MICROCYBER

NCS-TT306H Series
HART Temperature Transmitter
User Manual

Warning

1. Users are prohibited from disassembling and assembling the temperature transmitter by themselves.
2. Users are asked to check whether the power supply voltage of the temperature transmitter meets the power supply voltage requirements in the user manual.

Disclaimer

The contents of this manual have been checked for consistency with the hardware and software described. Since errors cannot be completely ruled out, absolute consistency cannot be guaranteed. However, we will regularly check the data in this manual and make necessary corrections in subsequent editions. Any suggestions for improvements are welcome.

Microcyber Corporation 2026

V2.0

Technical data are 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.

Content

1 Overview

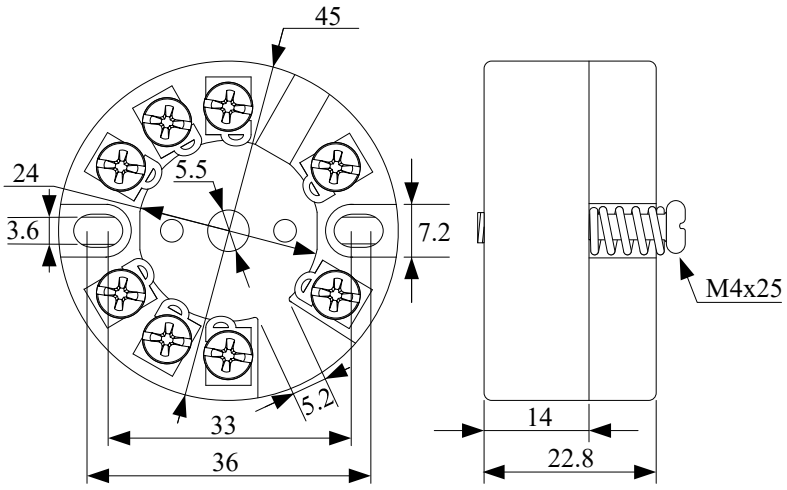
NCS-TT306H series HART temperature transmitter is a high-precision, low-temperature drift, and high-reliability product, including head-mounted NCS-TT306H and rail-mounted NCS-TT306H-R. It is indispensable in process control. Field equipment. The device integrates a wealth of functional modules, which can not only implement general detection functions, but also implement complex control strategies.

NCS-TT306H adopts digital technology and can be applied to a variety of thermal resistance and thermocouple sensors. It has a wide range and a simple interface between the field and the control room, and can greatly reduce installation, operation and maintenance costs.

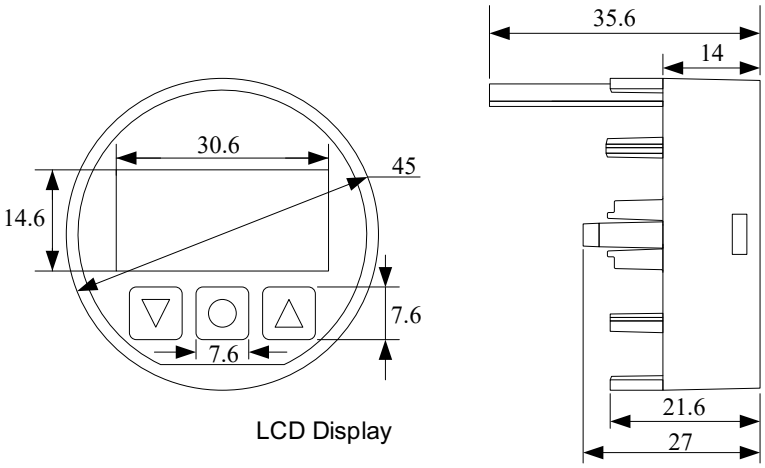
NCS-TT306H series temperature transmitter supports 4-20mA+HART protocol and LCD display, and can be widely used in petroleum, chemical, electric power, metallurgy and other industries.

2 Temperature Transmitter Installation

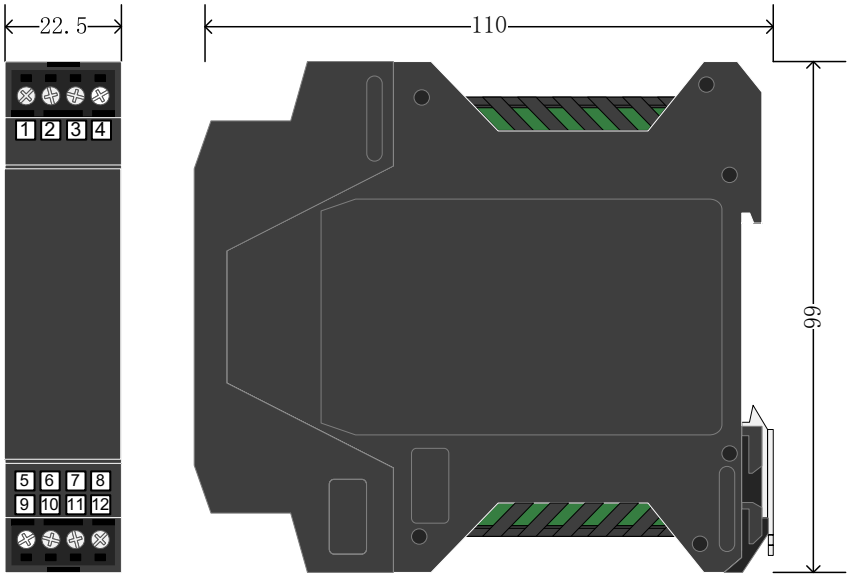
2.1 Dimension



NCS-TT306H head mounted



LCD Display



NCS-TT306H-R Rail Installation

Figure 2.1 Temperature transmitter size (unit: mm)

2.2 Installation

Fix the temperature transmitter to the temperature housing or guide rail through the positioning holes with two screws.

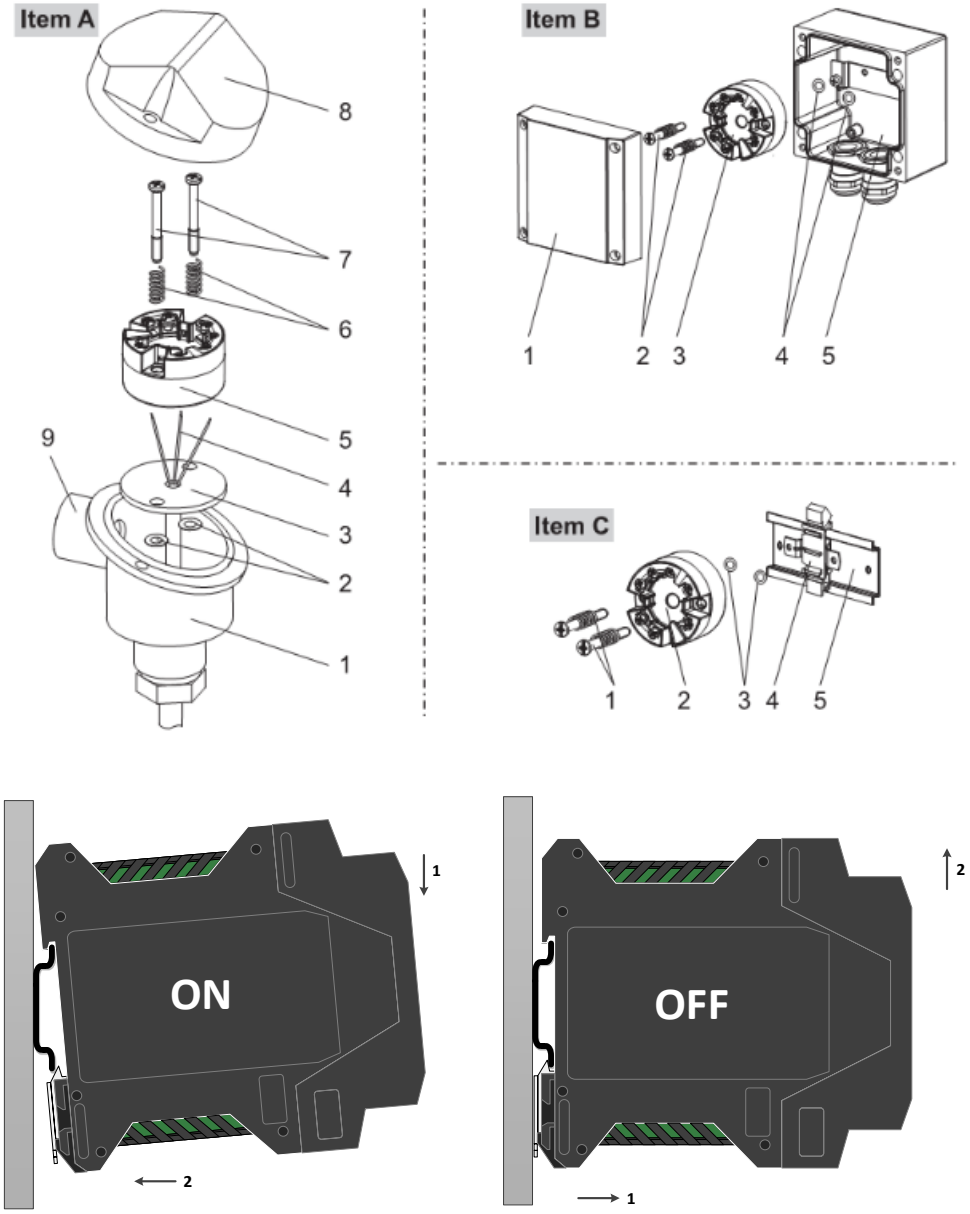
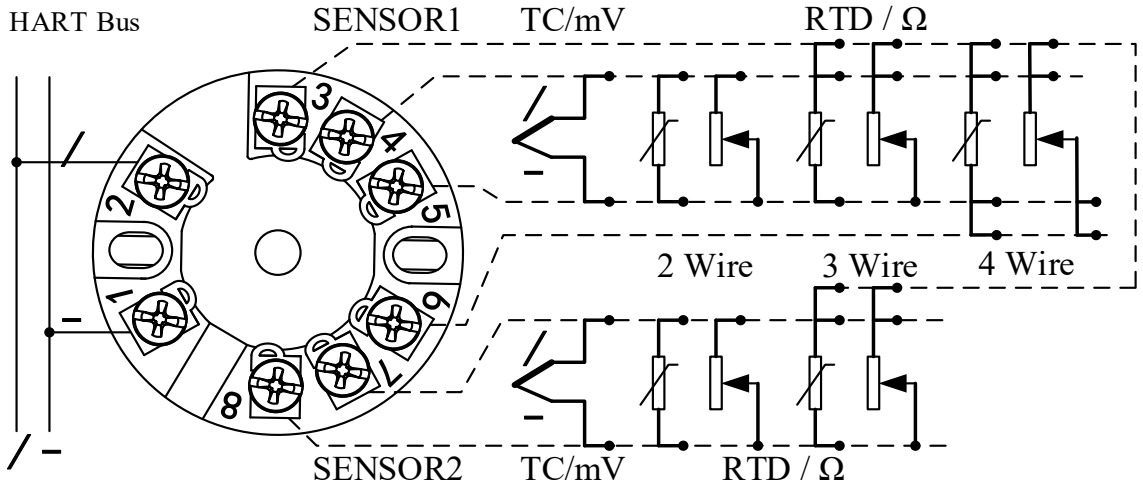
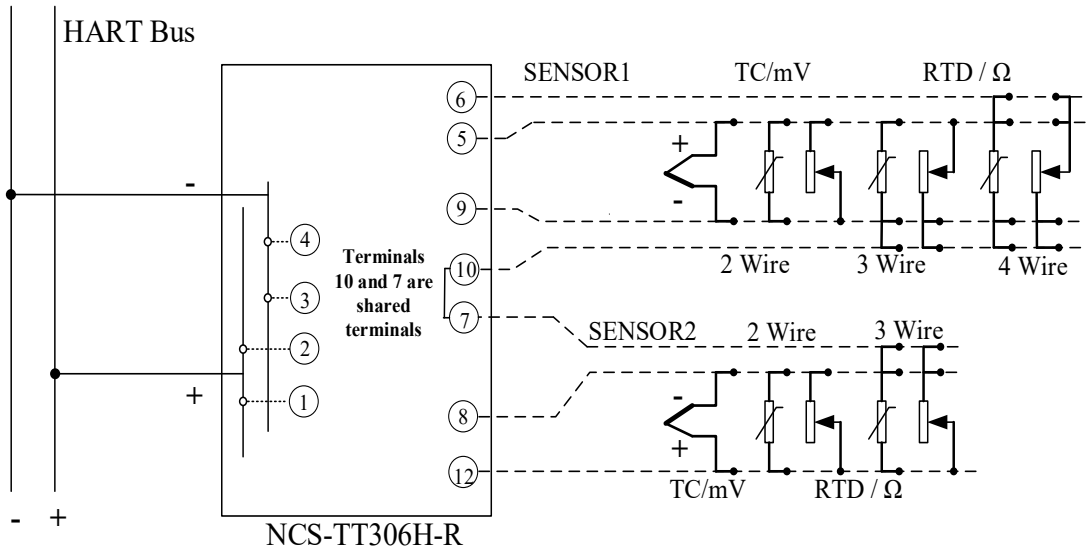


Figure 2.2 Temperature transmitter installation diagram

2.3 Wiring

Dual-channel wiring diagram:





Single-channel wiring diagram:

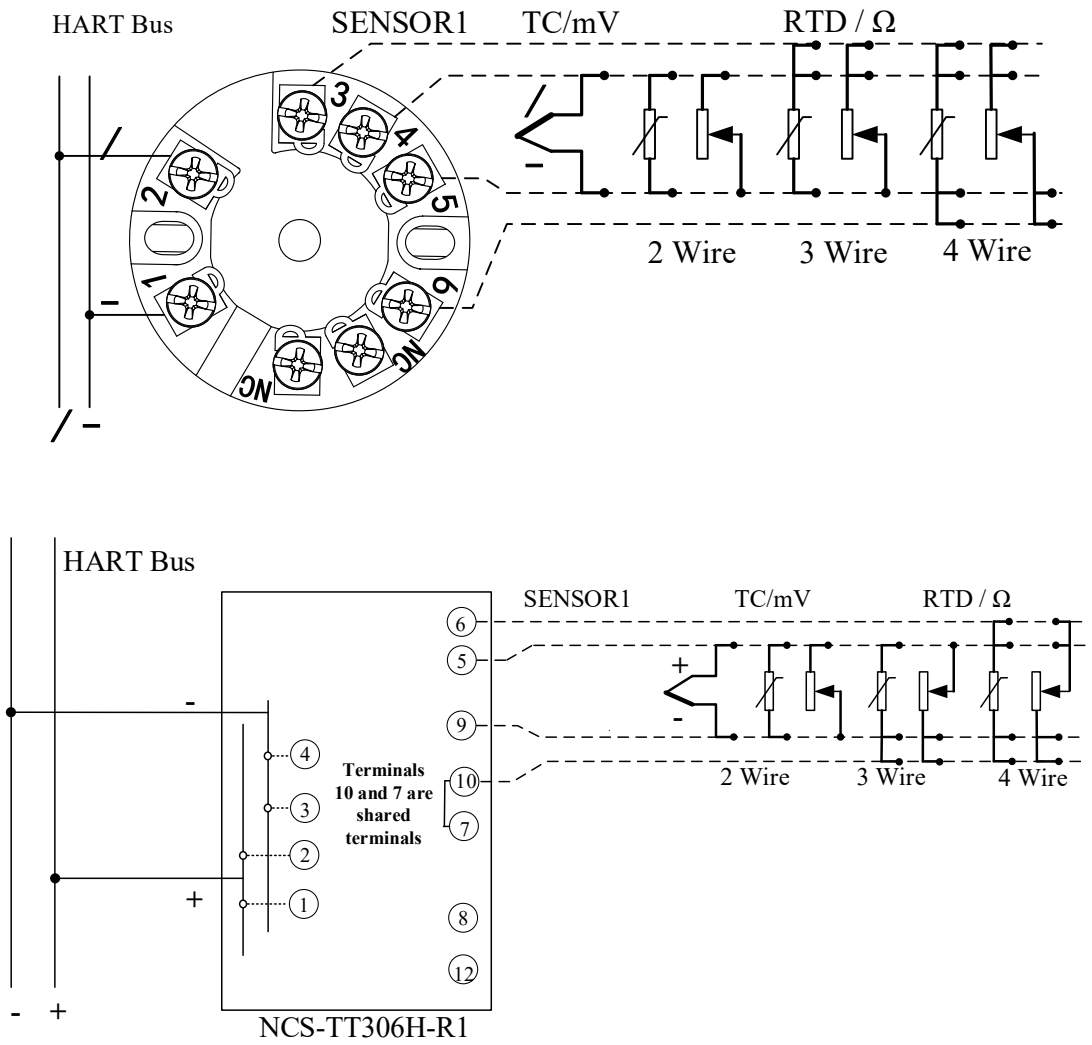


Figure 2.3Temperature transmitter wiring diagram

Note: When the sensor type for channel 1 is set to 0-40000R two-wire mode, terminals 3 and 4 should be short-circuited; when the sensor type for channel 2 is set to 0-40000R two-wire mode, terminals 3 and 7 should be short-circuited.

The power supply and bus signal of the temperature transmitter share a pair of cables, which are called bus cables. It is recommended to use the dedicated fieldbus cable recommended by IEC61158-2. Signal cables and bus cables should not share conduits or open wire troughs with power cords of other equipment, and should be kept away from high-power equipment. The shielded wires at both ends of the bus are grounded using single-ended grounding.

Note: The DIP switches on the back of the LCD display are reserved and have no actual function.

3 HART Temperature Transmitter Configuration

3.1 Topological Connection

The topological connection methods of the NCS-TT306H series HART temperature transmitter can be divided into two types: 4~20mA compatible mode and networking mode.

3.1.1 4~ 20mA Compatibility Mode

The NCS-TT306H series HART temperature transmitter 4-20mA compatible mode topology connection diagram is shown in Figure 3.1.

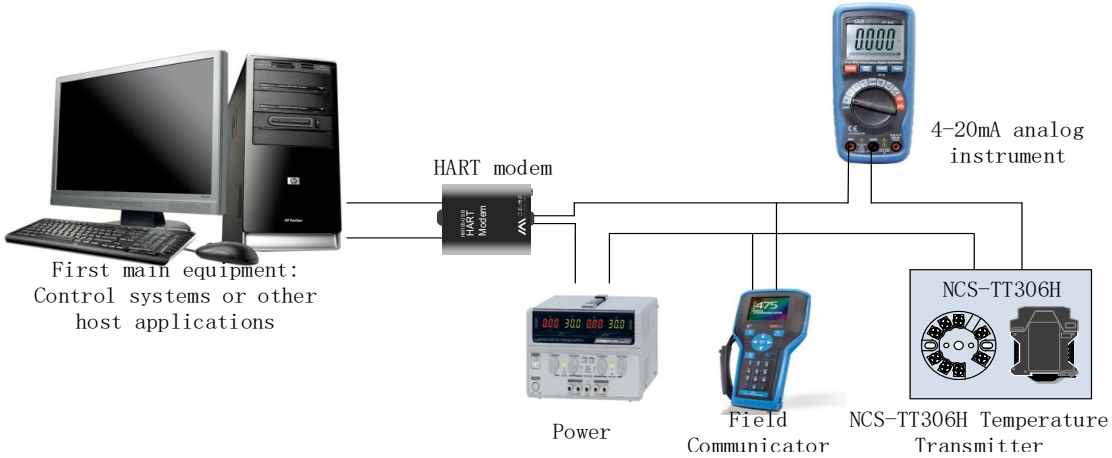


Figure 3.1 4~20 mA Compatibility mode topology diagram

Features:

(1) Connect to the upper-level control system through HART communication equipment

(2) Analog and digital communication methods are shared

(3) The short address of the HART slave device is 0

3.1.2 Networking mode

The topology connection diagram of the NCS-TT306H series HART temperature transmitter network mode is shown in Figure 3.2.

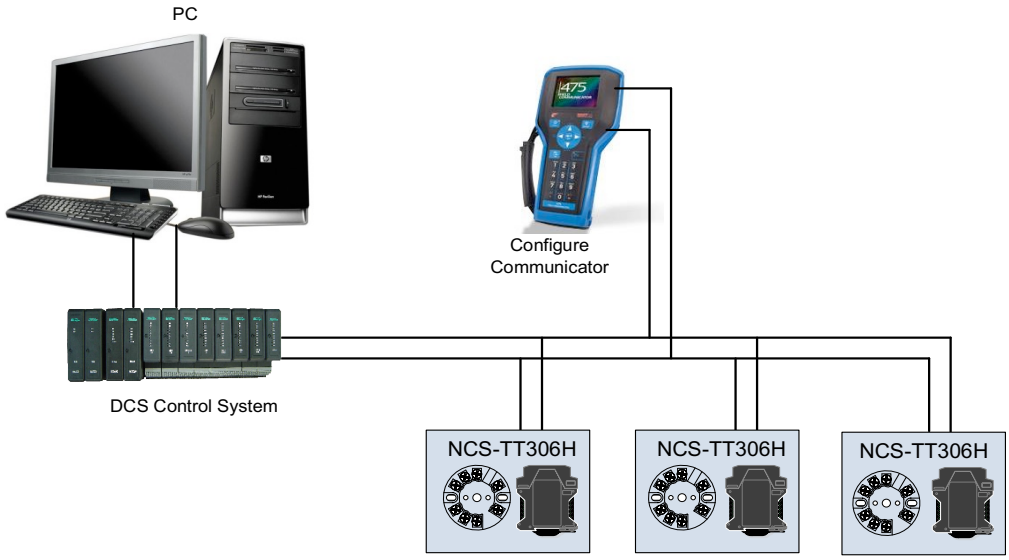


Figure 3.2 Networking mode topology diagram

Features:

(1) Connect to the upper-level control system through HART communication equipment

(2) Only use the digital function of the HART system, and the current on the line is fixed at 4mA

(3) HART7.0 supports up to 64 (polling address 0~63) device networking

3.2 Function Configuration

The NCS-TT306H series HART temperature transmitter supports the HartMPT configuration software of Microcyber, the SDC625 of the HART Foundation and other general HART configuration software for configuration and debugging. The following mainly uses the HartMPT configuration software of Microcyber as an example to introduce the configuration method of the temperature transmitter. It mainly includes the following functions:

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

(2) Configuration information configuration: configure the configuration information of online equipment, including main variable range, damping and other information

(3) Sensor information configuration: Configure sensor information of online devices, including type, wire system and other information

(4) Current calibration: The (4~20) mA current of online equipment can be calibrated, and a fixed current output can also be set

(5) Variable monitoring: All dynamic variables of the selected online equipment can be refreshed regularly and the trend curve of the main variable of the current equipment can be displayed

(6) LCD display settings: You can set the LCD display interface content and display mode

(7) Linear correction: The sensor can be calibrated at multiple points to further improve measurement accuracy

(8) Burst configuration: The temperature transmitter supports the Burst function and can configure Burst related parameters

(9) Diagnostic settings: Alarm levels can be set for parameters such as under-range limit, over-range limit, and equipment over-temperature.

(10) SIL settings: Allows control of entering and exiting SIL mode, etc.

3.2.1 Configure Environment

(1) PC with serial port, operating system is Windows XP\Windows 7\Windows 10

(2) HART Modem and serial port cable

(3) Matching resistance (230~550) Ω

3.2.2 Basic Information Configuration

The basic information of the temperature transmitter can be read or modified through the Basic Information tab. Modifiable information includes device short address, message, description, station number, date, assembly number; non-modifiable information includes alarm type, write protection, manufacturer ID, manufacturer, device type, device ID, long address and version information, as shown in Figure 3.3.

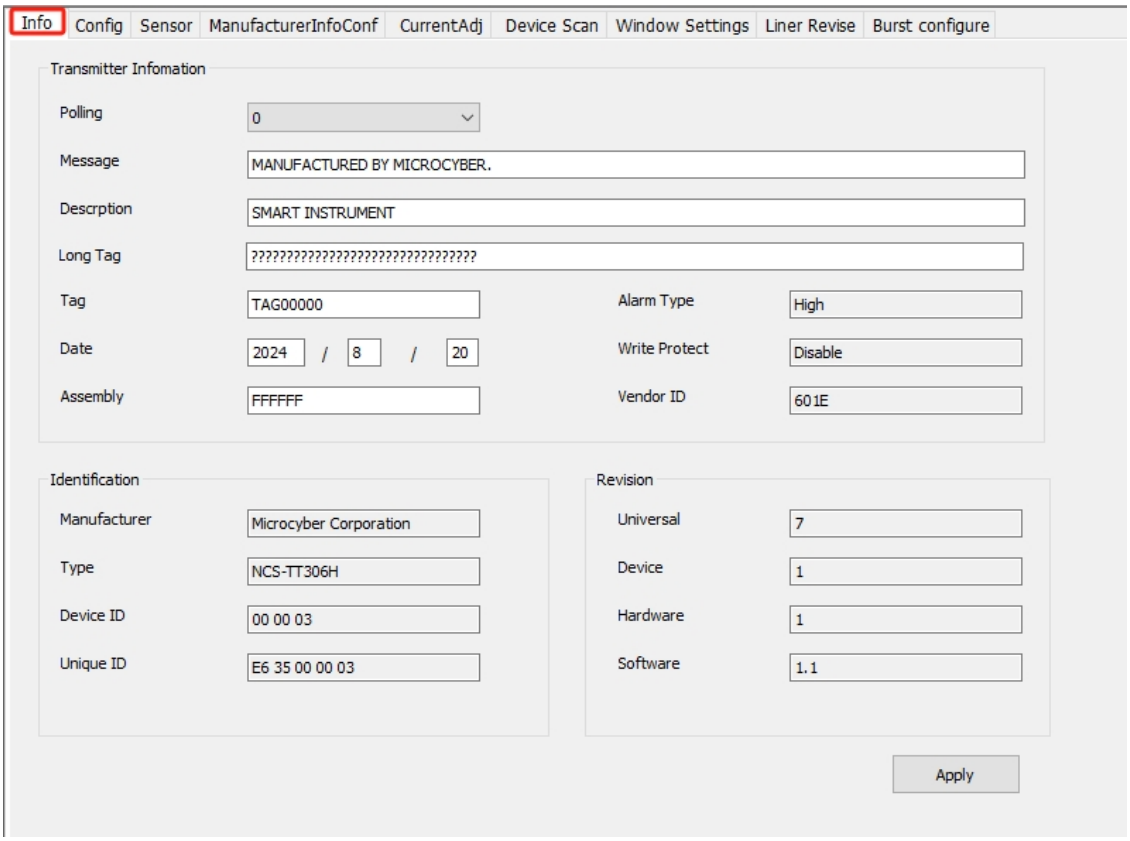


Figure 3.3 Basic information configuration interface

After the information is modified, you can press the "Apply" button to download it to the device.

(1) The address selection range is 0~63

(2) A maximum of 32 characters can be entered in the message

(3) A maximum of 16 specified characters can be entered in the description

(4) The maximum length of the workstation number is 8 specified characters

(5) The maximum length of a long station number is 32 specified characters

(6) Date range 1900 to 2155

3.2.3 Configuration Information Configuration

The configuration information of the temperature transmitter can be read or modified through the configuration information tab, including main variable settings (damping value, unit, upper limit of range, lower limit of range), dynamic variable mapping settings (main variable, cold end temperature value, current value, percentage), alarm current settings (alarm type, high alarm current value, low alarm current value), saturation current settings (high saturation current value, low saturation current value) and current inversion output settings, etc., as shown in the figure As shown in 3.4.

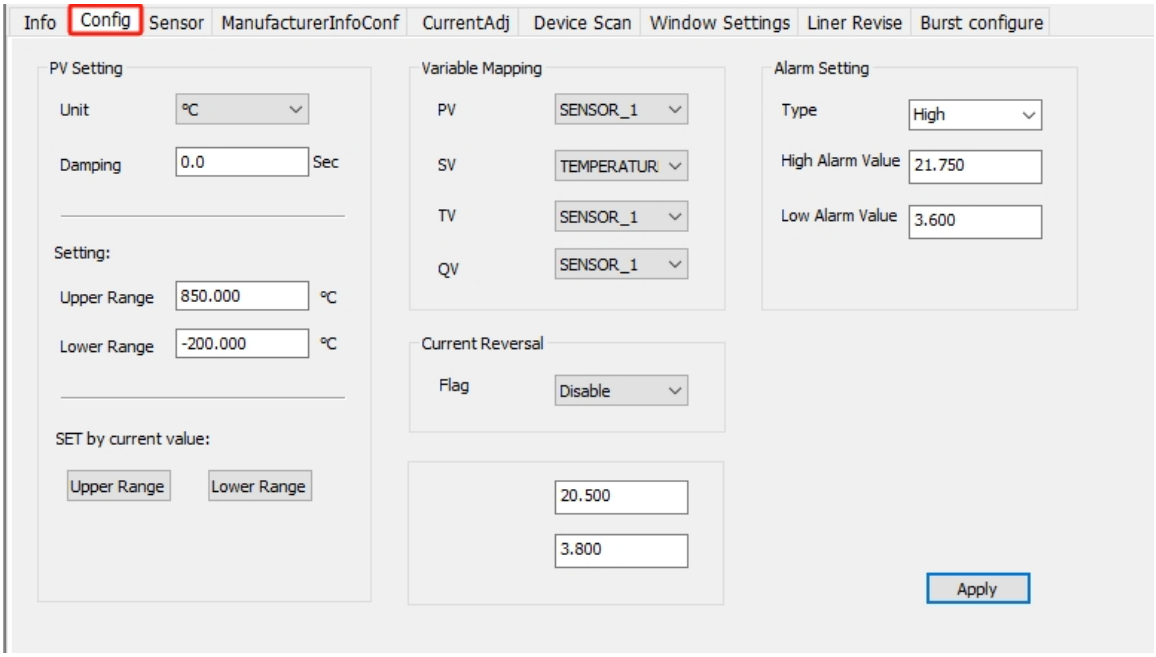


Figure 3.4 Configuration information configuration interface

- Unit setting: Supports ˚C, ˚F, ˚R, K, mV, Ohm and other unit settings. The change of PV unit directly affects the variables related to the unit, such as the upper and lower limits of the measuring range, the upper and lower limits of the sensor, etc. When modifying the unit, the upper and lower limits of the main variable range cannot be modified at the same time, but should be modified separately.
- Damping: range 0~32 seconds
- Maximum range: PV value corresponding to 20 mA output current
- Lower limit of range: PV value corresponding to 4 mA output current
- Use the current value to set the "upper limit of range" button: Set the current PV value of the device to the upper limit of the main variable range, and the lower limit of the range remains unchanged
- Use the current value to set the "lower limit of range" button: Set the current PV value of the device to the lower limit of the main variable range. This operation may also change the upper limit
- Dynamic variable mapping: supports SENSOR_1, SENSOR_2, ambient temperature, two-channel average, two-channel difference, two-channel sum value variable mapping dynamic variables
- Current reversal setting: The output current of the temperature transmitter can be reversed by setting the flag bit. For example, the current output current of the temperature transmitter is 4mA. After the current reversal flag is enabled, the output current of the temperature transmitter becomes 20mA
- Alarm type: high alarm and low alarm
- Alarm value: When the alarm type is high alarm, the alarm current can be set in the range 21.00mA to 23.00mA; when the alarm type is low alarm, the alarm current can be set in the range

3.50mA to 3.70mA

- Saturation current setting: The saturation current value can be set, the high saturation current setting range is 20.00mA to 20.8mA; the low saturation current setting range is 3.75mA to 4.0mA
- After modifying the information, press the "Apply" button to download the information to the device

3.2.4 Sensor Configuration

Through the sensor configuration tab, you can view and configure the sensor information of the temperature transmitter (upper limit, lower limit, minimum span), two-channel sensor configuration (sensor type, wire system), and cold junction compensation method (when the sensor type is a thermocouple) , correction coefficient R0, hot backup setting, calibration point setting, temperature transmitter calibration, temperature drift setting, viewing temperature drift diagnostic information, recovery settings, etc. As shown in Figure 3.5.

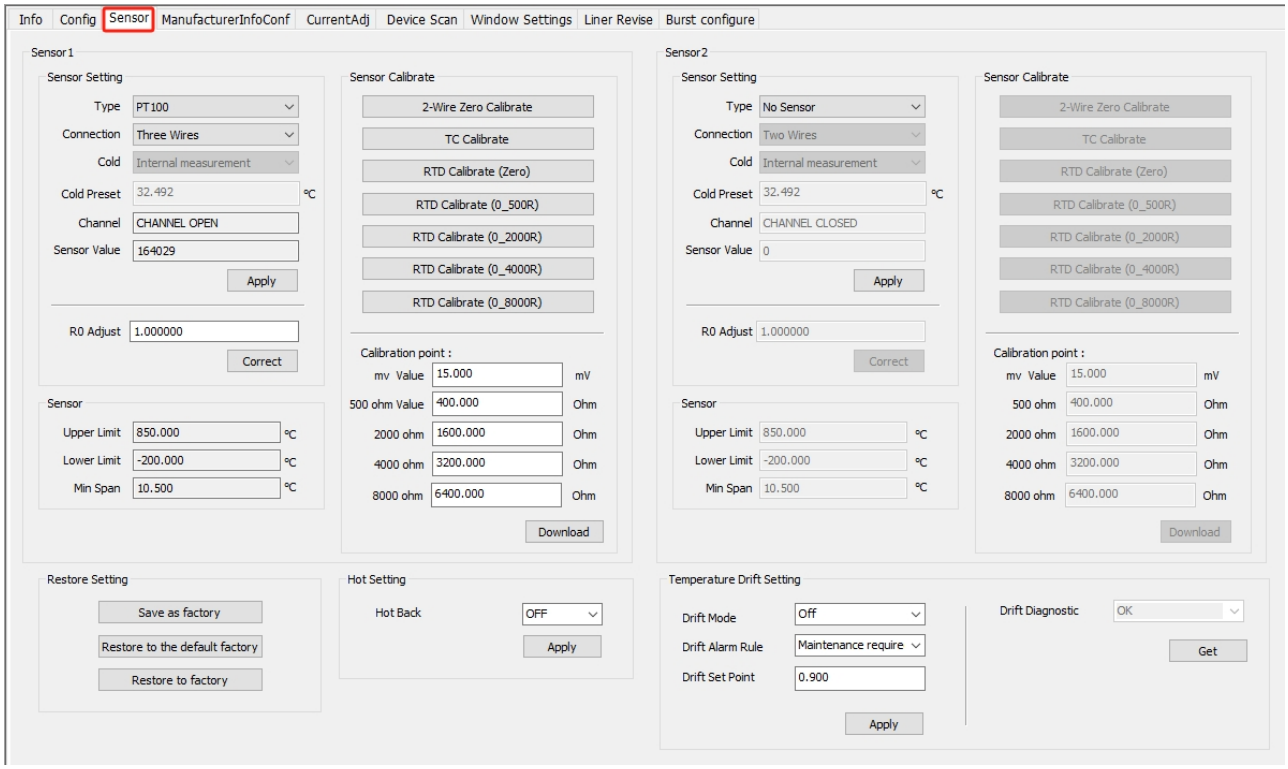


Figure 3.5 Sensor configuration interface

The sensor types supported by the temperature transmitter are shown in the table below:

Sensor type	Description
0_500R	resistance（0 ~ 500) Ω
0_2000R	resistance（0 ~ 2000) Ω
0_4000R	resistance（0 ~ 4000) Ω
0_40000R	resistance（0 ~ 40000) Ω
Cu50	Cu50
Cu50_GOST	Cu50_GOST
Cu100	Cu100
Cu100_GOST	Cu100_GOST

Pt50_GOST	Pt50_GOST
Callendar_Van_Dusen(PT100)	Callendar_Van_Dusen(PT100)
Pt100	Pt100
Pt100_GOST	Pt100_GOST
Pt200	Pt200
Pt500	Pt500
Pt1000	Pt1000
Ni50	Ni50
Ni100	Ni100
Ni120	Ni120
Ni1000	Ni1000
100MV	Millivolt voltage signal, range: -100 ~ 100 mV
B_TC	B thermocouple
E_TC	E thermocouple
J_TC	J thermocouple
K_TC	K thermocouple
N_TC	N thermocouple
R_TC	R thermocouple
S_TC	S thermocouple
T_TC	T thermocouple
L_GOST	L_GOST thermocouple
A（W5ReW20Re）	A（W5ReW20Re）thermocouple
C（W5ReW26Re）	C（W5ReW26Re）thermocouple
D（W3ReW25Re）	D（W3ReW25Re）thermocouple
NiCrAuFe	NiCrAuFe thermocouple
CuAuFe	CuAuFe thermocouple

- Sensor type setting: Supported sensor types are listed in the table above. For the Callendar_Van_Dusen (PT100) sensor type, the coefficients are defined as follows: R0: nominal resistance at 0°C, A: linear temperature coefficient, B: quadratic term (curvature) coefficient, C: cubic term coefficient; the Alpha, Beta, and Delta coefficients can be accurately converted from the A, B, and C coefficients.
- Wire system setting: Sensor one can be set to 2, 3, or 4 wire system (resistance, thermal resistance signal), thermocouple is 2 wire system; sensor two can be set to 2, 3 wire system
- Cold junction compensation setting: valid when the sensor type is thermocouple. It can be set to four modes: cold junction prohibition, internal measurement, fixed value and sensor 2 measurement. Cold junction is prohibited, the temperature transmitter will not compensate the cold junction; internal measurement, the temperature of cold junction compensation is provided

by the internal temperature measurement chip; fixed value, the temperature of cold junction compensation is the externally set temperature; sensor 2 Measurement, the temperature compensated by the cold end is the measured value of sensor 2. At this time, sensor 2 should be connected to Pt100 or other types of thermal resistance sensors

- Channel status: displays the sensor channel status (open circuit, short circuit, fault, etc.)
- Sensor channel value: displays the original collection value of the sensor channel
- R0 correction coefficient: corrects the error of the sensor itself (range 0.9~1.1)
- View the upper and lower limits of sensor range: View the upper and lower limits of the maximum range supported by the currently set sensor type
- Two-wire zero point calibration: When the temperature transmitter is connected to the RTD in a 2-wire system, in order to avoid errors caused by the resistance on the cable, you can short-circuit the sensor end, and then click the 'Two-wire zero point calibration' button. Eliminate errors caused by resistance on the cable
- TC calibration: Factory calibration of thermocouples and millivolt signals
- RTD calibration: Factory calibration of thermal resistance and resistance signals, including zero point calibration and full point calibration:
- Calibration point setting: You can set the calibration point values of resistance signal and mV signal
- Hot backup setting (applicable to dual-channel systems only): When hot backup is enabled, if the PV is mapped to sensor 1, sensor 2 acts as the backup; if the PV is mapped to sensor 2, sensor 1 acts as the backup; this achieves channel redundancy functionality.
- Temperature drift setting (applicable to dual-channel systems only): Set parameters related to sensor drift diagnosis
- Corrosion Detection Enable Setting: Clicking the "Enable" button will activate corrosion detection, and the interface will display the corrosion detection wire resistance limit setting window; clicking "Disable" will deactivate corrosion detection.
- Corrosion Detection Wire Resistance Limit Setting: Thermoresistor (4-wire system): The wire resistance limit can be set from 5Ω-250Ω; Thermocouple: The wire resistance limit can be set from 5Ω-10000Ω, with default values of 50Ω for thermoresistors and 5000Ω for thermocouples. Sensor 1 supports corrosion detection in both thermoresistor (4-wire system) and thermocouple modes; Sensor 2 (applicable to dual-channel systems only) supports corrosion detection in thermocouple mode.
- Save as factory values: Click this button to save the current configuration information as factory values. When you click the "Restore Factory Settings" button again, the configuration information saved this time will be restored
- Restore factory default values: Click this button and all data will be restored to the default factory state
- Restore factory settings: Click this button to restore data to factory settings. If the user has saved the factory values, it will be restored to the configuration saved by the user; otherwise, it

will be restored to the default factory state

Hot Backup Function:

The hot backup function is applicable to dual-channel devices.

Loop Current:

For a dual-channel temperature transmitter, when the hot backup function is enabled, and the PV is mapped to sensor 1, sensor 2 acts as a backup. If sensor 1 fails (open circuit or short circuit) and sensor 2 is functioning normally, the loop current will be based on sensor 2. When the PV is mapped to sensor 2, sensor 1 acts as a backup. If sensor 2 fails (open circuit or short circuit) and sensor 1 is functioning normally, the loop current will be based on sensor 1.

PV Value:

For a dual-channel temperature transmitter, when the hot backup function is enabled, and the PV is mapped to sensor 1, sensor 2 acts as a backup. If sensor 1 fails (open circuit or short circuit) and sensor 2 is functioning normally, the PV value will be the value of sensor 2. When the PV is mapped to sensor 2, sensor 1 acts as a backup. If sensor 2 fails (open circuit or short circuit) and sensor 1 is functioning normally, the PV value will be the value of sensor 1.

When hot backup is enabled, sensor 1 and sensor 2 can act as backups for each other. When the PV is mapped to sensor 1, enabling hot backup allows sensor 2 to act as a backup for sensor 1; when the PV is mapped to sensor 2, enabling hot backup allows sensor 1 to act as a backup for sensor 2.

Backup:

PV is Sensor 1	Sensor 1 Normal	Sensor 1 Fault
Sensor 2 Normal	☒	☑
Sensor 2 Fault	☒	☒

When the PV is mapped to sensor 1, if sensor 1 fails while sensor 2 is functioning normally, the PV mapping automatically switches to sensor 2. The PV value then becomes the value from sensor 2, and the loop current becomes the current value corresponding to sensor 2.

PV is Sensor 2	Sensor 1 Normal	Sensor 1 Fault
Sensor 2 Normal	☒	☒
Sensor 2 Fault	☑	☒

When the PV is mapped to sensor 2, if sensor 1 is functioning normally and sensor 2 is faulty, the PV mapping automatically switches to sensor 1. The PV value will be the value from sensor 1, and the loop current will be the current value corresponding to sensor 1.

Recovery:

PV is Sensor 1	Sensor 1 Normal	Sensor 1 Fault
Sensor 2 Normal	☑	☒
Sensor 2 Fault	☑	☒

When PV is mapped to Sensor 1, as long as Sensor 1 returns to normal operation, regardless of whether Sensor 2 is normal or faulty, the PV mapping automatically switches to Sensor 1. The PV value will be the value of Sensor 1, and the loop current will be the current value corresponding to Sensor 1.

PV is Sensor 2	Sensor 1 Normal	Sensor 1 Fault
Sensor 2 Normal	☑	☑
Sensor 2 Fault	☒	☒

When PV is mapped to Sensor 2, as long as Sensor 2 returns to normal operation, regardless of

whether Sensor 1 is normal or faulty, the PV mapping automatically switches to Sensor 2. The PV value will be the value of Sensor 2, and the loop current will be the current value corresponding to Sensor 2.

Temperature Drift Detection Function:

The temperature drift detection function is applicable to dual-channel devices.

When the drift mode is set to "Out Band," and the absolute value of the difference between the two channels is greater than the drift setpoint, the device will alarm; when the drift mode is set to "In Band," and the absolute value of the difference between the two channels is less than the drift setpoint, the device will alarm.

Example:

Sensor 1 is configured for 0-500Ω, 2-wire system, with an external 250Ω resistor; Sensor 2 is configured for 0-500Ω, 2-wire system, with an external 100Ω resistor.

No	Drift Mode	Drift Warning Rules	Drift Setpoint	Drift Diagnosis	Loop Current
1	Close	None	None	None	None
2	Out Band	Out of specification	100	(S)Sensor Drift	Normal
			300	OK	Normal
		Maintenance required	100	(M)Sensor Drift	Normal
			300	OK	Normal
		Failure	100	(F)Sensor Drift	Alarm
			300	OK	Normal
3	In Band	Out of specification	100	OK	Normal
			300	(S)Sensor Drift	Normal
		Maintenance required	100	OK	Normal
			300	(M)Sensor Drift	Normal
		Failure	100	OK	Normal
			300	(F)Sensor Drift	Alarm

3.2.5 Current Calibration

Enter the current calibration tab to calibrate the 4-20mA output current of the temperature transmitter. The calibration steps are as follows:

(1) To connect the circuit, an ammeter with an accuracy of more than five and a half digits needs to be connected in series to the output circuit of the equipment

(2) Set the polling address of the device to 0, see Basic Information Configuration. If the polling address is already 0, you can skip this step

(3) Enter the current calibration tab

(4) Select "Current Value" as 4 mA. After the ammeter is stable, enter the ammeter reading in the "Adjustment Value" text box and click the "Apply" button

(5) Select "Current Value" as 20 mA. After the ammeter is stable, enter the ammeter reading in the "Adjustment Value" text box and click the "Apply" button

(6) Select "Current Value" as blank so that the current output by the device is calculated according to the PV value

Note: When the current value output by the device is a high alarm current, the 4 mA cannot be calibrated; when the current output current value of the device is a low alarm current, the 20 mA cannot be calibrated;

The temperature transmitter supports fixed current output mode. The operation steps are as follows:

(1) The user can configure the fixed current output in the current calibration tab. After clicking "Manual Send", enter the current value that the device will output in the text box next to it, and click "Enter/Exit Fixed Current Mode" to realize fixed output writing. Input current value function

(2) Users can also choose 3.8mA, 4.0mA, 8mA, 12mA, 16mA, 20mA, 21mA and other options, and click "Enter/Exit Fixed Current Mode" to realize the fixed current output function

When the temperature transmitter is running continuously, it continuously compares the main variable value with the upper and lower limit values of the measuring range. When the main variable value exceeds the upper and lower limit range of the measuring range, the temperature transmitter outputs a fixed current to indicate that the main variable exceeds the measuring range. When the main variable is higher than the upper limit value, the temperature transmitter output is fixed at 20.8 mA; when it is lower than the lower limit value, the temperature transmitter output is fixed at 3.8 mA.

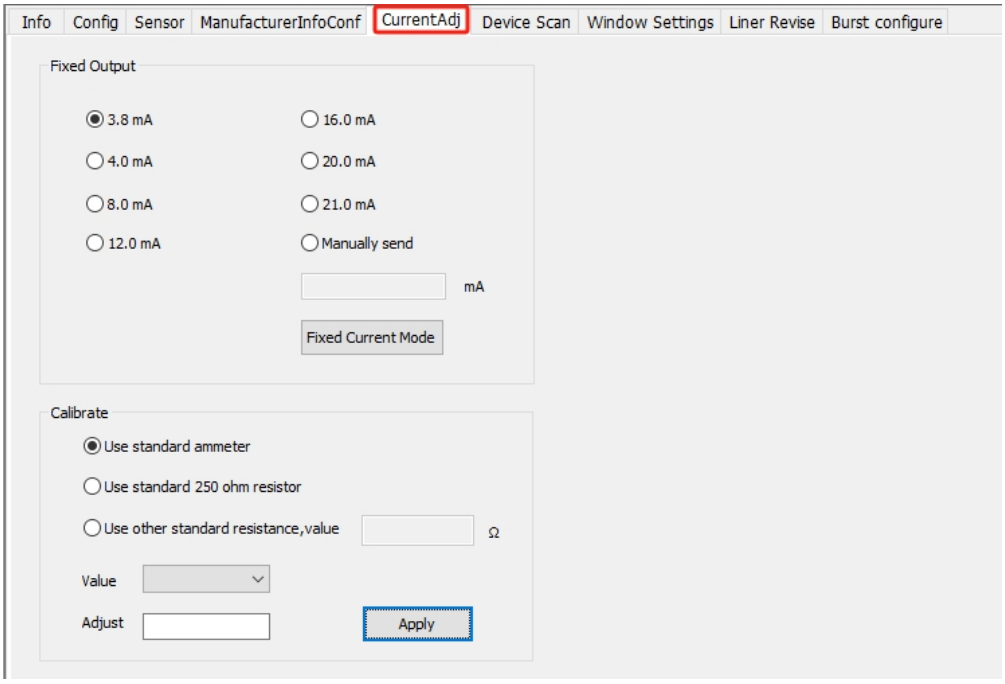


Figure 3.6 Current calibration interface

Note: Calibration current and fixed current output functions can only be performed when the device's polling address is 0. Other polling addresses are in fully digital communication mode, and the error message "Command execution failed" will be prompted.

3.2.6 Variable monitoring

Through the variable monitoring tab, you can regularly refresh all dynamic variables of the selected device and display the trend curve of the current device's main variables. The variables that support refresh are: PV value, current value, percentage, and cold end temperature.

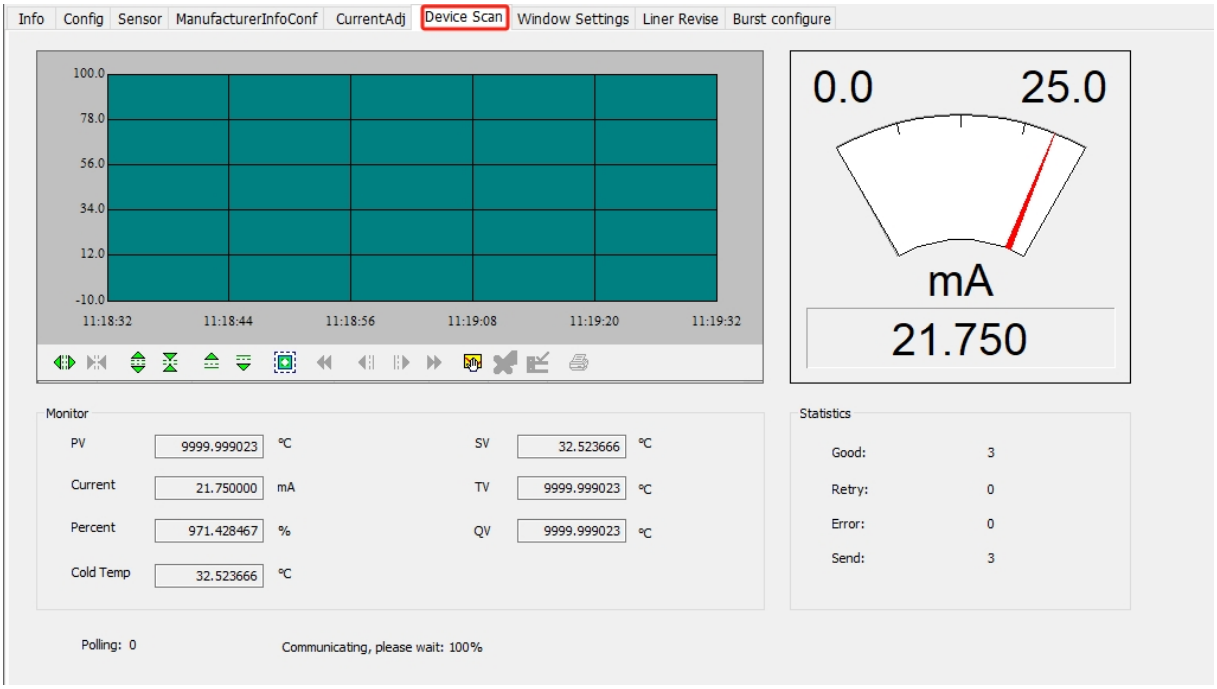


Figure 3.7 Variable monitoring interface

3.2.7 LCD display settings

The LCD display content of the temperature transmitter can be set through the LCD display setting tab, including the number of display screens, display time, display format, display source and display inversion settings, etc. The interface display interface is shown in the figure below.

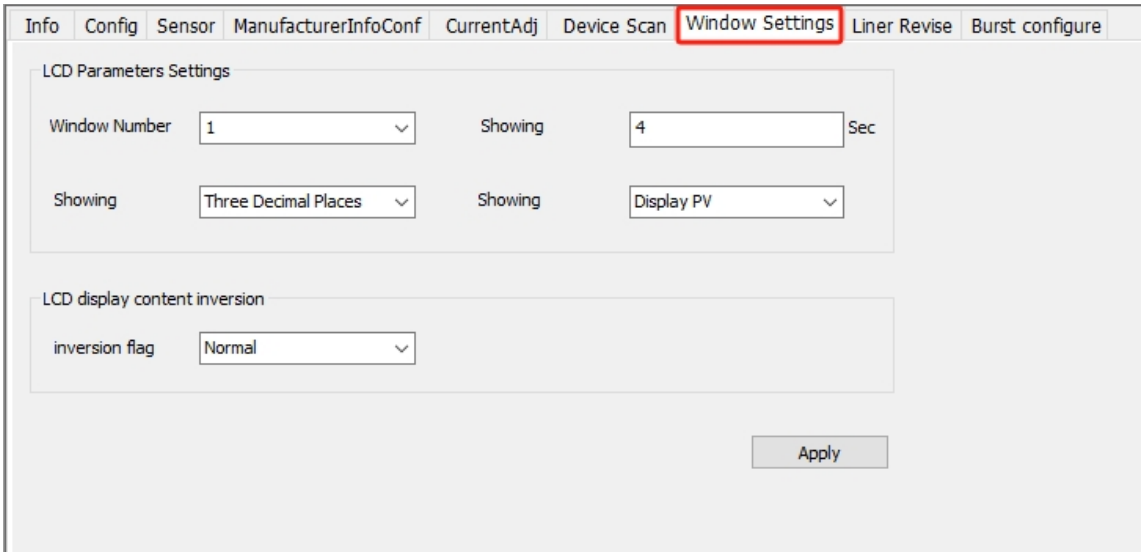


Figure 3.8 LCD Display

- Number of display screens: supports up to 4-screen LCD interface rotation display, which can be set to 1-4
- Display time: Set the display time of each LCD screen, the setting range is 4-60 seconds
- Display format: Set the number of decimal points displayed on the LCD
- Display source: Set the display data source of the LCD screen
- Display inversion: Set whether the LCD display content is inverted

Note: The NCS-TT306H-R rail mounting version does not support LCD display and you can ignore this feature.

3.2.8 Linear Revise

The sensor can be multi-point calibrated through the Liner Revise tab. Two correction methods are available: "Analog" and "Digital." The number of correction points can be freely selected between 1 and 16. When performing a second multi-point calibration, you must click the "Restore Default" button before proceeding with the next calibration.

The default values for the 16 digital points are based on 16 correction points within the range of -200 to 850, and will not change with changes in the range. If the upper and lower limits of the range are modified to other values, the 16 digital correction points need to be manually adjusted.

The 16 analog values are calculated based on the range of -200 to 850. If the upper and lower limits of the range are modified to other values, the 16 analog correction points need to be manually adjusted.

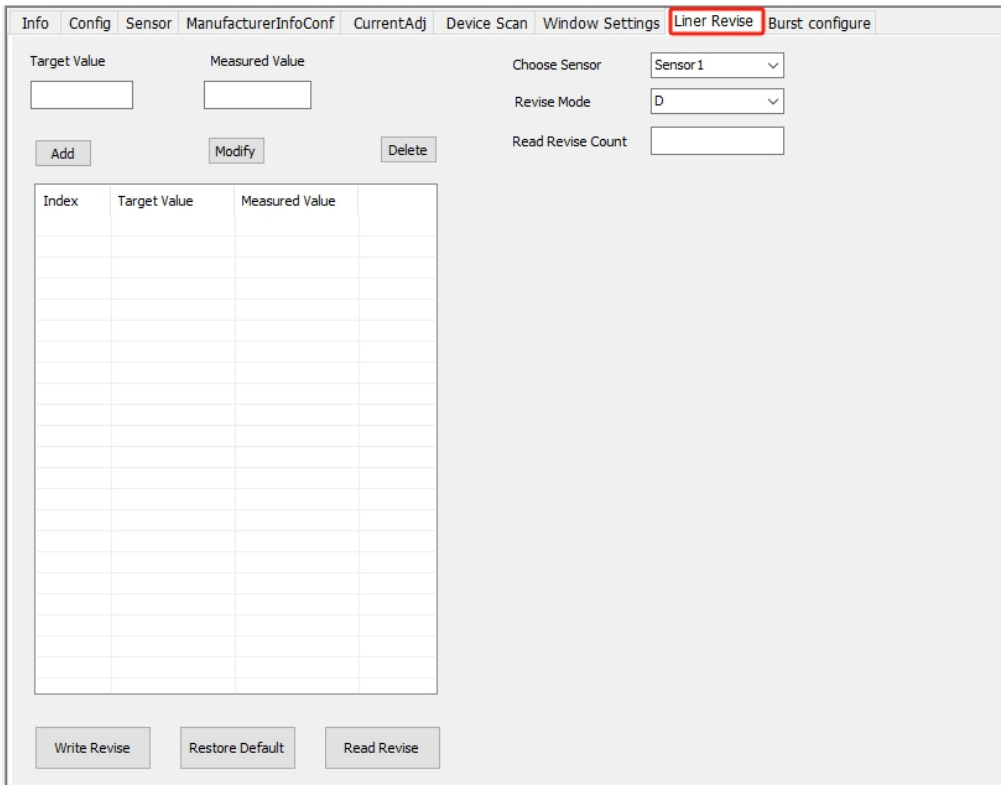


Figure 3.9 Linear correction

- Select Sensor: You can select Sensor 1 and Sensor 2; selecting Sensor 2 is suitable for dual-channel devices;
- Revise Mode: You can select digital or analog;
- Read Revise Count: Displays the number of revision points read. A total of 16 points are

supported;

- Add: You can add the target value and measured value to the table of 16 revision points;
- Modify: Select the point to be modified in the table, add the value to be modified to the target value and measured value, and you can modify the target value and measured value of that point;
- Delete: Select the point to be deleted in the table, and you can delete that point;
- Write Revise: You can write the revision points to the device;
- Restore Defaults: You can restore the revision points to their default values;
- Read Revise: You can read the revision points from the device;

3.2.9 Burst configuration

Through the Burst configuration tab, the temperature transmitter can be configured with Burst related information. The configuration interface is as shown in the figure below.

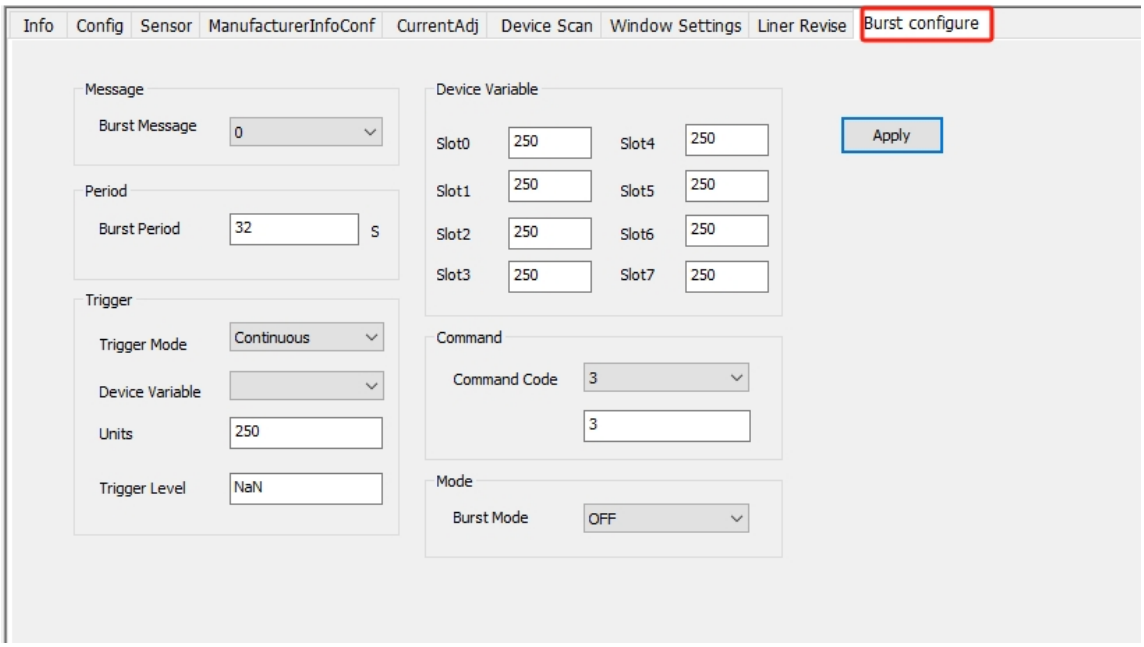


Figure 3.10 Burst configuration

Burst message supports 0, 1, 2; Burst cycle supports 1, 2, 4, 8, 16, 32, 60~3600, unit: seconds. Trigger modes support continuous, window, rising, falling and single triggering. The trigger command number supports 1, 2, 3, 9, and 33. When the trigger command number is 2, the trigger source is the PV range percentage, otherwise the trigger source is the PV value. When the command code is 9 or 33, device variables can be configured. When the command code is 9, only one Burst message can be enabled.

3.2.10 Diagnostic Settings

The diagnostic configuration tab allows you to configure diagnostic-related information for the temperature transmitter. The configuration interface is shown in the image below.

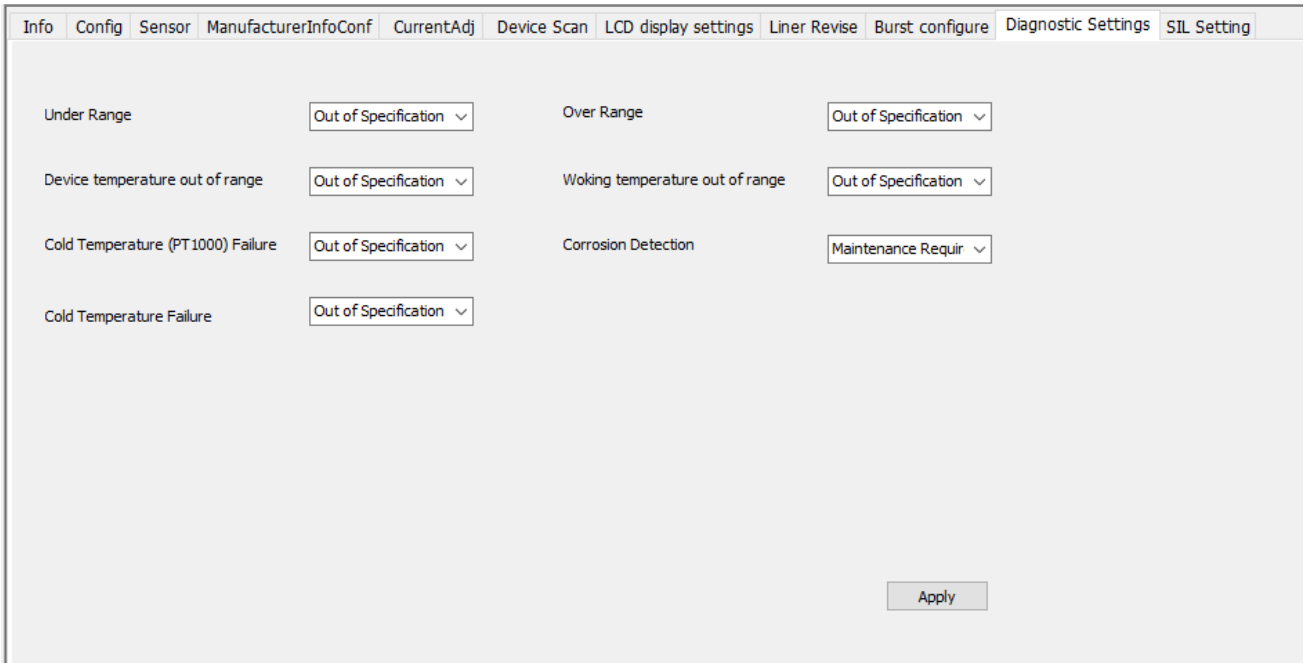


Figure 3.11 Diagnostic settings interface

Configurable diagnostics include:

No.	Diagnosis	Alarm Level	Default Level (Normal Mode)	Default Level (SIL Mode)
1	Under Range	F/C/S/M/N	S	S
2	Over Range	F/C/S/M/N	S	S
3	Device Temperature out of range	F/C/S/M/N	S	S
4	Working Temperature Exceeded Limit	F/C/S/M/N	S	F
5	Cold Temperature (PT1000) Failure	F/C/S/M/N	S	S
6	Cold Temperature Failure	F/C/S/M/N	S	F
7	Corrosion Detection	F/C/S/M/N	M	F

***When the device enters SIL mode, all alarm levels are not manually configurable and will automatically adopt preset fixed alarm levels to ensure compliance with safety certification requirements.**

The device diagnostic status supports the following five configuration types, each representing a different device operating condition:

(1) F (Failure)

A device failure is detected, the core functions cannot operate normally, the measured values are no longer valid, and an alarm current is generated.

(2) C (Function check mode)

The device is in service or debugging mode, typically used for device calibration, parameter configuration, or functional testing. In this state, the device does not perform regular measurements and only responds to service commands.

(3) S (Out of specification)

The device operating parameters are outside the normal range specified in the technical specifications, which may affect measurement accuracy or device lifespan.

(4) M (Maintenance required)

The device detects that preventive maintenance or component replacement is required. The current measured values remain valid, and maintenance should be scheduled.

(5) N (No effect)

A minor anomaly is detected, but it does not affect the normal function and measurement accuracy of the device. No immediate action is required; it can be checked during routine maintenance.

3.2.11 SIL Settings (Applicable only to SIL certified models)

The SIL settings tab is used for users to configure SIL-related information for the temperature transmitter. If it is a model that is not certified by SIL, the software interface will be as shown in the image below:

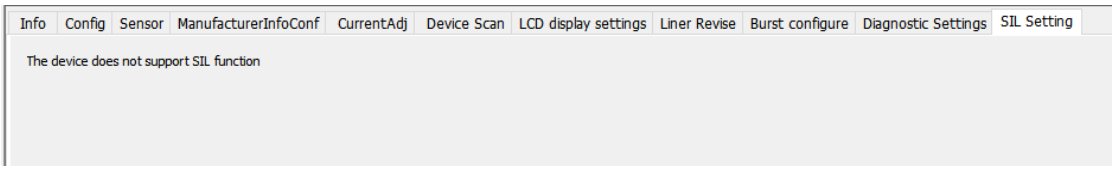


Figure 3.12 SIL settings interface for models not certified by SIL.

The configuration interface of SIL certified model is shown in the image below.

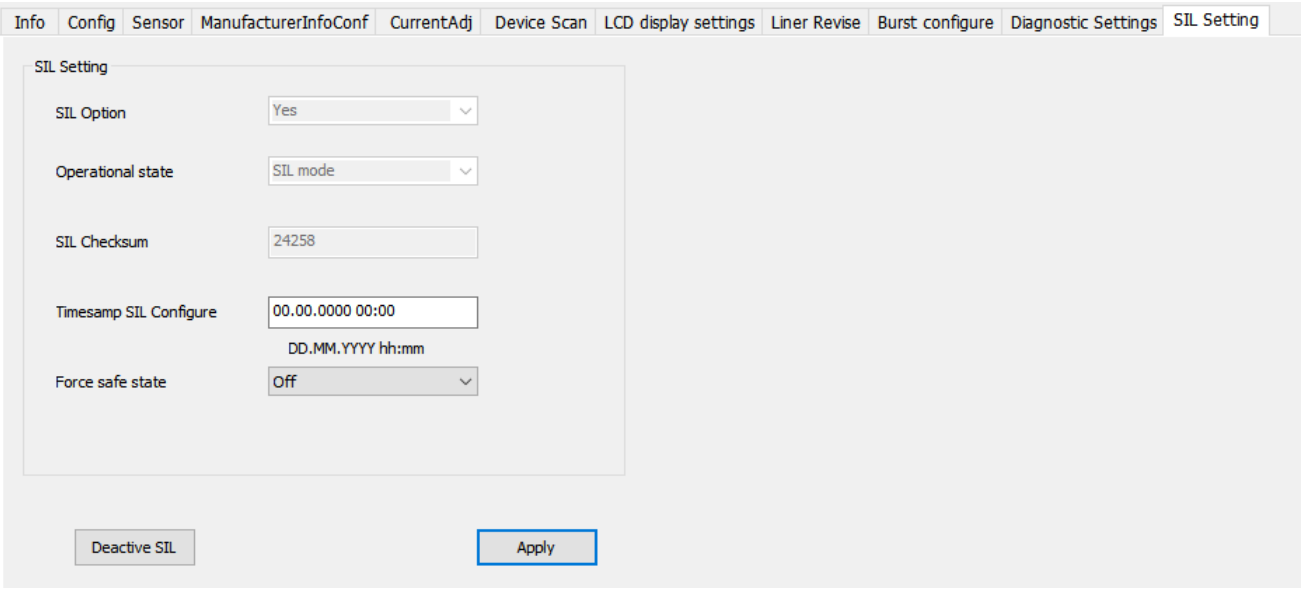


Figure 3.13 SIL settings interface for models certified by SIL

- SIL Option：It is divided into two attributes: "yes" and "no". "Yes" indicates that the temperature transmitter supports the SIL function; "no" indicates that the temperature transmitter does not support the SIL function.
- Operational state：Displays the current status of the temperature transmitter. The statuses include: Checking SIL option、Verify checksum、Self diagnostic、Normal mode、SIL mode、Safe para start、Safe param running、Save parameter values、Parameter check、Reboot pending、Reset checksum、Safe state – Active.

Status	Description
Checking SIL option	Check the properties of the "SIL Options." "Yes" indicates that the temperature transmitter supports SIL functionality; "No" indicates that the

	temperature transmitter does not support SIL functionality.
Verify checksum	Validate the current configuration. Failure to pass validation will prevent entry into SIL mode.
Self diagnostic	Perform a fault diagnosis self-test. Failure to pass the test will prevent entry into SIL mode.
Normal mode	Normal mode.
SIL mode	SIL mode. Relevant fault diagnosis can be performed.
Safe para start	Security parameter checking phase.
Safe param running	Security parameter checking phase.
Save parameter values	Security parameter checking phase.
Parameter check	Security parameter checking phase.
Reboot pending	Waiting for the device to restart.
Reset checksum	Configuration verification reset.
Safe state – Active	Secure state.

- Enter the access code: Enter the access code and click "Apply". The temperature transmitter will automatically switch to SIL mode. The default access code is: 7452.

After entering the access code, the temperature transmitter will enter SIL mode. The SIL settings tab is shown in the image below:

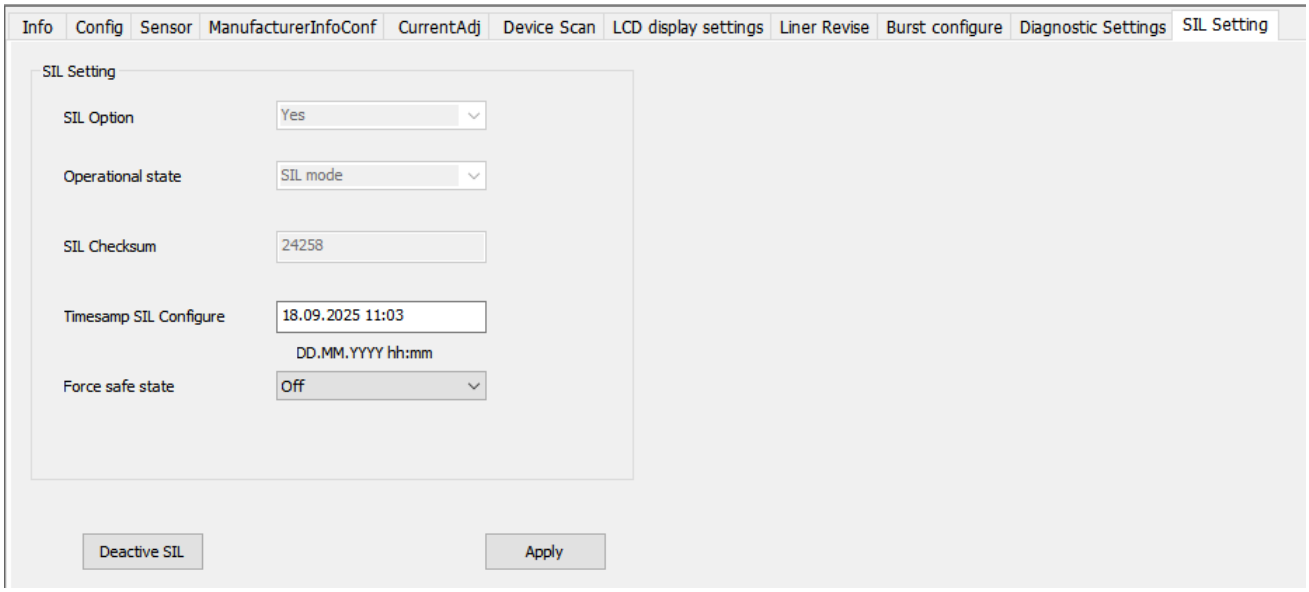


Figure 3.14 SIL settings interface

- SIL Checksum: Used to verify relevant parameters. Configuration changes are not allowed after the device enters SIL mode.
- Timestamp SIL Configure: Indicates the time the temperature transmitter entered SIL mode. Note: The temperature transmitter does not automatically record the time; the user needs to configure it manually. Format: DD.MM.YYYY hh:mm (DD: Day, MM: Month, YYYY: Year, hh: Hour, mm: Minute). Please configure according to the correct format.
- Forced Safety State: Select "On" and click "Apply"; the device will restart.
- "Deactive SIL" button: After clicking, the temperature transmitter will exit SIL mode and enter normal mode.

Activating SIL Mode (Entering SIL Mode) Steps:

1. Ensure the temperature transmitter supports the SIL function and is in normal mode.

2. Configure the relevant parameters.

3. Enter the access code: 7452 in the SIL settings tab.

*****Please confirm that the product is free of faults before entering the access code.*****

1. The SIL configuration timestamp can be set.

2. The temperature transmitter enters the "Restart Pending" state and restarts after a 60-second delay.

3. After the temperature transmitter restarts, it performs verification and fault diagnosis tests.

4. If the tests pass, the temperature transmitter enters SIL mode.

5. If the tests fail, the temperature transmitter cannot enter SIL mode. You need to exit SIL mode and re-enter SIL mode.

Exiting SIL Mode (Entering Normal Mode) Steps:

1. Whether the temperature transmitter is in SIL mode or another mode, you can click the " Deactive SIL" button in the SIL settings tab.

2. The temperature transmitter will reset the verification code, enter the "Safe State - Active" state, and restart after a 60-second delay.

3. After the temperature transmitter restarts, it will check the verification code. If the verification code is 0, the temperature transmitter enters normal mode.

4 On-site Adjustment

4.1 LCD and Button Description

The temperature transmitter is equipped with a dot matrix LCD and local button adjustment function, and the user can adjust the parameters of the temperature transmitter locally. There are three keys in total, [M], [S], and [Z]. The [M] key is the mode key, which is mainly responsible for "function selection", "cursor movement" and "OK". The [S] and [Z] keys are input adjustment keys, mainly responsible for "turning the menu back and forth" and "adding and subtracting values". The key function diagram is shown in the figure below.

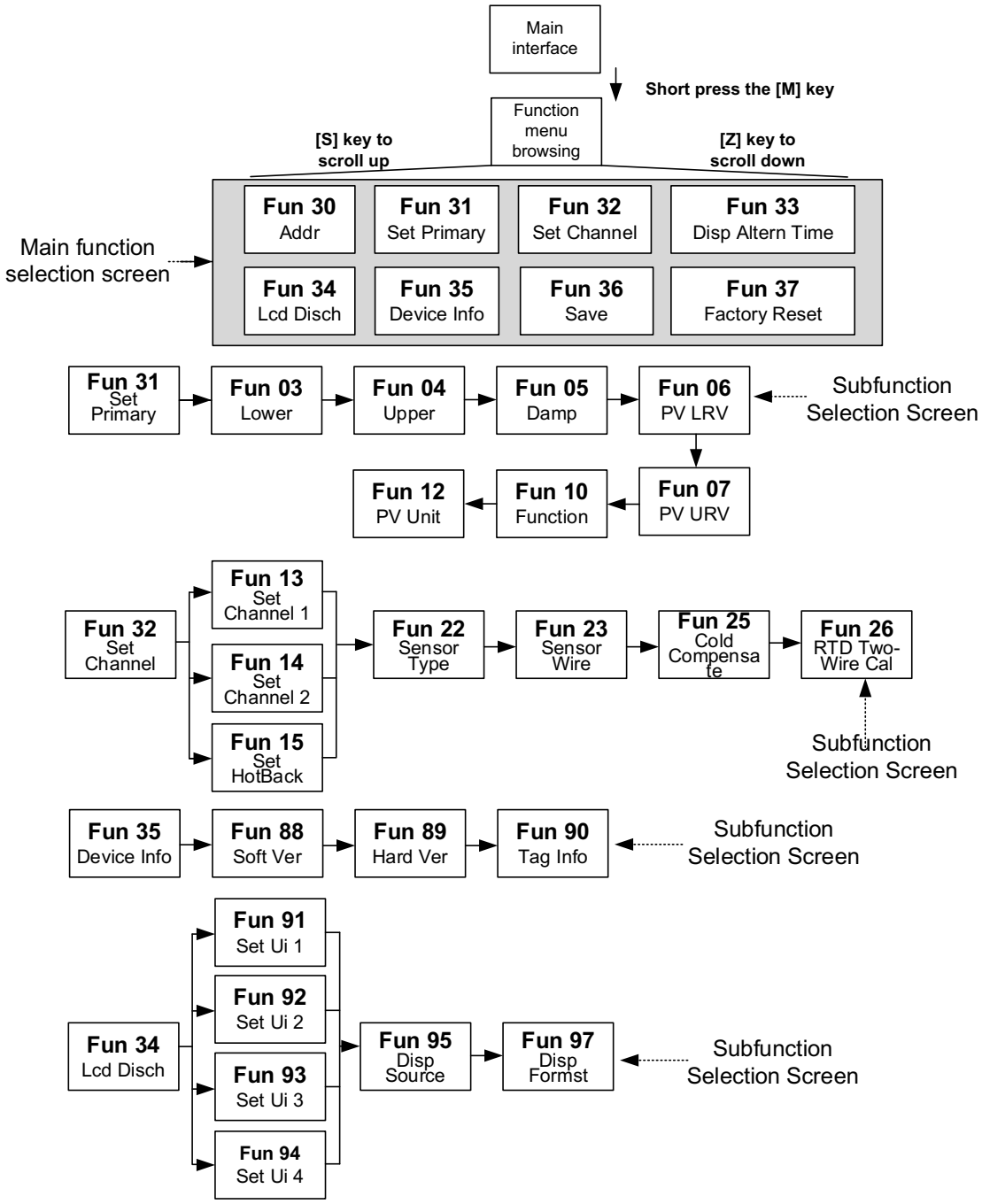


Figure 4.1 Button Function Diagram

*****When the temperature transmitter is in single-channel mode, the Fun13, Fun14, and Fun15 options are not available when entering the Fun32 function menu.**

*****When the temperature transmitter enters SIL mode, temperature transmitter parameters cannot be configured via local buttons.**

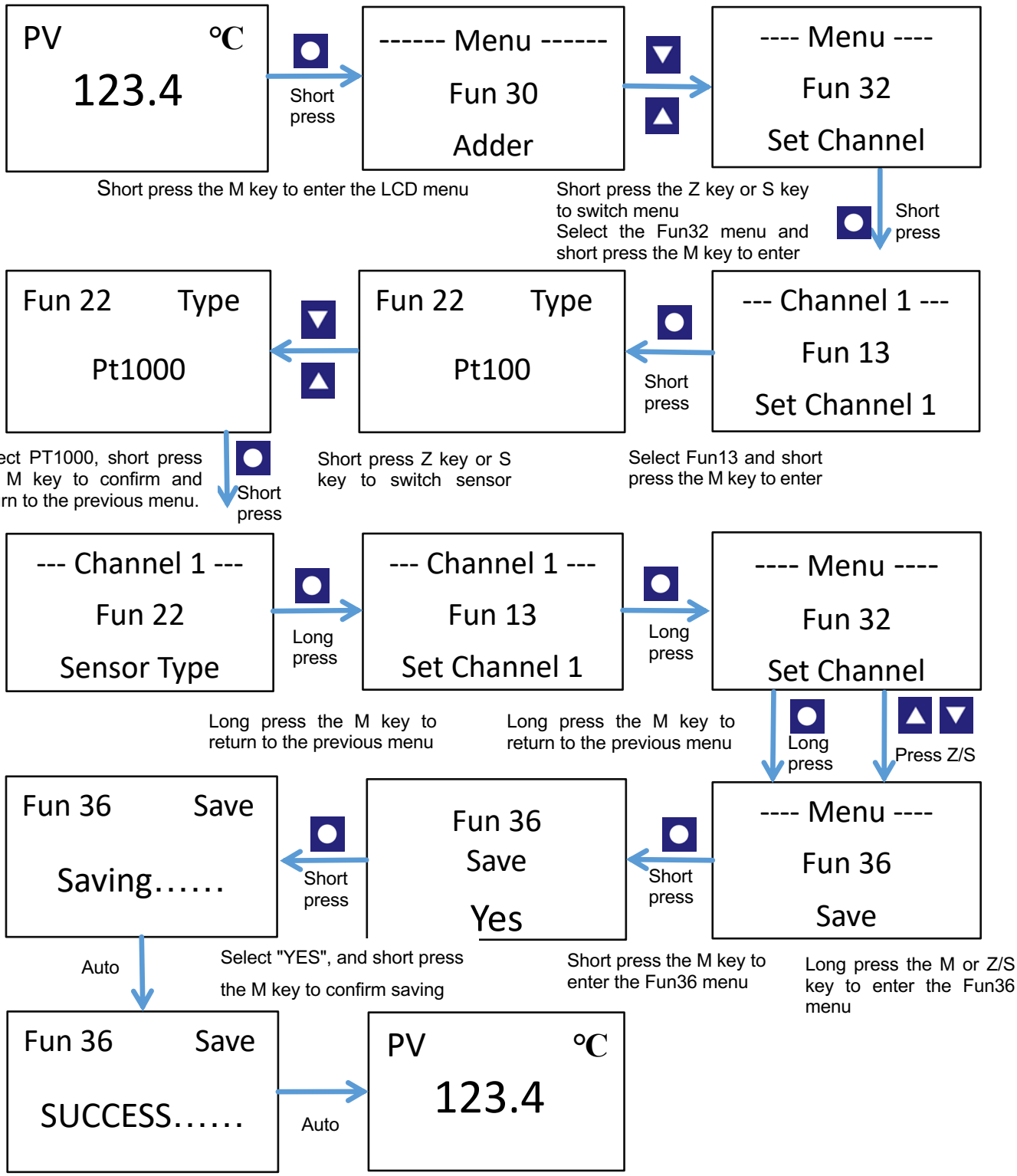
*****Each main function should be set and saved separately; do not set and save multiple main functions together.**

The key function description is as follows:

Function	【M】Key	【S】Key	【Z】Key
1	Short press to confirm/enter	Scroll up	Scroll down
2	Short press to move cursor	Increase the value	Decrease the value
3	Long press to return to the previous level	Move the decimal point to the right	Move the decimal point to the left

An example of local configuration of a temperature transmitter is as follows:

Example 1: Modify sensor type by pressing keys. Operation steps:



The word SUCCESS is displayed, and the display interface is returned after successful saving

Example 2: Modify engineering units by pressing keys. Key operation steps:

- Short press the M key to enter the LCD menu
- Short press the Z key or S key to switch menu
- Select the Fun31 menu and short press the M key to enter
- Short press the Z key or S key to switch menu
- Select the Fun12 menu and short press the M key to enter
- Select the S key or Z key to switch units
- Select the unit ℃, short press the M key to confirm and return to the previous menu
- Long press the M key to return to the previous menu
- Long press the M key to return to the previous menu
- Long press the M key to switch to the Fun36 menu
- Short press the M key to enter the Fun36 menu, select "YES", and short press the M key to confirm saving
- The word SUCCESS is displayed, and the display interface is returned after successful saving

Example 3: Modify the wire button operation steps through buttons:

- Short press the M key to enter the LCD menu
- Short press the Z key or S key to switch menu
- Select the Fun32 menu and short press the M key to enter
- Short press the Z key or S key to switch menu
- Select Fun13, short press the M key to enter, and configure channel 1
- Short press the Z key or S key to switch menu
- Select the Fun23 menu, short press the M key to enter, and configure the wire system
- Short press the Z key or S key to switch menu
- Select 3 Wires, short press the M key to confirm and return to the previous menu
- Long press the M key to return to the previous menu
- Long press the M key to return to the previous menu
- Long press the M key to switch to the Fun36 menu
- Short press the M key to enter the Fun36 menu, select "YES", and short press the M key to confirm saving
- The word SUCCESS is displayed, and the display interface is returned after successful saving

Example 4: Modify the upper limit of PV range by pressing keys. Key operation steps:

- Short press the M key to enter the LCD menu
- Short press the Z key or S key to switch menu
- Select the Fun31 menu and short press the M key to enter
- Short press the Z key or S key to switch menu
- Select Fun07, short press the M key to enter, and configure the upper limit of the PV range
- Short press the M key to move the cursor to the position you want to modify
- Short press the Z key or S key to modify the number

- After the modification is completed, press the M key briefly until you return to the previous menu
- Long press the M key to return to the previous menu
- Long press the M key to switch to the Fun36 menu
- Short press the M key to enter the Fun36 menu, select "YES", and short press the M key to confirm saving
- The word SUCCESS is displayed, and the display interface is returned after successful saving

Note: If you want to set the sensor type to RTD or TC. After modifying the engineering unit first, modify the corresponding sensor type.

4.2 LCD display logo description

The schematic diagram of the main interface of the temperature transmitter LCD display is shown in the figure below.

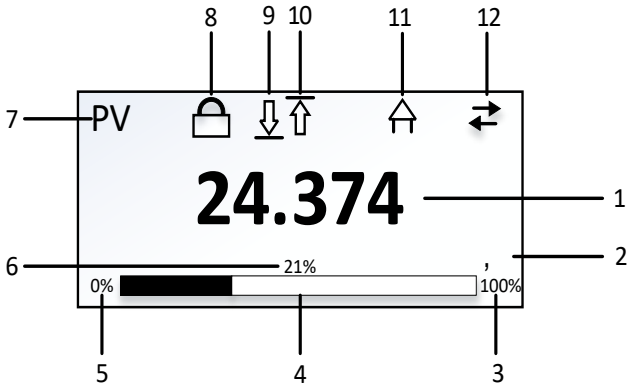


Figure 4.2 Main interface diagram

The meaning of the interface display identifier is as shown in the following table

No.	Meaning	No.	Meaning
1	Current measurement value type	7	Fault Alarm Indicator
2	Write protection flag	8	LCD Communication Indicator
3	Hot backup enabled flag	9	Measurement Unit
4	Device in SIL mode flag	10	Measurement Value
5	Under lower limit setting flag		
6	Over upper limit setting flag		

4.3 LCD Insertion/Removal Instructions

The NCS-TT306H temperature transmitter does not support hot-swapping of the LCD. Power must be disconnected from the temperature transmitter before installing or removing the LCD.

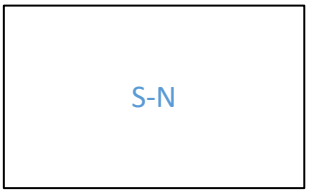
4.4 LCD Fault Display

1. When a fault occurs in the temperature transmitter, a fault code will be added to the interface.

Fault code format: Alarm Level + Fault Code.

2. When the temperature transmitter is in normal mode and then a mode switch is performed, the following interface will be added:

3. When the temperature transmitter is in SIL mode, and then a mode switch is performed, the following interface will be added:



5 Maintenance

5.1 Maintenance

Phenomenon	Measure
Unable to communicate	**Temperature transmitter connection** Check bus cable connection Check power polarity Check the bus cable shielding to see if it is grounded at a single point
	Network connection Check network topology correctness
	Address conflict The default short address setting of the temperature transmitter is 0 when it leaves the factory. However, there may still be address conflicts on a network due to other reasons. When a conflict occurs, the device's address needs to be reset. Sometimes it may fail to come online at all. You can power off the conflicting devices first, then power them on one by one, and modify the addresses of the newly powered-on devices to non-conflicting addresses. Power on and modify the addresses in sequence until everything is online.
	Temperature transmitter failure Replace the test with another temperature transmitter
Reading error or Output alarm current	**Temperature transmitter connection problem** Check the sensor for short circuit, open circuit, grounding, etc. Check whether the sensor is faulty
	Noise interference Adjust damping Check terminals for moisture Check whether the cable laying is away from strong interference sources
	Software settings Check if the sensor type configuration is correct

5.2 Fault Description

No.	Fault	Fault Code	Alarm Level	Normal Mode	SIL Mode	Remarks
1	Under lower limit	030	F	Support	Not Support	PV value is below the lower limit.
			C	Support	Not Support	
			S	Support	Support	
			M	Support	Not Support	
			N	Support	Not Support	
2	Over upper limit	031	F	Support	Not Support	PV value is above the upper limit
			C	Support	Not Support	
			S	Support	Support	
			M	Support	Not Support	
			N	Support	Not Support	
3	Device Temperature out of range	029	F	Support	Not Support	Device failure. Device temperature exceeds the set temperature range.
			C	Support	Not Support	
			S	Support	Support	
			M	Support	Not Support	

			N	Support	Not Support	
4	Working Temperature Exceeded Limit	007	F	Support	Support	Device failure. The operating temperature of the device exceeds the set temperature range.
			C	Support	Not Support	
			S	Support	Not Support	
			M	Support	Not Support	
			N	Support	Not Support	
5	Cold Temperature (PT1000) Failure	024	F	Support	Not Support	Device failure. Internal PT1000 failure.
			C	Support	Not Support	
			S	Support	Support	
			M	Support	Not Support	
			N	Support	Not Support	
6	Cold Temperature Failure	025	F	Support	Support	Device failure. Cold Temperature Failure
			C	Support	Not Support	
			S	Support	Not Support	
			M	Support	Not Support	
			N	Support	Not Support	
7	Corrosion Detection	005	F	Support	Support	Device failure.
			C	Support	Not Support	
			S	Support	Not Support	
			M	Support	Not Support	
			N	Support	Not Support	
8	Bus voltage exceeds upper limit	001	F	Not Support	Support	Device failure. The bus voltage is too high.
9	Bus voltage exceeds lower limit	002	F	Not Support	Support	Device failure. The bus voltage is too low.
10	External memory failure	003	F	Not Support	Support	Device failure.
11	DAC communication timeout	004	F	Support	Support	Device failure. DAC communication failure.
12	Loop current	008	F	Not Support	Support	Device failure.
13	Sampling accuracy failure	009	F	Support	Support	Device failure.
14	AD communication failure	010	F	Support	Support	Device failure.
15	Sensor 1 short circuit	011	F	Support	Support	Device failure.
16	Sensor 2 short circuit	012	F	Support	Support	Device failure.
17	Sensor 1 open circuit	013	F	Support	Support	Device failure.
18	Sensor 2 open circuit	014	F	Not Support	Support	Device failure.
19	AD hardware error 1	015	F	Not Support	Support	Device failure.
20	AD hardware error 2	016	F	Not Support	Support	Device failure.
21	AD hardware error 3	021	F	Not Support	Support	Device failure.
22	AD hardware error 4	022	F	Not Support	Support	Device failure.
23	AD hardware error 5	023	F	Not Support	Support	Device failure.
24	AD hardware error 6	026	F	Not Support	Support	Device failure.

25	Internal CPU failure	027	F	Not Support	Support	Device failure.
26	Internal Flash failure	028	F	Not Support	Support	Device failure.

When a failure of level F occurs, the loop current outputs an alarm current, the output of which is determined by the high or low alarm type configuration. However, when the bus voltage exceeds the upper or lower limit, the loop current only outputs a low alarm current. When the upper or lower limit of the range is exceeded, except for level F, the loop current outputs the saturation current value.

6 Technical Specifications

6.1 Basic parameters

Bus Interface	4～20mA (supports current reversal) + HART 7 (supports BURST mode)
Bus Power	10-45 VDC/10-30 VDC (Intrinsically Safe/SIL)
	13-45 VDC/13-30 VDC (Intrinsically Safe/SIL) with LCD
Wiring Method	2, 3, 4 wire
Input Signal	Resistance signal: 0～500Ω,0～2000Ω,0～4000Ω, 0～40000Ω Thermal resistance sensor: Cu50、Cu50_GOST、Cu100、Cu100_GOST、Pt50_GOST、Callendar_Van_Dusen(PT100)、Pt100、Pt100_GOST、Pt200、Pt500、Pt1000、Ni50、Ni100、Ni120、Ni1000； mV signal: -100mV～100mV； Thermocouple sensor: B、E、J、K、N、R、S、T、L_GOST、A（W5ReW20Re）、C（W5ReW26Re）、D（W3ReW25Re）、NiCrAuFe、CuAuFe
Protocol Version	HART 7
Number of Channels	Single/Dual channel
Input Impedance	≧10MΩ
Electrical Isolation	2kVAC/50VAC
Voltage Effect	±0.005%/V
LCD Display	Head mounted: supports LCD display or no display (optional) Rail installation: no display
Key Operation	Support button setting parameters
Working Temperature	-40（-55）℃～85℃ （with display） -20 ～ 70℃ （no display）
Humidity Range	(5～95)%RH
Storage Temperature	-40 ～ 85℃
Start Time	≤10 seconds
Update Time	0.8 ～ 1.3s
Damping Adjustment	Time constant 0~32 seconds

Alarm Signal	Saturation current lower limit: [3.75-4.0)mA, default value 3.8mA Upper limit of saturation current: (20-20.8]mA, default value 20.5mA Alarm current lower limit: [3.5-3.7]mA, default value 3.6mA Upper limit of alarm current: [21.0-23.0]mA, default value 21.75mA
Current Accuracy	0.05%, temperature drift 0.005%/℃
Voltage Effect	±0.005%/V
Terminal Torque	0.4Nm
Wire Specifications	1.5mm^2
Anti-vibration Specifications	2-25Hz：±1.6mm；25-100Hz：±4g
Protection Level	Terminal IP00, module housing IP20, rail housing IP20
Weight	Module ≦ 75g; graphics card: ≦50g; guide rail ≦ 100g

6.2 Technical indicators of thermal resistance

6.2.1 RTD normal temperature accuracy index (25℃)

Signal type	Sensor measuring range (℃)	Accuracy (25℃)	Temperature drift (/℃)
resistance signal	0~500Ω	±0.04Ω	±0.001Ω
	0~2000Ω	±0.35Ω	±0.015Ω
	0~4000Ω	±0.35Ω	±0.015Ω
	0~40000Ω	±8Ω	±0.3Ω
Cu50	-50 ~ 150 ℃	±0.10℃	±0.005℃
Cu50_GOST	-180 ~ 200 ℃	±0.10℃	±0.005℃
Cu100	-50 ~ 150 ℃	±0.10℃	±0.003℃
Cu100_GOST	-180 ~ 200 ℃	±0.10℃	±0.003℃
Pt50_GOST	-200 ~ 850℃	±0.10℃	±0.005℃
Callendar_Van_ Dusen (PT100)	-200 ~ 850℃	±0.10℃	±0.003℃
Pt100	-200 ~ 850℃	±0.10℃	±0.003℃
Pt100_GOST	-200 ~ 850℃	±0.10℃	±0.003℃
Pt200	-200 ~ 850℃	±0.10℃	±0.005℃
Pt500	-200 ~ 850℃	±0.10℃	±0.005℃
Pt1000	-200 ~ 850℃	±0.10℃	±0.005℃
Ni50	-60 ~ 180℃	±0.10℃	±0.004℃
Ni100	-60 ~ 180℃	±0.10℃	±0.002℃
Ni120	-60 ~ 180℃	±0.10℃	±0.002℃
Ni1000	-60 ~ 180℃	±0.10℃	±0.002℃

6.2.2 Other technical indicators of RTD

Wiring method	2, 3, 4 wire
common mode rejection ratio	≥70dB（50Hz and 60HZ）
Differential mode rejection ratio	≥70dB（50Hz and 60HZ）

6.3 Thermocouple technical indicators

6.3.1 Thermocouple normal temperature accuracy index (25℃)

Signal type	Sensor measuring range (℃)	Accuracy (25℃)	Temperature drift (/℃)
millivolt	-100 ~ +100mV	±0.025mV	±0.0015 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℃
L_GOST	-200 ~ 800℃	±0.50℃	±0.0375℃
A（W5ReW20Re）	0 ~ 800℃	±1.45℃	±0.06℃
C（W5ReW26Re）	0 ~ 800℃	±1.15℃	±0.09℃
D（W3ReW25Re）	0 ~ 800℃	±1.55℃	±0.07℃
NiCrAuFe	-273 ~ 7℃	±0.65℃	±0.020℃
CuAuFe	-270 ~ -196℃	±0.85℃	±0.035℃

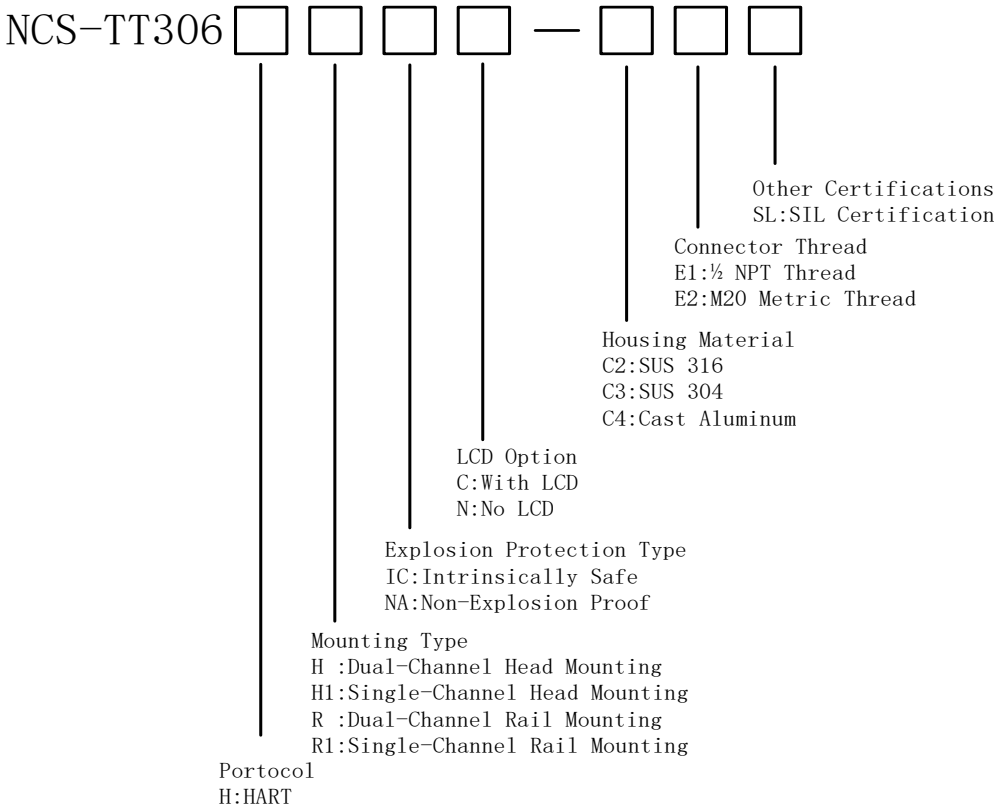
6.3.2 Other technical indicators of thermocouples

Compensation Accuracy	External PT100 connection: ±0.5℃; Internal compensation: ±1.0℃
Common Mode Rejection Ratio	≥70dB（50Hz and 60HZ）
Differential Mode Rejection ratio	≥70dB（50Hz and 60HZ）

6.4 Physical properties

Dimension	NCS-TT306H：¢45*23mm； NCS-TT306H-R：110*99*22.5mm
Housing Material	Polycarbonate

Appendix 1 Selection code table



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