Friendcom

PULSE915-LRW Terminal User Manual（05）

LoRaWAN Terminal Series

Version 2.1

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Friendcom has always been committed to technological innovation. Our aim is to provide customers with timely and comprehensive service. For any assistance, please contact our Shenzhen headquarters:

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TRADEMARKS

About This Document

Scope

Scope of this document is to present features and application of Friendcom wireless pulse acquisition terminal PULSE915-LRW

Audience

This document is intended for
system engineers (SEs),
application engineers,
and test engineers.

Related Documents

Friendcom_PULSE915-LRW_Terminal_Datasheet
Friendcom_PULSE915-LRW_Configuration_User_Manual

Conventions

Symbol	Indication
⚠ Warning	This warning symbol means danger. You are in a situation that could cause fatal device damage or even bodily damage.
⚠ Caution	Means reader be careful. In this situation, you might perform an action that could result in module or product damages.
ⓘ Note	Means note or tips for readers to use the module.

History

Issue	Date	Change
1.0	2018-05	Initial draft
1.1	2019-06	• Update Interface definition • Added pulse wiring method of Hall sensor type • Update the format of proactive data reporting • Added data short frame format • Update magnet active time and corresponding functions
1.2	2020-04	• Update product description • Added firmware upgrade content
2.0	2020-08	• Updating new LoRaWAN module • Updating of contents
2.1	2020-09	• Update product wired connection description. • Update the band support.

Content

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1   Introduction

This document describes the technical parameters and key functions which are connected with customers' applications, and it can help customers quickly understand the data format, wiring definitions, as well as other related information of PULSE915-LRW. Associated with configuration user manual, customers can use the terminal to any pulse emitting device (water, gas, electricity, etc.) easily.

2   Product Concept

2.1   General Description

PULSE915-LRW is an external pulse acquisition and wireless data transmission terminal. It is mainly used for data acquisition of single-pulse or double pulse of equipment, and based on LoRaWAN technology to implement active data reporting.

PULSE915-LRW supports two kinds of pulse signal output sensors of Hall and reed switch. That enables it to operate with any pulse emitting device (water, gas, electricity, etc.).

With pre-installed long-life battery and built-in antenna, the wireless pulse acquisition terminal PULSE915-LRW has the characteristics of simple deployment, high reliability, low power consumption and long transmission distance.

2.2   Key Features

The following shows the key features of wireless pulse acquisition terminal PULSE915.

- Long range wireless data transmission.

- Support active sensor (Hall) and passive sensor (reed switch).

- Multi-band support , EU868, US915, AU915, IN865, AU923-2.

- Configurable reporting interval.

- Pre-installed long-life battery and built-in antenna.

- UART serial port or air wireless configuration.

- UART firmware upgrade or FOTA.

- Battery power detection and optional automatic power reporting.

- Average life 10 years*.

- IP67 waterproof rating.

> Lifetime depends from the device location and reporting interval.

2.3 Specifications

The following table describes the specifications of PULSE915-LRW

Table 2‑1 Specifications of PULSE915-LRW

Specifications	Description
Physical features	Dimensions (L*W*H): 50 mm x 45.5±0.15 mm x 134 mm Weight: 146g (Contains the weight of 1 meter long cable) Cable length: 1m
Operating conditions	Operating temperature: -40 °C to +70 °C Operating humidity: 5%RH to 95%RH
Power supply	Pre-installed long-life battery, 2.6V to 3.7V
Power consumption	<8 µA@ Standby mode
Radio characteristics	Tx Power: Max. 20dBm Rx Sensitivity: < -138dBm
Communication range	Up to 15km (In visibility conditions)
Frequency bands	EU433, CN470, EU868, US915, AU915, IN865, AU923-2
MAC Layer	LoRaWAN ®
Antenna option	Build-in Antenna
Configuration	UART serial port or over-the-air
Upgrade	UART serial or FOTA
Certificate approval	CE, FCC, LoRa Alliance*, ANATEL

"*" Means for features and certifications in planning

2.4   Communication Interface

PULSE915-LRW has a UART communication port and a set of pulse signal input ports. UART interface can be used for parameters configuration and firmware upgrades, and the pulse signal input port supports single pulse and double pulse signal input.

It supports both active and passive sensors. The sampling pulse time is less than 5ms, which can meet the requirement of typical water, electricity and gas instrument pulse acquisition.

2.5   Safety Recommendations

Ensure that this product is used in compliant with the requirements of the country and the environment, the following safety precautions must be observed during all phases of the operation, such as usage, service or repair of wireless pulse acquisition products. If not so, Friendcom assumes no liability for customers' failure to comply with these precautions.

Full attention must be given to driving at all times in order to reduce the risk of an accident. Using the terminal while driving causes distraction and can lead to an accident. Please comply with laws and regulations restricting the use of wireless devices while driving.

Wireless devices may cause interference on sensitive medical equipment, so please be aware of the restrictions on the use of wireless devices when in hospitals, clinics or other healthcare facilities.

The wireless terminal contains a transmitter and receiver. RF interference can occur if it is used close to other electric equipment.

Do not use this product at any places with a risk of fire or potentially explosive atmospheres such as gasoline stations, oil refineries, etc.

3 Wiring Definition

3.1 Wiring definition

PULSE915-LRW uses wiring terminal for connection. The name of each terminal is marked on the PCB.
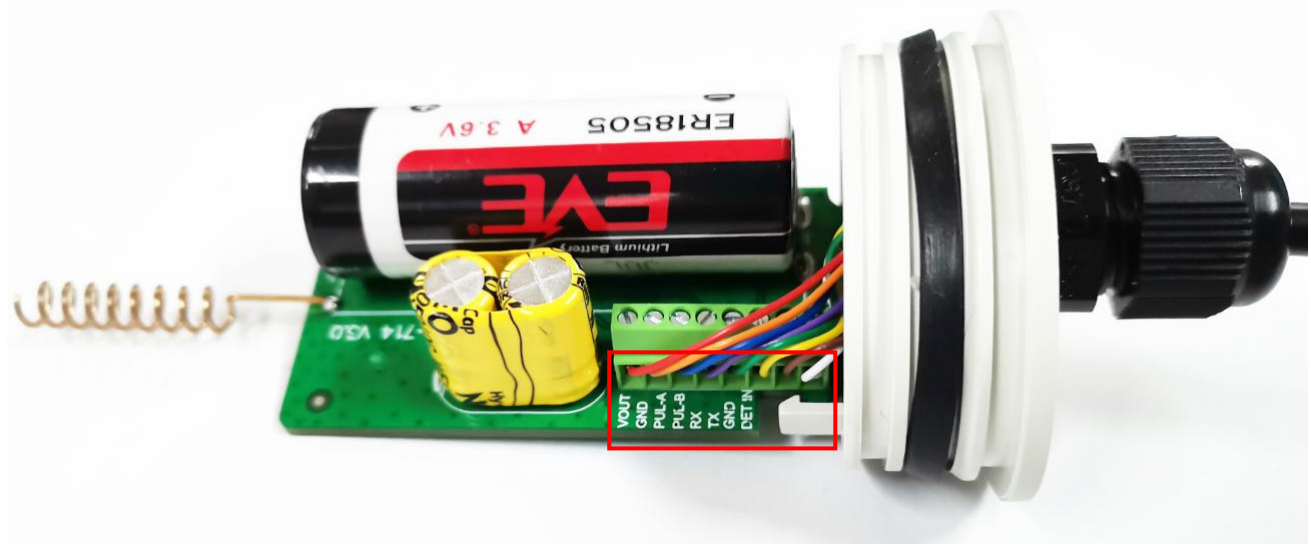
Figure 3- 1 PCB wiring diagram

The specific functions are defined as shown in the following table.

Table 3- 1 Wiring definition of PULSE915-LRW

NO.	Name	Function	Wiring color	Remarks
1	VOUT	Power Output	Red	3.6V controllable output, hall sensor use
2	GND	Ground	Orange	
3	PUL-A	Pulse sampling port A	Blue	Single pulse sampling using this port
4	PUL-B	Pulse sampling port B	Purple	
5	IO1-R	Serial port reception	Green	
6	IO1-T	Serial port transmission	Yellow	
7	GND	Ground	Brown	
8	LINE	Wire break detection	White	

3.2 **Pulse Acquisition**

PULSE915-LRW collects pulses and counts them, and the current accumulated index is sent to the gateway through the LoRaWAN module according to the preset reporting period, and finally uploaded to LoRaWAN server. The connection between active pulse (Hall) and passive pulse (reed switch) is as follows.

3.2.1 **Active Pulse**

The ports that need to be used for active pulses are as follows:

Table 3‑2 Active pulse wiring

Port	Single pulse	Double pulse
VOUT	√	√
GND	√	√
PUL-A	√	√
PUL-B		√

3.2.2 **Passive Pulse**

The ports that need to be used for passive pulses are as follows:

Table 3‑3   Passive Pulse wiring

Port	Single pulse	Double pulse
GND	√	√
PUL-A	√	√
PUL-B		√

4 Data Format And Setting Command

4.1 Data Format Of Reporting

PULSE915-LRW actively reports data according to the set period. The format of reported data frame can be set to two types: short format and long format. The information reported in the two formats is different, as follows:

Short data frame format:

Name	Byte	Note
Frame header	1	Fixed 0x56
Frame number and status	1	Bit 4- Bit 7: Frame number Bit 3: NC Bit 2: Magnetic interference flag, 0 means normal, 1 means abnormal. Bit 1: Broken line sign, 0 means normal, 1 means abnormal Bit 0: Low voltage alarm flag, 0 means normal, 1 means abnormal
Address field	4	The device address, the factory default is the last 4 bytes of LoRaWAN module DevEUI, which can be modified by command.
Data area	4	BCD code，Unit L, current cumulative number
Checksum	1	Accumulate sum, the cumulative sum of one byte of data from the frame header to the check

Long data frame format:

Name	Byte	Note
Frame header	1	Fixed 0x55
Frame number	1	Data frame accumulator, value range 0 to 255, cyclic accumulation
Address field	4	The device address, the factory default is the last 4 bytes of LoRaWAN module DevEUI, which can be modified by commands.
Function code	1	Fixed 0x01
Data area	4	BCD code, unit L, current cumulative number
Freeze data on previous day	4	BCD code, unit L
Clock	6	Format is Year, month, day, hour, minute

Battery voltage	1	Current battery voltage, the actual voltage value needs to be divided by 10
Status byte	1	Bit 4-Bit 7: Reserved, the default is 0 Bit 3: NC, the default is 0 Bit 2: Magnetic interference flag, 0 means normal, 1 means abnormal. Bit1: Broken line sign, 0 means normal, 1 means abnormal Bit 0: Low voltage alarm flag, 0 means normal, 1 means abnormal
Checksum	1	Accumulate sum, the cumulative sum of one byte of data from the frame header to the check
Terminator	1	Fixed 0x16

Take long data frame as an example

55 05 00 31 00 29 01 00 39 58 68 00 39 50 00 19 12 13 16 31 09 36 02 FD 16	
Bytes	**Remarks**
55	Frame header, fixed to 0x55
05	05 represents the 5th frame data sent by the module
00 31 00 29	It is the address of device, which is taken from the last four bits of DevEUI of LoRaWAN module
01	Reserved, fixed to 0x01
00 39 58 68	It is the current reading of the meter, representing 395868 liters, converted to 395.868 cubic meters
00 39 50 00	It is the value of freezing in previous day, representing 395000 liters, converted to 395 cubic meters
19 12 13 16 31 09	It is the current time of the equipment when transmitting this frame, representing 16:31:09 on December 13, 2019
36	36 represents the current battery voltage is 3.6V
02	02 is converted to binary 00000010, at this time, B0 is 0, B1 is 1, and B2 is 0, which respectively represents normal voltage, disconnected line and no magnetic interference.
FD	FD is the checksum, cumulative sum from the frame header to the previous byte
16	End character, fixed to 0x16

4.2   Setting Command

Parameters of PULSE915-LRW can be set and read by AT command, the format of commands is shown in the following table.

Command	Note	Ack (Success)	Ack (Failure)
AT+I	Query the current electronic index, the unit is m³	InitValue = xxx.xx	Error
AT+I=xxxxx.xxx	Set the initial index, such as the current value of meter. Max. value is 5 integers and 3 decimal, the unit is m³. For example, to set the initial index is 55.123, the command is as follows: AT+I=55.123	Set InitValue = xxxxx.xxx	Error
AT+P	Query pulse constant	PulseConst = xxx	Error
AT+P=xxxx	Set the pulse constant, 1≤set value≤2000. For example, to set the pulse constant is 1000, the command is as follows: AT+P=1000	Set PulseConst = 1000	Error
AT+T	RTC real-time clock query	RTC real-time = year.month.day_week_hour :minute:second	Error
AT+T=xx.xx.xx x xx:xx:xx	RTC real-time clock setting, the format is xx.xx.xx_x_xx:xx:xx (year.month.day_week_hour:minute:second) Note that Saturday and Sunday, correspond to number 6 and 7. For example, to set the time On January 21, 2018, Sunday at 14:00,	Set RTC Success	Error

	the input command is as follows: AT+T=18.01.21 7 14:00:00		
AT+DA	Check the product address	Address = ********	
AT+DA="Device address"	Set the product's mailing address, 4 bytes of hexadecimal digits. Example: AT+DA =ABCDEF01	Set Address = ABCDEF01	
AT+VP	Read pull-up resistor configuration of external Vcc and two pulse sampling ports	Vcc = **(ON), Pull Up = **(OFF)	
AT+VP="vcc state","Pull up state"	Set pull-up resistor of external Vcc and two pulse sampling ports. ON is open OFF is close Example: AT+VP=ON, OFF	Set Vcc = ON, Pull Up = OFF	
AT+NP	Read pulse type, support signal and double type. 1 is signal 2 is double	Pulses = 1	
AT+NP="Number of pulses"	Set type for single or double pulse, valid digits: 1, 2 Example: AT+NP=1	Set Pulses = 1	
AT+RC	Read reporting period	Report Cycle = ****	
AT+RC="Report cycle"	Set the reporting period in minutes. Valid range: 1-99999 Example: AT+RC=1440	Set Report Cycle = ****	
AT+UFM	Query report frame format	Frame Mode = 1	
AT+UFM="Update frame mode"	Configure the report frame format, which can be set to two formats: short frame and long	Set Frame Mode = 1	

	frame. 0 short frame format 1 long frame format Example: AT+UFM=1		
AT+RST	Reset the device	Reset now	
AT+V	Query the current software version	version:0.3	Error
AT+DR=band	Set the frequency band. For example, set the band to AU915. The command is: AT+DR=AU915.	+DR: XXXXXX	
AT+CH=NUM, chm-chn	Set channel. The transmit channel of the module must be consistent with the receive channel of the gateway. For example, set the channel to 0-7.　The command is: AT+CH=NUM, 0-7	+CH: NUM, 0-7	
AT+POWER=xx	Set the transmit power , For example, set the transmit power to 20dBm, the command is AT+POWER=20	+POWER: 20	
AT+ID=DevAddr, "xxxxxxxx"	Set DevAddr, "xxxxxxxx" to an 8-digit hexadecimal number. For example, set the DevAddr ID to 01234567, the command is: AT+ID=DevAddr, "01234567"	+ID: DevAddr, 01:23:45:67	
AT+ID	Query LoRaWAN module ID information: DevAddr, DevEui, AppEui	+ID:DevAddr, 00:F3:50:02 +ID:DevEui, 47:A7:CA:DD:00:2B:00:49 +ID:AppEui, 52:69:73:69:6E:67:48:46	
AT+MODE=LWOTAA	Set the module to LWOTAA mode	+MODE:LWOTAA	

| AT+MODE=LWABP | Set the module to LWABP mode | +MODE:LWABP | |

Note

- "_" means space.

- Pulse constant: The number of pulses generated per $1m^3$ of the water meter. Example: Each pulse of 1 liter of water produces 1 pulse, that is, 1 m^3 of water meter will produce 1000 pulses, then the pulse constant should be 1000 (if the pulse constant is reset, the initial reading must be reset).

- Parameter configuration can be manually entered through the serial port debugging assistant, or can be carried out using the PC software provided by Friendcom.

5 Parameters Configuration

5.1 Parameters Configuration

Before using the PULSE915-LRW terminal, we need to configure some parameters, such as initial index, pulse constant, RTC real-time clock, pulse type (single or double pulse), sensor type (hall or reed switch) and other LoRaWAN information. The configuration mode supports wired and wireless. For detailed operation steps, users can refer to Friendcom_PULSE915-LRW_Configuration_User_Manual.

5.1.1 Wired Configuration Mode

Connect this product to the USB port of computer through the USB to TTL interface adapter. The ports that need to be connected to this product are as follows:

Table 5- 1　Device to USB wiring

Device port name	Function definition	USB to TTL Adapter	Remarks
IO1-R	Data receive	RxD	TTL Level 0-3.6V

IO1-T	Data transmit	TxD	TTL Level 0-3.6V
GND	Power ground	GND	

5.1.2 **Wireless Configuration Mode**

Plug the wireless USB adapter FC-714-USB into your computer and install the correct driver to configure the product wirelessly.

5.1.3 **Entering Configuration Mode**

PULSE915-LRW terminal can be activated by magnet to enter configuration mode. Both the wired configuration mode and wireless configuration mode need to be activated before parameters configured.

The reed switch inside the product is triggered by the magnet to put the product into the configuration mode, and then the configuration command must be sent within 30 seconds. If the product does not detect the configuration command in 30 seconds, the configuration mode will be exited. Once the command is received, the product will keep in configuration mode for another 30 seconds.
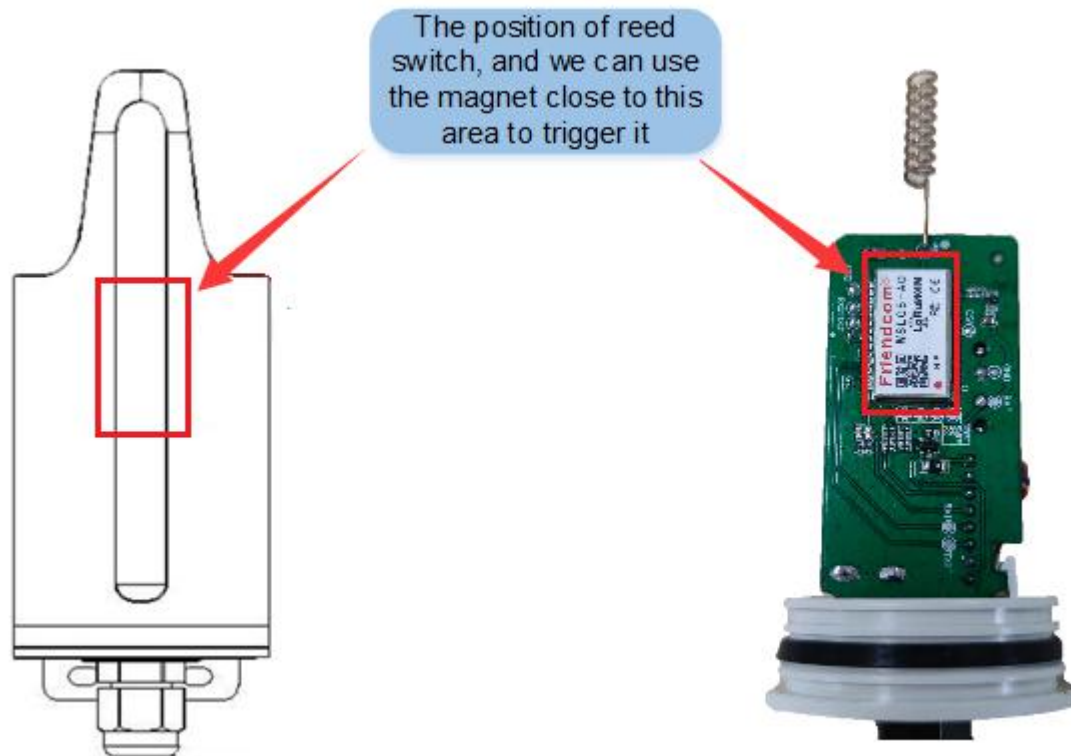
The trigger position is shown in the figure below.

Figure 5-1　Magnet activation position

The time that magnet triggers the reed switch to connect (the duration from connect to the break) and the corresponding functions are shown in the following table:

Magnet hold time	Features	Remarks
2s-4s	Report data once	Typically 3s
4s-9s	Configuration mode	Typically 5s
9s-15s	Reset	Typically 12s
>15s	No response	Close magnet detecting function 60s

Note

- When the product exits the configuration mode, basing on whether the user has sent a network access command (AT + JOIN) and whether the current mode is OTAA, it will automatically join the network if both are satisfied. The network access result can be verified by triggering whether the data report is successful.

- The parameters can be set through AT command, for detailed command information, please refer to section 4.2.

6 Dimensions and Installation Instructions

6.1 Dimensions

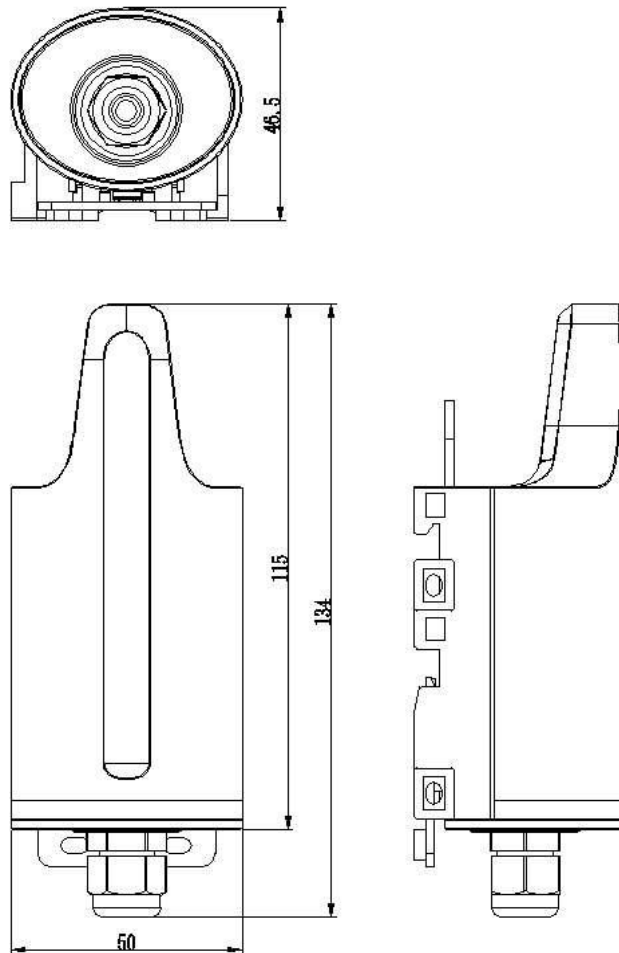The dimensions of PULSE915-LRW is show blew (not contains the cable, unit mm).

Figure 6- 1   Dimensions of PULSE915-LRW
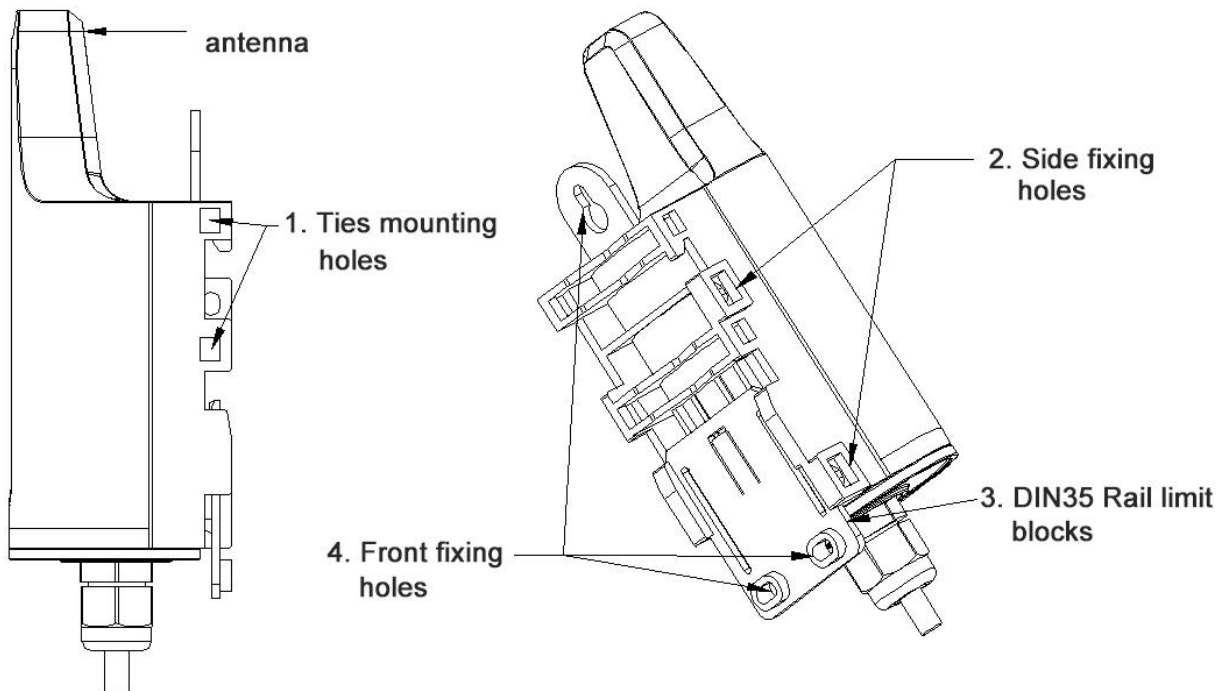
6.2 **Installation**

Figure 6- 2   Installation of PULSE915-LRW

Installation method:

1) Ties installed in water pipes

2) Use screw to fixed it through side fixing holes

3) Mounted on DIN35 rails

4) Use screw to fixed it through front fixing holes

6.3 **Transportantion and Storage**

Storage: -5°C to 55°C, non-corrosive gases.

Less than 4 layers stacked and pay attention to shockproof during transportation.