Class A PT100 Platinum Resistance Temperature Sensor

Core Product Perception

Product Definition:
The Anhui Qidian Class A PT100 platinum resistance temperature sensor is an industrial temperature-measuring element belonging to the platinum resistance thermometer category and complies with the IEC 60751 international standard. “PT100” indicates that the resistance of the platinum wire is 100 Ω at 0°C, while “Class A” denotes the sensor’s accuracy class. It is the most commonly used temperature sensing probe in industrial settings.

The product uses high-purity platinum wire as the temperature-sensing core and, combined with various protective sheaths and lead configurations, is available in multiple specifications: surface-mount, rod-type, threaded-mount, armored flexible, waterproof, and high-temperature types. It supports two-wire, three-wire, and four-wire output configurations and is compatible with direct integration into temperature transmitters.

Summary of Core Features:
1. Temperature Signal Acquisition: Real-time measurement of medium temperature (gases, liquids, solid surfaces), converting temperature changes into changes in resistance;
2. High-Precision Temperature Measurement: Class A accuracy ensures measurement errors are controlled within the permissible range of the Chinese National Standard Class A;
3. Versatility Across Multiple Scenarios: Suitable for temperature measurement in pipelines, tanks, equipment surfaces, ovens, water treatment systems, and other operating conditions;
4. Signal Compatibility: Outputs a resistance signal that can be connected to temperature controllers, PLCs, temperature transmitters, and data acquisition modules;
5. Wide Temperature Measurement Range: Covers low to medium-high temperature ranges with high stability and minimal temperature drift;
6. Optional Corrosion Protection: Available with optional 304/316L stainless steel sheaths and a waterproof sealed structure, suitable for humid and mildly corrosive environments;
7. Vibration-Resistant and Durable: The armored version is flexible and vibration-resistant, making it suitable for equipment operating under vibrating conditions.

Working Principle:
In simple terms: Platinum has a stable characteristic—**the higher the temperature, the greater the resistance of the platinum wire; the lower the temperature, the smaller the resistance**.
The platinum resistance core inside the PT100 has a resistance of exactly 100 ohms at 0°C. When the probe comes into contact with the medium being measured, heat is transferred to the platinum resistance core, and the resistance of the platinum wire changes linearly with temperature. The connected temperature controller or transmitter detects the resistance value and, using the resistance-to-temperature conversion formula specified in the IEC 60751 standard, automatically calculates the corresponding actual temperature value, ultimately enabling temperature measurement, display, alarms, and closed-loop control.

Workflow:
1. The PT100 probe comes into contact with the medium being measured, and heat is conducted to the internal platinum sensing element;
2. The resistance of the platinum wire changes correspondingly with temperature;
3. The downstream data acquisition device (temperature transmitter / PLC analog module) applies a small excitation current to the PT100 and reads the real-time resistance;
4. The device converts the resistance value to a temperature value according to the IEC 60751 standard;
5. The output temperature data is used for local display, central control monitoring, interlock alarms, and temperature control.

> Additional Note: Three-wire and four-wire configurations are designed to compensate for measurement errors caused by the resistance of the lead wires themselves; two-wire systems are suitable for short distances and applications with low accuracy requirements, while Class A high-precision measurements prioritize three-wire or four-wire systems.

Core Value:
Anhui Qidian Class A PT100 platinum resistance probes deliver precise temperature measurement in industrial settings thanks to their Class A accuracy and excellent long-term stability. They address customers’ pain points associated with standard temperature probes—such as poor accuracy, significant drift, short service life, and unreliable measurements—which fail to meet process temperature control requirements. Compatible with various industrial control instruments, these probes offer flexible installation options and can be mounted on pipes, tanks, and equipment surfaces in a variety of ways.

Benefits: High temperature measurement accuracy and minimal long-term drift ensure stable production processes; compliance with the IEC 60751 standard ensures broad compatibility and easy replacement; optional sheath materials provide waterproofing and shock resistance, making them suitable for a wide range of industrial environments; multiple lead configurations are available to accommodate both short- and long-distance signal transmission; Class A accuracy meets the stringent temperature requirements of industries such as pharmaceuticals, food processing, and fine chemicals.

Key Challenges & Solutions
Q1: On-site processes require high temperature accuracy, but standard Class B PT100 sensors have excessive error margins, affecting product quality. How can this be addressed?
A1: Select Anhui Qidian’s Class A PT100 probes, which comply with the IEC 60751 Class A standard. These probes have a smaller allowable error within the operating range, meeting the demands of high-precision temperature measurement scenarios such as precision temperature control, pharmaceuticals,

and food processing, thereby reducing temperature measurement deviations.

Q2: PT100 leads are relatively long, and the resistance of the leads themselves is superimposed on the measurement resistance, causing temperature readings to be too high and measurements to be inaccurate. How should this be addressed?
A2: For long-distance wiring scenarios, select three-wire or four-wire Class A PT100 sensors. The three-wire configuration can offset most of the lead resistance; the four-wire configuration completely eliminates the influence of lead resistance, making it suitable for high-precision, long-distance temperature measurement. For short-distance, simple monitoring, a two-wire configuration can be used.

Q3: Surface conditions on pipes, tanks, and equipment vary, making it difficult to find a temperature probe with a suitable mounting method. What should be done?
A3: Anhui Qidian's Class A PT100 probes are available in multiple configurations: threaded models can be screwed directly into pipes; surface-mount models can be attached to the outer walls of equipment; armored models can be bent to reach into tight spaces; and waterproof, sealed models are designed for liquid immersion applications. Select the appropriate model based on your needs.

Q4: There is vibration at the site, and the platinum wire inside standard PT100 probes is prone to breaking, resulting in a short service life. What should be done?
A4: Choose an armored Grade A PT100. The internal platinum core is protected by an armored metal sheath, making it vibration-resistant and capable of slight bending. It can be used reliably on vibrating equipment such as pumps and fans, extending the probe's service life.

Q5: The medium is slightly corrosive (weak acids, wastewater). Standard stainless steel sheaths are prone to rusting and damaging the probe. How can this be addressed?
A5: You can opt for a Class A PT100 with a 316L stainless steel protective sheath to enhance corrosion resistance; for standard clean water and air applications, choose a 304 stainless steel sheath to balance cost and protection.

Q6: What if I'm concerned about incompatibility with different brands of temperature controllers or PLC data acquisition modules, and worry that replacement will be troublesome?

A6: This product complies with the IEC 60751 international standard. The PT100 resistance-temperature characteristic curve is universal, so it is directly compatible with the vast majority of temperature meters, transmitters, and PLCs on the market. Replacement is simple and requires no custom programming.

Q7: What should be done if the temperature measurement point is in a humid environment and moisture seeps into the probe, causing signal drift or even damaging components?

A7: Choose a fully sealed, waterproof Grade A PT100 probe with a resin-sealed tail. This high-protection-rated design allows direct immersion in clean water, preventing moisture from entering the protective sheath and damaging the platinum resistance core.

Key Product Specifications & Detailed Specifications

I. Basic Electrical Parameters

Parameter Items	Technical Specifications
Scale Type	PT100
Nominal Resistance at 0°C (R_0)	100.00 Ω
Accuracy Class	Class A (IEC 60751); error ±(0.15 + 0.002 × t) °C
Temperature Coefficient of Resistance (TCR)	0.003851 Ω/Ω/°C
Recommended Excitation Current	0.3 mA to 1 mA (maximum 1 mA)
Self-Heating Effect	Temperature rise < 0.05 °C at 0.5 mA excitation
Wiring Configuration	Selectable two-wire, three-wire, or four-wire configuration
Insulation Resistance	≥100 MΩ @ 100 V DC
Dielectric Strength	Withstands 500 V AC for 1 minute without breakdown
Signal Output	Resistance signal (passive); 4–20 mA requires an external transmitter

II. Insulation Performance Parameters

Parameter Items	Technical Specifications
Probe Body Isolation	No built-in isolation; insulation between the platinum core and the sheath
Isolation Voltage of Matching Isolation Transmitter	AC 2000 V (power supply terminal ↔ PT100 signal terminal)
Intrinsically Safe Isolation	Intrinsically safe / non-intrinsically safe circuit isolation: AC 2500 V
Ground Loop Suppression	An external isolation module is required for long cables; shielded cables must grounded at a single point

III. Power Supply & Power Consumption Specifications

Parameter Items	Technical Specifications
Probe Power Supply	Passive; no separate power supply required
Power Supply for Back-End Data Acquisition Equipment	Typical: 24 V DC
Power Consumption of the Probe Itself	<25 μW at 0.5 mA drive current
Power Consumption of the Integrated Transmitter	≤1.2 W
Transmitter Power Output (Optional)	24 V DC, max. 50 mA, short-circuit protection
Excitation Current Range	0.3–1 mA

IV. Environmental Adaptation Parameters

Specifications	Standard Waterproof Type	Armored High-Temperature Type	Intrinsically Safe
Media Temperature Measurement Range	-50 to +200°C	-200 to +600°C	-50 to +450°C
Operating Ambient Temperature	-40 to +85°C	-40 to +100°C	-40 to +80°C
Storage Temperature	-50 to +100°C	-50 to +120°C	-50 to +100°C
Relative Humidity	5% to 95% RH, non-condensing	5% to 90% RH, non-condensing	5% to 90% RH, non-condensing
Protection Rating	IP65 (IP67 for potted version)	IP65 armored seal	IP65 (with explosion-proof junction box)
Explosion-Proof Rating	None	None	Ex ia IIC T6 Ga
Compatible Safety Barriers	Not applicable	Not applicable	Intrinsic isolation / Zener safety barrier
Corrosion Resistance Rating	WF1	WF1	WF1 (316L, upgraded to WF2)

V. Physical Parameters

Model Categories	Mounting Methods	Dimensions	Net Weight
Standard Plug-In (Threaded)	Threaded: M12/G1/2/M20	Φ6/Φ8 mm, L 50–1000 mm	0.08–0.45 kg
Armored Flexible	Threaded / Ferrule, bendable	Φ3/Φ4/Φ6 mm, L 50–2000 mm	0.05–0.6 kg
Surface-Mount	Surface-mount clip	Base 30 × 30 mm, Φ5 mm	Approx. 0.06 kg
Intrinsically Safe	Threaded + explosion-proof junction box	Φ6/Φ8 mm, L 50–800 mm	0.1–0.5 kg

Additional Physical Specifications	Contents
Installation Accessories	Threaded with gasket; armored with ferrule; surface-mounted with high-temperature double-sided adhesive tape
Material Upgrade	Sheaths can be upgraded to 316L or Hastelloy; leads are available in FEP fluoroplastic
Response Time t0.63	Φ6mm: approx. 1.2 s for liquids; approx. 5 s for air; the fine-armored Φ3mm version is faster
Pressure Resistance	Standard: ≤1.6 MPa; high-pressure versions with thickened sheaths are available upon request

Scenario-Based Selection Guide

1. Key Selection Criteria:

1. Signal Type: The PT100 outputs a passive resistance signal by default, which can be directly connected to PLCs or temperature controllers that support RTD data acquisition. If 4–20 mA analog signal transmission over long distances is required, an integrated temperature transmitter module must be selected. Wiring configurations include two-wire, three-wire, and four-wire systems. The two-wire system is suitable for short distances and applications with general accuracy requirements; In the vast majority of industrial applications, the three-wire system is preferred as it compensates for most lead resistance; for high-precision and long-distance transmission scenarios, the four-wire system is selected to completely eliminate measurement errors caused by lead resistance.

2. Number of Channels: Determine the number of probes based on the number of temperature measurement points at the site. Configure one Class A PT100 for each individual measurement point; For multi-point monitoring, each RTD acquisition channel must be paired with a separate sensor; parallel acquisition using a single probe across multiple channels is not supported.

3. Power Supply: PT100 probes are passive components that do not require a separate power supply; they are powered by a small, constant current of 0.3–1 mA supplied by the backend acquisition module. For the optional integrated transmitter version, the transmitter is powered by 24 V DC.

4. Explosion-Proof Requirements: For standard factory environments and scenarios without flammable or explosive media, use a conventional Class A PT100; for hazardous conditions in Zones 1 and 2 where flammable gases or dust are present, an intrinsically safe Class A PT100 must be used, installed in a safe area with a safety barrier of the corresponding rating. Standard probes must not be used directly in explosion-proof zones.

5. Installation Environment: For indoor, dry environments with clean water or air, select a standard insertion-type probe with a 304 stainless steel sheath; for environments with weak acids, wastewater, or mild salt fog corrosion, select a 316L stainless steel sheath; for high-temperature, high-vibration, or confined spaces, select an armored, flexible model; for temperature measurement on the outer walls of pipes, motor bearings, or other locations where drilling holes to immerse the probe in the medium is not possible, select a surface-mount PT100; For damp outdoor environments, select a potted structure with an IP65 rating or higher. Also, verify the medium's temperature range to ensure it does not exceed the probe's rated measurement range.

6. Other Selection Criteria: Confirm the installation thread specifications, probe outer diameter, and insertion depth to ensure the sensing tip is positioned within the medium's effective measurement zone; in environments with strong electromagnetic interference, select probes with shielded leads and, if necessary, pair them with signal isolation modules.

2. Selection Guidelines for Industry Applications

1. Chemical Industry: For temperature measurement in standard, non-explosion-proof, ambient-temperature fresh water storage tanks and recirculation pipelines where accuracy is required, use standard three-wire Class A PT100 insertion-type probes with 304 stainless steel sheaths; for mildly corrosive media such as weak acids and chlorine-containing wastewater, use 316L sheath-insertion-type probes; For temperature measurement on the outer surfaces of reactors and storage tanks, use Class A PT100 surface-mount sensors; for high-temperature pipelines and vibrating equipment, use armored Class A PT100 sensors; in hazardous areas containing flammable and explosive solvents or combustible gases, use intrinsically safe Class A PT100 sensors in conjunction with an intrinsically safe barrier.

2. Power Industry: For temperature measurement of auxiliary water supply pipes, HVAC piping, and equipment in dry switchgear rooms at power plants, use standard three-wire Class A PT100 insertion-type sensors; for surface temperature measurement of fan and pump bearing housings, use surface-mount Class A PT100 sensors; for temperature measurement of boiler flue ducts and high-temperature water and steam pipes, use armored high-temperature Class A PT100 sensors; For temperature measurement in fly ash silos and hazardous locations with combustible dust, use intrinsically safe Class A PT100 sensors.

3. Metallurgical Industry: For monitoring cooling water pipes and ambient-temperature silos, use standard insert-type Class A PT100 sensors; For acid washing sections and spray cooling equipment, where water and steam are accompanied by mild corrosion, use 316L-sheathed, armored Class A PT100 sensors; for temperature measurement in combustible dust silos in sintering and dust removal systems, use intrinsically safe, explosion-proof Class A PT100 sensors; for surface temperature measurement on highly vibrating smelting auxiliary equipment, use surface-mounted, armored probes.

4. Pharmaceutical Industry: For precise temperature control of purified water pipelines and raw material tanks in cleanrooms—where high measurement accuracy is required—select Grade A three-wire or four-wire insertion-type PT100s, which can be equipped with sanitary clamp-on connectors; For cleaning water tanks and acid/alkali cleaning tanks, use 316L stainless steel sealed models; in explosion-proof cleanrooms where organic solvents are volatilized, use intrinsically safe Class A PT100s to meet explosion-proof compliance requirements.

5. Smart Manufacturing Industry: For internal temperature measurement in hoppers, water tanks, and drying ovens on automated production lines, use standard Class A PT100 insertion-type sensors under normal operating conditions; For surface temperature measurement on motor housings and equipment enclosures, use surface-mount Class A PT100 sensors; for temperature measurement at explosion-proof locations in sealed powder silos, use intrinsically safe models; for temperature measurement in confined internal spaces or at vibrating workstations, use fine-diameter armored Class A PT100 sensors; when integrated with PLC remote data acquisition, an integrated transmitter module can be added to output a 4–20 mA signal.

3. Common Selection Mistakes: Ignoring Isolation Levels, Selecting the Wrong Signal Range, Neglecting Load Matching, and Choosing General-Purpose Models for Explosion-Proof Applications

1. Ignoring Isolation Levels: Many customers focus solely on probe accuracy while neglecting on-site electromagnetic isolation requirements. When using standard PT100 probes with long cables near variable frequency drives or high-power motors without a matching signal isolation module, ground loop interference can easily occur, causing continuous temperature signal fluctuations; In intrinsically safe circuits, customers mistakenly assume that the probe itself provides isolation and fail to install a separate safety barrier, resulting in energy levels exceeding the limit and creating safety hazards.

2. Incorrect Signal Range Selection: Confusing PT100 resistance signals with 4–20 mA analog signals, and directly connecting a passive PT100 probe to a 4–20 mA acquisition channel; During selection, the temperature measurement range exceeds the probe's rated range; using standard waterproof models in high-temperature environments causes the platinum core to age and drift; simultaneously, the probe's response speed is overlooked—using thick-sheath probes in processes with rapid temperature changes results in measurement lag, preventing timely capture of temperature changes.

3. Neglecting load matching: When the excitation current for a PT100 probe exceeds 1 mA, the self-heating effect increases, introducing additional measurement errors; when selecting an integrated transmitter, failing to verify the input impedance of the downstream PLC acquisition module results in load mismatch, causing distortion of the 4–20 mA output signal; In scenarios with long cable runs, a two-wire system is used, resulting in excessive lead resistance and causing consistently high temperature readings.

4. Incorrect selection of general-purpose models in explosion-proof environments: In flammable and explosive hazardous areas, standard waterproof PT100 probes are purchased directly under the mistaken belief that simply replacing the junction box with an explosion-proof model will meet safety requirements. However, the internal capacitance and inductance parameters of standard probes do not comply with intrinsically safe standards, posing an ignition risk; In explosion-proof applications, using standard cables and standard cable glands compromises the explosion-proof structure and renders the system non-compliant with explosion-proof regulations.

Additional common pitfalls: Using 304 stainless steel sheaths in corrosive environments can lead to pitting corrosion and perforation; focusing solely on accuracy grades while neglecting insufficient insertion depth causes the probe's sensing tip to remain in the dead zone near the pipe wall, resulting in measured temperatures that do not accurately reflect the actual temperature of the medium.

4. Customization Recommendations: Description of Custom Solutions for Special Signals, Non-Standard Operating Conditions, and Multi-Channel Integration

1. Customization for Special Signals: The basic PT100 resistance signal can be customized for any wiring configuration—two-wire, three-wire, or four-wire. An integrated temperature transmitter module can be incorporated at the probe's tail end to output 4–20 mA or RS485 Modbus digital signals. A version with M12 aviation connectors for quick wiring is available as an alternative to standard leads. Signal isolation components can be provided to achieve isolated RTD signal output and eliminate ground loop interference.

2. Customization for Non-Standard Operating Conditions: For highly corrosive media, the sheath material is upgraded to Hastelloy or titanium, with a PTFE lining; for ultra-low-temperature or high-temperature conditions, the lead material is replaced with FEP fluoroplastic high-temperature-resistant cable; for confined installation spaces, custom-made thin-diameter armored probes with short insertion depths are available; for high-pressure conditions, the protective sheath is reinforced to increase the pressure rating; For high-vibration conditions, a spring-loaded clamping mechanism is added; for outdoor, open-air environments, a rainproof protective cover is added; for sanitary-grade pharmaceutical and food applications, custom clamps and polished, dead-space-free sanitary probes are provided.

3. Multi-Channel Integration Solutions: For temperature measurement projects with multiple measurement points, uniformly select the same model of Class A PT100 to ensure consistency in probe parameters and reduce the complexity of calibration and spare parts management; For multi-channel data acquisition scenarios, we recommend using uniform three-wire shielded cabling to separate high- and low-voltage circuits; for explosion-proof projects with numerous measurement points, deploy multiple intrinsically safe PT100 probes in a distributed configuration, with each probe equipped with its own independent safety barrier—no shared safety barriers; the entire system can be supplied with integrated signal isolators and temperature acquisition modules as a complete package, reducing the workload of procuring individual components on-site, and pre-calibration is completed prior to shipment.

Installation and Commissioning Specifications

I. Pre-Installation Preparation

1. Checking Components: Upon unpacking, verify the probe model, wiring configuration (two-wire, three-wire, or four-wire), sheath material, and insertion depth to ensure the product model matches the order specifications; for standard threaded models, check that the threads and sealing gaskets are intact; for armored models, check that the armored sheath has no kinks or cracks; for surface-mounted models, confirm that the mounting base is complete; For intrinsically safe models, verify the explosion-proof certification, explosion-proof junction box, explosion-proof cable gland, and 配套 safety barrier; take inventory of lead wires, mounting hardware, and certificates of conformity; inspect the lead wire insulation for damage and ensure the conductors are free of breaks or short circuits.

2. Environmental Inspection: Verify that the medium temperature, pressure, and corrosive properties at the installation location match the probe specifications; the temperature measurement location must accurately reflect the medium temperature and avoid pipe bends, valve outlets, and blind spots where heat radiation is blocked; for vibrating environments, confirm whether an armored, vibration-resistant model has been selected; in explosion-hazard areas, confirm the hazardous zone classification—intrinsically safe probes must be paired with safety barriers of the corresponding rating, and safety barriers must be installed in the safe area; ensure sufficient maintenance space is reserved on-site; Inspect the grounding grid; ensure the protective grounding resistance is ≤4 Ω; in humid environments, verify that the waterproof seal is intact.

3. Tool List: Phillips screwdriver, adjustable wrench, torque wrench, wire strippers, crimping pliers, digital multimeter, insulation resistance tester, cable ties, color-coded tubing, PTFE thread sealant, thermal grease; explosion-proof tools must be used when working in explosion-hazard areas; For work at heights, provide safety harnesses and scaffolding; for calibration work, prepare a mixture of ice and water and a standard thermometer.

4. Safety Precautions: All wiring operations must be performed with the power disconnected; in explosion-hazardous areas, disconnect the power to all circuits and discharge residual charges before opening the cover; **it is strictly prohibited to open the cover while the equipment is energized in hazardous areas**; when installing probes for high-temperature media, take precautions against burns; Never replace original manufacturer parts with non-original components in explosion-proof circuits; when handling armored probes, ensure the minimum bending radius is no less than 5 times the outer diameter of the armor to prevent internal platinum wire breakage; confirm on-site process authorization before installation and, if necessary, shut down the equipment and relieve pressure.

II. Standard Installation Procedure

The PT100 probe body is not mounted on a rail; the optional integrated temperature transmitter module can be installed on a standard DIN rail

1. Probe Body Mounting: For threaded insertion probes, wrap the threads with PTFE tape or install a sealing gasket, then screw the probe into the equipment's threaded base, applying the correct torque to prevent stripping the threads; the insertion depth must be ≥ 10 times the outer diameter of the protective sheath to ensure the sensing tip is fully immersed in the medium and does not remain in a dead zone near the tube wall; armored probes can be bent as needed and secured with a compression fitting; For surface-mount probes, grind and clean the metal surface to be measured, apply thermal grease, and secure using snap-on clips or screws to ensure the base is flush against the measurement surface; intrinsically safe probes must be used with an explosion-proof junction box, installed with the cable outlet facing downward to prevent water accumulation. An optional integrated transmitter can be directly snap-mounted onto the DIN rail.

2. Wiring specifications: Distinguish between power supply, input, and output terminals. The PT100 probe itself is passive and has only signal leads; the integrated transmitter model includes power supply terminals and 4–20 mA output terminals. Two-wire system: Connect two signal wires to the RTD input terminals (non-polarized). Three-wire system: Two wires of the same color serve as the excitation leads, and a separate wire serves as the compensation lead; connect these to the instrument's compensation terminals; Four-wire system: one set of excitation wires (FORCE+ and FORCE-) and one set of measurement wires (SENSE+ and SENSE-); Integrated transmitter terminals: DC 24 V power supply +, DC 24 V power supply -; 4–20 mA output +, 4–20 mA output -; Intrinsically Safe Version: The intrinsically safe signal wires are connected separately to the intrinsically safe side of the safety barrier; the other side of the safety barrier is connected to the instrument in the control room.

3. Grounding Requirements: The PE protective ground wire of the instrument cabinet must be reliably connected to the plant's protective ground; for PT100 shielded cables, the shield must be grounded at a single point only at the control room instrument end, while the shield at the sensor probe end must be left electrically isolated; the intrinsically safe circuit grounding must be independent and must not share the grounding busbar with the power ground wire; metal protective conduits and the housings of explosion-proof junction boxes must be reliably connected to the protective ground.

III. Written Explanation of the Wiring Diagram

1. Basic Terminal Definitions
Two-wire PT100: Two leads, non-polarized, RTD+ and RTD-;
Three-wire PT100: RTD+ (two wires of the same color), RTD- (single wire), and COMP (compensation) terminal;
Four-wire PT100: FORCE+, FORCE- (current excitation), SENSE+, SENSE- (voltage measurement);
Integrated Transmitter and Power Supply Model: DC24V+, DC24V-; 4–20 mA OUT+, OUT-;
Isolated Transmitter Model: Electrical isolation between the power supply side and the RTD signal side, with an isolation voltage of AC2000V;
Intrinsically Safe Model: Probe leads connect to the intrinsically safe side terminals of the safety barrier; the non-intrinsically safe side of the safety barrier connects to data acquisition equipment in the control room.

2. Model-Specific Wiring Specifications
Standard PT100 (two-wire / three-wire / four-wire): Shielded twisted-pair cable; the shield must be grounded at a single point in the control cabinet only; for three-wire systems, ensure all three conductors are of the same material, gauge, and length to minimize compensation errors;
Integrated Power Distribution and Transmission Model: DC24V powers the transmitter, outputs a 4–20 mA analog signal, and connects to data acquisition instruments in series;
Isolated Transmitter Version: The power supply circuit and the RTD temperature measurement circuit are mutually isolated to eliminate ground loop interference; suitable for sites with strong interference near variable frequency drives;
Intrinsically Safe Version: Intrinsically safe cables must be routed through separate conduits; intrinsically safe cables and power cables must be routed in separate cable trays—sharing the same conduit is strictly prohibited; explosion-proof cable glands must match the cable's outer diameter, and unused ports must be sealed with explosion-proof plugs.

3. Comparison of Correct and Incorrect Wiring Practices
 Correct Practices: Ground the shielded cable at a single point in the control cabinet; ensure all three wires in a three-wire system have the same cross-sectional area and length; route the intrinsically safe circuit separately; connect the positive and negative terminals of the integrated transmitter according to the markings; ground the metal housing to PE; label terminal information on color-coded tubes; and allow sufficient bend radius for armored cables.
 Incorrect Practices: Grounding the shield at both ends, creating a ground loop that causes temperature readings to fluctuate continuously; inconsistent thickness or length of three-wire system leads; power cables and PT100 signal cables sharing the same conduit; mixing intrinsically safe circuits with power lines; reversing the polarity of the power supply; explosion-proof cable glands not tightened properly, resulting in loose cables; excessive pulling or bending of leads.

IV. Power-On Commissioning Procedure
1. No-Load Test: After all wiring is complete, disconnect the downstream data acquisition module and use a multimeter to measure the resistance of the probe leads. At room temperature, the PT100 resistance should be approximately 110 Ω; there should be no short circuits or open circuits. Verify that there are no short circuits in the integrated transmitter's power supply circuit. For intrinsically safe circuits, check the safety barrier wiring while the power is off. Power on under no-load conditions; the transmitter's power indicator light should illuminate, and there should be no overheating or unusual noises.

2. Signal Calibration: Use a signal generator to simulate an RTD resistance signal, connect it to the instrument channel by channel, and verify the temperature readings displayed by the instrument; Simple on-site calibration: Calibrate the zero point at 0°C using a mixture of ice and water, and calibrate the range using hot water; Simulate temperature changes and observe whether the readings follow the changes; For four-wire high-precision probes, focus on verifying the effectiveness of lead compensation; When calibrating intrinsically safe circuits, do not open the cover in hazardous areas.

3. Indicator Light Status Interpretation: For integrated transmitters, a steady green power light indicates normal power supply; a flashing channel indicator light indicates normal signal acquisition; a steady red light indicates an open-circuit or short-circuit fault; a flashing red light indicates a circuit overload or communication failure; a red light on the safety barrier indicates an intrinsically safe circuit fault, requiring immediate power disconnection for troubleshooting.

4. Accuracy Calibration Method: Enter the temperature control instrument/transmitter menu, select the PT100 temperature scale, and set the corresponding wiring configuration (two-wire, three-wire, or four-wire); calibrate the zero point at 0°C (ice point) and the full-scale point at 100°C using a standard heat source; save the parameters after calibration, repeat the test multiple times to confirm that the error meets Class A accuracy requirements; record and archive the calibration data after calibration.

V. Installation Prohibitions
1. Overvoltage supply is strictly prohibited: The PT100 probe is a passive component; the current applied must not exceed 1 mA. Excessive current will cause self-heating, increasing temperature measurement error or even burning out the platinum core. The integrated transmitter is rated for a 24 V DC supply; do not connect it to 220 V AC high voltage to avoid burning out the transmitter module. In intrinsically safe circuits, over-energy supply is strictly prohibited, as it will compromise the intrinsically safe explosion-proof performance.

2. Avoid High-Voltage Interference: Since the PT100 generates a weak resistive signal, signal wires must be routed separately from frequency converters and motor power cables, maintaining a parallel distance of ≥30 cm; where cables cross, they must be routed at a 90° angle. Inside enclosures, high- and low-voltage wiring must be kept in separate zones and must not be intertwined. In environments with severe interference, prioritize the use of integrated transmitters to convert the signal to a 4–20 mA current signal for transmission.

3. Protective Measures for Humid Environments: For outdoor or humid conditions, use IP65/IP67 sealed probes with the junction box cable outlet facing downward; ensure sealing gaskets and cable glands are tightly secured to prevent moisture ingress; verify the probe's waterproof rating for applications involving prolonged immersion; inspect the seals of explosion-proof junction boxes regularly; Ordinary, non-waterproof probes must not be submerged in liquids; desiccant may be placed inside the junction box to reduce condensation.

4. Other Installation Precautions: Probes must not be installed in locations subject to continuous, intense media scouring to prevent wear on the protective sleeve; armored probes must not be forcibly bent to a small radius; insufficient insertion depth causes the sensing tip to remain in a dead zone on the pipe wall, resulting in measurement distortion; do not use excessive force when threading during threaded installations, as this may damage the threads; Do not independently enlarge the mounting hole on explosion-proof probes or replace non-explosion-proof components, as this will directly void their explosion-proof certification; the surface of surface-mount probes must be free of oil residue and gaps, as these reduce thermal conductivity.

Recommendations for Daily Use & Operations and Maintenance

I. Key Points for Routine Inspections
1. Monitoring Signal Stability: Continuously observe temperature signals on the central control panel instruments and PLC data acquisition interface to verify that the values are stable and check for issues such as erratic fluctuations, intermittent signal loss, fixed deviations, or abnormal sudden changes. For standard plug-in PT100 sensors, focus on whether the temperature response is sensitive to changes in the medium; for armored high-temperature models, focus on monitoring signal drift under high-temperature operating conditions; For surface-mount PT100s, verify that the temperature reading changes in sync with the equipment surface to prevent measurement lag caused by a loss of thermal contact; for intrinsically safe explosion-proof models, in addition to monitoring the temperature signal, simultaneously check the status of the corresponding safety barrier indicator lights. If a safety barrier fault alarm is triggered, immediately mark the circuit and, if necessary, disable the interlock protection. Identify the source of the anomaly to determine whether the fault lies with the probe itself, cable interference, or a problem with the downstream data acquisition equipment.

2. Temperature and Humidity Monitoring: Monitor the ambient temperature and humidity in the probe installation area to ensure environmental parameters remain within the product's rated operating range. For standard waterproof models, focus on environmental condensation to prevent moisture from entering the probe interior via the leads; for armored high-temperature models, check the sheath surface for abnormal overheating; for surface-mount probes, monitor the heat generation of the equipment being measured to prevent temperatures from exceeding the probe's maximum temperature limit; For explosion-proof models, ensure no condensation accumulates inside the junction box and maintain relative humidity within the product's permissible range to prevent oxidation of the terminal blocks.

3. Visual Inspection: For standard threaded-insert probes, check the protective sleeve for corrosion, wear, or deformation, and inspect the threaded seal for leaks; for armored models, inspect the outer armor for scratches, crushing deformation, or fatigue-induced bending; For surface-mount probes, check whether the base has come loose, if there are any gaps, and whether the thermal grease has dried out; for intrinsically safe models, focus on ensuring the explosion-proof junction box is intact with no cracks, that the explosion-proof gland is securely fastened, that idle plug caps remain tightly fastened, and that the explosion-proof markings are complete.

4. Cable Inspection: Check the lead sheath for signs of aging, damage, or excessive tension, and ensure that cable tie fasteners are secure; verify that the outer sheath of shielded cables is undamaged and that the shielding layer is not exposed; cables in explosion-proof areas must not be subjected to compression or scratches.

II. Regular Maintenance Plan (Differentiated cleaning, tightening, and retesting intervals based on operating conditions)
1. Cleaning Intervals: In dry, clean indoor environments, remove dust from the surface of the sheath of standard plug-in PT100 sensors once every 12 months; in environments with heavy dust or oil contamination, shorten this interval to 6 months. For armored high-temperature models in high-temperature, dusty environments, perform external blow-off cleaning every 6 months using dry compressed air; do not vigorously scrape the outer wall of the armor. For surface-mount probes, clean carbon deposits and oil residue from the base every 6 months, and reapply thermal grease after cleaning; Intrinsically Safe Models: Clean the exterior every 6–12 months. When working in hazardous areas, the equipment must be shut down and powered off; opening the cover while the unit is energized is strictly prohibited. Clean the housing only with a soft-bristled brush or dry cloth; do not damage the explosion-proof structure.

Maintenance Notes: Do not use strong acid or alkali cleaning agents to clean the probe sheath; do not grind the armored surface with hard objects; do not remove the seals from the explosion-proof junction box without authorization.

2. Wiring Tightness Inspection: Under normal operating conditions in dry indoor environments, check and tighten the terminal connections for all probes quarterly; in environments with significant vibration or frequent temperature fluctuations, tighten the terminals every 2 months. For standard plug-in probes, check the lead terminals for oxidation or verdigris; for armored probes, focus on inspecting the base of the leads to prevent wire breakage due to repeated bending; for surface-mount probes, check the mounting screws on the base; For intrinsically safe explosion-proof models, disconnect power every six months to check the tightness of the explosion-proof gland and terminals inside the junction box; verify that the protective grounding wire is secure; clean any oxidation from the terminals; and ensure the shielding cable is intact with no damage to the outer sheath.

3. Recommendations for Accuracy Recalibration: Under normal indoor conditions, Class A PT100 sensors should undergo accuracy recalibration every 12 months; in environments with dust, vibration, corrosion, or high temperatures, shorten the interval to 6 months. Standard insertion-type and surface-mount probes can be removed and returned to the laboratory for calibration using an ice-water mixture and standard temperature-controlled equipment; for armored high-temperature models, it is recommended to calibrate the low- and high-temperature ranges separately; Calibration of intrinsically safe explosion-proof probes must be performed offline in a safe area; opening the probe housing for calibration is not permitted in hazardous locations. During recalibration, set the instrument parameters according to the probe's wiring configuration (two-, three-, or four-wire), simulate a temperature signal, and verify whether the acquisition error meets Class A standards; save the calibration record upon completion. If the error exceeds the Class A tolerance range, investigate issues such as water ingress into the sheath or aging leads; if the probe cannot be repaired, replace it.

III. Long-Term Maintenance Tips: Dust and Moisture Protection, Interference Mitigation, and Protection Against Extreme Environments

1. Dust and Moisture Protection

Standard Plug-In Waterproof PT100: Ensure the junction box at the probe's tail end remains properly sealed, with the cable outlet facing downward to minimize moisture ingress; during prolonged downtime, keep the installation site dry and well-ventilated; non-waterproof probes must not be used in immersion or high-condensation environments.

Armored High-Temperature PT100: Use FEP fluoroplastic high-temperature-resistant cables for the leads to prevent insulation aging in high-temperature environments; prevent dust accumulation in the armor gaps by blowing them out regularly; avoid repeated bending of the armor to protect the internal platinum wire.

Surface-Mount PT100: Ensure the mounting base remains in close contact with the metal surface being measured; periodically replenish thermal grease, as gaps will reduce thermal conductivity; avoid long-term accumulation of oil residue on the mounting surface.

Intrinsically Safe PT100: Keep all seals in the explosion-proof junction box intact; seal unused cable entry ports with original manufacturer explosion-proof plugs; Intrinsically safe cables must be routed through separate conduits to prevent moisture and dust from entering the junction box.

2. Interference Suppression Optimization

The entire series of Class A PT100 sensors prioritizes the use of shielded twisted-pair cables. The shield is grounded at a single point only at the instrument end in the control room, while the shield at the probe end is left floating to prevent signal fluctuations caused by ground loops formed when both ends are grounded. Signal cables must be routed separately from variable frequency drive (VFD) and high-power motor power cables, with a minimum parallel spacing of ≥30 cm; at crossing points, cables must be routed at a 90° perpendicular angle. Inside the enclosure, power and signal circuits must be kept separate; power cables and RTD signal cables must not be bundled or twisted together. For long-distance transmission or environments with strong electromagnetic interference, select a transmitter with an integrated converter at the tail end to convert the resistance signal into a 4–20 mA current signal, thereby enhancing interference resistance; for projects with multiple measurement points, ensure a consistent grounding method for all probe shielded cables to avoid grounding confusion.

3. Protection in Extreme Environments

High-temperature environments: Select the armored high-temperature model and keep it away from localized high-temperature heat sources; periodically inspect the lead sheath for signs of aging; do not use standard PVC leads in high-temperature conditions.

Low-temperature environments: Inspect rubber seals, as rubber tends to harden and crack at low temperatures; replace them with low-temperature-resistant seals if necessary; check the interior of the junction box for frost before starting up in low-temperature conditions.

Corrosive / salt spray environments: For weak acids, wastewater, and salt fog environments, use 316L stainless steel sheaths; for highly corrosive media, upgrade to Hastelloy or titanium sheaths; standard 304 sheaths must not be used long-term in chlorine-containing media to prevent pitting corrosion.

High-Dust Environments: Standard probes can be fitted with external dust covers; for armored probes, periodically blow away surface dust to prevent dust buildup from encasing the sheath and affecting temperature measurement response speed.

Explosion-Hazardous Areas: Do not replace intrinsically safe probes with non-original parts, and do not grind or drill holes in them without authorization; after maintenance, tighten the explosion-proof junction box and restore all seals; intrinsically safe return cables must not share cable trays with power cables, and the accompanying safety barriers must be calibrated according to the specified schedule.

Troubleshooting & Emergency Response

I. List of Common Faults

1. No Output: The temperature controller or PLC does not display a temperature reading or shows an out-of-range error; the probe circuit is open, with no resistance signal; the integrated transmitter has no 4–20 mA output. A standard PT100 displays an infinite value; the integrated transmitter has no current output.

2. Signal Drift: The medium temperature is stable, but the measured temperature value continues to drift slowly; the zero point deviates with changes in ambient temperature; readings gradually increase or decrease under the same operating conditions; Class A accuracy exceeds the permissible error range specified by national standards. Surface-mount probes are prone to persistent drift caused by poor contact at the heat transfer surface.

3. Indicator Light Abnormalities: The power indicator on the integrated transmitter does not illuminate; the red fault light remains on or flashes intermittently; the channel acquisition indicator does not flash; the alarm light on the 配套 intrinsically safe barrier illuminates.

4. Alarm Triggering: The instrument triggers high-temperature or low-temperature alarms prematurely when the actual temperature has not reached the alarm threshold; the alarm signal fails to trigger when the set temperature is reached; the alarm signal is intermittent, frequently turning on and off.

5. Interference and Distortion: Temperature readings fluctuate randomly or jitter up and down erratically; sudden changes in readings occur when variable-frequency drives or high-power motors start or stop; signals from multiple measurement points in a circuit interfere with one another.

II. Analysis of Failure Causes

1. Wiring Errors: Confusion between three-wire and four-wire probe wiring; compensation wires connected in reverse; shield grounded at both ends, creating a ground loop; loose terminal connections or short circuits in copper wires; intrinsically safe return cables connected to the wrong safety barrier terminals; power supply and output terminals of the integrated transmitter connected in reverse.

2. Power Supply Abnormalities: Insufficient or excessive supply voltage for the integrated transmitter; excessive loop voltage drop; power supply ripple exceeding specifications; PT100 probe excitation current exceeding 1 mA, causing self-heating; intrinsic safety barrier power supply abnormalities resulting in excessive loop energy.

3. Signal Overload: Load resistance downstream of the integrated transmitter exceeds specifications; Circuit surges have damaged the platinum resistance core; high temperatures beyond the measurement range have caused the platinum wire to age, resulting in a permanent shift in resistance.

4. Environmental Interference: Signal wires run parallel to power cables in the same conduit; electromagnetic interference from variable frequency drives and solenoid valves; poor grounding at the site, with multiple points sharing a common ground; probe seal failure, allowing moisture and dust to enter the sheath, resulting in reduced insulation; aging of lead wires due to high-temperature operating conditions.

5. Equipment Damage: Internal platinum wire breakage in the probe; corrosion and perforation of the sheath allowing water ingress, resulting in reduced insulation; internal wire breakage in armored probes due to repeated bending; detachment of the surface-mount base causing thermal conductivity failure; burnout of the integrated transmitter board; damage to the seal of the explosion-proof junction box, resulting in damage to the safety barrier components.

III. Step-by-Step Troubleshooting: Troubleshooting Steps, Repair Measures, and Emergency Workarounds for Specific Faults
Fault 1: No Output, No Reading on the Meter, Open Circuit
Troubleshooting Steps:
 Turn off the power, disconnect the probe from the data acquisition device, and use a multimeter to measure the resistance of the probe leads. The normal resistance at room temperature is approximately 107 Ω; infinite resistance indicates an open circuit, while a resistance close to 0 Ω indicates a short circuit;
 Check the terminals for looseness, oxidation, or short circuits caused by copper wire contact;
 Verify the meter parameters to ensure the data acquisition channel is set to PT100 and the wiring configuration matches the actual probe;
 For integrated transmitters, measure the DC 24 V power supply and check the status of circuit breakers and fuses;
 For intrinsically safe circuits, verify whether the safety barrier is damaged; do not open the cover in hazardous areas.

Remedial Actions:
Broken lead wire: Re-crimp the terminals; broken platinum wire inside the probe: Replace the probe directly; oxidized terminals: Clean off the verdigris and retighten the terminals; incorrect parameter selection: Modify the scale number and wiring configuration within the instrument; damaged safety barrier: Replace with a safety barrier of the same model.
Contingency Plan: If production cannot be shut down, temporarily switch to manual temperature measurement and recording; activate a spare PT100 probe to quickly replace the faulty probe; disable the temperature interlock for this circuit and perform repairs during a scheduled maintenance window.

Fault 2: Signal Drift—Measured Values Continuously Deviate, Accuracy Exceeds Limits
Troubleshooting Steps:
 Remove the probe from the process medium and measure its resistance at room temperature; compare the reading to the standard PT100 resistance value to determine whether the drift originates from the probe itself or external operating conditions;
 Inspect the probe seal for water leakage or corrosion in the sheath;
 Verify the wiring configuration; for long-distance installations, confirm whether a two-wire system has been incorrectly used;
 For surface-mount probes, check the fit of the base and whether the thermal grease has dried out;
 Rule out zero-point drift in the instrument itself by calibrating the data acquisition instrument separately using an RTD signal generator.

Remedial Actions:
If lead resistance causes drift, replace the probe with a three-wire or four-wire model; if water has entered the seal causing insulation degradation, replace the probe; For surface-mount probes, re-polish the contact surface and reapply thermal grease; if the instrument drifts, perform zero and full-scale calibration.
Contingency Plan: Temporarily increase the instrument's filtering and appropriately raise the temperature hysteresis to prevent false interlock trips; this solution is for short-term use only—replace the probe after shutdown; do not rely on parameter compensation long-term.

Fault 3: Abnormal indicator lights; transmitter/safety barrier alarms
Troubleshooting Steps:
 Power indicator does not light up: Check the upstream power supply circuit, circuit breaker, and power cord; measure the supply voltage;
 Red light remains on: Indicates a probe wire break, short circuit, or damaged transmitter module;
 Safety barrier red light is on: Intrinsically safe circuit failure; check the intrinsically safe cable for damage or short circuits.

Remedial Actions:
For power supply failures, repair the power supply circuit; if the probe body is damaged, replace it directly; for safety barrier failures, replace it with the same model in a safe area; for wiring errors, recheck the terminal connections.
Emergency Plan: In explosion-proof environments, immediately disengage the automatic interlock and conduct manual on-site inspections; in standard environments, isolate the faulty channel while allowing the remaining temperature measurement points to continue operating, and await shutdown for maintenance.

Fault 4: Abnormal alarm triggering, false alarms, or no alarms
Troubleshooting Steps:
① Enter the instrument menu to verify the high- and low-temperature alarm thresholds and hysteresis parameters;
② Use a signal generator to simulate a temperature signal and test the instrument's alarm output response;
③ Check the probe's response speed; thick-sheath probes may exhibit temperature measurement lag;
④ For surface-mount probes, check whether there are gaps in the heat-conducting surface.

Remedial Actions:
If parameter settings are incorrect, adjust the alarm thresholds; if the probe response is delayed, replace it with a thin-sheath or armored probe; if the heat-transfer surface is detached, reattach the surface-mount base.
Contingency Plan: Temporarily disable the automatic interlock for this circuit and monitor the temperature manually; after repairs are complete, conduct a comprehensive simulation test to confirm normal alarm operation before re-enabling the automatic system.

Fault 5: Interference-induced distortion, value fluctuations, or random variations
Troubleshooting Steps:
① Verify the routing of signal cables and power cables; check for any parallel runs at close proximity;
② Inspect the grounding method of shielded cables; confirm that both ends are grounded;
③ Observe the fluctuation phenomenon to determine if it synchronizes with the start/stop cycles of variable frequency drives or high-power equipment;
④ Inspect the grounding grid and confirm that the protective grounding resistance is ≤4Ω.

Remedial Measures:

Separate power and signal wiring; maintain a distance of ≥30 cm between signal lines and power cables; modify the shielding to a single-point ground connection in the control room only; in high-interference conditions, replace with an integrated transmitter model and switch to 4–20 mA current signal output; increase the filter time on the instrument side.
Contingency Plan: Temporarily increase the instrument's filter parameters to suppress jitter; subsequently, retrofit the wiring and install signal isolation modules to eliminate the root cause of interference.

IV. After-Sales Repair Guidelines
1. Criteria for Determining Malfunctions (If any of the following situations occur, it is recommended to contact after-sales service for repairs. Do not disassemble the explosion-proof housing of the explosion-proof probe on your own.)

 A multimeter detects an open circuit or short circuit in the platinum core, and the malfunction persists after checking the wiring;
 The probe sheath is corroded or perforated, allowing water ingress; insulation resistance has dropped significantly; retesting shows the device exceeds Class A accuracy specifications and cannot be calibrated to restore performance;
 The platinum wire inside the armored probe is broken or damaged due to repeated bending;
 The junction box of the intrinsically safe explosion-proof model has cracks, the explosion-proof threads are damaged, or the explosion-proof marking is damaged, resulting in the loss of explosion-proof performance;
 The integrated transmitter module is burned out; power supply is normal but there is no output;
 The probe has been subjected to excessive temperature shock, causing permanent resistance drift and rendering it impossible to restore Class A accuracy.

> Important Notice: Unauthorized cutting or grinding of the explosion-proof housing, or unauthorized modification of the probe structure, will immediately void the product warranty and pose an explosion safety risk.

2. Repair Process
1. Compile product information: probe type (standard insertion / armored / surface-mounted / intrinsically safe), wiring configuration, sheath material, and serial number; record on-site operating conditions: medium, temperature, and whether the location is a hazardous area;
2. Thoroughly document the fault symptoms, record completed troubleshooting steps and multimeter measurement data, and take photos of the nameplate, wiring, and fault indicator lights;
3. Call the after-sales technical support hotline, submit the documentation, and have an engineer assist with troubleshooting remotely;
4. Remotely confirm the hardware failure and assess the need for return-to-factory repair; for explosion-proof products, the medium must be thoroughly cleaned before returning the unit;
5. After repair is completed at the factory, the entire unit will undergo calibration and testing, and will be returned along with a factory test report.

3. Warranty Coverage
Warranty Period: The warranty is valid for 12 months from the product's date of manufacture. During the warranty period, any quality defects in the main body—such as the platinum resistance core or leads—that are not caused by human damage or medium corrosion will be repaired or replaced free of charge.
Exclusions from Warranty Coverage:
 Unauthorized disassembly or modification of the probe; for explosion-proof models, unauthorized drilling of holes or grinding of the explosion-proof structure;
 Damage to the sheath or components caused by incorrect model selection, highly corrosive media, or operating conditions exceeding temperature limits;
 Component burnout caused by excessive excitation current in the circuit or incorrect high-voltage connections;
 Fractures in the sheath or leads caused by external impact or pulling on the cable;
 Consumable parts such as sealing O-rings;
 Products beyond the warranty period.