DT420-4-20mA

1.General Information

DT420A is a low-power industrial collector with 4-20mA interface, built-in battery power supply, Use LoRa spread spectrum wireless communication, support standard LoRaWAN wireless protocol, built-in global regional specifications (such as CN470, CN779, EU433, EU868, US915, AU915, AS923, IN865, etc.). Users can use the LoRaWAN mode without changing software and hardware. They only need to configure to choose different regional specifications and adapt to various LoRaWAN standards in various countries and regions.

Interface	Model	Document
4~20mA collecting	DT420A-LF DT420A-HF	DT420A data logger user manualV1.0.pdf

Note
LF: Frequency: 433~510 MHz
HF: Frequency: 863~928 MHz

1.1.Introduction

DT420A supports both non LoRaWAN mode communication and LoRa full parameter open configuration, making it flexible for various LoRa communication application scenarios.
External current signals support two wire, three wire, and four wire systems. Simply configure the host to collect and report current signals.
The device is equipped with a 38Ah high capacity lithium-ion battery, with a service life of 3-5 years. There is no need for on-site wiring, and the installation is simple and reliable. The shell is made of aluminum alloy material, with a high specification waterproof design, suitable for use in industrial environments.

You can use AT Command for DT420A configuration or SensorTool. In addition, the product supports serial port firmware upgrade for easy maintenance and functional expansion.

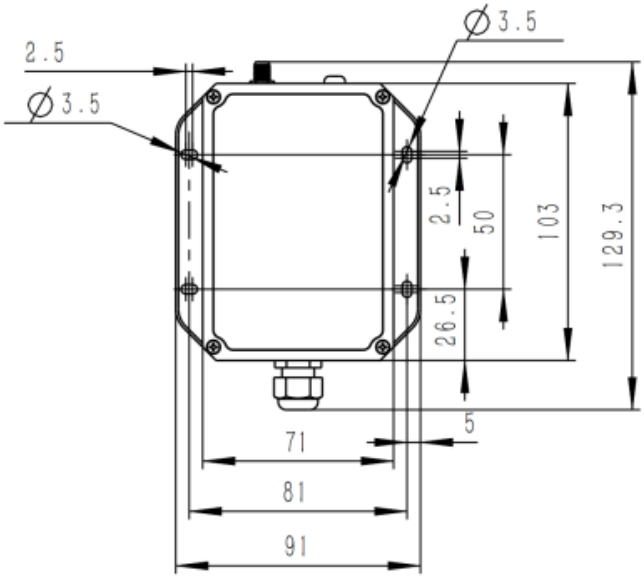
1.2.Features

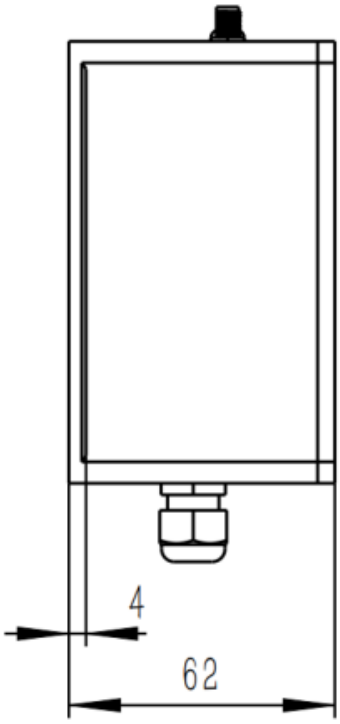
- The max TX power is 22dBm, with a long transmission distance and an open space of up to 3-5 KM;
- Supports LoRaWAN protocol and private protocol, with good adaptability;
- Support modifying LoRa parameters, and can be flexibly configured according to actual application;
- Built-in 38000mAh battery, which can power external sensors and is convenient to use;
- Various 4-20mA sensors can be configured according to the power on time of different probes, and are widely used;
- Built in Type-C USB for parameter configuration and firmware upgrade;
- Fully industrial grade chip design, working temperature can reach -40 ℃~+85 ℃;
- IP67 waterproof, easy installation and deployment.

2. Parameters

Parameter	Features
CPU	Cortex-M0+
Wireless	SX1268/SX1262
Encription	AES128
Power	15V (Max 50mA)
Sleeping current	5uA
Peak current	150mA(sensor power not included)
Battery	38000mAh
Life span	3 years default（current for external sensor less than 20mA）
Working temp	-30℃~+ 70℃
Data resolution	1uA, configurable, compatible with all 4-20mA sensor
Data rate	300bps-62.5kbps
Size	129mm*91mm*62mm
TX Power	Max 22dBm
Sensitivity	-140 dBm（BW=125K，SF=12）
Antenna	SMA
Frequency	433-510 MHz 863~928 MHz

3.Size



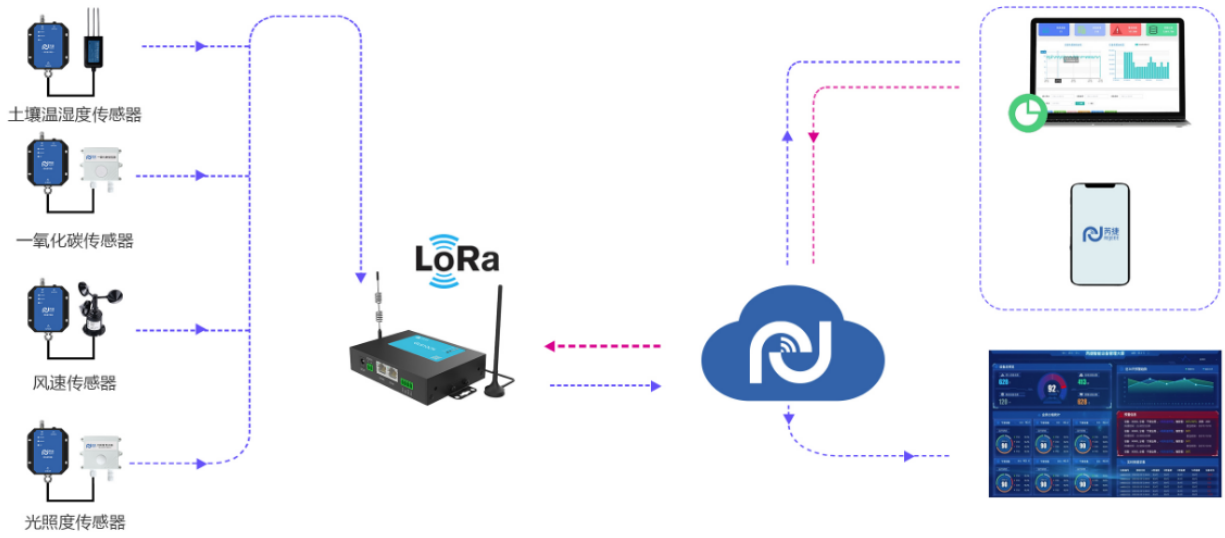


4.User instructions

4.1.Scenario

The device is used for connecting various 4-20mA sensors externally. Convenient wireless connection of current type sensors in various businesses. Convenient transformation and simple deployment. The overall architecture

of the system is shown below.



4.2.Device introduction

4.2.1.Interface

1.Waterproof PG interface

The sensor is connected to the inside of the device through this connector, and it is recommended to thread the wire with a size of 3-6mm (diameter). If there is a need for special dimensions, please contact Rejeee engineer for confirmation.

2.SMA antennna interface

The antenna interface adopts an external screw and internal hole form

3.Botton

Pressing the button can perform a soft shutdown on the device and trigger data reporting. Press and hold for 3 seconds to start and shut down the device. Short press (between 0.1-3 seconds), the device immediately collects data and reports it.

4.Indicator

POWER:

When the system is running, press the POWER button to turn on the green light. When you connect this device with PC through type-C, the LED displays red.

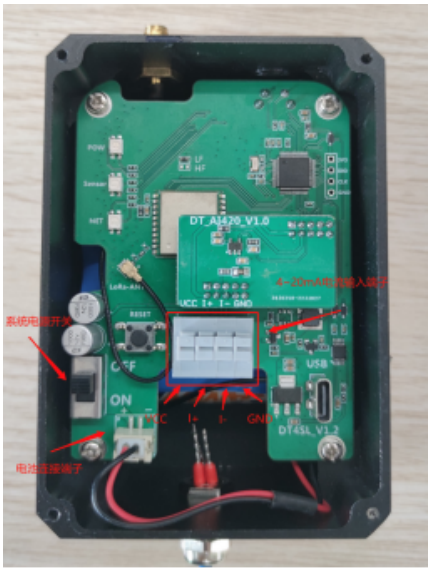
SENSOR:

When the device collects sensor data, the green light is on, and if the reading fails, it is displayed in red. Turn off the indicator light after reading is completed.

NET:

When the device is sending data, led is green.

4.2.2.Internal interface



1.Battery connector

Make sure battery is right connected.

2.System power on/off

When the device is in warehouse for a long time, it is recommended to turn the switch to the OFF position and operate normally in the ON position. This switch is a battery usage switch (ON for battery power supply, OFF for no battery use).

When the device battery runs out, if the battery is not replaced. The switch can be set to the OFF position, and users can connect an external USB to power the device.

3.USB-C for configuration

Connect the sensor to PC with USB-C cable, use sensor tool for sensor configuration, and bauld rate is 115200.

4.4~20mA connector

To facilitate equipment wiring, spring type PCB wiring terminals are used. The wiring sequence is: ①VCC ②I+ ③I- ④GND

Note: Here, the VCC is boosted to 15V by the internal battery of the device, with a max output current of 50mA to the external sensor。

5.Wire instruction

When the sensor is two wires, you need to connect ①VCC ②I+

When the sensor is three wires, you need to connect ①VCC ②I+ ④GND

When the sensor is four wires, you need to connect ①VCC ②I+ ③I- ④GND

4.3 Operating instructions

1. Using a screwdriver, open the device casing and remove the metal waterproof connector. Thread in the sensor cable, connect the 4-20mA cable to the terminals in sequence, and lock the waterproof PG interface.

2. Connect to PC with USB-C cable.

   > *Note: The serial port driver needs to be installed in advance, and the serial port to USB chip is CH340*

3. Open the SensorTool upper computer software, use the default Baud of 115200, “Serial port selection” the corresponding COM port of the device, and click “Open serial port” to automatically read the device parameters. Wait for the reading to complete before viewing or modifying parameters.

4. You can use Sensortool for data configuration as below:

4.4 Configutation instructions

4.4.1.Uplink peroid

The unit of this parameter is seconds. When the set time expires, the device actively wakes up, turns on the sensor power, preheats the sensor, and then collects and reports the current value.

The default data reporting cycle of the system is 600 seconds (i.e. 10 minutes, equivalent to heartbeat transmission). In a constant environment, data is reported every 10 minutes. This parameter can be adjusted according to the actual situation.

4.4.2.Check peroid

The unit of this parameter is seconds. When the set time expires, the device actively wakes up, turns on the sensor power, preheats the sensor, and then collects the current value.
After the collection is completed, determine whether the difference between the current value and the last reported value exceeds Change Amount . If it exceeds, it will be sent, and if it does not exceed, it will not be sent.
The default detection cycle of the system is 60 seconds, with a minimum configurable time of 1 second and a maximum configurable time of 65553 seconds. The smaller the cycle, the more sensitive the response, and conversely, the higher the power consumption.
This parameter can be adjusted according to the actual situation.

4.4.3.Variation

The purpose of designing **Variation** is to support the device to report on a periodic basis while also judging the change amount based on the **Check peroid**. Report immediately when the detected data exceeds the **Variation** compared to the last sent data, without waiting for the **Uplink peroid** time. To support rapid response to the measured object.

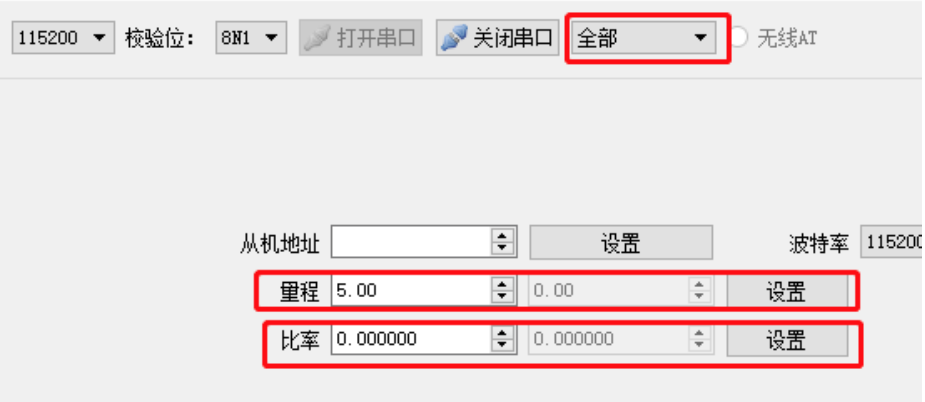
The internal default minimum variation is designed based on 100uA. If the system default change amount is not configured (i.e. 0), use 100uA as the change amount for logical judgment.

4.4.4.Measure range setting

For the new firmware(Firmware version for DT420 V1003+ and SensorTool V1.3.6+) support costimzed measure range, to compatible with all 4-20mA sensor data. As below **Red** notification and so on.

If 4~20mA to measure water level, and range is 5m, then put 5m.
The sensor data will automatically calculate the current value according to the range, and convert it to Floating-point arithmetic number for reporting. The unit is the range unit.

If 4~20mA to measure angle，measure range is 180 degree, then put 180.
The data content is automatically converted to a Floating-point arithmetic number for reporting, and the unit is the unit degree corresponding to the range.



4.4.5.Ratio configuration

Due to hardware differences, when the error is significant, it may be necessary to calibrate the sensor by setting a ratio.
If the equipment is shipped with an external probe, it is usually calibrated at the factory and does not require secondary adjustments from the customer.
If the probe is purchased by the customer and there is a significant reading error in individual sensor data, the value can be corrected by setting a change value.
Setting principle: i.e. sampling value *ratio=actual value.*
For example, when the device is unloaded, the expected value is 4000uA. If the reported ADC value is 3970, that is 4000=3970 1.007. Set the ratio to 1.007

4.5.Botton instructions

The device comes with a button for easy testing and on/off operation.

4.5.1.Turn on the device

There are two ways to turn on the device

1. Built in on/off botton：Turn the built in power botton from off to on, the device will turn on automatically.
2. If the external button soft shuts down, press and hold for 3 seconds to restart the device (the device indicator lights will light up from top to bottom and then turn off)

> *Under the button startup mode, the device will enter the wireless configuration waiting mode (the POWER green light is always on). At this time, the LoRa Dongle tool provided by Rejeee Intelligent can be used for wireless configuration. Please refer to Rejeee Intelligent’ s wireless AT operation document for details. If the user does not need to modify the configuration, they can press the button to interrupt the configuration and wait to directly enter normal operation mode.*

4.5.2.Turn off the device

There are two ways to turn off the device

1. Built-in on/off botton, turn the built in power botton from on to offce, the device will turn off.
2. Soft shutdown through external buttons. When the device is in normal operation, press the button and the POWER green light will light up. Until the button continues for 3 seconds, the device shuts down (the indicator lights are all on, and then turn off from bottom to top).

4.5.3.Trigger for data sending

By briefly pressing the button (between 0.1 and 3 seconds), it can be determined whether the device is in a power on or off state. It can also be used to test 4-20mA sensor data communication and wireless performance testing.
If the device LED is not displayed by short pressing, the device is in a shutdown state. Otherwise, the device will first remain on, and then collect data and send it.

4.6.Firmware update

You can upte the firmware following this instruction:

5.Wireless data format

5.1.In general

In order to meet different application requirement, this device can support both LoRaWAN and Non-LoRaWAN.

5.1.1.Non-LoRaWAN

Header	DevAddr	FCtrl	SeqNo	Sensor Data1	...	Sensor DataN	CRC
1 Byte	4 Bytes	1 Byte	2 Bytes	Data 1	...	Data N	2 Bytes
Head	Device add	Control character	Package no.	TLV(Refer to Type)	...	TLV(Refer to Type)	CRC16=Header to ensor DataN(e.g all the infor before CRC)

5.1.2.LoRaWAN

In order to save transmission bytes, duplicate or redundant data items are not reported in LoRaWAN mode, and only sensor data content is uploaded. As shown below, FRMPayload refers to sensor data in non LoRaWAN mode.

MHDR	FHDR	FPort	FRMPayload（SensorData）			MIC
			Data 1	...	Data N	
			TLV (Refer to specific types of SensorData)		TLV (Refer to specific types of SensorData)	

FPort：1
FRMPayload：eg. sensor data(Boday information)

5.2.Sensor data format

5.2.1.Sensor type instruction

Sensor type	Note
0x00~0x0F 和0xFF	Format（T+V), Basic sensor type, fixed data format, omitting length bytes
0x10~0x1F	Format（T+L+V），Universal type, retaining length to meet customized requirements
0x20~0x3F	Format（T+L+V），Customized projects require different content to be adapted to different projects
0x80~No-defined	Format（T+L+V），User parameter configuration and query, adapting different content to different projects

5.2.2.Basic sensor type list

Type	Value	Value description
Universal response 0xFF	2 Bytes	The first byte corresponds to the downstream instruction (the answered command) The second byte corresponds to the result
Device information 0x00	2 Bytes	Ignoring the length field to save bytes due to the known content of the device information package
Collecting data 0x03	2 Bytes	Universal collecting data
Sensor data 0x08	4 Bytes	Sensor floating value

5.3.Basic sensor data details

5.3.1 Device information（0x00)

Type	Value	Value	Value
1 Byte	3 bit	5bit	1 Byte
0x00	Version	Battery Level	Reserve

5.3.2. Conllecting data（0x03)

Type 1 Byte	Value 2 Bytes	Note
0x03	ADC collecting data	2-byte unsigned integer, unit is uA

5.3.3 Sensor data（0x08)

Type 1 Byte	Value 4 Bytes	Note
0x08	sensor data	4 bytes float, here is the sensor data Automatically calculate and adapt various ranges and units based on the range configured on the user terminal

5.4.Device uploading example

DT420A runs in non LoRaWAN mode by default, and the data content includes the complete content of prefix parts such as protocol header, device address, and CRC suffix parts.
As below, for sensor data part, including device information(0x00),collecting data(0x03),sensor data(0x08)

Header 1 字节	DevAddr 4 字节	FCtrl 1 字节	SeqNo 2 字节	传感器数据(消息体)			CRC 2 字节
				数据 1	…	数据 N	
协议头	设备 地址	控制字	包序号	Type+Data N Bytes	Type+Data N Bytes	Type+Data N Bytes	CRC16= 首字节至 Body

In LoRaWAN mode, the data only has FRMPayload, which is the sensor data section. By default, three types of content are reported: 0x00, 0x03, and 0x08.

5.5.CRC16

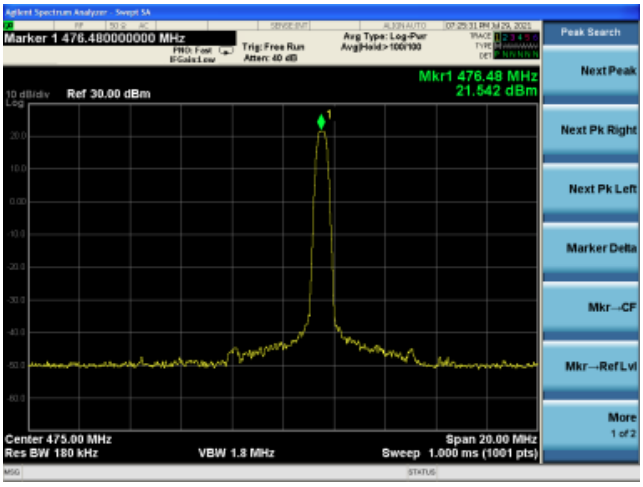
```
The CRC verification algorithm is as following:
static uint16_t get_crc16(uint16_t inData, uint16_t outData) {
  outData = (outData >> 8) | (outData << 8);
  outData ^= inData;
  outData ^= (outData & 0xff) >> 4;
  outData ^= outData << 12;
  outData ^= (outData & 0xff) << 5;
  return outData;
}

static uint16_t cal_crc16(const uint8_t *pData, const uint32_t len)
{
  uint32_t i = 0;
  uint16_t crc16 = 0xFFFF;
  for (i = 0; i < len; i++) {
    crc16 = get_crc16(*(pData++), crc16);
  }
  return crc16;
}
```

6.Performance

6.1.Sensitivty test

SF	Sensitivity dBm，@BW=125K，470MHz
SF=7	-126
SF=8	-129
SF=9	-131
SF=10	-134
SF=11	-136
SF=12	-139

6.2.TX power test



7.Package list

1.DT420A
2.User manual
3.LoRa antenna
If the above accessories are lost, please contact the seller with the original packaging and accessories for replacement.

8.Version

Edit	Version	Note
2023.06	V1.0	First draft release