PYRAMIDS



NLW1

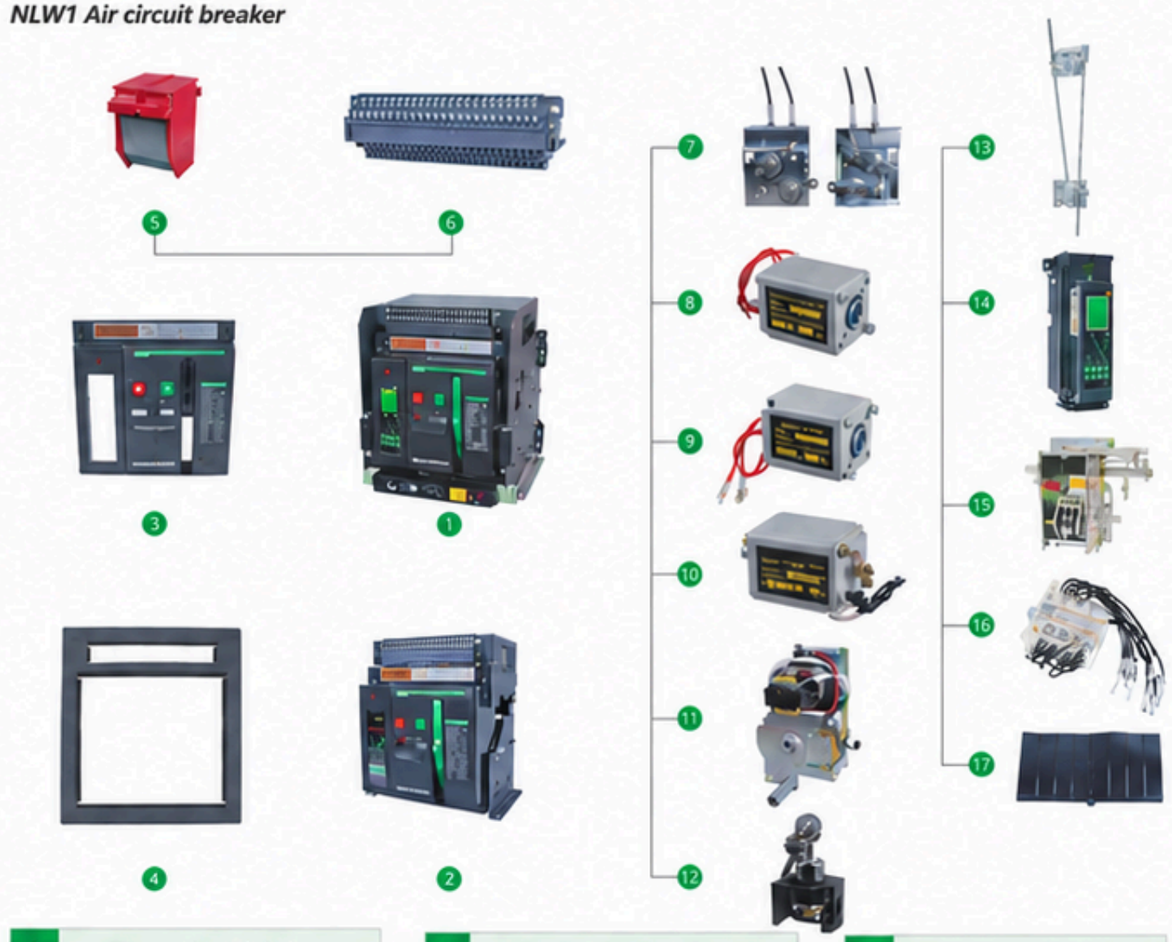
Air circuit breaker

PYRAMIDS

Warning

This product must be installed, connected, used and maintained by qualified personnel in ac cordance with the manual.

NLW1 Air circuit breaker



1	Drawer circuit breaker
2	Stationary circuit breaker
3	Front panel
4	Door frame
5	Arc chamber
6	Secondary circuit

7	Steel cable interlock
8	Closing electromagnet
9	Shunt release
10	Under voltage release
11	Electro drive energy storage mechanism
12	Lock

13	Lever interlock
14	Intelligent controller
15	Operating mechanism
16	Auxiliary switch
17	Phase partition

NLW1

Air circuit breaker





Application

NLW1 series intelligent circuit breaker is mainly suitable for a power distribution network with AC 50/60Hz, rated operating voltages of 400V, 690V, and rated current of 200A to 6300Adistribute power, protect circuit and power devices against overload, under voltage, short circuit, and ground faults. The core part of the circuit breaker adopts intelligent controller with precise selective protection, which can avoid unnecessary power failure so as to improve the reliability, continuity and safety of the power supply system.

The circuit breaker can be widely used in the power distribution system of power stations, factories, mines and modern commercial buildings, especially in intelligent buildings. It is also often used in wind power generation, solar power generation and other green energy filed The circuit breaker meets the IEC60947-2.

Type

Installation mode: stationary type drawer type

Operation mode: electric operation, manual operation

Category use: type B

Pole number: 3, 4

Type of release device: intelligent controllers, under voltage release trigger and shunt release trigger.

Intelligent type controller function

a. With overload long delay reverse time limit, short delay reverse time limit, short delay fixed time limit , instantaneous action and other protection functions, can be set by the user, composed of the required protection characteristics:

b. Ground fault protection function;
c. Overload alarm function;
d. Test function;
e. Overload alarm function;
f. Self-diagnostic function;
h. MCR function;
i. Thermal simulation function;
j. Contact loss indication;

Storage Environment

The minimum temperature shall not be lower than-25°C, and the maximum temperature shall not exceed + 55°C;

The relative temperature (+ 25°C) shall not exceed 95%;

Products in the process of transportation,should be handled with specialcare,should not be inverted, should be tried to avoid violent collision.

Working Environment

The ambient air temperature is-5°C ~ + 50°C, and the average value of 24h does not exceed + 35°C (except for special orders).

The altitude of the installation site shall not exceed 2,000 m.

The relative humidity of the air at the installation site shall not exceed 50% when the maximum temperature is +50°C. It can have higher relative humidity at lower temperature. The mean minimum temperature of the wettest month shall not exceed +25°C, and the mean maximum relative humidity of the month shall not exceed 90%, taking into account the condensation occurring on the surface of the product due to temperature changes.

The pollution grade is Grade 3.

The main circuit of circuit breaker, the under voltage tripping coil and the primary coil of power transformer are installed as IV, while the other auxiliary circuit and control circuit are installed as III.

The installation position shall be vertical,and the inclination ineach direction shall not exceed 5.

Technical Parameters

Technical parameter of circuit breaker (see Table 1)

Table 1 Technical Parameters

Model		NLW1-1600	NLW1-2000	NLW1-3200	NLW1-4000	NLW1-6300
Rated current In (A)		200,400,630 800,1000 1250,1600	400,630,800 1000,1250 1600,2000	2000,2500 2900,3200,4000 (Increase capacity type)	3600,4000	4000,5000 6300
Neutral pole current rating In (A)		100%In	100%In	100%In	50%In	50%In
Rated operating voltage Ue (V)		AC400/690/800				
Pole number		3P, 4P				
Rated impact withstand voltage Uimp (kV)		AC12				
Nominal insulation voltage Ui (V)		AC1000				
Power frequency withstand voltage (V)		AC3500				
Rated limit short circuit breaking capacity Icu(kA)	AC400V	65	80	100	100	120
	AC690V	50	50	65	65	-
Rated short circuit breaking capacity Ics (kA)	AC400V	55	65	80	80	100
	AC690V	50	50	65	65	-
Rated short time withstand current Icw/ 1s (kA)	AC400V	55	50	65	65	100
	AC690V	50	50	65	65	-
Category of use		B				
Full break time (no additional delay)		≤30ms				
Closing time		≤70ms				
Electrical life (times) ≤3200 1h/20 >3200 1h/10	AC400V	6000	5000	3000	2000	1500
	AC690V	5000	4000	2000	1500	1000
Mechanical life (times) ≤2500 1h/20 >2500 1h/10	Maintenance-free	15000	10000	8000	5000	2000
	Have maintenance	20000	12000	10000	6000	2500
Mechanical life of the drawer holder (1h/20times)		1000	1000	1000	600	300
Into the line way		Up or down incoming line				
Arc distance(mm)		0				
Installation mode		Stationary type or Drawer type				
Mode of connection		Horizontal wiring or vertical wiring			Horizontal wiring	

Note: One time of mechanical life of the drawer base refers to when the circuit breaker body is shaken from → "separated" to → "connected" and then to the → "separated" position in the drawer base.

Maximum power loss of circuit breaker incoming and outgoing line
(ambient temperature + 50°C)

Table 2 Power loss of incoming and outgoing lines of circuit breaker

Model	Frame current Inm (A)	Power loss(W)			
		3P Drawer type	4P Drawer type	3P Stationa type	4P Stationa type
NLW1- 1600	1600	230	306	136	182
NLW1-2000	2000	395	526	262	350
NLW1- 3200	3200	556	742	307	409
NLW1-4000	4000	660	880	332	450
NLW1-6300	6300	1429	1905	-	-

Note: Power consumption of the circuit breaker refers to the power consumption of the main circuit measured by the circuit breaker with the rated current at room temperature, excluding the power of other power loss accessories of the circuit breaker. This table data is only for reference and cannot be used as power consumption in actual use of thecircuit breaker.

Altitude reduction coefficient

When the altitude exceeds 2000 meters, the insulation performance, cooling performance and pressure in the atmosphere will change, and its performance can be corrected by referring to Table 4.

Table 4 Coefficient of capacity reduction at altitude

Altitude (m)	2000	3000	4000	5000
Working current Ie	1	0.93	0.88	0.82
Short circuit breaking capacity Icu, Ics	1	0.83	0.71	0.63
Short circuit tolerance Icw	1	0.83	0.71	0.63
Rated impact withstand voltage Uimp	1	0.9	0.71	0.63
Power frequency withstand voltage	1	0.9	0.71	0.63
Rated insulation voltage Ui	1	0.83	0.71	0.63

The recommendation for installing of busbar

Table 5 Recommendation for installing of busbar

Rated current (A)	External copper busbar (width*thickness) mm	Required busbar qty per pole	Cross-sectional area (mm²)
200	20×5	1	100
400	40×5	1	200
630	40×5	2	400
800	50×5	2	500
1000	60×5	2	600
1250	80×5	2	800
1600	100×5	2	1000
2000	100×5	3	1500
2500	100×5	4	2000
2900	100×10	3	3000
3200	100×10	4	4000
3600	100×10	5	5000
4000	100×10	5	5000
5000	100×10	6	6000
6300	100×10	8	8000

Note:

1. The specification in the table is that the circuit breaker used in ambient environment of 50°C and installed open.
2. The material of busbar is T2 bare copper. The specification of the external copper busbar can be changed according to the actual use situation, but it should meet the cross-sectional area requirements corresponding to different currents in the table.

a. Protection performance of the intelligent controller

The over current protection characteristic curve of the intelligent controller is shown in Figure 1.

The setting range I / In and accuracy of the intelligent controller:

Protection type	Long time delay		Short time delay		Instantaneous		Ground protection	
Frame grade	IR	Accuracy	Isd	Accuracy	Ii	Accuracy	Ig	Accuracy
NLW1-1600	(0.4~1)In	±10%	(0.4~15)In	±10%	1In~50kA +OFF	±15%	(0.2~1)In	±10%
NLW1-2000					1In~50kA +OFF			
NLW1-3200/4000					1In~75kA +OFF			
NLW1-6300					1In~100kA +OFF			

b. Long time delay over current protection reverse time limit action characteristics

For the long time delay over current protection, the reverse time limit curve conforms to the characteristic curve of $I^2TL = (1.5\ Ir)^2\ tL$. Where I is the actual action current; TL is the actual action time with a long time delay; and tL is the setting time for a long time delay of 1.5 IR.

Current multiple	Action time						
1.05IR	No action within 2 h						
1.3IR	<1h action						
1.5IR	Setting time(s)	15	30	60	120	240	480
2.0IR	Actuation time(s)	8.4	16.9	33.7	67.5	135	270

c. Short time delay over current protection action characteristics

Current	Action time					
I≥Isd, I≤8IR	Inverse time limit		I² Ts = (8IR)² ts			
I≥Isd, I>8IR	Fixed time limit	Setting time (s)	0.1	0.2	0.3	0.4
		Action time(s)	0.06	0.14	0.23	0.35

Note: a) action time tolerance ± 15%. b) I is the actual action current; ts is the set time for short time delay; and Ts is the actual action time.

d. Short circuit instantaneous protection action characteristics

The instantaneous protection function prevents the load from short circuit in the distribution system. This kind of fault usually happens between phases so the short circuit current is relatively big, which needs to be disconnected quickly.

This protection is executed based on the true effective value of the current. When I≤0.85Ii, I> 1.15 Ii (I is actual short circuit current).

e. The protection characteristics and curve of grounding fault (Figure 2)

There are two kinds of ground fault protection: one is to detect the current of neutral point, when the current of three-phase is in balance, the neutral point current is zero. When the current of three-phase is in imbalance, the current of neutral point exceeds the set value, the intelligent controller alarms, the circuit breaker is disconnected or constantly open according to the instruction after the fixed delay time. The other is to detect the current of the grounding wire, when the current exceeds the set value, the intelligent controller alarms, make the circuit breaker be disconnected or constantly open according to the instruction after the fixed delay time. The grounding fault protection characteristics is fixed time limit.

Action current Set 6Point Ig	(0.2~1)In+OFF
Action characteristic	≤0.8Ig failure to actuate
	≥1.1Ig deferred action
Setting time (s)	(0.2~1)In+OFF (OFF That only the alarm is not removed)

f. Self-diagnostic function

The intelligent controller can diagnose its own fault when failure happens to the computer. It can display "E" (means error) or alarm, and restart computer at the same time. The circuit breaker can be disconnected when necessary.

When the local ambient temperature reaches 80℃ or the temperature in the casing exceeds 80℃ due to the heat of the contact, an alarm can be issued, and the circuit breaker can be switched off at a smaller current (when the user needs).

Figure 1 Over current protection characteristic curve of the intelligent controller

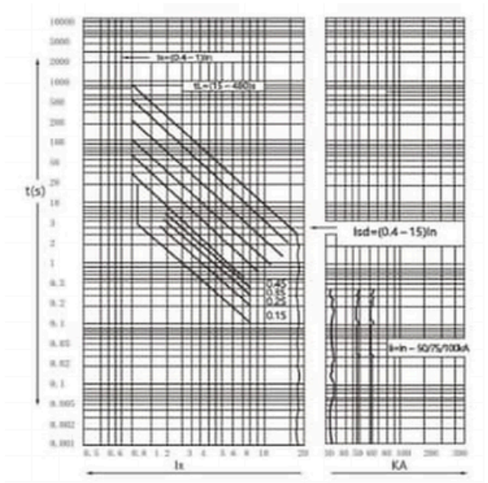
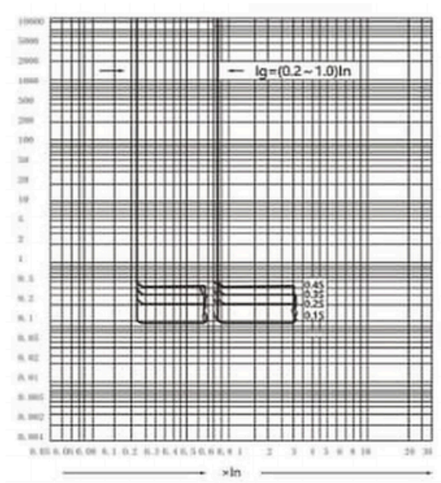


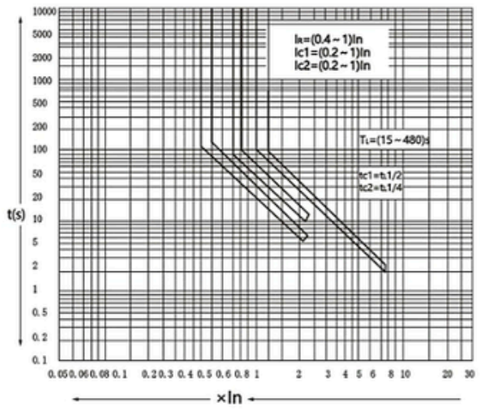
Figure 2 Ground fault protection characteristic curve



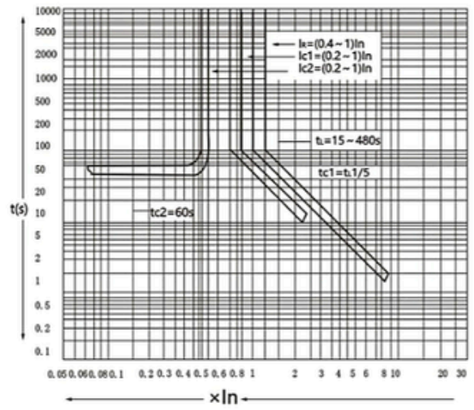
g. Load monitoring function

Set two set values Ic1 and Ic2, setting range of both are (0.2~1) In. The delay feature of Ic1 is the reverse time limit characteristic, Its delay setting value is 1 / 2 of the long delay setting value. There are two kinds of delay characteristics for Ic2: one is the reverse time limit characteristics, its value of time setting is 1/ 4 of the long delay setting value; The other is the fixed time limit characteristic, Its delay time is 60s. The first delay function is used to switch off the last important load when the current approaches the set overload value. The latter delay function is used to delay switching off unimportant load to decrease the current in order to maintain the power supply for main circuit and important load circuits when the current exceeds the Ic1 value. When the current drops to Ic2, a command is issued after a delay to reconnect the lower circuit that has been cut off restore the power supply to the entire system. The load monitoring features are shown in the following figure.

Ic1 Load monitoring function



Ic2 Load monitoring function



h. Display function of the controller

The controller can display the operating current and voltage (i. e., ammeter and voltmeter function) during operation.

When the fault occurs, it displays the section specified by its protection characteristics, and latch the fault display and fault current after disconnecting the circuit. During setting, it displays current, time and section type of the section. If it is a delay action, the indicator light will flash during the action.

The indicator light will change from flashing to constant lighting after the circuit breaker is disconnected. During the test, the test current, delay time, test indication and test action section are displayed.

i. DO signal and alarm function

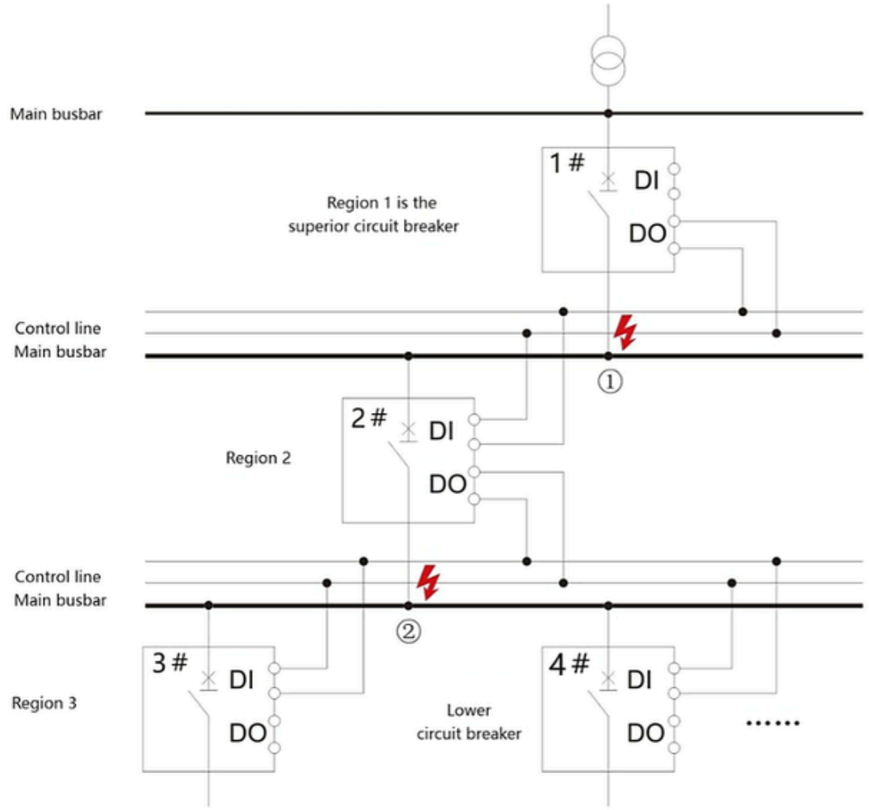
The controller can output 8 DO output signals for the controller or sound and light alarm indication.The corresponding functions include: overload pre-alarm signal, short circuit tripping signal (short delay and instantaneous), long delay tripping signal, ground tripping or alarm signal, load monitoring 1 signal, load monitoring 2 signal, self-diagnosis alarm signal and fault tripping signal (OCR).

j. MCR and over ultimate trip protection

The MCR and over ultimate trip function is high speed instantaneous protection. The fault current signal sends action command directly through the hardware comparison circuit. MCR protection only works at the moment of switch-on of the circuit breaker (about 100ms), while the over ultimate trip protection always plays a role during operation. MCR protection is to protect the ultimate switching capacity of the circuit breaker to prevent the power grid from being in the short circuit fault state before the switch is switched on. While switching on the circuit breaker, the current generated in the moment will be bigger than the switching capacity, the controller switches off the circuit breaker in an instantaneous manner. Over ultimate trip protection is to protect the ultimate load capacity of the circuit breaker, and prevent the circuit breaker from being damaged by the current exceeding the ultimate load capacity.

k. Thermal memory fuction

Due to overload or short delay tripping, there will be thermal effect which is similar to bimetal in the controller. The overload thermal effect energy is released in 30min while the short delay energy is released in 15min. During this period, if overload or short delay failure occurs again, the disconnection time will become shorter. The controller loses power and eliminates the energy automatically.



Preset value of the intelligent controller

Table 6 Preset value of the intelligent controller

Controller type	Long delay		Short delay		Instantaneous	Ground protection		Load monitoring	
	IR	tL	Isd	tL	Ii	Ig	tG	Ic1	Ic2
NLW1-M	1In	60s	8I R	0.2s	12I R	0.8I R	OFF	1In	
NLW1-2H/3H	1In	60s	8I R	0.2s	12I R	0.8I R	OFF	1In	

Structure Overview

Stationary type circuit breaker is mainly composed of the contact system, intelligent controller, manual operation mechanism, electric operation mechanism and fixed installation board.

Drawer type circuit breaker is mainly composed of the contact system, intelligent controller, manual operation mechanism, electric operation mechanism and drawer holder.

The contact system is closed in the insulating floor and each phase contact is separated by an insulation board to form a small chamber, while the intelligent controller, the manual operation mechanism and the electric operation mechanism are arranged in front of it, forming independent units. If one of the units is broken, the whole unit can be removed and replaced with a new one. The circuit breaker consists of a body and a fixed bracket, and becomes a stationary type.



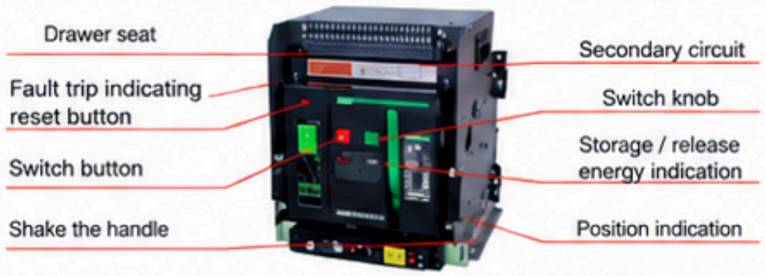
Drawer Type Circuit Breaker

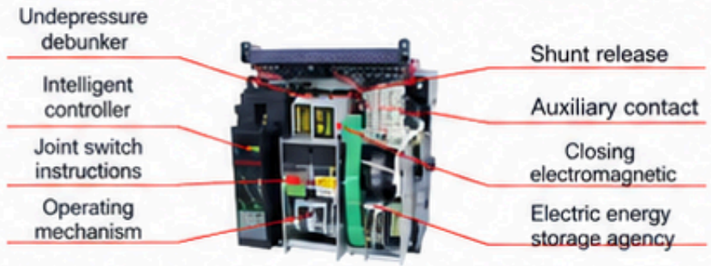
The drawer type circuit breaker is composed of the circuit breaker body and the drawer holder. The guide rail in the drawer holder can be pulled in and out, and the main loop is connected through the bus on the circuit breaker body and the bridge plug on the drawer holder.

The drawer type circuit breaker has three working positions: “connected”, “test” and “separated”. The position is changed by rotating the handle in or out, and the three positions are indicated by the pointer on the drawer seat beam.

- **Connected:** the main loop and the secondary loop are connected.
- **Test:** the main loop is disconnected and separated by an insulation partition; only the secondary loop is connected, so some necessary action tests can be carried out.
- **Separated:** the main loop and the secondary loop are all disconnected.

The drawer type circuit breaker also has a mechanical interlocking device: it can only be switched on in the “connected” or “test” position, and cannot be switched on in the middle position between “connected” and “test”.





There are two types of circuit breakers: drawer type and fixed type



The circuit breaker consists of two parts: the body and the drawer holder, and the body is inserted into the drawer holder.

Intelligent controller mechanical reset button



Normal operating state



When the intelligent controller is in the protected state, the circuit breaker is disconnected and the circuit fault is cleared. Press the button to switch on the circuit breaker again.

Operating state of the operating mechanism



Circuit breaker is disconnected and no energy storage

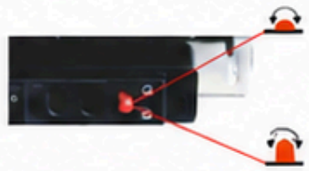
Circuit breaker is disconnected and the energy storage state has been completed

Circuit breaker switched on and no energy storage

Circuit breaker switched on and the energy storage state has been completed

Drawer type circuit breaker (Only the Drawer type circuit breakers have this function)





After the position is locked, operate the shake handle, press the position lock button to release the lock (unlock state)

In the separated state, the connected three positions: the main board is locked, and the shake handle cannot operate (lock state)



"Connected" position Main circuit and second circuit are connected



"Test" position: main circuit is disconnected and second circuit is connected

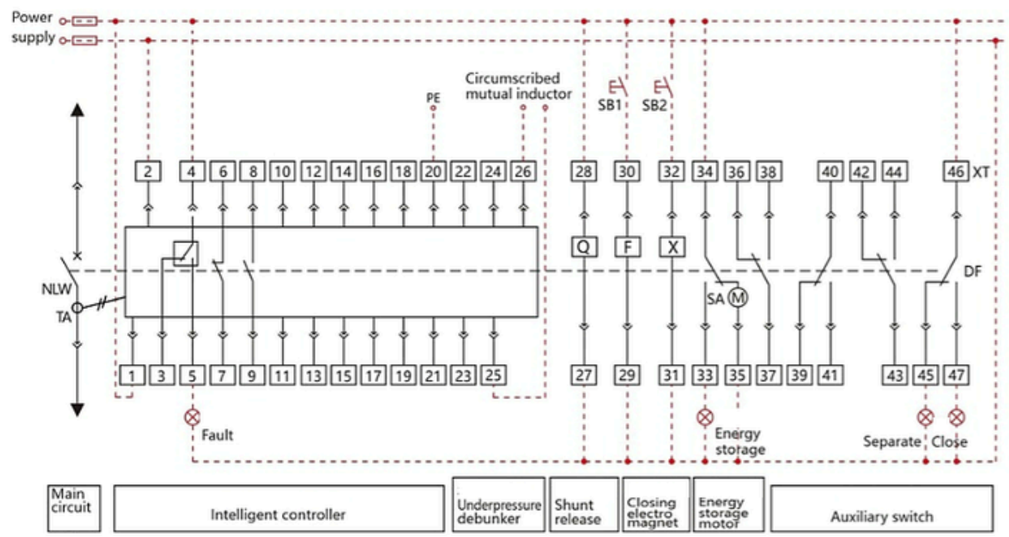
There position lock of the drawer holder: lock the circuit breaker body in the drawer holder: "separated", "test" and "connected".



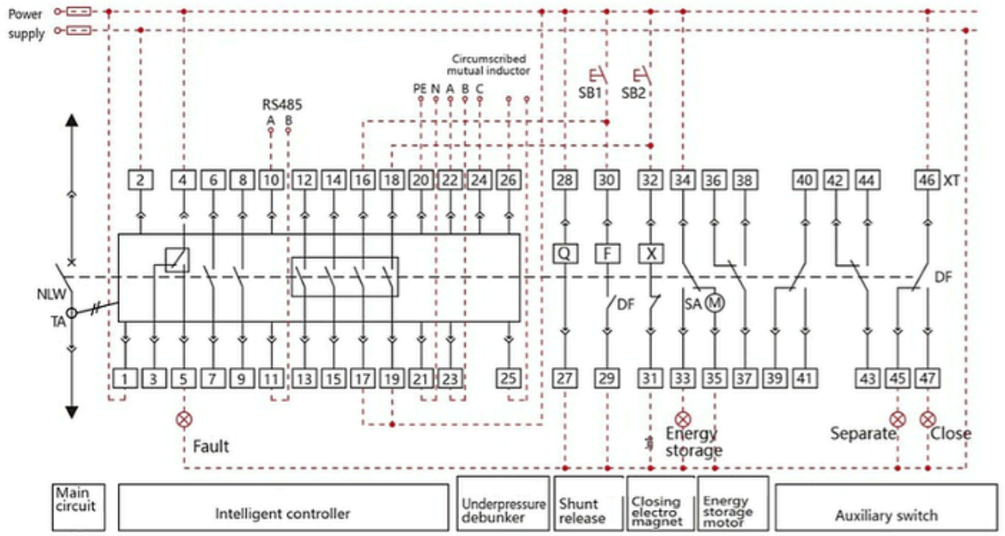
"Separated" position: Main circuit and seconda

Control Loop

Secondary loop wiring diagram of NLW1-1600~6300 with M-type intelligent controller



Secondary-circuit wiring diagram of NLW1-1600~6300 with H-type intelligent controller



The red dotted line in the wiring diagram is wired by the user himself, and the control circuit should be protected by the fuse.
Note: Under voltage release can also be connected frequently closed butt emergency cases.

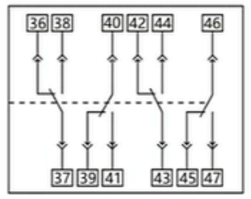
Symbol	Paraphrase	Remarks
Q	Under voltage release	Optional attachment
F	Shunt release	
X	Closing electromagnet	
DF	Auxiliary switch	
SA	Motor micro-dynamic switch	

Symbol	Paraphrase	Remarks
M	Electric motor	
XT	Terminal connector	User self-provided
⊗	Signal lamp	User self-provided
SB1	Manual switch button	User self-provided
SB2	Manual closing button	

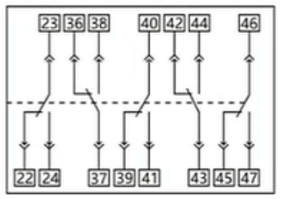
Terminal number	Terminal function description	Remarks
1,2	Auxiliary power supply input: AC230V, AC400V, DC220V, and DC110V	Type M default configuration 2H / 3H communication type confi guration
3,4,5	Fault trip contact output (4 # is the public end), contact capacity: AC250V, 3A	
6,7	Breaker state auxiliary contact output (often open), contact capacity: AC250V, 3A	
8,9	Breaker state auxiliary contact output (often open), contact capacity: AC250V, 3A	
20	Protection area (PE)	
10,11	Rs485 communication interf ace lead, 10 to A, 11 to B (default Modbus)	2H / 3H communication type confi guration
12,19	Relay contact output: 12 and 13 are DO 1; 14 and 15 are DO 2; 16,17 D 3 for remote switch DO contacts; 18 and 19 DO 4 for remote switch contacts	
21,22,23,24	Voltage measurement input: 21 N, 22 A, 23 B, 24 C	
25,26	a: Connect neutral wire transformer for 3P + N; b: Connect leakage transformer for leakage protection (alternative)	Optional attachment
27,28	Under voltage release (Direct connected to autonomous loop power supply to improve the reliability and security of power supply)	Optional attachment
29,30	Shunt release	
31,32	Closing electromagnet	
33,34,35	Electric motor(35 can be directly connected to the power supply automatic pre-storage, or can connect the power supply manual pre-storage)	
36~47	Auxiliary switch Terminal terminal (default four ad conversion)	

NLW1-2000~6300 Auxiliary swich (DF) type

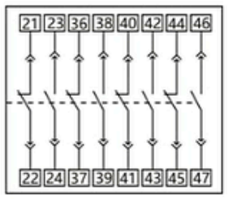
4 conversion contacts (default configuration)



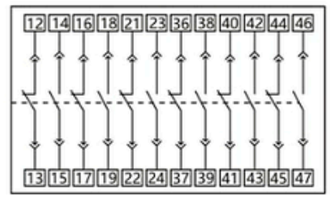
5 sets of transition contacts (Type M)



4NO+4NC (M type)



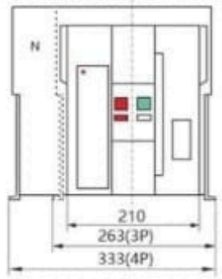
6NO+6NC(M type)



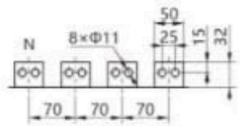
Overall Dimension

NLW1-1600

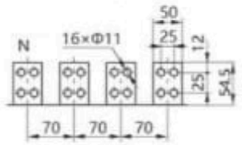
NLW1-1600 Fixed Circuit breaker Outline and mounting size (mm)



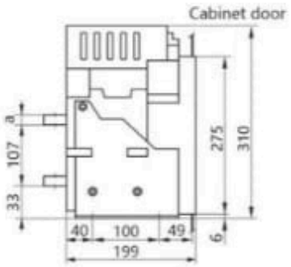
In	a
200~630A	8
800~1000A	10
1250~1600A	18

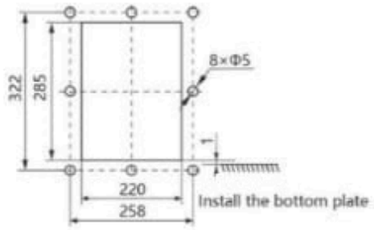


Horizontal sho usbar
(default conguration)



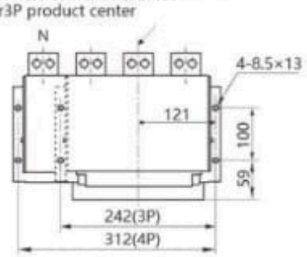
Horizontal long busbar (specially made)





Cutout size of cabinet doo

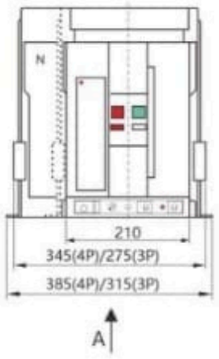
Open hole center of cabinet door3P product center



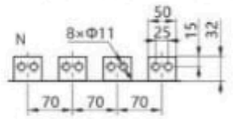
Installation size

NLW1-1600

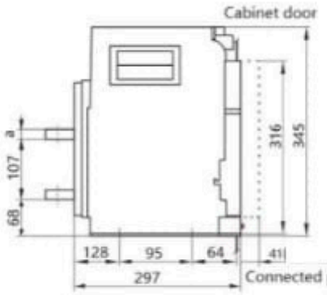
NLW1-1600 drawer type circuit breaker profile with installation size (mm)

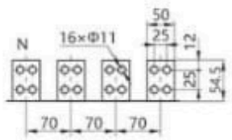


In	a
200~630A	8
800~1000A	10
1250~1600A	18

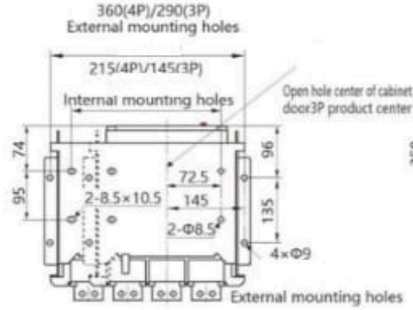


Horizontal sho usbar(default conguration)

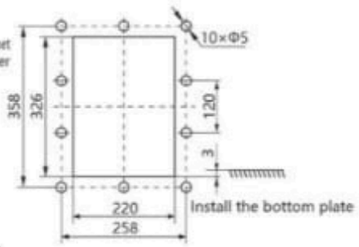




Horizontal long busbar (specially made)



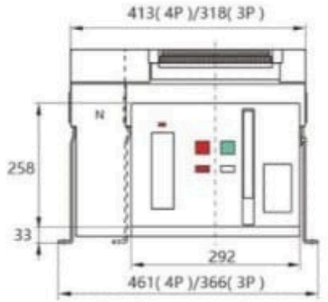
A installation size



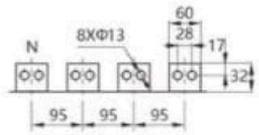
Cutout size of cabinet doo

NLW1-2000

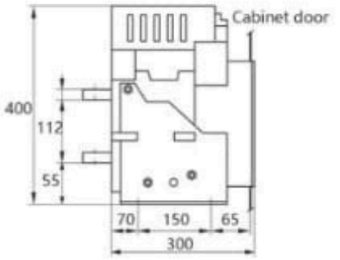
NLW1-2000 Fixed Circuit breaker Outline and mounting size (mm)



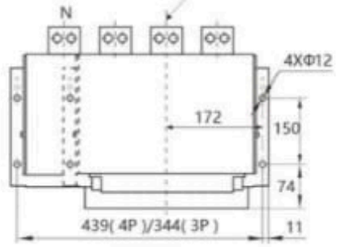
In	a
400~800A	10
1000~1600A	15
2000A	20



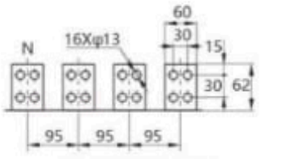
Horizontal sho usbar
(default conguration)



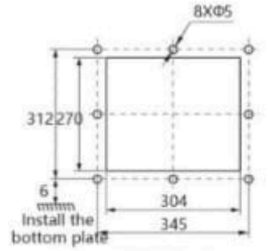
Open hole center of cabinet door
3P product center



Installation size



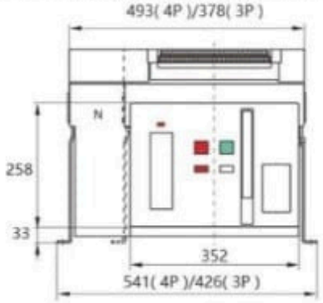
Horizontal long busbar (specially made)



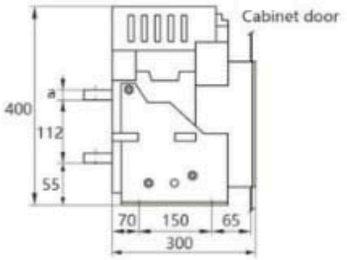
Cutout size of cabinet doo

NLW1-3200

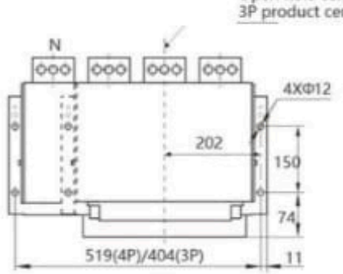
NLW1-3200 Fixed Circuit breaker Outline and mounting size (mm)



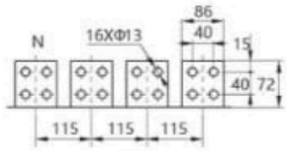
In	a
2000~2500A	20
3200A	30



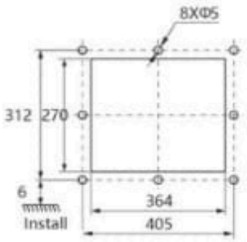
Open hole center of cabinet door
3P product center



A Installation size



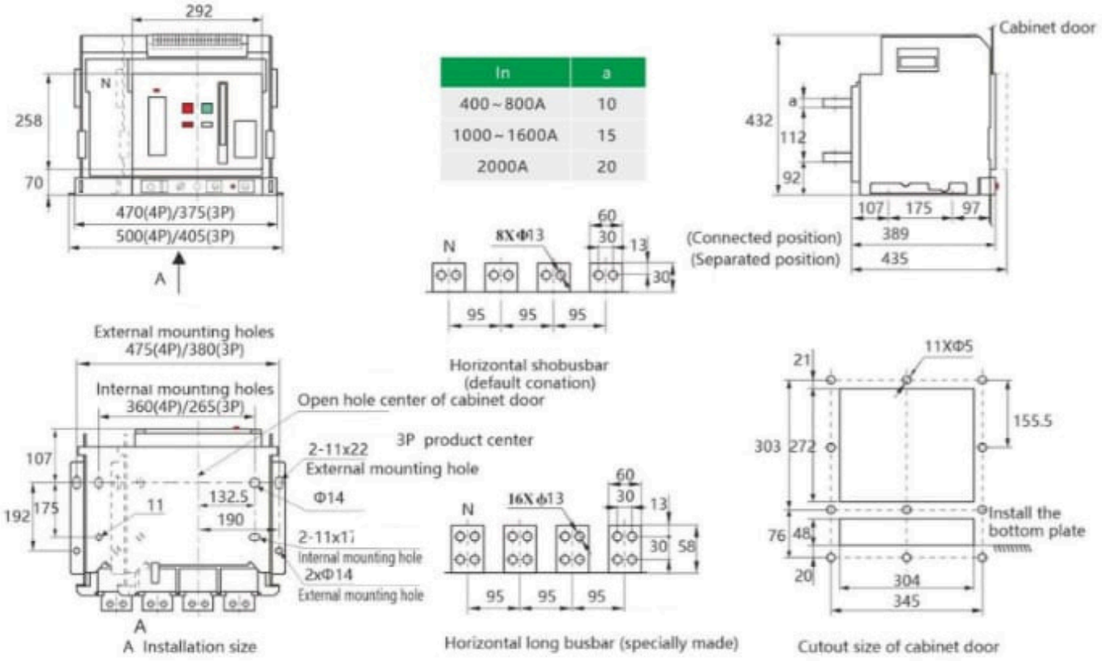
Horizontal long busbar
(specially made)



Cutout size of cabinet door

NLW1-2000

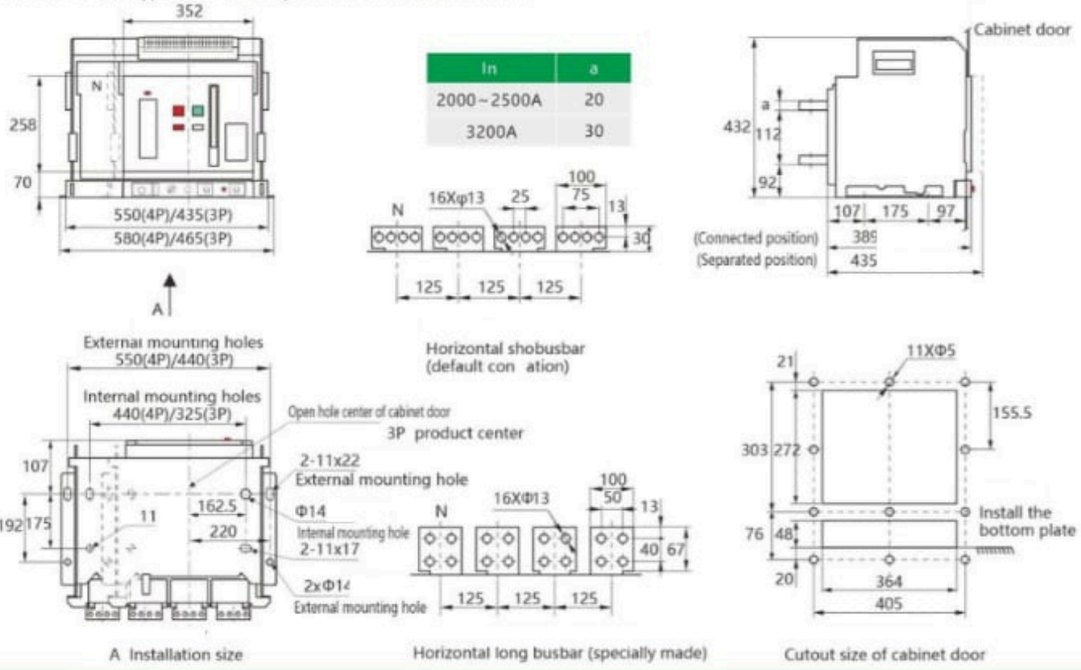
NLW1-2000 drawer type circuit breaker profile with installation size (mm)



In	a
400~800A	10
1000~1600A	15
2000A	20

NLW1-3200

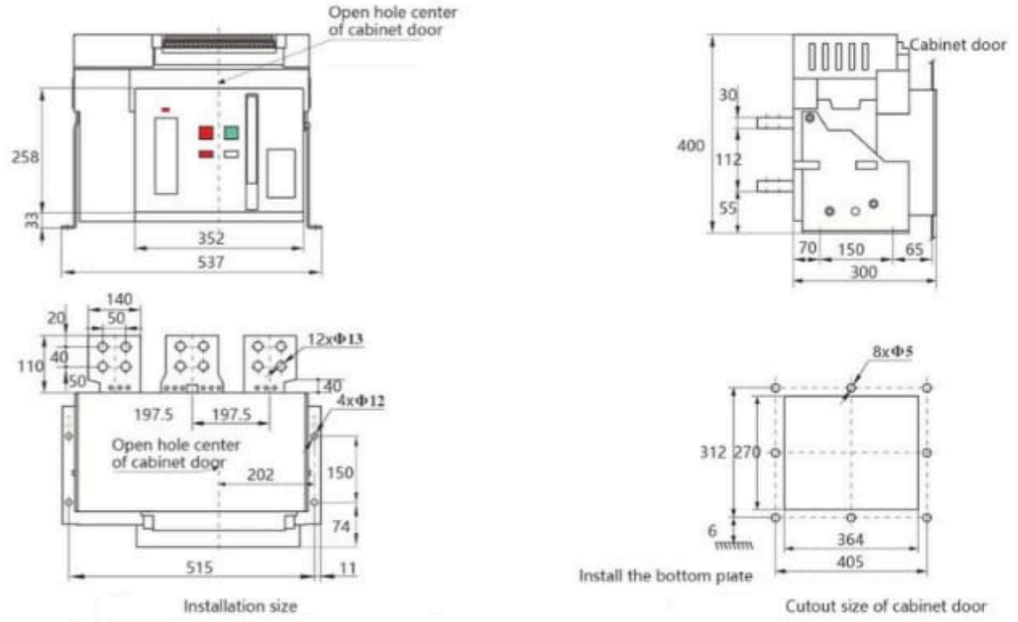
NLW1-3200 drawer type circuit breaker profile with installation size (mm)



In	a
2000~2500A	20
3200A	30

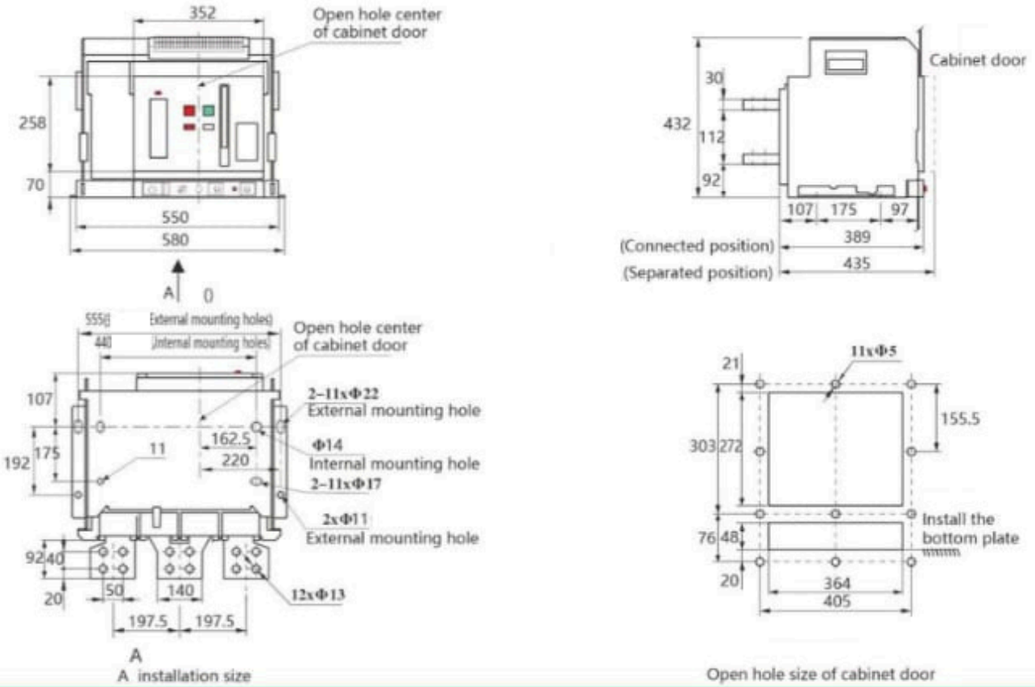
NLW1-4000/3P

NLW1-4000 / 3P Fixed Circuit breaker Outline and mounting size (mm)



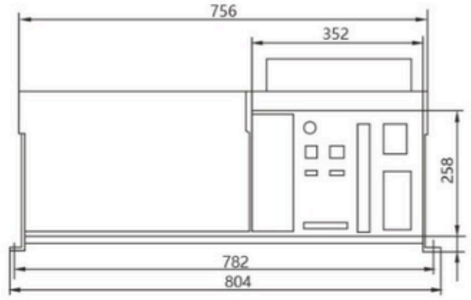
NLW1-4000/3P

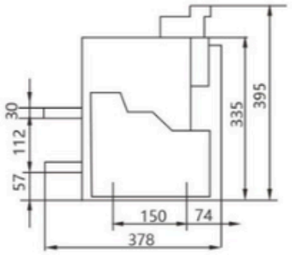
NLW1-4000 / 3P expansion drawer type circuit breaker profile with installation size (mm)

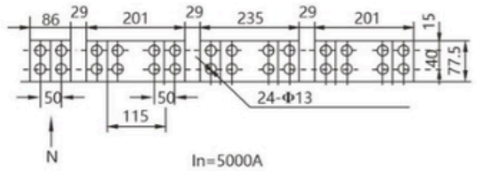


NLW1-6300/3P

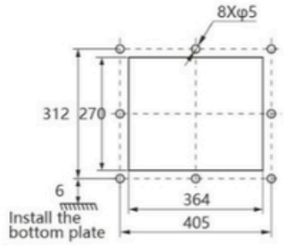
NLW1-6300 Fixed Circuit breaker Outline and mounting size (mm)



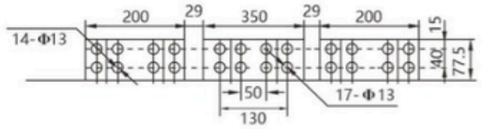




In=5000A



Cutout size of cabinet door

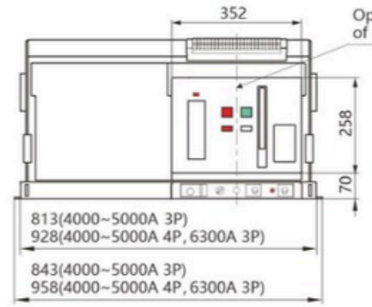


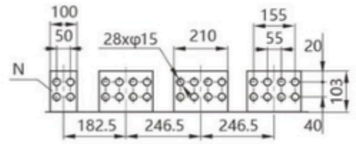
In=6300A

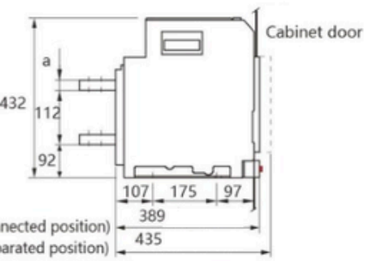
Horizontal long busbar (specially made)

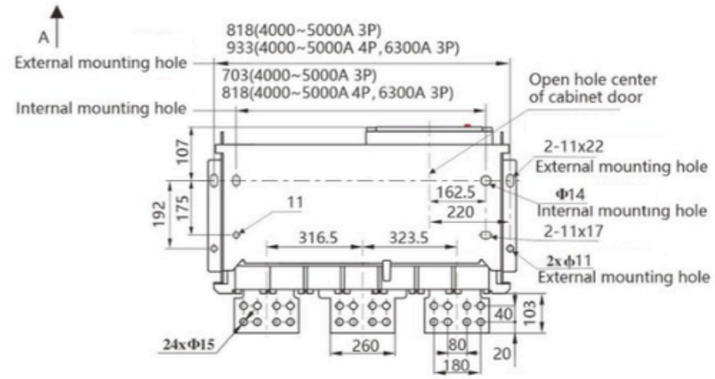
NLW1-6300

NLW1-6300 drawer type circuit breaker profile with installation size (mm)

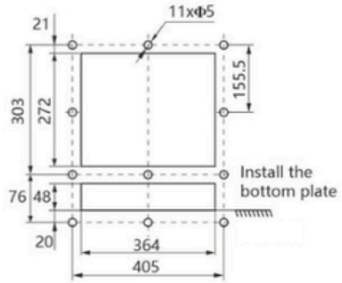








A installation size & 6300A/3P busbar size



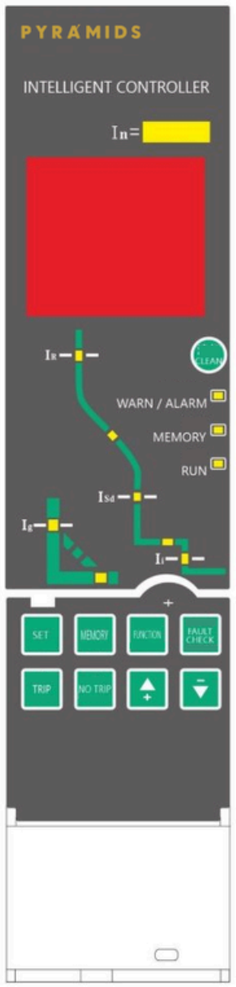
Open hole size of cabinet door

In	a
4000A	20
5000~6300A	30

Busbar thickness size

Intelligent Controller

The description of panel display and function of the controller



Information on the panel	Function declaration
In	Rated current of the controller
G	Current of ground or N phase (constant light refer to ground, ash refer to N phase)
L1	Current of phase A
L2	Current of phase B
L3	Current of phase C
MAX	Maximum phase current
A	Unit of current
kA	Unit of current
S	Unit of time (s)
test	Simulated tripping test
Ic1	Load monitoring No. 1
Ic2	Load monitoring No. 2
δ	Current imbalance protection
Ig	Ground protection
IR	Long time delay protection
Isd	Short time delay protection
Ii	Instantaneous protection
WARN / ALARM	Fault alarm
MEMORY	Save information
RUN	In normal operation state
Button Function declaration	
CLEAN	Clear the fault display on screen and return to the run state
SET	Press the button, then click the button continuously to display all of parameters in sequence
MEMORY	Conrm to save when the parameters are set
FUNCTION	Auxiliary function
FAULT CHECK	Check the fault record
TRIP	Simulate tripping test
NO TRIP	Simulated non-tripping test
▲ +	Adjust the set parameter value to be increased
▼ −	Adjust the set parameter value to be decreased

How to set the parameters of the intelligent controller

Use those four buttons on the controller panel: SET , ▲ , ▼ , MEMORY to set all the parameters of the controller.

The basic steps are described as follows:

① Click the button of " SET " continuously to check all of parameters in sequence periodically. When a parameter is checked, the original set value of the parameter is displayed on the screen, and the corresponding indicator on the panel will be light on. If you do not need to change this parameter, go on clicking the butt on of " SET ".

② If you need to change the original set parameter, click the button of " ▲ "or " ▼ " continuously. In the process of setting for current, in order to get the required set value quickly, the user can click the button of "function" to converse the mode of adjustment between fast adjustment code and fine adjustment code until the required value is achieved.

③ Press button of " MEMORY " to save the new set parameters. If no other parameters are required to be set, follow the step mentioned in ④ to exit the set. Otherwise, continue according to the step mentioned in ① .

④ Press the button of " CLEAN " to exit the setting state.

All the protection parameters of the controller should be set according to Ir1 <Ir 2 <Ir 3 strictly.

Simulation test operation of the controller

Simulation characteristics test against grounded, long delay, short delay and nstantaneous can be oper ated for the controller. Two kinds of test are available: tripping and non-tripping. The first one needs to break the circuit breaker, the second one does not break the circuit breaker. If faults such as overload or short circuit occurs during the test, the system will automatically terminate the test state and turn to the fault processing state.