



## WTSTemperature Sensor UserManual

# **Document Version: 0.1**

# Image Version: v1.0

Version Description Date		Version	Description	Date
--------------------------	--	---------	-------------	------



www.dragino.com

0.1	Draft	2021-Aug-9
1.0	Fix typo.	

1. Introduction	4
1.1 What is WTS Temperature & Humidity Sensor	4
1.2 Features	5
1.3 Specifications	5
1.4 Power Consumption	5
1.5 Storage & Operation Temperature	6
1.6 Applications	6
1.7 Functions Block	6
2. Operation Mode	8
2.1 How to activateWTS?	8
2.2 How it works?	8
2.3 Example to join LoRaWAN network	8
2.4 Uplink Payload	
2.5 Decoder	15
2.5.1 Example	15
2.5.2 Decode in TTN V3	16
2.6 Show data on Datacake	
2.7 Datalog Feature	24
2.7.1 How Datalog works	24
2.7.2 Unix TimeStamp	25
2.7.3 Set Device Time	26
2.8 Out of place indication	
2.9 Light on/off Detection (WTS-12 only)	
2.10 Transmit Data Rate	
2.11 LED Indicator	27
3. Configure WTS via AT Command or LoRaWAN Downlink	27
3.1 Set Transmit Interval Time	
3.2 SetExternal Sensor Mode	
WTS Temperature sensor	2 / 32



	5
3.3 Set system time	29
3.4 Set Time Sync Mode	29
3.5 Set Time Sync Interval	29
3.6 Clear Flash Record	
4 540	20
4. FAQ	
4.1 What is the frequency plan of WTS?	
4.2 Why I see packet payload is 00?	
5. Order Info	31
6. Packing Info	31
7. Support	31
8. warning	32



## 1. Introduction

## 1.1 What is WTS Temperature & Humidity Sensor



The WTS Temperature sensor is a Long Range LoRaWANSensor. It includes a **built-in Temperature sensor**.

The WTS allows users to send data and reach extremely long ranges. It provides ultra-long range spread spectrum communication and high interference immunity whilst minimizing current consumption. It targets professional wireless sensor network applications such as smart cities, building automation, and so on.



WTS supports Data-log feature, it will store the data when there is no LoRaWAN network and upload them to LoRaWAN server when there is LoRaWAN network coverage again

WTS has a built-in 3.8Ah non-chargeable battery which can be used for long term.

WTS is full compatible with LoRaWAN v1.0.3Class A protocol, it can work with standard LoRaWAN gateway.

## 1.2 Features

- ✓ Wall mountable, in place / out of place detection
- ✓ LoRaWAN v1.0.3 Class A Protocol
- ✓ Built-in 3.8Ah battery for more than 10 years use. (Base on configure)
- ✓ Built-in high accuracy Temperature sensor
- ✓ Remote configure via LoRaWAN downlink.
- ✓ Frequency Bands: KR920/US915/EU868/AS923/AU915
- ✓ Built-in data-log feature
- ✓ Tri-color LED to indicate status

### **1.3 Specifications**

#### **Built-in Temperature Sensor:**

- Operating Range: -40 °C ~ 70 °C
- Accuracy:
  - ✓ Max: ±0.10°C (-20°C to 50°C)
  - ✓ Max: ±0.15°C (-40°C to 70C)
  - ✓ Typ: +/-0,05°C (-40°C to 70°C)
- Resolution: 0.01°C
- Long term stability and drift: +/-0,03°C (300h at 150°C)

#### External Temperature Sensor: (for RPL-2 only)

- Operating range -50° to + 200°C
- Accuracy of +/- 0,4°C Long Term Drift: < 0.02 °C/y</p>
- Cable length of 1.5 m
- Metal probe dimension:  $\Phi 4 \times 100$  mm

#### **1.4 Power Consumption**

Idle: 8uA, Wireless Transmit: max 130mA. Idle:



www.dragino.com



#### MAX:



#### 1.5 Storage & Operation Temperature

-40°C to 65°C

### **1.6 Applications**

- ✓ Food Chain
- ✓ Smart Buildings & Home Automation
- ✓ Logistics and Supply Chain Management
- Smart Cities
- ✓ Smart Factory

#### **1.7 Functions Block**



www.dragino.com





#### 2. Operation Mode

#### 2.1 How to activateWTS?

The WTS has two working modes:

- ✓ <u>Deep Sleep Mode</u>: WTSdoesn't have any LoRaWAN activate. This mode is used for storage and shipping to save battery life.
- ✓ Working Mode: In this mode, WTS will work as LoRaWAN Sensor to Join LoRaWAN network and send out sensor data to server. Between each sampling/transmit periodically, WTS will be in <u>STOP mode</u> (IDLE mode), in STOP mode, WTS has the same power consumption as Deep Sleep mode.

The WTS is set in deep sleep mode by default; The ACT button on the top of device is used to switch to different modes:

Behavior on ACT	Function	Action
Pressing ACT	Test uplink	If WTS is already Joined to LoRaWAN network, WTS will
between 1s < time	status	send an uplink packet.
< 3s		
Pressing ACT for	Active Device	green led will fast blink 5 times, device will enter working
more than 3s		mode and start to JOIN LoRaWAN network. green led will
		solidly turn on for 5 seconds after joined in network.
Fast press ACT 5	Deactivate	red led will solid on for 5 seconds. Means WTS are in
times.	Device	Deep Sleep Mode.

#### 2.2 How it works?

The WTS is configured as LoRaWAN OTAA Class A mode by default. Each WTS is shipped with a worldwide unique set of OTAA and ABP keys. To use WTS in a LoRaWAN network, user needs to input the OTAA keys in the network server. So WTS can join the LoRaWAN network and start to transmit sensor data. The default period for each uplink is 20 minutes.

#### 2.3 Example to join LoRaWAN network

This section shows an example for how to join the TTN V3 LoRaWAN IoT server. Use with other LoRaWAN IoT server is of similar procedure.



## WTS in a LoRaWAN Network



Assume the LG308 is already set to connect to  $\underline{\text{TTN V3 network}}$ . We need to add the WTS device in TTN V3:

**Step 1**: Create a device in TTN V3 with the OTAA keys from WTS. Each WTS is shipped with a sticker with the default device EUI as below:





User can enter these keys in the LoRaWAN Server portal. Below is TTN V3 screen shot: <u>Add APP EUI</u> in the application.

Overview	Applications	🚽 Gateways	Crganizations					
			Add application					
ĺ			Owner*					
			Application ID*					
			Application name					
			WTS-TEST					
			Description	cation				
			Optional application descriptic	on; can also be u	used to save notes about the app	lication		
			Create application					
						2		
Applications >	WTS-TEST							
UD: W	S-TEST							
<ul> <li>No recent act</li> </ul>	ivity					🏃 0 End devices	🎎 1 Collaborator	🕶 0 API keys
General inform	ation				• Live data			See all activity →
Application ID		wts001	-21	1	14:29:21 wts001	Create application		
Last updated at		Nov 2, 2022 14:29	-21					
						≣t Import	and devices +	
End devices (	0)				Search Search			laa ena aevice
End devices ( ID \$	0)	Name	÷	DevEUI	JoinEU			Last activity



#### Add APP KEY and DEV EUI

A8 40 41 00 00 00	00 10 Reset			
This end device can be rep	istered on the network			
DevEUI ⑦ *				
70 B3 D5 7E D0 05	71 E2  Generate 1	L/50 used		
			<u> </u>	
AppKey ⑦ *				
BD 76 0B D7 E2 78	B2 24 FF C8 69 2C B4	3B E7 27 🗘	Generate	
End device ID @ "				
test001				
rins value is automaticall	prenited using the Deveor			
After registration				
<ul> <li>View registered end d</li> </ul>	evice	Click		

**Step 2**: Use ACT button to activate WTS and it will auto join to the TTN V3 network. After join success, it will start to upload sensor data to TTN V3 and user can see in the panel.

THE THINGS STACK	🖬 Overview 🗖 Applications 🚔 Gateways 👗 Organization		DEU1 Community No support plan (1)
ut WTS-TEST	·	Applications > End devices > WITE-TEST > test001 > Une data	
Uverstew		201 test001 101 test001	
🙏 End devices		↑n/a ψn/a + Last activity 11 seconds ago ⊙	
E Live data		Overview Live data Messaging Location Payload formatters Claiming General settings	
C Payload formatters v	Time Type Data previe	Verbose stream	🗴 🛓 Export as JSON
Ĵ, Integrations →	13:36:29 Fail to send webhook Request		
2% Collaborators	↑ 13:36:29 Forward uplink data message Payload: 4	BatV: 3.666, Ext: 5, Systimatamp: 1650778655, Temp_TP9137: 20.665, regotic_aniton_pitatum: "not_of_plane" } [ 46 10 01 00 20 00 00 61_ [ 0 ] 🐐 (Fort: 2 Data rate: 57786125 DNR: 4.2 R	SSI: 42
OT API keys			
General settings			



## 2.4 Uplink Payload

The uplink payload includes totally 11 bytes. Uplink packets use FPORT=2 and every 20 minutes send one uplink by default.

After each uplink of WTS-10 and WTS-11, the blue LED will flash once

If the PT100 is not connected, the red LED will flash once every time the WTS-11 uplinks

#### Normal Uplink Payload. Total 11 Bytes.

Size(bytes)	2	1	2	2	4
Value	In-Place	<u>Status</u>	<u>Temp</u>	<u>Temp_PT100</u> or	<u>Unix TimeStamp</u>
	<u>&amp;Light</u>		<u>TMP117</u>	Open Duration	<u>(UTC)</u>
	&Battery			Depends on Model	

#### In-Place & Light & Battery: Total 2 Bytes

Bits	15	14	[13:0]
Value	In Place	Light Status;	BAT:
	0: Device in place	0: Dark (Fridge is close)	Battery Voltage example:
	1: Device out of place	1: Bright (Fridge is open)	0x0BA4=2980mV

Notice:

In Place detection and light status both are interrupt event, device from in-place to out-of-place or light from dark to bright will cause an uplink packet.

#### Status Byte:

Bits	7	6	5	4	[3:0]
Value:	None-ACK Flag	Reserve	Sync time OK	UTC Time	Model
				Request	

None-ACK Flag:

- $\checkmark$  0: If this uplink payload is a new sampling payload, this flag is set to 0.
- ✓ 1: If this uplink is an old uplink payload which generated while there is none-LoRaWAN coverage, this flag is set to 1.
- Sync time OK: 1: Set time ok, 0: N/A. After time SYNC request is send, device will set this bit to 0 until got the time stamp from application server.
- Unix Time Request:1: Request server downlink Unix time, 0 : N/A. In this mode, WTS will set this bit to 1 every 10 days to request a time SYNC. (AT+SYNCMOD to set this)

Model:

- ✓ 0x01: WTS-10
- ✓ 0x02: WTS-11
- ✓ 0x03: WTS-12

#### Built-in Temperature (TMP1117): 2 bytes

- ➤ Temperature: 0x0ABB/100=27.47°C
- ➤ Temperature: (0xF5C6-65536)/100=-26.18°C



#### External Temperature (Temp\_PT100): 2 bytes (For model WTS-11 only)

► Temperature: 0x0ABB/100=27.47°C

➤ Temperature: (0xF5C6-65536)/100=-26.18°C

In WTS-10, WTS-12, these 2 bytes are always 00 00

#### **Open Duration & Open Timeout Alarm:** 2 bytes (For model WTS-12 only)

Bits	15	14	[13:0]
Value:	Reserve	Timeout Alarm	Bright Duration

Timeout Alarm: This bit indicates if the bright detection exceeds certain time. The default timeout is 5 minutes. If bright duration exceed timeout, WTS-12 will set this bit to 1 and immediately send an uplink packet as an Alarm.

0: Bright detection duration within timeout

1: Bright detection duration exceed timeout

This feature can be used to monitor if the fridge has been open for long time and provide an alarm.

Bright Duration: total 14 bits Shows the current / last bright duration.

Unit: second. range: 0 ~ 16383 Seconds (max ~ 4.5 hours)

- $\checkmark$  If current light detection state is dark, the bright duration shows last bright duration.
- ✓ If current light detection state is bright, the bright duration shows current bright duration.

#### In WTS-10, WTS-11, these 2 bytes are always 00 00

#### TTNV3 payload example

#### EXT=1

	Applications > WTS-TEST > End devices > test001 > Live data	
	Testion1           Dramotic           Trivia	attop
Time Type	Data preview	Verbose stream 💽 🛓 Export as JSON 🔢 Pause 📲 Clear
↑ 12.47.49 Formats willow data wasage ● 14.40.39 Create and device	Polos: [ Ber: 1.64, Br: 1. Systemster: 18877838, Teg.W417: 20.66, reports_extra_rester	"net_ef_piker" 1 (# 21 ( <u>6 04 22 05 04 1</u> () ( <u>*</u> ) ( <u>*7917</u> , <u>0</u> 05 off) (9796425 007, 4.2 0007, 42 ( <u># 21 (01 05 22 000 05 708 CFD</u> )
Example:8E3C0 Batv:0x8E3C=1	10B3200006170BCFD 000 1110 0011 1100	
00 1110	0011 1100/1000=3.644 V	

EXT:0x01=0001=1(3:0th bit)

Systimestamp:0x6170BCFD=1634778365=2021-10-21 09:06:05(GMT+8	)
Temp_TMP117:0x0B32/100=28.66℃	



## Magnetic\_switch\_status:0x8E3C=1000 1110 0011 1100 1(15th bit) 1:out of place

0:in\_place

## EXT=2

Security Overvie	w Applications	🛋 Gateways	A Organizations		EU1 Cor Fair use policy	appies ()	Iuhero	ng T
				Applications > WTS-TEST > End devices > test001 > Live data				
				textention           ch (n)         4-n(n)         4-n(n) </th <th></th> <th></th> <th></th> <th></th>				
Time	Туре		Data preview	Verbose stre	sm 💽 👲	Export as JSON	II Pause	Clear
↑ 14:49:28	Forward uplink date	a message	Payload: { BatW	/: 8.681, Ext: 2, Systimestamp: 1684784178, Temp_FT198: 81.87, Temp_TMP117: 27.11, magnetic_switch_status: "in_place" } 0E 2F 02 8A 97 14 25 61_ 0 🐞 FPort: 2 Data rate: Si	78W125 SNR: 4	.2 RSSI: 42		
₩ 14:49:22	Console: Events cle	eared	The events list	thas been cleared 0E2F020A9714256170D3B2				

Example:0E2F020A9714256170D3B2 Batv:0x0E2F=0000 1110 0010 1111 00 1110 0010 1111/1000=3.631 V EXT:0x02=0002=2 (3:0th bit) Systimestamp:0x6170D3B2=1634784178=2021-10-21 10:42:58(GMT+8) Temp\_TMP117:0x0A97/100=27.11 °C Temp\_PT100:0x1425/100=51.57 °C Magnetic\_switch\_status:0x0E2F=0000 1110 0010 1111 0(15th bit) 1:out\_of\_place 0:in\_place



Ext=3

	Applications > WTS-TEST > End devices > test001 > Live data	
	estation1 For land 2 ↑rvl s - Last activity 17 seconds age © Overview Last dats Massaging Lacation Phylode formation Claiming General actings	
Time Type	Data preview Verboss atmam 🗊 🗄 Expert as 2001 🔢 Pauce 🔳	Clear
↑ 14:50:51 Forward uplink data message	Phylod: { BatV: 3.584, Ext: 3, Systematery: 1655001300, Teng [Pf127: 27.33, last_lipt_dozetion: 3, lipt_sizer_state: "false", lipt_state: "fact", magnitiz_mittetus: "fact", jizze" } 🗄 🗄 83 054 AD 06 05 41. 🔿 👔 Physic	2 Date
14:50:41 Console: Stream reconnected	The stream connection has been re-established BE00030AAD0003617116F6	
# 14:50:39 Console: Events cleared	The events list has been cleared	

Example:8E00030AAD0003617116F6 Batv:0x8E00=1000 1110 0000 0000 00 1110 0000 0000/1000=3.584 V EXT:0x03=0003=3(3:0th bit) Systimestamp:0x6170D3B2=1634784178=2021-10-21 10:42:58(GMT+8) Temp\_TMP117:0x0A97/100=27.11℃ light\_alarm\_status:0x0003=0000000000011 0(14th bit) 0:false 1:true last light duration:0x0003=0000000000011 0011=3(13:0th bit) light\_status:0x8E00=1000 1110 0000 0000 0(14th bit) 1:bright 0:dark Magnetic\_switch\_status:0x8E00=1000 1110 0000 0000 1(15th bit) 1:out of place 0:in\_place

## 2.5 Decoder

## 2.5.1 Example



Uplink payload=8E3C010B3200006170BCFD "BatV": 3.644, "Ext": 1, "Systimestamp": 1634778365, "Temp\_TMP117": 28.66 "magnetic\_switch\_status": "out of place"

## 2.5.2 Decode in TTN V3

Overview	Overview Live data Messaging Location Payload formatters Claiming General settings
Lend devices	Uplink Downlink
🕕 Live data	
Payload formatters	These payload formatters are executed on uplink messages from this end device and take precedence over application level payload formatters.
↑ Integrations ∨	Formatter type
2. Collaborators	Use application payload formatter None Javascript GRPC service CayenneLPP Repository
🗣 API keys	Formatter parameter*
General settings	<pre>2 return { 3     data: { 4        bytes: input.bytes 5     }, 6     warnings: [], 7     errors: [] 8     };</pre>
	9 B
< Hide sidebar	Save changes

```
function Decoder(bytes, port) {
var poll_message_status=(bytes[2]&0x40)>>6;
var decode = {};
decode.Ext= bytes[2]&0x0F;
decode.BatV= ((bytes[0]<<8 | bytes[1]) & 0x3FFF)/1000;
decode.magnetic_switch_status=bytes[0]&0x80?"out_of_place":"in_place"
if(decode.Ext==0x01)
{
  decode.Temp TMP117=parseFloat(((bytes[3]<<24>>16 | bytes[4])/100).toFixed(2));
}
else if(decode.Ext==0x02)
  decode.Temp TMP117=parseFloat(((bytes[3]<<24>>16 | bytes[4])/100).toFixed(2));
  decode.Temp_PT100=parseFloat(((bytes[5]<<24>>16 | bytes[6])/100).toFixed(2));
}
else if(decode.Ext==0x03)
  decode.light_status=bytes[0]&0x40?"bright":"dark";
  decode.Temp_TMP117=parseFloat(((bytes[3]<<24>>16 | bytes[4])/100).toFixed(2));
  decode.last_light_duration=(bytes[5]<<8 | bytes[6])&0x3fff;
```



decode.light\_alarm\_status=bytes[5]&0x40?"true":"false";

```
}
decode.Systimestamp=(bytes[7]<<24 | bytes[8]<<16 | bytes[9]<<8 | bytes[10] );
if(poll_message_status===0)
{
    if(bytes.length==11)
    {
    return decode;
    }
}</pre>
```

## 2.6 Show data on Datacake

Datacake IoT platform provides a human friendly interface to show the sensor data, once we have sensor data in TTN V3, we can use Datacake to connect to TTN V3 and see the data in Datacake. Below are the steps:

<u>Step 1</u>: Be sure that your device is programmed and properly connected to the LoRaWAN network.

<u>Step 2</u>: Configure your application to forward data to Datacake you will need to add integration. Go to TTN V3 Console --> Applications --> Integrations --> Add Integrations.





#### Add Datacake:

Webhook ID *	
wtstest001	
Token* write Dataca	ke AP
······ • •	

In Datacake console (<u>https://datacake.co/</u>) , add WTS:

1		
2 DATACAKE		
Fleet > Devices		
Devices		Q Search Columns - + Add Device
i≣ List I Grid II Map		
DEVICE =↑	LOCATION	
	. There are no devices in your Workspace, yet. Start by adding your first Device us	sing the button above.
Showing 0 to 0 of 0 results		50 per page V Previous Next



www.dragino.com

•	LoRaWAN Choose from 13 LoRaWAN networks	
ି { ଲିଁ	API Generic API device with support for MQTT and HTTP connectivity	e
	Pincode claiming Claim an existing device by pincode	
୍ର [ତ୍ରି	IoT Creators NB-IoT and LTE-M connectivity by Deutsche Telekom	
	Particle <sub>CLE</sub> Connect your Particle devices	



#### $\times$ Add LoRaWAN Device STEP 1 STEP 3 STEP 4 STEP 2 Product Network Server Plan Devices **Datacake Product** You can add devices to an existing product on Datacake, create a new empty product or start with one of the templates. Products allow you to share the same configuration (fields, dashboard and more) between devices. New Product from Existing Product New Product Add devices to an template Create new empty Create new product existing product product from a template New Product If your device is not available as a template, you can start with an empty device. You will have to create the device definition (fields, dashboard) and provide the payload decoder in the device's configuration. Product Name WTS Back Next



Add Device	Particle API	D Zero	D Zero LTE PINCODE
STEP 1 Product	STEP 2 Network Server	STEP 3 Devices	STEP 4 Plan
Network Server Please choose the L	oRaWAN Network Server the The Things Stack V3 TTN V3 / Things Industries	at your devices	are connected to. Uplinks Downlinks
	The Things Network V2 The old Things Network		Uplinks Downlinks
🔿 🧭 helium	Helium		Uplinks Downlinks
	LORIOT		Uplinks Downlinks
kerlink	Kerlink Wanesy		Uplinks
Showing 1 to 5	of 8 results		Previous Next
			Back Next



Product	Network Server	STEP 3 Devices	STEP 4 Plan
Add Devices			
Manual Im	port from The Things Stack		
Enter one or more	e LoRaWAN Device EUIs and t	he names they will have	ve on Datacake.
		n ann a chunna (iu chuile a	device is Dev (10) as two
New: You can no columns (DevEUI	w upload a CSV file with eithe and Name), which will popula	r one column (just the ate the form below.	device's DevEUI) or two
New: You can no columns (DevEUI	w upload a CSV file with eithe and Name), which will popula	r one column (just the ate the form below.	device's DevEUI) or two
New: You can not columns (DevEUI	w upload a CSV file with eithe and Name), which will popula Drag and drop a .csv	r one column (just the ate the form below.  file here or click to cho	device's DevEUI) or two
New: You can not columns (DevEUI	w upload a CSV file with eithe and Name), which will popula Drag and drop a .csv	r one column (just the ate the form below. file here or click to cho	device's DevEUI) or two
New: You can not columns (DevEUI DEVEUI	w upload a CSV file with eithe and Name), which will popula () Drag and drop a .csv	r one column (just the ate the form below. file here or click to cho NAME	device's DevEUI) or two
New: You can not columns (DevEUI DEVEUI @ 00 00	w upload a CSV file with eithe and Name), which will popula () Drag and drop a .csv 00 00 00 5A 6B 7C 8 bytes	r one column (just the ate the form below. file here or click to cho NAME	device's DevEUI) or two



5		
DATACAKE		
Fleet > WTS		
WTS		
Serial Number 0000000005A6B7C	Last update Wed Nov 02 2022 15:17:53 GMT+0800	
🗄 Dashboard 📲 History 🚟 Downlinks 🛞	Configuration 🔊 Debug 🣭 Rules 🕌 Permissions	
BAT 18 minutes ago	magnetic_switch_status 18 minutes ago	
3- 2- 1-	out_of_place	
2022/11/2 202/11/2 202/11/2 202/10/2 202/10/2 202/10/2 202/10/2 202/10/2 202/10/2 202/10/2 202/10/2 202/10/2 202/10/2 202/10/2 202/10/2 202/10/2 2002/10/2 2002/100/2 202/100/2	2022/11/2 2022/11/2 2022/11/2	
TEMP-117 18 minutes ago		
25- 20- 15- 10- 5- 0- 2022/11/2 2022/11/2 2022/11/2 2022/11/2	2022(1)(2) 2022(1)(2) 2022(1)(2)	
-• Temp TMP117		
- comp_true try		



## 2.7 Datalog Feature

#### 2.7.1 How Datalog works

WTS uses confirmed uplink to send each uplink packet to LoRaWAN server, after the packet is sent, WTS will waiting for the ACK message from LoRaWAN server.

If WTS didn't got the ACK, WTS will consider out of LoRaWAN service and mark the <u>Status  $\rightarrow$  None</u> <u>ACK Flag</u> bit to 1, meanwhile, WTS will record this unarrived packet.

If WTS got the ACK from LoRaWAN server, WTS will consider it is in LoRaWAN service. Then WTS will check if there is some old unarrived packets and send them together to the server.

Each Normal data entry is 11 bytes,

To save airtime and battery, WTS will send max date entries according to the current DR and Frequency bands.

For example, in US915 band, the max payload for different DR is:

- a) DRO: max is 11 bytes so one entry of data
- b) DR1: max is 53 bytes so devices will upload 4 entries of data (total 44 bytes)
- c) DR2: total payload includes 11 entries of data
- d) DR3: total payload includes 22 entries of data.

If devise doesn't have any data in the polling time. Device will uplink 11 bytes of 0

#### Example:

If WTS has below data inside Flash:

Flash Addr	Time   I	Ext   BAT voltage	e  Val	ue				
8019540	systime=	2021/10/26	13:24:20	1	3599	Temp1=26.92	Temp2=0.00	1
8019550	systime=	2021/10/26	13:25:20	1	3599	Temp1=26.90	Temp2=0.00	1
8019560	systime=	2021/10/26	13:26:20	1	3599	Temp1=26.89	Temp2=0.00	1
8019570	systime=	2021/10/26	13:27:20	1	3599	Temp1=26.88	Temp2=0.00	1
8019580	systime=	2021/10/26	13:28:20	1	3599	Temp1=26.85	Temp2=0.00	1
8019590	systime=	2021/10/26	13:29:20	1	3599	Temp1=26.85	Temp2=0.00	1
80195A0	systime=	2021/10/26	13:30:20	1	3599	Temp1=26.83	Temp2=0.00	1
80195B0	systime=	2021/10/26	13:31:20	1	3599	Temp1=26.82	Temp2=0.00	1
80195C0	systime=	2021/10/26	13:32:20	1	3599	Temp1=26.81	Temp2=0.00	1
80195D0	systime=	2021/10/26	13:33:20	1	3599	Temp1=26.79	Temp2=0.00	1



#### WTS will uplink this payload when in LoRaWAN service

			Applications 3 3 End devices 3 3 Live deta
Dverview			It to esi 4000000000048-7c
🙏 End devices			↑ 625 → Last activity 32 seconds ago ①
Live data			Overview Live data Hessaging Location Phyload formatters Claiming General settings
Payload formatters	^	Time Type	Data preview Verbose stream 🕥 11 Pause 🔳 Ces
↑ Uplink		• 19:13:50 Fail to send webhook	Errorundefinedumdefined
↓ Downlink		$\hat{T}$ 19:13:50 Forward uplink data message	Paylond: { Batt: 3.899, Ext: 1, Systimestamp: 183333238, Temp_TMP117: 27,98, magnetic_mainter, status: "18,01000" } 102 6F 01 64 61 60 00 01. PPurt: 5 Data pate: 5F9Bn125 Data pate: 5F9Bn125 Data
. Internations	^	● 19:12:56 Fail to send webhook	Errorundefined
		🕈 19:12:56 Forward uplink data message	Payloud: [ } 85 0F 41 04 84 00 00 03. FPORT: 5 Data rate: SF984125 SNR: 4.5 NSST: -108
MQ11		0 19:12:50 Fail to send webhook	Eccurrundefineetunderiide 4104/2000061780014860/0410000617801000617801000617801000617801000617801000017801000017801480000001780248804104 2104010000178024880410410000178020880410410000017801000017801000017801480000001780048804100000178024880410410000001780248804100001780248041000000178024800410000000000000000000000000000000
>> Webhooks		↑ 19:12:50 Forward uplink data message	Payload: { Batty: 3.400, Ext: 1, Systimetemp: 1553333170, Temp_TPP117: 38.07, magnetic_meiton_status: "Sm_ghane" } 62:12:01:04 P7 00:00:61. Prott: 5 Sata tath: SP9Bu125 SNR: 11.8 RSS1: -39
Storage Integration		$\psi$ 19:11:61. Forward counlink data message	PPort: 1 Payload: 31.61.78.01.84.61.78.00
AWS IoT		0 19:11:50 Fail to send webhook	Errorundefined
Azure IoT Hub		↑ 19:11:60 Forward uplink data message	Payload: { BatV: 3.899, Ext: 1, Systemestamp: 1638333115, Temp_TMP137: 28.27, magnetic_match,status: "in_plant" } @ 69 60 60 00 00 01   PPurt: 6 Data rate: 59/86/26 SHE: 4 SHS1: -108
🛸 LoRs Cloud		0 19:19:50 Fail to send webhook	Errorundefindefind
Collaborators		↑ 19:19:50 Forward uplink data message	Payload: { Batty 3.600, Ext: 3, Systemestamp: 1638333068, Temp_TMP117: 28.3, magnetic_match:status: "in_jBlage" } 00 12 01 00 04 40 00 04 Pfort: 6 (bata rate: 54980125 SNR: 6 RSS1: -33
API keys		↑ 19:09:55 Forward uplink data message	Paylone: { Sati 3.699, Ett 1, Systmestamp: 655333938, Temp_TMP117: 28.38, magnetic_switch_status: "An plant" } 66 67 61 66 00 00 00 01 - FPutt 5 Bata mate; 57984125 500: -35
		• 19:09:61 Fail to send webhook	Errorundefinedumetimed
J General settings		↑ 19:09:50 Forward uplink data message	Paylond: { Satv: 3.600, Ext: 1, Systimestamp: 1655332996, Temp_TMP117: 28.33, magnetic_mainter, status: "im_miner" } 06 12 00 60 07 00 00 01. (Port: 5 Data mate: SF9B0125 SHR: 5.8 RSS1: -309
		↑ 19:08:50 Forward uplink data message	Paylow: { Satv: 3.699, Ext: 1, Systemestamp: 1655332830, Temp_TMP117: 28.28, magnetic_muiton_statum: 'in_place' } 00 0F 01 00 00 00 01 Point: 8 Data mate: SF9Bx128 SNR: 6.2 R051: -108

#### Uplinkpayload:

8E0F410A840000617801848E0F410A82000617801C008E0F410A81000617801FC8E0F410A8000 00617802388E0F410A7D000617802748E0F410A7D0000617802B08E0F410A7B0000617802EC8E 0F410A7A0000617803288E0F410A790000617803648E0F410A770000617803A0 Where the first 11 bytes is for the first entry: 8E0F410A84000061780184 BAT:0x8E0F=1000 1110 0000 1111 00 1110 0000 1111/1000=3.599V Temp\_TMP117:0x0A84/100=26.92 °C EXT:0x41=0100 0001 1(3:0th bit) Magnetic\_switch\_status:0x8E0F=1000 1110 0000 1111 1(15th bit) 1:out\_of\_place 0:in\_place Unix time is 0x61780184=1635254660=2021-10-26 21:24:20(GMT+8)

#### 2.7.2 Unix TimeStamp

WTS use Unix TimeStamp format base on

Size (bytes)	4	1		
DeviceTimeAns	32-bit unsigned integer : Seconds	8bits unsigned integer: fractional-		
Payload	since epoch*	second		
_		in 1/2^8 second steps		
Figure 10 : DeviceTimeAns payload format				

User can get this time from link: <u>https://www.epochconverter.com/</u>: Below is the converter example



EpochConverter	Code Beautify JSON Formatter		
Epoch & Unix Timestamp Conversion To	All Numbers Converter Numbers to Words Converter	Decimal to Hex	
	Decimal to Binary Converter	Enter the Decimal number to decode Sample 49	
The current Unix epoch time is 1611889418 Convert epoch to human-readable date and vice ver 1611889090 Timgstamp to Human date [batch convert] Supports Unix timestamps in seconds: milliseconds, microseconds and nanoseconds. Assuming that this timestamp is in seconds: GMT: 2021/01/29/iFiday 02:58:10	Decimal to Octal Converter Binary to Decimal Converter Binary to Hex Converter Binary to Octal Converter Binary to Text Converter Text to Binary Converter	■ 1611889405	
Your time zone:         2021/01/29 Friday         10:58:10 GMT+08:00           Relative:         3 minutes ago         3 minutes ago           Mon         Day         Yr         Hr         Min         Sec           Mon         Day         Yr         Hr         Min         Sec	Hex to Decimal Converter Hex to Binary Converter Hex to Octal Converter Octal to Decimal Converter	The number in hex (base 16) representation: 60137afd	

So, we can downlink 3060137afd00 to set current time2021– Jan -- 29Friday 03:03:25

## 2.7.3 Set Device Time

Once WTS Joined LoRaWAN network, it will send the MAC command (DeviceTimeReq) and server will reply with (DeviceTimeAns) to send the current time to WTS. If WTS fails to get the time from server, WTS will use the internal time and wait for next time request (AT+SYNCTDC to set time request period, default is 10 days).

Note: LoRaWAN Server need to support LoRaWAN v1.0.3(MAC v1.0.3) or higher to support this MAC command feature.

## 2.8 Out of place indication

WTS support out of place detection. If WTS is taken out from the holder, device will send an uplink packet to indicate this event. Payload detail please see <u>Payload Decoder</u>. When put the device back to holder, it will also send an uplink

## 2.9 Light on/off Detection (WTS-12 only)

Model WTS-12 has built-in Light Detection Feature. It can detect if there is bright on the front surface. If the environment is from dark to bright, the WTS-12 will uplink a packet with this indication. Payload detail please see <u>Payload Decoder</u>.



#### 2.10 Transmit Data Rate

Feature:Lock SF

#### AT Command: AT+HDR

Command Example	Function	Response	
AT+HDR=1	Lock SF	The sending rate will be in DR2-DR5 OK	

#### Downlink Command: 0xA1

Example: 0xA101 //Same as AT+HDR=1

## 2.11 LED Indicator

The WTS has a triple color LED which for easy showing different stage. While user press ACT button, the LED will work as per <u>LED status with ACT button</u>.

#### In a normal working state:

- ✓ For each uplink, the <u>BLUE LED</u> or <u>RED LED</u> will blink once.
  - ♦ <u>BLUE LED</u> when external sensor is connected
  - ♦ <u>RED LED</u> when external sensor is not connected
- ✓ For each success downlink, the <u>PURPLE LED</u> will blink once
- ✓ WTS-12 only lights up during sleep and restart. The <u>RED LED</u> light is on during sleep, and the <u>GREEN LED</u> light flashes 5 times quickly after restarting.

#### 3. Configure WTS via AT Command or LoRaWAN Downlink

Use can configure WTS via AT Command or LoRaWAN Downlink.

- > AT Command Connection: See FAQ.
- LoRaWAN Downlink instruction for different platforms:

http://wiki.dragino.com/index.php?title=Main\_Page#Use\_Note\_for\_Server

Since firmware v1.0(Note\*), there are two kinds of commands to configure WTS, they are:

**General Commands.** 

These commands are to configure:

- ✓ General system settings like: uplink interval.
- ✓ LoRaWAN protocol & radio related command.

They are same for all Dragino Device which support DLWS-005 LoRaWAN Stack(Note\*\*). These commands can be found on the wiki:

http://wiki.dragino.com/index.php?title=End Device Downlink Command

Note\*\*: Please check early user manual if you don't have v1.0 firmware.



#### Commands special design for WTS

These commands only valid for WTS, as below:

## 3.1 SetTransmit Interval Time

Feature: Change LoRaWAN End Node Transmit Interval.

#### AT Command: AT+TDC

Command Example	Function	Response
AT+TDC?	Show current transmit Interval	30000 OK the interval is 30000ms = 30s
AT+TDC=60000	Set Transmit Interval	OK Set transmit interval to 60000ms = 60 seconds

#### Downlink Command: 0x01

Format: Command Code (0x01) followed by 3 bytes time value. If the downlink payload=0100003C, it means set the END Node's Transmit Interval to 0x00003C=60(S), while type code is 01.

- Example 1: Downlink Payload: 0100001E // Set Transmit Interval (TDC) = 30 seconds
- Example 2: Downlink Payload: 0100003C // Set Transmit Interval (TDC) = 60 seconds

#### 3.2 SetExternal Sensor Mode

Feature: Change External Sensor Mode.

#### AT Command: AT+EXT

Command Example	Function	Response	
AT+EXT=1	Set the working mode to TMP117		
AT+EXT=2	Set the working mode to TMP117 and PT100		
	Set the working mode to photoresistor		
AT+EXT=3	photoresistor works: If the sensor goes from black to light, and at the same time exceeds the set time in the bright area, it will send a packet.		

## Downlink Command: 0xA2

Total bytes: 2~3 bytes

Example:

- ♦ 0xA201: Set model to TMP117
- ♦ 0XA202: Set model to TMP117 and PT100



- OxA2030005: Same as AT+EXT=3,5 (Model to photoresistor, and set bright timeout to 5 Second)
- ♦ 0xA200: Get the current timeout setting

### 3.3 Set system time

Feature: Set system time, unix format. See here for format detail.

#### AT Command:

Command Example	Function	
AT+TIMESTAMP=1611104352	OK Set System time to 2021-01-20 00:59:12	

#### **Downlink Command:**

0x306007806000 // Set timestamp to 0x(6007806000),Same as AT+TIMESTAMP=1611104352

#### 3.4 Set Time Sync Mode

Feature: Enable/Disable Sync system time via LoRaWAN MAC Command (DeviceTimeReq), LoRaWAN server must support v1.0.3 protocol to reply this command.

SYNCMOD is set to 1 by default. If user want to set a different time from LoRaWAN server, user need to set this to 0.

#### AT Command:

Command Example	Function
AT+SYNCMOD=1	Enable Sync system time via LoRaWAN MAC Command (DeviceTimeReq)

#### **Downlink Command:**

0x28 01 // Same As AT+SYNCMOD=1 0x28 00 // Same As AT+SYNCMOD=0

## 3.5 Set Time Sync Interval

Feature: Define System time sync interval. SYNCTDC default value: 10 days.

#### AT Command:

Command Example	Function
AT+SYNCTDC=0x0A	Set SYNCTDC to 10 (0x0A), so the sync time is 10 days.



#### **Downlink Command:**

0x29 0A // Same as AT+SYNCTDC=0x0A

## 3.6 Clear Flash Record

Feature: Clear flash storage for data log feature.

#### AT Command: AT+CLRDTA

Command Example	Function	Response	
AT+CLRDTA	Clear date record	Clear all stored sensor data OK	

#### Downlink Command: 0xA3

Example: 0xA301 //Same as AT+CLRDTA

## 4. FAQ

## 4.1 What is the frequency plan of WTS?

WTS use the same frequency as other Dragino products. User can see the detail from this link:

http://wiki.dragino.com/index.php?title=End\_Device\_Frequency\_Band#Introduction

## 4.2 Why I see packet payload is 00?

WTS will send MAC command to request time, in the case if DR only support max 11 bytes, this MAC command will be bundled to a separate uplink payload with 0x00.



## 5. Order Info

Part Number: WTS-XX-YY

#### **XX: Model Variant**

- ✓ 1: Basic Model, with internal Temperature sensor.
- ✓ 2: Equal to WTS-11 + External Temperature Sensor
- ✓ 3: Equal to WTS-12 + Light Detection Sensor

#### YY: The default frequency band

- ✓ AS923: LoRaWAN AS923 band
- ✓ AU915: LoRaWAN AU915 band
- ✓ EU433: LoRaWAN EU433 band
- ✓ **EU868**: LoRaWAN EU868 band
- ✓ KR920: LoRaWAN KR920 band
- ✓ US915: LoRaWAN US915 band
- ✓ IN865: LoRaWAN IN865 band
- ✓ CN470: LoRaWAN CN470 band

#### 6. Packing Info

#### Package Includes:

- ✓ WTS Temperature & Humidity Sensor x 1
- ✓ Program cable x 1
- ✓ Optional external sensor

#### **Dimension and weight**:

- ✓ Device Size: 13.5 x 7 x 3 cm
- ✓ Device Weight: 105g
- ✓ Package Size / pcs : 14.5 x 8 x 5 cm
- ✓ Weight / pcs : 170g

#### 7. Support

- Support is provided Monday to Friday, from 09:00 to 18:00 GMT+8. Due to different timezones we cannot offer live support. However, your questions will be answered as soon as possible in the before-mentioned schedule.
- Provide as much information as possible regarding your enquiry (product models, accurately describe your problem and steps to replicate it etc) and send a mail to

# support@dragino.com



# 8. warning FCC Caution:

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

## **IMPORTANT NOTE:**

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

-Reorient or relocate the receiving antenna.

-Increase the separation between the equipment and receiver.

-Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

-Consult the dealer or an experienced radio/TV technician for help.

## FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator& your body.