Digital Thermometer

I. Product Definition

The Qidian QD-WST/DTM-491 PT100 Digital Thermometer is an industrial-grade, all-in-one intelligent instrument for temperature acquisition, digital display, transmission, and isolation, developed by Anhui Qidian Automation. Utilizing a PT100 platinum resistance sensor as its core temperature measurement component, it integrates real-time on-site temperature display, remote transmission of standard electrical signals, electrical isolation protection, anti-interference capabilities, and optional power supply, power distribution, and explosion-proof functions. It is specifically designed for temperature monitoring and control in complex industrial environments.

II. Core Features

---Temperature Measurement: Utilizes a standard PT100 platinum resistance sensor to accurately acquire temperature signals across a wide range of -200°C to 600°C.

---Digital Display: High-brightness LCD/digital display for on-site temperature reading, supports °C/°F unit switching, with a resolution of up to 0.1°C.

---Electrical Isolation: Three-terminal isolation (input/output/power supply), isolation voltage ≥2000 V AC, effectively blocking ground potential differences and loop interference.

---Interference Resistance: Industrial-grade EMC design, suitable for industrial environments with strong electromagnetic fields, high vibration, and multiple sources of interference.

---Optional Features: Supports 24V DC power distribution (to power two-wire field sensors), Intrinsic Safety / Explosion-Proof (Exia II CT5), and Water/Dust Resistance (IP66/IP68).

III. Working Principle

PT100 temperature signal input → Input isolation and filtering → Signal amplification and A/D conversion → Microprocessor data processing → On-site digital display

Core isolation advantage: Three-terminal full isolation completely severs electrical connections between input, output, and power supply, eliminating common-mode interference, preventing signal crosstalk, protecting downstream instruments and control systems, and avoiding equipment breakdown and damage, making it suitable for complex multi-loop industrial temperature measurement scenarios.

IV. Core Value (Comparison with Non-Isolated Solutions)

1. Pain Points of Traditional Temperature Measurement Solutions Without Isolation or Local Display

Readings rely on a remote control room; on-site viewing is not possible, resulting in low operational and maintenance inspection efficiency;

Lack of electrical isolation makes the system susceptible to interference from motors, inverters, and cables, leading to significant measurement drift and data distortion;

Ground potential differences and surge impacts can easily cause breakdowns in instruments and control systems, resulting in high equipment failure rates and short service life;

Lack of explosion-proof or protective design makes it unsuitable for hazardous environments such as chemical and oil & gas industries;

2. Core Benefits of Qidian QD-WST/DTM-491

On-site Visualization: Real-time digital display eliminates the need to travel back and forth to the control room for inspections and debugging, boosting operational efficiency by 50%+,

Stable Transmission: Three-terminal isolation + anti-interference circuitry ensures measurement accuracy of ±0.2%–0.5% FS and long-term data reliability,

Equipment Protection: Isolation barriers block electrical surges, extending the lifespan of instruments and control systems by 30%+,

Safety Compliance: Optional explosion-proof / high-protection versions meet safety standards for industries such as chemicals and pharmaceuticals,

High Adaptability: Integrated design replaces the “sensor + transmitter + digital display” combination, reducing wiring and installation costs,

V. Product Series and Positioning (Differences from General-Purpose / Smart / Explosion-Proof Models)

---QD-WST/DTM-491 (Basic Isolated Digital Display Model)

Positioning: Standard industrial general-purpose model, featuring three-terminal isolation and on-site digital display. High cost-effectiveness

Core Features: PT100 input, standard analog output, IP66 protection, non-explosion-proof, dual power supply (battery/24V DC)

Applications: Conventional industrial temperature measurement scenarios without explosion-proof requirements

---General-Purpose Model (Non-Isolated)

No electrical isolation or digital display; provides only basic signal transmission. Weak interference resistance and prone to damage; suitable for simple, clean environments

---Smart Model (QD-WST/DTM-491S)

Adds RS485 communication (Modbus-RTU), button calibration, temperature compensation, and upper/lower limit alarm outputs. High level of intelligence; supports remote configuration

---Explosion-Proof Type (QD-WST/DTM-491Ex)

Intrinsically safe / flameproof construction (Exia II CT5), fully sealed cast aluminum housing, explosion-proof battery / power supply; suitable for flammable and explosive environments such as chemical, oil and gas, and pharmaceutical industries

VI. Typical Industries and Applications

--- Chemical Industry: Temperature monitoring of reactors, distillation columns, storage tanks, and pipelines; acid and alkali resistant, explosion-proof, and interference-resistant, suitable for temperature measurement in hazardous chemical processes

--- Power Industry: Temperature monitoring of boiler drums, superheaters, steam turbines, transformer windings, and cable trenches; high-temperature resistant, vibration-resistant, and long-term stable

---Metallurgy: Temperature data acquisition for blast furnaces, converters, continuous casting, and heat treatment furnaces; suitable for high-temperature, dusty, and strong electromagnetic interference environments

---Pharmaceuticals: Temperature control for cleanrooms, fermenters, autoclaves, and freeze dryers; sanitary-grade design, explosion-proof, high precision, compliant with GMP standards

---Smart Manufacturing: Temperature monitoring for injection molding machines, extruders, industrial furnaces, and motor bearings; integrated installation, on-site digital display, and compatibility with automated production lines

---Other: Temperature monitoring and control for food processing, HVAC, wastewater treatment, new energy (solar/wind power) equipment, and cold chain logistics

7: Key Parameters and Specifications

7.1 Basic Electrical Parameters

The Qidian QD-WST/DTM-491 PT100 Digital Thermometer primarily accepts PT100 platinum resistance temperature detectors (RTDs) as input signals, while also supporting Type K and other thermocouples. It can be customized to meet specific on-site requirements. The standard measurement range is -50 to 300°C, which can be extended to -200 to 600°C depending on the specific application. The high-temperature custom model supports temperatures up to 600°C, meeting the temperature measurement needs of various industrial scenarios. In terms of accuracy, the standard model offers ±0.5% FS, while the smart calibration model achieves ±0.2% FS, ensuring precise temperature measurements. Resolution varies depending on the temperature measurement range: within the -30 to 199.9°C range, the resolution is 0.1°C, enabling precise detection of minute temperature changes; within the 200 to 600°C range, the resolution is 1°C, balancing measurement efficiency and accuracy in high-temperature scenarios. Response times are available in standard and fast-response versions. The standard model has a response time of ≤5 seconds, while the fast-response model has a response time of ≤1 second, allowing for flexible selection based on on-site requirements for measurement speed. Output signals support multiple types, with the mainstream being a 4–20 mA analog signal. Additionally, 0–5 V and 0–10 V analog signals are available. Smart models also offer an optional RS485 communication interface using the Modbus-RTU protocol, facilitating integration with various control systems. Regarding load capacity, the maximum load for 4–20 mA output is ≤500 Ω, while the input impedance for 0–10 V output is ≥10 kΩ.

The overall input impedance is ≥10 MΩ, effectively ensuring the precise acquisition of weak temperature signals and preventing signal distortion.

7.2 Isolation Performance Parameters

The core advantage of this digital temperature meter lies in its three-terminal fully isolated design, which achieves complete electrical isolation between the input, output, and power supply. With an isolation voltage of ≥2000 V AC, it provides the core guarantee for industrial-grade interference resistance and completely severs electrical connections between different circuits. The dielectric strength reaches a withstand voltage of ≥2000 V AC for 1 minute; under these voltage conditions, there is no breakdown or flashover, ensuring safe operation of the equipment in high-voltage environments. The insulation resistance is ≥100 MΩ at a standard ambient temperature of 25°C, effectively preventing potential leakage hazards and ensuring stable equipment operation. In terms of electromagnetic compatibility, the device fully complies with the IEC 61326-3:2025 standard for industrial equipment, offering strong interference resistance. It can effectively withstand various types of electromagnetic interference commonly found in industrial environments, such as EFT (Electrical Fast Transient), ESD (Electrostatic Discharge), and surges. Temperature drift is controlled to ≤30 ppm/°C. There is no significant measurement drift throughout the entire temperature range, ensuring long-term stability of temperature data and preventing environmental temperature fluctuations from affecting measurement accuracy.

7.3 Power Supply & Power Consumption Parameters

The power supply voltage employs a standard battery-powered design while also supporting a customizable 220 V AC voltage, enabling adaptation to scenarios with voltage fluctuations in industrial environments and enhancing the device's adaptability. Full-load power consumption is ≤2W. The low-power design meets energy-saving requirements while reducing heat generation during operation, thereby extending the device's service life. An optional AC 220V power output function is available, capable of directly powering on-site two-wire PT100 platinum resistance thermometers, Type K thermocouples, and other sensors. With a maximum output current of 20mA, this eliminates the need for additional power supply equipment, simplifying on-site wiring and installation. Additionally, the device can operate on AA batteries. The standard model provides ≥1 year of continuous operation, while the low-power model offers ≥3 years, making it suitable for field applications without external power sources and ensuring uninterrupted temperature measurement.

7.4 Environmental Adaptation Parameters

The device operates within a temperature range of -20°C to 60°C and a relative humidity of ≤95% RH (no condensation), making it suitable for most industrial field environments. The storage temperature and humidity range is -40°C to 70°C, with relative humidity ≤85% RH and no condensation, facilitating long-term storage and transportation of the device while preventing damage caused by environmental factors during storage. In terms of protection ratings, the standard model achieves IP66, providing effective dust and water resistance suitable for general dusty and humid environments; The high-end model features an upgraded IP68 rating, offering enhanced water and dust resistance to withstand harsh, humid, and dusty industrial environments. Explosion-proof ratings are available as optional configurations; users can select either Exia II CT5 intrinsically safe or Ex d II BT4 flameproof types based on hazardous environment requirements, making the device suitable for flammable and explosive hazardous areas such as chemical and oil & gas facilities, while meeting relevant safety standards.

7.5. Physical Specifications

The device uses a 35mm standard DIN rail mounting system for quick and convenient installation, seamlessly integrating into industrial control cabinets while saving internal space. With dimensions of 100mm (L) × 72mm (W) × 62mm (H), its compact design minimizes the footprint, further optimizing cabinet space utilization. The device weighs approximately 0.3 kg, making it lightweight, easy to transport, and simple to install. This reduces logistics and transportation costs while also easing the workload for on-site installation personnel. The indicator lights are clearly labeled: the green PWR light indicates normal power supply, while the red ALM light signals an over-temperature or equipment failure alarm. This feature is standard on smart models, allowing on-site personnel to quickly assess the device's operational status and identify any abnormalities. The housing features a die-cast aluminum shell with a powder-coated finish, offering excellent corrosion resistance and vibration resistance to withstand complex industrial environments. The probe is made of 304 stainless steel; for high-end models, a PTFE corrosion-resistant material is available as an option, further enhancing the probe's corrosion resistance and making it suitable for special applications involving acids and alkalis.

7.6 Supplementary Notes on Core Parameters

The practical advantages of the three-terminal fully isolated design are significant. It completely eliminates ground potential differences and loop interference in industrial environments, effectively preventing damage to control system modules such as PLCs and DCSs caused by breakdown. It is particularly suitable for sites with intense electromagnetic interference, such as those with a high concentration of motors and variable frequency drives, ensuring stable transmission of temperature data. The output signals offer exceptional adaptability; standard analog signals such as 4–20 mA and 0–10 V can be directly connected to mainstream DCS and PLC control systems on the market without the need for additional signal conversion equipment. The RS485 communication interface supports remote parameter calibration and data monitoring, facilitating remote device management by on-site maintenance personnel and improving operational efficiency. The device features ample environmental resilience. With an IP68 protection rating and wide-temperature design, it operates reliably in environments ranging from -20°C to 60°C, as well as in high-dust and humid conditions, requiring minimal maintenance. The explosion-proof model strictly complies with safety standards for the chemical and pharmaceutical industries, ensuring safe operation in flammable and explosive hazardous areas and safeguarding production safety.

VIII. Selection Guide

8.1 Key Selection Criteria

1. Sensor Type: PT100/PT1000 resistance temperature detectors (RTDs), K/S/J/T-type thermocouples, NTC/PTC thermistors
2. Measurement Range: Low temperature (below -200°C), ambient temperature, high temperature (1000°C+), custom ultra-wide temperature ranges
3. Output Signal: 4–20 mA analog, RS485/Modbus digital, millivolt signal, resistance signal
4. Number of Channels: Single-channel, multi-channel (4-channel / 8-channel / 16-channel integrated modules)
5. Power Supply: Standard industrial 24 V DC, 220 V AC, low-voltage passive power supply
6. Explosion-proof requirements: Ex d/Ex ia explosion-proof ratings, intrinsically safe, flameproof, non-explosion-proof general-purpose models
7. Installation environment: Waterproof and dustproof (IP65/IP67/IP68), corrosion-resistant, high-temperature flue ducts, humid tanks, outdoor open-air environments.

8.2. Common Mistakes in High-Frequency Sensor Selection (Key Pitfalls to Avoid)

1. Type Mismatch: Misusing PT100 in high-temperature conditions or thermocouples in low-temperature, high-precision scenarios, resulting in significant measurement errors
2. Incorrect Range Selection: Too narrow a range causes over-temperature damage to the probe; too wide a range dilutes accuracy and causes significant data fluctuations
3. Neglecting Signal Isolation: In environments with strong electromagnetic interference (power/metallurgy), failing to use isolated transmitters leads to data jumps and communication dropouts
4. Mixing in Explosion-Proof Environments: Using general-purpose, non-explosion-proof models in chemical, flammable, or explosive environments poses significant safety hazards.
5. Neglecting Load Matching: Failing to account for the load of downstream instruments in 4-20mA output systems leads to signal attenuation and inaccurate readings.
6. Ignoring Temperature Drift: In precision pharmaceutical and laboratory settings, failure to calibrate temperature drift parameters results in errors exceeding acceptable limits over time.

8.3 Customized Upgrade Solutions (Exclusive for Non-Standard Applications)

1. Custom Signal Configuration: Custom dual-signal output, passive-to-active conversion, and proprietary communication protocol adaptation (for PLC/SCADA integration)

IX. Installation and Commissioning

9.1. Pre-installation Preparation

1. Checking Accessories

Carefully check each item in the complete set of accessories for the Qidianjia QD-WST/DTM-491 PT100 Digital Thermometer to ensure that all items are present and free from damage, deformation, or corrosion. The set includes: digital display unit (with LCD backlit display), PT100 thermoresistor probe (standard waterproof probe, available in lengths of 2 meters/10 meters, etc.), standard 35mm DIN rail clip, mounting screws, terminal block, shielded signal cable, O-ring, product manual, and calibration certificate; Carefully verify that the main unit model (QD-WST/DTM-491) and PT100 probe specifications match the selection requirements. Confirm that the digital main unit has no screen damage or malfunctioning buttons, that the probe cables have no damage or breaks, and that the terminal blocks are free of looseness or oxidation. Ensure the product meets high-precision temperature measurement standards (accuracy ±1°C).

2. Environmental Inspection

Based on the characteristics of the QD-WST/DTM-491 model, verify that the installation location meets the following requirements: Keep the unit at least 0.5 meters away from sources of strong electromagnetic interference (such as variable frequency drives and high-voltage cables) to prevent interference with temperature measurement accuracy. This model features waterproof protection; in humid environments (such as workshops or near water tanks), ensure the installation area is free of standing water and condensation, that the probe seal is intact, and that the main unit is installed in a location protected from direct rain. In high-temperature environments (not exceeding 300°C, compatible with the PT100 range), ensure there are no flammable or fragile components in the vicinity, and position the probe to avoid direct exposure to high-temperature radiation; in corrosive environments, verify that the probe is made of acid- and alkali-resistant materials and that the main unit's mounting surface has been treated with corrosion protection; for outdoor installation, install a rain and sun protection cover on the main unit to ensure compliance with the product's environmental requirements (main unit operating environment: -20°C to 60°C, relative humidity ≤80%).

3. Tool List

Phillips/flathead screwdrivers, wire strippers, crimping pliers, high-precision multimeter (calibrated for voltage/resistance, compatible with PT100 signal detection), Standard temperature-controlled chamber (for auxiliary accuracy calibration), fixed wrench, electrical tape, cable ties, waterproof connectors (for outdoor/humid environments; to seal the probe cable at the unit's connection port), soft cloth (for cleaning the unit's screen and probes). No explosion-proof tools are required (this model is non-explosion-proof; use in explosion-proof environments is strictly prohibited). Drilling tools may be prepared as needed for probe installation (e.g., for flush-mounted installations).

4. Safety Precautions

Disconnect all power sources before wiring and ensure proper insulation to prevent electric shock or signal short circuits; in high-temperature environments (e.g., equipment temperature measurement), confirm that the equipment is shut down and has cooled to below 50°C before installing the PT100 probe to prevent burns and probe damage; when installing the probe, do not pull on the cable forcefully to avoid cable breakage and signal interruption; When installing at heights, wear a safety harness and implement fall protection measures; avoid bumping the screen during host installation to prevent damage; calibration operations must be performed by qualified personnel in strict accordance with the product manual and metrological calibration standards.

9.2 Power-On and Commissioning Procedure

1. No-Load Test

Connect the power supply (verify the voltage is DC 12V/24V, matching the rated voltage of this model), and run the unit under no-load conditions for 5–10 minutes. Observe the main unit's status: the LCD backlit display should illuminate normally (with clear readability in dark environments), showing no garbled text or black screen; indicator lights should function normally (power light steady, signal light flashing); The main unit should not exhibit abnormal overheating, unusual noises, or alarm prompts. If a black screen or alarm occurs, immediately disconnect the power and troubleshoot the power connections and the main unit.

2. Signal Calibration (Compatible with PT100 signals, precise calibration)

Use a multimeter to measure the PT100 signal input and output: Connect a standard PT100 resistance signal source (simulating resistance values corresponding to different temperatures) and verify that the temperature displayed on the unit matches the temperature corresponding to the standard resistance, with a deviation not exceeding the accuracy range of this model (±1°C). If an RS485 signal output is connected, use configuration software or debugging tools to confirm that communication is normal, data reading is stable, and there are no packet losses or data fluctuations; Place the PT100 probe in a room-temperature environment; the displayed temperature should match the actual ambient temperature, with the error within the allowable range, ensuring normal signal transmission.

3. Indicator Light Status Assessment (Model-Specific, Precise Identification)

This model is equipped with 3 indicator lights, with the following corresponding statuses: Power Light (PWR): Steady on = Normal power supply; Off = Power not connected or main unit failure (check power wiring and main unit fuse); Signal Light (SIG): Flashing = Normal PT100 signal transmission; Steady on/Off = Signal abnormality or wiring error (check PT100 probe wiring or probe failure); Alarm Indicator (ALM): On = Out of range (exceeding the PT100 range of -200°C to 300°C), main unit malfunction, or short circuit in wiring. Power must be disconnected immediately for troubleshooting; after troubleshooting is complete, power on again to test.

4. Accuracy Calibration and Display Calibration Methods (Applicable to this model; practical and implementable)

(1) Accuracy Calibration: Use the standard constant-temperature chamber calibration method. Place the PT100 probe into a standard constant-temperature chamber and set 3–5 standard temperature points within the measurement range (e.g., 0°C, 50°C, 100°C, 200°C, 300°C). Once the temperature in the chamber has stabilized, compare the digital temperature displayed on the main unit with the standard temperature in the chamber. If the deviation exceeds the limit, adjust the calibration parameters using the calibration button on the main unit (refer to the product manual). Repeat the measurement three times at each temperature point, record the data, and ensure the deviation after calibration is ≤±1°C. Save the parameters after calibration is complete. It is recommended to calibrate once every three months; initial calibration must be performed before new equipment is put into service;

(2) Display Calibration: This model features an LCD display. Verify that the displayed temperature matches the standard temperature. If a display deviation occurs, use the host unit's buttons to enter the calibration menu and adjust the display offset to ensure the display accuracy meets requirements. Lock the parameters after calibration to prevent accidental modifications. The backlight brightness can also be calibrated to suit viewing needs in different environments.

9.4 Installation Precautions (Strictly adhere to these guidelines to minimize the risk of malfunctions and ensure compatibility with this model)

1. Never exceed the rated voltage: This model is rated for power supply by two AA batteries or a custom AC 220V power source. Failure to comply will directly burn out the internal circuitry of the main unit and the PT100 probe;

2. Avoid High-Voltage Interference: Never run PT100 signal cables parallel to high-voltage cables (220V AC or higher). Maintain a minimum distance of 0.5 meters to prevent electromagnetic interference from causing display fluctuations or measurement errors. In environments with strong electromagnetic fields, reinforce shielding and grounding measures;

3. Protection in humid, high-temperature, and dusty environments: In humid environments, failure to apply waterproofing or seal the wiring ports may cause short circuits at the main unit terminals or internal moisture damage; use in high-temperature environments (exceeding 300°C) will burn out the PT100 probe, rendering temperature measurement ineffective; in dusty environments, failure to seal the main unit and probe may cause terminal oxidation or probe blockage, affecting measurement accuracy;

4. Other Precautions: Do not pull on the PT100 probe cable with force or strike the main unit or probe; do not disconnect wires or adjust calibration parameters while the main unit is in operation; do not use this model (non-explosion-proof version) in explosion-hazardous

environments; Never connect thermocouple signals; only PT100 thermistors are permitted; never touch the main unit's screen with sharp objects to prevent screen damage; never disassemble the main unit without authorization, as this will void the product warranty and affect performance.

X. Recommendations for Daily Use and Maintenance

10.1 Key Points for Daily Inspections (To be performed daily to promptly identify potential hazards)

1. Display Status Check

After powering on the device each day, first check the LCD backlit display to ensure there is no black screen, garbled text, blurred display, or missing characters, and that the readings are clear and legible. Verify that the displayed temperature matches the actual ambient temperature (or the temperature of the measured medium) on-site; any deviation must be within the product's accuracy range (±1°C). If "———" appears on the display, it indicates that the measured temperature exceeds the PT100 range (-200°C to 300°C). Immediately adjust the probe position or verify the temperature of the measured medium to prevent probe damage. Also, check the display for a low-battery indicator; if present, replace the battery promptly (for battery-powered models) to prevent affecting measurement accuracy.

2. Indicator Light Monitoring

Pay close attention to the operational status of the device's three indicator lights to ensure they match the operating conditions: The power light (PWR) should remain lit to indicate normal power supply; if it is off, check the power connections or investigate internal faults in the main unit. The signal light (SIG) should flash to indicate normal PT100 signal transmission; if it remains lit or is off, inspect the probe connections, check for damage to the probe cable, or verify if the probe is faulty. If the Alarm (ALM) light illuminates, immediately check for out-of-range readings, short circuits in the wiring, or a unit malfunction. Power off the unit promptly to troubleshoot and prevent equipment damage.

3. Signal Stability Monitoring

During routine inspections, observe whether the digital temperature display is stable and free of frequent fluctuations (fluctuation range not exceeding ±0.5°C); If connected to an RS485/Modbus signal output, use configuration software or debugging tools to check the data transmission status and ensure there are no packet losses or disconnections; if signal fluctuations or disconnections occur, prioritize checking whether the terminal blocks are loose, whether the shielded cable is properly grounded, and whether there are strong electromagnetic interference sources nearby, and address the issue promptly to ensure signal stability.

4. Temperature and Humidity Monitoring

Monitor the temperature and humidity of the equipment's installation environment to ensure compliance with product standards: the operating environment temperature of the main unit should be maintained between -20°C and 60°C, with relative humidity ≤80% (in humid environments, this should be controlled at ≤70%). Avoid exceeding these limits to prevent premature aging of internal components and signal drift in the sensors. Additionally, record environmental temperature and humidity data; if the unit is exposed to high humidity or high temperatures for extended periods, take protective measures promptly to extend the equipment's service life.

10.2. Regular Maintenance Plan (Performed on a scheduled basis to ensure long-term stability of the equipment)

1. Cleaning Schedule and Methods

(1) Daily Cleaning: During daily inspections, wipe the main unit's screen and housing with a dry, soft cloth to remove surface dust and stains, preventing dust from entering the connection ports or screen crevices;

(2) Periodic Deep Cleaning: Perform a deep cleaning once a month, focusing on removing dust and oxidation layers from the terminal blocks (gently brush with a dry brush; do not wipe terminals with a damp cloth). Clean oil stains and deposits from the surface of the PT100 probe to ensure temperature sensitivity. After cleaning, inspect the probe's seal to prevent moisture ingress;

(3) Cleaning precautions: Never use sharp objects or corrosive cleaning agents on the equipment to avoid scratching the screen, damaging the housing, or corroding the terminals. The equipment housing is made of stainless steel (IP65 protection). After cleaning, ensure the seal is intact to maintain dust and water resistance.

2. Wiring Tightness Inspection

Inspect the terminal blocks once every 15 days. Gently press the terminals with a screwdriver to ensure that the power, PT100 signal input, and signal output terminals are secure and free of looseness; Inspect the connection points between the PT100 probe cables and terminals to ensure there are no loose cables or exposed wires; verify that the shielding wire is securely grounded and that the ground wire is free of looseness or breaks; if terminal oxidation or cable damage is detected, promptly replace the terminals or cables, rewire the connections, and properly insulate them to prevent signal short circuits or poor contact, thereby avoiding temperature measurement errors or equipment malfunctions caused by wiring issues.

3. Recommendations for Accuracy Retesting

Develop a precise accuracy retesting plan based on the equipment's usage frequency and operating environment:

(1) Standard environments (e.g., room-temperature measurements in workshops): Retest once every 3 months;

(2) Harsh environments (e.g., high temperature, high humidity, or strong interference): Retest once every month;

(3) Verification Method: Place the PT100 probe in a standard temperature-controlled chamber. Set 3–5 standard temperature points within the measurement range (e.g., 0°C, 50°C, 100°C, 200°C, 300°C). Once the temperature has stabilized, compare the digital display temperature on the main unit with the standard temperature in the chamber. If the deviation exceeds ±1°C, perform accuracy calibration promptly;

(4) Retest Records: Detailed records of each retest's temperature points, measured values, standard values, and deviation must be maintained to establish an operational and maintenance log for subsequent traceability and optimization. Calibration records must also be retained to meet compliance requirements.

10.3 Long-Term Maintenance Tips (Precise Protection to Extend Equipment Lifespan)

1. Dust and Moisture Protection

(1) Dust Protection: Install the main unit away from areas with high dust concentration whenever possible. If this is unavoidable, install a dust cover and regularly clean dust from its surface. Seal wiring ports with waterproof and dustproof connectors to prevent dust from entering internal circuits, thereby avoiding terminal oxidation and short circuits;

(2) Moisture Protection: In humid environments (such as near water tanks or outdoor settings), enhance waterproofing measures. Ensure that the main unit's wiring ports and probe cable connectors are properly sealed. Apply waterproof tape around the wiring ports, and regularly inspect the sealing rings for signs of aging or damage, replacing them promptly; Avoid exposing the equipment to prolonged condensation. If condensation occurs, power off and shut down the equipment; restart only after it has dried completely. The fully sealed structure of the equipment effectively adapts to humid and dusty environments, but the sealing performance must be checked regularly.

2. Interference Mitigation

(1) Keep Away from Interference Sources: Ensure the equipment is at least 0.5 meters away from strong electromagnetic interference sources such as variable frequency drives and high-voltage cables to prevent signal interference that could cause display fluctuations;

(2) Shielded Cable Optimization: Verify that shielded cable connections are properly configured. Ensure the shield is grounded at one end (near the main unit) and left floating at the other end. Never ground both ends simultaneously to prevent the formation of an interference loop;

(3) Wiring Optimization: Route PT100 signal cables separately from high-voltage power lines (220 V AC and above), maintaining a minimum distance of 0.5 meters. Prioritize the use of shielded twisted-pair cables to reduce signal attenuation and interference, thereby improving temperature measurement stability.

3. Protection in Extreme Environments

(1) High-Temperature Environments (100°C–300°C): Ensure the PT100 probe is made of high-temperature-resistant materials. Avoid prolonged exposure of the probe to temperatures exceeding 300°C. Regularly inspect the probe's protective sleeve for damage or oxidation and replace it promptly. Install the main unit away from direct high-temperature radiation and allow sufficient space for heat dissipation to prevent component aging caused by overheating;

(2) Low-Temperature Environments (below -20°C): Verify that the main unit's power supply is functioning normally to prevent

insufficient battery power due to low temperatures (for battery-powered models). Ensure probe cables are properly protected against freezing to prevent brittle fracture caused by low temperatures;
(3) Corrosive Environments: Select PT100 probes made of acid- and alkali-resistant materials. Regularly wipe down the main unit's housing and apply anti-corrosion treatment to prevent corrosion of the housing and terminals, thereby extending the equipment's service life.

XI. Troubleshooting & Emergency Procedures

11.1. List of Common Faults (Specifically tailored to this model, covering frequently encountered issues)

Based on the usage scenarios and product characteristics of the Qidianjia QD-WST/DTM-491 PT100 Digital Thermometer, we have identified six categories of frequently encountered faults covering core functions such as display, signal, output, and alarms, as detailed below:

- Fault 1: No Display (LCD screen is black, no backlight, and none of the indicator lights are on)
- Fault 2: Abnormal Display (garbled characters, missing characters, blurred readings, or error messages such as "———" or "Err")
- Fault 3: Signal Drift (frequent fluctuations in the displayed temperature, deviation exceeding ±1°C, or a continuously increasing deviation from the actual temperature)
- Fault 4: Output Abnormalities (No RS485/Modbus signal output, signal attenuation, or mismatch with the digital temperature display)
- Fault 5: False Alarm Triggering (Alarm lights illuminate without cause—e.g., no out-of-range conditions or faults—or alarms are not triggered in a timely manner)
- Fault 6: Interference and Distortion (Large fluctuations in digital readings, signal disconnections, or significant interference from surrounding equipment)

11.2. Analysis of Fault Causes (Tailored to the structure of this model to accurately pinpoint the root cause)

1. No display on the device

Core causes revolve around power supply and the main unit itself, tailored to the characteristics of this model: ① Power supply abnormality: Input voltage exceeds the rated range of DC 12V/24V, or the power supply polarity is reversed, preventing the main unit from receiving power; ② Wiring faults: Loose or disconnected power terminals, or damaged or broken power cables; ③ Main unit faults: Blown internal fuses, aging core components, or a damaged display; ④ Battery-powered models only: Depleted battery, poor battery contact, or failure to replace the battery in a timely manner.

2. Display Abnormalities

Focus on the display system and signal input, considering this model's accuracy characteristics: ① Signal input failure: Incorrect PT100 probe wiring, damaged probe cable, or probe damage (e.g., aging of the temperature-sensing element); ② Out-of-range: The measured temperature exceeds the PT100's rated range (-200°C to 300°C), and the screen displays "———"; ③ Main unit failure: Damaged screen backlight, poor internal circuit contact, or incorrect parameter settings (e.g., abnormal range settings); ④ Environmental factors: High temperature or high humidity causing condensation or blurring on the screen, or dust covering the screen.

3. Signal Drift

Primarily related to the probe, wiring, and environment, and influenced by this model's anti-interference capability: ① Probe failure: Aging of the PT100 probe, decreased temperature sensitivity, or oil or dirt on the probe surface affecting temperature measurement; ② Wiring issues: Loose or oxidized terminals, or incorrect wiring of the PT100 (3-wire or 2-wire system), leading to increased signal loss; ③ Environmental interference: Strong electromagnetic interference sources nearby (such as inverters or high-voltage cables), or improper grounding of shielded cables; ④ Calibration issues: Long-term lack of accuracy calibration, calibration parameter drift, or incorrect calibration methods.

4. Output Abnormalities

Regarding the signal output characteristics of this model (RS485/Modbus): ① Wiring faults: Loose or disconnected output terminals (5#, 6#), or reversed signal wires (incorrect connection of A/B terminals); ② Parameter settings: Incorrect output mode settings that do not match the communication protocol of the downstream PLC or instrument; □ Host unit failure: Damage to the internal output module, preventing normal signal transmission;
④ Wiring issues: Damaged output cables or improper shield grounding, resulting in signal attenuation or loss.

5. False Alarm Triggering

Related to alarm parameters and device status: ① Incorrect parameter settings: Unreasonable upper and lower alarm limits (exceeding actual operating requirements) or incorrect alarm type selection; ② Signal drift: Frequent fluctuations in the digital temperature display triggering the alarm threshold; ③ Probe failure: Abnormal probe signal, leading to incorrect temperature readings and triggering an alarm; ④ Host failure: Internal alarm module malfunction, causing alarm functionality to malfunction.

6. Interference and distortion

Considering this model's non-isolated design and interference resistance: ① Influence of interference sources: Equipment located within 0.5 meters of strong electromagnetic interference sources, or high-voltage power lines laid parallel to signal cables; ② Shielding cable issues: The shielded cable is not grounded at one end, is grounded at both ends, or has a damaged shield, rendering it ineffective against interference; ③ Grounding issues: Signal ground and power ground share the same ground, creating an interference loop; ④ Environmental factors: High temperature and humidity cause a decline in internal circuit insulation, exacerbating the impact of interference.

11.3 After-Sales Repair Guidelines

1. Troubleshooting (Quickly distinguish between issues that can be resolved independently and those requiring service)

Issues that can be resolved independently: Simple issues such as wiring errors, power supply abnormalities, incorrect parameter settings, contamination on the probe surface, or improper shielding grounding. These can be resolved by following the "Step-by-Step Solutions" in this module.

Faults Requiring Service: No display on the main unit despite a functional fuse, screen damage, aging of core components, output module failure, internal probe damage, failure to meet accuracy requirements (±1°C) even after calibration, and other faults that cannot be diagnosed or repaired independently.

2. Service Request Process (Concise and Efficient, Aligned with Qidianjia After-Sales Standards)

1. Fault Confirmation: Follow the troubleshooting methods in this module to confirm that the fault cannot be repaired on your own. Record the fault symptoms (e.g., no display, signal drift), the time the fault occurred, the operating environment, and the troubleshooting process.
2. Contact After-Sales: Report the issue via the official contact methods below, specifying the product model (QD-WST/DTM-491), detailed fault description, and usage scenario. Provide the product calibration certificate and maintenance records (if available).
3. Fault Reporting: Cooperate with after-sales staff to describe the fault in detail, perform simple tests as instructed, and assist in identifying the root cause of the issue.
4. Equipment Shipping/On-site Service: Depending on the nature of the fault, after-sales will inform you whether to ship the faulty equipment (ensure it is properly packaged and includes a fault description) or arrange for on-site repair (available only in designated areas).
5. Repair Acceptance: After the repair is completed, upon receiving the device or following on-site debugging by after-sales staff, test the device's functions to confirm the fault has been resolved, and verify that accuracy and all functions are normal.

3. Official Contact Information (tailored for the Qidianjia brand to facilitate quick contact)

- After-sales Hotline: 19715617532 (Weekdays 9:00 AM–6:00 PM; extended hours on public holidays)
- After-Sales Email: sales008@qd-zdk.com (Send details of the malfunction and relevant documentation; response within 24 hours)
- Official WeChat Account: Qidianjia Industrial Instruments (Select "After-Sales Repair" from the menu bar to submit repair requests online)
- Offline Service Center: No. XX, XX Road, XX District, XX City (Check the WeChat official account for information on the nearest service center)

4. Warranty Coverage (Clearly define the warranty policy for this model to avoid disputes)

□ Warranty Period: For the Qidianjia QD-WST/DTM-491 PT100 Digital Thermometer, the main unit is covered by a 1-year warranty, and the PT100 probe is covered by a 6-month warranty, effective from the date of product acceptance.

② Warranty Coverage: During the warranty period, any malfunctions caused by product quality issues (such as core component failure, natural screen damage, or probe defects) will be repaired or have parts replaced free of charge; technical support and calibration guidance will also be provided free of charge.
③ Exclusions: Damage caused by human error (such as impact, disassembly, or burnout due to incorrect wiring); malfunctions caused by force majeure (floods, lightning strikes, earthquakes); Failures occurring after the warranty period has expired; failures resulting from failure to follow the product manual; failures resulting from unauthorized modifications or repairs; normal wear and tear of consumables (such as batteries and O-rings).
④ Extended Warranty: After the warranty period ends, you may contact after-sales service for paid repairs, parts replacement, and calibration services. Pricing is transparent; please consult after-sales staff in advance.