AC Current & Voltage Combination Transmitter

Core Product Perception

I. Product Definition
The QD89UI AC Current and Voltage Combination Transmitter is an integrated electrical quantity transmitter that **simultaneously acquires one channel of AC voltage and one channel of AC current in a single module**.

Complete List of Core Functions:
1. **Simultaneous Acquisition**: The same module simultaneously measures two sets of electrical signals—power-frequency AC voltage and AC current—eliminating the need to purchase separate voltage and current transmitters.

2. **Signal Isolation and Conversion**: Built-in three-terminal isolation circuitry (mutually isolated input, output, and power supply) linearly converts raw high-voltage, power-frequency AC signals from the field into standard industrial automation DC analog signals (DC 4–20 mA / DC 0–5 V / DC 0–10 V); some versions support RS485 Modbus digital output.

3. **Overload Protection**: The current channel supports short-term overloads of up to 10 times the rated input, while the voltage channel supports short-term overloads of up to 2 times the rated input. This protects the downstream data acquisition circuit from short-term power grid surges.

4. **High-Precision Signal Conditioning**: Built-in filtering, temperature compensation, and linear correction circuits suppress electromagnetic interference at the field level, ensuring a stable linear relationship between the output signal and the input electrical quantity.

5. **Circuit Safety Isolation**: Isolation between high-voltage and low-voltage circuits prevents high voltage on the primary side, ground potential differences, and common-mode interference from inverters from being transmitted to the PLC/DCS/data acquisition modules, thereby protecting the control system.

6. **Quick DIN Rail Installation**: The blue plastic one-piece housing features a snap-on design that securely attaches to the DIN rail in a power distribution cabinet. Wiring is secured via screw-type terminals, facilitating easy integration within the cabinet.

7. **Customizable Ranges**: AC input ranges are customizable, with typical current ranges of AC 0–10 A and AC 0–100 A; AC 0–100 V and AC 0–500 V for voltage, suitable for power distribution, motors, charging stations, and energy monitoring applications.

> Application Scenarios: New energy charging stations, motor control cabinets, building power distribution, metallurgy, chemical industry, water conservancy, data center power monitoring, and energy management systems.

II. Working Principle
Layman's Explanation
The AC current and AC voltage in the power grid are high-power, high-voltage signals that a PLC cannot directly measure. The QD89UI functions as an electrical quantity transducer with isolation protection. It simultaneously reads the AC current and AC voltage in the circuit, filters out noise interference, proportionally reduces the high-voltage signal, and converts it into a safe, stable standard low-voltage signal for transmission to a PLC, digital display meter, or data acquisition system to read the electrical values.

Complete Workflow
1. Signal Acquisition Phase: AC voltage is connected directly to the voltage terminals; AC current passes through the through-hole in the module (or is connected to the current terminals) to capture the raw power-frequency AC signal.

2. Isolated Step-Down Sampling: An internal miniature current transformer isolates and steps down the AC current and AC voltage, converting high-amplitude high-voltage signals into weak, low-voltage AC sampling signals. The primary side is electrically isolated from the downstream circuitry, eliminating high-voltage hazards.

3. Signal Conditioning and Filtering: The weak sampled signals are rectified and filtered to remove high-frequency harmonics and spike interference caused by inverters and motors; a built-in temperature compensation circuit offsets measurement drift caused by changes in ambient temperature.

4. AD Conversion and Calculation: The circuit calculates the root mean square (RMS) value and performs linear calibration to ensure that the acquired values are proportional to the actual electrical quantities.

5. Signal Output Conversion: Converts the calculated electrical quantity values into standard industrial signals (4–20 mA, 0–10 V, or RS-485) for external output; the current and voltage channels are completely independent, ensuring that the two signals do not interfere with each other.

6. Continuous Cycling Acquisition: Continuously samples in real time, dynamically tracking changes in grid current and voltage, and updates the output signal in real time to support monitoring, alarms, and energy consumption statistics by the host system.

III. Core Value & Pain Points

Summary of Core Value:
1. **Space-saving and Cost-saving**: A single module simultaneously measures AC current and AC voltage, replacing two separate transmitters, reducing the number of components in the cabinet, and lowering procurement, wiring, and installation labor costs.

2. **Isolation Protection for Automation Systems**: Isolation between the input, power supply, and output terminals resists electromagnetic interference in industrial environments and prevents high-voltage surges from damaging PLC data acquisition ports.

3. **High Overload Tolerance**: Short-term surges and inrush currents will not directly damage the transmitter, making it suitable for circuits with motor starts/stops and significant load fluctuations.

4. **Stable Measurement and Low Temperature Drift**: A temperature compensation circuit ensures stable accuracy in both high and low-temperature environments, reducing the frequency of on-site calibration and maintenance.

5. **Easy Integration**: Standard DIN rail mounting and a universal 4–20 mA analog signal ensure compatibility with the vast majority of PLCs, DCS systems, and energy data acquisition instruments, eliminating the need for complex programming.

6. **Flame-Retardant Blue Housing**: UL94 V-0 flame-retardant ABS housing ensures greater safety when used inside distribution panels and prevents fire spread.

Challenges and Solutions:
Q1: A project requires simultaneous acquisition of AC current and AC voltage. If separate current and voltage transmitters are purchased, there may not be enough space in the distribution panel, wiring could become complex, and costs would be high.
A1: The QD89UI is a **combined all-in-one transmitter** that simultaneously measures one channel of AC current and one channel of AC voltage. A single unit replaces two separate transmitters, reducing the number of components, saving installation space inside the cabinet, and minimizing the number of terminals and cables, thereby lowering material and installation costs.

Q2: Industrial sites often contain variable frequency drives and high-power motors, resulting in severe electromagnetic interference. Do standard electrical measurement modules experience signal fluctuations and inaccurate readings?
A2: The QD89UI features a built-in three-terminal isolation circuit and a filter circuit that isolates high- and low-voltage circuits, suppresses common-mode interference and high-frequency harmonics, and stabilizes the output signal, thereby resolving the issue of fluctuating readings.

Q3: Do the start-up and shutdown of grid loads cause brief surges of high current and overvoltage, which can easily damage standard transmitters?
A3: The QD89UI features overload protection; its current channel can withstand a short-term overload of 10 times the rated input, while its voltage channel can withstand a short-term surge of 2 times the rated input. This enables it to handle instantaneous surges caused by the start-up and shutdown of motors and charging stations, thereby extending equipment lifespan.

Q4: In high-voltage circuits on-site, is there a risk of high voltage entering the PLC's analog ports and damaging expensive control systems?
A4: The module features electrical isolation between inputs, power supply, and outputs, preventing high-voltage currents and ground potential differences on the primary side from being transmitted to downstream automation equipment, thereby protecting the safety of PLCs and data acquisition instruments.

Q5: Different projects have varying voltage and current ranges, requiring customized data acquisition specifications and resulting in long procurement cycles?
A5: The QD89UI supports customizable input ranges (with multiple AC current and AC voltage options available) and offers a choice between analog or RS485 output, making it suitable for various operating conditions such as power distribution, new energy, and mechanical equipment.

Q6: Space inside power distribution cabinets is limited. Does meter installation and wiring take a long time, resulting in low installation efficiency?
A6: The blue plastic housing features standard DIN 35 rail snap-on mounting for direct installation. With screw terminal wiring, it allows for easy installation and removal, reducing assembly and commissioning time inside the cabinet.

Q7: Does the meter suffer from significant temperature drift due to large fluctuations in ambient temperature, resulting in measurement errors that increase with temperature and requiring frequent on-site calibration?
A7: The meter features a built-in temperature compensation circuit and a low-drift design, ensuring stable measurement accuracy across a wide temperature range and reducing the workload associated with on-site maintenance and calibration.

Key Product Specifications & Detailed Specifications

I. Basic Electrical Parameters

Project	Specifications
Product Model	QD89UI (Blue Housing, DIN Rail Mount)
Measurement Channels	1 AC current channel + 1 AC voltage channel, simultaneous acquisition, two independent output channels
Current Input Range (AC)	AC 0–1 A / AC 0–5 A / AC 0–10 A / AC 0–50 A / AC 0–100 A, customizable
Voltage Input Range (AC)	AC 0–50 V / AC 0–100 V / AC 0–250 V / AC 0–450 V / AC 0–500 V, customizable
Input Signal Frequency	20 Hz–5,000 Hz
Measurement Accuracy Class	0.2% FS / 0.5% FS (select one; specify on order)
Temperature Drift Coefficient	≤0.02% FS/°C
Short-Term Overload of Current Channels	10 times rated input, withstands 1-minute short-term surges
Short-Term Overload of Voltage Channels	2 times the rated input, withstands a 1-minute short-term surge
Analog Output (Optional)	DC 4–20 mA / DC 0–20 mA / DC 0–5 V / DC 0–10 V
Digital Communication Output (Optional)	RS485 Modbus-RTU protocol
Analog Output Load Capacity	Current output: ≤500 Ω; Voltage output: ≥10 kΩ input impedance
Sampling Rate	≥10 times per second

II. Insulation Performance Parameters

Project	Specifications
Isolation Architecture	Three-terminal isolation: Electrical isolation between the input side (high-voltage), power supply side, and output side (low-voltage)
Power-Frequency Withstand Voltage (Input ↔ Power Supply / Output)	3000 V AC, 50 Hz, 1 min—no breakdown, no flashover
Insulation Resistance	≥1000 MΩ @ 500 V DC
Common-Mode Rejection Ratio (CMRR)	≥100 dB
Isolation Type	Isolation via miniature electromagnetic transformers; non-optocoupler solution

III. Power Supply & Power Consumption Specifications

Project	Specifications
Standard Power Supply	24 VDC (wide voltage range: 18 VDC to 30 VDC)
Full-Load Power Consumption	≤1.2 W (analog output version); ≤1.5 W (version with RS485 communication)
Power Supply Polarity Protection	Built-in reverse-polarity protection prevents the module from being damaged if the power supply is connected incorrectly
Surge Protection	Built-in TVS diodes on the power supply side suppress transient spikes
Power Distribution Output	This model does not provide external power; it is designed solely for data acquisition and transmission and does not supply power to external sensors

IV. Environmental Adaptation Parameters

Product	Specifications
Operating Temperature	-20°C to +60°C
Storage Temperature	-40°C to +85°C
Operating Relative Humidity	5% to 90% RH, no condensation or frost
Protection Rating	IP20 (enclosure)
Explosion-Proof Rating	Standard model: Non-explosion-proof (for indoor use in standard distribution cabinets)
Compatible Safety Barrier Models	QD Series Isolated Safety Barriers (QD-6011)

Project	Specifications
Vibration Resistance	10–500 Hz, 1 g, 2 h on each of the X, Y, and Z axes
EMC (Electromagnetic Compatibility)	Complies with CE EMC standards; surge, electrostatic, and radio frequency immunity

V. Physical Parameters

Product	Specifications
Mounting Method	Standard DIN 35 mm rail snap-on mounting
Dimensions (L × W × H)	100 mm × 24mm × 70 mm (depth corresponds to cabinet depth)
Weight	Approx. 95 g (excluding terminal blocks)
Housing Color	Blue
Housing Material	UL94 V-0 flame-retardant ABS engineering plastic
Terminal Type	Screw-terminal blocks compatible with 0.5–2.5 mm² cables
Heat Dissipation Design	Heat dissipation grilles on the sides of the housing for natural cooling; no fan required

Scenario-Based Selection Guide

I. Key Selection Criteria

1. Signal Type: Confirm that the signal under test is power-frequency AC voltage and AC current, and select the appropriate input range. The output signal should be chosen based on the interface of the downstream PLC/DCS system; for analog signals, options include DC 4–20 mA, DC 0–5 V, and DC 0–10 V. For digital data acquisition scenarios, select the RS485 Modbus-RTU version. Current input distinguishes between terminal-connected and through-hole acquisition methods.

2. Number of Channels: The QD89UI is fixed at dual-channel synchronous acquisition—1 channel for AC current and 1 channel for AC voltage—making it suitable for projects requiring simultaneous monitoring of current and voltage in the same circuit. If a single circuit requires measurement of only current or only voltage, there is no need to select this combination transmitter; instead, choose a single-channel transmitter from Qidian.

3. Power Supply: The product's standard power supply is a wide-range 24 V DC (18 V DC–30 V DC). Verify the available power supply specifications in the distribution cabinet before selecting a model. This model does not support 220 V AC power; if a 24 V DC power source is not available on-site, an additional switching power supply must be configured.

4. Explosion-Proof Requirements: The standard blue-housed version of the QD89UI is a general-purpose, non-explosion-proof instrument and must not be installed directly in hazardous areas; if used in intrinsically safe applications, the transmitter must be installed on the safe side and paired with a Qidian QD series isolation safety barrier. The safety barrier connects to the hazardous area circuit to form a complete intrinsically safe monitoring circuit; the QD89UI must not be placed directly within the hazardous area.

5. Installation Environment: Verify the ambient temperature and humidity inside the cabinet, as well as the presence of condensation, dust, continuous vibration, and strong electromagnetic interference from sources such as variable-frequency drives or high-power motors. This product has an IP20 protection rating and is intended solely for installation inside electrical distribution cabinets; it is not suitable for outdoor exposed environments, high-humidity/condensation conditions, or environments with highly corrosive gases. In high-interference conditions, prioritize the 0.2% FS high-precision version, which utilizes three-terminal isolation to suppress interference.

6. Load Matching: When selecting the analog output version, verify the load parameters of the PLC's analog input module in advance. The current output supports a maximum load of 500 Ω, and the input impedance at the voltage output end must be ≥10 kΩ. For long-distance signal transmission, prioritize the 4–20 mA current output.

7. Accuracy Class: For energy consumption metering and electricity performance evaluation applications, select the 0.2% FS high-precision version; for general equipment condition monitoring, overload alarms, and basic energy consumption data collection, the 0.5% FS version is sufficient.

II. Recommended Selection for Industry Applications

Chemical Industry: For voltage and current monitoring in general chemical power distribution rooms, as well as in circuits for circulation pumps and fan motors, select the QD89UI standard blue-housing version, prioritizing 0.5% FS accuracy and 4–20 mA analog output; For monitoring in explosion-proof process areas, install the transmitter in a safe area and pair it with the QD-6011 isolation barrier; signals from the hazardous side are isolated by the barrier before being fed into the transmitter. In chemical workshops with a large number of variable frequency drives (VFDs), the three-terminal isolated, high-interference-resistant version is recommended.

Power Industry: For monitoring low-voltage distribution panels, plant power circuits, and backup power circuits, as well as for energy sub-metering applications, the QD89UI 0.2% FS high-precision version is recommended. For projects requiring centralized data collection by a host computer, select the RS485 Modbus communication output, which is suitable for multi-node network monitoring in distribution rooms.

Metallurgical Industry: For rolling mills, smelting fans, and high-power drive motor circuits—where on-site vibration is high and electromagnetic interference is intense—select the QD89UI three-terminal isolated version. Choose current channels with high overload ratings, and prefer 4–20 mA analog output to resist on-site harmonics and ground loop interference. This is used for motor operating status monitoring and overload early warning.

Pharmaceutical Industry: For power distribution monitoring in cleanroom power cabinets, chillers, and air compressors—where cleanroom distribution cabinets are located in non-explosion-proof areas—select the standard Class 0.5 version of the QD89UI with 4–20 mA output connected to the DCS. In explosion-proof pharmaceutical production areas, the transmitter is similarly installed on the safe side and used in conjunction with isolation safety barriers to meet the stability and low-drift requirements of pharmaceutical projects.

Smart Manufacturing Industry: Automated production lines, conveying equipment, and robot control cabinets monitor current and voltage in power circuits. Standard QD89UI models are used for general production lines; for centralized data acquisition across multiple production lines, the RS485 communication version is selected to reduce the number of analog acquisition cards and lower control cabinet wiring costs, while the slim DIN rail design saves installation space within the cabinet.

Other Applications: Building power distribution, wastewater treatment, and energy consumption monitoring of branch circuits in data center row-level cabinets—select the standard QD89UI Class 0.5 4–20 mA version; for charging stations and energy storage front-end AC circuit monitoring, prioritize the high-current through-hole input version, which utilizes the product's 10x current short-term overload capacity to handle load surges.

III. Common Mistakes in Product Selection
1. Ignoring the isolation rating and focusing solely on accuracy. Many selection personnel focus solely on measurement accuracy while neglecting the isolation withstand voltage between high-voltage and low-voltage circuits at the site. In environments with variable frequency drives (VFDs) and high-power motors, insufficient isolation withstand voltage can lead to ground loop interference, signal fluctuations, or even high-voltage intrusion that burns out the PLC. The QD89UI comes standard with 3000 VAC three-terminal isolation; in highly interfered environments, it must not be replaced with simple transmitters featuring lower isolation ratings.

2. Selecting the wrong signal range—either too wide or too narrow. If the range is set too wide, the actual operating value will occupy only a small portion of the full scale, reducing measurement resolution and making it impossible to detect minor load changes; if the range is set too narrow, load peaks exceeding the upper limit will cause signal saturation, preventing normal monitoring. It is recommended that normal operating values fall within the 30%–80% range of the full scale.

3. Neglecting load matching and making errors in analog output selection. If a 4–20 mA output is selected but the load resistance of the downstream PLC module exceeds the transmitter's maximum allowable load, it will cause output signal distortion; if a 0–10 V voltage output is selected and the transmission cable is too long, line voltage drop will introduce measurement errors—voltage output is not recommended for long-distance transmission.

4. Incorrect selection of general-purpose models in explosion-proof environments, such as directly installing the standard QD89UI in hazardous areas. The standard version of the QD89UI with a blue housing does not have explosion-proof certification and cannot be placed directly in areas with explosive gases or dust hazards. Many projects install standard transmitters directly in explosion-proof zones, creating safety hazards. The correct solution is to install the transmitter in a safe area and add an intrinsically safe isolating barrier to the circuit.

5. Confusion regarding channel types: Combination transmitters are incorrectly selected for single-channel data acquisition. Even when the field only requires monitoring current or voltage separately, the QD89UI dual-channel combination transmitter is still selected, resulting in wasted procurement costs and underutilized device functionality.

IV. Customization Recommendations
1. Customization for Special Signals: When standard ranges do not match operating conditions, non-standard AC current and voltage input ranges can be customized; special frequency signal acquisition can be customized to accommodate non-50 Hz power frequency and load circuits containing significant harmonics; special output signal specifications can be customized to meet the interfacing requirements of specific acquisition modules.

2. Customization for Non-Standard Operating Conditions: For special environments such as high temperatures, severe vibration, or salt fog, internal circuits can be reinforced and special protective treatments applied; when centralized acquisition of multiple electrical parameters is required on-site, a complete solution comprising multiple QD89UI units can be provided based on the cabinet layout, featuring unified calibration and accompanying wiring diagrams.

3. Multi-Channel Integration Solutions: When multiple circuits within the same distribution cabinet require simultaneous AC current and voltage data acquisition, multiple QD89UI units can be mounted side-by-side on a DIN rail and networked via an RS485 bus. A single communication cable connects all transmitters in series, significantly reducing the number of analog cables; If additional power or frequency measurements are required for a single circuit, we recommend other multi-parameter power meters from Qidian. The QD89UI is fixed to one AC current channel and one AC voltage channel and does not support expanding to additional measurement channels on a single unit.

4. Customized Support Services: We offer factory pre-calibration and customized batch labeling. For bulk project orders, we can provide wiring diagrams and test reports to facilitate on-site commissioning and acceptance testing. For export projects, we provide CE and EMC documentation to meet EU compliance requirements.

Installation & Commissioning Specifications

I. Pre-Installation Preparation

1. Verification of Components
Unpack the product and verify that it is the QD89UI model with a blue housing. Confirm that the input range, output type (4–20 mA/0–10 V/RS485), and accuracy class indicated on the nameplate match the order specifications. Check that the housing has no cracks and the terminals are not deformed. Ensure that the accompanying documentation includes the product certificate of conformity and the factory calibration report. Ensure the DIN rail clips are intact and free of breaks. If used in an explosion-proof application, additionally verify the model and certification of the QD-6011 safety isolator.

2. Environmental Inspection
Confirm that the installation location is inside a power distribution cabinet, with an ambient temperature between -20°C and +60°C; ensure there is no condensation, no corrosive gases, and no significant amounts of conductive dust inside the cabinet; maintain a distance of ≥20 cm between the transmitter and variable frequency drives, high-power contactors, and power cables; ensure that vibration levels inside the cabinet do not exceed the product's specified limits; it is strictly prohibited to install this IP20 module directly outdoors, in high-humidity environments exposed to rain, or in environments with heavy salt fog.

3. Tool List
Small Phillips-head screwdriver (for tightening terminals), multimeter (for measuring voltage, resistance, and signal verification), insulated voltage tester, wire strippers, wire marking tubes, label paper; prepare shielded twisted-pair cable for long-distance signal wiring; a standard signal source may be used for verification (optional). Wire Specifications: Copper wire with a cross-sectional area of 0.5–2.5 mm² is recommended for terminal connections.

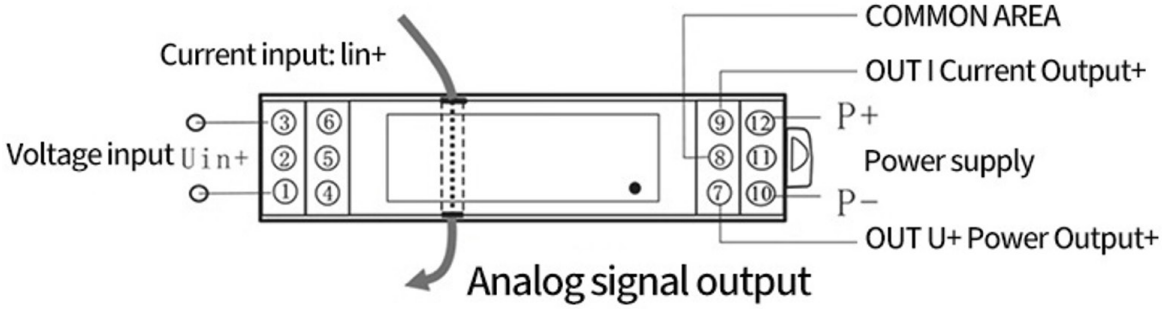
4. Safety Precautions
All wiring operations must be performed with the power disconnected; implement lockout/tagout procedures for the primary high-voltage circuit; clearly distinguish between the primary high-voltage input circuit and the low-voltage output circuit; do not mix them. Never open the secondary circuit of a current transformer, and never short-circuit the voltage input terminals; double-check all terminals before powering on to prevent high-voltage current from entering the low-voltage side, which could burn out the PLC; in explosion-proof environments, circuits on the hazardous area side must first pass through a safety barrier before connecting to the transmitter, and the transmitter body must be placed inside a safety cabinet.

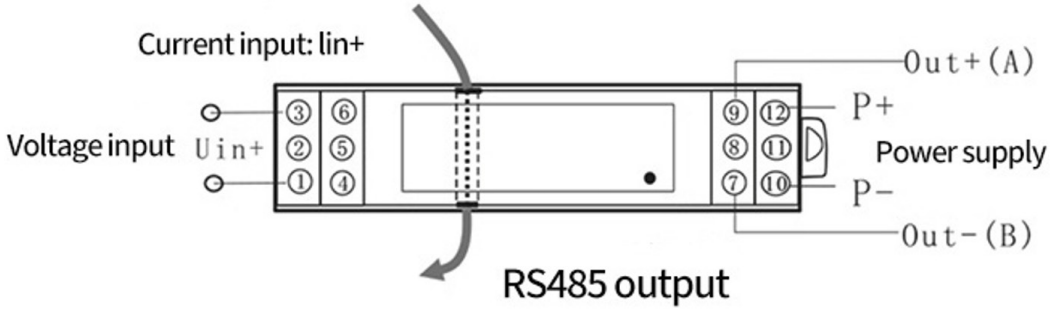
II. Standard Installation Steps
1. Mounting the Guide Rails
Use standard 35 mm DIN steel guide rails. First, hook the latches on the bottom of the module onto the lower edge of the guide rail, then press down on the top of the module. Once you hear the latches click into place, the module is securely mounted. Gently pull on the module to ensure it does not wobble. When installing multiple modules side by side, leave a gap of ≥5 mm between them for heat dissipation; to remove a module, flick the bottom latch downward and pull the module outward. Install the module vertically with the nameplate facing the cabinet door for easy viewing of the markings.

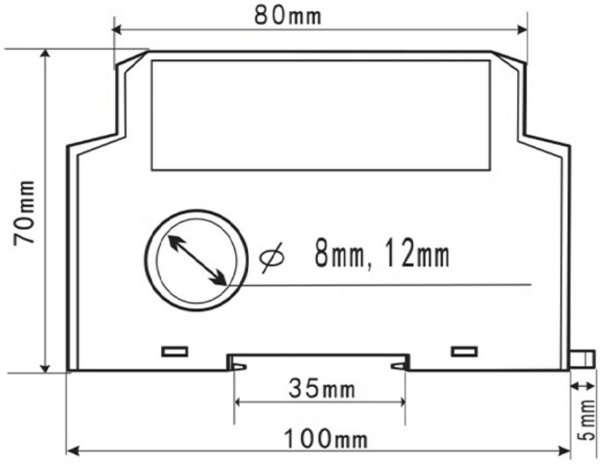
2. Wiring Specifications (Distinguish Between Power Supply / Input / Output Terminals)
Power Supply Terminals: V+ is the DC 24V positive terminal, and V- is the negative terminal. The product features built-in reverse connection protection; however, wiring must still strictly follow the on-site markings. The power supply range is DC 18–30 V.
AC Voltage Input Terminals: Uin+ and Uin–; voltage signals must be connected in parallel to the circuit under test and must not be connected in series.
AC Current Input Terminals: Iin+ and Iin–; current signals must be connected in series to the circuit via these terminals. For the through-hole version, simply thread the primary cable through the module's through-hole; connection to the current terminals is not required.
Analog Output Terminals: Two independent outputs: Uout+ and Uout- (voltage transmitter output); Iout+ and Iout- (current transmitter output), which are four-wire active outputs.
RS485 Communication Terminals: A and B. A is the differential positive, and B is the differential negative; A and B must not be reversed.

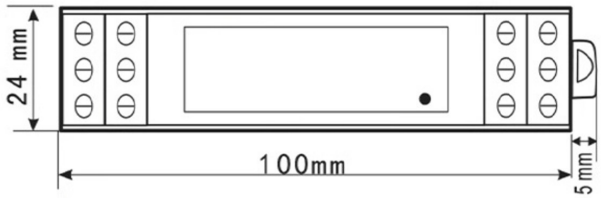
3. Grounding Requirements
The metal rails of the cabinet must be reliably connected to the protective ground, with a grounding resistance ≤ 4 Ω; analog signal lines and the shielded twisted-pair RS485 communication cables must be grounded at one end—specifically, on the PLC/DCS side of the control cabinet. The shield on the transmitter side must be left floating; grounding at both ends is prohibited to avoid ground loop interference; Grounding on the high-voltage input side must comply with power distribution standards; the low-voltage signal ground must be separated from the high-voltage protective ground, and direct short-circuiting is prohibited.

III. Wiring Diagram









Standard Wiring Instructions:
1. Power Supply Circuit: Connect the positive terminal of the 24 V DC power supply to Pin 1 (V+), and the negative terminal to Pin 2 (V-);
2. AC Voltage Measurement: Connect the AC voltage under test in parallel across Pins 3 and 4;
3. AC Current Acquisition (Terminal Connection Version): Connect the AC current under test in series to Pins 5 and 6; Through-Hole Version: Route the power cable through the through-hole; leave Pins 5 and 6 unconnected;
4. Analog Output: Connect the voltage output from Pins 7 and 8 to the DCS/PLC voltage AI channel; connect the current output from Pins 9 and 10 to the PLC current AI channel;
5. RS485 Communication: Pin 11 (A) and Pin 12 (B) connect to the host computer's communication bus; a 120Ω terminating resistor may be added at the bus terminus;
6. Shielding Wire Handling: The shielding layer of the signal cable must be connected to protective ground only on the PLC control cabinet side; on the transmitter side, the shielding jacket must be wrapped with insulating tape and left floating, without being connected to any terminals.

Exclusive Wiring Specifications for Isolated Models: This product features three-terminal isolation; the high-voltage input circuit, power supply circuit, and low-voltage output circuit are mutually independent. **The three circuits must not be short-circuited by sharing a common ground**; Explosion-Proof Configuration: Current and voltage signals from hazardous areas on-site are first connected to the QD-6011 isolation safety barrier; the output side of the safety barrier is then connected to the Uin and Iin terminals of the QD89UI, with the transmitter located in a safe area.

Comparison of Correct and Incorrect Wiring:
Correct: Voltage terminals connected in parallel, current terminals connected in series; shield grounded at a single point; high-voltage and low-voltage cables routed in separate cable trays; the three circuits do not share a common ground.
Incorrect: Voltage terminals directly short-circuited; current terminals open-circuited; shield grounded at both ends; high-voltage cables and signal cables routed in parallel within the same cable tray; ground wires on the input and output sides short-circuited.

IV. Power-On Commissioning Procedure
1. Pre-power-on verification: Turn off the power again to check that all terminals are secure and wire labels are correct; use a multimeter to measure the power supply terminals, confirming the supply voltage is DC 18–30 V with no short circuits; confirm that the primary circuit on the input side is de-energized, and perform commissioning under no-load conditions.

2. No-Load Test: Apply the 24 V DC power supply; a steady light on the module's power indicator indicates normal power supply. If the indicator light does not illuminate, immediately disconnect the power and check the power supply polarity and for open circuits in the wiring; Under no-load conditions, with no AC input signal, the output should be at zero: the 4–20 mA output should be 4 mA, and the 0–10 V output should be 0 V; for RS485 communication, use the debugging software to read voltage and current values; no-load readings should approach 0.

3. Signal Verification: Connect a standard analog source or power on with a load, apply standard AC signals at 50% and 100% of full scale, and measure the transmitter's output values; record the output readings, verify the error, and ensure it does not exceed the product's accuracy class. For 4–20 mA output, full scale corresponds to 20 mA; for 0–10 V output, full scale corresponds to 10 V.

4. Indicator Light Status Interpretation: Power green light steady = normal power supply; green light flashing: input signal out of range; light off: no power supply or internal fault; there is no separate fault alarm light; out-of-range conditions can be determined by monitoring the values collected by the host system.

5. Calibration Method: The product has undergone zero and full-scale calibration at the factory; **it is not recommended to adjust the potentiometers on-site for routine operations**. If on-site recalibration is absolutely necessary, use a small flathead screwdriver to adjust the ZERO (zero) and CAL (full-scale) potentiometers on the panel. Adjust the zero point under no-load conditions and the full-scale value with the rated full-scale signal. After calibration is complete, save the records and affix a calibration label.

6. Load Test Run: Connect to an actual field load and run continuously for 30 minutes. Observe that the PLC/DCS readings are stable, with no fluctuations or drift. For long-distance analog signals, check the load voltage drop; the load resistance in the 4–20 mA loop must not exceed 500 Ω.

V. Installation Precautions
1. Overvoltage Supply Strictly Prohibited: The supply voltage must not exceed 30 V DC. Direct connection to 220 V AC power is strictly prohibited, as it will immediately burn out the internal circuitry.

2. Avoid High-Voltage Interference: Power cables and inverter output cables must be routed in separate cable trays from the transmitter's low-voltage signal lines; they must not run parallel at close proximity. If crossing is unavoidable, use a perpendicular crossing method to minimize electromagnetic coupling interference.

3. Protective Measures for Humid Environments: Since temperature differences inside the cabinet can lead to condensation, install heaters and

dehumidifiers in the power distribution cabinet; do not route dripping water pipes above the transmitter; ensure dust-proof sealing at the terminals; do not use the transmitter in environments where humidity consistently exceeds 90% RH.

4. Other Prohibitions: Do not overload terminals; do not strip cable insulation excessively long to prevent short circuits caused by conductors touching adjacent terminals; do not insert or remove wires while the power is on; do not open the blue enclosure without authorization, as doing so will void the warranty.

Recommendations for Daily Use & Operations and Maintenance

I. Key Points for Routine Inspections

Inspections are categorized by operating conditions: routine power distribution scenarios require monthly inspections; high-interference and high-vibration environments—such as metallurgy, chemical processing, and high-power variable-frequency drives—require inspections every two weeks; and critical energy consumption metering and unit protection monitoring points require weekly inspections.

1. Visual Inspection of Appearance and Condition: Check the blue housing for cracks, deformation, or yellowing, and ensure the housing's cooling vents are free of dust buildup or blockages; confirm that the power indicator light remains steadily on without abnormal flickering; ensure the housing is free of unusual odors and shows no signs of localized overheating.

2. Signal Stability Monitoring: Connect to the PLC/DCS/host software and continuously observe the collected voltage and current data to determine if the values are stable; check for irregular fluctuations, sudden spikes or drops, or fixed offsets. For RS485 communication versions, additionally check for packet loss, disconnections, and read timeouts, and record the bus communication status. For analog versions, use a multimeter to spot-check the output signals and compare them with the values collected by the host system.

3. Temperature and Humidity Monitoring: Monitor the internal environment of the power distribution cabinet to ensure the internal temperature remains between -20°C and +60°C, with relative humidity between 5% and 90% RH, and no condensation. Pay special attention during high summer temperatures and periods of significant seasonal temperature fluctuations. If any signs of condensation appear, promptly activate the cabinet's dehumidification and heating systems.

4. Wiring and Terminal Inspection: Inspect all wiring terminals for looseness, oxidation, discoloration, or overheating; ensure wire insulation is free of tears or crushing damage; and verify that the outer layer of shielded cables shows no wear. Focus particularly on current circuits to eliminate the risk of loose connections or open circuits at current terminals.

5. Grounding and DIN Rail Inspection: Confirm that the protective ground connection on the DIN rail is secure and that the ground resistance is ≤4Ω; ensure that transmitter clips are securely locked in place and do not loosen or slip in vibrating environments; maintain single-ended grounding for shielded cables; do not ground both ends.

6. Load and Input Status Inspection: Verify the long-term operating values of current and voltage in the circuit under test; ensure the instrument is not operated outside its measurement range for extended periods; monitor for frequent surge overloads; and record transient signal changes caused by motor start-stop cycles and load fluctuations.

II. Periodic Maintenance Plan

> Maintenance must be performed with the power disconnected. For high-voltage circuits, implement the "tag-and-lock" procedure, and have the work completed by a licensed electrician. Distinguish between the 0.2% FS high-precision model, the 0.5% FS standard model, and the maintenance strategies for versions with analog output and RS485 communication.

1. Cleaning Schedule: Clean once every 6 months in normal environments; clean once every 3 months in workshops with high dust or oil contamination. Use only a dry, lint-free soft cloth to wipe the surface of the blue housing and the heat dissipation grille. Never use wet cloths, alcohol, or cleaning agents sprayed directly onto the housing to prevent liquid from seeping into the terminals. Do not disassemble the housing to clean the internal circuit board; opening the housing will void the product warranty.

2. Wiring Tightness Inspection: Retighten all terminals every six months; reduce this interval to three months for metallurgical applications or environments with high vibration. Apply moderate tightening force to prevent stripped threads. Inspect copper wire cores for fraying or blackening due to oxidation, and replace aged cables promptly.

3. Recommendations for Accuracy Retesting: For the 0.2% FS high-precision version (used for energy consumption metering and performance evaluation data collection), **conduct a full-range accuracy calibration once a year**; the 0.5% FS standard monitoring model may be calibrated once every 1–2 years; for trade metering applications, shorten the calibration cycle in accordance with local metrology regulations. It is recommended to use a standard AC signal source for calibration, verifying the zero point, 50% FS, and 100% FS points in sequence; upon completion, fill out the calibration record and affix the calibration label. For versions with RS485, verify during calibration that the values read via communication match the analog acquisition values.

4. Insulation and Isolation Performance Testing: Conduct random insulation withstand voltage tests every 2 years. Disconnect all external circuits and measure the insulation resistance between the input, power supply, and output terminals to ensure it is ≥1000 MΩ at 500 VDC, confirming that the isolation performance is intact.

5. Specialized Communication Maintenance (RS485 Version Only): Annually inspect the Bus A/B wiring; check the 120 Ω terminating resistor; update the bus node address log; and resolve address conflicts. Inspect the integrity of the bus shielding to minimize the likelihood of communication interruptions.

6. Spare Parts and Record Management: Establish an equipment log to record the installation date, measurement range specifications, and all past inspection and calibration records; for critical circuits, it is recommended to keep spare QD89UI modules on hand to facilitate rapid replacement in the event of a failure.

III. Long-Term Maintenance Tips

1. Dust and Moisture Protection: Keep the distribution cabinet doors closed and sealed to minimize dust ingress; install temperature-controlled heaters and dehumidifiers in cabinets exposed to high humidity or significant temperature fluctuations; install drip elbows at cable entry points to prevent condensation from flowing along the cables into the terminals; use dust-proof insulating sleeves in the terminal area to prevent electrical leakage caused by the accumulation of conductive dust. During long-term storage, remove modules and store them in a dry environment with temperatures ranging from -40°C to +85°C, avoiding moisture and corrosive gases.

2. Optimization and Maintenance for Electromagnetic Interference (EMI) Mitigation: Keep high- and low-voltage cables routed in separate cable trays; do not run power cables and signal cables in parallel over long distances. Use shielded twisted-pair cables exclusively for signal transmission, and ensure single-point grounding on the PLC side. After adding variable frequency drives or high-power motors to the site at a later stage, reassess interference and install power line filters on the power supply side if necessary. If persistent data fluctuations are observed, prioritize checking the grounding method and cable tray layout rather than directly adjusting the potentiometers inside the transmitter.

3. Protection in Extreme Environments: In high-temperature environments, install cooling fans inside the cabinet and leave a gap of ≥5 mm between modules to ensure natural heat dissipation; In high-vibration conditions, check the rail fastenings and install vibration-damping rail accessories if necessary; in salt fog or corrosive gas environments, do not place the transmitter directly in corrosive areas; use corrosion-resistant, sealed enclosures and periodically inspect the enclosure's seal integrity.

4. Operating Condition Control: Avoid long-term full-scale operation whenever possible; keep the measured value within the 30%–80% full-scale range to extend component lifespan; In circuits subject to frequent surge impacts, ensure proper front-end surge protection. Continuous overvoltage or overcurrent inputs are strictly prohibited.

5. Operation and Maintenance Prohibitions: Do not plug in or unplug signal or power cables while the device is powered on; do not disassemble the blue housing on your own; do not short-circuit high-voltage and low-voltage circuits at the transmitter terminals; do not test the transmitter directly with a megohmmeter while it is powered on to avoid damaging the internal isolation circuit.

Troubleshooting & Emergency Response

I. List of Common Faults

1. No Output: After the transmitter is powered on, there is no signal output from the analog channel (4–20 mA remains fixed at 4 mA / 0–10 V remains at 0 V); for the RS485 version, the host computer cannot read any data.

2. Signal Drift: Measured values slowly drift; zero point or full-scale value continuously changes with temperature or operating time; repeated measurements show errors exceeding the product's accuracy grade.

3. Indicator Light Abnormalities: Power indicator does not light up; power indicator flashes continuously; indicator light flickers on and off.

4. Out-of-range alarm (signal saturation): The measured signal exceeds the transmitter's rated input range, causing the output to lock at full scale (e.g., 20 mA, 10 V), and the reading no longer follows changes in the actual electrical signal.

5. Interference and distortion: Readings fluctuate erratically or exhibit jitter; data fluctuates frequently up and down while the load remains constant; RS485 communication experiences random packet loss or returns garbled data.

II. Analysis of Fault Causes

1. Wiring errors: Reversed power supply polarity; loose or faulty terminal connections; incorrect series connection in the voltage circuit or an open circuit in the current circuit; reversed A/B terminals on the RS485; shield grounded at both ends, creating a ground loop; short circuit between high-voltage and low-voltage ground wires.

2. Power Supply Abnormalities: Supply voltage is below 18 V DC or above 30 V DC; insufficient power supply capacity or excessive ripple in the switching power supply; poor contact in the power supply circuit, causing intermittent voltage drops.

3. Signal Overload: Primary-side current or voltage exceeds the transmitter's rated range for an extended period; motor start-stop cycles or power grid surges cause instantaneous or sustained overloads, damaging the internal sampling circuit.

4. Environmental Interference: The transmitter is too close to an inverter or high-power contactor; power cables and signal cables run parallel in the same cable tray; poor grounding at the site or large ground potential differences; high temperatures or condensation inside the cabinet causing terminal leakage.

5. Equipment Damage: Internal isolation circuits or sampling components are damaged by high-voltage surges; terminal short circuits burn out circuits; long-term aging due to high temperatures; physical impact damages the PCB.

III. Step-by-Step Troubleshooting

Fault 1: No Output, No Analog Signal / RS485 Data Cannot Be Read

Troubleshooting Steps:

1. Turn off the power and use a multimeter to measure the power supply terminals to confirm that the DC24V supply is within the DC18–30V range;
2. Verify terminal wiring: Double-check the power, input, and output terminals according to the terminal definitions, and inspect for loose terminal screws or broken wire strands;

3.Analog Version: Disconnect the wiring on the downstream PLC side and measure the transmitter's output terminals separately to determine whether the fault lies in the transmitter itself or the downstream data acquisition module;

4. RS485 Version: Check whether A and B are reversed, verify the configuration of the bus terminating resistors, confirm there are no short circuits on the bus, and verify the device's communication address and baud rate parameters.

Remedial Actions: Correct any wiring errors and tighten loose terminals; replace switching power supplies with excessive ripple; for communication failures, swap the A and B wires and correct the communication parameters.

Emergency Workaround: If the transmitter is determined to have hardware damage, directly replace it with a spare QD89UI module; for temporary monitoring, connect a single-channel voltage/current transmitter as a temporary data acquisition solution until the replacement part arrives, at which point the original combined monitoring configuration can be restored.

Fault 2: Signal drift, persistent reading offset, and error exceeding limits

Troubleshooting Steps:
1. Observe the temperature and humidity inside the cabinet to check for condensation or persistent overheating;
2. Check the input signal for persistent harmonics or slow-changing loads;
3. Power down the unit, retighten all terminal connections, and check the ground connection;
4. Use a standard AC signal source to perform zero and full-scale calibration to determine whether the drift is caused by external conditions or the transmitter itself.

Remedial Actions: If the issue is environmental, improve cabinet ventilation and dehumidification; if caused by wiring, retighten the terminals; if factory calibration has been lost, perform zero and full-scale calibration again if conditions permit;
Emergency Workaround: In high-precision measurement scenarios, temporarily replace the unit with a spare QD89UI, remove the faulty module for inspection and calibration—long-term on-site use of equipment with drift exceeding tolerance limits is not recommended.

Fault 3: Abnormal Indicator Lights
--- Power indicator does not light up:
Troubleshooting: Check whether the external 24V power supply is live, and inspect for open circuits or short circuits in the power cable. Remedy: Restore power supply and eliminate any short circuits in the front-end circuit.
--- Indicator light flashes continuously:
Troubleshooting: Input signal is out of range, or there are persistent surge impacts on the input. Remedy: Reduce the primary-side signal to within the transmitter's measurement range; install surge protection devices at the front end.
--- Indicator light flickers erratically:
Troubleshooting: Poor power connection; unstable supply voltage. Remedy: Replace the power supply line; replace the substandard switching power supply.
Emergency Workaround: Flickering indicates an out-of-range signal; prioritize reducing the primary load; in case of hardware failure, directly replace the module with a spare.

Fault 4: Out-of-range alarm; output locked at full scale

Troubleshooting Steps:
1. Verify the actual AC current/voltage in the measured circuit to confirm whether it exceeds the range specified on the QD89UI nameplate;
2. Check for load short circuits or sustained high-impact surges during motor startup;
3. Distinguish between transient surges (normal, short-term) and sustained out-of-range conditions (abnormal).

Remedial Measures: If the selected range is too small, replace with a version with a larger range; add current-limiting and surge-absorbing components to the circuit.
Emergency Workaround: For short-term surge conditions, temporarily reduce the load; for sustained out-of-range conditions, the transmitter must be replaced with one of the appropriate range—do not force continued use over the long term.

Fault 5: Interference-induced distortion, reading jitter or jumps, garbled communication, and packet loss

Troubleshooting Steps:
1. Check whether high- and low-voltage cables are running parallel in the same cable tray; verify the shielding grounding method and whether both ends are grounded;
2. Check whether the distance between the transmitter and the variable frequency drive or high-power drive equipment is less than 20 cm;
3. Check whether the cabinet's protective grounding is reliable and whether the grounding resistance exceeds the specified limit.

Remedial Measures: Install high- and low-voltage cables in separate cable trays; change the shielding to single-end grounding (grounded on the PLC side, left floating on the transmitter side); adjust the installation location to move it away from interference sources; install a power filter.
Temporary Workaround: Temporarily replace the signal cable with shielded twisted-pair cable and shorten the signal cable length; reduce the number of nodes on the RS485 bus to lower the bus load.

> General Troubleshooting Principles: Check the power supply first → then check the wiring → check for environmental interference → verify the input signal → determine if there is hardware damage. **All wiring operations must be performed with the power off; for high-voltage circuits, implement lockout/tagout procedures.**

IV. Guidelines for After-Sales Service Requests

1. Criteria for Determining Malfunctions

1. Power supply is normal, all wiring has been verified as correct, but the module's power indicator light does not illuminate at all;
2. Under no-load conditions, the output signal remains fixed and the zero point cannot be calibrated;
3. Breakdown of the three-terminal isolation, resulting in high-voltage current entering the low-voltage circuit;
4. Burn marks on the housing, damage to internal components, and a burning odor;
5. Calibration reveals persistent accuracy deviations that cannot be corrected through zero-point and full-scale adjustments.

> Note: Wiring errors, on-site interference, incorrect range selection, and external power supply failures are not considered product hardware quality issues and are not covered by the free warranty repair service.

2. Repair Request Process

1. Collect basic information: Product model QD89UI, housing color, measurement range, output type, serial number, on-site operating conditions, fault symptoms, and test data;
2. Take and save photos: photos of the nameplate, terminal blocks, on-site installation environment, and screenshots of the anomaly on the host computer;
3. Contact technical support and submit a description of the fault along with the documentation;
4. A technician will provide remote assistance to troubleshoot the issue. Once it is confirmed that on-site repair is not possible, obtain the return shipping address;
5. Ship the product back for repair, including a note describing the fault inside the packaging;
6. After testing is complete, the module will be repaired or replaced and returned; reinstall and commission it on-site upon receipt.

3. Warranty Coverage

Warranty Period: 12 months from the date of manufacture.

Warranty Coverage: Free repair or replacement for manufacturing defects in the product's components resulting in hardware failure under proper installation and rated operating conditions.

Exclusions from Free Warranty:

--- Incorrect wiring, overvoltage supply, electrical breakdown due to high voltage, or unauthorized disassembly of the housing;
--- On-site lightning strikes, power surges, physical impact, or corrosion caused by water ingress or condensation;
--- Incorrect product selection, accidental damage, or unauthorized modification of the circuit board;
--- Equipment beyond the warranty period.