

Shanghai Liangxin Electrical Co., Ltd.

NDM3EX-1600 Product Specification

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

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3. Specification and Model Description of Circuit Breaker

<u>ND</u> 1	<u>M</u> 2	<u>3</u> 3	<u>EX</u> - <u>1600</u> 4 5	<u> </u> 6	<u> </u> / <u> </u> / <u> </u> 7 8 9	<u> </u> 10	<u> </u> 11	<u> </u> 12	<u> </u> 13	<u> </u> <u> </u> 14 15				
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										
				HZ1: Horizontal wiring behind the board										
				CZ1: Vertical wiring behind the board										
14		Other code		CS2-A/150: Circular eccentric hole rotary handle + shaft length 150mm										
				CS2-A/200: Circular eccentric hole rotary handle + shaft length 200mm										
				CS2-A/300: Circular eccentric hole rotary handle + shaft length 300mm										
				CS2-A/350: Circular eccentric hole rotary handle + shaft length 350mm										
				CS2-A/650: Circular eccentric hole rotary handle + shaft length 650mm										
				DC1 24V:Electric operation voltage DC24V										
				DC1 110V: Electric operation voltage AC/DC110V										
				DC1 220V: Electric operation voltage AC230V/DC220V										
				DC1 380V: Electric operation voltage AC380/400/415V										
				230V: Shunt release/Under-voltage release operation voltage AC230V/DC220V										
				AC380V: Under-voltage release operation voltage										

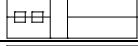
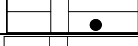
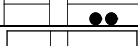
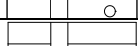
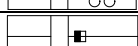
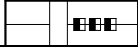
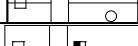
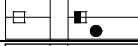
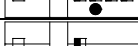
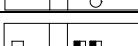
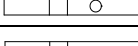
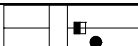
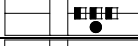
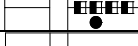
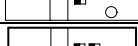
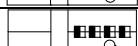
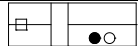
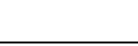
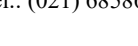
		AC380/400/415V
		110V: Shunt release /Under-voltage release operation voltage AC/DC110V
		24V: Shunt release operation voltage DC 24V
		Z: Terminal housing(only 3P)
		MS2: MS2 lock
15	Special code	Pin 35: default 800A/1000A
		Pin 40: default 1250A/1600A

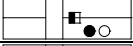
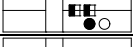
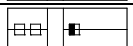
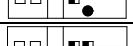
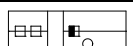
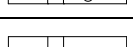
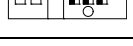
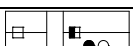
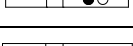
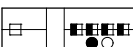
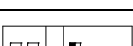
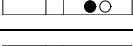
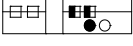
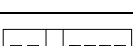
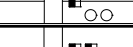
Note: The setting current is factory set to the rated current by default. If you need to set to other settings, please contact the sales person.

2: Default length of wiring screw: 800A/1000A: nail 35; 1250A/1600A: Pin 40. If you need other wiring screw lengths, please refer to Table 25;

3: The length of the wiring screw is reflected after the model, with model description characters exceeding 40, and the nail length is not reflected.

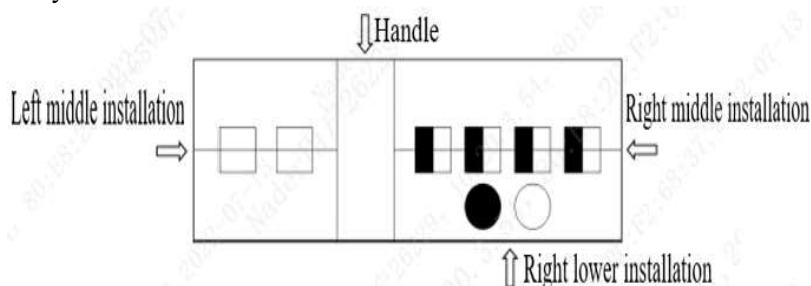
Table 1: Comparison Table of Accessory Code:

Accessory code	Accessory name	Installation
		3P、4P
00	None	—
08	Alarm contact	
98	Two sets of alarm contact	
10	Shunt release	
K01	Two sets of shunt release	
30	Under-voltage release	
A01	Two sets of under-voltage release	
21	Single auxiliary contact	
61	Two sets of single auxiliary contact	
23	Three sets of single auxiliary contact	
24	Four sets of single auxiliary contact	
18	Shunt release、alarm contact	
38	Under-voltage release、alarm contact	
22	Alarm contact、alarm contact	
88	Two sets of alarm contact、alarm contact	
26	Three sets of alarm contact、alarm contact	
25	four sets of alarm contact、alarm contact	
42	Shunt release、alarm contact、alarm contact	
44	Shunt release、two sets of single auxiliary contact、alarm contact	
46	Shunt release、three sets of single auxiliary contact、alarm contact	
14	Shunt release、four sets of single auxiliary contact、alarm contact	
75	Under-voltage release、alarm contact、alarm contact	
77	Under-voltage release、Two sets of single auxiliary contact、alarm contact	
81	Under-voltage release、three sets of single auxiliary contact、alarm contact	
82	Under-voltage release、four sets of single auxiliary contact、alarm contact	
41	Shunt release、alarm contact	
11	Shunt release、Two sets of single auxiliary contact	
12	Shunt release、three sets of single auxiliary contact	
13	Shunt release、four sets of single auxiliary contact	
71	Under-voltage release、alarm contact	
72	Under-voltage release、two sets of single auxiliary contact	
73	Under-voltage release、three sets of single auxiliary contact	
74	Under-voltage release、four sets of single auxiliary contact	
31	Under-voltage release、shunt release、alarm contact	

37	Under-voltage release、shunt release、Two sets of alarm contact	
50	Under-voltage release、shunt release	
51	Under-voltage release、shunt release、alarm contact	
52	Under-voltage release、shunt release、Two sets of single auxiliary	
53	Under-voltage release、shunt release、there sets of single auxiliary	
54	Under-voltage release、shunt release、four sets of single auxiliary	
19	Shunt release、two sets of alarm contact	
79	Shunt release、two sets of alarm contact	
63	Single auxiliary contact、two sets of alarm contact	
64	Two sets of single auxiliary contact、two sets of alarm contact	
65	There sets of single auxiliary contact、two sets of alarm contact	
66	Four sets of single auxiliary contact、two sets of alarm contact	
43	Shunt release、alarm contact、two sets of alarm contact	
45	Shunt release、two sets of alarm contact、two sets of alarm contact	
47	Shunt release、there sets of alarm contact、two sets of alarm contact	
15	Shunt release、four sets of alarm contact、two sets of alarm contact	
76	Under-voltage release、alarm contact、two sets of alarm contact	
80	Under-voltage release、two sets of alarm contact、two sets of alarm contact	
83	Under-voltage release、there sets of alarm contact、two sets of alarm contact	
84	Under-voltage release、four sets of single alarm contact、two sets of alarm contact	
32	Under-voltage release、shunt release、alarm contact、alarm contact	
33	Under-voltage release、shunt release、two sets of alarm contact、alarm contact	
34	Under-voltage release、shunt release、there sets of alarm contact、alarm contact	
35	Under-voltage release、shunt release、there sets of alarm contact、alarm contact	
39	Under-voltage release、shunt release、alarm contact、two sets of alarm contact	
55	Under-voltage release、shunt release、two sets of alarm contact、two sets of alarm contact	
56	Under-voltage release、shunt release、there sets of alarm contact、two sets of alarm contact	
36	Under-voltage release、shunt release、four sets of single alarm contact、two sets of alarm contact	
A02	Two sets of under-voltage release、alarm contact	
A07	Two sets of under-voltage release、two sets of alarm contact	
A08	Two sets of under-voltage release、there sets of alarm contact	
A09	Two sets of under-voltage release、four sets of single alarm contact	

A10	Two sets of under-voltage release、alarm contact、alarm contact	
A12	Two sets of under-voltage release、two sets of alarm contact、alarm contact	
A14	Two sets of under-voltage release、three sets of alarm contact、alarm contact	
A16	Two sets of under-voltage release、four sets of single alarm contact、alarm contact	
A11	Two sets of under-voltage release、alarm contact、two sets of alarm contact	
A13	Two sets of under-voltage release、two sets of alarm contact、Two sets of alarm contact	
A15	Two sets of under-voltage release、three sets of alarm contact、Two sets of alarm contact	
A17	Two sets of under-voltage release、four sets of single alarm contact、Two sets of alarm contact	
A05	Two sets of under-voltage release、alarm contact	
A06	Two sets of under-voltage release、two sets of alarm contact	
K04	Two sets of shunt release、alarm contact	
K06	Two sets of shunt release、two sets of alarm contact	
K07	Two sets of shunt release、three sets of alarm contact	
K08	Two sets of shunt release、four sets of single alarm contact	
K12	Two sets of shunt release、alarm contact、alarm contact	
K09	Two sets of shunt release、two sets of alarm contact、alarm contact	
K10	Two sets of shunt release、three sets of alarm contact、alarm contact	
K11	Two sets of shunt release、four sets of single alarm contact、alarm contact	
K13	Two sets of shunt release、alarm contact、Two sets of alarm contact	
K14	Two sets of shunt release、two sets of alarm contact、Two sets of alarm contact	
K15	Two sets of shunt release、three sets of alarm contact、Two sets of alarm contact	
K16	Two sets of shunt release、four sets of single alarm contact、Two sets of alarm contact	
K02	Two sets of shunt release、alarm contact	
K05	Two sets of shunt release、two sets of alarm contact	

Note: ■ Single auxiliary contact; □ Alarm contact; ● Shunt release; ○ Under-voltage release

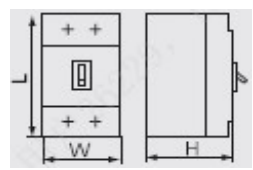


Attachment installation diagram

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		
Setting current Ir(A)			(0.4,0.5,0.6,0.7,0.8,0.9,1.0,OFF)×In		
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)	
Boundary dimension			L(mm)		268
			W(mm)		210(3P) ,280(4P)
			H(mm)		154
Flashover distance(mm)			≤100		

Note 1: The overall dimension does not include the dimension of terminal cover.

2: The setting current is factory set to the rated current by default. If you need to set to other settings, please contact the sales person.

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 specification	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							
	Temperature (°C)	40	45	50	55	60	65	70
NDM3EX-1600	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 (km)	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 current correction coefficient	690	690	620	580	550	520	500
Power frequency withstand voltage correction coefficient	3500	3500	3150	3000	2800	2650	2500
Isolation voltage correction coefficient	1000	1000	900	850	810	770	730

4.5 Power loss coefficient of circuit breaker

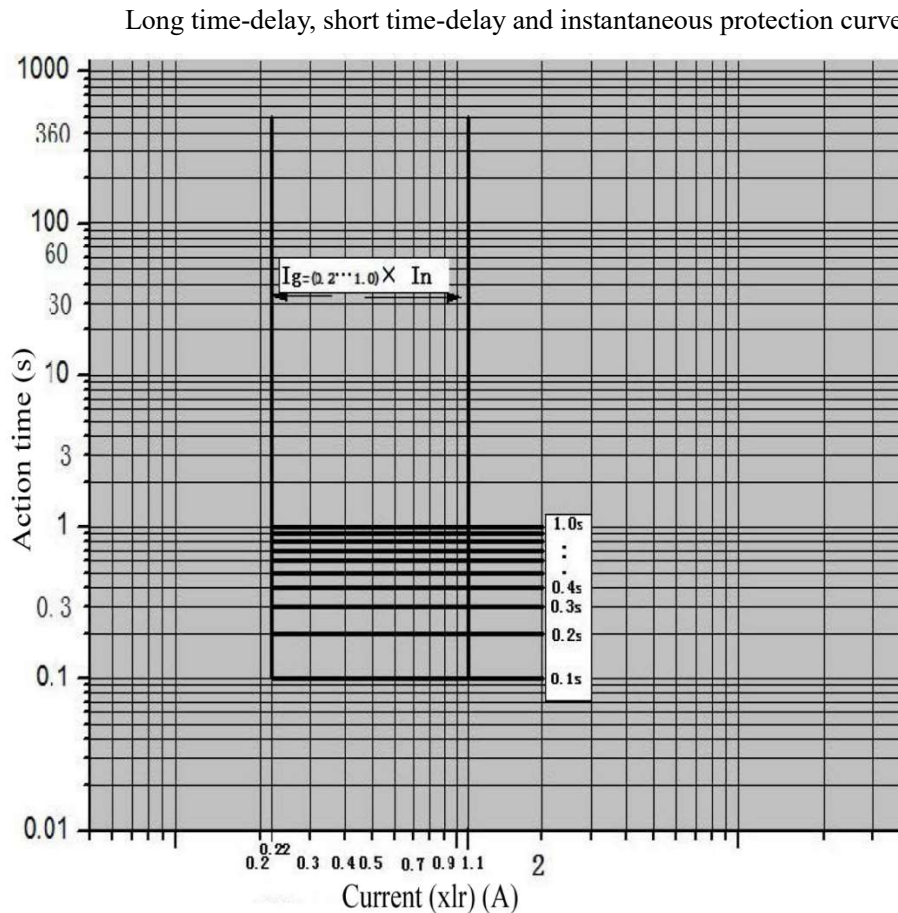
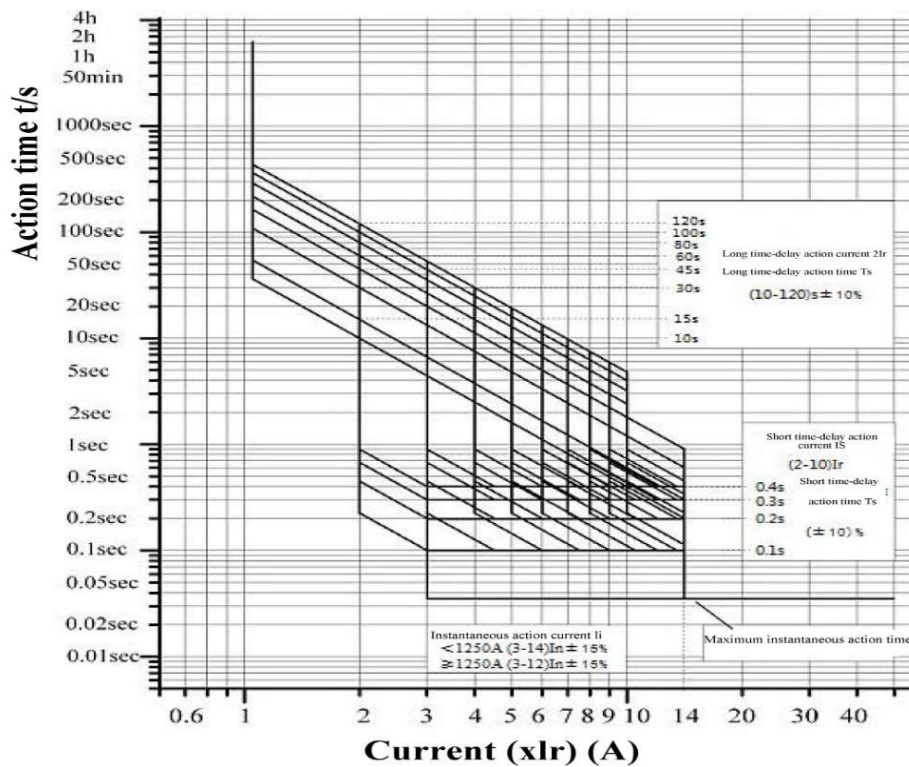
Table 8 Power loss coefficient table of circuit breaker

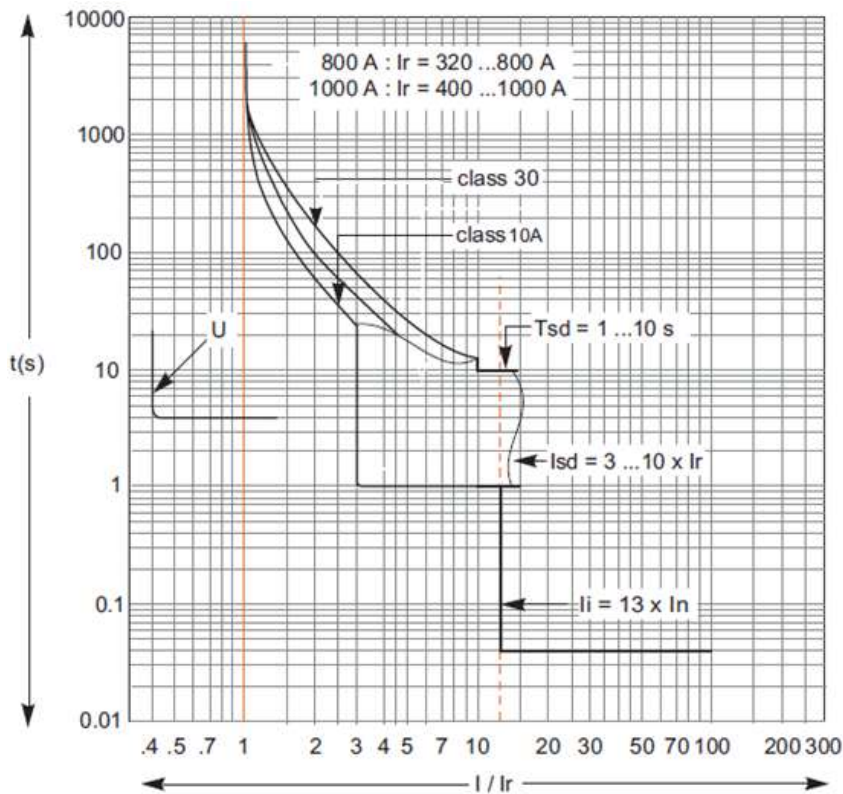
Model	Energizing current(A)	Total power loss(W)	
		Front panel wiring	Back panel connection
NDM3EX-1600	1600	153	153

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





7. Operation and Function Description of Circuit Breaker Controller

7.1 Operation and use of the controller

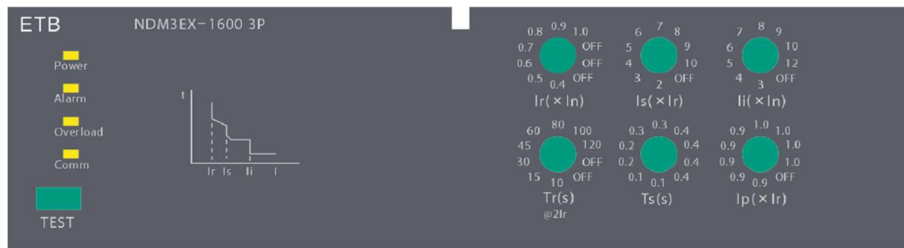
7.1.1 Control panel of the power distribution type controller

Components of the circuit breaker control panel:

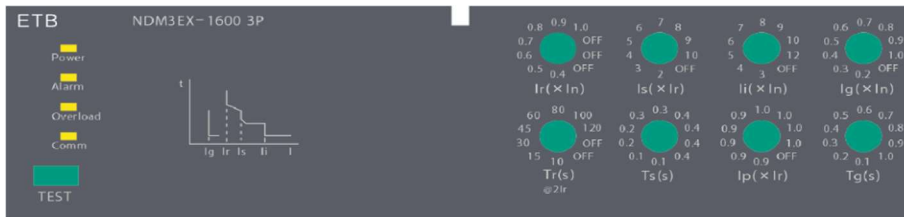
- (1) Ir long time-delay current setting value
- (2) Tr long time-delay action time
- (3) Setting value of the Is short circuit short time-delay current
- (4) Ts short circuit short time-delay action time
- (5) Setting value of the Ii short-circuit instantaneous current
- (6) Ip alarm current
- (7) Ig 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

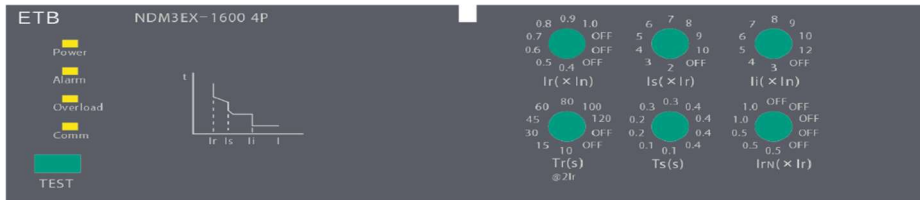
(14) Comm indicator



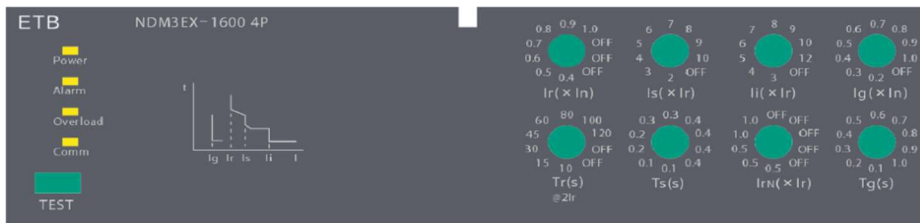
3P non-grounding type (1250A, 1600A)



3P grounding type (1250A, 1600A)



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



4P grounding type (1250A, 1600A)

Adjustment Gear Figure of Power Distribution Type Controller

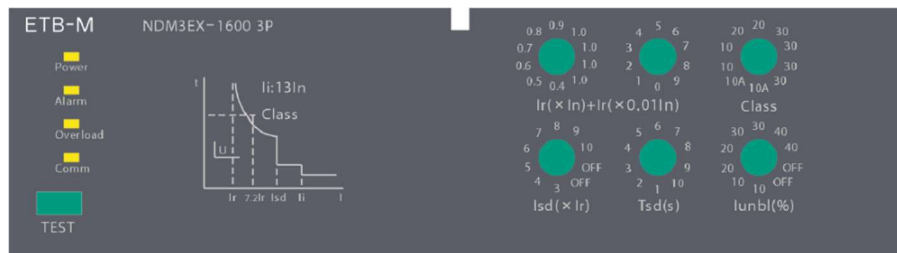
7.1.2 Motor type controller control panel

Components of the circuit breaker control panel:

- (1) I_r overload protection current setting value
- (2) Class tripping level action time
- (3) I_{sd} blocking protection current setting value
- (4) T_{sd} blocking protection action time
- (5) I_{unbl} 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: T_r is the action time of the circuit breaker when the actual current is 2 times of the I_r setting value.

For example: When I_r is set to 1.0, T_r 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 $\pm 10\%$ (Inherent error $\pm 20ms$) %.

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 $T = (2 \cdot I_r / I)^2 \cdot T_r / 2$.

(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 9

Rated current $I_n(A)$	Number of poles	Current and time parameters							
		$I_r(\times I_n)$	$T_r(s)$	$I_s(\times I_r)$	$T_s(s)$	$I_g(\times I_n)$	$T_g(s)$	$I_i(\times I_n)$	$I_p(\times I_r)$
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, OFF	0.9, 1.0, OFF

Table 10

Rated current $I_n(A)$	Number of poles	Current and time parameters							
		$I_r(\times I_n)$	$T_r(s)$	$I_s(\times I_r)$	$T_s(s)$	$I_g(\times I_n)$	$T_g(s)$	$I_i(\times I_n)$	$I_{rn}(\times I_r)$
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,OFF	0.5, 1.0, OFF

7.2.2 Parameters of motor protection controller

Table 11

Rated current $I_n(A)$	Number of poles	Current and time parameters				
		$I_r(A)$	Class	$I_{sd}(\times I_r)$	$T_{sd}(s)$	$I_{unbl}(\%)$
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 I_{sd} is in the OFF position, the blocking protection is closed;

2. When I_{unbl} 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 12

	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 13

Setting current I_r		See Table 9 and Table 10							
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	$\pm 10\%$ (Inherent error $\pm 20ms$)							

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 I_r : 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 14

Setting current I_s		See Table 9 and Table 10				
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	$\pm 10\%$ (Inherent error $\pm 20\text{ms}$)		

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

I_s : 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 15

Action characteristics	Setting current I_i ($\times I_n$)	See Table 9 and Table 10	
	Action time	$\leq 0.85I_i$	Inaction
		$\geq 1.15I_i$	$< 50\text{ms}$

(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 16

Setting current I_g		See Table 9 and Table 10										
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	$\pm 20\%$	$\pm 10\%$ (Inherent error $\pm 20\text{ms}$)								

(5) Overload pre-alarm

Table 17

Setting current Ip	See Table 9		Accuracy	Remarks
0.9Ir	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 Ir
1.0Ir	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 18

N-phase protection type	See Table 10
0.5Ir	The protective action point is half of the setting value in case of a N-phase overload fault
1.0Ir	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 Tr, and N-phase short time-delay protection time tracks the setting value of Ts.

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 19

	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 20

Setting current Ir		See Table 11			
Action features when the tripping level time has passed (inverse time limit)	Class setting value (s)	In =800A/1000A			
		4	8	16	24
	≤1.0 Ir	> 2h inaction			
	> 1.20 Ir	< 1h action			
	tr(s) at 1.5 Ir	92.2	184.3	368.6	553
	tr(s) at 6.0 Ir	5.8	11.5	23	34.6
	tr(s) at 7.2 Ir	4	8	16	24
Accuracy		±10% (Inherent error±20ms)			

Note: $L=1080\pm 3$ 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 I_r :

Overload protection action current setting value

2) See Table 10 for the setting current I_r value

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

(2) Blocking protection I_{sd}

Table 21

Setting current I_{sd}			See Table 11
Action characteristics	Fixed time limit $I > I_{sd}$	t action time (s)	See Table 11
		Accuracy	$\pm 15\%$ (Inherent error $\pm 20\text{ms}$)

Note: 1) See Table 10 for the setting current I_{sd} 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 I_{unbl}

Table 22

Setting value Iunbl(%)			See Table 11
$\delta \geq I_{unbl}(\%)$	During startup (<Class)	t action time (s)	0.7
	During normal operation ($\geq$ Class)		4
$\delta < I_{unbl}(\%)$	Inaction		

Note:

The actual current imbalance calculation is in accordance with $\delta = (|E_{\max}|) \times 100\% / I_{\text{avg}}$

$$\sum_{k=1}^3 I_k$$

—

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

δ : Percentage value of the actual current unbalance of the three-phase electricity

$E_{\max}$: Is the maximum difference between each phase current and I_{avg} I: three-phase current

I_{avg} : three-phase average current value, K is the serial number of three-phase current.

(4) Default phase protection

Table 23

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

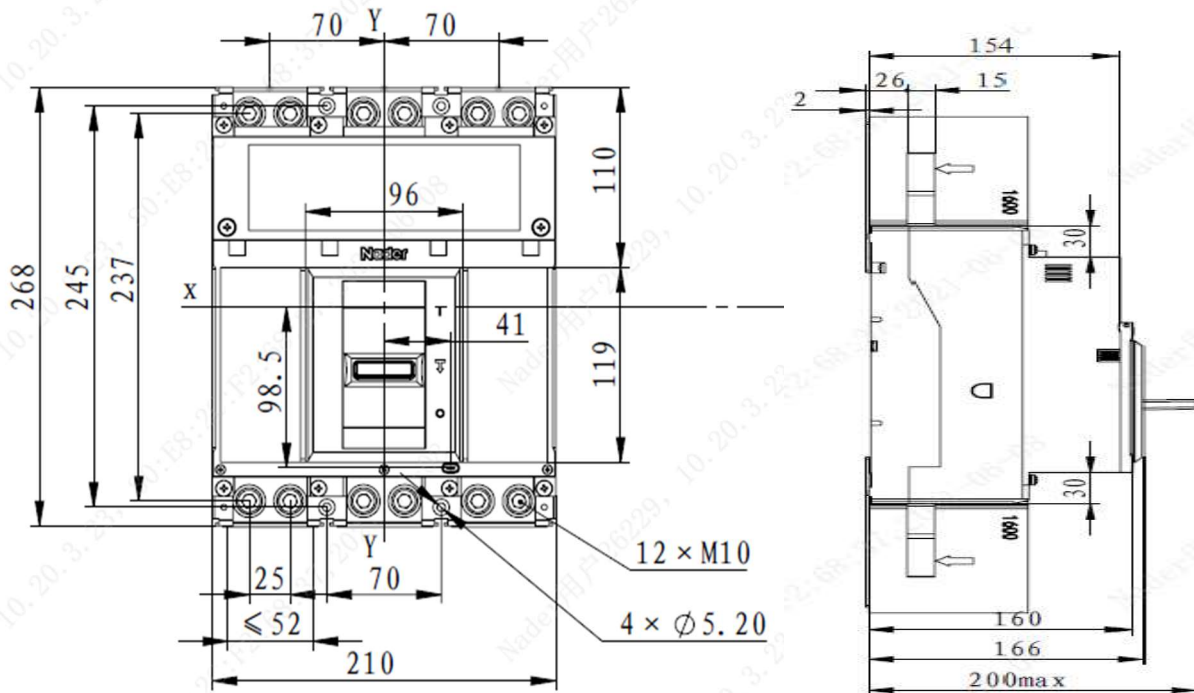
(5) Short-circuit instantaneous protection

Table 24

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

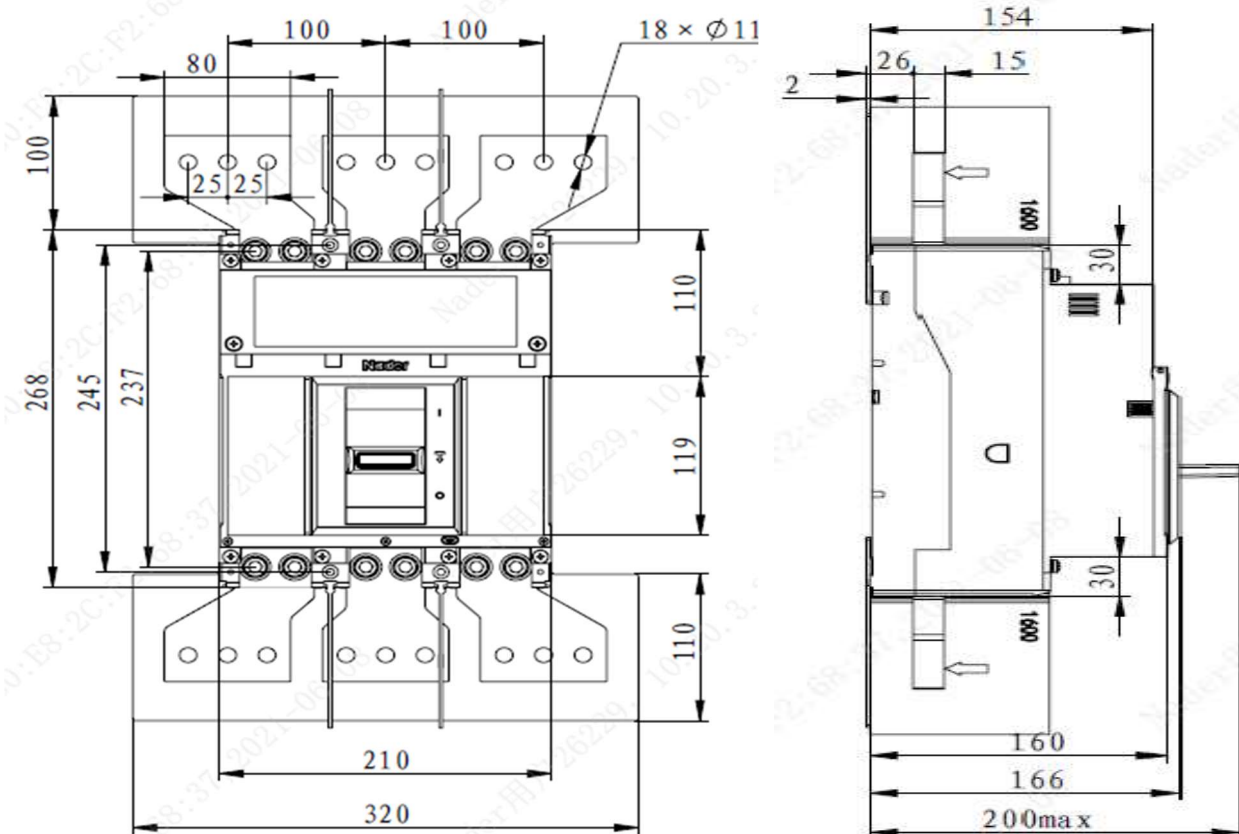
8. Outline and Mounting Hole Dimensions of Circuit Breaker

8.1 External dimensions of 3P front-plate connection products



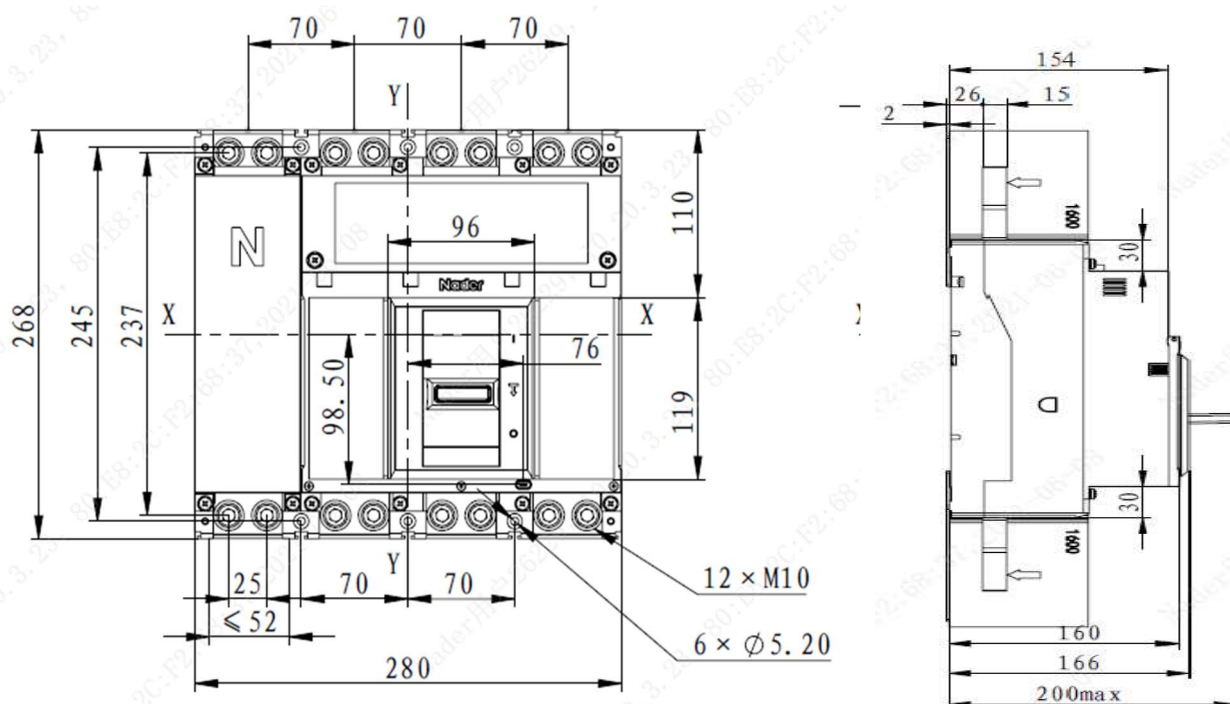
Note: the unmarked dimensional tolerance shall be in accordance with GB / T 1804-c.

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



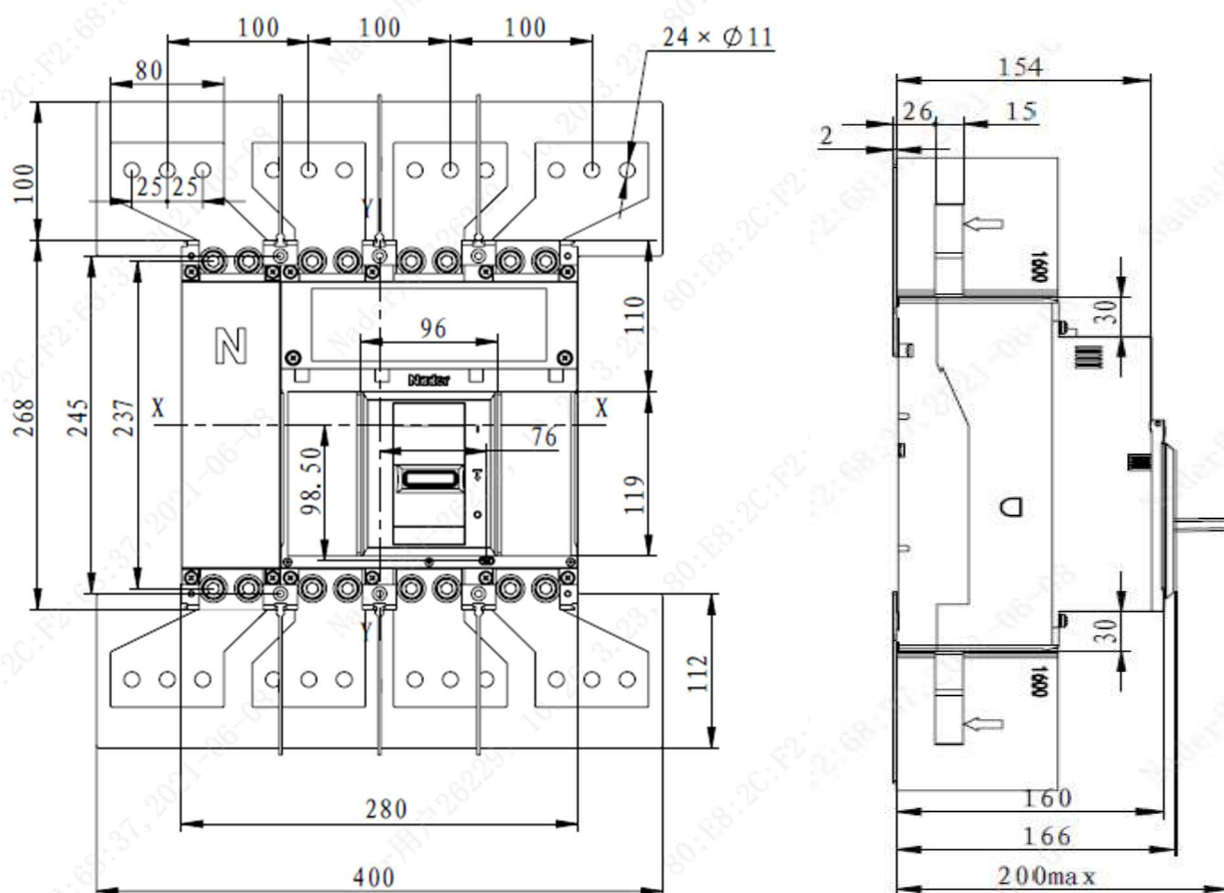
Note: the unmarked dimensional tolerance shall be in accordance with GB / T 1804-c.

8.3 External dimensions of 4P front-plate connection products



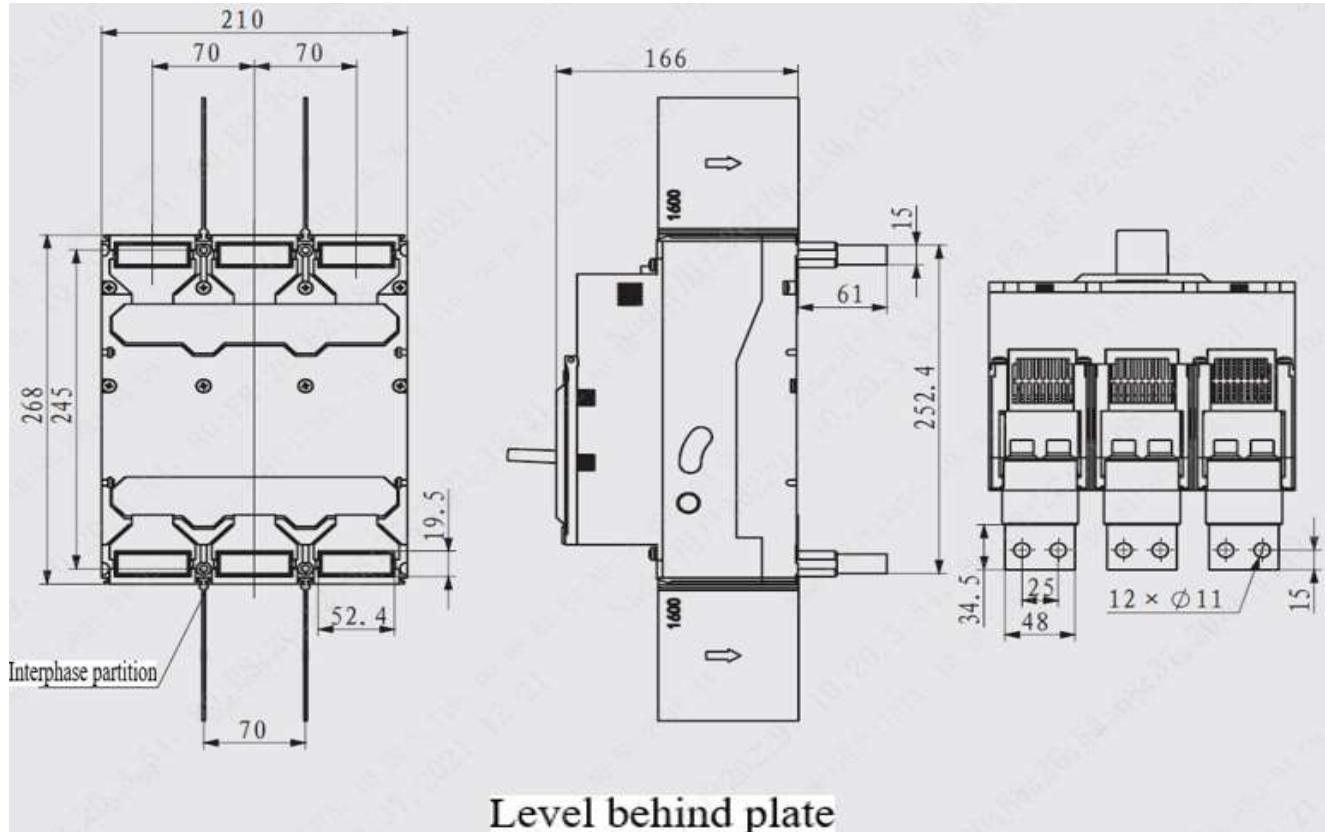
Note: the unmarked dimensional tolerance shall be in accordance with GB / T 1804-c.

8.4 External dimensions of 4P extended front-plate connection products

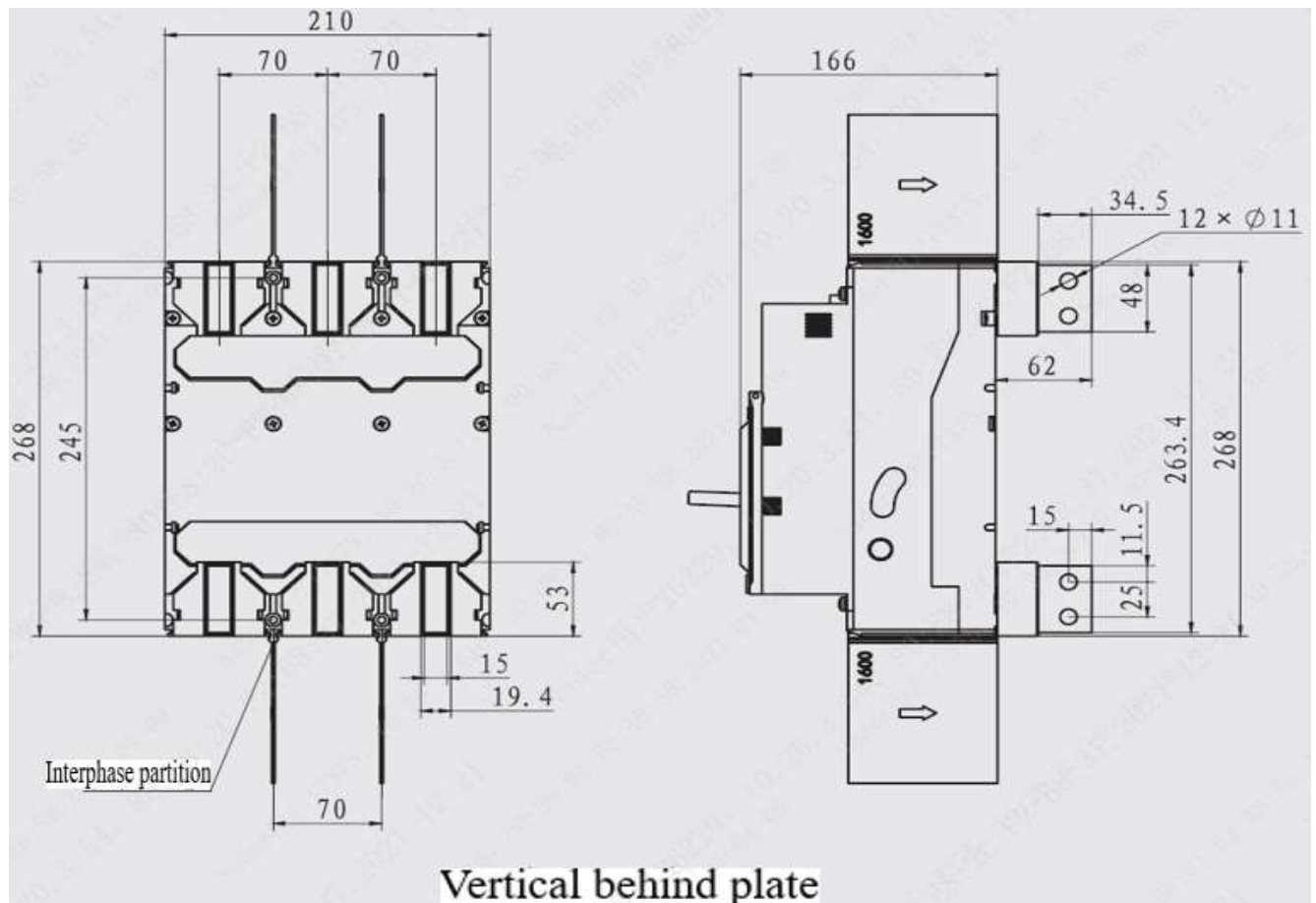


Note: the unmarked dimensional tolerance shall be in accordance with GB / T 1804-c.

8.5 Rear panel wiring

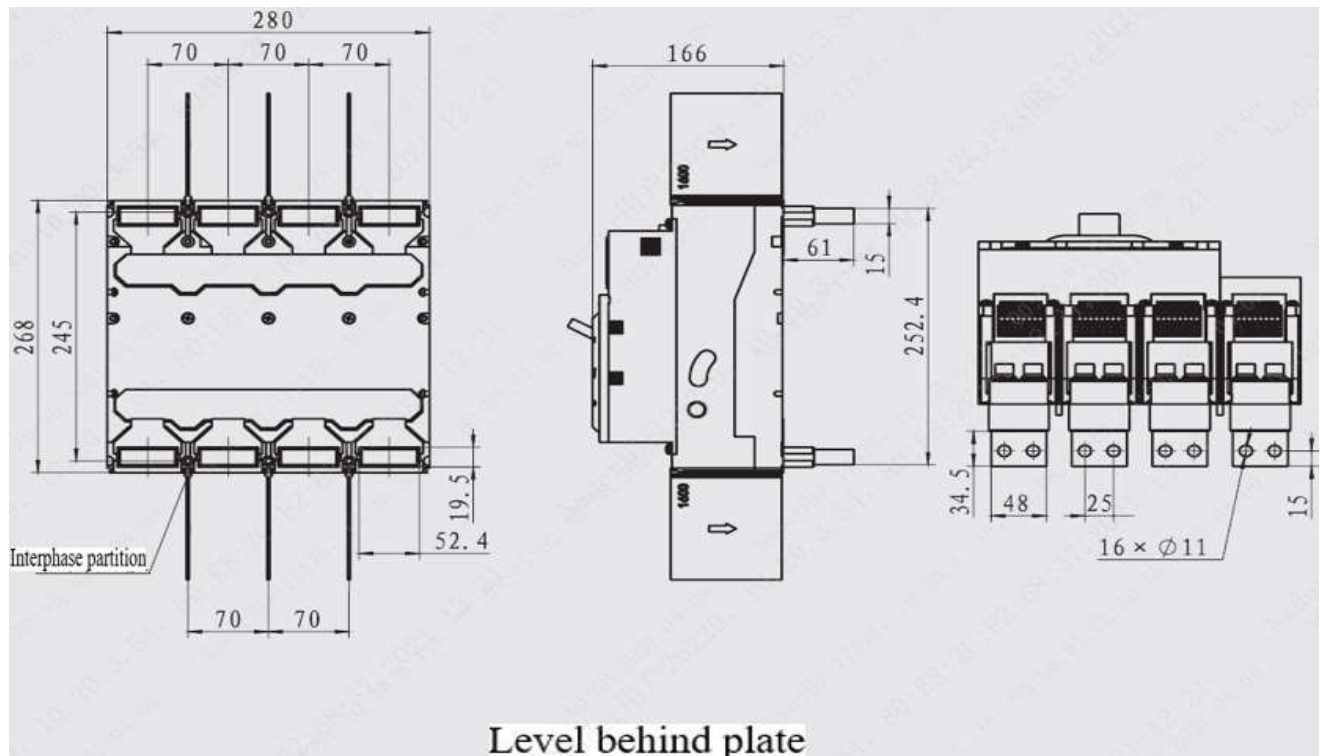


Note: the unmarked dimensional tolerance shall be in accordance with GB / T 1804-c.

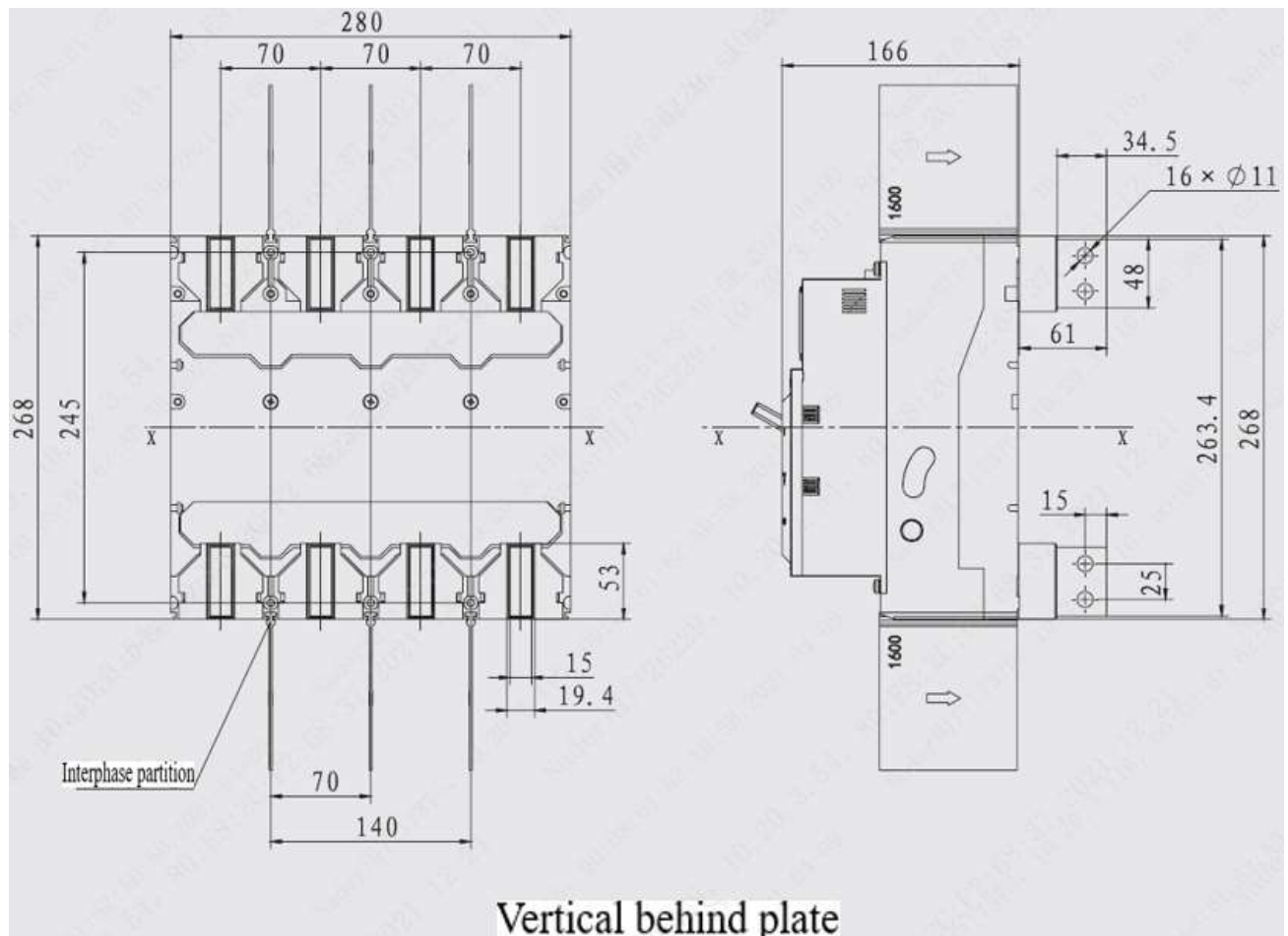


Note: the unmarked dimensional tolerance shall be in accordance with GB / T 1804-c.

8.6 Rear panel wiring

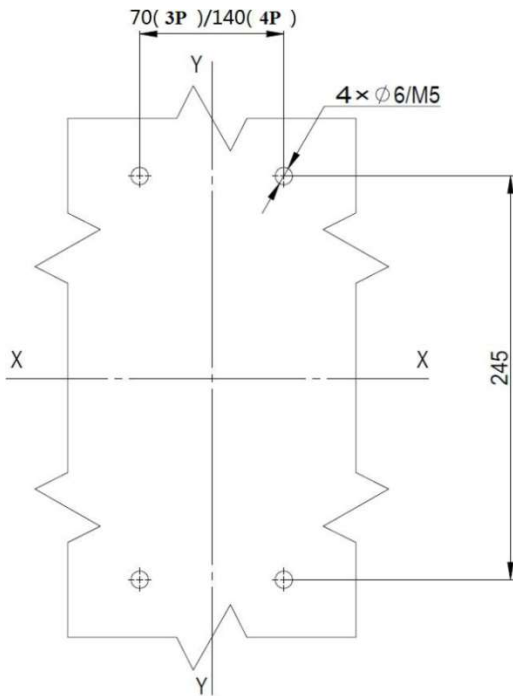


Note: the unmarked dimensional tolerance shall be in accordance with GB / T 1804-c.



Note: the unmarked dimensional tolerance shall be in accordance with GB / T 1804-c.

8.7 Product installation dimension diagram



Note: the unmarked dimensional tolerance shall be in accordance with GB / T 1804-c.

Table 25 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
4	20	M10X45

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

8.8 Safe mounting distance of circuit breaker

Table 26 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

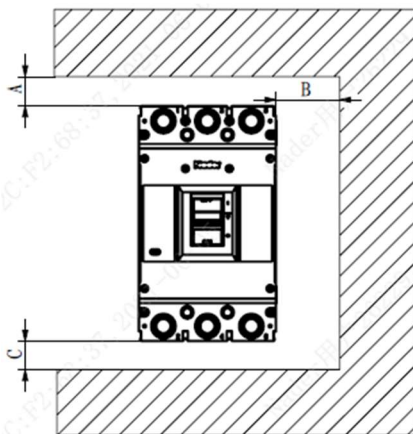


Table 27 Minimum Center Distance between Rowed Circuit Breakers (Unit: mm)

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

Note: Check the connected busbar or cable during rowing or stacking of the circuit breaker to ensure that the air insulation distance won't be reduced.

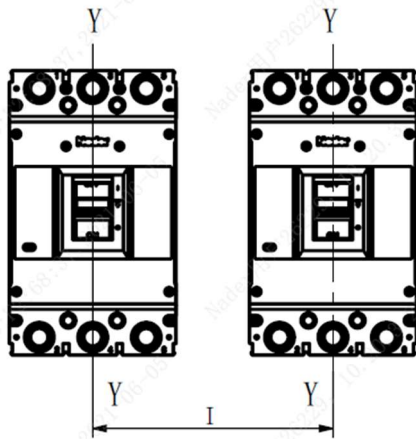


Table 28 Minimum Center Distance between Stacked Circuit Breakers (Unit: mm)

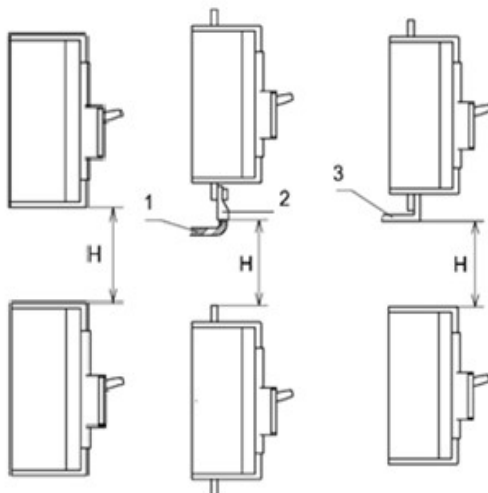
Model	H (distance of circuit breaker from bottom)	
	With a terminal cover	Without a terminal cover
NDM3EX-1600	/	155

Note: 1) Bare cable connection

2) Cable insulating connection

3) Connection without insulation

Requirements: Check whether the terminal cover or phase partition is assembled properly before products are energized.



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 29 Voltage Specifications and Power Consumption of Under-voltage 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

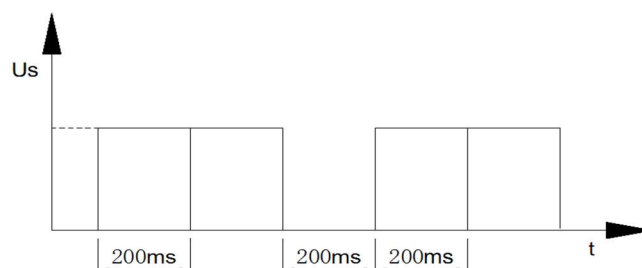
9.2 Shunt release

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 30 Voltage Specifications and Power Consumption of Shunt Release

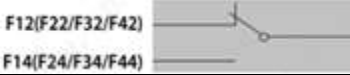
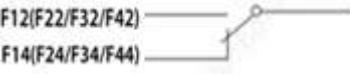
Accessory name	Shunt release		
Voltage specifications (V)	DC 24V	AC/DC 110V	AC/DC 230V
Retention power consumption (W)	3.5	3.5	3.5
Instantaneous power consumption (W)	240	230	300

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 31 Rated Parameters of the Auxiliary Contact

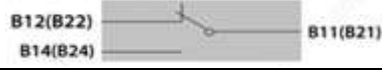
Accessory name		Auxiliary contact (conventional)	Auxiliary contact(Low power consumption)
Voltage specifications (V)/conventional (Ith)		AC250V/10A、AC400V/3A、 DC220V/0. 2A	DC30V/0. 1A
Wiring diagram	On, off		
	Free tripping		
Internal resistance		<30m Ω	<50m Ω

Note1): If need DC30V/0.1A Auxiliary contact, please explain when ordering.

2): The first auxiliary harness is identified as F11 (red), F12 (white), F14 (yellow), and the second auxiliary harness is identified as F21 (red), F22 (white), F24 (yellow), and so on. At most four groups of auxiliary harness are installed.

9.4 Rated parameters of the alarm contact

Table 32 Rated Parameters of the Alarm Contact

Accessory name		Alarm contact (conventional)	Alarm contact(Low power consumption)
Voltage specifications (V)/conventional (Ith)		AC250V/10A、AC400V/3A、 DC220V/0. 2A	DC30V/0. 1A
Wiring diagram	On, off		
	Free tripping		
Internal resistance		<30m Ω	<50m Ω

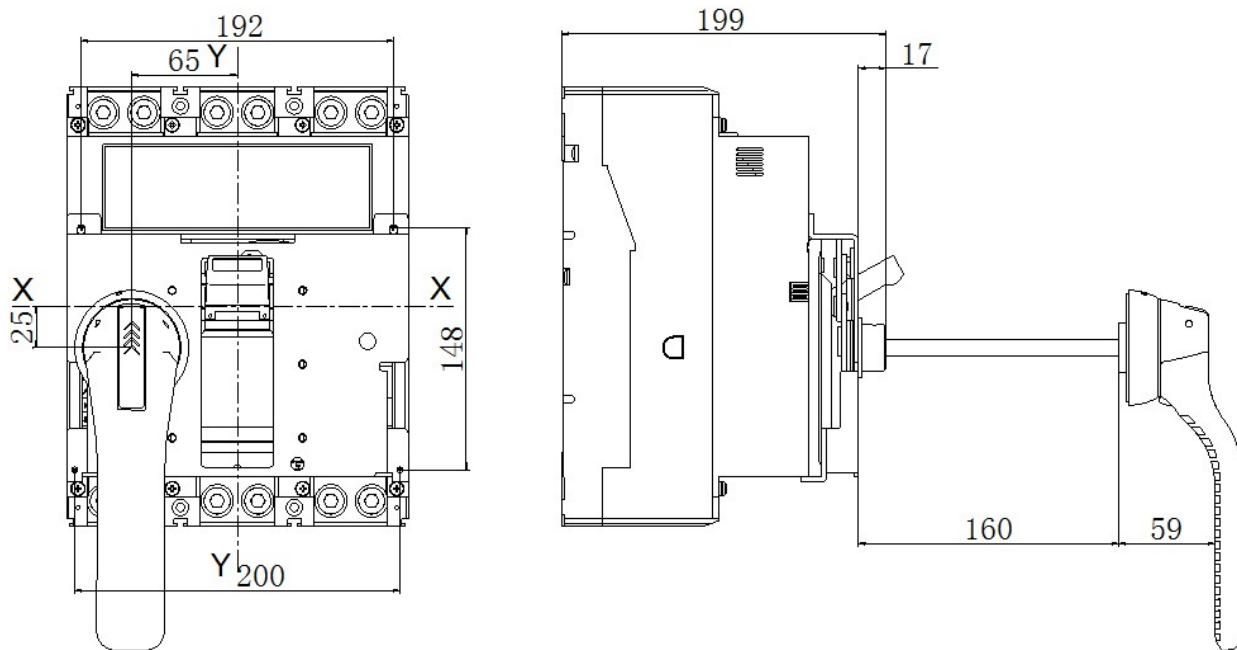
Note 1): If need DC30V/0.1A Auxiliary contact, please explain when ordering.

2) The first alarm harness is identified as B11 (red), B12 (white), B14 (yellow), and the second auxiliary harness is identified as B21 (red), B22 (white), B24 (yellow), and so on. At most two groups of alarms are installed.

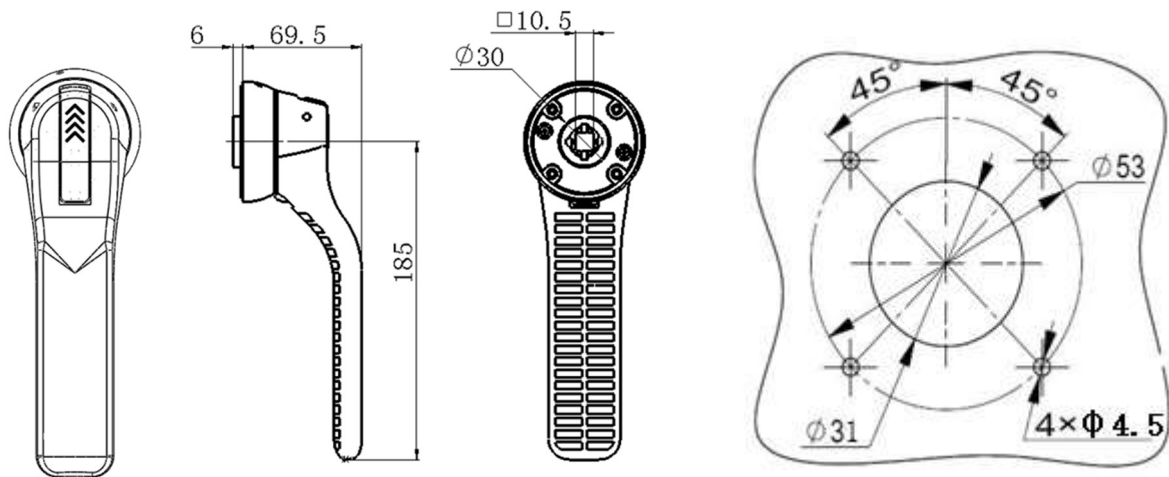
Note: The standard wire length of the under-voltage release, shunt release, auxiliary contact and alarm contact wiring is 0.7m, 1m、 2m、 4m can be customized according to the requirements.

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:



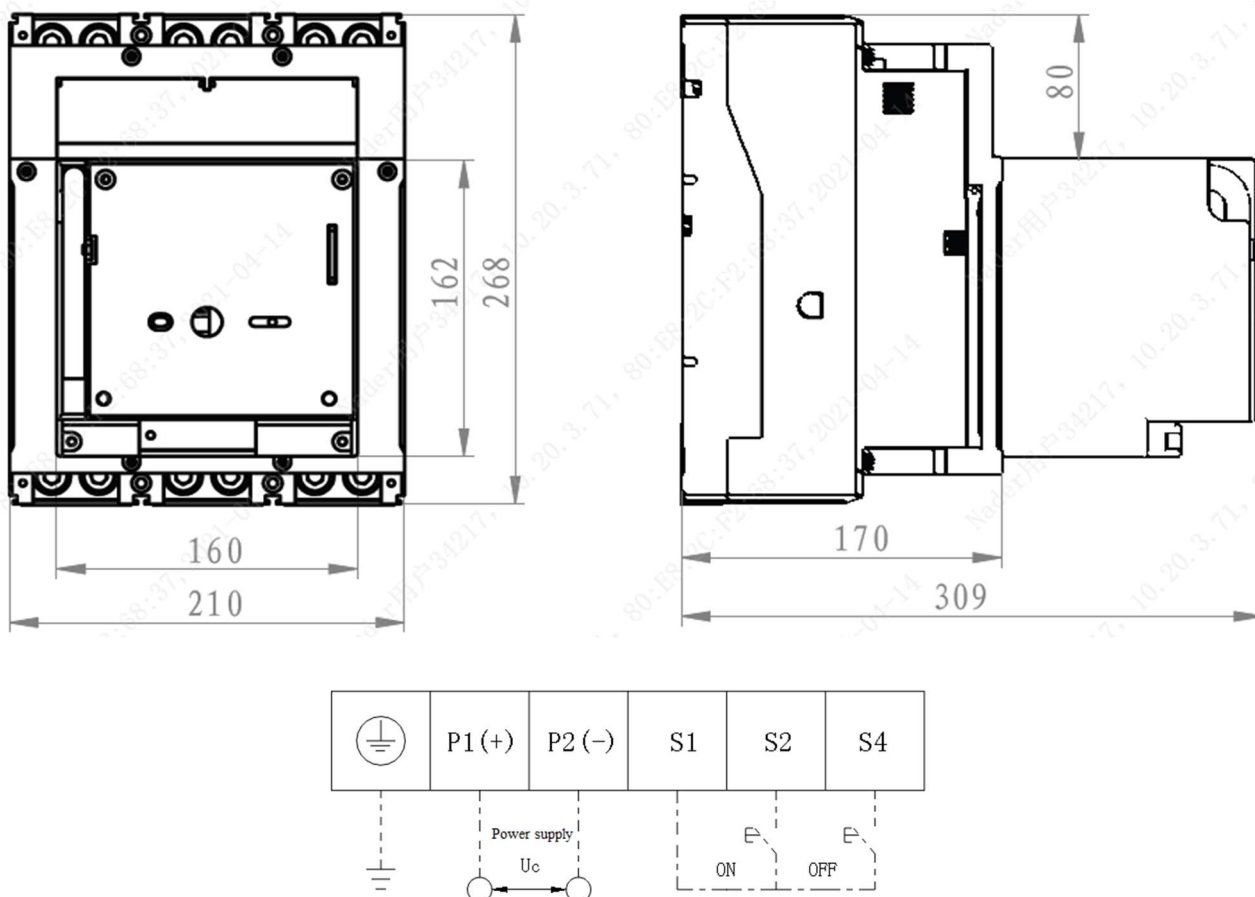
External Dimension Diagram of Manual Operation



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.

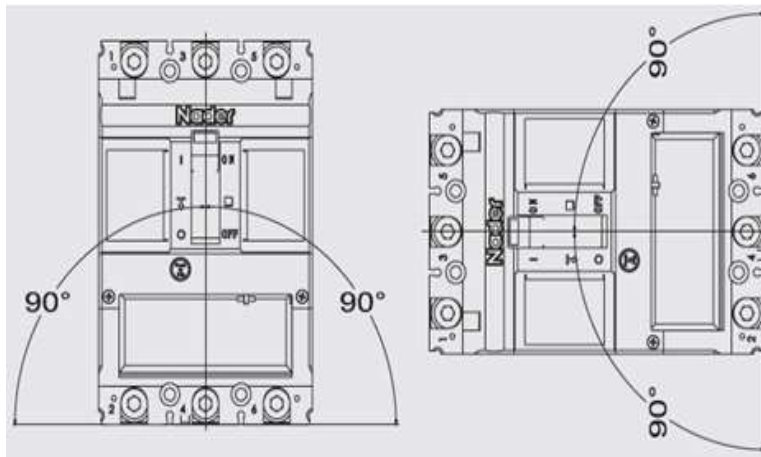
Table 33 Voltage Specifications and Power of Electric Operation

Accessory name	Electric operating mechanism			
Voltage specifications	DC24V	AC110V/DC110V	AC230V/DC220V	AC400V
Power	240W	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
8	Terminal screw*	see Table 25*	12	16

Note: Terminal screw see Table 25 Wiring Screw Dimensions.

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.

“The storage life is three years”

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