

UM020960**RHF1S052 LoRaWAN[®] Smart Water Meter User Manual**

V1.2

Document information

Info	Content
Keywords	<i>RisingHF, LoRaWAN^{®1}, Smart Water Meter</i>
Abstract	RHF1S052 Smart Water Meter User Manual.

¹ LoRa and LoRaWAN are trademark of Semtech.

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1 Introduction

RHF1S052 Smart Water meter is designed by RisingHF based on LoRaWAN[®], it makes user easy to setup metering network with suitable LoRa network server. Dual Pulse counter, magnetic sensor to achieve water metering, Built-in ball valve to support water meter controlling open and close, device control and management is also available, makes the metering application easy to use. History metering data reading is another feature makes the data management more powerful. It will not require manual meter reading and maintenance to reduce labor costs. RHF1S052 works in LoRaWAN Class B, this minimize the downlink control latency.



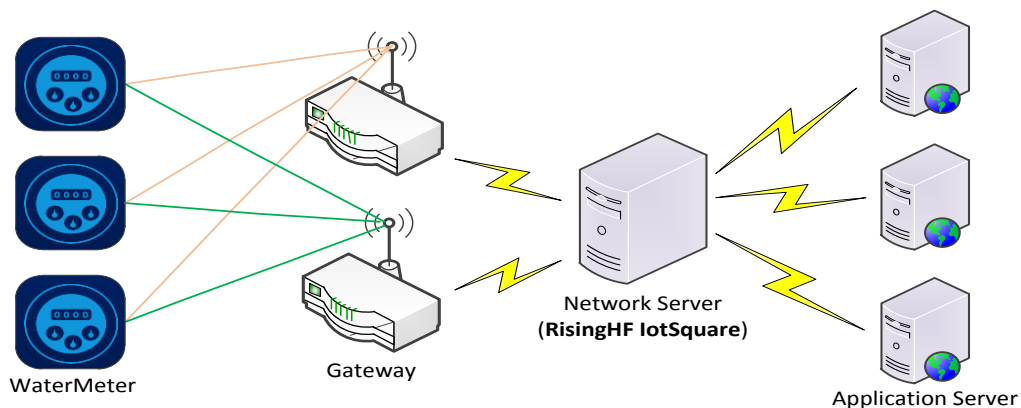
1.1 Main Feature

- Water medium temperature: 0.1~50°C
- Dry-dial water meter, with no condensation problem
- Normal Flow rate Q3: 2.5m³/h
- Flow ratio Q3/Q1: 100
- Accuracy: Class2, ≤5% (Q1~Q2), ≤2% (Q2~Q4)
- Built-in ball valve for controlling open or close
- Dual Pulse counter, magnetic sensor.
- Operation pressure: ≤1.6Mpa
- Ingress protection: IP68
- Installation: horizontal
- Global LoRaWAN[®] Standard, easy to deploy: ClassA and Class B.
- LoRa communication, long range of coverage.
- Radio Power up to 21dBm, Receiver sensitivity Down to -137dBm@SF12
- Automatic time synchronization
- Support periodical Metering data report by uplink.
- Support valve control by downlink to Open/Close water meter.
- High security, Real time device status and alert report by uplink.
- Historical metering data is available as a backup in need.

- Low power consumption, typical 8 years battery life time.

1.2 System structure

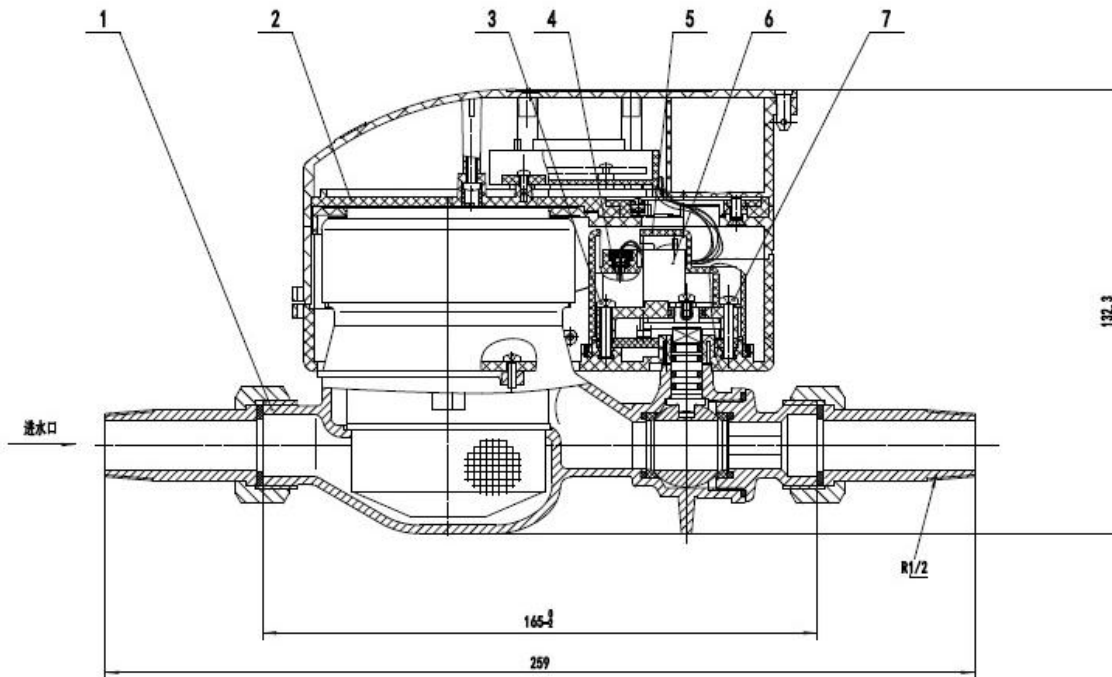
The Water meter is supposed to work in a LoRaWAN network. The system structure will be like below: Network comprise a certain amount of water meter as end nodes, suitable LoRa Gateways (better support Class B) , a network server and kinds of Application server.



2 Specification

2.1 Mechanical specifications

Dimension	165mm x 86mm x 132.3mm
Weight	About 1.55kg



NO:	Description
1	Inlet pipe of water meter, Brass
2	Control board box, rotatable, ABS
3	Screw, iron
4	O-ring, silicon rubber
5	Cap of Control motor
6	motor component
7	Screw, iron

2.2 Operation conditions

Temperature	Ambient temperature: 0.1~85℃ Water medium temperature: 0.1~50℃
Supply voltage	built-in Battery inside, 1.8v~3.6v

Power consumption	Sleep current 12uA, LoRa TX maximum 100mA, LoRa RX 6mA
Battery life time*	Typical 8 years

Note: * typical use case:

RHF1S052 LoRaWAN transmit water meter data every hour, battery type CR26500.

2.3 Electronic specification

Unless otherwise specified, the condition below is 3v power supply, temperature 20°C.

2.3.1 Water meter fundamental parameter

Metering accuracy	Class 2, accuracy From Q1 inclusive up to but excluding Q2 is $\pm 5\%$, Above Q2 is $\pm 2\%$
Water pressure	$\leq 1.6\text{MPa}$
Pipe diameter	DN15 inner pipe 15mm
Q4 max rate flow	3.125 m ³ /h
Q3 normal rate flow	2.5 m ³ /h
Q2 transition rate flow	0.04 m ³ /h
Q1 minimal rate flow	0.025 m ³ /h
Q3/Q1	100
IP grade	IP68
Metering reading in dial register	0.0000~99999 m ³
Digital sensor metering reading range	0~FFFFFFF (hexadecimal), Unit: litre (L) I.e. 0~4294967 m ³

2.3.2 RF specification

Frequency range	CN470: 470~510MHz EU868: 863~870MHz ID920: 920~923MHz AS923: 923~925MHz US915: 902~928MHz
RF TX power	Max 21dBm
RX sensitivity	-137dBm @SF12BW125
Antenna	0dBi Peak Gain

2.3.3 User interface

Main Battery	built-in Battery inside, 3V
Hall sensor	User use a magnet close to this hall sensor, to trigger field test function. Or more than 10s to Reset the water meter.

Water meter dial	Read metering data visually
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2.3.4 LoRaWAN parameter

Frequency plan	LoRaWAN regional optional: CN470 EU868 ID920 AS923 US915
LoRaWAN Protocol	1.0.3
LoRaWAN Class	Class B (Class A compatibility)
LoRaWAN Activation	OTAA

2.3.5 Application mode

Regular Spontaneous uplink	Uplink report accumulated flow data and battery level periodically, the default period is one hour.
Field test	There is a Hall sensor for field test, Manual trigger the sensor using a Magnet will set the water meter in field test mode, in this mode, RHF1S052 will send two message below: 1) Post accumulated flow data and status including battery level 2) Post period setting of Regular Spontaneous uplink
Alarm	Water meter will trigger alarm and report message automatically if abnormality. Refer to chapter 2.3.8
Downlink control, Configure and Query	Support LoRaWAN downlink to Configure and Query parameters. Support Downlink message for valve control. Refer to 《[RHF-UM01916]RHF1S052 water meter application protocol_v0.7 》
Sleep mode	when Battery capacity less than 10%, device will go into sleep mode to save power, device switch to LoRaWAN Class A, No more Regular Spontaneous uplink. And will close the valve automatically. However, in sleep mode, it support below: 1) Field test. 2) Downlink control, Configure and Query.

Below section 2.3.6~2.3.8 is definition of the uplink and downlink application specification, please Refer to 《[RHF-UM01916]RHF1S052 water meter application protocol_v0.7 》 .

2.3.6 Regular Spontaneous uplink

Each LoRaWAN uplink message, including below information:

- ✓ Accumulated metering flow and device status
- ✓ Battery level
- ✓ The last Downlink RSSI/SNR

2.3.7 LoRaWAN downlink

- ✓ Change period
- ✓ Set/calibration water metering flow data
- ✓ Valve control
- ✓ Query accumulated flow data
- ✓ Query historical flow data
- ✓ Query battery level

2.3.8 Alert function

- ✓ Battery low capacity alert: Less than 20% will trigger Battery low capacity alert, this alert will report every 24 hours, until it is above 20%.
- ✓ Reverse direction alarm: not support
- ✓ Valve abnormal alert: valve status abnormal
- ✓ Strong magnetic field alert: indicate that the environment have strong magnetic disturbance
- ✓ Backup power switch: when Battery capacity less than 10%, device will go into sleep mode to save power, No more Regular Spontaneous uplink. And will close the valve automatically.
- ✓ Hall sensor breakdown: when one of the magnetic sensor faulty, it will report an alarm.

2.3.9 Other specifications

Low voltage status: When Battery level is lower than 2.5v, the low voltage status bit will be set in device status segment.

2.4 DevEUI QR Code

Each device will have a DEVEUI, the ID is used to identify the device in LoRaWAN network, and this information will be indicated on the case of the water meter.

For example:

8CF957500000FDC4

2.5 Time zone

RHF1S052 will synchronize the time with GPS time via LoRaWAN network. And time zone is configurable, to make sure the local time is correct.

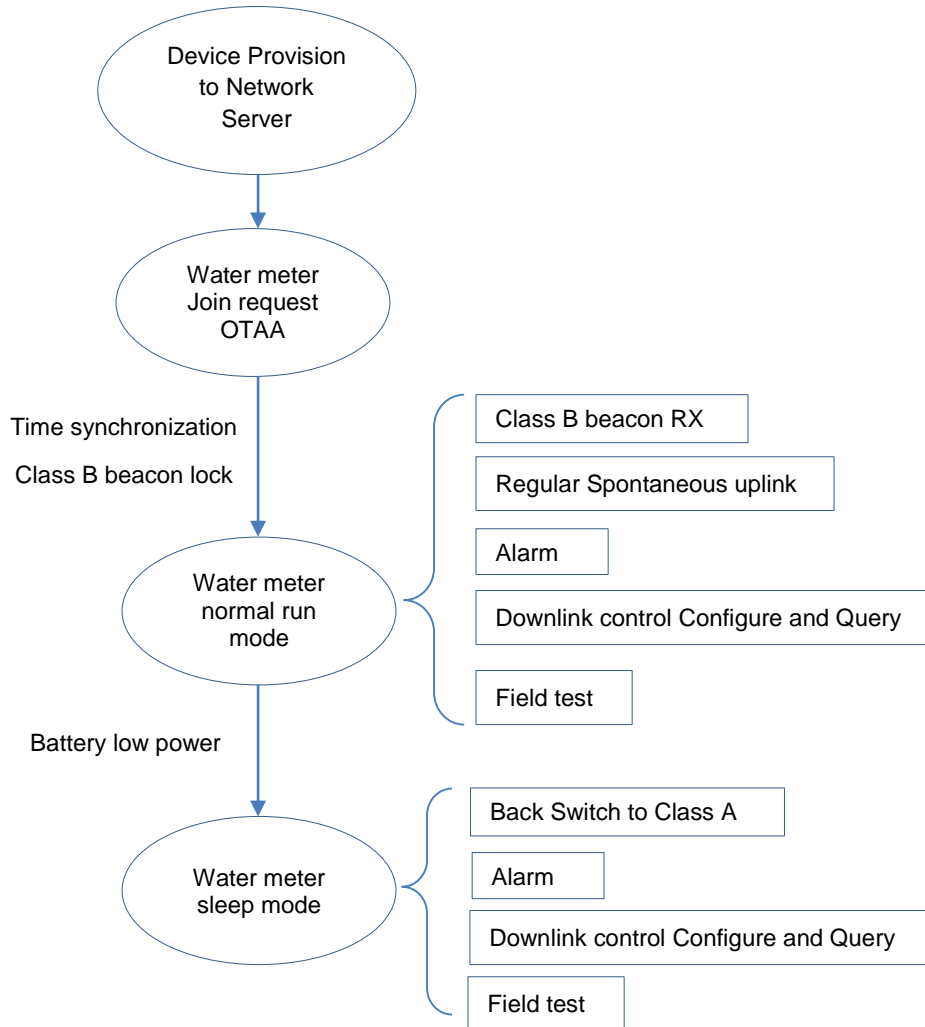
If any special time zone needed, please contact RisingHF when order.

3 User manual

3.1 Water meter operation procedure

Refer to Chapter 2.3.5 for the application mode description of water meter.

Below chart illustrate the operation procedure of water meter.



3.2 Device Provision to Network Server

Before RHF1S052 device Join network, make sure all the device is provisioned on LoRa network server properly. This is always done by water meter operator or management.

The necessary device information will be provided by device manufacturer.

3.3 Water meter Join request OTAA

After device is provisioned on LoRa network server properly, water meter will send Join request automatically, Join request will be retry until join succeed.

Once Device Join network successfully, it will start Time synchronization with network server automatically. Time synchronization will be retry until time synchronized.

After Device Join network successfully, it will start to switch to LoRaWAN Class B, Class B switch will be retry until Class B beacon locked.

For power saving, the Join request retry, time synchronization retry, Class B switch retry period will be increased in turn, until it become the maximum retry period.

Join request maximum retry period is 12 Hours.

Class B switch maximum retry period is 12 Hours.

3.4 Water meter normal run mode

After all are set, water meter will work in normal run mode

In normal run, water meter support application mode:

- 1) Regular Spontaneous uplink
- 2) Field test
- 3) Alarm
- 4) Downlink control, Configure and Query

3.5 Water meter sleep mode

when Battery capacity less than 10%, device will go into sleep mode to save power, device switch to LoRaWAN Class A, No more Regular Spontaneous uplink. And will close the valve automatically.

However, in sleep mode, it support below:

- 1) Field test.
- 2) Downlink control, Configure and Query.

Please refer to chapter 2 for the specification description of application mode in Normal run mode and Sleep mode.

3.6 Application protocol

All the message and command on RHF1S052, is defined in special protocol, please refer to 《[RHF-UM01916]RHF1S052 water meter application protocol_v0.7 》 for detail.

In most case, user don't need to do anything during the water meter working, Water meter will report reading flow data and device status by LoRaWAN uplink spontaneously, all the data format is following application protocol defined above.

Below are some operation user may need to do in case.

3.7 Field test

There is a Hall sensor for field test, Manual trigger the sensor using a Magnet will set the water meter in field test mode, in this mode, RHF1S052 will send two messages below, or start to join network if it did not joined successfully yet before.

- 1) Post accumulated flow data and status including battery level
- 2) Post period setting of Regular Spontaneous uplink



Picture above shows the position of Hall sensor, Place a Magnet close to this position for around 1 second (less than 10 seconds) and release (take away), RHF1S052 will trigger a field test.

Field test is useful when user is installing a water meter, and want to check the functionality and signal quality.

3.8 Valve control

RHF1S052 support downlink command to control Valve open and close, the control latency will depends on if it is LoRaWAN class A or Class B.

In LoRaWAN Class A, it will response until a next uplink happened, for example one hour period, or a field test manually if want to speed up.

In LoRaWAN Class B, it will response more quickly, it can response within a ping slot period.

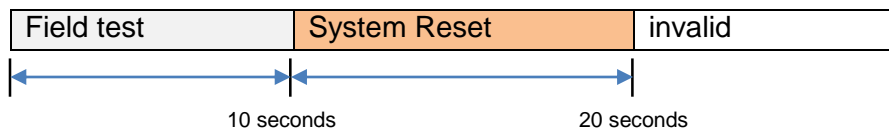
For specific downlink command, please refer to 《[RHF-UM01916]RHF1S052 water meter application protocol_v0.7 》 .

3.9 System Reset

Please don't reset the water meter unless user knows what to do.

We know there is a Hall sensor for field test, this hall sensor is also designed to be used for system reset. Manual trigger the sensor using a Magnet for a longer while will reset the water meter.

Place a Magnet close to this position for more than 10 second (but less than 20 seconds) and release (take away), RHF1S052 will reset.



The chart above show the time of hall sensor be triggered and its function designed.

Reset system will make the RHF1S052 Join network start over from operation procedure.

4 Installation Guide

4.1 Package list

The material list is provided with the water meter:

Sequence	Material	Qty
1	Water meter RHF1S052	1
2	coupling gasket	2
3	coupling tail piece	2
4	coupling nut	2

4.2 Attention

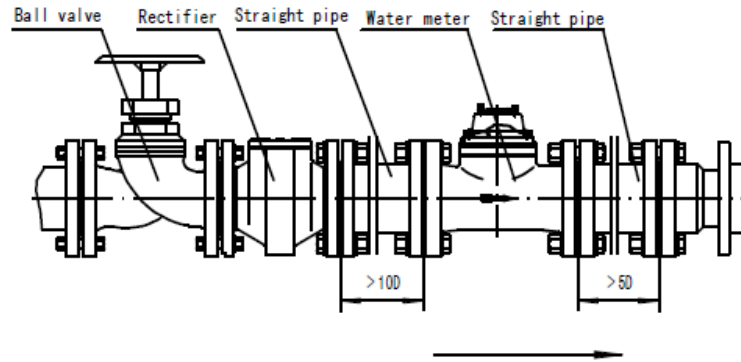
This water meter is used for measuring the flow volume of cold water passing through the meter. Don't use it for sewage or Corrosive liquid.

Make sure the conditions below should follow:

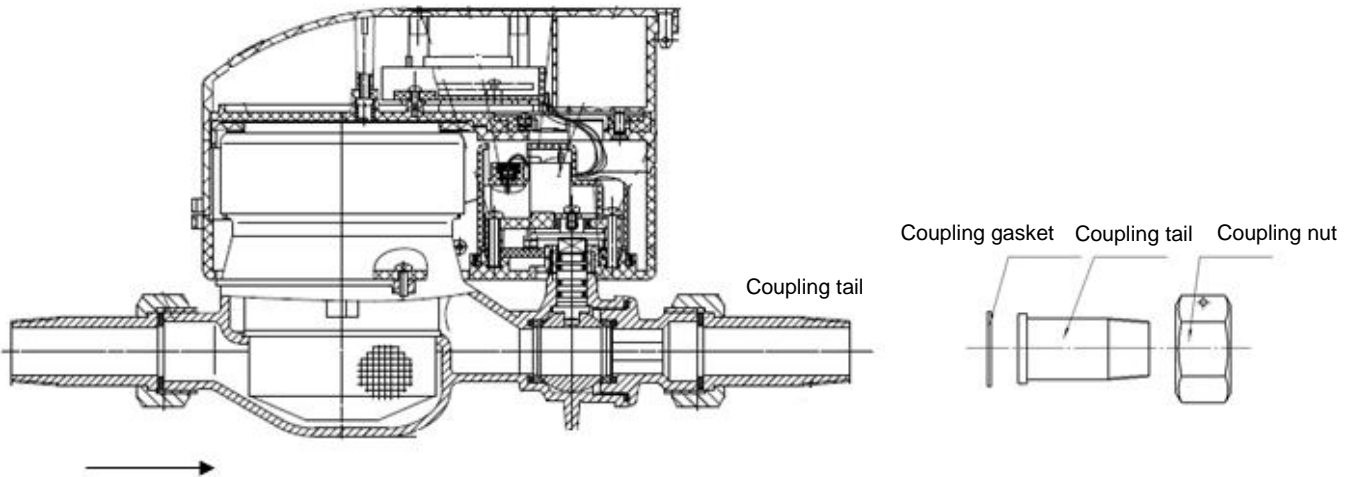
- 1) Water medium temperature: 0.1~50℃
- 2) Normal Flow rate Q3: 2.5m³/h
- 3) Operation pressure: ≤1.6Mpa

4.3 Installation instructions

- 1) Select the correct water meter, it is recommended that the flow rate pass the pipeline is often equal to or less than the normal flow rate.
- 2) Before installing the water meter with pipe, please first clear up the pipeline with water to make sure no impurity substance.
- 3) Water meter should be installed on the base or supported by bracket so that meter will not suffer extra press by pipeline.
- 4) The meter should be installed in horizontal position, and set the water meter dial upward.
- 5) Install the water meter with right direction (follow the arrow which indicates the flow direction)
- 6) Make sure a certain length of straight pipe is guaranteed upstream the water meter, the length is more than 5 times of the water meter size; if the length of straight pipe is not possible, a rectifier is suggested to be installed upstream the water meter.



- 7) A ball valve installed upstream the water meter for ease of maintenance.
- 8) Install a reflux valve downstream the water meter to prevent backflow if needed.
- 9) Last step to install the water meter, join the water meter inlet port and Outlet port to the water pipe with coupling gasket, coupling tail piece and coupling nut, this accessories will be provided together with the water meter when order.



- 10) For more accurate of the metering, water meter should be keep away from water pump.
- 11) Water meter should be protected against direct sunshine, frost, and flood.

Revision

V1.2 2020-05-26

-Correct Flow rate

V1.1 2020-05-10

- Modify some description errors

V1.0 2020-05-06

- Create

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