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NCS-TT105W
Wireless Temperature Transmitter
User Manual

Warning

1. It is forbidden for users to disassemble and install the wireless temperature transmitter board by themselves.

2. Users check by themselves whether the wireless temperature transmitter battery voltage meets the battery voltage requirements in the instruction manual.

Version: V1.2

Disclaimer

The contents of this manual have been checked to confirm the consistency of the hardware and software described. Since errors cannot be completely excluded, absolute consistency cannot be guaranteed. However, we will periodically check the data in this manual and make the necessary corrections in subsequent versions. Any suggestions for improvements are welcome.

Microcyber Corporation 2016

Technical data is subject to change.

Company Profile

Microcyber Corporation is a high-tech enterprise initiated and founded by Shenyang Institute of Automation, Chinese Academy of Sciences, mainly engaged in networked control system, industrial communication and instrumentation, development, production and application. Microcyber Corporation has undertaken a number of national science and technology projects such as the National Science and Technology Major Project, National High Technology Research and Development Program (863 Program), Smart Manufacturing Equipment Development Project, etc. It is the unit for the construction of National Engineering Research Center for Networked Control System.

Microcyber Corporation successfully developed the first internationally certified fieldbus protocol master stack, the first nationally certified fieldbus instrument, the first domestic safety instrument certified by TÜV Germany, and co-hosted with other units the formulation of the first domestic industrial Ethernet protocol standard EPA and the first industrial wireless communication protocol standard WIA-PA, which became an IEC international standard.

Our products and technologies have won two National Science and Technology Progress Awards, one National Science and Technology Invention Award, one First Prize of Science and Technology Progress of Chinese Academy of Sciences, one First Prize of Science and Technology Progress of Liaoning Province, and our products have been exported worldwide. We have successfully completed more than 200 large-scale automation projects.

Microcyber Corporation is a member of FCG organization; a member of PNO.

Microcyber Corporation has successfully passed ISO9001:2008 quality management system certification and ISO/TS16949 quality system certification for the automotive industry. Excellent R&D team, rich experience in automation engineering design and implementation, industry-leading products, large market network and excellent corporate culture have laid a solid foundation for the company's start-up and sustainable development.

Carrying employees' ideals, creating customer value and promoting corporate development.

TABLE OF CONTENTS

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Chapter 1. Product Review

NCS-TT105W is a WirelessHART wireless temperature transmitter developed by Microcyber Corporation. The transmitter can be used with a wide range of sensors for RTD, TC, Ω and mV signals with high accuracy and wide range, and provides stable and reliable wireless communication for process automation. WirelessHART technology is safe and affordable, allowing quick device installation of measurement points without wiring. LCD displays field measurement information for improved process data visibility.

Figure 1.1 Wireless temperature transmitter

Users can configure and configure through WirelessHART MPT configuration software provided by Microcyber, and also provide DD file supporting 475 hand controller format, which is convenient for users to configure and configure wireless temperature transmitter through 475 hand controller. The device can be configured and monitored for data through the gateway after it is connected to the network. In the case of local operation, the wireless temperature transmitter is also equipped with three buttons for rich tuning functions, such as configuration and configuration of sensor type, wiring method, upper and lower ranges and units, etc.

The wireless temperature transmitter LCD meter head adopts white backlight dot matrix LCD screen, which can intuitively display the current temperature value and the percentage of the range, and can be rotated within 90°/180°/360°, providing convenience for users to observe from any angle.

See the rest of this manual for additional details on the wireless temperature transmitter.

Chapter 2. Installation and nameplate

For wireless temperature transmitter mounting, L-bracket mounting, threaded mounting, and flange mounting are available.

2.1 L-bracket installation
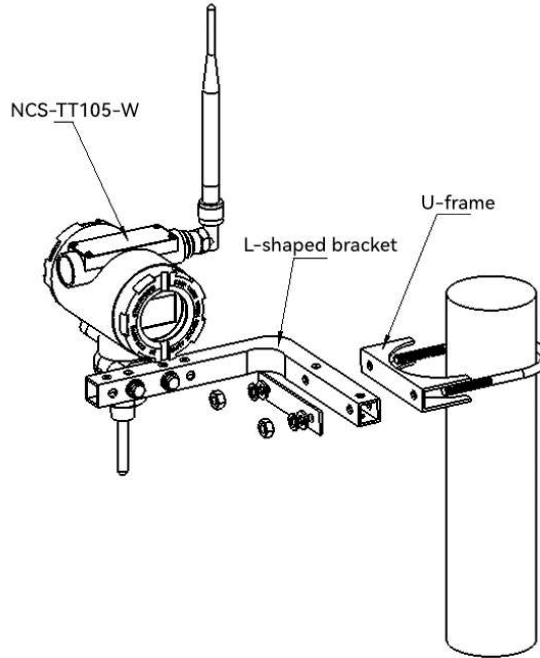

Figure 2.1 L-shaped bracket installation diagram

2.2 Threaded installation
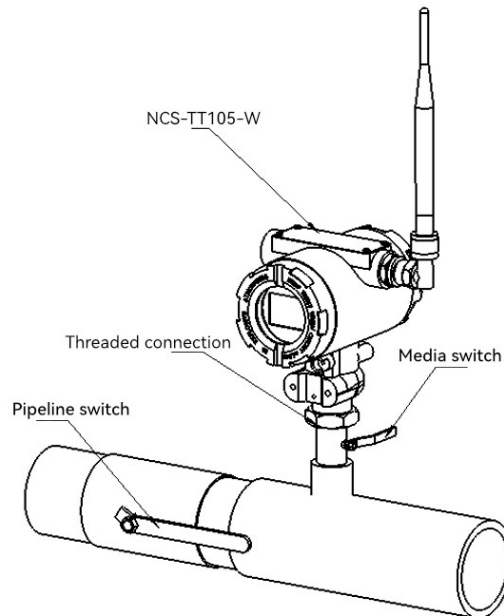
Figure 2.2 Threaded installation diagram

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2.3 Flange installation
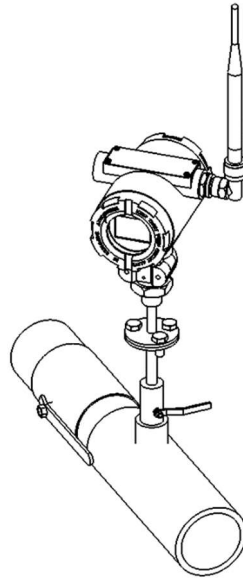
Figure 2.3 Flange installation diagram

2.4 Product nameplate

This product is only available with English nameplate, if you need Chinese nameplate, please specify before ordering.
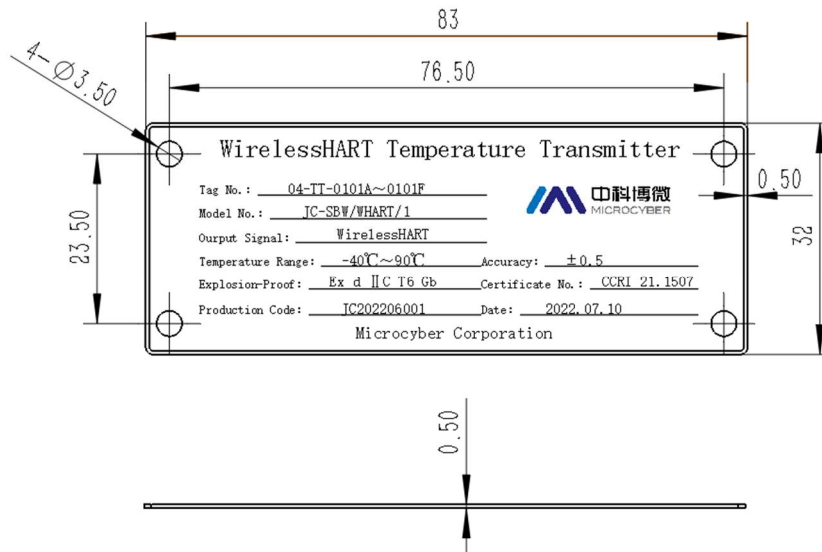
Figure 2.4 Product nameplate diagram

Chapter 3. Shape and structure

3.1 Mechanical structure

As shown in the figure below, the wireless temperature transmitter is installed with a set of cards for data acquisition and transmission. The front compartment set card consists of LCD card, communication acquisition card and wireless module, and the rear compartment consists of battery compartment, battery module, electrical plug-in, and battery top cover.

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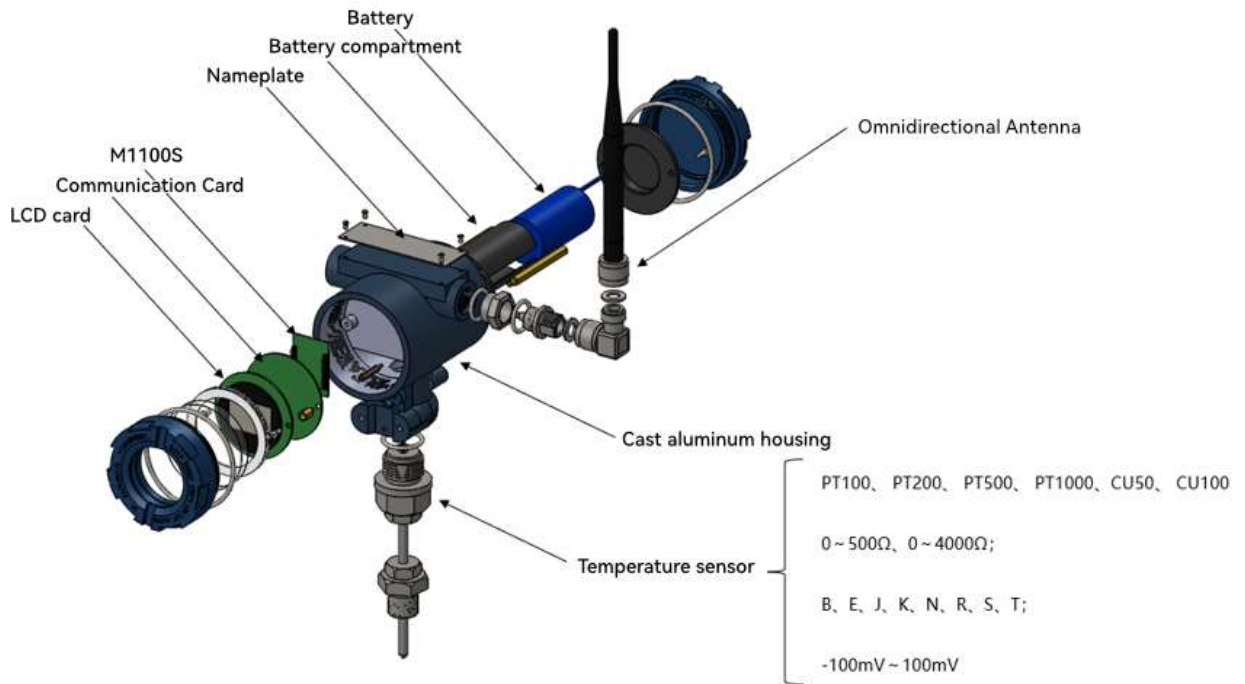
Battery installation:
1. First remove the back cover (rotate the back cover counterclockwise)
2. Then remove the upper cover of the battery compartment
3. Install the battery module into the battery compartment as shown in the diagram, and confirm that the electrical plug-in is well connected
4. Install the upper cover of the battery compartment, then screw the back cover into the instrument (clockwise rotation), the end face of the back cover and the end face of the instrument case can fit.
Note: The battery is installed when the instrument is powered on and used, and the instrument is powered on when the battery is installed and enters the work state.

Battery compartment

Battery module

Electrical plug-in

Battery compartment top cover

Back cover

Ex

Figure 3.1 Structure diagram
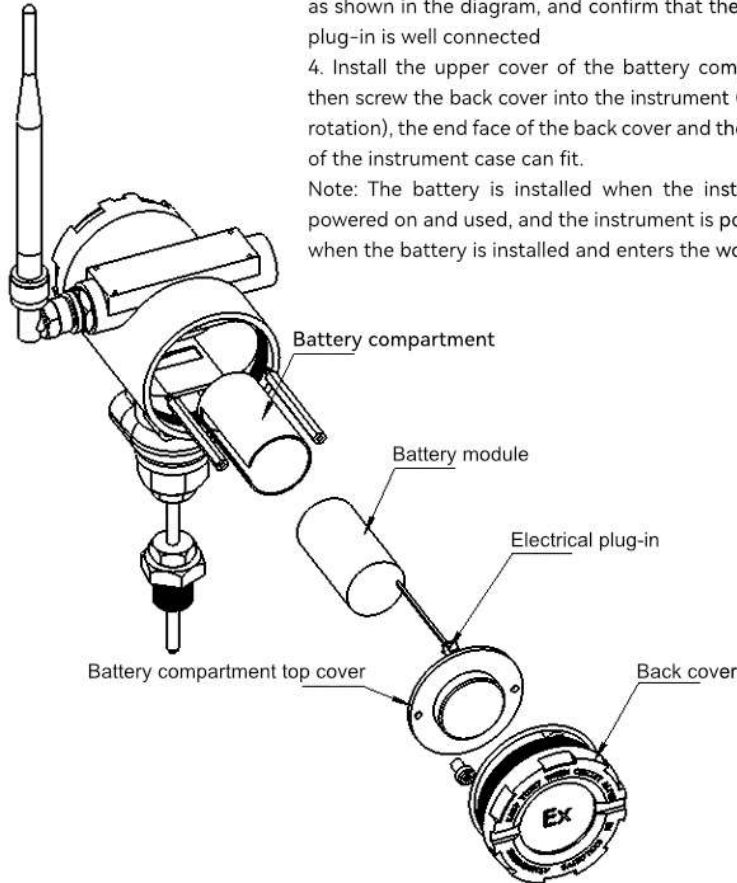
3.2 Dimension
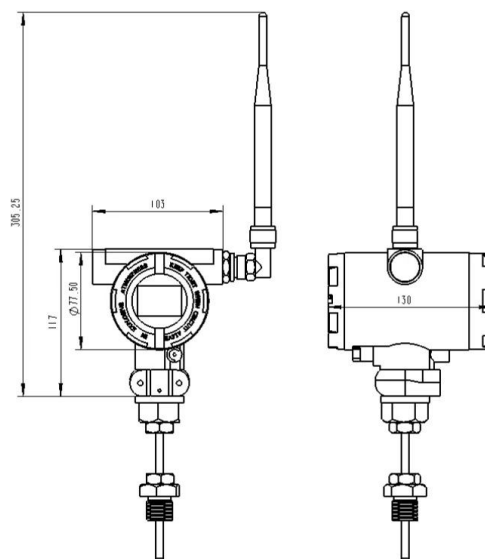
Figure 3.2 Overall dimensions

Chapter 4. Introduction of temperature transmitter

4.1 Hardware Interface

The wireless temperature transmitter is powered by a 3.6V battery.

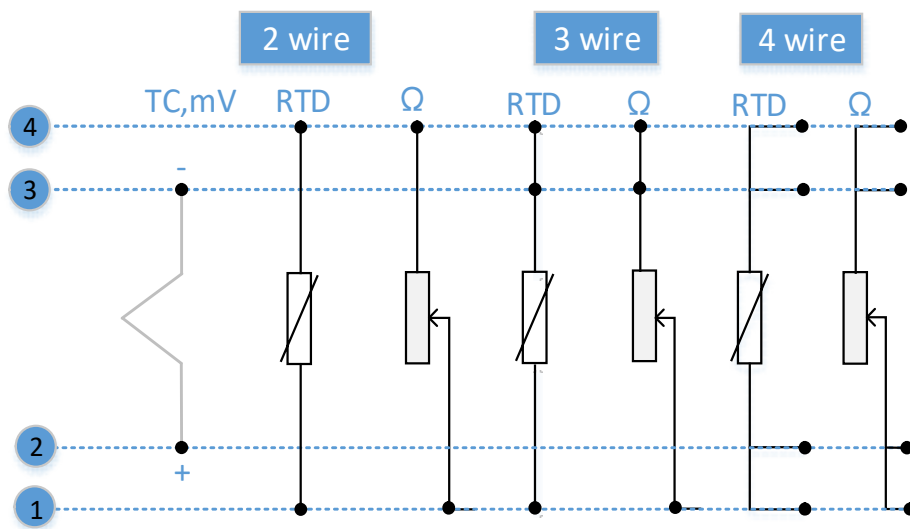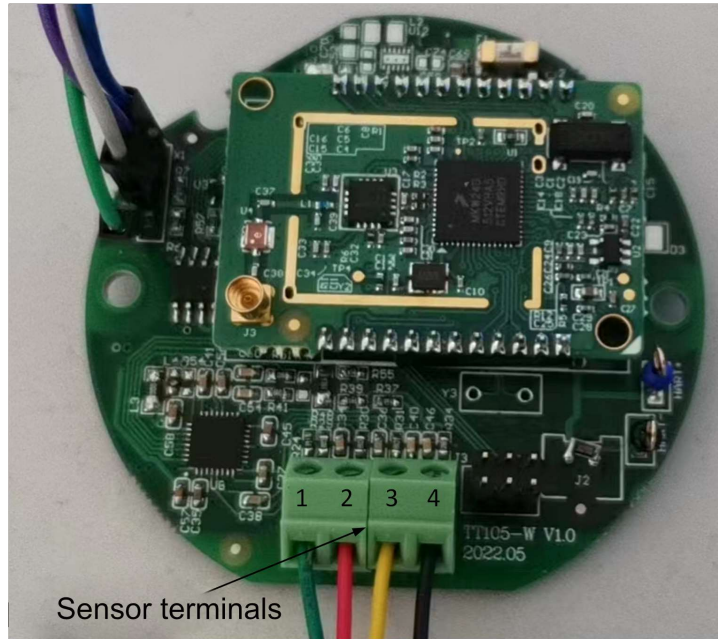The wireless temperature transmitter sensor hardware interface diagram is shown in Figure 4.1:

Sensor terminals

Figure 4.1

Hardware interface description

Figure 4.2 Sensor wiring description

Chapter 5. Wireless Temperature Transmitter Configuration

5.1 Net topology

In practical industrial applications, the system is generally divided into equipment layer and monitoring layer. The equipment layer generally includes WirelessHART temperature transmitter, WirelessHART pressure transmitter and WirelessHART adapter, etc. The wired HART equipment needs to connect to the WirelessHART adapter, and then convert the wired HART signal into WirelessHART signal for transmission. WirelessHART The network is equipped with WirelessHART gateway equipment, which is responsible for the resource allocation and data collection of the whole network, and is the core equipment of the whole wireless network. Finally, the data will be connected to the control system, the host configuration software or the data center through the gateway to ModbusRTU / ModbusTCP protocol, so as to realize the data monitoring and configuration work.
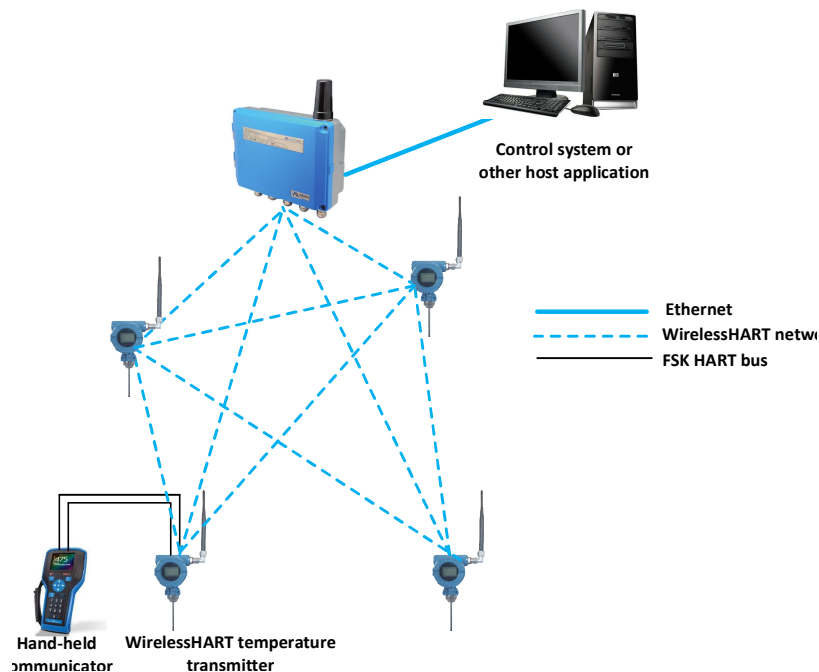
Figure 5. 1 Schematic diagram of the network topology

5.2 Functional Configuration

The wireless temperature transmitter supports the WirelessHART-MPT configuration software of Shenyang Microcyber Corporation, and the SDC625 of HART Foundation and other general WirelessHART configuration software for configuration debugging. The following mainly takes the WirelessHART-MPT configuration software of Microcyber Corporation as an example to introduce the configuration method of the wireless temperature transmitter. It mainly includes the following several functions:

1) Basic information configuration: Configure the basic information of the online equipment, including the label, address, date, assembly number and other information;

2) Sensor information configuration: Configure the sensor information of the on-line device, including the type and wiring information;

3) Configuration information configuration: configure the configuration information of the online

equipment, including the main variable range, damping and other information;

4) Interface display settings: configure the LCD information of the online device, including the interface number, display time, display number, display source and other information;

5) Linear correction: multi-point (16 data points (calibration for online equipment);

6) Variable monitoring: It can regularly refresh all the dynamic variables of the selected online device and display the trend curve of the current device main variable

7) Network information configuration: configure the network information of online equipment, including adding key, join mode and network ID;

8) Burst information configuration: Configure the Burst information of online devices, including;

9) Network monitoring: it can regularly refresh the network access status of the online device;

10) Other configuration: configure the RF information of the online equipment, which can modify the transmitting power (0 ~ 13 dBm);

5.2.1 Configuration Environment

1) PC with serial port, the operating system is Windows 2000 \ Windows XP \ Windows 7;

2) HART Modem and the serial port line;

5.2.2 Basic Information Configuration

The basic information of the wireless temperature transmitter can be read or modified through the Basic Information tab. Modifiable information include equipment short address, message, description, station number, date, assembly number; unmodifiable information include alarm selection, write protection, manufacturer ID, manufacturer, device type, device ID, long address and version information, as shown in Figure 5.2.

Figure 5. 2 Basic information

The information can be downloaded to the device by pressing the "Application" button.

1) The address selection range is 0~63;

2) Messages can enter up to 32 characters;

3) The description can enter up to 16 specified characters;

4) The maximum length of the label is 8 specified characters;

5) The date range is from 1,900 to 2,155;

6) The maximum length of the assembly number is 6 specified characters.

5.2.3 Sensor Configuration

The Sensor Information tab allows you to view the currently configured sensor information (upper, lower, minimum span) and the type, wire system, etc. of each sensor configured separately. As shown in Figure Figure 5.3.
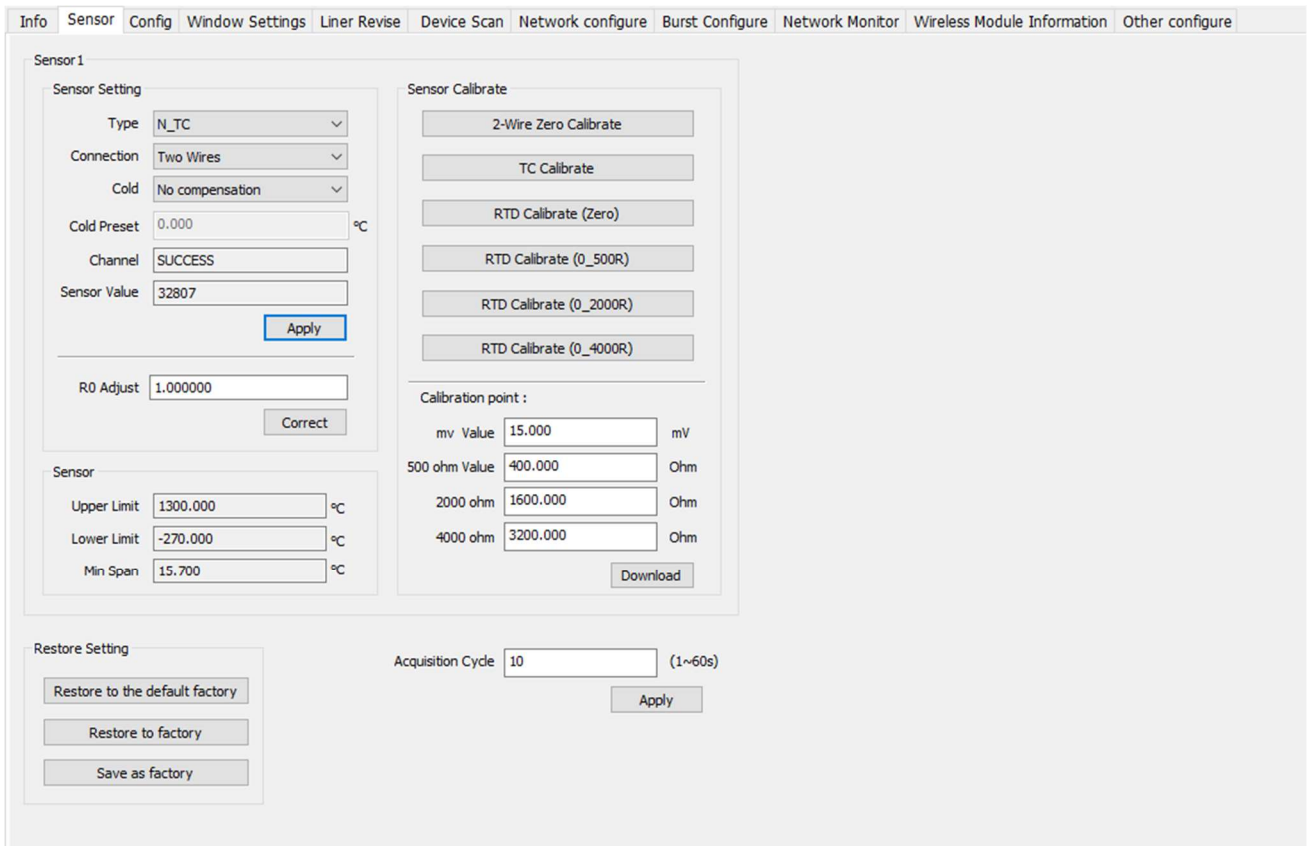

Figure 5. 3 Sensor configuration

Sensor type: Set the supported sensor models, see the table below:

Table 5. 1

Sensor type	Describe
0_500R	Resistance，(0 ~ 500) Ω
0_4000R	Resistance，(0 ~ 4000) Ω
CU50	Cu50
CU100	Cu100
PT100	PT100
PT200	PT200
PT500	PT500

PT1000	PT1000
100mV	mV voltage signal, range：(-100 ~ 100) mV
B_TC	B
E_TC	E
J_TC	J
K_TC	K
N_TC	N
R_TC	R
S_TC	S
T_TC	T

➢ Sensor type: including resistance (0_500 Ω, 0_4000 Ω), thermal resistance (Cu 50, Cu 100, Pt 100 and Pt1000), -100~ + 100 mV, thermocouple (B, E, J, K, N, R, S and T).

➢ Line system: can be set to 2,3,4 line system (resistance, thermal resistance signal), thermocouple for 2 line system. For sensor 2 can only be set to 2,3 wire system.

➢ Cold end compensation: it is only valid for thermocouples. It can be set to cold end prohibition, internal measurement, fixed value three ways. If the cold end is prohibited, the transmitter will not compensate the cold end; the temperature compensated by the cold end is provided by the internal temperature measuring chip; the temperature compensated by the cold end is the temperature set temperature;

➢ Channel status: display the sensor channel status (open circuit, short circuit, etc.).

➢ Sensor channel value: displays the original value of the sensor channel.

➢ R0 correction factor: correct the error of the sensor itself (range 0.9~1.1).

➢ Two-line zero calibration: when the temperature transmitter is connected to RTD in a 2-line system, in order to avoid the error caused by the resistance on the cable, you can short connect the sensor end, and then click the "two-line zero calibration" button to eliminate the error caused by the resistance on the cable.

➢ TC calibration: factory calibration of thermocouples and millivolt signals.

➢ RTD calibration: factory calibration of thermal resistance and resistance signals.

➢ Calibration point: the standard value used for the calibration of the transmitter.

➢ Restore factory default: click this button returns all data to the default factory state.

➢ Save as a factory value: click this button to save the current configuration as a factory value. When you click the"Restore Factory Settings"button again, it will be restored to this saved configuration.

➢ Restore the factory Settings: click this button to restore the data to the factory status. If the user has saved factory values, then returns to the user saved configuration; otherwise, returns to the default factory state.

➢ Acquisition period: configure the AD acquisition period, range (1 ~ 60) seconds.

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5.2.4   Configuration of Configuration Information

The configuration information of the card can be read or modified through the configuration information tab, including displaying the output variables of the device (main variable, cold end temperature value, battery voltage, primary variable percentage), the setting of the main variable information (damping value, unit, upper limit of range, lower limit of range), etc., as shown in Figure 5.3.
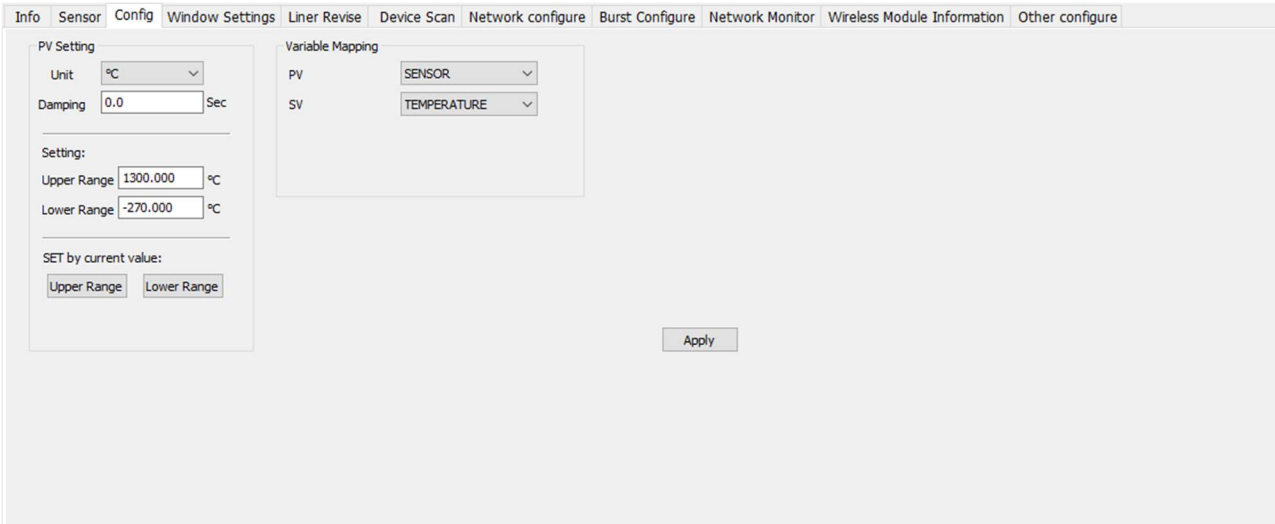

Figure 5. 4 Assembly information

➢   Damping: range from 0 to 32 seconds.

➢   Unit: the change of PV unit directly affects the variables associated with the unit, such as upper and lower limit of range, upper and lower limit of sensor, etc. When modifying the unit, the upper and lower limit of the main variable range cannot be modified at the same time, and should be modified respectively.

➢   The unit can be set to: ˚C, ˚F, ˚R, K, mV, Ohm。

➢   Upper range: upper limit of PV number.

➢   Lower range: lower limit of PV number.

The information can be downloaded to the device by pressing the Application button.

➢   Set the "Upper Range Limit" button with the current value: set the current PV value of the device to the upper limit of the main variable range, and the lower range is unchanged.

➢   Set the "Lower Range Limit " button with the current value: set the current PV value of the device to the lower limit of the main variable range, which may change the upper limit at the same time.

5.2.5   Interface Display Settings

Through the interface display setting card can read or modify the LCD configuration information, including select the set number (1~2), display time (20 seconds, 40 seconds, 60 seconds, and always bright), the interface shows the digits (display integer, two decimal, two decimal places) and display the source of the value (PV, SV, cancel display), as shown in Figure 5.5.
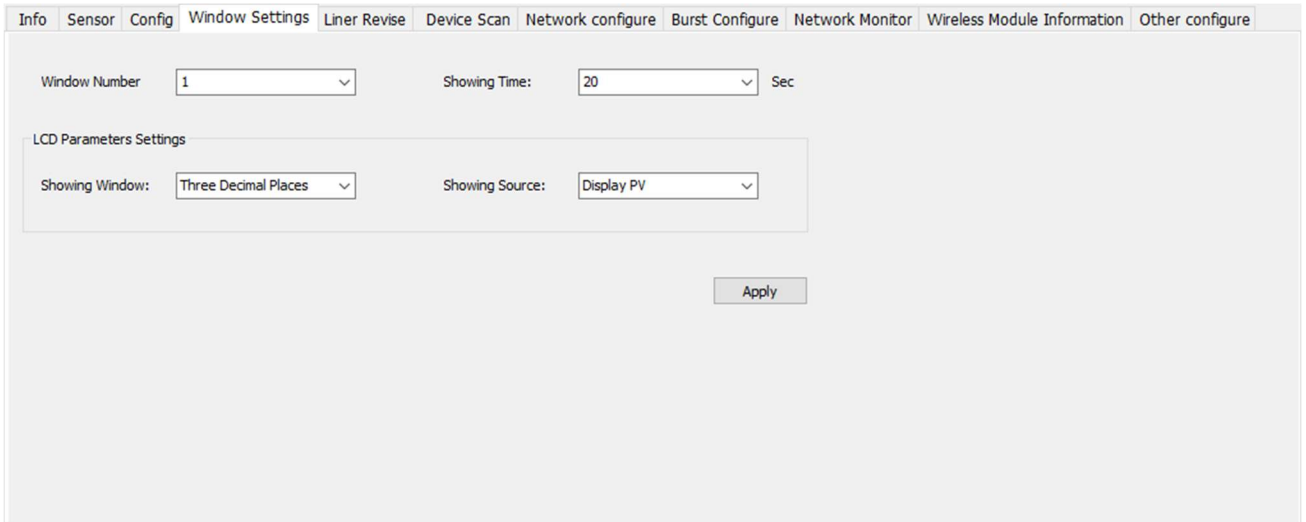
Figure 5. 5 Interface display settings

5.2.6 Linear Correction

Multi-point calibration of the sensor is possible through the linear correction function. The correction mode is the "Digital quantity" mode. The number of corrected points can be freely selected between 2~16 points. When the second multi-point calibration is required, click the "Restore Default" button for the next calibration.
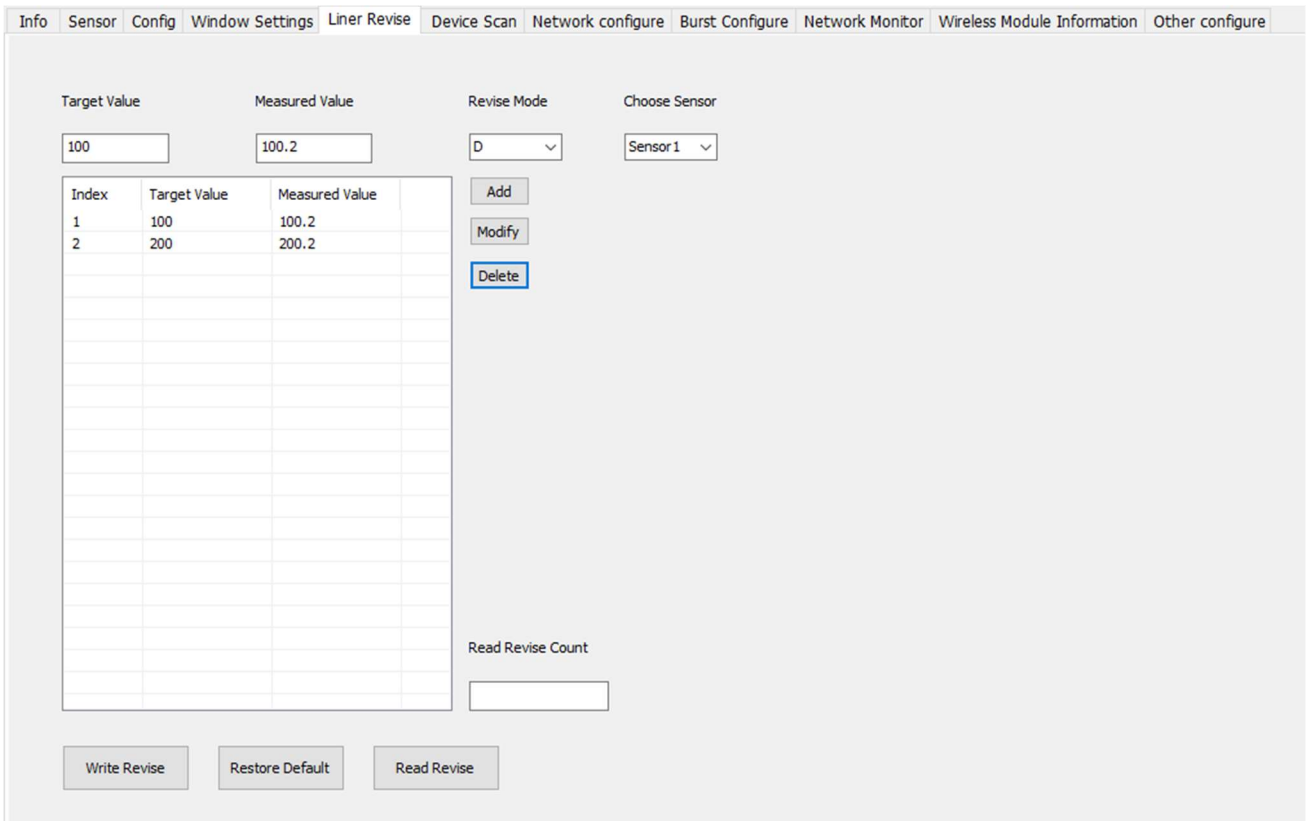

Figure 5. 6 Linear correction

5.2.7 Variable Monitoring

Through the variable monitoring tab, you can regularly refresh all the dynamic variables of the selected device and display the trend curve of the main variables of the current device. The current refreshed variables are: PV value, current value, battery voltage, and PV value range percentage.
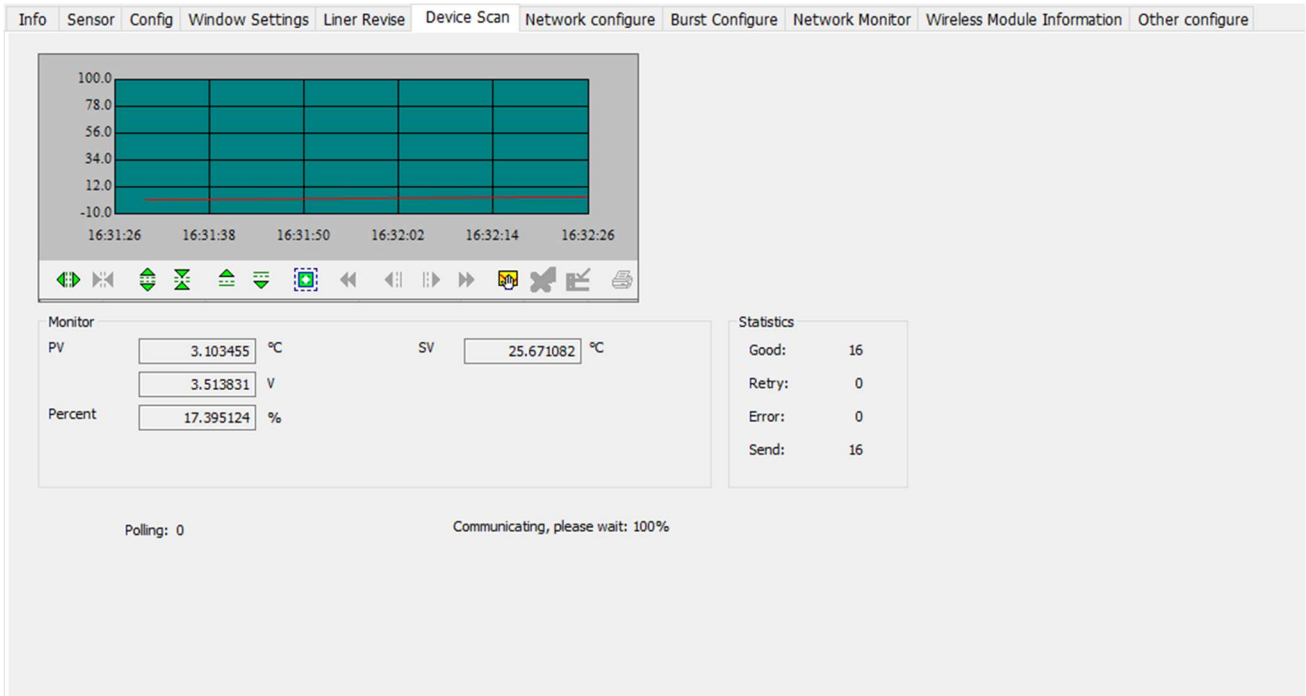
Figure 5. 7 Variable monitoring

5.2.8 Network Information Configuration

The input key and network ID of the network ID and entry key of the device must be consistent with the gateway (see G1100 WirelessHART Intelligent Gateway Manual for details). The network ID and entry key can be obtained from the Settings page in the intelligent wireless network, as shown in Figure 5. 8. Click "Network Information Configuration" of the configuration software, fill in the obtained accession key and network ID in the corresponding position, select the join mode is "Join now", and the device is ready to enter the network.
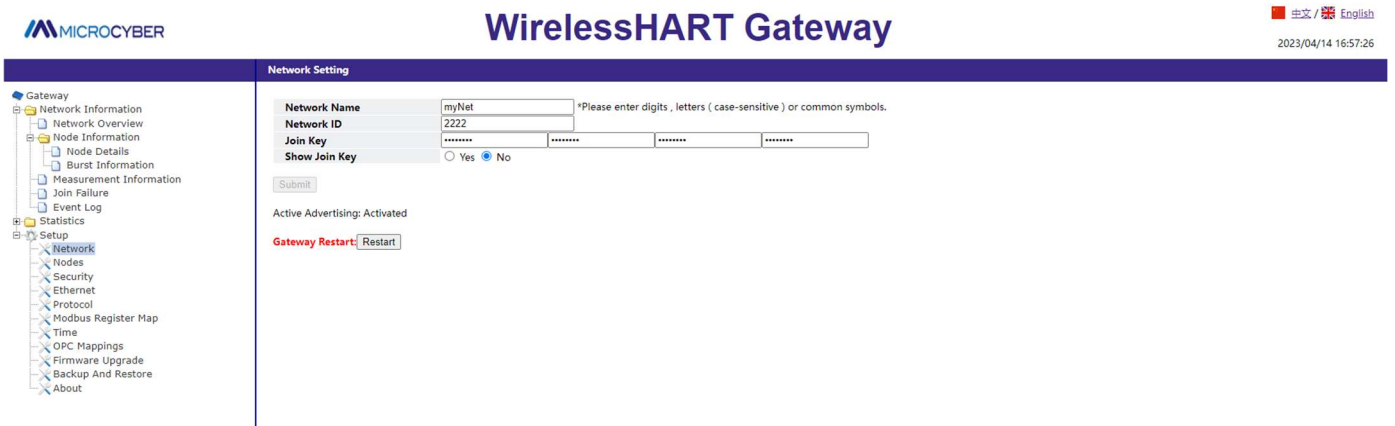

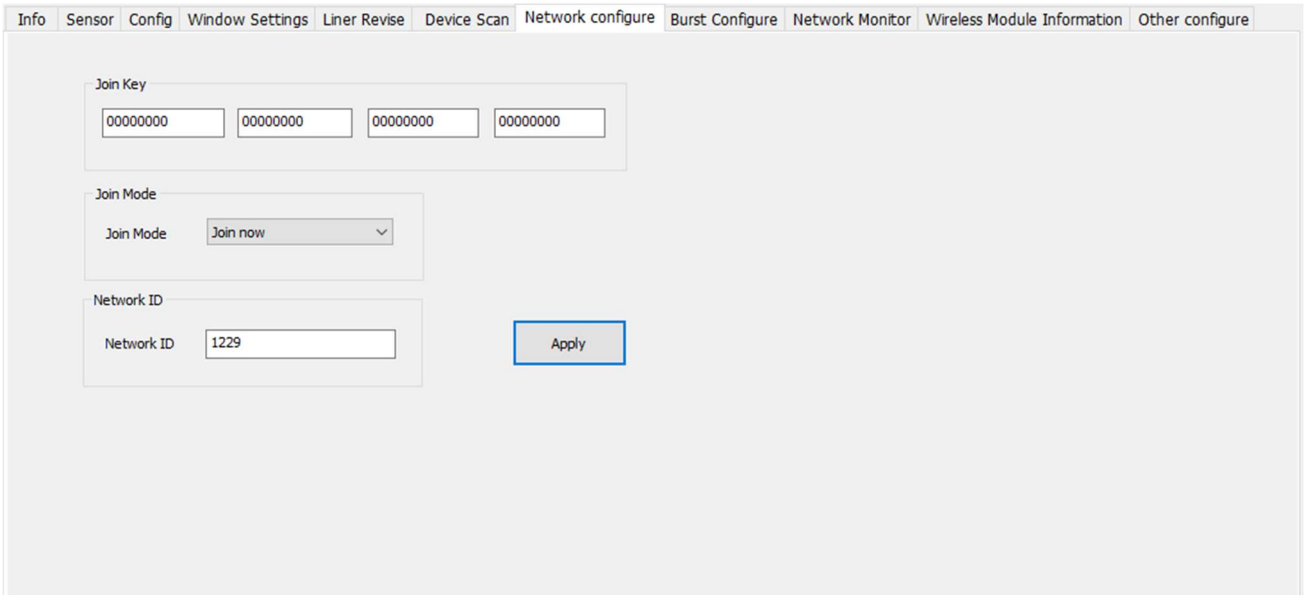Figure 5. 8 Wireless network information

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Figure 5. 9 Information configuration of the wireless network

5.2.9 Burst Configure

The wireless temperature transmitter uses Burst mode to regularly transmit the device data to the gateway, and Burst information can be configured in the WirelessHART-MPT configuration software and the wireless network network, as shown in Figure 5. 10. Burst messages support 0~34 messages, 4 message modes are independent of each other. The Burst cycle supports 1s, 2s, 4s, 8s, 8s, 16s, 32s and 60s~3600s. In the trigger box, the trigger mode and the device variables and units can be modified, and the wireless temperature transmitter only supports the continuous trigger mode. The device variable is only activated when the Burst command is 9, and you can modify the Burst transport variable. The command code supports six commands 1, 2, 3, 9, 33, 48. Switch Burst mode to ON and Burst mode on. When the device enters the network, open the Burst mode, need to wait for a certain delay start time.
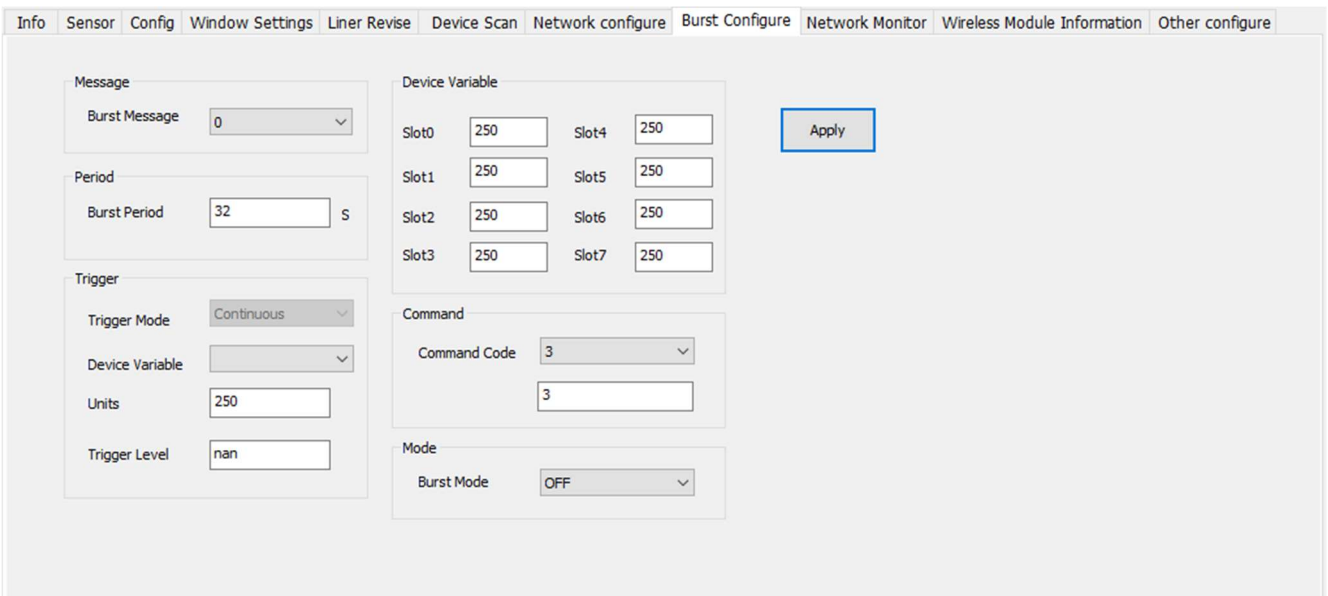

Figure 5.10 Burst configuration

5.2.10 Network Monitoring

To view the network status of the device, you can click on the network monitoring to view, as shown

in Figure 5. 11. The normal access process takes 2~5 minutes, and the length of access depends on the number of network equipment under the same network and the distance between the equipment and the gateway. When the infinite mode shows "Operational" in the status parameter bar, the device successfully enters the network. Entering the gateway page, you can see that the device has entered the network.
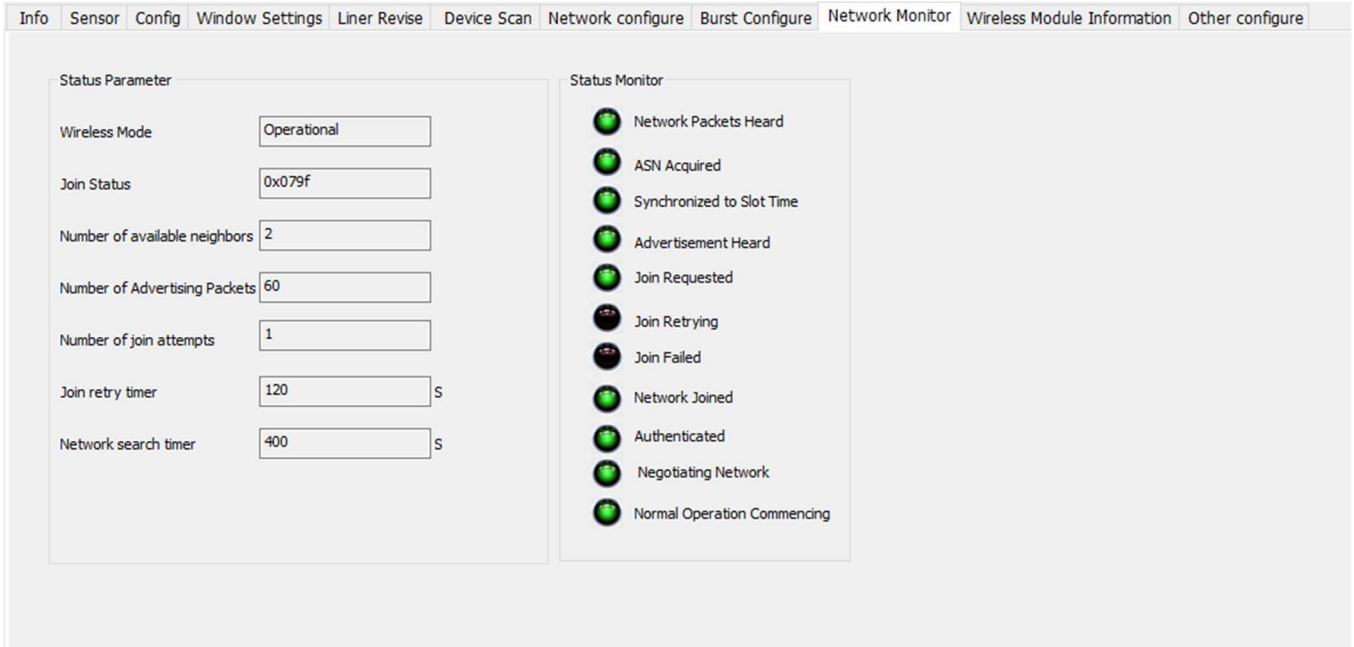
Figure 5.11 Network monitoring

5.2.11 Wireless Module Version Information

On this page, you can view the hardware and software version information of the wireless module.
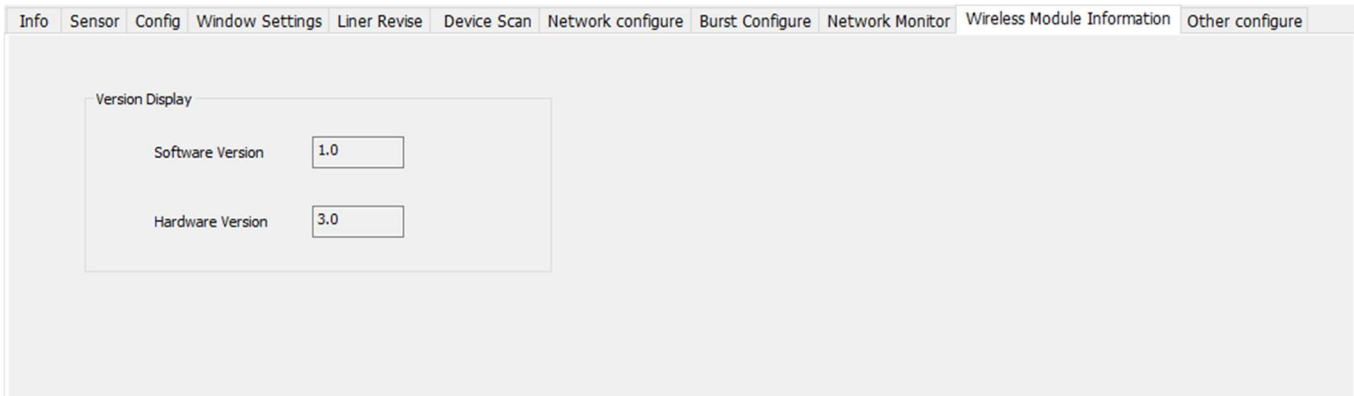
Figure 5.12 Wireless module version information

5.2.12 Other Configuration

Other configuration pages can be turned on or off the reception sensitivity. If the gateway is too far from the device or the signal strength is limited, the reception sensitivity can be turned on, and the transmission power is 10 dBm by default.

Figure 5. 13 Other configuration

Chapter 6. Field Configuration

6.1 LCD and Key Description

The wireless temperature transmitter is equipped with LCD liquid crystal and local keypad adjustment function, which allows the user to make rich parameter adjustments to the wireless temperature transmitter locally.

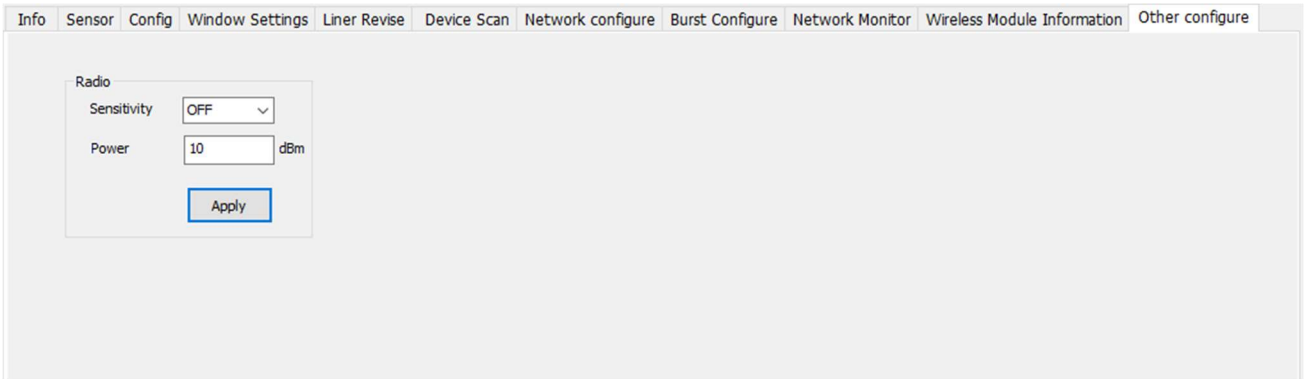LCD liquid crystal display for variable display, as shown in Figure 6.1
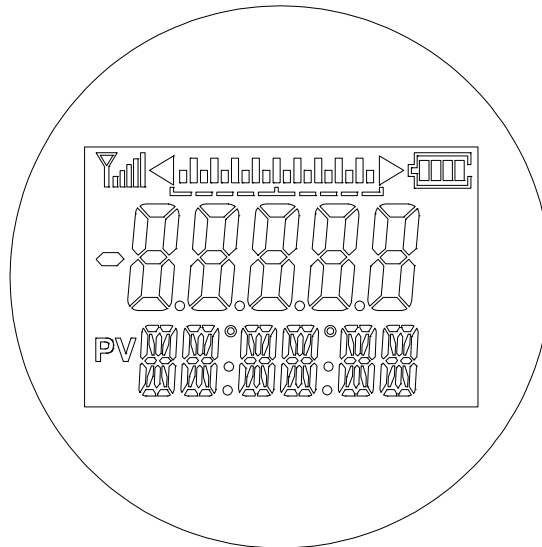
Figure 6.1 display information

The LCD display has six main components, as shown in the following table:

Table 6.1

No.	Display	Description
1		Wireless signal strength
2		Percentage of primary variables
3		Battery power
4		Temperature value
5	PV	Primary variable identification
6		Temperature unit

During normal operation, the LCD display will always show the temperature value (PV value). As shown below, the left side shows the display of wireless device without network (no signal strength display) and the right side shows the display of wireless device with network (signal strength display).

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Figure 6.2 Display schematic

There are 3 keys, [M], [S], [Z], [M] is the mode key, mainly responsible for "function selection", "cursor movement" and "OK". The [S] and [Z] keys are input adjustment keys, mainly responsible for "back and forth menu flip" and "the value of the addition and subtraction".

Figure 6.3 Function menu diagram

Figure 6.3

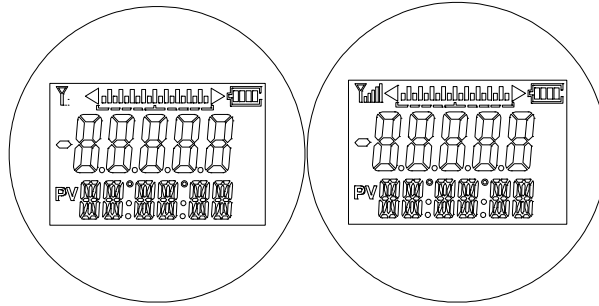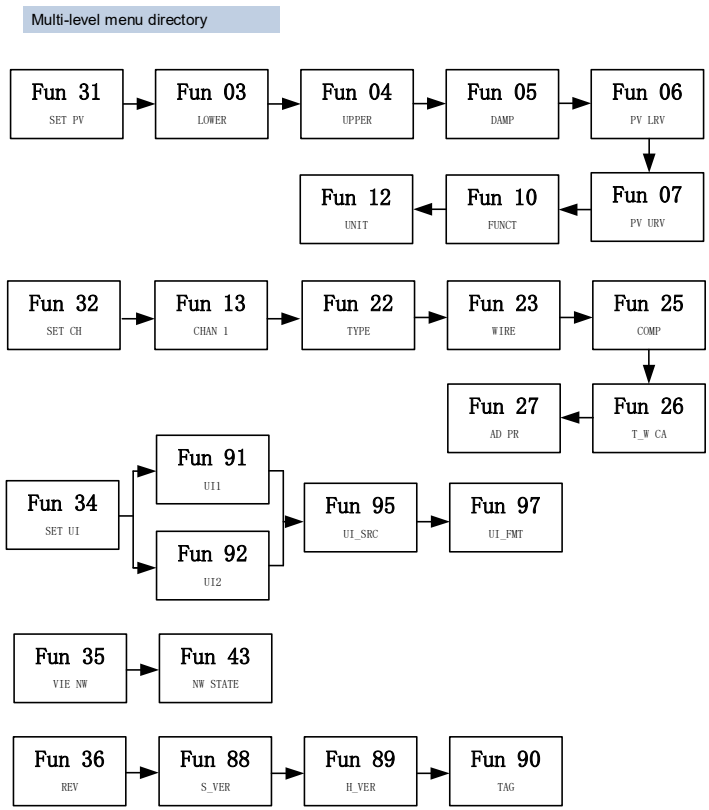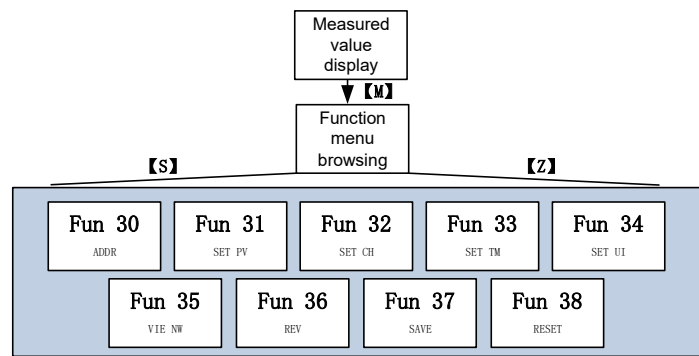| Main Menu Function Code	Main menu description	Submenu Function Code	Submenu function description
Fun30	Set short address	--	--
Fun31	Set PV parameters	Fun03	The current value is set to the lower limit of the PV range
		Fun04	The current value is set to the upper limit of PV range
		Fun05	Set the damping value of PV
		Fun06	Set the lower limit of PV range manually
		Fun07	Set the upper limit of PV range manually
		Fun10	Set the transfer function of PV
		Fun12	Set the unit of PV
Fun32	Set the parameters in the acquisition channel	Fun13	Select the desired channel to be set
		Fun22	Select the type of sensor to be connected to the acquisition channel
		Fun23	Select the wire system of the sensor connected to the acquisition channel
		Fun25	Set the cold end compensation
		Fun26	Set the two-line zero calibration
		Fun27	Set the acquisition period
Fun34	Display interface settings	Fun91	Set the display interface 1
		Fun92	Set the display interface 2
		Fun95	Setting the source of the displayed data
		Fun97	Set the number of bits of displayed data
Fun35	View wireless network information	Fun43	Checking the wireless network status
Fun36	View device information	Fun88	View software version information
		Fun89	View hardware version information
		Fun90	View short tag information

Chapter 7. Maintenance and repair

7.1 Battery Replacement

Under the reference conditions, the expected life of the power supply module is 3 years. When the power supply module needs to be replaced, perform the following steps.

1. Remove the back cover of the housing.

2. Unplug the power cord.

3. Replace the power supply module. 4.

4. Tighten the back cover of the housing and verify the operation.

7.2 Handling Precautions

The power supply module contains a 3.6V lithium battery that will not react under normal conditions as long as the battery and battery pack remain intact. Thermal damage, electrical damage or mechanical damage should be prevented. The contacts should be protected against premature discharge.

The power supply module should be stored in a clean and dry location. In order to maximize the service life of the power supply module, the storage temperature should not exceed 30 °C (86 °F). Care should be taken when handling and may be damaged if dropped from a height of more than 5 m (15 ft).

7.3 Environmental Considerations

As with any battery, local environmental regulations should be consulted for proper management of exhausted batteries. If there are no special requirements, recycling through a qualified recycling facility is recommended.

7.4 Shipping Precautions

This device is shipped to you without the power supply module connected. Please remove the power supply module before shipping the device.

7.5 Exception Handling

Phenomenon	Measurement
Maintenance port Unable to communicate	**Wireless Temperature Transmitter Connection** Check bus cable connection
	Network Connection Check network topology correctness

	Address error
	Wireless temperature transmitter factory default short address setting is 0. If you forget the previous setting after changing the address, click the full search on the configuration software, or log in the LCD to view the address information.
	Wireless temperature transmitter fault
	Replacement test with other wireless temperature transmitters.
	Battery failure
	Detection of battery depletion or abnormal battery supply line
Reading error or output alarm current	**Temperature transmitter connection problems**
	Check the sensor short circuit, open circuit, grounding and other problems
	Check the sensor for faults
	Noise interference
	Adjust the damping
	Check if the terminals are wet
	Check if the cable is laid away from strong interference sources
	Software setting
	Check for correct sensor type configuration
Unable to access the network	**Join-key error**
	The join key is not readable, i.e., the join key read back is all zeros, reconfigured according to the key information on the WirelessHART gateway
	Join mode error
	Select "Join now" for join mode
	Network ID error
	Reconfiguration based on network ID on WirelessHART gateway
	Poor signal
	Turn up the receive sensitivity in other configuration pages, but this operation will increase power consumption.

Chapter 8. Technical specifications

8.1 Basic Parameters

Table 8.1

Protocol	WirelessHART/HART
Input signal	Pt100,Pt1000,PT200,PT500,CU50,CU100,0～500Ω, 0～4000Ω;B E J K N R S T thermocouple, -100mV～100mV
RTD wiring method	2,3,4 wire
Battery	19000mAh/3.6V(Single unit)
Battery Life	3 years of battery life at 25℃ ambient temperature, update rate of 1 minute, and LCD off
Wireless Power	10mW(10dBm)
Wireless Transmission Distance	0~150m
Antenna Gain	5dBi
Antenna VSWR	≤2
Antenna Frequency Band	2400-2500MHz
Number of channels	Single Channel
Display	Segment LCD display
Temperature Range	Transmitter body working temperature: (-20～70) ℃
Storage Temperature	-40 ～ 85℃
Humidity Range	(0～95)%RH
Start-up time	≤5s
Burst update cycle	1~3600s user configurable
Damping Adjustment	Time constant 0~32s
Cold End Temperature	±0.5℃
Explosion	Ex d IIC T4 Gb (designed according to this standard, no

Protection Rating	certification)
Protection class	IP67
Electromagnetic compatibility	EN61326 standard

8.2 Technical specifications of RTD

● **RTD normal temperature accuracy index（25℃）**

Table 8.2. 1

Signal Type	Sensor range (℃)	Accuracy (25 ℃)	Temperature drift (per degree Celsius)
Resistance signal	0~500Ω	±0.04Ω	±0.001Ω
	0~4000Ω	±0.35Ω	±0.015Ω
PT100	-200 ~ 850℃	±0.15℃	±0.003℃
PT200	-200 ~ 850℃	±0.15℃	±0.005℃
PT500	-200 ~ 850℃	±0.15℃	±0.005℃
PT1000	-200 ~ 850℃	±0.15℃	±0.005℃
CU50	-50 ~ 150℃	±0.15℃	±0.005℃
CU100	-50~ 150℃	±0.10℃	±0.003℃

● **RTD Other technical specifications**

Table 8.2. 2

Wiring Method	2、3、4
Common Mode Rejection Ratio	≥70 dB(50 Hz and 60 Hz)
Differential mode rejection ratio	≥70 dB(50 Hz and 60 Hz)

8.3 Thermocouple technical specifications

● **Thermocouple temperature accuracy index (25℃)**

Table 8.3. 1

Signal Type	Sensor range (℃)	Accuracy (25 ℃)	Temperature drift (per degree Celsius)
mV	-100mV ~ +100mV	±0.025mV	±0.001 mV
B	500 ℃~ 1810℃	±0.77℃	±0.050℃
E	-200 ℃~ 1000℃	±0.20℃	±0.025℃

J	-190 ℃~ 1200℃	±0.35℃	±0.01℃
K	-200℃ ~ 1372℃	±0.40℃	±0.025℃
N	-190℃ ~ 1300℃	±0.50℃	±0.015℃
R	0℃ ~ 1768℃	±0.75℃	±0.023℃
S	0 ℃~ 1768℃	±0.70℃	±0.023℃
T	-200℃ ~ 400℃	±0.35℃	±0.015℃

- **Other technical specifications of thermocouple**

Table 8.3. 2

Sensor Type	B,E,J,N,K,R,S,T;(-100~100)mV
Common Mode Rejection Ratio	≥70 dB(50 Hz and 60 Hz)
Differential Mode Rejection Ratio	≥70 dB(50 Hz and 60 Hz)

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