IoT Smart Metering MCCB

MTM5M

User Manual

10/2024

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1 Overview

1.1 Function Overview

MTM5M smart MCCB is suitable for low-voltage power grids with AC 50Hz, rated insulation voltage 1000V, rated current 100A~630A, and rated working voltage of 400V and below. It is used to provide indirect contact protection to prevent fire hazards caused by ground fault current due to device insulation damage, and can be used to distribute energy and protect line overload and short circuit, and has protection functions for line overvoltage, undervoltage, and phase loss.

Models:

- MTM5M-125;
- MTM5M-250;
- MTM5M-400;
- MTM5M-630;

1.2 Main Functions and Features

- Adopt high-performance 32-bit ARM microprocessor to perform real-time signal processing and smart control;
- LCD display in Chinese and English, friendly human-machine interface, easy to operate;
- With automatic reclosing function; closing time ≤ 2s;
- Long delay, short delay and instantaneous three-stage protection; Using electronic tripping, independent of power supply voltage;
- High breaking capacity to ensure the reliability of line short-circuit protection;
- Overvoltage protection, undervoltage protection, phase loss protection, neutral loss protection; protection functions and parameters can be set and modified online;

- Real-time display of three-phase power supply voltage and load current;
- Identify and display the tripping type (remote locking, overload, undervoltage, overvoltage, voltage loss, phase loss, neutral loss, etc.), and store, query and delete it;
- Support remote signaling, remote measurement, remote control and remote adjustment;
- HPLC pluggable modules and micro-power Bluetooth wireless communication;
- 0.05In-1.2In metering can reach class 1.0;
- Real-time measurement of active power, reactive power, apparent power, power factor and other parameters, and accumulation of three-phase active energy;
- Time control, fee control and other modes are optional, making the application more flexible;
- Support DL/T645 protocol and Modbus protocol, and automatically identify;
- Real-time monitoring of incoming line terminal block temperature (optional);
- Support online remote upgrade, easy for maintenance and upgrade;
- Accuracy class: The current and voltage accuracy can reach up to class 0.5s; the active and reactive accuracy can reach up to class 1;
- Supports active power demand overrun, reactive power demand overrun, current mutation event, current interruption, voltage harmonic content, current harmonic content, voltage waveform distortion, and current waveform distortion;
- With passive island protection (optional);
- With terminal and contact over-temperature protection (optional);

- With power generation quality monitoring and protection (optional);
- With three-phase imbalance monitoring and protection of generating current (optional).

2 Functions and Classification

Function Classification		Conventional Type	Metering Type	Photovoltaic Type
Protection	Overload protection	●	●	●
	Short circuit protection	●	●	●
	Automatic reclosing	●	●	●
	Phase loss protection	●	●	●
	Overvoltage protection	●	●	●
	Undervoltage protection	●	●	●
	Neutral loss protection	●	●	●
	Over/under frequency protection	●	●	●
	Power failure protection	●	●	●
	Phase sequence protection	●	●	●
	Island protection	○	○	●
	Over temperature protection	△	△	●
	Power quality monitoring and protection	○	△	●
Measurement Display	Three-phase working voltage	●	●	●
	Three-phase working current	●	●	●

	Active Power	○	●	●
	Reactive power	○	●	●
	Apparent power	○	●	●
	Voltage imbalance	○	●	●
	Current imbalance	○	●	●
Performance Settings	Overload long delay	●	●	●
	Short circuit short delay	●	●	●
	Short circuit instantaneous	●	●	●
	Overvoltage protection value	●	●	●
	Undervoltage protection value	●	●	●
	Time, date	●	●	●
	Protection operation and exit	●	●	●
	Phase loss protection value	●	●	●
	Over/under frequency protection value	○	●	●
	Voltage imbalance protection value	○	●	●
	Current imbalance protection value	○	●	●
Information Query and Display	Action record, fault record	●	●	●
Communication Function	RS-485/Modbus	●	●	●
	Carrier	△	△	△

	Bluetooth	△	●	●
	Topology	△	△	△

●: indicates this function is available; △: indicates this function is optional; ◯: indicates this function is not available

3 Device Installation

- Precautions for unpacking and inspection

Check the appearance for any damage that occurred during transportation, such as damage to the casing, etc. In addition to the device, instruction manual and certificate of quality, the packaging box should also contain screws, nuts and related accessories for installation and use.

- Installation and connection

Please install it on flame retardant materials such as metal. The device can be installed vertically or horizontally.

- Connect to the main circuit

Wiring work must be performed by professionally qualified personnel.

Make sure that the input power is completely disconnected before wiring. Wiring must be done after the device is installed.

The wiring must comply with the top-in and bottom-out, that is, terminals 1, 3, and 5 are connected to the power line, and terminals 2, 4, and 6 are connected to the load end. Reverse wiring is not allowed. The N line is connected to the N line terminal on the right.

- Electrical wiring of the device

If the device needs to operate with full functionality, the N line must be connected, otherwise the device will only have basic protection functions.

- Maintenance

Maintenance inspections must be carried out by professional technicians. Device maintenance is performed once a year under normal operating conditions and once every six months under abnormal conditions. The maintenance includes: re-trip the device, close and open the device, and use the red emergency trip button to trip the switch when the device is closed. The number of operations is 5, and the device should be able to reliably perform re-trip, close, open and trip actions;

Remove dust from the device surface and connections (use a clean, dry rag); clean the arc isolation plate and replace it if necessary;

Check all connections, wipe off the oxide with gauze, clean with a dissolving agent, and tighten the bolts and nuts;

If the switch is equipped with a manual operating mechanism, open and close the device three times by manual operation, and the operating rod or handle should move freely;

If the device is equipped with an electric operation mechanism, use the electric operation to open and close the device three times, and the electrical operation control function should be normal.

4 MCCB Description

①: LED screen

②: Menu operation button

③: Port (RS485/control/pulse/input)

④: Indicator

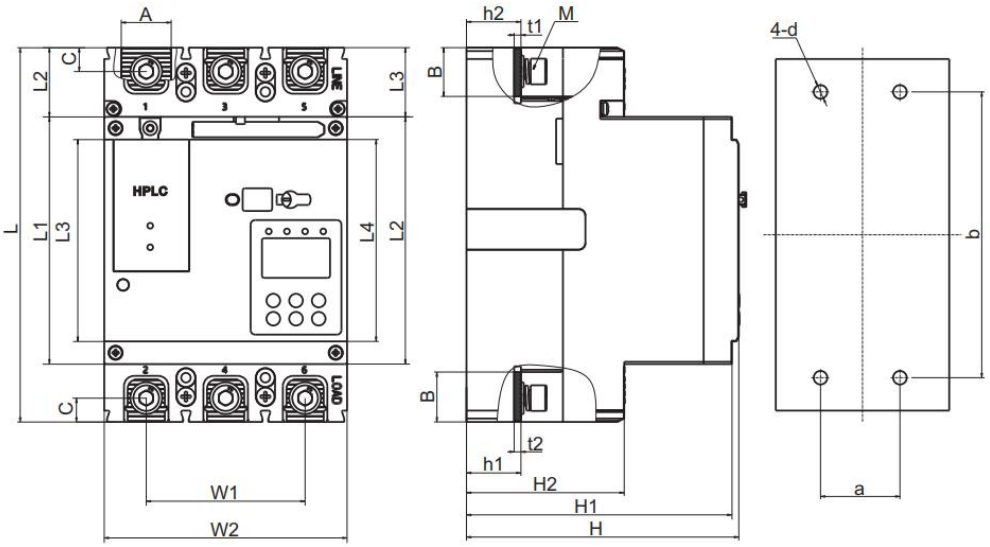
⑤: Auto/manual knob

⑥: HPLC module

⑦: Emergency trip button

⑧: Manually operated hexagonal wrench

5 Hardware and Installation Dimensions



Model	Overall Dimensions (mm)									Installation Dimensions (mm)		
	L	L1	L2	L3	W1	W2	H	H1	H2	a	b	d
MTM5M-125	150	108.7	24.7	88.7	60	92	120	117	65.5	30	129	⌀ 4.5
MTM5M-250	165	109	30.5	99	70	107	120	117	69.5	35	126	⌀ 4.5
MTM5M-400	258	177	40.5	148	96	150	160	157	98.5	44	195	⌀ 7
MTM5M-630	270	177	46.5	145.8	116	182	163.5	160.5	102	58	200	⌀ 7

Model	Terminal Board Size (mm)							Terminal Screws	Mounting Screws
	A	B	C	t1	t2	h1	h2	M	
MTM5M-125	18	17	8.5	3	3	23	26	M8x20	M4x45
MTM5M-250	22	21	10.5	3	3	24	24	M8x20	M4x45
MTM5M-400	33	28.5	16.5	5	4	36.5	37.5	M10X35	M5X100
MTM5M-630	44	30.5	17.7	6	6	41.5	43.5	M12x35	M6x65

6 Wiring


Incoming line end
matis
In 125A
MTM5E
RXD
TXD
PUSH TO TRIP
分闸待机
Load end

7 Electrical Characteristics

7.1 Main Technical Parameters

Models		MTM5M_125A	MTM5M_250A	MTM5M_400A	MTM5M_630A
Frame size rated current (A)		125	250	400	630
Poles		3P			
Rated working voltage Ue(V)		AC400/50HZ			
Rated insulation voltage Ui(V)		1000			
Rated impulse withstand voltage Uimp(V)		8000			
Arcing distance (mm)		≥50		≥100	
Ultimate short-circuit breaking capacity Icu(kA)		25(S) 36(L) 50(M)	36(S) 35(L) 50(M)	35(S) 65(L) 70(M)	50(S) 65(L) 70(M)
Operating short-circuit breaking capacity Ics(kA)		20(S)25(L)35(M)	25(S)35(L)35(M)	35(S)42(L)50(M)	50(S)50(L)70(M)
Rated short-time withstand current Icw (kA)/s		1.5	3	5	8
Automatic closing time(s)		≤2s			
Operation performance (times)	Power-on	1500	1000	1000	1000
	Power-off	8500	7000	4000	4000
	Total times	10000	8000	5000	5000
Overload and short circuit characteristics		Three-stage protection, electronically adjustable, see "Protection Characteristics Description" for details			
Overvoltage protection value (V)		Setting value (231~330)/Default value 275V			
Undervoltage protection value (V)		Setting value (88~209)/Default value 145V			
Phase loss protection value (V)		Setting value (10~130)/Default value 30V			
Control delay time (ms)		≤40ms			
Communication delay time (ms)		≤200ms			

7.2 Measurement Accuracy Class

Accuracy	Allowable Error
Current accuracy	0.5%
Voltage accuracy	0.5%
Active power accuracy	1.0%
Reactive power accuracy	1.0%

7.3 Action Characteristics

1. Overload delay protection action characteristics

Ambient Temperature	Current Name	Setting Current Multiple	Scheduled Time
+40℃	Conventional non-tripping current	1.05Ir1	≥2h
	Conventional tripping current	1.3Ir1	<2h

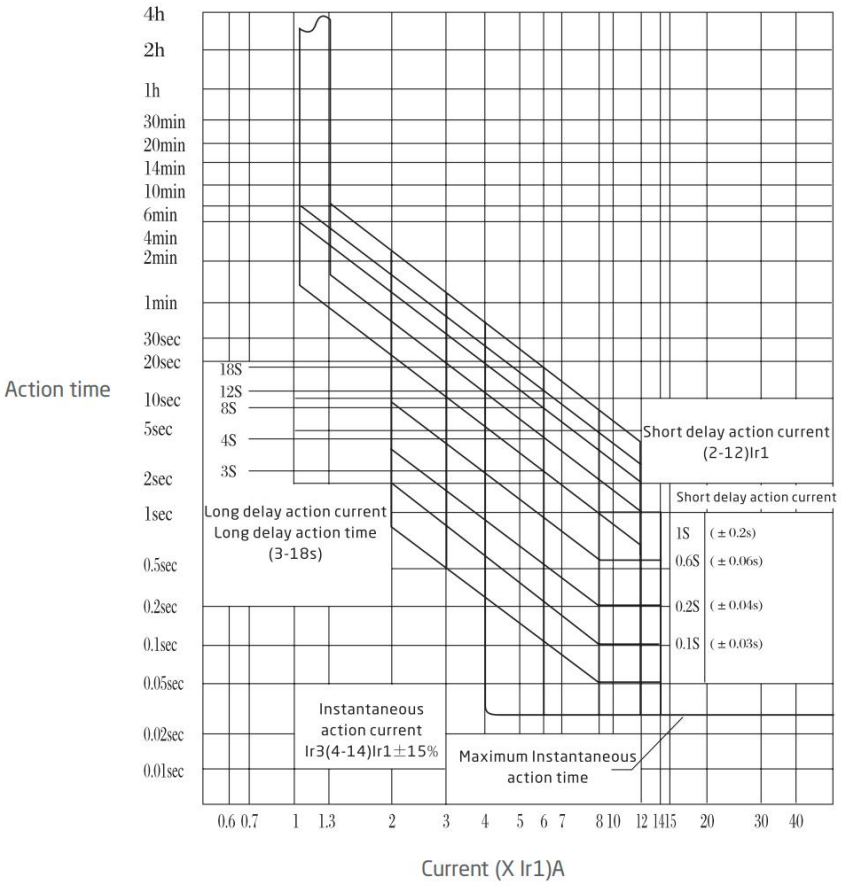
2. Short circuit short delay protection action characteristics

Characteristic	Fault Current Multiple	Trip Time	Delay Error
Non-action characteristics	≤0.85Isd	No action	/
Action characteristics	>1.15Isd	Delayed action	±40ms

3. Short circuit instantaneous protection action characteristics

Characteristic	Current Multiple (1/Ii)	Delay Error
Non-action characteristics	≤0.85	/
Action characteristics	>1.15	±40ms

4. Overcurrent short circuit protection characteristic curve



7.4 Protection: Overload Long Delay Protection

Overload protection is a kind of protection that controls the heating of simulated conductors based on rated current and actual current flow. The larger the current, the shorter the action time, which can effectively prevent product overload. After this protection, the product will be locked and will not automatically close, requiring manual closing.

Specifications	Set Value Ir1_A	Factory Setting Value
125A	50A-125A continuously adjustable	630A
250A	100A-250A continuously adjustable	630A
400A	160A-400A continuously adjustable	630A

630A	250A-630A continuously adjustable	630A
Delay time setting value Ir1_T	3s~18s adjustable	12s

7.5 Protection: Short Circuit Short Delay Protection

Short-circuit short-time delay protection prevents resistive short circuits in the distribution system, and the tripping delay is used to achieve selective protection. After this protection, the product will be locked and will not automatically close, requiring manual closing.

Parameter Settings	Setting Range	Factory Setting Value
Short delay action current setting value Ir2_N	2~12Ir1 adjustable	6Ir1
Short delay time setting value Ir2_T	0.1s~1.0s adjustable	0.4s

7.6 Protection: Short Circuit Instantaneous Protection

Parameter Settings	Set Value	Factory Setting Value
Instantaneous operating current setting value Ir3	4Irl, 6Irl, 7Irl, 8Ir, 10Irl, 11Ir, 12Irl, 13Ir, 14Irl, OFF	10Irl

7.7 Protection: Over-voltage Protection

When the line phase voltage is higher than the overvoltage protection setting value, the circuit breaker trips for protection.

When the line voltage returns to normal voltage, the circuit breaker can be automatically closed and put into operation. The setting value range of overvoltage protection is 250V-300V, and the factory setting is 265V. The user can set or turn off the protection by himself.

7.8 Protection: Under-voltage Protection

When the line phase voltage is lower than the undervoltage protection setting value, the circuit breaker trips for protection.

When the line voltage returns to normal voltage, the circuit breaker can be

automatically closed and put into operation. The setting value range of undervoltage protection is 145V~200V, and the factory setting is 165V. The user can set or turn off the protection by himself.

7.9 Protection: Phase Loss Protection

When a phase loss occurs at the power supply end of the line, the circuit breaker trips for protection.

When the line returns to normal voltage, it can be automatically closed and put into operation. The setting value range of the phase loss protection is 10V-50V, and the factory setting is 30V. The user can set or turn off the protection by himself.

7.10 Protection: Over-temperature Protection

Terminal and contact over-temperature protection setting value range: 50℃~120℃ adjustable, factory default is 116℃; high temperature action delay time: 1s~999s adjustable, default 5s; function is enabled by default.

7.11 Protection: Neutral Loss Protection

When the neutral line is disconnected at the power supply end of the line, the circuit breaker trips for protection. When the line returns to normal voltage, it can be automatically closed and put into operation. Neutral loss protection requires the circuit breaker outgoing line to be loaded. The factory default setting of the neutral loss protection function is off.

7.12 Protection: Linkage Protection

When local remote control is required (for example, the switch is in a distribution cabinet and a remote button on the cabinet door is required to control the switch), the external terminal of the switch can be used for linkage protection control. The user can turn on and off this function in the function selection menu.

7.13 Protection: Power-off Tripping, Power-on Closing

When there is a power outage at the power supply end of the line, the circuit breaker will trip for power outage protection; when the line voltage returns to normal range, the circuit breaker will automatically close; the factory

default is off for power-off tripping and power-on closing.

7.14 Protection: Passive Island Protection

The passive inspection method mainly detects whether the system is in an island status by detecting the amplitude, frequency, phase and harmonic content of the inverter output terminal / the common point voltage. It mainly includes over/under-voltage protection, over/under-frequency protection, phase mutation detection, harmonic detection, etc. Passive islanding detection criterion setting values: voltage amplitude swing (dUisl): 0.1~0.9Un, OFF; voltage frequency swing (dFisl): 0.5~25Hz, OFF;

Voltage phase swing (dPHisl): 1~60°, OFF; voltage waveform distortion rate swing (dUTHDisl): 0.5~30%, OFF; delay action characteristics are definite time limit, tPis setting range: 0.01-9.99s;

Passive island protection action comparison table:

Criterion Fluctuation Value	Action
Voltage amplitude swing or swing range	If the voltage amplitude swing range exceeds 20V within 100ms or the swing exceeds [187V, 234.5V], it is determined to be an island.
Voltage frequency swing or swing range	If the voltage frequency swing range exceeds 0.2Hz within 100ms or the swing exceeds [49.5Hz~50.2Hz], it is determined to be an island.

Note: 1. The swing range refers to the difference between the maximum value and the minimum value of the swing within a period of time;

2. The above criteria are mainly voltage frequency swing, supplemented by voltage amplitude swing. When the voltage frequency swing criterion is established, the grid connection point will be cut off within 2 seconds and reported.

7.15 Protection: Power Generation Quality Detection and Protection

Comparison table of current harmonics and protection actions:

Total current distortion rate	Action
≤5%	Normal grid connection
>5%	Continuously observe for 60 seconds. If the harmonics still exceed the standard after 60 seconds, cut off the grid connection point and report it.

Three-phase current imbalance rate and protection action comparison table:

Three-phase current imbalance rate	Action
≤2%	Normal grid connection
>2%	Continuously observe for 60 seconds. If the harmonics still exceed the standard after 60 seconds, cut off the grid connection point and report it.

7.16 Protection: Fee Control Function

This device can be connected to a fee-controlled meter and used as an external circuit breaker for the energy meter. It is compatible with pulse-type and level-type fee-controlled meters. This function requires the switch to be configured as fee-controlled mode and the control permission to be turned on before it can be used. When working in fee-controlled mode, the dynamic protection function automatically exits. When there is no meter fee-controlled signal, the circuit breaker cannot be closed manually. The device will automatically disconnect if it is forcibly closed.

7.17 Environmental Characteristics

Characteristic	Value
Environment temperature	-5 to 40 ℃
Relative humidity	≤50% (when the environment temperature is +40℃)

Altitude	Below 2000 meters above sea level
Installation location	Good ventilation and heat dissipation regulation
HPLC communication conditions	Ensure that all communication device works under one transformer
Installation location	No conductive dust, no corrosive gas, no flammable and explosive gas, no rain or snow