Frequency Signal Transmitter

I. Product Overview

1. Product Definition

The Qidian WS1528 is a fully isolated frequency signal conversion terminal. Its core function is to receive various types of frequency signals from the field (such as pulse square waves, sine waves, and open-collector signals), convert them with high precision, and, after three-port isolation, output standard voltage / current signals (such as 4-20mA, 0-10V, 1-5V, etc.) or RS485 communication signals, meeting the requirements for remote data acquisition, control, and data transmission in industrial automation systems.

2. Core Operating Principle

The WS1528 utilizes linear opto-isolation combined with frequency-to-voltage (F/V) conversion technology for signal processing. The core process consists of three steps:

2.1 - Signal Reception and Adaptation: Compatible with multiple types of input signals (suffixes indicate input mode: OC/PS; frequency range: 0-50Hz/0-1kHz/0-10kHz, etc.; input amplitude: 0-5V/0-24V, etc.), with an input impedance of ≥100kΩ to ensure stable connection of various field signals.

2.2 - Three-Port Isolation Protection: Full isolation is achieved between the input, output, and 24V DC power supply. Insulation strength reaches 1500 VDC for 1 minute, and insulation resistance is >100 MΩ (at 500 VDC), effectively blocking ground loop interference and surge impacts to ensure equipment and system safety.

2.3 - Conversion and Output: The internal circuitry performs F/V linear conversion with an accuracy of up to 0.3% and linearity of 0.1%. After conditioning, it outputs standard signals with a response time of <200 ms, making it suitable for fast-paced industrial control applications.

3. Core Value and Application Scenarios

3.1 Core Value

--- Signal Compatibility and Adaptability: Supports a wide range of input signal frequencies, with multiple measurement ranges and output formats available. It seamlessly integrates with signals from various industrial devices (such as motors, inverters, flow meters, and sensors) without requiring additional adapters.

-- -High-Reliability Isolation Protection: A three-port fully isolated design effectively resists electromagnetic interference, ground loop interference, and surges in industrial environments, ensuring precise signal transmission, extending equipment lifespan, and supporting hazardous operating conditions (e.g., chemical and power industries).

---High Precision and Efficiency: 0.3%–0.5% high precision and <200 ms fast response meet the demands of industrial automation for precise control and real-time data acquisition, making it suitable for high-precision measurement scenarios.

---Convenient Deployment and Low Power Consumption: Space-saving DIN rail mounting and simple wiring; low-power 24V DC operation (≤0.72W) reduces system energy consumption, making it suitable for dense deployment scenarios.

---Compliance and Expandability: Complies with international electromagnetic compatibility standards and supports certifications such as CE; optional RS485 communication enables remote monitoring and data networking in digital systems.

3.2 Typical Application Scenarios

---Industrial Automation: Motor speed monitoring on production lines, frequency signal acquisition for variable frequency drives, and signal interfacing for PLC systems.

---Power and Energy: Frequency monitoring of power and heating networks, acquisition of operating parameters for generator sets, and isolated signal transmission in substations.

---Petrochemicals: Isolated frequency signal transmission in hazardous conditions, and flow/speed monitoring of chemical processing units (suitable for explosion-proof environments).

---Environmental Protection and Water Resources: Frequency monitoring of wastewater treatment equipment, flow signal transmission for water conservancy projects, and data acquisition for environmental monitoring systems.

---High-end industrial applications such as metallurgy and steel, building automation, and aerospace, meeting requirements for high interference resistance and high reliability.

II. Product Specifications

1. Input Specifications

---Input Type: PS: Pulse square wave / Sine wave signal (compatible with flow meters, variable frequency drives, etc.)

---Frequency Range: 0–50 Hz (power frequency measurement) / 0–1 kHz (low-speed rotation, flow) / 0–10 kHz (medium-speed equipment, frequency transmission) / User-defined (supports extended ranges such as 0–100 kHz)

---Input Amplitude: A=0-5V (low-voltage signal) / B=0-24V (industrial standard signal) / C=220VAC (high-voltage AC signal, requires customization) / S = User-defined

---Input Impedance: ≥100 kΩ, ensuring no attenuation of weak signals. 2. Output Specifications (Multi-scenario Adaptability)

2. Analog Output:

Current Type: 4–20 mA (most universal, strong anti-interference), 0–10 mA

Voltage Type: 0–5 V, 0–10 V, 1–5 V (compatible with PLC analog modules)

---Digital Output: RS485 (Modbus-RTU protocol, selectable baud rates 9600–115200 bps), supports remote monitoring and data networking.

---Load Capacity:

Current Output: ≤500 Ω (at full scale 20 mA)

Voltage Output: ≥100 kΩ (to ensure signal accuracy).

3. Electrical Performance

---Power Supply and Power Consumption: Powered by DC 24V ±10%, full-load power consumption ≤0.72W, low system power consumption.

---Accuracy Specifications:

---Accuracy: 0.3%–0.5% (typically 0.3%, industry-leading)

---Linearity: ≤0.1% (Guarantees distortion-free signal conversion)

--- Temperature Coefficient: ≤100–150 ppm/°C (Stable accuracy across a wide temperature range).

--- Response Time: <200 ms, suitable for rapidly changing frequency signals (such as motor speed and flow fluctuations).

4. Isolation and Protection

---Three-port full isolation: Input, output, and power supply are independently isolated, completely blocking ground loop interference, common-mode interference, and surge impacts, ensuring the safety of both front-end sensors and back-end control systems.

---Insulation Performance: Insulation strength 1500 VDC/1 minute, insulation resistance >100 MΩ (500 VDC), meeting industrial high-voltage protection requirements.

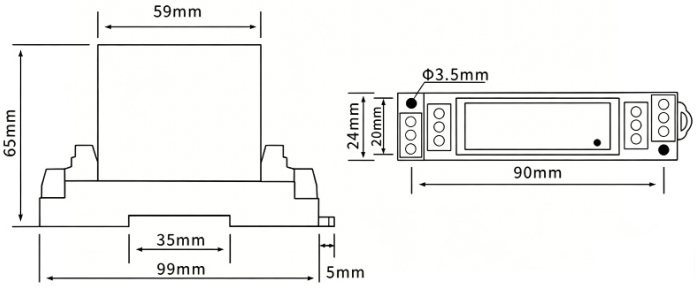
---Interference Resistance: Complies with GB/T18268.1 (IEC61326-1) electromagnetic compatibility standards, suitable for environments with strong electromagnetic interference such as petrochemical and power industries.

5. Environmental and Mechanical Specifications

---Temperature Range: Operating temperature -20°C to +55°C (some models support -10°C to +70°C); storage temperature -25°C to +85°C, suitable for complex environments such as outdoor settings and high-temperature workshops.

---Mounting Method: 35mm standard DIN rail (T-type) mounting, featuring convenient wiring, saving control cabinet space, and supporting dense deployment of multiple modules.

---Protection Rating: IP40, preventing the ingress of dust and foreign objects, meeting industrial site cleanliness requirements.



III. Selection Guide

1. Key Selection Criteria

1.1 Input Signal Compatibility

Confirm signal type: OC (Collector / Encoder) / PS (Square Wave / Sine Wave / Power Frequency)

Confirm frequency range: 0–50 Hz (Power Grid) / 0–1 kHz (Motor) / 0–10 kHz (General Purpose) / 0–100 kHz (High Speed)

Confirm input amplitude: 0–5 V / 0–24 V / 220 VAC (to prevent burnout due to amplitude mismatch)

1.2 Output Signal Format

Industrial PLC/DCS: Prefer 4–20 mA (high noise immunity, long transmission distance)

Instruments / Data Acquisition Cards: 0–5 V / 0–10 V (voltage-type compatibility)

Small-signal systems: 0–10 mA (Low power consumption)

1.3 Accuracy and Environment

Precision monitoring (power grid / metering): Select 0.2% FS accuracy

General industrial control (equipment monitoring): 0.5% FS is sufficient

Temperature-varying environments: Ensure temperature drift ≤ 100 ppm/°C

Outdoor / harsh environments: Select wide temperature range (-10 to 70°C) and reinforced isolation (2000 VAC)

1.4 Isolation and Safety

High-interference sites (near inverters/motors): Three-terminal full isolation (1500 VDC or higher)

High-voltage side monitoring (220 VAC input): Reinforced insulation (2000 VAC)

1.5 Load Capacity

Current Output (4–20 mA): Load ≤ 500 Ω (PLC input impedance is typically ≤ 250 Ω)

Voltage Output (0–5 V/0–10 V): Load ≥ 10 kΩ (to prevent signal attenuation due to low load)

1.6 Installation and Appearance

Standard Cabinet: 35mm DIN rail (WS1528 ultra-slim design)

Visual Management: Uniform blue housing labeling for easy maintenance identification

2. Common Selection Pitfalls (Guide to Avoiding Mistakes)

2.1 Misconception 1: The Wider the Frequency Range, the Better

Error: Blindly selecting 0–100 kHz (0–10 kHz is sufficient for general applications)

Consequences: Reduced accuracy, increased costs, and heightened susceptibility to interference

Correction: Select a range equal to 1.2 times the actual signal upper limit (e.g., for a 5 kHz motor, select 0–10 kHz)

Misconception 2: Ignoring Input Amplitude Matching

Error: Selecting a 0–5 V amplitude model for 220 VAC power-frequency signals

Consequences: Input module burnout and permanent damage

Correction: Strictly verify signal amplitude (0–5 V / 0–24 V / 220 VAC)

Misconception 3: Mismatched Output Load

Error: Connecting a 4–20 mA output to a 1 kΩ load (exceeding the 500 Ω upper limit)

Risks: Signal attenuation, data distortion, output overload

Correction: Current output load ≤ 500Ω; voltage output load ≥ 10kΩ

Misconception 4: Ignoring Isolation Level

Error: Selecting non-isolated or weakly isolated models for high-interference environments

Risks: Signal drift, system interference, equipment damage

Correction: Industrial environments must use three-terminal full isolation (1500VDC or higher)

Misconception 5: Blindly Pursuing High Accuracy

Error: Selecting 0.1% accuracy models for general equipment monitoring (far exceeding requirements)

Risks: Significant cost increase, poor cost-effectiveness

Correction: Select 0.2% for metering/power grid applications; 0.5% for general industrial control

Misconception 6: Ignoring Ambient Temperature

Error: Selecting standard -20°C to 55°C models for outdoor -30°C environments

Risks: Failure at low temperatures, accuracy drift, and inoperability

Correction: Select wide-temperature models (-10°C to 70°C) for extreme environments

Dual Output: 4-20mA + RS485, Dual Analog Channels

3. Customization Recommendations

1. Input Customization

Special Frequency: 0–20 kHz / 0–50 kHz / 0–100 kHz

Special Amplitude: 1–10 V / 15–30 V / 380 VAC

Special Signals: Differential pulses, Hall effect signals, dry contact pulses

2. Output Customization

Special Analog Outputs: 1–5 V / 0–20 mA / ±5 V / ±10 V

Digital Output: RS485 (Modbus-RTU)

Dual Output: 4-20mA + RS485, Dual Analog Channels

3. Performance Customization

High Accuracy: 0.1% FS (Metering Grade)

Fast Response: <50 ms (High-Speed Closed-Loop)

Strong Isolation: 3000 VAC/1 min (High-Voltage, High-Risk Environments)

IV. Installation and Commissioning

This specification is based on the original factory installation requirements for the Qidian WS1528 blue-cased frequency transmitter. It is applicable to standardized on-site installations in the power, industrial control, chemical, and metallurgical sectors, and can be directly used for pre-installation briefings and operation and maintenance manuals.

4.1. Pre-installation Preparation

1. Check accessories (must be checked upon unpacking)

--- Transmitter Unit: One WS1528 with blue ABS housing

--- Certificate of Conformity, User Manual, Factory Calibration Report

--- DIN Rail Clips (pre-installed at factory)

--- Terminal Screws (pre-installed)

--- Auxiliary Accessories: Shielded cable, terminal caps, cable ties (to be provided on-site)

2. Environmental Check

--- Ambient Temperature: -20°C to +55°C; no direct sunlight or strong heat sources

--- Relative Humidity: ≤90% RH; no condensation, corrosive gases, or dust

--- No strong electromagnetic interference sources: Keep away from inverters, contactors, high-power motors, and high-voltage busbars

--- Installation Space: Allow ≥10 mm of clearance on both sides for heat dissipation; allow ≥20 mm of clearance above and below for wiring

3. Tool List

--- Flathead / Phillips screwdrivers

--- Wire strippers, crimping pliers

--- Multimeter (voltage / current / frequency ranges)

---Signal generator (for debugging)

---Insulation tape, cable ties, wire marking tubes

---Anti-static wrist strap (recommended for precision applications)

4. Safety Precautions

---Never connect wires or insert/remove terminals while the unit is powered on

---Verify that the supply voltage matches the product label (default: 24 VDC)

--- High-voltage signal input (220VAC) must be handled by a licensed electrician

--- Disconnect the upstream power supply before wiring and post a warning sign

--- Avoid running signal cables in the same conduit as power cables

4.2 Standard Installation Steps

1. Mounting on DIN Rail

The WS1528 uses a 35mm standard DIN rail for installation. Align the rail clips on the back of the transmitter with the rail, press down vertically, and the unit is securely installed when you hear a “click.” Ensure there is no play when shaking the unit side-to-side. When installing multiple units side-by-side, maintain a spacing of ≥10mm to facilitate heat dissipation

2. Terminal Definitions (General Standard)

Standard terminal layout for the WS1528 Blue model (from left to right):

Power + (V+): DC 24V positive terminal

Power - (GND): Power ground / common terminal

Input + (IN+): Frequency / pulse signal positive

Input - (IN-): Frequency / pulse signal negative

Output + (OUT+): Analog output positive

Output - (OUT-): Analog output negative

Some custom dual-output or communication-enabled models may vary slightly; refer to the silkscreen markings on the unit.

3. Wiring Specifications

(1) Power Supply Wiring

Power Supply: DC 24V ±10%; AC 220V is strictly prohibited.

Recommended wire gauge: 0.5–1.5 mm² copper core wire.

Never reverse the positive and negative terminals (the product includes reverse polarity protection, but long-term reverse connection is not recommended).

(2) Input Wiring

Pulse / Frequency Signal: Shielded twisted-pair cable is recommended

Ground the shield at one end only (centralized grounding in the control room; leave the field end floating)

Input voltage must not exceed specified limits (0–5 V / 0–24 V / 220 VAC)

For long-distance transmission (>100 m), use thicker wire gauge and shorten the cable run

(3) Output Wiring

Current output (4–20 mA): Connect directly in series to the PLC or instrument acquisition modul

Voltage output (0–5 V/0–10 V): Connect in parallel; avoid using loads that are too small

The output negative terminal may share a ground with the power supply negative terminal (not recommended for isolated models)

4. Grounding Requirements

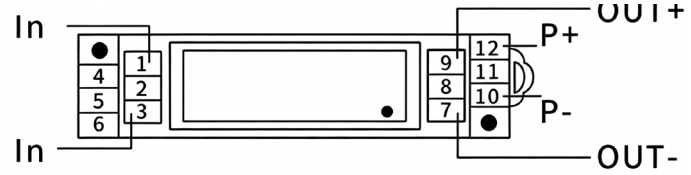
The enclosure does not require mandatory grounding; if interference suppression is needed, the enclosure may be grounded at a single point

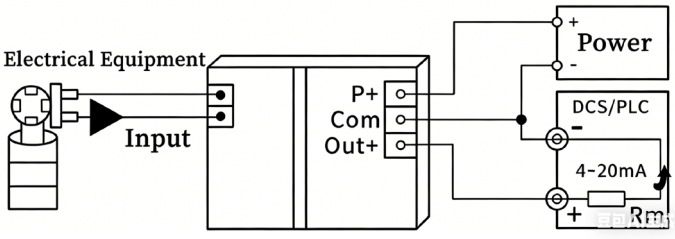
Shielded cable: Ground only at the control room end; do not ground both ends simultaneously to prevent ground loops

Ground resistance requirement: ≤4Ω

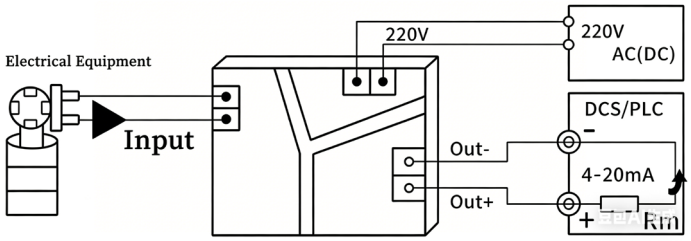
Strictly prohibited from being connected to lightning protection grounding or high-voltage power grounding

4.3 Wiring Diagram

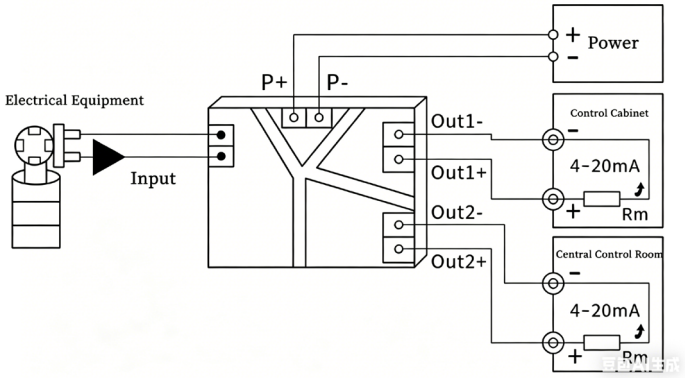




Example 1: General two-isolated, common-ground output (1 input, 1 output). This is the most common configuration in practical applications, where the power supply for the signal acquisition device and the current transmitter share the same power source, or the current transmitter is directly powered by the signal acquisition device.



Example 2: 220V-powered triple isolation (1 input, 1 output), commonly used in situations where no DC power is available on-site or where 220V power supply is required.



Example 3: Dual-output (1 input, 2 outputs) is commonly used when two different departments or locations need to simultaneously measure current signals. For example, if both a field control cabinet and a central control room require current signal acquisition, one output can be routed to the control cabinet and the other to the central control room.

2. Isolation-Specific Specifications (WS1528 Fully Isolated)

The input, output, and power supply are electrically isolated from one another.

The input negative, output negative, and power supply negative terminals are not connected.

Forced short-circuiting is prohibited, as it will compromise isolation and introduce interference.

3. Power Distribution Specifications (e.g., for external passive sensors)

If the transmitter needs to power a sensor, select a model with power distribution functionality.

Standard WS1528 units cannot directly power sensors; do so to avoid damage.

4.4 Power-On Commissioning Procedure

1. No-Load Test (Step 1)

Connect only the power supply; do not connect input or output signals.

Apply a 24V DC power supply

Observation: The power indicator on the unit should remain lit. There should be no unusual odors, overheating, or abnormal noises. Measure the voltage at the power terminals with a multimeter: it should be stable at approximately 24 V DC

No-load output: 4–20 mA output: should be 4 mA (zero point). 0–5 V/0–10 V output: should be 0 V

2. Signal Calibration

Apply a standard frequency signal (e.g., 10 Hz, 25 Hz, 50 Hz). Record the corresponding analog output.

Compare with theoretical values; the error should be ≤ ±0.2% FS / ±0.5% FS.

Example: Input 0 Hz → Output 4 mA / Input 50 Hz → Output 20 mA

3. Indicator Status Assessment

Constant On: Power supply normal, operation normal

Off: Power not connected / reverse polarity / fuse blown

Flashing: Abnormal input signal or overload (some custom versions)

Dim: Supply voltage too low

4. Accuracy Calibration Method

The WS1528 is an industrial, plug-and-play device that is factory-calibrated and generally requires no on-site adjustment.

If fine-tuning is required:

Open the calibration port on the panel (select models)

Zero Point Adjustment (ZERO): Input 0 Hz, adjust to 4 mA/0 V

Full-Scale Adjustment (SPAN): Input the upper frequency limit, adjust to 20 mA/5 V/10 V

Repeat 2–3 times to ensure good linearity

Important: Non-professionals are advised not to open the cover for calibration to avoid voiding the warranty.

4.5 Installation Prohibitions (Mandatory Restrictions)

1. Overvoltage Power Supply Strictly Prohibited

Do not connect to AC220V, DC36V, or DC48V

Overvoltage will directly damage the power supply module and burn out the PCB inside the blue housing

2. Strictly Prohibit Rough Wiring in Electrically Interfering Environments

Do not route cables in the same conduit as inverter output lines, power

cables, or high-voltage busbars
Do not allow input and output cables to become entangled
3. Strictly prohibited from use in damp, condensing, or water-immersed environments
The housing has an IP40 rating and is not waterproof
For outdoor, underground, or damp locations, a waterproof junction box and moisture-proof heater must be installed
4. Strictly prohibited from inputting signals exceeding the amplitude range
For 0-5V models, connecting 24V pulses is strictly prohibited
220VAC models must not be directly connected to low-voltage small signals to prevent loss of readings
5. Do not install in locations subject to severe vibration without reinforcement
Prolonged vibration may cause terminal loosening and poor contact
Install vibration-damping pads or reinforced mounting rails
6. Do not short-circuit the output terminals (current-type)
Direct short-circuiting of the 4-20mA output will trigger overload protection and may severely damage the output chip

V. Recommendations for Daily Use & Maintenance

5.1 Key Points for Routine Inspections
1. Visual and Installation Inspection
Check the transmitter's blue housing for damage, deformation, water ingress, or dust accumulation, and ensure it is securely installed with no looseness.
Verify that the DIN rail clips are securely fastened, with no tilting or wobbling, and that the terminal blocks show no signs of charring, overheating, or unusual odors.
2. Power Supply Status Inspection
The supply voltage should remain stable within the range of DC 24V ±10%, with no significant fluctuations, voltage drops, or power outages.
Observe the power indicator light (if present) to ensure it remains lit; flashing or being off indicates a power supply abnormality.
3. Signal Input and Output Inspection
The input frequency signal should be normal, with no interruptions, fluctuations, or loss of signal.
The analog output (4–20 mA/0–10 V) is stable, with no sudden changes, zeroing, or full-scale overflow.
Use a multimeter to verify that the output value corresponds to the actual frequency, with no significant deviation.
4. Environmental and Interference Inspection
The operating ambient temperature is within the range of -20°C to +55°C, with no exposure to high temperatures or low-temperature condensation.
No strong sources of electromagnetic interference (such as inverters, contactors, or high-power motors) are in close proximity, and cables are not routed alongside high-voltage lines.
5. Wiring and Grounding Inspection
Input, output, and power supply connections are secure, with no loose connections, oxidation, or broken wires.
The shielding layer is properly grounded at a single point; avoid double-ended grounding that could create a ground loop.
5.2. Regular Maintenance Plan
1) Monthly Maintenance (Basic Inspection)
Clean dust from the enclosure and terminal surfaces; ensure the area remains well-ventilated and dry.
Tighten all terminal screws to prevent loose connections caused by vibration.
Record the comparison values between the input frequency and output signal, and maintain a simple log.
2) Quarterly Maintenance (Accuracy Calibration)
Use a standard signal source to input a known frequency signal and verify that the output accuracy is within ±0.5%.
Check whether isolation performance is normal and whether there is any significant interference causing data fluctuations.
Inspect the cable insulation for signs of aging, wear, or damage from compression.
3) Annual Maintenance (Comprehensive Inspection)
Thoroughly clean the interior of the module and the terminals to remove oxidation.
Perform a complete accuracy calibration; return to the factory for calibration if necessary.
Verify that power supply ripple, the grounding system, and shielded cabling comply with specifications.
For equipment operating in environments with prolonged high temperatures, high humidity, or high dust levels, prioritize replacing or upgrading protective measures.

5.3 Long-Term Maintenance Tips
1. Environmental Protection
Install the device inside a control cabinet whenever possible to avoid direct exposure to sunlight, rain, dust, oil, and corrosive gases.
In high-humidity environments, it is recommended to install a dehumidifier to prevent condensation from causing short circuits or accuracy drift.
2. Wiring Standards to Extend Service Life
Use shielded cables for input/output signal lines and route them separately from power lines (AC 220/380V).
Allow sufficient cable slack to prevent damage to internal chips caused by excessive pulling or bending.
3. Power Supply Stability Protection
It is recommended to install a 24V regulated power supply and a surge protector at the front end to reduce damage from lightning strikes and switching surges.
When multiple transmitters share a power supply, avoid overloading the power source to prevent voltage drops.
4. Avoid Over-Range Operation
Do not operate continuously at maximum frequency, maximum load, or maximum temperature to prevent accuracy degradation and accelerated aging.
Short-circuiting at the output is strictly prohibited; current-type outputs must not be directly connected to voltage acquisition ports.
5. Equipment Logs and Spare Parts Management
Maintain records of equipment serial numbers, installation locations, model specifications, and calibration dates.
For critical production lines, it is recommended to keep 1–2 spare modules on hand for quick replacement in case of failure, thereby minimizing downtime.
6. Rapid Troubleshooting
When output abnormalities occur, prioritize troubleshooting in the following order: power supply → wiring → input signal → interference → load.
Do not disassemble the housing, solder, or modify the device yourself, as this may compromise isolation and void the warranty.

VI. Troubleshooting & Emergency Procedures

Fault 1: No output after power-on (4 mA/0 V or no signal at all)
I. Analysis of Causes (Pinpoint the issue and rule out irrelevant factors)
- Power supply abnormality: The 24 V DC power supply is not connected; the supply voltage exceeds the ±10% range (below 21.6 V or above 26.4 V); or the positive and negative terminals of the power supply are reversed, preventing the module from starting normally.
- Output Terminal Fault: A short circuit at the output terminal or a load resistance outside the specified range (current-type load > 500Ω, voltage-type load < 100KΩ) triggers the module's protection mechanism, halting output.
- Module Malfunction: Damage to internal chips, isolation circuit failure, or module failure caused by impact or static electricity during transportation or installation (even if the blue casing shows no visible damage, internal damage may still exist).
II. Step-by-Step Troubleshooting (From easiest to hardest, self-service procedures)
1. Check the power supply first: Use a multimeter to measure the voltage at the power supply terminals to confirm it is DC 24V ±10%. If the voltage is abnormal, adjust the regulated power supply to the standard range; check the positive and negative power connections. If they are reversed, immediately disconnect the power, swap the wires, and then reconnect the power.
2. Check the Output Terminals: Disconnect the output load. Use a multimeter to directly measure the module's output terminals and observe whether there is a normal output (e.g., 4–20 mA with an initial value of 4 mA, or 0–10 V with an initial value of 0 V). If the output returns to normal after disconnecting the load, this indicates a short circuit in the load or an out-of-range condition; simply replace the load with one that meets the specifications.

3. Verify module status: Replace the module with a spare WS1528 transmitter of the same model (blue housing). Connect it to the same power supply, input signal, and load. If the spare module outputs normally, the original module is faulty and must be reported for repair according to the after-sales procedure.

Fault 2: Output signal remains fixed and locked at full scale (20mA/10V)
I. Analysis of Causes
- Abnormal input signal: A broken or loose connection in the input signal line, or a fault in the input signal source, prevents the module from receiving the actual frequency signal, triggering full-scale protection.
- Range mismatch: The input frequency range of the selected WS1528 model is smaller than the actual input frequency at the site. The module cannot recognize signals outside its range and outputs full scale directly.
- Internal circuit failure: Abnormalities in the module's internal sampling circuit or F/V conversion circuit cause signal conversion failure, resulting in a fixed full-scale output.
II. Step-by-Step Troubleshooting
1. Check the input signal: Use an oscilloscope or multimeter to measure the input terminals and confirm the presence of a stable frequency signal (e.g., pulse square wave, sine wave). If no signal is present, check whether the input signal line is disconnected or the terminals are loose; retighten the connections or replace the shielded cable, and verify that the signal source (e.g., encoder, flowmeter) is functioning normally.
2. Verify Range Compatibility: Check the full model number of the WS1528 (e.g., WS1528-PS-3-B-E) to confirm the input frequency range (suffix 2: 1 = 0–50 Hz, 2 = 0–1 kHz, 3 = 0–10 kHz) and ensure it matches the actual input frequency at the site; if the range is too narrow, replace with a model of the appropriate range or request a custom solution.
3. Troubleshoot module failure: Re-tighten all terminals, restore the module to its default settings (if available), and test again; if the full-scale reading remains stuck, replace it with a spare module for testing to confirm the original module is faulty, then contact after-sales service for calibration or repair.

Fault 3: Output signal frequently fluctuates, drifts, or is unstable
I. Analysis of Causes
- Electromagnetic Interference: The module is installed near strong interference sources such as inverters, contactors, or high-power motors, or the input/output signal lines are routed alongside power lines (AC 220/380V), causing signal interference.
- Poor Grounding: The signal line shield is not grounded, is grounded at both ends, or the module's ground terminal is not reliably grounded, creating a ground loop that causes signal drift.
- Unstable Power Supply: Excessive power supply ripple or frequent voltage fluctuations cause the module's internal circuitry to operate erratically, resulting in output signal fluctuations.
- Wiring Issues: Loose input/output terminals, affected by on-site vibrations, lead to poor contact, causing intermittent or fluctuating signal transmission.
II. Step-by-Step Solutions
1. Interference Mitigation: Position the WS1528 module away from strong interference sources (distance ≥ 30 cm); Use shielded cables for input/output signal lines, route them separately from power lines (spacing ≥ 10 cm), and avoid running them parallel to each other.
2. Proper Grounding: Ground the shield of the signal cable at a single point (recommended: the device's ground terminal); do not ground both ends. Check the module's ground terminal to ensure a reliable connection, with ground resistance ≤ 4 Ω.
3. Stable Power Supply: Install a 24V regulated power supply and a filter module at the front end of the module's power supply to reduce power supply ripple; if multiple modules share a power supply, check for power supply overload and avoid voltage drops.
4. Secure Wiring: Thoroughly inspect all input, output, and power terminals, and retighten them with a screwdriver to prevent loose connections caused by vibration; if terminals are oxidized, sand them down and reconnect the wires

Fault 4: Output Value Severely Discrepant from Actual Frequency (Too High/Too Low)
I. Analysis of Causes
- Incorrect Range Selection: The module's input frequency range does not match the actual on-site frequency (e.g., actual frequency is 12 kHz but a 0–10 kHz range is selected), resulting in conversion error.
- Lack of calibration: The module has been in use for an extended period (over 1 year) without accuracy calibration. Temperature drift and aging have caused the measurement deviation to exceed the allowable range (0.3%–0.5%).
- Mismatched input signal amplitude: The on-site input signal amplitude (e.g., 0–5 V) does not match the selected input amplitude of the module (e.g., 0–24 V), resulting in inaccurate sampling.
- Environmental impact: The module's operating temperature exceeds the -20°C to +55°C range, increasing temperature drift and resulting in reduced accuracy and measurement errors.
II. Step-by-Step Troubleshooting
1. Verify model and range: Confirm the WS1528 model suffix (input frequency, input amplitude) to ensure it fully matches the actual on-site input signal (frequency, amplitude); if there is a mismatch, replace with the appropriate model or request a custom solution.
2. Perform Accuracy Calibration: Use a standard signal source to input a signal of a known frequency (e.g., 5 kHz) and verify whether the module's output signal falls within the allowable deviation range; if the deviation is excessive, perform self-calibration (if the calibration function is available) or return the module to the factory for calibration.
3. Match the input amplitude: Measure the amplitude of the on-site input signal. If it does not match the module's input amplitude, install a signal amplifier or attenuator to ensure the input signal amplitude meets the module's requirements (e.g., 0–5 V, 0–24 V).
4. Improve the operating environment: Install the module inside a control cabinet to avoid high temperatures, direct sunlight, and low-temperature condensation; in high-temperature environments, add ventilation and heat dissipation devices to reduce the impact of temperature drift.

Fault 5: Severe overheating of the device, hot terminals, and unusual odor
I. Analysis of Causes
- Output short circuit: A direct short circuit at the output terminals causes excessive internal current, severe overheating, and may even burn out the terminals.
- Excessive supply voltage: If the supply voltage exceeds the upper limit of DC 24V ±10% (> 26.4V), the module's internal circuitry becomes overloaded, leading to increased heat generation.
- Abnormal Load: For current-type outputs, a load resistance that is too low (<250Ω) causes excessive output current and module overheating; for voltage-type outputs, a load resistance that is too low increases power consumption.
- Poor Heat Dissipation: Multiple WS1528 modules installed too closely together with insufficient spacing, or inadequate ventilation in the control cabinet, prevents heat from dissipating, causing the modules to overheat.
II. Step-by-Step Troubleshooting
1. Emergency Response: Immediately disconnect power to prevent module burnout or safety hazards; check for short circuits at the output terminals. If a short circuit is detected, resolve the issue (e.g., replace damaged cables) before reconnecting power and retesting.
2. Check Supply Voltage: Use a multimeter to measure the supply voltage and ensure it remains stable within the range of DC 24V ±10%. If the voltage is too high, adjust the regulated power supply to the standard value.
3. Adjust the Load: For current-type outputs, adjust the load resistance to 250Ω–500Ω; for voltage-type outputs, adjust the load resistance to ≥100KΩ. Ensure the load meets the module's specifications.
4. Improve Heat Dissipation: Install modules in a dispersed arrangement, ensuring a spacing of ≥5 cm between modules; install cooling fans inside the control cabinet to maintain proper ventilation; avoid placing modules near high-temperature equipment (such as variable frequency drives).

Fault 6: No response after signal input; display remains at zero
I. Analysis of Causes
- Incorrect input mode selection: The input mode (OC/PS) selected for the module does not match the field signal type (e.g., the field signal is an OC open-collector signal, but a PS pulse square wave input model was selected).

- Insufficient input signal amplitude: The amplitude of the field input signal does not meet the module's trigger threshold (e.g., the module requires an input amplitude ≥5V, but the field signal is only 3V), preventing the module from recognizing the signal.
- Incorrect input wiring: The positive and negative terminals of the input wires are reversed, or there are broken or loose connections, preventing the signal from reaching the module.
- Signal source failure: The field signal source (e.g., encoder, flowmeter) is not functioning properly and is not outputting a frequency signal, leaving the module with no signal to acquire.

II. Step-by-Step Troubleshooting

1. Verify the input type: Check the WS1528 model suffix 1 (OC/PS) to confirm it matches the field signal type; if they do not match, replace the module with one corresponding to the correct input type.
2. Measure Input Signal Amplitude: Use a multimeter or oscilloscope to measure the signal amplitude at the input terminals and ensure it meets the module's requirements (e.g., 0–5 V, 0–24 V); if the amplitude is insufficient, install a signal amplifier.
3. Check Input Wiring: Swap the positive and negative terminals of the input wires, retighten the terminal connections, and inspect the signal lines for breaks; if a break is found, replace the shielded cable and rewire it.
4. Troubleshoot the signal source: Verify that the on-site signal source has normal power supply and is functioning properly. Use an oscilloscope to measure the output of the signal source and confirm a stable frequency signal output; if the signal source is faulty, repair or replace it.

Fault 7: RS485 Communication Failure, Data Packet Loss, or Garbled Data

I. Analysis of Causes

- Parameter Mismatch: The module's RS485 communication parameters (baud rate, device address, parity bit) do not match the settings on the host device (PLC, touchscreen), resulting in communication failure.
- Wiring errors: The RS485 A and B lines are reversed, or the wiring is loose or broken, causing abnormal signal transmission.
- Interference and terminating resistors: The communication bus is not connected to a 120Ω terminating resistor, or the bus is subject to electromagnetic interference, resulting in data loss or garbled characters; the bus is too long (exceeding 1000 meters) or has too many nodes, causing severe signal attenuation.

II. Step-by-Step Troubleshooting

1. Verify Communication Parameters: Confirm that the module's RS485 parameters (selectable baud rate: 9600–115200 bps; device address: 1–255) exactly match the host computer's settings; after reconfiguring the parameters, restart both the module and the host computer.
2. Check Wiring: Swap the RS485 A and B wires, retighten the terminals, and inspect the cables for breaks; Use shielded RS485 cables to reduce interference.
3. Add Terminating Resistors and Implement Anti-Interference Measures: Connect a 120Ω terminating resistor in parallel at the end of the communication bus (at the farthest module) to reduce signal reflection; route the bus away from strong interference sources, and ground the shield at one end; if the bus is too long, install an RS485 repeater.

Fault 8: Normal operation resumes after a power cycle, but the fault recurs after running for a period of time

I. Analysis of Fault Causes

- Loose connections: Loose terminal connections, affected by on-site vibrations, result in poor contact. After a power cycle, contact is temporarily restored but loosens again during operation.
- Environmental factors: Drastic changes in ambient temperature and humidity (e.g., large diurnal temperature fluctuations, high-humidity environments) cause internal condensation and moisture damage to the chip, leading to failure after a period of operation.
- Power supply fluctuations: Momentary power drops or voltage fluctuations cause the module to temporarily recover after a reboot, but the fault reoccurs during operation due to unstable voltage.
- Module Aging: Long-term use (over 3 years) causes internal components to age, reducing stability and resulting in intermittent failures.

II. Step-by-Step Solutions

1. Secure Wiring: Tighten all input, output, power, and communication terminals thoroughly. Secure cables with cable ties as needed to minimize the impact of vibration on the terminals. Replace terminals if they are worn out.
2. Improve the Environment: Install the module inside a control cabinet and install a dehumidifier to prevent condensation. Control the ambient temperature and humidity to avoid sudden changes, and keep the module away from high-humidity and dusty areas.
3. Ensure Stable Power Supply: Install a UPS (Uninterruptible Power Supply) and a voltage stabilizer upstream of the module's power supply to prevent voltage sags and fluctuations; check the power load to avoid overloading.
4. Troubleshoot Module Aging: If the module has been in use for a long time, replace it with a spare module for testing. If the spare module does not exhibit intermittent faults, this indicates that the original module has aged, and it is recommended to replace it with a new one.

VII. After-Sales Repair Guidelines (Authoritative Standards to Reduce Repair Time)

1. Information to Prepare Before Reporting a Repair (Required)

- Product Information: Full model number of the WS1528 (e.g., WS1528-OC-2-A-E), production date/serial number on the blue housing.
- Fault Information: Detailed description of the fault symptoms (e.g., "Output frequently fluctuates; ambient temperature 35°C; located near an inverter"), on-site installation environment, and wiring configuration (on-site photos are preferred).
- On-site Parameters: Supply voltage, input signal type (OC/PS), input frequency range, output load type and parameters.

2. Pre-Repair Self-Check (Required)

- You have followed the troubleshooting steps for the corresponding issue above to check for common problems such as power supply, wiring, interference, and load, but the issue remains unresolved.
- You have performed a comparison test using a spare module of the same model and confirmed that the original module is faulty, rather than the issue being caused by the on-site environment or the signal source.
- You have not performed any unauthorized disassembly, soldering, modification, or firmware flashing (otherwise, the warranty will be void).

3. Service Request Channels (Official Authorized Channels)

- Contact your official Qidian sales representative first, or call the Qidian technical support hotline.
- Provide on-site photos of the malfunction, measurement data, and video footage of the issue to help technicians quickly identify the problem.
- Specify the industry and application scenario (e.g., petrochemicals, power generation) to enable technicians to provide targeted solutions.

4. Repair and Replacement Policy

- Within the warranty period (typically 1 year), free repair or replacement is available for non-human-caused damage (no disassembly, no overloading, no wiring errors).
- When returning a unit for repair, please include the following in the packaging: module model, detailed description of the fault, contact person, and contact information to avoid delays in processing.
- In urgent situations (such as production line downtime), you may request "spare parts to be shipped first, followed by return of the faulty unit" to minimize downtime losses.