



Smart Thermostat

Featuring LoRaWAN®

WT201

Communication Protocol



Revision History

Date	Doc Version	Description
Jan. 17, 2025	V 2.0	Initial version based on hardware v2.x
May 20, 2025	V 2.1	Add downlink command to enable/disable plan type

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1. Overview

WT201 uses the standard Milesight IoT payload format based on IPSO. All data are based on following format:

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

Note:

- 1) All explanations and examples in this document are based on HEX format.
- 2) For all Milesight IoT decoder examples please find files on <https://github.com/Milesight-IoT/SensorDecoders>

2. Uplink Payload

Uplink payloads of WT201 are made up of device basic information and device data.

2.1 Basic Information

WT201 reports basic device information of device everytime joining the network.

Item	Channel	Type	Byte	Description
Protocol Version	ff	01	1	01 => V1
Hardware Version		09	2	01 20 => V1.2
Firmware Version		0a	2	01 01 => V1.1
Power On		0b	1	Device is on
Device SN		16	8	16 digits
Device Type		0f	1	00: Class A, 01: Class B, 02: Class C,
TSL Version		ff	2	02 01 =>V2.1
Reset Event		fe	1	ff, only report when the device resets

Example:

ff0bff ff0101 ff166791d19604050005 ff090210 ff0a0101 ff0f02 ffff0100					
Channel	Type	Value	Channel	Type	Value
ff	0b (Power On)	ff (Reserved)	ff	01 (Protocol Version)	01 (V1)
ff	16 (Device SN)	6791d19604050 005	ff	09 (Hardware Version)	0210 (V2.1)
ff	0a (Software Version)	0101 (V1.1)	ff	0f (Device Type)	02 (Class C)
ff	ff (TSL Version)	0100 (V1.0)			

2.2 Device Data

Item	Channel	Type	Byte	Description
Temperature	03	67	2	INT16/10, Unit: °C
Target Temperature	04	67	2	INT16/10, Unit: °C
Heating Target Temperature (Dual Target Mode)	04	67	2	INT16/10, Unit: °C

Cooling Target Temperature (Dual Target Mode)	0b	67	2	INT16/10, Unit: °C										
Temperature Control Mode and Status	05	e7	1	Byte 1: Current control mode, 00=Heat, 01=EM Heat, 02=Cool, 03=Auto Byte 2: Bit 7-4: Current control status, 0000=Standby, 0001=1-stage heat, 0010=2-stage heat, 0011=3-stage heat, 0100=4-stage heat, 0101=emergency heat, 0110=1-stage cool, 0111=2-stage cool, 1000=5-stage heat Bit 3-2: 00 Bit 1-0: Current control mode, 00=Heat, 01=EM Heat, 10=Cool, 11=Auto										
Fan Mode and Status	06	e8	1	Bit7-4: 0000 Bit 3-2: Current fan status, 00=Off, 01=High (Speed), 10=Low(Speed), 11=On Bit1-0: Current fan mode, 00=Auto, 01=On, 10=Circulate										
Plan Event	07	bc	1	00=Not executed, 01=Wake, 02=Away, 03=Home, 04=Sleep, 05=Occupied, 06=Unoccupied, 07=ECO										
Temperature Control System Status	08	8e	1	00=System Off, 01=System On										
Humidity	09	68	1	UINT8/2, unit: %RH										
Relay Status	0a	6e	1	For every bit: 0=off, 1=on Corresponding relay of every bit: <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>Bit</th> <th>Relay</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Y1</td> </tr> <tr> <td>1</td> <td>Y2/GL</td> </tr> <tr> <td>2</td> <td>W1</td> </tr> <tr> <td>3</td> <td>W2/AUX</td> </tr> </tbody> </table>	Bit	Relay	0	Y1	1	Y2/GL	2	W1	3	W2/AUX
Bit	Relay													
0	Y1													
1	Y2/GL													
2	W1													
3	W2/AUX													

				4	E
				5	G
				6	O/B
				7	0
Control Permission	ff	f6	1	00: Thermostat 01: Remote Control	
Wiring Settings	ff	ca	3	See Installation Setting	
Supported Control Mode	ff	cb	3	See Installation Setting	
Temperature Exception	b3	67	1	01: collection failure 02: out of measuring range	
Humidity Exception	b9	68	1	01: collection failure 02: out of measuring range	
Target Temperature Range	f9	40	6	Byte 1: temperature control mode, 00=Heat, 01=EM Heat, 02=Cool, 03= Auto, 04=Auto-Heat, 05=Auto-Cool Byte 2-3: target temperature of this mode, INT16/10, Unit: °C Byte 4-5: min. temperature range of current mode, INT16/10, Unit: °C Byte 6-7: max. temperature range of current mode, INT16/10, Unit: °C	

Examples:

1. Periodic packet when control permission is Thermostat: report as reporting interval (10 minutes by default) or when system status, target temperature, temperature control mode, or fan mode changes.

03671101 0467fa00 05e772 06e806 07bc00 088e01 096844					
Channel	Type	Value	Channel	Type	Value
03	67	Current Temp: 11 01=>01 11 =273/10=27.3°C	04	67	Target Temp: fa 00=>00 fa=250 /10 =25°C
Channel	Type	Value	Channel	Type	Value
05	e7 (Temperature Control Mode and	72=>0111 0010 Bit 7-4: 0111=2-stage cool Bit 1-0: 10=Cool	06	e8 (Fan Mode and Status)	06=> 0000 0110 Bit 3-2: 01=High Bit 1-0: 10=Circulate

Channel	Type	Value	Channel	Type	Value
07	bc (Plan Event)	00=Not executed	08	8e	01=System on
09	68	Humidity: 44=>68/2=34%RH			

2. Periodic packet when control permission is Remote Control: report as reporting interval (10 minutes by default) or when system status or relay status changes.

03671101 088e01 09684a 0a6e00					
Channel	Type	Value	Channel	Type	Value
03	67	Current Temp: 11 01=>01 11 =273/10=27.3°C	09	68	Humidity: 4a=>74/2=37%RH
08	8e	01=System on	0a	6e	00=> All relays are off

3. Control permission change packet: report immediately when control permission changes.

fff600		
Channel	Type	Value
ff	f6	00=Thermostat

4. Wiring change packet: report immediately when the wires are enabled or disabled in Installation Settings.

ffcb0d0703 ffca550005		
Channel	Type	Value
ff	cb (Supported Control Mode)	0d=>1101, Auto, Cool and Heat are supported 07=>00111, 1-stage, 2-stage and 3-stage Heat are supported 03=>0011, 1-stage and 2-stage cool are supported
ff	ca (Wiring Settings)	Byte 1: 55=> 01 01 01 01=W1, O/B, G, Y1 enable Byte 3: 05=> 00 00 01 01= Y2 enable, O/B=on heat

5. Target temperature range: report immediately when sending an invalid value to change target temperature or sending command to enquire the target temperature.

f940 0024006400bc00		
Channel	Type	Value
f9	40	00=Heat Target temperature: 2400=>0024=36/10=3.6°C Min. Range: 6400=>0064=100/10=10°C

		Max. Range: bc00 =>188/10=18.8°C
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2.3 Alarm

WT201 supports various types of alarms according to different settings:

Temperature threshold alarm: when current temperature is over or below the threshold value, the device will report the threshold alarm packet instantly. Only when the threshold is released and re-triggered, will the device report the alarm again.

Persistent low/high temperature threshold alarm: when current temperature is lower or higher than the target temperature for difference value and specific duration, the device will report the threshold alarm packet instantly. When the threshold is released, it will also report the alarm release packet.

Freeze protection alarm: when current temperature is lower than the protection temperature, the device will report this alarm packet instantly; when the temperature is higher than the protection temperature, it will also report the alarm release packet. This works when freeze protection option is enabled on Installation Settings.

Emergency heating timeout alarm: when the emergency heating time reaches this preset duration, report this alarm packet and switch back to Heat mode. This works when emergency heating duration option is enabled on Installation Settings.

Auxiliary heating timeout alarm: when current temperature does not reach the target temperature even heating for preset duration, the device will report this alarm packet and switch back to lower stage heating mode. This works when auxiliary heating duration option is enabled on Installation Settings.

Channel	Type	Byte	Description
83	67	3	<p>Byte 1-2: Temperature, INT16/10, Unit: °C</p> <p>Byte 3: Alarm Type</p> <p>01-Emergency Heating Timeout Alarm</p> <p>02-Auxiliary Heating Timeout Alarm</p> <p>03 -Persistent Low Temperature Alarm</p> <p>04 -Persistent Low Temperature Alarm Release</p> <p>05 -Persistent High Temperature Alarm</p> <p>06 -Persistent High Temperature Alarm Release</p> <p>07 -Freeze Protection Alarm</p> <p>08 -Freeze Protection Alarm Release</p> <p>09 -Temperature Threshold Alarm</p> <p>0a -Temperature Threshold Alarm Release</p>

Examples:

1. Temperature alarm or alarm release packet: report according to alarm settings.

8367140109		
Channel	Type	Value
83	67	Temperature: 14 01=>01 14=276/10=27.6°C Alarm type: temperature threshold alarm

3. Downlink Command

WT201 supports downlink commands to configure the device. The application port is 85 by default and can be configured via ToolBox.

Note: If confirmed mode on the device or network server is enabled, the device will reply the downlink command with reply format.

- 1) Command Format 1:

Channel	Type	Command
ff	1 Byte	N Bytes

Reply Format:

Channel	Type	Command
fe	Same as command	Same as command

- 2) Command Format 2:

Channel	Type	Command
f9	1 Byte	N Bytes

Reply Format:

Channel	Type	Command	Return Code
f8	Same as command	Same as command	00: success 01: not support 02: out of range

3.1 Basic Settings

Item	Channel	Type	Byte	Description
Reboot	ff	10	1	ff
Query Current Status		28	1	01, the device will return a periodic packet
Temperature Unit		eb	1	00=°C, 01=°F

				Note: the reported unit is fixed as °C.																
Reporting Interval	8e	3		Byte 1: 00 Byte 2-3: Interval time, unit: min																
System On/Off	c5	1		00=Off, 01=On																
Control Permission	f6	1		00=Thermostat, 01=Remote Control																
Child Lock	25	2		Byte 1: ff Byte 2: for every bit 0=disable, 1=enable. <table border="1"> <thead> <tr> <th>Bit</th> <th>Option</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>System on/off</td> </tr> <tr> <td>1</td> <td>Temperature +</td> </tr> <tr> <td>2</td> <td>Temperature -</td> </tr> <tr> <td>3</td> <td>Fan mode</td> </tr> <tr> <td>4</td> <td>Temperature control mode</td> </tr> <tr> <td>5</td> <td>Reset and reboot</td> </tr> <tr> <td>6-7</td> <td>00</td> </tr> </tbody> </table>	Bit	Option	0	System on/off	1	Temperature +	2	Temperature -	3	Fan mode	4	Temperature control mode	5	Reset and reboot	6-7	00
Bit	Option																			
0	System on/off																			
1	Temperature +																			
2	Temperature -																			
3	Fan mode																			
4	Temperature control mode																			
5	Reset and reboot																			
6-7	00																			
UTC Time Zone	bd	2		INT16/60																
Daylight Saving Time	ba	10		Byte 1: 00-disable, 01-enable Byte 2: DST bias, unit: min Byte 3-6: Start time, Month (1B)+Week (1B) + Hours of a Day (2B) Week: <table border="1"> <thead> <tr> <th>Bit7-4</th> <th>Bit3-0</th> </tr> </thead> <tbody> <tr> <td>1: 1st, 2: 2nd,...</td> <td>1: Monday, 2: Tuesday,...7: Sunday</td> </tr> </tbody> </table> Byte 7-10: End time	Bit7-4	Bit3-0	1: 1 st , 2: 2 nd ,...	1: Monday, 2: Tuesday,...7: Sunday												
Bit7-4	Bit3-0																			
1: 1 st , 2: 2 nd ,...	1: Monday, 2: Tuesday,...7: Sunday																			
Data Storage	68	1		00: disable, 01: enable																
Data Retransmission	69	1		00: disable, 01: enable																
Data Retransmission Interval	6a	3		Byte 1: 00 Byte 2-3: Interval time, unit: s range: 30~1200s (600s by default)																
Multicast group	82	1		Bit 7-4: multicast group 4 to 1 change status, 0 = not allow control, 1 = allow control. Bit 3-0: multicast group 4 to 1 control status, 0 for disable, 1 for enable. Note: after disabling or enabling, the																

				device will re-join the network.														
Temporary Child Lock Release	f9	5c	3	<p>Byte 1: enable button lock release feature, at least 2 buttons should be enabled 0=disable, 1=enable</p> <table border="1"> <thead> <tr> <th>Bit</th> <th>Option</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Button 1: System on/off</td> </tr> <tr> <td>1</td> <td>Button 2: Temperature +</td> </tr> <tr> <td>2</td> <td>Button 3: Temperature -</td> </tr> <tr> <td>3</td> <td>Button 4: Fan mode</td> </tr> <tr> <td>4</td> <td>Button 5: Temperature control mode</td> </tr> <tr> <td>5-7</td> <td>000</td> </tr> </tbody> </table> <p>Byte 2-3: release time, unit: s Note: if you enable the button 1 and 5 to release the lock, please press both buttons not more than 3s.</p>	Bit	Option	0	Button 1: System on/off	1	Button 2: Temperature +	2	Button 3: Temperature -	3	Button 4: Fan mode	4	Button 5: Temperature control mode	5-7	000
Bit	Option																	
0	Button 1: System on/off																	
1	Button 2: Temperature +																	
2	Button 3: Temperature -																	
3	Button 4: Fan mode																	
4	Button 5: Temperature control mode																	
5-7	000																	

Examples:

1. Reboot the device.

ff10ff		
Channel	Type	Value
ff	10 (Reboot)	ff

2. Set reporting interval as 2 minutes.

ff8e 00 0200		
Channel	Type	Value
ff	8e (Reporting Interval)	02 00=>00 02=>2 mins

3. Lock the reset and reboot feature of button.

ff25ff20		
Channel	Type	Value
ff	25	20=> 0010 0000 Bit5=1 => Reset and reboot lock

4. Allow to press fan mode and temperature control mode buttons together to release the button lock for 1 minute.

f95c183c00		
Channel	Type	Value
f9	5c	18=> 0001 1000 = Enable temperature control mode and fan mode buttons

		3c 00=>00 3c=60s=1 minute
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5. Set time zone.

ffbd10ff		
Channel	Type	Value
ff	bd	10 ff => ff 10 = -240/60=-4 the time zone is UTC-4

6. Set DST time: start time is October 1st Sunday 2:00, end time is April 1st Sunday 2:00, and bias is 1h (60 minutes).

ffba 01 3c 0a177800 04177800		
Channel	Type	Value
ff	ba	01=enable DST bias: 3c=>60 mins Start time: 0a=>10=October, 17=>1 st (1) Sunday(7), 78 00 =>00 78=120 hours=2:00 End time: 04=>April, 17=>1 st (1) Sunday(7), 78 00 =>00 78=120 hours=2:00

7. Set multicast group 1 as disable.

ff8210		
Channel	Type	Value
ff	82 (Multicast group)	10=>0001 0000 Bit4=1=>group1, bit 0=0=>disable

3.2 Installation Settings

Below settings only take effect when control permission is Thermostat.

Item	Channel	Type	Byte	Description												
Wiring Settings	ff	ca	3	Byte 1: <table border="1"> <thead> <tr> <th>Bit</th> <th>Wire</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>1-0</td> <td>Y1</td> <td rowspan="4">00=disable, 01=enable</td> </tr> <tr> <td>3-2</td> <td>G/GH</td> </tr> <tr> <td>5-4</td> <td>OB</td> </tr> <tr> <td>7-6</td> <td>W1</td> </tr> </tbody> </table>	Bit	Wire	Description	1-0	Y1	00=disable, 01=enable	3-2	G/GH	5-4	OB	7-6	W1
				Bit	Wire	Description										
1-0	Y1	00=disable, 01=enable														
3-2	G/GH															
5-4	OB															
7-6	W1															
Byte 2: <table border="1"> <thead> <tr> <th>Bit</th> <th>Wire</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>1-0</td> <td>E</td> <td rowspan="3">00=disable, 01=enable</td> </tr> <tr> <td>3-2</td> <td>DI</td> </tr> <tr> <td>5-4</td> <td>PEK</td> </tr> <tr> <td>7-6</td> <td>W2/AUX</td> <td>00=disable, 01=W2, 10=AUX</td> </tr> </tbody> </table>	Bit	Wire	Description	1-0	E	00=disable, 01=enable	3-2	DI	5-4	PEK	7-6	W2/AUX	00=disable, 01=W2, 10=AUX			
Bit	Wire	Description														
1-0	E	00=disable, 01=enable														
3-2	DI															
5-4	PEK															
7-6	W2/AUX	00=disable, 01=W2, 10=AUX														

				<p>Byte 3:</p> <table border="1"> <thead> <tr> <th>Bit</th> <th>Wire</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>1-0</td> <td>Y2/GL</td> <td>00=disable, 01=Y2, 10=GL</td> </tr> <tr> <td>3-2</td> <td>OB</td> <td>00=O/B on cool, 01=O/B on heat 11=Keep Original Setting</td> </tr> <tr> <td>7-4</td> <td>---</td> <td>0000</td> </tr> </tbody> </table>	Bit	Wire	Description	1-0	Y2/GL	00=disable, 01=Y2, 10=GL	3-2	OB	00=O/B on cool, 01=O/B on heat 11=Keep Original Setting	7-4	---	0000				
Bit	Wire	Description																		
1-0	Y2/GL	00=disable, 01=Y2, 10=GL																		
3-2	OB	00=O/B on cool, 01=O/B on heat 11=Keep Original Setting																		
7-4	---	0000																		
Reversing Valve		b5	1	00=Energize on cool, 01=Energize on heat																
Freeze Protection		b0	3	<p>Byte 1: 00-disable, 01-enable</p> <p>Byte 2-3: Protection temperature, INT16/10, unit: °C</p>																
Room Card Setting		c1	4	<p>Byte 1: 00-disable, 01-enable</p> <p>Byte 2: 00=System on/off, 01=Insert an event</p> <p>Byte 3:</p> <p>Bit 7-4: insert card event (default: home)</p> <p>Bit 3-0: remove card event (default: away)</p> <table border="1"> <thead> <tr> <th>Bit</th> <th>Event</th> </tr> </thead> <tbody> <tr> <td>0000</td> <td>Wake</td> </tr> <tr> <td>0001</td> <td>Away</td> </tr> <tr> <td>0010</td> <td>Home</td> </tr> <tr> <td>0011</td> <td>Sleep</td> </tr> <tr> <td>0100</td> <td>Occupied</td> </tr> <tr> <td>0101</td> <td>Unoccupied</td> </tr> <tr> <td>0110</td> <td>ECO</td> </tr> </tbody> </table> <p>Byte 4:</p> <p>00: DI low level= Insert card (default),</p> <p>01: DI high level=Insert card</p>	Bit	Event	0000	Wake	0001	Away	0010	Home	0011	Sleep	0100	Occupied	0101	Unoccupied	0110	ECO
Bit	Event																			
0000	Wake																			
0001	Away																			
0010	Home																			
0011	Sleep																			
0100	Occupied																			
0101	Unoccupied																			
0110	ECO																			
Compressor and Auxiliary Heat Linkage	f9	46	1	00=disable (default), 01=enable																
System Protection		47	2	<p>Byte 1: 00=disable, 01=enable</p> <p>Byte 2: minimum running duration, unit: min, range: 1-60</p>																
Fan Control		62	1	00=Furnace or Boiler, 01=Thermostat																

During Heating				
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Reply format:

The device will send a reply including wirings, supported mode and levels when it receives a wiring setting command.

Channel	Type	Description												
ff	cb	3 Bytes, for every bit: 0=disable, 1=enable Byte 1: Supported temperature control mode <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>Bit</th> <th>Event</th> </tr> </thead> <tbody> <tr><td>0</td><td>Heat</td></tr> <tr><td>1</td><td>EM Heat</td></tr> <tr><td>2</td><td>Cool</td></tr> <tr><td>3</td><td>Auto</td></tr> <tr><td>7-4</td><td>0000</td></tr> </tbody> </table>	Bit	Event	0	Heat	1	EM Heat	2	Cool	3	Auto	7-4	0000
		Bit	Event											
		0	Heat											
1	EM Heat													
2	Cool													
3	Auto													
7-4	0000													
Byte 2: Supported heat level, only works when using heat mode <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>Bit</th> <th>Event</th> </tr> </thead> <tbody> <tr><td>0</td><td>1-stage Heat</td></tr> <tr><td>1</td><td>2-stage Heat</td></tr> <tr><td>2</td><td>3-stage Heat</td></tr> <tr><td>3</td><td>4-stage Heat</td></tr> <tr><td>4</td><td>5-stage Heat (W1+AUX)</td></tr> <tr><td>7-5</td><td>000</td></tr> </tbody> </table>	Bit	Event	0	1-stage Heat	1	2-stage Heat	2	3-stage Heat	3	4-stage Heat	4	5-stage Heat (W1+AUX)	7-5	000
Bit	Event													
0	1-stage Heat													
1	2-stage Heat													
2	3-stage Heat													
3	4-stage Heat													
4	5-stage Heat (W1+AUX)													
7-5	000													
Byte 3: Supported cool level, only works when using cool mode <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>Bit</th> <th>Event</th> </tr> </thead> <tbody> <tr><td>0</td><td>1-stage Cool</td></tr> <tr><td>1</td><td>2-stage Cool</td></tr> <tr><td>7-2</td><td>000000</td></tr> </tbody> </table>	Bit	Event	0	1-stage Cool	1	2-stage Cool	7-2	000000						
Bit	Event													
0	1-stage Cool													
1	2-stage Cool													
7-2	000000													
ff	ca	The definition is the same as downlink command												

Examples:

1) Enable W1, Y1, Y2, G, O/B, O/B=on heat.

ffca 550005		
Channel	Type	Value
ff	ca (Wiring Settings)	Byte 1: 55=> 01 01 01 01=W1, O/B, G, Y1 enable Byte 3: 05=> 00 00 01 01= Y2 enable, O/B=on heat

Reply:

ffcb0d0703 ffca550005		
Channel	Type	Value

ff	cb	0d=>1101, Auto, Cool and Heat are supported 07=>00111, 1-stage, 2-stage and 3-stage Heat are supported 03=>0011, 1-stage and 2-stage cool are supported
ff	ca	The same as downlink command content

2) Enable freeze protection and set as 5°C.

ffb0 01 3200		
Channel	Type	Value
ff	b0 (Freeze Protection)	01=Enable 32 00=>00 32=50*0.1=5 °C

3.3 Thermostat Control Settings

When control permission is Thermostat, the device supports temperature control settings via below commands.

Item	Channel	Type	Byte	Description												
Temperature Control Mode Enable	f9	5d	1	0=disable, 1=enable												
				<table border="1"> <thead> <tr> <th>Bit</th> <th>Event</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Heat</td> </tr> <tr> <td>1</td> <td>EM Heat</td> </tr> <tr> <td>2</td> <td>Cool</td> </tr> <tr> <td>3</td> <td>Auto</td> </tr> <tr> <td>7-4</td> <td>0000</td> </tr> </tbody> </table>	Bit	Event	0	Heat	1	EM Heat	2	Cool	3	Auto	7-4	0000
				Bit	Event											
				0	Heat											
				1	EM Heat											
2	Cool															
3	Auto															
7-4	0000															
Byte 1: 00=system on, 01=system off																
Byte 2: 00=Heat, 01=EM Heat, 02=Cool, 03= Auto																
Byte 3-4: target temperature, INT16/10, Unit: °C																
Temperature Control Mode	ff	fb	1	00=Heat, 01=EM Heat, 02=Cool, 03= Auto												
Target Temperature		fa	3	Byte 1: 00=Heat, 01=EM Heat, 02=Cool, 03= Auto, 04=Auto-Heat (Dual Target), 05=Auto-Cool (Dual Target) Byte 2-3: Target temperature, INT16/10, unit: °C Note: this command does not support to switch temperature control mode.												
Query Target		28	1	02, enquire the target temperature and												

Temperature				regulation range of every control mode
Temperature Tolerance (Single Target)		b8	2	Byte 1: Target temperature tolerance, UINT8/10, unit: °C Byte 2: Temperature control tolerance, UINT8/10, unit: °C
Fan Mode		b6	1	00=Auto, 01=On, 02=Circulate
Fan Delay	f9	44	3	Byte 1: 00-disable, 01-enable Byte 2-3: duration of delay, unit: s, range: 1-3600
Fan Circulate Operation Time		06	1	UINT8, unit: min/h, range: 5-55
Fan Regulate Humidity		07	2	Byte 1: 00-disable, 01-enable Byte 2: regulate interval, UINT8, unit: min/h, range: 5-55
Target Humidity Range		09	2	Min. Value (1B) + Max. Value(1B) Min./Max. Value: UINT8, unit: %RH
Temp. Control and Dehumidify		0a	2	Byte 1: 00-disable, 01-enable Byte 2: tolerance value, UINT8/10, unit: °C
Target Temperature Resolution		41	1	00=0.5 resolution, 01=1 resolution
Target Temperature Regulation Range		42	5	Byte 1: temperature control mode, 00=Heat, 01=EM Heat, 02=Cool, 03= Auto Byte 2-3: min. Value of the range, INT16/10, Unit: °C Byte 4-5: max. Value of the range, INT16/10, Unit: °C
Target Temperature Mode		58	1	00=Single target, 01=Dual target
Dual Target Temperature Tolerance		5a	2	Byte 1: 00=heating tolerance, 01=cooling tolerance Byte 2: tolerance value, UINT8/10, unit: °C
Relay Change Report		3a	1	00=disable, 01=enable
W2/Y2 Auxiliary Mode		3b	1	10=disable (default) 11=Y2 auxiliary mode enable: when Y2 opens, it must work with Y1

				<p>12=W2 auxiliary mode enable: when W2 opens, it must work with W1</p> <p>13=Y2 and W2 auxiliary mode enable</p>
Setback/Setforward		1b	2	<p>Setback: switch to higher level according to ΔT.</p> <p>1) If $\Delta T_1 \leq \Delta T \leq \Delta T_2$, switch from 1-stage to 2-stage fan and cooling/heating;</p> <p>2) If $\Delta T > \Delta T_2$, switch from lower level to 3-stage fan and heating.</p> <p>Setforward: switch to lower level according to ΔT.</p> <p>1) If $\Delta T_1 \leq \Delta T \leq \Delta T_2$, switch from higher level to 2-stage fan and cooling/heating;</p> <p>2) If $\Delta T < \Delta T_1$, switch from higher level to 1-stage fan and cooling/heating.</p> <p>Command:</p> <p>Setforward: 0100=disable, 0101= enable</p> <p>Setback: 0200=disable, 0202=enable,</p> <p>Setforward and Setback: 0300=disable, 0303= enable (default)</p>
Setback/Setforward Threshold		43	3	<p>Byte 1: 00</p> <p>Byte 2: ΔT_1, UINT8/10, unit: unit: °C, default: 3</p> <p>Byte 2: ΔT_2, UINT8/10, unit: unit: °C, default: 5</p> <p>Note: $\Delta T = \text{Temperature} - (\text{Target Temperature} + \text{Target Temperature Tolerance} + \text{Temperature Control Tolerance})$</p>
Cool/Heat High Level Switch	ff	b9	3	<p>When the temperature does not reach to the change value within the detection time, the device will switch to higher cool/heat level.</p>

				Byte 1: 00=heat, 01=cool Byte 2: detection time, unit: min Byte 3: change value, UINT8/10, unit: unit: °C
--	--	--	--	--

Examples:

1. Enable to switch temperature control modes among Heat, Cool and Auto.

f95d0d		
Channel	Type	Value
f9	5d (Temperature Control Mode Enable)	0d=> 0000 1101 = Auto, Cool and Heat are enabled

2. Set temperature control mode as Auto.

ffb03		
Channel	Type	Value
ff	fb (Temperature Control Mode)	03=Auto

3. Set target temperature of Cool mode as 21.6°C.

ffa02d800		
Channel	Type	Value
ff	fa (Target Temperature)	02=Cool d8 00=>00 d8=216/10=21.6 °C

3.4 Remote Control Settings

When control permission is Remote Control, the device supports to control relay output status directly via below commands.

Item	Channel	Type	Byte	Description												
Relay Status	ff	f7	4	7f00+relay status(1B)+00												
				Relay status:												
				For every bit: 0=disconnected, 1=connected												
				Corresponding relay of every bit:												
				<table border="1"> <thead> <tr> <th>Bit</th> <th>Relay</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Y1</td> </tr> <tr> <td>1</td> <td>Y2/GL</td> </tr> <tr> <td>2</td> <td>W1</td> </tr> <tr> <td>3</td> <td>W2/AUX</td> </tr> <tr> <td>4</td> <td>E</td> </tr> </tbody> </table>	Bit	Relay	0	Y1	1	Y2/GL	2	W1	3	W2/AUX	4	E
				Bit	Relay											
0	Y1															
1	Y2/GL															
2	W1															
3	W2/AUX															
4	E															

				5	G
				6	O/B
				7	0
Room Card Setting		c1	4	00000000-disable 01000000-enable	
Offline Setting		f8	1	When the device is disconnected from server, the control status: 00: keep current status (default) 01: switch to thermostat control permission 02: disconnect all relays	

Examples:

1) Control Y1, Y2, W1, W2, G connected and others are disconnected.

fff77f002f00		
Channel	Type	Value
ff	f7 (Relay status)	2f=>00101111 Y1, Y2, W1, W2, G are connected, others are disconnected

3.5 Calibration and Threshold Settings

Item	Channel	Type	Byte	Description
Temperature Calibration	ff	ab	3	Byte 1: 00-disable, 01-enable Byte 2-3: calibration value, INT16/10, unit: °C
Humidity Calibration		f9	3	Byte 1: 00-disable, 01-enable Byte 2-3: calibration value, INT16/10, unit: %RH
Threshold Alarm		06	9	Temperature threshold: CTRL(1B)+Min(2B)+Max(2B)+ 00000000(4B) CTRL: 00=disable, 01=below (minimum threshold), 02=over (maximum threshold), 03=within, 04=below or over Persistent low temperature threshold: 09+Difference value(2B)+00000000(4B)+

				Duration(2B), duration unit: s Persistent high temperature threshold: 120000+Difference value(2B)+0000(2B) Duration(2B), duration unit: s
--	--	--	--	---

Examples:

- 1) Enable temperature and set calibration value.

ffab01fdff		
Channel	Type	Value
ff	ab (Temperature Calibration)	01=Enable fdff=>fffd=-3/10=-0.3 °C

- 2) Enable threshold alarm and set the below threshold value as 10°C.

ff06 01 6400 000000000000		
Channel	Type	Value
ff	06(Threshold Alarm)	CTRL: 01=below Threshold: 64 00=>00 64=100*0.1=10 °C

- 3) Enable persistent high temperature threshold difference as 1°C and duration is 10 minutes.

ff06120000 0a00 0000 5802		
Channel	Type	Value
ff	06(Threshold Alarm)	Difference: 0a 00=>00 0a=10*0.1=1°C Duration: 58 02=> 02 58=600s=10 mins

3.6 Schedule Settings

Below settings only take effect when control permission is Thermostat.

WT201 supports to send downlink commands to configure the contents of schedules.

Note:

- 1) if the repeat date is disabled, the schedule plan will only execute once.
- 2) When you send downlink command to modify current executing schedule plan, it will take effect in next time.

Item	Channel	Type	Byte	Description
Schedule Content (Single Target Temperature)	f9	5e	7	Byte 1: Plan, 00=Wake, 01=Away, 02=Home, 03=Sleep, 04=Occupied, 05=Unoccupied, 06=ECO Byte 2: Temperature Control Mode, 00=Heat, 01=EM Heat, 02=Cool, 03=Auto Byte 3: Fan Mode, 00=Auto, 01=On, 02=Circulate

				Byte 4-5: Target Temperature, INT16/10, Unit: °C Byte 6: Target Temperature Tolerance, UINT8/10, Unit: °C Byte 7: Temperature Control Tolerance, UINT8/10, Unit: °C								
Schedule Content (Dual Target Temperature)		59	9	Byte 1: Plan, 00=Wake, 01=Away, 02=Home, 03=Sleep, 04=Occupied, 05=Unoccupied, 06=ECO Byte 2: Temperature Control Mode, 00=Heat, 01=EM Heat, 02=Cool, 03=Auto Byte 3: Fan Mode, 00=Auto, 01=On, 02=Circulate Byte 4-5: Heat Target Temperature, INT16/10, Unit: °C Byte 6: Heat Target Temperature Tolerance, UINT8/10, Unit: °C Byte 7-8: Cool Target Temperature, INT16/10, Unit: °C Byte 9: Cool Target Temperature Tolerance, UINT8/10, Unit: °C								
Schedule Time	ff	c9	6	Byte 1: Plan, 00=Wake, 01=Away, 02=Home, 03=Sleep, 04=Occupied, 05=Unoccupied, 06=ECO Byte 2: Plan ID, range: 0-15 Byte 3: 00=disable, 01=enable Byte 4: Repeat Day, 0=disable, 1=enable <table border="1" data-bbox="836 1417 1347 1514"> <thead> <tr> <th>Bit7</th> <th>.....</th> <th>Bit1</th> <th>Bit0</th> </tr> </thead> <tbody> <tr> <td>Sun.</td> <td>,...</td> <td>Mon.</td> <td>0</td> </tr> </tbody> </table> Byte 5-6: Time: unit: min Note: the time of different schedule plans must be different.	Bit7	Bit1	Bit0	Sun.	,...	Mon.	0
Bit7		Bit1	Bit0								
Sun.		,...	Mon.	0								
Switch Schedule Plan		c2	1	00=Wake, 01=Away, 02=Home, 03=Sleep, 04=Occupied, 05=Unoccupied, 06=ECO								
Query Schedule	28	1	00, the device will reply schedule contents and times of all plans with the same format as downlink commands. Note: even the schedule time is blank, the device									

				will also reply totally 64 blank time records. The reply will take some times please do not send downlink commands during this time.																		
Schedule Plan Enable/Disable	f9	8b	2	<p>Byte 1: ff</p> <p>Byte 2: for every bit 0=disable, 1=enable.</p> <table border="1"> <thead> <tr> <th>Bit</th> <th>Option</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Wake</td> </tr> <tr> <td>1</td> <td>Away</td> </tr> <tr> <td>2</td> <td>Home</td> </tr> <tr> <td>3</td> <td>Sleep</td> </tr> <tr> <td>4</td> <td>Occupied</td> </tr> <tr> <td>5</td> <td>Unoccupied</td> </tr> <tr> <td>6</td> <td>ECO</td> </tr> <tr> <td>7</td> <td>0</td> </tr> </tbody> </table>	Bit	Option	0	Wake	1	Away	2	Home	3	Sleep	4	Occupied	5	Unoccupied	6	ECO	7	0
Bit	Option																					
0	Wake																					
1	Away																					
2	Home																					
3	Sleep																					
4	Occupied																					
5	Unoccupied																					
6	ECO																					
7	0																					

Examples:

1) Set Wake plan content: temperature control mode is Auto, fan mode is on, target temperature is 23°C, target temperature tolerance is 1°C, temperature control tolerance is 2°C.

f95e 00 03 01 fa00 0a 14		
Channel	Type	Value
f9	5e (Schedule Content)	00=Wake, 03=Auto, 01=Fan On Target temperature: fa 00=>00 fa=250/10=25°C Target temperature tolerance: 0a=>10/10=1°C Temperature control tolerance: 14=>20/10=2°C

2) Set Wake plan time: 6:30 am on weekdays (Mon. To Fri.), 8:00am on weekend (Sat. To San.).

ffc90000013e8601 ffc9000101c0e001		
Channel	Type	Value
ff	c9 (Schedule Time)	00=Wake, 00=Command ID is 0, 01=Enable 3e=>0011 1110 =Weekday enabled 86 01=>01 86=390 minutes=>6:30
ff	c9 (Schedule Time)	00=Wake, 01=Command ID is 1, 01=Enable c0=>1100 0000 =Weekend enabled e0 01=>01 e0=480 minutes=>8:00

3.7 Milesight D2D Settings

Item	Channel	Type	Byte	Description
D2D Feature	ff	c7	1	10=D2D Controller disabled, 11=D2D Controller enabled, 20=D2D Agent disabled, 22=D2D Agent

				enabled
D2D Controller		96	8	<p>Note: Below settings only take effect when control permission is Thermostat.</p> <p>Byte 1: 00-Wake, 01-Away, 02-Home, 03-Sleep, 04=Occupied, 05=Unoccupied, 06=ECO</p> <p>Byte 2: 00-disable, 01-enable</p> <p>Byte 3: 00-disable LoRa Uplink, 01-enable LoRa Uplink</p> <p>Byte 4-5: D2D control command</p> <p>Byte 6-8: 000000</p>
D2D Agent		83	5	<p>Byte 1: Command ID, 0~15</p> <p>Byte 2: 00-disable, 01-enable</p> <p>Byte 3-4: D2D control command</p> <p>Byte 5: control action, 00=System off, 01=System on, 10=Wake, 11=Away, 12=Home, 13=Sleep, 14=Occupied, 15=Unoccupied, 16=ECO</p>
D2D Data Sending Devices	f9	3e	9	<p>Byte 1: device ID, range: 0-4</p> <p>Byte 2-9: device EUI</p> <p>Note: if you require to delete a device, please leave the device EUI as all 0.</p>

Examples:

1) D2D Controller

ff96 03 01 01 04e0 000000		
Channel	Type	Value
ff	96 (D2D Controller)	03=> Sleep, 01=> Enable; 01=>Enable LoRa Uplink; 04 e0=>e0 04, Control Command is e004;

2) D2D Agent

ff83 03 01 04e0 01		
Channel	Type	Value
ff	83 (D2D Agent)	03=> Command ID, 01=> Enable; 04 e0=>e0 04, Control Command is e004; 01=>System on

3.8 Use External Sensor

WT201 supports to disable internal temperature and humidity sensors and use external sensor data via downlink commands.

Item	Channel	Type	Byte	Description
External Sensor Mode	ff	c4	2	Byte 1: 00=disable, 01=enable to receive data from LoRaWAN network server 02=enable to receive data from Milesight D2D devices Byte 2: timeout, unit: min, default: 10, range: 5-60
Send External Temperature Value	03	-	3	Byte 1-2: INT16/10, unit: °C Byte 3: ff
Send External Humidity Value	09	-	2	Byte 1: UINT8/2, unit: %RH Byte 2: ff
Offline Setting	ff	f8	1	When the device does not receive temperature values from network server or D2D device for timeout: 00: keep current status (default) 01: switch to internal sensors 02: disable temperature control

Examples:

1) Enable to receive external sensor data from network server and set the timeout as 60 minutes.

ffc4013c		
Channel	Type	Value
ff	c4 (External Sensor Mode)	01=Enable to receive data from LNS 3c=> 60 minutes

2) Send external temperature sensor data from network server.

036400ff	
Channel	Value
03	64 00=>00 64=100/10=10 °C

3.9 Screen Display Settings

Item	Channel	Type	Byte	Description
Screen Display	f9	08	1	00: enable 01: disable the display of plan status 02: disable

Example: Disable the display of plans.

f90801		
Channel	Type	Value
f9	08	01=disable the display of plans

4. Historical Data Enquiry

WT201 supports 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 2-3: interval time, unit:s range: 30~1200s (60s by default)

Reply format:

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 (4B) + Mode Status (2B) + (Cooling) Target Temperature (2B) + Heating Target Temperature (2B) + Temperature (2B) + Humidity (1B) Note: if no heating target temperature, the report will send ffff.

Mode Status Format:

Bit	15-11	10-7	6-5	4-3	2-1	0
	---	Temp. Control status	Temp. Control mode	Fan status	Fan mode	System
	00000	0000=Standby, 0001=1-stage heat, 0010=2-stage heat, 0011=3-stage heat, 0100=4-stage heat, 0101=emergency heat, 0110=1-stage cool, 0111=2-stage cool, 1000=5-stage heat	00=Heat, 01=EM Heat, 10=Cool, 11= Auto	00=Off, 01=High, 10=Low, 11=On	00=Auto, 01=On, 10=Circulate	on=1, off=0

Note:

1. The device only uploads 300 data records per range enquiry at most.
2. When enquiring the data at the specific time point, it will upload the data which is closest to the search point within the reporting interval range. For example, if the device reporting interval is 10 minutes and users send command to search for the data at 17:00, if the device find there is data stored in 17:00, it will upload this data; If not, 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 2023/10/16 16:30:00 to 2023/10/16 16:40:00.

fd6c 88f42c65 e0f62c65		
Channel	Type	Value
fd	6c (Enquire data in time range)	Start time: 88f42c65 => 652cf488 = 1697445000 =2023/10/16 16:30:00 End time: e0f62c65 => 652cf6e0 = 1697445600 =2023/10/16 16:40:00

Reply:

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

20ce e0f62c65 4100 1501 ffff f600 4e			
Channel	Type	Time Stamp	Value

20	ce (Historical Data)	e0f62c65 => 652cf6e0=2023 /10/16 16:40:00	4100=>0041=0000 10 00 00 1 =>system: on, fan mode: auto, fan status: off, temperature control mode: cool, temperature control status: standby Target temperature: 1501=> 0115 =277/10 =27.7°C Heating target temperature: ffff=None Temperature: f600=>00f6=246/10=24.6°C Humidity: 4e=>78/2=39%RH
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-END-