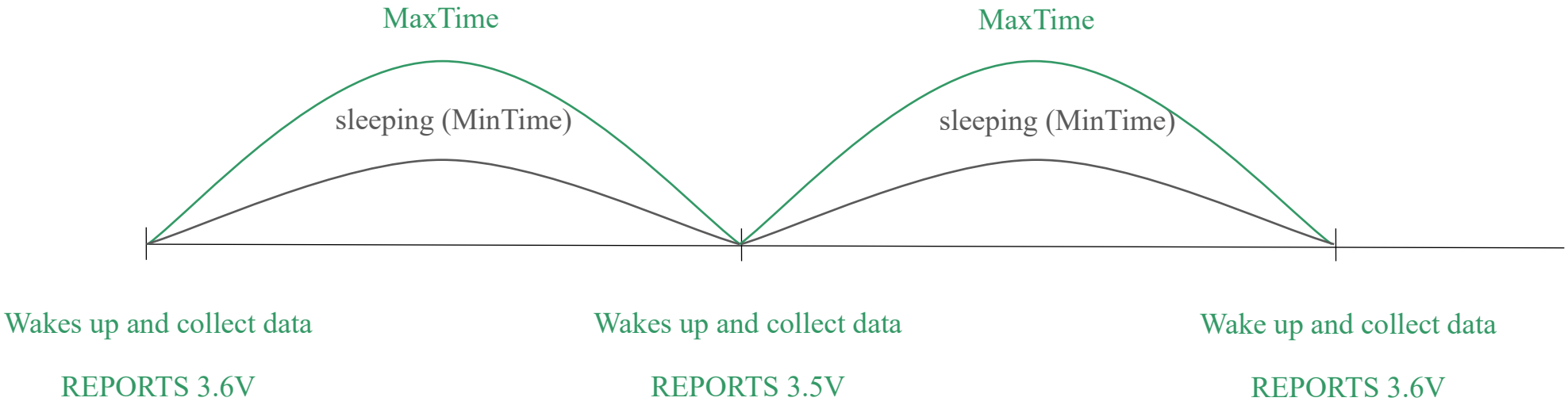
(3) ClearGlobalCalibrateReq (Voltage back to 100mV)

Downlink: 0300000000000000000000

Response: 8300000000000000000000

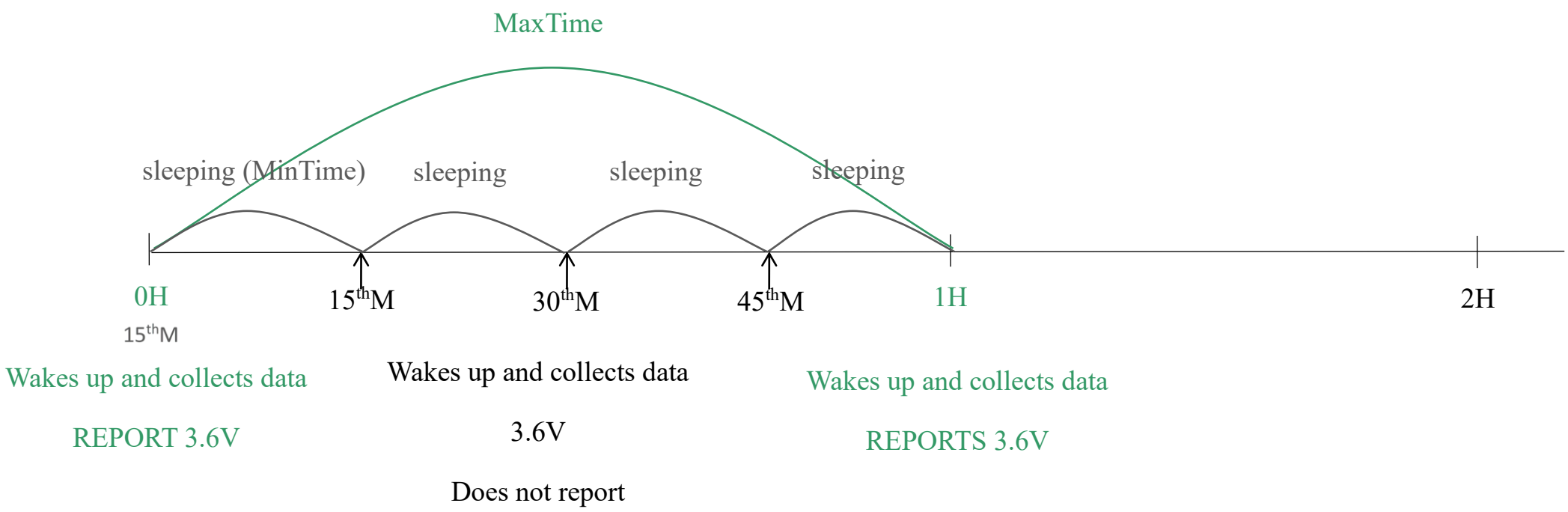
5.7 Example for MinTime/MaxTime logic

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

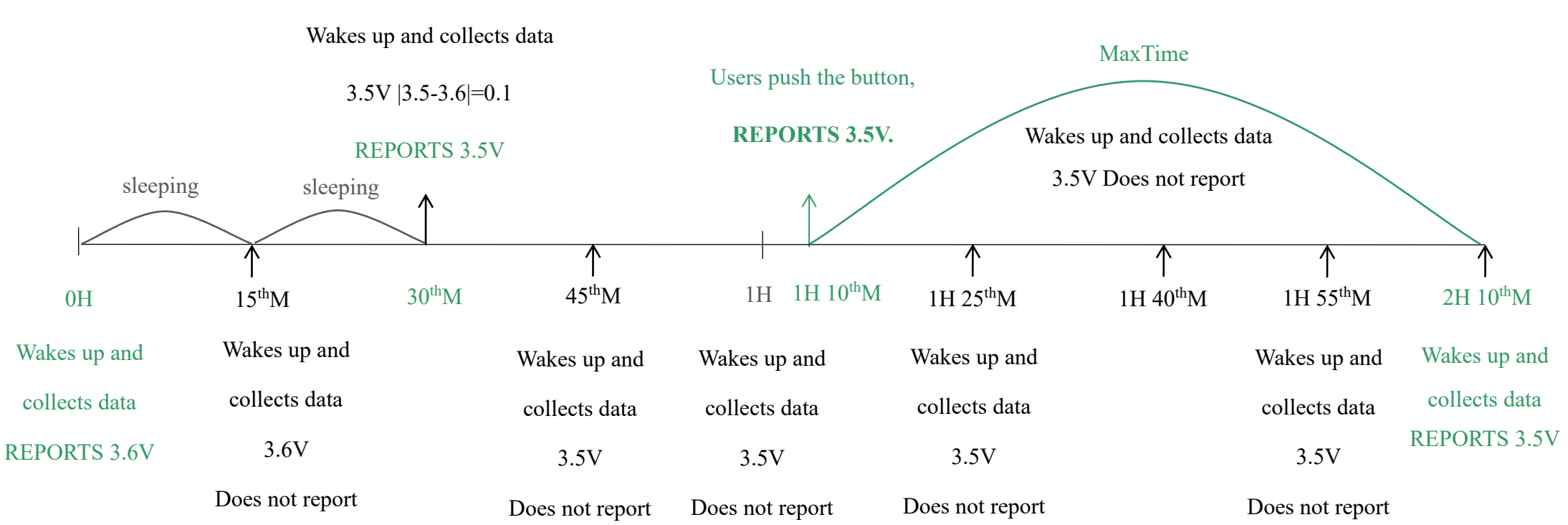


Note: MaxTime = MinTime. Data will only be reported according to MaxTime (MinTime) duration regardless BatteryVoltageChange value.

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. Battery Passivation

Many of Netvox devices are powered by 3.6V ER14505 Li-$SOCl_2$ (lithium-thionyl chloride) batteries that offer many advantages including low self-discharge rate and high energy density. However, primary lithium batteries like Li-$SOCl_2$ 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 reactions 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

6.1 How to tell 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**.

6.2 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.

7. Important Maintenance Instruction

Kindly pay attention to the following 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 a dusty or dirty environment. It might damage its detachable parts and electronic components.
- Do not store the device under excessively hot conditions. High temperatures 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 equipment 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 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.

8. Precautions for Outdoor Installation

According to the Enclosure Protection Class (IP code), the device is compliant to GB 4208-2008 standard, which is equivalent to IEC 60529:2001 degrees of protection provided by enclosures (IP Code).

IP Standard Test Method:

IP65: spray the device in all directions under 12.5L/min water flow for 3min, and the internal electronic function is normal.

IP65 is dustproof and able to prevent damage caused by water from nozzles in all directions from invading electrical appliances. It can be used in general indoor and sheltered outdoor environments. Installation in extreme weather conditions or direct exposure to sunlight and rain could damage the components of the device. Users may need to install the device under an awning (fig. 1) or face the side with an LED and function key downwards (fig. 2) to prevent malfunction.

IP67: the device is immersed in 1m deep water for 30 minutes, and the internal electronic function is normal.

Fig 1. Install under an awning

Fig 2. Install with LED and function key faced downwards