



# IoT Weather Station

Featuring LoRaWAN<sup>®</sup>

**WTS Series**

User Guide



## Applicability

This guide is applicable to WTS series shown as follows, except where otherwise indicated.

Model	Description
WS305	IoT Weather Station Standard Version (Temperature, Humidity, Wind Direction, Wind Speed, Barometric Pressure)
WS505	IoT Weather Station Pro Version (Temperature, Humidity, Wind Direction, Wind Speed, Barometric Pressure)
WS506	IoT Weather Station Pro Version (Temperature, Humidity, Wind Direction, Wind Speed, Barometric Pressure, Rainfall)

## Safety Precautions

Milesight will not shoulder responsibility for any loss or damage resulting from not following the instructions of this operating guide.

- ❖ The device must not be disassembled or remodeled in any way.
- ❖ In order to protect the security of the device, please change device password when first configuration. The default password is 123456.
- ❖ The device is not intended to be used as a reference sensor, and Milesight will not should responsibility for any damage which may result from inaccurate readings.
- ❖ Do not place the device close to objects with naked flames.
- ❖ Do not place the device where the temperature is below/above the operating range.
- ❖ Make sure electronic components do not drop out of the enclosure while opening.
- ❖ When installing the battery, please install it accurately, and do not install the reverse or wrong model.
- ❖ Make sure both batteries are newest when install, or battery life will be reduced.
- ❖ The device must never be subjected to shocks or impacts.

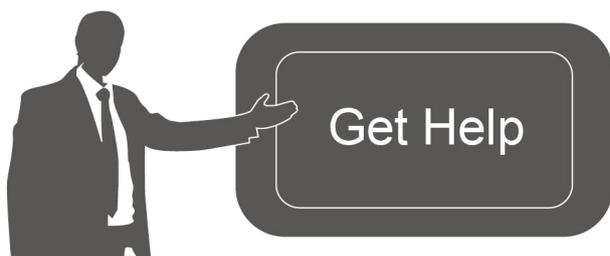
## Declaration of Conformity

WTS series is in conformity with the essential requirements and other relevant provisions of the CE, FCC, and RoHS.



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## Revision History

Date	Doc Version	Description
Oct.10, 2022	V 1.0	Initial version

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# 1. Product Introduction

## 1.1 Overview

IoT Weather Station (WTS Series) is an all-in-one LoRaWAN® weather monitoring system for various atmospheric conditions, such as temperature, humidity, wind speed, wind direction, barometric pressure and rainfall. Consisting of 3 main parts, WTS sensors, WTS Hub and solar panel, IoT Weather Station is designed to withstand the most challenging weather conditions and is easy to install in different scenarios to be widely used in meteorology, smart agriculture, smart building, etc.

Sensor data is transmitted using LoRaWAN® technology. Compliant with Milesight LoRaWAN® gateway and Milesight IoT Cloud solution, users can manage all sensor data and trigger other sensors or appliances easily via webpage or mobile App remotely.

## 1.2 Features

- Integrated with multiple sensors like humidity, temperature, barometric pressure, wind speed, wind direction, rainfall, etc.
- Waterproof, UV-proof and salt spray resistant enclosure for outdoor harsh environment applications
- High power solar powered with chargeable batteries backup
- Store locally more than 19,000 historical records and support retransmission to ensure no data miss
- Easy to carry and install
- Ultra-wide-distance wireless transmission up to the line of sight of 15 km in rural areas
- Equipped with NFC for easy and quick configuration
- Compliant with standard LoRaWAN® gateways and network servers
- Quick and easy management with Milesight IoT Cloud

## 2. Hardware Introduction

### 2.1 Packing List



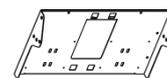
1 × WTS Sensor



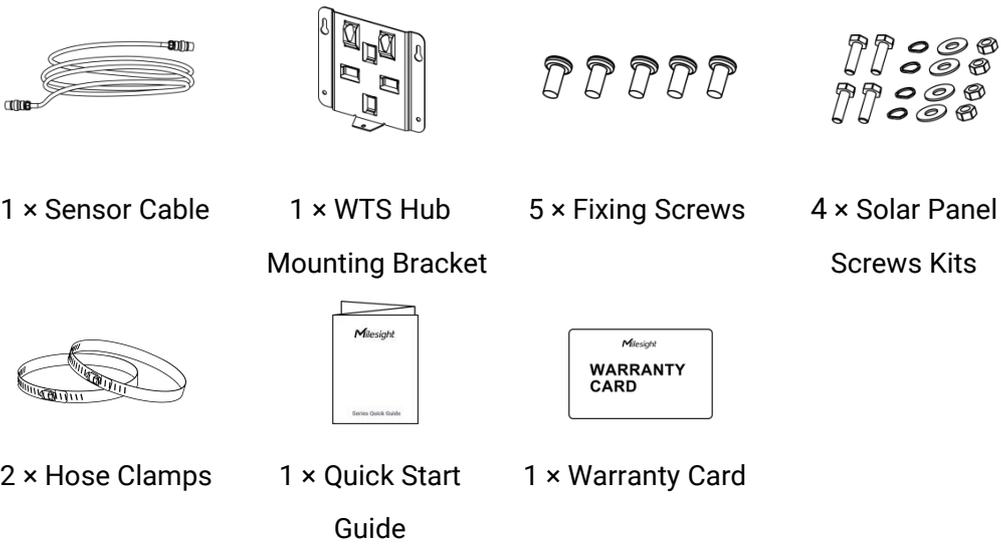
1 × WTS Hub



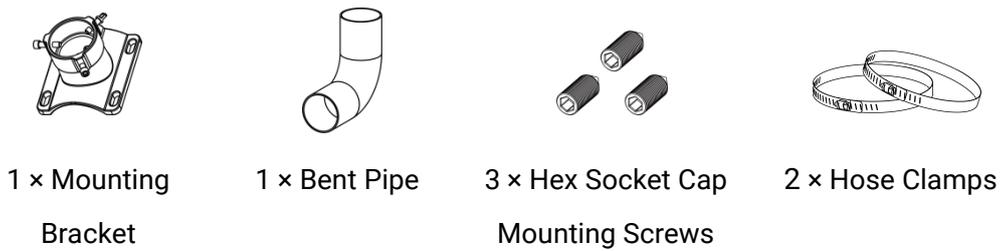
1 × Solar Panel  
(With Bracket)



1 × Solar Panel  
Mounting Bracket



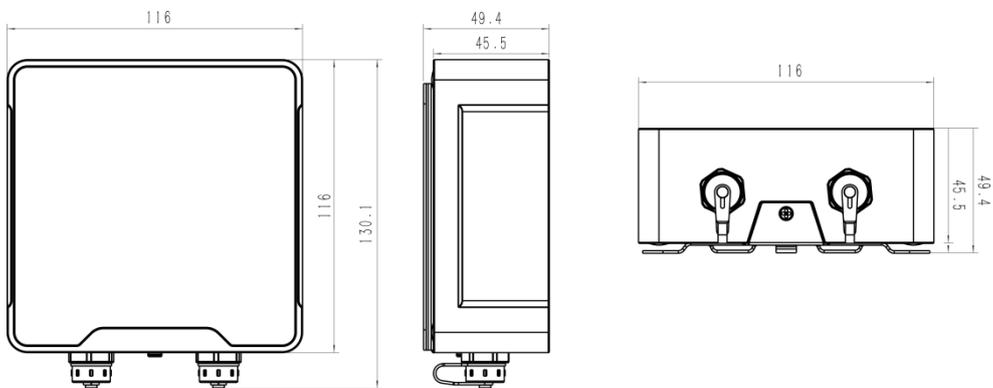
**WTS505/WTS506 Only**



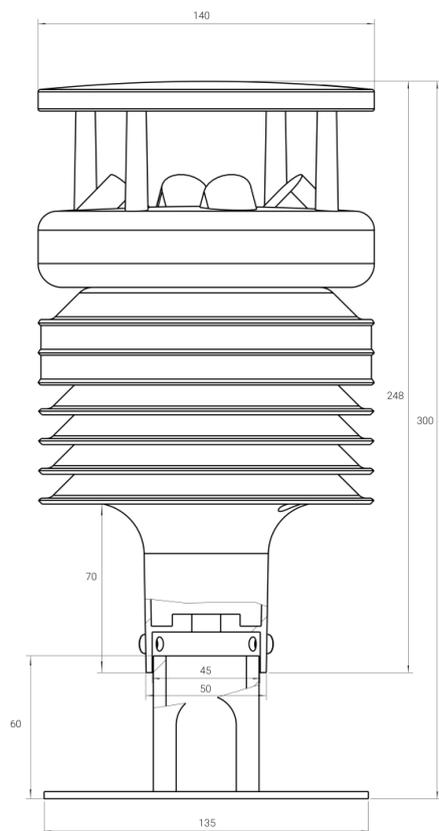
**!** If any of the above items is missing or damaged, please contact your sales representative.

**2.2 Dimensions(mm)**

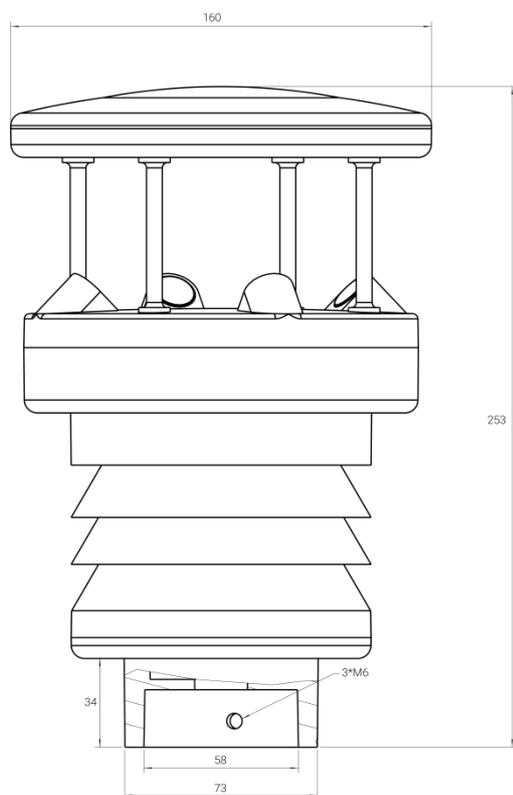
**WTS Hub**



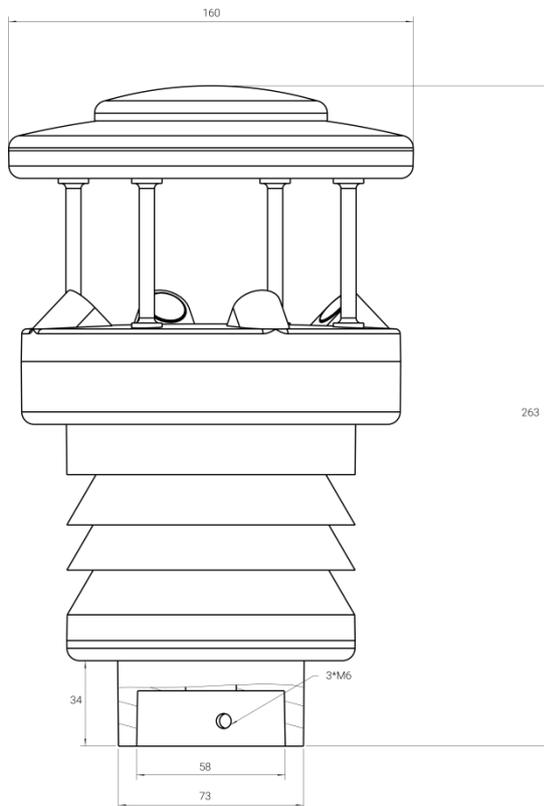
### WTS305



### WTS505



## WTS506



### 2.3 LED and Power Button

The LED indicator and power button are inside the WTS Hub device. Switch on/off and reset can also be configured via NFC.

Function	Action	LED Indication
Turn On	Press and hold the button for more than 3 seconds.	Off → On
Turn Off	Press and hold the button for more than 3 seconds.	On → Off
Reset	Press and hold the button for more than 10 seconds.	Blink 3 times.
Check On/Off Status	Quickly press the power button for within 3 seconds.	Light On: Device is on. Light Off: Device is off.

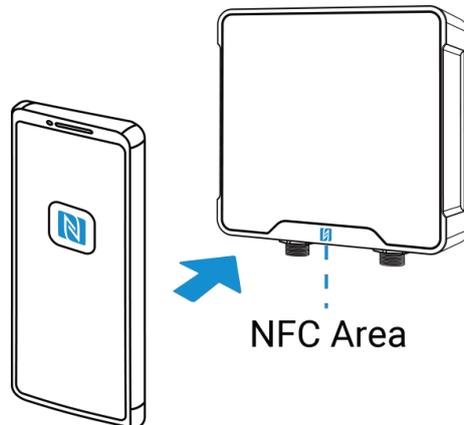
## 3. Operation Guide

### 3.1 NFC Configuration

WTS Hub can be configured via NFC. Before the configuration, please connect WTS Sensor to the right interface of WTS Hub via sensor cable to read and test.

1. Download and install “Milesight ToolBox” App from Google Play or Apple Store.

2. Enable NFC on the smartphone and open "Milesight ToolBox" App.
3. Attach the smartphone with NFC area to the device to read basic information.

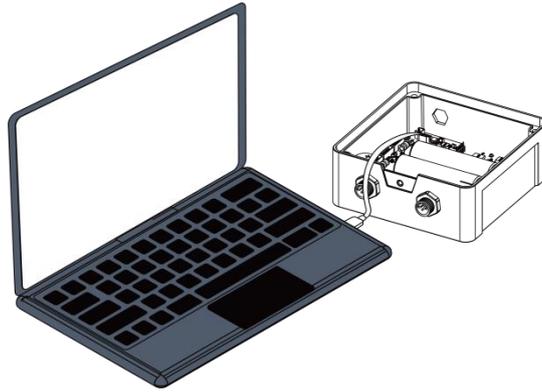


4. Basic information and settings of WTS Hub will be shown on ToolBox if it's recognized successfully. You can read and configure the device by tapping the buttons on the App. In order to protect the security of devices, password validation is required when configuring via unused phone . Default password is **123456**.

Status	Setting	Maintenance
SN	6454C32424650043	
Model	WTS506-915M	
Device EUI	24E124454C324246	
Firmware Version	V1.1-a3	
Hardware Version	V2.0	
Device Status	ON	<input checked="" type="checkbox"/>

**Note:**

- 1) Ensure the location of smartphone NFC area and it's recommended to take off phone case.
- 2) If the smartphone fails to read/write configurations via NFC, keep the phone away and back to try again.
- 3) WTS Hub can also be configured by dedicated NFC reader provided by Milesight IoT.
- 4) You can configure it via Type-C USB port inside the device by these steps: release the back panel of WTS Hub and connect the device to computer via Type-C port, run ToolBox PC software, select serial port as USB port and type as "General", then type password to login ToolBox and configure the device. (Default password: 123456)



## 3.2 LoRaWAN Settings

LoRaWAN settings is used for configuring the transmission parameters in LoRaWAN® network.

### Basic LoRaWAN Settings:

Go to “**LoRaWAN -> Basic**” of ToolBox software or “**Setting -> LoRaWAN Settings**” for ToolBox App to configure join type, App EUI, App Key and other information. You can also keep all settings by default.

Device EUI	<input type="text" value="24E1244"/>
App EUI	<input type="text" value="24E124C0002A0001"/>
Application Port	<input type="text" value="85"/>
Working Mode:	<input type="text" value="Class A"/>
Join Type	<input type="text" value="OTAA"/>
Application Key	<input type="text" value="*****"/>
RX2 Date Rate	<input type="text" value="DR8 (SF12, 500k)"/>
RX2 Frequency	<input type="text" value="923300000"/>
Spread Factor	<input type="text" value="SF7-DR3"/>
Confirmed Mode	<input type="checkbox"/>
Rejoin Mode	<input checked="" type="checkbox"/>
Set the number of packets sent	<input type="text" value="32"/> packets
ADR Mode	<input checked="" type="checkbox"/>
TXPower	<input type="text" value="TXPower0-22 dBm"/>

Parameters	Description
Device EUI	Unique ID of the device which can also be found on the label.
App EUI	Default App EUI is 24E124C0002A0001.
Application Port	The port used for sending and receiving data, default port is 85.
Join Type	OTAA and ABP mode are available.
Application Key	Appkey for OTAA mode, default is 5572404C696E6B4C6F52613230313823.
Device Address	DevAddr for ABP mode, default is the 5 <sup>th</sup> to 12 <sup>th</sup> digits of SN.
Network Session Key	Nwkskey for ABP mode, default is 5572404C696E6B4C6F52613230313823.
Application Session Key	Appskey for ABP mode, default is 5572404C696E6B4C6F52613230313823.
LoRaWAN Version	V1.0.2, V1.0.3, V1.1 are available.
RX2 Data Rate	RX2 data rate to receive downlinks.
RX2 Frequency	RX2 frequency to receive downlinks. Unit: Hz
Spread Factor	If ADR is disabled, the device will send data via this spread factor.
Confirmed Mode	If the device does not receive ACK packet from network server, it will resend data once.
Rejoin Mode	Reporting interval $\leq$ 30 mins: the device will send a specific number of LinkCheckReq MAC packets to the network server every 30 mins to validate connectivity; If there is no response, the device will re-join the network. Reporting interval $>$ 30 mins: the device will send a specific number of LinkCheckReq MAC packets to the network server every reporting interval to validate connectivity; If there is no response, the device will re-join the network.
ADR Mode	Allow network server to adjust datarate of the device.
Tx Power	Transmit power of device.

**Note:**

- 1) Please contact sales for device EUI list if there are many units.
- 2) Please contact sales if you need random App keys before purchase.
- 3) Select OTAA mode if you use Milesight IoT Cloud to manage devices.
- 4) Only OTAA mode supports rejoin mode.

**LoRaWAN Frequency Settings:**

Go to “LoRaWAN -> Channel” of ToolBox software or “Setting -> LoRaWAN Settings” for ToolBox APP to select supported frequency and select channels to send uplinks. Make sure the

channels match the LoRaWAN® gateway.

Basic
Channel

Support Frequency : EU868

	Index	Frequency/MHz	Max Datarate	Min Datarate
<input checked="" type="checkbox"/>	0	<input style="width: 80px;" type="text" value="868.1"/>	<span style="border: 1px solid #ccc; padding: 2px 5px;">5-SF7BW125</span>	<span style="border: 1px solid #ccc; padding: 2px 5px;">0-SF12BW125</span>
<input checked="" type="checkbox"/>	1	<input style="width: 80px;" type="text" value="868.3"/>	<span style="border: 1px solid #ccc; padding: 2px 5px;">5-SF7BW125</span>	<span style="border: 1px solid #ccc; padding: 2px 5px;">0-SF12BW125</span>
<input checked="" type="checkbox"/>	2	<input style="width: 80px;" type="text" value="868.5"/>	<span style="border: 1px solid #ccc; padding: 2px 5px;">5-SF7BW125</span>	<span style="border: 1px solid #ccc; padding: 2px 5px;">0-SF12BW125</span>
<input type="checkbox"/>	3	<input style="width: 80px;" type="text" value="0"/>	<span style="border: 1px solid #ccc; padding: 2px 5px;">5-SF7BW125</span>	<span style="border: 1px solid #ccc; padding: 2px 5px;">0-SF12BW125</span>
<input type="checkbox"/>	4	<input style="width: 80px;" type="text" value="0"/>	<span style="border: 1px solid #ccc; padding: 2px 5px;">5-SF7BW125</span>	<span style="border: 1px solid #ccc; padding: 2px 5px;">0-SF12BW125</span>
<input type="checkbox"/>	5	<input style="width: 80px;" type="text" value="0"/>	<span style="border: 1px solid #ccc; padding: 2px 5px;">5-SF7BW125</span>	<span style="border: 1px solid #ccc; padding: 2px 5px;">0-SF12BW125</span>
<input type="checkbox"/>	6	<input style="width: 80px;" type="text" value="0"/>	<span style="border: 1px solid #ccc; padding: 2px 5px;">5-SF7BW125</span>	<span style="border: 1px solid #ccc; padding: 2px 5px;">0-SF12BW125</span>

If the frequency is one of CN470/AU915/US915, you can enter the index of the channel that you want to enable in the input box, making them separated by commas.

#### Examples:

1, 40: Enabling Channel 1 and Channel 40

1-40: Enabling Channel 1 to Channel 40

1-40, 60: Enabling Channel 1 to Channel 40 and Channel 60

All: Enabling all channels

Null: Indicates that all channels are disabled

Support Frequency : AU915

Enabled Channel Index: 0-71

Channel Index	Frequency/MHz	Channel Spacing/MHz	BW/kHz
0 - 15	915.2 - 918.2	0.2	125
16 - 31	918.4 - 921.4	0.2	125
32 - 47	921.6 - 924.6	0.2	125
48 - 63	924.8 - 927.8	0.2	125
64 - 71	915.9 - 927.1	1.6	500

#### Note:

For -868M model, default frequency is EU868;

For -915M model, default frequency is AU915.

### 3.3 Basic Settings

Go to “**Device Settings -> Basic**” of ToolBox software or “**Device->Setting->General Settings**” of ToolBox App to change the reporting interval, etc.

**Basic Settings**

Device Type

Reporting Interval(min)

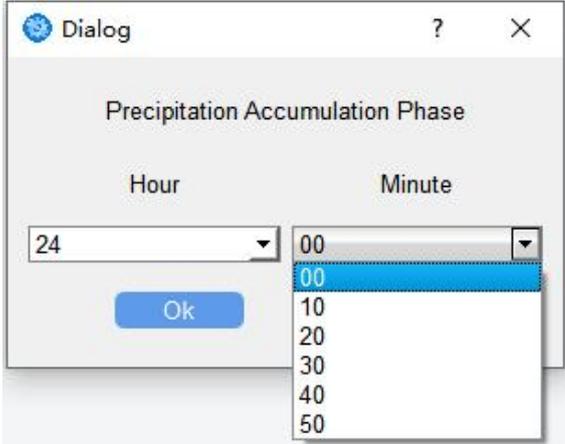
Restoration of Power

Rainfall Accumulation Phase

Data Storage

Data Retransmission

Change Password

Parameters	Description
Reporting Interval	Reporting interval of transmitting weather data and battery level to network server. Default: 10 mins, Range: 1-1080 mins.
Restoration of Power	If the device loses power and returns to power supply, the device will be on or off according to this parameter.
Rainfall Accumulation Phase (WTS506 Only)	<p>After the rainfall accumulates up to this time range or up to 500 mm, it will clear and re-count the accumulated rainfall value. There are two parameters to set the time range, range: 0~48 h</p> 
Data Storage	Disable or enable reporting data storage locally. (see section <a href="#">3.4.1</a> to export data )
Data Retransmission	Disable or enable data retransmission. (see section <a href="#">3.4.2</a> )

Change Password	Change the password for ToolBox App or software to read/write this device.
-----------------	--

## 3.4 Advanced Settings

### 3.4.1 Data Storage

WTS series sensor supports storing more than 19,000 data records locally and exports data via ToolBox App or ToolBox software. The device will record the data according to reporting interval even not joining to network.

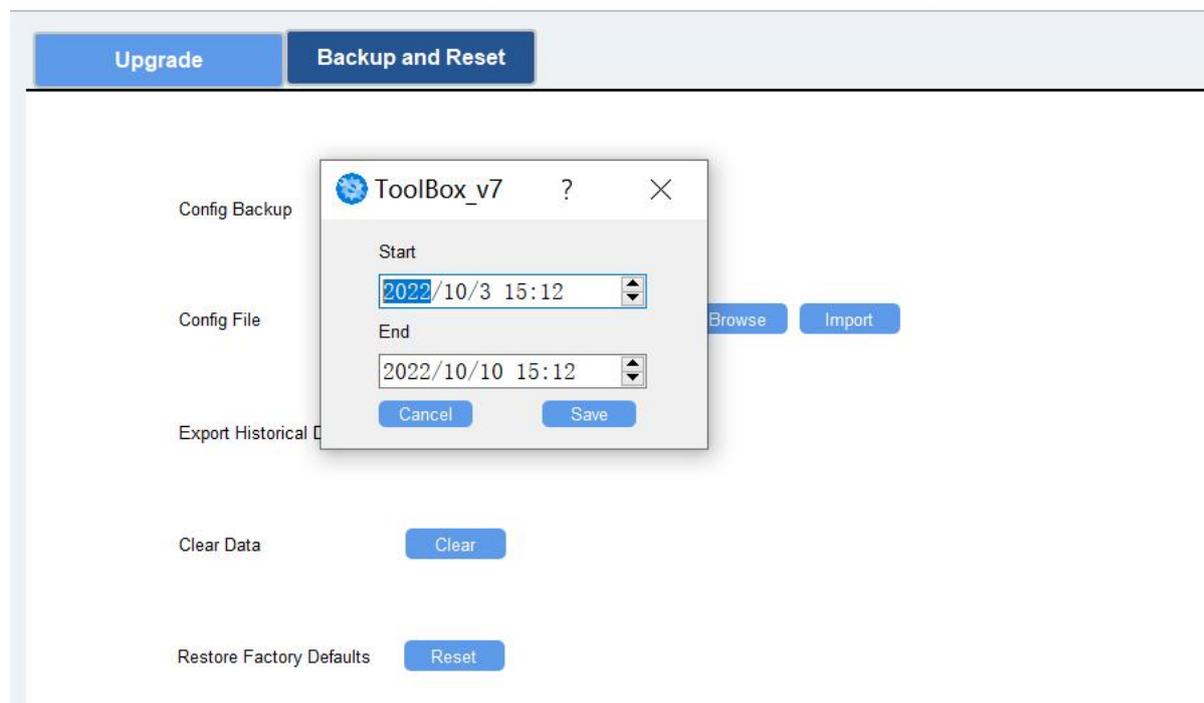
1. Go to **"Device Settings -> Basic"** of ToolBox software or **"Device -> Settings -> General Settings"** of ToolBox App to enable data storage feature.

2. Go to **"Maintenance -> Basic"** of ToolBox software or **"Device -> Maintenance"** of ToolBox App, click **"Export"**, then select the data time period and click **"Save"** to export data.

**Note:** Toolbox App can only export last 7 days' data. If you need to export more data, please use ToolBox software.

3. Click **"Clear"** to clear all stored data inside the devices.

#### Maintenance >



### 3.4.2 Data Retransmission

WTS Series sensor supports data retransmission to ensure network sever can get all data even if network is down for some times. There are two ways to get the lost data:

- Network server sends downlink commands to enquire the historical data for specifying time

range, refer section [5.4](#)

- When network is down if no response from LinkCheckReq MAC packets for a period of time, the device will record the network disconnected time and re-transmit the lost data after device re-connects the network.

Here are the steps for data retransmission:

1. Ensure the device time is correct, please use Toolbox software or ToolBox App to sync the time.

The screenshot shows a device status page with the following information:

Channel Mask:	0003	
Uplink Frame-counter:	86	
Downlink Frame-counter:	0	
Device Time:	2022-10-10 07:26:15	<input type="button" value="Sync"/>

Status	Setting	Maintenance
SN	6454C32424650043	
Model	WTS506-915M	
Device EUI	24E124454C324246	
Firmware Version	V1.1-a4	
Hardware Version	V2.0	
Device Status	ON	<input checked="" type="checkbox"/>
Join Status	De-activated	
RSSI/SNR	0/0	
Device Time	2022-10-10 14:54	<input type="button" value="Sync"/>

If you set LoRaWAN® version as 1.0.3 or 1.1, the network server will use MAC commands to assign the time to device every time when the sensor joins to network.

2. Enable data storage feature and data retransmission feature.

The screenshot shows the 'Basic Settings' page with the following configuration:

- Device Type: WTS506-915M
- Reporting Interval(min): 1
- Restoration of Power: Last Working Status
- Rainfall Accumulation Phase: 24 hour 0 minutes
- Data Storage:
- Data Retransmission:
- Change Password:

A 'Save' button is located at the bottom of the settings panel.

3. Enable rejoin mode feature and set the number of packets sent. Take below as example, the device will send LinkCheckReq MAC packets to the network server at least every 30 minutes to check if the network is disconnected. If there is no response for 4 times (4\*30 minutes = 120 minutes = 2 hours), device network status will change to de-activated and the device will record a data lost time point(disconnection time minus 2 hours).

**Note:** If the reporting interval is less than 30 minutes, the time = packets sent \* 30 minutes; if the reporting interval is more than 30 minutes, the time = packets sent \* reporting interval.

#### LoRaWAN >

Basic	Channel
App EUI	24E124C0002A0001
Application Port	85
Join Type	OTAA
Class Type	Class A
Application Key	*****
RX2 Data Rate	DR2 (SF10, 125 kHz)
RX2 Frequency	923200000
Spread Factor	SF10-DR2
Confirmed Mode	<input type="checkbox"/>
Rejoin Mode	<input checked="" type="checkbox"/>
Set the number of packets sent	4 packets
ADR Mode	<input checked="" type="checkbox"/>

4. After the network connected back, the device will send the lost data from the point in time when the data was lost according to the reporting interval.

**Note:**

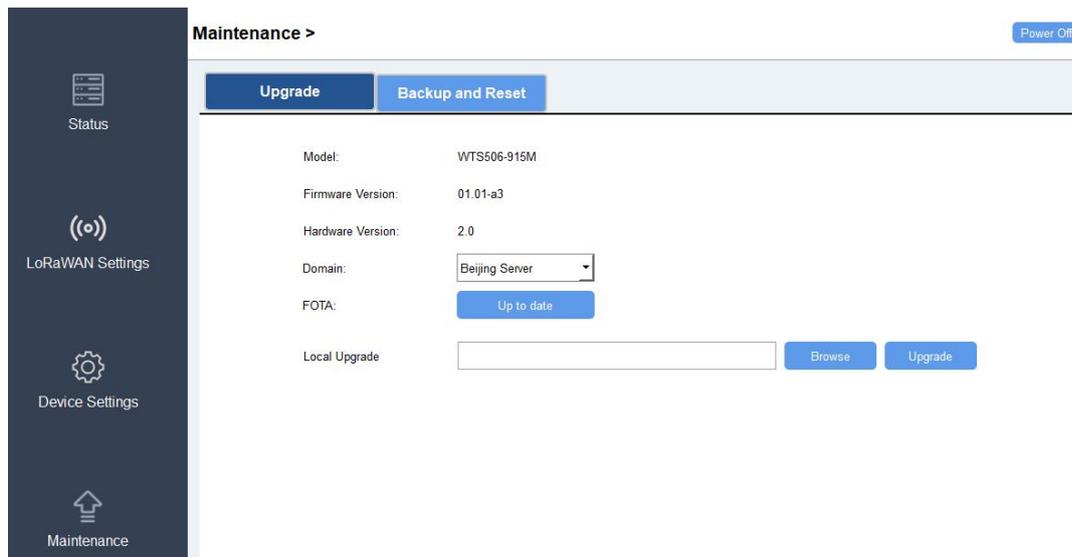
- 1) If the device is reboot or re-powered when data retransmission is not completed, the device will re-send all retransmission data again after device is reconnected to the network.
- 2) If the network is disconnected again during data retransmission, it will only send the latest disconnection data.
- 3) The retransmission data format is started with "20ce", please refer to section [5.4](#).
- 4) Data retransmission will increase the uplinks and shorten the battery life.

## 3.5 Maintenance

### 3.5.1 Upgrade

#### ToolBox Software:

1. Download firmware from Milesight website to your PC.
2. Run Toolbox App, go to "Maintenance > Upgrade", click "Browser" to import the firmware and upgrade the firmware.



#### ToolBox App:

1. Download firmware from Milesight website to your smartphone.
2. Open Toolbox App and click "Browse" to import firmware and upgrade the device.

#### Note:

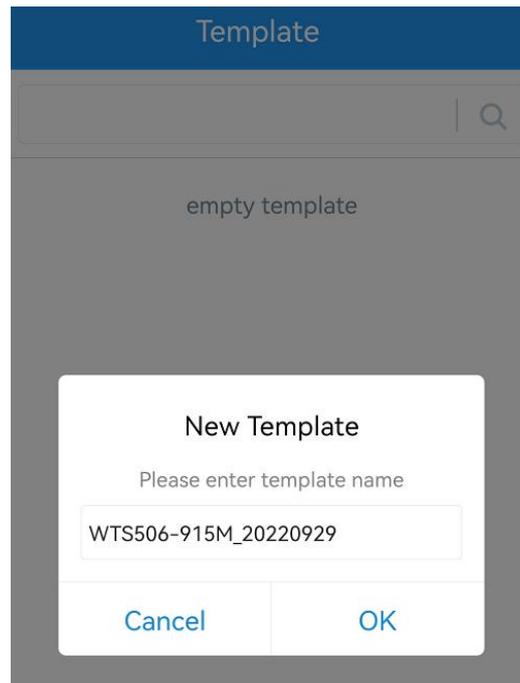
- 1) It is not supported to do any operation on ToolBox during upgrading.
- 2) Only Android version ToolBox App supports upgrade feature.

Status	Setting	Maintenance
SN	6454C32424650043	
Model	WTS506-915M	
Firmware Version	V1.1-a3	
Hardware Version	V2.0	
Manual Upgrade		
<input type="button" value="Browse"/>		

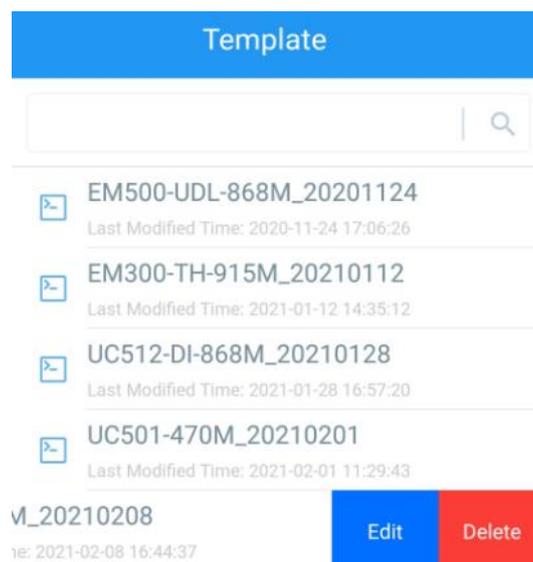
### 3.5.2 Backup

WTS Hub devices support configure backup for easy and quick device configuration in bulk. Backup is allowed only for devices with the same model and LoRaWAN® frequency band.

1. Go to “Template” page on the App and save current settings as a template. You can also edit the template file.
2. Select one template file which saved in the smartphone and click “Write”, then attach to another device to write configuration.



**Note:** Slide the template item left to edit or delete the template. Click the template to edit the configurations.



### 3.5.3 Reset to Factory Default

Please select one of following methods to reset device:

**Via Hardware:** Hold on power button (internal) of WTS Hub for more than 10s.

**Via ToolBox App:** Go to “Device->Maintenance” to click “Reset”, then attach smart phone with NFC area to WTS Hub to complete reset.

Status	Setting	Maintenance
SN	6454C32424650043	
Model	WTS506-915M	
Firmware Version	V1.1-a3	
Hardware Version	V2.0	
Manual Upgrade		
<input type="button" value="Browse"/>		
Restore Factory Default		
<input type="button" value="Reset"/>		

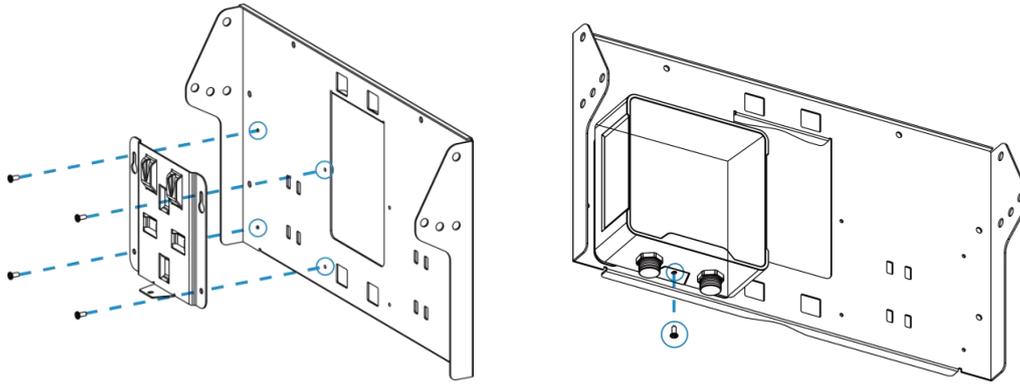
## 4. Installation

### 4.1 Installation Locations

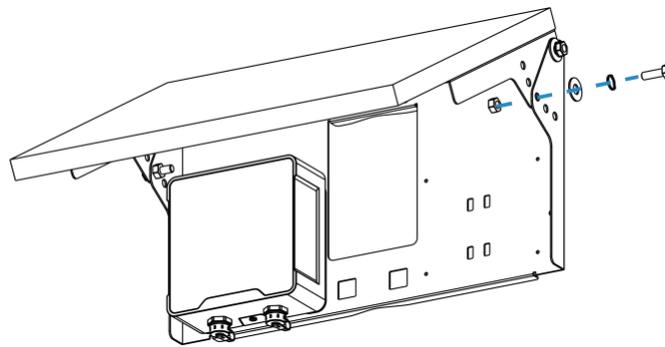
- Within the communication range of LoRaWAN® gateway.
- No high buildings or barriers (trees, telegraph poles) around; the distance between the IoT weather station and the nearest obstacle is preferably 10 times the height of the obstacle.
- Keep away from radars, transmitters and any other instruments which can generate electrical interference; keep a distance of more than 2 meters between sensor and radar.
- Keep away from heat sources like chimney, vents, etc.
- No fence plants (higher than 1m) around weather station within 10m.

### 4.2 Solar Panel and WTS Hub Installation

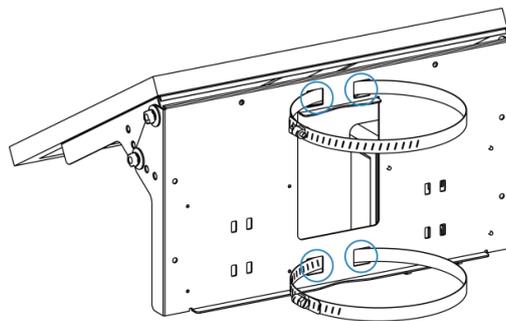
1. Fix the hub mounting bracket to the solar panel bracket with 4 fixing screws, then put the WTS Hub to the bracket fix the bottom of hub to the bracket with a fixing screw.



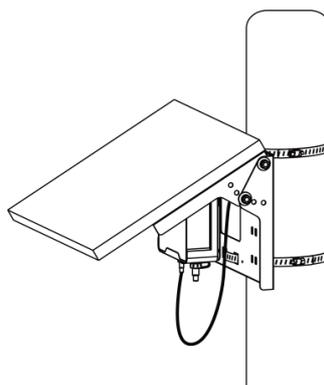
2. Adjust the angle of solar panel brackets (20°,40° or 60°is optional) according to the installation environment, then fix the two sides of bracket with screw kits.



3. Straighten the hose clamps and slide them through the rectangular rings in the solar panel's bracket, wrap the hose clamps around the pole. After that use a screwdriver to tighten the locking mechanism by turning it clockwise.

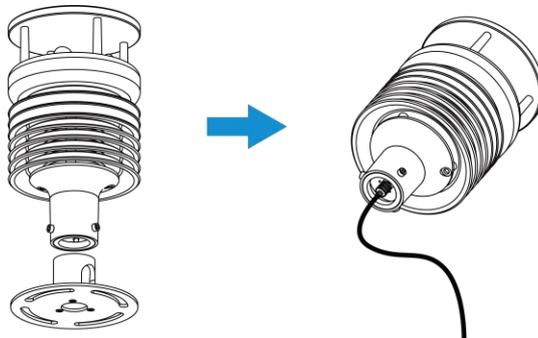


4. Connect the cable of solar panel to left interface of WTS Hub.

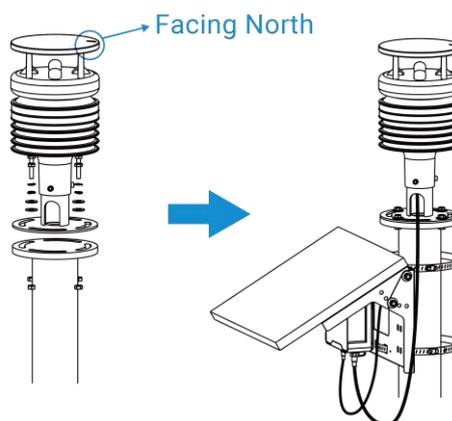


### 4.3 WTS305 Sensor Installation

1. Loosen the flange base of the sensor and connect one side of the sensor cable to the sensor and tighten the cable, then screw the flange base back to the sensor.

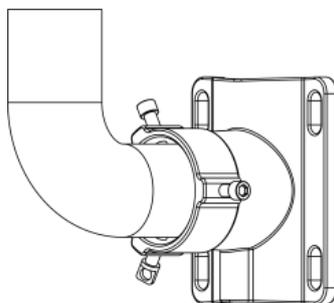


2. Connect the sensor to the pole top flange with nuts and bolts, then connect the other side of the sensor cable to the right interface of the WTS Hub. When installing, ensure the arrow on the sensor is facing north according to a compass. Users can install the sensor with other installation methods by selecting other accessories.



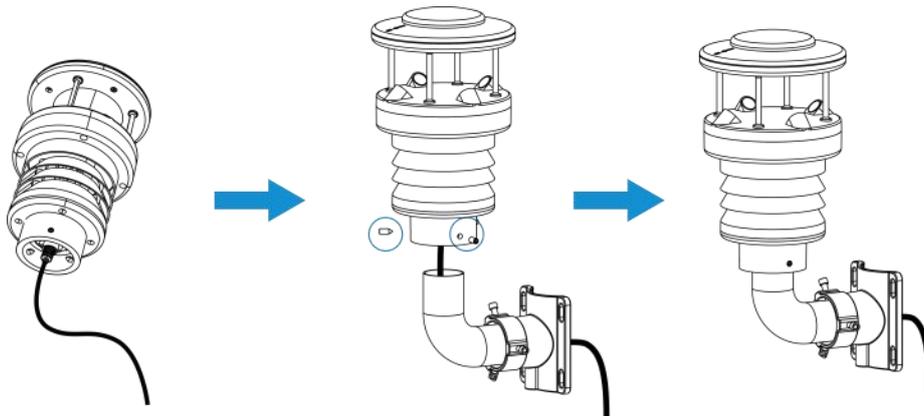
### 4.4 WTS505/WTS506 Sensor Installation

1. Connect the bent pipe to the mounting bracket, tighten the 2 hex socket cap screws with a screwdriver and tighten the insurance screw by hand to ensure the two parts are fixed well.

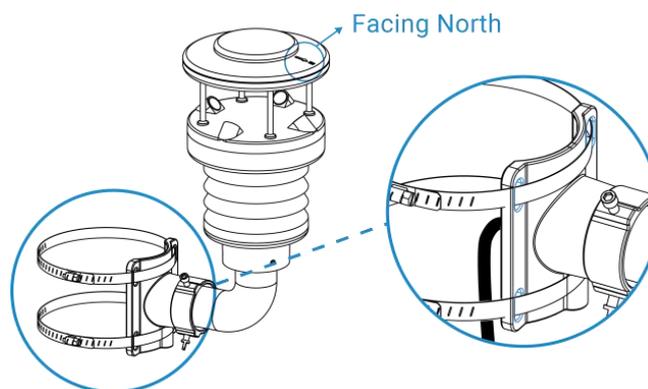


2. Connect one side of the sensor cable to the WTS Sensor and tighten the cable, pass the cable through the bent pipe and bracket, then connect the pipe to the bottom of the sensor and fix both.

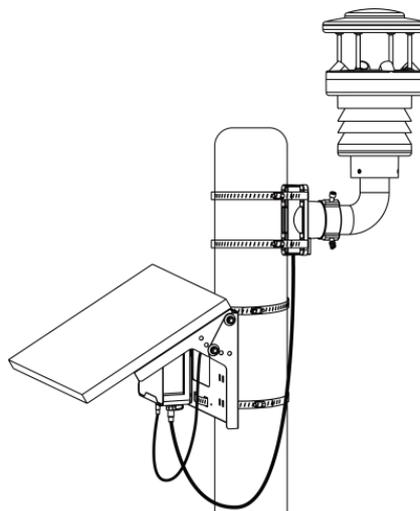
parts with 3 hex socket cap mounting screws.



3. Straighten the hose clamps and slide them through the rings in the bracket, wrap the hose clamps around the pole. After that use a screwdriver to tighten the locking mechanism by turning it clockwise. When installing, ensure the arrow on the sensor facing north according to a compass.



4. Connect the other side of sensor cable to the right interface of WTS Hub.



## 5. Device Payload

All data are based on following format (HEX), the Data field should follow little-endian:

Channel1	Type1	Data1	Channel2	Type2	Data2	Channel 3	...
1 Byte	1 Byte	N Bytes	1 Byte	1 Byte	M Bytes	1 Byte	...

For decoder examples please find files on <https://github.com/Milesight-IoT/SensorDecoders>.

### 5.1 Basic Information

WTS series sensors report basic information of sensor whenever joining the network.

Channel	Type	Description
ff	01(Protocol Version)	01=>V1
	09 (Hardware Version)	01 40 => V1.4
	0a(Software Version)	01 14 => V1.14
	0f(Device Type)	00: Class A, 01: Class B, 02: Class C
	16(Device SN)	16 digits

Example:

ff166454c32424650043 ff090200 ff0a0101 ff0f00					
Channel	Type	Value	Channel	Type	Value
ff	16(Device SN)	6454c3242 4650043	ff	09 (Hardware version)	0200 (V2.0)
Channel	Type	Value	Channel	Type	Value
ff	0a (Software version)	0101 (V1.1)	ff	0f (Device Type)	00 (Class A)

### 5.2 Sensor Data

WTS series report sensor and battery data according to reporting interval (10min by default).

Channel	Type	Description
01	75(Battery Level)	UINT8, Unit: %
03	67 (Temperature)	INT16, Unit: °C, Resolution: 0.1°C
04	68(Humidity)	UINT8, Unit: %RH, Resolution: 0.5%RH
05	84(Wind Direction)	UINT16, Unit: ° Resolution: 1° (WTS305) / 0.1°(WTS505/WTS506)
06	73(Barometric Pressure)	UINT16, Unit: hPa, Resolution: 0.1hPa

07	92(Wind Speed)	UINT16, Unit: m/s, Resolution: 0.1m/s
08	77(Rainfall)	<p>3 Bytes</p> <p>Byte 0-1: Accumulated rainfall, Unit: mm, Resolution: 0.01 mm</p> <p>B2: Frame counter to define whether device enters the new rainfall accumulation phase, it will plus 1 every upload, range: 0~255</p> <p><b>Note:</b></p> <p>1) When the rainfall is cleared and start a new accumulation phase, the counter will be also cleared to 0;</p> <p>2) When frame counter reaches 255 and not enter a new phase, it will always upload 255.</p>

**Example:**

## 1. WTS305

017564 03671001 046871 05840001 0673aa27 07929201					
Channel	Type	Value	Channel	Type	Value
01	75 (Battery)	64 => 100%	03	67 (Temperature )	10 01 => 01 10 = 272 Temp=272*0.1=27.2 °C
Channel	Type	Value	Channel	Type	Value
04	68 (Humidity)	71=>113 Hum=113* 0.5=56.5%	05	84 (Wind Direction)	00 01=> 01 00 = 256°
Channel	Type	Value	Channel	Type	Value
06	73 (Barometric Pressure)	aa 27=>27 aa=10154* 0.1=1015. 4 hPa	07	92(Wind Speed)	92 01 => 01 92 = 402*0.1= 40.2 m/s

## 2. WTS506

017564 03671001 046871 05844605 0673aa27 07929201 0877c41325					
Channel	Type	Value	Channel	Type	Value
01	75 (Battery)	64 => 100%	03	67 (Temperatu re)	10 01 => 01 10 = 272 Temp=272*0.1=2 7.2°C
Channel	Type	Value	Channel	Type	Value

04	68 (Humidity)	71=>113 Hum=113* 0.5=56.5%	05	84 (Wind Direction)	46 05=> 05 46 = 1350*0.1=135°
Channel	Type	Value	Channel	Type	Value
06	73 (Barometric Pressure)	aa 27=>27 aa=10154*0.1=1 015.4 hPa	07	92(Wind Speed)	92 01 => 01 92 = 402*0.1= 40.2 m/s
Channel	Type	Value			
08	77(Rainfall)	c413=>13 c4=5060*0.01=5 0.6 mm Counter=25=>37			

### 5.3 Downlink Commands

WTS series sensors support downlink commands to configure the device. The application port is 85 by default.

Channel	Type	Description
ff	03 (Set Reporting Interval)	2 Bytes, unit: s
	10(Reboot)	ff(Reserved)
	11 (Set Device Time)	4 Bytes, unix timestamp
	17 (Set Time Zone)	2 Bytes, desired UTC time zone * 10
	27(Clear)	01: Clear Historical Data 00: Clear Accumulated Rainfall
	67(Restoration of Power)	00: Off 01: On 02: Return to Previous Working State
	68(Data Storage)	01: Enable, 00: Disable
	6e(Set Rainfall Accumulation Phase )	2 Bytes, unit: min
	69(Data Retransmission)	01: Enable, 00: Disable
	6a(Set Retransmission Interval)	3 Bytes Byte 1: 00 Bytes 2-3: interval time, unit: s range: 30~1200s (600s by default)

**Example:**

1. Set reporting interval as 20 minutes.

ff03b004		
Channel	Type	Value
ff	03 (Set Reporting Interval)	b0 04 => 04 b0 = 1200s = 20 minutes

2. Reboot

ff10ff		
Channel	Type	Value
ff	10 (Reboot)	ff(Reserved)

3. Set time zone to GMT-4.

ff17d8ff		
Channel	Type	Value
ff	17 (Set Time Zone)	d8 ff => ffd8 = -40 = -4 * 10

4. Set the device time

ff 11 3d 1c de 5d		
Channel	Type	Value
ff	11(Set Device Time)	3d 1c de 5d=>5d de 1c 3d=1574837309(Unix timestamp) =>2019/11/17 14:48:29

## 5.4 Historical Data Enquiry

WTS series support sending downlink commands to enquire historical data for specified time point or time range. Before that, ensure **the device time is correct and data storage feature was enabled to store the data.**

### Command format:

Channel	Type	Description
fd	6b (Enquire data in time point)	4 Bytes, unix timestamp
fd	6c (Enquire data in time range)	Start time (4 bytes) + End time (4 bytes), Unix timestamp
fd	6d (Stop query data report)	ff

ff	6a (Report Interval)	3 Bytes, Byte 1: 01 Byte 2: interval time, unit: s, range: 30~1200s (60s by default)
----	----------------------	---

**Reply format:**

Channel	Type	Description
fc	6b/6c	00: data enquiry success 01: time point or time range invalid 02: no data in this time or time range
20	ce (Historical Data)	Data time stamp (4 Bytes) + Data Contents (Mutable)

**Note:**

1. The device only uploads no more than 300 data records per range enquiry.
2. When enquiring the data in time point, it will upload the data which is closest to the search point within the reporting interval range. For example, if the device's reporting interval is 10 minutes and users send command to search for 17:00's data, if the device find there is data stored in 17:00, it will upload these data. If no, it will search for data between 16:50 to 17:10 and upload the data which is closest to 17:00.

**Example:**

1. Enquire historical data between 2022/10/10 14:45:00 to 2022-10-10 15:35:00.

fd6c c3291a63 b09a1a63		
Channel	Type	Value
fd	6c (Enquire data in time range)	Start time: 6cbf4363 => 6343bf6c = 1665384300 =2022/10/10 14:45:00 End time: 24cb4363 => 6343cb24 = 1665387300 =2022-10-10 15:35:00

Reply:

fc6c00		
Channel	Type	Value
fc	6c (Enquire data in time range)	00: data enquiry success

20ce 60c34363 0e01 64 8c27 c706 0400 1000

Channel	Type	Time Stamp	Value
20	ce (Historical Data)	56991a63 => 2022-10-10 15:31:52	Temperature: 0e 01=>01 0e=27°C Humidity: 64=>100=50% Barometric pressure: 8c 27=>27 8c=1012.4 hPa Wind Direction: c7 06=> 06 c7=173.5° Wind Speed: 0400=>0004=0.4m/s Rainfall: 10 00=>00 10=0.16 mm

**-END-**