DW45

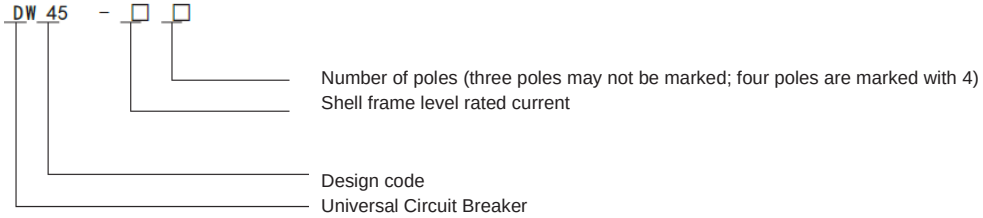
Series Intelligent Universal Circuit Breaker

I. Scope of Application

The DW45 Series Intelligent Universal Circuit Breaker (hereinafter referred to as “the circuit breaker”) is suitable for distribution networks with AC 50 Hz, rated voltage of 400 V and 690 V and rated current of 630 A to 6,300 A, and is used for power distribution, so as to protect circuits and power equipment from faults such as overload, undervoltage, short circuit, and single-phase grounding. The circuit breaker has the functions of intelligent protection and isolation. It has accurate selective protection, which can improve the reliability of power supply and avoid unnecessary blackout. The circuit breaker is equipped with an open communication interface to realize telemetering, telesignaling, telecontrol and teleregulation, thus meeting the requirements of the centralized control of the automation system.

The circuit breaker complies with GB 14048.2 *Low-voltage Switchgear and Controlgear — Low-voltage Circuit Breakers* and IEC 60947-2 *Low-voltage Switchgear and Controlgear — Part 2: Low-voltage Circuit Breakers*.

II. Model Description



III. Normal Operating and Installation Conditions

1. Ambient air temperature: The upper limit of ambient air temperature shall not exceed +40°C, the lower limit shall not be lower than -5°C, and the average value within 24 hours shall not exceed +35°C.

Note:

(1) The operating conditions with the lower limit of -10°C or -25°C shall be declared to the manufacturer by the user when ordering.

(2) If the upper limit exceeds +40°C or the lower limit is lower than -25°C, the user shall consult with the manufacturer.

2. Altitude: The altitude of the installation location shall not exceed 2,000 meters.

3. Atmospheric conditions: The relative atmospheric humidity does not exceed 50% when the maximum temperature is +40°C, and a higher relative humidity is allowed at a lower temperature. For example, the humidity is 90% at 20°C, and special measures shall be taken for occasional condensation due to the temperature change.

4. Contamination grade: Grade 3.

5. Installation category: The installation category of the breaker’s main circuit, undervoltage release’s coil and primary coil of the power transformer is IV, and that of other auxiliary circuits and control circuits is III.

6. Use category: Class B.

7. Installation conditions: The circuit breaker shall be installed according to the installation requirements of this instruction. The circuit breaker shall be installed smoothly without additional mechanical stress, so as to avoid damage to the circuit breaker or poor contact of the main busbar.

IV. Classification

1. According to the installation mode: Fixed type, drawer type.

2. According to the operation mode: Electrical operation, manual operation (for overhauling and maintenance).

3. According to the number of poles: Three-pole, four-pole.

4. According to the release type: Intelligent overcurrent controller, undervoltage instantaneous (or delay) release and shunt release.

5. According to the performance of the intelligent overcurrent controller: Type H (for communication), Type M (general), and Type L (economical). The functions of the three types of controllers are shown in Table 1.

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Table 1

Purpose	Series	Notes	Functions		
General industry	H	All digital units. Type L adopts the coding switch and toggle button setting mode. Types M and H adopt the digital display and button setting mode.	Series H		
	M		Series M		Communication interface: Provide the standard RS485 interface multi-protocol data transmission function (internal integrated ModBus communication protocol)
	L		Series L	Ammeter Power meter More protection functions, including five optional characteristics Load monitoring Contact wear and mechanical life indication Fault query Programming interface	
			RMS value protection Three-section protection + grounding or leakage protection Load current light column indication Multiple alarm functions Test function Fault memory function Self-diagnosis function MCR making/breaking and off-limit tripping functions		

Shell frame level rated current Inm (A)	Rated current In (A)	Rated insulation voltage Ui (V)	Rated impact withstand voltage Uimp (kV)	Rated voltage Ue (V)	Rated ultimate short-circuit breaking capacity Icu (kA) o-co		Rated operating short-circuit breaking capacity Ics (kA) o-co-co		Rated short-time withstand current Icw kA (1s) 0.4 s o-co delay		Power consumption (In) W	
					400 V	690 V	400 V	690 V	400 V	690 V	Fixed	Drawer
2000	630, 800 1000, 1250 1600, 2000	1000	12	AC 50 Hz 400 690	80	50	65	50	65 / 50		90	205
											150	310
											170	310
3200	2000 2500 2900 3200				100	65	65	50	65		170	400
											260	510
											320	650
											420	760
4000	2500 2900 3200 4000				100	70	100	70	100 / 70		430	780
											440	790
											450	800
6300	4000 5000 6300				120	85	100	75	100 / 85		1225	
											1250	
											1625	

2. See Table 3 (a) for the derating factor of the circuit breaker in different environments.

Table 3 (a)

Operating ambient temperature		+40°C	+45°C	+50°C	+55°C	+60°C
Continuous current carrying capability	Inm= 2000	1 In	0.97 In	0.91 In	0.87 In	0.82 In
	Inm= 3200	1 In	0.95 In	0.89 In	0.85 In	0.78 In
	Inm= 6300	1 In	0.93 In	0.87 In	0.82 In	0.75 In

Note: The measured temperature of 110°C at the inlet and outlet terminals of the circuit breaker under various ambient temperature conditions shall be taken as the benchmark.

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3. Protection characteristics and functions of the intelligent overcurrent controller

3.1 See Figures 1–4 for protection characteristics of the intelligent controller.

Figure 1. Basic functions (long time delay, short time delay and instantaneous protection)

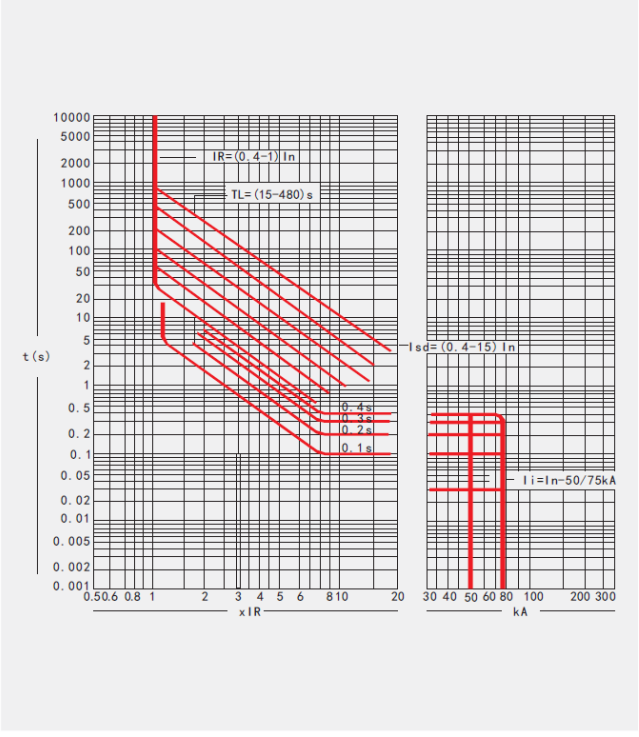


Figure 2. Grounding fault protection

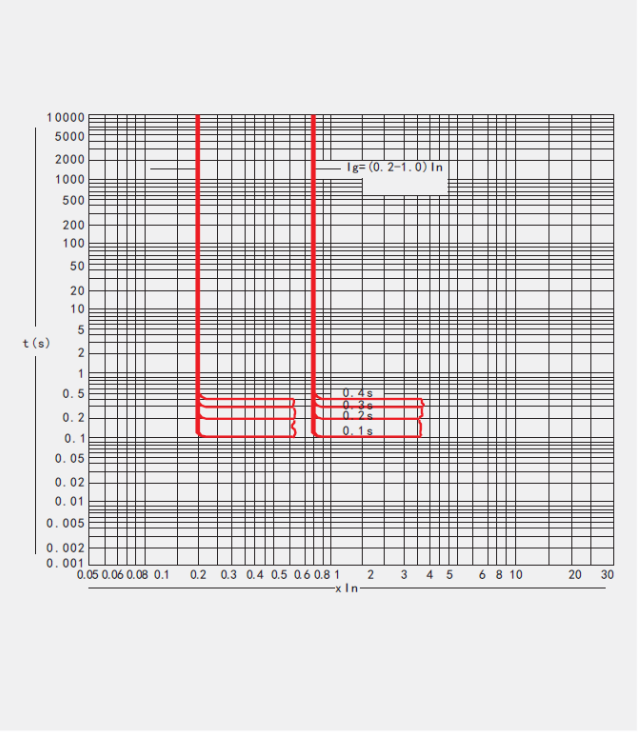


Figure 3. Load monitoring and control (protection characteristics of single-load limit and single-load overlap)

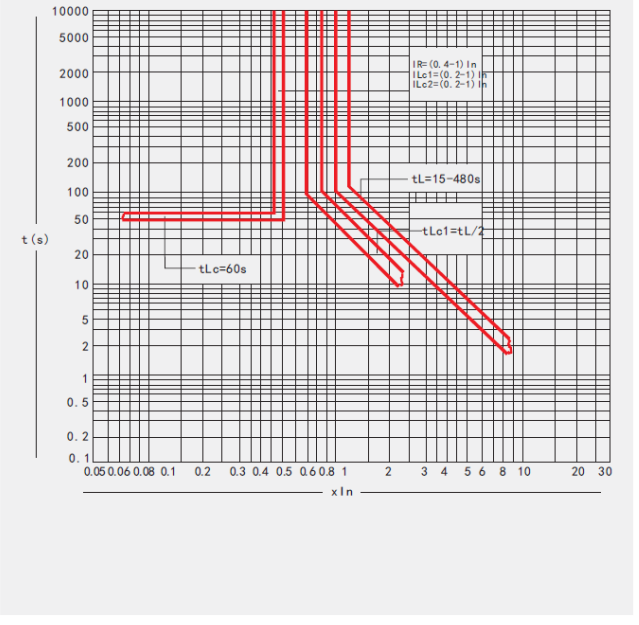
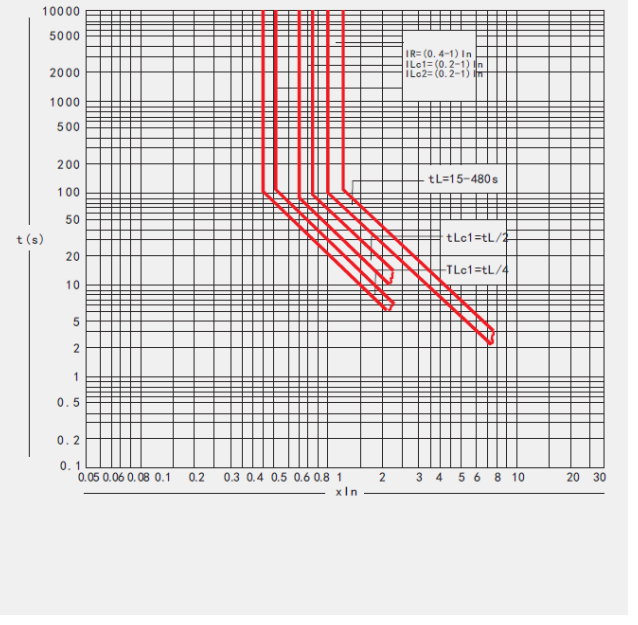


Figure 4. Load monitoring and control (protection characteristics of double-load limit)



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3.1.1 See Figure 4 for the current setting value Ir and tolerance of the release.

Table 4

Long time delay		Short time delay		Instantaneous		Grounding fault	
IR	Tolerance	Isd	Tolerance	Ii	Tolerance	Ig	Tolerance
(0.4～1)In	±10%	(0.4～15)In	±10%	1.0In～50kA	±15%	(0.2～1.0)In	±10%

Note: When three sections of protection are available at the same time, the setting values cannot cross, and IR < Isd < Ii.

3.1.2 See Table 5 for the inverse time operating characteristics of long-time delay overcurrent protection.

Table 5

I	Operating time						Tolerance
1.05IR	＞2 h Non-operating						±10%
1.3IR	＜1 h Operating						
1.5IR	15s	30s	60s	120s	240s	480s	
2.0IR	8.4s	16.9s	33.7s	67.5s	135s	270s	

Note: The time when I = 2.0 IR is calculated according to $I^2T = (1.5\ IR)^2t$, where t is the operating time when I = 1.5 IR, which is set by the user.

3.1.3 See Table 6 for the characteristics of short-time delay overcurrent protection.

Table 6

Current	Operating characteristics	Operating time (s)					Tolerance
I≥Isd I≤8IR	Inverse time	Setting time $T = (8\ IR)^2tsd/I^2$					±15%
I≥Isd I≤8IR	Fixed time	Setting time t2	0.1	0.2	0.3	0.4	
		Return time	0.06	0.14	0.23	0.35	

3.1.4 The grounding fault protection is characterized by short time delay and fixed time. See Table 6 for the fixed operating time and return time. The setting value of grounding fault delivery time is “OFF”.

3.1.5 If the user has no special requirements when ordering, the manufacturer shall configure the intelligent release according to Table 7.

Table 7

Long time delay	Setting value	IR	In
	Delay	tR(1.5IR)	15s
Short time delay	Setting value	Isd	8In
	Delay	tsd	0.4s
Instantaneous	Setting value	Ii	12In
Grounding fault	Setting value	Ig	0.4In
	Delay	tg	OFF (display only, with connection)

Note: In the table, IR is the setting current of long time delay protection; Isd is the setting current of short time delay protection; Ii is the setting current of instantaneous protection; and Ig is the setting value of grounding protection.

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3.2 Functions of the intelligent overcurrent controller
3.2.1 Functions of the Type-L overcurrent controller
The Type-L release adopts the coding switch and toggle switch setting mode, which is characterized by overload long time delay, short circuit short time delay, instantaneous and grounding leakage protection, as well as the functions of fault state and load current light column indication, but without digital display. It doesn't have as complete functions as the Type M/H release. It is only for users to choose in general situations.
3.2.2 Functions of the Type-M overcurrent controller
a. Ammeter
It is used to display the running current and grounding leakage current of each phase, the maximum phase current, as well as the current value or time value of setting, test and fault.
b. Voltmeter
It is used to display the voltage of each line and the maximum voltage value.
c. Load monitoring
It is used to set two setting values, ILc 1 and ILc2, with the setting range of (0.2–1) In. The delay characteristic of ILc1 is inverse time limit, and the time setting value is 1/2 of the delay setting value. ILc2 has two kinds of delay characteristics, including inverse time limit whose time setting value is 1/4 of the long time delay setting value, and fixed time limit whose delay time is 60 s. Among these two kinds of delay functions, the former is used to cut off the unimportant load at the lower level when the current is close to the overload setting value, while the latter is used to, when the current exceeds the setting value of ILc1, reduce the current after the delay breaking of the unimportant load at the lower level. This helps to protect the power supply of the main circuit and the important load circuit, and, when the current drops to the ILc2, to send an instruction after a certain delay to connect the cut-off circuit at the lower level again, thereby restoring the power supply of the whole system. Users can choose one of the above two kinds of monitoring protection. See Figure 3 and Figure 4 for monitoring characteristics.
d. Setting
Various parameters of the controller can be set with four keys of Set, +, -, and Save.
e. Test
Various protection characteristics of the controller can be checked with Set, +, -, Save, Tripping, No Tripping, Reset and other keys.
f. Remote monitoring and diagnosis
(1) The controller has the function of local fault diagnosis. When the computer fails, it can give an error “E” display or alarm and restart the computer. When the user needs, the circuit breaker can also be closed.
(2) When the local ambient temperature reaches 85°C, it can give an alarm and the circuit breaker trips itself when the current is small (if required by the user).
(3) The intelligent controller has overload, grounding, short circuit, load monitoring, pre-alarm, tripping indication (OCR) and other signals output through contacts or photo couplers, which is convenient for user’s external remote control. The contact capacity is DC 28 V, 3 A; and AC 125 V, 3 A.
g. MCR tripping and simulated tripping protection, which can be turned off according to user's requirements.
(1) MCR making/breaking protection is used when the circuit is switched on in case of line fault (when the controller is powered on), and the controller has the function of breaking the circuit breaker at a low short-circuit current. The factory setting is 10 kA, with an error of ±20%, and the setting current can be adjusted according to the user's requirements.
(2) The controller is equipped with the function of sending the tripping signal directly without being processed by the host chip in case of the extremely large short-circuit current.
h. Thermal memory
After the controller is tripped due to overload or short-circuit delay, it has the memory function of simulating bimetallic characteristics before the controller is powered off. The overload energy can be released after 30 min, and the short time delay energy after 15 min. In case of overload and short time delay fault during this period, the tripping time will be shortened, the controller will be powered off, and the energy will be automatically cleared.
3.2.3 Functions of the H-type overcurrent controller
In addition to all functions of the M-type overcurrent controller, it also has a serial communications interface, which can be matched with printer, language system or PC through special equipment, and can transmit various parameters such as circuit breaker numbers, on-off states, release set values, operating currents, voltages, fault currents, operating time and fault states and display or print them in the form of graphs and words, so as to realize the functions of telemetering, teleregulation, telecontrol and telesignaling. It is suitable for network systems.
(1) Communication interface hardware support
* CPU 16-bit single chip microcomputer, with a clock frequency of 25 MHz
* Communication baud rate up to 1 MHz
* Ports complying with EIA Rs485 protocol
* Duplex and half-duplex modes, 8 pairs of double-core cables, and shielded wires in situations with serious interference.
(2) Data transmission mode support
* Serial synchronization and serial asynchronous modes.
* 8-bit and 9-bit data transmission and parity check.
* Parallel communication when necessary
(3) Communication interface protocol
It can be divided into three layers: Application layer, link layer, and physical layer, with dedicated protocols for all layers.
(4) Communication interface function
It can mainly realize the four functions required by the low-voltage distribution system, namely, telecontrol, teleregulation, telemetering and telesignaling.

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4. Operating performance of the circuit breaker

The operation performance of the circuit breaker is expressed by the number of cycles, as shown in Table 7.

Table 7

Number of operation cycles per hour	Shell frame current	Number of energized operation cycles	Number of de-energized operation cycles
20	2000 A	6000	10000
	3200 A	5000	8000
	4000 A	5000	8000
	6300 A	2000	6000

5. Working voltages of shunt release, undervoltage release, electric operating mechanism, energy releasing (closing) electromagnet and intelligent controller of the circuit breaker, as shown in Table 8.

Table 8

Type	Rated voltage AC (50 Hz) V		DC V
Shunt release	Us	220, 380	110, 220
Undervoltage release	Ue	220, 380	—
Electric operating mechanism	Us	220, 380	110, 220
Energy releasing (closing) electromagnet	Us	220, 380	110, 220
Intelligent electronic release	Us	220, 380	110, 220

Note: The reliable operating voltage range of the shunt release is (70%–110%) Us, and that of the energy releasing (closing) electromagnet and electric operating mechanism is (85%–110%) Us.

6. Performance of undervoltage release of the circuit breaker, as shown in Table 9.

Table 9

Type		Undervoltage delay release	Undervoltage instantaneous release
Release operating time		Delay of 1, 3, 5 s	Instantaneous
Operating voltages of release	35 %- 70 % Ue	Disconnect the circuit breaker	
	≤35 % Ue	Fail to close the circuit breaker	
	≥85 % Ue	Close the circuit breaker in a reliable way	
Within 1/2 delay time, when the power voltage returns to 85% Ue,		the circuit breaker will not be disconnected.	

7. Performance of the auxiliary contact

7.1 The conventional thermal current of the auxiliary contact is 6 A.

7.2 Type of the auxiliary contact: Four Normally Open & Four Normally Closed

7.3 The abnormal making and breaking capacity of auxiliary contacts, that is, the making and breaking capacity of auxiliary contacts under abnormal use conditions as shown in Table 10.

Table 10

Use category	Making			Breaking			Number of cycles and operating frequency of making/breaking operation		
	I/ Ie	U/ Ue	COSΦ or T 0.95	I/ Ie	U/ Ue	COSΦ or T 0.95	Number of operation cycles	Number of operation cycles per minute	Energizing time (s)
AC- 15	10	1.1	0.3	10	1.1	0.3	10	6 (or the same as the operating frequency of the main circuit)	0.05
DC- 13	1.1	1.1	6 Pe	1.1	1.1	6 Pe			

Note: When Pe ≥ 50 W, the upper limit of T 0.95 = 6 Pe ≤ 300 ms.

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7.4 The making and breaking capacity of auxiliary contacts under normal conditions are shown in Table 11.

Table 11

Use category	Making			Breaking		
	I/ Ie	U/ Ue	COSΦ or T 0.95	I/ Ie	U/ Ue	COSΦ or T 0.95
AC-15	10	1	0.3	1	1	0.3
DC-13	1	1	6 Pe	1	1	6 Pe

8. Disconnected-position key lock

The circuit breaker is equipped with "disconnected-position key" accessory (supplied according to the supply requirements). When the circuit breaker is locked by this key in the disconnected position, it cannot be closed by using the closing button or the energy releasing (closing) electromagnet at this point. (See the attached table)

VI. Structure Overview

The circuit breaker is compact in structure and has the characteristics of three-dimensional partition. The contact system is enclosed between two insulation baseboards with partition structure, and the contacts of each phase are partitioned to form independent chambers. The controller, operating mechanism, manual and electric operating mechanisms are arranged in front of each other in turn to form their own independent units. If one of the units fails, the unit can be completely removed for the replacement (see Figure 6 and Figure 7).

Figure 5. Operation indicator diagram of the DW 45 Series Universal Circuit Breaker

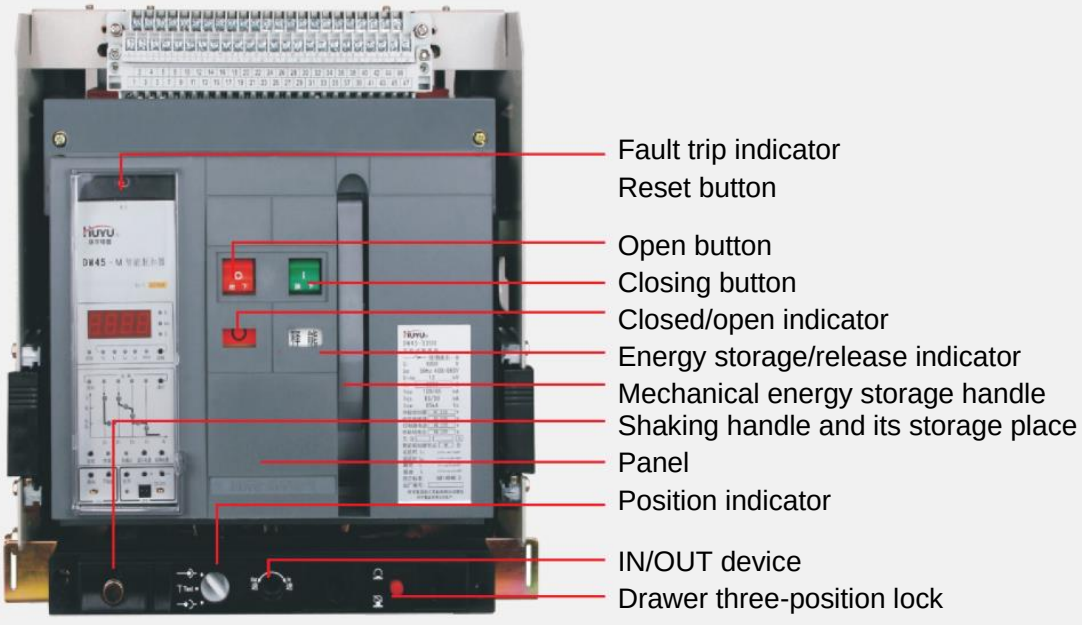

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Figure 6. Extraction position of the DW 45 Series Universal Circuit Breaker

Figure 7. Drawer seat of the DW 45 Series Universal Circuit Breaker

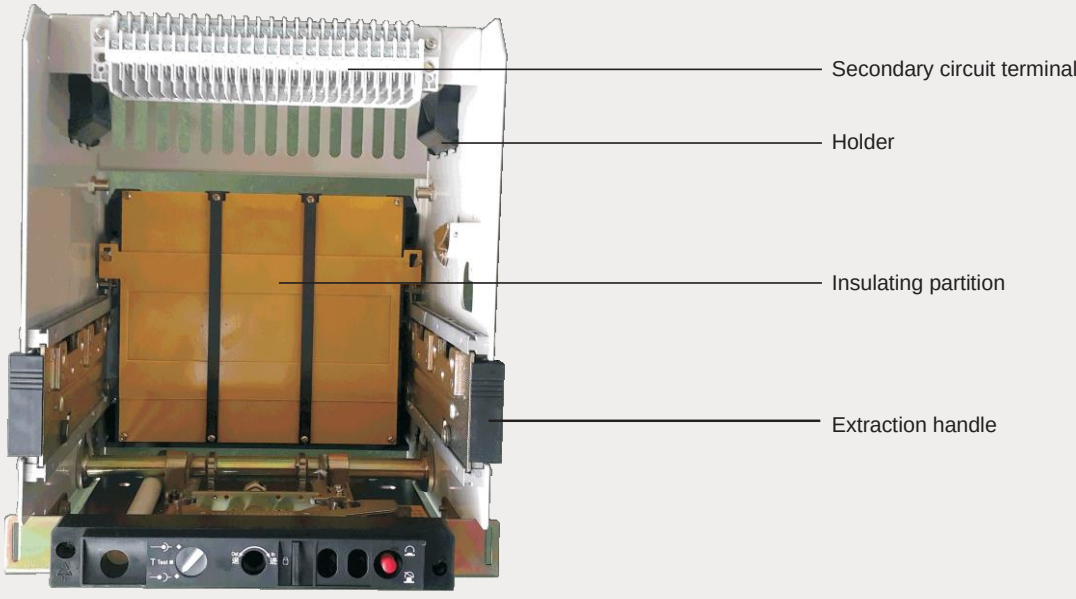

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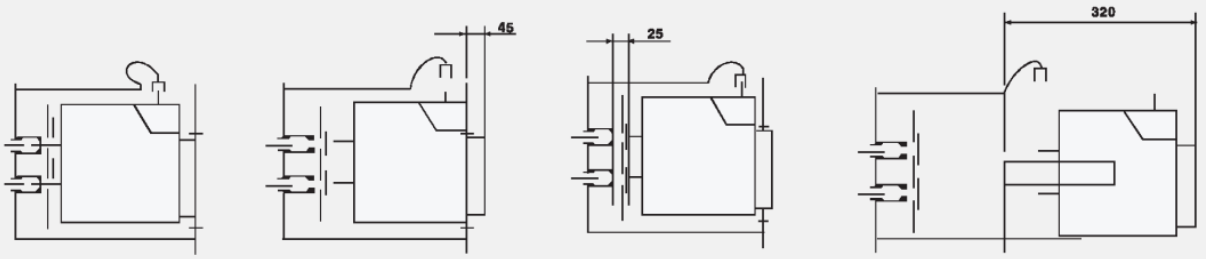
Figure 8. The circuit breaker is small in size and compact in structure, and only a small space is needed for buttons and operations. It has good safety at the "test" or "disconnection" position.



Connection position | Small distancea at the disconnection position | Large separation distance at the experimental position | Small space required for total extraction

1. Contact system (Figure 9)
Each phase contact system is installed in an insulation chamber, above which is an arc-extinguishing chamber. The contact system is connected with the main shaft outside the insulating plate by connecting rods, thus completing the closing and opening operations. To reduce the electric repulsion force, the contact system of each phase adopts the contact parallel connection (10 contacts in 2000 series, 14 contacts in 3200 and 6300 series), with each contact installed on a contact support, one end of which is connected with the busbar by soft connection. When the circuit breaker is closed, the main shaft drives the connecting rod to make the contact support rotate counterclockwise around the “0” point, while after the moving contact contacts with the stationary contact, the moving contact rotates clockwise around the “0” point, compressing the spring, thus generating the enough contact pressure to ensure the reliable connection of the circuit breaker.
2. Operation mechanism (Figure 10)
The circuit breaker can be operated manually and electrically. It is closed by spring energy storage (with pre-stored energy), and the closing speed is not influenced by the electric or manual operation speed.
The circuit breaker achieves the energy storage with a cam compressing a group of springs, and has the function of free tripping. The circuit breaker has three operation positions.
a. Energy storage: The cam, propped against an energy storage lever, is rotated by the external force from electric or manual operation. As the cam rotates, the energy storage lever continuously compresses the energy storage spring, and when the cam rotates to a certain angle, a series of transmission and energy storage are completed by the mechanism.
b. Closing: Press the closing button (the button for connecting the energy release electromagnet provided by the active user on the intelligent controller) to rotate the energy release half shaft and enable the energy storage lever to trip. Under the action of the energy storage spring force, the main shaft is driven to rotate through a series of violent transmissions to close the contact.
c. Disconnection: Press the breaking button or the test tripping signal from the overcurrent, undervoltage, shunt signal and intelligent controller to rotate the half shaft of the break tripping, enable the lever to trip and the connecting rod mechanism to change, and quickly disconnected the circuit breaker under the action of the contact counter-force and return spring force.

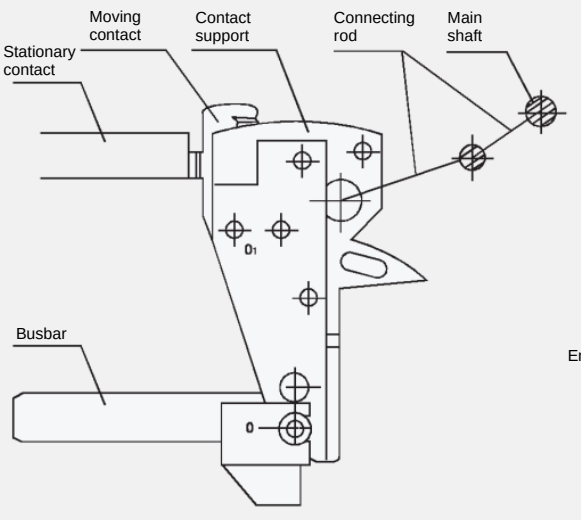


Figure 9

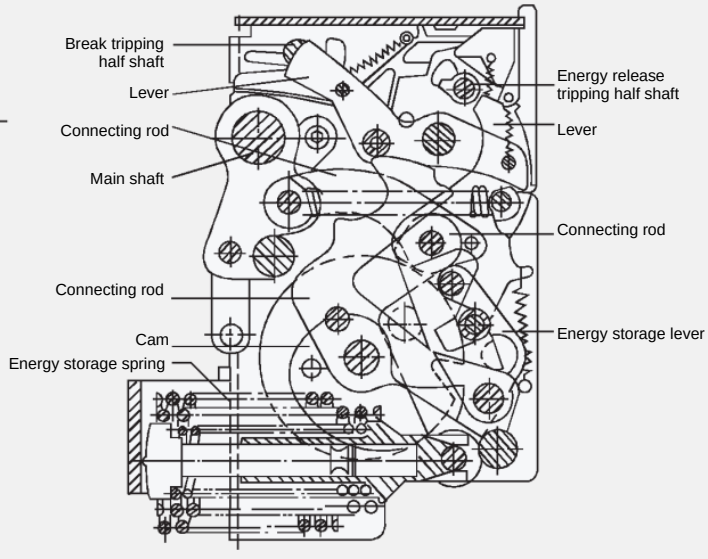


Figure 10

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3. Intelligent controller
Structural relationship of the intelligent controller (Figure 11)
3.1 Base
The base consists of the following parts, which become the function executing devices of the release.
A. Interlocking mechanism: The magnetic flux converter, used as the actuator of the controller, drives the tripping lever to break the circuit breaker and keep it in this position.
B. Reset mechanism: Reset the magnetic flux converter immediately after the magnetic flux converter acts to disconnect the main contact.
C. Magnetic flux converter: The current in the receiving control circuit generates a magnetic field, which changes the direction of magnetic fluxes, enabling a moving iron core to drive the tripping lever under the action of the counter-force spring.
D. Contact group: The position of the opening and closing of the contacts is determined according to the contact state of the circuit breaker.
3.2 Shell
The shell contains the basic circuit board of the controller, which, depending on the received signals, sends out various commands according to the predetermined functional requirements after judgment, so as to complete the functions required by the circuit breaker.
3.3 Sensor
The sensor is installed on the main circuit busbar in the molded case, and the neutral line transformer can be installed according to the user's requirements. The energy and signal of the controller are provided by the sensor. Different from the traditional transformer, the sensor is composed of a fast-saturation current transformer which provides the normal operating energy of the controller and another air-core transformer which mainly provides the change of line current. The secondary current of the air-core transformer is proportional to the current of the main circuit, and both the two transformers are installed in a circular plastic box.
3.4 Power accessories
Power accessories can be divided into several types. The voltage of the power accessory installed on the base is taken from the main circuit, which is used for the release to display and remember the operating state when the main circuit is disconnected or the current is small. AC power supply, DC power supply, uninterruptible (battery) power supply, etc. can be available near the power supply installed on the drawer seat to ensure the power supply near the computer and relay.
3.5 Relay
As an extension of the function of the controller, the relay can be divided into two types: One is to provide users with 16 different combinations of relay contact outputs including overload, short-circuit operation instructions, load monitoring operation commands and instructions, grounding fault area interlocking instructions, local fault instructions, etc. according to the instructions issued by the computer, and the other is to control relay outputs that remotely transmit various parameters and provide users with various instructions and operations.

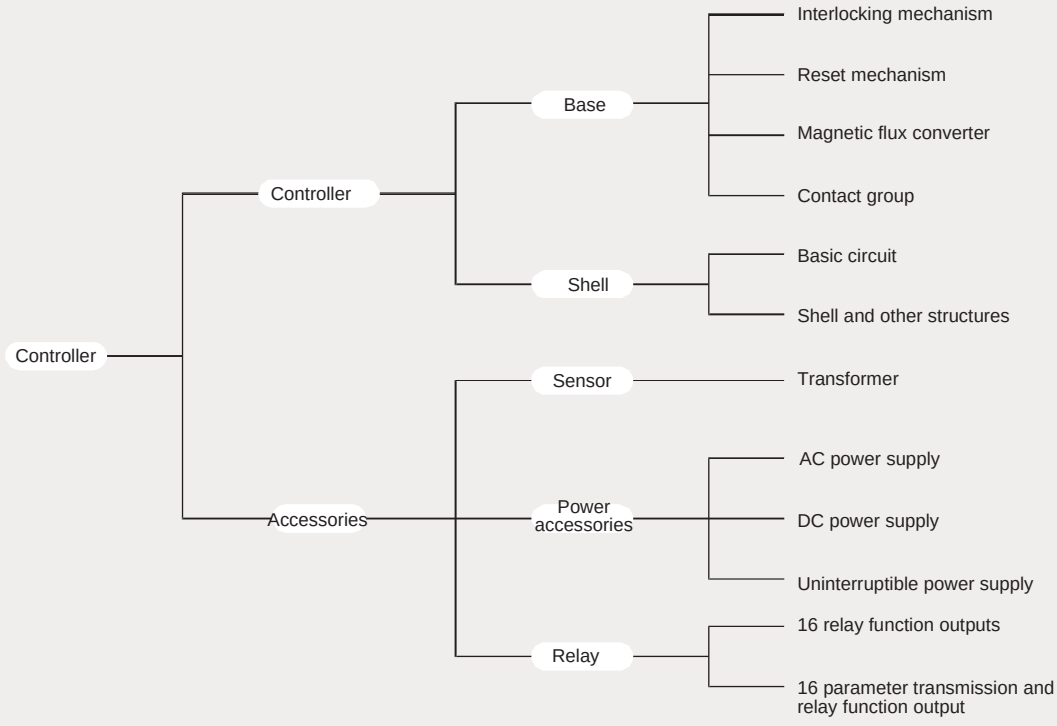

Figure 11

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4. Electric accessories

4.1 Undervoltage release

Release operation characteristics:

4.1.1 When the coil voltage of the release is within the range of 35% to 70% of the power voltage, the release opens the circuit breaker.

4.1.2 When the coil voltage of the release is equal to or greater than 85% of the power voltage, the circuit breaker can be closed reliably.

4.1.4 The undervoltage release is mainly composed of coil, iron core assembly and circuit board, which is divided into undervoltage instantaneous release and undervoltage delay release. The undervoltage delay release can adjust the delay time by the toggle switch on the undervoltage delay device, and the setting value of delay time can be 1, 3 and 5 s.

4.2 Shunt release

Release operation characteristics:

When the coil voltage of the release is within the range of 70% to 110% of the power voltage, the release opens the circuit breaker. The shunt release is mainly composed of coil and iron core assembly, which is suitable for the short-term operation system and can be operated from a long distance to disconnect the circuit breaker.

4.3 Energy releasing electromagnet

An energy releasing electromagnet, namely a closing electromagnet, is mainly composed of a coil and an iron core assembly. It is suitable for the short-term working system. In the state of energy storage, the circuit breaker can be closed as long as the electromagnet is energized.

4.4 Electric energy storage mechanism

The circuit breaker is operated by an electric energy storage mechanism, which can store the energy manually or electrically. The motor power consumption of the electric energy storage mechanism shall not be more than 150 W.

4.5 Auxiliary contact

Type	Normally open	Normally closed
Basic type	*4*	*4*
Special type	*2*	*2*
	6	*2*
	2	*6*

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5. Drawer out tyep circuit breaker
The drawer circuit breaker consists of a circuit breaker body and a drawer seat. Guide rails are arranged on both sides of the drawer seat, which have movable guide plates on them, and the main frame of the circuit breaker is placed on the left and right guide plates. The drawer circuit breaker is connected to the main circuit by inserting the busbar on the breaker body into the bridge contact on the drawer seat. Through cranking the handle of the lower beam of the drawer seat, three working positions of the drawer circuit breaker can be realized (there is a position indication beside the handle).

"Connection" position: Both the main circuit and the secondary circuit are connected.

"Test" position: The main circuit is disconnected and separated by an insulating plate. Only when the secondary circuit is connected, the necessary operation test can be carried out.

"Disconnection" position: The main circuit and the secondary circuit are all disconnected. If the circuit breaker body needs to be removed in the "Disconnection" position, the crank handle must be removed.

The drawer circuit breaker has a mechanical interlocking device, which can only make the circuit breaker closed at the connection position or the test position. It cannot be closed in the middle of the connection and test positions.

6. Interlocking mechanism
The interlocking mechanism is installed on the right side plate of the circuit breaker. The flat circuit breaker is interlocked by the steel cable (Figure 12), and the stacked circuit breaker is interlocked by the connecting rod (Figure 13). When one circuit breaker is in the closing state, the other one cannot be closed. The interlocking mechanism is installed by the user.
Figure 12 shows three stacked circuit breakers interlocked by connecting rods. If two circuit breakers are interlocked, only the top one shall be removed.

7. Connection of the circuit breaker
The DW 45-2000–6300 Circuit Breaker has 47 terminals, which are simple and convenient for users. See Figure 14–18 below for the wiring diagram.

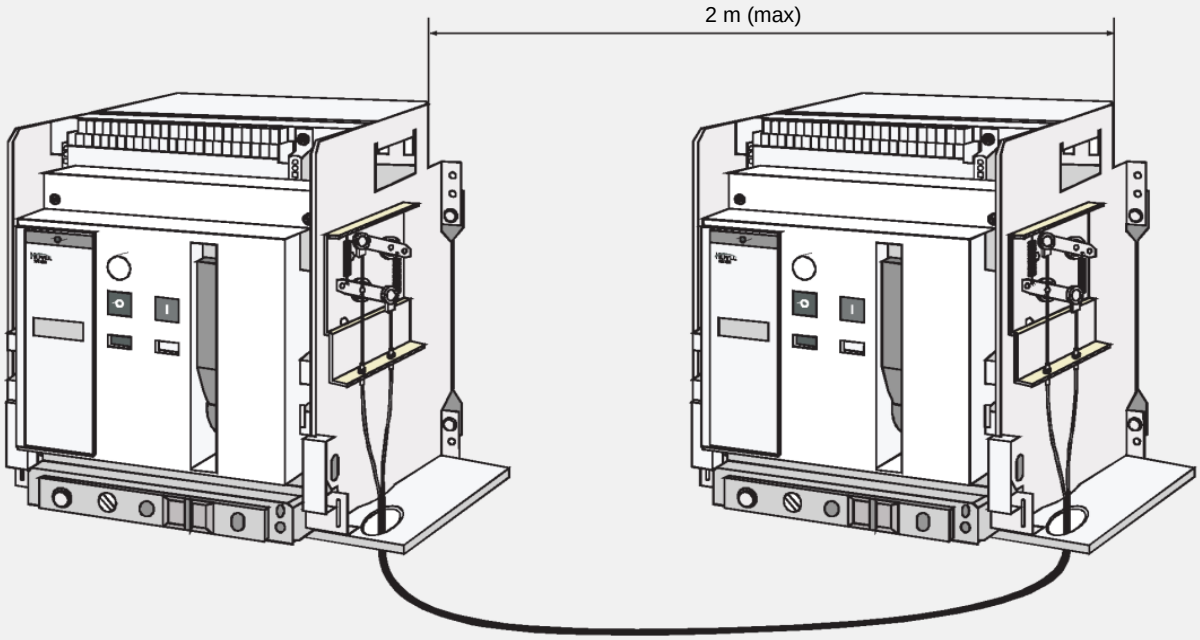

Figure 12 Interlocking with steel cable for the flat circuit breaker

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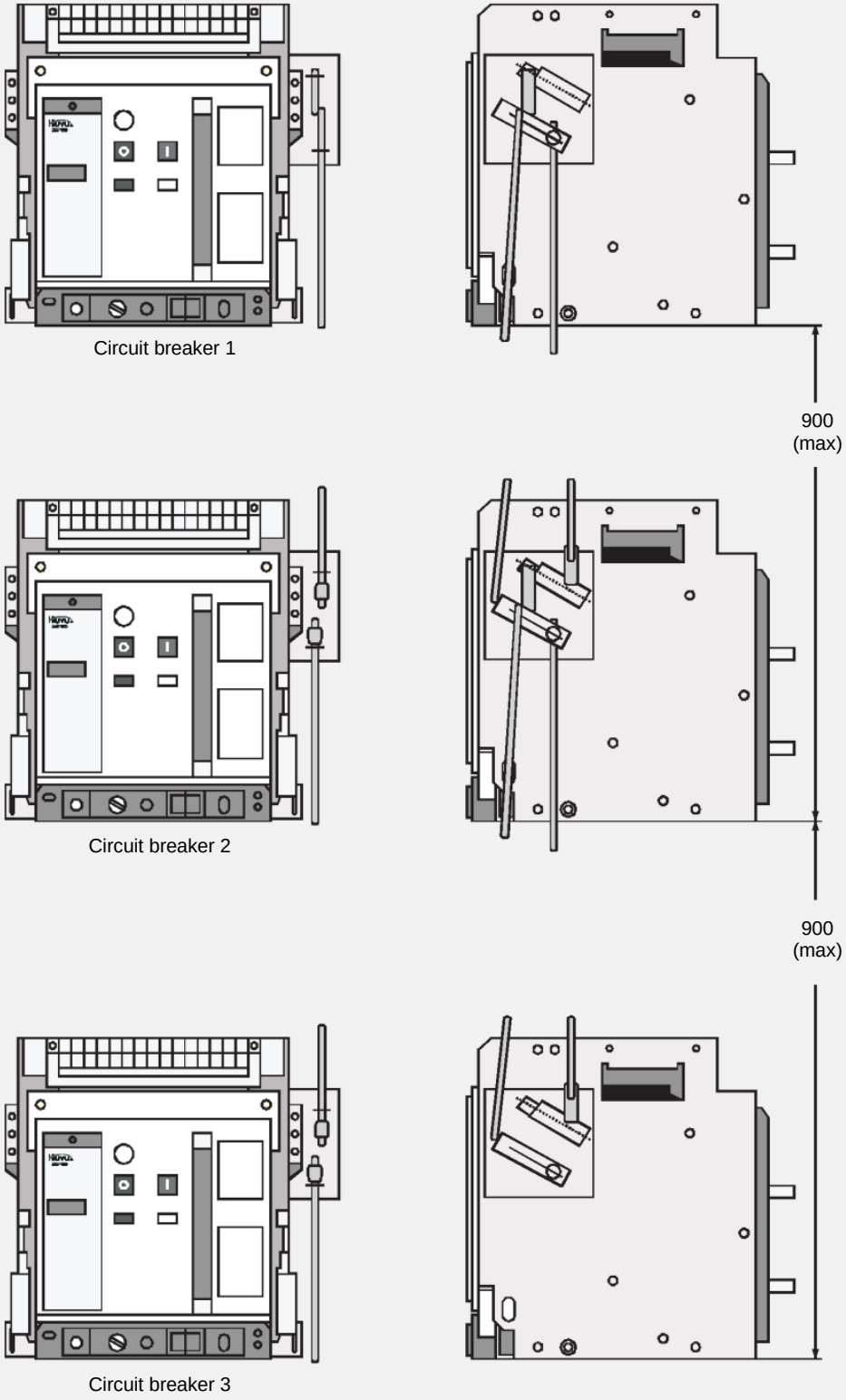
Figure 13 Interlocking with connecting rods for the stacked circuit breaker



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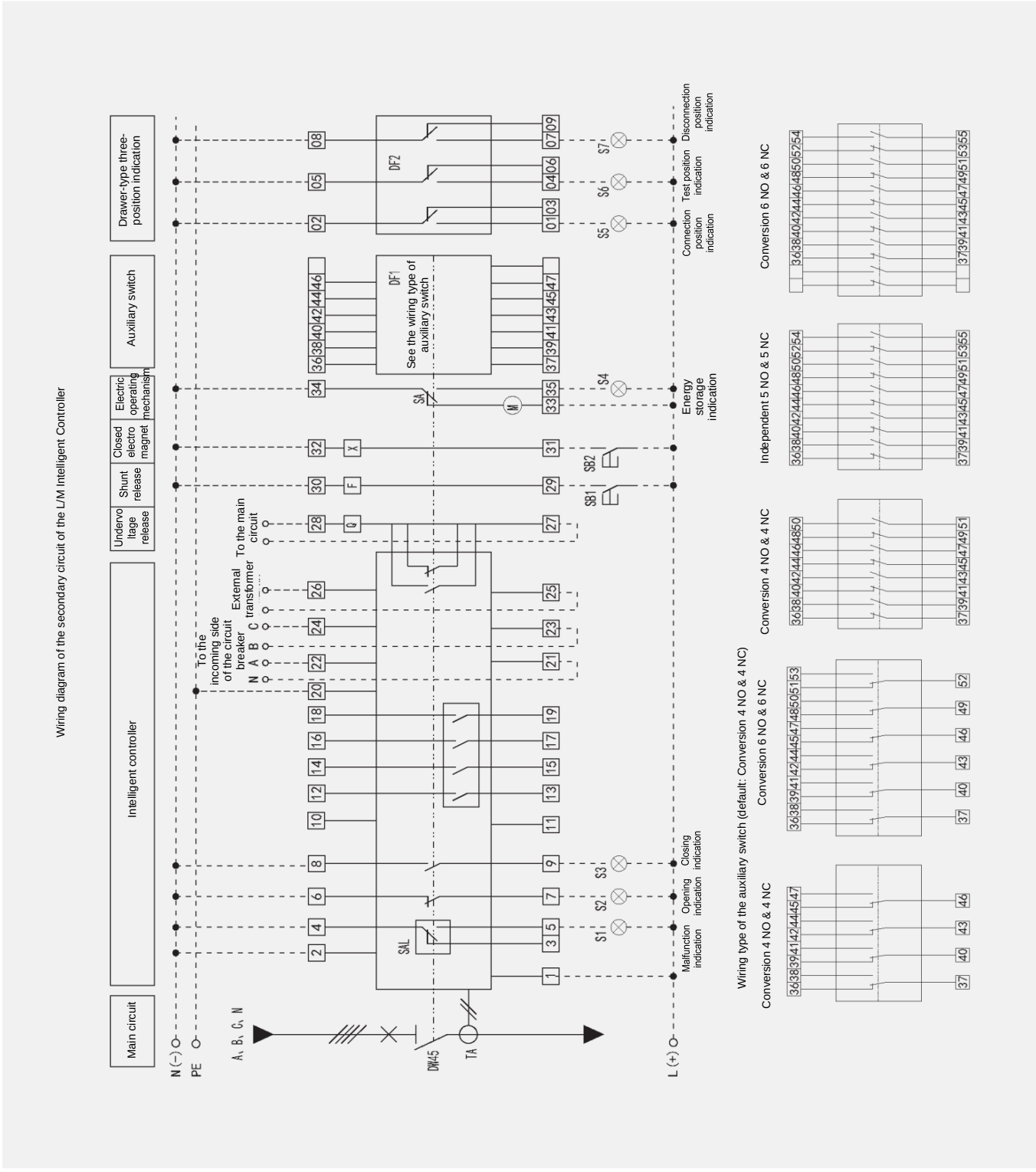
VII. Wiring Diagrams

1) The circuit on the dotted line is wired by the user, which cannot be performed when the optional accessories are not customized.

2) The accessories such as intelligent controller, undervoltage release, shunt release, closing electromagnet and electric operating mechanism shall be connected to different power supplies respectively when the voltages are different.

3) The undervoltage release must be directly connected to the power supply of the main circuit, with the highest working voltage not exceeding its rated working voltage; when the working voltage of the main circuit exceeds its rated working voltage, it needs to be isolated from the main circuit by a transformer.

4) The three-position indication function of the drawer seat is only optional for the drawer circuit breaker.



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Note: For the wiring type of independent six normally open and six normally closed of auxiliary switch, perform wiring adjustment at the space according to the user's order function requirements.

Terminal function in the wiring diagram of the secondary circuit of the L/M Intelligent Controller

Terminal number	Function description	Notes
1, 2	Auxiliary power input: AC 220 V, AC 380 V, DC 220 V, DC 110 V	
3, 4, 5	Fault trip auxiliary contact, contact capacity: AC 250 V, 3 A	
6, 7	Circuit breaker status auxiliary contact (normally closed), contact capacity: AC 250 V, 3 A	
8, 9	Circuit breaker status auxiliary contact (normally open), contact capacity: AC 250 V, 3 A	
20	Grounding (PE)	
21, 22, 23, 24	Voltage signal measurement: 21 connected to N, 22 connected to A, 23 connected to B, 24 connected to C	Optional functions
25, 26	External transformer input (leakage and neutral transformer)	Optional functions
27, 28	Undervoltage release	Optional accessories
29, 30	Shunt release	
31, 32	Closed electromagnet	
33, 34, 35	Electric operating mechanism, 35 connected to the green line, 34 connected to the black line and 33 connected to the red line	
36～…	DF1 auxiliary switch terminal	

Terminal function in the wiring diagram of the secondary circuit of the H-type and Reclosing Intelligent Controller

Terminal number	Function description	Notes
1, 2	Auxiliary power input: AC 220 V, AC 380 V, DC 220 V, DC 110 V	
3, 4, 5	Fault trip auxiliary contact, contact capacity: AC 250 V, 3 A	
6, 7	Circuit breaker status auxiliary contact (normally closed), contact capacity: AC 250 V, 3 A	
8, 9	Circuit breaker status auxiliary contact (normally open), contact capacity: AC 250 V, 3 A	
10, 11	Communication interface output, 10 connected to A, 11 connected to B	Default Modbus
12～19	Signal output; 12, 13: DO1; 14, 15: DO2; 16, 17: DO3; 18, 19: DO4;	Set based on functional requirements
20	Grounding (PE)	
21, 22, 23, 24	Voltage signal measurement: 21 connected to N, 22 connected to A, 23 connected to B, 24 connected to C	Optional functions
25, 26	External transformer input	Optional accessories
27, 28	Undervoltage release	Optional accessories
29, 30	Shunt release	
31, 32	Closed electromagnet	
33, 34, 35	Electric operating mechanism, 35 connected to the green line, 34 connected to the black line and 33 connected to the red line	
36～…	DF1 auxiliary switch terminal	

Interpretation of symbols in the wiring diagram

Symbol	Interpretation	Notes
DW45	DW45 Universal Circuit Breaker	
S1～S7	Signal lamp	User-provided
TA	Current transformer	
SAL	Microswitch	
SB1	Open button	User-provided
SB2	Closing button	User-provided
X	Closed electromagnet	
F	Shunt release	
Q	Undervoltage release	Optional accessories
M	Electric operating mechanism	
SA	Electric operating mechanism limit switch	

Symbol	Interpretation	Notes
PE	Grounding wire	
L(+), N(-)	Control power supply (DC L is positive; N is negative)	
A, B, C, N	Main circuit phase line	
DF1	Auxiliary switch	Type optional
DF2	Drawer-mode three-position electric indicator switch	Optional accessories
ST power module	Provided with DC 24 V power supply	Optional accessories
St201	Relay	Optional accessories
Protocol converter	Except Modbus protocol, other protocols need to be configured.	Optional accessories

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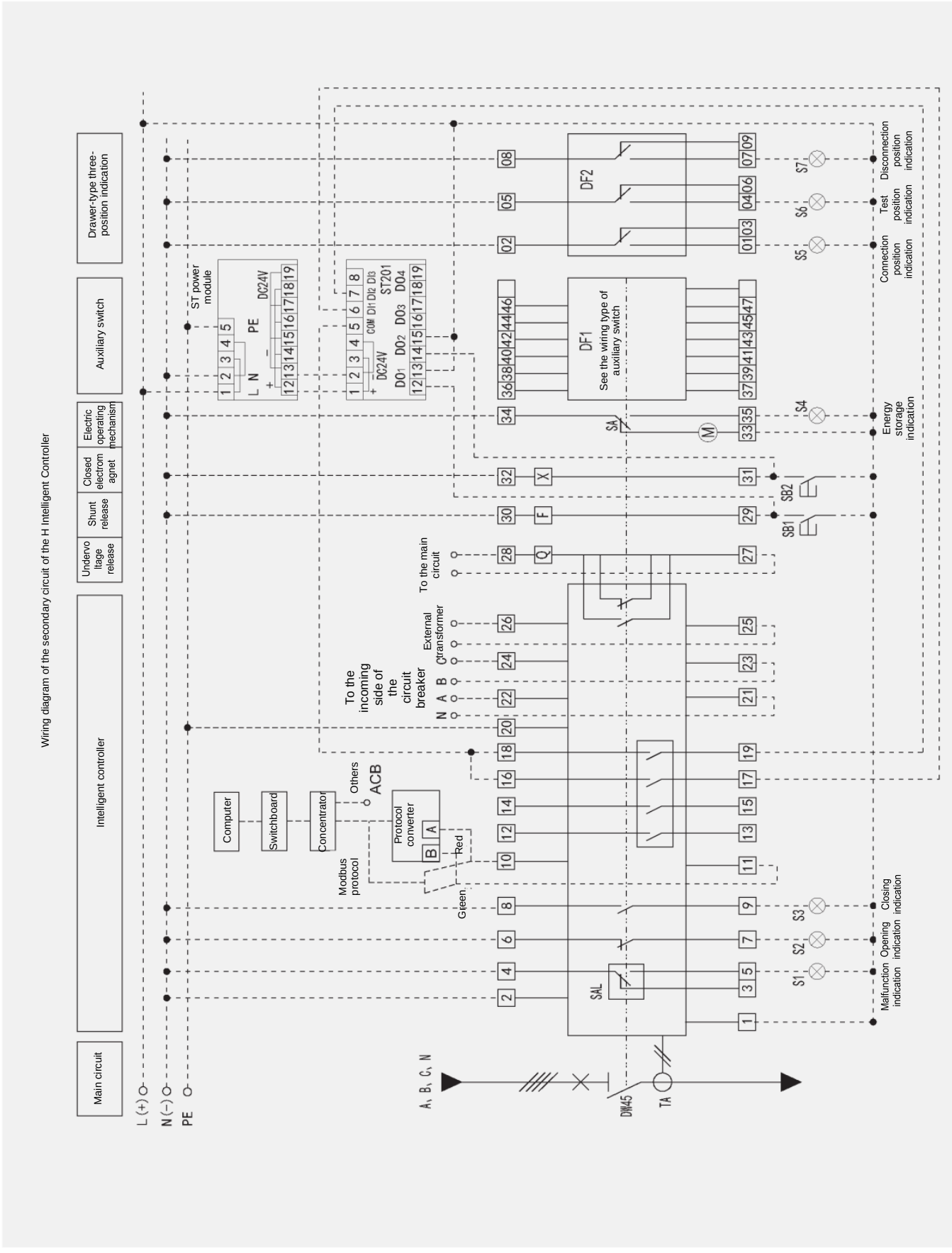

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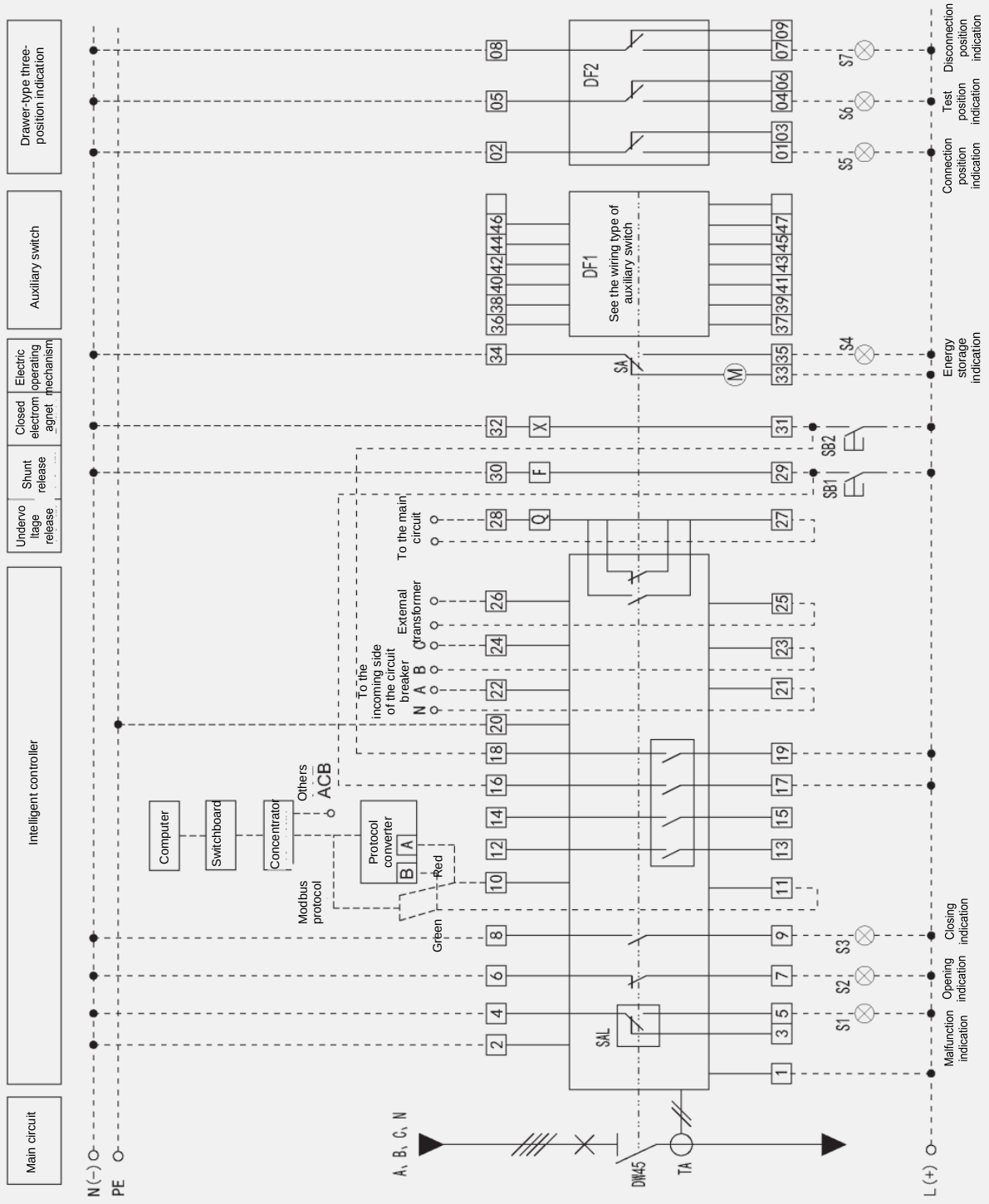
Wiring diagram of the secondary circuit of the reclosing intelligent controller



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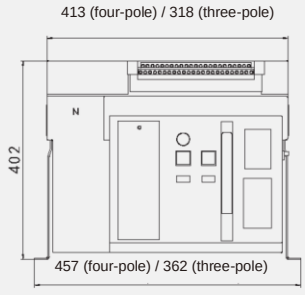
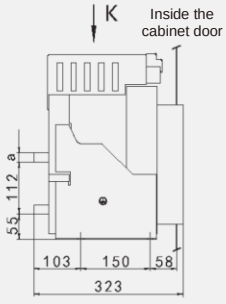
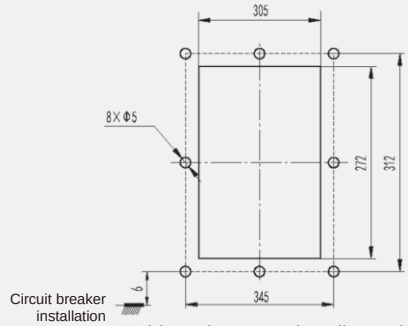
VIII. Outline and Installation Dimensions

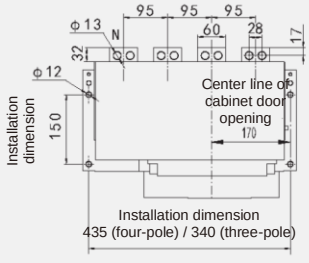
1. Outline and installation dimensions of the DW45-2000 Fixed Circuit Breaker



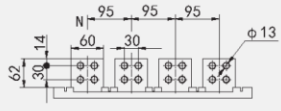




Cabinet door opening dimensions



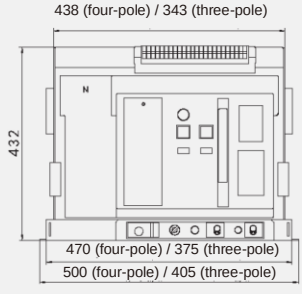
K-direction horizontal wiring and installation dimensions

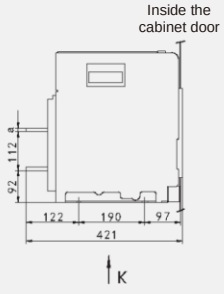


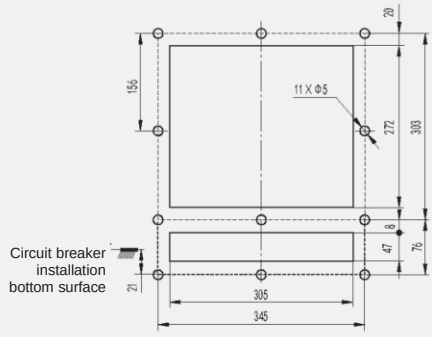
Horizontal extended busbar wiring (special supply)

In (A)	a (mm)
630、800	10
1000、1250、1600	15
2000	20

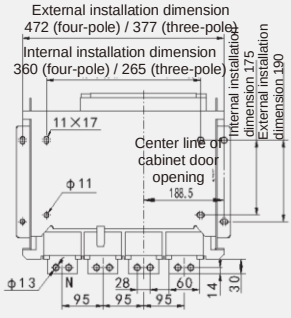
2. Outline and installation dimensions of the DW45-2000 Drawer Circuit Breaker



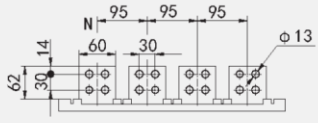




Cabinet door opening dimensions



K-direction horizontal wiring and installation dimensions



Horizontal extended busbar wiring (special supply)

In (A)	a (mm)
630、800	10
1000、1250、1600	15
2000	20

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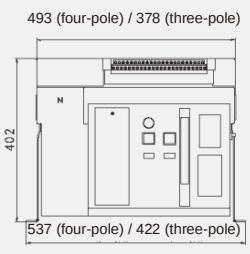
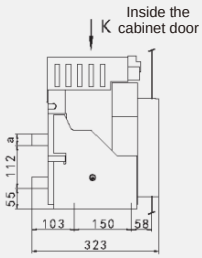
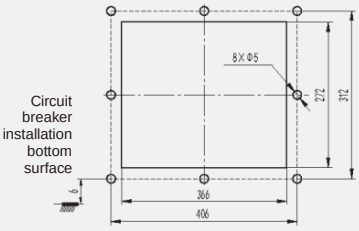
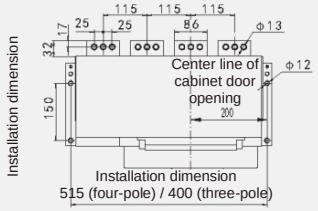
3. Outline and installation dimensions of the DW45-3200 Fixed Circuit Breaker



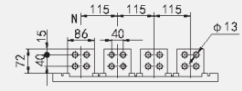




Cabinet door opening dimensions



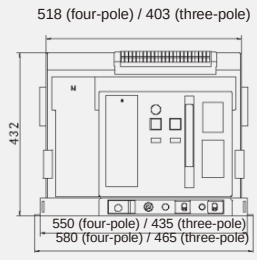
K-direction horizontal wiring and installation dimensions

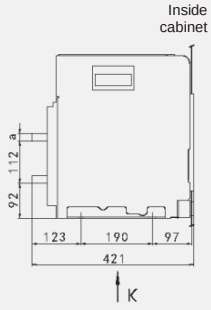


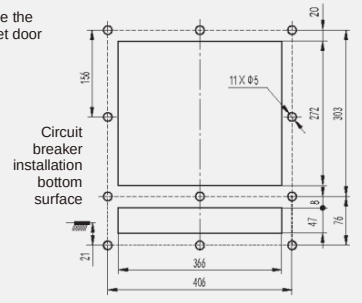
Horizontal extended busbar wiring (special supply)

In (A)	a (mm)
2000、2500	20
2900、3200	30

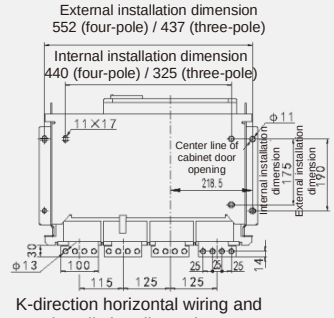
4. Outline and installation dimensions of the DW45-3200 Drawer Circuit Breaker



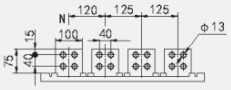




Cabinet door opening dimensions



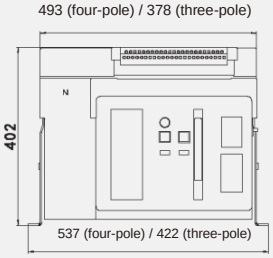
K-direction horizontal wiring and installation dimensions

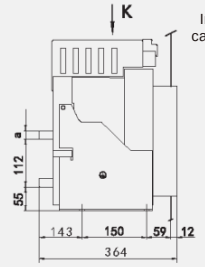


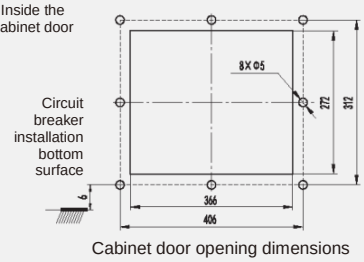
Horizontal extended busbar wiring (special supply)

In (A)	a (mm)
2000、2500	20
2900、3200	30

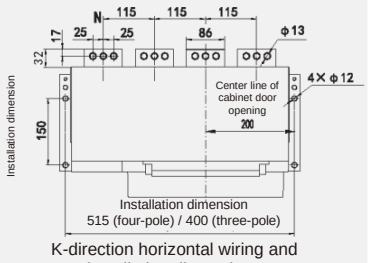
5. Outline and installation dimensions of the DW45-4000 Fixed Circuit Breaker



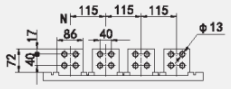




Cabinet door opening dimensions



K-direction horizontal wiring and installation dimensions



Horizontal extended busbar wiring (special supply)

In (A)	a (mm)
2500	20
2900、3200、4000	30

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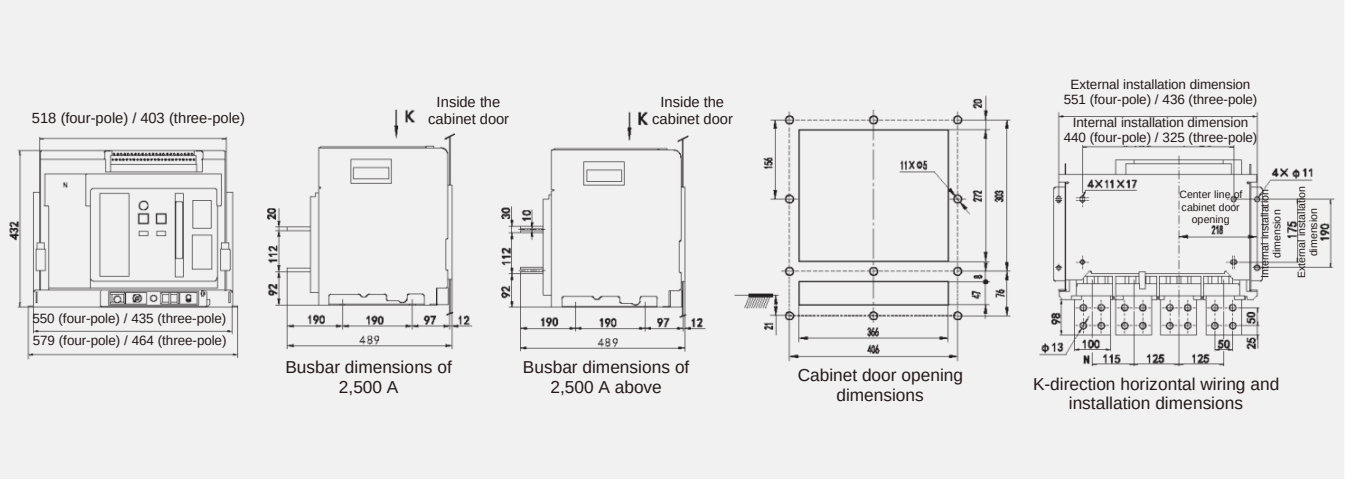
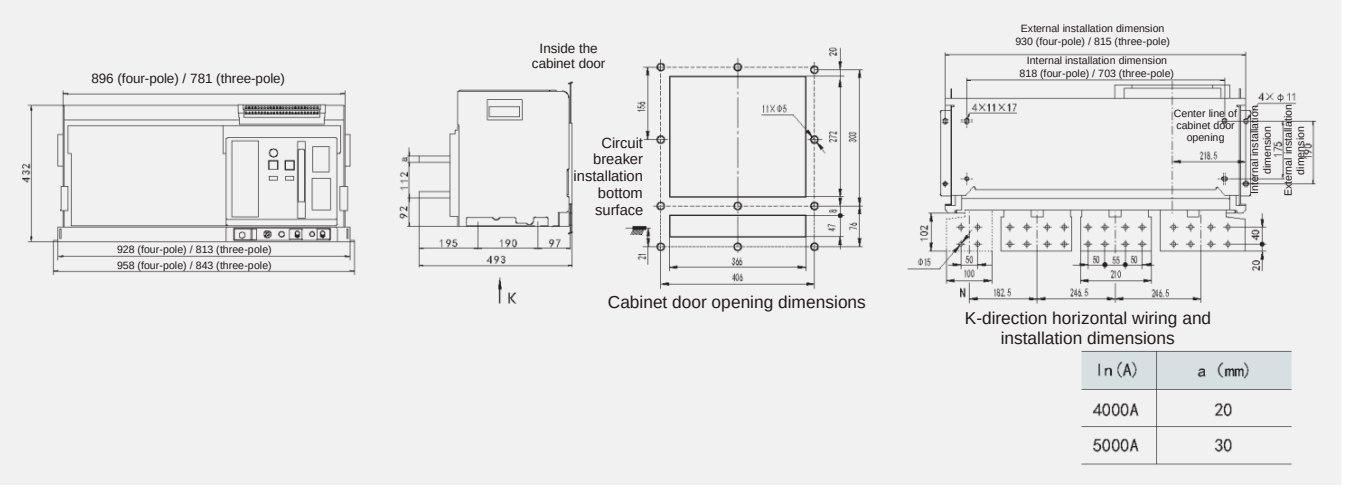
6. Outline and installation dimensions of the DW45-4000 Drawer Circuit Breaker

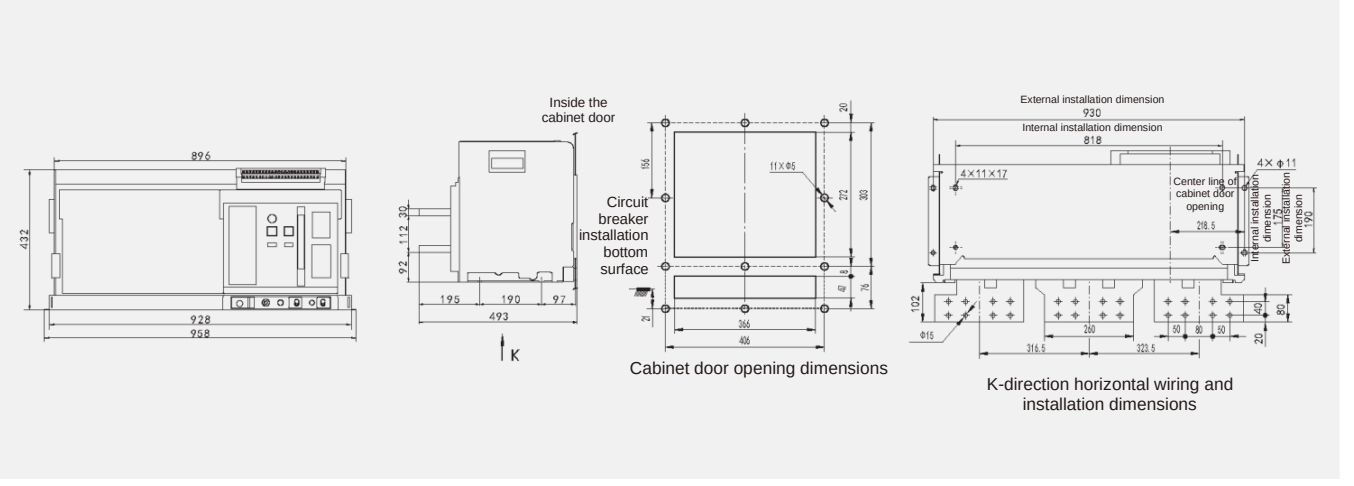


7. Outline and installation dimensions of the DW45-6300 Drawer Circuit Breaker (In = 4,000, 5,000)



In(A)	a (mm)
4000A	20
5000A	30

8. Outline and installation dimensions of the DW45-6300 Drawer Circuit Breaker (In = 6,300)



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9. See the following table for the specifications and quantities of customer connected copper busbars.

Rated current	Specification of external copper busbar	Number of poles	Rated current	Specification of external copper busbar	Number of poles
200 A	15 X 5	1	2500 A	100 X 5	4
400 A	50 X 5	1	2900 A	100 X 10	3
630 A	40 X 5	2	3200 A	120 X 10	3
800 A	50 X 5	2	3600 A	120 X 10	4
1000 A	60 X 5	2	4000 A	120 X 10	4
1250 A	80 X 5	2	5000 A	120 X 10	5
1600 A	100 X 5	2	6000 A	120 X 10	6
2000 A	100 X 5	2			

IX. Installation, Use and Maintenance

1. Installation

1.1 Check whether the specifications of the circuit breaker meet the requirements before installation.

1.2 Before installing the circuit breaker, check the insulation resistance of the circuit breaker with a 500 V megger, which shall not be less than 10 MΩ when the ambient temperature is 20±5°C and the relative humidity is 50% to 70%. Otherwise, it shall be dried and used only after the insulation resistance meets the requirements.

1.3 During the installation of the circuit breaker, it shall be vertical and fastened with M10 screws. For drawer circuit breakers, the breaker body shall be extracted first, and the drawer seat shall be fastened before the breaker is moved into the drawer seat through cranking.

1.4 During the installation, the circuit breaker shall be reliably grounded, with obvious grounding mark at the grounding point, and the fixed circuit breaker shall strictly abide by the specifications of the safety zone.

1.5 After the circuit breaker is installed and connected according to the relevant wiring diagram, the following operation tests shall be conducted before the circuit is energized (it shall be placed in the “Test” position for the drawer circuit breaker).

a. Check whether the rated voltage of the undervoltage release, shunt release, energy release electromagnet and electric energy storage mechanism is consistent with the connected power supply, and then connect the secondary circuit (the undervoltage release must be energized before the circuit breaker can be operated).

b. Check whether the reset button of the intelligent release is reset. Only when the reset button is in the “Reset” position can the circuit breaker be closed.

c. Move the handle on the panel up and down seven times, and then “Energy Storage” will be displayed with a “click” sound, that is, the energy storage is finished. Press the “I” button or the energy release electromagnet to energize, then the circuit breaker will be reliably closed, and the handle can be moved for energy storage again.

d. If the motor is used for energy storage, turn on the power supply to energize the motor until “Energy Storage” is displayed on the panel, and then the energy storage will be finished with a “click” sound, and the motor will be automatically powered off. Press the “I” button or the energy release electromagnet to energize, then the circuit breaker will be reliably closed. At the same time, the motor will be energized for energy storage to prepare for the next closing operation.

e. After the circuit breaker is closed, the “O” button on the panel or the tripping test button of the intelligent controller shall open the circuit breaker, regardless of whether the undervoltage release or shunt release is used.

2. Application of the intelligent controller

2.1 For controller setting, press the “Set” key of the intelligent controller to display the setting data of ILc1, ILc2, Ig, t4, IR, tR, Isd, tsd and Ii in turn. If the factory setting data cannot meet the user’s needs, it can be reset according to the following requirements.

For the long-delay current setting of the controller, press the “Clear Light” key and then the “Set” key until the long-delay current status indicator lights up, showing the setting value of the long-delay factory current. It can be set within the range of (0.4–1.0) In as required. Press the “+” or “-” key to increase or decrease the current, and increase or decrease it at an interval of ≤ 2% each time until it approaches the required current to finish the setting. Press the “Store Energy” key once, then the storage indicator will light up and go out again, indicating that the setting value of the long time delay current has been stored, and then the original setting value will automatically disappear.

For the long-delay time setting of the controller, after the setting of the long time delay current is finished, press the "Set" key again, then the long-delay time status indicator lights up, showing the factory setting value of the long delay time (1.5 Ir, operating time setting value). Press the “+” or “-” key to increase or decrease the time, and each time the key is pressed, the time will be doubled or decreased by half until the required time. After setting, press “Store” once, then the storage indicator will light up once and go out again, indicating that the long-time delay setting is finished, and then the original setting will automatically disappear. Short-time delay, instantaneous load monitoring, grounding protection operation value setting and operation time setting methods are the same as those of long-time delay. When setting these protection characteristics, it’s required to press the “Set” key to make the position of its status indicator light consistent with the setting parameters. When the setting value of grounding protection time is in the “OFF” position, it means that the fault state will only be alarmed without tripping. Instantaneous setting in the “OFF” position (when it is greater than 50 kA) indicates that the protection is removed. In the setting process, the release will automatically block the function once there is a fault signal, and will enter the fault handling state. The protection parameters of the controller shall not be cross-set. The setting value of ILc2 for reclosing is less than ILc1. After the setting of all the parameters of the controller, press the "Clear Light" key again or reset once after power failure to make the release in operation.

2.2 Controller test

After the setting of controller parameters, check various protection functions below of the controller before the circuit breaker is put into operation:

a. Move the circuit breaker to the “Test” position through cranking.

b. Check the setting values of various functions in turn by pressing the “Set” key.

c. Generate a simulated test current by pressing “Set”, “+” and “-”, and be careful not to store and lock it.

d. Press the “Trip” or “Non Trip” key. When the “Trip” key is pressed, the test indicator lights up, and the corresponding status indicator flashes. After the operating time, the circuit breaker opens, showing the operating time, and the fault indicator and the release indicator light up. When the “Non Trip” key is pressed, the process is the same as pressing the “Trip” key, but the circuit breaker does not open and the release indicator does not light up.

e. Overload test: Press the “Set” key to the delay state, and check the overload setting value and then the other current status. Press the “+” and “-” keys to adjust the current to be greater than 1.3 IR current, then press the “Test” key to enter the overload test state. The controller will delay the operation according to the inverse time limit rule and will indicate the fault category and test state. Other characteristic tests are basically the same. After the test, press the “Clear Light” key to enter the normal operation state, and at the same time, press the mechanical “Reset” key to close the circuit breaker.

2.3 Other rules of the controller

If the key is not pressed within 1 min under the setting and checking state of the controller, it will automatically clear the key function and enter the normal running state. At the same time, once a fault occurs, it will automatically block the key function and enter the fault handling state. For the intelligent controller with thermal memory function, after the power supply characteristic test, it is required to wait until the overload energy is released before the next test, otherwise the operating time will be shortened.

a. Setting check — After “clearing the light” of the controller, press the “Set” key continuously in case of no fault to circularly indicate various states and corresponding setting current and time. After the checking, press the “Clear Light” key, and it will automatically enter the normal working state without the key being pressed within 1 min.

b. Check the running current and voltage of the power grid — After “clearing the light” of the controller, press the “Select” key continuously in case of no fault to circularly indicate the running current and grounding current values of each phase, and normally display the maximum phase current. If the release is equipped with a voltage display module, press “Option 1” for current display and “Option 2” for voltage display. At this time, each line voltage will be indicated circularly, and the maximum line voltage will be displayed normally. After “clearing the light” of the controller, press the “Fault Check” key to display the last fault state and fault current. Press the “Select” key after the test or fault tripping to circularly indicate the test or fault current or time value. The memory fails in the test state.

c. Reset — Before closing the circuit breaker with auxiliary power supply, press the “Clear Light” key of the controller to enable the controller to enter the normal state, and then press the mechanical “Reset” key before closing the circuit breaker.

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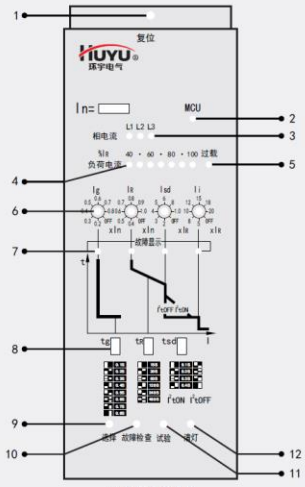
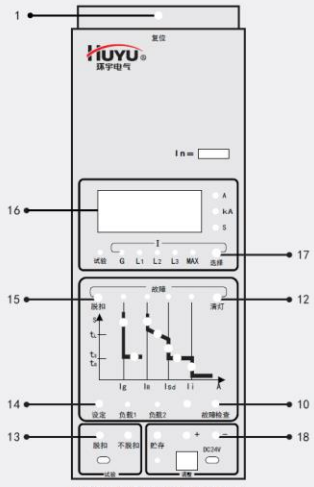
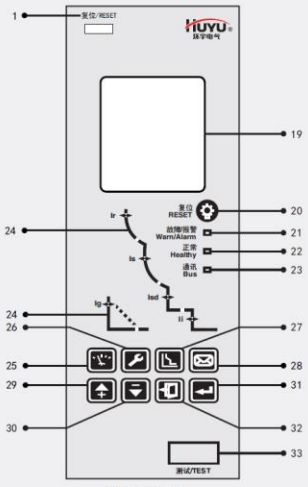
2.4. Controller panel structure


Type-L4 release panel


M-type release panel (without voltage display)


H-type release panel

1. “Reset” button: Press this button after circuit breaker failure and test tripping to close the circuit breaker again.
2. “MCU” indicator: Constant on indicates that the microcontroller (MCU) operates normally.
3. “Phase Current” indicator: Display L1, L2 and L3 phase currents, and show the phase with the largest current during the operation.
4. “Load Current Light Column” indicator: Display the percentage of load current to IR value.
5. “Overload” indicator: When the light is on, it means that the load current has exceeded the overload long time delay protection current value, and the overload long time delay starts to delay the action or the alarm.
6. “Ig”, “IR”, “Isd”, “Ii”: Grounding, long time delay, short time delay, instantaneous coding switch.
7. “Fault Display” indicator: Indicate the fault category.
8. “tg”, “tR”, “tsd”: Operating time of the grounding fault, overload long time delay and short-circuit short time delay.
9. “Select” key: Select L1, L2 and L3 phase currents.
10. “Fault Check” key: Press this key after fault tripping of the circuit breaker, which can indicate the cause of the fault tripping, and has a memory function after power failure.
11. “Test” key: Press this key to conduct the instantaneous tripping test to produce instantaneous tripping action.
12. “Clear Light” key: Press this key after setting, testing and failure of the release to reset the release and return to normal operation.
13. “Trip”, “Non Trip” keys: Used when testing functions.
14. “Set” key: Check or set the current or time of different protection characteristics. Press this key to indicate the status circularly.
15. “LED” indication: Indicate different states and categories.
16. “Current, Time Display”: Show the time or current value.
17. “Select” key: Press this key to cyclically display each phase current value under the normal running state or the fault current or time value under the fault state or fault checking state.
18. “Save”, “+”, “-” keys: Used when setting the current or time.
19. LCD interface display.
20. Fault & Alarm reset key.
21. “Fault/Alarm” LED: During the normal operation, the LED does not light up. The red LED will flash quickly in case of fault tripping, and be always on when there is an alarm.
22. For the “Normal” LED, as long as ST40-3 is energized and in a normal working condition, the green LED flashes all the time.
23. Communication indicators and their communication status indications are shown as follows: Profibus: Goes out when there is no communication, and keeps always on during communication. Modbus: Goes out when there is no communication, and flashes during communication. Device Net: Flashes when there is no communication, and keeps always on during communication.
24. Curve LED: The red LED indicator is hidden in the curve. In case of the fault tripping, the corresponding LEDs flash to indicate the fault type. When setting the protection parameters, the LED being always on indicates the current setting item.
25. Measurement: Function Key 1: Used to switch to the default theme menu of measurement (i.e. the “Left” key in the password input interface).
26. Setting: Function Key 2: Used to switch to the theme menu of parameter setting (i.e. The “Right” key in the password input interface).
27. Protection: Function Key 3: Used to switch to the theme menu of protection parameter setting.
28. Information: Function Key 4: Used to switch to the history and maintenance theme menu.
29. Up: Move the menu content up at the current level or change the selected parameter up.
30. Down: Move the menu content down at the current level or change the selected parameter down.
31. Exit: Exit the current level to enter the previous menu or cancel the selection of the current parameters.
32. Option: Enter the next menu pointed by the current item, select the current parameter, or save the modification.
33. Test port: At the bottom of the front panel, there is a 16-pin test port that can be inserted into a plug-in portable power box or detection unit.

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Series Intelligent Universal Circuit Breaker

X. Order Specification

(Please tick √ or fill in the number in □)

Unit		Contact person		Contact number		Order quantity	(set)	Order date	

Product model	☐DW45-1000	☐DW45-2000	☐DW45-3200	☐DW45-4000	☐DW45-6300
Rated current	☐200 ☐400 ☐630 ☐800 ☐1000	☐630 ☐800 ☐1000 ☐1250 ☐1600 ☐2000	☐2000 ☐2500 ☐2900 ☐3200	☐2500 ☐2900 ☐3200 ☐4000	☐4000 ☐5000 ☐6300
Number of poles	☐Three-pole ☐Four-pole				
Installation mode	☐Fixed ☐Drawer				

Selection of intelligent controller	Type	☐ L3 (economic DIP type,☐ three-section protection) L4 (economic DIP type)☐ 2M (ordinary digital type) ☐ 3M (ordinary liquid crystal type)☐ 2H (digital communication type)☐ 3H (liquid crystal communication type)	
	Controller voltage	☐AC220V ☐AC380V ☐DC220V ☐DC110V ☐DC24V	
	Protection parameter settings	Default factory settings: Ir = 1 In, Tr = 19.2 s; Fixed time Isd = 8 Ir, Tsd = 0.4 s; Inverse time Isd = 4 Ir; Ii = 12 In; Ig: OFF (open the default value Ig = In, inverse time shear coefficient k = OFF, Tg = 0.4 s)	
		Long time delay protection Ir	Ir = _____In (selected in 0.4–1.0 or OFF) Tr (1.5 Ir) = _____s (selected in 8, 12.8, 19.2, ..., 1,000)
		Short-circuit short time delay protection Isd	Isd = _____Ir (selected in 1.5–15 or OFF) ☐Fixed time Tsd = ____s (selected in 0.1–0.4)
		Short-circuit instantaneous protection Ii	Ii = _____In (selected in 1.0–20 or OFF) with the maximum of 100 kA
		Grounding protection Ig	Ig = _____In (selected in 0.2–1.0 or OFF) Tg = _____s (selected in 0.1–1.0) Inverse time shear coefficient k =_____(selected in 1.5–6 or OFF)
	Optional functions	☐Voltage measurement ☐Frequency measurement ☐Voltage imbalance rate measurement ☐Phase sequence detection ☐Power measurement ☐Power factor measurement ☐Temperature control monitoring (H type) ☐Electrical energy measurement ☐Zone selective interlocking (ZSI) function ☐Harmonic measurement ☐Overvoltage protection ☐Undervoltage protection ☐Voltage imbalance protection ☐Reclosing (H type) ☐Overfrequency protection ☐Underfrequency protection ☐Phase sequence protection ☐Reverse power protection ☐Demand value protection ☐Ground current type grounding protection ☐Residual action current protection ☐Load monitoring function ☐Neutral line protection ☐Demand value measurement (current and power) ☐DI input function ☐DO output function ☐Communication function: Modbus protocol (default, available for H type)	
Standard configuration accessories	Closed electromagnet	☐AC220V ☐AC380V ☐DC220V ☐DC110V	
	Shunt release	☐AC220V ☐AC380V ☐DC220V ☐DC110V	
	Energy storage motor	☐AC220V ☐AC380V ☐DC220V ☐DC110V	
	Auxiliary switch	☐Conversion Four Normally Open & Four Normally Closed ☐Independent Four Normally Open & Four Normally Closed ☐Conversion Six Normally Open & Six Normally Closed ☐Independent Six Normally Open & Six Normally Closed ☐Special form (Note: DW45-1000 has only Conversion Four Normally Open & Four Normally Closed)	
Optional accessories	Undervoltage release	☐AC220V ☐AC380V	
		☐Instantaneous (default) ☐0.5 s ☐1 s ☐3 s ☐5 s	
	Opening locking device	☐One circuit breaker with one lock and one key ☐Two circuit breakers with two locks and one key ☐Three circuit breakers with three locks and two keys ☐Special form (customized according to user's requirements)	
	Mechanical interlock	Two circuit breakers ☐Lever interlock (up and down interlock) ☐Cable interlock	
		Three circuit breakers ☐Lever interlock (up and down interlock) ☐Cable interlock (Note: Two closing & one opening or one closing & two opening)	
	Dual power controller	☐Two power supplies ☐Three power supplies ☐Two power supplies + busbar coupler (Note: Please indicate if firefighting or communication functions are required)	
	Others	☐Residual current transformer ☐Neutral current transformer ☐Ground transformer ☐Power adapter ☐Door interlock ☐Relay module ☐Protocol conversion module (Profibus-DP, Device Net) ☐Electric three-position lock of drawer seat ☐Energy storage ready indicator ☐Opening/Closing button lock ☐Secondary wiring terminal cover	

Note 1: If the user has other special requirements for ordering, please consult with the manufacturer before the ordering;

Note 2: The costs of circuit breaker's optional functions and accessories are not included in the standard configuration of the circuit breaker, and therefore will be calculated separately.