BSA AC Voltage Transducer

I. Product Definition

The Qidian BSA Series white-cased, three-terminal isolated AC voltage transmitters are high-precision, high-isolation, DIN-rail-mounted AC voltage signal conversion instruments developed by Anhui Qidian Automation specifically for industrial automation applications. They belong to the core product category of electrical transmitters at Anhui Qidian Automation Technology Co., Ltd.

Their core functions are fully defined as follows:

1. Precise Signal Acquisition and Conversion: Real-time acquisition of wide-range 0–1000 V AC voltage signals from industrial sites (supporting standard 40–60 Hz power frequencies and high-frequency scenarios of 50–400 Hz). Through internal circuitry, non-standard, high-level AC voltages are linearly converted into international standard DC analog signals such as 4–20 mA, 0–20 mA, 0–5 V, 0–10 V, 1–5 V, or RS485 digital signals, thereby achieving standardized mapping from high-voltage signals to standard low-voltage signals.
2. Three-way Electrical Isolation Protection: Features complete electrical isolation between input, output, and power supply, with an isolation strength of 2000 V AC/1 min. This thoroughly severs the electrical connection between the high-voltage input circuit, the output control circuit, and the power supply circuit, preventing the transmission of risks such as ground potential differences, surges, and short circuits.
3. Signal Conditioning and Interference Suppression: Features built-in RC filtering, true RMS conversion, and temperature drift compensation circuits. It effectively filters out high-frequency noise and harmonic interference from the field, accurately processes various AC waveforms such as sine waves, square waves, and distorted waves, and ensures stable measurement accuracy under non-ideal operating conditions.
4. Compatibility with Automation Systems: The standard output signal can be directly connected to automation equipment such as PLCs, DCS systems, industrial PCs, display instruments, and data acquisition modules, meeting the real-time voltage monitoring, control, and data transmission requirements of industries including power, chemical, metallurgy, and rail transit.
5. Stable and Reliable Industrial Adaptation: White ABS engineering plastic housing, 35mm standard DIN rail mounting, wide voltage input (DC/AC 85–265V, DC 24V), low power consumption (≤1.5W), operating temperature range of -20°C to +55°C, and compliance with the GB/T 18268.1 (IEC 61326-1) electromagnetic compatibility standard, making it suitable for harsh industrial environments.

II. Operating Principle

The Qidian BSA series AC voltage transmitters employ a closed-loop workflow consisting of "input conditioning → isolated step-down conversion → true RMS conversion → linear calibration → isolated output." A simplified explanation is provided below:

Step 1: Input Signal Preprocessing (Step-Down Conversion + Filtering)

High-voltage AC signals from the field (such as 220 V, 380 V, 600V) is connected to the transmitter's input terminal. It first passes through a high-precision resistive voltage divider network or a miniature voltage transformer (PT), which attenuates the high voltage to a safe low-voltage range of 0–5 V AC at a fixed ratio. Simultaneously, an RC filter circuit removes high-frequency harmonics and noise interference generated by equipment such as motors and inverters, laying the foundation for subsequent precise processing.

Step 2: Three-Port Isolation (Core Safety Mechanism)

The pre-processed signal enters the electromagnetic/optical isolation module, achieving complete electrical isolation between the input, power supply, and output circuits. The three ports are mutually independent with no direct electrical connection. This prevents high voltage from entering the low-voltage control system and damaging equipment, ensuring personnel safety, while also blocking common-mode interference and ground loop interference between different circuits.

Step 3: True RMS Conversion

To address non-sinusoidal waves commonly found in industrial environments (such as inverter outputs and distortion waves caused by equipment start-stop cycles), dedicated RMS chips or MCU-based digital calculations are employed to convert the instantaneous AC voltage value into a DC RMS value equivalent to the thermal effect. This completely resolves the issue of significant errors associated with traditional averaging methods under distorted wave conditions, ensuring measurement accuracy of 0.5% F.S.

Step 4: Linear Scaling and Temperature Drift Calibration

Using an operational amplifier circuit, the RMS signal is linearly mapped to a standard output signal in proportion to the measurement range (e.g., 4 mA corresponds to 0 V input, and 20 mA corresponds to full-scale voltage); At the same time, a built-in temperature compensation circuit automatically offsets errors caused by component temperature drift in the -20°C to +55°C range, with a temperature drift of only 0.02% F.S./°C, ensuring stable accuracy across the entire temperature range.

Step 5: Isolated Signal Output

The calibrated standard signal is output via a secondary isolation circuit. Analog signals (such as 4–20 mA) can be transmitted over long distances (up to kilometers) with strong resistance to interference, while digital signals (RS485) enable data transmission across networks of multiple devices, ultimately ensuring stable transmission to the backend automation system for monitoring and control.

III. Core Value

3.1 Core Value Positioning

As a "safety converter + precision processor + anti-interference barrier" for industrial voltage signals, the core value of the BSA series lies in addressing the three major pain points of safety, accuracy, and interference in industrial field voltage monitoring. It enables the safe acquisition, precise conversion, and stable transmission of high-voltage signals, providing reliable voltage data support for automation systems.

3.2 Key Customer Challenges Addressed

3.2.1 High-Voltage Safety Risks

Addresses safety hazards associated with directly connecting on-site high-voltage AC (up to 1000V AC) to control systems, which can lead to equipment burnout, electric shock, and short-circuit explosions. Three-terminal isolation completely blocks high-voltage conduction, achieving physical isolation between high-voltage and low-voltage circuits.

Prevents cascading damage caused by equipment failures or surge impacts, protects expensive control equipment such as PLCs and DCS systems, and reduces equipment maintenance and replacement costs.

3.2.2 Signal Interference and Accuracy Distortion Issues

Addresses issues such as voltage measurement drift, distortion, and high error rates caused by harmonics, electromagnetic interference, and ground loops generated by industrial equipment such as motors, variable frequency drives, and welding machines. A triple safeguard of filtering + isolation + true RMS conversion ensures stable accuracy of 0.5% F.S.

3.2.3 Addresses the pain point of measurement inaccuracies in traditional transmitters under non-sinusoidal and distorted waveforms, adapting to various complex waveform conditions.

Signal Mismatch and Transmission Challenges

Resolves issues with non-standardized on-site voltage signals that cannot be directly integrated into automation systems by uniformly converting them into universal standard signals such as 4-20mA, 0-10V, and RS485, enabling seamless integration with various industrial control devices.

Resolves issues of signal attenuation and interference during long-distance voltage transmission. The 4-20mA current signal offers strong anti-interference capabilities, enabling stable transmission over distances of up to several kilometers without the need for additional signal amplification equipment.

3.2.4 Installation and Maintenance Convenience

Compact white housing + 35mm DIN rail mounting: small footprint, simple wiring, and quick installation. No complex construction required; fits into the compact space of control cabinets.

Wide-range power supply, low power consumption, and high stability ensure stable and reliable long-term operation without the need for debugging or maintenance, thereby reducing operational and maintenance workloads.

3.3 Key Benefits for Customers

Safety Benefits: Completely eliminates high-voltage safety incidents, ensuring the safety of personnel and equipment, and complying with industrial safety production standards.

Accuracy Benefits: Precise and reliable voltage data provides accurate basis for system control, energy consumption monitoring, and fault early warning, preventing control errors and energy waste caused by data inaccuracies.

Stability Benefits: Strong anti-interference capability ensures continuous and stable 24-hour operation of automation systems, reducing the risk of downtime and malfunctions while improving production efficiency.

Cost-effectiveness: Reduces equipment damage, lowers operational and maintenance costs, simplifies system cabling, and enhances the overall cost-effectiveness of the automation system.
Compatibility: Features universal standard signal output, is compatible with various industrial control devices, and is suitable for a wide range of industries including power, chemical, metallurgy, metro, and environmental protection, offering high versatility.

IV. Key Product Specifications

4.1. Basic Electrical Specifications

Input Signal Type: Single-phase AC voltage
Input Voltage Range (Standard): AC 0–100 V, 0–220 V, 0–380 V, 0–500 V, 0–660 V, 0–1000 V (selectable)
Frequency Range: 40–60 Hz (power frequency); supports 50–400 Hz (custom high-frequency)
Measurement Method: True RMS measurement, compatible with sine waves, distorted waves, and non-sine waves
Output Signal Type (Analog): DC 4–20 mA, 0–20 mA, 0–5 V, 0–10 V, 1–5 V (selectable)
Output Signal Type (Digital): RS485 Modbus-RTU protocol (optional)
Output Load Capacity: Current output: ≤500Ω; Voltage output: ≥2kΩ
Accuracy Class: 0.5% FS (standard); 0.2% FS (high-precision customization)
Linearity error: ≤±0.1% FS
Repeatability error: ≤±0.1% FS
Temperature drift: ≤±0.02% FS/°C
Response time: ≤300 ms (standard); ≤100 ms (fast-response custom)
Ripple / Noise: ≤10 mVpp (voltage output); ≤10 μApp (current output)

4.2 Isolation Performance Parameters

Isolation Structure: Three-terminal full isolation: Input circuit ↔ Output circuit ↔ Power supply circuit; all three are completely electrically isolated
Isolation Withstand Voltage: Between input / output / power supply: AC 2000V/1min, leakage current ≤1mA
Insulation Resistance: ≥100MΩ (tested at DC 500V)
Common-Mode Rejection Ratio (CMRR): ≥100 dB (50/60 Hz)
Differential-Mode Rejection Ratio (DMRR): ≥80 dB (50/60 Hz)
Surge Immunity: Complies with IEC 61000-4-5, ±2 kV common-mode, ±1 kV differential-mode
Electrostatic Discharge Immunity: Contact discharge ±6 kV, air discharge ±8 kV (complies with IEC 61000-4-2)

4.3 Power Supply & Power Consumption Parameters

Power Supply (Standard): DC 24V (Typical: DC 18–30V)
Wide-Voltage Power Supply (Optional): AC/DC 85–265V (Universal AC/DC Power Supply)
Power Supply Ripple Rejection: ≥60dB
Full-Load Power Consumption: ≤1.5W (when powered by DC 24V, operating at full range)
Power Distribution Output: No built-in power distribution output; custom models are available if power distribution is required
Reverse Polarity Protection: Built-in reverse polarity protection circuit; device remains undamaged if power supply polarity is reversed
Overvoltage Protection: Built-in overvoltage protection on the power supply side; withstands up to DC 35V/AC 280V

4.4 Environmental Specifications

Operating Temperature Range: -20°C to +55°C (standard industrial grade); -40°C to +70°C (wide-temperature custom)
Storage Temperature Range: -40°C to +85°C
Operating Humidity Range: 10%–90% RH (non-condensing)
Protection Rating: IP20 (for indoor control cabinet installation)
Explosion-Proof Rating: Intrinsically Safe Exia II CT4 (customizable; compatible with safety barrier models such as Zener-type or isolating-type safety barriers; specific models must be configured according to explosion-proof zone requirements)
Electromagnetic Compatibility Standards: Complies with GB/T 18268.1 (IEC 61326-1) Industrial Environment EMC Standard
Vibration / Shock Resistance: Complies with GB/T 2423.10/GB/T 2423.5 standards; vibration 10–150 Hz, acceleration 1g

4.5. Physical Parameters

Mounting Method: Standard 35mm DIN rail mounting (compliant with EN 50022)
Dimensions (Standard Model): L × W × H: 100mm × 22.5mm × 115mm (standard 1-module width)
Housing Material: White ABS engineering plastic, flame retardant rating V-0 (UL94 standard)
Weight: Approx. 120g (single unit, excluding accessories)
Terminal Specifications: Plug-in terminals, compatible with wire sizes 0.5–2.5mm², wiring torque 0.5–0.8 N·m
Indicator Light Definitions: - PWR Power Indicator: Green, steady light indicates normal power supply; off indicates no power or power supply failure - ALM Alarm Indicator: Red; steady or flashing indicates input out-of-range, output failure, or communication error
Enclosure Protection Details: Terminal anti-disengagement latch design prevents wiring loosening due to on-site vibration; sealed enclosure structure provides dust and moisture protection, suitable for long-term operation inside control cabinets

V. Application-Based Selection Guide

5.1 Key Selection Criteria

1. Q: What signal specifications should be considered first?
A: First, determine the input AC voltage range (AC 0–220 V/380 V/500 V/660 V/1000 V) and the output signal type (4–20 mA, 0–10 V, RS485, etc.).
2. Q: How should the number of channels be selected?
A: For standard monitoring, choose 1 input and 1 output; if simultaneous connection to a PLC and a display meter or dual-system data acquisition is required, choose 1 input and 2 outputs.
3. Q: How should the power supply be matched to the field conditions?
A: For standard control cabinet power supplies, select 24 V DC; for complex field power supplies without stable DC, select the AC/DC 85–265 V wide-voltage model.
4. Q: How should the isolation rating be selected for safety?
A: For general industrial environments, select 2000 V AC three-terminal isolation; for high-voltage cabinets, high-interference environments, or power applications, we recommend reinforced 3000 V isolation.
5. Q: How should I select a model if explosion-proof requirements are needed?
A: In hazardous areas such as chemical and oil & gas facilities, you must select the intrinsically safe explosion-proof type Exia II CT4, along with the corresponding safety barrier; general-purpose models cannot be used.
6. Q: Does the installation environment affect model selection?
A: For standard indoor cabinets, select the conventional IP20 model; for high-temperature, low-temperature, or high-vibration conditions, choose wide-temperature or vibration-resistant reinforced models.

5.2. Selection for Industry Applications

1. Q: How should I select a BSA AC voltage transmitter for the chemical industry?
A: We recommend an intrinsically safe model with 1 input and 1 output, featuring 4–20 mA or RS485 output, to meet explosion-proof requirements and provide strong resistance to interference.
2. Q: How should one select a model for power system monitoring?
A: We recommend a model with wide-range power supply and high isolation (3000V), featuring 1 input and 1 output, suitable for high-voltage environments, ground loop interference, and complex power supply conditions.
3. Q: How should one select a model for metallurgy and steel mill sites?
A: We recommend the enhanced anti-interference model, featuring 1 input and 2 outputs (dual analog outputs), capable of simultaneously connecting to PLCs and DCS systems to withstand strong electromagnetic and harmonic interference.
4. Q: How should I select a model for pharmaceutical and cleanroom applications?
A: We recommend the standard high-precision model, with 1 input and 1 output, and 4-20mA/1-5V output, to meet precise process monitoring requirements (no explosion-proof certification required).
5. Q: How should I select a model for smart manufacturing and equipment maintenance scenarios?
A: We recommend the model with RS485 communication, featuring 1 input and 1 output. It supports IoT data collection and remote monitoring, making it suitable for automated production lines.
6. Q: How should I select a model for rail transit and vehicle-mounted applications?

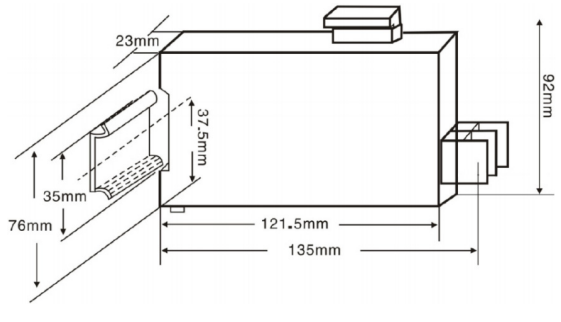
A: We recommend the wide-temperature, vibration-resistant model, featuring 1 input and 1 output. It is designed to withstand wide temperature ranges, power supply fluctuations, and vehicle vibrations.

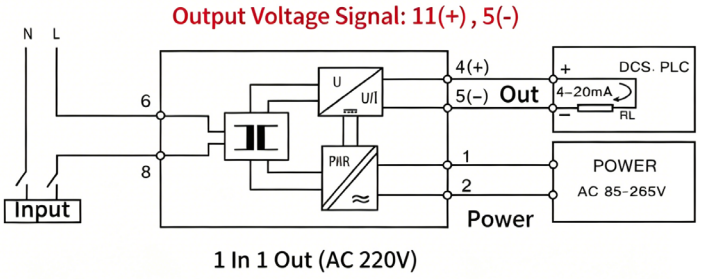
5.3 Common Selection Pitfalls & Guidelines for Avoiding Them
Pitfall 1: Ignoring isolation rating and focusing solely on measurement accuracy
Risk: On-site ground potential differences and surge impacts can burn out PLCs/DCS systems, causing cascading equipment failures
Correct Approach: Prioritize assessing on-site interference intensity. In high-interference environments, select models with three-terminal full isolation ≥2000 V AC. For power or high-voltage applications, upgrade to 3000 V AC isolation
Misconception 2: Selecting the Wrong Signal Range, Leading to Overrange Conditions or Wasted Accuracy
Risk: Selecting a range that is too small causes frequent alarms and data distortion; selecting a range that is too large results in insufficient measurement accuracy in the low-voltage range
Correct Approach: Select a range based on 1.2 to 1.5 times the maximum operating voltage at the site; for example, for AC 380V equipment, a 0–500V range is recommended
Misconception 3: Neglecting load matching, resulting in distorted output signals
Risk: Connecting current output to a high load causes excessive voltage drop, causing the signal to exceed the standard range; connecting voltage output to a low load results in insufficient load
Correct Approach: Verify the input impedance of downstream equipment; current output load ≤ 500Ω, voltage output load ≥ 2kΩ; if outside this range, add a signal repeater
Misconception 4: Selecting general-purpose models for explosion-proof environments, leading to compliance risks
Risk: Using general-purpose models in chemical/oil and gas explosion-proof zones poses safety hazards and may fail safety inspections
Correct Approach: In hazardous areas, intrinsically safe models with explosion-proof certification must be selected, along with safety barriers of the corresponding rating. Ensure the certification level matches the zone requirements
Misconception 5: Confusing channel count requirements, resulting in wasted or insufficient functionality
Risk: Selecting a 1-in/1-out model when multiple systems need to be connected simultaneously prevents concurrent data transmission; selecting a 1-in/2-out model when no multi-system connectivity is required results in wasted costs
Correct Approach: Determine the number of backend devices and signal requirements; choose 1-in/1-out for single-system applications, and 1-in/2-out for simultaneous data collection from two systems

5.4 Customization Recommendations (Solutions for Non-Standard Operating Conditions)
To meet the needs of special applications, the Qidian BSA series supports the following customization services:
1. Customization of Special Signals and Ranges
Non-standard input ranges: such as AC 0–150 V, 0–750 V, 0–1200 V, and other non-standard voltage ranges
Special frequency signals: such as AC voltage measurement at 50–4000 Hz for medium-frequency furnaces and high-frequency power supplies
Non-standard output signals: such as 0–1 mA, 0–24 mA, and other special current/voltage output formats
2. Customization for Non-Standard Operating Conditions
Extended Temperature Range: -40°C to +85°C ultra-wide operating temperature range, suitable for outdoor, low-temperature cold storage, and high-temperature furnace/kiln environments
High Protection Customization: IP40/IP54 protection ratings, suitable for dusty and humid control cabinet environments
Vibration-Resistant Enhanced Version: Reinforced terminal and housing structures, suitable for high-vibration environments such as metallurgy and mining
3. Multi-Channel and Integrated Function Customization
Multi-Channel Modules: 1-input/2-output and 1-input/3-output configurations, enabling simultaneous transmission of the same signal to multiple systems
Integrated Function Customization: Built-in alarm relay output, RS485 Modbus multi-address allocation, and multi-device cascading functionality
4. Industry-Specific Customization
Power Industry: Supports harmonic suppression and wide-band measurement, compatible with high-voltage busbars and inverter output waveforms
Explosion-Proof Industry: Custom intrinsically safe certified models with safety barrier parameter matching; provides complete explosion-proof system solutions
Rail Transit: Custom vehicle-grade models with EMC and vibration resistance, meeting the requirements of the EN 50155 standard

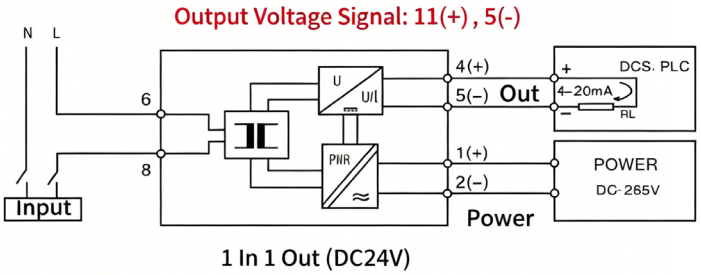
VI: Installation and Commissioning Specifications
6.1. Pre-installation Preparation
1. Check Accessories
Transmitter unit (white housing, BSA series)
Plug-in terminal blocks
Certificate of Conformity, User Manual
DIN rail clips (pre-installed)
2. Environmental Check
Installation Location: Inside a control cabinet, away from direct sunlight, water exposure, and excessive dust or oil contamination
Ambient Temperature: -20°C to +55°C
Keep away from strong interference sources such as variable frequency drives, contactors, and high-voltage cables
Ensure the cabinet is well-ventilated and free of condensation
3. Tool List
Flathead / Phillips screwdrivers
Wire strippers, crimping pliers
Multimeter (voltage/current range)
Insulation tape, cable ties
Oscilloscope/signal generator (optional, for high-precision calibration)
4. Safety Precautions
Never connect or disconnect wires while the unit is energized.
Confirm that the high-voltage input is completely de-energized, test for voltage, and discharge the circuit before proceeding.
For three-terminal isolated models, never ground the input, output, and power supply together.
In hazardous areas, ensure that the explosion-proof safety barrier is correctly connected before proceeding.

6.2 Standard Installation Procedure
1. Mounting on DIN Rail
Install using a standard 35mm DIN rail.
Align the bottom latches of the transmitter with the top of the rail, then press down to secure.
When installing multiple units side-by-side in the same cabinet, it is recommended to leave a spacing of ≥15mm to facilitate heat dissipation.
2. Wiring Specifications (Terminal Identification)
Typical terminal definitions for the BSA series:
Power Terminal: DC 24V± / AC 220V input
Input Terminal: AC Voltage input
Output Terminal: 4–20 mA / 0–10 V signal output
Wiring Sequence:
Connect the power ground / negative terminal first
Then connect the input signal
Finally, connect the output signal
Apply power only after all connections have been verified
3. Grounding Requirements
It is not recommended to ground the housing; keep it floating to enhance the three-terminal isolation effect
Single-end grounding of shielded cables: Ground only on the control cabinet side; leave the sensor/field side floating
Never short-circuit the input ground, output ground, and power ground; doing so will compromise the isolation function
6.3 Wiring Diagram

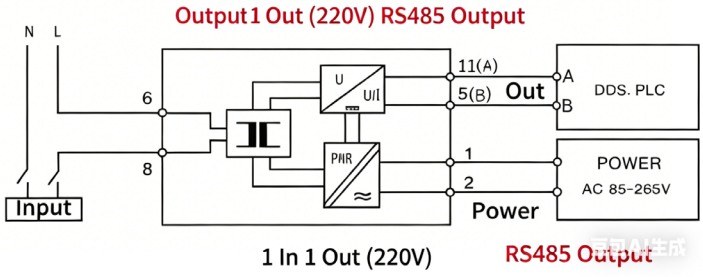




1 In 1 Out (AC 220V)



1 In 1 Out (DC24V)



1 In 1 Out (220V) RS485 Output

1. Standard 1-Input, 1-Output Analog Wiring
Power Supply:
V+ → DC 24V+
GND → DC 24V-
Input (AC Voltage):
IN-L → AC Live Wire (to be measured)
IN-N → AC Neutral Wire (to be measured)
Output (4-20mA):
OUT+ → PLC / Instrument AI+
OUT- → PLC / Instrument AI-
2. RS485 Communication Wiring
A → 485A
B → 485B
Shield grounded at one end
3. Shielding Wire Handling
Connect the shielding mesh only to the control cabinet grounding busbar
At the field end, cut off the shielding mesh and wrap it with insulation to prevent ground loops
4. Correct vs. Incorrect Comparison
☒ Correct:
Separate wiring for high- and low-voltage circuits
Shield grounded at one end
Input and output power lines completely separated
☒ Incorrect:
Input and output sharing the same neutral wire
Shield grounded at both ends
Runs parallel with power cables in the same cable tray
Plugging or unplugging terminals while energized

6.4 Power-On Debugging Procedure
1. No-Load Test
Connect the power supply and verify that the green PWR indicator remains lit.
With no input, the output should be:
4–20 mA: approximately 4 mA
0–10 V: approximately 0 V
If the indicator does not light up or an alarm sounds, immediately disconnect the power supply and check the wiring.
2. Signal Calibration
Apply a standard AC voltage (e.g., 220 V AC)
Measure the output signal with a multimeter
Compare the value to the converted range to determine if it is normal
Example:
0–500 V AC → 4–20 mA
When the input is 220 V
An output of ≈ 11.04 mA is normal
3. Indicator Light Status
PWR steady green: Power supply normal
PWR off: Power not connected / reversed / fuse blown
ALM Red On: Input out of range / Output overload / Internal fault
Flashing: Communication error (RS485 models)
4. Calibration Method
This product is an industrial, non-calibration-required model and is factory-calibrated.
If significant deviation occurs after prolonged use, return the unit for calibration.
Do not open the housing or adjust the potentiometers on-site.

6.5 Installation Precautions
Never exceed the rated input voltage; never exceed 1000 V AC.
Never connect to an incorrect voltage source: Do not connect the 24 V DC model to 220 V AC.
Never short-circuit any two terminals of the input, output, or power supply, as this will cause the isolation to fail.
Avoid sharing the same cable tray with high-interference equipment such as inverters and starters.
Do not use in open-air environments, areas exposed to rain, high humidity, or flammable/explosive environments without explosion-proof measures.
Do not install directly in environments with highly corrosive gases or large amounts of conductive dust.
Do not connect or disconnect terminal blocks while the unit is powered on.
In explosion-proof zones, do not open the cover or replace internal components.

VII: Recommendations for Daily Use & Maintenance
7.1 Key Points for Daily Inspections (Quick Troubleshooting)
1. Observe Indicator Light Status
PWR Power Indicator (Green): Steady light indicates normal power supply; if off or flashing, check the power connections, verify that the voltage meets specifications (DC 24V/AC 85–265V), and ensure the power terminals are secure.
ALM Alarm Indicator (Red): A steady light or flashing indicates an abnormal condition; troubleshoot as follows:
Input voltage out of range (exceeds the transmitter's rated input range)
Output load exceeds upper limit (current output load > 500Ω, voltage output load < 2kΩ)
Internal circuit failure (return to factory for repair)
Communication Indicator (RS485 Models): Flashing indicates normal data transmission; if not flashing, check the A/B wire sequence and terminating resistor settings.
2. Signal Stability Monitoring
Use a multimeter to periodically measure the output signal (4–20 mA/0–10 V) and compare it with the actual voltage conversion value at the site to determine if there is any drift or fluctuation.
Observe the data curves in the PLC/DCS backend. If periodic fluctuations occur, investigate whether they are caused by electromagnetic interference from equipment such as variable frequency drives or motors.
If the signal is intermittently lost, check whether the terminal blocks are oxidized or loose, and verify that the shielded cable is properly grounded.
3. Environmental Temperature and Humidity Monitoring
The temperature inside the control cabinet must be maintained between -20°C and +55°C. If the temperature exceeds 55°C, check whether the cooling fans and cabinet ventilation are functioning properly to prevent high temperatures from accelerating component aging.
Humidity should be maintained between 10% and 90% RH (non-condensing). If condensation occurs, inspect the cabinet's dehumidification system to prevent moisture from corroding circuit boards.
Regularly inspect the transmitter housing for dust or oil buildup and ensure that ventilation openings remain unobstructed.

7.2. Regular Maintenance Schedule (Performed on a Scheduled Basis)
1. Cleaning Frequency and Methods
Daily (Once a month): Use a dry brush or compressed air to remove dust from the transmitter housing and terminal blocks. Do not rinse directly with water or cleaning agents to prevent liquid from seeping into the terminals.
Quarterly (once every 3 months): Check whether the ventilation holes on the housing are blocked. Use a soft-bristled brush to remove dust and ensure proper heat dissipation.
Annually (once a year): Wipe the contact surfaces of the terminals with an alcohol-soaked cotton swab to remove oxidation and prevent signal abnormalities caused by poor contact.
2. Wiring Tightness Inspection
Quarterly (once every 3 months): With the power off, check the tightening torque of the power supply, input, and output terminals (standard: 0.5–0.8 N·m). Retighten any loose screws to prevent wiring disconnection caused by on-site vibrations.
Pay special attention to high-voltage input terminals (AC voltage terminals) to avoid safety hazards caused by loose connections and overheating.
Check the shielding wire grounding terminal for looseness or oxidation to ensure reliable single-point grounding.
3. Recommendations for Accuracy Retesting
Normal Operating Conditions (Once a Year): Apply the rated voltage (e.g., AC 220 V) using a standard AC voltage source and measure the output signal error. If the deviation exceeds ±0.5% FS, contact the manufacturer for calibration.
Harsh operating conditions (once every six months): In chemical, metallurgical, dusty, or humid environments, it is recommended to shorten the retest cycle to once every six months to promptly detect temperature drift and component aging issues.
When retesting, disconnect the on-site load and measure under no-load or standard load conditions to avoid load interference with the measurement results.

7.3 Long-Term Maintenance Tips (Extending Equipment Lifespan)
1. Dust and Moisture Protection
Install dust filters and dehumidifiers inside the control cabinet to prevent dust and moisture from entering the transmitter terminals and housing.
In high-humidity environments, place desiccants inside the cabinet or select a custom transmitter with an IP40 protection rating.
Regularly inspect the cabinet door gaskets for signs of aging to prevent outdoor moisture from entering.
2. Anti-Interference Optimization Measures
Route the transmitter's input and output signal cables separately from power cables; avoid running them in parallel within the same cable tray to reduce electromagnetic coupling interference.
Use shielded cables for output signals, grounding the shield only at the control cabinet end while leaving it floating at the field end to prevent ground loops.
In high-interference environments (near variable frequency drives or arc welders), install an EMI filter at the transmitter's power supply input to enhance interference resistance.
Never short-circuit the transmitter's input, output, and power supply grounds, as this will compromise three-terminal isolation and reduce interference resistance.
3. Protection in Extreme Environments
High-temperature environments (>45°C): Install cabinet cooling fans or select a wide-temperature custom model (-40°C to +70°C) transmitter to avoid prolonged operation at high temperatures.
Low-temperature environments (<0°C): Install insulation and heating devices inside the cabinet to prevent condensation and performance degradation of components caused by low temperatures.
High-vibration environments (metallurgy, mining): Select vibration-resistant, reinforced transmitters and install vibration-damping pads on the mounting rails during installation to minimize the impact of vibrations on terminals and circuit boards.
Explosion-proof environments: Do not open the enclosure or replace internal components without authorization. Regularly inspect the integrity of the explosion-proof junction box seals to ensure explosion-proof performance.

VIII: Troubleshooting & Emergency Procedures
8.1. List of Common Faults and Troubleshooting (Q&A Format)
1. Q: Transmitter has no output (no signal at all)
A:
First, verify that the power supply is normal:
DC24V models: Measure the terminal voltage; it should be between 18–30 V DC. Check whether the power supply is connected in reverse or if the terminals are loose.
Wide-voltage models: Verify that the AC/DC 85–265 V power supply is stable. Check the power circuit for tripped circuit breakers or blown fuses.
Check the input circuit: Verify that the measured AC voltage is correctly connected to the transmitter's input terminals. Check whether terminals 6 and 8 are loose or have a poor connection.
Check the output circuit: Verify that the 4–20 mA/0–10 V output wires are not broken, that terminals 4 and 5 are not reversed, and that the downstream PLC or instrument is operating normally.
If all of the above are normal and the PWR indicator is not lit, this indicates internal damage to the transmitter, which must be returned to the factory for repair.
2. Q: Signal drift / large deviation (inaccurate data)
A:
Check range matching: Verify that the transmitter's input range covers the actual on-site voltage. If the range is set too high, accuracy in the low-voltage range will decrease significantly.
Re-measure the input voltage: Use a multimeter to directly measure the on-site voltage and compare it with the transmitter's converted output value to determine whether the issue lies with the transmitter or on-site voltage fluctuations.
Check load matching:
Current output type: The downstream load resistance must be ≤500Ω. If it exceeds this range, the signal will be pulled down.
Voltage output type: The downstream input impedance must be ≥2kΩ. If the impedance is too low, the signal will be pulled off-center.
Troubleshoot environmental interference: Check whether signal cables are routed in the same conduit as power cables, whether shielded cables are properly grounded at one end, and whether there are strong interference sources such as inverters or welders.
If the deviation exceeds 0.5% FS and the above checks reveal no issues, it may be due to component aging. Contact the manufacturer for calibration or replacement.
3. Q: Abnormal indicator lights (PWR/ALM lights are not in the correct state)
A:
Table
Indicator Light Phenomenon Cause of Failure Troubleshooting
PWR light is off: Power not connected / reversed / insufficient supply voltage --Check power connections, voltage, and fuses; verify polarity
PWR LED flashing: Excessive power supply ripple / unstable power supply---Check power supply quality, replace the switching power supply, and move away from strong interference sources
ALM red LED constantly on: Input out of range / output overload / internal fault---Reduce input voltage, check downstream load; if still on, return to factory
ALM light flashing: RS485 communication error (digital model)---Check A/B wire sequence, terminating resistor, communication address, and baud rate
4. Q: Alarm triggered (system indicates transmitter fault)
A:
Check input signal: Check for out-of-range conditions (voltage exceeding the transmitter's rated input upper limit), short circuits, or open circuits.
Check the output signal: Check for open circuits (broken current output wires), short circuits (short-circuited voltage output), or loads outside the specified range.
Check environmental conditions: Check for high temperatures (>55°C), condensation, or strong vibrations that may have triggered the transmitter's protection mechanism.
If the alarm persists, power off and restart the transmitter to see if it recovers; if it still does not recover, it is a hardware failure and must be replaced.
5. Q: Signal interference and distortion (data fluctuations, high ripple)
A:
Check wiring configuration: Ensure that the input, output, and power supply lines are not grounded together, and that the shielding wire is grounded at a single point on the control cabinet side only.
Check cable routing: Ensure signal lines and power cables are laid separately, with a minimum distance of ≥30 cm, and avoid parallel routing.
Check power quality: Ensure power supply ripple is ≤100 mVpp; install an EMI filter if necessary.
Verify isolation integrity: Check whether three-terminal isolation has been compromised due to incorrect wiring (short circuits between input, output, or power lines). If isolation fails, it will introduce significant ground loop interference.

8.2 Classification of Fault Causes and Corresponding Solutions
1. Wiring-Related Faults
Typical Symptoms: No output, reversed signal, indicator light does not illuminate, communication failure
Common Causes:
Power terminals connected in reverse; input/output terminals connected in reverse
Short circuit between input, output, and power ground, compromising

three-terminal isolation
RS485 Models A/B: Reversed wiring, terminal resistor not connected
Solution: Disconnect power, refer to the wiring diagram to recheck the terminals, restore the correct wiring, and ground and route the cables according to specifications.
2. Power Supply Faults
Typical Symptoms: PWR indicator does not light up or flashes, unstable signal, transmitter reboots
Common Causes:
Supply voltage out of range (DC24V model connected to AC220V, insufficient power for wide-voltage models)
Excessive power supply ripple, poor contact, circuit breaker tripping
Insufficient power supply capacity to simultaneously power multiple transmitters
Solution: Replace with a power supply that meets specifications, check for voltage drops in the circuit, and ensure stable power supply.
3. Signal Overload / Out-of-Range Faults
Typical Symptoms: ALM indicator remains lit, output saturation (4-20mA fixed at 20mA, 0-10V fixed at 10V)
Common Causes:
On-site voltage exceeds the upper limit of the transmitter's input range
Downstream load exceeds the transmitter's output capacity (excessive current load, insufficient voltage load)
Remedial Actions: Reduce the input voltage or replace with a transmitter with a higher range; adjust the downstream load to ensure it remains within the rated range.
4. Environmental Interference Faults
Typical Symptoms: Signal fluctuations, high ripple, communication packet loss, accuracy drift
Common Causes:
Excessively close proximity to strong interference sources such as inverters, motors, or welders
Incorrect shielding grounding (grounded at both ends), signal lines routed in the same conduit as power lines
Excessive temperature and humidity inside the cabinet, causing condensation and moisture damage to circuit boards
Resolution: Optimize cabling, ensure proper grounding, and install filters; improve cabinet ventilation and dehumidification; replace with a model with a higher protection rating if necessary.
5. Equipment Damage-Related Failures
Typical Symptoms: All troubleshooting attempts are ineffective; the transmitter shows no response; indicator lights do not illuminate
Common Causes:
Incorrect connection to high-voltage power supply (e.g., connecting a DC24V model to AC220V), resulting in internal burnout
Input overvoltage causing breakdown of the isolation circuit
Long-term exposure to high-temperature and humid environments leading to component aging and failure
Remedial Actions: Such failures cannot be repaired on-site; contact the manufacturer for factory repair or equipment replacement.