Explosion-Proof Temperature Sensors User Manual



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Applicable Products: Explosion-Proof Thermocouples / Resistance Temperature Detectors (Plug-in / Cold-Junction / Threaded)

Manufacturer: Anhui Qidian Automation Technology Co., Ltd.

1 Product Overview

1.1 Product Introduction

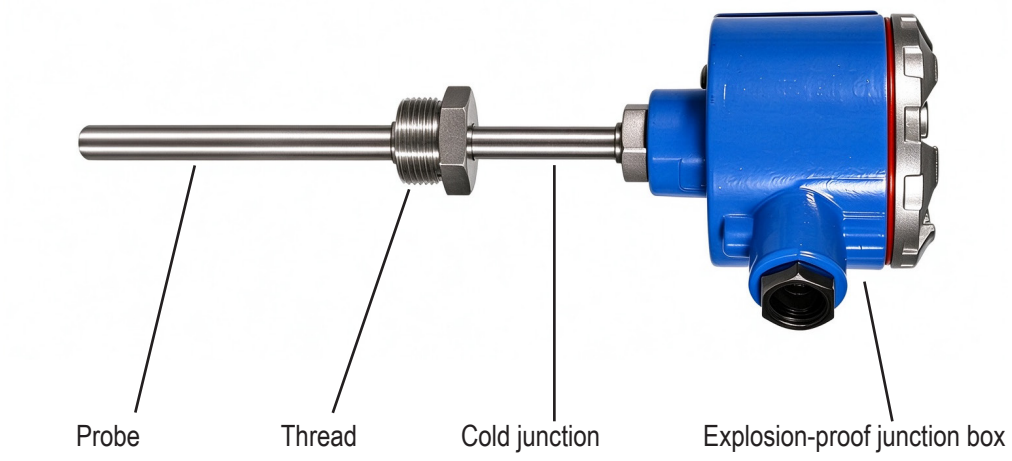
The Explosion-Proof Temperature Sensor is a high-performance industrial temperature measurement instrument independently developed and manufactured by our company. It is widely used in industrial settings—such as the petroleum, chemical, metallurgical, power, and light industrial sectors—where explosive gas atmospheres are present. This product features a flameproof design and has been certified by the National Quality Supervision and Inspection Center for Explosion-Proof Electrical Products. Its explosion-proof markings are ExdIIBT4 and dIICT5, and it fully complies with national and international standards such as IEC 60079 and GB 3836.

This product line encompasses two major series: explosion-proof thermocouples and explosion-proof resistance temperature detectors (RTDs), available in three configurations—plug-in, cold-junction, and threaded—to meet temperature measurement requirements under various complex operating conditions. As a professional armored temperature sensor, this product offers significant advantages such as high measurement accuracy, fast response time, high mechanical strength, and excellent pressure resistance, making it an ideal choice for temperature measurement in explosive environments.

Whether you require flameproof temperature sensors with a wide temperature range (thermocouple series, up to 1600°C) or explosion-proof temperature probes for high-precision low-temperature measurement (RTD series, with accuracy up to ±0.15°C), our products provide reliable solutions. In addition, we offer integrated explosion-proof temperature transmitters with signal conversion capabilities, capable of directly outputting a standard 4–20 mA signal for easy integration with control systems such as DCS and PLC.

1.2 Product Features and Benefits

No	Features	Description
1	Complete range of explosion-proof certifications	Certified by the National Quality Supervision and Testing Center for Explosion-Proof Electrical Products; explosion-proof marking: ExdIIBT4/dIICT5; complies with IEC 60079 and GB 3836 standards.
2	High measurement accuracy	Thermocouple accuracy: ±1.5°C (below 400°C); actual accuracy in use is approximately ±3°C; resistance temperature detector (RTD) accuracy can reach ±0.15°C.
3	Wide temperature measurement range	Thermocouple: -40°C to 1600°C; Resistance thermometers: -200°C to 500°C, meeting the demands of various operating conditions
4	Robust armored construction	Features an armored construction, providing high mechanical strength, excellent vibration resistance, and high pressure resistance (standard 6 mm models withstand 1.6 MPa; 8 mm models withstand 2.5 MPa)
5	Multiple design configurations	Available in three configurations—plug-in, cold-junction, and threaded—to accommodate different installation requirements
6	Optional transmitter output	Equipped with a transmitter output function that directly outputs a standard 4–20 mA signal, eliminating the need for compensation leads and improving immunity to interference
7	Choice of materials	Available in a variety of stainless steel grades, including 304, 316, 321, 316L, and 2520, to suit different corrosive environments
8	Customizable protective sleeves	Offers a variety of sheath configurations, including pagoda-shaped, round, male/female threaded, and hexagonal, with customizable rod diameters



1.3 Application Areas

This product is widely applicable in the following industrial sectors where explosive gases or vapors are present:

- Petroleum and Petrochemicals: Temperature monitoring in refineries, chemical plants, and oil and gas storage and transportation facilities
- Metallurgical Industry: High-temperature measurement in steel mills and non-ferrous metal smelting
- Power Generation: Temperature monitoring in thermal power plants and nuclear power plants
- Light Industry and Food Processing: Temperature control in food processing and the pharmaceutical industry
- Chemical Industry: Temperature monitoring during the production and storage of hazardous chemicals
- Environmental Protection: Temperature detection in wastewater treatment and exhaust gas treatment facilities
- Aerospace: Temperature testing of aircraft engines and spacecraft components
- Research Institutions and Universities: High-temperature laboratory experiments, materials research, etc.



1.4 Packing List

No	Item Name	Quantity	Notes
1	Explosion-Proof Temperature Sensor Unit	1 unit	Includes explosion-proof junction box and probe rod
2	Product Certificate of Conformity	1 copy	Includes a copy of the explosion-proof certification
3	Product User Manual	1 copy	Refers to this manual
4	Warranty Card	1 copy	Repairs are covered under warranty within the warranty period upon presentation of the warranty card
5	Accessory Kit (Optional)	1 set	Includes welded base, protective sleeve, fasteners, etc.

2 Safety Instructions

2.1 Explanation of Safety Warning Symbols

In this manual and on the product, the following safety warning symbols are used to alert operators to potential hazards:

Symbol	Name	Meaning	Precautions
	Warning	Hazardous situations that may result in serious personal injury or equipment damage	Strictly follow operating procedures; do not operate the equipment without authorization.
	Electric Shock Warning	Risk of electric shock	Ensure the power is turned off before operating, and take proper insulation precautions.
	High Temperature Warning	Surface temperatures may exceed safe limits	Wear heat-resistant gloves during operation, and wait for the equipment to cool down before handling it.
	Explosion Warning	Improper operation in explosive atmospheres may cause an explosion	Strictly adhere to explosion-proof operating procedures; never open the cover while the equipment is energized.
	Note	Important operating instructions or precautions	Read the instructions carefully and follow them as directed.

2.2 Explosion-Proof Safety Requirements

Explosion-proof safety is the most critical aspect of using this product. Please strictly adhere to the following requirements:
[Important Warning] The following matters concern personal safety; failure to comply may result in serious accidents:

1. Never open the cover while the power is on: In explosive atmospheres, never open the cover of the explosion-proof junction box while the power is on. You must first disconnect the power supply and confirm that the system is de-energized before opening the cover.

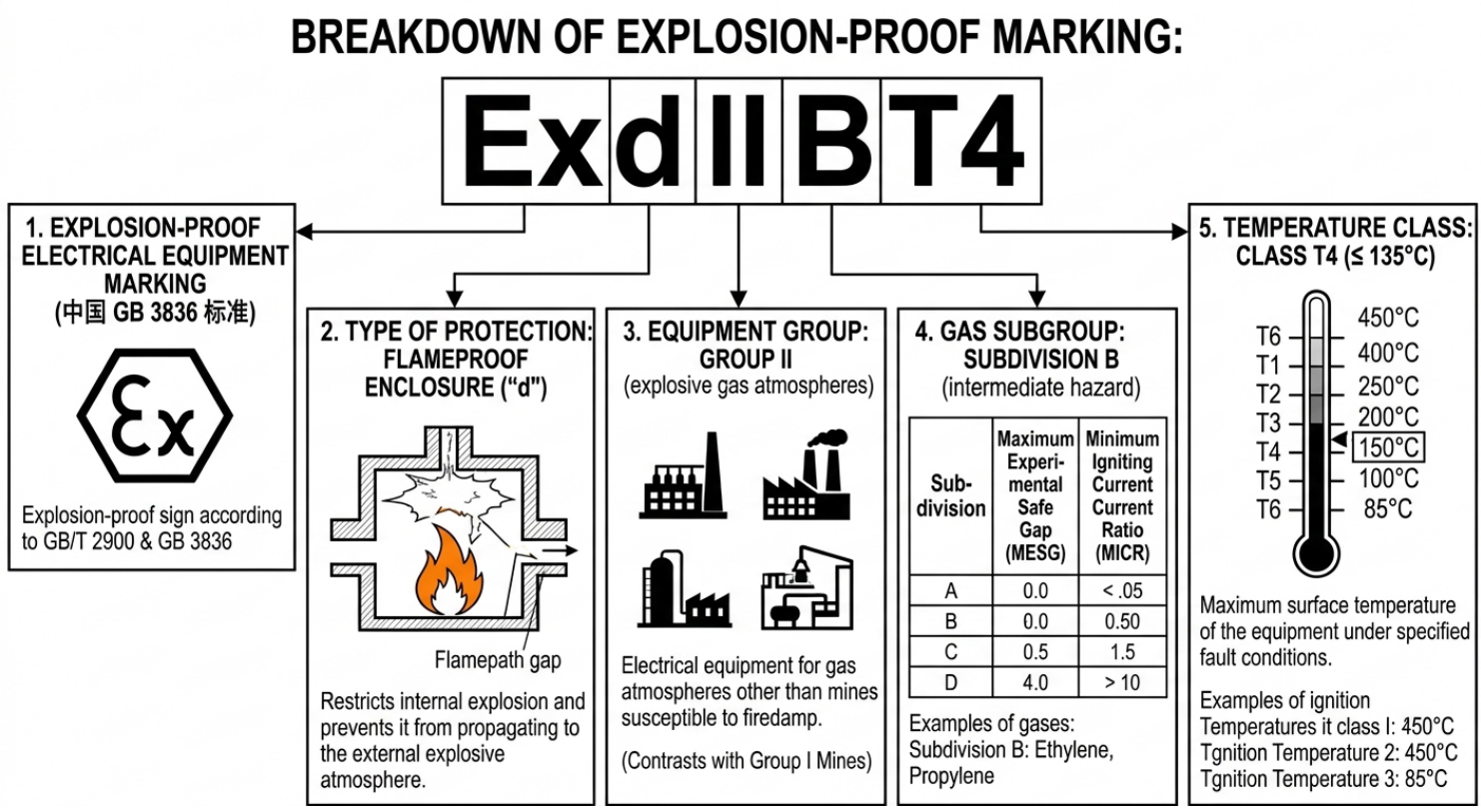
2.Verification of Explosion-Proof Certification: Before installation, you must verify the authenticity and validity of the product's explosion-proof certification and confirm that the explosion-proof marking (ExdIIBT4/dIICT5) matches the hazard zone classification of the site.

3.Grounding Requirements: The external grounding terminal of explosion-proof products must be reliably grounded, with a grounding resistance not exceeding 4 Ω. Poor grounding may result in the failure of explosion-proof performance.

4.Protection of Flameproof Joints: It is strictly prohibited to sand or paint flameproof joints. During routine maintenance, only a thin layer of anti-rust oil may be applied to keep the flameproof surfaces smooth, free of rust, and without dents or scratches.

5.Cable Entry: Explosion-proof cable glands must be tightly sealed; unused cable openings must be sealed with explosion-proof plugs to ensure the integrity of the explosion-proof joints.

6.Modifications Strictly Prohibited: Do not replace parts with non-original manufacturer components, non-certified cable glands, or plugs without authorization; otherwise, the explosion-proof certification will be revoked.



2.3 Safety Precautions for Installation

1. Before installation, ensure that the on-site power supply has been shut off and that a “Do Not Switch On” warning sign has been posted.
2. Installation personnel must possess the appropriate electrical work qualifications and be familiar with safety regulations for working in explosive atmospheres.
3. When installing in explosive gas atmospheres, use explosion-proof tools; the use of ordinary tools that may generate sparks is prohibited.
4. Take care to protect the flameproof surfaces during installation to avoid impacts or scratches.
5. For piping installations, it is recommended to install a shut-off valve upstream of the measurement point to facilitate maintenance and disassembly and to mitigate pressure surges.
6. For outdoor installations, install a rain cover and a sun shield to prevent rainwater from entering the junction box.
7.A U-shaped loop should be formed between the cable entry box and the transmitter, with the bottom of the U positioned below the transmitter to prevent liquid from flowing into the terminal box along the cable.

2.4 Safety Precautions for Use

1. Never exceed the maximum operating temperature specified for the product during use.
2. Do not perform any disassembly or maintenance operations on explosion-proof products in explosive atmospheres (such operations must be performed in a safe area after power has been disconnected).
3. When installing on high-temperature pipelines, it is recommended to install heat sinks or extension tubes to prevent the junction box from overheating.
4. Avoid subjecting the sensor to mechanical shock and severe vibration; install anti-vibration mounts if necessary.
5. In environments at risk of lightning strikes or overvoltage, install lightning and overvoltage protection devices between the distribution box or power supply and the transmitter.
6. Regularly inspect the integrity of the flameproof surface coating and sealing rings; if any abnormalities are found, immediately stop use and send the unit for repair.

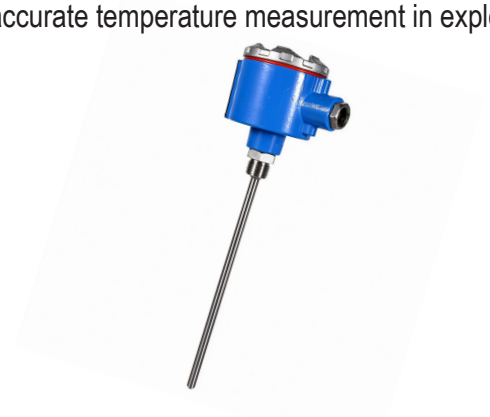
2.5 Safety Precautions for Maintenance

1. The power supply must be disconnected before maintenance; operation may only proceed after confirming that the junction box is de-energized.
2. When working in explosive atmospheres, maintenance personnel must wear antistatic work clothing and antistatic footwear.
3. Tools and materials used during maintenance must meet explosion-proof requirements.
4. After maintenance is complete, carefully check whether the gaps between the explosion-proof surfaces meet requirements; power may only be restored after confirming a proper seal.
5. Maintenance of explosion-proof equipment must be performed by professionally trained personnel, and maintenance records must be kept.
6. It is recommended to establish a regular maintenance schedule, checking for loose terminals and dust accumulation on sensors monthly, and calibrating the equipment once a year using a standard temperature source.

3 Product Structure

3.1 Product Components

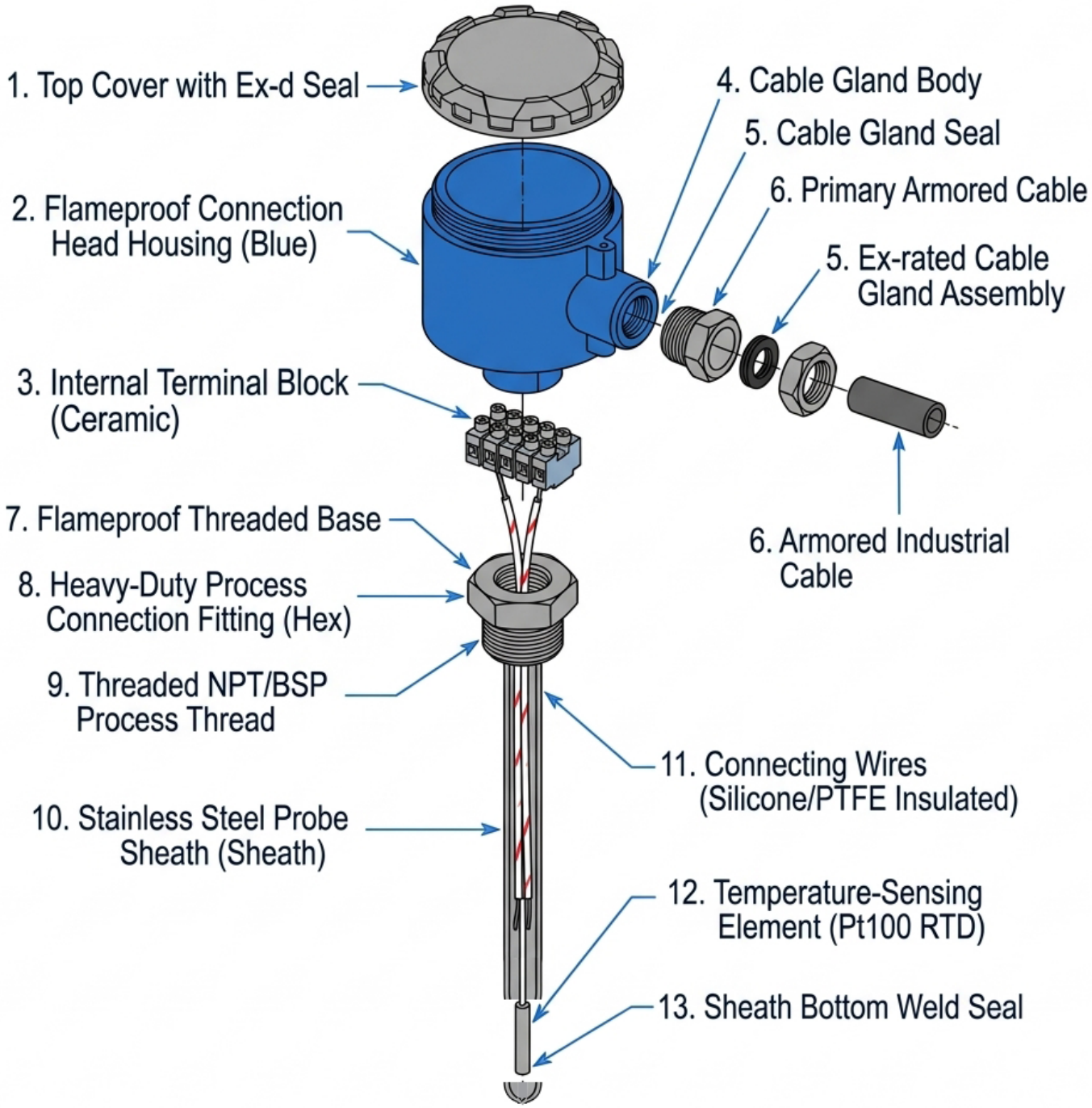
The explosion-proof temperature sensor consists of the following core components, which work together to ensure safe and accurate temperature measurement in explosive environments:





No.	Part Name	Functional Description
1	Explosion-proof junction box	Protects internal electrical components; features an explosion-proof design capable of withstanding internal explosion pressures and preventing the propagation of flames to the exterior.
2	Probe (protective tube)	Comes into direct contact with the measured medium; protects the internal temperature-sensing element; available in stainless steel grades such as 304, 316, 321, and 2520.
3	Threaded connector	Used for securely connecting the sensor to the mounting base or piping; common specifications include M20×1.5, M27×2, and G1/2.
4	Temperature-sensing element	Thermocouple wires or resistance temperature detectors (RTDs) directly sense temperature changes and convert them into electrical signals
5	Insulation material	High-temperature insulation materials (such as ceramic beads and magnesium oxide powder) ensure electrical insulation between the temperature-sensing element and the protection tube
6	Cable entry device	Explosion-proof cable glands ensure explosion-proof sealing at the cable entry point
7	Protective sleeve (optional)	Provides additional protection for the probe, extending the sensor's service life, and is suitable for harsh operating conditions

EXPLODED VIEW OF EXPLOSION-PROOF TEMPERATURE SENSOR



3.2 Product Configuration Types

This product is available in three configurations to accommodate different installation environments and measurement requirements:

Connection Types	Design Features	Applications	Installation Methods
Plug-in	The probe is inserted directly into the medium being measured, featuring a simple design and fast response time.	Direct insertion measurement in pipes; clean, non-corrosive media	Directly inserted into the pipe via threads or a flange
Cold-end	The cold-end design protects the transmitter inside the junction box, preventing high temperatures from damaging the internal circuitry.	High-temperature environments (recommended for temperatures above 400°C); products with transmitter output	Secured with threads, with the cold end positioned away from the heat source
Threaded	Installed via a threaded connection, it offers easy installation and excellent sealing performance.	Surface mounting on various pipes and equipment	Screwed into a pre-drilled threaded hole, using a sealing gasket

Selection Recommendations: - For products with transmitter output, we recommend selecting a cold-junction design, as the cold junction effectively protects the transmitter from high-temperature damage. - If the output is only a thermocouple or RTD signal (millivolt or resistance signal) and temperature requirements are not stringent, you may choose a through-hole or threaded type. - For high-temperature applications (exceeding 800°C), we strongly recommend using a cold-junction design.

3.3 Casing Types

The casing is an essential component for protecting the probe rod. Different types of casings can be selected based on operating conditions:

Casing Types	Rod Diameter Specifications	Features	Applications
Pagoda-shaped Welded Casing	Rod diameter: 16 mm	Pyramid-shaped structure with secure welds and a large heat dissipation area	High-temperature pipelines and applications requiring effective heat dissipation
Round Welded Casing	Rod diameter: 12 mm	Round cross-section for low fluid resistance	Small- to medium-diameter pipelines with high flow velocities
Internal &External Threaded Casing	Rod diameter: 16 mm	Male and female thread design for easy installation and removal	Applications requiring frequent maintenance and replacement
Hexagonal Welded Casing	Rod diameter: 16 mm	Hexagonal structure for high mechanical strength	Harsh operating conditions involving vibration or shock

Casing Specifications:

- Customizable casing threads: Standard M20×1.5, G1/2, M27×2; bore diameter 16 mm
- Casing length: The length specified in the order is the distance from the welding station to the end cap; unless otherwise specified by the customer, standard lengths will be shipped
- Customizable rod diameter: The rod diameters shown in the figure above are in-stock specifications; other rod diameters can be customized upon request

3.4 Differences Between Models with and Without a Cold End

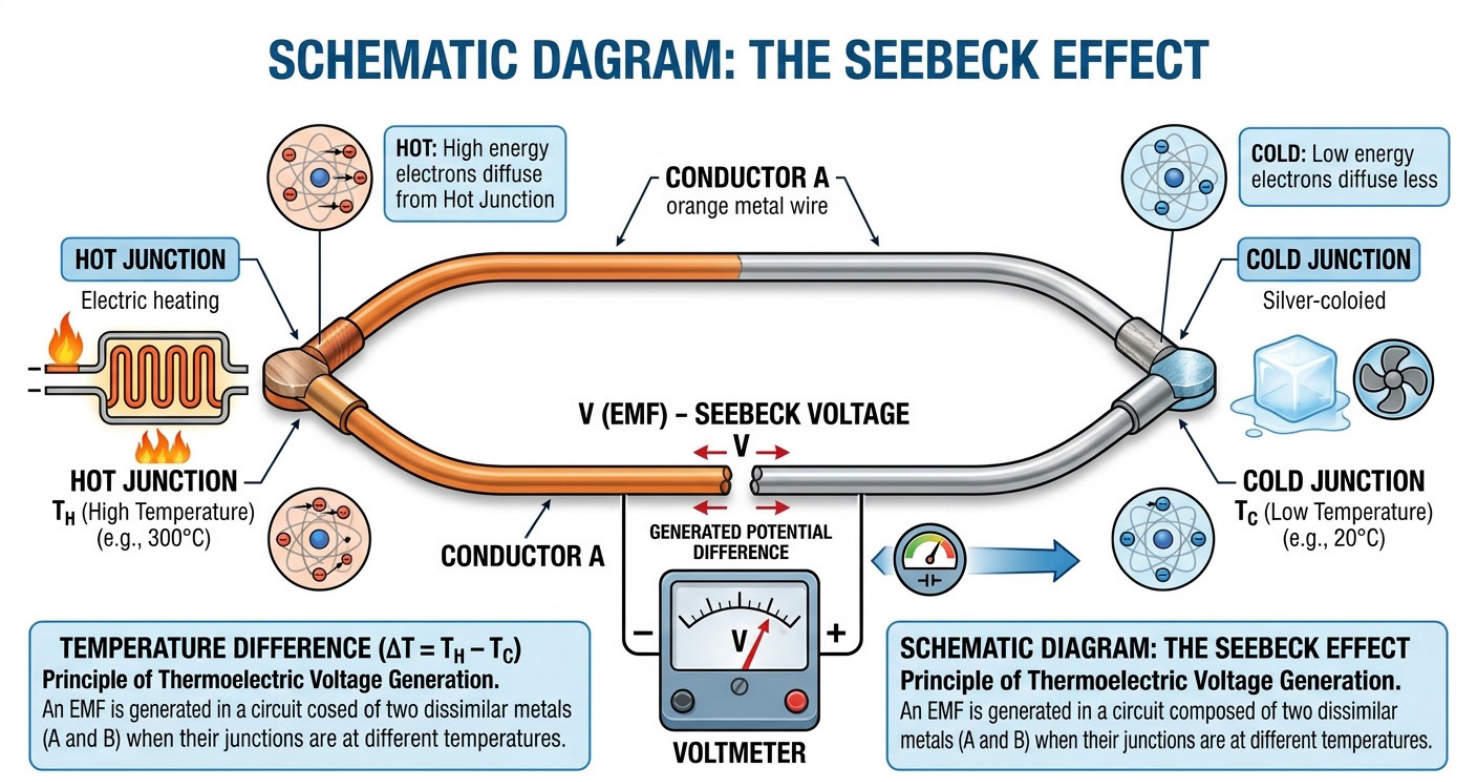
Comparison Items	Cold-End Design	No cold junction design
Structural Features	The probe features a cooling section (cold end) that lowers the temperature at the junction box location.	The probe connects directly to the junction box, with no cooling section
Protection Effectiveness	This effectively protects the transmitter inside the junction box and prevents high temperatures from damaging the internal circuitry.	In high-temperature environments, the junction box may reach high temperatures, which could affect the transmitter's service life
Operating Temperature	Suitable for high-temperature applications above 400°C.	Suitable for medium- and low-temperature applications below 400°C
Signal Type	Particularly suitable for products with transmitter output.	Suitable for pure thermocouple/RTD signal output
Response Speed	The cold-end section increases thermal resistance, resulting in a slightly slower response time.	Relatively fast response time
Price	Relatively high	Relatively economical

Selection Recommendations: For products with transmitter output, it is strongly recommended to choose a model with a cold-junction design; if the output is only a thermocouple or resistance signal and the operating temperature is not high, either a cold-junction or non-cold-junction design is acceptable.

4 Operating Principle and Technical Specifications

4.1 Overview of the Operating Principle

Explosion-proof temperature sensors operate based on the Seebeck effect. When two metal conductors of different compositions, A and B, are welded together at both ends to form a closed circuit, a thermoelectric potential is generated in the circuit if the two junctions are at different temperatures; the magnitude of this potential is proportional to the temperature difference between the two junctions. By measuring this thermoelectric potential, the actual temperature at the measuring end (hot junction) can be calculated.



4.2 Principle of Operation of a Thermocouple

A thermocouple is a temperature sensor formed by welding together two metal conductors of different compositions (known as thermoelements) at one end. Its principle of operation is as follows:

1. Place the welded end of the thermocouple (measuring end/hot junction) in the environment whose temperature is to be measured.
2. Maintain the other end at a known, constant temperature (reference end/cold junction, typically 0°C or room temperature compensation).
3. When there is a temperature difference between the hot junction and the cold junction, a thermoelectric potential (a weak voltage in the millivolt range) is generated within the circuit
4. The greater the temperature difference, the higher the output voltage; the actual temperature at the hot junction can be calculated by measuring this voltage

Accuracy specifications for thermocouples: - Below 400°C: According to national standards, the accuracy is ±1.4°C - Above 400°C: The accuracy is ±1.6°C - The accuracies listed above refer to the factory-specified accuracy of the thermocouple wire; in actual use, due to factors such as materials and manufacturing processes, the overall accuracy is approximately ±3°C - Conventional domestic Type K thermocouple wires have a measurement range of 0–1300°C, with limited measurement capability in the low-temperature range - Custom-made low-temperature thermocouple wires can reliably measure down to -40°C - For low-temperature measurements, it is recommended to use resistance temperature detectors (RTDs), which offer superior low-temperature performance

4.3 Working Principle of Resistance Temperature Detectors

A resistance temperature detector (RTD) is a sensor that measures temperature by utilizing the property that the resistance value of a conductor or semiconductor changes with temperature. Common RTD materials include platinum (Pt100) and copper (Cu50/Cu100).

Principle of Operation:

1. The resistance of a RTD varies linearly with temperature.
2. At 0°C, the resistance of a Pt100 is 100 Ω, with a temperature coefficient α of approximately 3.85×10^{-3}/°C.
3. By measuring the change in resistance, the corresponding temperature value can be calculated.
4. A three-wire or four-wire connection is recommended to eliminate the impact of lead resistance on measurement accuracy.

Advantages of RTDs over thermocouples: - Excellent low-temperature measurement performance, capable of measuring temperatures below -200°C - High measurement accuracy; Class A accuracy can reach ±(0.15 + 0.002|t|)°C - Stable output signal; no cold-junction compensation required - Suitable for precise temperature measurement in the medium- and low-temperature ranges

4.4 Key Technical Specifications

Key technical specifications for thermocouples:

Parameter Items	Technical Specifications
Product Name	Explosion-Proof Thermocouples/Resistance Temperature Detectors (Armored Temperature Sensors)
Structural Type	Plug-in / Cold-Junction / Threaded
Temperature Measurement Range (TC)	Type K: -40 to 1300°C; Type S: 0 to 1600°C; Type E: -40 to 800°C; Type J: -40 to 750°C; Type T: -40 to 350°C
Temperature Measurement Range (RTD)	Pt100: -200 to 500°C; Cu50: -50 to 100°C
Accuracy Class (TC)	Below 400°C: ±1.4°C (GB standard); Above 400°C: ±1.6°C (GB standard); Actual accuracy approximately ±3°C
Accuracy Class (RTD)	Class A: ±(0.15 + 0.002
Sheath Material	304/316/321/316L/2520 stainless steel (selected based on temperature)
Temperature Resistance	321/316: 800°C continuously, 1000°C intermittently; 2520/3039: 1200°C continuously
Probe Diameter	6 mm/8 mm/10 mm (standard), customizable up to 16 mm
Pressure Rating	6 mm: up to 1.6 MPa (static pressure); 8 mm: up to 2.5 MPa (static pressure)
Output Signal	Thermocouple millivolt signal / RTD signal / 4–20 mA transmitter signal (optional)
Insulation Resistance	≥100 MΩ (ambient temperature 20 ± 15°C, relative humidity ≤80%, test voltage 500 ± 50 V DC)
Protection Rating	IP65 (terminal box)

Material and Temperature Resistance Reference Table:

Material	Grade	Long-term Temperature Resistance	Short-term Temperature Resistance	Features
304 Stainless Steel	0Cr18Ni9	800°C	1000°C	General-purpose, excellent corrosion resistance, and high cost-effectiveness
321 Stainless Steel	0Cr18Ni9Ti	800°C	1000°C	Contains titanium, offering better high-temperature resistance than 304
316 Stainless Steel	0Cr17Ni12Mo2	800°C	1000°C	Contains molybdenum, offering better corrosion resistance than 304/321
2520 Stainless Steel	0Cr25Ni20	1200°C	1300°C	High-chromium-nickel alloy with excellent high-temperature resistance
3039 Stainless Steel	Special Alloys	1200°C	1300°C	High-performance alloy; higher price; currently out of stock

Note: The thicker the rod diameter, the higher its temperature resistance. Grades 304, 321, 310, and 316 can be used at 800°C for extended periods without issues and can also withstand short-term exposure to 1000°C. These common grades primarily differ in their corrosion resistance, which is determined by their elemental composition.

4.5 Explosion-Proof Ratings and Certifications

Project	Technical Specifications
Explosion-Proof Type	Flameproof Type (Ex d)
Explosion-Proof Marking	ExdIIBT4 / dIICT5
Explosion-Proof Certification	Certified and approved by the National Instrumentation and Metering Explosion-Proof Safety Supervision Station
Applicable Areas	Zone 1 and Zone 2 explosive hazardous locations containing explosive gas mixtures of Classes IIA and IIB, Groups T1–T4
Applicable Gases	Explosive mixtures such as hydrocarbon gases and vapors commonly found in the petroleum and petrochemical industries
Enclosure Protection Rating	IP65
Certification Standards	GB 3836.1-2000 “General Requirements for Explosion-Proof Electrical Equipment for Use in Explosive Atmospheres,” GB 3836.2-2000 “Explosion-Proof Electrical Equipment for Use in Explosive Atmospheres—Flameproof Type ‘d’”



CERTIFICATE OF CONFORMITY FOR EXPLOSION-PROOF EQUIPMENT

INTERNATIONAL EX CERTIFICATION SCHEME

CQST, China

CHINA NATIONAL QUALITY SUPERVISION AND TEST CENTER FOR EXPLOSION-PROOF ELECTRICAL PRODUCTS (CQST)

Certificate Number: CQST Ex23.1234X
Applicant/Manufacturer: GLOBAL INDUSTRIAL SYSTEMS LTD., 123 INDUSTRY ROAD, BEIJING, CHINA
Equipment: Flameproof and Dust Ignition Protected Motor, Type: GIM-100Ex
Explosion-proof Marking: Ex db IIC T4 Gb / Ex tb IIIC T135°C Db
Applicable Standards: IEC 60079-0, IEC 60079-1, IEC 60079-31, GB 3836.1, GB 3836.2, GB 3836.31
Issue Date: 2026-10-28 **Validity Date:** 2031-10-27

Equipment Rating	Power	Voltage	RPM	Conditiors of Use	Test report No.
Ex GIM-100Ex	1.8V	100.5V	180- mHz	Condinition aostredion, protected motor,	
Ex GIM-100Ex	2.8V	120+30N	250- mHz	Condintion aoxtiedion protected motor,	2026CQST-TR0987
Ex GIM-100Ex	2.8V	100+RPM	600- mHz	Condrition ar nuaalty protected motor	

The equipment ratings tt schedule annose the proofmation arta called explosion-proof equipment. The rating of use (wze conditttineed as test report insuad as anpernial date.

CQST OFFICIAL STICKT

AUTHORIZED SIGNATORY Dr. Chen Wei
Name: CHEN WEI
Title: DIRECTOR, CERTIFICATION DEPT.

CERTIFIED CQST APPROVED BY CQST

4.6 Applicable Standards

The design, manufacture, and inspection of this product comply with the following national and international standards:

Standard Number	Standard Title	Scope
IEC 60079	Electrical Equipment for Use in Explosive Atmospheres	General Requirements and Test Methods for Explosion-Proof Electrical Equipment
GB 3836.1-2000	Explosion-Proof Electrical Equipment for Use in Explosive Atmospheres—General Requirements	General Technical Requirements for Explosion-Proof Electrical Equipment
GB 3836.2-2000	Explosion-Proof Electrical Equipment for Use in Explosive Atmospheres—Flameproof Type “d”	Specific Requirements for Flameproof Electrical Equipment
IEC 584	International Standard for Thermocouples	Calibration Tables and Tolerances for Thermocouples
IEC 60751	International Standard for Industrial Platinum Resistance Temperature Sensors	Technical Specifications and Tolerances for Platinum Resistance Thermometers
GB/T 16839-1997	Thermocouple Calibration Tables	Standard for Thermocouple Calibration
JB/T 5518-1991	Technical Specifications for Industrial Platinum Resistance Temperature Sensors	Technical Requirements for Industrial Platinum Resistance Thermometers
JB/T 8622-1997	Compensation Cables for Industrial Thermocouples and Resistance Temperature Sensors	Technical Requirements for Compensation Cables
JB/T 8623-1997	Flexible Wires for Industrial Thermocouples and Resistance Temperature Sensors	Technical Requirements for Flexible Cables

5 Selection Guide

5.1 Selection Steps

Proper selection is key to ensuring the normal operation of explosion-proof temperature sensors. Please follow the steps below for selection:

Step 1: Determine the temperature range—confirm the maximum operating temperature at the site (be sure to distinguish between medium temperature and element temperature)—select a thermocouple or resistance temperature detector (RTD) based on the temperature range—for high temperatures (>500°C), prioritize thermocouples; For medium-to-low temperatures (<500°C) requiring high accuracy, select a resistance temperature detector (RTD)

Step 2: Determine the Installation Method - Determine the thread specification based on the pipe/equipment interface - Unless otherwise specified, we recommend shipping with a standard thread and a welded base - Since loose threads provide inferior sealing compared to fixed threads, prioritize fixed threads

Step 3: Determine Insertion Depth - For pipeline temperature measurement: insertion depth is typically 1/2 to 2/3 of the pipeline diameter - Ensure the sensing element is in full contact with the medium being measured - When measuring the temperature of the fluid at the center of the pipeline, the measuring end should be inserted into the center of the pipeline

Step 4: Determine Pressure Rating Requirements - Standard 6 mm products have a maximum pressure rating of 1.6 MPa (static pressure) - 8 mm products have a maximum pressure rating of 2.5 MPa (static pressure) - Larger pipe diameters are required for applications involving shock or vibration - Armored versions are available up to 10 mm; sizes exceeding this require a core-extraction design

Step 5: Determine the Output Signal - Confirm the signal type required by the customer (thermocouple millivolt signal / resistance temperature detector signal / 4–20 mA transmitter signal) - If the customer is unsure, check the internal terminal blocks: those with porcelain insulators typically indicate a thermocouple signal, while those with plastic housings indicate a transmitter function

Step 6: Determine the Material - Select the protection tube material based on the corrosiveness of the medium - Choose 304 stainless steel for standard corrosive environments - Choose 316L or Hastelloy for strong acid or alkali environments - Choose 2520 stainless steel for high-temperature environments

5.2 Selection Parameter Table

Selection Criteria	Parameter Options	Notes
Product Type	Thermocouple / RTD	Select based on temperature range and accuracy requirements
Model Number	K/E/J/T/S/N (TC); Pt100/Cu50 (RTD)	Select based on temperature measurement range and accuracy
Design Type	Plug-in / Cold-Junction / Threaded	Select based on installation environment and temperature
Sheath Material	304/316/321/2520	Select based on temperature and corrosiveness
Probe Diameter	6 mm/8 mm/10 mm	Select based on pressure rating and installation space
Thread Specifications	M20×1.5/M27×2/G1/2/G3/4	Select based on installation interface
Insertion Depth	Customizable to actual requirements	Typically 1/2 to 2/3 of the pipe diameter
Output Signal	TC Signal/RTD Signal/4–20 mA	Select based on control system requirements
Sheath Type	Pagoda-shaped/Round/Male/Female Threaded/Hexagonal	Select based on operating conditions
Explosion-Proof Rating	ExdIIBT4/dIICT5	Select based on hazardous area classification

5.3 Comparison Table of Common Models

Application Requirements	Recommended Types	Recommended Materials	Recommended Configurations	Notes
High-temperature measurement (< 800°C)	Type K	321SS	Cold-End Type	High cost-effectiveness, wide range of applications
Ultra-high-temperature measurement (1200°C)	Type S	2520SS	Cold-End Type	Highest temperature resistance, higher price
High-precision measurement at medium and low temperatures	Pt100	316SS	Threaded Type	High accuracy, good low-temperature performance
Measurement in corrosive environments	TC/RTD	316LSS	Cold-End Type + Sleeve	Resistant to acid and alkali corrosion
With remote signal output	Integrated Transmitter	304SS	Cold-End Type	4–20 mA output, strong interference resistance
Low-temperature measurement (<-40°C)	Pt100	316SS	Plug-In Type	Better low-temperature performance than thermocouples
High-pressure pipeline measurement	Type K	321SS	Threaded Type + Sleeve	High pressure resistance, fast response

6 Installation Guide

6.1 Preparations Before Installation

Before installing the explosion-proof temperature sensor, please complete the following preparations:

Tools Needed:

Tool Name	Applications	Notes
Adjustable Wrench	Tightening threaded connections	Use explosion-proof tools
Multimeter	Checking wiring and signals	Ensure the power is off before use
Insulation Resistance Tester	Testing insulation resistance	Verify insulation performance
Sealing Tape/Sealant	Thread sealing	Select sealing material based on the medium |
Pipe Wrench	Pipe installation	Select the appropriate size based on the pipe diameter

Pre-installation Inspection:

1. Verify that the product model and specifications match the order.
2. Check that the explosion-proof certification is valid.
3. Inspect the product's exterior for damage or deformation.
4. Check the flameproof surfaces for dents or scratches.
5. Check that the cable entry devices are intact.
6. Confirm that the temperature and pressure at the installation site are within the product's rated range.

6.2 Selection of Installation Location

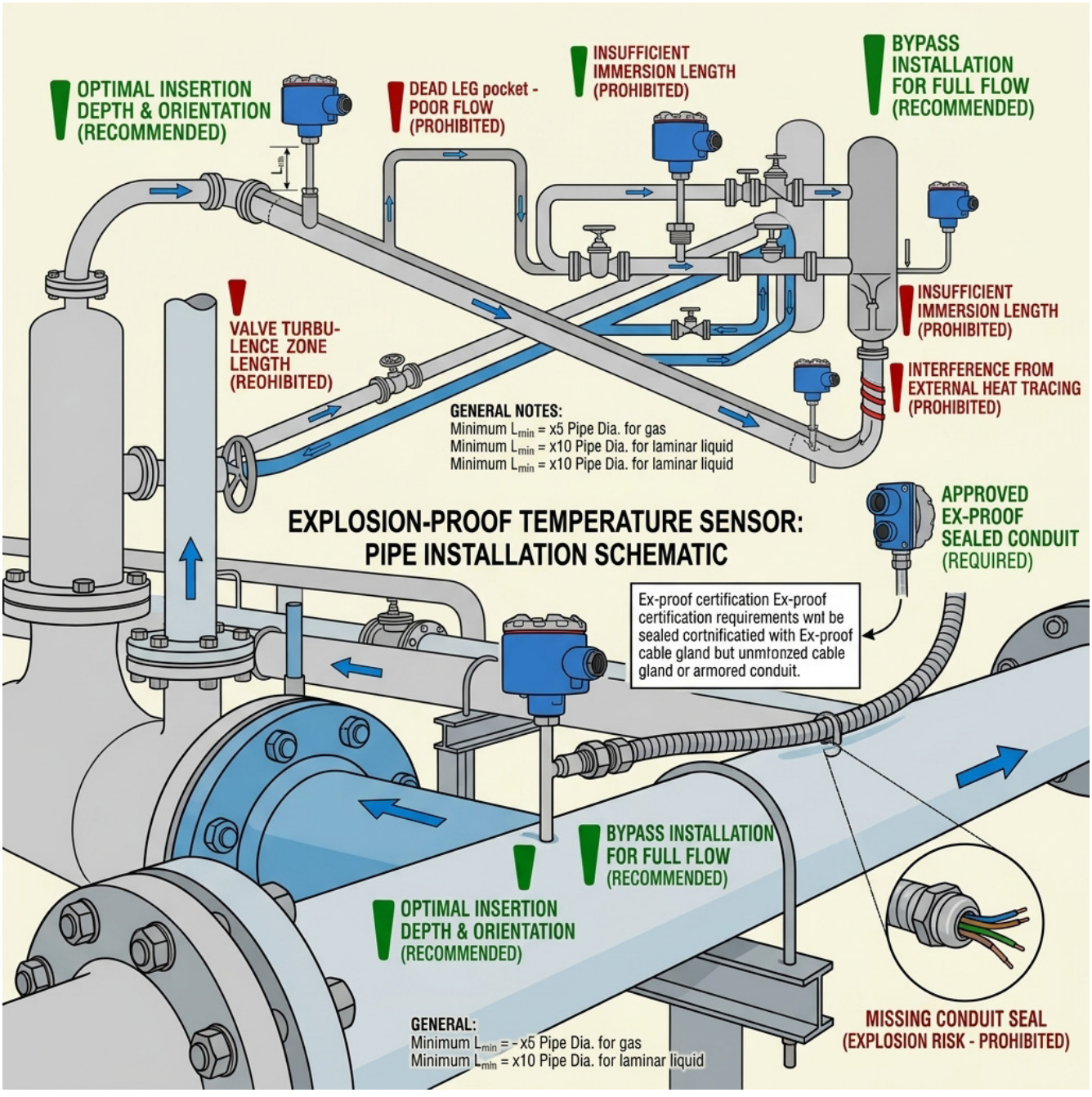
The correct installation location is critical to measurement accuracy and sensor life:

Principles for Selecting an Installation Location:

Principles	Specific Requirements	Reasoning
Avoid Sources of Interference	Avoid strong electromagnetic fields (motors, variable frequency drives), sources of vibration, and sources of high-temperature radiation.	Reduce measurement interference and sensor damage
Pipe Selection	Install in a straight section of pipe, avoiding areas of fluid turbulence such as elbows and valves.	Ensure fluid stability and measurement accuracy
Avoid Low Points	Do not install at the lowest point of a pipe or vessel.	Prevent liquid and dust buildup from affecting measurements
Outdoor Protection	For outdoor installation, install a rain cover and a sun shield.	Prevent rain and direct sunlight from affecting service life
High-Temperature Protection	When installing on high-temperature pipes, add heat sinks or extension tubes.	Prevent the junction box from overheating and damaging electronic components

Installation Direction Requirements:

1. Vertical installation is preferred: Vertical installation prevents the protective tube from bending or deforming under its own weight at high temperatures.
2. Facing the Flow: When measuring flowing liquids or gases, the sensing tip must face the direction of the medium flow (counter-current installation) to accurately reflect the temperature and avoid “dead-water zones.”
3. Cable Exit Hole of the Junction Box Facing Downward: This is the most critical installation detail! If the cable exit hole faces upward, rainwater or condensation may seep into the junction box along the cable, causing short circuits or reduced insulation.



6.3 Installation Procedure

Step 1: Select the Installation Location Select the optimal installation location based on the principles outlined in Section 6.2, and mark the installation point.

Step 2: Prepare the Mounting Interface - Machine a suitable threaded hole or weld a mounting base onto the pipe or equipment - Ensure the interface dimensions match the sensor's thread specifications - Ensure the threads are machined to a high standard to guarantee a tight seal

Step 3: Install the Sensor

1. Gently screw the sensor into the mounting interface.
2. Use a wrench to tighten the hex nut from the bottom of the equipment (do not turn the top of the equipment directly to prevent the connection cable from disconnecting).
3. Ensure the sensor is inserted to the required depth (1/2 to 2/3 of the pipe diameter).
4. Apply sealing material to the threaded connection as needed.

Step 4: Install the Protective Sleeve (if required) 1. Select the appropriate protective sleeve type based on operating conditions 2. Weld or secure the protective sleeve to the exterior of the probe 3. Ensure the protective sleeve is securely attached to the probe

Step 5: Wiring 1. Open the explosion-proof junction box cover (confirm power is off!) 2. Connect the signal wires according to the wiring diagram. 3. For thermocouples, ensure the positive and negative terminals are not reversed. 4. For RTDs, a three-wire or four-wire connection is recommended. 5. Tighten the terminal screws and apply waterproofing and moisture-proofing measures.

Step 6: Sealing and Inspection 1. Tighten the junction box cover to ensure a good seal at the explosion-proof interface. 2. Check that the cable gland is tightly secured and sealed. 3. Restore power and perform a power-on test.

6.4 Installation Orientation and Mounting

Installation Orientation Specifications:

Installation Methods	Applicable Scenarios	Precautions
Vertical Installation	Top Recommendation	Prevent the protective tube from bending or deforming due to high temperatures to ensure accurate temperature measurements.
Horizontal Installation	When Space Is Limited	The tube must be properly supported and secured to prevent internal circuit breaks caused by vibration.
Angled Installation	Specific Operating Conditions	Ensure that the temperature-sensing end is in full contact with the medium and is securely fastened.

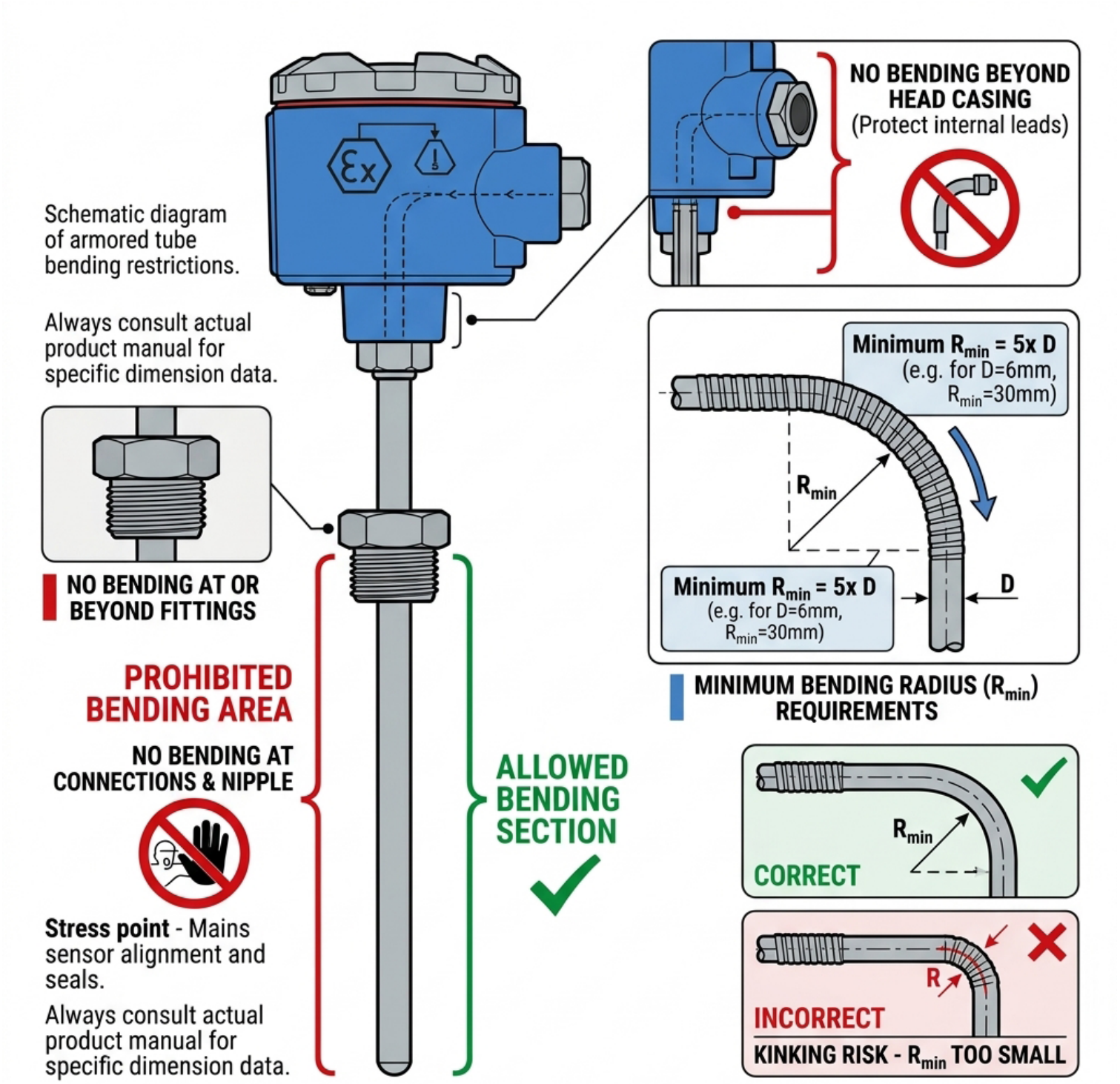
Installation Requirements:

1. In vibrating environments, use dedicated mounting brackets or vibration-damping measures to prevent loosening.
2. For piping installations, it is recommended to install a shut-off valve upstream of the measurement point to facilitate maintenance and disassembly and to mitigate pressure surges. 3. Where conditions permit, install a protective sleeve to allow for disassembly under pressure.
4. A U-shaped loop should be formed between the junction box and the transmitter, with the bottom of the U positioned below the transmitter to prevent liquid from flowing along the cable into the junction box.

6.5 Bending Restrictions

There are strict restrictions on bending armored cables; failure to comply may result in sensor damage:

Bending Specifications	Requirements	Notes
Bending in the Temperature Measurement Zone	Bending is strictly prohibited.	The front 30 mm of the armored tube is the core temperature-sensing area; bending may damage the internal insulation or cause wire breaks.
Minimum Bending Radius	Must be at least 5 times the outer diameter of the armored conduit.	For example, for an armored tube with an outer diameter of 6 mm, the bending radius must be at least 30 mm.
Number of Bends	Minimize bending as much as possible.	Repeated bending accelerates material fatigue and shortens the service life.



7 Wiring and Commissioning

7.1 Wiring Specifications

Proper wiring is essential for ensuring measurement accuracy and system safety. Please follow the specifications below strictly when wiring:

Thermocouple Wiring Specifications:

Project	Requirements	Notes
Cable Type	Must use the matching compensation leads.	The material of the compensation leads must match the thermocouple type.
Polarity	Do not reverse the positive (+) and negative (-) terminals.	Reversing the connection will result in an under-read or abnormal temperature display.
Terminal Block	Tighten securely.	Loose connections will cause changes in contact resistance, resulting in temperature fluctuations.
Shielding	Use shielded twisted-pair cable for the signal lines.	One end of the shield must be grounded in the control room, while the field end must remain floating.

Wiring Specifications for Resistance Temperature Detectors:

Project	Requirements	Notes
Wiring Method	A 3-wire or 4-wire system is recommended.	Minimize the impact of wire resistance on measurement accuracy
Wire Cross-Sectional Area	Cross-sectional area must be at least 1.0 mm².	Using wires that are too thin increases circuit resistance and affects accuracy
Wire Requirements	For a three-wire system, all three wires must be made of the same material and have the same cross-sectional area.	Ensure balanced circuit resistance
Terminals	Wires must be securely twisted together and properly protected against water and moisture.	Prevent poor contacts and short circuits

Transmitter Wiring Specifications (2-Wire 4–20 mA):

Terminal------Connection Instructions

+ (Red) Connect to the positive terminal of the 24 V power supply

- (Black) Connect to the signal output (AI+ returning to the PLC/DCS)

Loop Load Maximum load resistance RL = (Supply Voltage – 12) / 0.02; approximately 600 Ω at standard 24 V

Wiring Precautions:

1. Connecting to a high-voltage 220 V AC power source is strictly prohibited; only 24 V DC safety voltage may be used.
2. Long-term reverse connection of the positive and negative terminals will damage the transmitter module.
3. Terminal screws must be tightened securely, and the connections must be protected against water and moisture.
4. In areas with high electromagnetic or radio frequency interference, the sensor and the cable shielding must be properly grounded.
5. In environments at risk of lightning strikes or overvoltage, lightning and overvoltage protection devices must be installed.

7.2 Selecting Signal Cables

Signal Types	Recommended Cable Types	Shielding Requirements	Maximum Transmission Distance
TC millivolt signal	Compensation Cables (Matching Temperature Scale)	Must be shielded	≤100 m (transmitter recommended)
RTD signal	Three-wire Shielded Cables	Must be shielded	≤500 m
4–20 mA transmitter signal	Twisted-pair Shielded Cables	Shield must be grounded at one end	≤1000 m

Key Points for Cable Selection:

- Color coding for compensation wires: The positive terminal is typically red, and the negative terminal is typically blue or black (refer to the product manual for specifics)

- The shielding layer of shielded cables should be grounded at one end on the control room side and left floating on the field side to avoid ground loop interference - Signal cables should be routed away from power cables; if necessary, they should be protected by running them through metal conduits

7.3 Commissioning Procedures

Pre-commissioning Preparations:

1. Verify that the wiring is correct and the polarity is correct.
2. Verify that the supply voltage meets the standard requirements (24 VDC ±10%).
3. Verify that the sensor type and range settings match those of the DCS/PLC.
4. Prepare a standard temperature source (e.g., a temperature bath, standard thermocouple) for calibration.

Debugging Procedure:

Steps	Procedure	Acceptance Criteria
1	Check the wiring before powering on	Wiring must be secure, polarity must be correct, and there must be no short circuits.
2	Power on and allow the unit to warm up gradually	Do not subject the probe to sudden temperature changes.
3	Observe the output signal	The signal must be stable, with no fluctuations or spikes.
4	Compare with a standard temperature source	Measurement deviations must be within the allowable range.
5	Perform a full-range scan test	Deviations at each temperature point must be uniform, with no abrupt changes.
6	Record the calibration data	Complete the commissioning record form and file it for future reference.

7.4 Range Setting

Range setting for transmitters with HART functionality/buttons:

1.Verify before powering on: Ensure the sensor type (Pt100/thermocouple) and range (e.g., 0–100°C, 0–200°C) match the DCS range.

2. Zero calibration: Use a standard resistance box to simulate a standard resistance value for zero calibration.

3. Full-scale calibration: Perform full-scale calibration by applying a known temperature reference source

4. On-site calibration is recommended once a year, or when any of the following conditions apply:

- ◦After the sensor has been subjected to over-temperature conditions
- ◦ When measurement deviations exceed the permissible range
- ◦ As required by the periodic maintenance schedule

Calibration Precautions:

- The ambient temperature during calibration should be stable; avoid air turbulence
- The accuracy of the reference instrument should be at least three times higher than that of the instrument being calibrated
- After calibration, update the calibration record, noting the calibration date, the person who performed the calibration, and the calibration results

8 Use and Maintenance

8.1 Daily Operating Procedures

To ensure the long-term, stable operation of the explosion-proof temperature sensor, please follow these daily operating procedures:

Routine Operation Inspection Items:

Test Items	Inspection Items	Inspection Frequency	Normal Standards
Visual Inspection	Check the sensor for damage, deformation, or corrosion	Monthly	Appearance is intact, with no abnormalities
Wiring Inspection	Check the terminals for looseness or oxidation	Monthly	Wiring is secure, with no oxidation
Seal Inspection	Check the integrity of the explosion-proof surfaces and gland seals	Monthly	Explosion-proof surfaces are free of rust and well sealed
Signal Inspection	Check whether the output signal is stable	Weekly	Signal is stable, with no fluctuations
Temperature Comparison	Check for deviation from the actual temperature	Quarterly	Deviation is within the allowable range
Insulation Resistance	Check the insulation resistance between the electrodes and the outer sheath	Annually	≥100 MΩ

Operating Precautions:

1. Heat the probe slowly; do not subject it to sudden temperature changes to prevent sensor damage caused by thermal shock.
2. Do not strike or impact the explosion-proof housing to prevent damage to the flameproof surfaces.
3. Do not sand or paint the flameproof surfaces (only a thin layer of rust-preventive oil may be applied).
4. Periodically inspect the probe's protective tube for scale or material buildup, and clean it promptly to ensure measurement accuracy. 5. If significant measurement deviations, unstable signals, or other abnormalities are detected, immediately investigate and address the issue.

8.2 Regular Maintenance Schedule

It is recommended to establish the following regular maintenance procedures to ensure the long-term reliable operation of the sensor:

Monthly Maintenance:

No.	Maintenance Tasks	Maintenance Procedures	Standards
1	Exterior Cleaning	Wipe the sensor surface with a clean, soft cloth.	Free of dust and oil
2	Terminal Block Inspection	Check that the terminals are secure and tighten them if necessary.	Terminals are secure and free of looseness
3	Seal Inspection	Check that the gland and O-ring are intact.	No signs of aging or damage
4	Signal Stability Check	Check that the output signal is stable.	No jitter or fluctuations

Quarterly Maintenance:

No.	Maintenance Tasks	Maintenance Procedures	Specifications
1	Temperature Deviation Calibration	Compare with a standard thermometer	Deviation within acceptable limits
2	Flameproof Surface Inspection	Check the explosion-proof surfaces for rust or damage	Explosion-proof surfaces are smooth and undamaged
3	Cable Inspection	Check the cable sheath for damage	No damage or signs of aging
4	Grounding Inspection	Check the grounding resistance	≤4Ω

Annual Maintenance:

NO	Maintenance Items	Maintenance Procedures	Maintenance Procedures
1	Comprehensive Calibration	Perform full-range calibration using a standard temperature source	Perform full-range calibration using a standard temperature source
2	Insulation Resistance Test	Test with an insulation resistance tester	Test with an insulation resistance tester
3	Seal Integrity Test	Check the gap between the flameproof surfaces	Check the gap between the flameproof surfaces
4	Protective Tube Inspection	Inspect the protective tube for corrosion and wear	Inspect the protective tube for corrosion and wear
5	Replacement of Wear Parts	Replace aged seals, cables, etc.	Replace aged seals, cables, etc.

8.3 Maintenance Precautions

Maintenance for Long-Term Storage:

1. Thoroughly clean the sensor surface before taking it out of service.
2. Apply a thin layer of rust-preventive oil to the explosion-proof surfaces.
3. Store in a dry, well-ventilated environment free of corrosive gases.
4. Storage ambient temperature: -20°C to 60°C; relative humidity not exceeding 80%.
5. For products that have been out of service for more than one year, perform a comprehensive inspection and calibration before putting them back into service.

Storage Requirements:

Ambient Temperature: -20°C to 60°C
Relative Humidity: ≤80%, no condensation
Storage Environment: Dry, well-ventilated, free of corrosive gases
Stacking Method: Store vertically; avoid heavy pressure
Packaging: Original packaging or equivalent protective measures

9 Troubleshooting

9.1 Common Troubleshooting Checklist

Fault Symptoms	Possible Causes	Troubleshooting and Resolution Methods
No output signal; the PLC continuously displays 0	① 24V power supply is missing or voltage is too low; ② Broken wiring or reversed positive and negative terminals; ③ Transmitter module is burned out; ④ Open circuit in the probe's temperature-sensing element	Use a multimeter to measure the supply voltage; check for continuity in the circuit and reverse the polarity; measure the resistance of the temperature sensor—if an open circuit is detected, replace the sensor
Output remains at full scale (e.g., 20 mA) or triggers an out-of-range alarm	① Short circuit in the temperature-sensing element; ② Actual temperature exceeds the upper limit of the set range; ③ Incorrect range parameter settings	Turn off the power and test the insulation of the temperature sensor; verify the range setting; clean the probe in cases of overheating
Readings fluctuate erratically, vary widely, or are unstable	① Loose wiring or oxidized terminals; ② Incorrect shield grounding (multi-point grounding); ③ High-voltage interference from inverters, motors, etc.; ④ Water ingress or condensation inside the housing; ⑤ Probe vibration	Tighten the terminals; correct single-point grounding of the shield; route signal wires away from power cables; dry and replace seals; install anti-vibration mounts
Significant measurement deviation; inaccurate temperature readings	① Insufficient insertion depth; ② Scale buildup on the protective sleeve; ③ Mismatch between the set range and actual conditions; ④ Transmitter drift requiring calibration; ⑤ Aging of the temperature-sensing element	Increase insertion depth; clean the probe; verify the measurement range; perform zero and full-scale calibration; replace the temperature-sensing element
Very slow response to temperature changes	① Thick scale buildup or material buildup on the exterior of the probe; ② Protective sheath wall is too thick; ③ Extremely low medium flow velocity	Clean the probe; replace the thin-walled sleeve; adjust the installation position to an area with stable flow velocity
The meter does not light up, but the PLC signal is normal	The meter itself is damaged, but the transmitter module is functioning normally	Replace the local display unit separately
Temperature is displayed as a negative value or an abnormally low value	① Thermocouple polarity reversed; ② Compensation leads connected incorrectly; ③ Temperature-sensing element damaged	Check the wiring polarity; verify the compensation leads; replace the temperature-sensing element
Signal varies with ambient temperature	① Cold-junction compensation failure; ② Excessive temperature in the junction box; ③ Poor shielding	Check the cold-junction compensation circuit; improve heat dissipation conditions; check the shield grounding

9.2 Faults Related to Explosion Protection

Fault Symptoms	Risk Level	Corrective Actions
Impacts or scratches on the explosion-proof surfaces	High	Immediately take the product out of service, return it to the factory for repair, and strictly prohibit further use.
Aged or damaged seals	High	Immediately replace the seals; the product may only be put back into service after confirming that its explosion-proof performance has been restored.
Loose gland nuts; water ingress	High	Immediately disconnect the power supply, replace the cable glands and seals, and dry the interior.
Blurred or illegible explosion-proof markings	Medium	Re-label the explosion-proof marking and verify the product's compliance.
Poor grounding or broken ground connection	High	Immediately repair the ground connection and test the ground resistance to ensure it is ≤4Ω.
Damaged enclosure	High	Immediately take the product out of service and return it to the factory for replacement of the enclosure.

9.3 Troubleshooting Procedure

Standard Troubleshooting Procedure:

Fault Detection → Preliminary Assessment → Power Shutdown and Isolation → Fault Diagnosis → Repair → Functional Verification → Return to Service → Documentation and Archiving

Precautions for Troubleshooting:

1. Upon discovering a fault, first determine whether it involves explosion-proof safety issues; if so, immediately take the equipment out of service.
2. All maintenance work in explosion-proof areas must be preceded by power disconnection and the posting of warning tags; live-line work is strictly prohibited.
3. After the fault is resolved, functional verification must be performed; the equipment may only be returned to service after normal operation is confirmed.
4. All fault handling must be properly documented, including fault symptoms, cause analysis, corrective actions, the person responsible, and the date of resolution.
5. Faults involving the restoration of explosion-proof performance must be handled by qualified personnel and may only be put back into service after passing inspection.
6. It is recommended to maintain a fault log to analyze fault trends and proactively prevent similar faults from occurring.

9.4 List of Spare Parts

No.	Spare Part Name	Specifications and Models	Recommended Stock Levels	Notes
1	Explosion-proof junction box cover	Compatible Models	1 set/unit	Includes sealing gasket
2	Gland	Compatible Cable Diameter	2 per unit	Explosion-proof type
3	Sealing gasket	Compatible Models	2 per unit	High-temperature resistant type
4	Compensation lead	Matching Index Number	As needed	Observe positive and negative polarity
5	Protective sleeve	Select by Operating Conditions	1 per unit	Wear parts
6	Welded base	Select by Interface	1 per unit	Optional
7	Fasteners	M20/M27, etc.	As needed	Includes nuts and washers

9.5 Contact Information

Company Name: Anhui Qidian Automation Technology Co., Ltd.

Customer Service Hotline: +86 19715617532

Technical Support Hotline: +86 19715617532

Email: sales008@qd-zdk.com

Company Address: Building 14, Phase 2 of the University Science and Technology Park, No. 6 Fengxia Road, Fenghuangshan Economic Development Zone, Xiangshan District, Huaibei City, Anhui Province

Official Website: www.qidiansensor.com

After-Sales Service Free repair services are available within the warranty period upon presentation of the warranty card.