MICROCYBER

NCS-TT305 Series
HART Temperature Transmitter
User Manual

Warning

1. Users are prohibited from disassembling and assembling the temperature transmitter by themselves.
2. Users are strictly prohibited from connecting or installing the temperature transmitter while it is powered on.
3. Users are asked to check whether the power supply voltage of the temperature transmitter meets the power supply voltage requirements in the user manual.

Drawing No. NCS-TT305H-SC

Version Information

Version Number	Release Time	Revision Information
V1.0	2026-05-14	Initial Release

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
V1.0
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.

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1 Overview

The NCS-TT305 series HART temperature transmitter is a high-precision, low-temperature-drift, and high-reliability product, an indispensable field device in process control. This device integrates a rich set of functional modules, enabling both general detection functions and complex control strategies.

The NCS-TT305 utilizes digital technology, is compatible with various RTD and thermocouple sensors, has a wide measuring range, a simple interface between the field and control room, and significantly reduces installation, operation, and maintenance costs.

The NCS-TT305 series temperature transmitter supports 4-20mA+HART protocol and LCD display, and can be widely used in industries such as petroleum, chemical, power, and metallurgy.

2 Temperature Transmitter Installation

2.1 External Dimensions

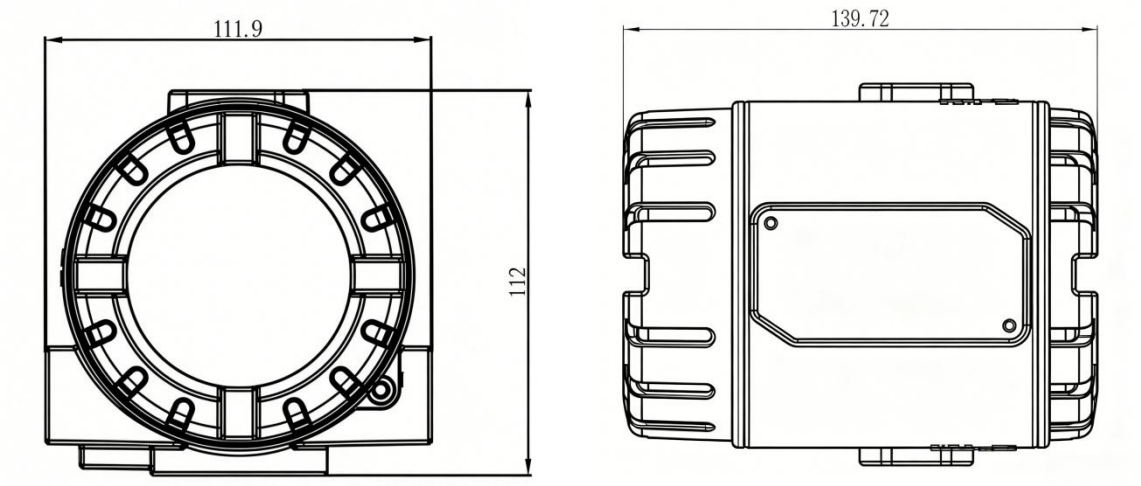


Figure 2.1 Temperature transmitter dimensions (unit: mm)

2.2 Installation

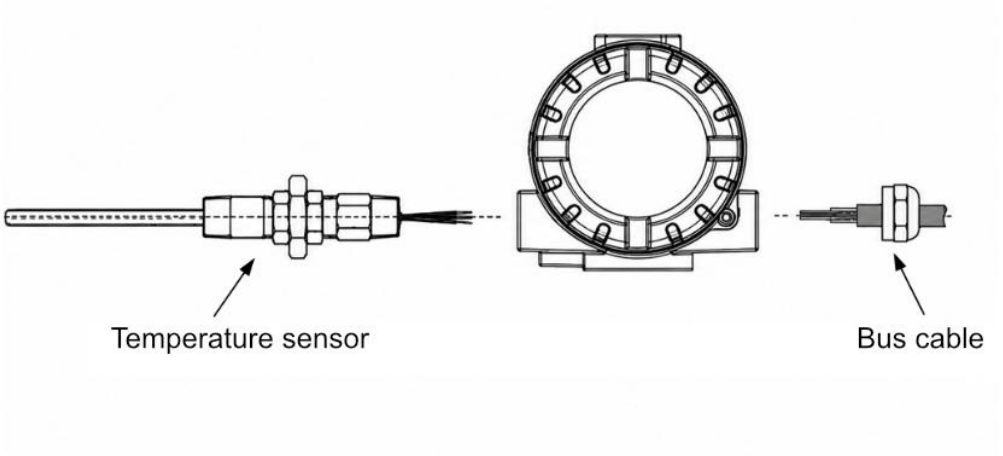


Figure 2.2 Directly mounted on sensor

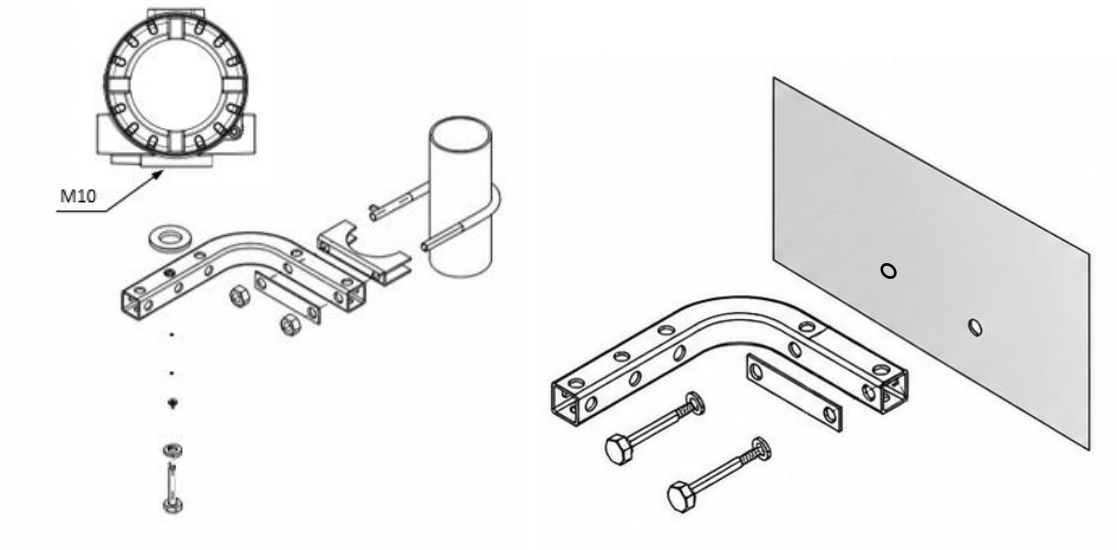


Figure 2.3 Split-type installation

2.3 Wiring

wiring diagram:

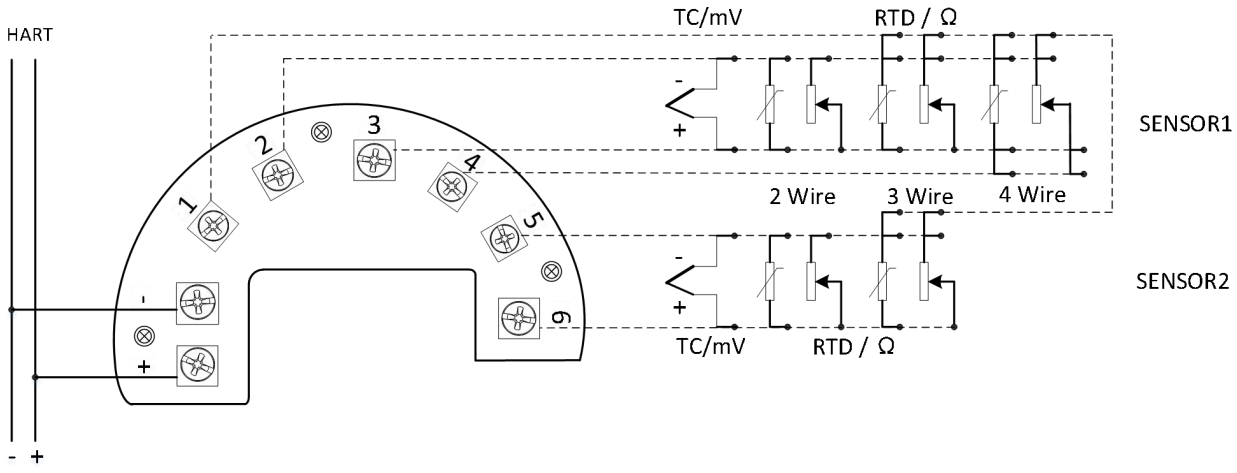


Figure 2.4 Temperature transmitter wiring diagram

Note: When the sensor type for Channel 1 is set to 0~40000R two-wire, the wiring is 1 and 3; when the sensor type for Channel 2 is set to 0~40000R two-wire, the wiring is 1 and 6.

The power supply and bus signal of the temperature transmitter share a single cable, called the bus cable. It is recommended to use the fieldbus-specific cable recommended by IEC61158-2. Signal cables and bus cables should not share conduits or exposed cable trays with the power lines of other devices, and should be kept away from high-power equipment. The shielding wires at both ends of the bus should be grounded using a single-ended grounding method.If the sensor cable length is not less than 30 m, shielded cable must be used and grounded at both ends. Shielded cable is generally recommended.

Remark: The DIP switch on the back of the LCD display is reserved and has no actual function.

When used in intrinsically safe (IS) hazardous areas, the “+” and “-” power terminals shall be connected to an IS barrier.

3 HART protocol temperature transmitter configuration

3.1 Topology connection

The NCS- TT305 series HART temperature transmitters can be connected in two ways: 4-20mA compatible mode and network mode.

3.1.1 4-20mA Compatibility Mode

NCS- TT305 series HART temperature transmitter in 4-20mA compatible mode is shown in Figure 3.1.

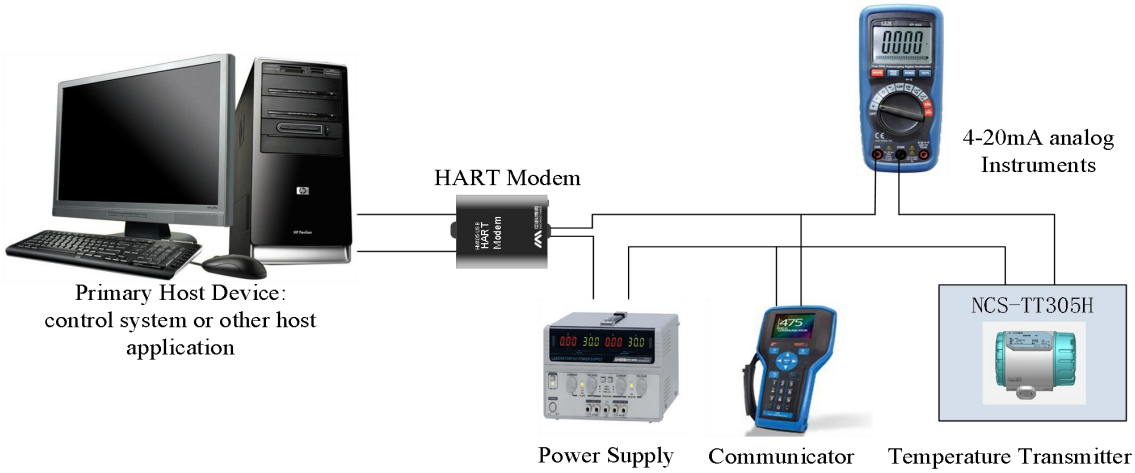


Figure 3.1 Topology diagram of 4 ~ 20 mA compatible mode

Features:

(1) It connects to the upper-level control system via HART communication equipment;

(2) Both analog and digital communication methods are used;

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

3.1.2 Networking mode

The network topology connection diagram of the NCS- TT305 series HART temperature transmitter is shown in Figure 3.2.

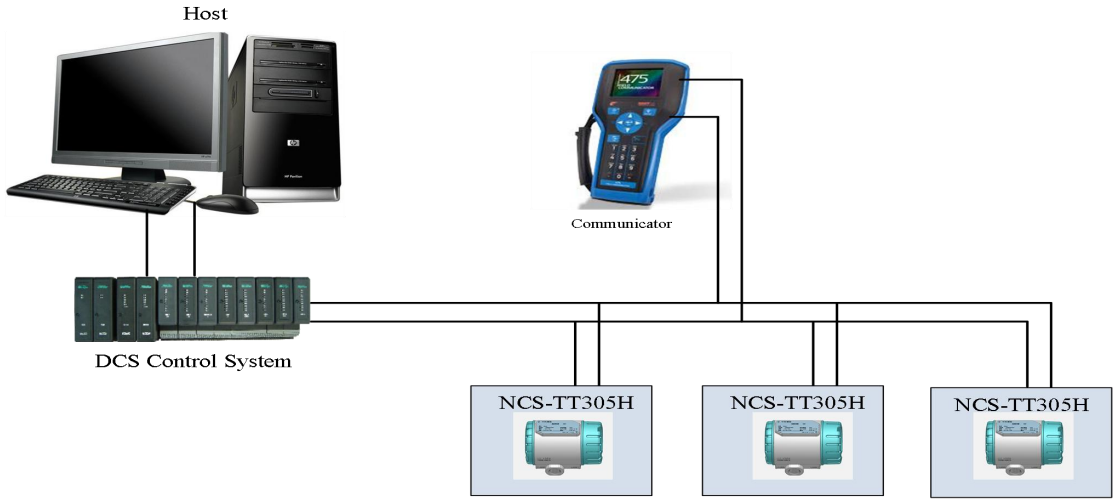


Figure 3.2 Network topology diagram

Features:

(1) It connects to the upper-level control system via HART communication equipment;

(2) Using only the digital functions of the HART system, the line current is fixed at 4mA;

(3) HART 7.0 supports a network of up to 64 devices (polling addresses 0 to 63).

3.2 Functional Configuration

The NCS-TT305 series HART temperature transmitter supports configuration and commissioning using HartMPT configuration software from Microcyber, and FDI from FieldComm Group, among other general HART configuration software. The following section primarily uses Microcyber's HartMPT configuration software as an example to introduce the configuration method for the temperature transmitter. This mainly includes the following functions:

(1) Basic information configuration: Configure the basic information of the online device, including label, address, date, assembly number, etc.

(2) Configuration information configuration: Configure the configuration information of online devices, including main variable range, damping and other information;

(3) Sensor information configuration: Configure the sensor information of online devices, including type, wiring type, etc.;

(4) Current calibration: It can calibrate the (4~20) mA current of online equipment, and can also set a fixed current output;

(5) Variable monitoring: It can periodically refresh all dynamic variables of the selected online device and display the trend curve of the current device's main variables;

(6) LCD display settings : Allows users to configure the content and display mode of the LCD display interface ;

(7) Linear correction: Enables multi-point calibration of the sensor, further improving measurement accuracy;

(8) Burst configuration: The temperature transmitter supports the Burst function, and Burst-related parameters can be configured .

(9) Diagnostic settings: Alarm levels can be set for exceeding the lower limit of the measuring range, exceeding the upper limit of the measuring range, and exceeding the equipment temperature limit;

(10) SIL settings: Allows users to control whether the device enters or exits SIL mode.

3.2.1 Configure environment

(1) A PC with a serial port, running Windows XP, Windows 7 , or Windows 10 .

(2) HART Modem and serial cable;

(3) Matching resistor (230～550) Ω .

3.2.2 Basic Information Configuration

The basic information tab allows you to read or modify the temperature transmitter's basic information. Modifiable information includes the device's short address, message, description, workstation number, long workstation number, date, and 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 .

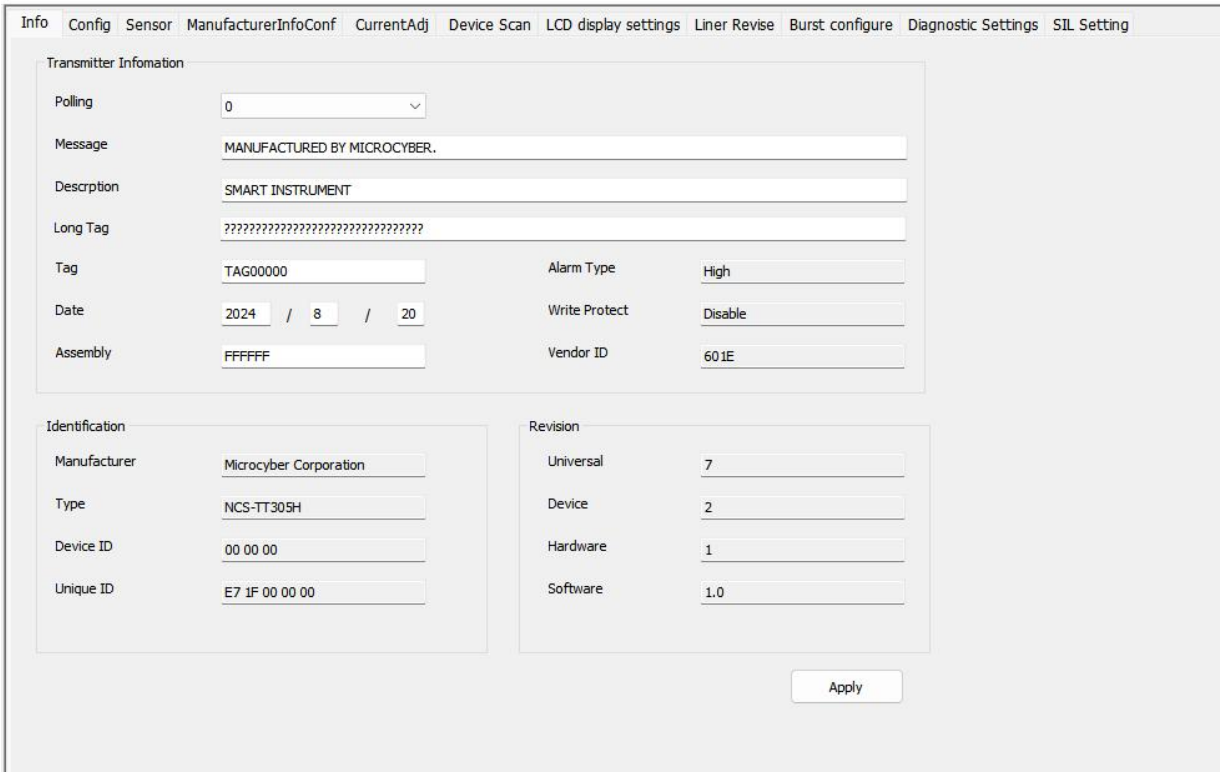


Figure 3.3 Basic Information Configuration Interface

After modifying the information, you can click the "Apply" button to download it to your device.

(1) The address selection range is 0 to 63;

(2) The message can contain a maximum of 32 characters;

(3) The description can contain a maximum of 16 characters.

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

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

(6) The dates range from 1900 to 2155 .

3.2.3 Configuration information configuration

The configuration information tab allows users to read or modify the temperature transmitter's configuration information , including settings for main variables (damping value, unit, upper limit of range, lower limit of range), dynamic variable mapping settings (main variable, cold junction 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 reversal output settings , as shown in Figure 3.4 .

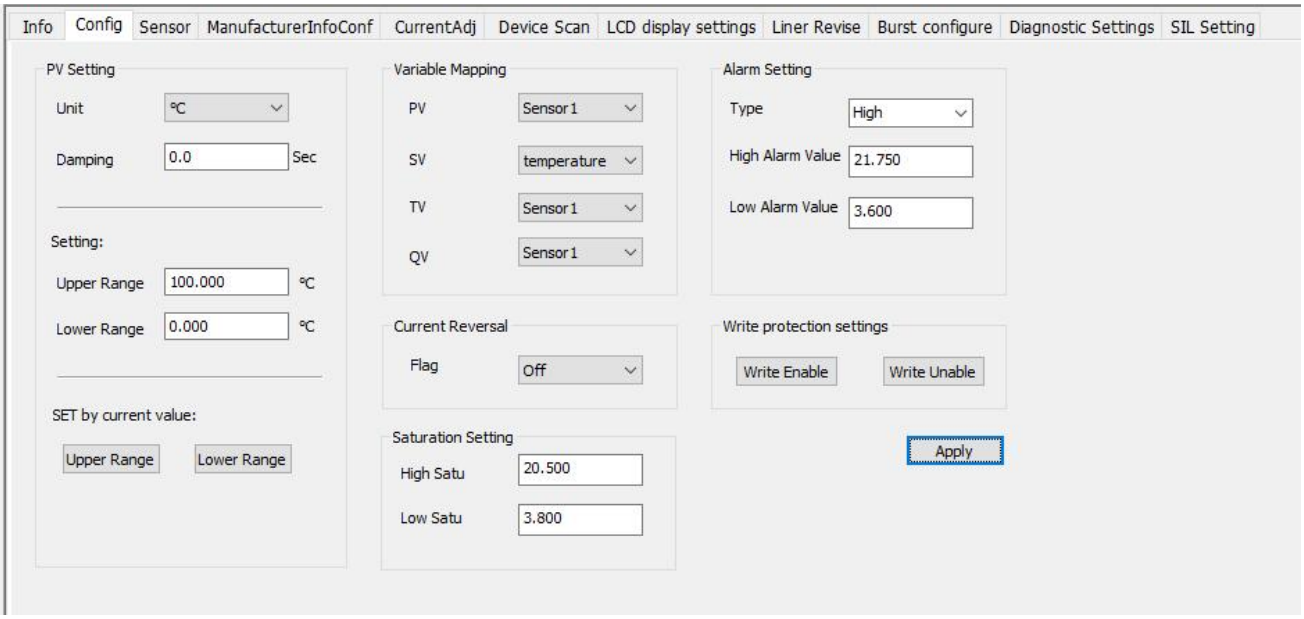


Figure 3.4 Configuration Information Configuration Interface

- Unit settings: Supports unit settings such as ° C, ° F, ° R, K, mV, Ohm、ft、meter、in、cm、mm etc. Changing the PV unit directly affects variables related to that unit, such as the upper and lower limits of the measurement range and the upper and lower limits of the sensor. When modifying the unit, the upper and lower limits of the main variable's range cannot be modified simultaneously; they should be modified separately.
- Damping: Range 0–32 seconds;
- Upper limit of range: PV value corresponding to 20 mA output current;
- Lower limit of range: PV value corresponding to 4 mA output current;
- The "Use Current Value to Set Upper Limit of Range" button sets the current PV value of the device as the upper limit of the main variable range, while the lower limit of the range remains unchanged.
- The "Use current value to set lower limit of range" button sets the current PV value of the device as the lower limit of the main variable range. This operation may also change the upper limit.
- Dynamic variable mapping: Supports mapping dynamic variables to sensor 1, sensor 2, temperature, two-channel average value, two-channel difference, and two-channel sum value;
- Current Reversal Setting: By setting the flag, the output current of the temperature transmitter can be reversed. For example, if the current output current of the temperature transmitter is currently 4mA, after enabling the current reversal flag, the output current of the temperature transmitter becomes 20mA.
- Alarm types: High alarm and low alarm ;
- Alarm values: When the alarm type is high alarm, the alarm current can be set from 21.00mA to 23.00mA; when the alarm type is low alarm, the alarm current can be set from 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.
- Write protection operation: When write protection is enabled, all write operations are disabled.
- After modifying the information, press the "Apply" button to download the information to the device.

3.2.4 Sensor configuration

The sensor configuration tab allows users to view and configure the temperature transmitter's sensor information (upper limit, lower limit, minimum span), two-channel sensor configuration (sensor type, wiring type), cold junction compensation method (when the sensor type is thermocouple), correction coefficient R0, hot backup settings, calibration point settings, temperature transmitter calibration, temperature drift settings, view temperature drift diagnostic information, corrosion detection limit settings (line resistance detection), corrosion detection enable, and restore settings, as shown in Figure 3.5 .

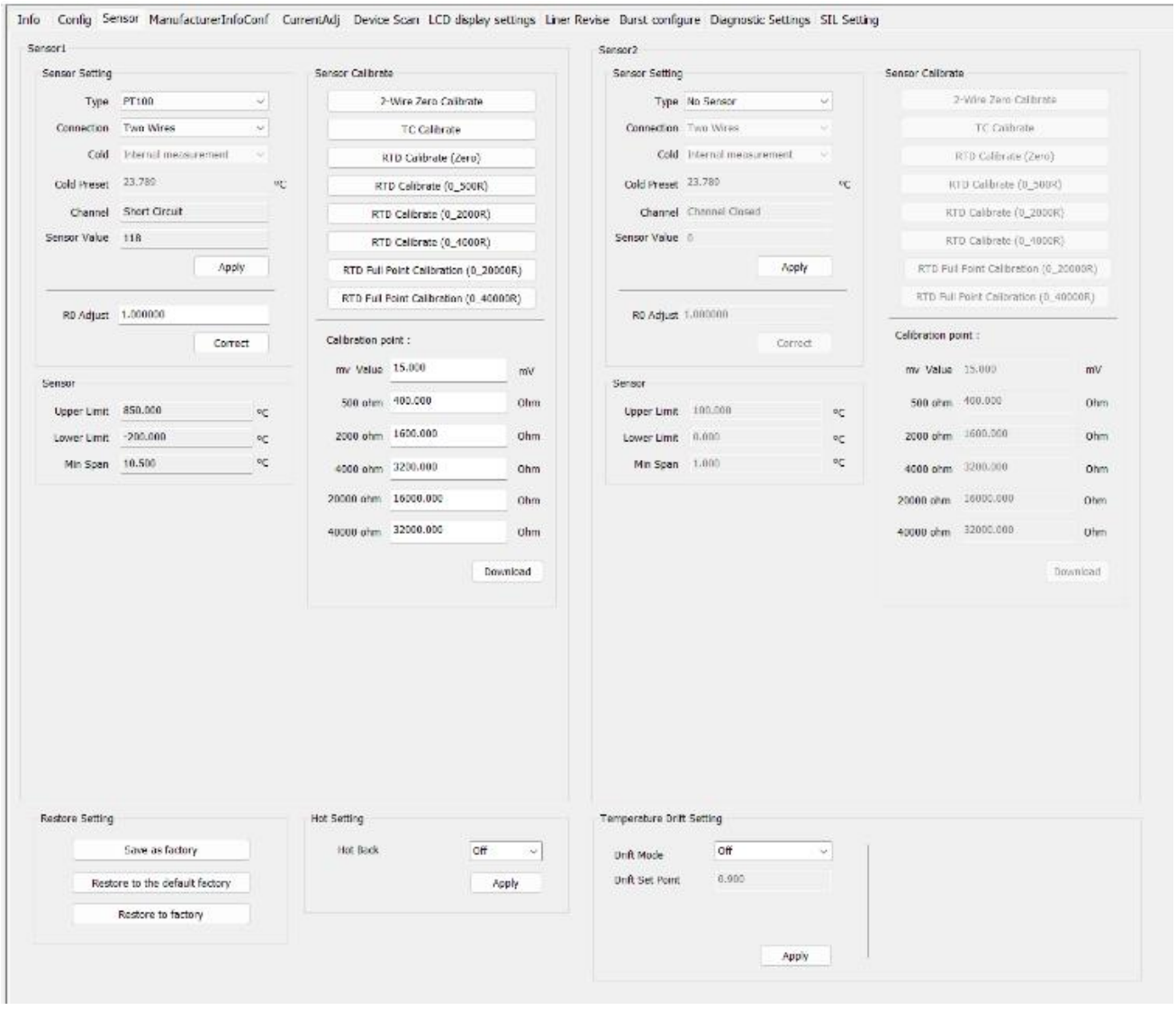


Figure 3.5 Sensor Configuration Interface

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_20000R	Resistance , (0 ~ 20000) Ω
0_40000R	Resistance , (0 ~ 40000) Ω
Cu50	Cu50
Cu50_GOST	Cu50_GOST
Cu100	Cu100

Sensor type	Description
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
E_TC	E
J_TC	J
K_TC	K
N_TC	N (even)
R_TC	R-dot
S_TC	S-Puppet
T_TC	T-Puppet
L_GOST	L_GOST
A (W5ReW20Re)	A（W5ReW20Re）even
C (W5ReW26Re)	C (W5ReW26Re)
D (W3ReW25Re)	D (W3ReW25Re)
NiCrAuFe	NiCrAuFe
CuAuFe	CuAuFe

- Sensor type settings: Supported sensor types are listed in the table above. The Callendar_Van_Dusen(Pt100) sensor type includes the following coefficients: R0, A, B, C, Alpha, Beta, Delta. The Alpha, Beta, and Delta coefficients can be accurately converted to the A, B, and C coefficients.

  R0: Nominal resistance at 0° C, default value: 100.000 ohms, input range: 0.999~2000.0 ohms;

  A: Linear temperature coefficient, default value: 0.003908299840987, input range: 0.003~0.004;

  B: Quadratic (curvature) coefficient, default value: -0.000000577499975, input range: -2E-06~2E-06;

  C: Cubic coefficient, default value: -0.000000000004183, input range: -1E-09~1E-09.
- Wiring settings: The resistance and RTD signals of sensor one can be set to 2, 3, or 4 wires, and the millivolt and thermocouple signals can be set to 2 wires; The resistance and RTD signals of sensor two (applicable to dual channels) can be set to 2 or 3 wires , and the millivolt and thermocouple signals can be set to 2 wires .
- Cold junction compensation setting: Effective when the sensor type is thermocouple. It can be set to four modes: cold junction disabled, internal measurement, fixed value, and sensor 2 measurement. In cold junction disabled mode, the temperature transmitter will not compensate for the cold junction; in internal measurement mode, the temperature for cold junction compensation is provided by the internal temperature sensing chip; in fixed value mode, the temperature for cold junction compensation is the externally set temperature; in sensor 2 measurement mode (applicable to dual channels) , the temperature for cold junction compensation is the measured value of sensor 2. In this mode, sensor 2

should be connected to an external Pt100 or other type of resistance temperature detector (RTD) sensor.

- Channel status: Displays the sensor channel status (open circuit, short circuit, fault, etc.);
- Sensor channel value: Displays the raw acquired values of the sensor channel;
- R0 correction factor: Corrects the error of the sensor itself (range 0.9~1.1).
- Sensor range upper and lower limits viewing: View the maximum upper and lower limits of the range supported by the currently set sensor type;
- Two-wire zero-point calibration: When the temperature transmitter is connected to the RTD in a two-wire configuration, in order to avoid errors caused by the resistance on the cable, the sensor end can be shorted, and then the 'two-wire zero-point calibration' button can be clicked to eliminate the errors caused by the resistance on the cable.
- TC calibration: Factory calibration of thermocouples and millivolt signals;
- RTD calibration: Factory calibration of RTDs and resistance signals, including zero-point calibration and full-point calibration.
- Calibration Point Settings: Allows setting calibration point values for resistance and mV signals;
- Hot Backup Settings: When hot backup is enabled, sensor 2 serves as backup when PV is mapped to sensor 1; sensor 1 serves as backup when PV is mapped to sensor 2; and either sensor 1 or sensor 2 serves as backup when PV is mapped to the average value, thus achieving channel redundancy.

PV Mapping	Fault conditions	Loop current	Alarm indicator
Sensor 1	Sensor 1 is normal, Sensor 2 is normal	Current value corresponding to sensor 1	No alarm indicator
	Sensor 1 is normal, Sensor 2 is faulty (open circuit/short circuit)	Current value corresponding to sensor 1	Sensor 2 fault
	Sensor 1 is faulty (open circuit/short circuit), Sensor 2 is normal	Current value corresponding to sensor 2	Sensor 1 fault
Sensor 2	Sensor 1 is normal, Sensor 2 is normal	Current value corresponding to sensor 2	No alarm indicator
	Sensor 1 is normal, Sensor 2 is faulty (open circuit/short circuit)	Current value corresponding to sensor 1	Sensor 2 fault
	Sensor 1 is faulty (open circuit/short circuit), Sensor 2 is normal	Current value corresponding to sensor 2	Sensor 1 fault
Average Value	Sensor 1 is normal, Sensor 2 is normal	Current value corresponding to average output	No alarm indicator
	Sensor 1 is normal, Sensor 2 is faulty (open circuit/short circuit)	Current value corresponding to sensor 1	Sensor 2 fault
	Sensor 1 is faulty (open circuit/short circuit), Sensor 2 is normal	Current value corresponding to sensor 2	Sensor 1 fault

- Temperature drift settings: Set the drift mode and drift setpoint. Drift modes include: Off, Outside Window, and Inside Window. Default drift setpoint: 0.900, input range: 0.099~999.001. An alarm will sound if the absolute difference between the two channels is greater than the drift setpoint when the drift mode is "Outside Window"; an alarm will sound if the absolute difference between the two channels is less than the drift setpoint when the drift mode is "Inside Window".
- Corrosion detection enable settings: Clicking the "On" button will enable corrosion detection, and the interface will display the corrosion detection line resistance limit setting window; clicking "Off" will disable corrosion detection.

- Corrosion detection line resistance limit settings: RTD (4-wire): Default upper limit line resistance: 50 ohms, input range: 5~250 ohms; Thermocouple: Default upper limit line resistance: 5000 ohms, input range: 5~10000 ohms. Sensor 1 supports corrosion detection in both RTD and thermocouple configurations; Sensor 2 supports corrosion detection in both RTD and thermocouple configurations.

Note: Corrosion detection is applicable to RTDs (4-wire) and thermocouples (2-wire).

- Level Calibration: Both Sensor 1 and Sensor 2 can perform level measurement; this includes configuring calibration points, calibration methods, calibration point level values, calibration point resistance values, and restoring default values.
- Calibration points include Calibration Point 1 and Calibration Point 2; selecting Calibration Point 1 allows configuration of the calibration point level and resistance values; selecting Calibration Point 2 allows configuration of the calibration point level and resistance values. Calibration methods include passive and active calibration; passive calibration can be performed without an external resistor; active calibration requires an external resistor. Restoring default values restores the level and resistance values of Calibration Points 1 and 2 to their default values.

Note: Level measurement requires the unit to be set to a level unit, including: ft, meter, in, cm, and mm; applicable sensor types for level measurement include 0-500R, 0-2000R, 0-4000R, 0-20000R, and 0-40000R.

- Save as factory settings: Clicking this button will save the current configuration information as factory settings. Clicking the "Restore Factory Settings" button again will restore the saved configuration information.
- Restore factory defaults: Click this button to restore all data to the default factory state;
- Factory Reset: Click this button to restore the data to its factory state. If the user has saved the factory settings, the saved configuration will be restored; otherwise, the default factory settings will be restored.

3.2.5 Current Calibration

The 4-20mA output current of the temperature transmitter can be calibrated by accessing the current calibration tab. The calibration steps are as follows:

(1) To connect the circuit, a 5.5-digit or higher precision ammeter needs to be connected in series with the device output circuit.

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

(3) Access the current calibration tab;

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

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

(6) Select "Current Value" as blank to make the device output current calculated based on PV value.

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

(1) Users can configure 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 the function of writing fixed output current value.

(2) Users can also select options such as 3.8mA, 4.0mA, 8mA, 12mA, 16mA, 20mA, and 21mA, and click "Enter/Exit Fixed Current Mode" to achieve the fixed current output function;

During continuous operation, the temperature transmitter constantly compares the value of the primary variable with the upper and lower limits of its range. When the value of the primary variable exceeds the upper or lower limit, the temperature transmitter outputs a fixed current to indicate that the primary variable is out of range. When the primary variable is higher than the upper limit, the temperature transmitter outputs a fixed 20.8 mA; when it is lower than the lower limit, the temperature transmitter outputs a fixed 3.8 mA.

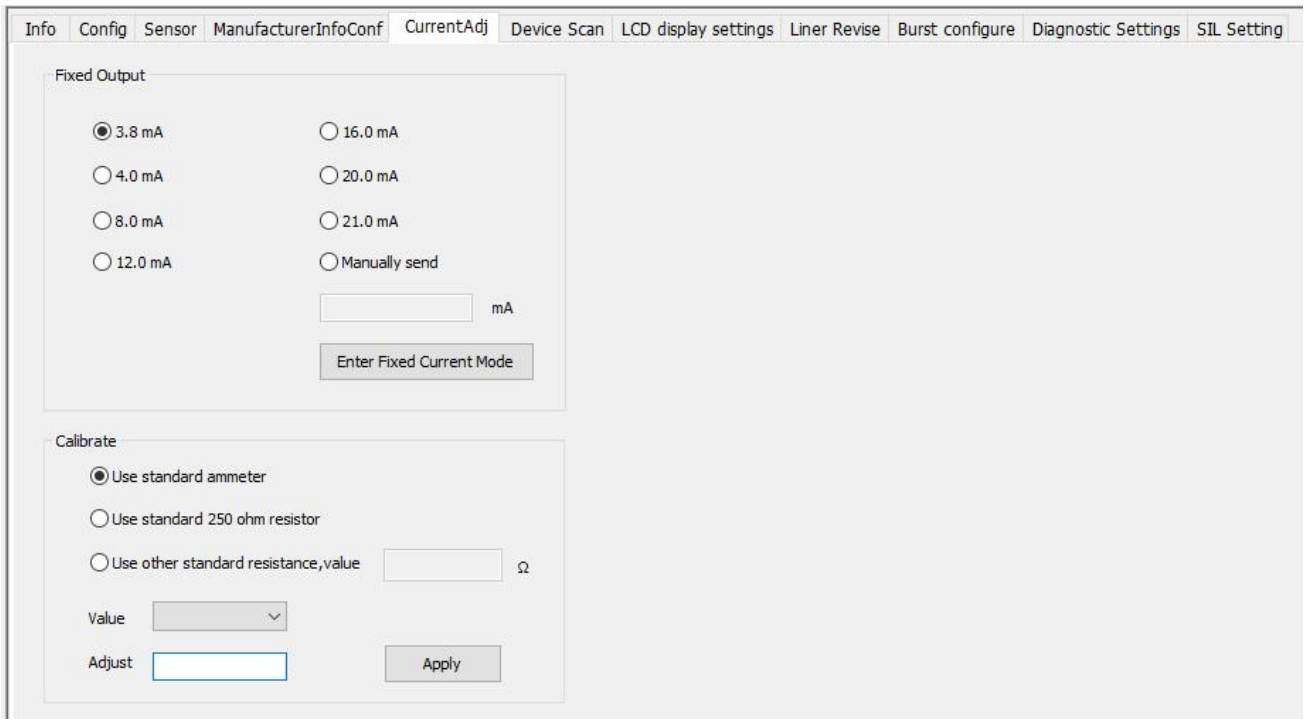


Figure 3.6 Current calibration interface

Note: The 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 will display the error message "Command execution failed".

3.2.6 Variable Monitoring

The Variable Monitoring tab allows you to periodically refresh all dynamic variables of the selected device and display the trend curve of the current device's main variables. The variables that can be refreshed are: first variable (PV), second variable (SV), third variable (TV), fourth variable (QV), current value, percentage, and cold junction temperature.

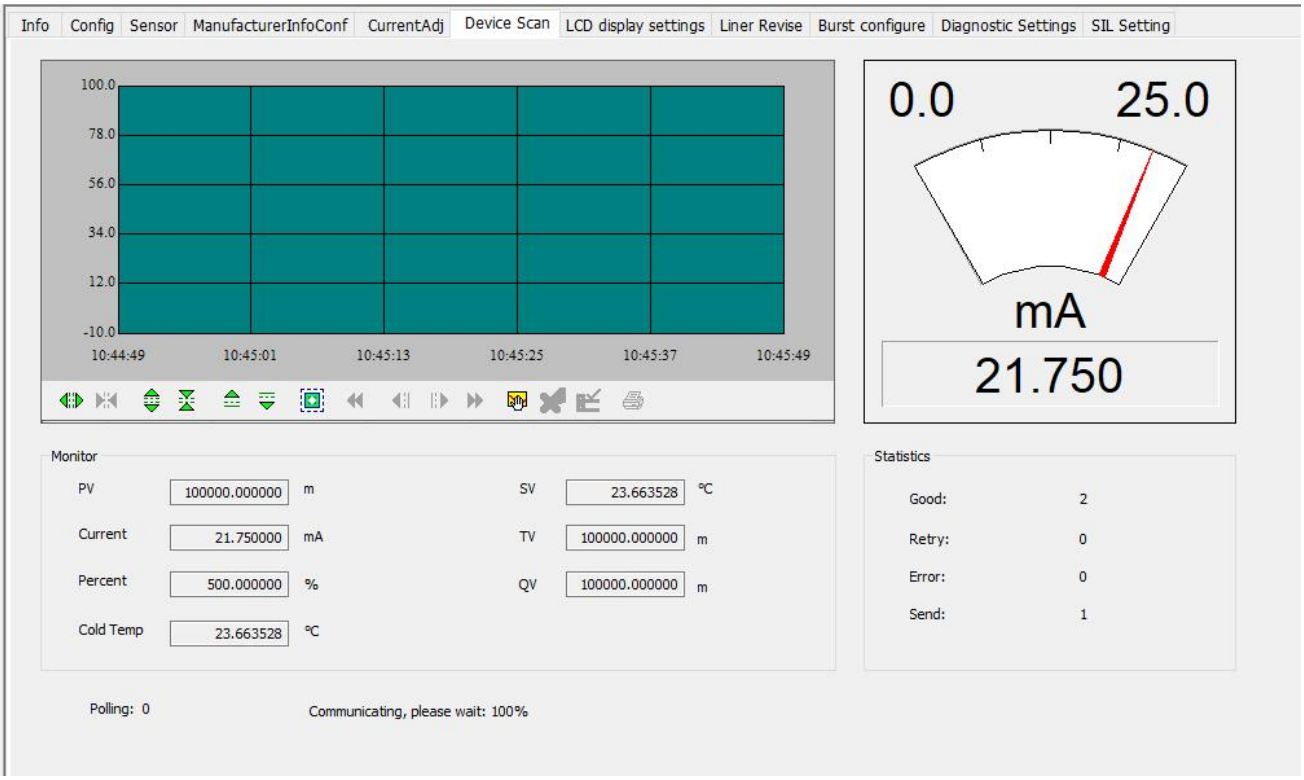


Figure 3.7 Variable Monitoring Interface

3.2.7 LCD Display Settings

The LCD display settings tab allows you to configure the LCD display content of the temperature transmitter, including the number of displays, display time, display format, display source, display type, and display inversion settings. The interface is shown in the figure below.

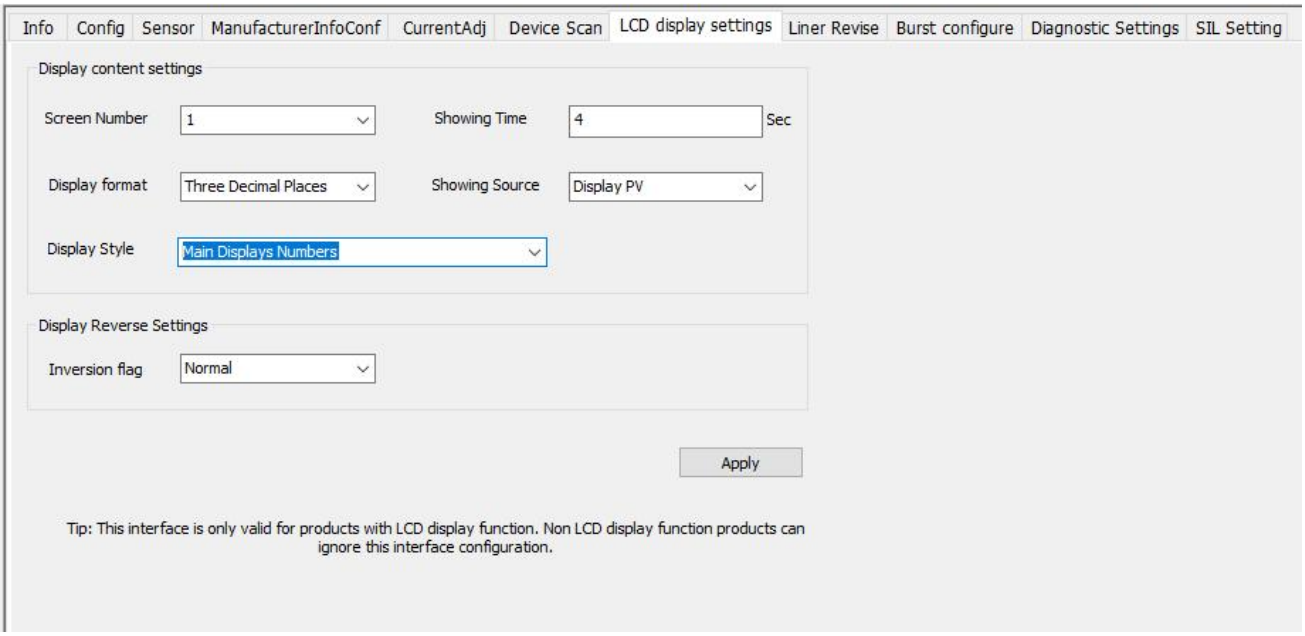


Figure 3.8 LCD display interface

- Number of displays: Supports up to 4 LCD screens for rotating display, which can be set from 1 to 4;
- Display time: Set the display time for each LCD screen, with a setting range of 4-60 seconds;
- Display Format: Sets the number of decimal places displayed on the LCD, including: displaying integers,

displaying one decimal place, displaying two decimal places, and displaying three decimal places;

- Display Source: Sets the display data source for the LCD screen, including: PV, SV, TV, QV, current value, percentage, cold junction temperature, and cancel display;
- Display Mode: Sets the display mode of the LCD interface, including: displaying only numbers and displaying numbers and bar graphs;
- Display Inversion: Sets whether the LCD display content is inverted.

3.2.8 Linear Calibration

The linear calibration tab allows for multi-point calibration of the sensor . Two calibration modes are available: "Analog" and "Digital." The number of calibration points can be freely selected between 1 and 16. To perform a second multi-point calibration, click the "Restore Defaults" button.

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

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

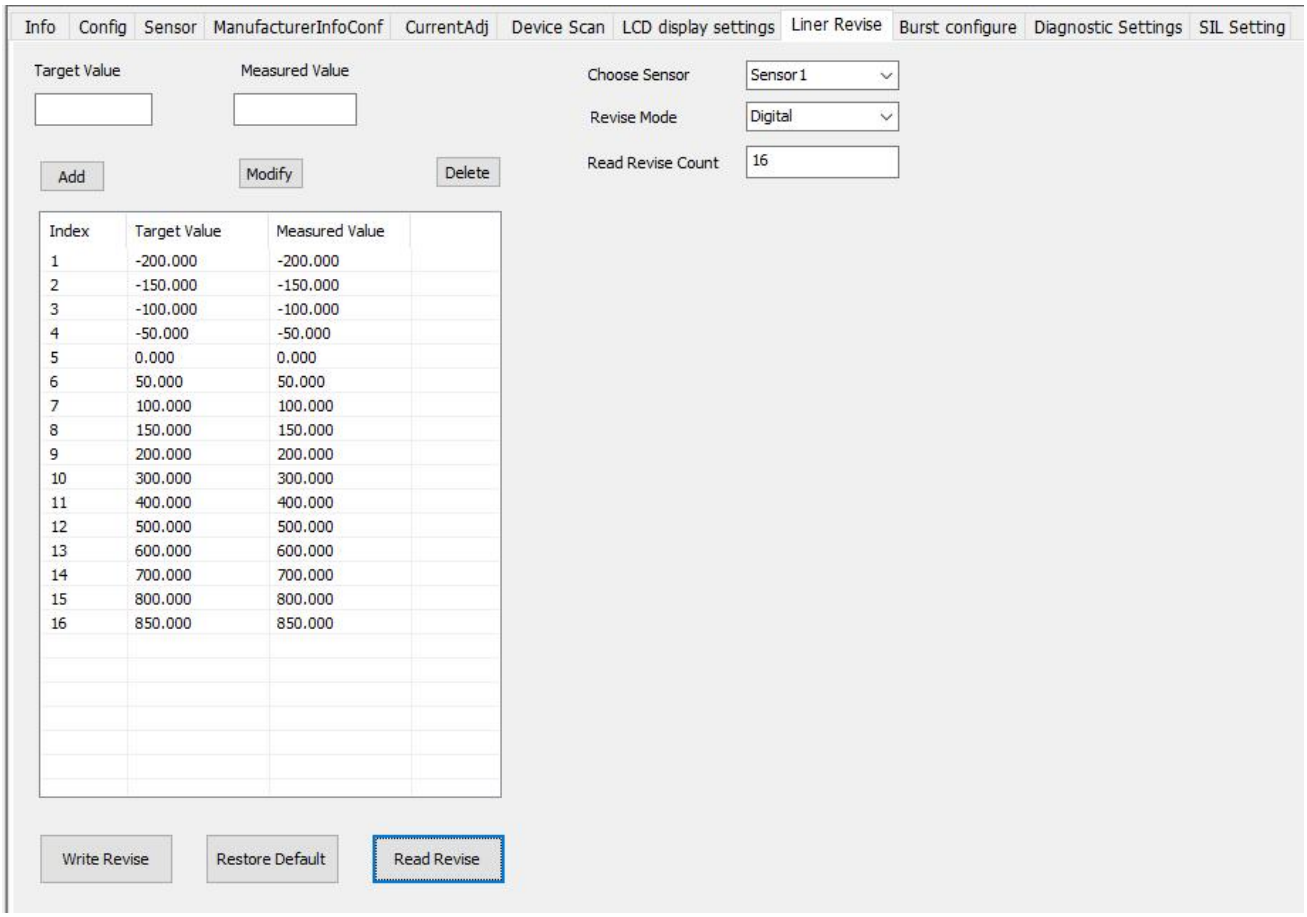


Figure 3.8 Linear Correction

- Sensor Selection: Sensor 1 and Sensor 2 can be selected.
- Correction mode: Selectable digital or analog input;
- Correction count: Displays the number of correction points read. A total of 16 points are supported.

- Add: Target values and measured values can be added to a table of 16 correction points;
- Modification: Select the point to be modified in the table, add the value to be modified to the target value and the measured value, and you can modify the target value and the measured value of that point;
- Delete: Select the point you want to delete in the table to remove that point;
- Write correction: This allows correction points to be written to the device;
- Restore Defaults: This will restore the correction point to the default value.
- Read corrections: Reads correction points from the device;

3.2.9 Burst Configuration

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

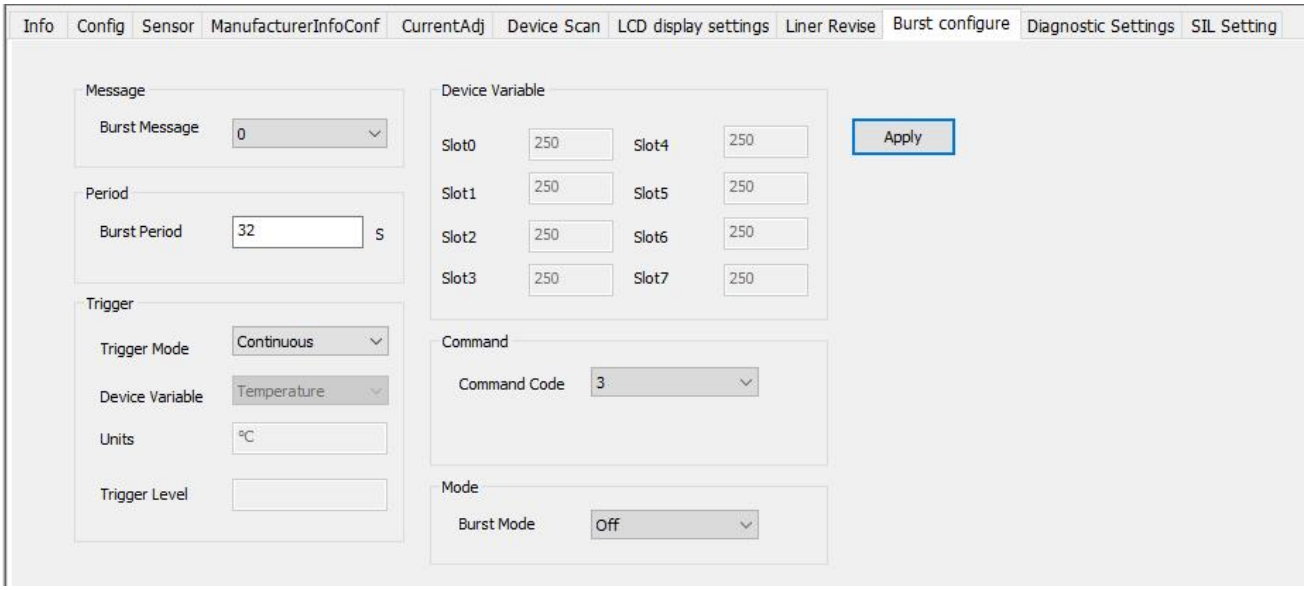


Figure 3.9 Burst configuration interface

Burst messages support 0, 1, and 2; Burst cycles support 1, 2, 4, 8, 16, 32, 60~3600 seconds. Trigger modes support continuous, windowed, rising, falling, and single triggers. Trigger command numbers support 1, 2, 3, 9, and 48 (supported in continuous trigger mode). When the trigger command number is 2, the trigger source is the PV range percentage; otherwise, the trigger source is the PV value. Device variables can only be configured when the command code is 9.

3.2.10 Diagnostic Settings

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

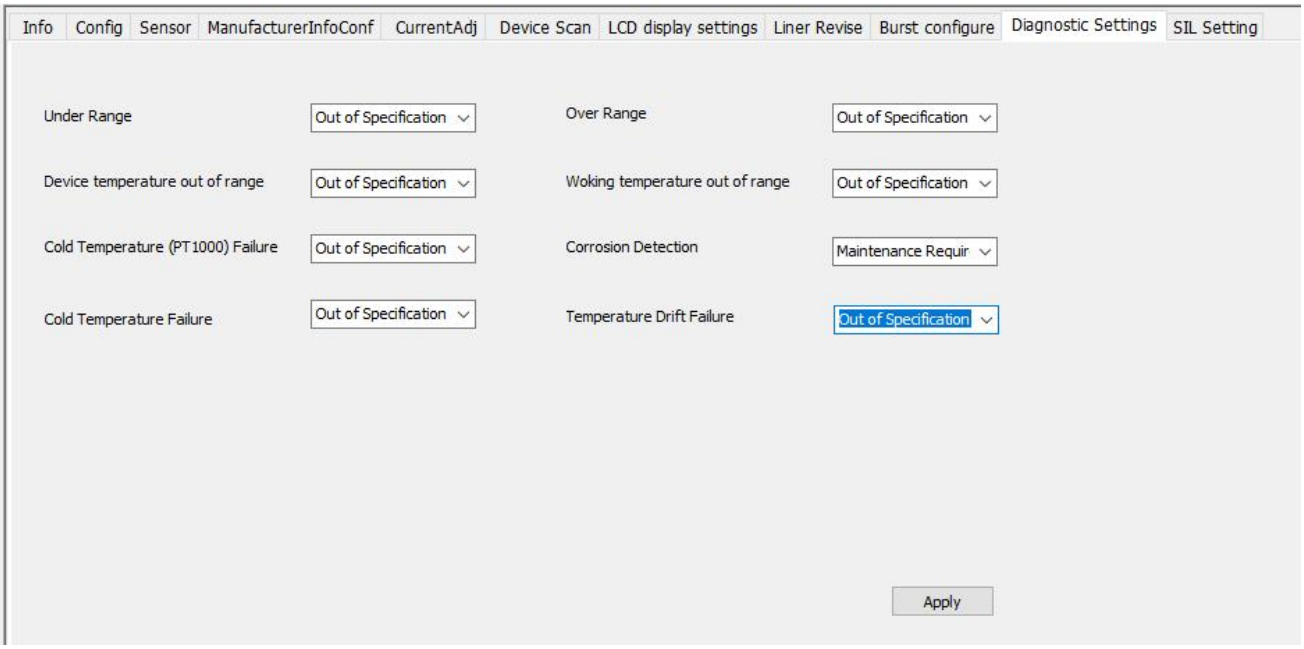


Figure 3.10 Diagnostic settings interface

Configurable diagnostics include:

No.	Diagnosis	Alarm Level	Default Level (normal mode)	Default Level (SIL Mode)
1	Over-range lower limit	F/C/S/M/N	S	S
2	Over the upper limit of the range	F/C/S/M/N	S	S
3	Equipment temperature exceeds limit	F/C/S/M/N	S	S
4	Operating temperature exceeded the limit	F/C/S/M/N	S	F
5	Cold junction temperature fault (Pt1000)	F/C/S/M/N	S	S
6	Cold junction temperature fault	F/C/S/M/N	S	F
7	Corrosion detection	F/C/S/M/N	M	F

Note: When the device enters SIL mode, all alarm levels cannot be manually configured 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 status:

1）F (Failure)

A device malfunction 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 debug mode, which is typically used for device calibration, parameter configuration, or functional testing. In this state, the device does not perform routine measurements and only responds to service commands.

3）S (Out of specification)

If the equipment's operating parameters exceed the normal range specified in the technical specifications, it may affect the measurement accuracy or the equipment's lifespan.

4）M (Maintenance required)

The equipment has detected that preventative maintenance or component replacement is required. The current measurement value remains valid, and maintenance needs to be scheduled.

5）N (No effect)

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

3.2.11 SIL Settings

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

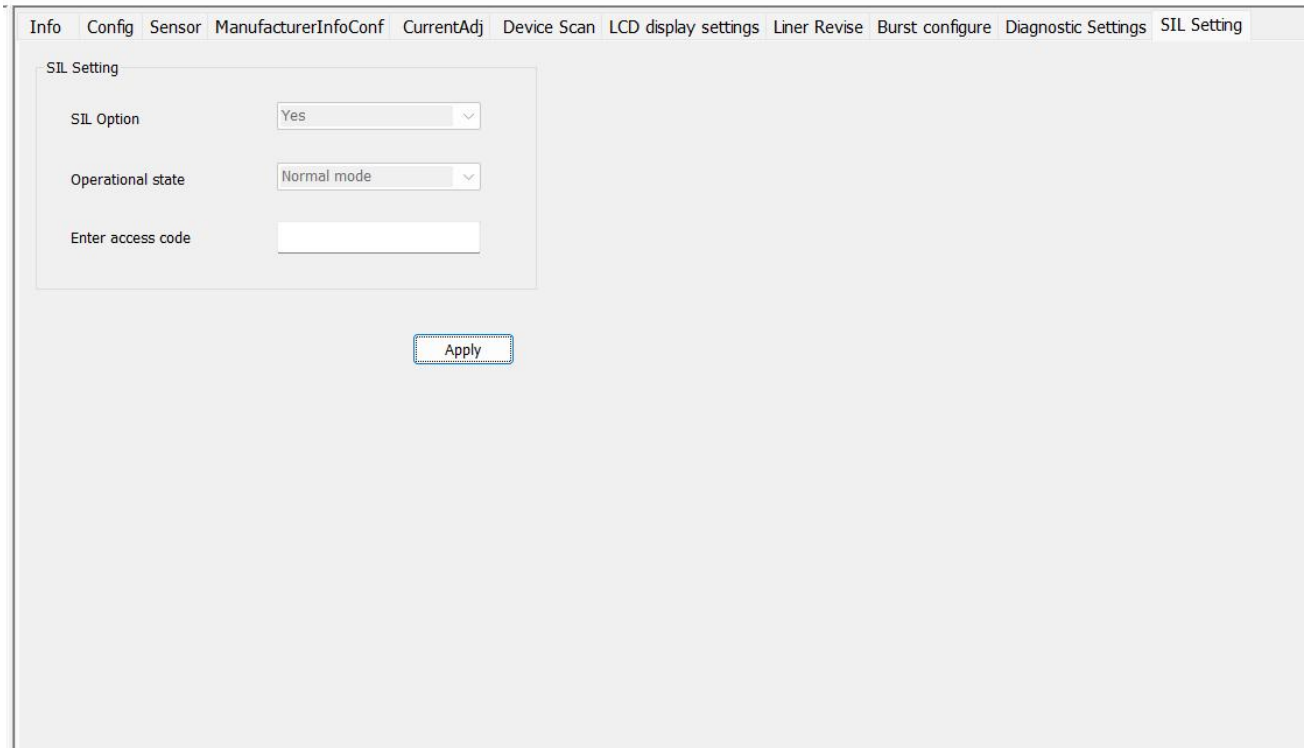


Figure 3.1 1 SIL settings interface

- SIL option: There are two attributes : "Yes" and "No". "Yes" means that the temperature transmitter supports the SIL function ; "No" means that the temperature transmitter does not support the SIL function .
- Operating Status: Displays the current status of the temperature transmitter. It includes: 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、Safe State - Temporary.

State	Describe
Checking SIL option	Check the properties of the "S IL Option". "Yes" means the temperature transmitter supports the S IL function; "No" means the temperature transmitter does not support the S IL function.
Verify checksum	Verify the current configuration. If the verification fails, you cannot enter SIL mode.
Self diagnostic	Perform a fault diagnosis self-test. If the test fails, you cannot enter SIL

State	Describe
	mode .
Normal mode	Normal mode.
SIL mode	SIL mode . This allows for relevant fault diagnosis.
Safe para start	Safety parameter check phase.
Safe param running	Safety parameter check phase.
Save parameter values	Safety parameter check phase.
Parameter check	Safety parameter check phase.
Reboot pending	Wait for the device to restart.
Reset checksum	Configure verification reset.
Safe state – Active	Safe status.

- Enter 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 figure below:

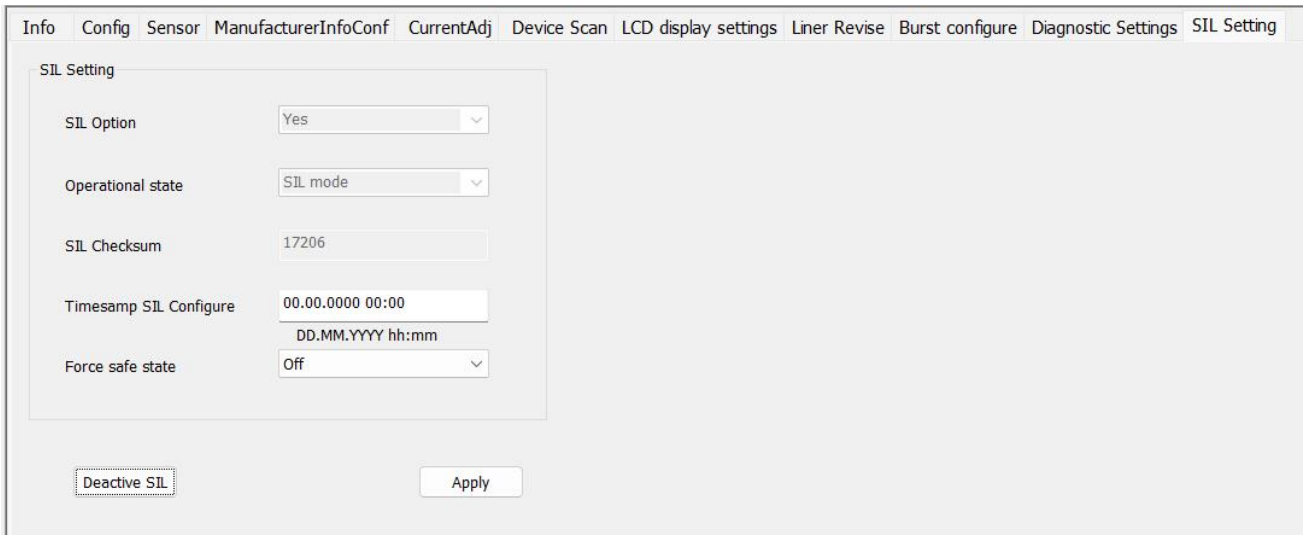


Figure 3.1 2 SIL settings interface

- SIL checksum: Used to verify relevant parameters. Once the device enters SIL mode, configuration modifications are not allowed .
- SIL Configuration Timestamp: This indicates the time when the temperature transmitter enters SIL mode . Note that the temperature transmitter cannot automatically record time; it needs to be manually configured by the user. Format: DD.MM.YYYY hh :mm (DD : day, MM : month, YYYY : year, hh: hour, mm: minute). Configure correctly according to the format.
- Force security mode: Select "On", click "Apply", and the device will restart.
- "Cancel S IL Status" button: Clicking this button will cause the temperature transmitter to exit S IL mode and enter normal mode.

4 On-site Configuration

4.1 LCD and button description

The temperature transmitter is equipped with a dot-matrix LCD and local button calibration, allowing users to adjust its parameters locally. There are three buttons in total: [M], [S], and [Z]. The [M] button is the mode key, primarily used for function selection, cursor movement, and confirmation. The [S] and [Z] buttons are input adjustment keys, primarily used for menu navigation and value increment/decrement. A diagram illustrating the button functions is shown below.

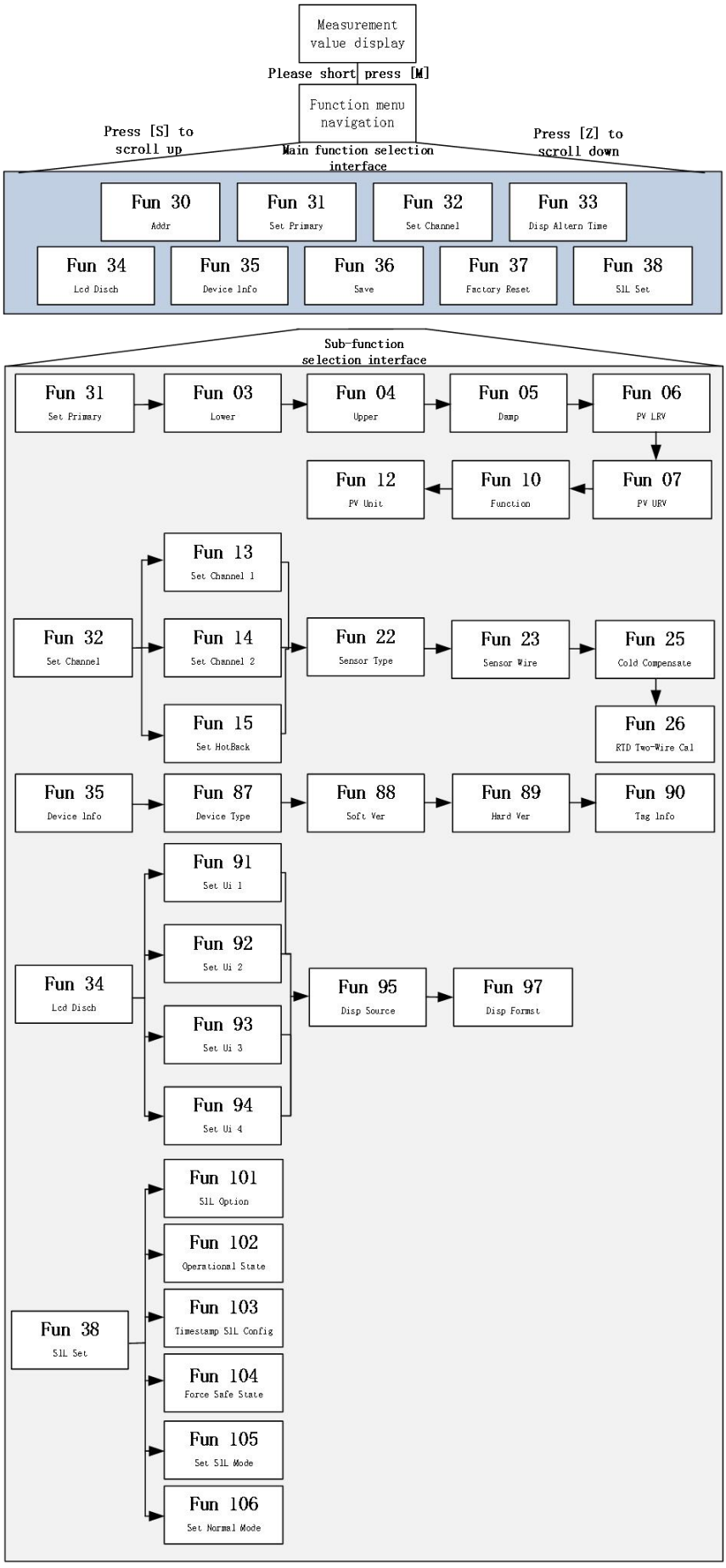


Figure 4.1Button function diagram

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

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

The button functions are explained below:

Function	【M】	【S】	【Z】
1.	Short press to confirm/enter(automatically return to the previous page)	Up	Down
2.	Long press to return to the previous page.	Value increase	Value decrease
3.	Short press to move the cursor.	Move decimal point right	Move decimal point left

4.2 LCD display description

The schematic diagram of the main interface of the temperature transmitter's LCD display is shown below.

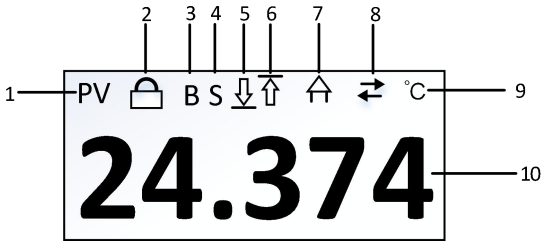


Figure 4.2 Main interface diagram

The meanings of the identifiers displayed on the interface are shown in the table below.

No.	Meaning	No.	Meaning
1	Current measurement type	7	Fault alarm identification
2	Write protection flag	8	LCD communication logo
3	Hot backup enabled indicator	9	Measurement unit
4	The device is in SIL mode	10	Measured value
5	Exceeding the lower limit setting indicator		
6	Exceeding the upper limit setting indicator		

4.3 LCD plug-in/plug-out description

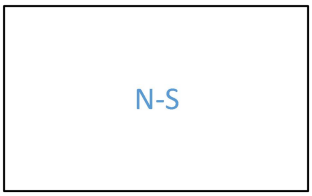
The NCS-TT305 temperature transmitter does not support hot-plugging of the LCD. The temperature transmitter must be powered off when installing or removing the LCD.

4.4 LCD fault display

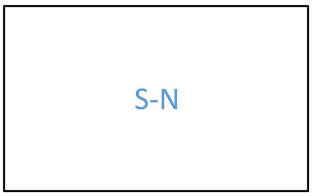
1、When the temperature transmitter malfunctions, a fault code display will be added to the interface. **The fault code format is: Alarm Level + Fault Code.**

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

Symptoms	Solutions
Unable to communicate	**Temperature Transmitter Connection** Check bus cable connection Check power polarity Check bus cable shielding and single-point grounding
	Network Connection Check network topology correctness
	Address Conflict Temperature transmitters are shipped with a default short address of 0. However, address conflicts can still occur on a network due to other reasons. When a conflict occurs, the device address needs to be reset. Sometimes, the device may fail to connect at all. In this case, power off the conflicting device, then power it on one by one, changing the address of the newly powered device to a non-conflicting address. Power on the devices sequentially, changing the addresses each time, until all devices are connected.
	Temperature Transmitter Fault Replace and test with another temperature transmitter
Incorrect reading or output alarm current	**Temperature Transmitter Connection Issues** Check for sensor short circuits, open circuits, grounding issues, etc. Check for sensor malfunctions
	Noise Interference Adjust damping Check if terminals are damp Check if cable laying is away from strong interference sources
	Software Configuration Check if sensor type configuration is correct

5.2 Fault Description

No.	Fault	Fault Code	Alarm Level	Normal Mode	SIL Mode	Remarks
1	Lower limit of over-range	030	F	Support	Not supported	PV value below the lower limit of the measurement range
			C	Support	Not supported	
			S	Support	Support	
			M	Support	Not supported	
			N	Support	Not supported	
2	Upper limit of over-range	031	F	Support	Not supported	PV value above the upper limit of the measurement range
			C	Support	Not supported	
			S	Support	Support	
			M	Support	Not supported	
			N	Support	Not supported	
3	Device temperature exceeds limit	029	F	Support	Not supported	Device fault Device temperature exceeds set
			C	Support	Not supported	

No.	Fault	Fault Code	Alarm Level	Normal Mode	SIL Mode	Remarks
			S	Support	Support	temperature range
			M	Support	Not supported	
			N	Support	Not supported	
4	Operating temperature exceeds limit	007	F	Support	Support	Device fault Device operating temperature exceeds set temperature range
			C	Support	Not supported	
			S	Support	Not supported	
			M	Support	Not supported	
			N	Support	Not supported	
5	Internal Pt1000 fault	024	F	Support	Not supported	Device fault Internal Pt1000 fault
			C	Support	Not supported	
			S	Support	Support	
			M	Support	Not supported	
			N	Support	Not supported	
6	Cold junction temperature fault	025	F	Support	Support	Device fault Cold junction temperature fault
			C	Support	Not supported	
			S	Support	Not supported	
			M	Support	Not supported	
			N	Support	Not supported	
7	Corrosion detection	005	F	Support	Support	Device fault
			C	Support	Not supported	
			S	Support	Not supported	
			M	Support	Not supported	
			N	Support	Not supported	
8	Temperature drift detection	032	F	Support	Support	Device fault Temperature drift fault
			C	Support	Not supported	
			S	Support	Not supported	
			M	Support	Not supported	
			N	Support	Not supported	
9	Bus voltage exceeds upper limit	001	F	Not supported	Support	Device fault Bus voltage too high
10	Bus voltage exceeds lower limit	002	F	Not supported	Support	Device fault Bus voltage too

No.	Fault	Fault Code	Alarm Level	Normal Mode	SIL Mode	Remarks
						low
11	External memory failure	003	F	Not supported	Support	Device fault
12	DAC communication timeout	004	F	Support	Support	Device fault DAC communication failure
13	Loop current sampling accuracy failure	008	F	Not supported	Support	Device fault
14	AD communication failure	009	F	Support	Support	Device fault
15	Sensor 1 short circuit	010	F	Support	Support	Device fault
16	Sensor 2 short circuit	011	F	Support	Support	Device fault
17	Sensor 1 open circuit	012	F	Support	Support	Device fault
18	Sensor 2 open circuit	013	F	Support	Support	Device fault
19	AD hardware error 1	014	F	Not supported	Support	Device fault
20	AD hardware error 2	015	F	Not supported	Support	Device fault
21	AD hardware error 3	016	F	Not supported	Support	Device fault
22	AD hardware error 4	021	F	Not supported	Support	Device fault
23	AD hardware error 5	022	F	Not supported	Support	Device fault
24	AD hardware error 6	023	F	Not supported	Support	Device fault
25	Internal CPU failure	026	F	Not supported	Support	Device fault
26	Internal Flash failure	027	F	Not supported	Support	Device fault
27	Internal RAM failure	028	F	Not supported	Support	Device fault

1、When a fault 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.

2、When only open circuit and short circuit faults exist, and the hot backup function is enabled, the loop current is output according to the PV value.

6 Technical Specifications

6.1 Basic Parameters

Bus Interface	4～20mA+ HART 7(supports BURST mode)
Protocol Version	HART 7
Bus Power Supply	Non-Ex：(13～45) VDC Ex d： (13～45) VDC Ex ia： (13～30) VDC
Wiring Method	2/3/4-wire
Input Signal	Resistance: 0～500Ω、0～2000Ω、0～4000Ω、0～40000Ω； RTD: Cu50 、 Cu50_GOST 、 Cu100 、 Cu100_GOST 、 Pt50_GOST 、 Callendar_Van_Dusen(Pt100)、Pt100、Pt100_GOST、Pt200、Pt500、Pt1000、Ni50、Ni100、Ni120、Ni1000； mV：-100mV～100mV； Thermocouple : B、E、J、K、N、R、S、T、L_GOST、A（W5ReW20Re）、C（W5ReW26Re）、D（W3ReW25Re）、NiCrAuFe、CuAuFe；
Number of Channels	Dual channel
Current Accuracy	Current accuracy0.05%；current temperature drift 0.005%/℃
Electrical Isolation	2kVAC/50VAC
Voltage Effect	±0.005%/V
Response Time	1.0s～1.65s depending on the sensor type and wiring method.
Start-up Time	≤10s
Damping Adjustment	Time constant 0～32s
EMC	IEC 61326
Ex Certification	IECEx：Ex ia IIC T6...T4 Ga ATEX：II2G Ex db IIC T6...T4 Gb II2D Ex tb IIIC T85℃...T110℃ Db
LCD Display	Support
Button Operation	Support button setting parameters
Operating Temperature	(-40～85)℃ (-55～85)℃ （optional）
Humidity Range	(5～95)%RH
Storage Temperature	-50 ～ 85℃

Alarm Signal	Lower limit of saturation current : [3.75-4.0)mA, default value 3.8mA Upper limit of saturation current: (20-20.8]mA, default value 20.5mA Lower limit of alarm current : [3.5-3.7]mA, default value 3.6mA Upper limit of alarm current: [21.0-23.0]mA, default value 21.75mA
Vibration Resistance Specifications	2-25Hz：±1.6mm；25-100Hz：±4g
IP code	IP67（Current rating: IP20 & IP67; follow-up certifications pending）
Weight	Approximately 1.67 kg

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 °C	±0.10°C	±0.005°C
Cu50_GOST	-180 ~ 200 °C	±0.10°C	±0.005°C
Cu100	-50 ~ 150 °C	±0.10°C	±0.003°C
Cu100_GOST	-180 ~ 200 °C	±0.10°C	±0.003°C
Pt50_GOST	-200 ~ 850°C	±0.10°C	±0.005°C
Callendar_Van _Dusen (Pt100)	-200 ~ 850°C	±0.10°C	±0.003°C
Pt100	-200 ~ 850°C	±0.10°C	±0.003°C
Pt100_GOST	-200 ~ 850°C	±0.10°C	±0.003°C
Pt200	-200 ~ 850°C	±0.10°C	±0.005°C
Pt500	-200 ~ 850°C	±0.10°C	±0.005°C
Pt1000	-200 ~ 850°C	±0.10°C	±0.005°C
Ni50	-60 ~ 180°C	±0.10°C	±0.004°C
Ni100	-60 ~ 180°C	±0.10°C	±0.002°C

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 (/℃)
mV	-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 ~ 2500℃	±1.45℃	±0.06℃
C（W5ReW26Re）	0 ~ 2315℃	±1.15℃	±0.09℃
D（W3ReW25Re）	0 ~ 2315℃	±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	≥70dB（50Hz and 60HZ）
Differential mode rejection	≥70dB（50Hz and 60HZ）

6.4 Physical properties

Dimension	139.7*111.9*112.0mm
Housing Material	Aluminum, polycarbonate

6.5 Certificated Information

6.5.1 Explosion-Proof Operation Requirements

6.5.1.1 Intrinsically safe

1、Installation

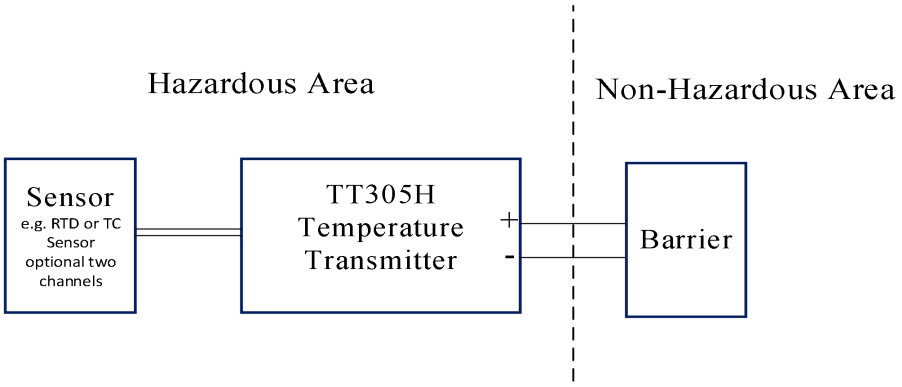


Figure 6.1 Installation

3、Marking

Ex ia IIC T6...T4 Ga

Ex：The universal international explosion-proof mark

Ia：Highest safety rating, suitable for Zone 0 (Ga)

IIC：Gas group, highest hazard level,Contains high-risk gases such as hydrogen, acetylene and carbon disulfide

T6...T4：Class temperature,maximum surface temperature of apparatus is under 85℃（T6）100℃（T5）135℃（T4）

Ga：Equipment Protection Level

3、Intrinsically safe parameters (input and output parameters)

Ui = 30V, Ii = 130 mA, Pi = 0.8W, Li = 248 μH, Ci = 3.3nF

Uo=5.36V，Io=19.3mA，Po=25.9mW . The capacitance and inductance of the temperature sensors connected to output terminals 1 to 6 must not exceed the following limits.

Group	Maximum External Capacitance (Co, μF)	Maximum External Inductance (Lo, mH)
IIA	996	764
IIB	996	382
IIC	61.2	95.5

4、Reference Standards

IEC 60079-0:2017

IEC 60079-11:2023

5、Warning: Specific Conditions of Use / Schedule of Limitations

1. Ambient temperature for equipment operation:

-40 °C ≤ Ta ≤ +60 °C for T6

-40 °C ≤ Ta ≤ +70 °C for T5

-40 °C ≤ Ta ≤ +85 °C for T4

2. The enclosure is coated with a non-metallic coating, which may present a risk of electrostatic charge accumulation. Therefore, it shall only be cleaned with a damp cloth.

3. Appropriate measures shall be taken during use of the equipment to prevent the risk of ignition due to impact or friction.

4. Installation shall be performed according to the latest version of IEC 60079-14.

6.5.1.2 Explosion-proof

1、Marking

II2G Ex db IIC T6...T4 Gb

II2D Ex tb IIIC T85℃...T110℃ Db

2、Ambient temperature for equipment operation

-40 °C ≤ Ta ≤ +85 °C for T4

-40 °C ≤ Ta ≤ +70 °C for T5

-40 °C ≤ Ta ≤ +60 °C for T6

3、Reference Standards

EN IEC 60079-0:2018+A11:2024

EN 60079-1:2014+A11:2024

4、Warning: Operating Conditions for Intrinsic Safety/Explosion-proof Certification

1.Only cable sealing joints that have obtained the necessary compliance certification, are compatible with the specified specifications, and meet the prescribed protection types and levels of protection can be used.

2.The external grounding terminal of the temperature transmitter must be connected to a protective ground and must comply with the electrical safety regulations of each country.

3.If the device allows for the provision of cable interfaces, any unused cable interfaces during installation must be sealed with certified sealing plugs.

4.Do not open the device casing in the presence of an explosive gas atmosphere while the circuit is energized.

5.The device contains non-metallic components and observation windows. Protective measures must be taken to prevent static electricity buildup on exposed non-metallic surfaces. Cleaning should only be performed with a damp cloth.

6.Users must properly protect the device to prevent damage to the flameproof joints, threaded interfaces, and viewing window from mechanical impact or harsh environmental conditions.

7.During device operation, all markings, symbols, displayed information, and polarity markings visible through the viewing window must remain clearly legible.

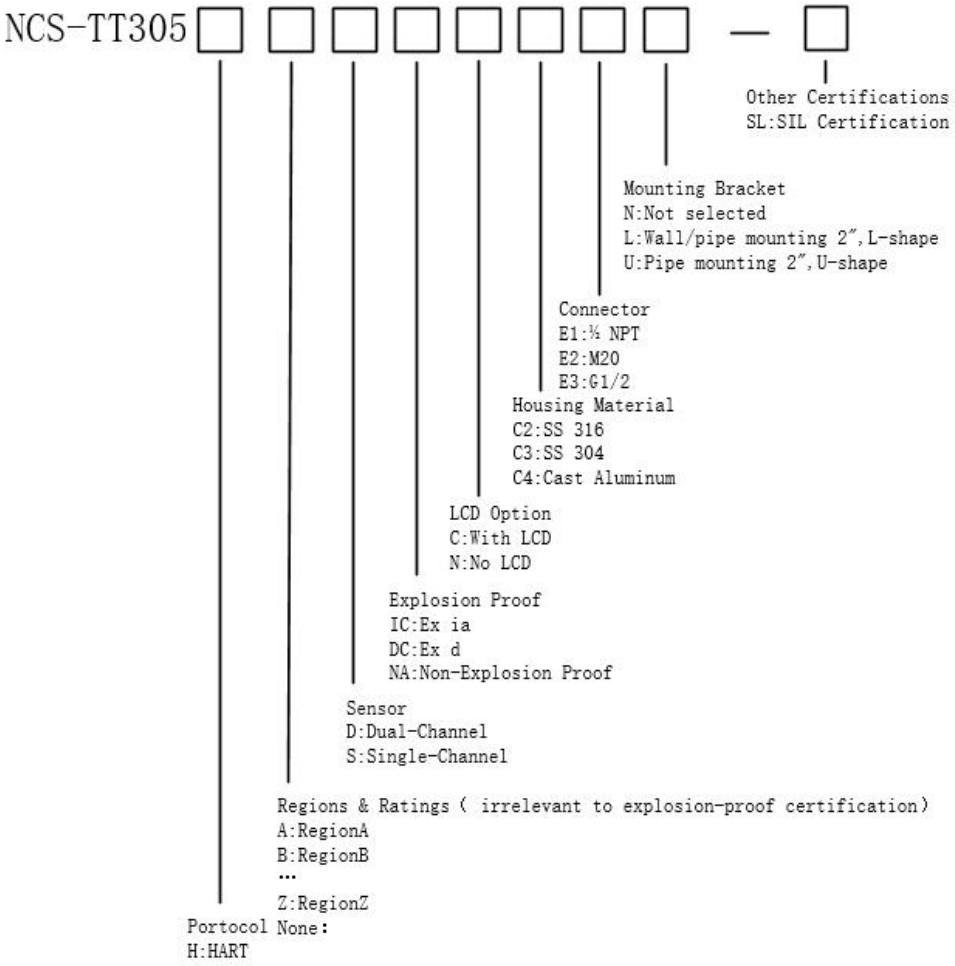
6.5.2 Functional safety certification

Safety-related Information

General		
Model	NCS-TT305H Series	
Hardware Version	1.0	
Software Version	1.4	
Safety-Related Output Signals	4-20mA	
Fault Current	≤3.7mA or ≥21mA	
Input Signals	RTD, Thermocouple, Voltage Signal, Linear Resistance	
Type	Type B	
Demand Mode	Low demand,continuous demand	
Assessment Types	☑Hardware/software assessment, including Failure Mode, Effects, and Hazard Analysis (FMEDA), is completed concurrently with development.	
	☐The "real-world operational verification" performance of the hardware/software (including Failure Mode, Effects, and Hazard Analysis and change requests) is assessed according to IEC 61508-2 and 3 standards.	
	☐Evaluation of hardware/software field data to verify compliance with previous requirements in IEC 61511 standard.	
	☐Evaluation of device without software by FMEDA according to IEC 61508-2 standard.	
Functional Safety Integrity Level		
System Safety Integrity	SC 3	
Hardware Safety Integrity	HFT=0	SIL2
	HFT=1	SIL3
FMEDA	Field-Mounted Type	
λDU	23.26 FIT	
λDD	152.31 FIT	
λS	78.18 FIT	
SFF	91.07%	
PFDavg(T1=1 year）	1.061*10--4	
PFDavg(T1=5 year）	5.137*10-4	
PFH	2.326*10-8	
MTBF	45.2 year	

For further details, please refer to the "NCS-TT305H Series Intelligent Temperature Transmitter Functional Safety Manual".

Appendix 1 Selection Code Table



Appendix 2 Function Configuration Guide

The following configurations are performed using the HARTMPT configuration software:

1. Hot backup function:

1.1. Scan the device online with the HARTMPT software.

1.2. On the Sensor Configuration page, configure the type and wiring of Sensor 1, and click Apply.

1.3. On the Sensor Configuration page, configure the type and wiring of Sensor 2, and click Apply.

Note: The types of Sensor 1 and Sensor 2 should be consistent.

1.4. On the Configuration Information page, configure Sensor 1 as the main variable, and click Apply.

1.5. On the Configuration Information page, configure the upper and lower limits of the range for Sensor 1, and click Apply.

1.6. On the Configuration Information page, configure Sensor 2 as the main variable, and click Apply.

1.7. On the Configuration Information page, configure the upper and lower limits of the range for Sensor 2, and click Apply.

Note: The upper and lower limits of the range for Sensor 1 and Sensor 2 should be consistent.

1.8. On the Sensor Configuration page, select "Enable" for hot backup, and click Apply.

2. Corrosion detection configuration steps

Corrosion detection is applicable to RTD (4-wire) and thermocouples (2-wire).

Example: Sensor 1: Pt100, 4-wire; Sensor 2: K_TC, 2-wire.

Configuration steps are as follows:

2.1. Scan the device online with the HARTMPT software.

2.2. On the sensor configuration page, configure Sensor 1 as Pt100 type and 4-wire, then click Apply.

2.3. On the sensor configuration page, configure Sensor 2 as K_TC type and 2-wire, then click Apply.

2.4. On the sensor configuration page, enable corrosion detection for Sensor 1.

2.5. On the sensor configuration page, enable corrosion detection for Sensor 2.

2.6. On the sensor configuration page, configure the upper limit value for corrosion detection for Sensor 1.

2.7. On the sensor configuration page, configure the upper limit value for corrosion detection for Sensor 2.

3. Temperature drift detection function:

3.1. Scan the device online with the HARTMPT software.

3.2. On the sensor configuration page, configure the type and wiring of sensor 1, and click Apply.

3.3. On the sensor configuration page, configure the type and wiring of sensor 2, and click Apply.

3.4. On the sensor configuration page, configure the drift mode and drift setpoint, and click Apply.

3.5. On the diagnostic settings page, configure the alarm level for temperature drift faults.

Example: Sensor 1 is configured with 0-500R, 2-wire, and an external 250Ohm resistor; Sensor 2 is configured with 0-500R, 2-wire, and an external 100Ohm resistor.

No.	Drift mode	Drift warning rules	Drift setpoint	Loop current
1	Close	**None**	**None**	**None**
2	Outside the window	Non-F	100	Normal
			300	Normal
		F	100	Alarm
			300	Normal
3	Inside the window	Non-F	100	Normal
			300	Normal
		F	100	Normal
			300	Alarm

4. Liquid level measurement configuration steps

4.1. Scan the device online with the HARTMPT software.

4.2. On the configuration information page, configure the unit to liquid level.

4.3. Configure the sensor type and wiring.

4.4. On the sensor configuration page, perform liquid level calibration.

5. To activate SIL mode (enter SIL mode)

5.1. The temperature transmitter supports the SIL function and is in normal mode.

5.2. Configure relevant parameters.

5.3. Enter the access code 7452 in the SIL settings tab .

Note: please ensure the product is working properly before entering the access code.

5.4. SIL configuration timestamp can be set.

5.5. The temperature transmitter enters the " restart pending " state and restarts after a 60s delay .

5.6. After restarting the temperature transmitter, perform calibration and fault diagnosis tests.

5.7. If the test passes, the temperature transmitter enters SIL mode .

5.8. If the detection fails, the temperature transmitter cannot enter SIL mode . You need to exit SIL mode and re-enter SIL mode .

6. To exit SIL mode (enter normal mode)

6.1. If the temperature transmitter is in SIL mode or other modes, you can click the "Cancel SIL Status" button in the SIL settings tab .

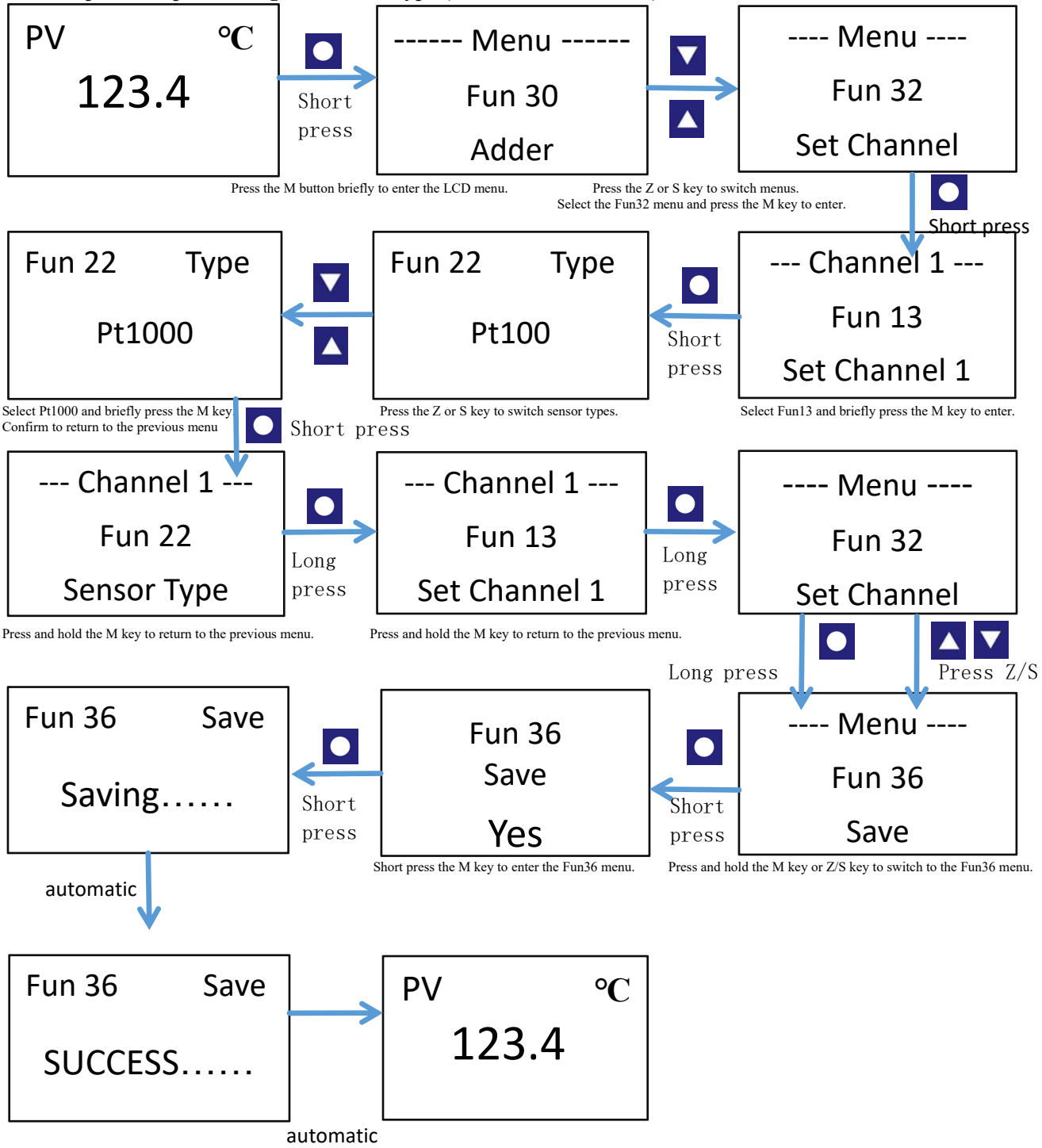
6.2. The temperature transmitter will reset the verification code, enter the " Safe State - Active " state, and restart after 6s.

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

Appendix 3 Local Configuration Guide

The following is an example of a local configuration for a temperature transmitter:

1. Example 1: Steps to change the sensor type (from Pt100 to Pt1000) via buttons:



The message "SUCCESS" will be displayed, and the page will return to the display screen after successful saving.

2. Steps for modifying engineering units via buttons:

2.1. Short press the M button to enter the LCD menu.

2.2. Short press the Z or S key to switch menus.

2.3. Select the Fun31 menu and press the M key briefly to enter.

2.4. Short press the Z or S key to switch menus.

2.5. Select the Fun12 menu and short press the M key to enter.

2.6. Select the S or Z key to switch units.

2.7. Select the unit ℃, short press the M key, and confirm to return to the previous menu.

2.8. Press and hold the M key to return to the previous menu.

2.9. Press and hold the M key to return to the previous menu.

2.10. Press and hold the M key to switch to the Fun36 menu.

2.11. Short press the M key to enter the Fun36 menu, select "YES", and short press the M key to confirm and save.

2.12. The message "SUCCESS" will be displayed, and the page will return to the display screen after successful saving.

3. Steps to modify the wired button operation via buttons:

3.1. Press the M button briefly to enter the LCD menu.

3.2. Short press the Z or S key to switch menus.

3.3. Select the Fun32 menu and short press the M key to enter.

3.4. Short press the Z or S key to switch menus.

3.5. Select Fun13, short press the M key to enter, and configure channel 1.

3.6. Short press the Z or S key to switch menus.

3.7. Select the Fun23 menu, short press the M key to enter, and configure the wiring.

3.8. Short press the Z or S key to switch menus.

3.9. Select 3 Wires, short press the M key, and confirm to return to the previous menu.

3.10. Press and hold the M key to return to the previous menu.

3.11. Press and hold the M key to return to the previous menu.

3.12. Press and hold the M key to switch to the Fun36 menu

3.13. Press the M key briefly to enter the Fun36 menu, select "YES", and press the M key briefly to confirm and save.

3.14. The message "SUCCESS" will be displayed, and the page will return to the display screen after successful saving.

4. Steps for modifying the upper limit of PV range via buttons:

4.1. Short press the M button to enter the LCD menu.

4.2. Short press the Z or S key to switch menus.

4.3. Select the Fun31 menu and short press the M key to enter.

4.4. Short press the Z or S key to switch menus.

4.5. Select Fun07, short press the M key to enter, and configure the PV range upper limit.

4.6. Short press the M key to move the cursor to the location you want to modify.

4.7. Short press the Z or S key to change the number.

4.8. After making the changes, short press the M key until return to the previous menu.

4.9. Press and hold the M key to return to the previous menu.

4.10. Press and hold the M key to switch to the Fun36 menu

4.11. Short press the M key to enter the Fun36 menu, select "YES", and short press the M key to confirm and save.

4.12. The message "SUCCESS" will be displayed, and the page will return to the display screen after successful saving.

Note: If you want to set the sensor type to RTD or TC, first change the engineering units, and then change the corresponding sensor type.

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