

Shanghai Liangxin Electrical Co., Ltd.

NDW2X-1600 Frame Circuit Breaker

Product Specification

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

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Revision history					
Version	Revision reason/content	Implementation date	Prepared by	Reviewed by	Approved by
0	Add	2024-8-20	Han Jiaxu	Zhao Peng	Chen Yanqin
1	Errata of some contents	2024-9-10	Han Jiaxu	Zhao Peng	Chen Yanqin
2	Version update	2024-10-15	Han Jiaxu	Zhao Peng	Chen Yanqin
3	①Certificate Number Update ②Correction of power consumption of Under-voltage release (no change in real object) ③7.1Change the wiring diagram and add the connection ready for closing	2025-04-07	Han Jiaxu	Zhao Peng	Chen Yanqin
4	1、 1.4.2 Certificate number update delete cqc voluntary certification Cause: CCC certification is now mandatory for LV components and no need for cqc 2、 Increase voltage specification below 690 V 2.1 Technical parameter table update 3、 Increase voltage specification below 690 V 2.1 Technical parameter table update 4、 Ordering Specification Update	2026-01-19	Yanglvfeng	Cai gen	Luogorui

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Product Overview

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1.1 NDW2X-1600 product picture



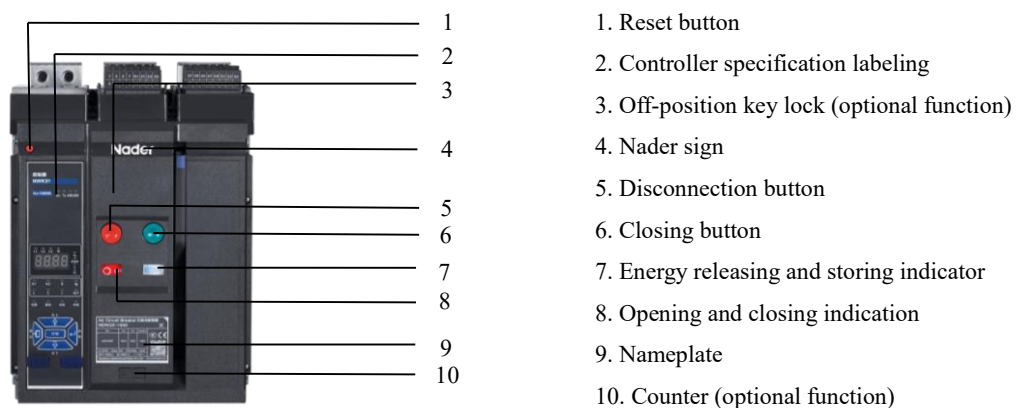
Note: The appearance of the product will change due to different selection and configuration, and the above picture is for reference only. The physical object shall prevail.

1.2 Structure design

■ Installation mode



■ Brief description of structure and indications



1.3 Product features

1.3.1 Highly efficient arc extinguishing

The arc extinguishing chamber and contact system of circuit breaker have been optimized, using the principle of air-blast arc extinguishing, optimizes the arc extinguishing gate design, increases the driving force of arc, and improves the breaking ability of the product. In addition, it also designs and optimizes the time for acquiring signal and giving command by the controller, and can greatly shorten the time when there is a large fault current.

1.3.2 High breaking capacity

The body design adopts high strength reinforced moulded plastics, and has extremely high impact strength and insulating properties. The design of the arc contact structure improves the opening distance of the product, the contact system and operating mechanism have been greatly optimized and designed, and the strength of the metal structural parts is higher, which improves the reliability and high breaking performance of the product.

1.3.3 Miniaturization

This product is installed in the front board wiring mode, by means of plastic shell wall mounting, and the product has small size, thus reducing the customer's copper bar installation size, and saving the space in the cabinet.

1.3.4 New Smarink X-Series Controllers

Wide range of controllers with enhanced functionality

- NWK31 controller: digital tube display, practical and simple functions, can be adapted to low-temperature places;
- Measurement and protection: With current, voltage, power measurement and protection functions;
- Current protection characteristics: overload long-delay protection, short-circuit short-delay protection, short-circuit instantaneous protection, current imbalance protection, MCR connectivity protection, etc.
- Maintenance functions: With fault record (30 times), historical current peak record, query of operation times, test function, and fault display function.

1.3.5 Applicable to multiple application scenarios

On the basis of satisfying the requirements of thermal-humidity type circuit breaker, it can also be used under the environment condition of plateau and low temperature till -40°C , complying with the GB/T20645 "Technical Requirements of the Plateau Low-voltage Apparatus under Special Circumstances", and has passed the standard related test.

1.3.6 Convenient wiring mode

- Upper and lower wiring of the main circuit is available
- Connection mode

Wiring mode		NDW2X-1600
Conventional	■ Front board wiring	√

1.3.7 Multiple safety protection devices

Optional guards, such as disconnect position locks and push-button locks, are available.

1.4 Conforming standards and certification

1.4.1 Criteria met

GB/T 14048.1-2023 Low-voltage Switchgear and Control Equipment - Part 1: General Rules (IEC 60947-1:2020, MOD)

GB/T 14048.2-2020 Low-voltage Switchgear and Control Equipment - Part 2: Low-voltage Circuit Breaker (IEC 60947-2:2019, IDT)

GB14048.5-2017 Low-voltage Switchgear and Control Equipment - Part 5-1: Control Circuit Electrical Appliances and Switch Elements - Electromechanical Control Circuit Electrical Appliances (IEC 60947-5-1:2016, MOD)

GB/T 2423.4-2008 Environmental Testing for Electric and Electronic Products - Part 2: Test Method - Test Db: Alternating Thermal Humidity (12h + 12h Cycle)

GB/T 2423.18-2008 Environmental Testing for Electric and Electronic Products - Part 2: Test Method - Test Db: Alternating Thermal-humidity Salt Spray Test Method

GB/T 2900.18-2008 Electrical Terminology-- Low Voltage Appliances

GB/T 4207-2022 Methods for the Determination of the Proof and the Comparative Tracking Indices of Solid Insulating Materials

GB/T 14092.3-2009 Environmental Condition for Machinery Products - High Altitude

GB/T 19608.3-2004 Classification of Special Environmental Condition- Part 3: Plateau

GB/T 20645-2006 Specific Environmental Condition - Technical Requirements of Low-voltage Apparatuses for Plateau

GB/T 20626.3-2022 Specific Environmental Condition - Electric and Electronic Products for Plateau - Part 3: Protection Requirement of Thunder and Lightning, Pollution, Condensation

1.4.2 Certification of conformity

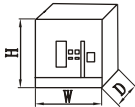
Standard name	Certificate number
China CCC Certification	2024010307627899
European Union CE marking	AN 50690267 0001
Germany TUV certification	R50646230 0001-0003

Technical Characteristics

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2.1 NDW2X-1600 technical parameter list

Circuit breaker model		NDW2X-1600	NDW2X-1600H	NDW2X-1600HU	NDW2X-1600Y ^{注1}
Rated current I_n (+40°C) (A)		200、400、630、800、1000、1250、1600			
Rated operating voltage U_e (V)		AC220V/230V/240V/380V/400V/ 415V/600V/630V/645V/660V/690 V/760V/		AC800V/1000V/ 1140V/	AC220V/230V/ 240V/380V/400V/ 415V/600V/630V/ 645V/660V/690V/ 760V/800V/1000V/ 1140V/
Rated frequency f (Hz)		50/60			
Rated insulation voltage U_i (V)		1250			
Rated impulse withstand voltage U_{imp} (kV)		12			
Number of poles pole		3			
Closing time ^{Note 2} (ms)		≤85			
Separating time 1 ^{Note 3} (ms)		≤85 (conventional shunt) / ≤160 (holding shunt)			
Separating time 2 ^{Note 4} (ms)		≤350			
Reclosing time ^{Note 5} (ms)		≥500			
Full break time ^{Note 6} (ms)		≤50			
Rated limit short-circuit breaking capacity I_{cu} (effective value) (kA)	AC645V and below	57.6	60		/
	AC660V/690V	55			/
	AC760V	35	35		/
	AC800V/1000V/1140V			30	/
Rated operating short-circuit breaking capacity I_{cs} (effective value) (kA)	AC690V and below	40	50		/
	AC760V	35	35		/
	AC800V/1000V/1140V			30	/
Rated short-circuit switching capacity I_{cm} (peak) (kA)	AC645V and below	126.7	132		/
	AC660V/690V	121			/
	AC760V	73.5	73.5		/
	AC800V/1000V/1140V			63	/
Rated Limiting Short Circuit Current I_{cc} (kA)	AC690V and below	/	/		40
	AC760V	/	/		35
	AC800V/1000V/1140V	/	/	/	30
Rated short time withstand current I_{cw} (effective value) 1s (kA)	AC690V and below	40	40		/
	AC760V	35	35		/
	AC800V/1000V/1140V			30	/

Operating performance	Electrical life (times)	AC690V and below	3000		3000
	Operation frequency (20 times/hour) (25±5℃)	AC760V	500		500
		AC800V/1000V/1140V		500	500
	Mechanical life (times)		11000 ^{注7}		
Contact resistance ^{Note 8}		New product	≤30μΩ		
Installation mode		Fixed type			
Wiring method of the main circuit		Front-plate connection			
External dimensions: W×D×H (mm) 		218×220×320			
Weight (kg)		20			

Notes: 1. NDW2X-1600Y: CBI-Y circuit breaker without overcurrent protection requirement;

2. Closing time: The closing (or connecting) time is the time interval from the moment when the closing electromagnet is energized to the moment when all poles' contacts are in contact;

3. Separating time 1: The separating (or disconnecting) time is the time interval from the moment the shunt release is energized to the moment when all poles' arcing contacts are separated;

4. Separating time 2: The separating (or disconnecting) time is the time interval from the moment for loss of energy of the undervoltage release to the moment when all poles' arcing contacts are separated;

5. Reclosing time: The time interval from when the circuit breaker receives a tripping command to the moment when it receives a closing command again;

6. Make-break time: Interval from the beginning of the circuit breaker disconnection to the end of the arcing time;

7. Mechanical life: the mechanical life verification 200 times at low temperature -40 °C + the mechanical life 200 times in the high temperature environment +70 °C + verification for 9600 times in room temperature environment;

8. Contact resistance: Contact resistance is the additional resistance that occurs when fixed and moving contacts come into contact with each other. Hua Yi Electric's HLY-200A loop resistance tester is used as the test equipment. Please refer to "HLY-200A Loop Resistance Tester User Manual" for the testing method.

9. Unless otherwise noted in the above table, all parameters are measured in the laboratory environment (room temperature 25±5°C, humidity controlled at: 30%-70%RH, dust-free, pollution-free, impact-free and vibration-free conditions)

Smarink X Controller

3

Smarink X Controller is a new circuit breaker control unit developed by my company, and one of the main components of the circuit breaker, which can provide the function of protection against overload, short circuit, grounding, current unbalance and other failures. It also has the function of measuring the current, voltage and other power grid parameters; and the function of recording the fault, alarm, operation and other operating maintenance parameters. When the power network is carrying on communication network, the controller can realize the remote sensing, remote communication, remote control and remote regulating at the remote terminal of the electric power automation network.

3.1 Types of Smarink X Controller

Model	NWK31
Controller pictures	 The image shows the front panel of the Smarink X Controller (NWK31). At the top, it says 'Control Trip Unit NWK31'. Below that, 'In=1600A' is displayed. To the right of this, there are four status indicators: 'Rx', 'Tx', 'Fault', and 'Alarm'. In the center, there is a large LCD screen showing 'L1 L2 L3 N' and '0.000'. To the right of the screen, there are units for '%', 'A/kA', 's', and 'Pt'. Below the screen, there are four buttons labeled 'Ic1', 'Ic2', 'δ', and 'Ig'. Under these buttons are labels 'L', 'S', 'I', and 'N/T'. Below the buttons are four function buttons: 'Setting', 'Query', 'Test', and 'Save'. At the bottom, there is a navigation pad with 'Up' and 'Down' arrows, a 'Function' button in the center, and 'Esc' and 'Enter' buttons on the sides. Two yellow buttons are at the very bottom.

3.2 Functions of Smarink X Controller

Functional items			NWK31
Display interface		Digital tube numbers and symbols display	√
Protection function	Current protection	Overload long-time delay protection	√
		Overload thermal memory	√
		Overload pre-alarm	√
		Short circuit short-time delay protection	√
		Short-time delay thermal memory	√
		Short circuit instantaneous protection	√
		Ground protection	√
		Grounding alarm	√
		Neutral wire protection	√
		Current unbalance protection	√
		MCR	√
		HSISC	√
Measuring function	Current	Current measurement (phase pole, N-pole, grounding)	√
		Current heat capacity	√
Data management and diagnostics	Data management	Fault record (30 times) and query	√
		Query of number of operations	√
		LED fault status indication	√
		Controller fault trip signal output	√
		Self-diagnosis	√

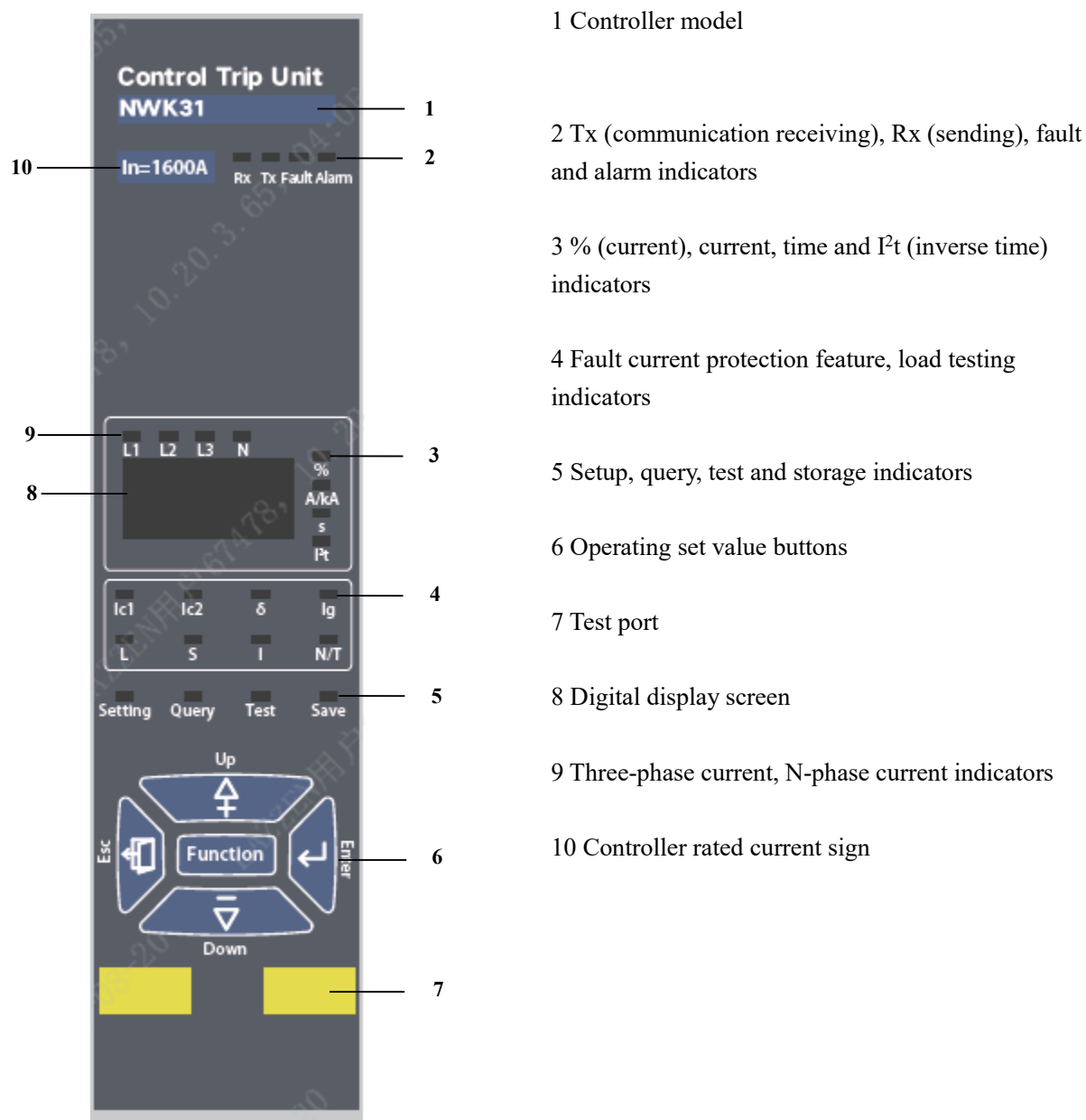
Note: "√" means that this function is available

3.3 Layout of Smarink X Controller

■ NWK31 Controller

Layout display of NWK31 Controller

Figure 1



3.4 Setting values and protective features of controller

Setting values and protective features of controller:

Overload long-time delay protection													
Current setting value Ir		(0.4~1.0 or 1.25 ^{Note}) In or OFF (OFF - function off) Note: 1.0In in case of the power distribution protection											
Protection curve type		Standard distribution protection I²t: tr = 2.25 Tr/N² (factory default) N= I/Ir I—Fault current tr—Long time-delay action time Ir—Long time-delay setting current Tr—Long time-delay setting time Description: NWK31 controller has only standard power distribution protection I²t											
Standard power distribution protection I²t		15s、30s、60s、120s、240s、480s											
Time setting value Tr (@1.5 Ir)													
Tripping timetr (s) (Accuracy of ±10%)	1.5Ir	15	30	60	120	240	360	480	600	720	840	960	
	2.0 Ir	8.44	16.88	33.75	67.5	135	202.5	270	337.5	405	472.5	540	
	6.0 Ir	0.94	1.88	3.75	7.5	15	22.5	30	37.5	45	52.5	60	
	7.2 Ir	0.65	1.30	2.60	5.21	10.4	15.6	20.8	26	31.3	36.5	41.7	
Protective feature (Accuracy ±10%)		Current (I/Ir)						Tripping time					
		≤1.05						> 2h Inaction					
		≥1.3						< 2h Action					
		≥1.2 Ir						The action time is calculated according to the protection formula or curve queried					
Thermal memory time		30min (ON) or OFF											
Overload pre-alarm NWK31													
Current setting value Ip		OFF+(0.75~1.05) Ir											
Overload pre-alarm output		Needed signal output; added a signal unit If there is no signal unit output, observe the controller display screen or read from the display indicator											
Short circuit short-time delay protection NWK31													
Current set value Isd		(1.5~15) Ir or OFF (OFF-Function off)											
Time setting value Tsd (s)		0.1、0.2、0.3、0.4											
I²t		ON or OFF											
Protective feature (Accuracy ±10%)		Current				Tripping time							
I²t-ON		Isd ≤I≤8Ir				(8Ir)² × Tsd /I² inverse time-limit characteristic							
		I>8Ir				Tsd definite time limit characteristic							
I²t-OFF		I≥ Isd				Tsd definite time limit characteristic							
Thermal memory time		15min (ON) or OFF (OFF - function off) Factory setting, not adjustable after leaving the factory											
Short circuit instantaneous protection NWK31													
Current set value Ii		(1.0~20) In or OFF (OFF - function off)											
Protective feature (Accuracy ±10%)		Current (I/Ii)						Tripping time					
		<0.85						Inaction					

	≥1.15	<40ms Action
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Continued:

MCR Protection NWK31		
Current setting value I_{MCR}	(1.0~20) In or OFF (Factory default 10In) Factory setting, not adjustable after leaving the factory	
Protective feature (Accuracy ±10%)	Current (I/I_{MCR})	Tripping time
	≤0.8	Inaction
	≥1.1	<30ms Action

The MCR provides the high-speed instantaneous protection, which is valid at the closing moment of the circuit breaker. After 100ms that the circuit breaker is closed, MCR protection will be canceled automatically

Ground protection/alarm NWK31		
Protection type	Differential type (T), ground current type (W), with the latter as the optional function	
Current setting value I_g	(0.2~1.0) In or OFF (OFF - function off)	
Time setting value T_g (s)	0.1~0.4 definite time limit	
Protective feature (Accuracy ±10%)	Current (I/I_g)	Tripping time
	≤0.8	Inaction (no alarm)
	≥1.0	For action (or alarm), see the time setting value
Inherent absolute error: ±40ms		
Grounding alarm output	Needed signal output; added a signal unit If there is no signal unit output, observe the controller display screen or read from the display indicator	

Neutral line protection NWK31	
Neutral wire protection setting value	50%In, 100%In or OFF;
Protective features	Same-phase pole overload long time-delay protection, short-circuit short time-delay protection, short-circuit instantaneous protection, ground protection

Current unbalance protection/alarm NWK31		
Current unbalance setting value δ	(40%~100%) + OFF (OFF - function off)	
Action delay time t_δ (s)	0.1~1.0	
Protective feature (Accuracy ±10%) Inherent absolute error: ±40ms	Actual current unbalance rate/setting value	Tripping time
	≤0.9	Inaction (no alarm)
	≥1.1	Acts (or gives an alarm) according to the set delay time
Protective return features (accuracy of ±10%) Inherent absolute error: ±40ms	Actual current unbalance rate/setting value	Tripping time
	≥1.1	Non-return
	≤0.9	Returns according to the alarm return delay time
Current unbalance protection alarm DO output	The signal output is required to add a signal unit; set one DO of the signal unit as "I unbalanced alarm".	

		Without signal output, observe the controller display screen or read from the display indicator.			
Execution mode		Alarm/tripping/close			
Load monitoring function NWK21/NWK31					
Operation mode		Current setting		Time setting	
Current way 1	Ic1	(0.2~1.0) In+OFF	Tc1	15s、30s、60s, 120s、240s、480s	
	Ic2		Tc2		
Current way 2	Ic1		Tc1	60s、120s、240、480s	
	Ic2		Tc2		
Off (OFF)					
Thermal memory			30min (ON)、OFF		

See the table below for the setting time of action delay for overload long-delay protection and the time for the current in the corresponding multiple:

Curve type	Fault Current	Delay time (s)										
		C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11
I ² t	1.5×Ir	15.00	30.00	60.00	120.00	240.00	360.00	480.00	600.00	720.00	840.00	960.00
	2×Ir	8.44	16.88	33.75	67.50	135.00	202.0	270.00	337.50	405.00	472.50	540.00
	6×Ir	0.94	1.88	3.75	7.50	15.00	22.50	30.00	37.50	45.00	52.50	60.00
	7.2×Ir	0.65	1.30	2.60	5.21	10.42	15.63	20.83	26.04	31.25	36.46	41.67

Controller Factory Setting:

Protective features	Setting current	Setting time	Remarks
Overload long-time delay protection	1.0In	60s	Thermal memory ON
Short circuit short-time delay protection	8Ir	0.2s	Definite time limit, I ² t-OFF
Short circuit instantaneous protection	10In	-	-
Neutral wire protection	100% In	-	-
Ground protection	0.5 In	0.2s	This function is default as off for 3P, and as on for 4P; the user can activate it as needed for the 3P product
Current unbalance protection	OFF	-	Users can open it as needed

3.5 Working power supply of controller

The controller can be powered by the internal power supply CT (Current Transformer) or by an external rated working power source.

In order to ensure that the controller works reliably at small main circuit current and performs breaking action reliably under the fault condition, internal power supply CT and external rated operating power supply must be used at the same time.

1) To be powered by internal power supply CT

The power supply CT is located inside the product. Normal working conditions of the controller: in case of $I_n > 400A$, the primary current of the main circuit is $\geq 0.4I_n$ in single phase, and the primary current is $\geq 0.2I_n$ in three phases. When the rated current is $\leq 400A$, the primary current of the main circuit is $\geq 1.0I_n$ for single-phase, and the primary current is $\geq 0.6I_n$ for three-phase. Otherwise, an external rated operating power supply must be used simultaneously.

2) External rated operating power supply

■ Rated power consumption of controller

Rated power consumption: $< 7W$.

■ Contact capacity of controller

DO signal alarm output, contact capacity: $5A/AC250V$;

Fault tripping contact output, contact capacity: $AC250V/16A$;

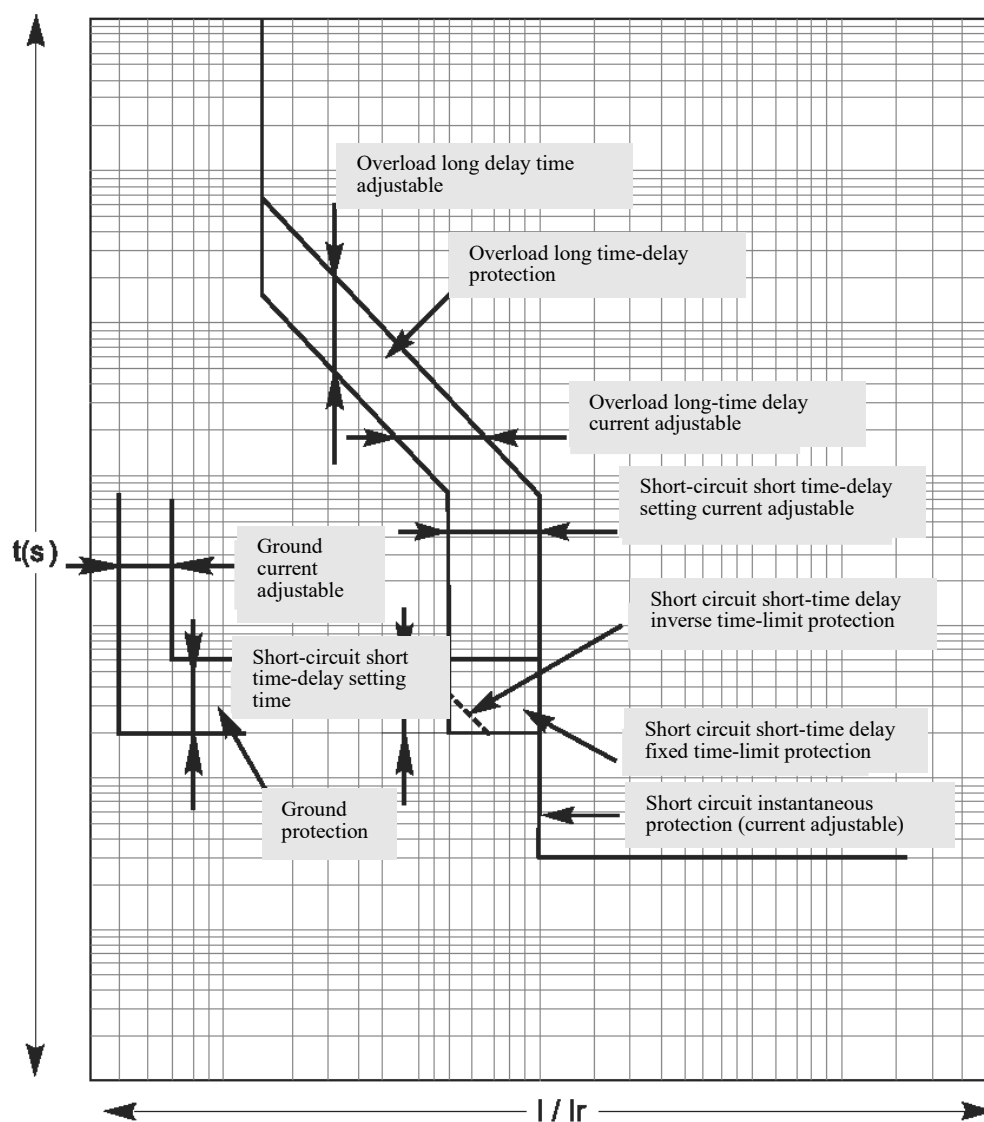
Circuit breaker status auxiliary contact output, contact capacity: $10A/AC250V$.

3.6 Introduction of controller functions

See the controller instruction- 《NWK21 and NWK31 Controller Use Instruction" for the introduction of controller functions》.

3.7 Protection characteristic curve

See the figure below for the schematic diagram of overload long time delay, short-circuit short time delay, short-circuit instantaneous and ground protection curve.



See the controller instruction- "NWK21 and NWK31 Controller Use Instruction" for protection characteristic curves of the controller

Accessories

4

4.1 Accessory list

Accessory category	Accessory name	Configuration	Remarks
Electrical control accessories	Closed electromagnet	Standard configuration	
	Shunt release/retention shunt release	Standard configuration	Either
	Motor operating mechanism	Standard configuration	
	Undervoltage release	Optional ordering for customers	
Signal output accessories	Auxiliary switch	Standard configuration	
	Secondary terminal	Standard configuration	
Safety accessories	Phase partition	Standard configuration	
	Counter	Optional ordering for customers	
lock	Button lock	Optional ordering for customers	

4.2 Electrical control accessories

Note: Unless otherwise noted, the calibration parameters of the following accessories are all measured in the laboratory environment (room temperature $25\pm 5^{\circ}\text{C}$, humidity controlled at: 30%-70%RH, dust-free, pollution-free, impact-free and vibration-free).

4.2.1 Closed electromagnet

Closed electromagnet is mainly composed of coil, iron core component and electronic parts. In the condition of mechanism energy storage, as long as the closed electromagnet is energized, the circuit breaker can be closed.

◆ Action features of the closed electromagnet.

- 1) When the power supply voltage of the closed electromagnet maintains at 85%~110% of the rated control supply voltage U_s , operation of the closed electromagnet can make reliable closing of the circuit breaker;
- 2) Closed electromagnet is the short-time duty-type;
- 3) It has a built-in control circuit with a power-on time of more than 200ms. Users shall not connect the auxiliary switch contact of the circuit breaker in series;
- 4) The interval required between the power-loss of the breaking coil and the issuing of the closing command is: 500ms.

◆ Technical parameters of closed electromagnet

Power Consumption Table of Closed Electromagnet

Rated insulation voltage (U_i)	Rated control supply voltage (U_s)	Instantaneous power
	AC220V/AC230V 50/60Hz	330VA
	DC220V	330W



4.2.2 Shunt release

Shunt release is mainly composed of coil, iron core component and electronic parts, and can disconnect the circuit breaker by remote operation.

◆ Action features of the shunt release

- 1) When the power supply voltage of the shunt release maintains at 70%~110% of the rated control supply voltage, operation of the shunt release can make the circuit breaker disconnect;
- 2) Shunt release is the short-time duty-type;
- 3) It has a built-in control circuit with a power-on time of more than 200ms. Do not connect to the auxiliary switch contact of the circuit breaker in series;

◆ Technical parameters of shunt release



Power Consumption Table of Shunt Release

Rated insulation voltage (Ui)	Rated control supply voltage (Us)	Instantaneous power
400	AC220V/AC230V 50/60Hz	330VA
	DC220V	330W

4.2.3 Retention shunt release

Retention shunt release is mainly composed of coil, iron core component and electronic parts, and can operate the circuit breaker by remote operation, so that the circuit breaker is disconnected and maintained in the open position.

◆ Action features of the retention shunt release

- 1) When the power supply voltage of the retention shunt release maintains at 70%~110% of the rated control supply voltage, operation of the shunt release can make the circuit breaker disconnected;
- 2) When the applied voltage is 85%~110% of the rated operating voltage of the retention shunt release, the retention shunt release can guarantee the circuit breaker to be reliable without closing;
- 3) The retention shunt release is the long-term duty type, which can send closing signal with an interval of more than 500ms after power failure;
- 4) Each power-on trigger time $t > 200\text{ms}$.

◆ Technical parameters of retention shunt release



Power Consumption Table of Retention Shunt Release

Rated insulation voltage (Ui)	Rated control supply voltage (Us)	Instantaneous power	Operating power
400V	AC230V 50/60Hz	<500VA	< 5VA
	DC220V	<500W	<10W

4.2.4 Motor operating mechanism

The circuit breaker can only be closed after the motor operating mechanism make the circuit breaker to store energy in advance.

◆ Operation features

- 1) If the rated supply voltage of the motor operating mechanism is between 85%~110%, energy storage of the circuit breaker can be made in place;
- 2) The motor will close the power supply automatically and stop operation after it stores energy in place;
- 3) The motor operating mechanism can realize the automatic pre-energy storing;
- 4) Each power-on trigger time: $t > 8s$, long-term energization is allowed for the secondary circuit input terminal;

◆ Technical parameters of motor operating mechanism

Power Consumption Table of Motor Operating Mechanism

Rated insulation voltage (Ui)			400V	
Energy storage time			3s~5s	
Rated operating voltage (Us)			AC220V	DC220V
Apparent power ^{Note 1} (Input power)	1600 shell frame	Transient	680VA	770VA
		Steady state	180VA	290VA
Active power ^{Note 2} (Output power)	1600 shell frame		90W	

Notes: 1. Apparent power: the input power to drive the operation of the electric operating mechanism;

2. Active power: the output power of the electric operating mechanism during its operation;



4.2.5 Undervoltage release

◆ Action features of the undervoltage release

- 1) When the applied voltage drops, even slowly drops to 70%~35% of the rated operating voltage, the undervoltage release will work to disconnect the circuit breaker;
- 2) When the applied voltage is less than 35% of the rated operating voltage of the undervoltage release, the undervoltage release will make the circuit breaker unable to be closed;
- 3) When the applied voltage is 85%~110% of the rated operational voltage of the undervoltage release, the undervoltage release can be closed reliably to guarantee the reliable closing of the circuit breaker.
- 4) Undervoltage release is the short-time duty-type, which will not work without the power supply input.

◆ Undervoltage release can be divided into two types (instantaneous release and delayed release), which is mainly composed of coil, iron core component and electronic parts.

◆ Power consumption table of undervoltage release

Power Consumption Table of Undervoltage Release



Rated insulation voltage (Ui)	Rated operating voltage (Ue)	Operating power
400V	AC220V/AC230V 50/60Hz	3VA
	DC220V	3W
	DC24V	<5W

4.3 Signal output accessories

4.3.1 Auxiliary contacts

Circuit breaker auxiliary contact is a signal output device reflecting the opening and closing status of the circuit breaker.

◆ Technical Parameters of Auxiliary Contact

Applicable shell frame	NDW2X-1600 Circuit Breaker	
Auxiliary contact form	Conventional	■ Four groups conversion
Agreed thermal current Ith	10A	
Minimum load	10mA/DC24V	
Breaking capacity	DC-12	0.3A/DC250V
	AC-12	10A/AC250V

4.3.2 Closing ready signal output device

Closing ready signal output device of the circuit breaker is the output signal device that reflects the operating mechanism to achieve the closed state. It can output signals if it meets all of the following mechanical states. See the table below for technical parameters.

- ◆ Circuit breaker off state;
- ◆ Energy storage in place;
- ◆ No disconnection instruction;
- ◆ Under-voltage release, no-voltage release (optional accessories) maintain the pull-in state;
- ◆ Rest of the reset button after the controller fault tripping;
- ◆ Off-position key lock (interlocking accessory) not interlocked.

4.3.3 Secondary wiring terminal

- ◆ See the table below for parameters of the secondary wiring terminal

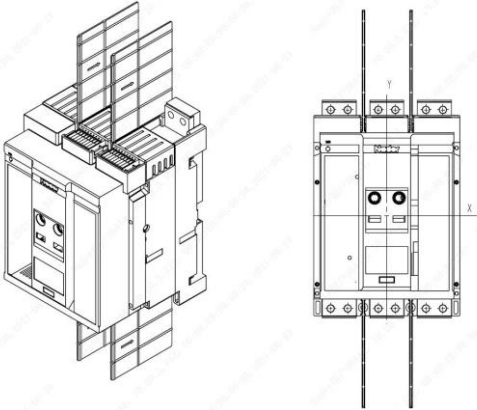
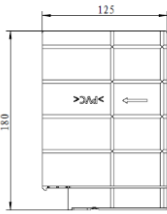
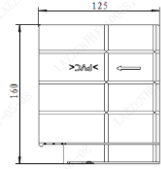
Project	parameters
Connection mode	Clamping
Flame retardant rating, according to UL 94	V0
Pollution level	3
Voltage category	III
Material group	IIIa

Applicable connection standards	GB/T 14048.7-2016
Maximum load current	10A
Rated current	10A
Rated voltage	500V
Minimum cross section area of the rigid (flexible) conductor	0.5mm ²
Maximum cross section area of the rigid (flexible) conductor	1.5mm ²
Recommended striping length	10±1mm
Minimum test pull-force after the conductor connection	30N

4.4 Safety accessories

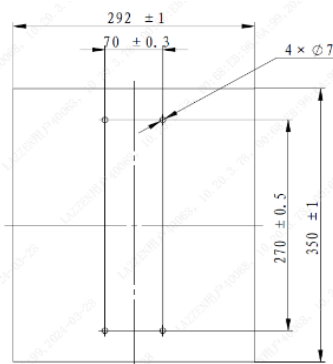
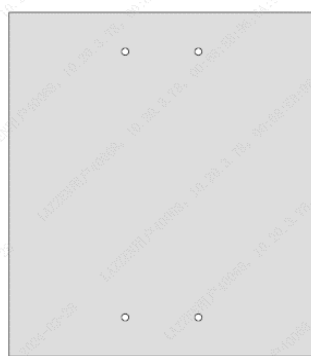
4.4.1 Phase partition

As part of the standard configuration for the product, phase partition is installed in the groove between all the phase bus bars, used to increase the insulation strength between phase to phase of the main circuit and improve the insulation performance.

Chart	Phase partition size W×H (mm)	material	Standard number of partitions
		PVC	×2
			×2

4.4.2 Insulating pad

Insulating pads are placed at the back of the body, fixed with the product and the cabinet, used to increase the insulating strength between the product and the cabinet to improve the reliability of the power supply. For the voltage above AC690V (excluding AC690V), it is recommended that the user adds the insulating pads between the mounting back plate or beam between the circuit breaker and the switchgear, which shall be provided by the customer, with the size recommended as follows



4.4.3 Counters

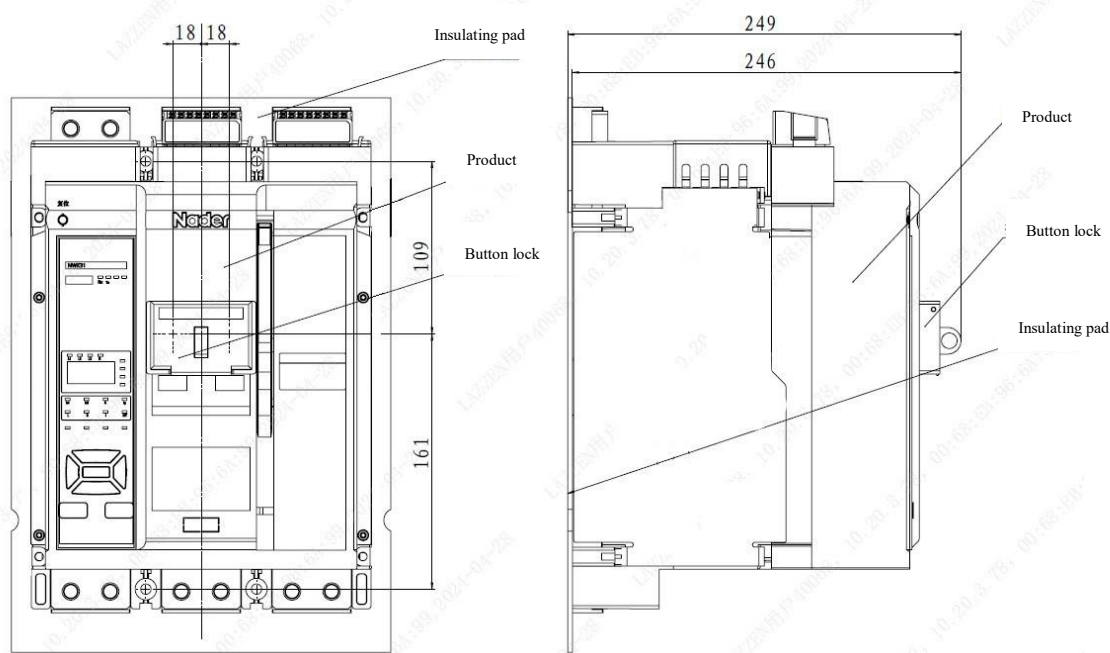
Counter is used to record the number of the "close-open" operation of the disconnecting switch



4.5 Locks

4.5.1 Button lock

- ◆ To be used with a padlock, it is used to prevent non-staff from illegally operating the opening/closing button (padlock should be prepared by users).
- ◆ When the off-position key lock is optionally selected, this accessory is sent to the user after being assembled with the circuit breaker. As the off-position key lock protrudes out of the circuit breaker mask, the installer shall pay attention to the protruding dimension when opening the power distribution cabinet door. This dimension diagram is shown as follows,



Note: If the user configures an insulating pad, the thickness of this mat (3mm) needs to be considered.

Scope of Application

5

The NDW2X universal circuit breaker (hereinafter referred to as circuit breaker) can be applied to the distribution network with AC of 50Hz/60Hz, rated current of 200A-1600A, rated insulation voltage of 1250V, rated operational voltage of AC600V/630V/645V/660V/690V/760V/800V/1000V/1140V for distribution of electrical energy and protecting the circuit and power equipment from overload, undervoltage, short circuit, single phase grounding and harm of other faults. It also has an isolating function at the same time. The circuit breaker has multiple protection functions. It can avoid unnecessary sudden power failure while realizing highly accurate selective protection, and improve the reliability and security of the power supply system.

5.1 Working environment

5.1.1 Ambient temperature

Applicable ambient temperature $-40^{\circ}\text{C} \sim +70^{\circ}\text{C}$, higher than $+40^{\circ}\text{C}$ users need to reduce the capacity to use, with the derating data shown in the following table. (No derating required below 1000A)

Ambient temperature	$+40^{\circ}\text{C}$	$+50^{\circ}\text{C}$	$+60^{\circ}\text{C}$	$+65^{\circ}\text{C}$	$+70^{\circ}\text{C}$
$I_n=1000\text{A}$	1000A	1000A	1000A	1000A	950A
$I_n=1250\text{A}$	1250A	1100A	1050A	1000A	950A
$I_n=1600\text{A}$	1600A	1400A	1350A	1250A	1200A

Note: The above data is calculated according to the test and theory. The data represent only guidelines and recommendations.

5.1.2 Atmospheric environment conditions

When the ambient air temperature is $+40^{\circ}\text{C}$, the relative humidity of atmosphere shall not be more than 50%. At low temperature, a higher relative humidity is allowed, for example, in case of $+20^{\circ}\text{C}$, the relative humidity of atmosphere can be 90%. For condensation due to temperature change, dehumidification or corresponding measures should be taken.

5.1.3 Altitude

Altitude of the installation site shall not exceed 2,000 m;

If the altitude of the installation site is between 2,000m to 5,000m, it can be specially customized. For the working performance, refer to High Altitude Derating Tables 1 and 2.

Electric Current High-altitude Derating Table 1

Operating current		Altitude			
Model	Rated current (A)	2000m	3000m	4000m	5000m
NDW2X-1600	1250~1600	1.0 I_n	1.0 I_n	0.88 I_n	0.82 I_n

Voltage and Breaking Capacity High Altitude Derating Table 2

Elevation (m)	2000	3000	4000	5000
Impulse withstand voltage U_{imp} (kV)	12	12	12	12
Rated insulation voltage U_i (V)	1250	1250	1140	1000
Rated operating voltage (V)	645	645	645	645
	690	690	690	690
	760	760	760	760

	1140	1140	1000	800
Industrial frequency withstand voltage (V)	3500	3500	3000	2500
Derating factor of the breaking capacity	1.0	1.0	1.0	0.9

5.1.4 Anti-corrosion Level

Salt spray: severe level (3)

Passed GB/T 2423.18 Environmental Testing for Electric and Electronic Products- Part II: Test Method Test

Kb: Salt spray.

5.1.5 Pollution level

Pollution level: Level 3

The circuit breaker can be operated in the industrial environment specified in INC 60664-1. However, it is still recommended that it shall be installed in a switchgear with suitable temperature and without excessive dust pollution.

5.1.6 Shockproof requirements

◆ The circuit breaker can ensure resistance to mechanical shock, and has passed the GB/T 4798.3 standard test;

◆ Amplitude: $\pm 1.5\text{mm}$ (2Hz-9Hz);

◆ Constant acceleration: 5 m/s^2 (9Hz-200Hz);

◆ Super strong shock may result in damage to the parts, and impact the reliable action of the circuit breaker.

5.1.7 Electromagnetic interference

1) The circuit breaker can resist the following electromagnetic interference

◆ Overvoltage caused by electromagnetic interference

◆ Overvoltage due to aging of the distribution system or environmental interference

◆ Radio wave

◆ Electrostatic discharge

2) The circuit breaker has passed the electromagnetic compatibility test (EMC) specified in the following standards

◆ GB/T 14048.2-2008 Low-voltage Switchgear and Control Equipment - Part 2: Circuit Breaker - Appendix F

◆ GB/T 14048.2-2008 Low-voltage Switchgear and Control Equipment - Part 2: Circuit Breaker - Appendix N

The above tests can ensure that the circuit breaker won't wrongly occur tripping.

5.2 Installation conditions

With the vertical gradient of no more than 5° , the circuit breaker shall be installed under the environment condition without explosion danger, without conductive dust and without the possibility of corroding metal and damaging the insulation.

5.2.1 Installation type

The installation category of circuit breaker's main circuit and undervoltage release coils, power transformer primary coil is IV; the installation category of the remaining auxiliary circuit and control circuit is III.

5.2.2 Protection level

IP30, IP40 (installed in cubicle with protective doorframe)

5.2.3 Utilization category

Category B

5.3 Main circuit wiring of the circuit breaker

Main Circuit Wiring of the Circuit Breaker

Rated current of frame Inm (A)	Rated operating current In (A) 40°C	Copper bar specification	
		Dimensions (mm)	Number
1600	200-400	50×5	1
	630 to 800	50×10	1
	1000 to 1600	50×10	2

Notes: 1. The table indicates the copper bar specifications adopted when the circuit breaker is under the ambient temperature of +40°C and the open wide installation under the heating condition meets the stipulation in GB/T 14048.2. If the temperature is higher than +40°C, the quantity of copper bar should be increased, or it should be derated for use;

2. The above data is calculated according to the test and theory, for reference only;

3. The maximum permissible temperature of the copper bar does not exceed +110°C (temperature measurement point being at the center of the mounting hole of the copper bar);

4. Electrical clearance of copper bar (rated operating voltage $\geq 800\text{V}$, electrical clearance $\geq 25\text{mm}$; rated operating voltage $\leq 690\text{V}$, electrical clearance $\geq 20\text{mm}$, and when the altitude is more than 5000m and the relative humidity exceeds 90%, the electrical clearance should be adjusted in accordance with the contents of Table 1 of 7.1.1 in GB/T 20645).

5.4 The power loss of the incoming and outgoing lines of the circuit breaker (ambient temperature +40 °C)

The Power Loss of the Incoming and Outgoing Lines of the Circuit Breaker

Model	Power consumption
NDW2X-1600	$\leq 123.5\text{W}$

5.5 Preventive maintenance

Preventive maintenance refers to the regular inspection according to predetermined standards in order to lower the probability of system operation failures or performance degradation.

■ Regular maintenance

Periodic maintenance ensures that system components in delivery period are maintained in proper operating condition for the intended life cycle through appropriate inspection procedures. Users can carry out such inspections within the cycle specified herein.

■ Conditional maintenance

Conditional maintenance can reduce the recommended regularly maintenance operations (lowering them to the required minimum level instead of completely replacing them), and thus reduce the equipment downtime caused by regularly scheduled maintenance operations each year.

Preventive maintenance includes testing, measurement, and maintenance and repairs according to specially designed technical plans. It can lower the probability of equipment failure and reduce the wear and tear on machinery during operation.

a) Environmental Type, Table 1

Environmental type	Range of conditions
Normal environment	Temperature: Average temperature outside the switch cabinet $\leq 25^{\circ}\text{C}$ Load: $<80\%$ (In) (24-hour operation per day) Harmonic: Harmonic current per phase $<30\%$ (In) Relative humidity: $<70\%$ Pollution level: III Salt-spray environment: None Dust: Low, equipment protected by a switch with filter or ventilated IP54 enclosure Vibration: None
Special environment	Temperature: Average temperature outside the switch cabinet $-40^{\circ}\text{C}-70^{\circ}\text{C}$ Load: $\leq 80\%$ (In) (8-hour or 24-hour operation per day) Relative humidity: $>80\%$ Pollution level: Salt-spray environment: III Dust: High, equipment unprotected. Vibration: Continuous vibration between 0.2 and 0.5g

b) Preventive Maintenance Table, Table 2

Maintenance operation	Time interval	
	Normal environment	Special environment
Level 1 maintenance	One year or operate 10,000 times	Six months or operate 5,000 times
Level 2 maintenance	One year	Six months

Specific maintenance is described in the "NDW Series Universal Circuit Breaker Apparatus Installation, Operation and Maintenance Manual".

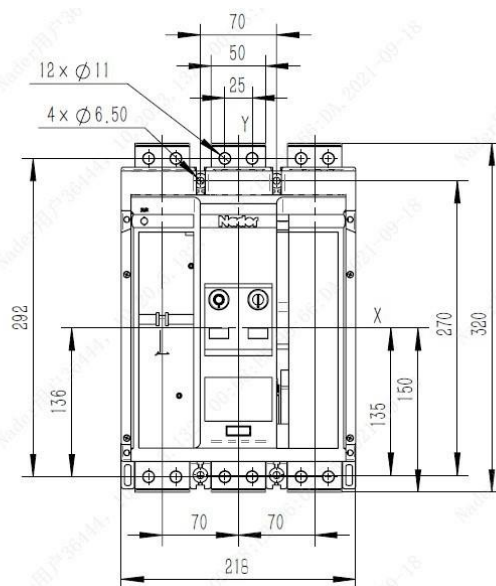
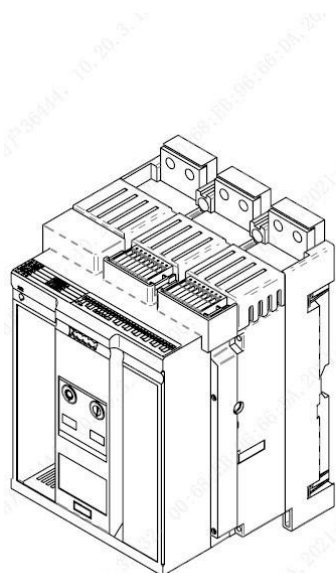
Outline and Installation Dimensions

6

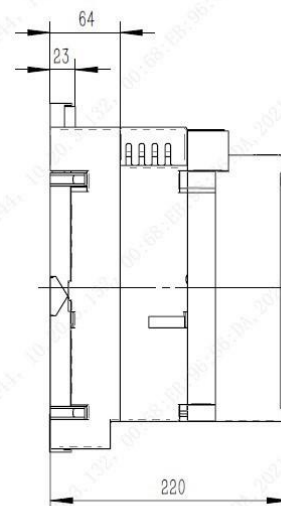
6.1 NDW2X-1600 outline installation dimensions

NDW2X-1600 board front wiring (unit: mm)

Dimensions

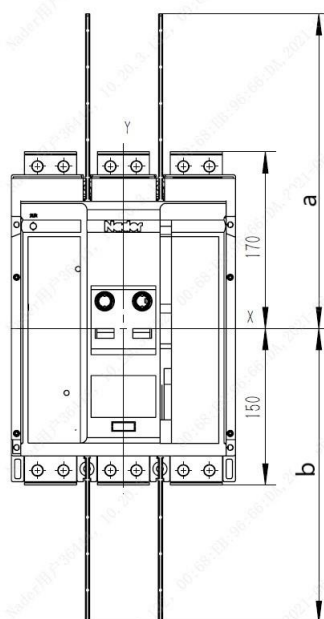
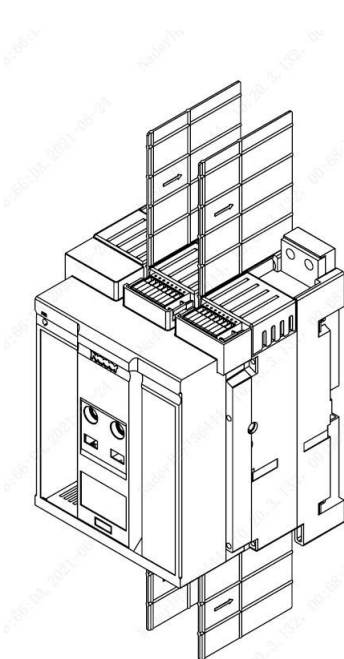


Fixed Details

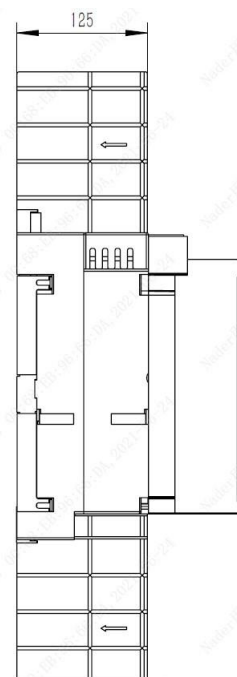


NDW2X-1600 board front wiring (unit: mm)

Dimensions



Fixed Details



Notes: 1. For the circuit breaker, X and Y are the symmetric axes of the front cover;

2. Dimension tolerance $\pm 1.5\text{mm}$;

3. After assembling the interphase spacer, see the following table for the dimensional change of the external dimensions of the circuit breaker:

Product-With Mounting Dimension Chart of Interphase Spacer

a	b
302	282

6.2 Circuit breaker installation notes

To ensure the safety of you and the electric equipment, before put the circuit breaker into operation, users must:

- ★ Carefully read the Operation Manual before installation and use of the circuit breaker.
- ★ Check whether the specification of the circuit breaker is in line with the requirements before installation.
- ★ Install the circuit breaker under the environment condition without explosion danger, conductive dust or the possibility of corroding metal and damaging the insulation.
- ★ Measure the insulation resistance of the circuit breaker with a 1000V megohmmeter before installation of the circuit breaker. When the surrounding medium temperature is $20^{\circ}\text{C}\pm 5^{\circ}\text{C}$, the relative humidity 50%-70% should not be less than 20 mge; otherwise, it needs to be dried, and it can be used until the insulation resistance meets the requirements.
- ★ The relative air humidity at a maximum temperature of $+40^{\circ}\text{C}$ should not exceed 50%, and the product can be stored for 1 year without unpacking. The product can be stored for 3 months under the condition of packaging. For continuous use, the surface shall be subjected to dust and moisture removal, and measure the loop resistance less than $35\mu\Omega$.
- ★ Prevent foreign matters from falling into the circuit breaker when installing the circuit breaker.
- ★ Ensure the circuit breaker is flat without additional mechanical stress when installing the conductive busbar.
- ★ Conduct reliable grounding protection when installing the circuit breaker. The grounding place of the circuit breaker has an obvious grounding symbol.
- ★ Carry out wiring of the control circuit according to the wiring diagram when installing the circuit breaker; check whether the operating voltage of the undervoltage, shunt, closing electromagnet, motor, controller and related parts conforms to the actual voltage, and then carry out the secondary circuit energizing. In case of drawout circuit breaker, the circuit breaker should be shaken into the test position, then the undervoltage release will close and then the circuit breaker can be closed.
- ★ Pressing (or powering on) the closing button after the energy storage of the motor, the circuit breaker will close.

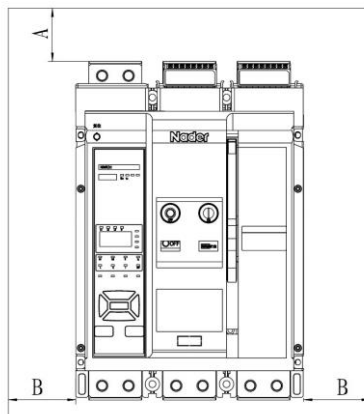
- ★ Pressing (or powering on) the opening button, the circuit breaker will open.
- ★ For manual storage of energy, pull the handle on the front panel up and down, when a "click" sound can be heard after seven times; the panel shows "storage of energy", and the storage of energy ends. At this point, if there's undervoltage tripping, power on it (no need if without undervoltage tripping), then carry out closing operation.
- ★ Installation screws of the circuit breaker is shown in the table below

Installation Screws of the Circuit Breaker

Circuit breaker	Terminal Block Thickness (mm)	Bolt length (mm)	Tightening torque
NDW2X-1600	4 to 5	M10×25	20N.m
	6 to 8	M10×30	
	10-12	M10×35	
	20	M10×45	

The circuit breaker is installed in the cabinet, the safe distance between the circuit breaker and the cabinet

When users install the circuit breaker into the cabinet, the safe distance between the circuit breaker and the cabinet is shown in the figure below, and the installation dimensions are shown in the table below.



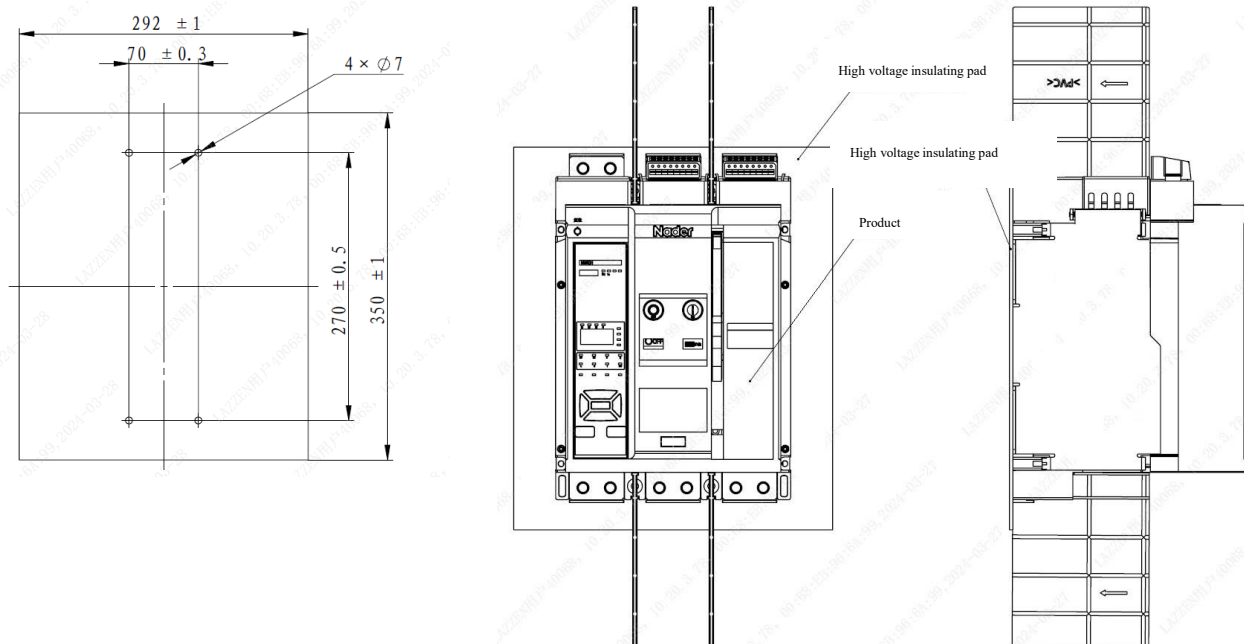
Safe Distance between Circuit Breaker and Cabinet

Installation mode of the circuit breaker	To the insulator		To the metallic body		To the live part	
	A	B	A	B	A	B
Fixed type	0	0	60	60	60	60

Notes:

1. 150 mm space needed for removing the arc extinguishing chamber should be considered for the safe spacing of the fixed type circuit breaker;
2. If the distance from the live body cannot meet the requirements in the table, the insulation measures need to be taken between the circuit breaker and the live body;

3. The voltage above AC690V (excluding AC690V) needs to be in the circuit breaker and switchgear installation between the back plate or beam to increase the insulating pad, and the pad plate shall be provided by the customer, with the size recommended as follows.



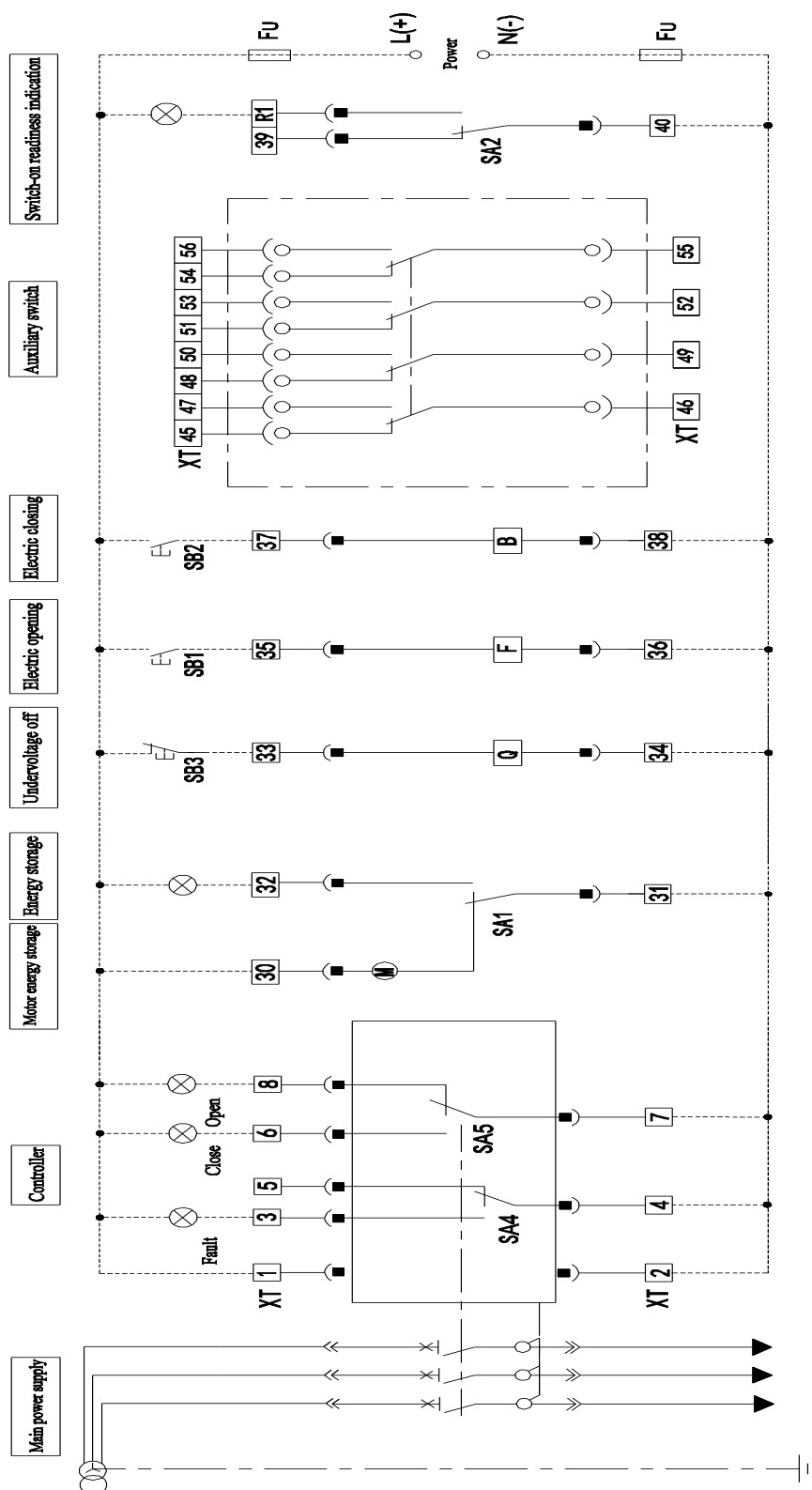
Insulating Pad Material and Size Recommendation Table

Material	Length (mm)	Width (mm)	Horizontal hole position (mm)	Vertical hole position (mm)	Hole Diameter (mm)	Thickness (mm)
Epoxy glass cloth board/phenolic plastic board	292	350	70	270	7	3

Electrical Wiring Diagram

7

7.1 NDW2X-1600 circuit breaker full function wiring diagram



1, 2 - Controller operating power;
3, 4, 5 - Fault tripping contact output (4 for public end), contact capacity of AC250V/16A;
6, 7, 8 - Opening and closing contact output (7 for public end), contact capacity of AC250V/16A;
30, 31, 32 - Electric energy storage and energy storage indication;
33, 34 - Under-voltage tripper;
35, 36 - Shunt tripper;
37, 38 - Closed electromagnet;
39, 40 - Switch-on readiness indication (optional);
45 to 56 - Auxiliary contacts (four sets of transitions);
SB1 - Shunt button (to be prepared by users);
SB2 - Close button (to be prepared by users);
SB3--Undervoltage release button (it cannot be connected in case of conventional condition, and if designed for emergency stop button, it needs to be provided by the user);
SA1 - Motorized operating mechanism travel switch;
SA2 - Switch-on readiness indication travel switch;
SA4 - Fault tripping travel switch;
SA5 - Opening and closing indicating travel switch;
XT - Secondary terminal;
F - Shunt tripper;
B - Closed electromagnet;
Q - Undervoltage release (instantaneous or delayed);
Fu - Fuse (to be prepared by users);
M - Motorized operating mechanism (energy storage motor).

Notes:

1. The circuit breaker is in the non-live, opening and non-energy storage status;
2. The dotted part is the user's self-wiring;
3. If the rated operating voltages of Q, F, B, M and controller are not the same, please connect to the rated voltage of control power supply;
4. Status indicator lamps, buttons and switches should be provided by the user;
5. If the product type is no overcurrent protection circuit breaker, 1, 2, 3, 4, 5, 6, 7, 8, 39, 40 are empty.

Model Selection Specification for Ordering

8

8.1 NDW2X-series circuit breaker model explanation and encoding rules

ND W 2X- □ □ / □ □ / □ □ / □ □ □ □ □ □ / □ □ □ □ / □ □ / □ □ / □ □ / □ □ / □ □

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

SN	Name	Specification, type code	Description
1	Enterprise code	Nader 耐德 brand low-voltage electrical appliance	
2	Product code	Air Circuit Breaker	
3	Design SN	2X-Miniaturization	
4	Shell frame level	16-1600	
5	Product type	Empty - Circuit Breaker ^{Note 1} , H - High Breaking Capacity Circuit Breaker, HU - High Voltage Breaking Capacity Circuit Breaker, Y- Circuit Breaker without Overcurrent Protection (CBI-Y)	
6	Rated current	02-200A, 04-400A, 06-630A, 08-800A, 10-1000A, 12-1250A, 16-1600A	
7	Installation Mode	Empty - Fixed	
8	Number of poles	3-3 poles	
9	Smarink X Controller	K0-No Controller	Select this configuration if the product type is a circuit breaker without overcurrent protection
		KM2- NWK31 (AC220V/AC230V), KM3- NWK31 (DC220V)	Select this configuration if the product type is a circuit breaker
10	Electric energy storage mechanism	D2-AC220V/AC230V, D3-DC220V	
11	Shunt release	F0-No shunt release, F2-AC220V/AC230V, F3-DC220V	Either
	retention shunt release	F6-AC220V/DC220V	
12	Closed electromagnet	B2-AC220V/AC230V, B3-DC220V	
13	Undervoltage	Empty-no undervoltage release, Q2-AC220V/AC230V, Q3-DC220V,	
14	Undervoltage release acting time	0-Instantaneous, 1-1s delay, 3-3s delay, 5-5s delay	
15	Auxiliary contact	A4 - four groups of conversion ^{note 1}	
16	Closing ready	Empty - no closing ready, BX - closing ready signal output unit	
17	Counter	Empty - without counter, JS - function unit with counter	
18	Button lock	Empty - no pushbutton lock, S - pushbutton lock	

19	Phase partition	G-Interphase spacer ^{note 1}	
20	Off-position lock	Empty - no disconnect position lock, SF11 - one lock with one key	
21	Wiring mode	Empty - Front Board Wiring	
22	Product use scenarios	FD-Wind Power, GF-Photovoltaic, GFUL-Photovoltaic UL CN-Energy Storage, CNUL-Energy Storage UL	UL means random certification Monoblock is recognized by UL as NDW3A series product
23	Rated operating voltage	Empty-AC760V and below, KV4-AC800V, KV5-AC1000V, KV6-AC1140V	
24	Language type	Empty - Chinese Y - English	
25	Special notes	** - Customer code	Usually the user's initials

Note 1: This code is not reflected in the material description by default;

8.2 Order specifications

(Please fill in numbers in _____, and check ☒ in ☐. Related contents can be found in the Manual)

User unit:		Number of units ordered:		Date of ordering:		
Basic parameters	Shell frame level	☐ NDW2X-1600 ☐ NDW2X-1600H ☐ NDW2X-1600HU ☐ NDW2X-1600Y (CBI-Y)				
	Installation Mode	☒ Fixed type				
	Rated current (A)	☐ 200 ☐ 400 ☐ 630 ☐ 800 ☐ 1000 ☐ 1250 ☐ 1600				
	Number of poles	☒ 3 (3 poles)				
	Wiring mode	☒ Front-plate connection				
	Rated operating voltage	☐ AC220/230/240V ☐ AC380/400/415V ☐ AC600/630/645V ☐ AC660/690V ☐ AC760V ☐ AC800/1000/1140V				
	Product use scenarios	☐ FD-Wind Power ☐ GF-Photovoltaic ☐ GFUL-Photovoltaic UL ☐ CN-Energy Storage ☐ CNUL-Energy Storage UL				
Controller	Controller type	☐ KM-NWK31 (digital screen) ^{Note 1} ☐ K0 (without controller, with model NDW2X-1600Y)				
	Controller voltage	☐ 2(AC220V) ☐ 3(DC220V)				
	Protection type	☒ Conventional type				
Required accessories	Electric operating mechanism	☐ D2(AC220V/AC230V) ☐ D3(DC220V)				
	Shunt release/retention shunt release	☐ F0-None ☐ F2(AC220V/AC230V) ☐ F3(DC220V) ☐ F6 (AC230V/DC220V) Holding type			Either	
	Closed electromagnet	☐ B2(AC220V/AC230V) ☐ B3(DC220V)				
Standard Accessories	Auxiliary contact	☒ A4- Four groups of conversion				
	Phase partition	☒ G - Phase partition				
Optional accessories	Undervoltage release	Voltage specifications	☐ Q2(AC220V/AC230V) ☐ Q3(DC220V) ☐ Q5(DC24V)			
		Delay time	☐ 0-Instantaneous (0s) ☐ 1-Delay (1s) ☐ 3-Delay (3s) ☐ 5-Delay (5s)			
	Closing ready	☐ BX - Closing ready signal output unit				
	Button lock	☐ S - Button lock				
	Counter	☐ JS-Counter				
	Off-position lock	☐ SF11 - One lock with one key				
Language type		☐ Chinese ☒ English				
Special requirements						
Notes: 1. The current and time setting value of the controller shall be set according to the factory setting; 2. " ☐ " means that the user needs to choose the configuration, " ☒ " is the default configuration of the product.						