3-Phase LED/LCD Digital Ammeter & Voltmeter

I. Product Definition

The three-phase LED/LCD digital current meter and voltmeter are embedded panel-mounted electrical measurement instruments designed for industrial three-phase power distribution systems. They are specifically engineered for monitoring the voltage and current in the A, B, and C phase circuits; the current meter focuses on three-phase current acquisition, while the voltmeter focuses on three-phase voltage acquisition.

Summary of Core Features:

1. Simultaneously acquires electrical parameters for phases A, B, and C, supporting both three-phase three-wire and three-phase four-wire wiring configurations; the LED model uses red LED displays for phase-by-phase polling or cyclic display, while the LCD model supports simultaneous display of multiple parameters on a single screen, allowing users to switch between phase values.

2. Utilizes a true RMS measurement algorithm to maintain stable measurement accuracy even in non-sinusoidal industrial power grids containing harmonics and distortion; accuracy class 0.5.

3. Supports on-site programmable parameter settings: CT (current transformer) ratio, PT (voltage transformer) ratio, decimal point position, and display switching time, making it suitable for high-voltage and high-current power distribution circuits without requiring hardware modifications.

4. Optional expansion features: upper and lower limit relay alarm outputs (phase-by-phase out-of-limit alarms), RS485 Modbus-RTU communication, and multiple isolated 4–20 mA analog transmitter outputs, allowing the A/B/C phase data to be uploaded separately to PLCs, industrial control panels, and SCADA/DCS upper-level monitoring systems.

5. The hardware features built-in EMC (electromagnetic compatibility) protection and input overvoltage and overload protection, making it suitable for workshops with strong electromagnetic fields where inverters and motors are densely concentrated; parameters are permanently retained even during power outages, ensuring that the set transformation ratios and thresholds are not lost.

6. The panel features a snap-in, flush-mount design for direct installation into switchgear or control cabinet panels; power supply options include 24 V DC and 85–265 V AC/DC wide-voltage models.

7. Independent measurement per unit: The three-phase ammeter measures only three-phase currents, and the three-phase voltmeter measures only three-phase voltages; the instrument includes built-in phase sequence anomaly detection, capable of identifying phase loss and phase sequence reversal faults in three-phase circuits.

II. Working Principle

1. Signal Sampling Stage: The three-phase voltmeter acquires three-phase voltage signals via a voltage divider circuit; the three-phase ammeter is connected to three current transformers, which convert high primary-side currents into low-current signals recognizable by the meter, with the A/B/C channels sampled independently.

2. Signal Conditioning and Analog-to-Digital Conversion: The acquired analog signals enter the meter's internal conditioning circuit; after filtering and noise reduction, they are sent to a high-precision ADC (analog-to-digital converter) chip, which converts the continuous analog electrical signals into digital signals.

3. MCU Processing: The main control microprocessor reads the digitized sample data and calculates the voltage and current of each phase using the true RMS algorithm; it retrieves the preset CT/PT transformation ratio parameters to convert the values to the actual electrical quantities of the primary circuit; it simultaneously checks for phase loss and out-of-limit conditions.

4. Display Drive: The LED display version cycles through the values of phases A, B, and C; the LCD version displays all three-phase data on the same screen.

5. Optional Function Processing: When the alarm function is enabled, if the value of any phase exceeds the set threshold, the relay contacts are activated; when the communication/transmitter function is enabled, the three-phase measurement data is output to an external automation monitoring system.

Core Values:

1. This product is designed for on-site, real-time monitoring of three-phase voltage and current in industrial power distribution panels, motor control panels, high- and low-voltage feeder panels, and complete electromechanical systems. It replaces the traditional setup of three analog meters, as a single unit can monitor all three phases (A, B, and C), thereby saving installation space within the panel;

2. It addresses common pain points such as the inability to promptly detect three-phase imbalance or phase loss, significant reading errors in analog meters, and the inability to remotely upload three-phase data. It supports the 24 V DC power supply commonly used in international trade projects, offers strong interference resistance, and is compatible with complex industrial power grids;

3. It can monitor three-phase current or three-phase voltage independently. Compared to multifunctional power meters, it offers lower procurement costs and simplifies the selection process.

Challenges:

Q1: Traditional solutions for monitoring three-phase electrical parameters require the installation of three analog meters, which take up a significant amount of cabinet space and are prone to parallax errors when reading the readings. How can this be simplified?
A1: A single unit from this series of three-phase digital meters can simultaneously measure the A, B, and C phase voltages or currents. One unit replaces three analog meters, saving space in the panel; the uniform digital display eliminates visual discrepancies during manual readings and reduces meter-reading errors.

Q2: Three-phase power distribution systems are prone to phase loss and three-phase imbalance. Traditional analog meters cannot quickly identify these faults. How can this be resolved?
A2: The meter features built-in phase sequence and phase loss detection. If a phase loss, incorrect phase sequence, or excessive three-phase imbalance occurs, the panel displays an anomaly alert. When paired with an alarm-equipped model, it can trigger a relay output to promptly alert operations and maintenance personnel to troubleshoot the fault and protect downstream motor loads.

Q3: Industrial power grids contain harmonics, and variable frequency drives (VFDs) cause waveform distortion. What should be done if standard meters provide inaccurate measurements or erratic readings?
A3: The meter uses True RMS (True Root Mean Square) calculation, maintaining Class 0.5 measurement accuracy even for distorted, harmonic-laden industrial electrical signals. Combined with an EMC anti-interference circuit, it ensures stable readings in environments with strong interference from variable frequency drives and motors, reducing value fluctuations.

Q4: For high-current, high-voltage three-phase circuits, how can current transformers (CTs) and potential transformers (PTs) be flexibly configured, and how can parameters be quickly set on-site?
A4: The meter supports programmable CT/PT ratio settings. Parameters can be modified directly via the SET button on the front panel, making it suitable for high-voltage and high-current power distribution scenarios. There is no need to replace the meter's hardware, and on-site commissioning is straightforward.

Q5: We need to feed the A/B/C three-phase data into a central control DCS/PLC system. Traditional analog meters cannot transmit data remotely—how can this be achieved?
A5: You can choose the RS485 Modbus communication version or the 4–20 mA multi-channel transmitter version. The A, B, and C three-phase data can be uploaded separately to the upper-level monitoring system, enabling remote real-time monitoring and data logging.

Q6: The customer only needs to monitor three-phase current (or only three-phase voltage). Multifunctional power meters have redundant features and high procurement costs. How should we select the appropriate model?
A6: Select standalone three-phase current meters or three-phase voltage meters from this series. These retain only the corresponding electrical quantity measurement functions, offering a streamlined feature set and better value for money. They meet the needs of simple three-phase current/voltage monitoring while avoiding cost waste caused by unnecessary features.

Key Product Specifications & Detailed Specifications

I. Basic Electrical Parameters

Project	Three-Phase Digital Current Meter (LED / LCD)	Three-Phase Digital Voltmeter (LED / LCD)
Accuracy Class	Class 0.5 (±0.5% FS, True RMS)	Class 0.5 (±0.5% FS, True RMS)
Measurement Algorithm	True RMS, suitable for distorted and harmonic-laden power grids	True RMS, suitable for distorted and harmonic-laden power grids
Wiring Configuration	Configurable for three-phase three-wire or three-phase four-wire systems	Configurable for three-phase three-wire or three-phase four-wire systems
Standard Input Signal	AC: 1A / 5A (with external CT)	AC: 0–500 V direct connection; external PT (voltage transformer) required for high-voltage applications
Overrange Capability	Continuous: 1.2 times rated; Instantaneous: 10 times rated, with 5-second protection	Continuous: 1.2 times rated; Instantaneous: 2 times rated, with 1-second protection
Measurement Frequency	45–65 Hz	45–65 Hz
Display Specifications	LED Model: 4-digit red LED display, cyclically switching between phases A, B, and C; LCD Model: Simultaneous display of phase A, B, and C values on the same screen, with switchable interfaces	LED Model: 4-digit red LED display, cyclically switching between phases A/B/C; LCD Model: Simultaneous display of phase A, B, and C values on the same screen, with switchable interfaces
Refresh Rate	Approx. 1 update per phase; full three-phase data refreshes every 1 second	Approx. 1 update per phase; full three-phase data refreshes every 1 second
Programmable Parameters	CT ratio, decimal point, cyclic display time, phase loss/unbalance thresholds	PT transformation ratio, decimal point, cyclic display time, phase loss/unbalance thresholds
Optional Outputs	① RS485 Modbus-RTU; ② Multiple 4–20 mA isolated transmitters; ③ Phase-specific upper and lower limit relay alarms (passive contacts, AC 220 V/3 A)	① RS485 Modbus-RTU; ② Multi-channel 4–20 mA isolated transmitters; ③ Phase-specific upper and lower limit relay alarms (passive contacts, AC 220 V/3 A)
Fault Detection	Phase loss, incorrect phase sequence, and three-phase unbalance monitoring	Phase loss, incorrect phase sequence, and three-phase unbalance monitoring

II. Isolation Performance Parameters
---Insulation Resistance: ≥100 MΩ between signal input terminals, auxiliary power supply, and output terminals @ 500 V DC
---Power-Frequency Withstand Voltage: Input Circuit ↔ Auxiliary Power Supply: 2000 V AC, 50 Hz, sustained for 1 min, with no breakdown or flashover
---Input Circuit ↔ Instrument Housing: 2000 V AC, 50 Hz, sustained for 1 min
---Output Circuit (Communication / Transmitter / Alarm) ↔ Power Supply: 1000 V AC, 50 Hz, sustained for 1 min
---EMC (Electromagnetic Compatibility): Complies with the IEC 61000 series of standards; resistant to electrostatic discharge, surges, and fast transient bursts; suitable for industrial environments with strong electromagnetic fields, such as those with a high concentration of variable frequency drives and motors
---Mutually Isolated Multi-Channel Transmitter Outputs: The optional multi-channel 4–20 mA version features electrical isolation between the A, B, and C three-phase analog output channels to prevent channel crosstalk

III. Power Supply & Power Consumption Parameters
---Power Supply Options:
Version 1: 24 VDC (Standard for export automation equipment; input range 22–28 VDC)
Version 2: Wide-voltage AC/DC 85–265 V (Commonly used in domestic distribution cabinets)
---Full-Load Power Consumption: LED Basic Model ≤ 3.5 VA; LCD Basic Model ≤ 4 VA; Communication + Multi-Channel Transmitter Combo Model ≤ 5 VA
---Optional Power Feed-Out: 24 VDC feed-out, maximum load 30 mA, capable of powering small field sensors; the feed-out circuit is isolated from the instrument's main power supply
---Power Supply Tolerance: Permissible power supply ripple ≤ 10%; does not affect three-phase measurement accuracy

IV. Environmental Adaptation Parameters

Model	Specifications
Operating Temperature	-10°C to +55°C
Storage Temperature	-25°C to +70°C
Relative Humidity	5% to 93% RH, no condensation, no corrosive gases, no salt fog
Operating Altitude	≤2,500 m; up to 4,000 m altitude—high-altitude versions available upon request
Panel Protection Rating	IP54 on the front panel; IP30 on the terminal side at the rear of the instrument (when installed inside a cabinet)
Explosion-Proof Rating	The standard model is a non-explosion-proof instrument; when used in hazardous areas, the instrument must be installed in a safe area, and the front-end circuit must be equipped with Qidian QD Series intrinsically safe barriers to form an intrinsically safe monitoring system. The instrument body must not be placed directly within an explosion-proof zone.
Pollution Degree	Pollution Degree 2; for indoor control cabinet installation only; outdoor use without protection is prohibited.
MTBF (Mean Time Between Failures)	≥50,000 h

V. Physical Specifications
1. **Installation Method**: Panel-mounted snap-in installation; comes with transparent plastic elastic clips; slides into a cutout in the cabinet for secure mounting; no panel mounting screws required

2. Dimensions (Width × Height × Depth): **96mm × 96mm × 82mm**
3. Cabinet Cutout Dimensions: **91 mm × 91 mm**; compatible with control cabinet panel thicknesses ranging from 1 to 5 mm

4. Net Weight: LED version approximately 220 g; LCD version approximately 240 g

5. Housing Material: UL94-V0 flame-retardant black ABS engineering plastic, matte finish, resistant to aging

6. Panel structure: The front features 4 blue operation buttons (Shift, SET/Confirm); the upper right corner is marked with "V/A" to distinguish between voltmeter and ammeter models; the LED version has a red digital display, while the LCD version has an LCD screen; the rear is equipped with green pluggable terminal blocks, and snap-fit slots are provided on both sides

> 1. Panel outer dimensions: 96 mm (W) × 96 mm (H)
> 2. Cabinet cutout: 91 mm × 91 mm square cutout
> 3. Meter cabinet insertion depth: 82 mm (including rear terminal block)
> 4. Slots on both sides of the instrument panel are fitted with 2 sets of plastic latches to secure the panel from the rear of the cabinet

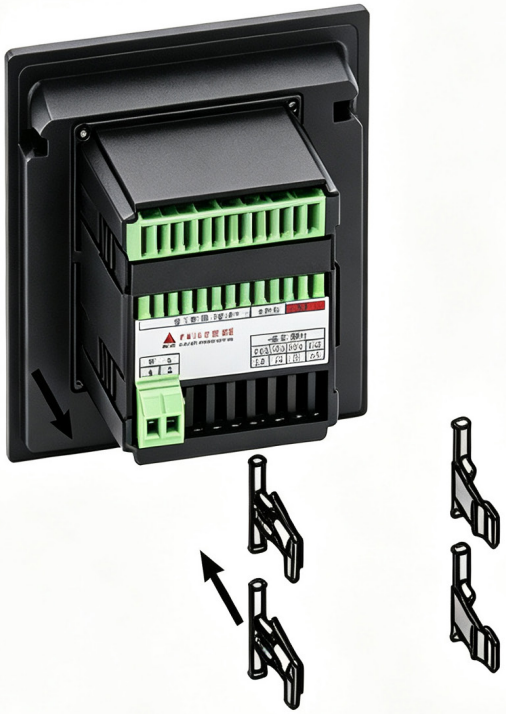




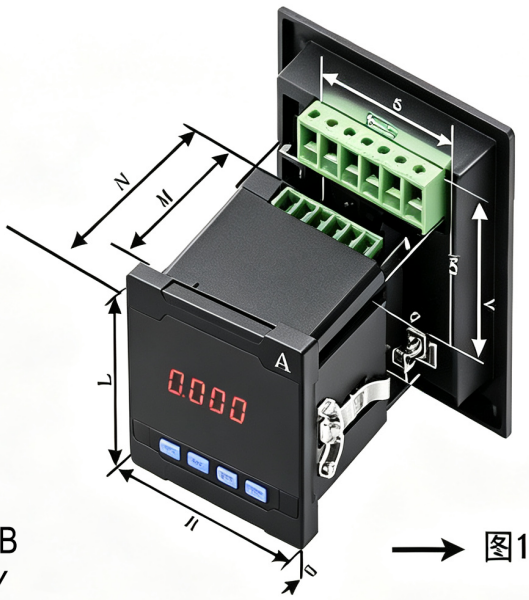





Front View



Rear View



→ 图1

Mounting Dimensions: A x B
Cutout Dimensions: S x Y
Panel Dimensions: L x H (Unit:mm)

Dimensions (L x H) Unit: mm	Mounting Dimensions (A x B) Unit: mm	Cutout Dimensions (S x Y) Unit: mm	Overall Length (N)mm	Depth (M)mm
120 x 120	110 x 110	111 x 111	93	85
96 x 96	90 x 90	91 x 91	93	85
80 x 80	75 x 75	76 x 76	81	71
72 x 72	66 x 66	67 x 67	81	71

Scenario-Based Selection Guide

Key Selection Criteria

1. **Signal Type**: Confirm that the system under test is a three-phase AC system, and distinguish between voltage and current measurements. The input signal for the three-phase ammeter is the secondary output of a CT (current transformer) at 1 A or 5 A; the three-phase voltmeter can be directly connected to voltages ranging from 0 to 500 V. In high-voltage applications, a PT (potential transformer) must be used. Confirm whether the power grid contains harmonics or nonlinear loads; for harmonic conditions, a version with true RMS measurement must be selected.

2. **Number of Channels**: This series consists of three-channel, independently sampling meters; a single meter can simultaneously measure the A/B/C phase currents or the three-phase voltages. Three-phase current meters measure only the three-phase currents, while three-phase voltage meters measure only the three-phase voltages. If you need to monitor both three-phase voltages and three-phase currents simultaneously, you must select one three-phase voltage meter and one three-phase current meter.

3. **Power Supply**: The 24 V DC version is suitable for automated equipment and international trade projects, powered by the DC power supply in a PLC cabinet; the 85–265 V AC/DC wide-voltage version is suitable for domestic high- and low-voltage power distribution switchgear and can be directly connected to the mains power supply within the cabinet.

4. **Display Type**: The LED numeric display version is suitable for basic on-site inspections, cycling through the three-phase data in sequence, and offers a lower cost; the LCD version supports simultaneous on-screen display of A/B/C phase parameters, providing a more intuitive on-site view and is suitable for scenarios requiring frequent on-site reading of multi-phase data.

5. **Explosion-Proof Requirements**: Standard meters are non-explosion-proof products and must not be installed directly in hazardous areas. In explosion-proof environments, the meter must be placed in a safe area, with the front-end measurement circuit paired with Qidian's QD series intrinsically safe barriers to form an intrinsically safe monitoring circuit; standard meters must not be installed directly within Zone 0 areas.

6. **Installation Environment**: Select the standard model for general indoor distribution cabinets; in workshops with strong electromagnetic interference near variable frequency drives or high-power motors, the enhanced EMC interference-resistant version must be used; in environments with high humidity, heavy dust, or salt fog, select the version with a three-proof coating on the circuit board; for altitudes above 2,500 m, a high-altitude-adapted model must be customized in advance.

7. **Additional Features**: Evaluate whether you need phase-by-phase upper/lower limit relay alarms, RS485 Modbus-RTU communication, or multiple isolated 4–20 mA transmitter outputs. If only local display is required, select the basic model to reduce procurement costs; if integration with DCS or PLC upper-level systems is needed, opt for models with communication or analog transmission capabilities.

Industry Application Selection Guidelines:

1. Chemical Industry: For power distribution cabinets and motor control cabinets in standard, non-explosion-proof workshops, prioritize the enhanced EMC version; for monitoring in explosion-proof zones, install instruments in safe areas and equip circuits with QD intrinsically safe barriers. We recommend models with LCD displays and RS485 communication capabilities to upload three-phase power data to the DCS system, enabling real-time monitoring of three-phase imbalance and phase loss faults.

2. Power Industry: For high- and low-voltage distribution rooms and feeder switchgear, versions with AC/DC 85–265 V wide-voltage power supply are recommended. These should be connected to external CTs/PTs and may optionally include phase-separated relay alarm functions for on-site monitoring of three-phase voltage and current in distribution circuits. LED versions are suitable for long-term, stable operation in distribution rooms.

3. Metallurgical Industry: Smelting workshops contain a large number of variable frequency drives and high-power motors, resulting in intense electromagnetic interference. Prioritize the use of versions with enhanced EMC interference resistance. A 24 V DC power supply is recommended to reduce interference introduced through power lines. Select either LED or LCD displays based on on-site inspection practices to monitor the status of three-phase circuits for fans, pumps, and smelting equipment.

4. Pharmaceutical Industry: For complete control cabinets in cleanrooms, select the basic model instrument. The LCD version is recommended, paired with RS485 communication to interface with the central SCADA system. The instrument housing is made of flame-retardant ABS material to meet cleanroom safety standards and is used for monitoring the power consumption of three-phase equipment such as air compressors and chillers.

5. Smart Manufacturing and Automation Equipment Industry: For export equipment and automation production line cabinets, the recommended option is the basic 24 V DC-powered LED model. Optionally configure multiple 4–20 mA transmitters or Modbus communication as needed to acquire three-phase voltage and current data for transmission to the PLC, enabling equipment load monitoring and phase loss fault alerts.

Common Selection Pitfalls

1. Ignoring Isolation Rating: Failing to verify the isolation withstand voltage between input, power supply, and output during selection. Using low-isolation basic models in high-voltage power distribution circuits can lead to fluctuating measurement values and allow high voltage to leak into downstream PLCs and industrial control equipment, causing damage. High-voltage circuits should use models with an AC 2000 V isolation rating between input power sources.

2. Incorrect Signal Range Selection: In high-current applications, directly using a direct-connection three-phase ammeter without a matching CT (current transformer); in high-voltage circuits, directly connecting to the voltmeter's input terminal without using a PT (potential transformer) can cause the instrument's input to overload and burn out. Selection must match the primary circuit, and CT and PT transformation ratio parameters must be set correctly.

3. Neglecting load matching: When configuring multiple 4–20 mA transmitter output channels, the total load resistance of the downstream data acquisition equipment is not calculated; if the load exceeds the instrument's permissible range, analog signals become distorted, and three-phase measurement data becomes inaccurate; failure to isolate the multiple transmitter output channels results in crosstalk between channels.

4. Incorrect Selection of General-Purpose Models for Explosion-Proof Environments: Installing standard, non-explosion-proof instruments directly in hazardous areas violates explosion-proof safety regulations and poses significant safety hazards; in explosion-proof environments, the instrument housing must be located in a safe area, and intrinsically safe barriers must be installed in the measurement circuit.

5. Misconceptions regarding functional selection: It is mistakenly believed that a single meter can simultaneously measure three-phase voltage and three-phase current. Meters in this series are designed for monitoring a single electrical quantity; the three-phase ammeter measures only current, and the three-phase voltmeter measures only voltage. Separate models must be selected for each function.

Customization Recommendations
1. Customization for Special Signals: For non-standard power frequency ranges and special three-phase signals with severe distortion, the meter's sampling algorithm can be customized, and the measurement range and number of decimal places can be adjusted to accommodate non-standard three-phase circuits under test.

2. Customization for Non-Standard Operating Conditions: For high-altitude environments above 2,500 m, low-temperature conditions below -10°C, coastal salt fog, and highly dusty or corrosive environments, components can be replaced and a three-proof coating applied to the PCB to enhance the meter's weather resistance and corrosion protection.

3. Panel Appearance Customization: Customize panel silk-screen markings, modify V/A labels, and incorporate the customer's own brand logo; adjust LED display brightness and LCD backlight modes to suit low-light or high-light cabinet environments; support private-label manufacturing.

4. Customizable Output Functions: Output functions can be added, removed, or combined as needed. For example, relay alarms can be disabled to retain only RS485 communication, and phase-by-phase alarm logic, three-phase imbalance thresholds, and alarm hysteresis parameters can be customized. For multi-channel 4–20 mA transmitter versions, the measurement ranges corresponding to phases A, B, and C can be customized.

5. Factory Preset Service: CT/PT ratios, communication addresses, baud rates, and wiring configurations (three-phase three-wire / three-phase four-wire) can be pre-set at the factory. Customers can simply unpack the unit, power it on, and start using it immediately on-site without the need for secondary debugging, saving on-site debugging time.

Installation and Commissioning Specifications

Pre-installation Preparation
1. **Check Components**
Unpack and count the contents: 1 main unit, 2 sets of plastic snap-on clips, and 1 user manual; optional versions include pluggable terminal blocks. Verify the meter model, power supply specifications, display type (LED/LCD), and optional features (RS485 / multi-channel transmission / phase-by-phase alarm); check that the housing has no dents or scratches and that the terminals are not deformed; confirm that the model matches the purchase order.

2. **Environmental Check**
Confirm that the ambient temperature inside the installation cabinet is between -10°C and +55°C, with no persistent condensation, corrosive gases, or excessive dust; keep the meter away from strong sources of electromagnetic radiation such as variable frequency drives, high-power contactors, and motors; for altitudes above 2,500 m, verify that the meter is a high-altitude customized version; ensure there is at least 80 mm of space at the rear of the cabinet to allow for heat dissipation and wiring operations. Do not install the instrument directly outdoors without protection.

3. **Tool List**
Small Phillips-head screwdriver, wire strippers, multimeter, voltage tester, electrical tape, marker pen; a standard three-phase signal source may be used for accuracy calibration; shielded twisted-pair cables are preferred for signal wiring.

4. **Safety Precautions**
All wiring work must be performed with the power off; wear insulated protective gear when working on high-voltage circuits; before wiring, de-energize and test the circuit under test for voltage, and post a "Do Not Close Circuit—Work in Progress" warning sign; For the three-phase ammeter CT circuit, the CT secondary S1 and S2 terminals must be short-circuited with a jumper before connecting the instrument; it is recommended to install a 1A fuse at the input end of the high-voltage PT circuit to prevent short circuits.

Standard Installation Steps
- The meter is designed for snap-in panel mounting and does not support DIN rail mounting
1. Cut a 91mm × 91mm square opening in the control cabinet panel. Remove any burrs from the opening. Suitable for panel thicknesses of 1–5 mm;
2. Slide the meter into the opening from the front of the cabinet. From the back of the cabinet, snap the two sets of plastic clips into the slots on either side of the meter. Tighten the clips evenly so that the front of the meter lies flush against the control cabinet panel;

3. Follow wiring specifications and distinguish between terminal types
--- Power terminals: The DC 24 V version distinguishes between positive (+) and negative (-) terminals (V+ and V-); the AC/DC 85–265 V wide-voltage version is non-polarized;
--- Signal input terminals: Three-phase voltmeters Ua, Ub, Uc, Un; Three-phase ammeters Ia/Ib/Ic, corresponding to CTs S1 and S2; distinguish between three-phase three-wire and three-phase four-wire wiring configurations;
---Output Terminals: RS485 communication A/B; positive and negative terminals for multi-channel 4–20 mA transmitters; phase-separated relay alarm NO/COM/NC dry contacts;

4. Grounding Requirements
The instrument enclosure's PE protective terminal must be connected separately to the cabinet's protective grounding busbar using a grounding wire of ≥1.0 mm² multi-strand copper wire, with a grounding resistance of ≤4 Ω. Signal shielded cables must be grounded at a single point on the instrument end only; the shielding layer at the remote end must remain floating and ungrounded to prevent interference introduced by ground loops. The secondary S2 terminal of the CT must be uniformly and reliably grounded.

Wiring Diagram for Three-Phase Digital Voltmeter
1. Power Supply Terminals: DC 24 V (positive and negative terminals must be distinguished); for AC/DC wide-voltage models, connect L and N to the auxiliary power supply;
2. Voltage Input Terminals: Connect Ua, Ub, and Uc to the three-phase voltages; connect the neutral wire (Un) to the three-phase four-wire system; for high-voltage applications, connect the secondary winding of the PT (voltage transformer) to the front end;
3. Optional Output Terminals: RS485 A/B; multi-channel 4–20 mA transmitters; phase-separated relay alarm contacts;
4. Shielding: Use shielded twisted-pair cable for voltage signals; ground the shield at a single point on the meter side.

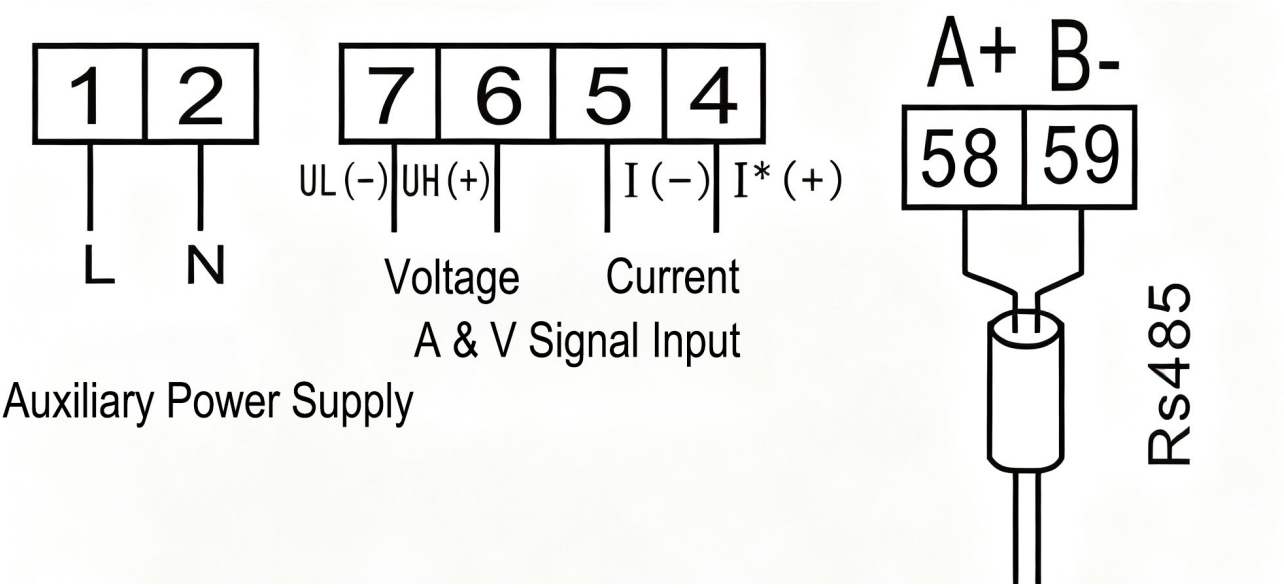
Three-Phase Digital Ammeter Wiring Diagram
1. Power supply terminals as above;
2. Current input terminals: Connect the S1 terminals of the three-phase CTs (A/B/C) to the meter's Ia+/Ib+/Ic+ terminals; connect the S2 terminals to Ia-/Ib-/Ic-; ground the CT secondary S2 in parallel; **Open circuits are strictly prohibited in the entire CT secondary circuit; short-circuit the circuit before installation or removal**; For the three-phase, three-wire configuration, connect only 2 sets of CTs; for the three-phase, four-wire configuration, connect 3 sets of CTs;
3. Optional output terminals are the same as those for the voltmeter;
4. Shielding: Use shielded twisted-pair cable for the CT secondary signal lines; the shield must be grounded at a single point on the meter side.

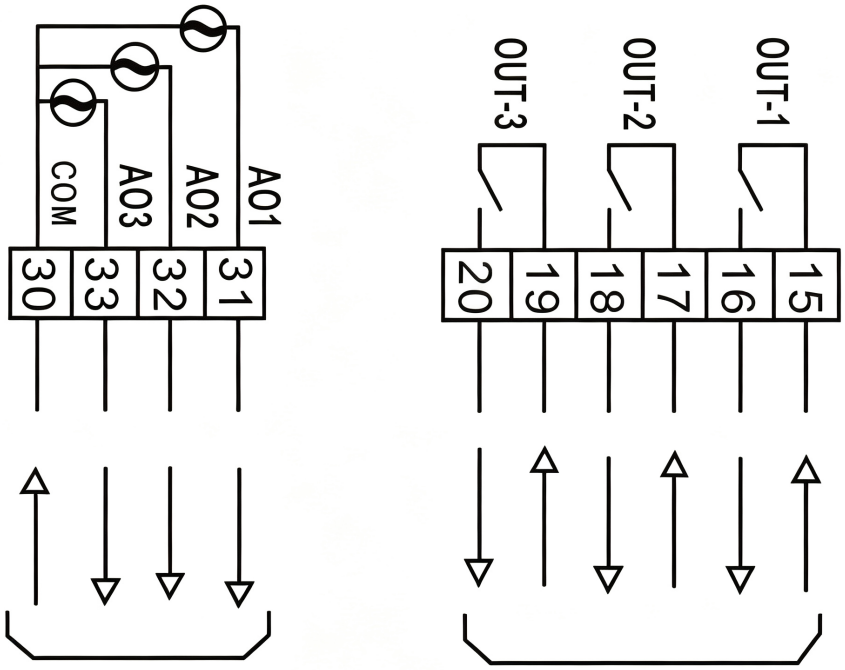
Specific Wiring Specifications for Power Distribution Type / Isolated Type
--- Power Distribution Type: The meter is equipped with a built-in 24 VDC output terminal. The output circuit is independently isolated and is intended solely for powering external sensors; **it must not be used to power the meter itself**. The negative terminal of the output must not be short-circuited to the negative terminal of the meter's power supply.
--- Isolated Type: The input, power supply, and multiple transmission channels are electrically isolated from one another. Each circuit has an independent ground wire; short-circuiting across circuits is prohibited to prevent channel crosstalk.

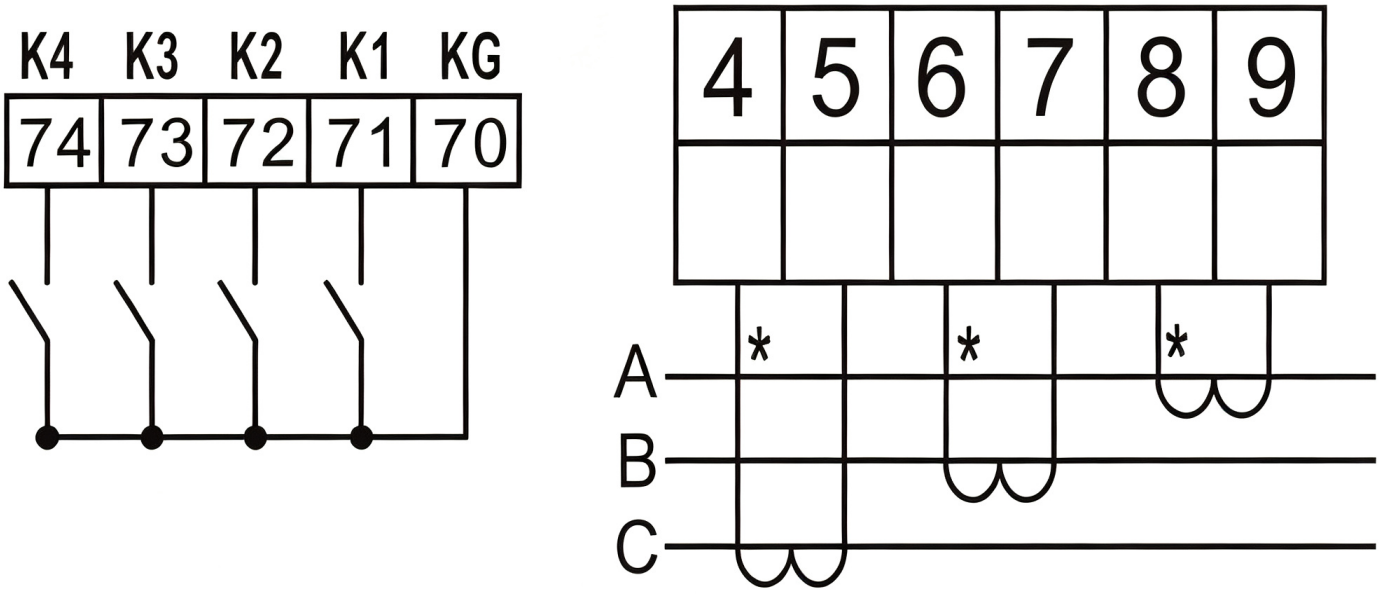
Correct vs. Incorrect Wiring Comparison
 Correct: CT secondary circuit continuously short-circuited for protection; shielded wire grounded at a single point; power cables and signal cables routed in separate cable trays; CT polarity S1/S2 correct; three-phase sequence Ua/Ub/Uc connected in order;
 Incorrect: CT secondary circuit is open; shielding wire is grounded at both ends; power cables and signal cables run parallel over long distances in the same cable tray; three-phase sequence is reversed; high voltage is connected directly to the voltmeter's input terminals without a PT transformer.

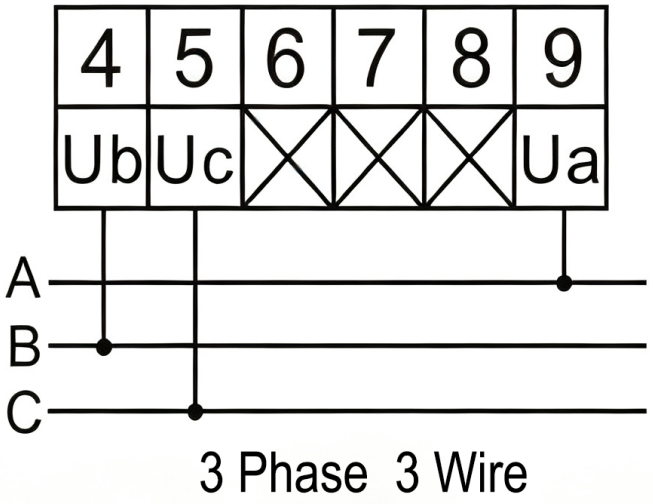
Power-On Commissioning Procedure
1. **No-Load Test**
After all wiring is complete, double-check the terminal connections item by item. Once confirmed, power on the meter under no-load conditions. Upon power-on, the meter performs a self-test: LED models sequentially display A/B/C in rotation, while LCD models display all three-phase data on the same screen; there should be no garbled characters or persistent flickering. If the meter does not display anything, immediately turn off the power and check the supply voltage and polarity.
2. **Signal Verification**
After the no-load self-test is successful, connect the three-phase signals to be measured; observe the A/B/C phase readings and verify three-phase balance and phase loss alerts; for the three-phase ammeter, check the CT polarity—if negative values appear, swap S1 and S2; for the three-phase voltmeter, verify the line voltage and phase voltage values.
3. **Indicator Light Status Assessment**
Normal operating conditions: Readings are stable, with no alarm flashing; phase loss or incorrect phase sequence triggers a fault code on the screen; if a phase exceeds the limit, the meter flashes and the relay contacts actuate; for RS485 communication versions, the communication transmit/receive indicator lights flash in sync with data exchange; persistent, significant fluctuations in readings indicate electromagnetic interference—check grounding and wiring.
4. **Accuracy Calibration Method**
Press the SET button on the panel to enter the meter menu. Select the wiring configuration (three-phase three-wire / three-phase four-wire), set the CT/PT transformation ratio, decimal point, and rotation display time. Connect a standard three-phase signal source to compare readings; if a deviation occurs, perform internal calibration. Once calibration is complete, save the parameters and exit the settings menu.

Installation Precautions
1. Never exceed the rated supply voltage: The DC 24V version must not be powered at more than 28V; for the AC/DC 85–265V wide-voltage model, the upper limit is 265V. Exceeding the rated voltage will directly burn out the meter's power supply circuit.
2. Avoid high-voltage interference: Signal cables must not run in the same conduit or cable tray as power cables from variable frequency drives or contactors over long distances; When signal cables cross power cables, ensure they cross at right angles to minimize electromagnetic coupling interference; install a power filter at the input end of the power supply in environments with strong interference.
3. Protective Measures for Humid Environments: During periods of high humidity or the rainy season, install dehumidifying heaters in the power distribution cabinet; condensation must not form on the terminal block area at the rear of the instrument; do not allow the instrument to come into direct contact with water; in environments with corrosive gases, add sealing and isolation measures to the cabinet.
4. Other Prohibitions: Never insert or remove terminal connectors while the equipment is energized; do not press panel buttons with hard objects; never create an open circuit in the CT secondary circuit during operation; do not modify the CT secondary wiring while the instrument is energized.

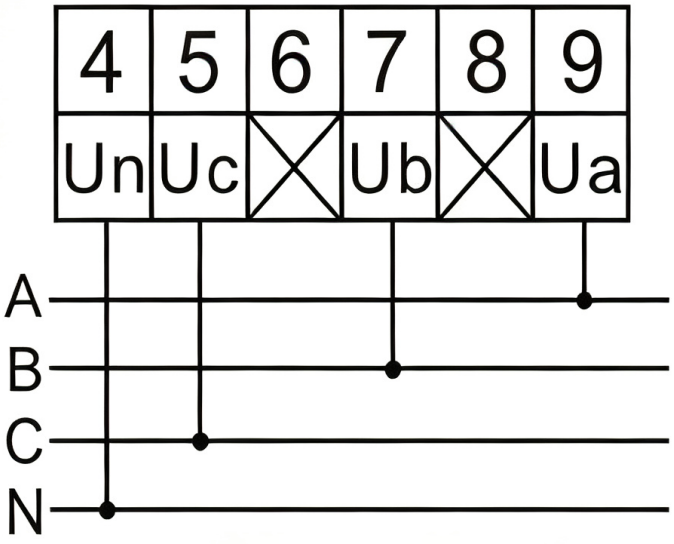

1 2
L N
Auxiliary Power Supply
7 6 5 4
UL(-) UH(+) I(-) I*(+)
Voltage Current
A & V Signal Input
A+ B-
58 59
Rs485


COM AO3 AO2 AO1
30 33 32 31
Analog Signal Output
OUT-3 OUT-2 OUT-1
20 19 18 17 16 15
Relay Signal Output

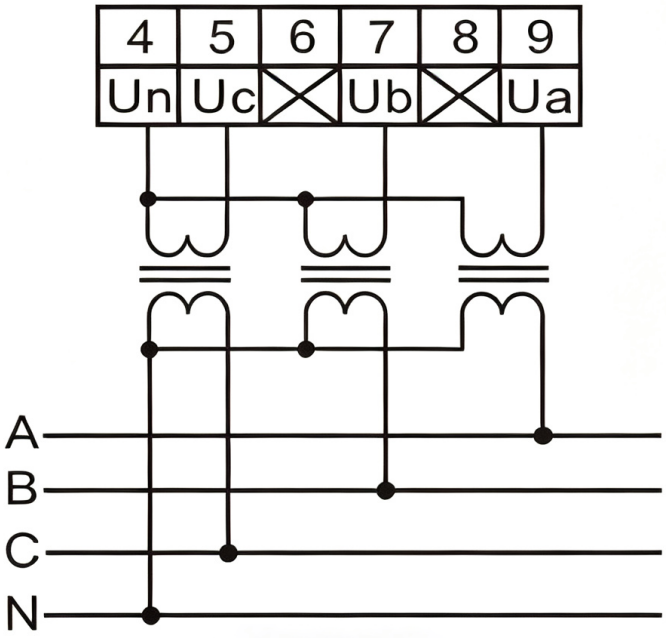

K4 K3 K2 K1 KG
74 73 72 71 70
Relay Signal Input
4 5 6 7 8 9
A
B
C
3-Phase Current



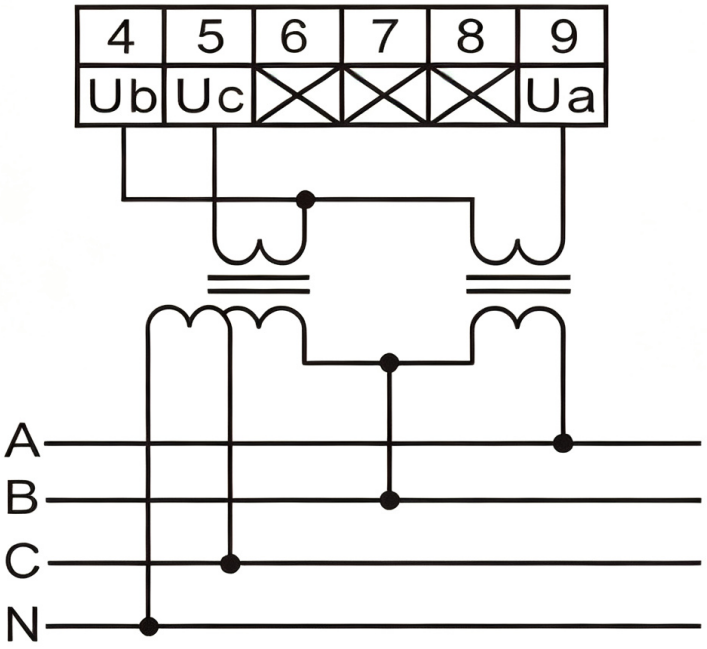
3 Phase 3 Wire



3 Phase 4 Wire



High Voltage 3 Phase 4 Wire



High Voltage 3 Phase 3 Wire

Note: If the terminal numbers in the wiring diagram differ from those on the actual product's rear panel, please refer to the actual wiring diagram on the product's rear panel.

Recommendations for Daily Use & Operations and Maintenance

Key Points for Routine Inspections:

1. **Appearance and Display Inspection**: During daily inspections, the work team should examine the instrument housing to ensure there are no cracks, deformations, or burn marks. For models with LED displays, check that the digital displays for each phase are complete and free of missing segments; for models with LCD displays, check the screen for dark spots, distortion, or backlight failure. Verify that the panel buttons are intact and that the interior of the cabinet shows no signs of water ingress, condensation, or rust.

2. **Signal Stability Monitoring**: Continuously observe the A/B/C three-phase measurement readings; under normal operating conditions, the values should fluctuate slightly and remain stable. If erratic, significant fluctuations or three-phase value drift occur, investigate the grounding, cable shielding, and transformer status. For meters with communication capabilities, simultaneously verify that the three-phase data received by the central control host computer is continuous and free of packet loss. For three-phase current meters, focus on verifying the status of the CT circuits to eliminate the risk of secondary CT open circuits; for three-phase voltage meters, focus on monitoring phase voltage balance and watch for alerts indicating missing phases or abnormal phase sequence.

3. **Temperature and Humidity Monitoring**: Monitor the temperature inside the cabinet surrounding the instruments and maintain it within the operating range of -10°C to +55°C; closely monitor the humidity inside the cabinet in real time, and strictly prevent condensation. Under high-humidity conditions, pay special attention to the operating status of the cabinet's dehumidification system to prevent short circuits caused by moisture on the terminals.

4. **Optional Function Inspection**: For versions with phase-by-phase upper and lower limit alarms, periodically verify the trigger logic for phase loss and

three-phase imbalance alarm thresholds; for versions with multiple 4–20 mA transmitters, compare the values collected by the PLC with the instrument's local display values; for RS485 communication versions, check the communication transmission and reception status to confirm that data for phases A, B, and C can be uploaded normally.

5. **Environmental Anomaly Inspection**: Check for any burning odors or abnormal heat emanating from the instrument housing; ensure there is no significant dust accumulation near the instrument and that no corrosive gases are entering the area; inspect the operating status of nearby high-power variable-frequency drives and contactors to determine whether electromagnetic interference has intensified.

Regular Maintenance Schedule
1. **Cleaning Interval**: In typical indoor power distribution environments, **clean the unit once every 6 months after turning off the power**; in metallurgical and high-dust workshops, shorten this interval to 3 months. Use only a dry, lint-free soft cloth to wipe the panel and housing; use low-pressure dry compressed air to blow out the gaps between buttons and the screen surface. Do not use organic solvents such as alcohol or acetone to wipe the ABS housing or LCD screen, as this may corrode the coating or damage the liquid crystal; under no circumstances should any liquid come into contact with the terminal blocks on the rear of the instrument.

2. **Wiring Tightness Inspection**: Every six months, turn off the power and tighten all terminal blocks. Inspect the wiring for power supply, three-phase signal inputs, communication, and alarm circuits, and check the terminals for signs of oxidation, discoloration, or overheating. For three-phase ammeters, pay special attention to the CT secondary wiring to prevent high-voltage open circuits caused by loose connections; simultaneously inspect shielded cable joints and the PE protective ground wire to ensure reliable grounding.

3. **Cable Aging Inspection**: Check the insulation of three-phase signal cables for cracks or damage, and the shielding for breaks; in high-interference environments, pay special attention to the integrity of shielded twisted-pair cables.

4. **Recommendations for Accuracy Retesting**: For Class 0.5 three-phase digital meters, **accuracy calibration should be performed once every 12 months** under normal indoor conditions; at critical monitoring points in the chemical and power industries, retesting is recommended every 6 months. Perform comparison calibration using a standard three-phase signal source with a higher accuracy class than the meter; retain test data after recalibration and maintain a meter equipment log; if the error exceeds 0.5% FS, enter the meter menu to perform an internal calibration.

5. **Complete System Self-Test**: After maintenance is complete and power is restored, enter the meter menu to run the complete system self-test program, sequentially testing all functions including three-phase sampling, display switching, button operation, alarm output, and communication transmission.

Long-Term Maintenance Tips:
1. **Dust Prevention**: Keep the control cabinet doors closed at all times to minimize dust ingress; in heavily dusty environments, install dust-proof sealing strips on the cabinet. For instruments stored during long-term downtime, place them in dry, dust-proof packaging and power them on for 4 hours every 3 months to dispel moisture from the circuit boards and slow down component aging.

2. **Moisture and Condensation Protection**: In high-humidity conditions or during the rainy season, equip distribution cabinets with dehumidifiers and cabinet heaters to regulate internal humidity; in environments with corrosive gases, add gas isolation measures to the cabinet to prevent corrosive media from eroding instrument circuit boards and terminals. Before reactivating equipment that has been out of service for an extended period, perform a 15-minute no-load warm-up before connecting three-phase measurement signals to prevent condensation damage to instruments caused by temperature fluctuations.

3. **Long-Term Optimization for Interference Resistance**: Three-phase signal cables and power cables must be routed in separate cable trays; running them in parallel within the same conduit over long distances is prohibited. Shielded twisted-pair cables must adhere to **single-ended grounding**; grounding at both ends to form a ground loop is prohibited. Near equipment that generates strong interference, such as variable frequency drives, minimize the length of signal cables as much as possible; if necessary, install a power filter upstream of the instrument's power supply. Re-measure the protective grounding resistance annually to ensure it is ≤4 Ω.

4. **Protection Against Extreme Environments**: For high-altitude (□2500 m) custom versions, conduct annual re-inspections of withstand voltage and low-voltage performance; ensure proper internal insulation of the cabinet in low-temperature environments; for coastal salt fog conditions, prioritize custom versions with PCBs coated with triple-proof varnish, and inspect the corrosion resistance of the circuit boards annually.

5. **Operational Protection**: Do not press the blue function buttons on the panel with sharp or hard objects to prevent button damage; all internal maintenance and wiring operations must be performed with the power disconnected. When selecting a model, allow for a 1.2-times range margin to avoid the meter operating at full-scale overload for extended periods, thereby delaying component aging.

Troubleshooting & Emergency Response

List of Common Faults, Cause Analysis, Step-by-Step Troubleshooting, and Emergency Workarounds

Fault 1: No Display on Meter After Power-On (LEDs Do Not Light Up / LCD Screen Remains Black)
Symptoms: No display on the screen after power-on; buttons do not respond
Cause Analysis: Broken power supply wires or loose terminals; reversed positive and negative terminals on the 24V DC version; power supply voltage exceeds specifications; power supply circuit burned out due to overvoltage or condensation-induced short circuit.

Step-by-Step Troubleshooting
Turn off the power. Use a multimeter to measure the voltage at the instrument's power supply terminals and verify the power supply specifications (DC 24V / AC/DC 85–265V).
Inspect the power supply terminals and tighten any loose connections; for DC 24V models, reverse the positive and negative terminals and try again.
If the supply voltage is normal but the display remains blank, conclude that the instrument's hardware is damaged.

Emergency Workaround: Directly replace the instrument with a spare unit of the same model to quickly restore three-phase on-site monitoring; temporarily use a portable three-phase multimeter to manually inspect and record data.

Fault 2: Signal Drift—Three-Phase Readings Remain Inaccurate and Values Slowly Shift
Fault Symptoms: The measured values for phases A, B, and C do not match the actual on-site electrical quantities, and the values continue to drift under static operating conditions.
Cause Analysis: Incorrect parameter settings for CT/PT transformation ratios or wiring configurations (three-phase three-wire / three-phase four-wire); loose or oxidized connection terminals; the meter has not been calibrated for an extended period; aging current transformers causing output drift; incorrect three-phase sequence or polarity.

Step-by-Step Troubleshooting
Enter the SET menu, verify the CT/PT transformation ratios and wiring configuration, correct the parameters, and save.
Turn off the power and tighten all signal terminals; clean any oxidation or corrosion from the terminals; check the CT polarity; if readings are negative, swap S1 and S2.
Use a standard three-phase signal source for comparison and perform an internal accuracy calibration on the meter.
If drift persists after calibration, inspect the front-end CTs/PTs for faults.
Emergency Workaround: Temporarily use a portable three-phase calibrator or multimeter to read on-site values while simultaneously replacing the faulty CTs/PTs or the meter.

Fault 3: Interference-induced distortion; readings fluctuate erratically and significantly
Fault Symptoms: The three-phase load on-site is stable, but the digital readings for phases A, B, and C fluctuate frequently.
Cause Analysis: Power cables and signal cables run parallel in the same cable tray; electromagnetic interference from variable frequency drives (VFDs) and contactors; shielding wires grounded at both ends, forming a ground loop; grounding resistance exceeds specifications; signal cable insulation is damaged, causing leakage.

Step-by-Step Solution
Rewire the system so that signal cables and power cables are routed in separate cable trays; minimize parallel runs and ensure vertical crossings at intersections.
Modify the shielded cables: ground the shield at a single point on the instrument side only, leaving the shield floating at the far end; re-test the protective grounding to ensure grounding resistance ≤ 4 Ω.
Install ferrite beads on signal cables and add power line filters to the instrument power supply input; inspect cable jackets for damage.
Emergency Workaround: Shorten the signal cable length and temporarily disable the RS485/4–20 mA output channels to prioritize stable display on the local screen.

Fault 4: Alarm Abnormality (Alarm Triggers Without Cause / Alarm Does Not Trigger When Limits Are Exceeded)
Symptoms: The instrument continuously sounds an alarm under normal operating conditions; or the instrument does not trigger an alarm when three-phase power exceeds the set thresholds.
Cause Analysis: Improper settings for upper and lower limit thresholds, unbalanced power thresholds, or hysteresis parameters; aged relay contacts or loose wiring in the alarm circuit; or measurement signal abnormalities causing the instrument to make an incorrect judgment.

Step-by-Step Troubleshooting
Enter the instrument's settings menu, verify the per-phase upper and lower limits, three-phase imbalance threshold, and alarm hysteresis parameters, then save the changes.
Turn off the power and inspect the alarm output terminals; check the wiring of external audible and visual alarms.
Apply a standard out-of-limit signal to test relay operation and verify alarm functionality.
Emergency Workaround: Temporarily disconnect the alarm interlock circuit and rely on manual patrols to monitor the three-phase status; restore the interlock once the fault is repaired.

Fault 5: Abnormal Optional Outputs (No RS485 Communication / No Output from Multi-Channel 4–20 mA Transmitters)
Fault Symptoms: The instrument's local display is normal, but the PLC and DCS upper-level systems cannot acquire three-phase data; analog output remains static, and signals are distorted.
Cause Analysis: RS485 A and B wires are reversed; communication address or baud rate does not match; bus terminating resistors are missing; the load on the 4–20 mA transmitter's output exceeds the instrument's permissible range; or output channel hardware is damaged.

Step-by-Step Troubleshooting
RS-485 Failure: Swap the A and B signal wires; verify the communication address, baud rate, and parity bit; install terminating resistors at both ends of the bus.
4–20 mA Failure: Calculate the load resistance; reduce the load to within the instrument's rated range; check the output circuit wiring.
Test the output lines individually to determine whether the fault lies with the wiring or the instrument itself.
Temporary Workaround: Temporarily disable remote data acquisition and read the three-phase data locally via the instrument's LED/LCD display.

Fault 6: Abnormal Screen Display (Missing Digits, LCD Distortion, Garbled Characters, Continuous Flickering)
Symptoms: Missing strokes in LED digits; black spots or distortion on the LCD screen; garbled characters that continuously flicker upon power-up.
Cause Analysis: Surge or lightning strike causing MCU program malfunction; damaged display driver circuit; panel buttons sticking, resulting in continuous input triggering.

Step-by-Step Troubleshooting
Turn off the power and let the unit sit for 5 minutes, then power it back on to reset the meter.

Inspect the four blue buttons, remove any foreign objects from the button gaps, and ensure they are not stuck.
If the fault persists after the reset, determine that the meter's internal hardware is damaged.
Emergency Workaround: Directly replace the meter with a spare unit.

After-Sales Service Request Guidelines

1. Criteria for Determining Malfunctions

After completing all of the above external troubleshooting steps and confirming that the power supply, wiring, cables, current transformers, and host system are all functioning normally, if the meter still fails to operate properly, the issue is deemed a malfunction of the meter itself, and a service request may be submitted.

The following instances of human-caused damage are not covered by the free warranty: burnout due to overpressure, damage caused by a CT secondary circuit open, corrosion due to water ingress or condensation, damage from external impact, unauthorized opening of the case to modify hardware, and firmware modifications.

2. Warranty Coverage

A 24-month warranty applies from the date of manufacture. During the warranty period, hardware failures not caused by human error will be repaired or replaced free of charge.

The following situations are not covered by the warranty:

Meter burnout caused by input overpressure, overload, or a CT secondary circuit open;

Water ingress, condensation, corrosion from corrosive gases, or damage from external forces;

Unauthorized disassembly, hardware modification, or unauthorized firmware rewriting by the user;

Damage caused by force majeure natural disasters such as lightning strikes or floods.

3. Repair Process

 Record the meter model, serial number, and on-site fault symptoms; take photos of the meter and the on-site operating conditions;

 Contact technical support, provide product information and the purchase contract number, and describe the fault in detail;

 A technical engineer will provide remote assistance to troubleshoot the issue; if the issue cannot be resolved remotely, return the unit to the factory for inspection and repair according to the instructions;

 The unit will be returned to the customer after repair and successful testing.