

Shanghai Liangxin Electrical Co., Ltd.

NDM3EX-1600 Product Specification

(IPD-ENG-DEV-T20 A1 2016-09-23)

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Revision History					
Version	Revision Reason/Content	Implementati on Date	Prepared by	Reviewe d by	Approve d by
0	Newly added	2020/08/30	Sun Lanping	Wang Zhongbin	Ding Fei
1	Update the product appearance picture and product dimension outline drawing	2021/09/30	Sun Lanping	Wang Zhongbin	Ding Fei

1. Applicable Scope and Purpose of Circuit Breaker

The NDM3EX-1600 electronic molded case circuit breaker (hereinafter referred to as circuit breaker) applies to infrequent switching of circuits with the AC 50/60Hz, the working voltage of AC690V and working current of 1600A as well as infrequent motor starting. With the overload, short circuit and undervoltage protection functions, the circuit breaker can protect lines and power equipment from damage.

2. Product Picture of Circuit Breaker (The picture is for reference only; the specific kind prevail)



Picture of the Product

3. Specification and Model Description of Circuit Breaker

$\frac{\text{ND}}{1}$	$\frac{\text{M}}{2}$	$\frac{3}{3}$	$\frac{\text{EX}}{4}$	$\frac{-}{5}$	$\frac{1600}{6}$	$\frac{\square}{7}$	$\frac{/}{8}$	$\frac{\square}{9}$	$\frac{/}{10}$	$\frac{\square}{11}$	$\frac{\square}{12}$	$\frac{\square}{13}$	$\frac{\square}{14}$
SN		SN name				NDM3EX							
1		Enterprise code				ND: “Nader” low-voltage apparatus							
2		Product code				M: Molded case circuit breaker (MCCB)							
3		Design SN				3							
4		Derived code of the series				EX: Electronic							
5		Shell frame level				1600							
6		Breaking capacity level				M: Relatively high breaking type							
7		Operation mode				No code: Direct handle-operated mode							
						P: Motor-operated							
						Z: Rotary operation							
8		Derived code of the function				No code: Basic type intelligent release							
						G: Ground protection type intelligent release							
9		Number of poles				3, 4							
10		Accessory code				See Table 1							
11		Application code				No code: Power distribution type							
						2: Motor protection type							
12		Rated current				See Table 2							
13		Cabling type				No code: Normal product							
						P: Connection busbar							
14		Other codes				Codes of internal and external accessories: Such as manual operation: CS1-A, electric operation: DC1 220V, shunt: AC230V, undervoltage: DC220V							

Table 1: Comparison Table of Accessory Code:

<div> </div>				<div> Legend Single auxiliary contact Dual-auxiliary contact Alarm contact Shunt release Under-voltage release Auxiliary alarm contact (a single accessory features the auxiliary and alarm functions) </div>	
Accessory code		Installation Position	Model	Accessory name	
			3	4	
300		None			
308		One set of alarm contacts			
308		Two sets of alarm contacts			
310		Shunt release			
3K01		Two sets of shunt releases			
330		Under-voltage release			
3A01		Two sets of under-voltage releases			
321		Single auxiliary contact			
361		Two sets of single auxiliary contacts			
323		Three sets of single auxiliary contacts			
324		Four sets of single auxiliary contacts			
318		Shunt release, alarm contact			
338		Under-voltage release, alarm contact			
322		Single auxiliary contact, alarm contact			
388		Two sets of single auxiliary contacts, alarm contact			
326		Three sets of single auxiliary contacts, alarm contact			
325		Four sets of single auxiliary contacts, alarm contact			
342		Shunt release, single auxiliary contact, alarm contact			
344		Shunt release, two sets of single auxiliary contacts, alarm contact			
346		Shunt release, three sets of single auxiliary contacts, alarm contact			
314		Shunt release, four sets of single auxiliary contacts, alarm contact			
3/3		Under-voltage release, single auxiliary contact, alarm contact			
377		Under-voltage release, two sets of single auxiliary contacts, alarm contact			
345		Shunt release, two sets of single auxiliary contacts, two sets of single alarm contacts			
347		Shunt release, three sets of single auxiliary contacts, two sets of single alarm contacts			
315		Shunt release, four sets of single auxiliary contacts, two sets of single alarm contacts			
375		Under-voltage release, single auxiliary contact, two sets of single alarm contacts			
377		Under-voltage release, two sets of single auxiliary contacts, two sets of single alarm contacts			
381		Under-voltage release, three sets of single auxiliary contacts, two sets of single alarm contacts			
382		Under-voltage release, four sets of single auxiliary contacts, two sets of single alarm contacts			
332		Under-voltage release, shunt release, single auxiliary contact, alarm contact			
333		Under-voltage release, shunt release, two sets of single auxiliary contacts, alarm contact			
334		Under-voltage release, shunt release, three sets of single auxiliary contacts, alarm contact			
335		Under-voltage release, shunt release, four sets of single auxiliary contacts, alarm contact			
339		Under-voltage release, shunt release, single auxiliary contact, two sets of single alarm contacts			
355		Under-voltage release, shunt release, two sets of single auxiliary contacts, two sets of single alarm contacts			
356		Under-voltage release, shunt release, three sets of single auxiliary contacts, two sets of single alarm contacts			
336		Under-voltage release, shunt release, four sets of single auxiliary contacts, two sets of single alarm contacts			
3A02		Two sets of undervoltage releases, single auxiliary contact			
3A07		Two sets of undervoltage releases, two sets of single auxiliary contacts			
3A08		Two sets of undervoltage releases, three sets of single auxiliary contacts			
3A09		Two sets of undervoltage releases, four sets of single auxiliary contacts			
3A10		Two sets of undervoltage releases, single auxiliary contact, alarm contact			
3A12		Two sets of undervoltage releases, two sets of single auxiliary contacts, alarm contact			
3A14		Undervoltage release			
3A16		Undervoltage release			

Accessory code		Installation Position	Model	Accessory name	
			3	4	
381		Under-voltage release, three sets of single auxiliary contacts, alarm contact			
382		Under-voltage release, four sets of single auxiliary contacts, alarm contact			
341		Shunt release, single auxiliary contact			
311		Shunt release, two sets of single auxiliary contacts			
312		Shunt release, three sets of single auxiliary contacts			
313		Shunt release, four sets of single auxiliary contacts			
371		Under-voltage release, single auxiliary contact			
372		Under-voltage release, two sets of single auxiliary contacts			
373		Under-voltage release, three sets of single auxiliary contacts			
374		Under-voltage release, four sets of single auxiliary contacts			
331		Under-voltage release, shunt release, alarm contact			
337		Under-voltage release, shunt release, two sets of single alarm contacts			
351		Under-voltage release, shunt release, single auxiliary contact			
352		Under-voltage release, shunt release, two sets of single auxiliary contacts			
353		Under-voltage release, shunt release, three sets of single auxiliary contacts			
354		Under-voltage release, shunt release, four sets of single auxiliary contacts			
319		Shunt release, two sets of single alarm contacts			
370		Under-voltage release, two sets of single alarm contacts			
363		Single auxiliary contact, two sets of single alarm contacts			
364		Two sets of single auxiliary contacts, two sets of single alarm contacts			
365		Three sets of single auxiliary contacts, two sets of single alarm contacts			
366		Four sets of single auxiliary contacts, two sets of single alarm contacts			
343		Shunt release, single auxiliary contact, two sets of single alarm contacts			
3A11		Two sets of undervoltage releases, single auxiliary contact, two sets of single alarm contacts			
3A13		Two sets of undervoltage releases, two sets of single auxiliary contacts, two sets of single alarm contacts			
3A15		Two sets of undervoltage releases, three sets of single auxiliary contacts, two sets of single alarm contacts			
3A17		Two sets of undervoltage releases, four sets of single auxiliary contacts, two sets of single alarm contacts			
3A05		Two sets of undervoltage releases, alarm contact			
3A06		Two sets of undervoltage releases, two sets of single alarm contacts			
3K04		Two sets of shunt releases, single auxiliary contact			
3K06		Two sets of shunt releases, two sets of single auxiliary contacts			
3K07		Two sets of shunt releases, three sets of single auxiliary contacts			
3K08		Two sets of shunt releases, four sets of single auxiliary contacts			
3K12		Two sets of shunt releases, single auxiliary contact, alarm contact			
3K09		Two sets of shunt releases, two sets of single auxiliary contacts, alarm contact			
3K10		Two sets of shunt releases, three sets of single auxiliary contacts, alarm contact			
3K11		Two sets of shunt releases, four sets of single auxiliary contacts, alarm contact			
3K13		Two sets of shunt releases, single auxiliary contact, two sets of single alarm contacts			
3K14		Two sets of shunt releases, two sets of single auxiliary contacts, two sets of single alarm contacts			
3K15		Two sets of shunt releases, three sets of single auxiliary contacts, two sets of single alarm contacts			
3K16		Two sets of shunt releases, four sets of single auxiliary contacts, two sets of single alarm contacts			
3K02		Two sets of shunt releases, alarm contact			
3K05		Two sets of shunt releases, two sets of single alarm contacts			

Note: The first number "3" of the release accessory code represents the intelligent controller with the three-section protection while the last two numbers represent the inner accessory code.

4. Main Technical Parameters of Circuit Breaker

Table 2 Main Technical Parameters of Circuit Breaker

Model		NDM3EX-1600	
Rated current of frame Inm (A)		1600	
Rated current In (A)		800, 1000, 1250, 1600	
Rated insulation voltage Ui (AC V)		1000	
Rated impulse withstand voltage Uimp (V)		12000	
Rated working voltage Ue (AC V)		400/415, 500, 660/690	
Power frequency withstand voltage U (1min) (V)		3500	
Utilization category		B	
Rated short-time withstand current Icw (kA/1s)		20	
Number of poles		3, 4	
Rated limit short-circuit breaking capacity Icu (kA)	AC400/415V		70
	AC500V		50
	AC660/690V		20
Rated operating short-circuit breaking capacity Ics (kA)	AC400/415V		50
	AC500V		50
	AC660/690V		20
Operating performance (times)	Electrical life	AC400/415V	1000
		AC500V	800
		AC690V	500
	Mechanical life	Maintainable free life	10000(3P), 6000(4P)
		Maintainable life	20000 (3P) 、 12000 (4P)

4.1 Selection of the circuit breaker connecting bus or cable cross-section area:

4.1.1 Front-plate connection:

Table 3 Reference Dimensions of the Connecting Copper Bar of Front-plate Connection Products

Rated current (A)	800	1000	1250	1600
Copper bar size (mm ²)	50×5	50×6	50×8	50×10
Quantity	2	2	2	2

4.1.2 Extended front-plate connection:

Table 4 Reference Dimensions of the Connecting Copper Bar of Extended Front-plate Connection Products

Rated current (A)	800	1000	1250	1600
Copper bar size (mm ²)	80×6	80×8	80×5	80×6
Quantity	1	1	2	2

4.2 Tightening Torque of the Circuit Breaker Terminal and Mounting Screw

Table 5 Tightening Torque of the Circuit Breaker Terminal and Mounting Screw

Model	Thread diameter (mm)	Torque (N·m)
NDM3EX-1600	M10	20
	M5	4

4.3 Derating factor of temperature change for the circuit breaker

Table 6 Derating Factor Table of Temperature Change for the Circuit Breaker

Model	Derating factor of product temperature change							
NDM3EX-1600	Temperature (°C)	40	45	50	55	60	65	70
	Derating factor	1	0.98	0.95	0.92	0.88	0.84	0.80

Note: 1) When the operating ambient temperature is below 40°C, the product can be used normally without derating capacity.

2) The above derating factors are measured at the frame current.

4.4 High-altitude derating factor of the circuit breaker

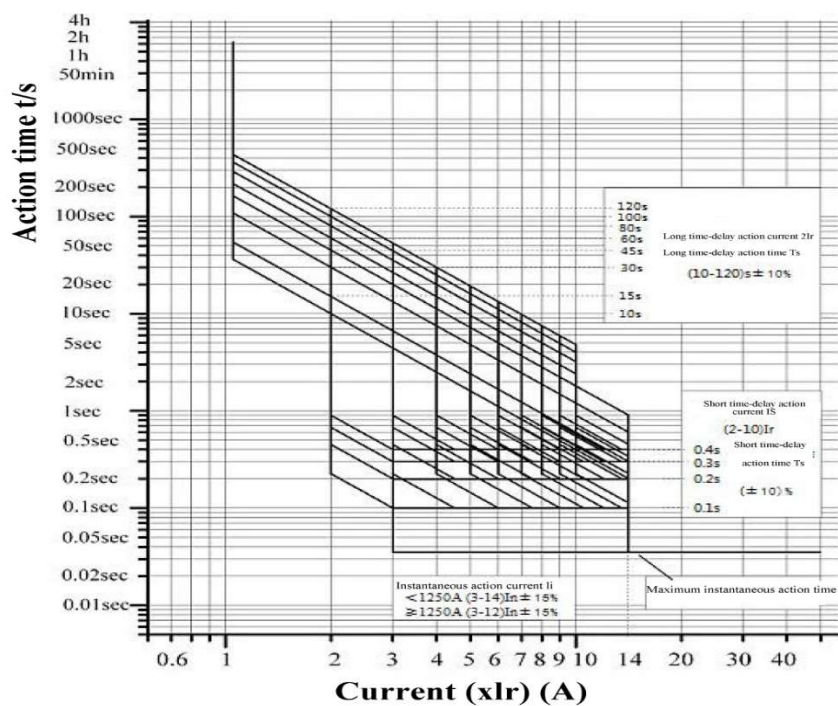
Table 7 High-altitude Derating Factor Table of Circuit Breaker

Altitude (m)	2000	2500	3000	3500	4000	4500	5000
Correction factor of the working current	1	1	0.98	0.97	0.95	0.94	0.93
Maximum working voltage(V)	690	690	620	580	550	520	500
Power frequency withstand voltage(V)	3500	3500	3150	3000	2800	2650	2500
Insulation voltage(V)	1000	1000	900	850	810	770	730

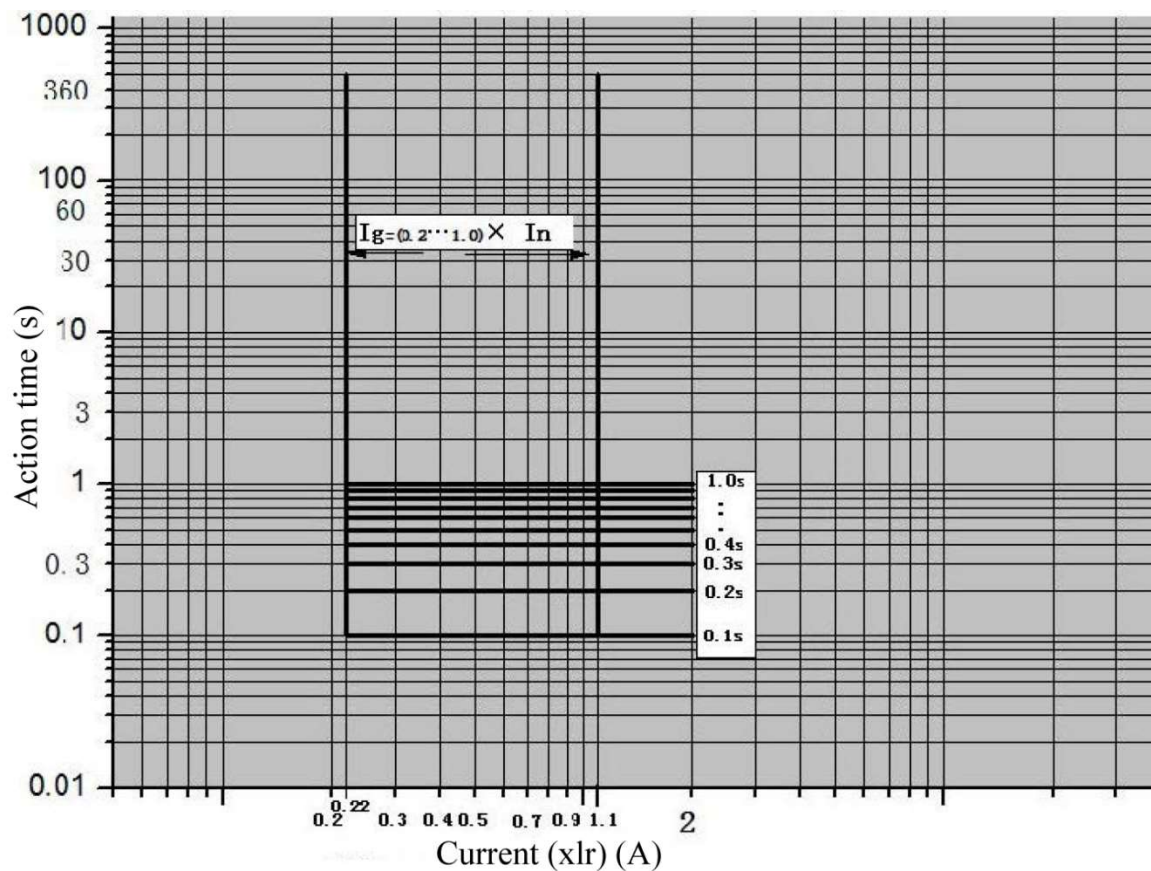
5. Normal Working Environment of Circuit Breaker

- 1) The altitude of the installation site doesn't exceed 2,500m. See the "High-altitude Derating Factor Table of Circuit Breaker" for the derating factor at the altitude;
- 2) The ambient temperature is $-35^{\circ}\text{C} \sim +70^{\circ}\text{C}$; the average within 24 h shall not be more than $+35^{\circ}\text{C}$. If the ambient temperature is higher than $+40^{\circ}\text{C}$, the user needs to reduce the capacity. See the "Derating Factor Table of Temperature Change for the Circuit Breaker" for the derating factor;
- 3) Wet heat resistance: Meets the standard IEC60086-2-30 wet heat (95% relative humidity at 40°C);
- 4) The product can withstand the effects of wet air, salt mist, oil mist and mould;
- 5) The installation category of the circuit breaker connected to the main loop is: Category III (power distribution and control level), The installation category of the circuit breaker not connected to the main loop is: Category II (load level);
- 6) The pollution level is Level 3;
- 7) The product should be installed in places that are free from explosive media, media corrosive to metal, insulation damaging gas, and conductive dust, which should be also avoided from snow and rain;
- 8) In case of stricter user conditions than the above description, negotiate with the manufacturer.

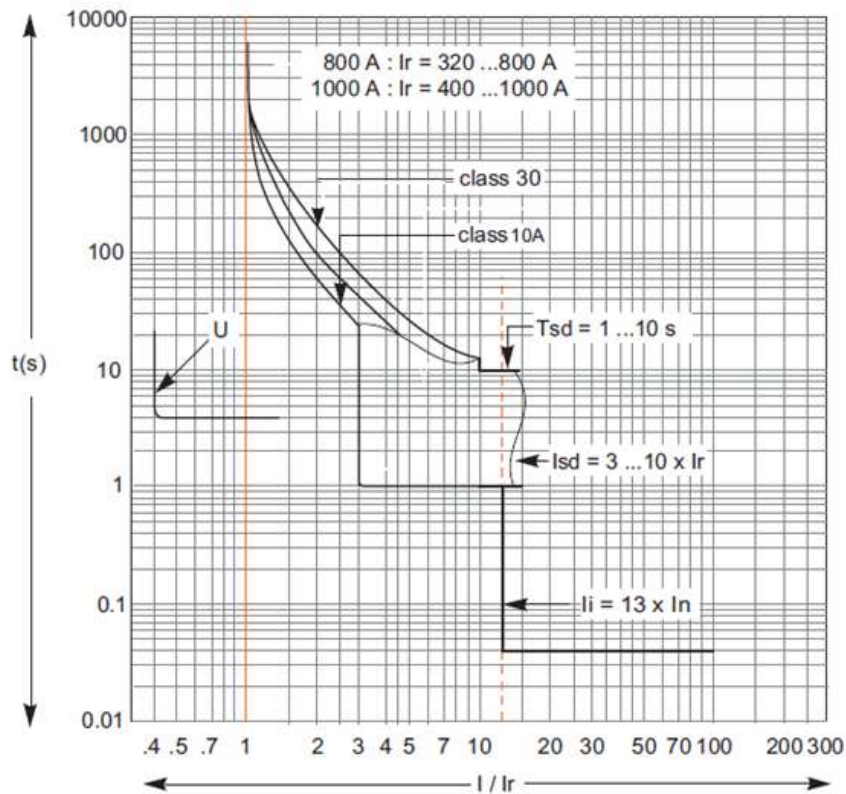
6. Short-circuit Overload Protection Characteristic Curve of Circuit Breaker



Long time-delay, short time-delay and instantaneous protection curve



Ground-type protection curve



Motor-type protection curve

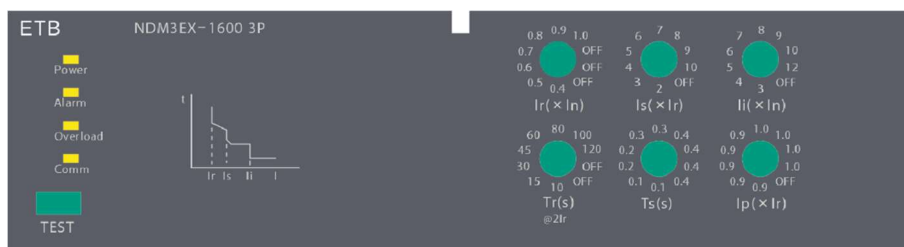
7. Operation and Function Description of Circuit Breaker Controller

7.1 Operation and use of the controller

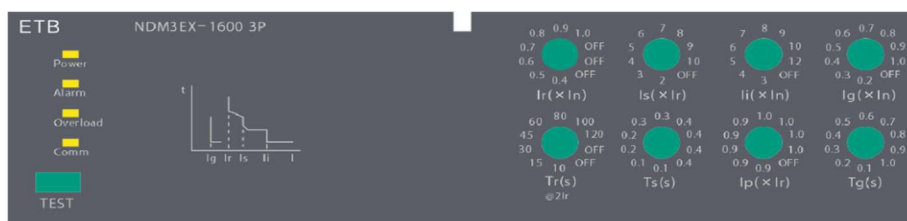
7.1.1 Control panel of the power distribution type controller

Components of the circuit breaker control panel:

- (1) Ir long time-delay current setting value (2) Tr long time-delay action time (3) Setting value of the Is short circuit short time-delay current
- (4) Ts short circuit short time-delay action time (5) Setting value of the Ii short-circuit instantaneous current (6) Ip alarm current
- (7) Ig ground fault protection current (8) Tg ground fault protection time (9) IrN N-phase setting current value
- (10) TEST test port (11) Power indicator (12) Alarm indicator
- (13) Overload indicator (14) Comm indicator



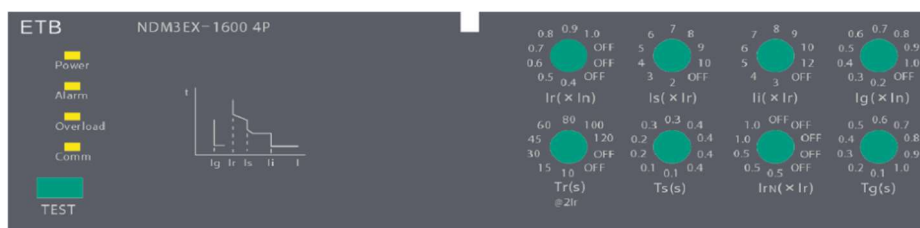
3P non-grounding type (1250A, 1600A)



3P grounding type (1250A, 1600A)



4P non-grounding type (1250A, 1600A)



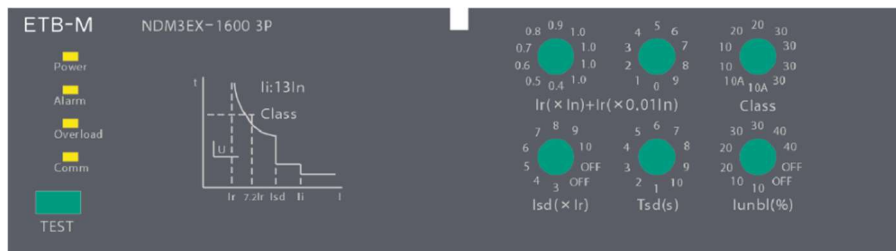
4P grounding type (1250A, 1600A)

Adjustment Gear Figure of Power Distribution Type Controller

7.1.2 Motor type controller control panel

Components of the circuit breaker control panel:

- (1) Ir overload protection current setting value (2) Class tripping level action time (3) Isd blocking protection current setting value
 (4) Tsd blocking protection action time (5) Iunbl current imbalance setting value (6) TEST test port
 (7) Power indicator (8) Alarm indicator (9) Overload indicator
 (10) Comm indicator



Adjustment Gear Diagram of Motor Type Controller (800A, 1000A)

7.1.3 Each part function of the controller control panel

(1) Test port

Namely the "TEST" port: the NDM3EX special tester connects with the controller via this port for test, debugging and other operation, only used in the company.

(2) Current and time adjustment knobs

By adjusting the current and time knobs, select proper combinations to protect lines and devices. This operation must be exclusively performed by specialized technicians!

Note: Tr is the action time of the circuit breaker when the actual current is 2 times of the Ir setting value.

For example: When Ir is set to 1.0, Tr to 10s and the main loop current is $2 \times 1600A$, the circuit breaker will break the main loop after lasting 10s. The action time accuracy is about $\pm 10\%$.

At the overload current, the breaking time of the main loop performed by the circuit breaker depends on the formula below: $t = (2 \cdot I_r / I)^2 \cdot T_r$

I-it indicates that the actual current value of the main loop under overload conditions.

7.1.4 Power distribution type indicator

(1) Power indicator

The indicator flashes when the controller is in the working state.

(2) Alarm indicator

When the alarm indicator flashes, it indicates that the actual current exceeds the setting value of the alarm current I_p , which will change to be constantly on from flashing (yellow) after $T=(2*I_r/I)^2*T_r/2$.

(3) Overload indicator

When the overload indicator is constantly on, it indicates that the actual current exceeds 1.15 times of the overload long time-delay current setting value I_r ; in the overload state, the circuit breaker will disconnect after a specified period of time.

7.1.5 Motor type indicator

(1) Power indicator

The indicator flashes when the controller is in the working state.

(2) Alarm indicator (built-in)

When the alarm indicator is constantly on and flashes, it indicates that the actual current exceeds $0.9I_r$, and shows different states depending on the current.

(3) Overload indicator

When the overload indicator is constantly on, it indicates that the actual current exceeds 1.1 times of the overload long time-delay current setting value I_r ; in the overload state, the circuit breaker will disconnect after a specified period of time.

7.2 Setting of controller parameters

7.2.1 Parameters of power distribution protection controller

Table 8

Rated current In(A)	Number of poles	Current and time parameters							
		Ir(\times In)	Tr(s)	Is(\times Ir)	Ts(s)	Ig(\times In)	Tg(s)	Ii(\times In)	Ip(\times Ir)
800/1000	3	0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0, OFF	10, 15, 30, 45, 60, 80, 100, 120, OFF	2, 3, 4, 5, 6, 7, 8, 9, 10, OFF	0.1, 0.2, 0.3, 0.4	0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0, OFF	0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0	3, 4, 5, 6, 7, 8, 10, 12, 14, OFF	0.9, 1.0, OFF
1250/1600	3	0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0, OFF	10, 15, 30, 45, 60, 80, 100, 120, OFF	2, 3, 4, 5, 6, 7, 8, 9, 10, OFF	0.1, 0.2, 0.3, 0.4	0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0, OFF	0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0	3, 4, 5, 6, 7, 8, 9, 10, 12, 14, OFF	0.9, 1.0, OFF

Table 9

Rated current In(A)	Number of poles	Current and time parameters							
		Ir(\times In)	Tr(s)	Is(\times Ir)	Ts(s)	Ig(\times In)	Tg(s)	Ii(\times In)	Irn(\times Ir)
800/1000	4	0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0, OFF	10, 15, 30, 45, 60, 80, 100, 120, OFF	2, 3, 4, 5, 6, 7, 8, 9, 10, OFF	0.1, 0.2, 0.3, 0.4	0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0, OFF	0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0	3, 4, 5, 6, 7, 8, 10, 12, 14, OFF	0.5, 1.0, OFF
1250/1600	4	0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0, OFF	10, 15, 30, 45, 60, 80, 100, 120, OFF	2, 3, 4, 5, 6, 7, 8, 9, 10, OFF	0.1, 0.2, 0.3, 0.4	0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0, OFF	0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0	3, 4, 5, 6, 7, 8, 9, 10, 12, 14, OFF	0.5, 1.0, OFF

7.2.2 Parameters of motor protection controller

Table 10

Rated current In(A)	Number of poles	Current and time parameters				
		Ir(A)	Class	Isd(*Ir)	Tsd(s)	Iunbl(%)
800	3	320-800 In step of 8A	10A, 10, 20, 30	3, 4, 5, 6, 7, 8, 9, 10, OFF	1, 2, 3, 4, 5, 6, 7, 8, 9, 10	10%, 20%, 30%, 40%, OFF
1000	3	400-1000 In step of 10A	10A, 10, 20, 30	3, 4, 5, 6, 7, 8, 9, 10, OFF	1, 2, 3, 4, 5, 6, 7, 8, 9, 10	10%, 20%, 30%, 40%, OFF

Note: 1. When Isd is in the OFF position, the blocking protection is closed;

2. When Iunbl is in the OFF position, the current imbalance protection is off while the default protection is

off;

3. The short circuit protection I_i has built-in $13I_n$;

4. When the current is $7.2I_r$, the corresponding time for the Class gear is: 4s (10A), 8s (10), 16s (20), 24s (30).

7.3 Function description

7.3.1 Basic function table of power distribution type

Table 11

	Protection function	Other functions	Human Machine Interface
Type	Overload long-time delay protection	Alarm indication function	LED indicator
	Short circuit short-time delay inverse time-limit protection		code switch operation
	Short circuit short-time delay fixed time-limit protection		
	Short circuit instantaneous protection		

Note: All protection must meet the power supply requirements of the circuit breaker, $0.2I_n$ for the three-phase power supply, $0.4I_n$ for the single-phase power supply.

7.3.2 Setting value of the power distribution type controller

(1) Overload long time-delay protection

The overload long time-delay protection is based on the true (RMS) value for protecting the load.

Table 12

Setting current I_r		See Table 8 and Table 9							
Action characteristics	Tr setting value (s)	$I_n=800/1000/1250/1600A$							
		10	15	30	45	60	80	100	120
	$\leq 1.05I_r$	$> 2h$ (no action)							
	$> 1.30I_r$	$< 1h$ (action)							
	t(s) at $1.5I_r$	17.77	26.67	53.33	79.99	106.67	142.22	177.77	213.33
	t(s) at $2.0I_r$	10	15	30	45	60	80	100	120
	tr(s) at $7.2I_r$	0.77	1.16	2.31	3.47	4.63	6.17	7.72	9.26
	Accuracy (%)	± 10							

Note: The action curve complies with $tr=(2I_r)^2 \times Tr/I^2$

tr: Overload long time-delay action time Tr: Setting value of the overload long time-delay action time

I: Actual running current

Ir: Setting value of the overload long time-delay

action current

(2) Short-circuit short time-delay protection

The short time-delay protection prevents the impedance short-circuit of the distribution system

The short time-delay protection is divided into two segments: reverse time limit and fixed time limit.

Table 13

Setting current Is		See Table 8 and Table 9				
Action characteristics	Reverse time limit $I_s \leq I < 1.5I_s$	Ts setting value (s)	0.1	0.2	0.3	0.4
		ts action time (s)	$t_s = (1.5I_s)^2 \times T_s / I^2$			
	Fixed time limit $1.5I_s \leq I < I_i$	ts action time (s)	0.1	0.2	0.3	0.4
		Accuracy (%)	±20	±10		

Note: The action curve of the reverse time limit complies with $t_s = (1.5I_s)^2 \times T_s / I^2$, while the action time of the fixed time limit tracks the Ts setting value.

ts: Short-circuit short time-delay action time Ts: Setting value of the short-circuit short time-delay action time

I: Actual running current

Is: Setting value of the short-circuit short time-delay action current

(3) Short circuit instantaneous protection

The instantaneous protection function can prevent short circuit of metal solids of the distribution system. Due to larger short-circuit current of the fault, the system requires being disconnected rapidly.

Table 14

Action characteristics	Setting current $I_i (\times I_n)$	See Table 8 and Table 9	
	Action time	$\leq 0.85I_i$	Inaction
		$\geq 1.15I_i$	<50ms

(4) Ground fault protection

The ground protection function can prevent the grounded short circuit of metal solids of the distribution system with the fixed time-limit protection.

Table 15

Setting current I_g		See Table 8 and Table 9										
Action characteristics	Fixed time limit	tg action time (s)	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
		Accuracy (%)	±20	±10								

(5) Overload pre-alarm

Table 16

Setting current I_p	See Table 8		Accuracy (%)	Remarks
0.9 I_r	Alarm indicator	The indicator changes to be constantly on from flashing	± 5	The four-pole controller is not available with the adjustment gear, built-in 0.9 I_r
1.0 I_r	Alarm indicator	The indicator changes to be constantly on from flashing		
OFF	OFF	OFF	OFF	

(6) N-phase protection

The four-pole controller features the N-phase overload long time-delay protection features:

Table 17

N-phase protection type	See Table 9
0.5 I_r	The protective action point is half of the setting value in case of a N-phase overload fault
1.0 I_r	The protective action point equals to the setting value in case of a N-phase overload fault
OFF	N-phase protection off

Note: N-phase overload long time-delay protection time tracks the setting value of T_r , and N-phase short time-delay protection time tracks the setting value of T_s .

The short-circuit instantaneous protection of the four-pole controller is the same as other phases.

7.3.3 Basic function table of the motor type controller

Table 18

	Protection function	Other functions	Human Machine Interface
Type	Overload long-time delay protection	Alarm indication function	LED indicator
	Blocking protection		code switch operation
	Short-circuit protection		
	Current unbalance protection		
	Default phase protection		

7.3.4 Setting value of the motor type controller

(1) Overload long time-delay protection

Table 19

Setting current Ir		See Table 10			
Action features when the tripping level time has passed (inverse time limit)	Class setting value (s)	In =800A/1000A			
		4	8	16	24
	$\leq 1.0 I_r$	$> 2h$ inaction			
	$> 1.20 I_r$	$< 1h$ action			
	tr(s) at $1.5 I_r$	92.2	184.3	368.6	553
	tr(s) at $6.0 I_r$	5.8	11.5	23	34.6
	tr(s) at $7.2 I_r$	4	8	16	24
Accuracy (%)		± 10			

Note: L=1080±3 when n=60

1) The action curve complies with $t=(7.2)^2 \times (I_r)^2 \times \text{Class} / I^2$

t: Overload protection action time Class: Tripping level time setting value I: Actual running current Ir:

Overload protection action current setting value

2) See Table 10 for the setting current Ir value

3) When the normal current is more than $1.5 I_r$ and runs to the tripping level time point, it will act according to the current tripping level time.

(2) Blocking protection Isd

Table 20

Setting current Isd			See Table 10
Action characteristics	Fixed time limit $I > I_{sd}$	t action time (s)	See Table 10
		Accuracy (%)	± 15

Note: 1) See Table 10 for the setting current Isd value

2) The blocking protection will be effective only when the tripping level time is exceeded, and the action feature is a time limit

(3) Current unbalance protection Iunbl

Table 21

Setting value Iunbl(%)			See Table 10
$\delta \geq I_{unbl}(\%)$	During startup (<Class)	t action time (s)	0.7
	During normal operation (≥Class)		4
$\delta < I_{unbl}(\%)$	Inaction		

Note: 1) The calculation of the actual current unbalance conforms to $\delta = \frac{\sum_{k=1}^3 |I_k - I_{avg}|}{I_{avg}} \times 100\%$

$$I_{avg} = \frac{\sum_{k=1}^3 I_k}{3}$$

δ : Percentage value of the actual current unbalance of the three-phase electricity I: Three-phase current I_{avg} : Three-phase average current value, k is the three-phase current SN

(4) Default phase protection

Table 22

Action characteristics	$I < 0.4I_r$	During startup ($< \text{Class}$)	t action time (s)	0.7
		During normal operation ($\geq \text{Class}$)		4

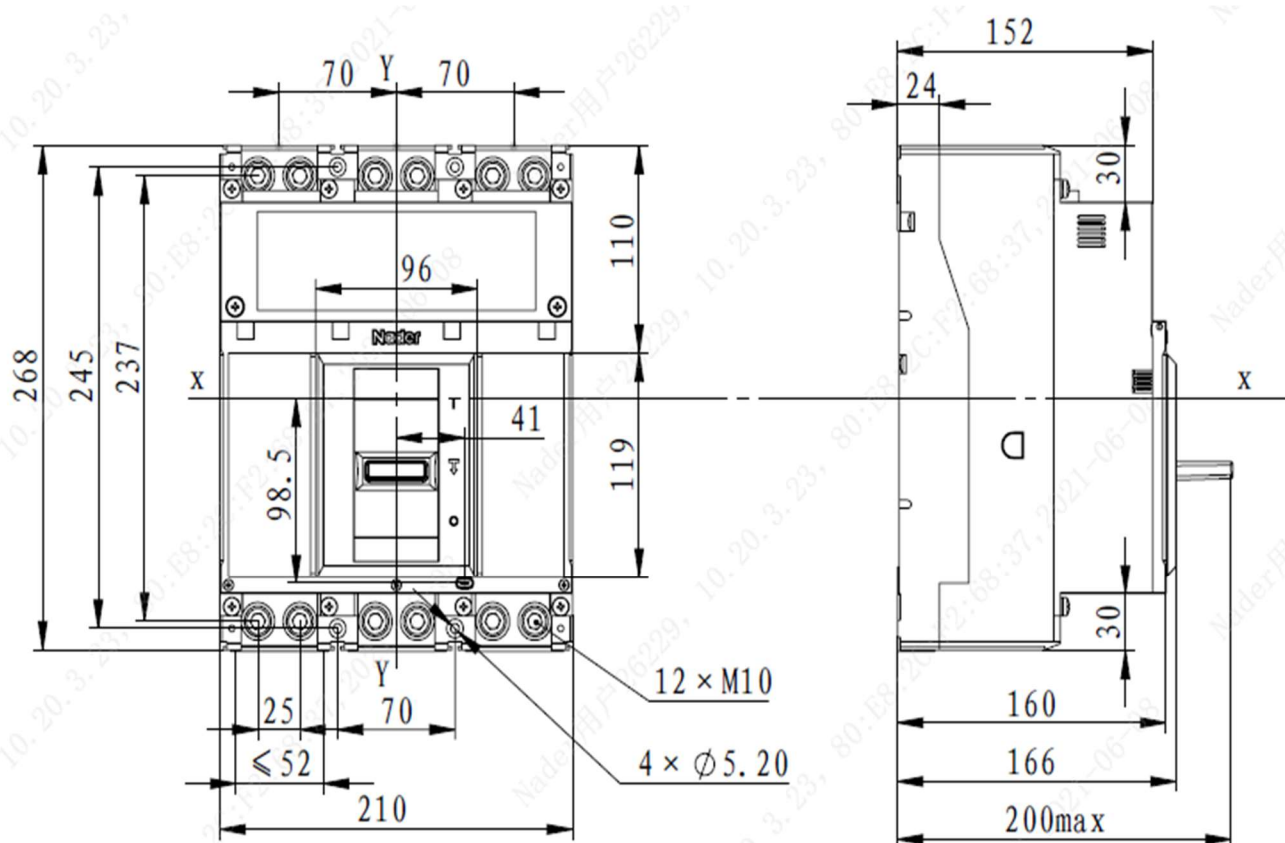
(5) Short-circuit instantaneous protection

Table 23

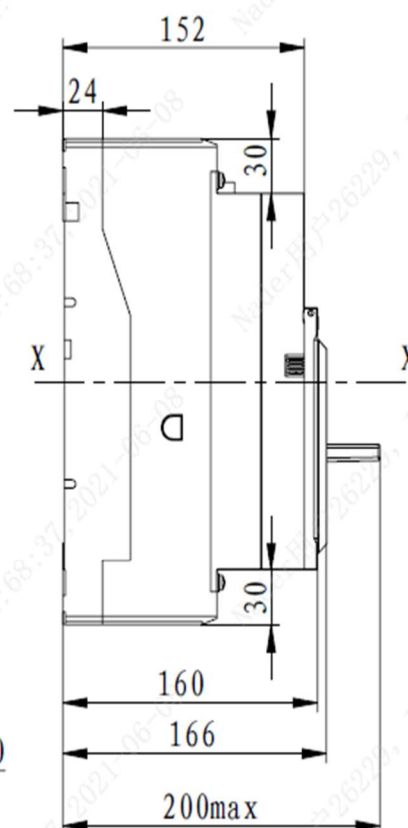
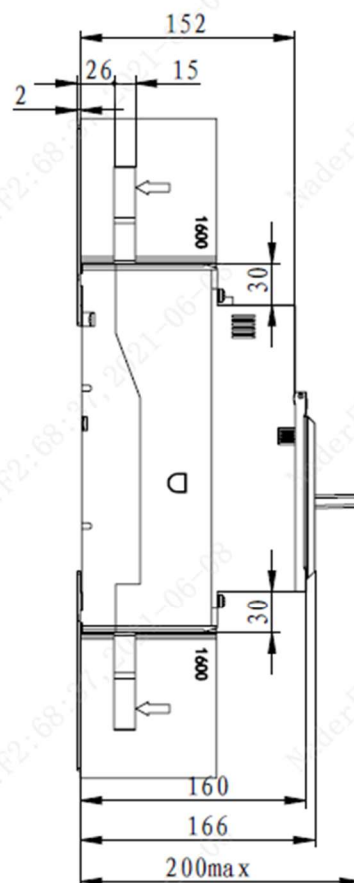
Action characteristics	Setting current $I_i (\times I_n)$	$13 I_n$	
	Action time	$\leq 0.85 I_i$	I_{inaction}
		$\geq 1.15 I_i$	$< 50 \text{ms}$

8. Outline and Mounting Hole Dimensions of Circuit Breaker

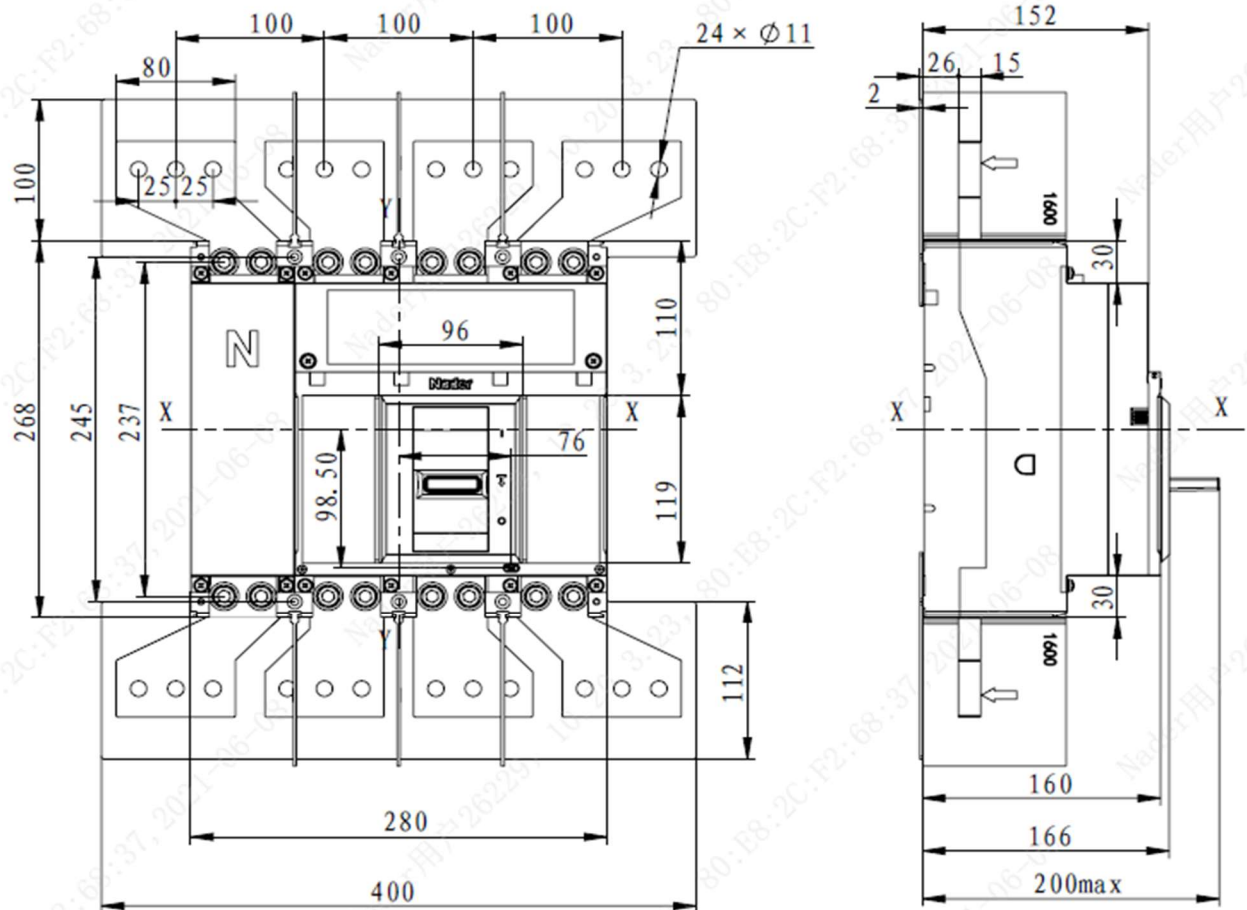
8.1 External dimensions of 3P front-plate connection products



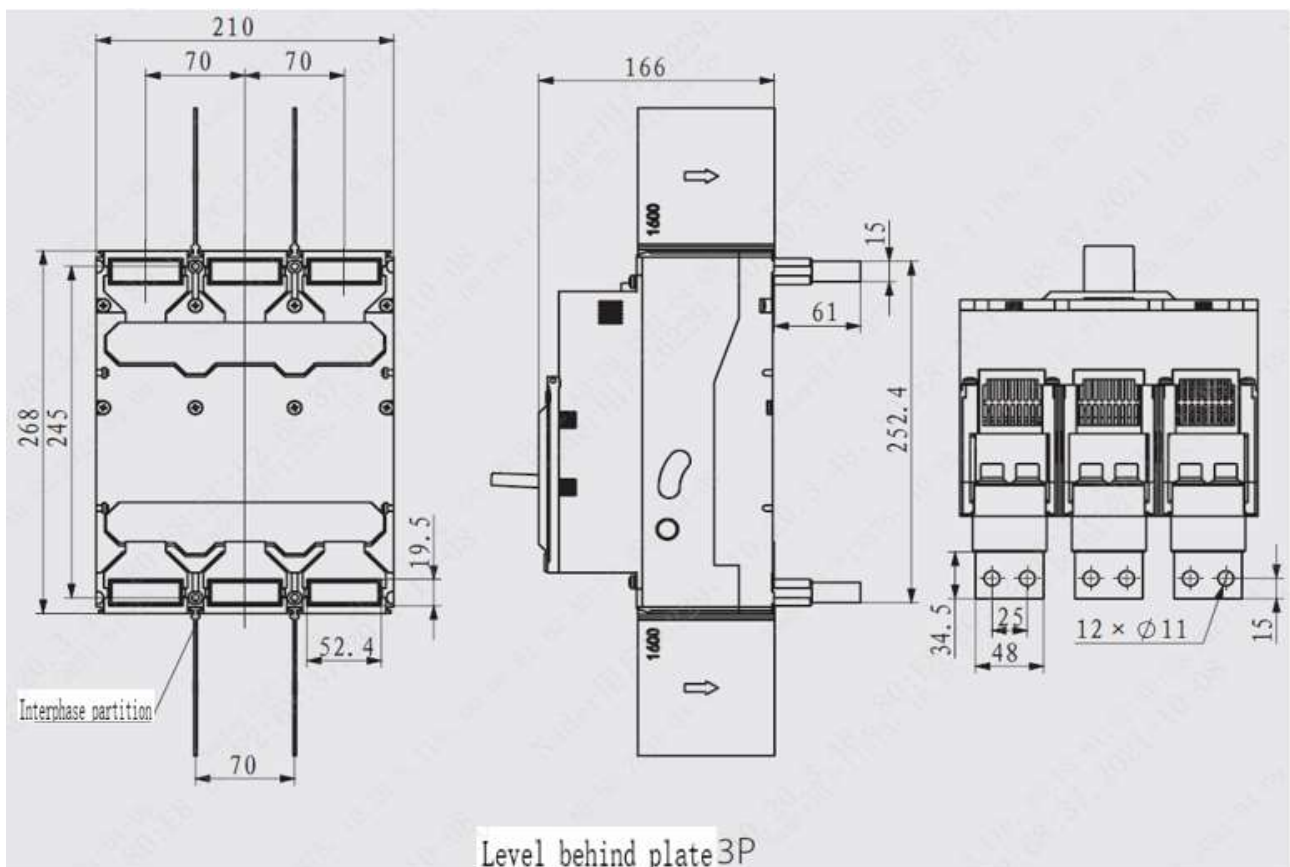
8.2 External dimensions of 3P extended front-plate connection products

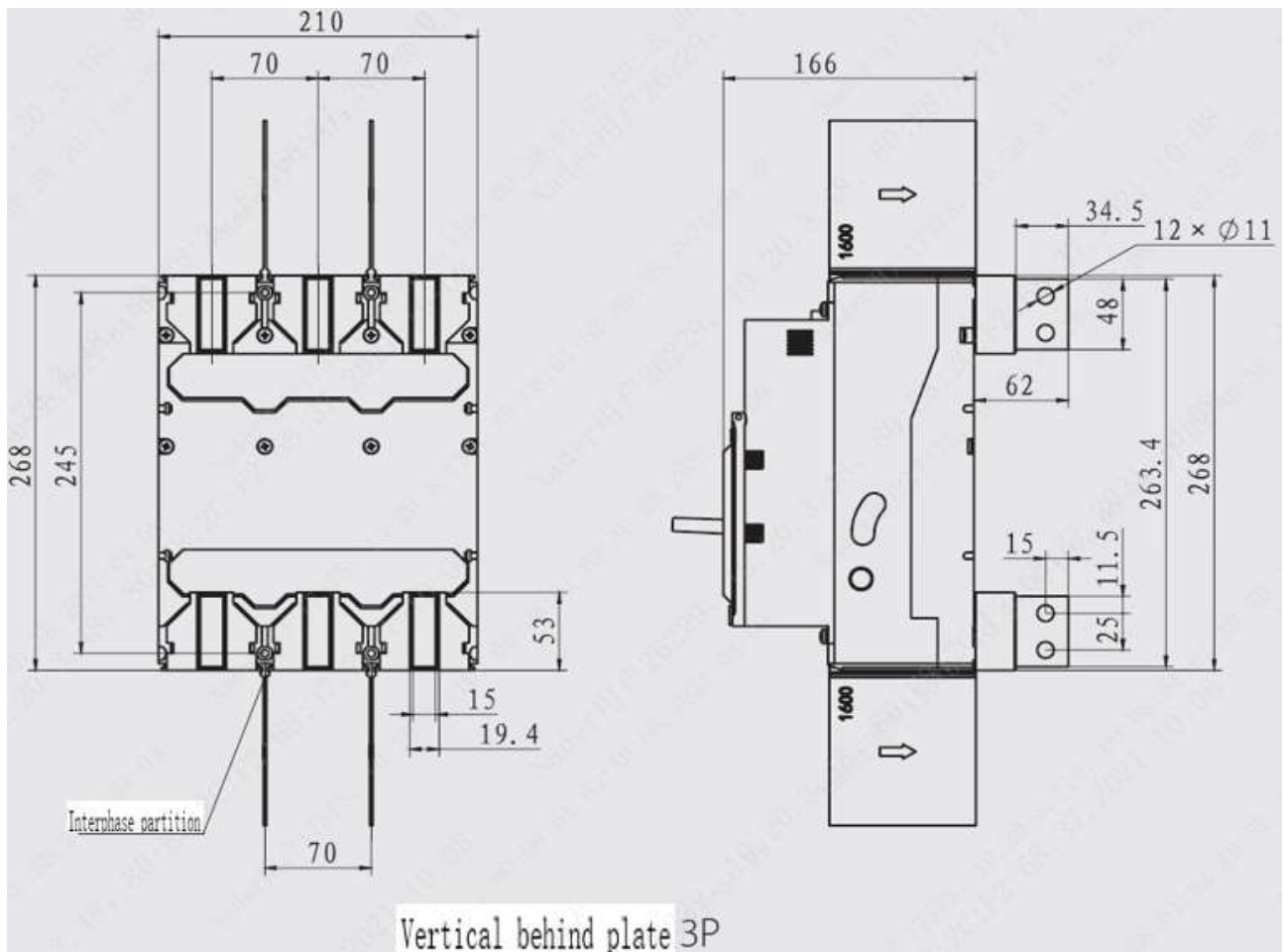


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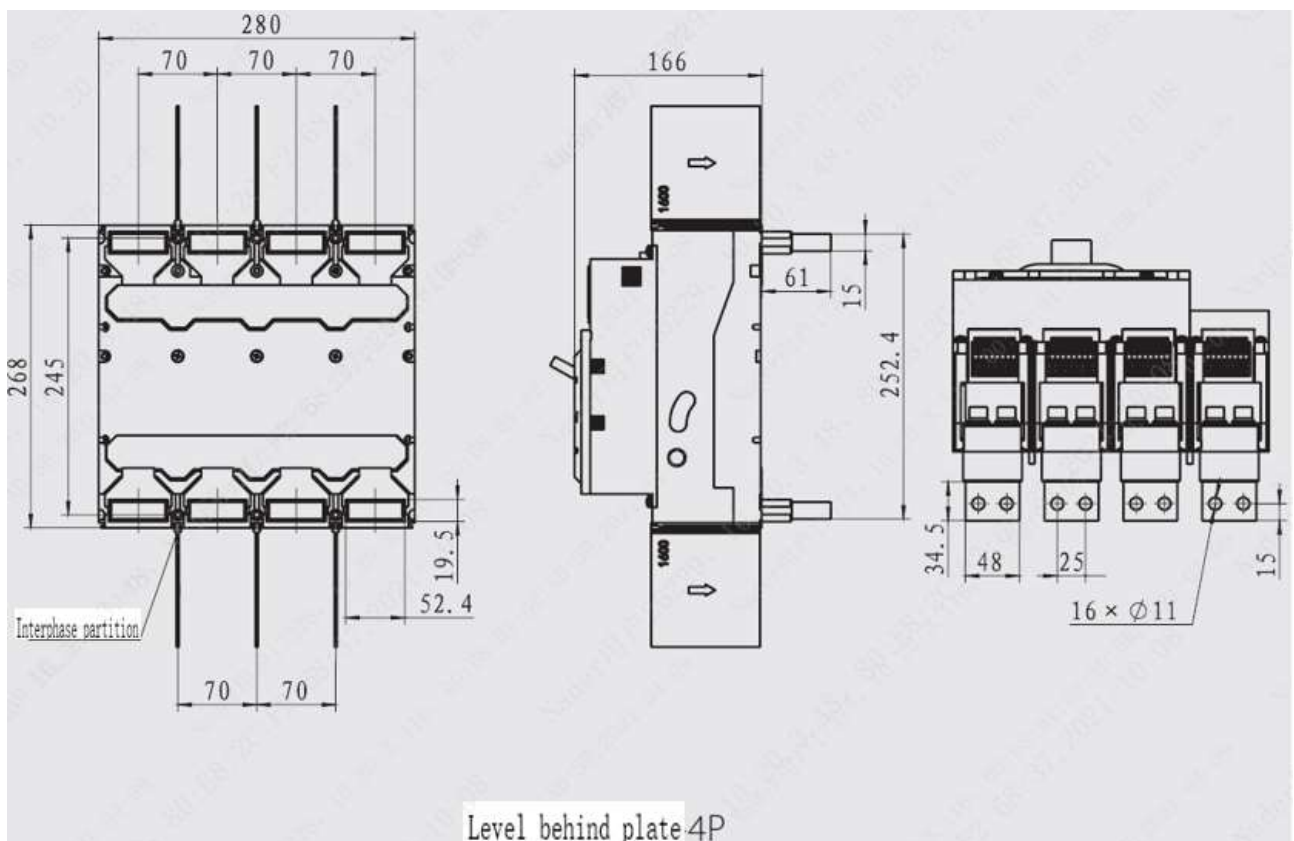


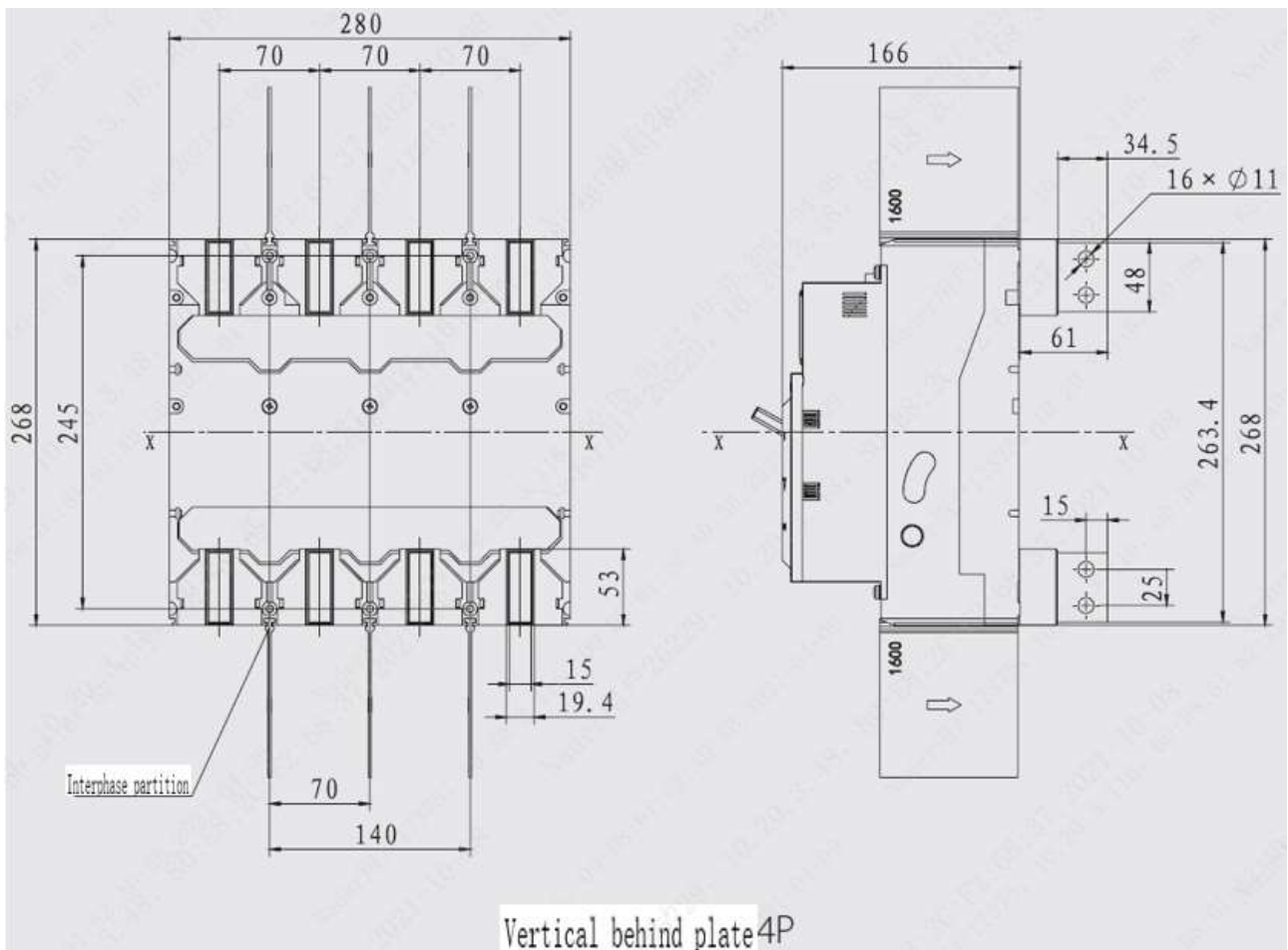
8.5 3P Rear panel wiring





8.6 4P Rear panel wiring





8.7 Product installation dimension diagram

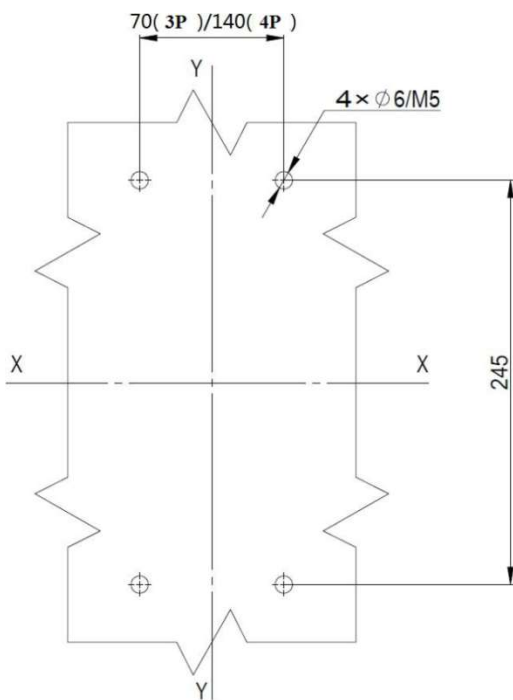


Table 24 Wiring Screw Dimensions

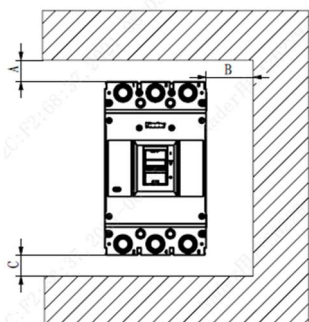
SN	Thickness of the wiring copper bar (mm)	Hexagon screw length (mm)
1	6, 8	M10X30
2	10, 12	M10X35
3	15	M10X40

Note: The hexagon screw length shall be indicated when ordering.

8.8 Safe mounting distance of circuit breaker

Table 25 Insulation Distance Mounted in the Metal Cabinet (Unit: mm)

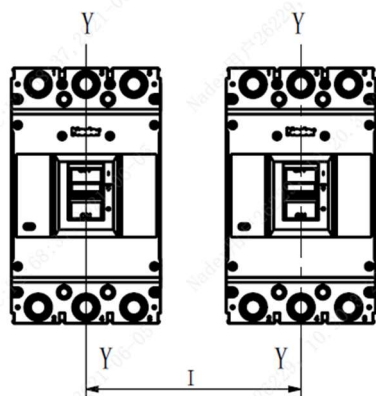
Mounting distance	A (inlet wire end to the cabinet face)		B (distance from side to the cabinet face)	C (outlet wire end to the cabinet face)
Model	With a terminal cover	Without a terminal cover		
NDM3EX-1600	25	110	35	35



8.9 Insulation distance installed in metal cabinet

Table 26 Minimum Center Distance between Rowed Circuit Breakers (Unit: mm)

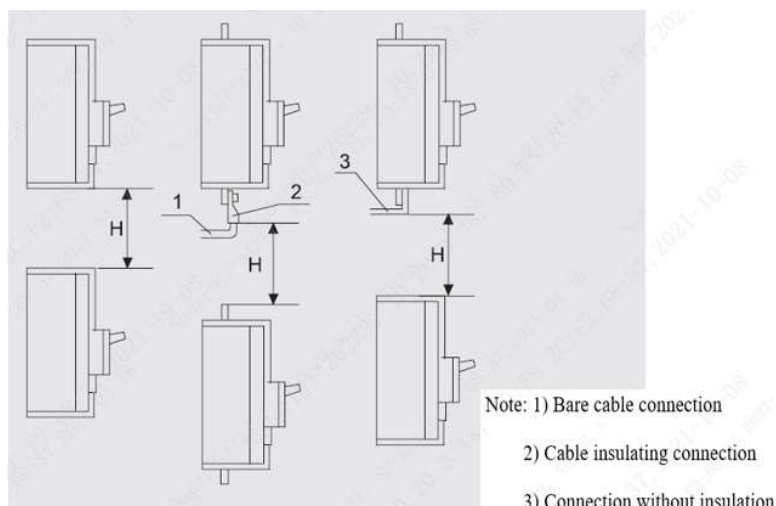
Model	Width of circuit breaker		I Center distance	
	3 poles	4 poles	3 poles	4 poles
NDM3EX-1600	210	280	250	320



8.10 Minimum center distance of circuit breaker row

Table 27 Minimum Distance between Stacked Circuit Breakers (Unit: mm)

Model	H (distance of circuit breaker from bottom)	
	With a terminal cover	Without a terminal cover
NDM3EX-1600	/	155



Note: The limit deviation not indicated with the tolerance dimensions is as per GB/T 1804-c.

9. Accessories Function Description

9.1 Under-voltage release

When the power voltage drops to the range (35%~70%) of the under-voltage release, the release can break the circuit breaker reliably; when the power voltage is 35% lower than the rated working voltage of the under-voltage release, the release can prevent closing of the circuit breaker; when the power voltage is 85% higher than the rated working voltage of the under-voltage release, the release can guarantee reliable closing of the circuit breaker.

Table 28 Voltage Specifications and Power Consumption of Undervoltage Release

Accessory name	Under-voltage release		
Voltage specifications (V)	AC/DC 110V	AC/DC 230V	AC 400V
Retention power consumption (W)	7	8	10
Instantaneous power consumption (W)	230	500	270

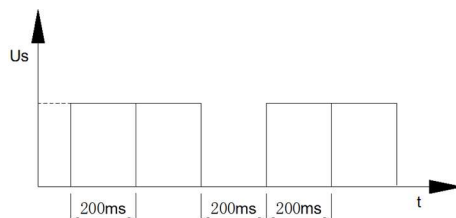
9.2 Shunt release

When the external voltage of the shunt release is between 70% and 110% of the rated control power voltage, the release can break the circuit breaker reliably.

Table 29 Voltage Specifications and Power Consumption of Shunt Release

Accessory name	Shunt release		
Voltage specifications (V)	DC 24V	AC/DC 110V	AC/DC 230V
Retention power consumption (W)	3.5	3.5	3.5
Instantaneous power consumption (W)	240	230	300

Note: Working principle of the shunt release: a single pulse action (the suggested power-on time above 200ms). If another action is required, the shunt release can only be operated after being off (the suggested interval time above 200ms), reset and energized. The time from power on of the shunt release (receiving signal) to product tripping is 100ms.



9.3 Rated parameters of the auxiliary contact

Table 30 Rated Parameters of the Auxiliary Contact

Accessory name		Auxiliary contact		
Voltage specifications (V)/conventional thermal current (Ith)		AC250V/10A, DC24V/10mA	AC400V/3A,	DC220V/0.2A,
Wiring Diagram	Off			
	On			
Internal resistance		<30mΩ		

Note: For the DC24V/10mA auxiliary contact, please indicate it when ordering.

9.4 Rated parameters of the alarm contact

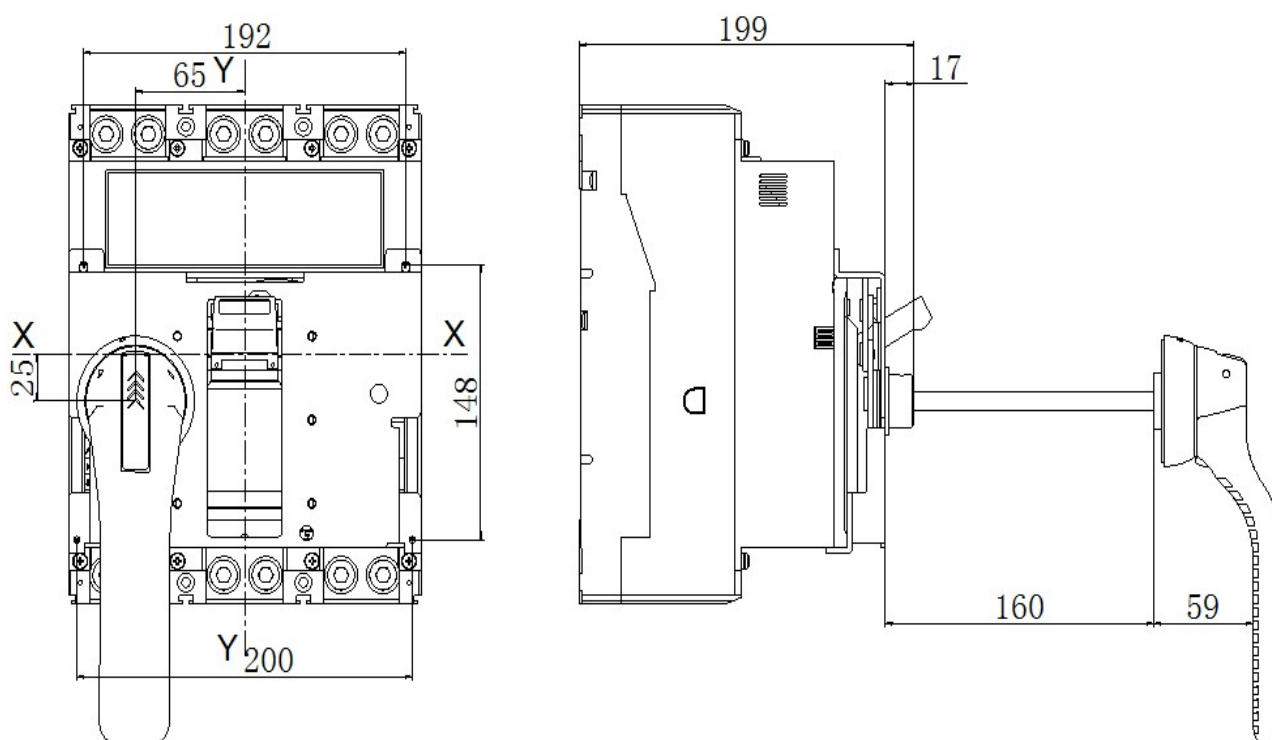
Table 31 Rated Parameters of the Alarm Contact

Accessory name		Alarm contact		
Voltage specifications (V)/conventional thermal current (Ith)		AC250V/10A, AC400V/3A, DC220V/0.2A		
Wiring diagram	On, off			
	Free tripping			
Internal resistance		<30mΩ		

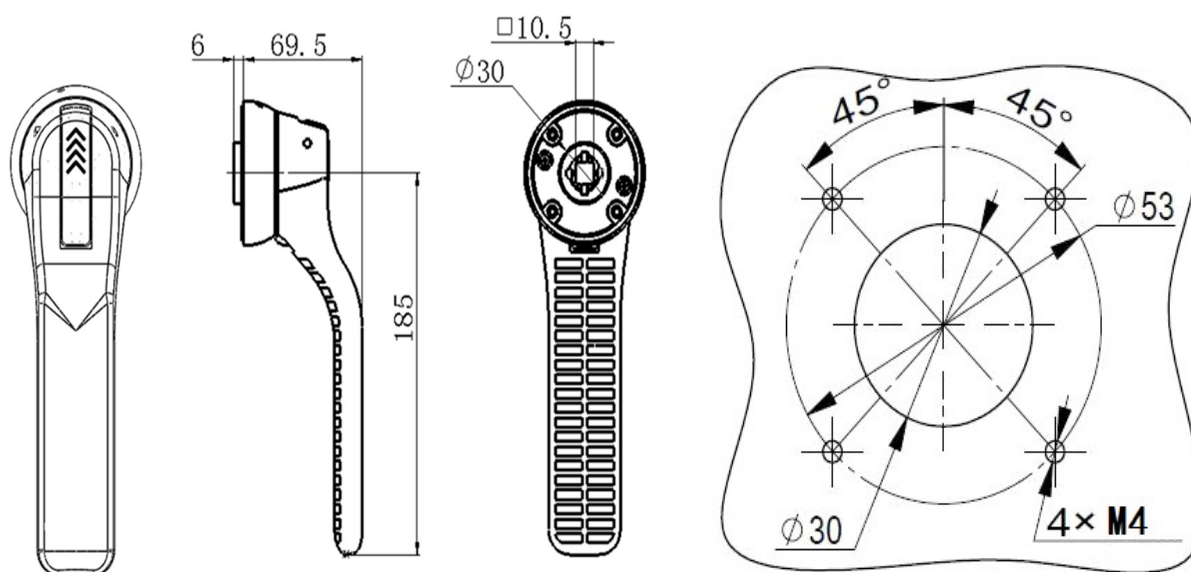
Note: The standard wire length of the undervoltage release, shunt release, auxiliary contact and alarm contact wiring is 0.7m, which can be customized according to the requirements.

9.5 Operating mechanism of the rotation handle

Manual operation—the handle mounting hole diagram and external dimension diagram of manual operation are shown as below:



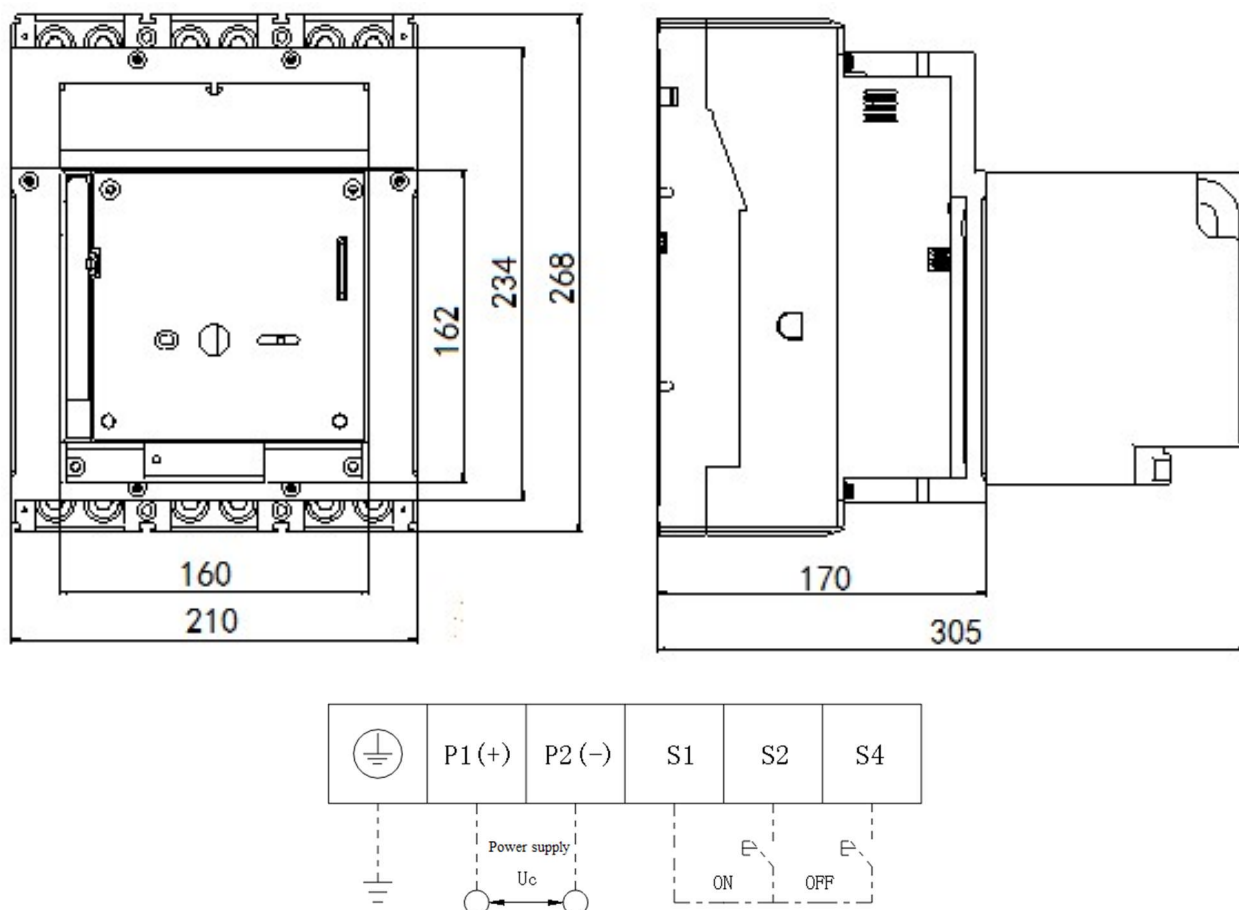
External Dimension Diagram of Manual Operation



Handle Mounting Hole Diagram

9.6 Electric operating mechanism

Electric operation-the external dimensions of the circuit breaker and its electric operating mechanism installed:



Note: For manual operation, operate it 180° in the clockwise direction while operation in the counterclockwise direction is prohibited; for electric operation connection, it is prohibited to connect P1 and P2 with S1, S2 and S4.

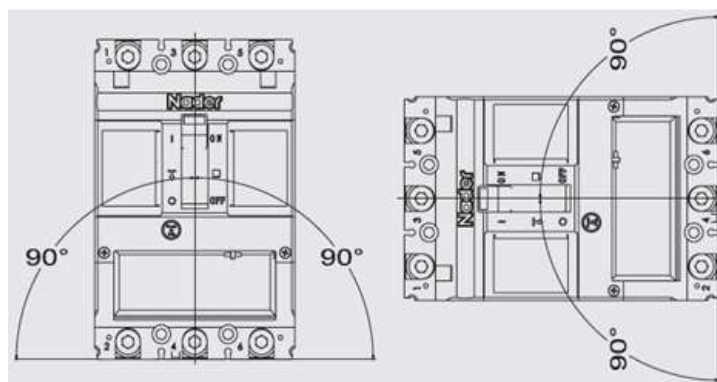
Table 32 Voltage Specifications and Power of Electric Operation

Accessory name	Electric operating mechanism			
Voltage specifications	DC24V	AC110V/DC110V	AC230V/DC220V	AC400V
Power	80W	400W	400W	400W

10. Installation Direction of Circuit Breaker

For vertical installation of the product, the gradient between the installation surface and the vertical plane is no more than $\pm 5^\circ$.

Horizontal installation of the product.



Vertical Installation

Horizontal Installation

11. Packaging and Storage of Circuit Breaker

Minimum packaging quantity: 1 piece/box. The packaged products should be stored in a warehouse with the air ventilation and the relative humidity no more than 80% when the ambient temperature is $-40^{\circ}\text{C}\sim+75^{\circ}\text{C}$. No acidic alkaline or other corrosive gas exists in the ambient air in the warehouse. Under the conditions above, the storage period shall be no more than three years since the manufacturing date.

12. List of Accessories and Installation

SN	Name	Specification	3P Quantity/Set	4P Quantity/Set
1	Cross small pan-head screw	M5×100	4	4
2	Hexagon nut	M5	4	4
3	Spring washer	5	4	4
4	Plain washer	5	4	4
5	Phase partition	——	4	6
6	Ground partition	——	2	2
7	Extended handle	——	1	1

13. Circuit Breaker Notes

- 1) Various characteristics and accessories of the circuit breaker are set in the factory. The circuit breaker, tripping unit or other accessories can only be adjusted, installed and maintained by the trained or qualified professionals according to the parameter requirements of the line design;

- 2) Ensure that the power supply is off before installing or removing any device;
- 3) The circuit breaker handle can be located in three positions, indicating three states: on, off and free tripping. When the handle is in the free tripping position, pull the handle in the off direction when the circuit breaker is connected and on.