

M5DC(PV) Series DC Moulded-case Circuit Breaker

Operation Manual

● Overview

With the development of the solar energy industry, large-capacity solar photovoltaic power plants are growing rapidly. Higher performance requirements are placed on control and protection electrical devices used in large-scale solar PV power plants. When the power output of a PV power plant exceeds a certain level, circuit breakers or disconnectors are required, especially for the protection and isolation of inverters, which brings new requirements for low-voltage components. Accordingly, our company has developed the new-generation M5DC(PV) series PV-specific DC circuit breaker based on our existing PV DC circuit breakers.

The M5DC(PV) series PV-specific DC circuit breaker (hereinafter referred to as circuit breaker) is applied in DC power grid circuits with rated voltage DC250V~DC1500V and rated operating current 63A~800A. Equipped with long-time overload protection and instantaneous short-circuit protection functions, this circuit breaker distributes electric energy and protects circuits and power equipment against damages caused by overload, short-circuit and other faults.

Standards complied with by this circuit breaker:

IEC 60947-1, IEC 60947-2

GB 14048.1 Low-voltage switchgear and controlgear — Part 1: General rules

GB 14048.2 Low-voltage switchgear and controlgear — Part 2: Circuit-breakers

● Normal Operating Conditions

2.1 The altitude of installation site shall not exceed 2000 m;

2.2 Permissible ambient temperature: maximum +50 °C, minimum -5 °C. (Derating is required for operation above +40 °C; consult the manufacturer for details.)

2.3 Atmospheric conditions: At ambient temperature of 40 °C, relative humidity shall not exceed 50 %. Higher relative humidity is permitted at lower temperatures, e.g. 90 % at 20 °C.

Condensation on product surfaces due to temperature variation shall be taken into account.

2.4 Pollution degree: 3;

2.5 Installation category: III;

2.6 The magnetic field at the installation position shall not exceed 5 times the earth's magnetic field in any direction;

2.7 Used in non-explosive atmospheres, free of gases and conductive dust that may corrode metals or damage insulation;

2.8 Installed in locations free from wind-driven snow and rain immersion;

2.9 Installation requirements:

- a) Horizontal and vertical mounting are permitted;
- b) No significant shock or vibration at installation site. Installation in flammable and explosive areas is prohibited.

● Normal Operating Conditions

SJK M 5 DC(PV) - 250 / 2 300 250A DC1000V
 1 2 3 4 5 6 7 8 9

- 1 – Manufacturer code
- 2 – Moulded-case circuit breaker
- 3 – Design sequence number
- 4 – PV: For photovoltaic application; DC: For direct-current application
- 5 – Frame size
- 6 – Number of poles
- 7 – Accessory code (see table below for details)
- 8 – Rated current
- 9 – Operating voltage

Accessory Code Table:

Accessory	None	Alarm contact	Shunt release	Shunt release + Alarm	Auxiliary contact	Auxiliary + Alarm	Shunt release + Auxiliary	Shunt release + Auxiliary + Alarm	Two-set auxiliary	Two-set auxiliary + Alarm
Accessory Code	00	08	10	18	20	28	40	48	60	68

● Internal and External Accessories

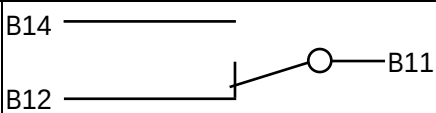
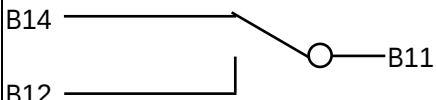
1. Alarm Switch



Function

When the circuit breaker trips due to overload, short-circuit, external shunt-release signal or manual trip-reset button operation, the alarm switch outputs an alarm signal. It is particularly useful in automation systems for transmitting fault signals to designated locations. Fault signals are activated by the built-in micro-switch upon circuit-breaker tripping. No signal will be generated during normal closing and opening operations.

Operating Characteristics

Circuit-breaker Status	Alarm Switch Status
Circuit-breaker in ON / OFF position	
Circuit-breaker in tripped position	

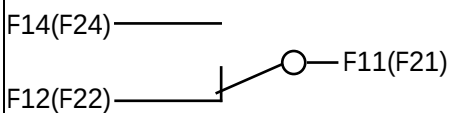
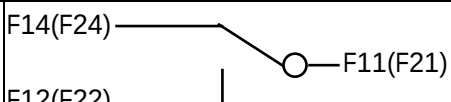
2. Auxiliary Switch



Function

The auxiliary switch is used for remote ON/OFF indication and electrical interlocking. Each switch consists of two contacts with one common terminal. Its switching status follows the main contacts of the circuit breaker. When the circuit-breaker is open, one contact is normally open and the other is normally closed, and vice-versa.

Operating Characteristics

Circuit-breaker Status	Auxiliary Switch Status
Circuit-breaker in OFF position	
Circuit-breaker in ON position	

Rated Operating Current of Alarm Switch and Auxiliary Switch

Category	Rated Current I_n	Conventional Thermal-current I_{th} (A)	Rated Operating Current I_e (A)	
			AC400V	DC400V
Auxiliary Contact	≤ 250	3	0.3	0.15
	$400 \leq I_{nm} \leq 1000$	3	0.4	0.2
Alarm Contact	$10 \leq I_{nm} \leq 1000$	-	AC220V / 1.0A	0.15

Making and Breaking Capacity of Alarm Switch and Auxiliary Switch under Normal Conditions

Utilization Category	Making (ON)				Breaking (OFF)				Operating cycles under energized condition	Operating cycles per minute	Energized duration
	I/I_e	U/U_e	$\cos\Phi$	$T_{0.95}$	I/I_e	U/U_e	$\cos\Phi$	$T_{0.95}$			
AC-15	6	1	0.7	-	1	1	0.7	-	10	6	$\geq 0.05s$
DC-13	1.1	1.1	-	$6 \times P_e$	1.1	1.1	-	$6 \times P_e$	10	6	$\geq 0.05s$

- Notes: 1. Formula $T_{0.95} = 6P_e$ is an empirical formula. P_e is in watts; $T_{0.95}$ is in milliseconds;
 2. When the total operating cycles of the circuit-breaker is less than 6050, the energized operating cycles of auxiliary switch shall be equal to the total operating cycles of the circuit-breaker;
 3. Operating frequency and energized duration shall comply with those of the main circuit of circuit-breaker;
 4. If $T_{0.95}$ is greater than 0.05s, the energized duration shall be at least $T_{0.95}$.

3. Alarm Switch

Function

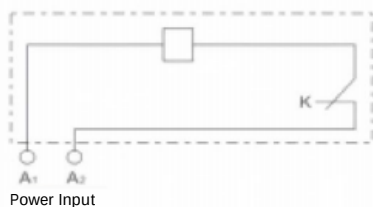
The shunt release is a device for tripping the circuit-breaker remotely by electrical signal;

After the circuit-breaker trips, the shunt release automatically cuts off the signal circuit.

Operating Characteristics

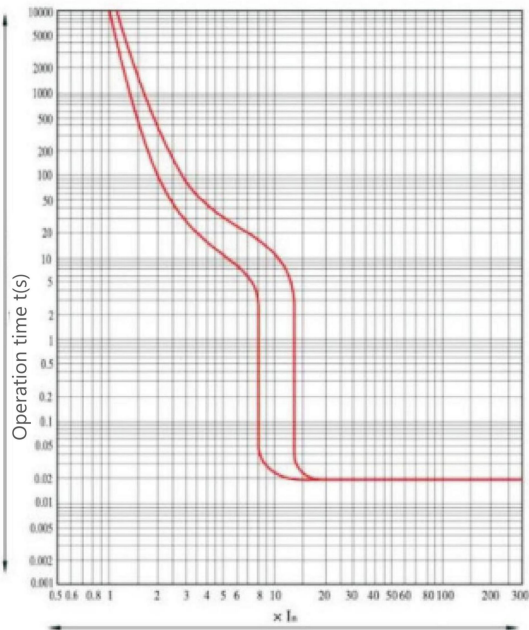
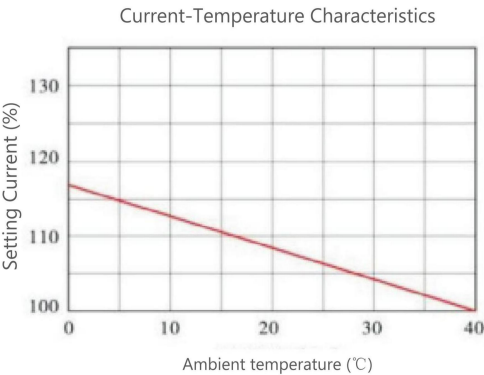
Voltage Ratings	AC 50Hz: 24V, 110V, 230V, 400V DC: 24V, 110V, 220V
Operating Feature	The shunt release shall trip the circuit-breaker when the control voltage ranges from 70 % to 110 % of its rated control voltage.

Wiring Diagram (Items inside the dashed box are internal accessories of circuit - breaker)

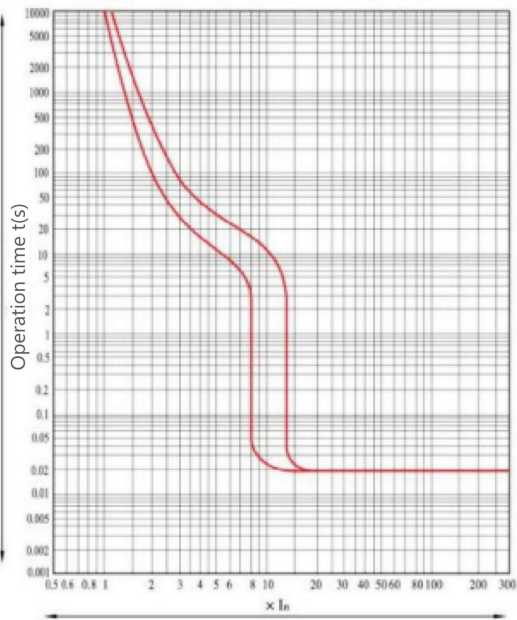
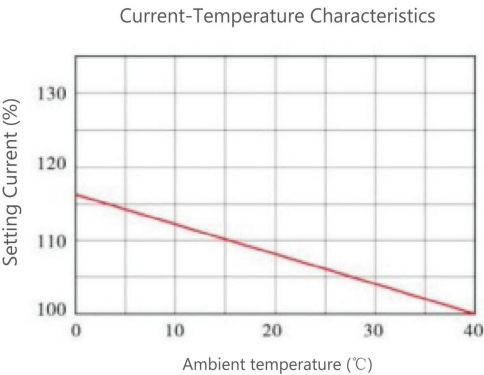


K is a normally-closed micro-switch connected in series with the coil inside the shunt release. This contact opens automatically after the circuit-breaker trips, and closes when the circuit-breaker is closed.

● Thermal-Magnetic Protection Operating Characteristic Curves



M5DC(PV)-250/315 Time-Current Characteristic Curve



M5DC(PV)-400/630/800 Time-Current Characteristic Curve

● Main Technical Parameters

Product Model		SJKM5DC									
Frame Size Rating		250		315		400		630		800	
Rated Current (A)		63A,80A,100A,125A,140A,160A,180A,200A,225A,250A				250A,315A,350A,400A		400A,500A,630A		630A,700A,800A	
Nominal Insulation Voltage (V)		1500V									
Rated Impulse Withstand Voltage (KV)		12KV									
Type		DC	PV	DC	PV	DC	PV	DC	PV	DC	PV
Rated Operating Voltage (V)	2P	DC250V,DC500V,DC750V,DC1000V,DC1500V				DC250V,DC500V,DC750V,DC1000V,DC1500V					
	3P	DC1000V,DC1250V,DC1500V				DC1000V,DC1500V					
Rated Ultimate Short-Circuit Breaking Capacity (kA)	2P	DC1000V (2P): 15 DC1500V (2P): 5	DC250V,DC500V (2P): 50 DC750V,DC1000V (2P): 25 DC1500V(2P): 7.5	DC1000V (2P): 15 DC1500V (2P): 5	DC250V,DC500V (2P): 50 DC750V,DC1000V (2P): 25 DC1500V(2P): 7.5	DC250V,DC500V (2P): 25 DC750V,DC1000V (2P): 15 DC1500V(2P): 10	DC250V,DC500V (2P): 50 DC750V,DC1000V (2P): 25 DC1500V(2P): 10	DC250V,DC500V (2P): 25 DC750V,DC1000V (2P): 15 DC1500V(2P): 10	DC250V,DC500V (2P): 50 DC750V,DC1000V (2P): 25 DC1500V(2P): 10	DC250V,DC500V (2P): 25 DC750V,DC1000V (2P): 15 DC1500V(2P): 10	DC250V,DC500V (2P): 50 DC750V,DC1000V (2P): 25 DC1500V(2P): 10
	3P	DC1500V (3P): 20	DC1000V,DC1250V,DC1500V(3P): 25	DC1500V (3P): 20	DC1000V,DC1250V,DC1500V(3P): 25	DC1000V(3P): 30 DC1500V(3P): 25	DC1000V(3P): 40 DC1500V(3P): 30	DC1000V(3P): 30 DC1500V(3P): 25	DC1000V(3P): 30 40DC1500V(3P):30	DC1000V(3P): 30 DC1500V(3P): 25	DC1000V(3P): 40 DC1500V(3P): 30
Rated Short-Circuit Breaking Capacity (kA)	2P	100%Icu									
	3P										
Connection Mode		2P (Figure1),3P (Figure2)			2P (Figure1),3P (Figure3)						
Isolation Function		YES									
Selective Category Cat		A									
Mechanical Life (Cycles)		20000			10000						
Electrical Life (Cycles)		1500			1000		800		500		
Flashover distance (mm)	2P	≤50	≤100	≤50	≤100	≤100					
	3P	200×73×135			270×130×156						
Overall dimensions (mm)		200×107×135			310×182×156						

● Wiring Diagram

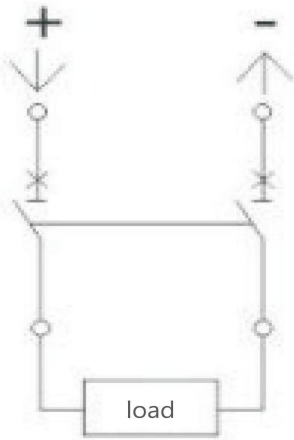


Figure1

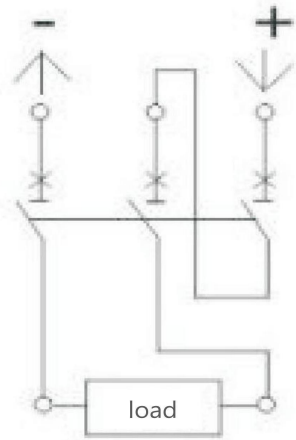


Figure2

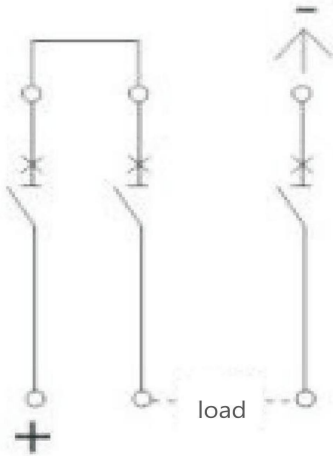
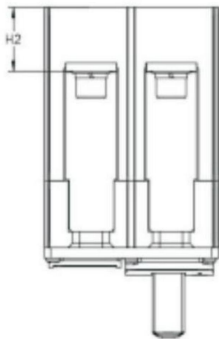
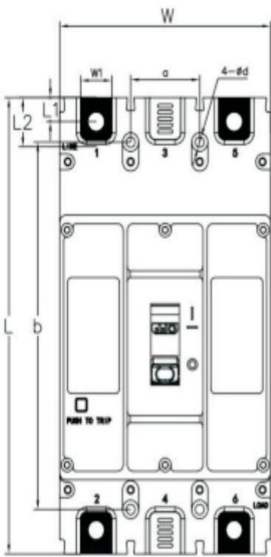
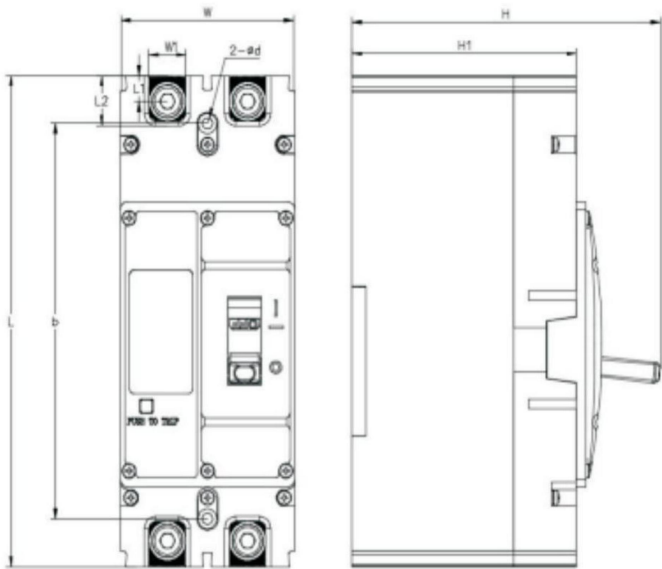
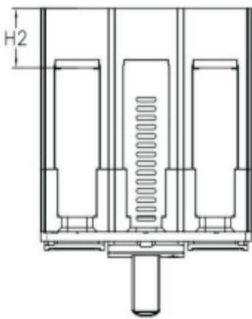


Figure3

● Outline And Installation Dimensions



2P Shape



3P Shape

Model Specification	Overall Dimensions (mm)								Mounting Dimensions (mm)		
	L	W	H	L1	L2	W1	H1	H2	a	b	4-Φd
250/2P	200	76	135	10.5	9.5	22	98	26	/	161	4.5
250/3P	200	107	135	10.5	9.5	22	98	26	35	161	4.5
400/2P	257	140	170	16	10.5	30	94	36	43.5	197	6.5
400/3P	257	184	170	16	10.5	30	94	36	43.5	197	6.5
630/2P	257	140	170	16	10.5	30	94	36	43.5	197	6.5
630/3P	257	184	170	16	10.5	30	94	36	43.5	197	6.5

● Cross-Section Area Of Connecting Conductors

Rated Current (A)	63	80	100	125/140	160	180/200/225	250	280/300/315	350/400	500/630	700/800
Conductor Cross-sectional Area (mm ²)	16	25	35	50	70	90	120	Copper busbar 20×5×2	Copper busbar 40×5	Copper busbar 40×8	Copper busbar 40×5×2

● Ordering Instructions

When placing an order, please specify the model, designation and rated current of the moulded-case circuit-breaker, as well as the required quantity.

Example: M5DC-250/2P, 250A DC Moulded-Case Circuit-Breaker, quantity: 50 units. Special product requirements shall be subject to negotiation.

● Company Warranty

Provided that the user complies with operating and storage conditions and the product seal remains intact, our company shall provide free repair or replacement for damage or malfunction caused by manufacturing defects within eighteen (18) months from the date of product manufacture. Repairs outside the warranty period shall be chargeable.

Damage arising from the following conditions shall be subject to chargeable repair even within the warranty period:

- (1) Improper operation, maintenance or storage;
- (2) Unauthorized modification or improper repair.

Product Certificate

This product has passed inspection
and complies with technical
standards for factory release.

Inspector: 检3

Inspection Date:

This manual is for operation guidance only. Actual operations shall be performed by certified professional personnel in combination with the factory-issued technical documents and on-site practical conditions.

The manufacturer shall not be liable for equipment damage or safety accidents caused by non-compliant operations.