

AW45 Intelligent universal low-voltage breaker

Instruction Manual

intelligent universal low-voltage breaker

Application



Generally-used AW45-2000 intelligent universal low-voltage breaker

Rated current (In)A:
630,800,1000,1250,1600,2000

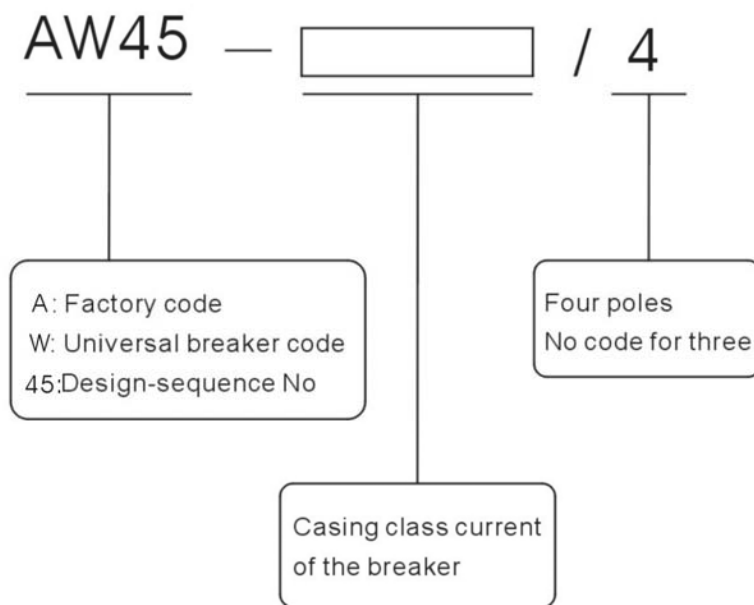
The product is in conformity with
the standards IEC60947-2 and GB14048.2-94

The breaker applicable to distribution net work of power station, factory, mine and high-rise.

The breaker feature in with intellignetized protection, and precise selective protection,which can improve the reliablity of power supply and avoid unnecessary power failure.

Model meaning and classification

Model meaning

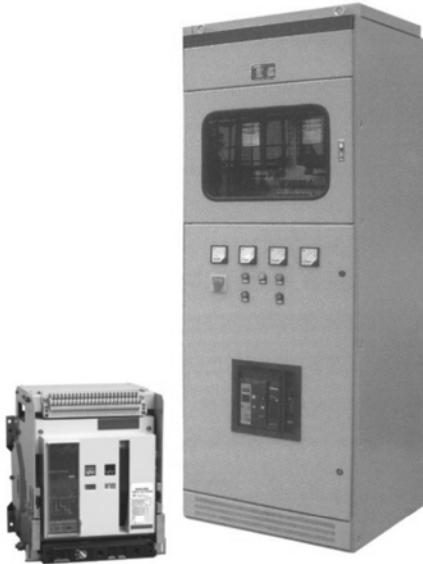


Classification

- ◆ According to installation mode:
Fixed type and drawer type
- ◆ According to transmission mode:
Motor driven and manual operated

intelligent universal low-voltage breaker

Working condition



Intelligent condition of

Environmental temperature

- ◆ The upper limit shall not exceed $+40^{\circ}\text{C}$.
- ◆ The lower limit shall be not less than -5°C .
- ◆ The average value in 24 hours shall not exceed $+35^{\circ}\text{C}$.

Note: When placing an order, users shall indicate the lower limit, if it is 10°C to 25°C . User should coordinate with the factory, if the upper limit exceeds $+40^{\circ}\text{C}$ or the lower limit is lower than 25°C .

- ◆ The altitude of the installation place shall not exceed 2000m.

Atmosphere condition

The relative humidity shall not exceed 50% when the environmental temperature is $+40^{\circ}\text{C}$. The relative humidity may be higher at the lower temperature condition. The maximum month-average relative humidity is 90% in the most humid month with a minimum month-average temperature $+25^{\circ}\text{C}$.

The factor that dew may occur on the product surface due to temperature change shall be taken into consideration.


Pollution grade: Grade III

Installation condition

Erection category IV is applicable to the breaker with the rated working voltage equal to or less than 690V. Erection category III is for an auxiliary circuit with the rated working voltage of 440V, excluding the coil of under-voltage tripping gear and the primary coil of power supply transformer, which adopt the same erection category as the main circuit of the breaker does.




intelligent universal low-voltage breaker

Application

Type			2000						
Short-circuit breaking capacity									
			<div>I_{cu}=80kA (440V) 50kA (690V)</div> <div>I_{cs}=I_{cw}=50kA (400V) 40kA (690V)</div>						
Rated current I _n (A)			(400V)	630	800	1000	1250	1600	2000
Number of poles			3、4						
Rated voltage U _e (V)			440V、690V						
Rated insulation voltage U _i (V)			1000V						
Rated current of N-Pole I _N (A)			50% I _n 、100% I _n						
Fix-disconnection time			23~32ms						
Intelligent controller	Typeical type (A)		●	●	●	●	●	●	●
	Communiction (B)		●	●	●	●	●	●	●
Operation performance		Electric life	500						
	Mechanical life	Non-maintanance	2500						
		maintenance	10000						
Connection pattern			Horizontal			Vertical			

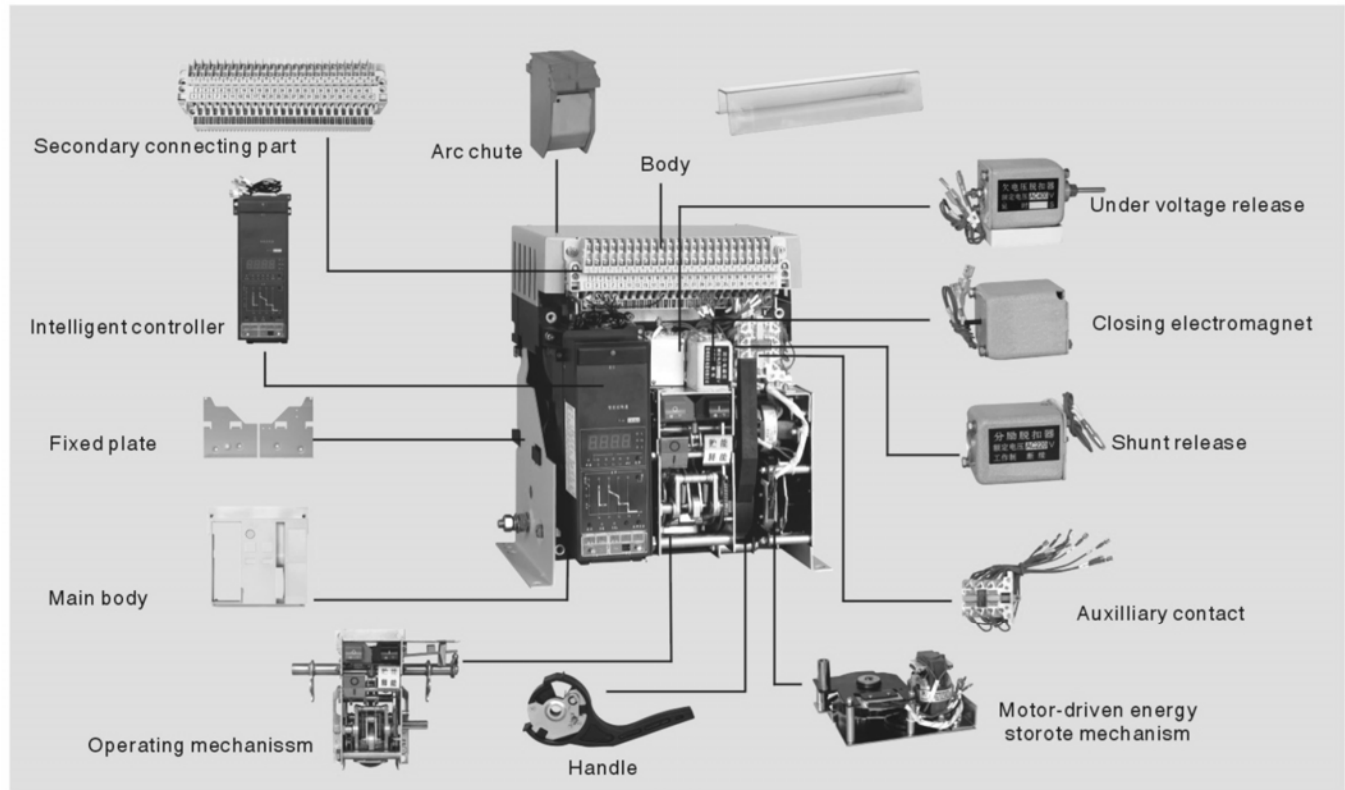
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Working condition

3200				4000			6300				
											
Icu=100kA (440V) 80kA (690V) Ics=Icw=80kA (440V) 65kA (690V)				Icu=100kA (440V) 80kA (690V) Ics=Icw=80kA (440V) 65kA (690V)			Icu=120kA (440V) 80kA (690V) Ics=Icw=80kA (440V) 70kA (690V)				
2000	2500	2900	3200	3200	3900	4000	4000	5000	6300		
3、4				3、4			3、4				
440V、690V				440V、690V			440V、690V				
1000V				1000V			1000V				
50% In、100% In				50% In、100% In			50% In、100% In				
23~32ms				23~32ms			23~32ms				
●	●	●	●	●	●	●	●	●	●		
●	●	●	●	●	●	●	●	●	●		
500				500			500				
2500				2000			2000				
10000				8000			8000				
Horizontal		Vertical		Horizontal		Vertical		Horizontal		Vertical	

Application

Fixed type structure explosion



Contact system

- ◆ Adopt one-shift contact system with only main contact, which not only reduce operating force, but also omit the arc transferred process and accelerate short-circuit breaking.
- ◆ Adopt new arc-resistant matched contact materials and feature the contact good arc-resistant and stable contact resistance, which avoids contact's over-heat arising from short circuit breaking current and over temperature-rise.
- ◆ The frame of movable contact is made of insulation material, the movable contact is installed inside and the contacts of each phase are in insulated chamber, which avoid the short circuit between phases and make sure the subaltern input wire's reliable service.
- ◆ The system adopts such connecting method that multiple circuits are connected in parallel, which lowers the electric repulsion and improve the electric stability.

Arc-chute

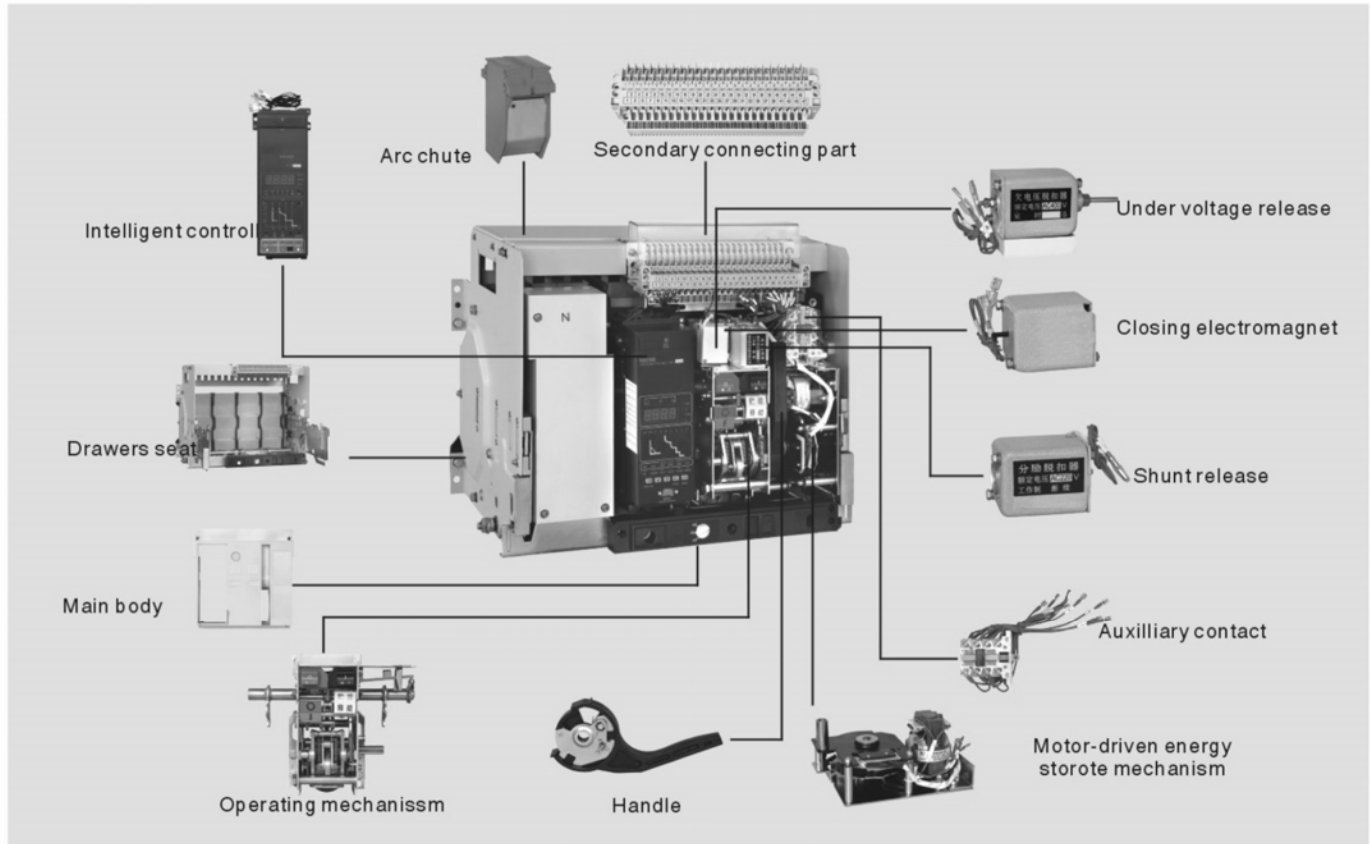
- ◆ Arc-chute is made of insulated materials with barrier and flame barriers inside, thus the electric arc can extinguish quickly and dissociate after go into arc-chute. The exit is very narrow and then obtain double arc-extinguish, the height of the dissociated gas spray out doesn't exceed the maximum height of the breaker and realize zero-arc spot, and then save the space that the breaker is installed in distribution cabinet.
- ◆ The whole arc-chute is installed in the insulated base of the breaker and enhance the mechanical intension of the arc-chute so as to avoid the blast arising from the breaking higher than the short-circuit current.

Operating mechanism

- ◆ There are two kinds of separate operating mechanisms which are installed together in the right face of the breaker, i.e. motor operating and handle operation.
- ◆ The operating mechanism is made up of trip-free mechanism, save-energy mechanism, motor and handle operation mechanism.

Working condition

Drawer type structure explosion



The breaker consists of noumenon and drawer-seat. The drawer-type breaker is to insert the nonmenoninto the drawer-seat.

The noumenon of the breaker is made up of operatingmechanism, contact system, arcing chamber, insulated base, release, secondary connecting parts and auxiliariavcontact etc.

Structure features

The breaker has compact structure with shape “田” and shape “III” solid collocation(see the diagram). Side elevation is shape “田” collocation,the rightupper is arc elimination chamber and contact system and the lower current transformer, the left upper is the accessories such as under-voltage release, shunt release, closed magnetic iron, auxiliary contact and secondary connecting parts and the lower is operation mechanism, the above are insulated isolation between. The spacing of moving position for connection necessary is limited to the minimum, which prevent the gas arising from breaking short circuit current of contact system from spraying to tripping operating mechanism and transformer and achieve double insulation. The face of breaker is two layers of shape “III” collocation, For the upper layer, the left is intelligent controller, the middle operating mechanism(free tripping mechanism) and the right motor operating handle; the bottom is main circuit of phase A, B, C, the reliable insulation between phases make sure the impossibility of short-circuit between.

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Types of intelligent controller

Intelligent controller is the core part of breaker, classified as standard controller and communicational controller.

Communicational controller is based on standard controller and add one communication function.

Basic functions:

- ◆ over-load long time-delay reverse protection
- ◆ Short time-delay reverse or definite time-delay protection
- ◆ Instantaneous protection
- ◆ Earthing fault protection
- ◆ Ammeter Function
- ◆ Self-diagnostic function
- ◆ Setting function
- ◆ Test function
- ◆ Load monitoring function
- ◆ Display function

Optional functions:

- ◆ Voltage, frequency, power factor and active power display

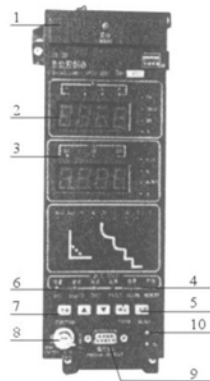
Standard Controller (Type M)



- 1-RESET button.,push reset button after fault trip, the breaker restore close state.
- 2-CURRENT-TIME indicator display current or time
- 3-LED(light-emitting diode) can display breaker's various status and classifications.
- 4-SELECT key,display the maximum phase current or maximum line voltage under normal status, push the key then display each phase current or each line voltage in turn.

- 5-CLEAN key, push the key after setting the release or test fault or before closing the breaker in order that the breaker is in normal work status.
- 6-SET key.Check or set each protection characteristic current or time Push the key then display each status in turn.
- 7-FAULT-CHECK key. Display or indicate the last fault status and fault current or time when push the key
- 8-TRIP and NON-TRIP key, for test function time
- 9-STORAGE, + and - key, for setting current or time.

Communication controller(type H)

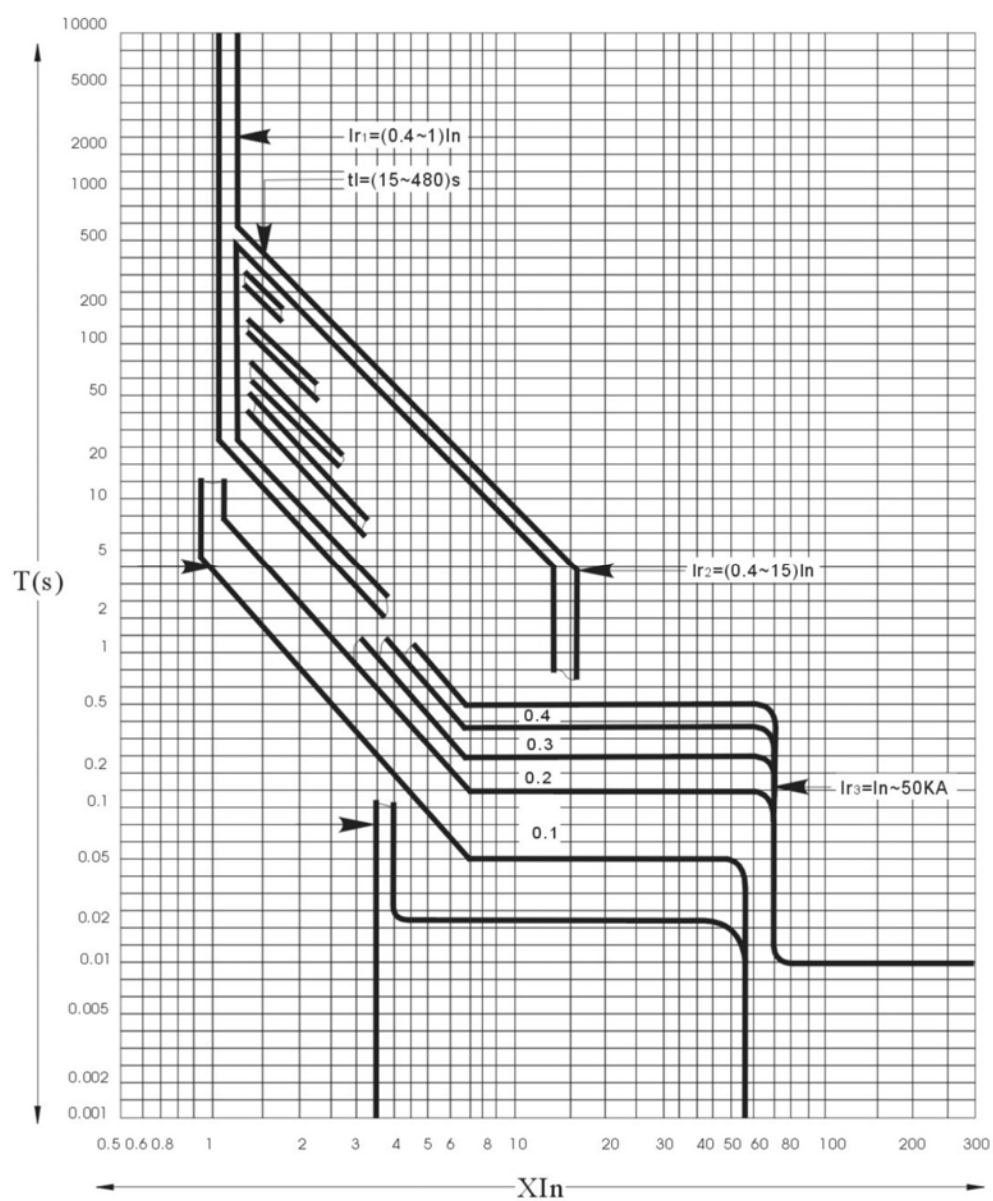


- 1-RESET button.,push reset button after fault trip, the breaker restore close state.
- 2-CURRENT-TIME indicator display current or time
- 3-LED(light-emitting diode) can display breaker's various status and classifications.
- 4-SELECT key
- 5-RESET key
- 6- key. Check or set each protection characteristic current or time.Push the key then display each status in turn.

- 7 - FUNCTION key
- 8 - POSITION KEY, for test function time
- 9 - PROGRAM INTERFACE
- 10 - COMMUNICATION LIGHT

Working condition

Over-current protection characteristics (diagram 1)



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Intelligent controller characteristics

Long time-delay over-current protection, inverse time operating characteristics

Current setting range (Ir1)	error	current	Operating time						Time error
(0.4-1)	±10%	1.05Ir1	≥2h Non-operating						±15%
		1.3Ir1	<1h Operating						
		1.5Ir1	15	30	60	120	240	480	
		2.0Ir1	8.4	16.9	33.7	67.5	135	270	

Shor time-delay over-current protection operating characteristics

inverse time operate in low multiple current and the time $I_{ts} = (8I_r) t_s$, where I = actual current, T_s = actual operating time, t_s = setting delayed time switch to definite time operating mode when current is more than $8I_r$; and at short time delay "OFF" condition, multiple current shows its definite time delay characteristics.

Current setting (Ir2)	error	Setting delayed time t_s (s)				Returnable time (s)				error
(1-15)	$\pm 10\%$	0.1	0.2	0.3	0.4	0.06	0.14	0.23	0.35	$\pm 15\%$

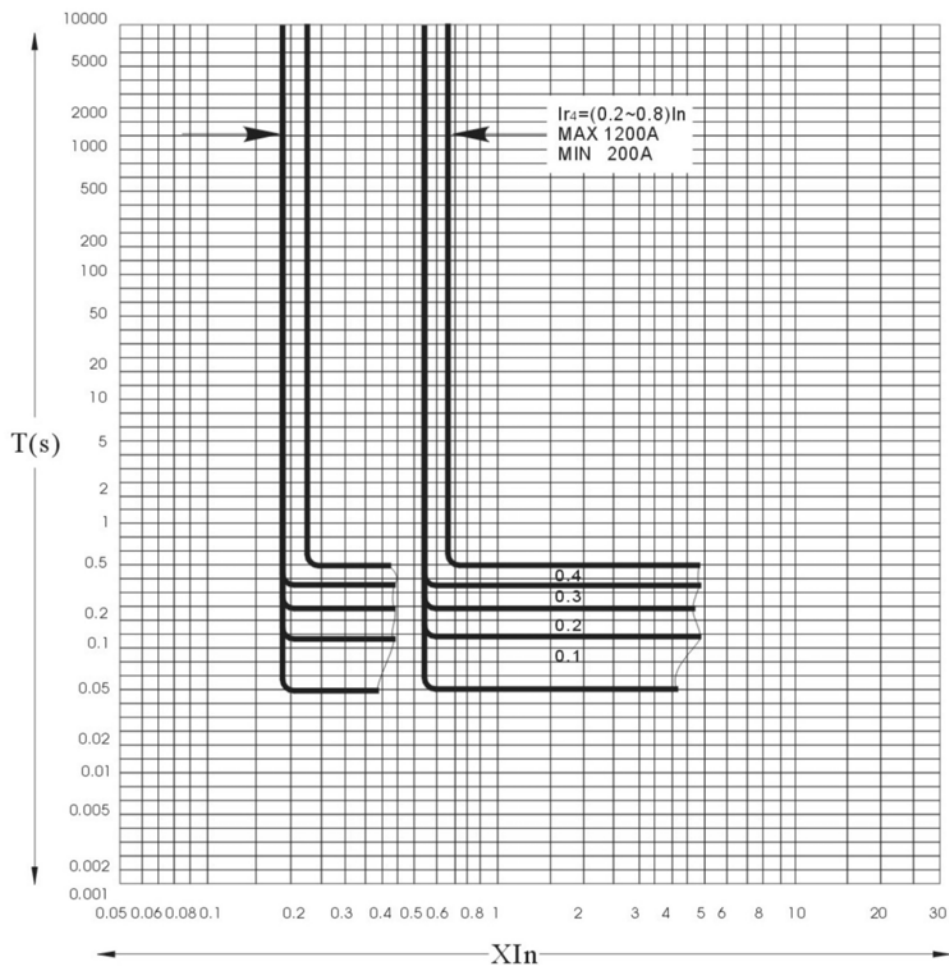
Instantaneous operating characteristics

Current setting (Ir3)	error
1.0In-50/75kA	$\pm 15\%$

Intelligent controller characteristics

single phase earthing fault protection characteristics (diagram)

single phase earthing fault protection is metal earthing protection for fault current with several hundred ampere or more , it is normally used for such system that central point earth directly.

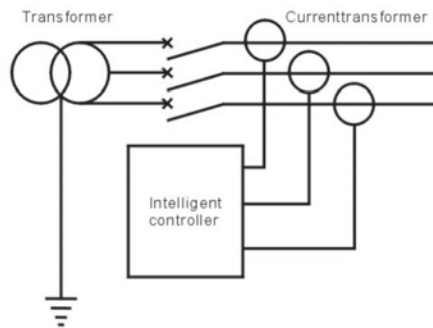


Earthing fault protection is definite time delay operation , the setting feature as follows:

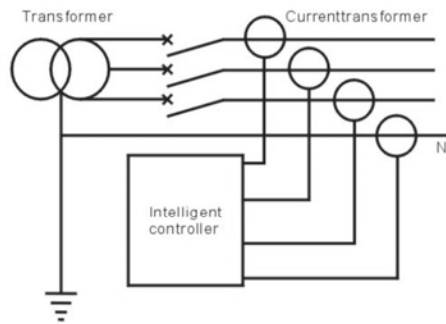
Model	Current setting I_{r4}	error	Setting delayed time $t4$ (s)				Returnable time (s)				error
-2000 -3200	(0.2~0.8) I_n max. 1200A min. 200A	$\pm 10\%$	0.1	0.2	0.3	0.4	0.06	0.14	0.23	0.35	$\pm 15\%$
-6300	(0.2~0.8) I_n										

Intelligent controller characteristics

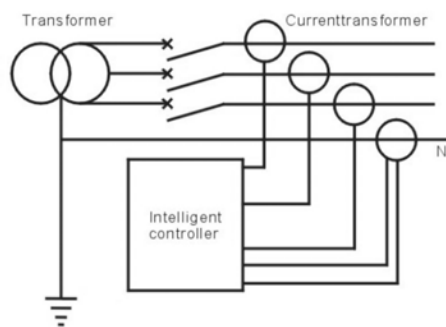
Modes of earthing fault protection



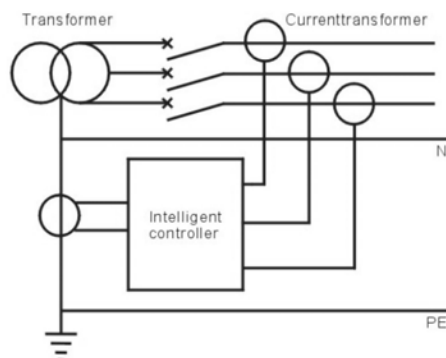
- ◆ To select three-pole breakers for triphase-three line system no accessional transformer
- ◆ The earthed errors protection signal only form sum of vectors of triphase current
- ◆ The protection property is time-element protection



- ◆ To select four-pole breakers for triphase fourline system.
- ◆ the earthed errors protection signal from sum of vectors of triphase current and N-pole current.
- ◆ The protection property is time-element protection



- ◆ To select three-pole breakers for triphase fourline system
- ◆ The current transformer, linking externally to N-pole, works for earthed errors protection, (connected with terminals 6, 7)
- ◆ The protection property is time-element protection



- ◆ To select three-pole breakers for TN-S system
- ◆ The current transformer, linking externally to N-pole, works for earthed errors protection. (connected with terminals 25, 26)
- ◆ The protection property is time-element protection

Intelligent controller characteristics

Indication Function

Indicating current (select 1)	Nixie light	Showing I_1 、 I_2 、 I_3 、 I_{max} 、 I_G (earthed)、 I_N (N pole)
Indicating voltage (select 2)	Nixie light	Showing U_{12} 、 U_{23} 、 U_{31} 、 U_{mix}

Alarm and Prompt Function

Over-current alarm	Corresponding LED	After tripping by trouble corresponding LED on
Judge errors indication	Corresponding LED	Over-load long-delay, over-load short-delay Instantaneous short-circuit, earthed error
Error phase esquence,current, time indication	Nixie light	Showing error phase sequence、current、breaking time
Contact wastage indication	Nixie light	Showing wastage percentage
Auto-diagnosis function	Nixie light	Outgoing signal to show error

Test Function

Touch key on face	To release	Inspect the T-I feature of the intelligen controller and the condition of breakers operation system
	Not to release	Inspect the T-I feature of the intelligen controller

Intelligent controller characteristics

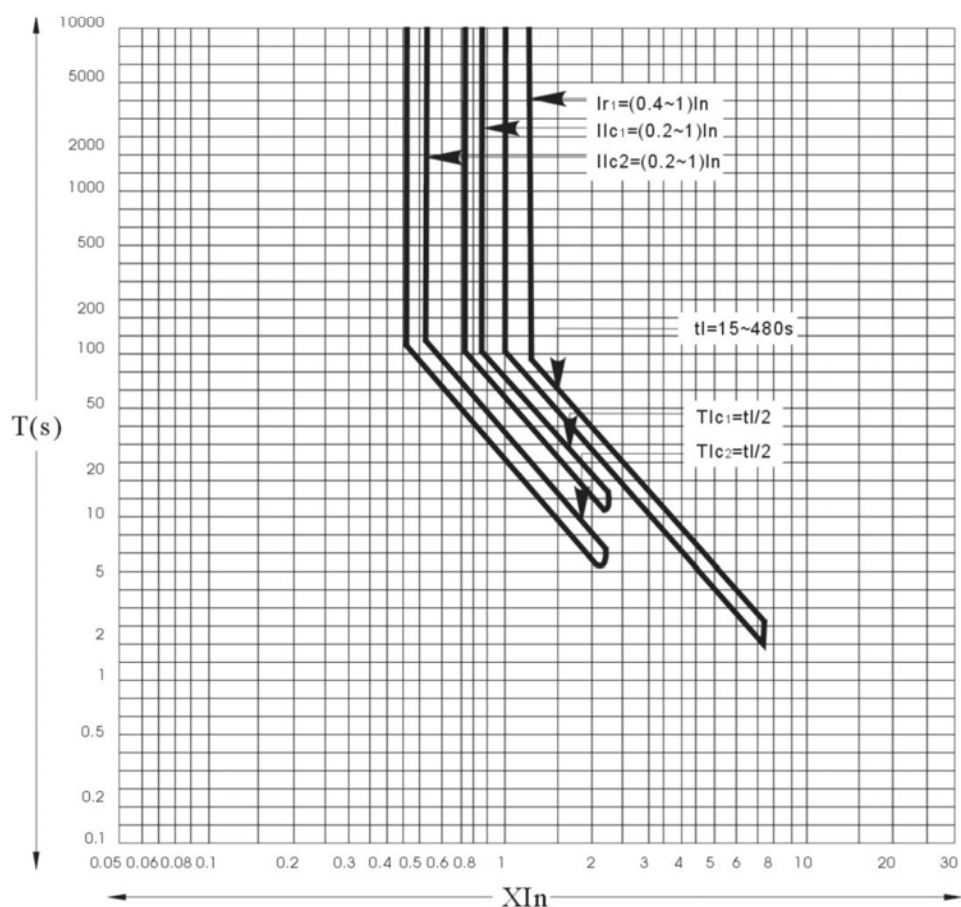
Load monitoring characteristics (diagram)

Pattern 1	Adjusting area of setting current I_{lc1} 、 I_{lc2} Allowable error of setting current $\pm 10\%$	(0.2-1.0) I_n in adjusting successively with 20A for each step
	Delay feature t_{c1} 、 t_{c2}	Inverse time feature $t_{c1}=0.5t_1$ $t_{c2}=0.25t_1$
Pattern 2	Adjusting area of setting current I_{lc1} 、 I_{lc2} Allowable error of setting current $\pm 10\%$	(0.2-1.0) I_n in adjusting successively with 20A for each step
	Delay feature t_{c1} 、 t_{c2}	Inverse time feature $t_{c1}=0.5t_1$
		Definit time feature $t_{c2}=60s$

There are two options for load monitoring , the users can choose alternative.

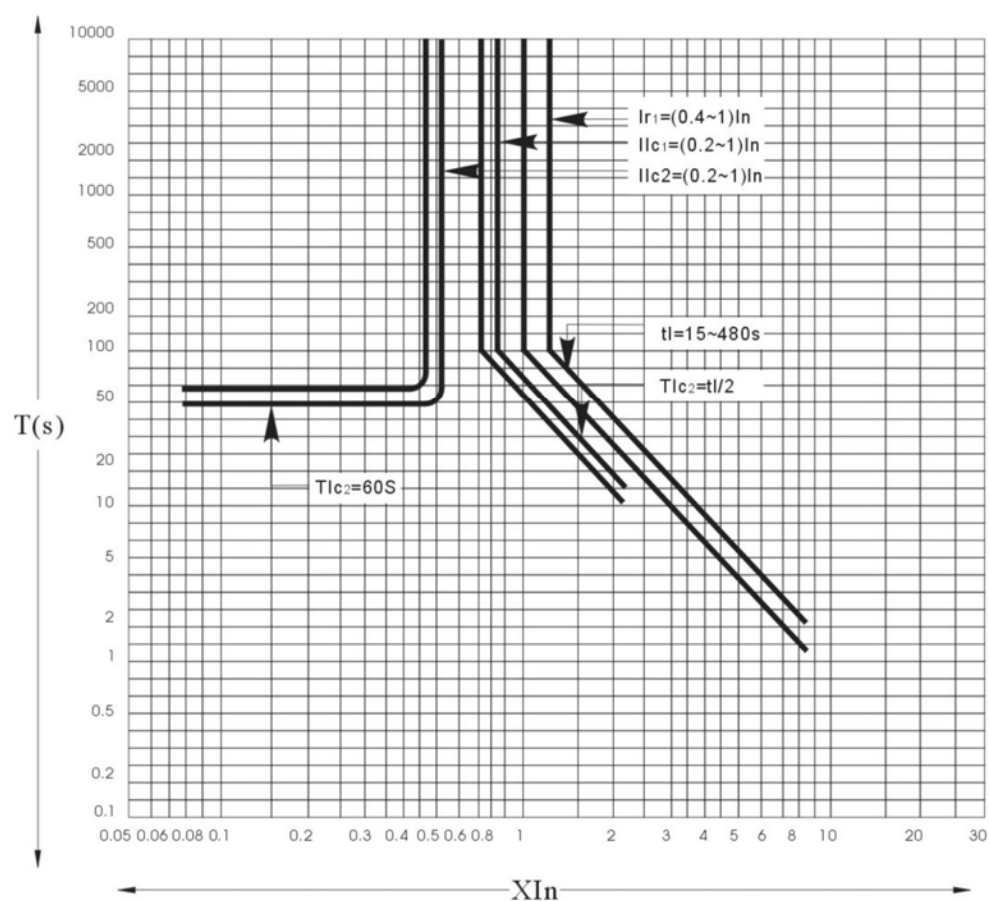
Monitoring current setting is I_{lc1} and I_{lc2} , normally $I_{lc1} > I_{lc2}$.

Mode 1: can control two way loads , when service current exceeds overload reverse long time delay setting current I_{rl} , the load monitoring device emit the connecting signal and break the lower level unimportant load and make sure the power supply of main system.



Intelligent controller characteristics

Mode 2: only control one way loads, when service current exceeds I_{lc1} current setting, the loading monitoring device emit the signal by delay and break the lower level unimportant load, the system supply power normally. If main current decrease to and maintain I_{lc2} for a period of time, the controller can make the broken load and restore the power supply of the whole system.



Electric attachments

Undervoltage Release



💡 *The breaker should be switched on the power supply before work*

The undervoltage release consists of release coil and control unit;

The undervoltage release works in two ways: acting instantaneously and time delay;

There are four time delay specifications for the undervoltage time delay release: 0.5s、1s、2s and 3s.

It would be dealt with as special standards, if users require 3s-9s, and should consult with manufacturer.

The time-delay accuracy is $\pm 10\%$.

If the voltage of power supply returned to 85% U_e or more in half of the delay time, the breakers would not break away.

Features

Rated working voltage U_e (V)	AC440、230、127	Dc220、110
Acting voltage (V)	$(0.35 \sim 0.7)U_e$	
Reliable switching voltage (V)	$(0.85 \sim 1.1)U_e$	
Reliable repelling switching voltage(V)	$\leq 0.35U_e$	
Power wastage	48VA (W)	



Shunt Release

💡 *Forbid being on the power supply for a long time to a void damage*

They are available for operating remotely to break away.

Features

Rated voltage of control U_s (V)	AC440、230、127	DC220、110
Acting voltage (V)	$(0.7 \sim 1.1)U_s$	
Power wastage	40VA	40W
Breakaway time	$\geq 30ms$	

Electric attachments

Closing Electromagnet

Forbid being on the power supply for a long time to a void damage

After the motor ended is energy stored,the closing electromagnet would make the charging spring to release its energy in stantaneously,then to close the breaker quickly.



Features

Rated voltage of control supply $U_s(V)$	AC 440、230、127	DC 220、110
Acting voltage(V)	(0.85~1.1) U_s	
Power wastage	40VA	40W
Switching time	$\geq 70ms$	

Motor-driven Energy-storge system

It has the functions of motor-driven to store energy and to restore energy automotively

The energy-storage of the device could be done with motor-driven or manually



Features

Rated voltage of control supply $U_s(V)$	AC 440	AC 230	DC 220
Acting voltage(V)	(0.85~1.1) U_s		
Power wastage	192VA		192W
Energy-storage time	$\geq 5s$		

Auxialiary contacts

- ◆ The normal type of auxialiary contacts is 4NO (normal open) 4NC (normal close)
- ◆ The special type can be classified as three patterns: 3NO 5NC, 5NO 3NC, 6NO 2NC and 2NO 6NC

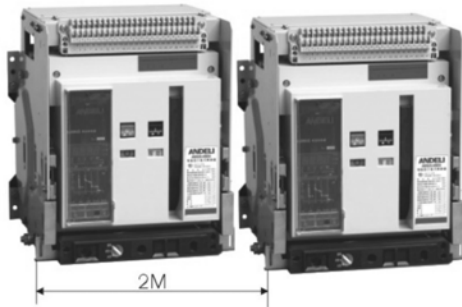


Features

Rated voltage		Rated thermal current	Rated capacity
AC	230	6	300VA
DC	220		600VA

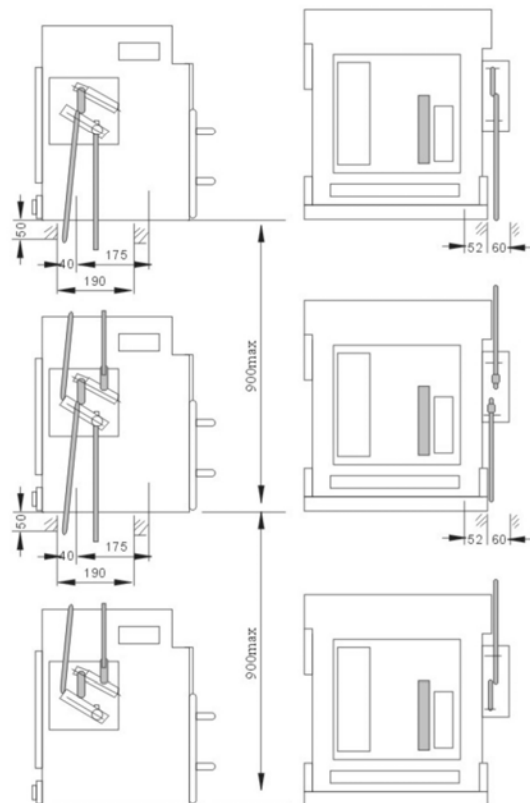
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Mechanical attachments



Wire cable interlock

- ◆ Can realize the interlock of two horizontal breakers or vertically installed breakers with three poles or four poles



Linkage interlock

- ◆ Three breakers with three poles or fourpoles that are superposed can realize the interlock which one breaker is different form the other two

Installation and application

How to install and use the breaker

- ◆ Check the specifications of breaker IN or OUT accordance with the requirements of order before installation. Check the insulating resistance with a 500V megameter, the resistance should not be less than $20M\Omega$ when ambient temperature is $20^{\circ}C \pm 5^{\circ}C$ and relative humidity is 50~70%.
- ◆ After finished installation, and wiring the secondary circuit according with the wiring diagram, for drawout breaker, pull out the rails in two sides, push the breaker body to separated position, insert the handle into the hole of device, shake it clockwise, make it to the test position and do following operation test.

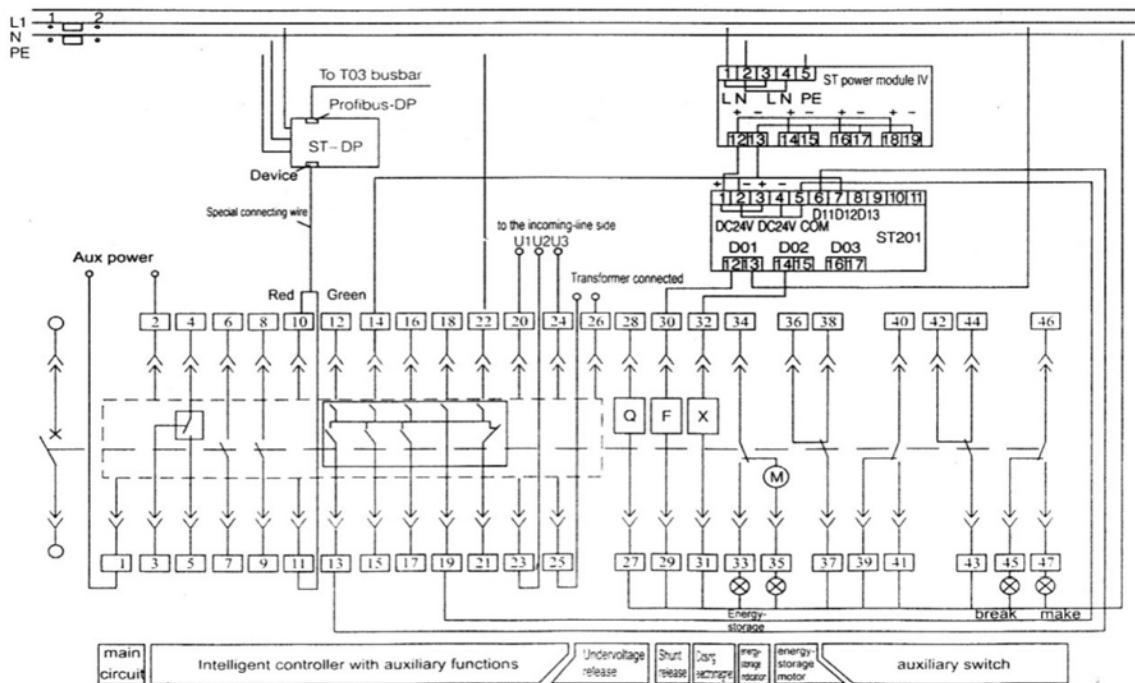
A) Check the rated voltage of under voltage release, shunt release closing, electromagnet, motor-driven energy-storage system and intelligent controller, auxiliary supply (external) is IN or OUT accordance with the voltage of supply power, the Energize the secondary circuit (at the time, the under voltage Release should be ON).

b) There are two ways for breaker energy-storage: manual and motor-driven. For manual energy-storage, turn the handle on face until a click comes and indicator shows “energy-storage” that it tells the energy-storage process finished.

At the time, press the button “1” or energize the closing electromagnet, the breaker could be closed reliably. For motor-driven system, it would be recharged automatically.

c) As the breaker closed, you could make the breaker released, whatever using the under-voltage release, shunt release, “o” button or tripping test of the intelligent controller.

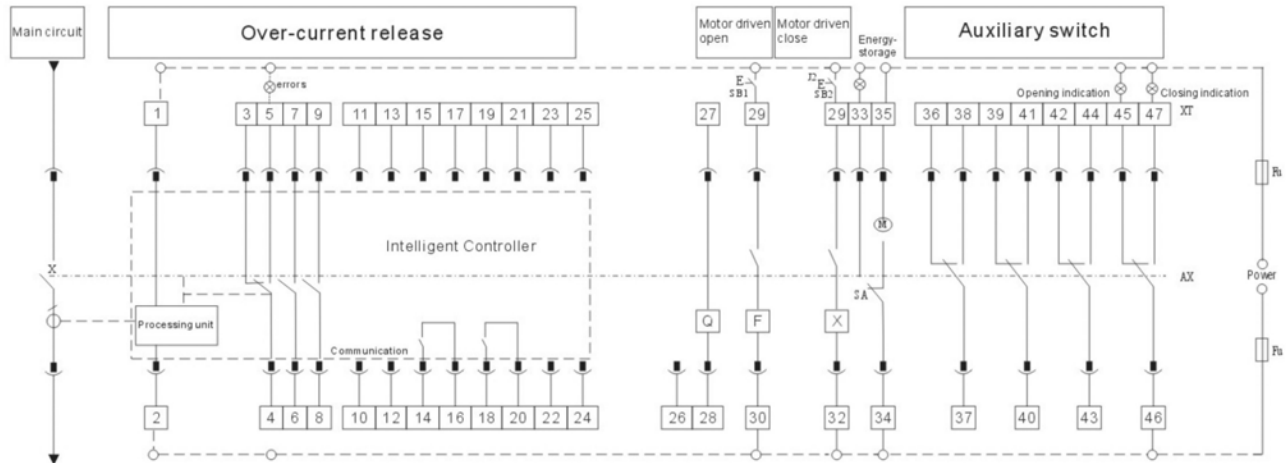
Secondary circuit wiring diagram



- 1#, 2#: Aux power input
- 12#: Overload prewarning signal output
- 13#: M is wireless, H is breaking signal
- 14#: M is the sort-circuit tripping signal, H is the making signal
- 15#: M indicates the long delay tripping signal, H is wireless
- 16#: Earthing tripping or warning signal output, or leakage warning signal

- 17#: Unloading output of No2 signal
- 19#: Output common line of contacts
- 20#: Self-diagnose warning signal output
- 21#: Fault breaking signal output
- 22#, 23#, 24#: Input terminal of A, B, C three-phase power

Secondary circuit wiring diagram



Note:

- (1) Terminals of No.1 and 2: if the system's controlling voltage is D.C.200v. Then No.1 and 2 auxiliary.
- (2) Terminals of No.6 and 7: if current transformer is connected with circuit breaker externally in the neutral phase, terminals of No.6 and 7 should be wired in circuit.
- (3) Terminals of No.10 and 12: if the intelligent controller is in communication type, terminals of No.10 and 12 should be input and output ones of Rs485 respectively.
- (4) Terminals of No.14 and 16: if the load monitoring is of pattern one, terminals of No.14 and 16 should be wired in circuit. Terminals of No.18 and 20: if the load monitoring is of pattern two, terminals of No.18 and 20 should be wired in circuit.
- (5) Terminals of No.21, 23 and 25: if voltage indication function is choosed, terminals of No.21, 23 and 25 should be wired in phase A,B and C of the main circuit respectively.
- (6) The secondary wiring diagram here of is suitable for the breaker with auxiliary contacts of 4NO (normal open) and 4NC (normal close), We will also provide with other secondary wiring diagrams with auxiliary contacts of 2NO, 6NC and 6NO, 2NC together with the breaker.

AX auxiliary switch of the breaker

SB1 Shunt button

SB2 Closing button

Q Under voltage release, terminals of No.27 and 28 should be wired in the main circuit.

F Shunt release

X Closing electromagnet

M Charging motor

SA Over travel-limit switch of motor

XT terminals of secondary circuit of the circuit breaker

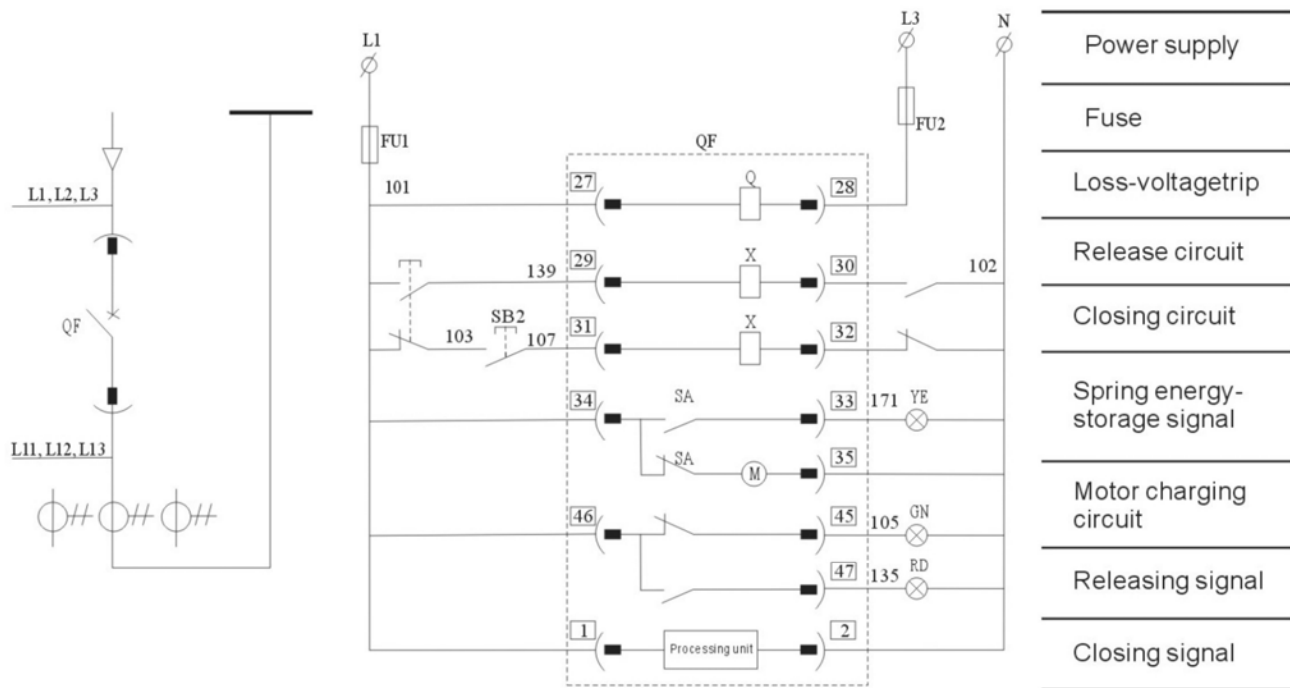
FU fuse

33 to power supply directly (auto energy pre-store). Or to power supply with a NO (normal open) button simultaneously (manual energy prestore)

Power supply to different power supply for different rated voltage of processing unit, Q, F and X etc..

Secondary circuit wiring diagram

→ Two-way incoming operation loop ←



QF: breaker

FU1~2: fuse RT 14-20/10A

SB1~2: button LA 18-22 one red and one green

YEHL: signal lamp AD11-25~230V Yellow

GNHL: signal lamp AD11-25~230V Green

RDHL: signal lamp AD11-25~230V Red

Numbers in the dotted line frame are the numbers of the terminals which are in the terminal block of the Na1 breaker body

(Inside elements of)

Q: loss-voltage coil of the breaker ~400V

F: shunt coil of the breaker ~230V

X: closing electromagnet of the breaker ~230V

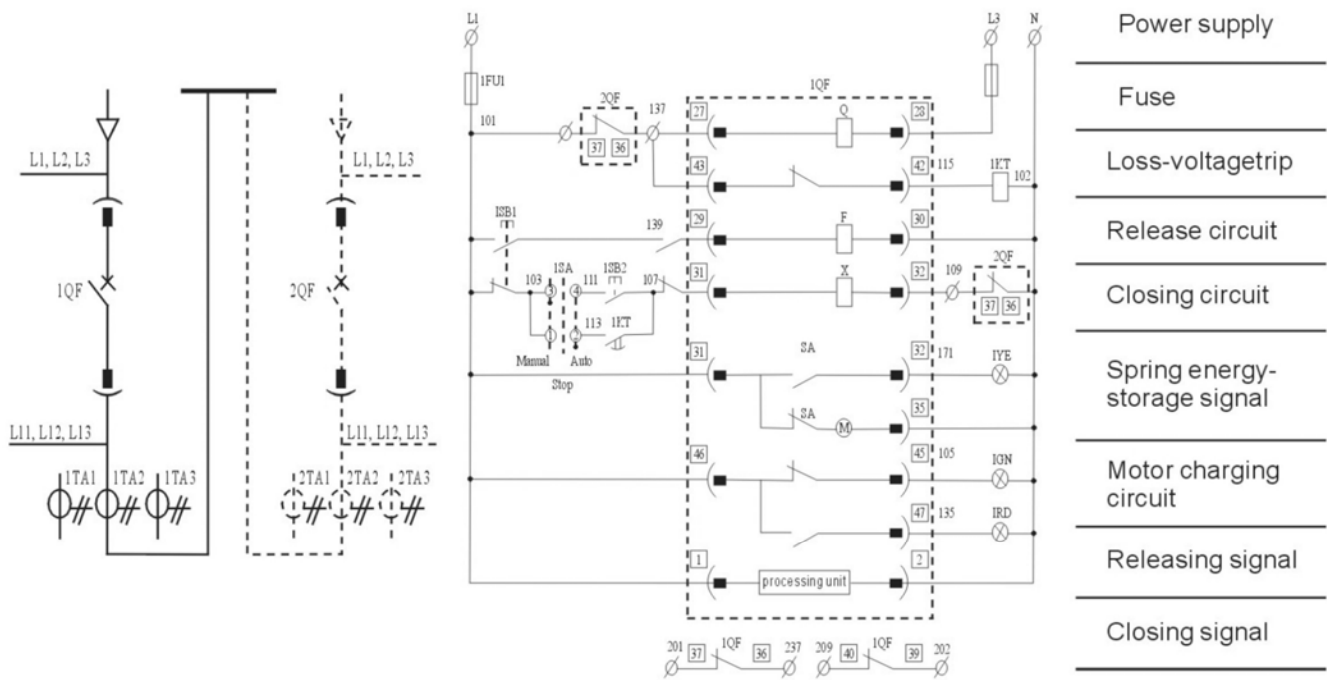
M: energy-storage motor ~230V

SA: over travel-limiting switch of motor

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Secondary circuit wiring diagram

→ Two-way incoming operation loop ←



1QF: breaker

1FU1~2: fuse RT 14-20/10A

1SB1~2: button LA 18-22 one red and one green

1SA: alternation switch LW12-16/4.0081.1

1KT: mid relay JZ7-44-230V

1YEHL: signal lamp AD11-25~230V Yellow

1GNHL: signal lamp AD11-25~230V Green

1RDHL: signal lamp AD11-25~230V Red

Numbers in the dotted line frame are the numbers of the terminals which are in the terminal block of the Na1 breaker body

(Inside elements of)

Q: loss-voltage coil of the breaker ~400V

F: shunt coil of the breaker ~230V

X: closing electromagnet of the breaker ~230V

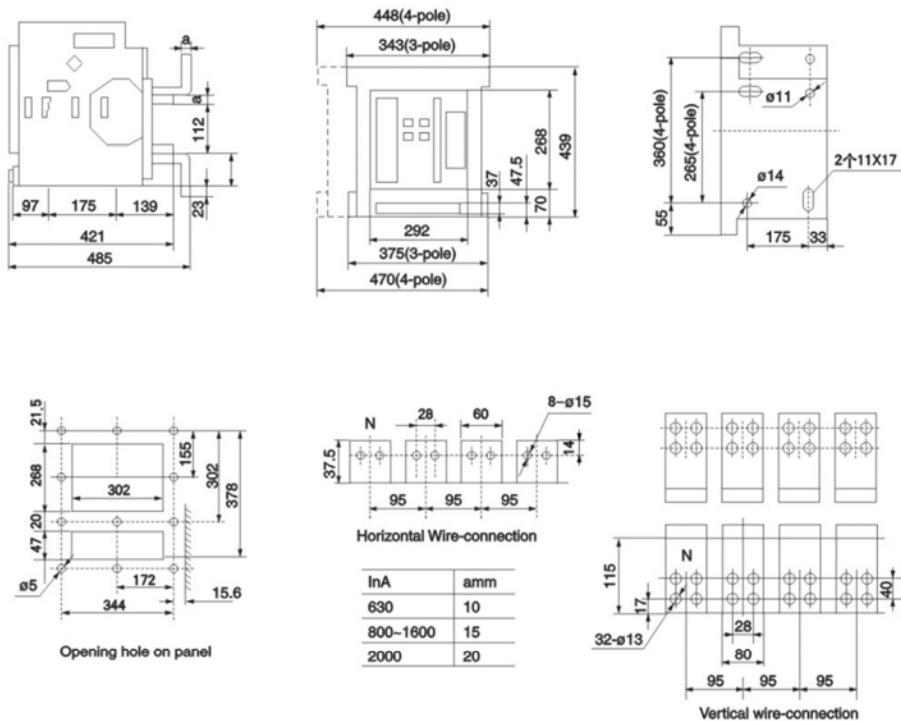
M: energy-storage motor ~230V

SA: over travel-limiting switch of motor

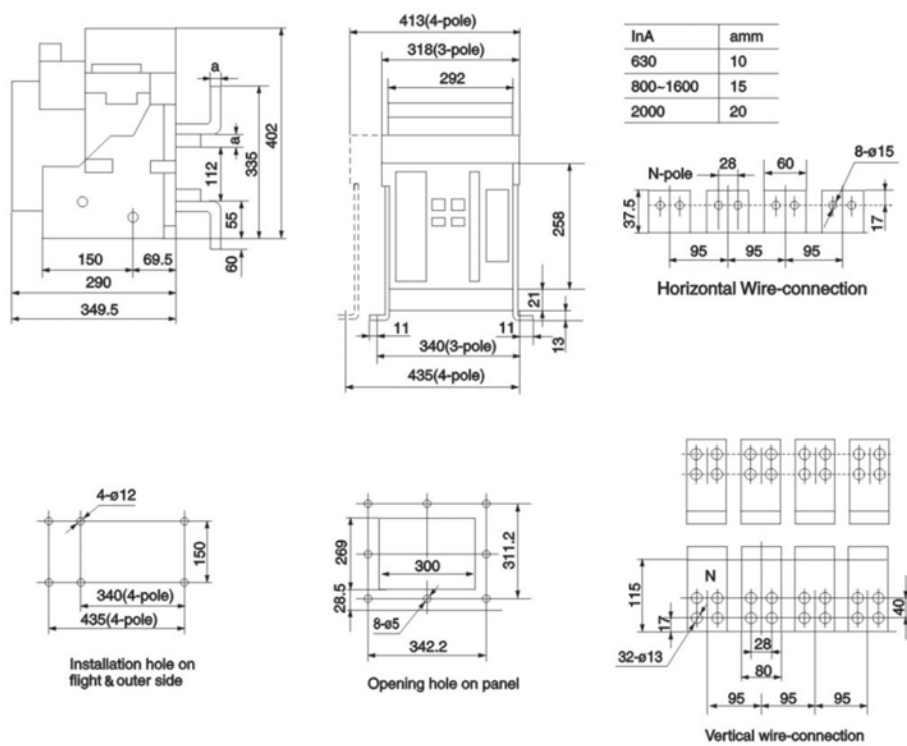
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Installation size and outline dimension

DW45-2000 Drawer-type

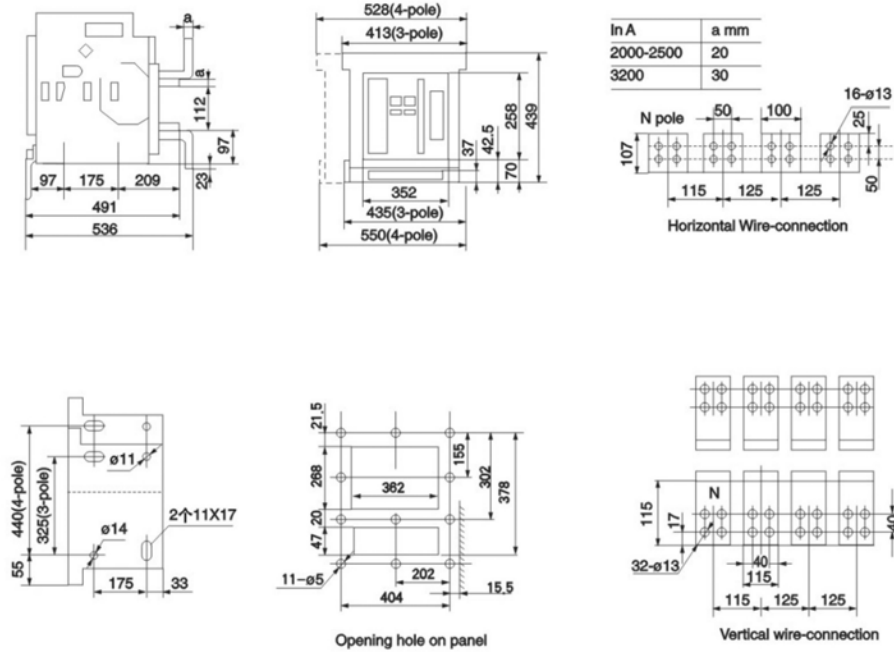


AW45-2000 Fixed type

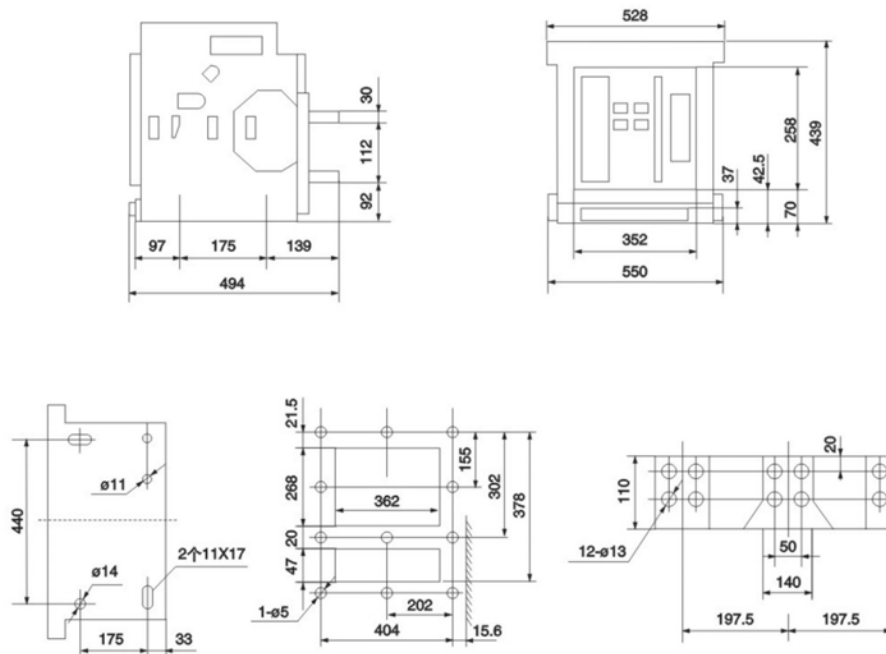


Installation size and outline dimension

AW45-3200 Drawer type

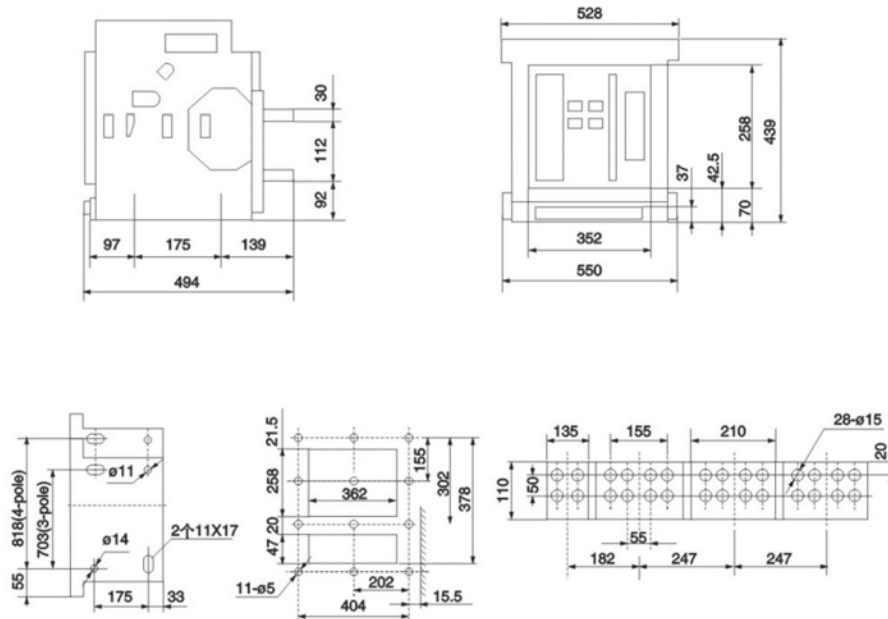


AW45-4000 Drawer type (3-pole)



Installation size and outline dimension

AW45-4000 Drawer type (3-pole)



AW45-6300 Drawer type (3-pole)

