MICROCYBER

MS0210 HART Temperature Board Set

User Manual

Microcyber Corporation

Caution

1. Please don't take off/install temperature board set at random.
2. Please check if the power of temperature board set meets the power request in the User Manual.

Version

V1.3

Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

The technical data may change at any time.

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Section 1 Overview

HART temperature board MS0210, using the fieldbus technology, is a new generation of smart temperature module and it is an indispensable field device for process control. It can be widely used in the petroleum, chemicals, electricity, and metallurgical industries, etc.

HART temperature board uses digital technology and it shall match multiple thermal resistance and thermocouples sensors. It has wide range and simple interface between field and control room, which reduces the expense of installation, operation and maintenance.

Section 2 Introduction

2.1 Dimension

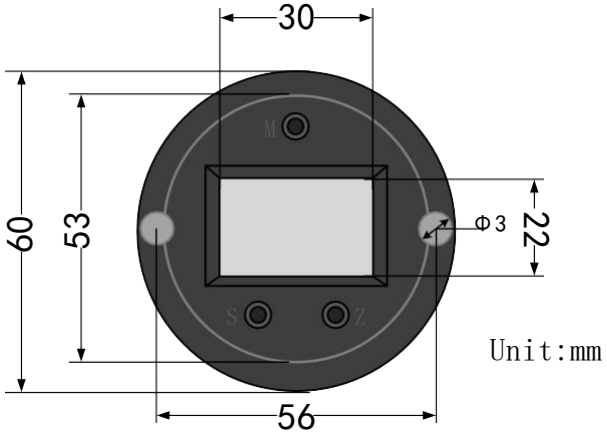

Figure 1 Temperature Board Set Dimension

2.2 Hardware Interface

The hardware interface of HART temperature board set is shown as Figure 2.

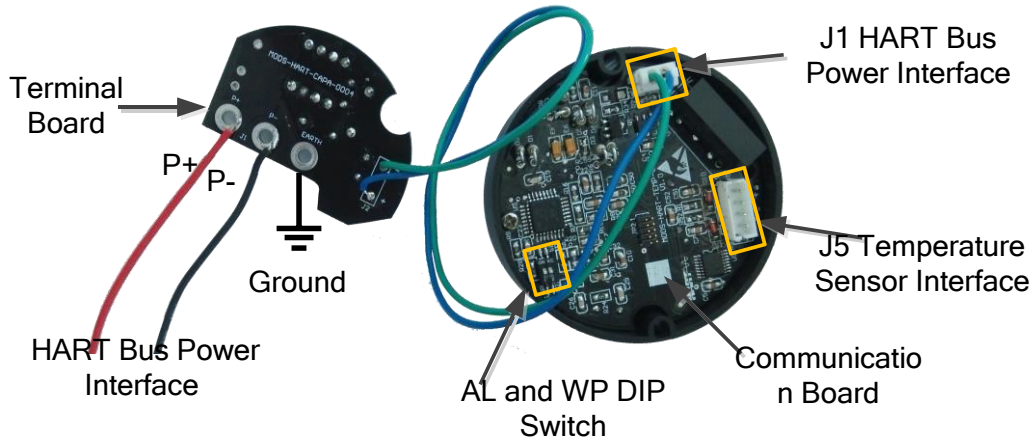

Figure 2 Hardware Interface Introduction

There are 3 main interfaces for HART temperature board set:

- Alarm setting (AL) and configuration protection setting (WP) hardware DIP switch;
- J1, HART bus power interface (P+ and P-);
- J5, temperature sensor connection interface.

2.3 Failure Alarm and Configuration Protection DIP Switch

The DIP switch with “AL” is failure alarm current setting and the one with “WP” is configuration protection setting.

- **Failure Alarm Setting**

HART temperature board set has self-diagnosis function. Once the failure is tested, such as sensor open circuit, sensor short circuit or AD failure, the board set shall output alarm current automatically. The alarm current methods depend on the failure alarm current DIP switch setting of the communication board. When AL DIP switch at OFF position is high alarm, the alarm current is ≥21.75mA. When AL DIP switch at ON position is low alarm, the alarm current is ≤3.7mA.

- **Configuration Protection Setting**

HART temperature board set provides configuration protection DIP switch setting. When it is (DIP switch at ON position) configuration protection, the board set is not allowed to do any device configuration operation modification. When it is (DIP switch at OFF position) configuration protection, the board set is allowed to do device configuration operation modification.

2.4 Bus Power Interface

MS0210 HART temperature board set power and bus share the same a pair of cable and it is called bus cable. The specific fieldbus cable recommended by IEC61158-2 is suggested.

Bus cable should not share the same wiring pipe or wiring slot with other devices, and it shall be away from high-power devices. The bus ends shall be grounded.

There is HART bus power interface for the communication board of HART temperature board set, and it can be used directly. And there is a terminal board to protect communication board to protect bus power interface, shown as

Figure 2 Hardware Interface Introduction

Please refer to Section 6.1 “Basic Parameter” for HART bus power voltage and requested matching resistance in serial.

2.5 Sensor Wiring

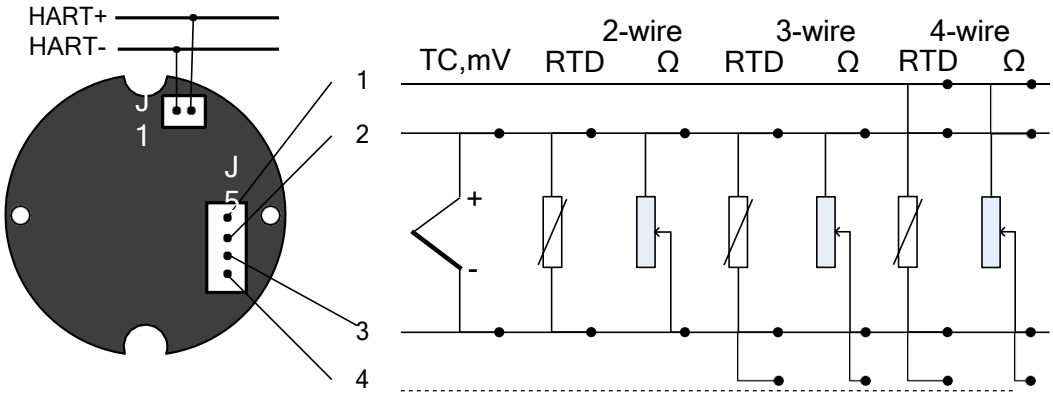

Figure 3 Temperature Board Set Sensor Wiring

HART temperature set sensor wiring support 2-wire, 3-wire and 4-wire, shown as Figure 3. TC represents thermocouple type sensor, mV represent voltage signal, Ω represents resistive and RTD represents thermal resistive type sensor.

2.6 System Connection

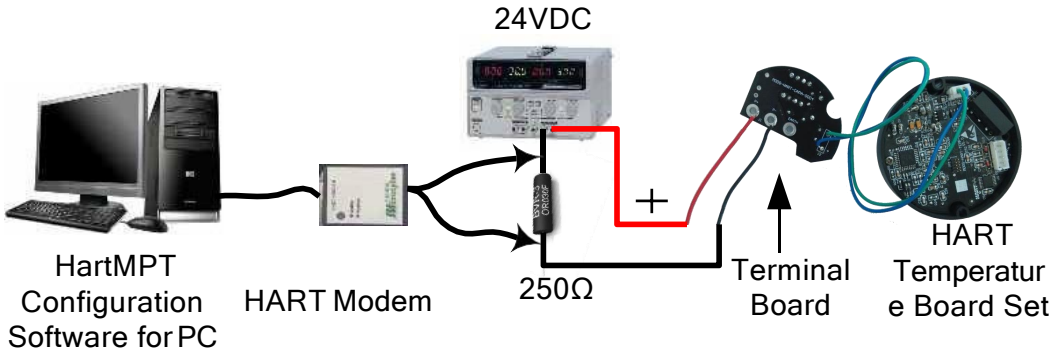

Figure 4 System Connection

Section 3 Temperature Board Set Setting

3.1 Topology Connection

The connection modes of smart transmitter with HART temperature board set can be divided into 4~20mA compatible mode and networking mode.

3.1.1 (4~20) mA Compatible Mode

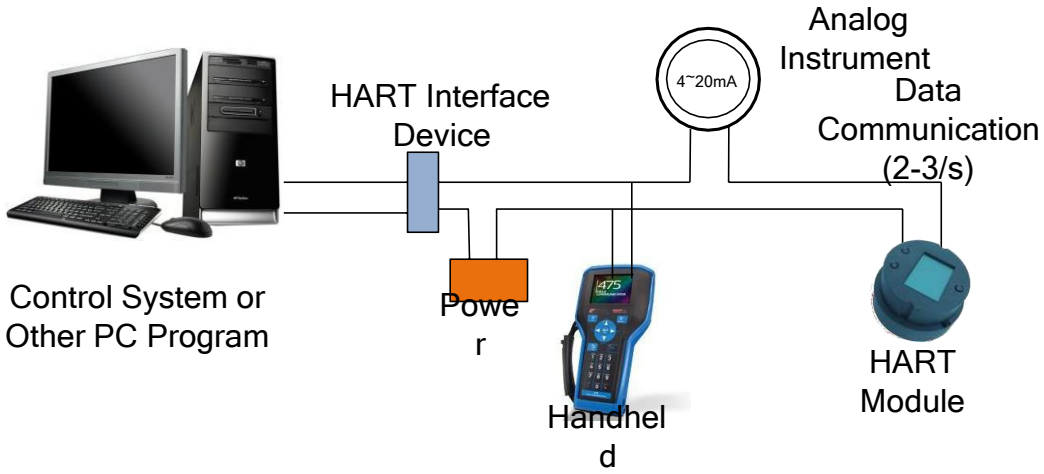

Figure 5 (4~20) mA Compatible Mode

Feature：

1) Connect to upper control system via AI module and HART communication device;
2) Use digital and analog communication;
3) Device address is 0.

3.1.2 Networking Mode

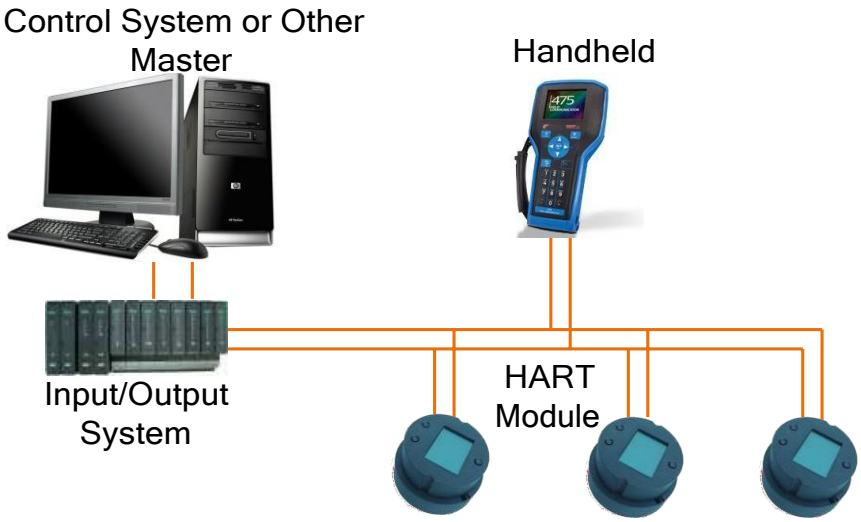

Figure 6 Networking Mode

Feature:

1) Connect to upper control system via HART communication device;
2) Use digital function only and the current is fixed 4mA;
3) Support 64 (polling address is 0~63) devices networking for HART 7.0.

3.2 Function Configuration

HART temperature board set supports Microcyber's HartMPT Configuration Software and universal software such HART Organization's SDC625 for configuration debugging. Following is an example for HartMPT Configuration Software, including functions:

1) Basic information configuration: configure the basic information of device online, including tag, address, date, assemble number and so on;
2) Configuration information configuration: configure the configuration information of device online, including PV range, damp and so on;
3) Sensor info configuration: configure the sensor info of the online device, including type, wiring, etc.;
4) Current calibration: Can calibrate 4~20mA current of online device, also can set fixed current output;
5) Variable monitoring: refresh all dynamic variable of selected online device timely and display trend curve of present device primary value.

3.2.1 Configuration Environment

1) PC with serial port, Windows 2000/Windows XP/Windows 7;
2) HART Modem and serial wire;

3) Matching resistance 230Ω~550Ω.

3.2.2 Basic Information Configuration

Through basic information dialog, the basic information of the smart transmitter can be read or modified, including device address, information, description, date, assembly number, alarm, write protection, manufacturer ID, manufacture, device type, device ID, long address and version info, shown as Figure 7.

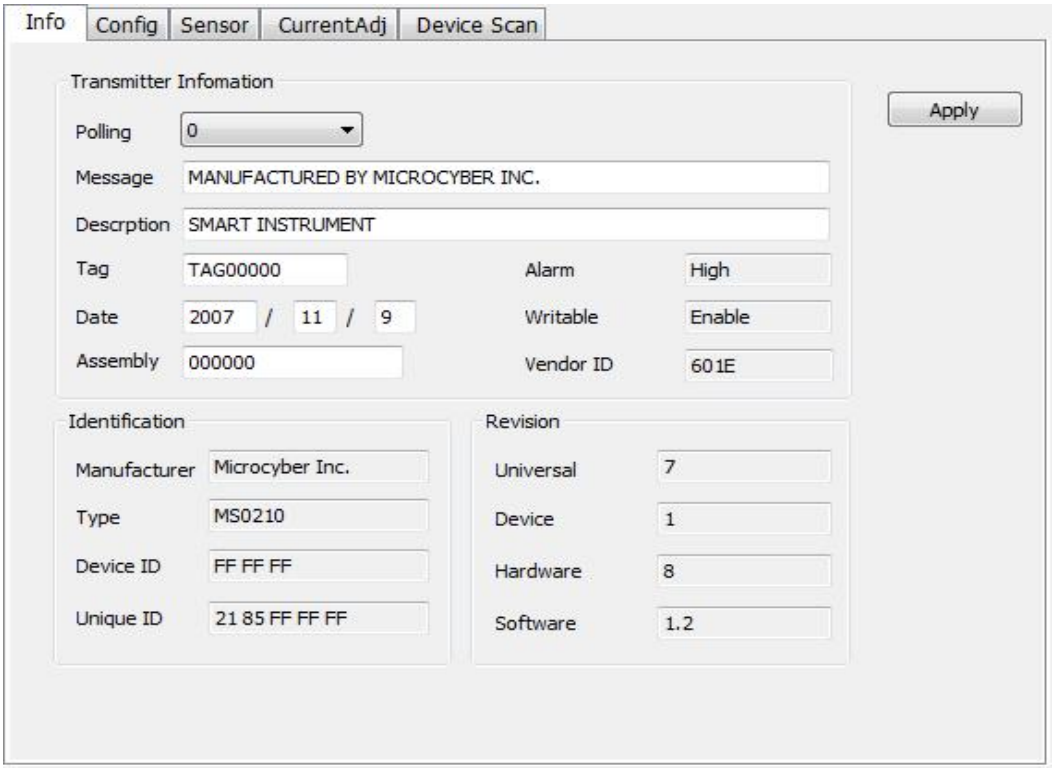

Figure 7 Basic Information

After information modification, click the “Apply” button to download it into device.

1) The address selection range is 0~15;
2) Information can be input 32 characters at most;
3) The maximum length of the description is 16 defined characters;
4) The maximum length of the tag is 8 defined characters;
5) Date range is from the year 1900 to 2155.
6) Assembly number is 6 defined characters at most.

3.2.3 Configuration Information Setting

Through configuration information dialog, the configuration information of smart transmitter can be read or modified, including displayed device output variable (primary variable, cold end temperature value, current value and percentage), primary variable info setting (damp value, unit, upper limit and lower limit) and range calibration, etc., shown as Figure 8.

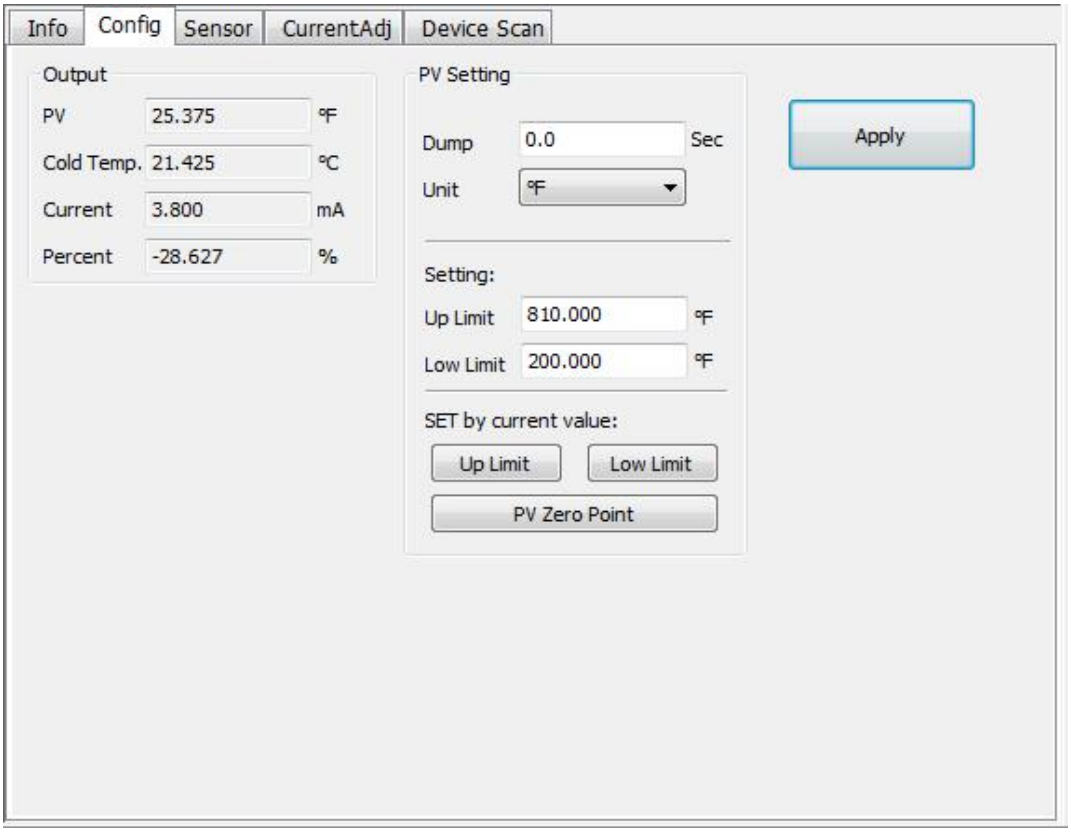

Figure 8 Configuration Information

- Damp: range 0~32s
- Unit: PV unit modification affects variables related to unit, such as the upper or lower limit for the range or for the sensor. When you modify the unit, you can't modify upper or lower limit for the primary variable range, instead, you should modify them separately.
- The unit can be set as: ˚C, ˚F, ˚R, K, mV, Ohm.
- Upper limit of the range: Corresponding to PV value of 20mA output current.
- Lower limit of the range: Corresponding to PV value of 4mA output current.

You should press "Apply" to download it into device after the modification.

- Set "upper limit of range" with present value: Set the PV as the upper limit of primary variable range, and keep the lower limit of range the same as previously.
- Set "lower limit of range" with present value: Set the PV as the lower limit of primary variable range, it may probably modify upper limit at the same time.
- Set "primary variable zero point" with present value: Set the PV as the primary variable zero point when the temperature is 0 ˚C.

3.2.4 Sensor Configuration

You may check the current configuration sensor info (upper limit, lower limit and minimum span) via sensor info TAB. Also, you may configure the sensor type and wiring with it,

shown as Figure 9.

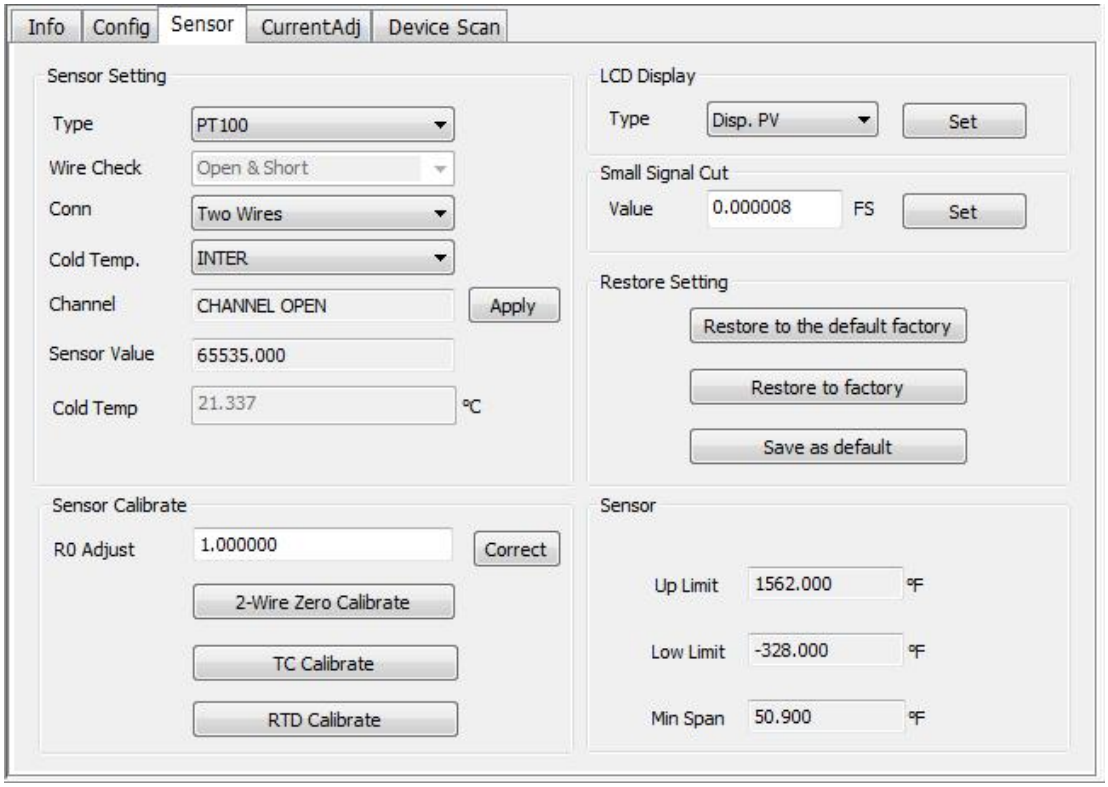

Figure 9 Sensor Configuration

Sensor type: Sensor type supported by device, shown as following:

Sensor Type	Description
0_500R	Resistance, (0 ~ 500) Ω
0_4000R	Resistance, (0 ~ 4000) Ω
CU50	Cu50
CU100	Cu100
PT100	PT100
PT1000	PT1000
100MV	mV voltage signal, range: (-100~100) mV
B_TC	B type thermocouple
E_TC	E type thermocouple
J_TC	J type thermocouple
K_TC	K type thermocouple
N_TC	N type thermocouple
R_TC	R type thermocouple
S_TC	S type thermocouple
T_TC	T type thermocouple

- Wiring: It can be set as 2-wire, 3-wire or 4-wire, only effective to RTD.

- Cold-end Compensation: It enables or disables thermocouple's cold-end

compensation function. When the user is using internal cold-end compensation, the present cold-end compensation value is internal measurement temperature value. When the user is using external cold-end compensation, the user may use “external setting temperature value” to set fixed cold-end compensation value.

- Channel status: Display sensor channel status (open circuit, short circuit, etc.)
- Sensor channel value: Display original value of sensor channel.
- External setting temperature: When external cold-end compensation is set as “Enable”, the present cold-end compensation value can be set via “external setting temperature”.
- Cold-end compensation temperature: Display present cold-end temperature compensation value.
- R0 correction factor: Correct the sensor’s own error (range 0.9~1.1).
- 2-wire zero point calibration: When the temperature transmitter is connected to RTD in 2-wire way, in order to avoid the resistance error in the cable, you should short-circuit the sensor and execute zero point calibration button.
- TC calibration: Factory calibration for thermocouple ranges. (only for manufacturer)
- RTD calibration: Factory calibration for thermo resistances ranges. (only for manufacturer)
- Recover to factory default value: Click this, all the data shall be recovered to factory default status.
- Save as factory value: Click this, all the present setting shall be saved as factory value. Click “Recover to factory”, it shall be recovered to the saved setting.
- Recover to factory setting: Click this, all the data shall be recovered to factory status. If the user has saved factory value, then it shall recover to user’s saved setting. Otherwise, it shall be recorvered to default factory status.

3.2.5 Current Calibration

The steps of current calibration are shown as following:

1) Connect the loop, an ammeter with the 5 1/2 digit precision should be series-wounded in the device output loop.
2) Set device rolling address as 0, please refer to basic info configuration. If rolling address is 0 already, this step can be skipped.
3) Enter current calibration option TAB.
4) Select “current value” as 4mA, when the ammeter is stable, input the value in ammeter to “adjustment value”, and then click “Apply”.
5) Select “current value” as 20mA, when the ammeter is stable, input the value in ammeter to “adjustment value”, and then click “Apply”.
6) Select “current value” as blank, makes the device output current as PV value.

Notes: When the present output current value is high alarm current, the user cannot calibrate 4mA. When the present output current value is low alarm current, the user cannot calibrate 20mA.

Configure Current Fixed Output

The user may set fixed current output in current calibration tab. Input the value of the current the smart transmitter will be fixed on, to “fixed current value”, and click the button “enter/exit fixed current mode” to enter or exit the mode of fixed current output. The text of the button can display “exit fixed current mode” and “enter fixed current mode” in turn, to tell users what to do.

In the run of the HART smart transmitter, compare the value of the primary variable and range upper/lower limit of the primary variable continuously. When the value of the primary variable exceeds the range of the primary variable, the smart transmitter will output fixed current to indicate that the value of the primary variable is exceeded. When it is over the upper limit, the smart transmitter output fixed current 20.8mA； When it is less than the lower limit, output is 3.8mA.

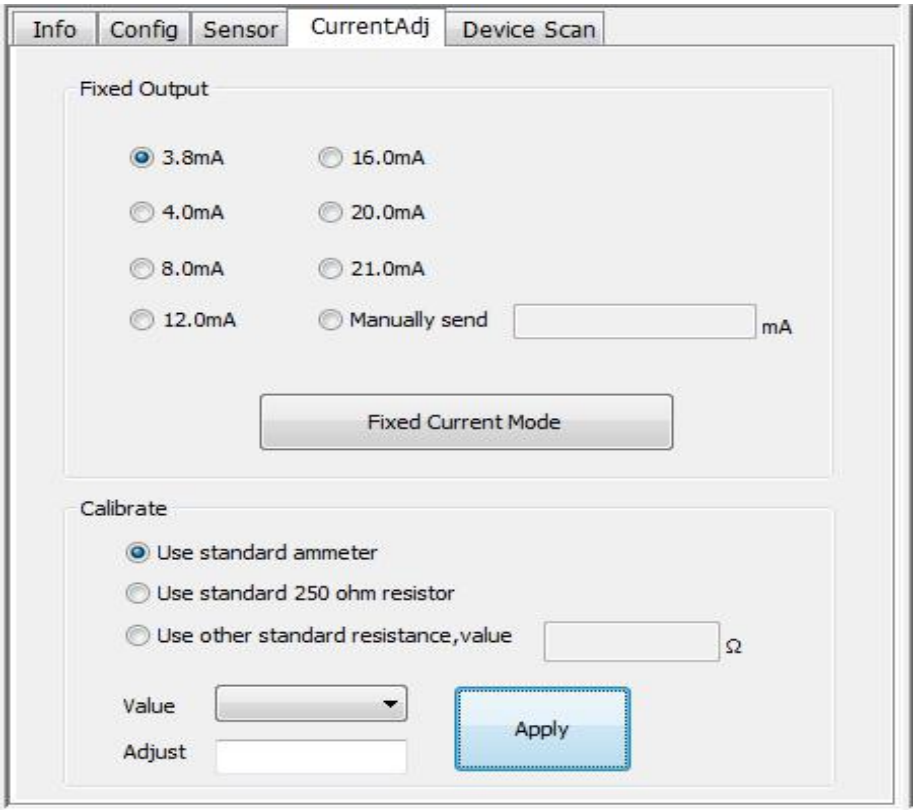

Figure 10 Current Calibration

Note: Calibration current and fixed current output functions are only in the moment when the polling address is 0. It will be at absolute digital communication mode at other polling addresses, the failure info is “Command Execution Failure”.

3.2.6 Variable Monitoring

The user is able to refresh all the dynamic variables of the selected device and display trend curve of present device primary variable via variable monitoring tab. The present refreshing variables are: PV value, current value, percentage and cold end temperature.

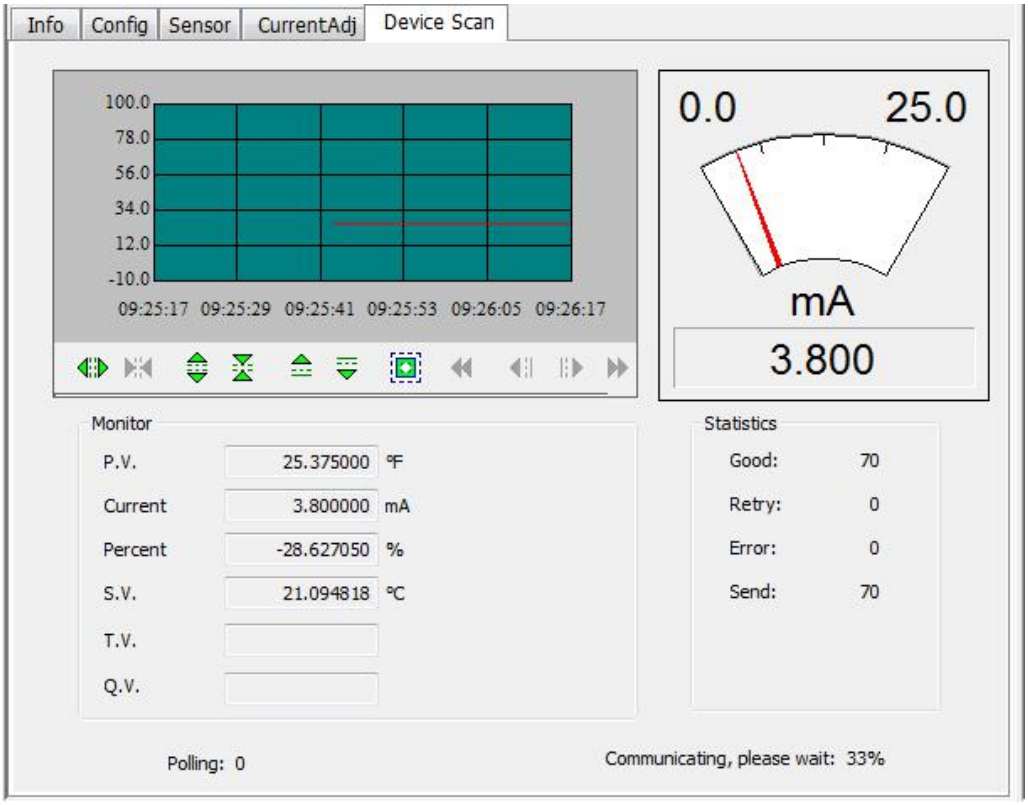

Figure 11 Variable Monitoring

Section 4 Adjustment in the Field

4.1 LCD and Button Instruction

HART temperature board set has lattice LCD and local button adjustment function, and the user can do parameter adjustment in local for HART temperature transmitter (HART temperature board set + sensor + housing).

There are 3 buttons, 【M】, 【S】and【Z】. 【M】is mode button, in charge of “function option”, “cursor move” and “confirm”. 【S】 and 【Z】are input adjustment buttons, in charge of “list front/back turn” and “data add and subtract”.

4.2 General Adjustment Method

4.2.1 List Scan

In measurement display mode, press 【 M 】 for lone, to enter function list tab, and then press 【S】or【Z】to scan the whole function list tab.

4.2.2 Password Input

Press 【S】or【Z】to adjust list as “Fun 01”, and the list is password function, so the user shall only operate other function if the input password is right. And then the user shall press 【M】to enter password input status, and the password is “00005”. Press 【S】or 【Z】to adjust the value, and then press 【M】to adjust cursor position, after that, press 【M】to confirm, and then the system shall be return automatically to list scan mode.

4.2.3 Function Setting

In list scan mode, press 【S】or【Z】to choose function to adjust, and press 【M】to enter function adjustment, after that, press 【M】to confirm and return to list scan mode, and then go on to adjust following functions.

4.2.4 Data Save

After finishing the function setting, in list scan mode, press 【S】or【Z】to adjust list as “Fun 99”, and this list is data save confirm function. Press 【M】to enter, 【S】or【Z】to choose “SAVE”, and then press 【M】to confirm to save. After successful save, the LCD will show “SUCCESS”. Otherwise, there is “FAILED” is save is not successfully or no modification.

Now the local adjustment functions are finished, the user shall adjust many function items once, and then adjust to “Fun 99” to save all the data once.

4.3 List Function Items

Here is the introduction for HART temperature board's local button operations. With field adjustment, the user shall adjust PV unit, PV upper limit, PV lower limit, sensor type, sensor wiring, etc. The supported functions are shown as following:

No.	Parameter	Remarks
01	PASSWORD	Local adjustment, input password: 00005 Save as factory value, input password: 62259 Recover as factory value, input password: 25917 It shall execute as soon as input password for "Save as factory value" and "Recover as factory".
03	LOWER	User present value to set PV lower limit, after the setting, the system shall save automatically, no need to return to "Fun 99" to save manually.
04	UPPER	User present value to set PV upper limit, after the setting, the system shall save automatically, no need to return to "Fun 99" to save manually.
05	DAMP	0~32 Set damping time 0~32s
06	LRV	Passive setting for PV lower limit
07	URV	Passive setting for PV upper limit
08	ZERO	User present value to set PV zero point
10	FUNCT	Choose PV output function
11	DISPLAY	Set LCD display content
12	UNIT	Set PV unit
22	SENSOR TYPE	Set temperature sensor type
23	SENSOR WIRE	Set RTD wiring: 2/3/4 wire
25	COLD COMPENSTATE	Thermal couple cold end compensation function option
26	TWO WIRE CALIBRATION	Resistive type sensor 2 wire zero point calibration
99	SAVE	After the above functions, the user shall execute SAVE function to finish local adjustment.

Notes:

- If the sensor type is resistive, there shall be no display for "Fun 25" cold end compensation function in list.

- If the sensor type is resistive, and the wiring is not 2-wire, or the sensor type is mV,

there shall be no display for “Fun 26” cold end compensation function in list.

- If the sensor type is mV, there shall be no display for “Fun 23” wiring option function in list.
- The user shall execute “Fun 99” data save function, all the function adjustments shall be finished.

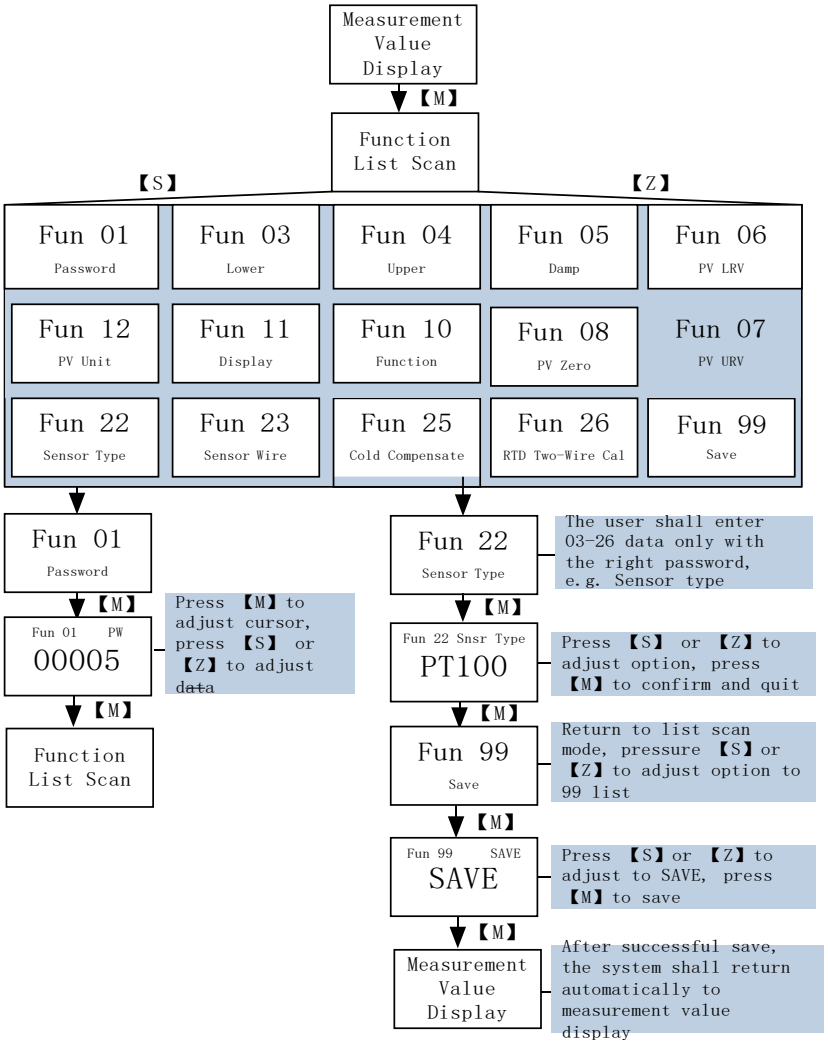

Figure 12 Function Switch

4.4 Description for Special Symbols

No.	Display	Description
1	PV	PV mark
2	SV	SV mark

3		Square root mark

4		larger or equal to range upper limit mark
5		Smaller or equal to range lower limit mark
6		Write protection mark
7		Alarm mark
8		Communication mark

Section 5 Maintenance

Phenomenon	Solution
No Communication	**Temperature Module Connection** Check the bus cable connection Check bus power polarity Check bus cable shield, whether it is single point earthing or not
	Bus Power Bus power should in the range 10.5~42V for the temperature module, and bus noise and ripple should fulfill: 1) peak-to-peak value noise 16mV, 7~39kHz; 2) peak-to-peak value noise 2V, 47~63HZ, non-intrinsically safety 3) peak-to-peak value noise 0.2V, 47~63HZ, intrinsically safety 4) peak-to-peak value noise 1.6V, 3.9M~125MHZ.
	Network Connection Check network topology structure Check terminal matcher and wiring Check the length of main trunk and branch
	Address Conflict When coming to market, the temperature module has a random address, avoiding address conflict. But on a network segment it still possibly appears address conflicts. When conflict occurs, sometimes conflicting device will be temporary address online, you should just reset the device address. Sometimes device will not be temporary address online, you should cut off the electricity of conflicting device, and then power them one by one, modify the address of new powered device as non-conflicting.
	Temperature Module Failure Replace the temperature module with others for testing.
Reading Error	**Temperature Module Connection Failure** Check sensor short circuit, open circuit, and earthing. Check sensor
	Noise Disturb Adjust damping Check the house earthing Check the terminal Check the cable is away from the strong electromagnetic interference

	Software Configuration Check sensor type configuration Check function block parameter configuration
	Temperature Module Failure Replace the temperature module with others for testing.

Section 6 Technical Specification

6.1 Basic Parameter

Content	Index
Bus Connection	(4~20)mA + HART
Bus Power	(10.5~42)VDC (10.5~30)VDC (Intrinsically Safety)
Load Resistive	(0~1500)Ω (Normal) (230~550)Ω (With HART)
Input Signal	Pt100, Pt1000, CU50, CU100, (0~500)Ω, (0~4000)Ω resistance; B, E, J, N, K, R, S, T thermal couples; (-100~100) mV voltage signals.
Channel	Single channel
RTD Wiring	2/3/4 wire
Display	COG128x64
Working Temperature	(-20~70)℃
Storage Temperature	(-40~85)℃
Start Time	≤5s
Refresh Time	0.5s
Humility Range	(5~95)% RH
Isolation Voltage	500 VAC
EMC	GB/T 18268.1-2010 GB/T 18268.23-2010

6.2 RTD Parameter

- RTD Parameter at Normal Temperature (25℃)

Signal Type	Suggested Range (℃)	Accuracy
Resistance Signal	(0~500) Ω, (0~4000) Ω	±0.09Ω /±0.7 Ω
PT100	(-200~850) ℃	±0.3 ℃
PT1000	(-200~850) ℃	±0.3 ℃
CU50	(-50~150) ℃	±0.5 ℃
CU100	(-50~150) ℃	±0.4 ℃

- RTD Other Parameter

Wiring	2/3/4
Common Mode Rejection	≥70 dB (50 Hz and 60 Hz)
Series Mode Rejection	≥70 dB (50 Hz and 60 Hz)
Temperature Effect	<50 ppm/℃

6.3 Thermocouple Parameter

- Thermocouple Parameter at Normal Temperature (25℃)

Signal Type	Suggested Range (℃)	Accuracy
mV	(-100~100) mV	0.05%
B	(500~1810) ℃	±1.0℃
E	(-200~1000) ℃	±0.4℃
J	(-190~1200) ℃	±0.4℃
K	(-200~1372) ℃	±0.4℃
N	(-190~1300) ℃	±0.8℃
R	(0~1768) ℃	±1.0℃
S	(0~1768) ℃	±1.0℃
T	(-200~400) ℃	±0.4℃

- Thermocouple Other Parameter

Compensation Accuracy	(-2~5) ℃
Sensor Type	B, E, J, N, K, R, S, T; (-100~100)mV Voltage
Common Mode Rejection	≥70 dB (50 Hz and 60 Hz)
Series Mode Rejection	≥70 dB (50 Hz and 60 Hz)
Temperature Effect	<50 ppm/℃

MICROCYBER

YOUR FIELDBUS EXPERT

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