3-Phase AC Current Transducer

I. Product Definition

The PA-23 Three-Phase AC Current Transmitter is a three-terminal, isolated device designed specifically for industrial automation applications. Featuring a black housing, its core function is to convert AC current signals from a three-phase power grid into standard industrial DC analog signals, thereby enabling the isolated acquisition, conversion, and transmission of three-phase current. It provides a stable and reliable source of current data for PLCs, DCS systems, and upper-level monitoring systems.

Its core functions comprehensively cover the following aspects:
1. Synchronous three-phase current acquisition: Supports simultaneous input of A, B, and C phase AC currents, with typical input specifications ranging from 0–5 A (compatible with user-defined ranges), and is compatible with standard current transformer secondary signals;

2. Signal Isolation and Conversion: Achieves electrical isolation between the input (three-phase current loop), output (analog signal loop), and power supply, then converts the AC current signal into a standard 4–20 mA linear DC signal output (also supports custom signals such as 0–20 mA, 0–5 V, and 10 V);

3. Signal Conditioning and Calibration: Features built-in zero (ZERO) and range (CAL) adjustment potentiometers, supporting on-site zero-point calibration and range correction to meet accuracy requirements under various operating conditions;

4. Industrial-Grade Interference Suppression: The black metal housing provides electromagnetic shielding to suppress electromagnetic interference generated by inverters and high-power equipment, making it suitable for complex industrial environments;

5. Standard Mounting Options: Supports 35mm DIN rail mounting or base screw mounting, compatible with standard installation scenarios in power distribution cabinets and control panels.

II. Working Principle

The operational process of the PA-23 Three-Phase AC Current Transmitter can be broken down into 5 core steps, centered around "Acquisition – Isolation – Conversion – Conditioning – Output" to ensure stable signal transmission:
1. Signal Acquisition: AC current signals from the three-phase power grid (typically 0–5 A from the secondary side of current transformers) are fed into the transmitter's internal current sampling circuit via terminals A, B, and C, converting high currents into weak millivolt-level voltage signals;

2. Three-way Isolation: Using optical or magnetic isolation technology, the input high-voltage circuit, the output low-voltage signal circuit, and the power supply circuit are electrically isolated from one another. The isolation voltage can reach 2 kVAC for 1 minute, preventing on-site interference signals from entering the downstream control system while also protecting low-voltage equipment from high-voltage surges;

3. AC Signal Conversion: The isolated, weak AC signal undergoes precision full-wave rectification to convert it into a pulsating DC signal. A low-pass filter circuit then removes high-frequency noise and power-frequency interference, yielding a smooth and stable DC signal;

4. Linear Amplification and Calibration: The filtered DC signal undergoes high-precision linear amplification. Zero-point calibration and range correction are performed via the ZERO and CAL potentiometers to eliminate circuit temperature drift and errors, ensuring a strict linear proportional relationship between the output signal and the input current;

5. Standard Signal Output: The processed signal is converted into an industrial-standard 4–20 mA (or custom specification) DC analog signal, which is transmitted via output terminals to control systems such as PLCs and DCSs, enabling remote acquisition and monitoring of current data.

III. Core Value and Solutions to Pain Points

3.1 Overview of Core Value

The core value of the PA-23 three-phase AC current transmitter lies in addressing issues such as interference, common-ground problems, high-voltage surges, and data distortion during the acquisition and transmission of three-phase current signals in industrial environments. It provides stable, isolated, and linear current data for automation control systems, ensuring reliable operation in scenarios such as equipment monitoring, energy consumption metering, and overload protection.

3.2 Pain Points and Solutions

Problem: Strong electromagnetic interference from industrial equipment such as inverters and motors often causes current signal distortion and fluctuations, leading to inaccurate monitoring data.
Solution: The PA-23 employs a dual anti-interference design featuring three-terminal isolation and a metal housing. The input, output, and power supply are fully isolated to prevent interference signals from entering the system; The black metal housing provides electromagnetic shielding to suppress on-site electromagnetic radiation interference, while the built-in filter circuit removes high-frequency noise, ensuring stable and non-fluctuating current signal acquisition with an accuracy grade of 0.5% or higher.

Issue: Direct connection between high-voltage circuits and low-voltage control systems can easily cause high-voltage intrusion, potentially damaging downstream equipment such as PLCs and DCS systems?
Answer: The PA-23's three-terminal isolation technology achieves electrical isolation between the high-voltage input circuit and the low-voltage output circuit, with an isolation voltage of up to 2 kVAC. This effectively blocks high-voltage surges, safeguarding downstream control system equipment and preventing damage caused by high-voltage intrusion.

Question: Current transformer specifications and system signal requirements vary across different field sites, making standard transmitters incompatible and replacement costs high?
A: The PA-23 supports multiple input and output specifications. The input can accommodate standard 0–5 A current signals (with user-defined options), while the output defaults to 4–20 mA but is also compatible with standard industrial signals such as 0–20 mA, 0–5 V, and 10 V. This allows the device to adapt to the needs of different systems without replacement, reducing selection and replacement costs.

Question: Do changes in field conditions cause zero-point errors in current signals? Traditional transmitters cannot be calibrated on-site and must be returned to the factory for adjustment, affecting production?
Answer: The PA-23 features built-in ZERO (zero-point) and CAL (range) adjustment potentiometers on its panel, supporting direct on-site calibration of zero-point errors and range deviations. There is no need to disassemble the unit or return it to the factory; signal errors can be quickly corrected to adapt to changing field conditions, ensuring data accuracy.

Question: Does three-phase current acquisition require multiple transmitters, resulting in complex installation and wiring that takes up a lot of space in the control cabinet?
Answer: The PA-23 features an integrated three-phase acquisition design. A single unit can simultaneously acquire A, B, and C phase current signals, eliminating the need for multiple transmitters. This reduces the number of devices and wiring complexity, saves installation space in the control cabinet, and lowers installation and maintenance costs.

Question: Is installation space limited in industrial environments, and do standard transmitters offer only a single mounting method, making them incompatible with DIN rail or screw-mount scenarios?
Answer: The PA-23 supports both 35mm standard DIN rail mounting and base screw mounting, making it compatible with conventional installation scenarios in power distribution cabinets and control cabinets. It adapts to various on-site spatial layout requirements, offering convenient installation and high versatility.

IV. Key Product Parameters & Specifications

4.1 Basic Electrical Parameters

Input Signal Specifications

Rated Input Current: Three-phase AC 0–5 A (supports 0–1 A, 0–10 A, and user-defined ranges)

Compatible Current Transformers: Secondary CT signals, input load ≤ 0.2 VA

Frequency Range: 50Hz/60Hz (compatible with industrial power frequency applications)

Overload Capacity: Can withstand continuous operation at 2 times the rated value, and short-term operation at 10 times the rated value (for 10 seconds)

Output Signal Specifications

Standard Output Signal: DC 4–20mA (default configuration); supports custom signals such as 0–20mA, 0–5V, 0–10V, and 1–5V

Output Load Capacity: Current-type output load resistance ≤300Ω; Voltage-type output load resistance ≥1kΩ

Linearity Error: ≤±0.2% FS / ±0.5% FS (optional)

Response Time: ≤400ms (0-90% step response)

Temperature Drift Coefficient: ≤300ppm/°C

Accuracy and Stability

Accuracy Class: Class 0.5 (default), optional Class 0.2 high-precision configuration

Zero Drift: ≤±0.1% FS/year

Span Drift: ≤±0.1% FS/year

4.2 Isolation Performance Parameters

Isolation Method: Three-terminal electrical isolation (input, output, and power supply), utilizing dual isolation technology combining magnetic isolation and optical isolation

Withstand Voltage: Supports AC 2000 Vrms/1 min withstand voltage testing between input/output, input/power supply, and output/power supply, with no breakdown or arcing

Insulation Resistance: Under DC 500 V test conditions, insulation resistance between each isolation terminal is ≥100 MΩ

Electromagnetic Compatibility: Complies with the GB/T 18268 (equivalent to IEC 61326-1) industrial equipment electromagnetic compatibility standard; capable of withstanding electromagnetic interference generated by on-site inverters and high-power equipment

4.3 Power Supply & Power Consumption Parameters

Supply Voltage: DC 24V (standard configuration; allowable voltage fluctuation range: DC 18V–30V); Supports custom AC 220V/110V power supply

Full-load power consumption: ≤2VA (when powered by DC 24V and operating at full output of 20mA)

Power distribution output: No additional power distribution output; this is a pure signal transmission device

Power supply ripple suppression: ≥40dB; suppresses ripple interference in the power supply circuit to ensure stable operation of the device

4.4 Environmental Adaptation Parameters

Operating Environment Temperature and Humidity: Temperature -10°C to +55°C, Relative Humidity 10% to 90% RH (non-condensing)

Storage Environment Temperature and Humidity: Temperature -20°C to +70°C, Relative Humidity ≤70% RH (non-condensing, no corrosive gases)

Protection Rating: IP20 (for installation in indoor distribution cabinets/ control cabinets; prevents finger contact with internal circuits; no waterproof or dustproof requirements)

Explosion-Proof Compatibility: Non-explosion-proof device, suitable for standard non-hazardous chemical and power applications; for use in explosion-proof environments, must be used with explosion-proof safety barriers; compatible with standard intrinsically safe safety barrier models (selection must be based on the site's explosion-proof rating)

4.5. Physical Parameters

Mounting Method: Supports 35mm standard DIN rail mounting and is compatible with base screw mounting, suitable for standard installation scenarios in power distribution cabinets / control cabinets

Dimensions (L × W × H): 120mm × 75mm × 110mm (industry-standard dimensions for three-phase transmitters, compatible with standard DIN rail mounting spaces)

Weight: Approx. 250 g (including terminal blocks and housing)

Housing Material and Protection Details

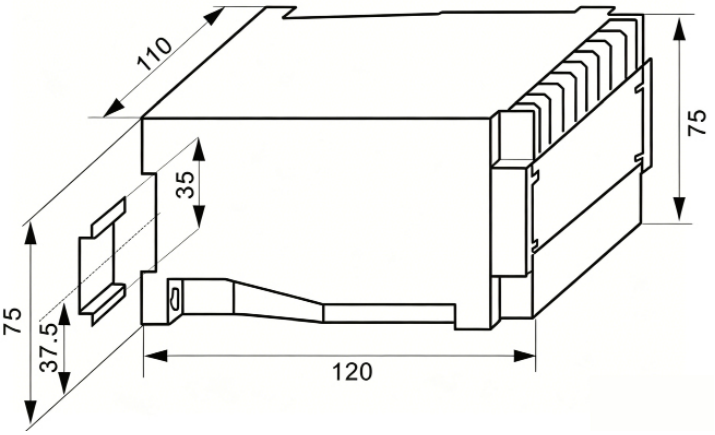
Housing Material: Black engineering plastic housing with electromagnetic shielding properties to suppress electromagnetic interference in the field

Terminal Protection: Upper and lower terminal blocks are made of flame-retardant ABS insulating material, with clearly labeled terminals (terminals 1–16) and a misinsertion-prevention design

Calibration Interface: The front panel integrates ZERO (zero point) and SPAN (full scale) adjustment potentiometers, supporting direct on-site calibration. The potentiometers are equipped with dust-proof covers to prevent dust ingress from affecting adjustment accuracy

Mounting Structure: Metal mounting screws at all four corners; rail-clip mounting ensures a secure installation that is resistant to loosening





V. Application-Specific Selection Guide

5.1 Key Selection Criteria

1. Signal Type

Input Signal: First, confirm the rated signal on the secondary side of the on-site current transformer. The PA-23 is configured by default to support three-phase AC 0–5 A input, but can be customized for non-standard current ranges such as 0–1 A or 0–10 A. Selection must be based on the specifications of the on-site CT.

2. Output Signal: Select based on the type of data acquisition module in the backend PLC/DCS/host computer. The standard configuration is a DC 4–20 mA current signal, but voltage signals such as 0–20 mA, 0–5 V, and 0–10 V can also be customized. Current signals are preferred for long-distance transmission scenarios, while voltage signals are suitable for short-distance data acquisition scenarios.

3. Number of Channels

The PA-23 is a three-phase current integrated data acquisition transmitter. A single unit can achieve synchronous three-phase current acquisition (3 inputs, 1 output / 3 inputs, 3 outputs optional), eliminating the need for multiple single-channel transmitters. If only single- or two-phase current acquisition is required on-site, single-channel models from the same series can be selected to avoid equipment redundancy.

4. Power Supply Option

The standard power supply is 24 V DC, compatible with the DC power circuits of industrial PLCs/DCS systems. If DC power is not available on-site, a custom 220 V AC or 110 V AC version can be provided; the specific model must be selected based on the on-site power supply specifications.

5. Explosion-Proof Requirements
The PA-23 is a non-explosion-proof general-purpose device, suitable only for conventional non-hazardous chemical, power, and metallurgical applications. If the site is an explosion-hazardous area, it must be used in conjunction with an explosion-proof safety barrier; general-purpose transmitters must not be installed directly in hazardous areas. The site's explosion-proof rating (e.g., Ex II 2G Ex ia IIC T4 Ga) must be confirmed, and a compatible safety barrier model must be selected.

6. Installation Environment
Prioritize installation in indoor distribution cabinets or control cabinets. With an IP20 protection rating, this device is not suitable for outdoor environments exposed to moisture, heavy dust, or corrosive gases. If strong electromagnetic interference is present (e.g., near variable frequency drives or medium-frequency furnaces), prioritize the PA-23 model with a black metal housing and high isolation rating to enhance interference resistance. The preferred installation method is 35mm standard DIN rail mounting, which fits standard control cabinet layouts. If DIN rail mounting is not available on-site, the unit can be secured using base screws.

5.2 Industry Application Recommendations
1. Chemical Industry Applications: The standard three-terminal isolated version of the PA-23 three-phase AC current transmitter is recommended. It meets the three-phase current monitoring requirements for motors and pumps in chemical plants. The three-terminal isolation blocks electromagnetic interference from on-site variable frequency drives and high-power motors, ensuring stable current data acquisition. For explosion-proof chemical workshops, it must be used in conjunction with an intrinsically safe barrier; general-purpose transmitters must not be installed directly.

2. Power Industry Applications: We recommend the high-precision Class 0.2 PA-23 transmitter, which is suitable for three-phase current measurement and monitoring in substations and distribution rooms. Its high linearity and low temperature drift meet the power system's requirements for high-precision current data acquisition. It also supports standard 24V DC power supply, making it compatible with conventional power supply circuits in power distribution cabinets.

3. Metallurgy Industry Applications: The enhanced anti-interference version of the PA-23 transmitter is highly recommended. It is suitable for environments with strong electromagnetic interference, such as high-power motors and medium-frequency furnaces in metallurgical workshops. The black metal housing and three-terminal isolation design effectively suppress electromagnetic radiation interference. It also supports a wide operating temperature range, making it suitable for high-temperature operating conditions in metallurgical workshops.

4. Pharmaceutical Industry Applications: The standard version of the PA-23 transmitter is highly recommended. It meets the current monitoring needs for motors and fans in pharmaceutical cleanrooms. With an IP20 protection rating, it is suitable for indoor clean environments free from corrosive gases. The 4–20 mA standard signal output enables seamless integration with PLC control systems commonly used in the pharmaceutical industry.

5. Smart Manufacturing Scenarios: The standard three-terminal isolated PA-23 transmitter is highly recommended. It is suitable for monitoring the current of three-phase motors and measuring energy consumption on automated production lines. Its integrated three-phase data acquisition design reduces wiring complexity, and it supports on-site zero and span calibration, making it ideal for production line commissioning and adapting to changing operating conditions.

5.3 Common Misconceptions in Selection
Misconception 1: Ignoring isolation level requirements and directly using non-isolated transmitters
When high-voltage circuits at the field level are directly connected to low-voltage control systems without isolation protection, it can easily lead to high-voltage leakage, potentially damaging downstream PLC/DCS equipment. Additionally, transmitters without isolation cannot block electromagnetic interference from the field, which can cause signal fluctuations and data distortion. When selecting a transmitter, priority should be given to confirming its three-terminal isolation voltage rating. The PA-23's 2 kVAC isolation voltage rating meets the isolation requirements for the vast majority of industrial applications.

Misconception 2: Selecting based solely on the rated range without considering the range of current fluctuations at the field
Selecting a 0–5 A range transmitter based solely on the current transformer's rated current, without considering the fluctuation range of in-field equipment startup currents and overload currents, results in insufficient transmitter range, leading to output saturation and data distortion. When selecting a transmitter, a range margin of 1.2–1.5 times should be reserved. If significant current fluctuations exist in the field, a wide-range version of the PA-23 transmitter can be customized.

Misconception 3: Neglecting Output Load Matching, Leading to Abnormal Signal Transmission
Failure to select the transmitter's output specifications based on the input impedance of the downstream data acquisition module. For example, if the load resistance of a current-output transmitter exceeds 300Ω, it will cause excessive voltage drop in the output signal, resulting in inaccurate data; If the load resistance of a voltage-output transmitter is too low, the output signal will be pulled down. When selecting a transmitter, verify the input impedance of the downstream data acquisition module. Current-output transmitters are best suited for high-impedance acquisition modules, while voltage-output transmitters are best suited for low-impedance acquisition modules.

Misconception 4: Directly selecting general-purpose transmitters for explosion-proof environments without safety barriers
Installing non-explosion-proof general-purpose transmitters directly in hazardous chemical, petroleum, and other explosion-proof zones poses safety risks. When selecting equipment, the on-site explosion-proof rating must be clearly defined. Non-explosion-proof transmitters must not be installed directly in explosion-proof zones; they must be used in conjunction with flameproof safety barriers to implement an intrinsically safe circuit design, thereby preventing safety incidents caused by electrical sparks.

5.4 Customization Recommendations
1. Custom Solutions for Special Signals
If the site requires non-standard input/output signals—such as three-phase AC 0–1 A or 0–10 A inputs, or DC 0–20 mA, 0–5 V, or 1–5 V outputs—we offer range customization services for the PA-23 transmitter. Based on the user's on-site CT specifications and data acquisition module requirements, we can match the corresponding signal specifications, eliminating the need for additional signal conversion modules.

2. Custom Solutions for Non-Standard Operating Conditions
For special operating conditions, such as wide temperature ranges (-20°C to +70°C), enhanced anti-interference capabilities, upgraded protection ratings (IP30), or AC 220V power supply, we offer customized upgrade services for the PA-23 transmitter to accommodate specific environments such as metallurgy and outdoor applications; We also support customized calibration parameters, with factory pre-calibration to match the zero point and span deviations at the user's site, thereby reducing on-site commissioning efforts.

3. Multi-Channel Integrated Customization Solutions
For sites requiring the acquisition of three-phase current signals from multiple circuits, we offer integrated customization solutions for multi-channel PA-23 transmitters. These solutions enable the simultaneous acquisition and transmission of three-phase current signals from multiple circuits, reducing the number of devices and wiring complexity within control cabinets. They also support modular installation, making them suitable for multi-circuit acquisition scenarios such as large-scale automated production lines and electrical distribution rooms.

VI. Installation and Commissioning Guidelines

6.1. Pre-installation Preparation

1. Component Verification

After unpacking, first verify that the PA-23 transmitter unit, terminal block, and rail clips are intact. Inspect the equipment housing for any dents or deformation. Verify that the model designation (PA-23), input/output specifications, and supply voltage match the order requirements. Confirm that the accompanying certificate of conformity and calibration report are complete.

2. Environmental Inspection

Ensure the installation location is inside an indoor distribution cabinet or control cabinet, free from significant dust, corrosive gases, and condensation. The ambient temperature must be within the range of -10°C to +55°C, and humidity between 10% and 90% RH (non-condensing). The installation location must be kept away from strong sources of electromagnetic interference, such as variable frequency drives, high-power contactors, and medium-frequency furnaces, with a minimum distance of 30 cm from such sources.

3. Tool List

Prepare a Phillips screwdriver, wire strippers, crimping pliers, a multimeter (with current and voltage ranges), electrical tape, and cable ties. If on-site calibration is required, additionally prepare a signal source or standard current generator.

4. Safety Precautions

Before installation, the power supply to the site's high-voltage circuits must be disconnected; live-line work is strictly prohibited. Ensure that the secondary side of the three-phase current transformers (CTs) is securely short-circuited to prevent high voltage caused by an open circuit on the CT secondary side. Verify the positive and negative polarity markings on the 24V DC power supply circuit to prevent equipment damage due to reverse connection.

6.2 Standard Installation Steps

1. DIN Rail Mounting

Secure a 35mm standard DIN rail inside the distribution cabinet, ensuring it is level and firmly installed;

Press the rail latches on the bottom of the transmitter and slide the device onto the rail from top to bottom; a "click" sound indicates proper installation;

Gently push the transmitter body to ensure it is secure. If additional securing is required, mounting brackets can be installed using the screw holes at the four corners.

2. Wiring Specifications (Terminal Identification and Function Definitions)

Terminal numbering and functions are based on the PA-23 marking. Specific wiring rules are as follows:

Input Terminals (1–8):

Terminals 1-2: Phase A current input (connect to the secondary side of the CT for Phase A);

Terminals 3-4: Phase B current input (connect to the secondary side of the CT for Phase B);

Terminals 5-6: Phase C current input (connect to the secondary side of the CT for Phase C);

Terminals 7-8: Reserved terminals; do not connect.

Power Supply and Common Terminals (15-16):

Terminal 15: DC 24V+ power supply;

Terminal 16: DC 24V- power supply;

Output Terminals (9-14):

Terminals 9-10: Phase A output (4-20mA signal +);

Terminals 11-12: Phase B output (4-20mA signal +);

Terminals 13-14: Phase C output (4-20mA signal +);

3. Wiring Requirements:

Power Supply Circuit: The positive and negative terminals of the 24V DC power supply must be strictly distinguished; connect Terminal 15 to + and Terminal 16 to -. Reverse connection is strictly prohibited. A fuse (0.5A) must be installed in series with the power supply circuit for protection.

Input Circuit: The secondary current wires of the three-phase CT must use 1.5mm² copper core wire. When wiring, ensure the terminal screws are tightened to prevent loose connections; The secondary circuit of the CT must not be open-circuited; it must remain short-circuited until wiring is complete.

Output Circuit: Use shielded twisted-pair cable for the 4–20 mA signal lines. Ground the shield at one end (to the grounding busbar inside the control cabinet). Connect the signal + to the PLC or data acquisition module's input +, and the signal – to the COM terminal

4. Grounding Requirements

The transmitter housing does not require a separate ground connection; it is indirectly grounded via the DIN rail to the control cabinet's grounding busbar. The shielding of the output signal cables should be grounded only at the control cabinet end and left floating at the field device end to prevent ground loops. The negative terminal of the power supply circuit must be securely connected to the control cabinet's grounding busbar to reduce common-mode interference.

6.3 Wiring Diagrams and Correct/Incorrect Comparison Notes

1. Standard Wiring Logic (for PA-23 Three-Phase 4-20mA Output)

Power Supply Circuit: DC 24V Power Supply + → Fuse → Terminal 15; DC 24V Power Supply - → Terminal 16; The power supply circuit has no reverse polarity protection; positive and negative terminals must be strictly distinguished.

Input Circuit: CT secondary side Phase A circuit → Terminals 1-2; Phase B circuit → Terminals 3-4; Phase C circuit → Terminals 5-6; All input circuits are current-type inputs with no polarity distinction, but consistency among the three-phase circuits must be maintained.

Output circuits: Terminals 9-10 (Phase A output +) → PLC / data acquisition module AI+; Terminals 11-12 (Phase B output +) → PLC / data acquisition module AI+; Terminals 13-14 (Phase C Output +) → PLC / Acquisition Module AI+; Output signal lines use shielded twisted-pair cable, with the shield grounded at one end to the control cabinet ground bus.

Three-terminal isolation specifications: The grounding of the input, output, and power supply circuits must be mutually independent. It is strictly prohibited to directly short-circuit the secondary side ground of the input circuit's CT, the PLC ground of the output circuit, and the ground of the power supply circuit, to avoid compromising the three-terminal isolation effect.

2. Comparison of Common Wiring Errors and Correct Practices

Reversed Power Supply Polarity

Incorrect Operation: Reversing the polarity of the PA-23 power supply terminals—connecting the 24V negative terminal to the positive power supply terminal and the positive terminal to the negative power supply terminal.

Consequences: The device cannot power on and operate normally. Prolonged reverse polarity will cause the internal power supply chip to fail, resulting in permanent damage to the entire unit and loss of isolation and transmission functions.

Correct Procedure: Strictly distinguish between power supply terminal definitions; connect the DC 24V positive terminal to the designated positive terminal and the negative terminal to the designated negative terminal. Install a small fuse in the power supply circuit to prevent reverse or incorrect connections.

3. Issue with Shielded Cable Grounded at Both Ends

Incorrect Operation: For three-phase output signal shielded twisted-pair cables, one end is grounded in the control cabinet, while the other end is simultaneously grounded at the field device.

Consequences of Error: This creates a loop current interference, leading to frequent fluctuations in current signals, value drift, and unstable data acquisition, significantly reducing the anti-interference effectiveness of the three-terminal isolation.

Correct Procedure: The signal shielding cable must be grounded at a single point throughout its entire length, connected only to the grounding busbar inside the control cabinet; the shielding layer at the transmitter end must remain completely floating and unconnected.

4. Open Circuit on the Secondary Side of Current Transformers

Incorrect Practice: During wiring installation, the CT secondary circuit is not short-circuited in advance, and disconnection and reconnection work is performed directly.

Hazards: An open circuit on the secondary side of a current transformer can instantly generate a high-voltage arc, posing a serious risk to personal

safety. It can also cause a breakdown in the transmitter's input sampling circuit, leading to equipment burnout.
Correct Procedure: Before performing any wiring work on the secondary sides of all three-phase CTs, short-circuit protection must be established. Only after all wiring is complete and verified should the short-circuit connections be removed.

5. Short-Circuiting of Multiple Circuits Sharing a Common Ground
Incorrect Operation: Manually short-circuiting the common ground of the transmitter's high-voltage input circuit, the ground of the low-voltage output signal, and the power supply ground.
Consequences: This directly compromises the PA-23's three-terminal isolation structure, allowing high-voltage interference and common-mode voltage to directly feed into the downstream PLC and DCS control systems. At best, this causes data distortion; at worst, it can burn out the downstream low-voltage data acquisition modules.
Correct Procedure: Maintain electrical isolation between the input, output, and power supply circuits. Do not short-circuit ground wires across circuits; rely on the cabinet's overall grounding to uniformly dissipate interference.

6. Input-Output Connection Mix-Up and Misconnection Issues
Incorrect Operation: Accidentally connecting three-phase current input signal wires to the transmitter's output terminals, or connecting control output lines to the current acquisition input terminals.
Consequences: Incorrect loading of internal sampling circuits and output driver circuits results in complete failure to acquire signals; in severe cases, this causes internal modules to overload and fail.
Correct Procedure: Strictly follow the terminal labels on the device to distinguish between three-phase input terminals, power supply terminals, and three-phase output terminals. Wire each connection to its corresponding terminal, and verify each connection individually after wiring is complete.

6.4 Power-On Commissioning Procedure
1. No-Load Test (No Input Current)
After confirming the wiring is correct, connect the DC 24V power supply and observe the device status:
The power indicator light (if present) should illuminate, and the device should show no abnormal heating or odors;
Use a multimeter to measure the output terminals; under no-load conditions, the output signal should be approximately 4 mA (zero-point state), with a deviation not exceeding ±0.1 mA.

2. Signal Verification (Standard Current Input Test)
Disconnect the secondary circuit of the on-site CT and connect a standard current signal source;
Apply signals corresponding to 0%, 50%, and 100% of the rated current to phases A, B, and C, respectively, and measure the corresponding output signals:
0% input (0A): Output 4mA;
50% input (2.5A): Output 12mA;
100% input (5 A): Output 20 mA;
Record the error at each point; calibration is required if the deviation exceeds ±0.2% FS.

3. Indicator Status Assessment (General Logic)
Normal power supply: Power indicator is constantly on;
Signal Abnormality: If the device has an alarm indicator, the alarm light will illuminate when the output exceeds the full scale;
Non-indicator Version: Use a multimeter to measure the output signal to determine the device status; if there is no output, check the power supply circuit and wiring first.

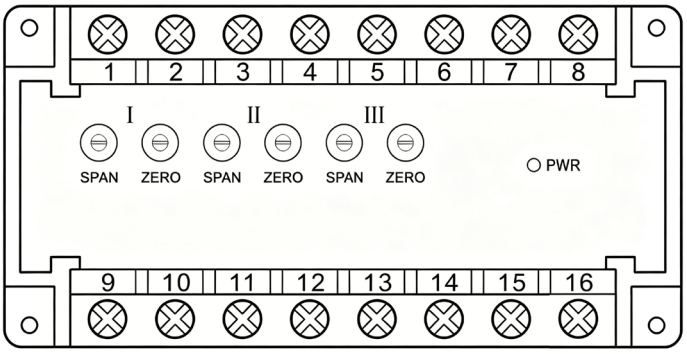
4. Accuracy Calibration Method (Field Calibration)
Zero Calibration: Apply a 0A standard current and adjust the ZERO potentiometer on the panel to stabilize the output signal at 4mA;
Range Calibration: Apply a rated 5A standard current and adjust the CAL potentiometer on the panel until the output signal stabilizes at 20mA;
Repeat Verification: After calibration, apply 0%, 50%, and 100% currents again to confirm that the error is within the allowable range. Once calibration is complete, secure the potentiometer with electrical tape to prevent accidental contact.

6.5 Installation Precautions and Protective Measures
1. Never exceed the rated voltage
The standard power supply for the device is 24 V DC, with a voltage range of 18 V to 30 V. Never connect the device to 220 V AC or a DC power source exceeding 30 V, as this will cause the device to burn out immediately; a fuse must be installed in series with the power supply circuit to provide overcurrent protection.

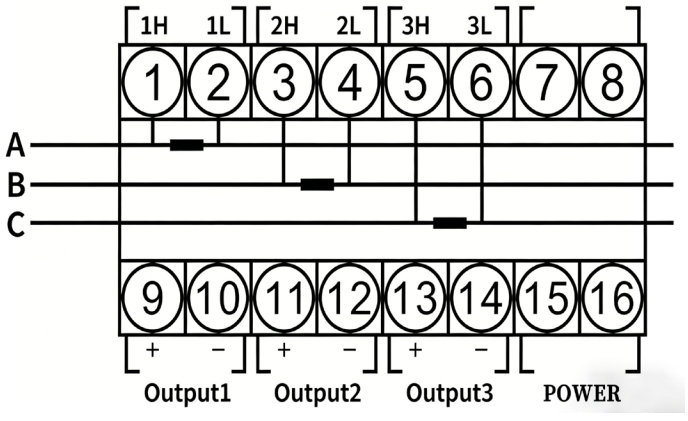
2. Avoid High-Voltage Interference
The transmitter must be installed away from sources of strong electromagnetic interference, such as variable frequency drives, high-power contactors, and cable trays. When routing cables parallel to power cables, maintain a distance of at least 30 cm, or use shielded conduit for isolation. Output signal cables and power cables must be routed in separate cable trays; do not install them in the same tray.

3. Protective Measures for Humid Environments
The device has an IP20 protection rating and must not be installed directly outdoors or in environments with high humidity or significant condensation. If on-site humidity is high, install a dehumidifier inside the control cabinet or use a custom moisture-resistant version of the transmitter. Install dust covers on the terminal blocks to prevent dust and moisture from entering the terminals.

4. Other Prohibitions
Never insert or remove terminal blocks while the power is on to prevent arcing and damage to the terminals; never strike or shake the transmitter while the equipment is running to prevent internal circuit loosening; do not disassemble the equipment housing yourself, as doing so will void the warranty.



Non-technical personnel are prohibited from performing calibration
① Zero adjustment: With the input signal set to 0, adjust the "ZERO" potentiometer on the panel so that the output signal is the minimum output signal (e.g., 0 or 4 mA)
② Full-scale adjustment: Apply the nominal signal (full-scale signal) to the input terminal, and adjust the "SPAN" potentiometer on the panel so that the output signal is the maximum output signal (e.g., 20 mA)
③ Repeat this adjustment several times to achieve optimal accuracy.



Installation Precautions
1. Be sure to follow the wiring diagram when connecting the wires, and verify that the power supply and wiring are correct before turning on the power;
2. Ensure that the input signal is within the detection range;
Product Warranty Information
1. This manual is not a general manual for this type of product; the contents are subject to change without notice;
2. For normal use of this product, the company provides free warranty service for one year from the date of purchase;

VII. Recommendations for Daily Use and Maintenance
7.1 Key Points for Daily Inspections
1. Equipment Appearance and Condition Inspection
Conduct daily/weekly visual inspections of the transmitter housing to ensure the black casing shows no deformation, damage, or significant dust accumulation. Check the installation status to confirm that the rail clips are secure, terminal blocks are tight, and wiring is intact. If the device has a power indicator light, verify that it remains steadily lit without flickering, turning off, or displaying abnormal alarm conditions.

2. Signal Stability Monitoring
Daily, review the three-phase current data via the PLC/DCS monitoring system, paying close attention to any abnormal phenomena such as frequent fluctuations, value drift, or step-like variations; compare the balance of the three-phase current data; if the data for a particular phase shows a persistent significant deviation, prioritize troubleshooting the wiring or the condition of the current transformer for that phase; Record the range of data fluctuations; under normal operating conditions, fluctuations should be ≤±0.1% FS. If the range is exceeded, promptly investigate potential interference or equipment malfunctions.

3. Environmental Temperature and Humidity Monitoring
Check the temperature and humidity inside the power distribution cabinets/control cabinets daily to ensure the ambient temperature remains within the range of -10°C to +55°C and humidity between 10% and 90% RH (non-condensing); If on-site humidity is high, check whether the cabinet's dehumidification system is operating normally and whether condensation has formed on the transmitter's terminal block; during periods of high summer temperatures, pay close attention to heat dissipation around the equipment to prevent increased temperature drift caused by excessive cabinet temperatures.

4. Inspection of Surrounding Interference Sources
Conduct weekly inspections of equipment that may cause interference near the transmitters, such as variable frequency drives, high-power contactors, and motors, to confirm normal operation and the absence of abnormal electromagnetic radiation; check the routing distance between power cables and transmitter signal lines to ensure there are no new interference sources or improper wiring, thereby preventing interference signals from entering the transmitter circuit.

7.2. Regular Maintenance Plan
1. Monthly Maintenance: Cleaning and Visual Inspection
After powering down, use a dry brush or lint-free cloth to clean dust from the transmitter housing and terminal block surfaces to prevent dust accumulation from affecting terminal conductivity;
Check whether terminal block screws are loose and use a screwdriver to tighten each terminal individually to prevent signal abnormalities caused by loose connections;
Check whether the signal cable shielding is intact and whether the grounding terminal is loose to ensure reliable shield grounding.

2. Quarterly Maintenance: Wiring and Grounding Verification
Conduct a comprehensive review of the wiring for the three-phase current input circuit, power supply circuit, and output signal circuit. Compare against the terminal definition diagram to confirm there are no miswiring or mixed connections;
Check the short-circuit status of the CT secondary circuits (if applicable) to confirm there is no risk of an open circuit;
Verify the single-ended grounding status of the output signal cable shielding to ensure grounding is only on the control cabinet side and that there is no double-ended grounding;
Check whether the connection between the transmitter and the control cabinet grounding busbar is reliable, ensuring the grounding resistance is ≤4Ω.

3. Annual Maintenance: Accuracy Retesting and Calibration
Disconnect the secondary circuit of the on-site CT, connect a standard current source, and perform accuracy retests on each of the three-phase channels at 0%, 50%, and 100% of the full scale (FS);
Compare the deviation between the measured output signal and the standard value; if the deviation exceeds ±0.2% FS, perform on-site calibration using the ZERO (zero) and SPAN (range) potentiometers on the panel;
After calibration, record the calibration data and compile an annual maintenance report. Secure the potentiometers with dust-proof covers to prevent accidental adjustment due to changes in on-site conditions;
Check the transmitter's insulation performance by testing the insulation resistance between each isolation terminal with a 500V megohmmeter to ensure it is ≥100 MΩ.

7.3 Long-Term Maintenance Tips
1. Long-Term Dust and Moisture Protection
During installation, install dust covers on the transmitter terminal blocks to reduce the ingress of dust and moisture;
Install dust filters and dehumidifiers inside the distribution cabinet/control cabinet to control humidity and prevent condensation from corroding terminals and internal circuits;
If the on-site environment is highly dusty, consider customizing an upgraded version with an IP30 protection rating to enhance the device's dust and moisture resistance;
During long-term shutdowns, disconnect the power supply and cover the transmitter body with a dust cover to prevent dust accumulation and moisture absorption caused by prolonged inactivity.

2. Techniques for Optimizing Interference Resistance
Use shielded twisted-pair cables for the entire length of the output signal lines, with the shield grounded at one end to prevent ground loop interference;
Route signal lines and power cables in separate cable trays, maintaining a parallel distance of ≥30 cm; when crossing, use a perpendicular crossing method to reduce electromagnetic coupling interference;
Install the transmitter away from strong interference sources such as variable frequency drives and medium-frequency furnaces; if necessary, install a metal shielding enclosure to further suppress electromagnetic interference;
Install EMI filters in the power supply circuit to filter out ripple interference and ensure stable power supply to the equipment.

3. Protection Solutions for Extreme Environments
High-temperature environments: Install cooling fans or air conditioning in the distribution cabinet to maintain a cabinet temperature ≤50°C, preventing increased temperature drift in the equipment due to high temperatures; consider using wide-temperature-range transmitters with an operating temperature range extended to -20°C to +70°C;
Low-temperature environments: During cold winter periods, ensure proper insulation within the cabinet to prevent equipment startup failures caused by temperatures below -10°C;
Corrosive Gas Environments: Install transmitters in sealed control cabinets to prevent corrosive gases from coming into direct contact with the equipment housing and terminals; consider using custom corrosion-resistant enclosures to enhance the equipment's corrosion resistance;
High-Vibration Environments: Secure the transmitter body with mounting screws to prevent rail clips from loosening due to prolonged vibration, and simultaneously inspect terminal block connections for loosening caused by vibration.

VIII. Troubleshooting & Emergency Procedures
8.1 List of Common Faults
The device has no output signal (all three-phase outputs are 0 mA or a fixed value)
Signals drift continuously or values fluctuate, preventing stable data acquisition
The power indicator light is off or flashing abnormally (for versions with an indicator light)
Output signal exceeds upper/lower range limits (e.g., fixed at 20mA or below 4mA)

Excessive deviation in three-phase signals, abnormal single- or two-phase data, or three-phase imbalance
Severe data interference, resulting in irregular fluctuations or step-like jumps
Abnormal overheating of the equipment, hot casing, or even the presence of an unusual odor

8.2 Analysis of Fault Causes
1. No Output from the Device
Wiring errors: Reversed polarity of power terminals, reversed or loose output signal wires, or missing common (COM) connection
Power supply issues: No 24 VDC power supply, blown fuse in the power supply circuit, or supply voltage below 18 V or above 30 V
Input circuit faults: Open circuit on the CT secondary side, loose or broken connections in the three-phase input circuit
Equipment Damage: Internal power module burned out; output driver circuit damaged

2. Signal Drift / Unstable Data
Environmental Interference: Signal cables routed in the same conduit as power cables; shielding grounded at both ends, creating a ground loop; influence from strong nearby electromagnetic interference sources
Loose Connections: Terminal block screws loose; loose connections in input/output circuits; unstable contact resistance
Calibration Abnormalities: Zero/range potentiometers not calibrated or accidentally adjusted on-site, causing zero drift or range deviation
Environmental Temperature and Humidity: Excessively high or low cabinet temperature, high humidity causing condensation, leading to increased thermal drift or reduced insulation

3. Indicator Light Abnormalities (Versions with PWR Indicator)
Not Lit: Power not connected, reversed polarity, or burned-out power module
Flashing: Unstable supply voltage, excessive power supply ripple, or overload triggering power protection
Constant On with No Signal: Power supply is normal but input/output circuit failure, or internal circuit failure

4. Output Signal Out of Range
Input Overload: Three-phase current exceeds the transmitter's rated range, causing output saturation
Range Calibration Error: Range potentiometer was accidentally adjusted, causing overall output signal offset
Input circuit fault: A short circuit on the secondary side of a CT in one phase, causing an abnormal increase in input current
Output circuit short circuit: The positive and negative terminals of the output signal lines are shorted, causing an abnormal output signal

5. Three-phase signal imbalance / Single-channel anomaly
Single-channel wiring fault: Loose connection or broken wire at a phase's input/output terminal
Single-channel calibration anomaly: ZERO/SPAN potentiometer for a phase is uncalibrated or incorrectly adjusted
Damage to internal single-channel circuitry: Sampling circuit or output channel failure

6. Interference distortion / Data glitches
Improper Cabling: Signal cables laid in the same conduit as power cables; failure to use shielded twisted-pair cables
Grounding Errors: Shield grounded at both ends; short circuit between equipment ground and system ground, compromising three-point isolation
External Interference Sources: Electromagnetic radiation interference from devices such as variable frequency drives, high-power contactors, and medium-frequency furnaces

7. Abnormal Equipment Heating / Unusual Odors
Overvoltage Supply: Connection to a DC power source exceeding 30V or accidental connection to 220V AC power
Circuit Short Circuit: Short circuits in the power supply or output circuits, causing internal circuit overcurrent and overheating
Prolonged Overload: Input current consistently exceeds the rated value, causing the sampling circuit to overheat
Internal Circuit Burnout: Damage to the power module or driver circuit, resulting in localized overheating

8.3 Step-by-Step Troubleshooting
1. Troubleshooting for No Output
Step 1: Check the power supply circuit. Use a multimeter to measure the voltage at the power supply terminals to confirm it is between 18V and 30V DC, and ensure the positive and negative terminals are not reversed. Check whether the fuse in the power supply circuit has blown, and replace any damaged fuses.
Step 2: Inspect the terminal blocks. Tighten the terminal screws for the power supply, input, and output circuits one by one to ensure there are no loose connections or broken wires. Refer to the terminal definition diagram to verify that the positive and negative output signal wires are correctly connected to the COM terminal.
Step 3: Inspect the input circuit. Confirm that there are no open circuits in the CT secondary circuit and that the three-phase input signals are normal. You can measure the input circuit current with a multimeter (Note: The short circuit on the CT secondary side must be restored first).
Step 4: If all the above checks are normal, replace the transmitter with a spare unit for testing to confirm whether the issue is caused by internal circuit damage.
Contingency Plan: If a spare PA-23 transmitter is available on-site, quickly replace the faulty unit with the spare to restore signal acquisition; send the faulty unit for repair after the system is shut down.

2. Troubleshooting Signal Drift / Unstable Data
Step 1: Check the shield grounding. Ensure that the output signal shield is grounded at only one end (on the control cabinet side) and is not grounded at the field end. Reorganize the signal cable routing to separate it from power cables in different cable trays, maintaining a distance of at least 30 cm.
Step 2: Tighten all terminal connections, particularly the CT secondary terminals on the input circuit and the acquisition module terminals on the output circuit, to eliminate contact resistance variations caused by loose connections.
Step 3: Perform zero and span calibration. Disconnect the field CT signal, apply a standard current signal, and recalibrate the ZERO and SPAN potentiometers to correct zero drift and span deviation.
Step 4: Check the temperature and humidity inside the cabinet. Install a dehumidifier or cooling fan to maintain the ambient temperature between -10°C and +55°C and ensure humidity levels do not cause condensation.
Contingency Plan: Temporarily configure the signal lines for single-ended grounding and route them away from interference sources. Simultaneously, configure signal filtering parameters via the PLC to reduce data fluctuations. Perform a thorough rectification after the system is shut down.

3. Troubleshooting Abnormal Indicator Lights
Step 1: Check the supply voltage and polarity to confirm that the 24 V DC power supply is normal and not reversed. If the voltage is normal, replace the fuse in the power supply circuit.
Step 2: If the indicator light is flashing, check the power supply circuit for excessive ripple; a power filter may be installed. Simultaneously, check the output circuit for short circuits; disconnect the output signal lines and observe the indicator light status.
Step 3: If the indicator light still does not illuminate, use a multimeter to measure the power supply terminals to confirm there is no voltage output. This indicates a failure of the internal power module, and the device must be replaced.
Emergency Procedure: Directly replace the unit with a spare transmitter to restore power supply and signal acquisition; send the faulty unit for repair.

4. Troubleshooting for Output Signal Out-of-Range Faults
Step 1: Check the three-phase input current. Use a clamp meter to measure the current on the secondary side of the CT to confirm whether it exceeds the transmitter's rated range; if overloaded, adjust the CT ratio or replace the transmitter with a wide-range model.
Step 2: Disconnect the on-site CT signal and apply a 0A standard current to observe whether the output signal returns to 4mA; if it remains at 20mA, this indicates that the range potentiometer has been incorrectly adjusted and requires recalibration.
Step 3: Inspect the output signal lines to confirm there are no short circuits; if the output circuit is shorted, troubleshoot the wiring fault and replace any damaged signal lines.

Contingency Plan: Temporarily lower the upper range limit of the downstream data acquisition module to prevent system alarms; replace the transmitter or adjust the CT ratio after the system is shut down.

5. Three-Phase Signal Imbalance / Single-Channel Abnormality Troubleshooting
Step 1: Inspect the input/output terminals of the corresponding phase to ensure there are no loose connections or broken wires; tighten the terminal screws and reinsert the signal cables.
Step 2: Calibrate the abnormal channel separately by applying a standard current signal, then recalibrate the ZERO and SPAN potentiometers for that phase to correct the deviation.
Step 3: If calibration fails, swap the input signal cable of the abnormal phase with that of a normal phase. If the fault follows the signal cable, it indicates an input circuit fault; if the fault remains in the original channel, it indicates damage to the internal single-channel circuitry of the device.
Contingency Plan: Temporarily switch the signal from the faulty channel to a backup channel for data acquisition, and replace the transmitter after the system is shut down.

6. Troubleshooting Interference Distortion / Data Jitter Faults
Step 1: Reorganize the cabling. Replace signal cables with shielded twisted-pair cables, route them in separate cable trays from power cables, and maintain perpendicular cross-routing to reduce electromagnetic coupling.
Step 2: Verify that the shielded cable is grounded at one end only. Disconnect the shield grounding at the field side, retaining grounding only at the control cabinet side. Simultaneously, check the connection between the equipment ground and the system ground to prevent ground loops.
Step 3: Install EMI filters in the power supply circuit to remove power supply ripple. If there are strong interference sources nearby, install a metal shielding enclosure to enhance the equipment's immunity to interference.
Contingency Plan: Enable signal filtering via the PLC/DCS system and set a longer sampling period to filter out high-frequency interference; perform wiring modifications after the system is shut down.

7. Troubleshooting for Abnormal Equipment Overheating / Unusual Odors
Step 1: Immediately cut off the equipment's power supply and cease operation to prevent the fault from escalating; use a multimeter to measure the resistance of the power supply circuit to confirm there is no short circuit.
Step 2: Check the supply voltage to ensure it is not exceeding the rated voltage; If AC 220V is mistakenly connected or the DC voltage exceeds 30V, this indicates that the device's power supply module has been damaged and the device must be replaced.
Step 3: Check the input/output circuits for short circuits; disconnect the signal lines and observe the device's status. If a short circuit is detected, troubleshoot the wiring and replace any damaged wires.
Contingency Plan: Immediately replace the device with a spare transmitter. Do not power on the faulty device again; it must be sent to the factory for inspection and repair.

8.4 After-Sales Repair Guidelines
1. Criteria for Determining a Malfunction (Situations Requiring Repair)
The device has no output, and the issue cannot be resolved after checking the power supply and wiring;
Single- or multi-channel signals cannot be calibrated, with deviations exceeding ±0.5% FS, and cannot be corrected through on-site calibration;
The device exhibits abnormal heating, emits an unusual odor, or has indicator lights that do not illuminate, suggesting internal circuit burnout;
Failure of three-terminal isolation, resulting in high-voltage current entering the downstream system, confirmed by insulation testing;
Repeated signal abnormalities on the same device within a short period, which cannot be resolved after ruling out external interference and wiring issues.

2. Repair Process
Prepare device information: PA-23 model, product serial number, purchase date, on-site operating conditions, and description of the fault;
Contact after-sales technical support, provide device information and a description of the fault, and cooperate with technicians to complete remote troubleshooting;
If the issue cannot be resolved through remote troubleshooting, follow the technician's instructions to arrange for the device to be returned for repair or replacement;
After the device is returned, technicians will complete inspection, repair, or replacement, issue a repair report, and arrange for its return shipment.

3. Warranty Coverage and Terms
Warranty Period: A 12-month warranty period begins on the date of purchase. During this period, free repair or replacement services will be provided for equipment failures not caused by human error;
Exclusions: Damage caused by excessive voltage supply, incorrect wiring, or on-site environmental factors such as corrosion, water ingress, or severe vibration; faults resulting from unauthorized disassembly of the equipment housing or modification of the circuitry; and equipment failures occurring after the warranty period has expired;
Warranty services for customized versions of the equipment shall be subject to the terms specified in the contract.