QDL80D Explosion-Proof Model 2088 Intelligent Digital Pressure Controller

I. Product Definition

1. Product Positioning

The Anhui Qidian QDL80D Explosion-Proof 2088 Smart Digital Pressure Controller is an integrated industrial measurement and control instrument** developed based on the 2088-type industrial explosion-proof housing, combining pressure measurement, digital display, switch control, analog transmission, and digital communication. It is a control-type model in the QDL80 series (The QDL80A is a pure transmitter model, while the QDL80D adds relay control output). It is specifically designed for flammable and explosive hazardous environments in industries such as petroleum, chemicals, natural gas, pharmaceuticals, and coal chemical processing, serving as an upgraded replacement for traditional mechanical pressure switches and pointer-type electric contact pressure gauges.

2. Core Functions

(1) Pressure Measurement Function

---Supports measurement of three pressure types: gauge pressure, absolute pressure, and seal pressure, with a range covering -0.1 MPa to 100 MPa**, capable of meeting all application requirements from vacuum to high-pressure pipelines;

--- Selectable overall accuracy of Class 0.2 or Class 0.5; zero-point temperature drift ≤ ±0.15% FS; long-term stability ≤ ±0.2% FS per year; wide temperature compensation range of -10°C to 70°C; operating temperature range of -40°C to 70°C;

--- The core sensing element consists of a 316L stainless steel isolation diaphragm paired with a diffused silicon or monocrystalline silicon piezoresistive chip, making it compatible with all gases and liquids that are compatible with stainless steel.

(2) Intelligent Control Functions

--- Features two built-in independent relay outputs (SPDT, single-pole double-throw), supporting four logic modes: upper limit alarm, lower limit alarm, window control, and hysteresis control. The engagement and release values can be freely set, and the hysteresis value is customizable to prevent frequent on/off cycling caused by pressure fluctuations;

--- Supports auxiliary control functions such as delayed action, reverse protection, and short-circuit protection; select models support peak value recording, zero-point reset, and unit conversion (MPa/bar/kPa/psi);

--- Response time ≤ 10 ms with low control execution latency, enabling rapid detection of sudden pressure changes and triggering of protective actions.

(3) Signal Output and Networking Capabilities

--- Standard 4–20 mA two-wire analog output, compatible with mainstream PLC and DCS systems; optional RS485-MODBUS RTU digital communication interface supports multi-device networking to build a distributed pressure monitoring network;

--- Power supply: 12–32 V DC (default 24 V DC); supports a wide voltage range, making it suitable for industrial field power supply environments.

(4) Explosion-Proof and Protection Features

--- Features an explosion-proof structure (Exd II CT6), has passed national-level explosion-proof certification, complies with the GB3836 series of standards, and can be used in Zone 1 and Zone 2 explosive gas environments; certain models can be customized with an intrinsically safe design (Exia II CT6);

--- Enclosure protection rating: IP65, dustproof and waterproof; The housing is die-cast from a low-copper aluminum alloy, providing corrosion and impact resistance; the sensor interface supports various industrial standard threads, including M20×1.5, G1/2, and NPT1/2.

(5) Human-Machine Interaction and Operation & Maintenance Features

--- Equipped with a high-definition LCD/LED display with backlighting, allowing on-site reading of real-time pressure values, setpoints, and status information;

--- Three-button on-site configuration allows for setting parameters such as range, control points, units, and filtering without opening the housing; supports password locking to prevent accidental operation;

--- Features 150% FS overload tolerance, 20g mechanical vibration tolerance, and 100g shock tolerance, making it suitable for harsh operating conditions.

II. Operating Principle

1. Overall Workflow

This product employs a fully digital operating architecture consisting of “pressure sensing—signal conversion—digital compensation—logic control—multi-terminal output.” The complete process is as follows:

1. **Pressure Sensing**: The pressure of the measured medium acts on a 316L stainless steel isolation diaphragm through the process interface; the pressure is then transmitted to the internal diffused silicon piezoresistive chip via a silicone oil filling; The chip’s resistance value changes linearly in response to pressure-induced deformation, converting the physical pressure quantity into a millivolt-level electrical signal.
2. **Signal Conditioning and Digitization**: After amplification and filtering, the front-end signal is converted into a digital signal by a high-precision A/D converter; the microprocessor performs temperature compensation and nonlinearity correction to eliminate the effects of temperature drift and zero-point drift on measurement accuracy.
3. **Control Logic Operations**: The microprocessor compares the real-time pressure value with the user-preset upper limit, lower limit, and hysteresis values, and outputs switching control signals according to the set control mode (upper limit / lower limit / window / hysteresis). It also supports logic functions such as delayed action and anti-bounce filtering.
4. **Signal Output and Display**: One output channel provides a relay switch signal to directly drive actuators such as contactors, solenoid valves, and audible/visual alarms; another channel outputs a standard 4–20 mA analog signal or an RS-485 digital signal for transmission to the control system. Additionally, the local display shows real-time pressure values, units, status, and other information.

2. Explosion-Proof Operating Principle

--- **Flameproof Explosion Protection**: The product housing features a high-strength aluminum alloy flameproof structure, with all electrical components enclosed within the flameproof chamber; if explosive gases ignite inside the chamber, the flameproof joints cool the flames and prevent the explosion from propagating to the exterior of the housing, thereby preventing the ignition of explosive media in the external environment.

--- **Circuit Safety Design**: The internal circuitry incorporates multiple protections against overvoltage, reverse connection, surges, and static electricity, and its EMC performance complies with the IEC 61000 series of standards; intrinsically safe products further limit the energy of the circuit to ensure that, under both normal operating and fault conditions, the generated electrical sparks and thermal effects are insufficient to ignite explosive gas mixtures.

III. Core Value and Customer Benefits

1. Core Value

--- **Safety and Compliance Value**: Meets mandatory explosion-proof requirements for flammable and explosive environments; replaces mechanical-contact pressure gauges that pose a spark risk; eliminates explosion hazards at the hardware level; complies with safety supervision and fire safety inspection standards; and avoids compliance risks.
--- **Integrated Measurement and Control Value**: Integrates pressure measurement, display, switch control, and transmitter output into a single device, replacing the multi-device combination of “pressure gauge + pressure switch + transmitter,” thereby reducing the number of installation points, wiring points, and potential failure points.
--- **High Precision and Reliability**: Measurement accuracy is 5 to 10 times higher than that of traditional mechanical pressure switches. It features minimal long-term drift and strong resistance to vibration, shock, and interference, significantly reducing the probability of false trips and missed alarms.
-- - **Operational Cost Savings**: Parameters can be configured directly on-site without the need to open the housing for calibration; calibration intervals are extended from six months to 1–2 years; the modular design facilitates maintenance, reducing costs associated with manual inspections, debugging, and replacement.
---**Digital Integration Benefits**: Supports standard industrial bus protocols and can be directly integrated into factory automation systems to enable remote monitoring, data acquisition, and anomaly alerts, meeting the needs of industrial digital transformation.

2. Typical Customer Issues Addressed

--- Addresses the issue of standard instruments not being explosion-proof in flammable and explosive environments, which poses safety hazards;
--- Addresses the issues of traditional mechanical pressure switches having low accuracy, significant hysteresis, frequent false trips, and short service life;
--- Addresses the lack of local display at the field site, difficulties in parameter tuning, and the need for repeated opening of the housing for calibration;
--- Addresses the high installation costs, complex wiring, and numerous potential failure points associated with installing multiple devices in combination;
--- Addresses the inability of legacy systems to support data transmission, remote monitoring, and centralized management;
--- Addresses the rapid instrument failure and poor stability caused by harsh operating conditions such as vibration, high temperatures, and corrosion.

IV. Key Challenges and Solutions

Q1: What are the risks of using standard pressure controllers or electric-contact pressure gauges in flammable and explosive workshops, such as those in the petroleum and chemical industries?

A1: Standard instruments lack explosion-proof certification. The opening and closing of mechanical contacts generate electrical sparks, which can easily trigger explosions if explosive gases or dust are present in the environment. Additionally, enclosures without explosion-proof structures cannot prevent internal explosions from propagating outward, posing a major safety hazard. Such instruments also fail to meet safety supervision and fire safety inspection requirements, exposing operations to the risk of production shutdowns and penalties.
Solution: The QDL80D explosion-proof model features a flameproof design and has obtained national-level explosion-proof certification (Exd II CT6). The electrical chamber is completely isolated from the external environment, and sparks generated by contact operation are confined within the flameproof chamber. It can be safely used in Zone 1 and Zone 2 explosive gas environments and fully meets compliance requirements. Anhui Qidian...

Q2: Traditional mechanical pressure switches have poor accuracy and frequently malfunction during pressure fluctuations. What can be done?

A2: Traditional mechanical pressure switches rely on mechanical structures such as springs and bellows for triggering. Their accuracy is typically only ±1.5% FS, and their hysteresis is non-adjustable. During pipeline pressure fluctuations or vibrations, they are highly prone to erroneous start-stop operations and false alarms, which can even lead to equipment failure.
Solution: The product utilizes diffused silicon digital sensing technology, achieving accuracy up to Class 0.2; it features a built-in digital filtering algorithm with customizable filter coefficients; and supports freely adjustable hysteresis values, allowing the pressure differential for engagement and release to be tailored to operating conditions. This dual-level approach—combining hardware and software—prevents frequent false operations caused by pressure fluctuations (Douyin Encyclopedia).

Q3: The site requires simultaneous local display, on/off control, and remote signal transmission. Does this necessitate installing multiple devices, resulting in high costs and complex wiring?

A3: Traditional solutions require the separate installation of pressure gauges, pressure switches, and pressure transmitters. Not only are procurement costs high, but they also require multiple mounting interfaces and sets of wiring, resulting in numerous potential failure points and difficult maintenance.
Solution: The QDL80D features an integrated measurement and control design. A single unit combines pressure measurement, digital display, two-channel relay control, 4–20 mA transmitter output, and optional RS485 communication. It replaces three separate devices, reducing installation, wiring, and maintenance costs while lowering the system failure rate.

Q4: When selecting explosion-proof instruments, if one only considers the measurement range and accuracy, why do they often fail acceptance testing or get damaged on-site?

A4: There are numerous misconceptions regarding the selection of explosion-proof instruments: the most common issues include products labeled only as “explosion-proof” without authoritative certification, explosion-proof ratings that do not match the on-site hazardous area, ignoring the corrosiveness of the medium, and neglecting installation specifications, all of which lead to failure of the explosion-proof protection.
Solution: When selecting instruments, confirm the following three points: ① The product must possess authoritative explosion-proof certifications such as CNEX, ATEX, or IECEx, and these certifications must cover the specific product model and explosion-proof rating; ② The explosion-proof rating must match the on-site hazardous area (Zone 0 requires intrinsically safe type; Zones 1 and 2 may use flameproof type), as well as the gas group and temperature class; ③ The diaphragm and housing materials must be compatible with the corrosiveness of the medium, ambient temperature and humidity, and vibration levels. The QDL80D provides complete explosion-proof certifications and supports customization of medium, thread, and explosion-proof type to suit various operating conditions.

Q5: What should be done if on-site temperature fluctuations are significant, causing severe pressure measurement drift and inaccurate data?

A5: Conventional pressure transducers are highly susceptible to temperature changes; their zero point and sensitivity vary with temperature. In industrial environments ranging from -40°C to 70°C, temperature drift can cause measurement errors exceeding 1% FS, failing to meet control accuracy requirements.
Solution: The product employs a laser resistance adjustment process and a digital temperature compensation algorithm to provide full-range temperature compensation within the -10°C to 70°C range. Zero-point temperature drift is ≤±0.15% FS, ensuring measurement accuracy in a wide temperature range and making it suitable for outdoor environments, high-temperature workshops, and low-temperature operating conditions.

Q6: The equipment is installed at heights or in hazardous areas. Does opening the cover for each calibration or parameter adjustment result in low efficiency and high risk?

A6: Traditional mechanical pressure switches require opening the cover to adjust the spring, resulting in short calibration cycles. Furthermore, opening the cover in explosion-proof zones compromises explosion-proof performance, posing safety risks. At the same time, working at heights or in hazardous areas involves high costs and significant risks.
Solution: The product supports on-site configuration via three buttons without opening the cover. All parameters—including range, control points, units, and filtering—can be set using the panel buttons and feature password protection. With long-term stability of ≤±0.2% FS per year, the calibration cycle can be extended to 1–2 years, significantly reducing the frequency of on-site operations and associated safety risks.

Q7: What should be done if the system experiences high pressure peaks and water hammer impacts, causing frequent instrument damage?

A7: Pump startup and valve opening/closing can generate instantaneous pressure peaks of 2–3 times the rated pressure. Standard instruments lack sufficient overload capacity; prolonged exposure to such impacts can lead to permanent diaphragm deformation and sensor damage, resulting in faults such as inaccurate pressure readings or loss of output.
Solution: The product features a 150% FS overload tolerance and can withstand shocks of up to 100g. Depending on operating conditions, dampers and buffer tubes can be selected as optional accessories. Additionally, by setting a reasonable range margin (normal operating pressure should be 30%–70% of the full scale) and utilizing software filtering, the system effectively resists water hammer and pressure surges, thereby extending equipment lifespan.

Q8: Can older PLC/DCS systems be directly connected to smart pressure controllers?

A8: Traditional control systems typically only support 4–20 mA analog inputs, leading some users to worry about compatibility issues with smart instruments; meanwhile, new systems require digital communication for networking.
Solution: The QDL80D comes standard with a 4–20 mA two-wire analog output, allowing direct connection to the analog input modules of all mainstream PLCs and DCS systems without the need to modify existing systems. It also offers an optional RS485-MODBUS RTU interface that supports digital networking, ensuring compatibility with legacy systems while accommodating future digital upgrade requirements.

Q9: Can improper installation of explosion-proof instruments lead to the failure of explosion protection?

A9: Yes. Installation errors—such as using non-certified cable glands, failing to apply the required torque to flameproof joints, opening the cover without authorization, or failing to ground the instrument as required—can all compromise the explosion-proof structure, invalidate the explosion-proof certification, and create safety hazards.
Solution: Installation must strictly follow the product manual: use cable glands matching the explosion-proof rating, tighten the flameproof joints to the specified torque, do not open the cover while the device is energized, and ensure reliable grounding. The QDL80D comes with comprehensive installation guidelines and technical support to ensure the effectiveness of on-site explosion protection.

Q10: How can common faults in explosion-proof pressure controllers be quickly troubleshot?

A10: Common faults and their corresponding solutions are as follows:
- No output signal: First, check if the power supply connections are loose; then, verify that the parameter settings are correct; finally, inspect the relay contacts or sensor for damage;
- Frequent false trips: Check if the hysteresis value is set too low or if there are pressure fluctuations or vibrations in the piping; you can increase the hysteresis value or install a dampener;
- Inaccurate pressure display: First, check for zero-point drift and perform a zero-point reset; then, check whether the sensor is clogged or the diaphragm is damaged, or perform pressure calibration;
- Explosion-proof malfunction: Check for damage to the explosion-proof surfaces, ensure the seals are intact, and verify that the cable glands are secure; do not modify the housing without authorization.

I. Basic Electrical Parameters

Parameter Category	Detailed Metrics	Description
Pressure Measurement	Pressure Type: Gauge Pressure, Absolute Pressure, Sealed Pressure Measuring Range: -0.1 MPa to 100 MPa (Full range customizable) Accuracy Class: Class 0.2 / Class 0.5 (selectable) Zero-Point Temperature Drift: ≤±0.15% FS (-10°C to 70°C) Sensitivity Temperature Drift: ≤±0.15% FS (-10°C to 70°C) Long-Term Stability: ≤±0.2% FS per year Sampling Frequency: 3 times per second; Damping time adjustable from 0 to 10 seconds	Diffused-silicon piezoresistive sensor chip, 316L isolation diaphragm, Full-range digital temperature Compensation and nonlinearity correction.
Relay Control Output	Number of Output Channels: 2 independent SPDT (Single-Pole Double-Throw) channels Contact Rating: DC 24V / 5A; AC 250V / 3A Switch Life: ≥1 million cycles Control Modes: Upper limit alarm, lower limit alarm, window control, hysteresis control Hysteresis Range: 0–100% FS (customizable) Delay Time: 0–60 s (configurable); supports reverse protection and short-circuit protection	Can directly drive contactors, solenoid valves, and audible and visual alarms without the need for intermediate relays
Analog Output	Output Type: 4–20 mA, 2-wire Load Capacity: Maximum 600 Ω at 24 VDC Output Accuracy: ±0.1% FS Output Ripple: ≤10 mV	Compatible with all major PLC and DCS analog input modules
Digital Communication (Optional)	Interface Type: RS485 Communication Protocol: MODBUS RTU Baud Rate: 1200–115,200 bps (default: 9,600) Address Range: 1–247 (configurable)	Supports multi-device networking, remote parameter configuration, and data acquisition
Display and Operation	Display Type: LCD/LED high-definition digital display with green backlight Display Range: -1999 to 9999 Display Units: MPa / bar / kPa / psi (switchable) Operation: Three-button on-site configuration; supports password lock Display Resolution: Minimum 1 Pa (adaptive based on range)	All parameter settings can be completed without opening the enclosure
Response Characteristics	Step response: ≤10 ms (rise to 90% FS) Control response: ≤15 ms (from pressure trigger to relay activation)	Can quickly detect sudden pressure changes, meeting the requirements of protection applications

2. General Parameter Ranges for Similar Products on the Market

--- Measurement Range: -0.1 MPa to 160 MPa; some low-pressure models cover 0 to 100 Pa, while high-pressure models can reach up to 250 MPa;
--- Accuracy Class: Mainstream models are Class 0.2 or Class 0.5; high-end products can reach Class 0.1;
--- Relay Output: 1–2 SPDT channels; some models support 3 output channels, with contact ratings up to AC 250 V/15 A;
--- Analog Output: In addition to 4–20 mA, optional voltage outputs include 0–10 V, 0–5 V, and 1–5 V;
--- Communication Protocols: In addition to MODBUS RTU, some high-end models support HART, PROFIBUS DP, and EtherNet/IP.

II. Insulation Performance Parameters

Parameter Category	Detailed Metrics	Description
Isolation Architecture	Input (Sensor) – Output (Signal / Relay) – Power Supply: Three-terminal electrical isolation	Prevents ground loops and common-mode interference, protecting downstream systems
Insulation Resistance	≥100 MΩ (250 V DC, between any two of the following: input, output, power supply, and enclosure)	Tested under normal temperature and humidity conditions
Dielectric Strength	1500 V AC / 1 min, no breakdown, no arcing Test points: Input – Output, Input – Enclosure, Output – Enclosure, Power Supply – Enclosure	Complies with industrial instrument withstand voltage standards
Immunity to Interference	Common-Mode Rejection Ratio: ≥120 dB (50/60 Hz) Differential-Mode Rejection Ratio: ≥60 dB (50/60 Hz) Electrostatic Discharge Immunity: ±8 kV contact, ±15 kV air (IEC 61000-4-2, Level 3) Electrical Fast Transient Burst: ±2 kV (power/signal ports, IEC 61000-4-4, Level 3) Surge Immunity: ±2 kV common-mode, ±1 kV differential-mode (power ports, IEC 61000-4-5, Level 3) Radio-frequency radiated immunity: 10 V/m (80 MHz–2 GHz, IEC 61000-4-3, Level 3)	Operates reliably in environments with strong electromagnetic interference; CE-EMC certified
Circuit Protection	Power ports: Reverse polarity protection, overvoltage protection (36 V), overcurrent protection, surge protection Signal ports: Short-circuit protection, overcurrent protection Relay output: Inrush protection, contact arc suppression	Protects instruments from damage in the event of incorrect wiring, surges, or short circuits

2. General Parameter Ranges for Similar Products Across the Market

--- Isolation Method: Most models feature three-terminal isolation, while some low-cost models use two-wire non-isolated configurations;
--- Insulation Strength: Mainstream models typically support 1500 V AC for 1 minute; intrinsically safe products support 500 V AC for 1 minute;
--- EMC Rating: Industrial-grade products generally meet Level 3, while some mining-grade and military-grade products can reach Level 4.

III. Power Supply & Power Consumption Specifications

Parameter Category	Detailed Metrics	Description
Supply Voltage	Standard Power Supply: DC 12V to 32V, typical value 24V DC Intrinsically Safe Power Supply: DC 15V to 28V (Power must be supplied via an explosion-proof safety barrier) Custom Option: AC 220V Power Supply (requires built-in power supply module)	Wide-voltage design, suitable for fluctuating power supply conditions in industrial environments
Power Consumption Specifications	Standby Power Consumption: ≤1.2W (digital display lit, relays not activated) Full-Load Power Consumption: ≤3W (digital display + both relays energized simultaneously) Pure Transmitter Power Consumption: ≤1.5W (no display, no relays)	Low-power design, suitable for loop-powered and solar-powered applications
Output Circuit Characteristics	4–20 mA two-wire loop: Maximum load resistance = (Supply voltage – 12 V) / 0.02 A Under standard 24 VDC power supply, maximum load resistance is 600 Ω	Cable voltage drop must be accounted for during long-distance transmission
Power Distribution & Redundancy	No additional power output; relays are powered by the internal power supply Withstands reverse polarity connection without damage; normal operation resumes once correct wiring is restored	No separate power supply is required for the relay, simplifying wiring

2. General Parameter Ranges for Similar Products Across the Market

--- Supply Voltage: DC 10.5V to 42V (two-wire loop-powered), AC 85V to 265V (mains-powered);
--- Power Consumption Range: Pure transmitter models ≤1W, digital display control models ≤5W;
--- Some models support redundant dual power supplies and UPS backup power interfaces.

IV. Environmental Adaptation Parameters

Parameter Category	Detailed Metrics	Description
Temperature Range	Operating ambient temperature: -40°C to +70°C (display module operating temperature: -10°C to +60°C) Process medium temperature: -40°C to +85°C (high-temperature models can be customized up to 150°C; a heat sink is required) Storage temperature: -40°C to +100°C	Wide-temperature design, suitable for low temperatures in the north, high temperatures in the south, and outdoor operating conditions
Humidity Range	Operating humidity: 5% to 95% RH, non-condensing Storage humidity: 5% to 95% RH	No condensation issues in high-humidity environments
Protection Rating	Enclosure protection rating: IP65 (dust-tight, protected against water jets) Process interface protection rating: IP67	Suitable for outdoor, open-air, dusty, and water-exposed environments
Explosion-Proof Certification	Flameproof Type (Standard): Explosion-proof marking Ex d Ⅱ C T6 Gb Compliance Standards: GB 3836.1-2010, GB 3836.2-2010 Applicable Areas: Explosive gas environments Zone 1 and Zone 2; Class IIA, IIB, and IIC gases; Temperature groups T1–T6 Intrinsically Safe Type (Optional): Explosion-proof marking: Ex ia IIC T6 Ga Standards: GB 3836.1-2021, GB 3836.4-2021 Applicable Areas: Zone 0, Zone 1, and Zone 2 explosive gas atmospheres	Holds a national-level explosion-proof certification and meets safety supervision and fire safety inspection requirements
Safety Barrier Compatibility	Intrinsically safe devices must be used in conjunction with isolated explosion-proof safety barriers. Safety barrier requirements: Explosion-proof rating not lower than Ex ia IIC T6; circuit parameters (Ui, Ii, Pi, Ci, Li) must match those of the instrument. Recommended types: Input/output isolated safety barriers; Zener-type safety barriers must be reliably grounded.	Overall certification for intrinsically safe circuits requires parameter matching between “equipment + safety barrier + cable”
Mechanical Environment	Vibration Resistance: 20 g (20 Hz–5000 Hz, IEC 60068-2-6) Shock Resistance: 100 g (11 ms half-sine wave, IEC 60068-2-27) Overload Pressure: 150% FS (standard), 300% FS (customizable)	Suitable for high-vibration and water hammer impact conditions, such as those found in pump units, compressors, and pipelines
Media Compatibility	Standard Compatibility: Gases, liquids, and oils compatible with 316L stainless steel Corrosive Media: Customizable tantalum diaphragms, Hastelloy C-276, Monel alloy diaphragms, and fluorocarbon rubber seals	Compatible with corrosive media such as weak acids, weak alkalis, and organic solvents

2. General Parameter Ranges for Similar Products Across the Market

--- Operating Temperature: -40°C to 85°C is the standard range; high-temperature models can reach 120°C to 200°C, while low-temperature models can go as low as -55°C;
-- - Explosion-proof rating: Mainly Exd II CT6; some products are Exd II BT4/T5; intrinsically safe models are mostly Exia II CT4/T6;
--- Protection rating: Mainly IP65; some models with stainless steel housings can reach IP66/IP67;
--- Overload capacity: Standard 150% FS; high-pressure models can reach 2–5 times FS.

V. Physical Parameters

Parameter Category	Detailed Metrics	Description
Installation Methods	Standard: Direct pipe thread mounting (vertical or horizontal) Optional: Flange mounting, clamp mounting, wall bracket mounting, pipe clamp mounting	Preferably install vertically to avoid uneven stress on the diaphragm
Dimensions	Housing diameter: φ97 mm Total housing height (excluding process connection): approx. 140 mm Total height (including standard M20×1.5 male thread): approx. 165 mm Wiring Ports: 2 M20×1.5 explosion-proof cable glands (arranged symmetrically left and right) Display Window Diameter: Approx. 60 mm Explosion-Proof Joint Width: ≥12.5 mm, compliant with GB 3836.2 requirements	2088 General-Purpose Industrial Explosion-Proof Enclosure; mounting dimensions are fully interchangeable with leading brands
Weight	Aluminum Alloy Housing (Standard): Approx. 1.0 kg Stainless Steel Housing (Optional): Approx. 1.8 kg	Does not include mounting hardware or cables
Housing and Materials	Housing Material: Low-copper die-cast aluminum alloy, surface anodized + electrostatic powder coating Explosion-proof Surfaces: Precision-machined and rust-proofed; scratches and impacts are strictly prohibited Process Connection Material: 304/316 stainless steel Separating Diaphragm: Standard 316L stainless steel; optional tantalum or Hastelloy C-276 Filling fluid: Standard methyl silicone oil; optional fluorinated oil, food-grade silicone oil Seals: Standard nitrile rubber; optional fluorocarbon rubber, PTFE	Low-copper aluminum alloy meets explosion-proof enclosure requirements; corrosion-resistant and impact-resistant
Process Connections	Standard connection: M20×1.5 male thread Optional Connections: G1/2, NPT 1/2, G1/4, NPT 1/4, DN25 flange, clamp connection	Customizable with various non-standard threads and flanges
Electrical Connections	Standard: 2 M20×1.5 explosion-proof cable glands, compatible with φ8–φ12 mm cables Optional: M25×1.5 cable glands, explosion-proof flexible hose connections	One inlet and one outlet for convenient wiring

2. Dimensions and Markings

The Model 2088 explosion-proof enclosure features a standard industry design and consists of three main parts:
1. **Upper Wiring Compartment**: Contains internal terminal blocks and a circuit board; cable glands are located on both sides, and the top is sealed with an explosion-proof end cap;
2. **Middle Display Chamber**: The front features an LCD/LED display window and control buttons; the interior houses the display board and buttons;
3. **Lower Sensor Chamber**: Contains the pressure sensor element; the bottom features a process connection thread.

3. General Specifications for Similar Products Across the Market
--- Housing Dimensions: The mainstream model is the φ97mm standard 2088 housing; some compact models are φ80mm, while larger models can reach φ120mm;
--- Weight: 0.8–2.0 kg, with slight variations depending on material, measurement range, and accessories;
--- Process Connection: M20×1.5, G1/2, and NPT1/2 are industry-standard specifications compatible with the vast majority of field piping systems.

Scenario-Based Selection Guide

I. Core Selection Criteria
When selecting a device, check the following criteria in order. Any mismatch in any item may result in the device being unusable, safety failures, or system compatibility issues; therefore, each item must be verified individually:

1. **Signal Type**
--- If only local on/off control is required and no remote transmission is needed: Prioritize models with pure relay outputs, such as the Anhui Qidian QDL80D Basic Edition. Its two SPDT relays directly drive actuators, offering the lowest cost and simplest wiring.
--- If integration with a PLC/DCS system for data acquisition is required: Select the model with standard 4–20 mA two-wire analog output, which is compatible with all mainstream industrial control systems and is the top choice for retrofitting existing installations.
--- Requires multi-device networking, remote parameter configuration, and digital data acquisition: Choose the RS485-MODBUS RTU digital communication model, which supports parallel networking of multiple instruments and is suitable for smart manufacturing and unmanned operations.
--- High-end digital applications: Customizable industrial bus protocols such as HART, PROFIBUS DP, and EtherNet/IP are available to integrate with high-end DCS systems and digital factory architectures.

2. **Number of Channels and Control Logic Dimensions**

--- Single-point alarm/control: A single relay output is sufficient; suitable for simple overpressure alarms and low-pressure start/stop scenarios.

--- Upper and Lower Limit Dual Control, Window Control, Dual-Loop Interlocking: Select the model with 2 independent relay outputs (standard configuration of Anhui Qidian QDL80D). Upper limits, lower limits, and hysteresis values can be set separately to implement logic such as high-pressure pump shutdown, low-pressure pump startup, and window pressure stabilization.

--- Complex multi-loop control: Customizable 3–4-channel relay output is available, supporting multiple sets of independent control logic and suitable for multi-device interlocks and multi-level alarm scenarios.

--- Differential pressure control scenarios: Select a differential pressure controller to accommodate special measurement requirements such as filter differential pressure, furnace chamber differential pressure, and liquid level differential pressure.

3. **Power Supply Options**

--- Standard DC Power Supply for Industrial Sites: Select a model with a wide DC 12–32 V voltage range (typically 24 V DC), compatible with the vast majority of industrial control cabinets and safety barrier circuits; this is the preferred choice for explosion-proof environments.

--- Sites without DC power: Customize models with a wide-range AC 85–265 V mains power supply. These feature a built-in power module and can be directly connected to 220 V mains power on-site, eliminating the need for an additional power converter.

--- Intrinsically Safe Applications: Power must be supplied via an isolated safety barrier; the supply voltage range must match the safety barrier's output parameters. Direct connection to mains power or standard DC power sources is strictly prohibited.

--- Wireless Mobile / Field Applications: Battery-powered models are available; their low-power design provides a battery life of 1–3 years, making them suitable for inspection rounds, temporary monitoring, and field pipeline applications.

4. **Explosion-Proof Requirements**

--- Zone 1 and Zone 2 explosive gas environments (conventional hazardous scenarios such as chemical, oil and gas, and natural gas): Select the flameproof type Ex d IC T6 Gb, corresponding to the Anhui Qidian QDL80D standard explosion-proof model, which covers Class □A, □B, and □C gases and meets the requirements of the vast majority of chemical and petrochemical scenarios.

--- Zone 0 (extremely hazardous areas, such as the interiors of storage tanks or pipelines where explosive gases are continuously present): The intrinsically safe type Ex ia IC T6 Ga must be selected and must be paired with a isolating safety barrier with matching parameters to form a complete intrinsically safe circuit.

--- Explosive dust environments: Select the dust-proof explosion-proof model ExtD A21 IP65 T80°C, suitable for areas with dust explosion hazards such as flour, coal dust, and metal dust.

--- Non-explosion-proof general industrial applications: Standard enclosure models may be selected to reduce procurement costs; however, their use in hazardous areas is strictly prohibited.

--- Key Selection Criteria: You must request a national-level explosion-proof certification to confirm that the model, explosion-proof rating, gas group, and temperature class listed on the certificate fully match the on-site operating conditions. Do not rely solely on the term "explosion-proof" as the basis for selection.

5. **Installation Environment and Medium Considerations**

--- Conventional water, gas, and oil media: Select standard 316L stainless steel isolation diaphragms + 304 stainless steel process connections, which meet the requirements of the vast majority of industrial applications.

--- Strong acids, strong alkalis, and highly corrosive media: Customize tantalum diaphragms, Hastelloy C-276 diaphragms, or Monel alloy diaphragms, paired with fluorocarbon rubber seals, to prevent corrosion and damage to the diaphragms.

--- High-temperature media (above 85°C): Select high-temperature sensors and install heat sinks; the maximum media temperature can be customized to 150°C–200°C. Do not use standard models directly in high-temperature steam or high-temperature oil applications.

--- Severe vibration and water hammer impact scenarios: Select high-overload models (150% FS or higher), install dampers and buffer tubes, and ensure a measurement range with at least a 2x margin to prevent sensor damage from pressure surges.

-- - Outdoor, open-air, water-exposed, or high-dust environments: Ensure the protection rating is no lower than IP65; select models with lightning and surge protection; install a rain cover if necessary.

-- - Food, pharmaceutical, and sanitary-grade environments: Select models with clamp-on quick-connect fittings, sanitary-grade diaphragms, and a design free of sanitary dead zones to meet CIP/SIP cleaning requirements; do not use standard threaded connections.

II. Recommended Selection for Industry Applications

1. **Chemical Industry (Petrochemicals, Coal Chemicals, Fine Chemicals)**

Typical operating conditions include pressure monitoring of reaction vessels, pressure control of storage tanks, pressure interlocks for pipelines, and pressure alarms for flammable and explosive media. The site is subject to explosive gases, corrosive media, and strong electromagnetic interference, requiring the highest safety standards.

Selection Recommendation: Prioritize the Anhui Qidian QDL80D explosion-proof model (Ex d II C T6), which comes standard with 4–20 mA analog output and two relay control channels, with Class 0.5 accuracy. For highly corrosive media, customize with Hastelloy or tantalum diaphragms; for high-temperature media, install heat sinks; Optionally equip critical interlock points with RS485 communication to integrate with DCS systems for remote monitoring and interlock protection; For Zone 0 applications, select intrinsically safe models paired with isolation safety barriers to ensure the entire explosion-proof circuit complies with regulations.

2. **Power Industry (Thermal Power, Hydropower, New Energy, Power Distribution)**

Typical operating conditions include monitoring boiler drum pressure, feedwater pipeline pressure, hydraulic system pressure, and gas pipeline pressure. The field environment involves high temperatures, severe vibration, and strong electromagnetic interference, requiring long-term stable operation and fast response times.

Selection Recommendations: Choose the 2088 explosion-proof pressure controller with a Class 0.2 accuracy rating and a response time of ≤10 ms. It comes standard with a 4–20 mA output and two relays, and is compatible with PLC/DCS systems; For high-temperature steam applications, select high-temperature sensors with a measurement range that includes a margin of at least 2 times the full scale to withstand water hammer impacts; for environments with strong electromagnetic interference, prioritize three-terminal isolated models with an insulation strength of no less than 1500 V AC and an EMC rating of Class 3 or higher; for outdoor substation applications, select models with IP65 protection and lightning surge protection.

3. **Metallurgical Industry (Steel, Non-ferrous Metals, Metallurgical Furnaces and Kilns)**
Typical operating conditions include monitoring the pressure of hydraulic systems, rolling mills, furnace and kiln gas, and circulating water. On-site environments feature high temperatures, high dust levels, intense vibration, and heavily oil-contaminated media, placing high demands on equipment durability.

Selection Recommendations: Choose explosion-proof pressure controllers with flameproof design; aluminum alloy die-cast housings provide impact resistance, while 316L diaphragms resist oil contamination, with an overload capacity of no less than 150% FS; install dampers at locations subject to severe vibration, and set appropriate filtering coefficients and hysteresis values to prevent false triggering; in coal gas and combustible gas areas, strictly comply with the Ex d II C T6 explosion-proof rating; For routine monitoring, select Class 0.5 accuracy; for critical control points, select Class 0.2 accuracy; prioritize wide-temperature and wide-pressure designs to accommodate harsh on-site power supply and temperature conditions.

4. **Pharmaceutical Industry (Active Pharmaceutical Ingredients, Formulations, Biopharmaceuticals)**
Typical operating conditions include reactor pressure, purified water system pressure, aseptic transfer line pressure, and cleanroom pressure differential control. These applications require sanitary-grade construction, no dead corners, and easy cleaning; some explosion-hazard areas must also meet explosion-proof requirements.

Selection Recommendations: For cleanrooms and material transfer lines, select sanitary-grade models with clamp connections and 316L polished diaphragms to meet CIP/SIP cleaning requirements; For areas handling organic solvents or flammable and explosive materials, select explosion-proof models with flameproof enclosures, ensuring the explosion-proof rating matches the on-site hazardous zone; for differential pressure control applications, use differential pressure controllers with Class 0.2 accuracy to ensure stable pressure differentials in cleanrooms; for system integration, use 4–20 mA analog signals or MODBUS digital communication to meet the pharmaceutical industry's automation and data traceability requirements.

5. **Smart Manufacturing and Discrete Manufacturing Industries (Automotive, Machinery, Electronics, New Energy)**
Typical applications include pressure control for hydraulic stations, pneumatic systems, cooling systems, and air compressors. These applications require high responsiveness and reliability, support for networking and data acquisition, and compatibility with Industrial Internet upgrades.

Selection Recommendations: For standard non-explosion-proof workshops, standard-enclosure digital pressure controllers may be selected; for hazardous areas such as explosion-proof spray booths and lithium-ion battery production facilities, flameproof models should be used. Prioritize models with RS485-MODBUS communication to integrate with MES/PLC systems for centralized monitoring and data acquisition. For hydraulic control applications requiring rapid response, select models with a response time of ≤10 ms. For multi-point scenarios, adopt a unified networking solution to reduce wiring and O&M costs; for routine monitoring, select Class 0.5 accuracy; for precision control points, select Class 0.2 accuracy.

6. **Municipal and Public Utilities (Gas, Water Supply, Heating, Wastewater Treatment)**
Typical operating conditions include gas pipeline pressure monitoring, water supply network pressure control, heating pipeline network pressure regulation, and wastewater treatment aeration pressure. Since these sites are mostly outdoor and open-air environments, low power consumption, high stability, and strong remote transmission capabilities are required.

Selection Recommendations: For gas and flammable/explosive media applications, strictly select explosion-proof models with an IP65 protection rating; For outdoor applications, select models with lightning and surge protection, and a wide-temperature design suitable for environments ranging from -40°C to 70°C; for unattended sites, select models with RS485 communication to connect to a SCADA system for remote monitoring; for remote locations with limited power access, choose battery-powered models; for pipeline network pressure control, select models with dual relay outputs to enable stable pressure control and overpressure alarms.

III. Common Mistakes in Selection
The following are the most common errors made when selecting explosion-proof pressure controllers. Each of these can lead to safety incidents, failure to pass acceptance inspections, equipment damage, or system failure, and must be carefully avoided.

1. **Misconception 1: Ignoring Isolation Levels and Focusing Only on Measurement Accuracy**
Manifestation of the error: During selection, users focus only on accuracy and measurement range without verifying the isolation method, insulation strength, or EMC rating, resulting in the selection of non-isolated or two-wire non-isolated models.

Risks and Consequences: In industrial environments with ground loops, common-mode interference, or surge voltages, this can cause measurement data to drift or fluctuate. In severe cases, it can burn out sensors and downstream PLC/DCS modules, or even trigger system shutdowns. In explosion-proof applications, non-isolated circuits may also compromise explosion-proof safety performance, posing an explosion risk.

Correct Approach: Prioritize models with three-terminal electrical isolation (input, output, and power supply), with an insulation strength of no less than 1500 V AC/1 min and an EMC rating of Level 3 or higher. In fields with strong interference or poor grounding, isolated models must be used; in intrinsically safe applications, isolated safety barriers must be used, and the use of Zener-type safety barriers as substitutes is strictly prohibited.

2. **Misconception 2: Incorrect Signal Range Selection—Insufficient or Excessive Margin**
Manifestation of the error: The range is set exactly equal to the maximum operating pressure at the site, leaving no margin for overload; or the range is set too

wide, with the operating pressure accounting for only 10% or less of the range, resulting in reduced measurement accuracy.

Risks and Consequences: Instantaneous pressure peaks caused by water hammer, pump startup, or valve opening/closing can reach 2 to 3 times the rated pressure. Insufficient range margin will directly result in permanent deformation or damage to the sensor diaphragm, leading to faults such as inaccurate pressure readings or no output; conversely, an excessively large range will result in insufficient resolution and excessive error at low pressures, failing to meet control accuracy requirements.

Correct Practice: Under steady-state conditions, the normal operating pressure should be between 30% and 70% of the measurement range, with an overload margin of no less than 150% FS; under pulsating, water hammer, or shock conditions, the normal operating pressure should not exceed 50% of the measurement range, with an overload margin of no less than 200% FS, and a damper or buffer tube should be installed; For negative pressure and low-pressure applications, select the corresponding dedicated range; never substitute a high-range model for a low-range one.

3. **Misconception 3: Neglecting Load Matching, Leading to Relay and Output Circuit Overload**
Manifestation of the error: Directly using the pressure controller's relay to drive high-power motors, solenoid valves, or contactors without verifying contact capacity; failing to calculate load resistance in 4–20 mA circuits, resulting in excessive voltage drop over long transmission distances.

Risks and Consequences: Overloading relay contacts can cause them to stick or burn out, leading to control failure, malfunctions, or even equipment accidents; when the load in a 4–20 mA loop exceeds the maximum value, signal output becomes inaccurate or fails to reach full scale, resulting in system data distortion.

Correct Procedure: When a relay directly drives a load, ensure that the load voltage and current do not exceed the contact rating (Anhui Qidian QDL80D: DC 24 V/5 A, AC 250 V/3 A); High-power loads must be connected via an intermediate relay; direct driving is prohibited. The formula for calculating the maximum load resistance in a 4–20 mA two-wire circuit is: (Supply Voltage – 12 V) / 0.02 A. With a 24 V supply, the maximum is 600 Ω. For long-distance transmission, cable voltage drop must be accounted for; if necessary, increase the supply voltage or use a four-wire output.

4. **Misconception 4: Incorrect Selection of General-Purpose Models in Explosion-Proof Environments; Non-Compliant Explosion-Proof Certification and Installation**
Manifestations of the error: Using ordinary, non-explosion-proof pressure controllers in potentially explosive atmospheres; or purchasing explosion-proof instruments but using standard cable glands during installation, opening the enclosure without authorization, damaging the flameproof surfaces, or failing to ground the equipment as required—all of which compromise the explosion-proof structure.

Risks and Consequences: Standard instruments lack explosion-proof construction; sparks from contacts or circuit failures can directly ignite explosive gases, causing explosions. Non-compliant installation invalidates explosion-proof certification, resulting in failure to pass safety and fire inspection approvals, and exposing operations to the risk of production shutdowns and penalties, while also posing significant safety hazards.

Correct Procedure: In hazardous areas, products with authoritative explosion-proof certification must be selected, and it must be confirmed that the explosion-proof rating, gas group, and temperature class fully match the site conditions. During installation, cable glands corresponding to the explosion-proof rating must be used, and the flameproof joints must be tightened to the specified torque. Opening the cover while the device is energized is prohibited, as is unauthorized modification of the housing or replacement of components; Intrinsically safe equipment must be paired with safety isolators that have matching parameters to form a complete intrinsically safe circuit; cable parameters and ground resistance must comply with regulations.

IV. Customization Recommendations

For scenarios where standardized products cannot meet requirements—such as special signals, non-standard operating conditions, and multi-channel integration—both Anhui Qidian and industry-standard 2088-enclosure explosion-proof pressure controllers support flexible customization. The key customization options are as follows:

1. **Customization for Special Signals and Protocols**
--- Analog Output Customization: In addition to the standard 4–20 mA, voltage/current outputs such as 0–10 V, 0–5 V, 1–5 V, and 0–20 mA can be customized to match the input requirements of special control systems.
--- Digital Communication Customization: In addition to the standard RS485-MODBUS RTU, industrial bus protocols such as HART, PROFIBUS DP, EtherNet/IP, and CANopen can be customized to adapt to DCS and PLC systems from different manufacturers.
--- Custom Special Functions: Special functions such as peak value recording, self-diagnostic fault detection, power-off protection, multi-group logic control, delayed operation, and reverse protection can be customized to meet personalized control requirements.

2. **Customization for Non-Standard Operating Conditions**
--- Measurement Range Customization: Supports full-range customization from -0.1 MPa to 100 MPa; low-pressure ranges down to 100 Pa; high-pressure ranges up to 160 MPa–250 MPa; special measurement ranges, negative pressure ranges, seal pressure, and absolute pressure can also be customized.
--- Customization of Media and Materials: Diaphragms can be customized in tantalum, Hastelloy C-276, Monel, and PTFE; seals can be customized in fluorocarbon rubber, perfluoroether rubber, and PTFE; housings can be customized in 304/316 stainless steel to suit special environments such as highly corrosive, marine, and food-grade applications.
--- Temperature Customization: Low-temperature models (-55°C) and high-temperature models (150°C–200°C) are available to accommodate extreme cold, high-temperature steam, high-temperature oils, and other special temperature conditions.
--- Connection Method Customization: Process connections can be customized with various non-standard threads, flanges, clamps, quick-connect fittings, and sanitary-grade interfaces; Electrical interfaces can be customized to specifications such as M25 and NPT 1/2 to accommodate various on-site wiring requirements.
--- Protection and Explosion-Proof Customization: Customizable IP66/IP67 high protection ratings, as well as dust-proof, mining-grade, marine-grade, and other specialized explosion-proof and protection ratings to suit specific industry applications.

3. **Multi-Channel and System Integration Customization**

--- Multi-Channel Integration Customization: Customizable multi-channel pressure controllers allow a single device to simultaneously monitor multiple pressure points and output independent control signals for each, reducing installation points and wiring costs. Ideal for centralized control scenarios with multiple measurement points.

--- Complete System Customization: Can be integrated with explosion-proof distribution boxes, safety barriers, audible and visual alarms, solenoid valves, intermediate relays, and more, providing a “sensor - Control - Actuation - Display” turnkey solutions, with wiring and debugging completed before shipment for direct on-site installation and use.

--- Digital Networking Customization: We provide multi-device networking solutions that, when combined with gateways and cloud platforms, enable remote monitoring, data storage, anomaly alerts, historical trend curves, and other functions, meeting the digital upgrade needs of the Industrial Internet, unmanned operations, and smart factories.

Installation and Commissioning Specifications

I. Pre-Installation Preparation

1. Verification of Components and Certifications

--- Equipment Body Verification: Verify that the product model, measurement range, accuracy, explosion-proof rating, and output configuration are fully consistent with the purchase contract and design drawings; inspect the housing for cracks, deformation, or dents; check the flameproof joints for scratches, corrosion, or foreign matter; and inspect the sealing O-rings for signs of aging or damage.

--- Verification of Accessories: Standard accessories include 2 explosion-proof cable glands, sealing gaskets, the product certificate of conformity, the explosion-proof certification, and the user manual; optional accessories include mounting brackets, flanges, dampers, safety barriers, and specialized tools. Verify the quantity and specifications of each item individually.

--- Certification Verification: A copy of the national-level explosion-proof certification must be retained. Confirm that the certificate is valid and that the product model, explosion-proof marking, gas group, and temperature class covered by the certificate fully match the on-site hazardous area; for intrinsically safe types, also verify that the explosion-proof certificate and parameters of the safety barrier match.

--- Medium and Operating Conditions Verification: Confirm that the medium being measured is compatible with the materials of the sensor diaphragm and seals; confirm that the maximum operating pressure, maximum temperature, and vibration level at the site fall within the equipment’s rated parameters.

2. Installation Environment Inspection

--- Installation Location Selection: Prioritize locations with minimal vibration, stable temperatures, easy observation and operation, and free from corrosive gases and strong electromagnetic interference; keep a distance of ≥300 mm from heat sources, strong vibration sources, high-power motors, and variable frequency drives, as well as power cables; For outdoor installation, install a rain shield to prevent direct sunlight and water exposure.

--- Pressure Tap Location: When measuring gaseous media, position the pressure tap at the top or upper side of the pipe to prevent blockage by liquid accumulation; when measuring liquid media, position the pressure tap on the side of the pipe to avoid blockage by trapped gas or sediment; when measuring steam, position the pressure tap on the side of the pipe and install a condensation ring.

--- Environmental Conditions: The on-site ambient temperature must be within the range of -40°C to 70°C, with humidity ≤95% RH and no condensation; in potentially explosive atmospheres, verify that the zone classification (Zone 0 / Zone 1 / Zone 2), gas group, temperature group, and the device’s explosion-proof rating are compatible.

--- Installation Conditions: Before installation, verify that the pipeline has been purged, is depressurized, and has no medium leaks; the electrical circuit has been de-energized, and the site meets safe installation conditions; for installation in explosion-hazard zones, hot work and power-off work permits must be obtained.

3. Tool List

--- Mechanical Installation Tools: Open-end wrenches / torque wrenches of corresponding sizes (for gripping the sensor’s hexagonal section), PTFE tape / PTFE sealing tape, pipe thread sealant, level, torque wrench (for tightening bolts on explosion-proof surfaces).

--- Electrical Wiring Tools: Phillips / flathead screwdrivers, wire strippers, crimping pliers, multimeter (voltage / current / resistance / continuity modes), megohmmeter, voltage tester, electrical tape, color-coded tubing.

--- Commissioning tools: Standard pressure source (piston-type pressure gauge / digital pressure calibrator), handheld programmer (model with communication capabilities), ammeter, signal generator, ground resistance tester.

--- Safety protection equipment: Work in explosion-proof areas requires explosion-proof tools, anti-static clothing, safety helmets, and safety goggles; it is strictly prohibited to bring non-explosion-proof electronic devices into hazardous areas.

4. Safety Precautions

--- All installation, wiring, commissioning, and maintenance work must be performed with the power **disconnected and pressure relieved**. Opening covers while energized or disassembling/assembling under pressure is strictly prohibited. Live-line work is strictly prohibited in explosive hazardous areas, and opening covers for commissioning in hazardous areas is strictly prohibited.

--- The flameproof joints of flameproof instruments are the core of the explosion-proof design; scratching, bumping, or rusting of these surfaces is strictly prohibited. Before installation, remove any debris from the flameproof surfaces and apply a thin layer of anti-rust grease; fasten bolts evenly to the specified torque; omitting or under-installing bolts is prohibited.

--- Intrinsically safe instruments must be used in conjunction with certified isolating safety barriers; direct connection to a standard power source is strictly prohibited. The cables, safety barriers, and instrument parameters of the intrinsically safe circuit must be fully compatible; arbitrary substitution is strictly prohibited.

-- - During installation, do not twist the instrument head by hand; do not strike or bump the sensor diaphragm; and do not poke or press the pressure-taking holes with sharp objects to prevent permanent deformation or damage to the diaphragm.

--- The “power off, test for voltage, discharge, tag, and lockout” procedure must be strictly followed at the construction site; work may only begin after confirming that the power is off. Work in high-voltage or hazardous areas must be supervised by a designated person.

II. Standard Installation Procedures

1. Mechanical Installation

1. Clean the pipe pressure tapping port and the instrument threads. Evenly wrap PTFE tape around the instrument's external threads or apply sealant, taking care to ensure that the PTFE tape does not enter the pressure-taking hole.
2. Use a wrench to grip the hexagonal flat surface of the sensor and screw the instrument into the pipe fitting until it is tight; never turn the instrument housing or dial directly to prevent relative rotation between the sensor and the housing, which could damage the internal leads.
3. When installing on a female threaded connection, the pipe fitting must not be screwed into the sensor's internal thread more than 12 mm deep to avoid damaging the diaphragm.
4. Low-pressure instruments with a range ≤100 kPa must be installed vertically to ensure even force distribution on the diaphragm; instruments with other ranges may be installed vertically or horizontally, though vertical installation is preferred.
5. In applications with severe vibration or water hammer, install a damper, buffer pipe, or buffer tank upstream of the gauge; at locations with strong pulsations—such as pump outlets or downstream of valves—it is recommended to install a micro-hose to achieve mechanical decoupling.
6. For flange or clamp installations, replace the process connection fittings accordingly to ensure the sealing surfaces are flat and undamaged, bolts are tightened evenly, and there are no leaks.
7. After installation is complete, slowly open the pressure-taking valve to check for leaks at the connections; once no leaks are confirmed, fully open the valve to put the instrument under pressure.

2. Electrical Wiring Specifications

(1) General Wiring Requirements

--- All wiring must be performed with the power off; use a multimeter to verify that the circuit is de-energized before wiring. Wire the cables only after they have passed through the explosion-proof cable gland; after wiring is complete, evenly tighten the gland's clamping nut to ensure the cable is sealed and secure; unused cable glands must be sealed with explosion-proof plugs.
--- Strip the cable conductors to an appropriate length; crimp the terminals securely, ensuring there are no burrs or loose connections; multi-strand conductors must be crimped using cold-crimp terminals; directly twisting wires together is strictly prohibited.
--- All cables must be labeled with terminal numbers and circuit numbers; verify the wire numbers after wiring is complete to prevent incorrect connections; The cable bending radius must be ≥ 10 times the cable's outer diameter; forceful bending is strictly prohibited.
--- Shielded cables must be used for signal cables, and they must be routed separately from power cables with a minimum spacing of ≥ 300 mm; routing them in the same conduit or cable tray is strictly prohibited; bundling signal cables with power or motor cables is prohibited.

(2) Power Connection

--- Standard 12–32 V DC power supply: Connect the positive terminal of the power supply to the instrument's "24V+" terminal, and the negative terminal to the "24V−" terminal; direct connection to 220 V AC mains power is strictly prohibited (except for custom AC-powered models).
--- Intrinsically Safe Power Supply: Power must be supplied via an isolated safety barrier; connect the positive output of the safety barrier to the instrument's positive power terminal and the negative output to the instrument's negative power terminal; bridging, reverse connection, or bypassing the safety barrier to supply power directly is strictly prohibited.
-- - A suitable fuse or circuit breaker must be connected in series with the power supply circuit; a rated current of 2A is recommended. The peak power supply ripple must be ≤100mV to prevent signal fluctuations caused by power supply interference.

(3) Relay Output Wiring

--- The QDL80D comes standard with 2 independent SPDT relays; each channel includes a common terminal (COM), a normally open terminal (NO), and a normally closed terminal (NC).
--- Upper Limit Alarm / High-Pressure Pump Shutdown: Connect the COM and NO terminals of the first channel; the contacts close when the pressure reaches the upper limit. Lower Limit Alarm / Low-Pressure Pump Start: Connect the COM and NC terminals of the second channel; the contacts close when the pressure falls below the lower limit.
--- The relay contact rating is 24 V DC/5 A and 250 V AC/3 A; when driving high-power loads (motors, high-power solenoid valves), an intermediate relay must be used. Directly driving overloaded loads is strictly prohibited to prevent contact burnout or sticking.
--- Inductive loads (relays, solenoid valves) must be connected in parallel with a freewheeling diode or surge suppressor to protect the contacts and extend their service life.

(4) 4–20 mA Analog Output Wiring

--- Two-wire circuit: Connect the positive power supply terminal to the instrument's "24V+" terminal; connect the instrument's "IOUT-" terminal to the PLC's analog input module AI+, and connect the PLC's analog input AI– to the negative power supply terminal to form a series circuit; Never connect the power supply directly across the instrument terminals, as this will burn out the instrument.
--- Loop load resistance: The maximum load resistance for a 24V power supply is 600Ω. For long-distance transmission, calculate the cable voltage drop and increase the supply voltage if necessary; the total loop resistance must be ≥250Ω to ensure signal stability.
--- On the PLC side, set the input channel to "Current Input" with a range of 4–20 mA; setting it to "Voltage Input" is strictly prohibited.

3. Grounding Requirements

--- The metal enclosure of explosion-proof instruments must be reliably grounded, with a grounding resistance of ≤4 Ω; use a dedicated yellow-green grounding wire with a cross-sectional area of ≥2.5 mm² and connect it to the on-site equipotential bonding grid. It is strictly prohibited to use pipes or cable trays as grounding electrodes.
--- The shielding layer of intrinsically safe instruments must be **grounded at one end only**; it must be grounded only on the safety barrier side in the control room, while the field end must be insulated. Grounding at both ends is strictly prohibited to prevent ground loop interference and failure of explosion protection.
--- Metal pipes, cable trays, and instrument enclosures in explosion-hazard areas must be bonded to the equipotential bonding system to eliminate electrostatic potential differences; grounding systems must be inspected periodically to ensure that grounding resistance meets requirements.

--- In outdoor areas and areas at risk of lightning strikes, lightning surge protectors must be installed; power and signal ports must be protected separately, with grounding resistance ≤ 10 Ω.

III. Wiring Diagrams and Correct/Incorrect Comparisons

1. Standard Model Wiring Diagram (2-Channel Relay + 4–20 mA)

Taking the standard terminal layout of the 2088 enclosure (from top to bottom) as an example, the terminal definitions and wiring methods are as follows:

--- Power terminals: 24V+ (positive power terminal), GND/24V- (power supply negative terminal)

--- Relay Channel 1: 1COM (common), 1NO (normally open), 1NC (normally closed)

--- Relay Channel 2: 2COM (common), 2NO (normally open), 2NC (normally closed)

--- Analog Output: IOUT+ (current output positive), IOUT- (current output negative)

Wiring Logic:

--- Power Supply Circuit: 24V DC positive terminal → Instrument 24V+; Power supply negative terminal → Instrument 24V-

--- 4–20 mA Two-Wire Circuit: 24V positive terminal → Instrument 24V+; Instrument IOUT- → PLC AI+; PLC AI- → 24V negative terminal

--- Relay control circuit: Power supply live wire → Relay COM; Relay NO/NC → One end of the load; Other end of the load → Power supply neutral wire

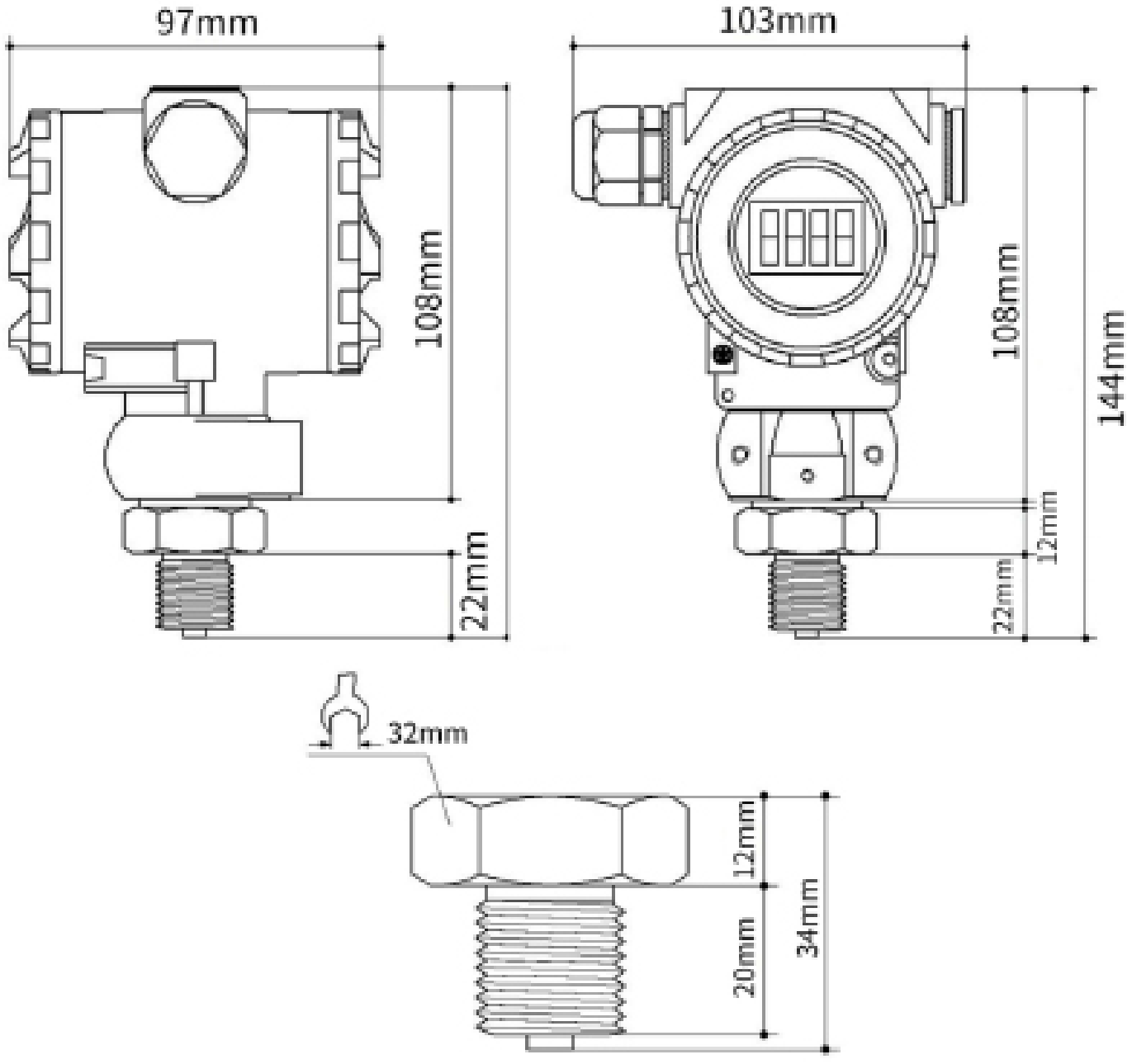
2. Dedicated Wiring Specifications for Intrinsically Safe Circuits

--- Intrinsically safe circuits must use intrinsically safe explosion-proof cables; the cable parameters (distributed capacitance, distributed inductance) must match the parameters of the safety barrier and the instrument.

--- The safety barrier must be installed in the safe area, with the intrinsically safe side connected to the field instrument and the non-intrinsically safe side connected to the control system and power supply; it is strictly prohibited to install the safety barrier in a hazardous area.

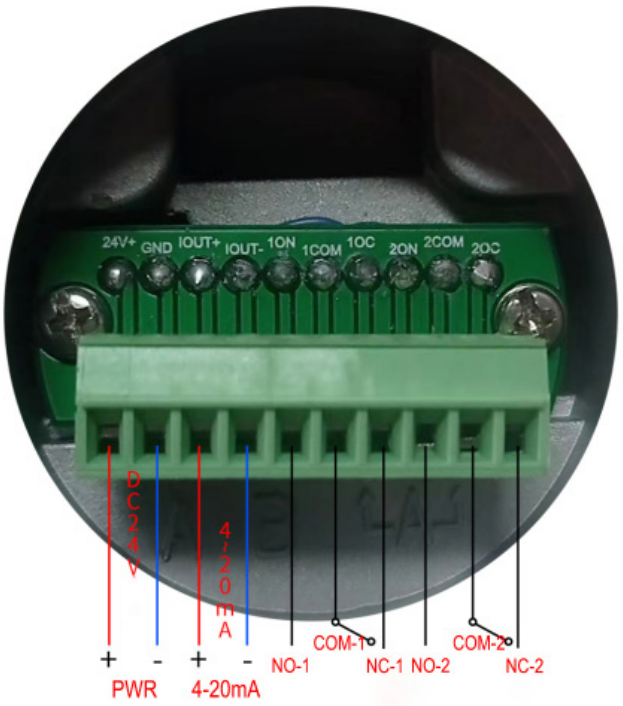
--- Intrinsically safe circuits and non-intrinsically safe circuits must be routed separately; sharing cables, cable trays, or junction boxes is strictly prohibited; intrinsically safe circuits must not be grounded, nor may they share a common ground with other circuits.

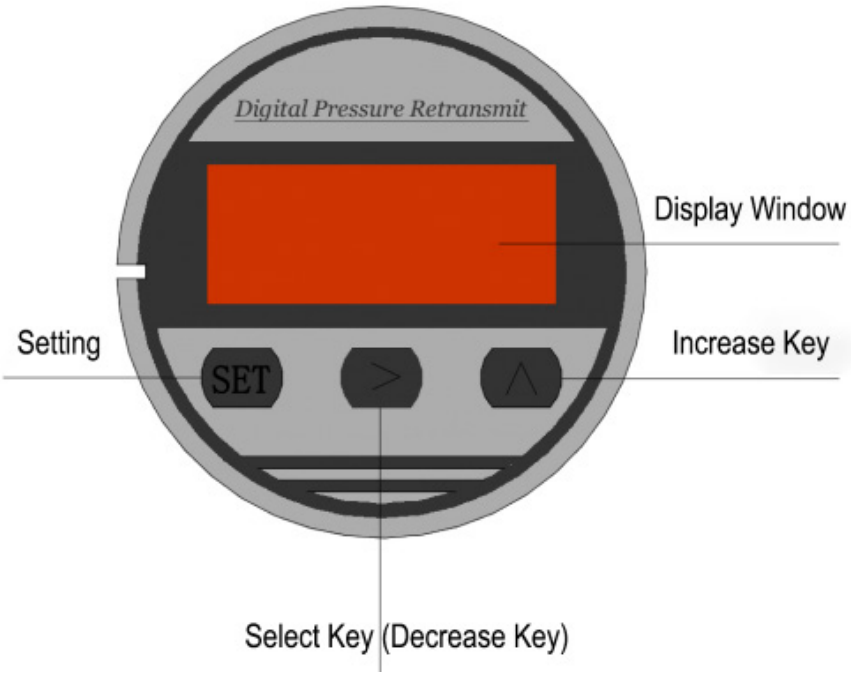
--- Protective grounding for the housing of intrinsically safe instruments may be connected normally and must be independent of the intrinsically safe signal circuit.



Wire

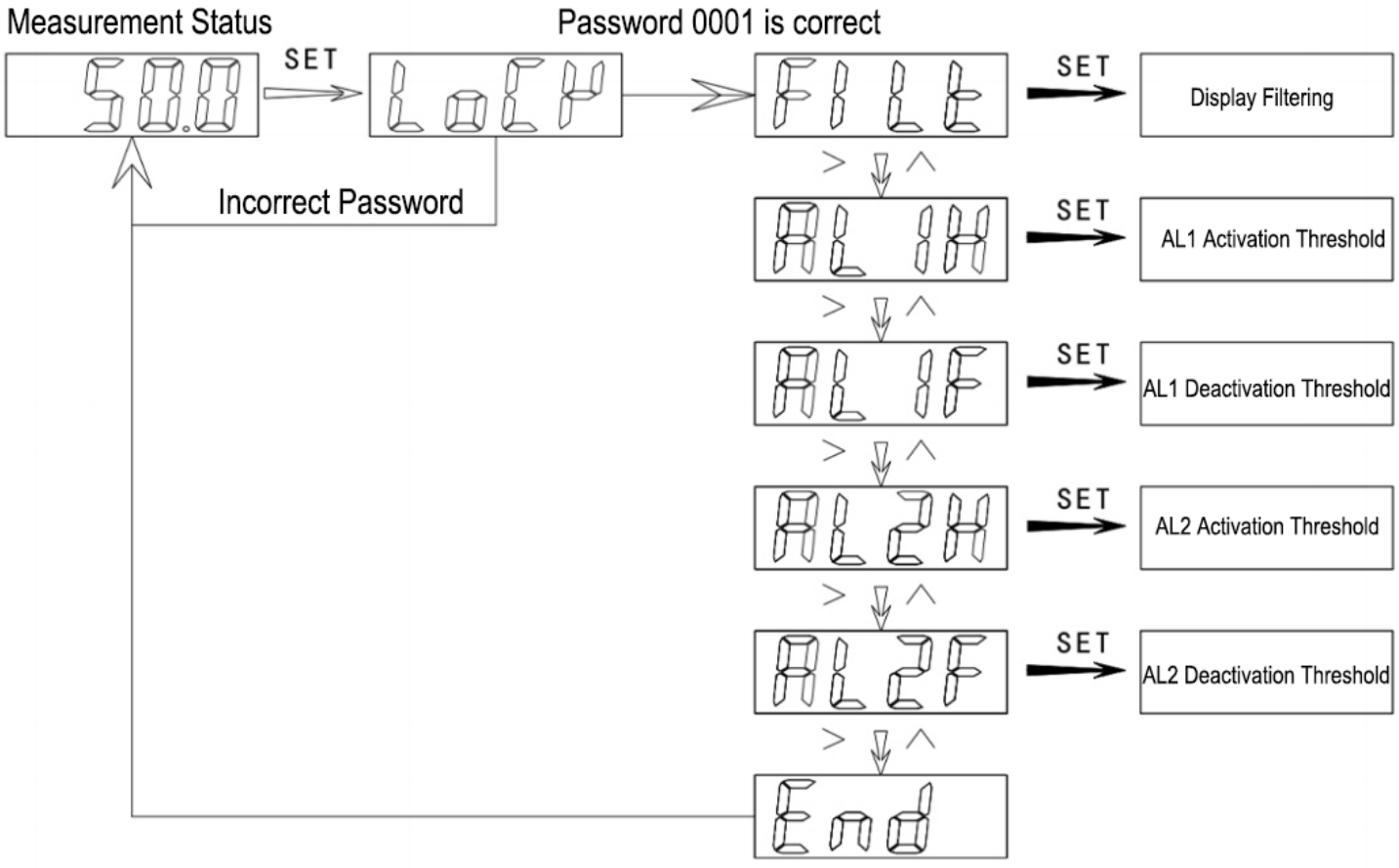
The terminal blocks are located in a separate compartment within the electrical box. To make connections, unscrew the cover on the wiring side.





The panel has 4 LED displays and 3 buttons: the SET button for setting, the SUB button for selecting digits, and the ADD button for incrementing.

1. Switch Point Setup Process



FILT: This value represents the display filter coefficient.
AL1H: This value represents the energization threshold for Switch 1 (AL1/SP1).
AL1F: This value represents the de-energization threshold for Switch 1 (AL1/SP1).
AL2H: This value represents the energization threshold for Switch 2 (AL2/SP2).
AL2F: This value represents the de-energization threshold for Switch 2 (AL2/SP2).
END: Save and exit

Note: If AL1H > AL1F, SP1 operates in upper limit alarm mode; if AL1H < AL1F, SP1 operates in lower limit alarm mode; if AL1H = AL1F, SP1 is disabled. Hysteresis = Abs(AL1H - AL1F). SP2 settings are the same as SP1.

2. Zero Reset:
While the pressure is at zero, press and hold the shift key (the middle button) for 3–4 seconds to reset to zero. Performing the reset operation again will restore the device to its factory-calibrated state. The default factory reset value is 0.

3. Comparison of Commonly Seen Correct and Incorrect Wiring Configurations

4–20 mA 2-wire wiring	The positive and negative terminals of the power supply are connected in parallel directly across the instrument, assuming that “the two wires are the positive and negative terminals.”	The power supply, instrument, and PLC analog inputs are connected in series to form a loop: the power supply’s “+” terminal is connected to the instrument’s “+” terminal, the instrument’s “−” terminal is connected to the PLC’s AI+ terminal, and the PLC’s AI− terminal is connected to the power supply’s “−” terminal.
Shield grounding	The cable shield is grounded at both ends, with the field end connected to the instrument housing.	The shield is grounded at a single point only on the control room/safety barrier side; the field end is left floating.
Relay load	Using the instrument’s relay to directly drive high-power motors or solenoid valves.	High-power loads must be connected via an intermediate relay, and the load current must not exceed the contact rating.
Intrinsically safe circuit wiring	Connecting an intrinsically safe instrument directly to a standard 24V power supply without a safety barrier.	Power must be supplied through an isolating safety barrier with matching parameters to form a complete intrinsically safe circuit.
Explosion-proof cable gland	The cable’s outer diameter does not match the cable gland, so the cable is forced in, and unused cable glands are left unsealed.	Select cable glands that match the cable’s outer diameter, tighten them securely to ensure a seal, and seal any unused ports with explosion-proof plugs.
Grounding	The instrument housing is not grounded, or it is connected to piping or cable trays in lieu of a grounding electrode.	Connect the enclosure’s dedicated grounding terminal to the equipotential bonding grid; the grounding resistance must be ≤4 Ω.

IV. Power-On Commissioning Procedure

1. Pre-Power-On Inspection
--- Mechanical Inspection: Verify that process connections are secure and free of leaks; that instruments are firmly installed; that all bolts on explosion-proof surfaces are tightened; that cable gland seals are intact; and that the housing is undamaged.
--- Electrical Inspection: Verify that all wiring terminals are correctly connected, secure, and free of short circuits; Use a multimeter to measure the voltage in the power supply circuit to confirm it is within the rated range and that there are no short circuits or reverse connections; measure the insulation resistance of the signal circuit to ensure it is ≥10 MΩ.
--- Environmental Verification: Confirm that there is no accumulation of explosive gases at the site and that commissioning tools comply with explosion-proof requirements; commissioning in hazardous areas must be performed via remote system operation from a safe zone; opening the cover while the equipment is energized on-site is strictly prohibited.

2. No-Load Power-On Test
1. Slowly turn on the power and observe whether the instrument display lights up normally, checking for a black screen, distorted display, or garbled characters; observe whether the power indicator and status indicators are functioning normally.
2. Allow the unit to warm up for 5–10 minutes until the sensor reaches thermal stability; under no-pressure conditions, observe whether the pressure value on the display is near zero and shows no significant fluctuations.
3. Measure the current in the power supply circuit; the no-load current should be within the rated range (approximately 30–50 mA for the QDL80D), with no signs of overcurrent or short circuits.
4. Check the relay status: By default, the normally closed contacts should be closed, and the normally open contacts should be open. Manually set thresholds to test whether the relay engages and releases normally, and check for any contact sticking.

3. Zero and Range Calibration

--- Zero Calibration: Under atmospheric pressure or zero pressure conditions, enter the instrument settings menu and execute the “Zero Reset” function; zero calibration can also be performed using a key combination to eliminate zero-point offset caused by the installation location or static pressure in the piping.
--- Range Calibration: For high-precision calibration, connect a standard pressure source, enter the zero-point and full-scale standard pressure values in sequence, record the instrument’s display values and output signal values, and calculate the error; if the error exceeds the tolerance, perform full-scale calibration via the menu.
--- Calibration Precautions: Calibration must be performed after the ambient temperature has stabilized; calibration under pressure or in vibrating conditions is strictly prohibited; Calibration of explosion-proof instruments must be performed in a safe area; opening the cover for calibration in hazardous areas is strictly prohibited.

4. Parameter Settings and Function Verification
1. Follow the manual to enter the parameter settings menu and configure the following in sequence: pressure units, range, upper and lower control limits, hysteresis value, control mode (upper limit / lower limit / window / hysteresis), delay time, and filter coefficient.
2. Control function test: Slowly increase the pressure to the upper limit setting and observe whether the relay engages and the alarm is triggered; slowly decrease the pressure to the lower limit setting and observe whether the relay releases. The error at the switching points should be within the accuracy range.
3. Signal Output Verification: Use a multimeter to measure the 4–20 mA output current in series; zero corresponds to 4 mA, and full scale corresponds to 20 mA. The linearity error must be ≤ the accuracy class requirement. For instruments with communication capabilities, verify that communication with the host computer is normal and that the data matches.
4. Abnormal Condition Testing: Simulate scenarios such as overpressure, underpressure, and sensor failure to verify that the instrument’s alarm and protection functions operate normally.

5. Commissioning and Acceptance
--- After all parameter settings are complete, save the parameters and exit the setup menu to confirm that the instrument automatically enters the measurement and control state.
--- Slowly open the pressure tapping valve to allow the pressure to rise gradually. Observe whether the instrument’s display, output, and relay operations are normal, and ensure there are no leaks or abnormalities.
--- Run the instrument continuously for 24 hours, record operating data, and confirm that the pressure display is stable, control actions are accurate, signal output is normal, and there is no drift, no sudden changes, and no false actions.
--- Compile the installation and commissioning records, calibration records, and explosion-proof certification documents, and complete the acceptance procedures.

V. Installation Precautions

1. Do not operate the instrument beyond its rated pressure, temperature, or specifications.
--- Never exceed the instrument’s rated range, rated pressure, or rated temperature; sufficient range margin must be reserved for water hammer and shock conditions; the range must never be exactly equal to the working pressure.
--- Never use standard-temperature instruments directly with high-temperature steam or high-temperature oil media; High-temperature media must use high-temperature models equipped with heat dissipation devices.
--- Do not drive loads that exceed the relay contact capacity; do not directly drive high-power inductive loads; do not supply power outside the specified voltage range; do not connect directly to 380V or 220V mains power (except for custom models).

2. Do Not Compromise the Explosion-Proof Structure
--- Never open the end cap of a flameproof instrument while it is energized or under pressure; never open the end cap for debugging or maintenance in potentially explosive atmospheres.
--- Never scratch, bump, or corrode the flameproof joint surfaces; never paint or wrap foreign objects around the flameproof surfaces; never replace bolts or seals with non-original parts; never omit or fail to install fastening bolts.
- -- Never use non-explosion-proof cable glands; never force a cable into a gland if its outer diameter does not match; never leave unused cable glands unsealed; never enlarge holes or modify the housing without authorization.
--- For intrinsically safe instruments, never bypass the safety barrier to supply power directly; never replace safety barriers or cables with incompatible ones; never mix intrinsically safe circuits with non-intrinsically safe circuits.

3. Improper Wiring and Grounding Are Strictly Prohibited
--- Reversing the positive and negative terminals of the power supply is strictly prohibited; connecting 4–20 mA two-wire instruments in parallel to the power supply is strictly prohibited; running signal wires and power cables in the same conduit or cable tray with a spacing of less than 300 mm is strictly prohibited.
--- It is strictly prohibited to ground both ends of the shield; it is strictly prohibited to ground intrinsically safe circuits; it is strictly prohibited to leave the instrument housing ungrounded; it is strictly prohibited to use pipes or cable trays as substitutes for dedicated grounding electrodes.
--- It is strictly prohibited to insert or remove terminals or make connections while the power is on; it is strictly prohibited to directly twist together multi-strand wires without crimping them to terminals.

4. Prohibited Improper Mechanical Installation
-- - Do not install the instrument head or housing by hand; always grip the sensor by its hexagonal section. Do not strike or bump the sensor diaphragm, and do not probe the pressure ports with sharp objects.
--- Do not screw internal threaded fittings in too deeply, as this may damage the diaphragm. Do not allow Teflon tape, welding slag, or debris to remain inside the instrument’s pressure ports, as this may block the pressure channels.
--- Do not install low-pressure gauges horizontally; do not install the gauge at an angle exceeding the specifications in the manual; do not install the gauge directly in locations subject to strong vibrations without a shock-absorbing device.

5. Do not use the instrument in harsh environments without proper protection.
--- Do not use instruments with a protection rating lower than IP65 in open-air, wet, or high-dust environments; outdoor installations must be equipped with a

rain cover.
--- Do not use unshielded cables in environments with strong electromagnetic interference; do not install the instrument unprotected near strong interference sources such as high-power motors, variable frequency drives, or transformers.
--- Never use standard 316L diaphragm instruments in corrosive media; custom diaphragms and seals must be used for highly corrosive media.
--- Never use non-explosion-proof instruments in potentially explosive areas; never put instruments into service if their explosion-proof rating, gas group, or temperature class do not match the site conditions.

Recommendations for Daily Use & Operations and Maintenance

I. Key Points for Routine Inspections

Routine inspections consist of two levels: **on-site inspections during each shift** and **remote system monitoring**. The core objective is to detect early-stage faults—such as leaks, loose components, drift, and abnormal temperature rises—as soon as possible to prevent them from escalating into safety incidents or equipment shutdowns. Inspection priorities vary depending on the product model and must be carried out accordingly.

1. On-site Inspection per Shift (Conducted by Operators)
1. **Visual Inspection and Explosion-Proof Structure Check**
--- Inspect the instrument housing for deformation, cracks, or dents; ensure the explosion-proof nameplate and markings are clear and complete, with no alterations or peeling; check that the flameproof surfaces show no exposed rust or accumulation of debris; painting or applying putty to flameproof surfaces is strictly prohibited.
--- Check that explosion-proof cable gland heads are securely tightened, cables are not loose or shifting, and sealing rings are free of damage or deterioration; unused gland heads must be sealed with explosion-proof plugs; leaving them empty is strictly prohibited.
--- Check that process connection interfaces have no medium leakage or condensation, and that threaded areas are free of corrosion; pressure-taking lines and valves must be free of deformation and leakage, and valve openings must be normal.
--- Additional inspection for intrinsically safe products: Ensure that the field-side covers have not been opened without authorization, that there are no bypass connections, and that no additional power sources have been connected; verify that intrinsically safe circuits are physically separated from non-intrinsically safe circuits, and that there are no mixed connections or shared conduits.

2. **Display and Operating Status Inspection**
--- Observe that the display is clear, with no black screens, distorted images, or garbled characters; ensure that pressure readings do not fluctuate continuously or freeze; units and status indicator lights are displayed normally.
--- Verify that the relay operating status matches the pressure value; there should be no frequent false trips or failure to operate; no abnormal noises, burning odors, or smoke should be present.
--- Check the surface temperature of the enclosure by touch; there should be no abnormally high temperatures, and the maximum enclosure temperature must not exceed the limit for the explosion-proof temperature class (85°C for T6).

3. **Grounding and Environmental Inspection**
--- Verify that the protective grounding wire is securely connected to the housing, with no breaks, corrosion, or loose connections; grounding markings must be clear.
--- Check that the installation environment is free of standing water, excessive dust, and splashes of corrosive liquids; ensure the outdoor rain cover is intact, with no signs of water ingress or leakage.
--- In high-vibration environments, verify that mounting brackets and bolts are secure and that the instrument does not exhibit noticeable shaking; in high-temperature environments, verify that the heat sinks and condensation rings are intact and free of blockages.

2. Remote System Monitoring (Performed by Central Control / Operations and Maintenance Personnel)
1. **Signal Stability Monitoring**
--- Monitor pressure value fluctuations in real time: Under normal operating conditions, pressure fluctuations should remain within the process tolerance range. If irregular spikes, stuck readings, or sustained drift occur, an immediate investigation is required.
--- Monitor the 4–20 mA output signal: Zero corresponds to 4 mA, and full scale corresponds to 20 mA. Signal fluctuations of ≤±0.5% FS are considered normal; if the signal exceeds the full scale, remains constant, or exhibits sudden jumps, prioritize troubleshooting wiring, power supply, and sensor failures.
--- Additional Monitoring for Digital Communication Products: Ensure the communication status is normal, with no frequent disconnections, data packet loss, or address conflicts; historical curves should be smooth, with no sudden changes or breaks.
--- Control Loop Monitoring: Record the number of relay actuations and the actuation pressure values, and compare them to the setpoint deviation. If the deviation continues to increase, calibration or inspection for contact wear is required.

2. **Temperature, Humidity, and Environmental Monitoring**
--- Monitor the ambient temperature in the area where the instrument is located to ensure it remains within the operating range of -40°C to 70°C; when the temperature approaches the limits, increase inspection frequency and implement cooling or insulation measures.
--- Monitor ambient humidity; during periods of high humidity or the rainy season, pay special attention to checking wiring compartments and gland heads for condensation or signs of water ingress.
--- In flammable and explosive areas, simultaneously monitor gas concentrations; if levels exceed limits, immediately inspect equipment seals and wiring for potential spark hazards.

3. **Operational Data Recording**
--- Record real-time pressure values, output current, number of relay actuations, and ambient temperature and humidity for each shift; calculate zero-point drift and set-point deviation weekly, and maintain an equipment operation log.
--- In the event of an anomaly, record the time of the anomaly, pressure values, output values, and ambient operating conditions; retain the data for fault tracing.

3. Differences in Inspection Focus for Different Product Styles

Flameproof (Standard Model)	Integrity of explosion-proof surfaces, gland seals, enclosure temperature rise, interface leakage	Corrosion of explosion-proof surfaces, loose gland nuts, aged seals, and operation at excessive temperatures
Intrinsically Safe	Safety barrier operating status, intrinsically safe circuit isolation, shield grounding, absence of additional power sources	Unauthorized power bypasses, mixing of intrinsically safe and non-intrinsically safe circuits, and grounding of both ends of the shield
4–20 mA Analog	Output current stability, circuit load, supply voltage, ground interference	Signal fluctuations, circuit breaks, ground loop interference, and excessive cable voltage drop
High-Temperature High-Pressure	Heat dissipation devices, condensation rings, interface seals, overload margin	Diaphragm damage due to overheating, aged seals, water hammer, and operation at excessive pressure

II. Regular Maintenance Plan

1. Monthly Maintenance (Performed by Professional Maintenance Personnel)

1. **Cleaning and Dust Removal**

--- After turning off the power and relieving pressure, use dry compressed air (pressure ≤ 0.5 bar) to blow away dust and oil residue from the instrument housing, display screen, ventilation holes, and the interior of the terminal box; wipe the display screen with a clean, soft cloth. Do not use organic solvents or hard objects to scrape the surface.

--- Remove accumulated water, dust, and impurities from the pressure-taking lines, filters, and condensation tanks; in gas applications, drain contaminants; in liquid applications, vent gas and remove sediment.

--- Clean the flameproof joint surfaces; after wiping with a clean, soft cloth, apply a thin layer of anti-corrosion grease specifically designed for flameproof applications. Painting or applying adhesives is strictly prohibited. In dusty environments, additionally clean the heat dissipation channels to prevent excessive temperature rise caused by dust accumulation.

2. **Wiring and Fastening Inspection**

--- After powering down, inspect all wiring terminals and retighten them evenly to eliminate loosening caused by vibration; check the wire insulation for yellowing, cracking, or aging, and replace any damaged sections promptly.

--- Check the tightening torque of mounting bolts, process connection bolts, and compression nuts on gland heads, and retighten them to the specified torque; under no circumstances should standard bolts be used in place of explosion-proof bolts.

--- Verify that the shield grounding and protective grounding connections are secure, with a measured ground resistance of ≤4 Ω; for intrinsically safe circuits, the shield must be grounded at a single point on the control room side only, while the field end must remain electrically isolated.

3. **Inspection of Seals and Wear Parts**

--- Inspect the process interface gaskets, gland seals, and end cap seals for hardening, cracks, or deformation; replace immediately if signs of aging are present, giving priority to original manufacturer seals of the same specifications.

--- Inspect pressure-taking lines, valves, and fittings for leaks; re-wrap leaking areas with PTFE tape or replace seals; it is strictly prohibited to use adhesive tape or glue for temporary sealing.

--- Test the functionality of the control buttons. If a button is sticky or lacks spring action, wipe the crevices with a cotton swab dipped in anhydrous alcohol to remove dust; replace the panel assembly immediately if a button fails.

2. Quarterly Maintenance

1. **Performance and Functional Verification**

--- During process-permissible downtime, perform zero-point verification: release pressure to atmospheric pressure, observe the deviation of the displayed value from zero, and perform a zero-point reset if the deviation exceeds the allowable range.

--- Verify relay trip points: by simulating pressure changes, test the deviation of the upper and lower trip values from their setpoints; recalibrate the trip points if the deviation exceeds accuracy requirements.

--- Test the linearity of the 4–20 mA output by measuring the output current at 0%, 50%, and 100% of the full scale (FS). Perform range calibration if the error exceeds ±0.2% FS.

--- For products with digital communication, test communication response, parameter read/write, and remote control functions; troubleshoot bus interference and address conflicts.

2. **Explosion-Proof Special Inspection (in accordance with GB 3836.16 requirements)**

--- Use a feeler gauge to check the clearance at the flameproof joint surfaces to ensure compliance with explosion-proof rating requirements (Class IIC clearance ≤ 0.15 mm); verify that the effective length and surface roughness of the joint surfaces meet standards, and that there are no through scratches or deep corrosion.

--- Inspect the sealing performance of the cable entry devices; ensure the cable outer diameter matches the cable gland, and that the clamping force is uniform; reliably seal unused entry ports with explosion-proof plugs; the use of ordinary plugs as substitutes is strictly prohibited.

--- Check the grounding continuity and equipotential bonding of the enclosure, and test the grounding resistance; inspect for any unauthorized modifications to the enclosure, such as enlarging holes or replacing components, that compromise the explosion-proof structure.

3. **Maintenance of Front-End Piping and Accessories**

--- Clean or replace the filter element in the pressure tapping port; replace it entirely if severely clogged. Inspect dampers, buffer tubes, and condensation rings for blockages, deformation, or corrosion.

--- In high-vibration environments, check the mounting brackets and vibration-damping pads for looseness or aging, and replace any failed vibration-damping components; check the vertical alignment of the instrument; low-pressure instruments must be kept perfectly vertical.

3. Annual Maintenance (Accuracy Calibration + Comprehensive Inspection)

1. **Accuracy Calibration (Core)**

--- **Calibration Interval**: Once every 12 months for general industrial applications; once every 6 months for safety-critical applications (boilers, pressure vessels, gas pipelines) and precision control applications; once every 3 months for trade settlement and safety interlock applications. It is strictly prohibited to put instruments into service without calibration after the specified interval has elapsed.

--- **Calibration Standards**: Use a standard pressure source with an accuracy class 3 to 5 times that of the instrument being calibrated (e.g., Class 0.02 piston-type pressure gauge, digital pressure calibrator). The calibration process shall comply with the JJG 882-2019 Verification Regulations for Pressure Transmitters.

--- **Calibration Procedure**: Perform zero-point calibration first (correct the zero point under zero-pressure conditions), followed by span calibration. Verify the 0%, 25%, 50%, 75%, and 100% span points in sequence, while simultaneously verifying the rising and falling travel ranges, and calculate the basic error and hysteresis error; If errors exceed tolerance limits, adjust the calibration coefficients via the instrument menu; if adjustment is not possible, return the unit to the factory for repair.

--- **Calibration Record**: Detailed records must be kept of the calibration date, reference standard information, standard values at each point, measured values, deviation values, and the calibrator's name. Retain the calibration certificate and maintain a metrological log for the equipment.

2. **Complete Disassembly and Inspection (Explosion-proof models only; to be performed in a safe area)**

--- After completely disconnecting power and relieving pressure, open the cover in a safe area to inspect the internal circuit board, terminal blocks, and sensor assembly; remove internal dust and moisture; and check for signs of corrosion or burn marks.

--- Inspect the relay contacts for burn marks or sticking; replace the relay assembly if the contacts are severely worn; Check the sensor diaphragm for deformation, corrosion, or blockage; replace the sensor element if the diaphragm is damaged.

--- Replace all seals and O-rings; retighten all fasteners and tighten the flameproof surface bolts to the specified torque; after reassembly, perform insulation resistance and withstand voltage tests to ensure electrical performance meets requirements.

3. **System-Level Validation**

--- Simulate abnormal operating conditions such as overpressure, underpressure, sensor failure, and power interruption to verify that the instrument's alarm, interlock, and protection functions operate normally.

--- Verify the validity periods of the explosion-proof certification and metrological calibration certificates; promptly conduct re-inspections if expired; update the equipment operation and maintenance ledger and equipment records.

III. Long-Term Maintenance Tips

For long-term use in various environments and operating conditions, targeted protection and optimization can extend the equipment's service life from 3–5 years to 8–10 years, while significantly reducing the failure rate.

1. Dust and Moisture Protection and Sealing

1. **Dust Protection Optimization**

--- In environments with high levels of dust, coal dust, or metal dust, install a dust cover over the instrument and wrap sealing tape around the wiring compartment connections; regularly blow out the ventilation holes with compressed air to prevent dust buildup, which can lead to poor heat dissipation and internal short circuits.

--- Install a Y-type filter or sintered filter at the front end of the pressure tapping port to prevent dust and impurities from entering the pressure-sensing holes and clogging the sensor; clean or replace the filter element every 1–3 months depending on dust concentration.

--- When cleaning the housing, use a damp cloth to avoid static electricity generated by dry wiping; never rinse the instrument directly with a high-pressure water gun to prevent water from seeping in through the cable glands or gaps around the buttons.

2. **Moisture and Condensation Prevention**

--- In high-humidity, outdoor, or underground utility tunnel environments, select models with an IP67 protection rating; place desiccant inside the wiring compartment and replace it regularly; install waterproof O-rings at cable glands and create drip loops on cables to prevent rainwater from flowing in along the cables.

--- During the rainy season or in low-temperature, high-humidity environments, regularly inspect the wiring compartment for condensation. If water ingress is detected, immediately shut off the power, use a heat gun on a low setting to dry the circuit board, and replace aged O-rings. Never energize the device while it is wet.

--- For intrinsically safe equipment, moisture protection focuses on the safety barrier side; install the safety barrier in a dry control room and avoid installing it in damp areas on-site; Ensure that intrinsically safe cable joints are properly waterproofed and sealed.

3. **Long-Term Maintenance of Seals**

--- Replace the anti-rust grease on explosion-proof surfaces once a year; use explosion-proof-grade silicone grease or anti-rust grease—the use of ordinary grease is strictly prohibited. When replacing seals, use original manufacturer products of the same material and specifications; fluorocarbon rubber seals are suitable for high-temperature and corrosive environments, while nitrile rubber is suitable for normal-temperature, non-corrosive media.

--- For threaded connections, prioritize the use of PTFE teflon tape; ensure it does not enter the pressure-transmitting holes when wrapping. For high-temperature media, use high-temperature-resistant sealant to prevent seal failure.

2. Interference Mitigation and Electrical Protection

1. **Electromagnetic Interference Protection**

--- Signal cables must be shielded twisted-pair cables and must be routed in separate channels or conduits from power cables, with a minimum spacing of 300 mm; signal cables must never be bundled with power or motor cables, nor routed through the same conduit.

--- In environments with strong electromagnetic interference (near variable frequency drives, motors, or transformers), install power filters on the instrument's power supply side and signal isolators on the signal side; install surge protectors and isolation barriers on the RS485 bus.

--- Ensure the instrument housing is reliably grounded, with a ground resistance ≤4Ω; ground the shield at a single point to prevent ground loops; Intrinsically safe circuits must be electrically isolated using isolated safety barriers to suppress common-mode interference at the source.

2. **Power Supply and Load Protection**
--- Install fuses and surge protectors in the power supply circuit, and keep power supply ripple within 100 mV; prevent power supply voltage fluctuations from exceeding the DC 12–32 V range; install a regulated power supply in environments with unstable voltage.
--- When relays drive inductive loads (solenoids, contactors), connect a freewheeling diode or surge suppressor in parallel to absorb back-EMF, protect the contacts, and extend the relay's service life; never drive loads beyond the contact rating; high-power loads must be connected via an intermediate relay.
--- In 4–20 mA circuits, strictly control the total load resistance; under a 24 V power supply, it must not exceed 600 Ω. For long-distance transmission, calculate the cable voltage drop and, if necessary, increase the supply voltage or use a four-wire output.

3. Protection Against Extreme Environments
1. **High-Temperature Conditions (>60°C)**
--- When measuring high-temperature steam or high-temperature oils, a condensation loop or heat dissipation tube must be installed to ensure the sensor operates within its rated temperature range; for every 10°C increase in medium temperature, add at least one additional loop of condensation tubing.
--- In high-temperature environments, use high-temperature sensors and fluorocarbon rubber seals to prevent standard nitrile rubber seals from aging and failing; periodically check the elasticity of the seals and replace them immediately if they show signs of aging.
--- Avoid exposing the instrument to direct sunlight; install a sunshade in outdoor high-temperature environments; install the instrument in a well-ventilated location away from heat sources.

2. **Low-Temperature Environments (<-10°C)**
--- In cold winter conditions, select wide-temperature-range products (operating temperature of -40°C); when there is a risk of medium freezing, provide heat tracing and insulation for the pressure-taking lines and the instrument to prevent the medium from freezing and causing the diaphragm to rupture due to expansion.
--- In low-temperature environments, preheat the instrument before powering it on to avoid display abnormalities caused by direct power-up at low temperatures; periodically check the display backlight and button functionality; a slower response of the LCD display at low temperatures is normal.

3. **Highly Corrosive Environments**
--- For strong acids, strong alkalis, and highly corrosive media, diaphragms (tantalum, Hastelloy, Monel) and seals (fluoroelastomer, perfluoroelastomer) made of appropriate materials must be selected; the use of standard 316L diaphragms as substitutes is strictly prohibited.
--- Periodically inspect the housing and process connections for corrosion; replace them promptly if deep rust or pitting is observed; Select stainless steel fasteners for corrosive environments and apply anti-corrosion grease periodically.

4. **High-Vibration and Water Hammer Conditions**
--- In locations prone to water hammer impacts—such as at the pump outlet or downstream of valves—install dampers, buffer pipes, or buffer tanks upstream of the instrument; ensure the measurement range has a margin of at least 2 times the expected pressure to prevent damage to the diaphragm from instantaneous overpressure.
--- In environments with strong vibration, install vibration-damping pads and vibration-isolating brackets, and use flexible pressure-transmitting tubing to achieve mechanical decoupling; regularly check the tightness of mounting bolts and joints to prevent loosening.
--- Set the filter coefficient and hysteresis value appropriately to prevent frequent false tripping of relays caused by pressure fluctuations; set an overpressure protection threshold to trigger automatic interlock shutdown when activated.

5. **Long-Term Storage and Maintenance**
--- When the equipment is out of service for an extended period, first disconnect the power supply, relieve pressure, clean out the internal medium, and seal the unit after drying; store it in a dry, well-ventilated, non-corrosive environment with a temperature range of -10°C to 40°C, avoiding stacking or compression.
--- Power on the device once every 3 months for at least 30 minutes to expel moisture and check the operating status; for battery-powered models, replace the batteries periodically to prevent leakage from corroding the circuit board.
--- Before putting the device back into service, conduct a comprehensive visual inspection, zero-point calibration, and insulation test; ensure normal performance before use.

4. Long-Term Maintenance Principles for Different Product Models
--- **Flameproof Type**: The key is to protect the flameproof structure; opening the cover, modifying the device, or replacing non-original parts without authorization is strictly prohibited. Focus maintenance on the flameproof surfaces, seals, and cable glands; conduct a specialized explosion-proof inspection at least once a year.
--- **Intrinsically Safe Type**: The key is to ensure the integrity of the intrinsically safe circuit; bypassing safety barriers and altering circuit parameters are strictly prohibited; regularly calibrate safety barrier parameters to ensure compatibility with the instrument; intrinsically safe cables, connectors, and grounding must comply with intrinsically safe standards throughout the entire system.
--- **Digital Intelligent Type**: Back up parameter configurations regularly to prevent loss due to operational errors; firmware upgrades must be performed by the manufacturer—do not flash firmware on your own; clean the communication bus periodically to ensure stable data transmission.
--- **High-Precision Type**: Minimize the frequency of on-site zero-point and range adjustments to avoid compromising accuracy through frequent calibration; calibration must be performed by qualified metrology personnel using standard instruments that meet the required accuracy class.

Troubleshooting & Emergency Response

I. List of Common Faults and Classification of Root Causes

(1) Comprehensive List of Common Faults
Sorted by frequency of occurrence from highest to lowest, covering five major categories: electrical, measurement, control, explosion-proof, and environmental:

1. **No Output / No Display**: Instrument screen is black with no display; no 4–20 mA signal output; relay does not actuate;

2. **Signal Drift / Inaccuracy**: Significant deviation in pressure readings, zero-point drift, full-scale deviation, signal jumps or fluctuations, display values do not match actual pressure

3. **Indicator Lights and Status Anomalies**: Power light does not illuminate, alarm light remains on or does not illuminate, garbled display or distorted screen, unresponsive buttons

4. **Alarm and Control Anomalies**: Frequent false relay operations, relays failing to operate, significant deviation from alarm setpoints, relay contact sticking, control logic failure

5. **Interference and Distortion**: Irregular signal fluctuations, display value jitter, frequent communication disconnections, data packet loss, high output ripple

6. **Explosion-Proof and Structural Issues**: Interface leakage, corrosion of explosion-proof surfaces, failed gland seals, abnormally high enclosure temperature, intrinsically safe circuit failure

(2) Classification of Core Causes

Major Categories of Causes	Typical Triggers	Percentage	Investigation Priority
Wiring errors	Reversed power supply polarity, incorrect 4–20 mA loop connection, reversed relay terminals, incorrect shield grounding, loose terminals	45%	Highest
Power supply abnormalities	Supply voltage out of range, high power supply ripple, circuit short circuit/open circuit, intrinsically safe devices not connected to a safety barrier, damage from power supply surges	20%	High
Installation and manufacturing issues	Blocked pressure tapping ports, liquid/air accumulation in pressure tubing, blocked/deformed diaphragm, incorrect installation angle, seal leakage, water hammer impact	15%	High
Environmental interference	Strong electromagnetic interference, ground loops, temperature drift, condensation due to high humidity, severe vibration, dust blockage	10%	Medium
Equipment damage	Damaged sensor diaphragm, burned-out relay contacts, burned-out circuit board, damaged display module, failure of explosion-proof structure	8%	Low
Incorrect parameter settings	Incorrect measurement range setting, incorrect control point setting, hysteresis value too small, incorrect unit selection, communication address conflict	2%	Medium

Inspection Principles: **First check the wiring and power supply; then check the process and environment; finally, check the equipment itself**. In explosion-proof areas, it is strictly prohibited to open covers while the equipment is energized or to perform maintenance while the system is under pressure. All internal inspections must be conducted in a safe area after the power has been turned off and the system has been depressurized.

II. Step-by-Step Troubleshooting and Solutions

1. Problem 1: Instrument Screen Is Black with No Display and No Output

Symptoms

After powering on, the display does not light up, the power indicator light does not illuminate, there is no signal output, and the relay does not operate.

Step-by-Step Troubleshooting

Step 1: Check the Power Supply Circuit (Perform with power off)

Use a multimeter to measure the input voltage at the instrument's power terminals and confirm it is within the rated range of 12–32 V DC; If the voltage is 0, check the upstream power supply, fuses, and circuit breakers for tripping, and inspect the wiring for open circuits.

Check whether the positive and negative power supply terminals are reversed. For intrinsically safe models, verify that power is not being supplied directly bypassing the safety barrier, and check whether the safety barrier is de-energized or damaged.

Check the terminal blocks for looseness, oxidation, or loose connections, and retighten them; inspect the cables for broken wires or short circuits.

Step 2: Load and Short Circuit Troubleshooting

Disconnect the instrument-side wiring and measure the power supply's no-load voltage separately to confirm the power supply is functioning normally; if the voltage drops significantly after reconnecting the instrument, this indicates a short circuit in the loop or an internal short circuit in the instrument.

Check whether the 4–20 mA loop is reversed or short-circuited, and whether the relay output is short-circuited, causing the power supply protection to trip.

Step 3: Inspection of the Device Itself (Perform in a safe area; open the cover only after power is off and pressure is relieved)

Check whether the internal power fuse has blown; if so, replace it with a fuse of the same specification. Inspect the circuit board for burn marks, bulging, or a burnt smell.

Check whether the display and power connectors are loose or disconnected, and reinsert them; if the display module is damaged, replace the display assembly.

Repair and Emergency Measures

Wiring errors, loose terminals: Rewire and tighten the terminals; after confirming correct polarity, restore power.

Power supply failure: Replace with a spare power supply or temporarily connect a spare 24V DC power supply; in the event of an intrinsically safe (IS) failure, temporarily replace with a compatible spare safety barrier.

Internal damage: If on-site repair is not possible, replace with a spare instrument of the same specification; if no spare instrument is available, switch the interlock for that point to bypass and schedule a shutdown for replacement.

Safety Precautions

Never open the cover to inspect internal circuits in potentially explosive atmospheres; the instrument must be removed and taken to a safe area for maintenance.

2. Fault 2: Display Present but No 4–20 mA Signal Output / Abnormal Output
Symptoms
The pressure reading on the display is normal, but there is no current signal at the PLC/DCS end, or the signal is stuck at 4 mA or 20 mA, or the signal is out of range.

Step-by-Step Troubleshooting

Step 1: Check the Loop Wiring and Load
Confirm that the 4–20 mA circuit is a two-wire series circuit: Power Supply + → Instrument 24V+ → Instrument IOUT- → PLC AI+ → PLC AI- → Power Supply -; parallel wiring is strictly prohibited.
Connect a multimeter set to the current range in series with the circuit to measure the actual output current; if the current is normal, this indicates an incorrect PLC setting (e.g., set to voltage input), a damaged channel, or an open circuit in the wiring.
Calculate the total load resistance of the circuit; under a 24V power supply, it must not exceed 600Ω. If the load is too high, increase the supply voltage or replace the instrument with a four-wire model.

Step 2: Parameter and Range Check
Verify that the instrument's range setting matches the actual range and that the units are correct. Confirm that the output mode is set to 4–20 mA and has not been set to another mode, such as 0–10 V.
Check whether an out-of-range or sensor fault alarm has been triggered, causing the output to saturate; verify that the zero and span calibrations are correct.

Step 3: Output Circuit Inspection
Check whether the output terminals are loose or oxidized, and whether the shield is grounded at both ends, introducing interference; check the circuit for short circuits or ground faults.
If it is safe to do so, open the cover to inspect the output module and current loop circuit for damage, and check whether the output protection components have been shorted.

Repair and Emergency Measures
Wiring error: Rewire according to two-wire system specifications and confirm that the PLC channel is set to current input.
Parameter error: Reset the range, units, and output mode, then perform zero calibration.
Damaged output module: Temporarily enable RS485 communication to replace analog transmission; if communication is unavailable, replace with a spare instrument.

3. Fault 3: Inaccurate Pressure Display, Zero Drift, and Significant Value Deviation
Symptoms
The displayed pressure does not match the actual pressure; zero-point offset; large full-scale error; values drift slowly; or values remain fixed at a certain level.

Step-by-Step Troubleshooting

Step 1: Process and Installation Inspection

Check whether the pressure-taking valve is fully open and whether the pressure-taking tubing is blocked, contains liquid or air, or has leaks; drain accumulated liquid from gas media and release trapped air from liquid media.

Check whether the pressure tapping ports are blocked and whether the filters are clogged; disassemble the pressure-conducting tubing to remove impurities and clean the filters.

Check the installation angle; low-pressure instruments must be installed vertically; check whether the diaphragm is being pressed against by foreign objects or has deformed.

Step 2: Environmental and Interference Check

Check whether the ambient temperature exceeds the rated range; sudden temperature changes can cause temperature drift; recalibrate the zero point after the temperature stabilizes.

---Check for severe vibration or strong electromagnetic interference; verify that the shielding layer is properly grounded and check for ground loops.

2. **Step 3: Calibration and Sensor Inspection**
--- Release the pressure to atmospheric pressure and perform a zero-point reset; if the zero point continues to drift, check whether the sensor has aged or the diaphragm has deformed.
--- Connect a standard pressure source to perform full-range calibration; if the error exceeds the accuracy class and cannot be calibrated, the sensor is damaged.
--- Check parameter settings: Verify that the range, units, zero point offset, and filter coefficient are correct.

Repair and Emergency Measures

--- Blockage / Liquid Accumulation / Air Lock: Clean the pressure-conducting tubing and filters; vent air and drain contaminants before putting the instrument back into service.
--- Zero Drift: Perform on-site zero calibration; if temperature drift is significant, install temperature compensation or implement heat dissipation/insulation measures.
--- Sensor Failure: Replace with a spare instrument; for non-critical points, temporarily reduce the accuracy for continued use; for critical points, shut down immediately and replace the sensor.

4. Fault 4: Frequent False Trips, Failure to Operate, or Abnormal Alarms in the Relay

Symptoms
The relay frequently engages or disengages before the pressure reaches the setpoint, or fails to operate when the setpoint is reached; alarm points deviate significantly; or contacts stick.

Step-by-Step Troubleshooting
1. **Step 1: Parameter and Logic Check**
--- Check whether the control mode (Upper Limit / Lower Limit / Window / Hysteresis) is set correctly, whether the upper and lower limit setpoints are reasonable, and whether the hysteresis value is set too low.
--- Check whether the delay time is set too long or too short, and whether special functions such as reverse protection or peak triggering are enabled.
--- Verify that the pressure unit matches the unit of the setpoint and that the range setting is correct.

2. **Step 2: Troubleshooting Pressure Fluctuations and Interference**
--- Observe whether the pressure display fluctuates frequently; pipeline pulsations, water hammer, and vibrations can cause the relay to trip frequently. Increase the hysteresis value, raise the filtering coefficient, or install a dampener.
--- Check for electromagnetic interference that may cause the relay to trip erroneously; inspect the power supply ripple and ensure proper grounding.

3. **Step 3: Inspection of the Relay Unit**
--- After powering off, measure the continuity of the relay contacts to verify whether they are stuck, burned out, or have poor contact.
--- Check whether the load exceeds the contact rating and whether a freewheeling diode is connected in parallel with inductive loads; overloading can cause contact burnout or sticking.
--- Check whether the relay's power supply and control circuits are functioning normally, and whether the coil is damaged.

Repair and Emergency Measures
--- Incorrect parameter settings: Reset the control points, hysteresis values, and control mode; the hysteresis value should be no less than 0.5% of the measurement range.
--- Pressure fluctuations: Install dampers or buffer pipes, and increase the filtering coefficient and hysteresis value; install a buffer tank at locations prone to severe water hammer.
--- Damaged contacts: Temporarily replace with a spare relay from another channel; if both channels are damaged, replace the instrument or use an external intermediate relay to implement control.
--- Emergency response: In the event of a failure at a critical interlock point, immediately switch control to manual mode, assign a dedicated person to monitor the site, and perform repairs after shutting down the system.

5. Problem 5: Signal Fluctuations, Jitter, Communication Disconnections, Interference, and Distortion

Symptoms
The pressure display fluctuates erratically, values exhibit jitter, the 4–20 mA signal shows significant fluctuations, and RS-485 communication frequently disconnects or experiences data packet loss.

Step-by-Step Troubleshooting
1. **Step 1: Wiring and Grounding Check**
--- Check whether the signal cable is routed in the same conduit or cable tray as power cables, and whether the spacing is ≥300 mm; ensure they are routed separately and kept away from high-power motors, variable frequency drives, and transformers.
--- Check whether the shield is grounded at both ends; if so, change it to single-point grounding on the control room side, with the field end left floating; check whether the shield is damaged and whether the grounding is reliable.
--- Check whether the RS485 bus topology is daisy-chain; verify that 120Ω terminating resistors are connected at both ends, that the A and B wires are not reversed, and that there are no address conflicts.

2. **Step 2: Power Supply and Interference Troubleshooting**
--- Measure the power supply voltage ripple; install a power filter if the ripple is excessive; check whether the power supply shares a circuit with high-power equipment.
--- Check whether the protective grounding of the instrument housing is reliable, with grounding resistance ≤ 4 Ω; check for ground loops and disconnect any unnecessary grounding points.

3. **Step 3: Process and Equipment Inspection**
--- Check the pressure tubing for pulsation, cavitation, or water hammer; if the pressure itself fluctuates, this is a normal process phenomenon, and installing a dampener will resolve the issue.
--- Check whether the sensor is loose or has poor internal wiring contact; inspect the circuit board for cold solder joints or corrosion.

Repair and Emergency Measures
--- Wiring and Grounding Issues: Rewire, ensure proper grounding, and install shielded cable trays; temporarily use a 4–20 mA analog signal as a substitute in case of RS485 failure.
--- Electromagnetic Interference: Install power filters and signal isolators; replace shielded cables; install EMC filters on the variable frequency drive side.
--- Process Fluctuations: Install dampers and buffer pipes; adjust the instrument's filtering coefficient to prevent false alarms.

6. Failure 6: Faults in Explosion-Proof Structures and Seals
Symptoms
Interface leaks, corrosion of explosion-proof surfaces, failure of gland seals, abnormally high temperatures in the enclosure, and failure of intrinsic safety circuit explosion protection.

Step-by-Step Troubleshooting
Step 1: Inspection of External Seals and Leaks
Check the process interfaces, glands, and end caps for medium leaks; use soapy water to detect leak points; tighten bolts or replace seals.

Check the flameproof surfaces for rust, scratches, or foreign matter, and verify that all flameproof surface bolts are fully tightened and torqued to specification.
Check that the cable outer diameter matches the cable gland, and inspect the sealing rings for aging or damage; ensure any unused cable glands are sealed with explosion-proof plugs.

Step 2: Temperature and Explosion-Proof Inspection
Measure the surface temperature of the enclosure to confirm it does not exceed the limits for the explosion-proof temperature class (85°C for T6); if the temperature is too high, investigate for overload, excessive ambient temperature, or blocked heat dissipation.

Check for any actions that compromise the explosion-proof structure, such as unauthorized opening of the cover, modification of the enclosure, enlargement of openings, or replacement with non-original parts.
For intrinsically safe types, verify that the safety barrier parameters match specifications, check for any cross-connection between intrinsically safe and non-intrinsically safe circuits, and ensure no additional power sources are connected.

Step 3: Repair of Explosion-Proof Structure
Corrosion on explosion-proof surfaces: Gently sand with fine sandpaper, clean the area, and apply specialized anti-rust grease for explosion-proof applications; replace the enclosure if there is deep corrosion or through-penetrating scratches that cannot be repaired.

Seal failure: Replace with original manufacturer's seals and gland nuts of the same specifications; it is strictly prohibited to substitute standard seals for explosion-proof seals.

Repairs and Emergency Measures
Minor Leaks or Aging Seals: After powering down and depressurizing, replace the seals, retighten the bolts, and confirm there are no leaks before resuming operation.
Severe Damage to Flameproof Surfaces or Compromised Explosion-Proof Structure: Immediately cease operation and replace with a qualified explosion-proof instrument; under no circumstances should the instrument be operated while defective.
Intrinsically Safe Circuit Failure: Immediately cut off power, inspect the safety barrier, cables, and wiring, and restore the integrity of the intrinsically safe circuit. The instrument may only be put back into service after passing an explosion-proof inspection.

7. Problem 7: Garbled Display, Unresponsive Keys, Lost Parameters

Symptoms
The display shows distortion, garbled characters, or missing segments; key presses do not register; parameter settings cannot be saved; parameters are lost after a power outage.

Step-by-Step Troubleshooting

1. **Step 1: Power Supply and Environmental Check**
--- Check if the supply voltage is stable and whether there are frequent power outages or voltage fluctuations; install a voltage regulator if power supply ripple is high.
--- Check if the ambient temperature is too low or too high. In low temperatures, the LCD display may respond slowly or show distortion, which is normal; the display will return to normal once the temperature recovers.
--- Check whether the buttons are stuck due to dust or grease; wipe the gaps between the buttons with anhydrous alcohol.

2. **Step 2: Parameter and Reset Check**
--- Reset the meter to factory settings and reconfigure the parameters; confirm that the parameters have been saved before exiting the menu.
--- Check whether the password lock is enabled, preventing button operation; enter the correct password to unlock.

3. **Step 3: Hardware Inspection**
--- Open the cover in the safety area to check if the display and keypad flex cables are loose; reinsert them. Replace the display module or keypad if damaged.
--- Check whether the memory chip or circuit board is damaged; if damaged, return the instrument to the factory for repair.

Troubleshooting and Emergency Measures
--- Stuck buttons or dust: Clean the buttons to restore operation; screen distortion due to low temperature: The display will recover automatically once the temperature stabilizes.
--- Lost parameters: Reset the parameters and back up important settings; if parameters are frequently lost, replace the instrument or return it to the factory for repair.

III. Emergency Response and Temporary Workarounds

1. General Principles for On-Site Emergency Response
1. **Safety First**: Upon the occurrence of a malfunction, first confirm whether there are any safety risks (overpressure, leaks, or explosion risks); immediately activate the corresponding safety interlocks; perform an emergency shutdown if necessary; and strictly prohibit risky operation.

2. **Safety First, Production Second**: In the event of a failure at a critical safety interlock point, prioritize switching to manual control or a backup circuit, assign a dedicated person to monitor the situation, and strictly prohibit bypassing safety interlocks.

3. **Live-line maintenance is strictly prohibited in explosion-proof areas**: All operations involving opening covers, wiring, or repairs must be performed in a safe area after power has been shut off and pressure relieved; if on-site handling is required, a work permit must be obtained, and gas concentrations at the site must be confirmed to be within acceptable limits.

4. **Fault Isolation**: For faults that cannot be repaired immediately, disconnect the instrument power supply, close the pressure-taking valves, isolate the faulty equipment, post warning signs, and arrange for subsequent maintenance.

2. Emergency Alternatives for Typical Scenarios

Failure Scenarios	Contingency Plans	Applicable Conditions	Risk Warnings
Analog output failure	Replace with a spare instrument	Equipped with communication capabilities; non-safety-critical locations	Monitoring is lost during communication failures; increase the frequency of on-site inspections.
One relay failure	Switch to another spare relay, or use an external intermediate relay to implement control	The other relay is functioning normally; load is properly matched	Do not force the system to operate if both channels are damaged.
Display module failure	Monitor pressure remotely via PLC/DCS without affecting control functions	Control circuit is functioning normally; remote monitoring is available	Do not adjust on-site parameters if the display is not functioning.
Slight sensor drift	Perform on-site zero calibration and temporarily adjust alarm thresholds	Deviations are within acceptable limits; non-precision control	Arrange for formal calibration as soon as possible.
Intrinsically safe barrier failure	Replace with a spare safety barrier of the same model, or temporarily switch to a spare explosion-proof circuit	A backup safety barrier is available; circuit parameters are properly matched	It is strictly prohibited to operate intrinsically safe equipment without a safety barrier.
Instrument housing failure	Replace with a spare instrument of the same specifications, or temporarily substitute with a combination of a pressure switch and a pressure gauge	Backup equipment is available; not intended for long-term operation	The temporary workaround has low accuracy and should be used only in emergencies.

3. Conditions Triggering an Emergency Shutdown

In the following situations, the instrument must be shut down immediately, the power supply disconnected, and the pressure-taking valves closed:
--- The instrument housing is cracked, resulting in a significant leak of the medium, posing a risk of explosion or poisoning;
--- The flameproof surfaces are severely damaged, causing the explosion-proof structure to fail and making it impossible to ensure explosion-proof safety;
--- The sensor diaphragm is ruptured, allowing the medium to enter the electrical compartment, posing a risk of short circuits or explosions;
--- Smoke emanating from inside the instrument, a burning smell, or abnormally high temperatures, posing a fire risk;
--- Safety interlocks have failed, preventing overpressure protection, posing a risk of equipment overpressure.

IV. After-Sales Service Request Guidelines

1. Troubleshooting and Prerequisites for Service Requests
(1) On-site Self-Troubleshooting and Verification
Before submitting a service request, you must complete the following troubleshooting steps to rule out issues related to on-site installation, wiring, process procedures, and parameter settings:
1. Verify that the supply voltage is within the rated range, that the wiring is correct, and that there are no loose connections, short circuits, or reversed polarity;
2. Verify that the pressure-taking lines are free of blockages, leaks, liquid accumulation, or air pockets, and that all valves are fully open;
3. Verify that parameter settings are correct, and that the range, units, control points, and communication address are properly configured;
4. Verify that ambient temperature, humidity, vibration, and explosion-proof rating are within the equipment's rated range;
5. Verify that the device has not been opened, modified, or had components replaced without authorization, and that it has not been operated under overpressure, overtemperature, or overload conditions.

(2) Determination of Non-Warranty Failures (Not Covered by Free Warranty)
--- Equipment damage resulting from failure to install, wire, or use the device in accordance with the manual;
--- Damage to sensors or diaphragms caused by overpressure, overtemperature, overload, or incompatible media;
--- Damage resulting from unauthorized opening of the housing, modification, or replacement of non-original parts, or from compromising the explosion-proof structure;
--- Water ingress, moisture exposure, lightning strikes, physical impact, or intentional damage;
--- Failures due to normal wear and tear, aging, or failure to perform maintenance as specified;
--- Lack of a valid proof of purchase, or a product serial number that does not match the factory records.

2. Repair Process
1. **Fault Information Collection**
   --- Record the product model, serial number, measurement range, accuracy, explosion-proof rating, and date of purchase;
   --- Provide a detailed description of the fault symptoms, time of occurrence, on-site operating conditions, and environmental conditions;
   --- Record the troubleshooting steps already taken, test data, and changes in symptoms;
   --- Provide photos of the product nameplate, photos of the fault site, wiring diagrams, and operational data.

2. **Technical Support Request**
   --- Contact the manufacturer's technical support hotline, submit the fault information, and have a technical engineer perform a remote diagnosis;
   --- Follow the engineer's instructions to complete further troubleshooting, parameter adjustments, and on-site testing;
   --- If the issue cannot be resolved remotely, request on-site service or return the unit to the factory for repair.

3. **Factory Repair Process**
   --- Fill out the repair request form, specifying the fault symptoms, product information, and contact information;
   --- Remove the instrument, clean the surface of any media, ensure explosion-proof sealed packaging, and ship it to the manufacturer's repair center;
   --- After inspection, the manufacturer will issue a repair report and quotation; repairs will proceed upon confirmation;
   --- Upon completion of repairs, a calibration report and explosion-proof inspection report will be issued, and the unit will be shipped back to the site.

4. **On-Site Service**
   --- For emergency failures or issues that cannot be resolved on-site, request on-site service from the manufacturer;
   --- Confirm on-site safety conditions and explosion-proof requirements in advance, and cooperate in completing entry procedures and work permits;
   --- After on-site repair, conduct a joint acceptance inspection and sign the service confirmation form.

3. Warranty Coverage and Service Commitment

(1) Standard Warranty
--- For the Anhui Qidian QDL80D series and similar explosion-proof pressure controllers from reputable brands available nationwide, the standard warranty period is **12 months from the date of manufacture**; for some brands, this may be extended to 18–24 months.
--- During the warranty period, free repairs and replacement of parts will be provided for quality issues resulting from product design, raw materials, or manufacturing processes;
--- During the warranty period, free calibration and repairs will be provided for accuracy deviations or functional failures occurring under normal use;
--- For explosion-proof products, the explosion-proof structure and performance will comply with standards throughout the warranty period, and complete explosion-proof certification will be provided.

(2) Post-Warranty Services
--- Paid repair, calibration, and upgrade services are available outside the warranty period; material and service fees will apply;
--- Lifetime technical support, spare parts supply, and calibration services are provided;

--- Value-added services such as explosion-proof certification re-inspection, product upgrades, and system retrofits are provided.

(3) Service Contact Information (Industry Standard)
--- Technical Support Hotline: Weekdays 9:00–17:30; 24-hour response for emergency malfunctions;
--- Email Support: Provide a description of the malfunction, photos, and data; response within 24 hours;
--- On-site Service: Generally arrive within 48 hours domestically; within 72 hours in remote areas;
--- For Anhui Qidian products, service requests can be submitted through official channels or authorized dealers; please retain your proof of purchase and the product nameplate.

4. Important Notes for Service Requests
1. Do not disassemble or repair explosion-proof instruments on your own; doing so will invalidate the explosion-proof certification and void the warranty;
2. When returning the instrument for repair, ensure the medium is completely removed and the package is securely sealed to prevent leakage or corrosion during transport;
3. After repair, the instrument must undergo re-inspection and recalibration for explosion-proof compliance; it may only be used in hazardous areas after passing these tests;
4. For instruments at critical safety points, it is recommended to have them inspected periodically and retain calibration reports to meet safety supervision and metrology requirements.