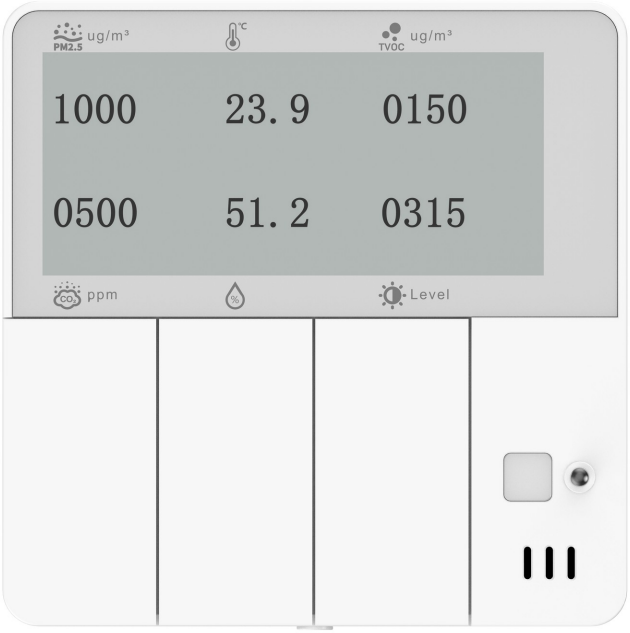
MANTHINK / INDUSTRIAL IoT

KS61

LoRaWAN Sensor

Standardized Device Manual



VERSION	DOCUMENT
当前版本	**Device Manual**

Product Introduction

KS61 is a set of multi-functional and sophisticated design in one of the 86 type wall switch type indoor environment monitoring sensor. It can monitor PM2.5 (zero fire version support), temperature, humidity, light intensity, CO_2, TVOC and human movement (PIR) and other environmental parameters in real time, and is equipped with electronic ink screen, which supports local intuitive view of air quality data, and the information is clear and easy to read.

KS61 adopts standard 86 box size design, built-in three physical buttons, easy to install, can directly replace the traditional wall switch. After the remote control function is enabled, the user can realize the intelligent control of the switch on and off through the network, taking into account the local operation habits and remote intelligent management.

The product is based on LoRa®Wireless technology, supports standard LoRaWAN®Protocol, with the advantages of long-distance communication and ultra-low power consumption, is suitable for large-scale, long-life IoT deployment scenarios.

KS61 compatible with ManThink and third party LoRaWAN®Gateway, and seamless access to ThinkLink, ChirpStack, The Things Network(TTN) and other mainstream Internet of Things platforms, easy to achieve environmental data collection, remote monitoring, intelligent analysis and energy-saving linkage control, widely applicable to smart office, smart home and building management system.

Features

- 86 box installation, can directly replace the original 86 box switch
- Support 3 phiscal switches
- Support PM2.5, temperature, humidity, light, CO_2, TVOC, PIR seven environmental parameter monitoring
- Ink screen display
- Support single Live wire/LN power supply (two versions)
- Support RS-485 interface (zero fire version support)
- Support ThinkLink/ChirpStack/TTN platform docking
- Support US902,AU915,AS923,EU868,EU433,CN470 LoRaWAN standards

Specifications

Parameter	Value
Push-button switches	3
Display	E-ink display

Item	Value
MEASUREMENT	
Temperature	Neutral-and-live version: 10-second acquisition interval, ±1 °C accuracy, -20–60 °C range Single-live-wire version: 10-second acquisition interval, ±3 °C accuracy, -20–60 °C range
Humidity	measure period 10 seconds accuracy ± 3% RH, range 0 - 100%
PIR	trigger type horizontal 80°, vertical 55° effective distance 5 meters
Illumination	10-second acquisition interval, 0.01–83 klux range Levels: L0 < 100 lux; L1 < 200 lux; L2 < 500 lux; L3 > 500 lux
CO2	measure period 10 seconds accuracy ± 40.0 ppm ± 5.0 %m.v. Range 400-5000ppm
TVOC	10-second acquisition interval, ±15 VOC Index points or ±15% m.v. accuracy, 1–500 VOC Index points range
PM2.5	Neutral-and-live version: 180-second acquisition interval, ±10% accuracy, 0–1000 μg/m³ range Single-live-wire version: 3-hour acquisition interval, ±10% accuracy, 0–1000 μg/m³ range
PM1.0	Hidden by default and uploaded through LoRaWAN; ±10% accuracy, 0–1000 μg/m³ range Neutral-and-live version: 180-second interval; single-live-wire version: 3-hour interval
PM10	Hidden by default and uploaded through LoRaWAN; ±25% accuracy, 0–1000 μg/m³ range Neutral-and-live version: 180-second interval; single-live-wire version: 3-hour interval

Item	Value
WIRELESS PARAMETERS	
Protocol	standard LoRaWAN
regional Standards	CN470/EU433/EU868/AS923/AU915/Us902
Transmit power	max 22dBm (LN version) maximum 14dBm (L version)
receiving sensitivity	-142dBm(SF=12,BW=125kHz)

Item	Value
Working mode	OTAA/ABP Class A

Item	Value
CONFIGURATION	
test /Trigger mode	long press switch 1 2 seconds trigger heartbeat data 6 seconds trigger network
parameter configuration	by NS issue instruction

Item	Value
CHARACTERISTICS	
power supply mode	L/LN AC
receiving current	<8mA (25 °C at room temperature)
emission current	<110mA (22dBm transmit power)
average power consumption	<100mW
working temperature	-40°C ~85°C
relative humidity	≤95% (no condensation)
protection level	IP30
material &Color	ABS + PC, White
dimensions	86mm * 86mm * 17mm (17mm is the thickness outside the wall)
installation method	86 box embedded installation

Product Model

Model example

KS618–A2–AS923–N

Model component breakdown

- **KS618: product series and RF band.**
  - KS61 identifies a second-generation indoor air quality monitor.
  - 8 identifies the 800 MHz-and-above RF version for EU868, AS923, AU915 and US902.
  - Other band option: 4 identifies the 400 MHz RF version for EU433 and CN470.
- **-A2: sensor combination and power configuration.**

- A identifies the seven-sensor configuration for temperature, humidity, illuminance, PIR, TVOC, CO_2 and PM2.5. This configuration requires live-and-neutral power.
- Other sensor options: B includes temperature, humidity, illuminance, PIR, TVOC and CO_2; C includes temperature, humidity, illuminance and PIR. Both B and C support single-live-wire or live-and-neutral power.
- 2 identifies live-and-neutral power.
- Other power option: 1 identifies single-live-wire power.

- **-AS923: LoRaWAN regional standard.**
  - AS923 means that the device supports the LoRaWAN AS923 regional parameters.
  - Other regional codes are CN470, EU433, EU868, AU915 and US902; US902 denotes the LoRaWAN US915 (902–928 MHz) regional parameters.
- **-N: default version.**
  - N identifies the default version.
  - Other values are reserved for customized or special versions.

Complete model meaning

The complete meaning of KS618–A2–AS923–N is:

This is a second-generation indoor air quality monitor in the 800 MHz-and-above RF class. It monitors temperature, humidity, illuminance, PIR, TVOC, CO_2 and PM2.5, uses live-and-neutral power, supports the LoRaWAN AS923 regional standard, and uses the default final version code N.

Instructions for use

Network topology

KS61 is a terminal device that conforms to the standard LoRaWAN protocol, and its normal operation depends on the complete LoRaWAN network support. The network needs to include a LoRaWAN gateway and a web server (NS). KS61 can be connected to ManThink self-developed Gateway or third-party compatible gateway, and supports connection to mainstream LoRaWAN Network servers, such as ThinkLink, ChirpStack and The Things Network(TTN).

Through the ThinkLink IoT platform, users can easily configure the object model, realize the definition of business functions, card view display and other personalized business logic, and quickly build application scenarios.

A typical LoRaWAN network topology is as follows:

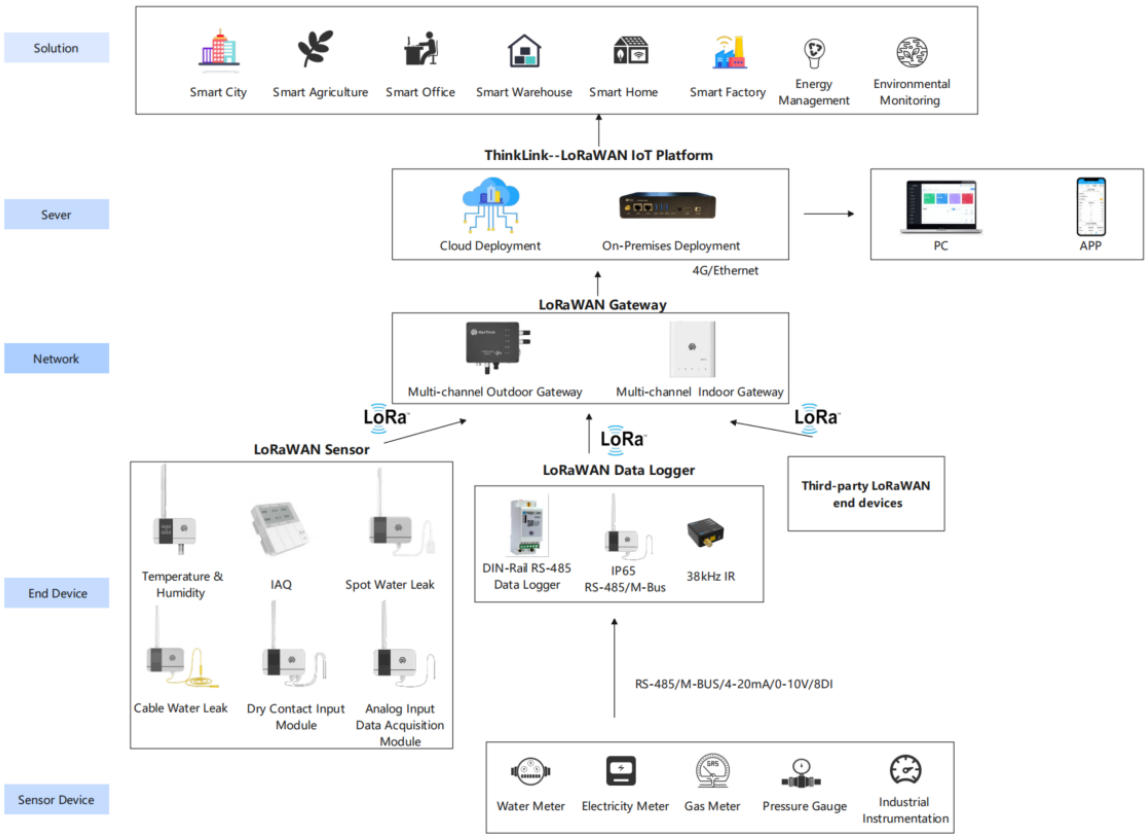


Figure Network topology

Working mode

Collection and Upload

KS61 collects data according to a preset fixed period, and supports three Upload modes: periodic Upload, event trigger Upload and change value Upload (COV).

In the periodic Upload mode, KS61 will regularly report the complete data of all sensors according to the set time interval. For variables that support COV(Change of Value), the system will automatically trigger a data Upload when the Value Change exceeds the preset threshold. In addition, event-type variables such as PIR (human body sensing) and switch status trigger a single data report immediately when the status changes.

All uplink data uses a unified packet format to ensure transmission consistency and resolution efficiency. The overall acquisition and upload mechanism combines three strategies: timing, threshold and event-driven, taking into account data integrity and real-time response.

Measurement

Data item	Acquisition method / interval	Uplink trigger
Temperature	Every 10 seconds	Change exceeds the COV threshold; default 1 °C
Humidity	Every 10 seconds	Change exceeds the COV threshold; default 5%RH
PIR	Event driven	Triggered when the detection state changes
Illumination	Every 10 seconds	Periodic report
CO_2	Every 10 seconds	Change exceeds the COV threshold; default 100 ppm
TVOC	Every 10 seconds	Change exceeds the COV threshold; default 50
PM2.5	Neutral-and-live version: every 180 seconds Single-live-wire version: every 3 hours	Periodic report

Communication Test

By switching on and off the switch once, a packet of data can be implemented to trigger uplink.

Network access

Long press Switch 3 (right most switch) for more than 6 seconds to trigger the network access operation.

Communication Protocol

Data Items and Identifiers

- LoRaWAN port number = 11

KS61 supports only one data format and sends data periodically according to a set period. When a COV event occurs, it triggers one frame of uplink data.

Example (hex): 82 24 07 00 ED00 4902 2402 0200 44000000 01 01 07 40 27502642

Number	Data Item	Example	Start Address	Length	Description
1	Version number	`0x82`	0	1 byte	Fixed at `0x82`
2	Control word	`0x24`	1	1 byte	Fixed at `0x24`
3	Identifier	`0x07`	2	1 byte	Fixed at `0x07`
4	Status identifier	`0x00`	3	1 byte	`0`: normal; greater than `0`: fault
5	Temperature	`0x00ED`	4	2 bytes	`int16`, little-endian, unit: 0.1 °C
6	Humidity	`0x0249`	6	2 bytes	`int16`, little-endian, unit: 0.1%RH

Number	Data Item	Example	Start Address	Length	Description
7	CO_2	0x0204	8	2 bytes	int16, little-endian, unit: ppm
8	Illumination	0x0002	10	2 bytes	int16, little-endian, unit: lux
9	TVOC	0x00000004	12	4 bytes	int32, little-endian, unit: μg/m³
10	Reserved	0x01	16	1 byte	Reserved; do not use for application parsing
11	PIR	0x01	17	1 byte	uint8; 0: unoccupied; greater than 0: occupied
12	Switch status	0x07	18	1 byte	See the bit0–bit2 mapping and values below
13	PM2.5	0x42265027	20	4 bytes	Little-endian, unit: μg/m³

Switch status bit mapping

Bit	Switch	0	1
bit0	Switch 1 (left)	Open	Closed
bit1	Switch 2 (center)	Open	Closed
bit2	Switch 3 (right)	Open	Closed

ThinkLink parsing rules

```
let payload = Buffer.from(msg?.userdata?.payload, "base64");
    let port=msg?.userdata?.port;
    //let preTelemetry = device?.telemetry_data?.[thingModelId];
    function parseSharedAttrs(payload) {
        if (port!=214||payload[0]!=0x2F) { return null}
        let shared_attrs ={}
        shared_attrs.content = payload.toString('hex')
        if (payload.length<5) { return null}
        let size=payload.length-4
        let regAddress=payload[2]
        for (let i=0; i<size; i++) {
            regAddress=payload[2]+i
            switch (regAddress) {
                case  58:
                    if  ( size<(2+i) ) { break }
                    shared_attrs.period_data = payload.readUInt16LE(4+i)
                    break;
                case 152:
                    if  ( size<(1+i) ) { break }
                    shared_attrs.enable =
"0x"+payload.readUInt8(4+i).toString(16).padStart(2, '0')
                    break;
                case 153:
```

```
                    if  ( size<(1+i) ) { break }
                    shared_attrs.cov_temperatrue = payload.readUInt8(4+i)*0.1
                    break;
                case 154:
                    if  ( size<(1+i) ) { break }
                    shared_attrs.cov_humidity = payload.readUInt8(4+i)
                    break;
                case 155:
                    if  ( size<(1+i) ) { break }
                    shared_attrs.cov_tvoc = payload.readUInt8(4+i)
                    break;
                case 156:
                    if  ( size<(1+i) ) { break }
                    shared_attrs.cov_co2 = payload.readUInt8(4+i)
                    break;
                case 157:
                    if  ( size<(1+i) ) { break }
                    shared_attrs.cov_pm25 = payload.readUInt8(4+i)
                    break;
                case 158:
                    if  ( size<(2+i) ) { break }
                    shared_attrs.pir_delay = payload.readUInt16LE(4+i)
                    break;
                case 160:
                    if  ( size<(2+i) ) { break }
                    shared_attrs.lux_threshold1 = payload.readUInt16LE(4+i)
                    break;
                case 162:
                    if  ( size<(2+i) ) { break }
                    shared_attrs.lux_threshold2 = payload.readUInt16LE(4+i)
                    break;
                case 164:
                    if  ( size<(2+i) ) { break }
                    shared_attrs.lux_threshold3 = payload.readUInt16LE(4+i)
                    break;
                case 166:
                    if  ( size<(1+i) ) { break }
                    shared_attrs.pir_mask ="0x"+
payload.readUInt8(4+i).toString(16).padStart(2, '0')
                    break;
                default: break
            }
        }
        if (Object.keys(shared_attrs).length == 0) {
            return null
        }
        return shared_attrs;
    }
    function parseTelemetry(payload){
        if (port!=11) { return null}
        if (payload[0]!=0x82||payload[1]!=0x24||payload[2]!=0x07){  return null }
        let telemetryData={}
        if (payload.length <24) {   return null }
        if (payload[3]>0) {
            telemetryData.status="fault"
            return telemetryData
```

```
        }
        telemetryData.temperatrue=Number((payload.readInt16LE(4)/10).toFixed(1))
        telemetryData.humidity=Number((payload.readInt16LE(6)/10).toFixed(1))
        telemetryData.co2=Number(payload.readInt16LE(8))
        telemetryData.light=Number(payload.readInt16LE(10))
        telemetryData.tvoc=Number(payload.readInt32LE(12))
        let pirval=payload.readUInt8(17)
        telemetryData.pir= (pirval>0)?1:0
        let relayval =payload.readUInt8(18)
        telemetryData.relay1=((relayval&0x01)===0x01)?1:0
        telemetryData.relay2=((relayval&0x02)===0x02)?1:0
        telemetryData.relay3=((relayval&0x04)===0x04)?1:0
        telemetryData.pm25=Number((payload.readFloatLE(20)).toFixed(2))
        return telemetryData
    }
    let appData= parseTelemetry(payload)
    let sattrs=parseSharedAttrs(payload)
    return {
        telemetry_data: appData,
        server_attrs: null,
        shared_attrs: sattrs,
    }
```

Parameter modification

Parameter changes follow *PTL-D01 ManThink Technology IoT Terminal Application Layer General Protocol V1.5*.

Configuration parameter address table

Number	Data Item	Default Value	Start Address	Length	Description
1	reset	write Only	9	1 byte	write 0x01
2	upload cycle	15	58	2 bytes	upload cycle, in minutes
3	Function-enable bits	—	152	1 byte	See the bit0–bit6 mapping and values below
4	temperature COV	10	153	1 byte	unit 0.1 °C
5	humidity COV	20	154	1 byte	unit 0.1 RH%
6	TVOC COV	50	155	1 byte	
7	CO2 COV	100	156	1 byte	unit ppm
8	pm2.5 COV	10	157	1 byte	unit ug/m³
9	PIR delay	1800	158	2 bytes	`uint16`, little-endian, unit: seconds; used to confirm the unoccupied state
10	Illumination threshold 1	100	160	2 bytes	`uint16`, little-endian, unit: lux
11	Illumination threshold 2	100	162	2 bytes	`uint16`, little-endian, unit: lux
12	Illumination threshold 3	100	164	2 bytes	`uint16`, little-endian, unit: lux
13	PIR Control Mask	0x07	166	1 byte	PIR someone turn on the light control mask, bit0-bit3 valid. When it is 1, PIR detects a person and turns on the light.

Function-enable bit mapping

Bit	Function	0	1
bit0	Temperature	Disabled	Enabled
bit1	Humidity	Disabled	Enabled
bit2	TVOC	Disabled	Enabled
bit3	Illumination	Disabled	Enabled
bit4	CO_2	Disabled	Enabled
bit5	PM2.5	Disabled	Enabled
bit6	Lighting control	Disabled	Enabled

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