Potentiometer Converter

I. Product Definition

The Qidian WS90201 Green-Housed Potentiometer Transmitter (also known as a potentiometer signal isolation transmitter or displacement signal conditioner) is a dedicated isolation and conversion module for potentiometer and sliding resistor signals, developed by Anhui Qidian Automation specifically for industrial automation applications. Its core function is to perform high-precision acquisition, conditioning, electrical isolation, and standard signal conversion of the resistance variation signals (0–1 kΩ, 0–5 kΩ, 0–10 kΩ, etc.) output by potentiometers, sliding resistors, and resistive displacement / position sensors (resistance signals ranging from 0-1KΩ, 0-5KΩ, 0-10KΩ, etc.). It simultaneously provides a stable excitation power supply for the front-end potentiometer sensors, ultimately outputting industrial-standard analog signals to meet the signal acquisition requirements of various industrial control devices such as PLCs, DCS systems, variable frequency drives, and display instruments.

Detailed Analysis of Core Functions:

1. Precise Signal Acquisition: Features a built-in high-precision sampling circuit compatible with 3-wire and 2-wire potentiometers, sliding resistors, and displacement sensors. Supports mainstream resistance ranges such as 0–1 kΩ, 0–5 kΩ, and 0–10 kΩ, with an acquisition accuracy of up to 0.2%, ensuring distortion-free capture of raw position/displacement signals.
2. Excitation Power Supply: Features a built-in stable constant-current/constant-voltage sensor excitation power supply (typical constant current: 200μA). No external power supply is required; it directly drives potentiometer sensors for stable operation and is compatible with various passive resistive sensing devices.
3. Three-Point Electrical Isolation: Achieves complete electrical isolation between the input signal, output signal, and power supply terminals (isolation strength: 1000 VDC for 1 minute; insulation resistance > 100 MΩ), thoroughly severing electrical connections between different circuits and blocking the transmission of interference.
4. Standard Signal Conversion: Linearly converts non-linear, interference-prone resistance signals into industrial-standard analog signals. Mainstream output specifications include 4–20 mA current signals and 0–5 V/1–5 V voltage signals, meeting the unified signal acquisition standards of industrial control systems.
5. Signal Conditioning and Interference Suppression: Built-in filtering, voltage regulation, ESD protection, and surge protection circuits filter out electromagnetic interference and noise signals in industrial environments, suppressing common-mode and differential-mode interference to ensure a clean and stable output signal.
6. Industrial-Grade Mounting: Features a standard 35mm DIN rail clip-on structure with European-standard terminal blocks. Its compact design (green ultra-thin housing) ensures easy installation and simple wiring, making it suitable for dense wiring scenarios in various control cabinets.

Multi-Specification Customization: Supports customization of input resistance and output signal specifications, enabling signal distribution modes such as one-to-one or one-to-many, to meet the signal transmission and distribution requirements of different industrial control systems.

II. Working Principle

The Qidian WS90201 Potentiometer Transmitter is based on the principles of resistive voltage division, signal isolation and modulation, and standard signal amplification and output technology. It employs a constant voltage or constant current measurement mode (with constant voltage division being the mainstream approach). The general workflow is as follows:

Step 1: Sensor Excitation and Signal Acquisition

The transmitter first outputs a stable excitation power supply (constant voltage/constant current) to the external potentiometer sensor. A potentiometer is essentially a sliding variable resistor with three terminals (two fixed resistor terminals and a central sliding terminal). When the measured device undergoes displacement or a change in position, the sliding contact moves along the resistive element, altering the resistance ratio between the sliding terminal and the fixed terminals.

The transmitter captures the voltage divider signal output from the sliding terminal via the input circuit (this voltage exhibits a strictly linear relationship with the potentiometer's sliding position and resistance change),Performs the initial conversion of the original physical quantity (displacement/position) into an electrical signal.

Step 2: Signal Isolation and Modulation

The acquired weak voltage-divider signal enters the isolation module, which uses transformer isolation or optocoupler isolation technology to completely electrically isolate the input-side signal from the output-side and power-supply-side. During isolation, the signal undergoes modulation processing (such as high-frequency modulation), and demodulation is performed at the isolation end. This preserves the linear characteristics of the original signal while completely blocking field interference, ground potential differences, surges, and other disturbances from being conducted from the input side to the industrial control system side.

Step 3: Signal Conditioning and Amplification

The demodulated signal enters the conditioning circuit, where it undergoes filtering, voltage stabilization, and error correction to eliminate the effects of noise, temperature drift, and zero drift. It is then processed through a high-precision operational amplifier to linearly amplify and calibrate the weak signal, matching it to the amplitude range of standard analog signals.

Step 4: Standard Signal Output

The conditioned and calibrated signal is ultimately converted into a standard industrial signal of 4–20 mA (current type) or 0–5 V/1–5 V (voltage type), which is output from the terminal block to devices such as PLCs and DCS systems. Simultaneously, the transmitter maintains real-time closed-loop feedback throughout the process, ensuring a 1:1 linear correspondence between the output signal and changes in input resistance, and transmitting position/displacement information without distortion or delay.

Simple Summary: Converts the potentiometer's "resistance changes" into "standard electrical signals" recognizable by industrial control equipment, while isolating interference and ensuring stable transmission.

III. Core Value

1. Core Value Positioning

The Qidian WS90201 serves as a "translator + protector + stabilizer" for potentiometer signals in industrial automation. It addresses the core pain points of resistance signals—namely, inability to directly connect to industrial control systems, susceptibility to interference, short transmission distances, and poor compatibility—to achieve reliable acquisition, safe isolation, standard conversion, and long-distance transmission of displacement/position signals. It acts as the critical bridge connecting resistive sensing devices to industrial control systems.

2. Core Customer Challenges Addressed

2.1 Resolving Signal Incompatibility

Potentiometers output weak resistance or voltage-divider signals that cannot be directly connected to standard industrial control devices such as PLCs and DCS systems (which only recognize standard signals like 4-20mA or 0-10V). The WS90201 "translates" these signals, breaking down the connectivity barriers between sensing devices and control systems.

2.2 Resolving Signal Interference and Distortion Issues

Industrial environments contain strong electromagnetic interference from sources such as motors, variable frequency drives, and high-voltage lines. Weak resistive signals are prone to attenuation, interference, and drift during long-distance transmission, leading to measurement inaccuracies. The product features three-terminal isolation and anti-interference circuitry, which completely blocks the transmission of interference, ensuring high-precision, distortion-free, and stable signal transmission (accuracy: 0.2%, temperature drift <150 ppm/°C).

2.3 Addressing Transmission Distance Limitations

Resistive weak signals suffer severe attenuation beyond 50 meters, whereas standard 4–20 mA current signals can be transmitted stably over 1,000 meters. After conversion by the WS90201, reliable long-distance signal transmission is achieved, meeting the monitoring needs of large industrial sites and dispersed measurement points.

2.4 Addressing System Safety and Grounding Issues

Potential differences exist between different devices and circuits; direct connection can cause circuit short-circuits and equipment damage. Three-terminal isolation eliminates ground loops and protects downstream industrial control equipment, preventing high-voltage intrusion that could burn out PLCs and DCS modules, thereby enhancing system electrical safety.

2.5 Addressing Complex Installation and Adaptation Issues

Green, ultra-slim housing + 35mm DIN rail mounting; no complex brackets required and simple wiring; supports multiple input/output configurations and custom single-input-to-multiple-output setups, enabling quick adaptation to various control cabinets and industrial control systems, thereby reducing selection, installation, and commissioning costs.

2.6 Solving the Problem of Cumbersome Sensor Power Supply

Built-in excitation power supply eliminates the need for a separate power module for the potentiometer, simplifying field wiring, reducing the number of devices, and lowering system complexity.

3. Key Benefits for Customers

--- More Accurate Measurement: High-precision data acquisition + linear conversion + anti-interference design ensure displacement/position measurement errors ≤0.2%, providing reliable data that serves as a precise basis for equipment control and process adjustment.

--- More Stable System: Isolation protection + signal conditioning eliminate interference, short circuits, and crosstalk, ensuring more stable operation of industrial control systems and reducing downtime and malfunctions caused by signal failures.

--- Greater Deployment Flexibility: Long-distance transmission + rail mounting + compatibility with multiple specifications allow for flexible deployment in dispersed, complex, and highly interfered-with industrial environments, suitable for industries such as petroleum, chemicals, metallurgy, power, machinery, and building materials.

--- Better Cost Control: Reduces costs associated with signal conditioning equipment, cabling, and commissioning time; lowers the risk of equipment damage; extends system lifespan; and reduces the overall construction and operational costs of the automation system.

---Simpler Maintenance: Industrial-grade design (operating temperature 0–50°C), no wear-prone components, and no commissioning required—it operates stably as soon as power is applied, with minimal maintenance required.

IV. Key Product Specifications

4.1. Basic Electrical Specifications

Input Signal: 0–1 kΩ, 0–5 kΩ, 0–10 kΩ

Input Impedance: ≥500 Ω

Output Signal: 4–20 mA (current output), 0–5 V/1–5 V (voltage output)

Measurement Accuracy: ±0.2% FS

Temperature Coefficient: ＜ 150 ppm/°C

Response Time: ≤300 ms

Excitation Power Supply: Constant voltage 2.5 V (typical)

4.2 Isolation Performance Parameters

Isolation Method: Three-terminal full isolation (input - output - power supply)

Dielectric Strength: 1000 VDC/1 minute

Insulation Resistance: >100 MΩ (500 VDC)

Common-Mode Rejection Ratio: ≥120 dB

4.3. Power Supply & Power Consumption Parameters

Supply Voltage: 24 VDC ±10%

Full-Load Power Consumption: ≤1.2 W (typically <50 mA)

Power Distribution Output: Built-in sensor excitation power supply

Output Load Capacity: Voltage type ≥10 kΩ; Current type ≤250 Ω (typical)

4.4, Environmental Adaptation Parameters

Operating Temperature and Humidity: 0°C to 50°C, ≤95% RH (non-condensing)

Storage Temperature and Humidity: -20°C to 70°C, ≤95% RH (non-condensing)

Protection Rating: IP20

Explosion-Proof Rating: Non-explosion-proof; safety barriers can be configured for explosion-hazardous environments

Pollution Degree: Class 2 Suitable for contaminated environments such as industrial dust and oil

Altitude: ≤2000m

4.5. Physical Parameters

Mounting Method: Standard 35mm DIN rail (TS-35/7.5)

Dimensions: Approx. 100 × 99 × 12.7 mm (L × W × H)

Weight: Approx. 0.2 kg / unit

Indicator Lights: PWR (Power): Green steady light indicates normal power supply;

Housing Material: Flame-retardant PC/ABS alloy

Protection Details: Fully enclosed housing design, dustproof, drip-proof, and resistant to electromagnetic interference

Key Selection Guidelines

Input/Output Matching: Select the appropriate model based on the potentiometer range (1K/5K/10KΩ) and the control system signal type (4-20mA/0-5V)

Power Supply Confirmation: Ensure the on-site power supply is DC 24V ±10% to prevent voltage fluctuations from affecting device stability.

Environmental Adaptation: In high-temperature, high-humidity, or high-interference environments, select a model with an IP20 or higher protection rating; install shielded cables as needed to enhance interference resistance.

Explosion-Proof Requirements: For use in hazardous locations such as the petroleum or chemical industries, a separate isolated safety barrier compliant with the Ex ia IIC T4 Ga standard must be purchased for use with this device.

V. Application-Specific Selection Guide

5.1. Key Selection Criteria

1. Signal Type

Input Resistance: Must match the range of the potentiometer or displacement sensor exactly. The WS90201 supports three mainstream specifications: 0–1 kΩ, 0–5 kΩ, and 0–10 kΩ. Do not operate outside the specified range (doing so will cause a sharp drop in accuracy and signal distortion).

Output Signal: Select based on the control system interface

4-20mA: Highly recommended! Suitable for long-distance transmission (≥100 meters), high-interference environments, and outdoor/long-cable scenarios (chemical, metallurgy, power industries).

0-5V/1-5V: Suitable for short distances (≤50 meters), cabinet installation, and low-interference environments (smart manufacturing, pharmaceutical workshops).

2. Number of Channels

1 Input, 1 Output (Standard Model WS90201): Single potentiometer signal → single standard output; the preferred choice for 90% of typical applications (lowest cost, simplest wiring).

1 Input, 2 Outputs (Custom Model WS90201-1T2): 1 input → 2 independent isolated outputs, suitable for dual-channel data acquisition in “PLC + display instrument / backup system” configurations (critical points in power generation and chemical plants).

2-Input 2-Output (Custom Model WS90201-2T2): Synchronous conversion of two independent signals, suitable for parallel monitoring of displacement/position across multiple devices (metallurgical rolling mills, smart manufacturing production lines).

3. Power Supply

Standard DC 24V ±10%: Universal industrial power supply, preferred for standard control cabinets and field instrument enclosures (default specification for WS90201).

Non-standard power supply (custom): Supports DC 12V/DC 36V/AC 220V, suitable for legacy systems and environments without 24V power (requires advance customization).

4. Explosion-proof Requirements

General Non-Explosion-Proof Model (WS90201): Standard workshops and environments without flammable or explosive gases/dust (smart manufacturing, general electrical rooms).

Explosion-Proof Solution (WS90201 + Safety Barrier): Chemical, petroleum, and pharmaceutical explosion-proof zones; requires pairing with an Ex ia IIC T4 Ga-rated isolation safety barrier (meets Zone 0/1 intrinsic safety requirements).

5. Installation Environment

Standard industrial environments (0–50°C, no severe corrosion): Select the standard IP20 model for 35mm DIN rail mounting (general applications).

High/low temperatures (-10–60°C), high humidity (≤95% RH), and severe vibration: Select the reinforced WS90201-E model (thickened PCB, vibration-resistant terminals, wide-temperature compensation).

Dust / mild corrosion: Select the sealed reinforced version (reinforced enclosure sealant, gold-plated terminals).

5.2 Industry Applications

Chemical Industry: Reactor displacement, valve opening, and storage tank liquid level monitoring

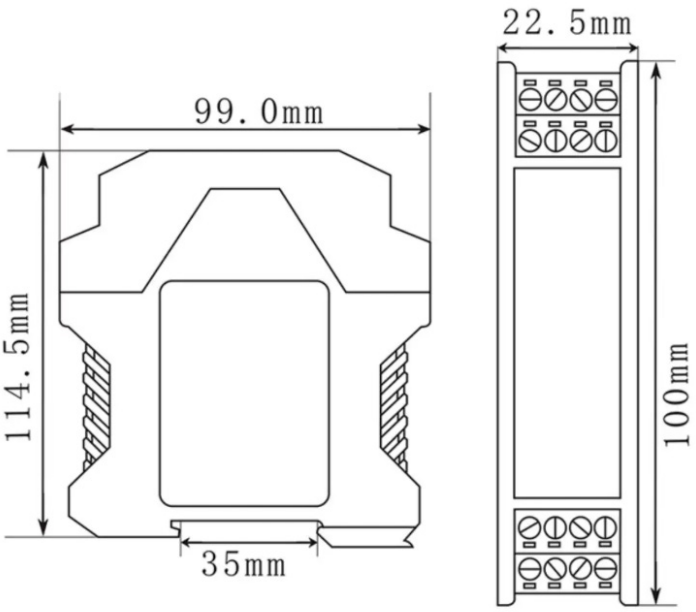
Power Industry: Turbine stroke, gate opening, and transformer tap position monitoring

Metallurgical Industry: Roll gap in rolling mills, blast furnace material

level, and crane position control
Pharmaceutical Industry: Valve positioning in cleanrooms, fermenter liquid level, dryer stroke
Smart Manufacturing: Robot joints, assembly line positioning, injection molding machine stroke
Water Treatment: Screen opening, sludge scraper stroke, valve position

5.3 Common Selection Pitfalls
1. Ignoring Isolation Levels (The Most Critical Mistake)
Pitfall: Selecting “non-isolated” or “two-way isolated” options instead of three-terminal full isolation, assuming “there is no interference at the field site.”
Consequences: Ground potential differences and inverter interference cause signal drift of ±5% to 20%, PLC module burnout, and system malfunctions.
Correct Approach: Three-terminal full isolation (input - output - power supply) is mandatory for all industrial applications; comply with the WS90201 standard for 1000 VDC isolation.
2. Selecting the Wrong Signal Range (Accuracy Killer)
Misconception 1: For a potentiometer with a 0–5 kΩ range, selecting a 0–10 kΩ transmitter → 50% accuracy loss and insufficient resolution.
Misconception 2: Actual range is only 0–3 kΩ, but a 0–5 kΩ transmitter is forced → Signal compression and large control errors.
Correct Approach: Input resistance = sensor range, with a margin of ≤10% reserved.
3. Neglecting Load Matching (Root Cause of Signal Instability)
Misconception: Connecting a 4-20mA output to a ≥500Ω load(e.g., long cables + high-impedance instruments) → Insufficient output current, signal drops off abruptly.
Correct Approach: Current-type loads ≤250Ω (WS90201 standard); voltage-type loads ≥10KΩ.
4. Incorrectly Selecting General-Purpose Models for Explosion-Proof Environments (Safety Violation)
Misconception: Directly installing a general-purpose WS90201 in a chemical explosion-proof zone → Non-compliance with explosion-proof regulations, safety hazards, and failure to pass inspection.
Correct Approach: Explosion-proof zones must use intrinsically safe barriers or select models specifically certified for explosion-proof environments.
5. Blindly Pursuing High Specifications (Cost Waste)
Misconception: Selecting 0.1% accuracy and 3000V isolation for standard operating conditions → Increases costs by 30%+ and results in over-specified performance.
Correct Approach: ±0.2% accuracy and 1000V isolation fully meet requirements for standard operating conditions (WS90201 standard).

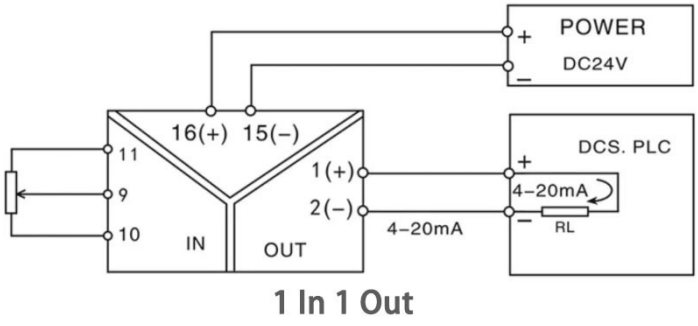
5.4 Customization Recommendations
1. Custom Signal Support
Non-standard resistance: Supports non-standard inputs such as 0–2 kΩ, 0–20 kΩ, and 1–5 kΩ (compatible with older imported potentiometers).
Special outputs: 0–10 V, 0–20 mA, 2–10 V, and RS485-Modbus outputs (compatible with new PLCs and IoT systems).
2. Customization for Non-Standard Operating Conditions
Wide Temperature Range: Operating temperature -40°C to 85°C (suitable for outdoor, cold storage, and high-temperature furnace environments).
High Isolation: 2500 VDC/3000 VAC isolation (for environments with strong electromagnetic fields or near high-voltage cabinets).
Low-Power Type: ≤0.8W (for battery-powered and solar monitoring applications).
3. Multi-Channel Integration Customization
4-Input 4-Output: Centralized conversion of 4 potentiometer signals (for large production lines and dense multi-point monitoring).
Mixed Signals: Integrated potentiometer + temperature/pressure signals within a single module (reduces cabinet equipment and simplifies wiring).
4. Customization Process
Provide: Input resistance, output signal, number of channels, power supply, ambient temperature, and explosion-proof requirements.
Qidian Technology Confirmation: Customized solution, model, parameters, and delivery schedule provided within 3 business days.
Custom Model Designation: WS90201-XX (Input)-XX (Output)-XX (Channels)-E (Reinforced).



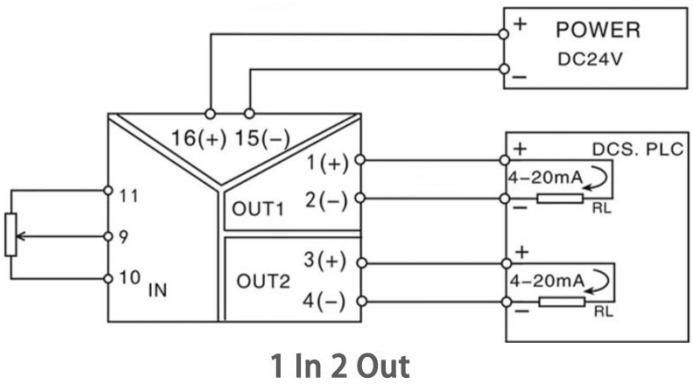
VI: Installation and Commissioning Guidelines
6.1. Pre-installation Preparation
1. Verification of Components
Main Unit: WS90201 Potentiometer Transmitter (green housing) – 1 unit
Certificate of Conformity, User Manual, Factory Calibration Report
Terminal Block (pre-installed at factory)
35mm DIN rail clips (included with the unit)
2. Environmental Check
The installation location must be free from severe vibration and strong corrosive gases.
Keep away from strong interference sources such as inverters, contactors, and high-voltage cables.
Ambient temperature: 0–50°C; humidity ≤95% RH (non-condensing).
The control cabinet must have good ventilation and be free from standing water and heavy dust.
3. Tool List
Flathead / Phillips screwdriver
Wire strippers, crimping pliers
Multimeter (voltage / resistance / current ranges)
24V DC power supply
Shielded cable (recommended: 2×2×0.5–1.0 mm²)
4. Safety Precautions
Never connect or disconnect wires while the unit is energized.
Verify that the power supply is 24 V DC; never connect to 220 V AC or 380 V AC.
In explosion-proof areas, power must be disconnected before work begins, and a safety barrier must be used.
Use a multimeter to verify there is no residual voltage before wiring.
6.2 Standard Installation Steps
1. DIN Rail Mounting
The WS90201 is designed for standard 35mm DIN rail mounting.
Align the bottom latches of the transmitter with the top edge of the rail, then press down to secure.
When installing multiple units side-by-side in the same cabinet, a spacing of ≥10mm is recommended to facilitate heat dissipation.
Mounting orientation: Vertical or horizontal is acceptable; vertical mounting is recommended for easier wiring.
2. Wiring Specifications
Power Cable: Use BV or RV cable with a cross-sectional area of 0.5–1.5 mm², ensuring a secure connection
Input Signal Cable: Use shielded twisted-pair cable to minimize interference
Output Signal Cable: Shielded twisted-pair cable is mandatory for 4–20 mA long-distance transmission
Apply moderate torque when tightening screws to avoid crushing the wire insulation or causing loose connections
3. Grounding Requirements
Single-point shield grounding: It is recommended to ground the shield centrally at the control cabinet side; leave the sensor side floating.
Ground resistance ≤ 4 Ω; use a dedicated grounding busbar; do not mix with power grounding.

The transmitter housing does not require additional grounding; interference resistance is achieved through isolation.

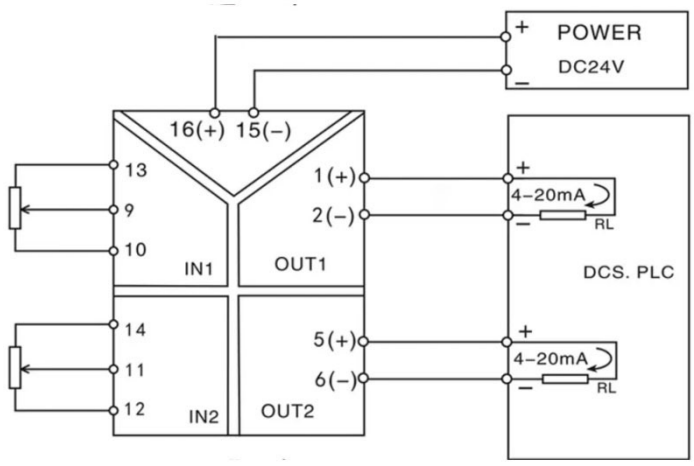
6.3, Wiring Diagram



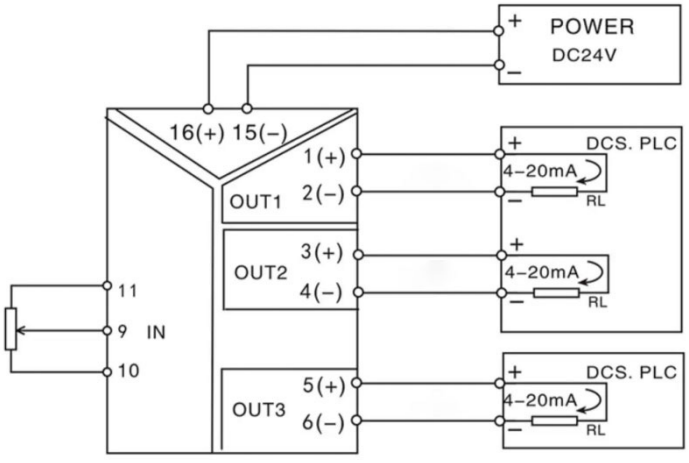
1 In 1 Out



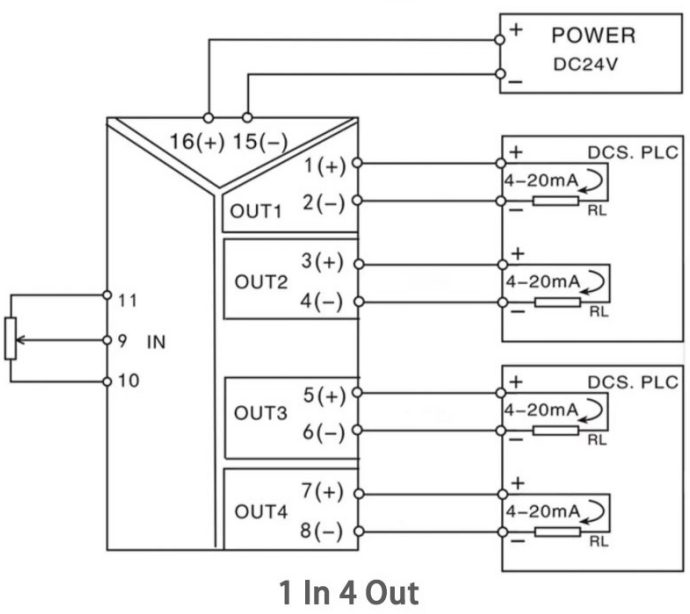
1 In 2 Out



2 In 2 Out



1 In 3 Out



1 In 4 Out

1. Shielded Cable Handling

Shielding mesh: Ground only at the control cabinet end

Leave the shielding layer on the sensor side floating and wrap it with insulation to prevent ground loops

2. Wiring in Explosion-Proof Zones (Safety Barriers)

Connect the safety barrier between the WS90201 and the potentiometer

Route the safety barrier power supply and signal lines strictly in accordance with intrinsically safe standards

Intrinsically safe cables and non-intrinsically safe cables must be routed in separate cable trays

3. Comparison of Common Wiring Errors and Correct Practices

Correct: Shield grounded at one end only; power and signal lines routed separately

Incorrect: Shield grounded at both ends → Causes ground loops and signal drift

Correct: Strictly distinguish between IN+ and IN-; do not reverse connections

Incorrect: Input and output polarity reversed → No output or alarm

6.4 Power-On Debugging Procedure

1. No-Load Test

Connect to a 24V DC power supply

Observe that the green PWR indicator remains lit, indicating normal power supply

No alarms, no overheating, no unusual odors; no abnormalities after 2 minutes of no-load operation

2. Signal Verification

Connect a standard potentiometer or precision resistance box

Input minimum resistance → Output should be close to 4mA (or 0V/1V)

Input maximum resistance → Output should be approximately 20mA (or 5V/5V)

Linearity at intermediate points should be smooth, with no abrupt changes

3. Indicator Status Assessment

PWR green light steady: Power supply normal

PWR light off: Power supply not connected / reversed / fuse blown

No change in output: Possible wiring error or open circuit in potentiometer slider

4. Accuracy Calibration Method

The WS90201 is an industrial, pre-calibrated model and is factory-calibrated:

If there is a slight deviation on-site, check the wiring, grounding, and excitation power supply

For severe deviations, do not disassemble the unit yourself; return it to the factory for calibration

Do not arbitrarily adjust the internal potentiometers, as this will cause linearity failure

6.5 Installation Precautions

1. Overvoltage supply is strictly prohibited

Only DC 24V ±10% is permitted; connecting to AC 220V will immediately burn out the module

2. Do not route signal and power lines in the same conduit

Signal lines must not be run in parallel with power lines (380V/220V)

over long distances in the same conduit
If crossing is unavoidable, ensure a 90° perpendicular crossing
3. Never install the unit in a damp or condensing environment.
In high-humidity, outdoor, or spray environments, the unit must be placed inside a sealed control cabinet.
Condensation can cause short circuits, terminal corrosion, and signal drift.
4. Never apply input resistance values beyond the rated range.
Exceeding the rated resistance range will cause output saturation and loss of accuracy.
5. Never short-circuit the output terminals or force a load.
The load on the 4–20 mA output must not exceed 250 Ω; otherwise, insufficient current will cause control failure.
6. Never install non-explosion-proof models directly in explosion-hazardous areas.
Intrinsically safe barriers must be used; otherwise, safety regulations will not be met.

VII: Recommendations for Daily Use & Maintenance

7.1 Key Points for Daily Inspections (Mandatory for Every Shift / Every Day)
1. Observe Indicator Light Status
PWR Green Light: Must be constantly on. If it is off or flashing, this indicates a power supply abnormality, loose wiring, or an internal module fault.
ALM Red Light: Should be off under normal operating conditions. If it is constantly on or flashing, this indicates: input open circuit, out-of-range, output short circuit, or potentiometer wire break.
Inspection Action: Visually inspect the indicator light status once and record any abnormalities.
2. Signal Stability Monitoring
Observe current and voltage values on the PLC, host computer, or display instrument. There should be no frequent fluctuations, slow drift, or sudden drops to zero.
Key Focus: Pay close attention to whether signals exhibit significant fluctuations during equipment startup/shutdown or while the inverter is operating.
Abnormality Determination:
Drift > ±0.5% FS: Check grounding and interference
For sudden signal changes or zero dropouts, prioritize checking potentiometer cables and terminal blocks
3. Temperature, Humidity, and Environmental Inspection
Touch the enclosure temperature: It should be close to room temperature with no noticeable overheating (normal operating temperature rise ≤10°C)
Check the cabinet for condensation, standing water, excessive dust, or oil contamination
Confirm there are no high-temperature heat sources or equipment causing strong vibrations near the transmitter
7.2. Periodic Maintenance Plan (Performed on a scheduled basis)
1. Cleaning Schedule
Once a month: Remove surface dust; use a dry brush or compressed air to clean dust from the housing and terminal areas
Once a quarter: Increase frequency to twice a month in dusty, humid, or corrosive environments
Cleaning Requirements: Never rinse directly with water, alcohol, or cleaning agents; ensure all operations are performed in a dry environment
2. Wiring Tightness Inspection
Once every six months (recommended quarterly in humid or vibrating environments)
Tighten the screws on the power, input, and output terminals one by one, with a focus on:
24V power supply terminals
Potentiometer inputs: EXC+/EXC-/IN+
Shielded cable connection points
Key inspection points: Check for blackening, oxidation, looseness, or arcing marks; replace terminal lugs or cables immediately if any abnormalities are found
3. Recommended Accuracy Recalibration
Perform a full-unit accuracy calibration once a year
Recalibration Method:
Replace the potentiometer with a precision resistance box and input the minimum, midpoint, and maximum resistance values
Use a multimeter to measure the 4-20mA or 0-5V output
Compare the error; if it exceeds ±0.3% FS, investigate potential interference or grounding issues, or return the unit for factory calibration
Critical equipment and safety interlock points: Recommended to retest every six months
7.3 Long-Term Maintenance Tips (Extending Service Life & Ensuring Stable Operation)
1. Dust and Moisture Protection Measures
Keep the control cabinet closed; install dust filters and cooling fans to reduce dust accumulation.
For high-humidity, coastal, or underground locations:
Place desiccant inside the cabinet or install a dehumidifying heater.
Seal cable entry points to prevent moisture ingress.
When restarting after prolonged shutdown: First check for condensation; power on only after the unit is dry.
2. Long-Term Interference Mitigation Optimization
Use shielded twisted-pair cables for all input and output lines; avoid bundling with power cables
Ensure the shield is grounded at one end only (grounded at the control cabinet side, left floating at the sensor side)
Position transmitters at least 20 cm away from inverters, contactors, and servo drives
In high-interference environments, install a 24V anti-interference filter on the power supply side
3. Protection Against Extreme Environments
High-temperature environments: Ensure adequate ventilation inside the cabinet, avoid direct sunlight, and install heat sinks if necessary
Low-temperature environments: Select a wide-temperature custom version, or install a low-temperature heating module inside the cabinet
Vibration environments (near rolling mills, crushers, pumps, and valves):
Install mounting clips at both ends of the mounting rail
Secure cables at connection points to prevent loosening due to vibration
Corrosive environments (chemical, pharmaceutical): Apply triple-proof coating to terminals to reduce oxidation and corrosion
7.4 Summary of Basic Maintenance (for on-site personnel)
Daily: Check indicator lights, monitor readings, and check temperature
Monthly: Remove dust, inspect terminals
Semi-annually: Tighten screws, inspect wiring
Annually: Calibrate accuracy, perform protective maintenance

VIII: Troubleshooting & Emergency Procedures

8.1 List of Common Faults
No output signal after power-on
Signal drift, fluctuation, or instability
Signal distortion, jumping, or glitches due to interference
Output stuck at full scale / cannot be zeroed
8.2 Fault Symptoms → Causes → Step-by-Step Solutions
1. No Output Signal (4-20mA = 0 / 0-5V = 0)
Possible Causes
Power supply not connected, reversed, or insufficient voltage
Output wire open circuit / loose connection
Potentiometer input open circuit
Output short-circuit protection triggered
Internal module damage
Troubleshooting Steps
Check the PWR indicator: If it is off, first verify the polarity and voltage of the 24V power supply
Use a multimeter to measure the power supply terminals: Confirm DC24V ±10%
Check whether the output terminals OUT+ and OUT- are loose or have broken wires
Short the input signal (to the minimum analog range) to see if output is restored
Disconnect the load and measure the output separately to rule out damage to the PLC channel
If all the above are normal, determine that the module is faulty; stop using it and report for repair
Emergency Measures
For critical points, temporarily replace with a spare transmitter to quickly restore the signal
Temporarily use a resistance box to simulate the signal to keep the system running
2. Signal Drift, Slow Change, or Inaccuracy
Possible Causes
Loose wiring, oxidation, or poor contact

Incorrect shield grounding (grounding at both ends creates a ground loop)
Excessive temperature drift, drastic changes in ambient temperature
Wear and tear on the potentiometer itself, poor contact
Fluctuations in supply voltage
Troubleshooting Steps
Tighten all terminals, paying special attention to the potentiometer input wires
Check the shielding: Switch to single-ended grounding in the control cabinet, leaving the sensor side floating
Measure whether the supply voltage is stable and check for voltage drops
Supply power to the transmitter separately to eliminate interference from the cabinet's power supply
Test using a resistance box instead of the potentiometer:
If the resistance box signal is stable → The problem lies with the potentiometer or the wiring
If the resistance box still drifts → Transmitter malfunction
Emergency Measures
Re-crimp terminals; replace shielded cable
Temporarily shorten wiring length; avoid heat sources
3. Signal Interference, Distortion, Jitter, or Glitches
Possible Causes
Routed in the same conduit as inverters or power lines
No shielded cable used or incorrect shield grounding
Large ground potential difference; ground loop interference
Confusing grounding within the cabinet; shared grounding with power circuits
Troubleshooting Steps
Route signal cables separately from 220V/380V power lines
Ground shielded cables at one end only; do not ground both ends
Establish a dedicated ground for the instrument; do not share grounding with motors or inverters
Install a 24V filter on the power supply side
Emergency Measures
Temporarily install a ferrite core or replace with shielded twisted-pair cable
Move the transmitter at least 20 cm away from the interference source
4. Output at Full Scale / Unchanging
Possible Causes
Open circuit at the potentiometer slider
Input wiring error (IN+ and EXC+ reversed)
Mismatched range, signal saturation
Internal circuit failure in the module
Resolution
Verify the wiring diagram and correct the wiring
Replace the potentiometer or transmitter

8.3, After-Sales Repair Guidelines
1. Criteria for Determining a Malfunction (Eligible for Direct Repair)
If any of the following conditions are met, the product is deemed to have a manufacturing defect:
Power supply is normal, wiring is correct, but the PWR indicator does not light up
When a standard resistance signal is input, the error exceeds ±0.3% FS and cannot be corrected externally
ALM alarm persists, and issues with external wiring and sensors have been ruled out
Housing is charred, emits an odor, or shows obvious signs of burning
Functional failure occurs during normal use within one year of manufacture
2. Repair Process
Gather Information:
Product Model: WS90201
Manufacturing Date / Serial Number
Fault Symptoms, On-site Environment, Wiring Photos
Contact Technical Support for Initial Remote Diagnosis
Return the unit for testing or request on-site service as instructed
After Testing: Repair / Replacement / Issuance of Report
3. Warranty Coverage
Warranty Period: 12 months from date of manufacture
Warranty Coverage: Component failure or functional failure under normal use
Exclusions:
Damage caused by overpressure, incorrect wiring, or intrusion of high-voltage power
Water ingress, corrosion, mechanical damage, or unauthorized disassembly
Installation not in accordance with specifications, or improper use in explosion-proof zones
Failures resulting from force majeure or on-site modifications