IND PNP Operating Handbook

1. Introduction

This document describes the operation, electrical parameters, and mechanical dimensions of the slope transmitter. It provides users with guidance to quickly commission and apply the product.

2. Overview

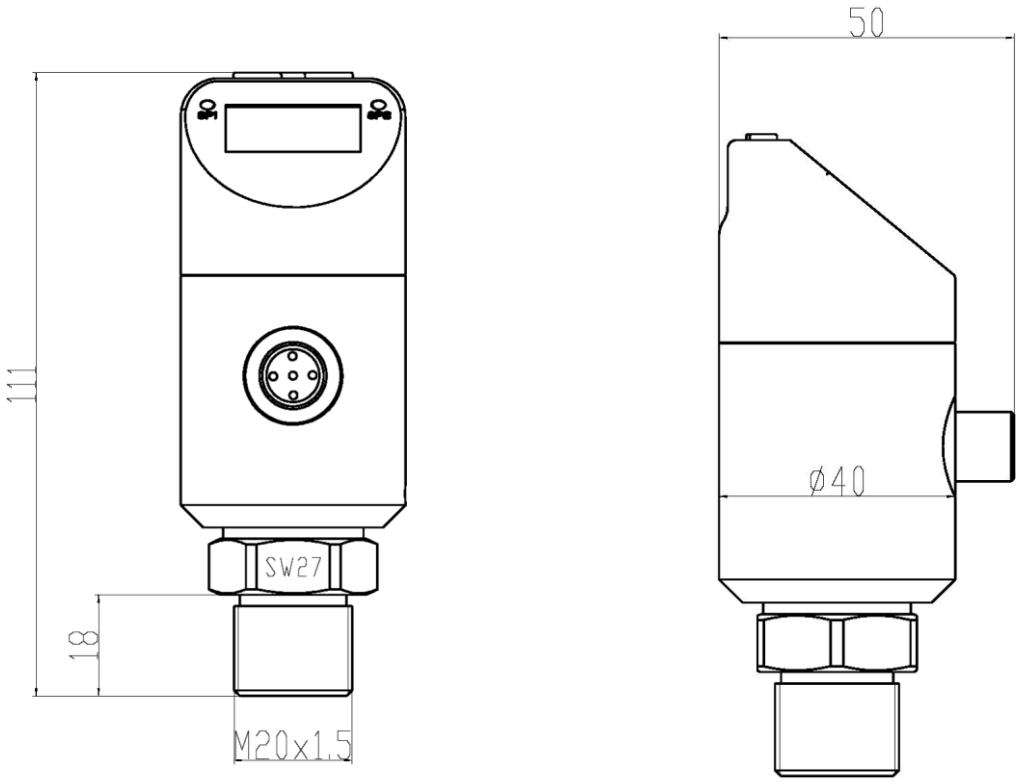
The slope transmitter provides 4–20mA analog output, two relay switch outputs, and on-site display functionality. It uses SMT technology and an integrated design, offering constant-voltage or constant-current excitation for sensors such as diffused silicon, ceramic, and strain gauge pressure sensors. The built-in microprocessor allows zero point, full scale, decimal point, and control point settings via three-button programming—no potentiometer adjustment required. The unit is designed for industrial temperature ranges with strong anti-interference capability.

Product Features:
- OLED display supporting both Chinese and English.
- Microprocessor-based design for enhanced flexibility and functionality.
- One analog output and two switch outputs.
- Supports calibration via both debugging tool and keys, with two-point or three-point calibration options.
- Ultra-low temperature drift suitable for -40°C to 85°C environments.
- Flexible switch point configuration with automatic direction recognition and hysteresis insertion.
- Excellent anti-interference performance exceeding comparable products.

3. Technical Specifications

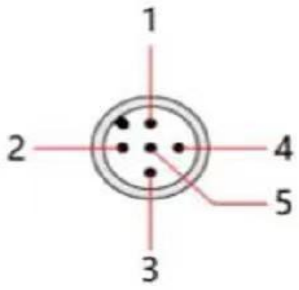
Control Range	-0.1...0~0.01...100MPa	Accuracy	≤±0.5%FS
Stability	≤±0.5% / year	Display Accuracy	±0.1%FS
Display Type	OLED screen	Display Range	-9999~99999
Power Supply	13-30VDC	Static Power Consumption	< 12mA
Response Time	< 5mS	Wiring	M12 Industrial Connector
Output Mode	2 Switch Outputs + 1 Analog Output	Load Capacity	<2A
Protection Level	IP65	Switch Life	>1000000 cycles
Ambient temperature	-30℃~70℃	Medium Temperature	-40℃～85℃

4.Appearance parameters



5.Wiring Instructions

The switch output and current output use five-core M12. The wiring definition is as follows:



1：Brown， 24V+

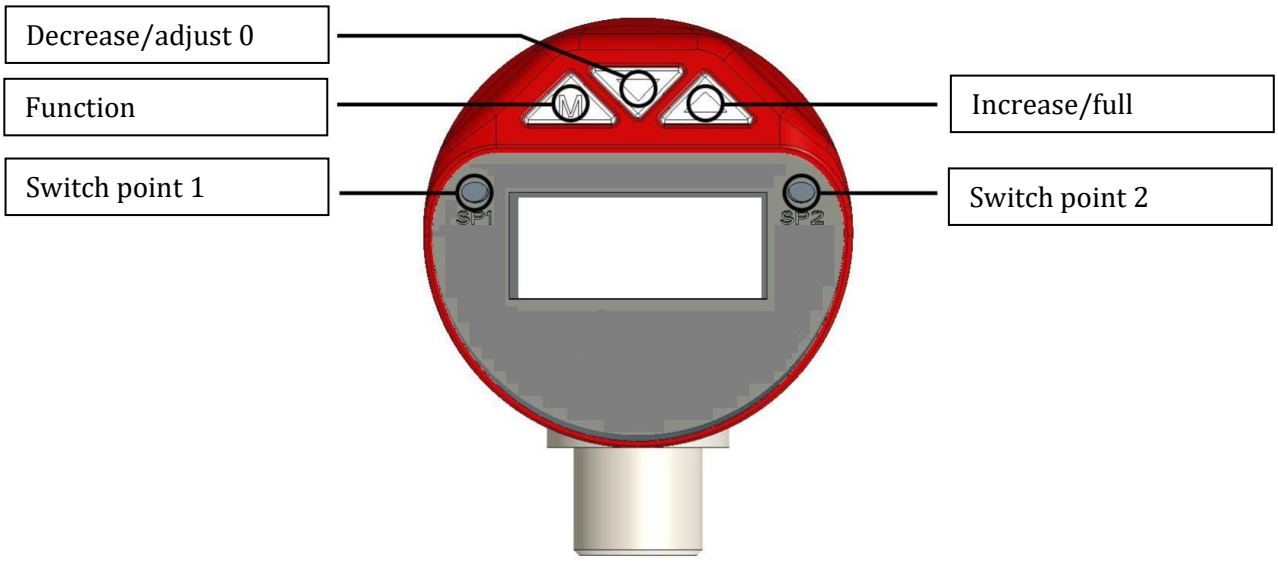
2：White， SP1 switch output

3：Blue， 24V-

4：Black， 4-20mA analog output

5：Glay， SP2 switch output

*Display Interface



6. Key Function Description

6.1 Key Function Description

6.1.1 Function Key "Mode"

In measurement mode, a short press enters password settings.

In setup mode, a short press enables parameter modification; the modified parameter flashes. A second short press confirms the change; the modified parameter stops flashing.

6.1.2 Zero/Decrease Key "▼"

In setup mode, a short press decrements the parameter by one.

In setup mode, a long press decrements the parameter by one.

In parameter modification mode, a shift function is available.

6.1.3 Full/Increase Key "▲"

In setup mode, a short press increments the parameter by one.

In setup mode, a long press increments the parameter by one.

6.2 Key Function Overview

The menu can be scrolled up and down. You can scroll up and down at will without exiting the menu. If no key is pressed within 60 seconds while in the setup state, the setup state will automatically exit, and the modified data will not be saved.

● Press the "Mode" key

● "PSW" will be displayed (prompting for password entry)

● Press the "▲" key to select the password digit, and press the "▼" key to enter the password for that digit

● Press the "Mode" key to confirm

● Press the "▲" or "▼" key to scroll up or down through the menus

● Press the "Mode" key to enter the selected menu

● Press the "▲" or "▼" key to change the setting value

● Press the "Mode" key to confirm. If necessary, use the "▲" or "▼" key to select another menu to modify.

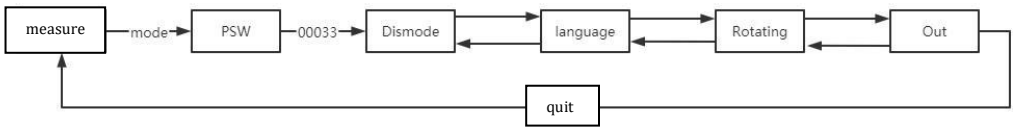
● After completing the modification, select the "Save" menu. Select "0" to not save, "1" to save, and press the "Mode" key to confirm and exit.

7. Menu Settings

7.1 Menu Category Description

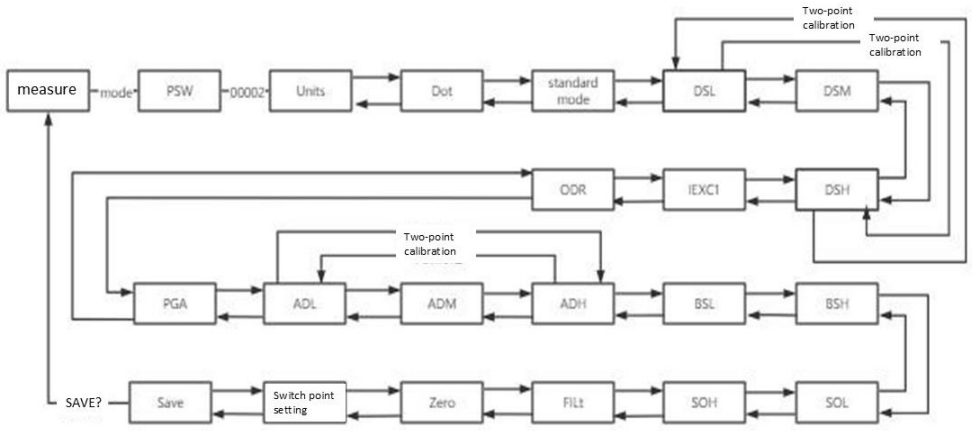
"Display Mode Menu"

The password to enter is "00033." This menu is used to switch between Chinese and English, set the main interface display mode, and adjust screen rotation.



*Display mode menu operation flow chart

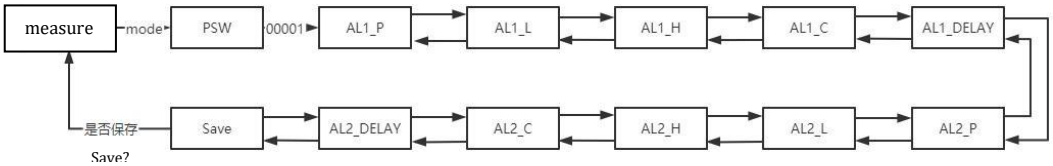
The Production Debug Menu has a password of "01000" and is used by the transmitter manufacturer to set basic parameters for the pressure intelligent switch. This determines the transmitter's accuracy, calibration values, and other parameters. Therefore, the Production Debug Menu is not accessible to general users to prevent the calibration data from being corrupted.



*Production debugging menu operation flow chart

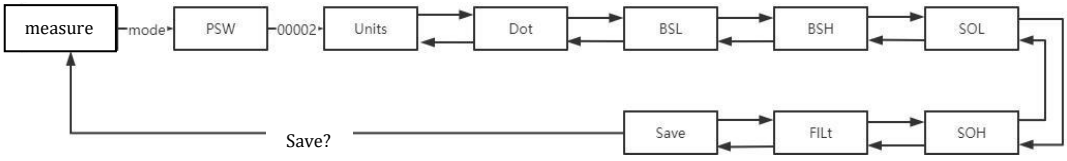
"Switch Point Quick Setup Menu"

The password is "00001" and allows quick setting of the pull-in, release, and delay values.



*Switch point quick setting menu operation flow chart

The password for entering the "Normal User Menu" is "00002," which allows quick settings of commonly used parameters for ordinary users.



* General user menu operation flow chart

(Passwords 00001 and 00002 are for customer on-site data changes.)

7.2 Detailed Description of Menu Function Parameter Settings

7.2.1 Quick Key Zero Menu Function Description

Press and hold the "Mode" key for 5 seconds to reset the main variable to zero. The zeroing range is less than 10% of the range.

7.2.2 Restore Factory Settings Menu Function Description

Enter Password -0001. A "Restore" option will pop up. Select "Yes" to restore. The data will be restored to the factory settings.

7.2.3 Display Mode Menu Function Description

PSW (Password): Password input menu, configurable range (-9999 to 99999).

DisMod (Display Mode): Configurable range (0 to 3).

This function is used to set the display options for pressure, current, percentage, and units on the main screen. 0: Displays pressure value, current value, percentage, and unit; 1: Does not display current value; 2: Does not display percentage; 3: Displays only pressure value and unit.

Language (Language Selection): Configurable range (0 to 1).

This function facilitates switching between Chinese and English display. "0": Chinese; "1": English.

Rotation: Configurable range (0-1)

The OLED display can be rotated 180 degrees. This setting is useful when the display is mounted in an awkward position. "0": No rotation; "1": Rotation.

Out: This function prompts you to exit after completing the display mode menu settings. Press the "Mode" key to exit the main interface directly.

7.2.4 Other Menu Functions

Units: Unit settings, configurable range (0-21).

Unit settings support MPa, KPa, Pa, bar, Mbar, psi, mH2O, mmH2O, inH2O, ftH2O, mHg, mmHg, inHg, kg/cm, g/cm, atm, Torr, m, cm, mm, g, and °C. Dot (Decimal Point): Decimal point position, adjustable range (0-4).

DSL (Span Low): Sets the zero pressure value for the calibration range. Adjustable range (-9999-99999). This setting corresponds to the zero pressure value applied during production.

DSM (Span Mid): Sets the midpoint pressure value for the calibration range. Adjustable range (-9999-99999). This setting corresponds to the midpoint pressure value applied during production.

Note: This menu does not appear in two-point calibration mode.

DSH (Span High): Sets the full pressure value for the calibration range. Adjustable range (-9999-99999). This setting corresponds to the full pressure value applied during production.

IEXC1 (Constant Current Source): Constant current source setting value (unit: uA)

Selectable values:
0/50/100/150/200/250/300/350/400/450/500/550/600/650/700/750.

ODR (Odds/Degree): Acquisition rate (unit: Hz)

2400/1200/600/300/150/75/37.5/18.75/10.06/10.05/5.06/5.05/2.56/2.55.

PGA (Amplification):

Since the entire circuit is microprocessor-controlled, the appropriate amplification factor must be selected based on the sensor signal. (255x) indicates the sensor's full-scale signal amplitude is between 0 and ±8mV.

(192x) indicates the sensor's full-scale signal amplitude is between 0 and ±10mV.

(128x) indicates the sensor's full-scale signal amplitude is between 0 and ±16mV.

(96x) indicates the sensor's full-scale signal amplitude is between 0 and ±21mV.

(64x) indicates the sensor's full-scale signal amplitude is between 0 and ±32mV.

(48x) indicates the sensor's full-scale signal amplitude is between 0 and ±42mV.

(32x) indicates the sensor's full-scale signal amplitude is between 0 and ±64mV.

(24x) indicates the sensor's full-scale signal amplitude is between 0 and ±85mV.

(16x) indicates the sensor's full-scale signal amplitude is between 0 and ±126mV.

(12x) indicates the sensor's full-scale signal amplitude is between 0 and ±170mV. (8x) indicates the sensor's full-scale signal amplitude is between 0 and ±256mV.

(6x) indicates the sensor's full-scale signal amplitude is between 0 and ±341mV.

(4x) indicates the sensor's full-scale signal amplitude is between 0 and ±512mV.

(2x) indicates the sensor's full-scale signal amplitude is between 0 and ±1024mV.

(1x) indicates the sensor's full-scale signal amplitude is between 0 and ±1024mV.

(0x) indicates the sensor's full-scale signal amplitude is between 0 and ±2048mV.

Note: The input ranges listed above are the maximum input values the circuit board can accommodate. In actual use, overload requirements should be considered. The sensor's input signal should ideally not exceed 80% of the maximum input value. A simple way to select the amplification factor is to look at the "Ad-H" value. Generally, when equipped with a transmitter output, this value should be within the range of "0x4000H-0x6500H," or "16384-25856" in decimal. Without a transmitter output, the amplification factor can be appropriately reduced to improve anti-interference performance.

Standard Mode (Calibration Mode): Adjustable range (2-3).

This function is used to select the calibration mode during key calibration. Two-point and three-point calibration modes are supported.

ADL (Acquisition Low): Zero-point AD sampling value

This data is automatically acquired by the instrument and does not require user input. When this menu appears, press the "Mode" key. The display will show the currently acquired raw AD value in real time. Apply zero pressure to the sensor. Once the data stabilizes, press the "Mode" key to confirm.

ADM (Acquisition Midpoint): Midpoint AD sampling value

This data is automatically acquired by the instrument and does not require user input. When this menu appears, press the "Mode" key. The display will show the currently acquired raw AD value in real time. Apply mid-point pressure to the sensor. After the data stabilizes, press the "Mode" key to confirm.

Note: This menu does not appear in two-point calibration mode.

ADH (Acquisition High): Full-point AD sampling value

This data is automatically acquired by the instrument and does not require user input. When this menu appears, press the "Mode" key. The display will show the currently acquired raw AD value in real time. Apply full-point pressure to the sensor. After the data stabilizes, press the "Mode" key to confirm.

BSL (Transmit Low): Transmit range lower limit setting, adjustable from -9999 to 99999.

This function enables passive zero shifting of the transmitter output. The set pressure value will correspond to the current value set in the "SOL" zero current menu. The transmitter's minimum range can be compressed by 3:1 of the sensor range, and the maximum range can be set by 1:1 of the sensor range. Exceeding this range will affect the transmitter output accuracy.

BSH (Transmitter High): Sets the upper limit of the transmitter range, with a configurable range of -9999 to 99999.

This function enables passive full-scale shifting of the transmitter output. The set pressure value will correspond to the current value set in the "SOH" full-scale current menu. The transmitter's minimum transmitter range can be compressed by 3:1 of the sensor range, and the maximum range can be set by 1:1 of the sensor range. Exceeding this range will affect transmitter output accuracy.

SOL (Current Zero Adjustment): Initial value 4000

The instrument transmits the output value when the sensor is at zero. A high-precision ammeter must be connected in series between the transmitter output port and ground. Press the "▲" or "▼" key to modify the setting, adjust the current to the standard 4mA, and press the "Mode" key to confirm. SOH (Full Current Trim): Initial value: 20000

The meter transmits the output value at the full sensor range. A high-precision current sensor must be connected in series between the transmitter output and ground.

For an ammeter, press the "▲" or "▼" key to modify the setting. Adjust the current to the standard 20mA, then press the "Mode" key to confirm.

FILt (Filter Factor): Configurable range (3 to 33).

This menu value is used for recursive averaging filtering of the acquired values. A larger value results in more stable display, but the calculation rate will be slightly reduced. For general applications, a setting of "15" is sufficient. This value can be increased in situations with strong interference.

Zero (Zero Point Blanking Factor): Configurable range (0.0 to 1.0).

If you do not want to display zero drift, use this menu to blank the displayed value within 1% of the full scale range, so that the zero value is always displayed within the blanking range. Note: 1 digit represents one thousandth.

AL1_P (Channel 1 Mode): Select the output mode for switch point 1. Configurable range (0 to 1). "0" (hysteresis output mode); "1" (window output mode). See the switch point setting instructions for details.

AL1_C (Channel 1 Hysteresis): Hysteresis for switch point 1 window output.

To prevent oscillation of switch point 1 due to unstable pressure, use this menu to set the window switch point hysteresis to eliminate oscillation. See the switch point setting instructions for details.

AL1_L (Channel 1 Lower Limit): Lower limit value for switch point 1, settable range (-9999 to 99999). The meaning of this menu item varies depending on the switch point output mode. See the switch point output instructions for details.

AL1_H (Channel 1 Upper Limit): Upper limit value for switch point 1, settable range (-9999 to 99999). The meaning of this menu item varies depending on the switch point output mode. See the switch point output instructions for details.

AL1_DELAY (Switch Delay, Channel 1): Sets the delay for switch point 1 operation. The range is -9999 to 99999.

When switch point 1 is triggered, you can set a delay before the switch is actuated. Units are 10ms.

AL2_P (Mode, Channel 2): Selects the output mode for switch point 2. The range is 0 to 1.

"0" (Hysteresis output mode); "1" (Window output mode). See the switch point setting instructions for details.

AL2_C (Hysteresis Value, Channel 2): The hysteresis for the window output of switch point 2.

To prevent oscillation of switch point 2 due to unstable pressure, set the window switch point hysteresis in this menu to eliminate oscillation. See the switch point setting instructions for details.

AL2_L (Lower Limit, Channel 2): The lower limit of switch point 2. The range is -9999 to 99999. The meaning of this menu item varies depending on the switch point output mode. See the switch point output description for details.

AL2_H (Upper Limit 2): Upper limit value of switch point 2, adjustable range (-9999 to 99999). The meaning of this menu item varies depending on the switch point output mode. See the switch point output description for details.

AL1_DELAY (Switch Delay 2): Action delay setting for switch point 2, adjustable range (-9999 to 99999).

When switch point 2 is triggered, you can set a delay before the action begins (unit: 10ms).

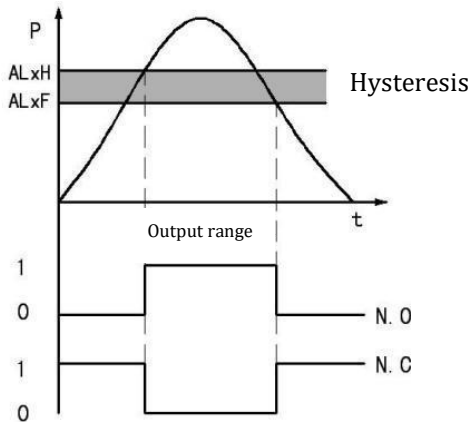
Save (Save or Not): Adjustable range (0 to 1).

In this menu, press the "Mode" key to select "0": Do not save; "1": Save. Press the "Mode" key again to confirm and exit the menu settings.

7.4 Switch Point Settings

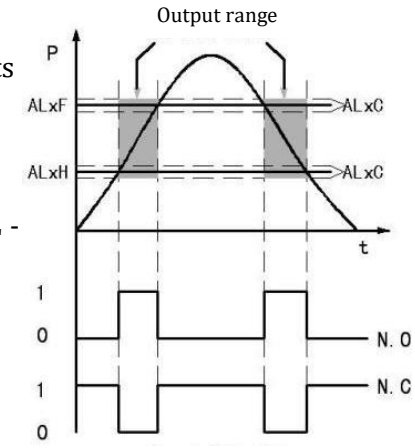
7.4.1 Hysteresis Function

The hysteresis value can be set via the menu. Its output can be used to control pump inlet and outlet, requiring only a single output point. As shown in the figure to the right, using the normally open (NO) type as an example, the gray band represents the hysteresis value (ALxL - ALxH). When pressure rises, the switch point closes only when the pressure value exceeds ALxL. When pressure falls, the switch point opens only when the pressure value falls below ALxH. Reversing the upper and lower limits will invert the output logic.



7.4.2 Window Function

This function can be used to monitor a specific range, and its output can be used for control, alarm, and other tasks, requiring only a single output point. As shown in the figure to the right, using the normally open (NO) type as an example, the gray band represents the window value (ALxL - ALxH). The switch point engages only when the pressure value is within the window range; it disengages when the pressure value exceeds this range. When the upper and lower limits are reversed, the output logic is also reversed.



Note: The "x" in ALxL and ALxH represents switch point "1" or "2."

Note: The switch point is determined by the configured pull-in and release values. When the pull-in value is greater than the release value, an upper limit alarm output (normally open function) is generated; when the pull-in value is less than the release value, a lower limit alarm output (normally closed function) is generated.

8. Prompt Information

If a fault occurs during operation, the following message will appear on the display:

Please wait: This message indicates that debugger calibration is in progress and is normal.

EPROM ERROR: This message indicates that debugger calibration data storage failed. AL2 or AL1 short fault: This message indicates a short circuit fault in switch point 1 or 2. AL1 short fault: This message indicates a short circuit fault in switch point 1.

AL2 short fault: This message indicates a short circuit fault in switch point 2.

Error Not Ready: This message indicates an error while writing data to the microcontroller. Repeat the operation. Error Address Alignment: If this message continues to appear, the system hardware is damaged and data cannot be saved.

9. Precautions

1. Please connect the wires correctly according to the diagram. If connected incorrectly, the transmitter will not output a signal due to internal protection measures. The transmitter will operate immediately after power is turned on, but the output signal will be more stable and reliable after a 30-minute warm-up period. 2. Use in media that are non-corrosive to ceramics (except for special corrosion-resistant models).

3. The maximum pressure in the measured system must not exceed the rated overload value. The transmitter back pressure terminal must not be directly connected to conductive or corrosive liquids or gases. The air vents of the level-sealed air cable must not be blocked.

4. Do not insert sharp or hard objects into the pressure output port. Do not strike the diaphragm of a flush-type diaphragm transmitter with hands or other objects.

5. This product is a precision primary measuring instrument. Do not drop it, forcefully clamp it, disassemble it, or poke the pressure port with sharp metal objects.