

S-type intelligent controller -NA8 series air circuit breaker

Instruction manual

Thank you for choosing this product. Please read this Instructions Manual carefully before installing, using or maintaining the product.

Safety Warning

- 1 It is strictly forbidden to install the product in an environment containing flammable or explosive gases or humid condensation, and it is strictly forbidden to operate the product with wet hands.
- 2 It is strictly forbidden to touch the conductive parts of the product during work on the product.
- 3 When installing, maintaining and servicing the product, it is necessary to ensure that the line is cut off.
- 4 Children are strictly prohibited from playing with the product or packaging.
- 5 Adequate space and a safe distance should be reserved around the installation location of the product.
- 6 Do not install where gaseous media can corrode metal and damage insulation.
- 7 When the product is installed and used, it must apply standard wires and be equipped with power supplies and loads that meet the requirements.
- 8 In order to avoid dangerous accidents, the installation and fixation of the product must be carried out in strict accordance with the requirements of this manual.
- After removing the packaging, the product should be checked for damage and the integrity of the item.



This is the general warning sign. It is used to alert the user to potential hazards. All safety messages that follow this sign shall be obeyed to avoid possible harm.



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1 Main uses and scope of applications of the product

S-type intelligent controller (hereinafter referred to as the controller) is the core component of NA8 series air circuit breaker, suitable for 50/60Hz power grid, mainly used for power distribution, feed or power generation protections, so that power lines and power supply equipment can be protected from hazards of faults such as overload, short circuit, grounding/leakage, current unbalance, overvoltage, undervoltage, voltage unbalance, overfrequency, underfrequency, reverse power, underpower, and overpower etc. Through functions of load monitoring (load shedding), zone interlock, temperature monitoring, and automatic reclosure etc., a reasonable operation of the power grid can be achieved. At the same time, it has functions such as electrical measurement, data analysis and alarm, status perception and diagnosis, health indication and reminder, and fault and historical records, allowing local and/or remote monitoring and parameter setup and can access to the Internet of Things (IoT) cloud platform, while meeting network security requirements.

2 Function configuration and main performance parameters of the product

2.1 Function configuration of the product

2.1.1 Basic functions of S-type controller

Table 1 Basic functional configuration

Protection function	Measurement function	Maintenance function	Communication function	Man-machine interface
Multi-curve long-time	Measurement of phase	Trip records	●RS485	●TFT color liquid crystal
protection	current and earth current	Alarm records	●NFC	display
Short-time inverse	Thermal capacity	Displacement records	●USB	 LED status indicators
time protection	measurement	Historical peak records		 Key + touch operations
•Short-time definite time	Average current	Contact wear		 Quick View Mode
protection	measurement	Remaining life		
•Instantaneous protection	Current unbalance rate	 Number of operations 		
MCR protection	measurement	Clock function		
HSISC protection	Average voltage	 Controller self-diagnosis 		
Current unbalance	measurement	 Position status diagnosis 		
protection	Voltage measurement	Firmware upgrade function		
Current phase loss	Frequency measurement	Maintenance reminder		
protection	Voltage unbalance rate	function		
Earth fault protection	measurement	Authority management		
(default is T type)	Phase sequence detection	function		
Earth fault alarm	Power measurement	 Power quality analysis 		
Demand current protection	Power factor measurement	Health degree prediction		
Neutral line protection	Electric energy	 Parameter modification 		
Over-voltage protection	measurement	records		
Under-voltage protection	Harmonic measurement	 accumulated operating 		
Voltage unbalance	Demand value	records		
protection	measurement			
Voltage phase loss	Controller temperature			
protection	measurement			
Phase sequence protection				
Frequency change rate				
protection				
Overfrequency protection				
Underfrequency protection				
Under-power protection				
Overpower protection				
Reverse power protection				
Thermal memory				
Demand power protection				

2.1.2 Optional function configurations

Table 2 Optional function configurations

Table 2 Optional function configurations						
Protection function	Measurement function	Maintenance function	Communication function			
Load monitoring Regioselective interlock Leakage/ earth current protection Dual grounding protection Dual parameter protection Busbar temperature monitoring Overload reclosure Three-phase reclosure with voltage on detection	Busbar temperature measurement (Note: If you need busbar temperature measurement and monitoring related functions, please contact the manufacturer's sales.)	Maintenance mode protection (ERMS) Circuit Breaker Accessory Diagnosis Circuit breaker body diagnosis Controller self-healing function Fault recording	DL/T 645 communication DL/T 698.45 Communication Ethernet communication HPLC communication			



2.2 Main performance parameters

2.2.1 Operating power supply

The auxiliary power supply and internal current transformer will supply power at the same time to ensure that the controller can work reliably under the condition of low loads and short circuits.

The controller can be powered by:

A.Internal current transformer: In the case of overload or short circuit on the load side of the circuit breaker, it can meet the need of self-powered protection;

b. Auxiliary power supply: When the load is less than 20%In, it can be powered by the auxiliary power supply to satisfy other functions such as protections, display, communication, and control;

c. USB power supply: When the circuit breaker is disconnected from the source, such as tripping, commissioning or maintenance, etc., power supply can be provided through the USB port;

2.2.2 Input and output

A) Digital output (DO) contact capacity (with RU-1 relay module):

DC110V 0.5 A resistive;

AC250V 5A resistive.

b) Digital input (DI) Power Requirements

Voltage level: AC220V ~ 250V

Minimum opening voltage: 220Vrms

Maximum shutdown voltage: 30Vrms

2.2.3 EMC performance

The product has passed all the tests in Appendix F of IEC 60947-2:2019, with improved EMC anti-interference level. The EMC test parameters are shown in Table 3.

Test item Parameter				
Parameter				
Peak factor ≥ 2.1				
Class 4, 4kV, frequencies 5kHz and 100kHz				
Class 4, line-to-ground 6.6 kV, line-to-line 4.4 kV;				
Class 4, air discharge 15kV, contact discharge 8kV				
Frequency 80MHz ~ 1GHz, field strength 20V/m				
Frequency 1GHz ~ 3GHz, field strength 20V/m				
Frequency (I30 ~ 230) MHz 30db (uV/m)				
Frequency (230 ~ 1000) MHz 37db (uV/m)				
Frequency 0.15 MHz ~ 80MHz Power Supply Port 20V				
Common mode/differential mode: 2.5 kV				
1MHz and 100kHz				
Continual (60s): 100A/m				
Short time (3s): 1000A/m				
100A/m 100kHz and 1MHz				
Level 4, start test voltage (Vrms): 15Hz ~ 150Hz: 30 ~ 3; 150Hz ~				
1.5 kHz: 3; 1.5 kHz ~ 15kHz: 3 ~ 30; 1.5 kHz ~ 15kHz: 30;				
1000A/m (8/20 us)				
Power ports: 15th harmonics and below: 10% Un; 15th ~ 100th				
harmonics: 10% Un				
Decreased to 1%Un (minimum 3Vrms); 100th ~ 200th harmonics:				
1%Un (min. 3Vrms)				

2.2.4 Protection characteristics

Any kind of protection action will be recorded, and the detailed parameters and time of tripping can be obtained through information queries. Each protection can be set with a corresponding digital output (DO).

2.2.4.1 Overload long-time protection

The overload long-time protection function is generally used to provide the cable from overload, and is based on the true RMS of the current.

2.2.4.1.1 overload long-time protection setting parameters

Table 4 overload long-time protection setting parameters

Parameter name	Setting range	Setting step size	Remarks
		1A (frame size is less than 3200A)	
protection setting: Ir	(0.4 ~ 1.0) In	2A (frame size is greater than	
		or equal to 3200A)	

Parameter name	Setting range	Setting step size	Remarks
Protection curve selection	DT: Definite time It: Quick Inverse time I²t: Express Inverse time I²t: High voltage fuse compatible		
Delay time setting: Tr	15s, 30s, 60s, 120s, 240s, 480s	-	
Thermal memory time setting	(0 ~ 30) min	1min	
Alarm pick-up value	(0.4 ~ 1.0) In	1A (frame size is less than 3200A) 2A (frame size is greater than or equal to 3200A)	
Alarm pick-up time delay	(1 ~ 10) s	1s	These settings are only available if the execution
Alarm drop-out value	0.9 times alarm action setting value	-	mode is "Alarm".
Alarm drop-out time delay	Same as alarm action time	-	
Execution mode	Close/Action/Alarm		

Note: By ex-factory default, the conventional curve type is I2t, the action current is Ir = 1.0 In, the action time is Tr = 15s, the thermal memory time is set to 0min, and the protection type is action

2.2.4.1.2 Overload long-time protection characteristics

Table 5 Overload long-time protection characteristics

Characteristic Current multiple (I/Ir)		Conventional operation time	Allowable delay error
Non-pickup characteristic	< 1.05	> 2 hours non-trip	_
Pick-up characteristic	> 1.3	< 1h trip	_
Pick-up delay	Dick up dolay	See Table 6	± 10% (inherent absolute
Fick-up delay	≥ 1.3	See lable 6	error ± 40 ms)

Table 6 Types of characteristic curves and related parameters

Curve	Fault			operatio	n time tr			Damada
type	current	15s	30s	60s	120s	240s	480s	Remarks
	1.5 × lr	2s	4s	8s	16s	32s	64s	
DT	2 × Ir	2s	4s	8s	16s	32s	64s	tr = Tr/7. 5;
DI	6 × Ir	2s	4s	8s	16s	32s	64s	ti = 11/7. 3,
	7.2 × Ir	2s	4s	8s	16s	32s	64s	
	1.5 × lr	15s	30s	60s	120s	240s	480s	
lt	2 × Ir	11.25s	22.5s	45s	90s	180s	360s	$tr = (1.5 \text{ lr/l}) \times Tr$
"	6 × Ir	3.75s	7.5s	15s	30s	60s	120s	(min. 0.8 s, max. 655s)
	7.2 × Ir	3.125s	6.25s	12.5s	25s	50s	100s	
	1.5 × lr	15s	30s	60s	120s	240s	480s	
l²t	2 × Ir	8.44s	16.87s	33.75s	67.5s	135s	270s	$tr = (1.5 \text{ Ir/I})^2 \times Tr$
11	6 × Ir	0.94s	1.87s	3.75s	7.5s	15s	30s	(min. 0.8 s, max. 655s)
	7.2 × Ir	0.8s	1.3s	2.6s	5.2s	10.41s	20.83s	
	1.5 × Ir	15s	30s	60s	120s	240s	480s	
l l⁴t	2 × Ir	4.75s	9.5s	19s	38s	75.94s	151.87s	tr = (1.5 lr/l)⁴ × Tr
''	6 × Ir	0.8s	0.8s	0.8s	0.8s	0.94s	1.87s	(min. 0.8 s, max. 655s)
	7.2 × Ir	0.8s	0.8s	0.8s	0.8s	0.8s	0.904s	

2.2.4.1.3 Thermal memory

To prevent unacceptable repeated or periodic overloads, the controller tracks and records the thermal effect of the load current. When the cumulative thermal effect of the overload reaches a predetermined level, the trip will be initiated. The change mode of thermal capacity is determined by the selected curve.

The thermal capacity increases only when the measured current is greater than 1.2Ir. When the circuit breaker trips due to overload or inverse time short circuit fault, or returns to a non-overload state from an overload state, the thermal capacity decays according to exponential law. Users can set the thermal capacity cooling time as: 0 ~ 30minutes, whose step length is 1 minute.



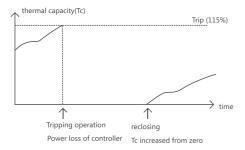


Fig. 1 Thermal memory characteristics without auxiliary power supply

When the controller is not connected to the auxiliary power supply, if the circuit breaker closes immediately after the trip, the thermal capacity generated by the previous current will be ignored. That is to say, the reclosing makes the controller power-on again and reset, and the thermal capacity is restored to zero.

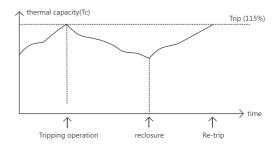


Fig. 2 Thermal memory characteristics with auxiliary power supply

When the controller is connected to the auxiliary power supply, the thermal capacity decreases after the operation of the circuit breaker, and the thermal capacity generated by the previous current after the circuit breaker is closed is remembered. That is to say, the thermal capacity decreases after the operation of opening, and the thermal capacity continues to change according to the current at this time after reclosing.

2.2.4.2 Short-time (Short-circuit) protection and short-time delay

Short-time protection serves to prevent impedance short-circuits in distribution systems, typically caused by local short-circuits where the current exceeds the range of an overload but may not be excessively high. This protection is based on true RMS current and is divided into two sections: the inverse time section and the definite time section. Incorporating a short-time delay enhances protection coordination with downstream devices, improving time selectivity.

The short-time protection can be equipped with a Zone Interlock (ZSI) function to enhance selectivity. When a short-circuit fault occurs at the outgoing side of the downstream circuit breaker, it sends an inhibit signal to the upstream breaker to hold it while the downstream breaker trips instantaneously. If the fault persists beyond the duration of the short-time delay set on the upstream breaker, the upstream breaker will initiate a tripping order to open the circuit. Implementing this function requires the use of digital input (DI) to detect the zone interlock signal of the downstream circuit breaker and digital output (DO) to send the interlocking signal to the upstream circuit breaker.

2.2.4.2.1 Short-time protection related settings parameters

Table 7 short-time protection setting parameters

Parameter name	Setting range	Setting step size	Remarks
Protection setting Isd	(1.5 ~ 15) Ir (In < 3600) 1.5 Ir ~ 50kA (In ≥ 3600)	1A (frame size is less than 3200A) 2A (frame size is greater than or equal to 3200A)	Ir is the overload long-time protection setting value.
Protection curve selection	Definite time Inverse time		
Delay time setting Tsd	(0.10, 0.20, 0.30, 0.40) s	Step size: 0.1	
Alarm pick-up value	(1.5 ~ 15) Ir (In < 3600) 1.5 Ir ~ 50kA (In ≥ 3600)	1A (frame size is less than 3200A) 2A (frame size is greater than or equal to 3200A)	
Alarm pick-up time delay	(1 ~ 10) s	1s	These seetings are only available if the protection type is "Alarm".
Alarm drop-out value	0.8 times alarm pick-up value	-	the protection type is Alaim.
Alarm drop-out time delay	Same as the alarm pick-up time delay	-	
Execution mode	Close/Action/Alarm		

Parameter name	Setting range	Setting step size	Remarks
Short Circuit Zone Interlock (ZSI)	1. At least one digital output (DO) is set as "zone interlock" or "short circuit interlock" 2. At least one digital input (DI) is set as " zone interlock" or " short circuit interlock"		When DI/DO is set as "zone interlock", it works for both " ground region interlock" and " short circuit zone interlock", and when it is set as "short circuit interlock", it only works for "short circuit zone interlock". If the function is not set, the zone interlock function will not work.

Notes: 1. When there are three zones of this protection at the same time, the setting values cannot be crossed, and Ir < Isd < Ii;

2. By conventional ex-factory default, the curve type is definite time, protection type is action, action current $Isd = 8.0 Ir (In \le 5000) or Isd = 50kA (In \ge 6300)$, and action time Isd = 0.40s.

2.2.4.2.2 Action characteristics of short-time definite time protection

Table 8 Short-time definite time protection characteristics

Characteristic	Current multiple (I/Isd)	Conventional operation time	Allowable delay error
Non-pickup characteristic	< 0.9	Non-trip	
Pick-up characteristic	> 1.1	Trip	
Pick up dolay	Pick-up delay 1.5	Definite time equals the	±15% or inherent absolute error
Fick-up delay		protection setting Tsd	±40ms (take the maximum value)

2.2.4.2.3 Short-time inverse time protection characteristics

Table 9 Short-time inverse time protection characteristics

Characteristic	Current multiple (I/Isd)	Conventional operation time	Allowable delay error
Non-pickup characteristic	< 0.9	Non-trip	
Pick-up characteristic	> 1.1	Trip	
Pick-up delay	1 5	Note	±15% or inherent absolute error
Fick-up delay	1.5	Note	±40ms (take the maximum value)

Note: Short-time inverse time delay characteristics: when $I \ge 8Ir$, it is definite time; $T = (8Ir/I)^2 \times Tsd$ (1.1 Isd < I < 8Ir). For example:

- 1. Long delay setting value: Ir; Short-time inverse time setting value: Isd = 4Ir; Fault current: I = 9Ir, in which case the fault delay is T, and the action type is a short delay definite time.
- 2. Long delay setting value: Ir; Short delay inverse time setting value: Isd = 2Ir; Fault current: I = 3Ir; At this time, the fault delay is T = $(8Ir/I)^2 \times Tsd$, and the protection type is short-circuit inverse time.

2.2.4.3 Short-circuit instantaneous protection

The instantaneous protection function prevents solid short-circuit in the distribution system. Such faults are generally phase-to-phase faults, and the short-circuit current is relatively large, which requires rapid disconnection. This protection is based on the true RMS or peak current.

2.2.4.3.1 Instantaneous protection setting parameters

Table 10 Instantaneous protection setting parameters

Parameter name	Setting range	Setting step size	Remarks
	(1.5 ~ 15) In (In ≤ 5000)	1A (frame size is less than 3200A)	
Protection setting li	1.5 ln ~ 75kA (ln ≥ 6300)	2A (frame size is greater than	
	1.5 III ~ 75KA (III ≥ 0500)	or equal to 3200A)	
Protection mode selection	RMS value		
Protection mode selection	Peak value		
	(1.5 ~ 15) In (In ≤ 5000)	1A (frame size is less than 3200A)	
Alarm pick-up value	1.5 ln ~ 75kA (ln ≥ 6300)	2A (frame size is greater than	
	1.5 III ~ 75KA (III ≥ 0500)	or equal to 3200A)	
Alarm pick-up time delay	(1 ~ 5) s	1s	These settings are only available if the execution mode is
A1 1 1	0.7 times the alarm		"Alarm".
Alarm drop-out value	pick-up value	-	
Alarm drop-out time delay	Same as alarm pick-up		
	time delay	-	
Execution mode	Close/Action/Alarm		

Note: By conventional ex-factory default, the protection method is RMS value, the protection type is action, and the action current is $Ii = 12.0 In (In \le 5000) or Ii = 75kA (In \ge 6300)$.



2.2.4.3.2 Instantaneous protection characteristics

Table 11 Instantaneous protection characteristics

Characteristic	Current multiple (I/Ii)	Conventional operation time
Non-pickup characteristic	< 0.9	Non-trip
Pick-up characteristic	> 1.1	Trip
Pick-up delay	≥ 1. 1	≤ 0. 2 s

2.2.4.4 Earth fault protection characteristics

For single-phase earth fault protection, there are two protection modes: vector summation (difference) type (T) and earth current type (W). T-type detects zero-sequence current, that is, the controller computes the vector sum of conductors (3-phase 4-wire system) or conductors (3-phase 3-wire system) currents for protection. The earth current mode directly detects the current in on the earth cable through a special external transformer, and which can protect the circuit breaker from the upper and lower level earth faults at the same time. The maximum distance between the transformer and the circuit breaker is no more than 5 meters. Region interlock can be realized for differential earth fault.

2.2.4.4.1 Earth fault protection (vector sum) setting parameters

Table 12 Earth fault protection (vector sum) setting parameters

Protection setting Ig Protection setting Ig Protection setting Ig Delay time setting Tg Protection curve selection Execution mode Earth fault zone interlock (for T-type earth fault) (ZSI) Earth fault zone interlock (for T-type earth fault) (ZSI) Earth fault zone interlock (for T-type earth fault) (ZSI) Protection setting Ig 100A ~ 1.0 In, (In ≤ 400 A) (0.2 ~ 1.0) In, (630A ≤ In ≤ 3200 A) 100.2 In ~ 3200 A, In > 3200 A Definite time Inverse time Close/Action/Alarm Close/Action/Alarm When DI/DO is set to as "zone interlock" or "ground interlock" or "gr				
Protection setting Ig (0.2 ~ 1.0) In, (630A ≤ In	Parameter name	Setting range	Setting step size	Remarks
Protection curve selection Execution mode Close/Action/Alarm Close/Action/Alarm When DI/DO is set to as " zone interlock", it works for both " ground zone interlock", and " short circuit zone interlock", and when it is set as "short circuit zone interlock", it only works for " short circuit zone interlock", it only works for " short circuit zone interlock", it only works for " short circuit zone interlock". If the function is not set, the zone	Protection setting Ig	(0.2 ~ 1.0) In, (630A ≤ In ≤ 3200 A)	2A (Frame size is greater than	
Execution mode Close/Action/Alarm Close/Action/Alarm When DI/DO is set to as " zone interlock", it works for both " ground zone interlock", and " short circuit zone interlock", and when it is set as "short circuit interlock", it only works for " short circuit zone interlock", it only works for " short circuit zone interlock", it only works for " short circuit zone interlock". If the function is not set, the zone	Delay time setting Tg	(0.1 ~ 0.4) s	0.1 s	-
Earth fault zone interlock (for T-type earth fault) (ZSI) 1. At least one digital output (DO) is set as " zone interlock" or "ground interlock" or "groun	Protection curve selection		-	-
Earth fault zone interlock (for T-type earth fault) (ZSI) 1. At least one digital output (DO) is set as "zone interlock" or "ground interlock" 2. At least one digital input (DI) is set as "zone interlock" or "ground interlock" or "ground interlock" or "short circuit zone interlock", it only works for "short circuit zone interlock", it only works for "short circuit zone interlock". If the function is not set, the zone	Execution mode		Close/Action/Alarm	
	,	(DO) is set as " zone interlock" or "ground interlock" 2. At least one digital input (DI) is set as "zone interlock" or "	-	interlock", it works for both " ground zone interlock" and " short circuit zone interlock", and when it is set as "short circuit interlock", it only works for " short circuit zone interlock". If the function is not set, the zone

Note: The ground default protection is vector summation protection, and by conventional ex-factory default, the protection type is Close.

2.2.4.4.2 Earth fault protection (earth current) setting parameters

Table 13 Earth fault protection (earth current) setting parameters

Parameter name	Setting range	Setting step size	Remarks
	100A ~ 1.0 ln, (ln ≤ 400A)		
Protection setting Ig	(0.2 ~ 1.0) × In, (630A ≤ In <	1A	earth current mode
Frotection setting ig	1250A)	IA	earth current mode
	500A ~ 1200A, (In ≥ 1250A)		
Delay time setting Tg	(0.1 ~ 0.4) s	0.1 s	
Protection curve selection	Definite time	_	_
	Inverse time		
	Set one DO of the signal unit to	as "earth current fault".	
Protection Alarm DO Output	(This is not necessary. If this iter	n is not set, the alarm information	can only be read from the
	controller display screen, and th	ere is no contact output.)	
Execution mode	Close/Action/Alarm		
Note: By conventional ex-factory default, the protection type is Close.			

2.2.4.4.3 Earth fault protection definite time action characteristics

The action characteristics and allowable delay error of the ground fault protection are shown in Table 14.

Table 14 Earth fault protection definite time action characteristics

	•		
Characteristic	Current multiple (I/Isd)	Operation time	Allowable delay error
Non-pickup characteristic	< 0.9	Nonactivation within 2Tg	
Pick-up characteristic	≥ 1. 1	Delayed activation within 2Tg	
Pick-up delay	1.1	Definite time equals the delay	±15% or inherent absolute error
Fick-up delay	1.1	time setting value Tg	±40ms (take the maximum value)

2.2.4.4.4 Earth fault protection inverse time action characteristics

Table 15 Earth fault protection inverse time action characteristics

Characteristic	Current multiple (I/Ig)	Trip time	Allowable delay error
Non-pickup characteristic	< 0.9	Nonactivation within 2Tg	
Pick-up characteristic	≥ 1. 1	Delayed activation within 2Tg	
Pick-up delay	1.1	Note	±15% or inherent absolute error
Fick-up delay	1.1		±40ms (take the maximum value
Note: Inverse time characteristic of earth fault: when I ≥ In or 1200A or 3200A, it is definite time;			
When I < In or 1200A or 3200A, T = $(In/I)^2 \times Tg$ or T = $(1200/I)^2 \times Tg$ or T = $(3200/I)^2 \times Tg$.			

2.2.4.4.5 Detection schematic diagram

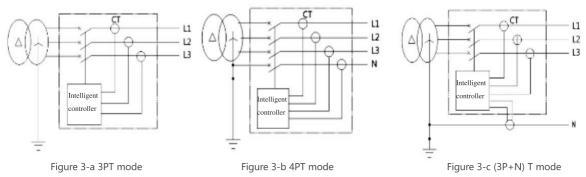
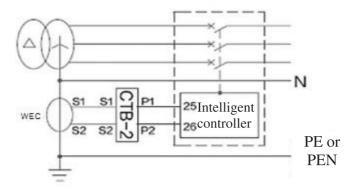


Fig.3 Principle of vector sum type ground protection



WEC: Earth Current Transformer CTB-2: Earth Current Transformer Conversion Module
Fig.4 Detecting Principle of Earth Current Mode (W) Earth fault Protection

2.2.4.5 Dual earth protection

When the intelligent controller is equipped with dual grounding protection function, the protection can be carried out according to the vector summation type and the earth current type at the same time. In the vector summation type protection, the controller trips the circuit breaker directly. In the ground current protection, in addition to tripping the circuit breaker, a DO control signal is output at the same time, which can be connected to the front end of the transformer to control the trip of the medium voltage circuit breaker.

2.2.4.6 Earth fault alarm

2.2.4.6.1 Principles of Action

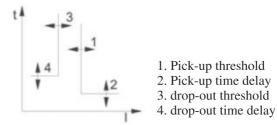


Fig.5 Alarm action principle



As shown in Figure 6: the alarm will be initiated when the earth current is greater than the pick-up threshold setting (1) and for a duration longer than the pick-up time delay (2). The ground alarm DO is operated.

When the earth current drops below the drop-out threshold (3) for a duration longer than the drop-out delay (4), the alarm is reset, and the ground alarm DO is reset.

The drop-out threshold (3) must be less than or equal to the pick-up threshold (1).

2.2.4.6.2 Earth fault (Vector Sum) setting parameters

Table 16 Earth Fault (Vector Sum) Alarm Setting Parameters

Parameter name	Setting range	Setting step size	Remarks
Alarm pick-up threshold	100A ~ 1.0 ln, (ln ≤ 400 A) (0.2 ~ 1.0) ln, (630A ≤ ln ≤ 3200 A) 0.2 ln ~ 3200 A, ln > 3200 A	1A (frame size is less than 3200A) 2A (frame size is greater than or equal to 3200A)	
Alarm pick-up time delay	(1 ~ 10) s	1s	These settings are only available
Alarm drop-out threshold	0.2 In ~ pick-up threshold	1A (frame size is less than 3200A) 2A (frame size is greater than or equal to 3200A)	if the execution mode is "Alarm".
Alarm drop-out time delay	(1 ~ 10) s	1s	

2.2.4.6.3 Earth fault (earth current) alarm setting parameters

Table 17 Earth fault(earth current) alarm setting parameters

Parameter name	Setting range	Setting step size	Remarks
Alarm pick-up threshold	100A ~ 1.0 ln, (ln ≤ 400A) (0.2 ~ 1.0) ln, (630A ≤ ln < 1250A) 500A ~ 1200A, (ln ≥ 1250A)		These settings are only available if the execution mode is "Alarm".
Alarm pick-up time delay	(1 ~ 10) s	1s	In the execution mode is Alann .
Alarm drop-out threshold	0.2 In ~ pick-up threshold	1A	
Alarm drop-out time delay	(1 ~ 10) s	1s	

2.2.4.6.4 Earth fault alarm pick-up characteristics

Table 18 Earth Fault Alarm Pick-up Characteristics

Characteristic	Current multiple (I/Isd)	Conventional operation time	Allowable delay error
Non-pick-up characteristic	< 0.9	Nonactivation	-
Pick-up characteristic	> 1.1	Activation	-
Pick-up delay	> 1. 1	Definite time is equal to the	± 10% (inherent absolute error
Fick-up delay	2 1. 1	alarm pick-up time delay	±40ms)

2.2.4.6.5 Earth fault alarm drop-out characteristics

Table 19 Earth fault alarm drop-out characteristics

Characteristic	Current multiple (I/return value)	Conventional operation time	Allowable delay error
Non-drop-out characteristic	> 1.0	Continuous activation	-
Drop-out characteristic	< 0.9	Deactivation	-
Drop-out delay	≤ 0. 9	Definite time is equal to the	± 10% (inherent absolute error
		alarm drop-out time delay.	±40ms)

2.2.4.7 Dual parameters protection

This intelligent controller can be preset with two sets of protection parameters, each includs four zones of protection functions: overload long-time protection, short circuit short-time protection, instantaneous protection, and single-phase earth fault protection. This is only effective when the protection type corresponding to parameter A is Action. It is used to switch from one set of parameters to another under certain operating conditions, such as power supply side of the circuit breaker is from transformer and generator, or change of the factory loads.

The switching between these two sets of parameters can be carried out in the following ways: activating through DI input status; setting through the human-machine interface; or sending a setup command over a communication network.

2.2.4.8 Neutral pole protection

In practical applications, the cable used by the neutral pole and current characteristics are often very different from those of the other three-phase. Intelligent controllers implement different protections for the neutral pole according to different applications. When the neutral pole is relatively smaller in dimensions (half of the phase conductors), the 50% setting can be used for protection; When the neutral pole is the same size as the other phases, 100% full setting may be used. Neutral pole protection is suitable for quadrupole (4P) and 3P + N products. The neutral pole protection setting parameters are shown in Table 20.

Table 20 Neutral pole protection setting parameters

Neutral pole protection type	Description
	Semi-neutral pole protection
	• In the case of neutral pole overload fault, the protection threshold is equal to half of the setting
	value.
500/	• In the case of neutral pole short-circuit short-time fault, the protection threshold is equal to half of
50%	the setting value.
	• In the case of neutral pole short circuit instantaneous fault, the protection threshold is equal to half
	of the setting value.
	• In the case of neutral pole grounding fault, the protection threshold is equal to the setting value.
	Full neutral pole protection
	• In the case of neutral pole overload fault, the protection threshold is equal to the setting value.
	• In the case of neutral pole short-circuit short-time fault, the protection threshold is equal to the
100%	setting value.
	• In the case of neutral pole short circuit instantaneous fault, the protection threshold is equal to the
	setting value.
	• In the case of neutral pole grounding fault, the protection threshold is equal to the setting value.
Off	Neutral pole protection off.
Note: Neutral pole protection	of the frame size 7500A can only be set to 50% or off. By conventional ex-factory default, it is set to

50% for this frame size, and 100% for all other frame sizes.

2.2.4.9 MCR protection

The MCR refers to making current release, which protects the making ability of the circuit breaker to prevent the circuit breaker from being damaged due to the current exceeding the making capacity limit. This protection works at the moment (within 100ms) from opening to closing of the circuit breaker, and the MCR will exits is disabled after 100ms.

2.2.4.9.1 MCR protection setting parameters

Table 21 MCR protection setting parameters

Frame size	Setting range I _{MCR}	Ex-factory default setting
	5.0 kA ~ 10kA + off (In = 200A ~ 400A)	5.0 kA
1600	10kA ~ 20kA + off (In = 630A ~ 800A)	10kA
	16kA ~ 30kA + off (In = 1000A ~ 1600A)	16kA
2500	10kA ~ 20kA + off (In = 630A ~ 800A)	10kA
2500	16kA ~ 30kA + off (In = 1000A ~ 2500A)	16kA
3200	25kA ~ 49kA + off (In = 1600A ~ 3200A)	25kA
4000	16kA ~ 30kA + off (In = 800A ~ 1600A)	16kA
4000	25kA ~ 49kA + off (In = 2000A ~ 4000A)	25kA
7500	40kA ~ 80kA + off	40kA

Notes: 1. This group of setting values is generally set according to the breaking capacity of the circuit breaker when the circuit breaker leaves the factory.

2. Users cannot adjust and close this function. If there are special requirements (such as for testing, etc.), please specify when ordering.

2.2.4.9.2 MCR protection characteristics

Table 22 MCR protection characteristics

Characteristic	Current multiple (I/IMCR)	Conventional operation time
Non-pick-up characteristic	< 0.85	Non-trip
Pick-up characteristic	> 1.15	trip
Pick-up delay	≥ 1.15	≤ 0.2s

2.2.4.10 HSISC protection

HSISC is High setting instantaneous short circuit protection, which is a high-speed instantaneous protection within the circuit breaker. When the over-limit fault current is detected, the controller will send a trip command within 10ms.

2.2.4.10.1 HSISC protection setting parameters

Table 23 HSISC protection setting parameters

Frame size	Setting range I _{HSISC}	Ex-factory default setting
1600	40kA ~ 60kA + off	Off
2500	40kA ~ 60kA + off	Off
3200	50kA ~ 80kA + off	Off
4000	50kA ~ 80kA + off	Off
7500	80kA ~ 100kA + off	Off

Notes: 1. These settings are locked when the circuit breaker leaves the factory, and are non-user adjustable. 2. If there are special requirements for it to be unlocked (such as testing, etc.), please specify when ordering.



2.2.4.10.2 HSISC protection characteristics

Table 24 HSISC Protection Characteristics

Characteristic	Current multiple (I/IHSISC)	Conventional operation time
Non-pick-up characteristic	< 0.85	Non-trip
Pick-up characteristic	> 1.15	trip
Pick-up delay	≥ 1. 15	≤ 0. 2 s

2.2.4.11 Leakage Protection (E)

This is used to protect against earth leakage in equipment due to insulation failure and to protect human beings against electric shocks due to indirect contact via the exposed conductive parts. The leakage tripping value $I\Delta n$ is directly expressed in amperes and is independent of the circuit breaker rating. An additional zero-sequence rectangular transformer is required for earth leakage detection. This method is highly precise, has good sensitivity and is suitable for the protection against small leakage currents. 2.2.4.11.1 Leakage protection setting parameters

Table 25 Leakage protection setting parameters

Parameter name	Setting range	Setting step size		
Protection setting I∆n	(0.50 ~ 30.00)A	0.01A		
Delay time setting $T\Delta n$ (s)	Instantaneous, 0.18, 0.25, 0.50, 0.75, 1.00,			
Delay time setting TAIT (s)	1.25, 1.50, 1.75, 2.00, 2.25, 2.50	-		
	Set one DO of the signal unit as "Leakage Fa	ult".		
Protection Alarm DO Output	(This is not necessary. If this item is not set, the alarm information can only be read from			
	the controller display screen, and there is no contact output.)			
Execution mode	Close/Action/Alarm			

2.2.4.11.2 Leakage Protection Characteristics

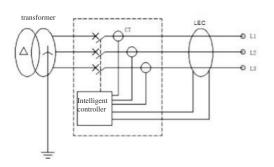
Table 26 Leakage Protection Characteristics

Characteristic	Current multiple (I/I∆n)	Conventional operation time	Allowable delay error
Non-pick-up Characteristics	< 0.8	Non-trip	-
Pick-up Characteristics	> 1.0	trip	-
Pick-up delay	Pick-up delav > 1.0	See Table 27	± 10% (inherent absolute error
Fick-up delay	≥ 1.0	See Table 27	± 40 ms)

Table 27 Leakage protection operation delay

						-							
Set time (s)	Instant	0.18	0.25	0.5	0.75	1	1.25	1.5	1.75	2	2.25	2.5	Remark
Set current					On	oration	time T(s	`					
multiple					Ор	eration	ume i(s)					
l∆n	0.04	0.36	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	Inverse time limit
2l∆n	0.04	0.18	0.25	0.5	0.75	1	1.25	1.5	1.75	2	2.25	2.5	T = (2IΔ n/l)
5l∆n	0.04	0.072	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1	* T∆n
> 5l∆n	0.04	0.072	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1	Definite time
Returnable time	0.02	0.06	0.08	0.17	0.25	0.33	0.42	0.5	0.58	0.67	0.75	0.83	-

2.2.4.11.3 Leakage protection detection principle



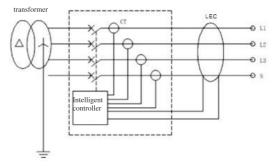


Fig.6 Detection principle of LEC leakage protection

Note: LEC is suitable for circuit breakers with in less than or equal to 3200A, among which frame size 2500 and 3200 products need to be vertically wired for working properly.

2.2.4.12 Leakage alarm

The action principle, action characteristics and return characteristics of the leakage alarm function are the same as the ground alarm. The relevant parameter settings of leakage alarm are set shown in Table 28.

Table 28 Leakage Alarm Setting Parameters

Parameter name	Setting range	Setting step size	Remarks
Alarm pick-up threshold	(0.5 ~ 30) A	0.01 A	
Alarm pick-up time delay	(1 ~ 10) s	1s	These settings are only available
Alarm drop-out threshold	0.5 A ~ pick-up threshold	0.01 A	if the execution mode is "Alarm".
Alarm drop-out time delay	(1 ~ 10) s	1s	

2.2.4.13 Current unbalance protection

The current unbalance protection protects against the phase loss fault and the three-phase current unbalance fault, and its operation principle is the same as that of the earth fault protection.

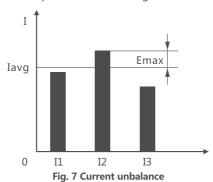
Calculation of unbalance rate:

 $lunbal = (Emax/lavg) \times 100\%$

Where lavg is the average value of true RMS of three-phase currents I1, I2, and I3

lavg = (11+12+13)/3;

Emax: is the maximum difference between each phase current and lavg



2.2.4.13.1 Current unbalance protection setting parameters

Table 29 Current Unbalance Protection Setting Parameters

Parameter name	Setting range	Setting step size	Remarks		
Protection Pick-up threshold	20% ~ 60%	1%			
Protection pick-up time delay	(1 ~ 40) s	1s	-		
Protection drop-out threshold	20%~pick-up threshold	1%	These settings are only available		
Protection drop-out time delay	(1 ~ 360) s	1s	if the protection type is "Alarm".		
Set one DO of the signal unit to as "current unbalance fault". Alarm DO output (This is not necessary. If this item is not set, the alarm information can only be read from the controller display screen, and there is no contact output.)					
Execution mode	Close/Action/Alarm				

2.2.4.13.2 Current unbalance protection pick-up characteristics

Table 30 Current unbalance protection pick-up characteristics

Characteristic	Actual current unbalance/ Protection Pick-up threshold	Setting step size	Remarks			
Non-pickup characteristic	< 0.9	Nonactivation	-			
Pick-up characteristic	> 1.1	Activation	-			
Pick-up delay	≥ 1. 1	logual to the protection pick up	± 10% (inherent absolute error ±40ms)			
Note: The current unbalance protection is enabled only when the maximum phase current is greater than 25% In.						

2.2.4.13.3 Current unbalance protection drop-out characteristics (these characteristics are only available when the execution mode is set to "Alarm")

Table 31 Current unbalance protection drop-out characteristics

Characteristic	Actual current unbalance/ Protection Pick-up threshold	Setting step size	Remarks
Non-drop-out characteristic	> 1.1	Continuous activation	_
Drop-out characteristic	< 0.9	Deactivation	-
Drop-out delay	≤ 0. 9	Definite time characteristic is equal to the protection drop-out time delay	± 10% (inherent absolute error ± 40 ms)



2.2.4.14 Current phase loss protection

The current phase loss protection is the limit state of three-phase current unbalance protection. The relevant parameters of the current phase loss protection are shown in Table 32.

Table 32 current phase loss protection setting parameters

Parameter name	Setting range	Setting step size	Remarks				
Protection pick-up threshold	90% ~ 99%	1%					
Protection pick-up time delay	(0.1 ~ 3) s	0.1 s	-				
Protection drop-out threshold	20% ~ Protection pick-up	1%					
Trotection drop-out timeshold	threshold	1 78	These settings are only available				
Protection drop-out time delay	(1 ~ 360) s	1s	if the protection type is "Alarm".				
	Set one DO of the signal unit as	"Current phase loss fault".					
Protection Alarm DO Output	(This is not necessary. If this item is not set, the alarm information can only be read from the						
	controller display screen, and there is no contact output.)						
Execution mode	Close/Action/Alarm	Close/Action/Alarm					

^{2.2.4.14.1} Current phase loss protection characteristics

Table 33 Current phase loss protection characteristics

Characteristic	Actual current unbalance rate/ Alarm pick-up threshold	Conventional operation time	Allowable delay error
Non-pick-up characteristic	< 0.9	Nonactivation	-
Pick-up characteristic	> 1.1	Activation	-
Pick-up delay	≥ 1. 1	legual to the protection pick-up	± 10% (inherent absolute error ±40ms)
Note: Only when the maximum phase current exceeds 25%In will the current phase loss protection be enabled.			

^{2.2.4.14.2} Current phase loss drop-out characteristic (this characteristic is only available when the execution mode is set to "alarm")

Table 34 Current phase loss drop-out characteristics

Characteristic	Actual current unbalance rate/ Alarm drop-out threshold	Conventional operation time	Allowable delay error
Non-drop-out characteristic	> 1.1	Nonactivation	-
Drop-out characteristic	< 0.9	Activation	-
		Definite time characteristic	± 10% (inherent absolute error
Drop-out delay		equals the protection drop-out	±40ms)
		time delay	±40HS)

2.2.4.15 Demand current protection

The controller calculates the demand value of the true RMS of each phase current in a measurement window, and activates a protection when the required value exceeds the limit. When the execution mode is alarm, its action is in principle the same as that of the ground alarm. The sliding time window can be modify in the "Measurement Table Settings" menu, and the relevant parameter settings for demand current protection are shown in Table 35.

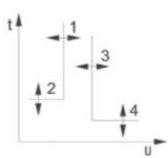
Table 35 Demand current protection setting parameters

Parameter name	Setting range	Setting step size	Remarks	
		1A (Frame size is less than		
Protection pick-up threshold	(0.4 ~ 1.0) In	3200A)	_	
Frotection pick-up tilleshold	(0.4 ~ 1.0) 111	2A (Frame size is greater than or		
		equal to 3200A)		
Protection pick-up time delay	15s ~ 1500s	1s	-	
		1A (Frame size is less than		
Protection drop-out threshold		3200A)	These settings are only available	
Frotection drop-out timeshold		2A (Frame size is greater than or	if the protection type is Alarm.	
		equal to 3200A)	in the protection type is Alaim.	
Protection drop-out time delay	15s ~ 3000s	1s		
	Set one DO of the signal unit as " Demand Current Fault".			
Protection Alarm DO Output	can only be read from the			
	controller display screen, and there is no contact output.)			
Execution mode	Close/Action/Alarm			

2.2.4.16 Under-voltage protection

The controller measures the true RMS of the primary circuit voltage. When the maximum value of the three line voltages is less than the setting value of the undervoltage protection, the undervoltage protection operates; When the minimum value of the three line voltages is greater than the return value, this alarm action is reset.

2.2.4.16.1 Undervoltage protection operation principles



- 1. pick-up threshold
- 2. pick-up time delay
- 3. drop-out threshold
- 4. drop-out time delay

Fig.8 Undervoltage protection operation principles

When the maximum voltage value is less than the pick-up threshold value (1) for a duration longer than the pick-up time delay (2), an alarm or trip signal activates, and an undervoltage fault DO is operated; When the voltage minimum value is greater than the drop-out threshold value (3) for a duration longer than the drop-out time delay (4), the alarm is reset, and the undervoltage fault DO is returned.

2.2.4.16.2 Undervoltage protection setting parameters

Table 36 Undervoltage protection setting parameters

Parameter name	Setting range	Setting step size	Remarks
Protection pick-up threshold	(0.2 ~ 0.7) Ue	1V	-
Protection pick-up time delay	(0.2 ~ 10) s	0.1 s	-
Protection drop-out threshold	Protection pick-up threshold ~ Ue	1V	These settings are only available if the execution mode is Alarm.
Protection drop-out time delay	(1 ~ 36) s	1s	
Execution mode	Close/Action/Alarm		

2.2.4.16.3 Undervoltage protection characteristics

Table 37 Undervoltage protection characteristics

Characteristic	Voltage multiple (Umax/ Protection pick-up threshold)	Conventional operation time	Allowable delay error
Non-pick-up characteristic	> 1.1	Nonactivation	-
Pick-up characteristic	< 0.9	Activation	-
Pick-up delay		leguals protection pick-up time	± 10% (inherent absolute error ±40ms)

2.2.4.16.4 Undervoltage protection alarm drop-out characteristics (only available when the execution mode is set to "Alarm")

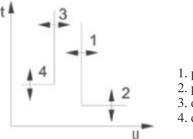
Table 38 Under-voltage protection alarm drop-out characteristics

Characteristic	Voltage multiple (Umin/ Protection drop-out threshold)	Conventional operation time	Allowable delay error
Non-drop-out characteristic	< 0.9	Continuous activation	-
Drop-out characteristic	> 1.1	Deactivation	-
Drop-out delay		leguals to the protection nick-up.	± 10% (inherent absolute error ±40ms)

2.2.4.17 Overvoltage protection characteristics

The controller measures the true RMS of the primary circuit voltage. When the minimum value of the three phase-to-phase voltages (line voltages) are all greater than the set value of the overvoltage protection, the overvoltage protection operates. When the maximum values of the three line voltages are less than the drop-out value, the alarm is reset.

2.2.4.17.1 Overvoltage protection operating principles



- 1. pick-up threshold
- 2. pick-up time delay
- 3. drop-out threshold
- 4. drop-out time delay

Fig.9 Overvoltage protection operating principles



When the minimum line voltage is greater than the pick-up threshold value (1) for a duration longer than the pick-up time delay time (2), an alarm or trip signal is activated, and an overvoltage fault DO is operated; During this time, when the maximum line voltage is less than the drop-out threshold value (3) for a duration longer than the drop-out time delay (4), the alarm is reset, and the overvoltage fault DO is returned.

2.2.4.17.2 Overvoltage protection setting parameters (overvoltage setting value must be greater than undervoltage setting value)

Table 39 Overvoltage protection setting parameters

Parameter name	Setting range	Setting step size	Remarks
Protection pick-up threshold	(1.0 ~ 1.35) Ue	1V	
Protection pick-up time delay	(1 ~ 5) s	1s	-
Protection drop-out threshold	1.0 Ue ~ protection pick-up	1V	
Totection drop-out timeshold	threshold	IV	These settings are only available
Protection drop-out time delay	(1 ~ 36) s	1s	if the execution mode is "Alarm".
	Set one DO of the signal unit as "overvoltage fault".		
Protection Alarm DO Output	(This is not necessary. If this item is not set, the alarm information can only be read from the		
	controller display screen, and there is no contact output.)		
Execution mode	Close/Action/Alarm		

2.2.4.17.3 Overvoltage protection characteristics

Table 40 Overvoltage Protection Characteristics

Characteristic	Voltage multiple (Umin/ Protection pick-up threshold)	Conventional operation time	Allowable delay error
Non-pickup characteristic	< 0.9	Nonactivation	_
Pick-up characteristic	> 1.1	Activation	-
Pick-up delay	≥ 1. 1	Definite time characteristic is	± 10% (inherent absolute error
		equal to the Protection pick-up	,
		time delay	±40ms)

2.2.4.17.4 Overvoltage protection alarm drop-out characteristics (only available when the execution mode is set to "alarm")

Table 41 Overvoltage protection alarm drop-out characteristics

· · · · · · · · · · · · · · · · · · ·				
Characteristic	Voltage multiple (Umax/ Protection drop-out threshold)	Conventional operation time	Allowable delay error	
Non-return characteristic	> 1.1	Continuous activation	-	
Return characteristic	< 0.9	Dea	-	
Return delay			± 10% (inherent absolute error ±40ms)	

2.2.4.18 Voltage unbalance protection

Voltage unbalance protection acts according to the unbalance rate between the three line voltages.

Its operation principle is the same as overvoltage protection.

Calculation of unbalance rate:

 $Uunbal = (|Emax|/Uavg) \times 100\%$

Where: Uavg: average true RMS of U12, U23, U31 three-phase voltages

Uavg = (U12+U23+U31)/3

Emax: Maximum difference between each line voltage and the average value

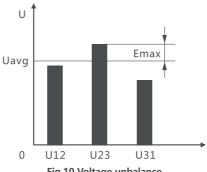


Fig.10 Voltage unbalance

2.2.4.18.1 Voltage unbalance protection setting parameters

Table 42 Voltage unbalance protection setting parameters

Parameter name	Setting range	Setting step size	Remarks
Protection pick-up threshold	2% ~ 30%	1%	
Protection pick-up time delay	(1 ~ 40) s	1s	-
Protection drop-out threshold	2% ~ Protection pick-up	1%	
riotection drop-out timeshold	threshold	170	These settings are only available
Protection drop-out time delay	(1 ~ 360) s	1s	if the protection type is "Alarm".
	Set one DO of the signal unit as "voltage unbalance fault".		
Protection Alarm DO Output	(This is not necessary. If this item is not set, the alarm information can only be read from the		
	controller display screen, and there is no contact output.)		
Execution mode	Close/Action/Alarm		

2.2.4.18.2 Voltage unbalance protection characteristics

Table 43 Voltage unbalance protection characteristics

Characteristic	Actual current unbalance rate/ Alarm pick-up threshold	Conventional operation time	Allowable delay error
Non-pick-up characteristic	< 0.9	Nonactivation	-
Pick-up characteristic	> 1.1	Activation	-
Pick-up delay		legual to the Protection nick-up	± 10% (inherent absolute error ±40ms)
Note: Voltage unbalance protection is enabled only when maximum phase voltage > 85% Ue.			

2.2.4.18.3 Voltage unbalance alarm drop-out characteristics (only available when the execution mode is set to "alarm")

Table 44 Voltage Unbalance Alarm Drop-out Characteristics

	Actual Voltage Unbalance Rate /Protection drop-out threshold		Allowable delay error
Non-drop-out characteristic	> 1.1	Continuous activation	_
Drop-out characteristic	< 0.9	Deactivation	-
Drop-out delay		Definite time characteristic is equal to the Protection dropout time delay	± 10% (inherent absolute error ±40ms)

2.2.4.19 Voltage phase loss protection

Voltage phase loss protection is the limit state of three-phase voltage unbalance protection.

2.2.4.19.1 Voltage phase loss protection setting parameters

Table 45 Voltage phase loss protection setting parameters

Parameter name	Setting range	Setting step size	Remarks	
Protection pick-up threshold	90% ~ 99%	1%		
Protection pick-up time delay	(0.1 ~ 3) s	0.1 s	-	
Protection drop-out threshold	20% ~ Protection pick-up	1%		
Protection drop-out tilleshold	threshold	1% T	These settings are only available	
Protection drop-out time delay	(1 ~ 360) s	1s	if the protection type is "Alarm".	
	Set one DO of the signal unit as	"voltage phase loss fault".		
DO output	(Not necessary. If this item is not set, the voltage phase loss information can only be read from			
	controller display screen, and there is no contact output.)			
Execution mode	Close/Action/Alarm			

2.2.4.19.2 Voltage phase loss protection characteristics

Table 46 Voltage phase loss protection characteristics

Characteristic	Actual Voltage Unbalance Rate / Protection pick-up threshold	Conventional operation time	Allowable delay error
Non-pickup characteristic	< 0.9	Nonactivation	_
Pick-up characteristic	> 1.1	Activation	-
Pick-up delay		legual to the Protection nick-up	± 10% (inherent absolute error ±40ms)
Note: Voltage phase loss protection is enabled only when the maximum phase voltage is > 85% Ue.			

2.2.4.19.3 Voltage phase loss alarm return characteristics (only available when the execution mode is set to "alarm")



Table 47 Voltage Phase Loss Alarm Return Characteristics

Characteristic	Actual Voltage Unbalance Rate /Protection drop-outthreshold	Conventional trip time	Allowable delay error
Non-pickup characteristic	< 0.9	Continuous activation	_
Pick-up characteristic	> 1.1	Deactivation	-
Pick-up delay	≥ 1. 1	Definite time characteristic is	± 10% (inherent absolute error
		legual to the Protection dron-	±40ms)
		out time delay	±40ms)

2.2.4.20 Phase sequence protection

The phase sequence is identified based on the incoming voltage. When the detected phase sequence matches the preset protection setting, the protection system activates instantly. However, this functionality is disabled if one or more phase voltages are lost. The relevant parameter settings of phase sequence protection are shown in Table 48.

Table 48 Phase sequence protection setting parameters

Parameter name	Setting range	Setting step size	
Action phase sequence	ABC/ACB	Effective when minimum line voltage >	
Action phase sequence	ABC/ACB	35% Ue	
	Set one DO of the signal unit as "phase sequence fault".		
Protection Alarm DO Output (Not necessary, if this is not set, the alarm information can only		formation can only be read from the	
	controller display screen, and there is no contact output.)		
Execution mode	Close/Action/Alarm		

2.2.4.21 Under-frequency and over-frequency protection

The controller detects the frequency of the system voltage, and executes the protection if frequence taken from phase-A is too high or too low. The operating principle and operating characteristics of over-frequency and under-frequency protections are the same as that of over-voltage and under-voltage protections. Refer to 2.2.4.16 and 2.2. 4.17.

2.2.4.21.1 Underfrequency protection setting parameters

Table 49 Underfrequency protection setting parameters

Parameter name	Setting range	Setting step size	Remarks
Protection pick-up threshold	(46.0 ~ 60.0) Hz	0.1 Hz	Maximum phase-A voltage > 20% Ue
Protection pick-up time delay	(0.2 ~ 5.0) s	0.1 s	-
Protection drop-out threshold	Protection pick-up threshold ~ 60.0 Hz	0.1 Hz	These settings are only available when the execution mode is " Alarm" (the protection drop-out
Protection drop-out time delay	(1 ~ 360) s	1s	threshold must be greater than or equal to the pick-up threshold)
Alarm DO output	Set one DO of the signal unit as "underfrequency fault". (Not necessary. If this item is not set, the alarm information can only be read from the controller display screen, and there is no contact output.)		
Execution mode	Close/Action/Alarm		

2.2.4.21.2 Overfrequency protection setting parameters (overfrequency setting value must be greater than underfrequency setting value)

Table 50 Overfrequency protection setting parameters

table 50 Over nequency protection setting parameters			
Parameter name	Setting range	Setting step size	Remarks
Protection pick-up threshold	(50.0 ~ 64.0) Hz	0.1 Hz	Maximum phase-A voltage
rotection pick-up tillesiloid	(30.0 % 04.0) 112	0.1 HZ	> 20% Ue
Protection pick-up time delay	(0.2 ~ 5.0) s	0.1 s	
			These settings are only available
Protection drop-out threshold	50Hz ~ setting value	0.1 Hz	if the Execution mode is "Alarm"
			(the Protection drop-out
			threshold must be less than or
Protection drop-out time delay	(1 ~ 360) s	1s	equal to the pick-up threshold.)
	Set one DO of the signal unit as	"overfrequency fault".	
Protection Alarm DO Output	tection Alarm DO Output (Not necessary. If this item is not set, the alarm information can only be read from the coldisplay screen, and there is no contact output.)		
Execution mode	Close/Action/Alarm		

2.2.4.22 Frequency change rate protection characteristics

The controller detects the frequency of the system voltage. When the frequency change rate is higher than the setting value, the frequency change rate protection operates. The relevant parameter settings of the frequency change rate protection are

shown in Table 51.

Frequency change rate = (Fmax-Fmin)/s;

Table 51 Frequency Change Rate Protection setting parameters

table 31 Trequency change rate Trocection setting parameters			
Parameter name	Setting range	Setting step size	Remarks
Protection pick-up threshold	(0.4 ~ 10) Hz/s	0.1 Hz/s	Effective in 45Hz ≤ F ≤ 65Hz
Protection pick-up time delay	(0.5 ~ 10) s	0.1 s	-
Protection drop-out threshold	0.4 Hz/s ~ Protection pick-up threshold	0.1 Hz/s	These settings are only available if the Execution mode is Alarm.
Protection drop-out time delay	(1 ~ 360) s	1s	
Protection Alarm DO Output	Set one DO of the signal unit as "Frequency Change Rate Fault". (Not necessary. If this item is not set, the alarm information can only be read from the controller display screen, and there is no contact output.)		
Execution mode	Close/Action/Alarm		

2.2.4.23 Power protection

2.2.4.23.1 Under-power (active) protection characteristics

The controller detects the active power of the system. When the absolute value of the total active power is lower than the setting value, the under-power (active power) protection operates. The relevant parameter settings of the under-power (active power) protection are shown in Table 52 (Sn refers to the rated apparent power).

Table 52 Under-power (active) protection setting parameters

Table 32 Officer-power (active) protection setting parameters			
Parameter name	Setting range	Setting step size	Remarks
Protection pick-up threshold	(0.4 ~ 1.0) In	1A (Frame size is less than 3200A) 2A (Frame size is greater than or	-
		equal to 3200A)	
Protection pick-up time delay	15s ~ 1500s	1s	-
Protection drop-out threshold	I .	1A (Frame size is less than 3200A) 2A (Frame size is greater than or equal to 3200A)	These settings are only available if the protection type is Alarm.
Protection drop-out time delay	15s ~ 3000s	1s	
Protection Alarm DO Output	Set one DO of the signal unit as " Demand Current Fault". (This is not necessary. If this item is not set, the alarm information can only be read from the controller display screen, and there is no contact output.)		
Execution mode	Close/Action/Alarm		

Table 53 Under-power (active) protection pick-up characteristics

<u> </u>			
Characteristic	Under-power (active power) /Protection pick-up threshold	Conventional operation time	Allowable delay error
	· · · · · · · · · · · · · · · · · · ·		
Non-pick-up characteristic	< 0.9	Nonactivation	-
Pick-up characteristic	> 1.1	Activation	-
Pick-up delay	≥ 1. 1	Definite time characteristic is	± 10% (inherent absolute error
		equal to the Protection pick-up	±40ms)
		time delay	±40ms)

Table 54 Under-Power (Active) Alarm drop-out Characteristics

Characteristic	Under-power (active power) /Protection drop-out threshold	Conventional operation time	Allowable delay error
Non-drop-out characteristic	> 1.1	Continuous activation	_
Drop-out characteristic	< 0.9	Deactivation	-
Drop-out delay	≤ 0. 9	Definite time characteristic is	± 10% (inherent absolute error
		equal to the Protection drop-	±40ms)
		out time delay	±40ms)

2.2.4.23.2 Overpower (active) protection characteristics

The controller detects the active power of the system. When the absolute value of the total active power is higher than the setting value, this protection operates. The relevant parameters settings of the overpower (active) protection are shown in Table 55.



Table 55 Overpower (active) protection setting parameters

Parameter name	Setting range	Setting step size	Remarks	
Protection pick-up threshold	(0.4 ~ 1.5) Sn	1kW (frame size is less than 3200A) 2kW (frame size is greater than or equal to 3200A)	-	
Protection pick-up time delay		0.1 s	-	
Protection drop-out threshold	0.4 Sn ~ Protection pick-up threshold	1kW (frame size is less than 3200A) 2kW (frame size is greater than or equal to 3200A)	These settings are only available if the execution mode is Alarm.	
Protection drop-out time delay	(1 ~ 360) s	1s		
Protection Alarm DO Output	Set one DO of the signal unit to as "overpower (active) fault". (Not necessary. If this item is not set, the alarm information can only be read from the controller display screen, and there is no contact output.)			
Execution mode	Close/Action/Alarm	Close/Action/Alarm		

2.2.4.23.3 Overpower (reactive) protection characteristics

The controller detects the reactive power of the system. When the absolute value of the total reactive power is higher than the setting value, the overpower (reactive) protection operates. The relevant parameter settings of the overpower (reactive) protection are shown in Table 56.

Table 56 Overpower (reactive power) protection related setting parameters

Parameter name	Setting range	Setting step size	Remarks
Protection pick-up threshold	(0.4 ~ 1.5) Sn	1kVar (frame size is less than 3200A) 2kVar (frame size is greater than or equal to 3200A)	-
Protection pick-up time delay	(0.2 ~ 20) s	0.1 s	-
Protection drop-out threshold	0.4 Sn ~ Protection pick-up threshold	1kVar (frame size is less than 3200A) 2kVar (frame size is greater than or equal to 3200A)	These settings are only available if the execution mode is Alarm.
Protection drop-out time delay	(1 ~ 360) s	1s	
Protection Alarm DO Output	Set one DO of the signal unit as "overpower (reactive) fault". (Not necessary. If this item is not set, the alarm information can only be read from the controller display screen, and there is no contact output.)		
Execution mode	Close/Action/Alarm		

2.2.4.23.4 Inverse power (active) protection characteristics

The controller detects the active power of the system. When the flow direction of the total active power is opposite to the direction of the set active power and is the active power is higher than the setting value, the inverse power (active) protection operates. See Table 57 for the parameter settings of the inverse power (active) protection.

Table 57 Inverse power (active power) protection setting parameters

Parameter name	Setting range	Setting step size	Remarks	
		1kW (frame size is less than		
Protection pick-up threshold	(0.1 ~ 1.0) Sn	3200A)		
Frotection pick-up threshold	(0.1 ~ 1.0) 311	2kW (frame size is greater than		
		or equal to 3200A)		
Protection pick-up time delay	(0.2 ~ 20) s	0.1 s	-	
		1kW (frame size is less than		
Protection grop-out threshold	0.1 Sn ~ Protection pick-up threshold	3200A)	These settings are only available	
		2kW (frame size is greater than	if the execution mode is Alarm.	
		or equal to 3200A)	If the execution mode is Alaim.	
Protection drop-out time delay	(1 ~ 360) s	1s		
	Set one DO of the signal unit as	"Inverse Power (Active) Fault".		
Protection Alarm DO Output	etection Alarm DO Output (Not necessary. If this item is not set, the alarm information can only be read from the			
	display screen, and there is no co	display screen, and there is no contact output.)		
Execution mode	Close/Action/Alarm			

2.2.4.23.5 Inverse power (reactive) protection characteristics

The controller detects the reactive power of the system. When the flow direction of the total reactive power is opposite to the set reactive power direction and is the reactive power is higher than the setting value, the inverse power (reactive) protection operates. See Table 58 for the parameter settings of the inverse power (reactive) protection.

Table 58 Inverse power	(reactive nower)	protection related	setting parameters

Parameter name	Setting range	Setting step size	Remarks
Protection pick-up threshold	(0.1 ~ 1.0) Sn	1kVar (frame size is less than 3200A) 2kVar (frame size is greater than or equal to 3200A)	-
Protection pick-up time delay	(0.2 ~ 20) s	0.1 s	-
Protection drop-out threshold	0.1 Sn ~ Protection pick-up threshold	1kVar (frame size is less than 3200A) 2kVar (frame size is greater than or equal to 3200A)	These settings are only available if the Execution mode is Alarm.
Protection drop-out time delay	(1 ~ 360) s	1s	
Protection Alarm DO Output	Set one DO of the signal unit to as "inverse power (reactive) fault". (Not necessary. If this item is not set, the alarm information can only be read from the controller display screen, and there is no contact output.)		
Execution mode	Close/Action/Alarm		

2.2.4.23.6 Three-phase power factor alarm function

Parameter settings related to the three-phase power factor alarm are shown in Table 59.

Table 59 Three-phase power factor alarm setting parameters

Parameter name	Setting range	Setting step size	Action error
Alarm pick-up threshold	0.20 ~ 0.95	0.01	-
Alarm pick-up time delay	(1 ~ 40) s		± 10% (inherent absolute error
Alaim pick-up time delay	(1 ~ 40) \$	15	±40ms)
Alarm drop-out threshold	Alarm pick-up threshold +0.05	-	-
Alarm drop-out time delay	(1 ~ 360) s	up threshold +0.05 $\begin{array}{cccccccccccccccccccccccccccccccccccc$	± 10% (inherent absolute error
Alaim drop-out time delay	(1 ~ 300) \$		±40ms)
	Set one DO of the signal unit as "Power Factor Alarm".		
Protection Alarm DO Output	(Not necessary. If this item is not	set, the alarm information can or	ly be read from the controller
	display screen, and there is no contact output.)		
Execution mode	Close/alarm		

2.2.4.23.7 Demand power protection

The controller calculates the demand value of the total active power of the system in a measurement window, and executes a protection when the demand value exceeds the limit. When the execution mode is alarm, its action principle is the same as that of the ground alarm. The sliding time window is set in the "Measurement Table Settings" menu, and the parameter settings related to the demand power protection are shown in Table 60.

Table 60 Demand power protection setting parameters

table to bethank power protection setting parameters				
Parameter name	Setting range	Setting step size	Remarks	
		1kW (frame size is less than		
Dratastian nisk up throshold	(0.4 1.0) 5 =	3200A)		
Protection pick-up threshold	(0.4 ~ 1.0) Sn	2kW (frame size is greater than		
		or equal to 3200A)		
Protection pick-up time delay	15s ~ 1500s	1s		
Protection drop-out threshold		1kW (frame size is less than		
	0.4 Sn ~ Protection pick-up threshold	3200A)	These settings are only available	
		2kW (frame size is greater than	if the execution mode is Alarm.	
		or equal to 3200A)	In the execution mode is Alarm.	
Protection drop-out time delay	15 s ~ 3000s	1s		
	Set one DO of the signal unit as	"required power fault".		
Protection Alarm DO Output	(Not necessary. If this item is not	(Not necessary. If this item is not set, the alarm information can only be read from the controller		
	display screen, and there is no contact output.)			
Execution mode	Close/Action/Alarm			

Note: 2.2.4.10 ~ 2.2.4.23 Conventional ex-factory default execution mode is Close.

2.2.4.24 Load monitoring(load shedding) function

Load monitoring serves dual purposes: providing pre-alarming and controlling branch load. It can be configured based on either power or current. Typically, it regulates the load within the same branch. When operational parameters exceed the predefined pick-up threshold, the 'Load Monitoring 1' digital output (DO) is triggered after a delay, either in pulse or level mode, to disconnect the branch load. If the parameter value drops below the drop-out threshold after disconnection and following a specified delay, the 'Load Monitoring 1' DO is restored. Subsequently, the 'Load Monitoring 2' DO is activated, either in level mode or pulse mode, to restore power supply to the disconnected load.

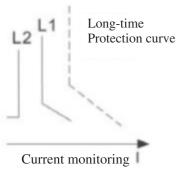
2.2.4.24.1 Operating Principles of Current-based Load Monitoring



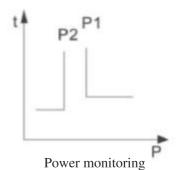
With current as the operating parameter; the action inverse time characteristic is the same as that of the overload protection, the drop-out threshold is set independently, and the load drop-out time delay is definite.

2.2.4.24.2 Operating principles of load monitoring based on active power

The protection takes the active power of the system as the operating parameter; both action and return delay time are definite.



Note: Pick-up threshold L1 ≥ Drop-out threshold L2 Figure 11 Operation characteristics of load monitoring mode based on current



Note: Pick-up threshold P1 ≥ Drop-out threshold P2. Figure 12 Operation characteristics of load monitoring mode based on power

2.2.4.24.3 Load monitoring setting parameters

Table 61 Current based load monitoring setting parameters

Parameter name	Setting range	Setting step size	Remarks
		1A (frame size is less than	
Protection pick-up threshold	0.4 lr (or 100A) ~ lr	3200A)	
Protection pick-up tilleshold	0.4 II (01 100A) ~ II	2A (frame size is greater than or	
		equal to 3200A)	Ir: overload long-time protection
Protection pick-up time delay	(20 ~ 80) % Tr	1%	setting, Tr: overload long-time
		1A (frame size is less than] 3
Protection drop-out threshold	0.2 Ir (minimum value is 80A) ~	3200A)	protection delay time
rotection drop-out timeshold	Protection pick-up threshold	2A (frame size is greater than or	
		equal to 3200A)	
Protection drop-out time delay	(10 ~ 600) s	1s	
Note: To use this function, the br	eaker should be equipped with ac	dditional PSU-1 power supply mod	dule and RU-1 relay module

Table 62 Power load monitoring setting parameters

Parameter name	Setting range	Setting step size	Remarks
Protection pick-up threshold	(200 ~ 10000) kW	1kW	
Protection pick-up time delay	(10 ~ 3600) s	1s	
Protection drop-out threshold	100kW ~ Protection pick-up	ction pick-up 1kW	
Frotection drop-out tilleshold	threshold		
Protection drop-out time delay	(10 ~ 3600) s	1s	
Note: To use this function, the breaker should be equipped with additional PSU-1 power supply module and RU-1 relay module			

2.2.4.25 Busbar temperature monitoring and protection characteristics

Busbar temperature monitoring can be used for pre-alarming or control of branch load or tripping circuit breaker. The protection will be carried out according to the temperature of the busbar, generally used to control the load of the same branch or the circuit breaker itself. When the busbar temperature exceeds the pick-up value, the 'Temperature Monitoring 1' digital output (DO) is triggered after a delay, either in pulse or level mode to cut out the branch load or trip the circuit breaker itself. If the busbar temperature after execution is lower than the drop-out value, after a set delay, "Temperature Monitoring 1" DO is restored, and "Temperature Monitoring 2" DO (level mode or pulse mode) is activated, either in level mode or pulse mode, to restore power supply to the disconnected load.

2.2.4.25.1 Operating principles of load monitoring based on busbar temperature

The load monitoring takes the busbar temperature as the operating parameter, whose pick-up and drop-out delays are definite time.

2.2.4.25.2 Busbar temperature monitoring setting parameters

Table 63 Busbar Temperature Monitoring Setting Parameter
--

Parameter name	Setting range	Setting step size	Remarks
Protection pick-up threshold	100 °C ~ 150 °C (default 120 °C)	1 °C	
Protection pick-up time delay	(10 ~ 3600) s	1s	
Protection drop-out threshold	100 °C ~ Protection pick-up		
Protection drop-out timeshold	threshold	1 ℃	
Protection drop-out time delay	(10 ~ 600) s	1s	
	Set one DO of the signal unit as "busbar temperature". (Not necessary. If this item is not set, the alarm information can only be read from the controller display screen, and there is no contact output.)		
Protection Alarm DO Output			
Execution mode	Open/Close		
Note: To use this function, the br	eaker should be equipped with ac	Iditional PSU-1 power supply mod	dule and RU-1 relay module

2.2.4.26 Automatic reclosure function

The intelligent controller can be configured with automatic reclosure for unimportant fault protections. There are two reclosure modes. In Mode 1, when the automatic reclosure function is enabled, the shunt release will be controlled through the DO output to open the circuit breaker, and the circuit breaker will be reclosed by a closing electromagnet controlled by DO output. If the shunt release cannot open the circuit breaker through the DO output, the circuit breaker will be tripped via the magnetic flux converter, and in this case, the automatic reclosure cannot be achieved. In Mode 2, when the automatic reclosure function is enabled, the circuit breaker will be open through the magnetic flux converter, and then the DO output will control the remote reset module and the closing electromagnet reset interlock mechanism and the closing circuit breaker. Whether in Mode 1 or Mode 2, if the reclosure fails twice, the controller will generate an alarm (the DO function must be set correctly for this purpose). The circuit breaker product must be electric, that is to say, having a motor.

2.2.4.26.1 Overload reclosure settings parameters

Overload reclosure is set in Mode 1 by default. After operation of overcurrent or overload long-time protection, automatic reclosure will be executed according to the following reclosure delay. The overload reclosure parameter settings are shown in Table 64.

Table 64 Overload reclosure setting parameters

	31		
Parameter name	Setting range	Setting step size	Remarks
Reclosure delay	(10 ~ 3600) s	10	In case of reclosure failure, a
Treclosure delay	(10 12 3000) \$	15	manual check reset are required
Execution mode	Open/Close		

Notes: 1. To use this function, the breaker should be equipped with additional PSU-1 power supply module and RU-1 relay module; 2. If you choose Mode 2, please specify when ordering. For Mode 2, you need to purchase a remote reset module and a "ready for closing" device.

2.2.4.26.2 Three-phase reclosure with voltage on detection setting parameters

Three-phase reclosure with voltage on detection is set in Mode 1 by default. Automatic reclosure can be implemented when under-voltage, voltage loss, or volage phase loss protection is activated, utilizing the following parameters for three-phase reclosure with voltage detection and delay in Table 65.

Table 65 Three-phase reclosure with voltage on detection setting parameters

Parameter name	Setting range	Setting step size	Remarks
Reclosure setting value	(85% ~ 100%) Ue	1V	
Reclosure delay time setting value	(1 ~ 10) s	1s	
Execution mode	Open/Close		

Notes: 1. To use this function, the breaker should be equipped with additional PSU-1 power supply module and RU-1 relay module; 2. If you choose Mode 2, please specify when ordering. In Mode 2, you need to purchase a remote reset module and a "ready for closing" device.

2.2.4.27 Electric energy quality settings (conventional ex-factory default is off)

2.2.4.27.1 Overload pre-alarming function

The overload pre-alarming function generates early alarm before overload. The parameter setting range is shown in Table 66.



Table 66 the settings of Overload Pre-alarming Setting Parameters

Parameter name	Setting range	Setting step size	Remarks	
Alarm pick-up threshold	(0.75 ~ 1.05) Ir	1A (frame size is less than 3200A) 2A (frame size is greater than or equal to 3200A)	Ir: overload long-time protection	
Alarm pick-up time delay	0.5 Tr	-	setting value, Tr: overload long-	
Alarm drop-out threshold	0.9 x alarm current pick-up threshold	-	time delay time.	
Alarm drop-out time delay	0.5 Tr	-		
Protection Alarm DO Output	Set one DO of the signal unit as "Overload Pre-Warning". (Not necessary. If this item is not set, the alarm information can only be read from the controller display screen, and there is no contact output.)			
Execution mode	Close/Open			

2.2.4.27.2 See Table 67 for setting parameters related to power grid monitoring functions such as voltage and current unbalance rate, short-term voltage interruption, voltage temporary drop and temporary rise, and average voltage.

Table 67 Various power grid monitoring functions setting parameters

Parameter name	Setting range	Setting step size	Allowable delay error
Voltage unbalance rate	2% ~ 10%	1%	
Current unbalance rate	2% ~ 10%	1%	
Voltage short-term interrupt	0.04 s ~ 60s (< 0.2 Ue)	0.01 s	
	These values can be set	Voltage: 1V	
Voltage temporary rise	respectively: voltage: 1.05 Ue ~		Count the number of
	1.25 Ue; Time: 0.04 s ~ 60s	Time: 0.01 S	occurrences(sliding) per year
	These values can be set	Voltage: 1V	occurrences(sharing) per year
Voltage temporary drop	respectively: voltage: 0.2 Ue ~	Time: 0.01 s	
	0.9 Ue; time: 0.40 s ~ 60s	Time. 0.01 s	
Average voltage	Upper limit: (1.05 ~ 1.25) Ue	1V	
	Lower limit: (0.75 ~ 0.95) Ue	I V	
Execution mode	Close/Open		

2.2.4.27.3 Harmonic alarms

The harmonic alarm function is carried out in terms of the harmonic current total distortion rate THDi and the harmonic voltage total distortion rate THDu. The harmonic alarm setting parameters are shown in Table 68.

Table 68 Harmonic Alarm Setting Parameters

table of Harmonie Adam Setting Farameters						
Parameter name	Setting range	Setting step size	Allowable delay error			
Current Harmonic Alarm pick-up	100/ 200/	1%	_			
ithreshold: IHDi		170				
Voltage Harmonic Alarm pick-up	30/ 100/	10/	_			
threshold: THDu	3% ~ 10%	1%				
Harmonic alarm pick-up time	(10 120) -	1 -	±10% (inherent absolute error			
delay:	(10 ~ 120) s	1s	±40ms)			
Harmonic Alarm drop-out	Alarma misk up throshold 20/		_			
threshold	Alarm pick-up threshold - 2%	_				
Harmonic Alarm drop-out time	(10 ~ 360) s	1 -	±10% (inherent absolute error			
delay	(10 ~ 360) \$	1s	±40ms)			
-	Set one DO of the signal unit as	"Harmonic Alarm".				
Protection Alarm DO Output	(Not necessary. If this item is not set, the alarm information can only be read from the controller					
	display screen, and there is no contact output.)					
Execution mode	Close/Open					

2.2.5 Measurement functions

The intelligent controller has a built-in high-precision measurement function, which meets the requirements of IEC 61557-12: 2007.

2.2.5.1 Current measurement

Table 69 Current Measurement Range and Accuracy

Symbol	Measuring range	Accuracy of measurement
I _A , I _B , I _C		± 0.5%
I _N	0.2 ln ~ 1.2 ln (A)	
I _{avq}	> 1.2 In (A)	(error range: ±0.5A at I < 100 A)
I _A , I _B , I _C , I _N	1	± 10%
la .	0.2 ln ~ 1.2 ln (A)	± 5%
ig	> 1.2 In (A)	± 10%
l∆n	0.3 ~ 36 (A)	± 10%
I _A , I _B , I _C	0 ~ 100%	± 5
	_{A' B'} _C _N _{Svq} _{Svq} _{A' B'} _{C' N} _B _{C' N} _D _D _D _D _D _D _D _D	$\begin{array}{lll} I_{_{A\!\!\!/}} I_{_{B\!\!\!/}} I_{_{C}} & & & & \\ I_{_{N}} & & & & \\ I_{_{N}} & & & \\ I_{_{S\!\!\!/}} I_{_{C}} I_{_{N}} & & & \\ I_{_{A\!\!\!/}} I_{_{B\!\!\!/}} I_{_{C\!\!\!/}} I_{_{N}} & & & \\ I_{_{C\!\!\!/}} I_{_{B\!\!\!/}} I_{_{C\!\!\!/}} I_{_{N}} & & & \\ I_{_{C\!\!\!/}} I_{_{B\!\!\!/}} I_{_{C\!\!\!/}} I_{_{N}} & & & \\ I_{_{C\!\!\!/}} I_{_{C\!\!\!/}} I_{_{C\!\!\!/}} I_{_{N\!\!\!/}} & & & \\ I_{_{C\!\!\!/}} I_{_{C\!\!\!/}} I_{_{C\!\!\!/}} I_{_{C\!\!\!/}} I_{_{C\!\!\!/}} & & \\ I_{_{C\!\!\!/}} I_{_{C\!\!\!/}} I_{_{C\!\!\!/}} I_{_{C\!\!\!/}} I_{_{C\!\!\!/}} & & \\ I_{_{C\!\!\!\!/}} I_{_{C\!\!\!/}} I_{_{C\!\!\!/}} I_{_{C\!\!\!/}} I_{_{C\!\!\!/}} & & \\ I_{_{C\!\!\!\!/}} I_{_{C\!\!\!\!/}} I_{_{C\!\!\!\!/}} I_{_{C\!\!\!\!/}} I_{_{C\!\!\!\!/}} & & \\ I_{_{C\!\!\!\!/}} I_{_{C\!\!\!\!/}} I_{_{C\!\!\!\!/}} I_{_{C\!\!\!\!/}} I_{_{C\!\!\!\!/}} & & \\ I_{_{C\!\!\!\!\!/}} I_{_{C\!\!\!\!/}} I_{_{C\!\!\!\!/}} I_{_{C\!\!\!\!/}} I_{_{C\!\!\!\!\!/}} & & \\ I_{_{C\!$

Note: The controller displays the currents of A, B, C and neutral pole (selected according to the system type) in a histogram and indicates the percentage of each current relative to the overload setting value (relative to the rated current when the overload is off)

2.2.5.2 Voltage measurement

Table 70 Voltage Measurement Ranges and Accuracy

Measured parameter	Symbol	Measuring range	Accuracy of measurement
Phase voltage	Uan, Ubn, Ucn	69V ~ 300V	±0.5%
Line voltage	Uab, Ubc, Uca	120V ~ 600V	
Average voltage	Uavg	120V ~ 600V	
Voltage unbalance rate		0 ~ 100%	±5
Phase sequence	Display the order of the phases		

2.2.5.3 Waveforms and Waveform Capture

The controller can capture current and voltage waveforms using digital sampling technique similar to those used in oscilloscope techniques. Waveform capture is a method to detect weak nodes in systems and equipment. By capturing the information displayed by the waveforms, the level, direction and amplitude of harmonics can be determined, and recorded on for one cycle. Users of the S-type intelligent controller can browse the following waveforms through the operation interface:

4 currents Ia, Ib, Ic and I_N

3 phase voltages Uan, Ubn, Ucn

2.2.5.4 Frequencies

Measurement range: 45.0 Hz ~ 65.0 Hz

Measurement accuracy: ±0.1%

Note: The frequency signals are taken from the phase A voltage.

2.2.5.5 Power measurement

Measurement parameters: system active power (P), reactive power (Q), apparent power (S), and power factor (PF);

Active power and reactive power, apparent power (not applicable to three-phase three-wire system), power factor of each phase;

Table 71 Power Measurement Ranges and Accuracy

Measured parameter	Symbol	Measuring range	Accuracy of measurement	
Total power	P, Q, S		Active powers 1 10/	
A-phase power	Pa, Qa, Sa	0.8 Ue ~ 1.2 Ue (V)	Active power: ± 1%	
B-phase power	Pb, Qb, Sb	0.2 In ~ 1.2 In (A)	Reactive power: ± 2%	
C-phase power	Pc, Qc, Sc	7	Apparent power: ± 1%	
Power factor	PF	0.5 L ~ +0.8 C	± 0.02	
Demand value	P, Q, S	0.8 Ue ~ 1.2 Ue (V) 0.2 In ~ 1.2 In (A)	Active power: ± 1% Reactive power: ± 2% Apparent power: ± 1%	

2.2.5.6 Electrical energy measurement

Measurement contents: total active electric energy (EP), total reactive electric energy (EQ), total apparent electric energy (ES), input active electric energy (EPin), input reactive electric energy (EQin), output active electric energy (EPout), output reactive electric energy (EQout)

Measured ranges: Active electric energy: -79999999.9 kWh ~ + 79999999.9 kWh

Reactive electric energy: -79999999.9 kVrh ~ + 799999999.9 kVarh;

Apparent electric energy: 0 ~ 79999999.9 KVAh

Measurement accuracy: The accuracy of active electric energy and apparent electric energy is \pm 1%, and the accuracy of reactive electric energy is \pm 2%

Note: The active power and reactive power, and input/output of electric energy shall be set to "upper incoming line" or "lower incoming line" in the "incoming line mode" option under the "measurement table setup" menu according to the actual use. 2.2.5.7 Harmonic measurement



2.2.5.7.1 Concerning harmonics

Harmonics are the most common problem in modern electrical equipment. When harmonics occur, the current or voltage waveform is distorted, no longer an absolute sinusoidal curve. Distorted current or voltage waveforms affect the distribution of electric energy, and the quality of the power supply is not optimal. Harmonics are caused by nonlinear loads for which the ralationship between voltage and crrent is not a linear function. Typical nonlinear loads are usually used in power electronics, and their proportion in the consumer market of electronic products is increasing. Common nonlinear loads include welding machines, arc furnaces, rectifiers, speed regulation devices for asynchronous or DC motors, computers, copiers, fax machines, TVs. microwave ovens, neon lights, and UPS, converters or other devices.

2.2.5.7.2 Definition of harmonics

A signal consists of the following factors:

- Original sinusoidal signal at fundamental frequency
- ② Other sinusoidal signals (harmonics) whose frequencies are integral multiples of the fundamental frequency
- 3 DC component (in some cases)

Any signals can be expressed by the formula:

$$y(t) = YO + \sum_{n=1}^{\infty} Yn \times sin(nt\omega - \phi n)$$

In the formula: YO is the DC component (generally regarded as 0)

Yn is the RMS value of the nth harmonic;

 ω is the angular frequency of the fundamental wave

 φ is the phase shift of the harmonic at t = 0

The harmonic order n refers to the nth harmonic, the frequency of which is n times that of the fundamental wave.

For example, the current and voltage waveforms are sinusoidal signals having the following characteristics.

Fundamental frequency 50Hz

The second harmonic frequency is 100Hz;

The third harmonic frequency is 150Hz;

The distorted waveform is the result of the superposition of several harmonics on the fundamental waveform.

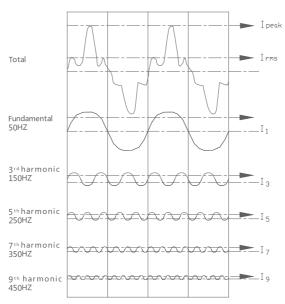


Figure 13 Harmonic waveform

2.2.5.7.3 Effects of harmonics

Increase the current of the system, which results in overload;

Excessive loss of equipment, and premature aging;

Voltage harmonics affect the normal work of the load;

Communication networks are affected.

2.2.5.7.4 Acceptable Harmonic Levels

Standards and regulations for harmonic interference:

Public Utility Compatibility Standards: Low voltage: IEC6000-2-2;

Medium voltage: IEC6000-2-41

Electromagnetic Compatibility (EMC) Standards: Loads below 16A: IEC6000-3-2

Loads above 16A: IEC6000-3-4

Some data have been developed internationally, and can be used to estimate typical harmonic values in distribution systems. A table of harmonic levels is shown below. Do not exceed the value listed in the table in applications.

Table 72 Acceptable Harmonic Levels

(1		rmonic Itiple of 3	3)	Odd harmonic (multiple of 3)			Even harmonic				Remarks	
Order n	LV	MV	EHV	Order n	LV	MV	EHV	Order n	LV	MV	EHV	
5	6	6	2	3	5	2.5	1.5	2	2	1.5	1.5	Low Voltage (LV)
7	5	5	2	9	1.5	1.5	1	4	1	1	1	System; Medium
11	3.5	3.5	1.5	15	0.3	0.3	0.3	6	0.5	0.5	0.5	Voltage (MV)
13	3	3	1.5	21	0.2	0.2	0.2	8	0.5	0.2	0.2	System; Extra
17	2	2	1	> 21	0.2	0.2	0.2	10	0.5	0.2	0.2	High Voltage
19	1.5	1.5	1					12	0.2	0.2	0.2	(EHV) System
23	1.5	1	0.7					> 12	0.2	0.2	0.2	(LITV) System
25	1.5	1	0.7									

Note: The harmonic content of the nth order harmonic is the percentage of the RMS value to the fundamental wave. This value is displayed on the controller's screen.

2.2.5.7.5 The harmonics we care about are low frequency odd harmonics, mainly the 3rd, 5th, 7th, 11th and 13th harmonics.

2.2.5.7.6 Harmonic measurement parameters

Purposes of harmonic measurement: obtain system information and detect drift as preventive measures;

As a corrective measure, diagnose the disturbance or detect the effectiveness of the scheme.

Fundamental wave measurement: Currents-----IA, IB, IC and IN

Voltages-----Uan, Ubn, Ucn

2.2.5.7.6.1 Total harmonic distortion THD and thd current:

Current:

The total distortion rate of THD harmonics relative to the fundamental wave is the rate of the square root of the sum of the squares of all harmonic currents of order 2 and higher to the fundamental wave current.

The total distortion rate of thd harmonics relative to the RMS of the current is the rate of the square root of the sum of the squares of all harmonic currents of order 2 and higher to the RMS current.

When this value is less than 10%, it is considered normal, and there is no risk of abnormal operation. When this value is in (10 -50) %, it means that there is obvious harmonic interference, which may cause temperature rise, and the cable size needs to be enlarged. When this value is greater than 50%, it means that there is a major harmonic interference. It may affect the normal operation, and the equipment needs to be analyzed in depth.

Voltage:

The total distortion rate of THD harmonics relative to the fundamental wave is the rate of the square root of the sum of the squares of the voltages of all harmonics of order 2 and higher to the fundamental wave voltage.

The total distortion rate of the thd harmonics relative to the RMS of the voltage is the rate of the square root of the sum of the squares of the voltages of all harmonics of order 2 and higher to the RMS voltage.

When this value is less than 5%, it is considered normal, and there is no risk of abnormal operation. When this value is in (5-8) %, it means that there is obvious harmonic interference, which may cause temperature rise, and the cable size needs to be enlarged. When this value is greater than 8%, it means that there is a major harmonic interference. It may affect the normal operation, and the equipment needs to be analyzed in depth.

Amplitude spectrum of the first 31st odd harmonics: The controller can display the FFT amplitudes of the 3rd to 31st harmonics, and the controller displays the amplitudes of harmonics of different frequencies in the histogram to form the spectrum analysis of harmonics.

2.2.5.8 Temperature measurement

Measurement parameters: Controller temperature;

Bus temperature A, bus temperature B, bus temperature C, bus temperature N;

Measurement range: controller temperature: -40 °C ~ + 70 °C;

Bus temperatures: -25 °C ~ + 200 °C; Measurement accuracy: ± 2 °C

2.2.6 Health diagnostics

The controller can monitor its own various states during start-up and operation, diagnose failures of the circuit breakers and its accessories, provide information for maintenance and indication of health status, and transmit information to local and/or remote terminals.

2.2.6.1 Circuit Breaker Diagnosis

The controller can monitor the position status of the circuit breaker proper (open, closed, tripped due to fault, energized and



ready, drawer seat position) and the temperature of the contact bus.

It can diagnose and monitor the service life of the circuit breaker proper (mechanical life, electrical life, contact wear, thermal aging) and predict the remaining mechanical life and electrical life, and finally reflect the health through the algorithm. If the diagnostic information of the circuit breaker proper is abnormal, an alarm can be generated through HMI and/or communication.

2.2.6.1.1 Health

Assuming that there are m indicators of equipment health status, they together constitute the eigenvector X = (X1, X2, ..., Xm) to characterize the health status, then the general definition of health is H = f(X1, X2, ..., Xm).

By integrating the health state indices of contact wear and thermal aging rate of circuit breaker, the health degree of the circuit breaker can be calculated, with the result indicated by 0-100 points. The recommended health scores are defined as follows:

- --71 ~ 100 points: the health degree is above 70 points, the health status of the circuit breaker is good and healthy, and regular (such as once a year) inspection and maintenance are required;
- --41 ~ 70 points: the health degree is between 40 and 70 points, the health status of the circuit breaker has declined, it is necessary to formulate a maintenance plan, and regular (such as once half a year) inspection and maintenance are required;
- $-0 \sim 40$ points: The health degree is below 40 points, which has reached a dangerous level. Regular inspection and maintenance are required (such as once one quarter), and the circuit breaker needs to should be replaced immediately if possible.

2.2.6.1.2 Contact wear

The controller assesses and presents the wear on the contact, indicating the contact's lifespan based on factors such as mechanical usage and the breaking current. The result is given by a percentage. The recommended definition of the circuit breaker contact wear represented by the percentage is as follows:

- --Contact wear 0-50%: the circuit breaker can operate normally, the remaining operating performance is 50%-100%, and there is no sudden change risk of contact pressure drop or temperature rise;
- --Contact wear 51% \sim 80%: the circuit breaker can operate normally, but the contact pressure drop or temperature rise has changed severely, and the remaining operating performance is 20% \sim 50%, which means a maintenance is required;
- --Contact wear 81% \sim 100%: normal operation cannot be ensured, which remains operating performance is less than 20%, and the circuit breaker needs to be replaced immediately.

2.2.6.1.3 Thermal aging rate

The controller assesses and presents the thermal aging rate on the contact, indicating the circuit breaker's lifespan based on factors such as current, temperature and other working condition information obtained by operational sensing combined with the operating time and service life. The results can be given by a percentage. The recommended definition is as follows:

- --Thermal aging rate 0 ~ 40%: the circuit breaker can operate normally;
- --Thermal aging rate 41% ~ 80%: the circuit breaker can operate normally, but the thermal aging rate of thermal components such as the soft connection of the circuit breaker is already high, and a maintenance needs to be arranged;
- \sim Thermal aging rate 81% \sim 100%: normal operation cannot be ensured, and the circuit breaker needs to be replaced immediately. 2.2.6.2 Controller self-diagnosis

2.2.6.2.1 Controller self-diagnostic content

This controller can diagnose its internal metering chip, memory, display module, the internal temperature, and the connection status of the trip coil. If there is an abnormality, an alarm can be generated through HMI and/or communication.

2.2.6.2.2 Controller self-healing function

For the internal metering chip of the controller, the reverse connection of the N-pole transformer and the self-capacity reduction due to temperature changes can be automatically controlled and corrected if the self-healing mode (optional) is enabled. If the metering chip is abnormal, it can be detected by measuring the protection signal current, which does not affect the normal measurement of the circuit breaker, but the measurement accuracy is reduced.

Reverse connection of the N-pole transformer can be automatically corrected by software, by automatic reversing of the reverse sequence transformer signals, without affecting the measurement accuracy, and avoiding misoperation.

For automatic capacity reduction due to temperature change, the intelligent controller can automatically adjust the overload long-time protection value according to the capacity reduction coefficient table of the circuit breaker to realize automatic capacity reduction.

2.2.6.3 Power grid diagnostics

This controller can monitor the voltage quality of the power grid, including voltage unbalance, short-term voltage interruption, voltage temporary drop and rise, voltage fluctuation, and average voltage, etc.to meet the needs of the development of new type power loads. For details, please refer to 2.2.4.27.2 and set the monitoring range as needed.

Table 73 Power Grid Quality Parameter Types

Parameter name	Data type	Page Display		
	Voltage unbalance			
	Voltage temporary drop and temporary			
	rise			
	Short voltage interruption			
	Average voltage	Count the number of (sliding) occurrences		
Electric energy quality parameters	Voltage harmonic alarm	, 3,		
	Frequency change rate	per year		
	Current unbalance			
	Three-phase power factor alarm			
	Current harmonic alarm			
	Overload warning			
		Real-time trend chart (10 cycles per one		
		point, 64 points)		
Voltage fluctuation diagram		Real-time trend chart (10 cycles per one		
voltage nuctuation diagram		point, 64 points)		

2.2.6.4 Environmental Diagnostics

The controller collects data through the temperature sensor to judge the ambient temperature. When the ambient temperature is > 60 °C, an alarm can be genetated through HMI and/or communication to remind user to reduce the capacity of the product. When the ambient temperature is <-20 °C, an alarm can be generated through HMI and/or communication to remind the user to check the working environment in the cabinet.

2.2.6.5 Diagnosis of Circuit Breaker Accessories

Circuit breaker accessories (undervoltage release, shunt release, closing electromagnet, electric operating mechanism, and external extended communication module) can be monitored through an external module or internal communication method. In case of abnormalities, an alarm can be generated through HMI and/or communication.

2.2.6.6 Fault recording

When the controller implements a protection, it can be chosen to record waveforms of long-time, short-time, instantaneous, or 2 cycles before tripping upon grounding fault. The long-delay, short-delay, and instantaneous protection waveforms include those of the fault phase current and voltage, and the grounding protection waveforms include three-phase or four-phase current waveforms. The waveforms are stored in a non-volatile memory.

2.2.7 Maintenance reminder function

This controller has the function of circuit breaker maintenance reminder, composed of circuit breaker proper maintenance and accessory maintenance, controller self-diagnosis maintenance prompts, and regular maintenance prompts. According to the diagnosis content and risk degree, different maintenance prompts are provided to meet the needs of safe use of products. The health diagnosis risk levels and prompts are shown in Table 74.

Table 74 Health Diagnosis Risk Levels and Prompts

Diagnostic type	Diagno	stic type	Risk level	Maintenance Prompt	Remarks
1	Position Red clo	Open/ Close state		When there are current measurement data but wrong trip/close state, it reminds checking for correct position.	
		Ready to close	Medium risk	With the CB fully energized, reset from fault tripping, and in open state, "ready to close" is abnormal, and a check of "ready to close" indication is prompted.	Optional
		Drawer seat position		Madium rick	With current detected and drawer seat at separated or test position, it prompts a check of drawer seat



Diagnostic type	Diagnos	stic type	Risk level	Maintenance Prompt	Remarks
		Contact	Medium risk	Contact wear rate > 50% and < 80%: medium risk, it prompts a check of contact system Contact wear rate > 80%: high risk, it prompts a check	
		wear rate	High risk	of contact wear rate > 80%: high risk, it prompts a check of contact system and replacement if necessary	
		Residual	Medium risk	Remaining mechanical life < 40%: medium risk, it prompts a check of operating mechanism	
		mechanical life	High risk	Remaining mechanical life < 20%: high risk, it prompts a check of operating mechanism and replacement if necessary	
		Residual	Medium risk	Remaining electrical life < 40%: medium risk, it prompts check of contact system	
	Service life diagnosis	electrical life	High risk	Remaining electrical life < 20%: high risk, it prompts a check of contact system and replacement if necessary	
CB proper diagnosis			Medium risk	Thermal aging rate > 40% and < 80%: medium risk, it prompts a check of CB proper system	
			High risk	Thermal aging rate > 80%: high risk, it prompts a check of CB proper system and replacement if necessary	
		Lloolth	Medium risk	Health > 40 and < 70: medium risk, it prompts a check of CB proper system	
		Health	High risk	Health degree < 40: high risk, it prompts a check of CB proper system and replacement if necessary	
	Busbar temperature diagnosis	Busbar ature overheating sis	Medium risk	Busbar temperature > 120°C: medium risk, it prompts a check of contact system and screw tightening	Feature optional
			High risk	Busbar temperature > 140°C: high risk, it prompts a check of contact system and screw tightening	reature optionar
	Undervoltage Release	Action logic	High risk	According to logical judgment, the voltage of the under-voltage release is normal, but the CB breaks for unknown reason; it prompts a check of the under-voltage release	
	Diagnosis	Residual life	Medium risk	Under-voltage release powered on for > 5 years, it prompts an inspection and maintenance each year	
Accessory	Diagnosis	Action logic	High risk	According to logical judgment, if the shunt release is energized but the CB fails to break, it prompts a check of the shunt release	Eastura antional
diagnosis	of Shunt Release	Residual life	Medium risk	Shunt release powered on for >5000 times, it prompts an inspection and maintenance very 1000 times	Feature optional
	Closing	Action logic	High risk	According to logical judgment, the closing electromagnet is energized but the CB fails to close, it prompts a check of the closing electromagnet	
	electromagnet diagnosis	Residual life	Medium risk	Closing electromagnet powered on for >5000 times, it prompts a check of inspection and maintenance every 1000 times	

Diagnostic type	Diagnos	stic type	Risk level	Maintenance Prompt	Remarks
	Energy storage	Action logic	High risk	According to logical judgment, the energy storage motor is energized but its energy state does not change accordingly; it prompts a check of the energy storage motor	
Accessory diagnosis	motor diagnosis	Residual life	Medium risk	With the energy storage motor powered on for >5000 times, it prompts a check of inspection and maintenance every 1000 times	Feature optional
	Communication diagnosis	Connection detection	Medium risk	When no feedback of the communication data of the accessory monitoring module and the position monitoring module:it prompts a check of wiring or the accessory module	
Controller	Metering chip diagnosis	Connection status	High risk	If the connection of the metering chip is abnormal, switch to display of protection current signal and prompt check of the controller, maintenance and replacement	
	Memory diagnosis	Connection status	High risk	With abnormal memory connection, prompt check of the controller, its maintenance and replacement	
	Display Module diagnosis	Connection status	Medium risk	With abnormal connection of the display module, prompt check of the controller, its maintenance and replacement	
self-diagnosis	Ambient temperature diagnosis	Ambient	Medium risk	Ambient temperature > 60°C or < -20°C, prompt reduction of product capacity and check of environment in the cabinet	
		overtemperature	High risk	Ambient temperature > 80°C or < -30°C: high risk; prompt reduction of product capacity and check of environment in the cabinet	
	Trip coil connection diagnosis	Connection status	High risk	Abnormal trip coil connection: high risk; prompt check of trip coil wiring and its maintenance and replacement	
	Installation and use environment		Low risk	Prompt check and maintenance of controller as per manual for every year of accumulative power-on of the controller	
Regular maintenance reminders		Installation and use environment		With accumulative power-on of controller >8 years, prompt check and maintenance of the controller as per manual once half a year	
	Installation a environment		High risk	With accumulative power-on of controller >16 years, prompt check and maintenance of the controller once every quarter, and its replacement if necessary	

2.2.8 Information recorder

This intelligent controller has a function of event recorder, coversing tripping, alarm, operation, running, maintenance prompt, firmware upgrade, and electrical fault, etc., as is detailed in Table 75.

Table 75 Event Record Information and Quantities

Type of information	Level 1 Page	Level 2 Page	Information content	Number of records
Trip record	Basic Protection Trip Records		Action type, action current, action time, action clock, fault records	20
	Other Protection Trip Records		Action Type, Action Value, Action Time, Action Clock	20



Type of information	Level 1 Page	Level 2 Page	Information content	Number of records
	Protection type alarm		Alarm type, alarm value, alarm time, alarm clock	100
Alarm record	Power quality alarm		Alarm type, alarm value, alarm clock	100
	Health diagnosis alarm		Alarm type, alarm clock	100
		The total number of operations The number of protection	-	1
	The Number of operations	operations The number of live manual operations	-	1
		The number of remote operations	-	1
		The number of alarms	-	1
Operation record		Basic protection	Parameter type, modification method, change content, set clock	20
	Parameter Modification Record (HMI, USB, Remote)	Other protections	Parameter type, modification method, change content, set clock	20
		Ex-factory settings Reset Record	Modification mode, set clock	200
	Displacement record (live manual, remote control, protection, test)		Displacement state, displacement mode, displacement clock	40
	Accessory Connection	AMU	Connected or disconnected status, clock	20
	Record	PMU	Connected or disconnected status, clock	20
		Electrical parameter	The maximum and minimum values of current, voltage, frequency, power, required current, and required power, and clock in the past 32 days	32 each
	Daily historical peak record	Controller temp.	Controller temperature maximum and minimum values, and clock in the past 32 days	32 each
		Busbar temp.	The maximum and minimum values of busbar temperature, and the clock in the past 32 days	32 each
Running record		Recordings of power loss and recovery	Power-off clock, power-recover clock	40
	Consulation was income and	Load zone tim	Load zones (I < 50%; 50% \leq I < 75%; 75% \leq I < 90%; I \geq 90%); Cumulative time (year/month/day/hour)	4
	Cumulative running record	Cumulative running time	Cumulative running time (year/month/day/ hour)	1
		Busbar temp. zone time	Temperature zone (T < 60° C; 60° C \leq T < 80° C; 80° C \leq T < 100° C; 100° C \leq I < 120° C; I \geq 120 °C); Cumulative time (year/month/day/hour)	5

Type of information	Level 1 Page	Level 2 Page	Information content	Number of records
Historical peak	Maximum values		Maximum temperature in history, maximum current in each phase, maximum required current, maximum voltage in each phase, maximum power, maximum required power, maximum frequency	1 for each
record	Minimum temperature in	Controller temp.	The lowest temperature in history in the past year	1
		Busbar temp.	The lowest temperature in history in the past year	1
Maintenance reminder records			Maintenance Type, Risk Level, Clock	20
Firmware upgrade record (USB)			Program update mode, operator identity, update version, update clock	5
Electrical fault record			Fault type, clock	20

2.2.9 System function settings

2.2.9.1 Clock Settings

This controller has the function of real time clock, which can be set and display year, month, day, hour, minute and second, keep running for 240 hours, and the clock error is ≤ 10 s.

2.2.9.2 Mode settings

2.2.9.2.1 Quick view settings

Quick view covers 5 types of data, namely current measurement, current protection parameters, health diagnosis information, voltage measurement, and power measurement, as well as polling interval, which can be adjusted from 3s to 15s.

Each measurement data can be selected as On or Off separately. Quickly press the "n" home page key twice and the interface will display various data pages in turn by itself. Press the "n" key once to pause the interface polling display and press it again to continue the polling display. Press the "" return key once to exit.

2.2.9.2.2 Test tripping

There are three testing methods for tripping test: three-zone protection, earth/leakage fault, and mechanism action time. The first two methods are used for checking the setting value of action characteristics.

Three-zone protection test: Input simulated fault current to simulate the protection function of the controller when overload, short circuit, of instantaneous fault occurs.

Earth/leakage fault test: Input simulated grounding/leakage fault current to simulate the protection function of the controller when the grounding/leakage fault occurs.

Mechanism action time test: Force the magnetic flux converter to act to test the inherent mechanical time of the controller trip.

Table 76 Test setting parameters

Table 70 lest setting parameters						
Test type	Test parameter	Step length				
		1A (frame size is less than 3200A)				
Three-zone protection	(1.5 ~ 20) In, max131kA	2A (frame size is greater than or equal to				
		3200A)				

2.2.9.2.3 Quick test of tripping

By pressing the controller simulation test button, the circuit breaker can execute the instantaneous tripping function.

2.2.9.2.4 Maintenance mode

For working at arc flash boundary areas with potential dangers or a live maintenance of circuit breaker, in order to ensure the electrical safety of the workplace, the controller can be set as "no intentional delay" protection, that is, the short-circuit instantaneous protection can be adjusted to its minimum setting value.

The switching of maintenance mode parameters can be carried out in any of the following ways: activating via the DI input state; setting via the human-machine interface; or sending a setup command over a communication network.

2.2.9.3 Measurement Table Setup

2.2.9.3.1 Frequency settings

The frequency can be set to 50Hz or 60Hz, which matchings with power grids with different frequencies.

2.2.9.3.2 Settings of System rated Voltage

The system rated voltage can be set to 400V or 690V or 800V or 1140V, meeting different product requirements.

Note: When the rated voltage of the main circuit is greater than AC415V, it is necessary to install an isolation transformer to convert it to AC400V, and then connect it to the input terminal of the voltage measurement signal of the intelligent controller.



2.2.9.3.3 System Types

System type 3P3W3CT, representing three-phase three-wire, the number of circuit breaker poles is three (3P);

System type 3P4W3CT, representing three-phase four-wire, the number of circuit breaker poles is three (3P);

System type 3P4W4CT, representing four-phase and four-wire, and the number of poles of the circuit breaker is four (4P) or three-pole plus phase N (3P + N);

2.2.9.3.4 Incoming line modes

Upper incoming line: The power incoming line is on the upper side of the circuit breaker Lower incoming line: The power incoming line is on the lowerside of the circuit breaker

2.2.9.3.5 Power Directions
Active power direction: P+/P-;

Reactive power direction: Q+/Q-;

2.2.9.3.6 Demand value selection time setting

The demand value is taken as the average value within the set time, which ranges from 5 minutes to 30 minutes.

2.2.9.4 I/O Settings

2.2.9.4.1 DO/DI Settings

2.2.9.4.1.1 DI input function

This controller can provide two sets of independent programmable optical isolation digital inputs (AC220 V \sim 250V), and the digital input setting parameters are shown in Table 77.

Table 77 Digital input (DI) setting parameters

Function Settings	Common, Trip, Alarm, ZSI (Zone Interlock), Short Circuit Interlock, Earth Interlock, Double Parameter, ERMS (Maintenance Mode)		
Execution mode	Normally open level, Normally closed level		

2.2.9.4.1.2 DO output function

This controller can provide 4 sets of independent signal contact outputs (used with RU-1 relay module). The digital output parameter settings and function settings are shown in Table 78 and Table 79.

Table 78 Digital output (DO) setting parameters

Function Settings	See Table 79			
Execution mode	Normally open level	Normally closed level	Normally open pulse	Normally closed pulse
Pulse time	None	None	(1 ~ 360) s, at step size 1s	(1 ~ 360) s at step size 1s

Table 79 DO Function Setup Table

Common	Load Monitoring 1	Ie (Leakage fault)	Voltage unbalance fault	Reverse power [P]	with voltage on detection reclosure fault
Fault trip	Load Monitoring 2	Iw (Earth fault (earth current))	Voltage phase loss fault	Reverse power [Q]	MCR Trip
Alarm	Overload pre-alarming	Current unbalance fault	Voltage harmonic fault	Overpower [P]	HSISC Trip
ZSI(Zone interlock)	Ir (Overload fault)	Current phase loss fault	Phase Rotation(Phase sequence fault)	Overpower [Q]	Temperature Monitor 1
Short circuit interlock	Isd (Short-time fault)	Demand current fault	Overfrequency fault	Under-power [P]	Temperature Monitor 2
Earth interlock	Ii (Instantaneous failure)	Current harmonic alarm	Underfrequency fault	Demand power fault	Remote reset
Close	Self-check alarm	Undervoltage fault	Frequency change rate fault	Busbar temperature	
open	Ig (Earth fault)	Overvoltage fault	PF Alarm(Power factor alarm)	Overload reclosure fault	

2.2.9.4.2 I/O status

Users can view the current I/O status: closed or open

2.2.9.5 Authority Settings

This controller can be accessed through NFC, HMI, mobile APP, USB software, and remote access method. Different access methods are assigned with different access contents, and all access methods need the verification of user roles. So you need to authenticate and authorize people's identities and authorities to ensure that commands and data come from trusted people. The access methods and authority levels corresponding to identities are shown in Table 80.

Table 80 Access Modes and Authorization Levels Corresponding to Identities

	Local access			Remote Access		Authorities management			
Operational content	NFC	HMI Color screen	Mobile phone APP	USB Software	RS485	HPLC/ Industrial Ethernet	High	Middle	Low
Fault record query	√	√	√	√	√	√	√	√	√
Event Record and Data Query	-	√	√	√	√	√	√	√	√
Basic Protection Parameter Setup	-	√	√	√	√	√	√	√	-
Other Protection Parameter Setup	-	√	√	√	√	√	√	-	-
System parameter setup	-	√	√	√	√	√	√	-	-
Open/Close/Reset	-	√	√	√	√	√	√	√	-
Firmware Upgrade	-	-	√	√	-	-	√	-	-
Password complexity	-	-	-	-	-	-		Six digits	

Authority management enabled: In the "On" state, after logging out of the account, to modify and save parameters, user needs to log in. Please remember the account and password.

Authority management disabled: In the "Off" state, user can modify and save parameters.

Note: Before entering the "Authority Setup" interface, the users need to enter the user password correctly. (Default password: 000000)

2.2.9.6 Firmware Upgrade

The controller can realize firmware upgrades through mobile APP or USB software. Firmware upgrades can only be carried out by personnel with administrator authority. In order to ensure the safe operation of the circuit breaker, firmware upgrades are not allowed when the circuit breaker is working.

The firmware upgrade processed for circuit breakers must have safety and reliability, including:

Capable of authenticity and consistency check of the upgraded firmware to ensure the correctness and integrity of the running firmware, such as digital certificates;

No matter what fault occurs during the upgrade process, the circuit breaker can return to normal working mode.

2.2.10 Communication functions

2.2.10.1 Communication protocol

The communication protocols that can be used for different communication modes can be selected according to Table 81.

Table 81 Communication Protocols for Different Communication Modes

Communication protocol	RS485	HPLC	Industrial Ethernet	USB	NFC
Modbus-RTU	√	-	-	\checkmark	√
Modbus TCP	-	-	√	-	-
DL/T645	√	√	-	-	-
DL/T698.45	√	-	-	-	-

2.2.10.1.1 Modbus-RTU communication protocol

The S-type controller can realize the "four-remote" data transmission functions such as telemetry, remote control, remote regulation, and remote communication through the communication port according to the specified protocol requirements. The output of the communication port adopts photoelectric isolation, which is suitable for strong electrical interference environments. For details of communication, please refer to "NA8 Series Air Circuit Breaker Communication Protocol (S Type Intelligent Controller)-Modbus-RTU Mode operation Manual".

Table 82 Communication parameter settings

Communication protocol	Modbus-RTU
Correspondence Address	3 ~ 247
Baud rate (bit/s)	9600/19200
Stop bit	1/1.5/2
Check bit	No check/odd check/even check

2.2.10.1.1.1 Hardware Connection of the Controller

Terminals 10 and 11 are connected to the RS232/RS485 converter A+ and B-, and the RS232/RS485 converter is connected to the RS232 or USB port of the computer. The maximum number of connections is 32 sets.

2.2.10.1.1.2 Serial port settings

Select the COM port (COM1, COM2...) according to the computer serial port, the serial port byte has 8 bits, and the check bit



is no check (None). Set the baud rate, address and stop bit corresponding to the controller communication settings (default baud rate is 9.6 Kbps, address is 3, and stop bit has 1 bit).

2.2.10.1.1.3 Communication instructions

All function codes, definitions, and behaviors are shown in Table 83 below:

Table 83 Definitions and Behaviors of Functional Codes

Function code	Definition	Functional behavior				
03H	Read data register	Read data values from one or more registers				
04H	Read "read-only" data register	Read the data values of one or more "read-only" registers				
06H	Write a single register	Write data to a register				
10H	Write special register	Write data to a special register				
14H	Read file record	Read the data value of a file record register				

2.2.10.1.1.3.1 Read instructions

Address (1 byte) + read instruction code (1 byte) + register start address (2 bytes) + read address number (2 bytes) + 16-bit CRC check code (2 bytes, lower bit in the front).

Example 1: Read phase A current value 1000A

Format of sent instruction: 03 04 00 00 00 01 30 28

[03 (address) 04 (read instruction code) 0000 (la register address) 0001 (read a register address) 3028 (CRC check code)]

Format of received instruction: 03 04 02 03 E8 C0 4E

[03 (address) 04 (read instruction code) 02 (data length) 03E8 (value 1000) C04E (CRC check code)]

2.2.10.1.1.3.2 Write instructions

Address (1 byte) + write instruction code (1 byte) + write register address (2 bytes) + write value (2 bytes) + CRC check code (2 bytes, lower bit in the front).

Example 2: Write long-time current setting value

Format of sent instruction: 03 06 20 00 03 E8 83 56

[03 (address) 06 (write instruction code) 2000 (long-time current setting value address) 03E8 (value 1000) 8356 (CRC check code)] 2.2.10.1.2 DL/T645 protocol

This S-type controller can realize the "four-remote" data transmission functions such as telemetry, remote control, remote regulation, and remote communication through the communication port according to the specified protocol requirements. The output of the communication port adopts photoelectric isolation, suitable for strong electrical interference environments.

For details of communication, please refer to "NA8 Series Air Circuit Breaker Communication Protocol (S-Type Intelligent Controller)-DL/T645 Mode Operation Manual"

Table 84 Communication parameter settings

Correspondence Address	0-9999999998	Default: 3
Communication baud rate	600/1200/2400/4800/9600/19200	Default: 9600

2.2.10.1.2.1 Hardware Connection of the Controller

Terminals 10 and 11 are connected to the RS232/RS485 converter A+ and B-, and the RS232/RS485 converter is connected to the RS232 or USB port of the computer. The maximum number of connections is 32 sets.

2.2.10.1.2.2 Serial port settings

Select the COM port (COM1, COM2...) according to the computer serial port, the serial port byte has 8 bits, the check bit is even check, and the stop bit has 1 bit. Set the baud rate and address corresponding to the controller communication settings (default baud rate is 9.6Kbps, default address is 3).

2.2.10.1.2.3 Communication instructions

Send test frame 68 AA AA AA AA AA AA AA 68 13 00 DF 16; if the controller returns data 68 03 00 00 00 00 00 68 93 06 36 33 33 33 33 A1 16, the communication is normal.

2.2.10.1.3 DL/T698.45 Protocol

The S-type controller can realize the "four-remote" data transmission functions such as telemetry, remote control, remote regulation, and remote communication through the communication port according to the specified protocol requirements. The output of the communication port adopts photoelectric isolation, suitable for strong electrical interference environments. For details of communication, please refer to "NA8 Series Air Circuit Breaker Communication Protocol (S-Type Intelligent Controller)-DL/T 698.45 Mode Operation Manual".

2.2.10.1.3.1 Hardware Connections of the Controller

Terminals 10 and 11 are connected to the RS232/RS485 converter A+ and B-, and the RS232/RS485 converter is connected to the RS232 or USB port of the computer. The maximum number of connections is 32 sets.

2.2.10.1.3.2 Serial Port Settings

Select the COM port (COM1, COM2...) according to the computer serial port: the serial port byte has 8 bits, even check, and the stop bit has 1 bit; Set the baud rate corresponding to the controller communication settings (default baud rate 9.6Kbps). 2.2.10.1.3.3 Communication instructions format

The 698 protocol adopts asynchronous transmission, which does not require the clock synchronization between the receiver

and the sender. There will be a start character and an end character. The format of the communication instruction is shown in Table 85 below:

Table 85 Communication Instruction Format

Start Character (68H)	
Length Domain L	
Control Domain C	Frame header
Address Domain A	
Frame Header Check HCS	
Link user data	
Frame check FCS	
End character (16H)	

Example: Read Controller Current

	Request	FE FE FE FE 68 17 00 43 05 11 11 11 11 11 100 EB 26 05 01 13 20 01 02 00 00 93 EC 16
Current	Pocnonco	68 24 00 43 05 11 11 11 11 11 11 00 97 4B 85 01 13 20 01 02 00 01 01 03 12 00 00 12 00 49 12 00 00 00
(three-phase)	Response	00 FC 1C 16
	Value	The current values of phase A, B, C are 0, 73, and 0 respectively.

2.2.10.2 USB communication function

The S-type controller can be connected to a computer or mobile phone through the TYPE-C interface, and can realize the "four-remote" data transmission functions such as telemetry, remote control, remote regulation, and remote communication. The function contents are the same as that of the RS485 communication function, saw in 2.2.10.1.1.

Note: The mobile APP only supports the Android system, and the download link of the mobile APP can be found on the official website.

2.2.10.3 NFC communication function

With the function of NFC communication, parameter settings and data of the last trip are stored and can be read by turning on the mobile phone APP and putting the mobile phone close to the controller's NFC antenna area.

Note: The mobile phone requires the NFC function, which shall be turned on. A dedicated APP shall be installed.

2.2.11 Zone Selective Interlock Function (ZSI)

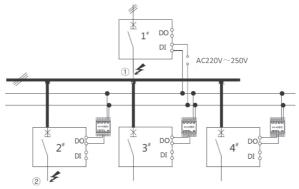


Fig. 14 Schematic diagram of regional connections

Zone selective interlock includes short circuit interlock and earth interlock. In the identical power circuits of two or more upstream and downstream associated circuit breakers:

a. When the position where the short circuit or earth fault occurs is on the outlet side (such as position ②) of the downstream circuit breaker (2 # ~ 4 # circuit breaker), the downstream circuit breaker trips instantaneously and sends an zone interlock trip signal to the upstream circuit breaker; The upstream circuit breaker (1 # circuit breaker) receives the zone interlock trip signal, and delays according to the short circuit or earth protection setting. If the fault current is eliminated during the delay of the upstream circuit breaker, the protection returns, and the upstream circuit breaker does not operate; If the fault current has not been eliminated after the downstream circuit breaker trips, the upstream circuit breaker will operate according to the short circuit or earth protection setting to cut off the faulty line.

b. When the position where the short circuit or earth fault occurs is between the upstream circuit breaker (1 # circuit breaker) and the downstream circuit breaker (2 # \sim 4 # circuit breaker) (such as position ①), the upstream circuit breaker does not receive the Zone interlock signal, so it trips instantaneously and quickly cuts off the faulty line. Parameter settings:

At least one DI of the upstream circuit breaker is set for zone interlock detection;

At least one DO of the downstream circuit breaker is set as an zone interlock signal output.



3 Installation, commissioning and operation, utilization

3.1 Installation

S-type intelligent controller is designed to support the NA8 series air circuit breaker (installed when leaving the factory).

3.2 Input and output interfaces

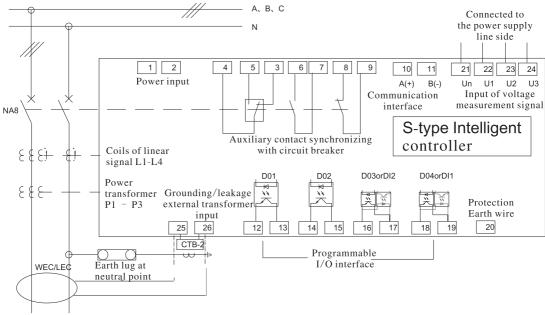


Figure 15 Input and output interfaces of S-type intelligent controller

- ① Internal busbar: internal busbar interfaces 6# and 7#; used for communication when configured with modules AMU-1 and PMII-1
- ② Communication output: communication interface 10# and 11# outputs
- 3 Programmable input/output interface: If no signal unit is selected, 12 # ~19 # will be null. (DO: DC 24V, 50mA; DI: AC220V ~ AC250V).
- 4 Signal unit types:

Table 86 Input/Output Contacts Corresponding to Signal Units

table of input output contacts contesponding to signal ontis						
Signal unit type	Programmable output/input contact					
	12 #, 13 #: programmable output contact 1 (Do1);					
C1 (4DO	14 #, 15 #: Programmable output contact 2 (DO2);					
S1 (4DO mode)	16 #, 17 #: programmable output contact 3 (DO3);					
	18 #, 19 #: Programmable output contact 4 (DO4).					
	12 #, 13 #: programmable output contact 1 (DO1);					
(2) (200 + 10)	14 #, 15 #: Programmable output contact 2 (DO2);					
S2 (3DO + 1DI mode)	16 #, 17 #: programmable output contact 4 (DO3);					
	18 #, 19 #: Programmable digital input 1 (DI1).					
	12 #, 13 #: programmable output contact 1 (DO1);					
(2) (200 + 201	14 #, 15 #: Programmable output contact 2 (DO2);					
S3 (2DO + 2DI mode)	16 #, 17 #: Programmable digital input 2 (DI2);					
	18 #, 19 #: Programmable digital input 1 (DI1).					

- (5) Protective ground wire: 20 # is the ground wire of the controller.
- ⑥ Voltage signal input: 21#-24# pins are the input terminals of the voltage measurement signal; pay attention to their correct sequence and connection at the power supply incoming line side. These pins are null when voltage measurement function is optional.
- External transformer input: 25#, 26# pins are used for the input of external transformer. When the grounding mode is ground current mode (W), these pins are connected to the output terminal of CTB-2 matching the external ground current transformer WEC. When the grounding protection mode is leakage type, these pins are used to connect the output of the external LEC leakage transformer. When the grounding protection mode is (3P + N) difference type, these pins are used to connect the external phase transformer.

3.3 Menu operation instructions

3.3.1 Display & Operation Panel

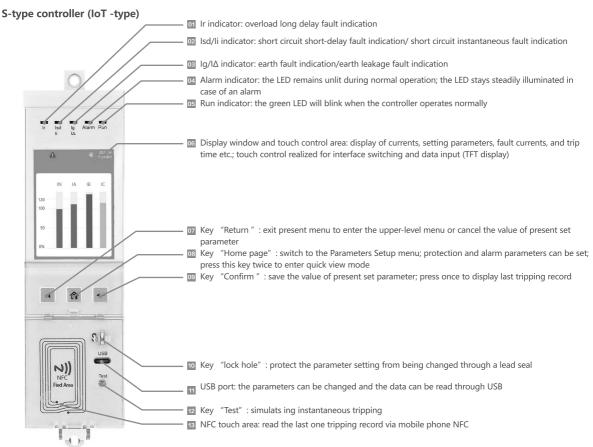


Figure 16 User interface of S-type intelligent controller

3.3.2 Intelligent Controller Theme Menu

This intelligent controller provides one boot interface and power-on self-diagnosis interface, one default interface, one main interface, six theme menus and one quick view interface. There may be some differences in the interface content according to different functions selected.

3.3.2.1 Boot interface and power-on self- diagnosis interface

When the controller is powered on, the boot page and self- diagnosis page are displayed, and if there is a fault, an abnormality will be displayed.



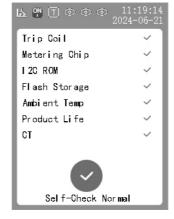


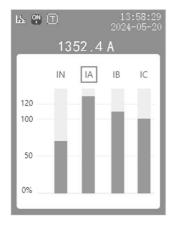


Figure 17 Boot interface and power-on self-test



3.3.2.2 Default interface

The controller displays the currents of A, B, C and neutral poles (selected according to the system type) in a histogram, indicating the percentage of each current relative to the overload setting value (relative to the rated current when the overload is disabled). When the displayed current is greater than 1.2 times the setting value, the light column is red. When the displayed current is greater than 1.0 times but less than or equal to 1.2 times the setting value, the light column is yellow. When the displayed current is less than or equal to 1.0 times the setting value, the light column is green.

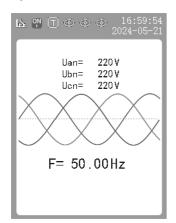


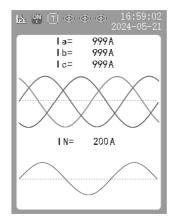
Press the "◀" return key under the main menu to return to the default screen. If no operation within 1 minute, the box will automatically indicate the current maximum item (except for the polling display interface). In the non-fault pop-up display, if there is no button operation within 1 minute, it will automatically return to the default screen.

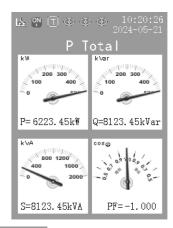
Figure 18 Default interface

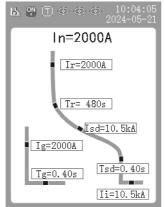
3.3.2.3 Quick view interface

Press the home key "a" twice to enter the Quick View page (display contents are optional), which includes current measurement, voltage measurement, power measurement, current protection parameters, and health diagnosis information. Press the " 4" return key to return to the default screen.









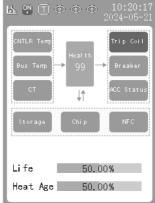


Figure 19 Quick View Interface

3.3.2.4 Last Fault Record Interface

When in the default page, press the Confirm key "■" once to enter the last fault recording page (the fault recorder function is optional), and then press the Return Key " ◀" to return to the default screen.





Figure 20 Fault Record Page

3.3.2.5 Main interface

Press the Home key "¬"once to enter the main menu. Press the Return Key ¬" ¬" to return to the default screen.



Figure 21 Main interface

3.3.2.6 "Protection" menu

Touch the "Image area once to enter the protection menu, and press the Return Key" ◀" to return to the default screen.

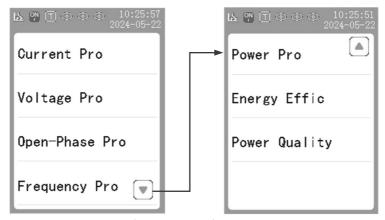


Figure 22 "Protection" menu



3.3.2.7 "Health" menu

Touch the "¡ image area once to enter the health menu and press the Return Key " ◀" to return to the default screen.



Figure 23 "Health" menu

3.3.2.8 "Message" menu

Touch the "☐" image area once to enter the message menu and press the Return Key " ◀" to return to the default screen.

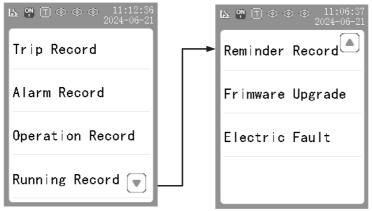


Figure 24 "Information" menu

3.3.2.9 "Measurement" menu

Touch the "

" image area once to enter the measurement menu and press the Return Key "

" to return to the default screen.

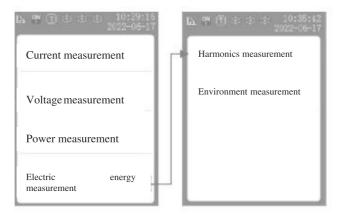


Figure 25 "Measurement" menu

3.3.2.10 "System" Menu

Touch the "Is " image area once to enter the system menu and press the Return Key " ◀" to return to the default screen.

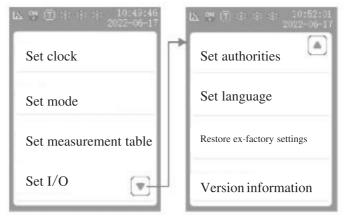


Figure 26 "System" menu

3.3.2.11 "Communication" Menu

Touch the "➡" image area once to enter the communication menu and press the Return Key " ◀" to return to the default screen.



Figure 27 "Communication" menu

3.3.2.12 Examples of submenu operations

3.3.2.12.1 Overload Long-time Protection Settings

Example: The indicated range is 1280 \sim 3200, enter 3199, press the confirm key to save, and the actual displayed value will be 3198 after successful saving.



Figure 28 Overload Long-time Protection Settings



3.3.2.13.2 Quick View Settings

To modify the quick view settings in "System", click the right side switch to select the polling display screen, and click " 📺 🥅 below to modify the interval time of the polling display page, and then, press the "🛶" confirm key to save.



Figure 29 Quick View Settings

3.3.2.13.3 Authority management function

To enter the screen of the authority management function in the "system" for modification, users need to enter a password. The initial password is "000000". After logging-in, users can choose to modify the password. When changing the password, users need to enter the existing password correctly; otherwise modification is not possible. After modifying, click the confirm key to save. Enter the new password when logging in next time.

If you choose to turn on authority management, users need to enter their account number and password for subsequent function of setting and saving.

To use the "Assign Authority" function, click "New" to enter the authority level selection, User only needs to click on the right boxes of authorities. "Low, Medium, and High" automatically correspond to different authority scopes options. Then, press " - confirm key to save.

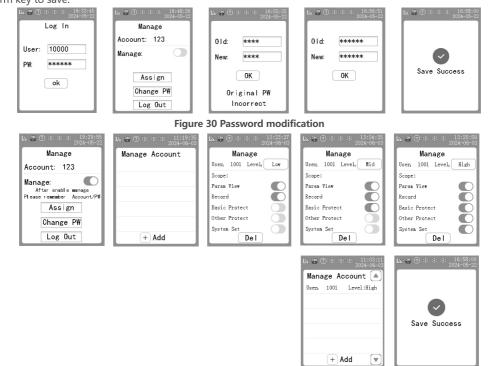


Figure 31 Authority Management Settings

3.3.3 Intelligent Controller Menu Structure

The menu of the intelligent controller consists of six parts: protection menu, health menu, information menu, measurement menu, system menu and communication menu, as well as a keyboard and a saving page. (The actual menu changes according to the functions selected by the user.)

3.3.3.1 Protection Menu



Table 87 Protection Menu

Level 1 menu	Level 2 Menu	Level 3 Menu		Protection Men Level 4 Menu	iu	Level 5 Menu
		Ir protection	Long-time Protection type: Close	Cool time: 0min	Long-time Protection type: Alarm Action value: 1000A Action time: 10s Return value: 900A Return time: 10s	
		lsd protection	Short-time Protection type: Close	Short-time Protection Type: Action Isd: 15.0 Ir 6000A Tsd: 0.4 s Hamiltonian Curve type: definite time	Short-time Protection type: Alarm Action value: 7000A Action time: 10s Return value: 5600A Return time: 10s	
Current protection setting	Basic protection	li protection	Instantaneous Protection type: Close	Instantaneous Protection Type: Action Protection Mode: RMS Ii: 12In 12000A	Instantaneous Protection type: Alarm Action value: 11000A Action time: 5s Return value: 7700A Return time: 5s	
		Earth protection		Vector sum		Vector sum Protection type: Action value: 1000A Action type: Close



Level 1 menu	Level 2 Menu	Level 3 Menu		Level 4 Menu		Level 5 Menu
	Current unbalance protection	Current unbalance Protection type: Close	Current unbal Protection Type: Actic Operate value Operate time	ance Prote type: Operate : 60% Operate e: 5s Return v	unbalance ection Alarm value: 60% e time: 5s alue: 20% time: 5s	
	Neutral line protection			ral line ion 100%		
		IA Demand	IA Demand Protection type: Close	IA Demand Protection Type: Action Operate value: 1000A Operate time: 15s	IA Demand Protection type: Alarm Operate value: 1900A Operate time: 15s Return value: 1800A Return time: 16s	
		IB Demand	IB Demand Protection type: Close	IB Demand Protection Type: Action Operate value: 1000A Operate time: 15s	IB Demand Protection type: Alarm Operate value: 1900A Operate time: 15s Return value: 1800A Return time: 16s	
Current protection setting	Demand current Protection	IC Demand	IC Demand Protection type: Close	IC Demand Protection Type: Action Operate value: 1000A Operate time: 15s	IC Demand Protection type: Alarm Operate value: 1900A Operate time: 15s Return value: 1800A Return time: 16s	
		IN Demand	IN Demand Protection type: Close	IN Demand Protection Type: Action Operate value: 1000A Operate time: 15s	IN Demand Protection type: Alarm Operate value: 1900A Operate time: 15s Return value: 1800A Return time: 16s	

Level 1 menu	Level 2 Menu	Level 3 Menu	Level 4 Menu	Level 5 Menu
	Undervoltage protection	Undervoltage 1	Undervoltage Undervoltage 1 Protection type: Close Close Undervoltage 1 Protection Type: Action Operate value: 338V Operate time: 10.0 s Coperate time: 10.0 s Return Undervoltage 1 Protection type: Alarm Operate value: 338V Operate time: 10.0 s Return time: 36.0 s	
		Undervoltage 2	Undervoltage 2 Undervoltage 2 Protection Type: Action type: Operate value: 798V Operate time: 10.0 s	
Voltage protection setting	Overvoltage protection	Overvoltage 1	Overvoltage 1 Protection type: Close Overvoltage 1 Protection Type: Action Operate value: 540V Operate value: 540V Operate time: 5.0 s Return value: 400V Return time: 36.0 s	
		Overvoltage 2	Overvoltage 2 Protection type: Close Overvoltage 2 Protection Type: Action Operate value: 540V Operate time: 5.0 s	
	Voltage unbalance protection	Voltage unbalance Protection type: Close	Voltage unbalance Protection Type: Action Operate value: 30% Operate time: 40s Voltage unbalance Protection type: Alarm Operate value: 30% Operate time: 1s Return value: 2% Return time: 360s	
	Phase sequence protection	Phase sequence Protection type: Close	Phase sequence Protection Type: Action Operate values: A, B, C Phase sequence Protection type: Alarm Operate values: A, B, C	



Level 1 menu	Level 2 Menu	Level 3 Menu	Lev	el 4 Menu	Level 5 Menu
Phase loss	Current phase loss	Current phase loss Protection type: Close	Current phase loss Protection type: Close	Current phase loss Protection type: Alarm Operate value: 99% Operate time: 3.0 s Return value: 20% Return time: 360s	
protection setting	Voltage phase loss	Voltage phase loss Protection type: Close	Voltage phase loss Protection Type: Action Operate value: 99% Operate time: 3.0 s	Voltage phase loss Protection type: Alarm Operate value: 99% Operate time: 3.0 s Return value: 20% Return time: 360s	
	Underfrequency protection	Underfreque Protection ty Close	Underfrequence Protection Type: Action Operate value: 46.0 Hz Operate time: 5.0 s	Operate value: 46.0 Hz Operate time:	
Frequency Protection Settings	Overfrequency protection	Overfrequer Protection ty Close		e: Operate value: 64.0 Hz c: Operate time: 5.0 s	
	Frequency change rate protection	Frequency change rate Protection type: Close	Frequency change rate Protection Type: Action Operate value: 10.0 Hz/s Operate time: 10.0 s	Frequency change rate Protection type: Alarm Operate value: 10.0 Hz/s Operate time: 5.0 s Return value: 0.4 Hz/s Return time: 360s	

Level 1 menu	Level 2 Menu	Level 3 Menu	Leve	el 4 Menu	Level 5 Menu
	Underpower (P)	Underpower [P] Protection type: Close	Underpower [P] Protection Type: Action Operate value: 197kW Operate time: 20.0 s	Underpower [P] Protection type: Alarm Operate value: 197kW Operate time: 20.0 s Return value: 692kW Return time: 360s	
	Overpower (P)	Overpower [P] Protection type: Close	Overpower [P] Protection Type: Action Operate value: 2961kW Operate time: 20.0 s	Overpower [P] Protection type: Alarm Operate value: 2961kW Operate time: 20.0 s Return value: 2200kW Return time: 360s	
Power protection setting	Overpower (Q)	Overpower [Q] Protection type: Close	Overpower [Q] Protection Type: Action Operate value: 2961kVar Operate time: 20.0 s	Overpower [Q] Protection type: Alarm Operate value: 2961kVar Operate time: 20.0 s Return value: 2200kVar Return time: 360s	
	Reverse power (P)	Reverse power [P] Protection type: Close	Reverse power [P] Protection Type: Action Operate value: 1974kW Operate time: 20.0 s	Reverse power [P] Protection type: Alarm Operate value: 1974kW Operate time: 20.0 s Return value: 1800kW Return time: 360s	
	Reverse power (Q)	Reverse power [Q] Protection type: Close	Reverse power [Q] Protection Type: Action Operate value: 1974kVar Operate time: 20.0 s	Reverse power [Q] Protection type: Alarm Operate value: 1974kVar Operate time: 20.0 s Return value: 1800kVar Return time: 360s	



Level 1 menu	Level 2 Menu	Level 3 Menu	Lev	el 4 Menu	Level 5 Menu
	Power factor alarm	Power factor alarm Switch: off	Power factor alarm Switch: on Operate value: 0.95 Operate time: 40s Return value: 1.00 Return time: 360s		
Power protection setting	Demand power	Demand power Protection type: Close	Demand power Protection Type: Action Operate value: 1974kW Operate time: 1500s	Demand power Protection type: Alarm Operate value: 1974kW Operate time: 1500s Return value: 1974kW Return time: 3000s	
Energy Efficiency Management Settings	Load monitoring	Load monitoring Monitoring type: Close	Load monitoring Monitoring Type: Current Monitoring Operate value: 400A Operate time: 80% Tr Return value: 200A Return time: 600s	Load monitoring Monitoring type: Power monitoring Operate value: 10000kW Operate time: 3600s Return value: 100kW Return time: 3600s	
Electric energy	Overload pre-alarming	Overload pre-alarmin Switch: off	Overload pre-alarming Switch: on Operate value: 420A Operate time: 7.5 s Return value: 378A Return time: 7.5 s		
quality setting	Current unbalance rate	Current unbalance rate Switch: off	Current unbalance rate Switch: on Setting value: 10%		
	Voltage unbalance rate	Voltage unbalance rate Switch: off	Voltage unbalance rate Switch: on Setting value: 10%		

Level 1 menu	Level 2 Menu	Level 3 Menu	Leve	el 4 Menu	Level 5 Menu
	Voltage short-time interruption	Voltage short-time interruption Switch: off			
	Voltage temporary rise	Voltage temporary rise Switch: off	Voltage temporary rise Switch: on Setting value 1: 500V Time value 1: 60.00 s; Setting value 2: 460V; Time value 2: 60.00 s; Setting value 3: 400V Time value 3: 60.00 s;		
Electric energy quality setting	Voltage temporary drop	Voltage temporary drop Switch: off	Voltage temporary drop Switch: on Setting value 1: 80V Time value 1: 60.00 s; Setting value 2: 220V Time value 2: 60.00 s; Setting value 3: 360V Time value 3: 60.00 s;		
	Average voltage	Average voltage Switch: off	Average voltage Switch: on Upper limit value: 1425V Lower limit value: 1083V		
	Current harmonic Alarm	Current harmonic alarm Switch: off	Current harmonic alarm Switch: on Operate value: 30% Operate time: 120s Return value: 28% Return time: 360s		



Level 1 menu	Level 2 Menu	Level 3 Menu	Level 4 Menu	Level 5 Menu
Electric energy quality setting	Voltage harmonic Alarm	Voltage harmonic alarm Switch: off;	Voltage harmonic alarm Switch: on Operate value: 10% Operate time: 120s Return value: 8% Return time: 360s	

3.3.3.2 Health menu

Table 88 Health menu

Level 1 menu	Level 2 Menu	Level 3 Menu	Level 4 Menu
Circuit breaker diagnosis	On-Off state Close Fault state Normal Residual mechanical life 0.00% Residual electric life 0.00% Contact wear rate 0.00% Heat aging rate 0.00% Health degree 100		
Controller diagnosis	Trip coil √ Metering chip √ I2C ROM √ Flash Storage √ Clock chip √ CT √		
Power grid diagnosis	Power quality data	Overload pre-alarming 0 Voltage temporary rise 0 Voltage temporary drop 0 Voltage short-time interruption 0 Average voltage 0 Frequency change rate 0 Three-phase power factor alarm 0 Current harmonic alarm 0 Voltage harmonic alarm 0 Current unbalance rate 0 Voltage unbalance rate 0	

Level 1 menu	Level 2 Menu	Level 3 Menu	Level 4 Menu
Power grid diagnosis	Current wave diagram	Wave(I) 1In 0.8 In 0.6 In 0.4 In 0.2 In 0In	
J	Voltage wave diagram	Wave(U) 1In 0.8 In 0.6 In 0.4 In 0.2 In 0ln	
Environmental diagnosis	D		
Attachment diagnosis	External communication module Normal Shunt release Normal Closed electromagnet Normal Undervoltage (UV)release Normal Energy storage motor Normal Drawer position Connected		



3.3.3.3 Information Menu

Table 89 Information Menu

Table 89 Information Menu Level 1 Level 2 Level 6 Lo					Level 6	Level 7
menu	Menu	Level 3 Menu	Level 4 Menu	Level 5 Menu	Menu	Menu
Trip record	Basic protection	Trip record 1. Long-time fault 2. None 20. None	Long-time fault Fault data: 2007A Action delay: 33.50 s Set parameters: 1000A Set delay: 60s Other data: Ia: 2001A Ib: 2010A Ic: 2003A Id: 0A 2022/06/20 13:48:45			
	Other Protection Trip Records	Trip record 1. Current unbalance fault 2. None 20. None	Current unbalance fault Fault data: 33.5% Action delay: 2.00 s Set parameter: 30% Set delay: 2s Other data: A: 33.5% B: 16.6% C: 16.7% 2022/06/20 13:59:42			
Alarm record	Protection type alarm	Alarm record 1. phase A demand alarm 2. None 100. None	Phase A Demand Alarm Alarm data: 1934A Action delay: 15s Other data: la Required: 1934A			



Level 1 menu	Level 2 Menu	Level 3 Menu	Level 4 Menu	Level 5 Menu	Level 6 Menu	Level 7 Menu
			Ib Required: 1800A Ic Required: 1803A Id Required: 0A			
	Power quality alarm	Alarm record 1. Voltage temporary rise alarm 2. None 100. None	12:57:42 Voltage temporary rise alarm 2022/06/20 12:57:42			
	Health diagnosis alarm	Alarm record 1. Trip coil fault alarm 2. None 100. None	Trip coil fault alarm 2022/06/20 12:57:42			
Operation record	Number of operations	Total 6 number of operations Number 0 of protection operations Number of 6 manual live operations Number of 0 remote control operations Number of 5 alarms				
	Parameter Modification Record	Basic protection	Parameter Modification Record 1 Long-time action value	Parameter modification Method: Local Parameter type: Long-time		



Level 1 menu	Level 2 Menu	Level 3 Menu	Level 4 Menu	Level 5 Menu	Level 6 Menu	Level 7 Menu
			2022/06/20 09:42:25 2 None 20 None	action value Operator: 10000 Before modification: 400 Modified: 1000 2022/06/20 09:42:25		
		Other protections	Parameter Modification Record 1 underfrequency 2022/06/20 09:42:25 2 None 20 None	Parameter modification Method: Local Parameter type: underfrequency Operator: 10000 2022/06/20 09:42:25		
		Restore of ex-factory setup record	Parameter Modification Record 1 Method: local 2022/06/20 09:42:25 2 None 20 None			
Operation record	Displacement record	Displacement record 1 manual closing 2022/06/20 09:42:25 2 None 40 None				
	Accessory Connection Record	AMU	AMU Connection Record 1 disconnected 2022/06/20 09:42:25 2 None			

Level 1 menu	Level 2 Menu	Level 3 Menu	Level 4 Menu	Level 5 Menu	Level 6 Menu	Level 7 Menu	
menu	IVICIIU				IVICIIU	Iviella	
			20 None				
			PMU Connection				
			Record				
			1 disconnected				
		PMU	2022/06/20				
			09:42:25				
			2 None				
			 20 None				
Running	Daily	Electrical parameters	20 Notice	IA	Maximum value	IA max. 1 12598A 2022/06/20 09:42:25 2 None 32 None	
record	historical peak record			IA	Minimum value	IA Min. 1 0A 2022/06/20 09:42:25 2 None 32 None	
			Current	Current	ID.	Maximum value	IB max. 1 135982A 2022/06/20 09:42:25 2 None 32 None
Running record	historical	Electrical parameters		IB	Minimum value	IB min. 1 0A 2022/06/20 09:42:25 2 None 32 None	
				IC	Maximum value	IC Max. 1 135982A 2022/06/20 09:42:25	



Level 1	Level 2	Level 3 Menu	Level 4 Menu	Level 5 Menu	Level 6	Level 7
menu	Menu	Level 5 Iviena	Ecver 4 Iviena	Level 5 Wiena	Menu	Menu
						2 None
						32 None
						IC min.
						1 0A
					N 4 ! !	2022/06/20
					Minimum value	09:42:25
						2 None
						32 None
						IN max.
						1 6000A
						2022/06/20
					Maximum	09:42:25
					value	2 None
				181		32 None
				IN		IN Min.
						1 0A
					N 41:1:	2022/06/20
					Minimum	09:42:25
					value	2 None
						32 None
						IG Max.
						1 6000A
					Maxima	2022/06/20
					Maximum value	09:42:25
					value	2 None
				ıc		32 None
				IG	Minimum value	IG min
						1 0A
						2022/06/20
						09:42:25
						2 None
						32 None

Level 1	Level 2	Level 3 Menu	Level 4 Menu	Level 5 Menu	Level 6	Level 7
menu	Menu	Level 5 Wella	Level 4 Iviella	Level 5 Mena	Menu	Menu
			Voltage		Maximum value	Uab max. 1 426.5 V 2022/06/20 09:42:25 2 None 32 None
				Uab	Minimum value	Uab min. 1 0.0 V 2022/06/20 09:42:25 2 None 32 None
	Daily historical peak record Electrical parameters			Ubc	Maximum value	Ubc Max 1 426.5 V 2022/06/20 09:42:25 2 None 32 None
		historical historical			Minimum value	Ubc Min. 1 0.0 V 2022/06/20 09:42:25 2 None 32 None
Running record					Maximum value	Uca max. 1 426.5 V 2022/06/20 09:42:25 2 None 32 None
			Minimum value	Uca min. 1 0.0 V 2022/06/20 09:42:25 2 None 32 None		
				Uan	Maximum	Ubn Max.



Level 1 menu	Level 2 Menu	Level 3 Menu	Level 4 Menu	Level 5 Menu	Level 6 Menu	Level 7 Menu
					value	1 426.5 V 2022/06/20 09:42:25 2 None 32 None
					Minimum value	Ubn min. 1 0.0 V 2022/06/20 09:42:25 2 None 32 None
					Maximum value	Ubc Max 1 426.5 V 2022/06/20 09:42:25 2 None 32 None
				Ubn	Minimum value	Ubc Min. 1 0.0 V 2022/06/20 09:42:25 2 None 32 None
				Ucn	Maximum value	Ucn max. 1 426.5 V 2022/06/20 09:42:25 2 None 32 None
Running record	Daily historical peak record	Electrical parameters		odi	Minimum value	Ucn min. 1 0.0 V 2022/06/20 09:42:25 2 None 32 None
			Frequency	Maximum value	Maximum frequency	

Level 1	Level 2	Level 3 Menu	Level 4 Menu	Level 5 Menu	Level 6	Level 7
menu	Menu				Menu	Menu
					1 60.0 Hz	
					2022/06/20	
					09:42:25	
					2 None	
					 32 None	
					Minimum	
					frequency	
					1 46.0 Hz	
					2022/06/20	
				Minimum value	09:42:25	
					2 None	
					 32 None	
				Total active	Maximum value	Maximum total active power 1 120 0.00 kW 2022/06/20 09:42:25 2 None 32 None
			Power	power	Minimum value	Minimum total active power 1 0.00 kW 2022/06/20 09:42:25 2 None
				Total reactive power	Maximum value	Maximum total reactive power 1 700.00 KVar 2022/06/20 09:42:25 2 None



Level 1	Level 2	Level 3 Menu	Level 4 Menu	Level 5 Menu	Level 6	Level 7
menu	Menu				Menu	Menu
					Minimum value	32 None Minimum total reactive power 1 0.00 KVar 2022/06/20 09:42:25 2 None 32 None
				Total apparent	Maximum value	Max. total apparent power 1 140 0.00 KVA 2022/06/20 09:42:25 2 None 32 None
	Running record historical peak record			power	Minimum value	Min total apparent power 1 0.00 KVA 2022/06/20 09:42:25 2 None 32 None
		Electrical parameters	Demand current	IA Demand	Maximum value	Max demand IA 1 100 0A 2022/06/20 09:42:25 2 None 32 None
					Minimum value	Min demand IA 1 0A 2022/06/20 09:42:25

Level 1	Level 2	Level 3 Menu	Level 4 Menu	Level 5 Menu	Level 6	Level 7
menu	Menu	Level 5 Mellu	Level 4 Mellu	Level 5 Mellu	Menu	Menu
						2 None
						 32 None
						Max
					Maximum value	demand IB 1 100 0A 2022/06/20 09:42:25 2 None 32 None
				IB Demand	Minimum value	Min demand IB 1 0A 2022/06/20 09:42:25 2 None 32 None
					Maximum value	Max demand IC 1 100 0A 2022/06/20 09:42:25 2 None 32 None
				IC Demand	Minimum value	Min demand IC 1 0A 2022/06/20 09:42:25 2 None 32 None
				IN Demand	Maximum value	Max demand IN 1 100 0A 2022/06/20 09:42:25 2 None 32 None



Level 1 menu	Level 2 Menu	Level 3 Menu	Level 4 Menu	Level 5 Menu	Level 6 Menu	Level 7 Menu
Пени	IVIEHU				Minimum value	Min demand IN– 1 0A 2022/06/20 09:42:25 2 None 32 None
				Total active	Maximum value	Max total active power demand 1 120 0.00 kW 2022/06/20 09:42:25 2 None 32 None
Running record	historical	Electrical parameters	Required power	power demand	Minimum value	Min total active power demand 1 0.00 kW 2022/06/20 09:42:25 2 None 32 None
			Total reactive power demand	Maximum value	Max total reactive power demand 1 700.00 KVar 2022/06/20 09:42:25 2 None 32 None	
					Minimum value	Min total reactive power



Level 1 menu	Level 2 Menu	Level 3 Menu	Level 4 Menu	Level 5 Menu	Level 6 Menu	Level 7 Menu
menu	Menu			Total apparent power demand	Maximum value	Menu demand 1 0.00 KVar 2022/06/20 09:42:25 2 None 32 None Max total apparent power demand 1 140 0.00 KVA 2022/06/20 09:42:25 2 None 32 None Min total apparent power demand 1 0.00 KVA 2022/06/20 09:42:25 2 None 32 None
Running	Running Daily	Daily historical peak record Controller temperature	Maximum value	Max controller temperature 1 45.0 °C 2022/06/20 09:42:25 2 None 32 None		
record			Minimum value	Min controller temperature 1 0.0 °C 2022/06/20 09:42:25 2 None 		



Level 1 menu	Level 2 Menu	Level 3 Menu	Level 4 Menu	Level 5 Menu	Level 6 Menu	Level 7 Menu
menu	Iviella			32 None	IVICIIU	IVIEIIU
	Daily historical peak record	Busbar temperature	Maximum value	32 None Max busbar temperature 1 45.0 °C 2022/06/20 09:42:25 2 None 32 None Min busbar temperature 1 0.0 °C 2022/06/20		
				09:42:25 2 None 32 None		
Running record	Accumulated running	Records of power loss and recovery	Records of power loss and recovery 1 Power loss: 2022/06/20 09:42:25 Recovery: 2022/06/20 09:43:25 2 Power loss: Recovery: 40 Power loss: Recovery: Recovery: Recovery:			
	record	Load section time	Load section time I < 50% 0/0/0 at 1:16 50% ≤ I < 75% 0/0/0 at 00.0 75% ≤ I < 90% 0/0/0 at 00.0 I ≥ 90%) 0/0/0 at 00.0			
		Accumulated running time	Accumulated running time			

Level 1 menu	Level 2 Menu	Level 3 Menu	Level 4 Menu	Level 5 Menu	Level 6 Menu	Level 7 Menu
IIICIIG	1110114		0/0/0 at 00.0			IIICIIG
			Busbar			
			temperature			
			zone time			
			T < 60 °C			
			0/0/0 at 1:16			
			60 °C ≤ T < 80			
		Ducker	℃			
		Busbar	0/0/0 at 00.0			
		temperature zone time	80 °C ≤ T <			
		ume	100 ℃			
			0/0/0 at 00.0			
			100 °C ≤ I <			
			120 ℃			
			0/0/0 at 00.0			
			I ≥ 120 °C			
			0/0/0 at 00.0			
			Temperature	Max		
				temperature in		
				history		
				Controller		
	Historical			temperature:		
	peak record			45.0 °C		
				Busbar		
				temperature:		
			_	45.0 °C		
			Current	Largest current		
				in history		
				IA: 0A IB: 0A IC:		
		Maximum value		OA IN: OA IG:		
				0A;		
				Largest voltage in history		
				Frequency:		
Running				0.00Hz		
record				Uab: 0.0 V		
			Voltage	Ubc: 0.0 V		
				Uca: 0.0 V;		
				Uan: 0.0 V;		
				Ubn: 0.0 V;		
				Ucn: 0.0 V;		
				Largest power		
			Power	in history		



Level 1	Level 2	Level 3 Menu	Level 4 Menu	Level 5 Menu	Level 6	Level 7
menu	Menu	Level 5 Wella	Level 4 Mena		Menu	Menu
				P: 0.00 kW		
				Q: 0.00 kVar;		
				S: 0.00 kVA;		
				Largest		
				demand		
				current in		
			Demand	history IA: 0A;		
			Current	IB: 0A;		
				IC: 0A;		
				IN: 0A;		
				Largest		
				demand power		
			Demand	in history		
			Power	P: 0.00 kW		
				Q: 0.00 kVar		
				S: 0.00 kVA		
			Min temp. in			
			history			
		Min temperature	Controller			
		in history	temp.: 0.0°C			
			Busbar temp.:			
			0.0°C			
	Maintenance					
	Prompt					
	record					
Maintenance	1 Motor life					
prompt	Risk: medium 2022/06/20					
record	09:42:25					
	2 None					
	20 None					
		Firmware				
	Firmware	Upgrade				
	Upgrade 1 Vers. No.:	Upgrade method:				
Firmware	V1.06. 03	USB				
Upgrade	2022/06/20	Operator:				
Record	09:42:25	10000				
Record	2 None	Version before				
		upgrade: V1.00.				
	20 None	03				
		Upgraded				

Level 1	Level 2	Level 3 Menu	Level 4 Menu	Level 5 Menu	Level 6	Level 7
menu	Menu				Menu	Menu
		version: V1.06. 03				
		2022/06/20				
		13:59:42				
	Electrical					
	fault record					
	1 Protection					
	breaking					
Electrical	fault					
fault record	2022/06/20					
	09:42:25					
	2 None					
	20 None					



3.3.3.4 Measurement menu

Table 90 Measurement menu

Level 1 menu	Level 2 Menu	Level 3 Menu	Level 4 Menu	Level 5 Menu
			Instantaneous value	
			IA: 0.0 A	
		Present current	IB: 0.0 A	
		value	IC: 0.0 A	
	Instantaneous		IN: 0.0 A	
	value		IG: 0A	
	value		Current unbalance	
			rate	
		Unbalance rate	IA: 0.0%	
			IB: 0.0%	
			IC: 0.0%	
		Thermal		
		capacity		
	Present thermal	0%		
Current	capacity (Existing)	Estimated		
measurement		cooling time:		
		0s		
		Ia: 0.0 A		
		Ib: 0.0 A		
	Current waveform	Ic: 0.0 A		
	Carrette Waveroriii	$\overline{}$		
		IN: 0.0 A;		
		$\overline{}$		
	Average current	Average		
	/(verage carrent	0.0 A		
		IA: 0.0 A		
		IB: 0.0 A		
	Demand value	IC: 0.0 A		
		IN: 0.0 A		
		Uab 0.0 V		
		Ubc 0.0 V		
Voltage	Instantaneous	Uca 0.0 V		
measurement	value	Uan 0.0 V		
casar criticité		Ubn 0.0 V;		
		Ucn 0.0 V;		
	Average	Average		

Level 1 menu	Level 2 Menu	Level 3 Menu	Level 4 Menu	Level 5 Menu
		0.0 V		
	Unbalance rate	Unbalance rate		
	Official rate	0.0%		
	Phase	Phase		
	sequence(rotation)	sequence		
	sequence(rotation)	None		
		Uan = 0.0 V;		
		Ubn = 0.0 V;		
	Voltage waveform	Ucn = 0.0 V;		
		F = 0.00 Hz;		
			Total power	
			P 0.00 kW	
		Total power	Q 0.00 kVar;	
			S 0.00 kVA;	
			PF 0.000	
			A-phase power	
		A-phase power	Pa 0.00 kW	
		A-phase power	Qa 0.00 kVar; Sa 0.00 kVA;	
	Instantaneous		PFa 0.000	
	value		B-phase power	
Power	Variac		Pb 0.00 kW	
measurement		B-phase power	Qb 0.00 kVar	
		-	Sb 0.00 kVA	
			PFb 0.000	
			C-phase power	
			Pc 0.00 kW	
		C-phase power	Qc 0.00 kVar	
			Sc 0.00 kVA	
			PFc 0.000	
		Demand value		
	Demand value	P 0.00 kW		
	Demand value	Q 0.00 kVar;		
		S 0.00 kVA;		
		Total electric		
	Total electric	energy		
EL . '	energy	EP 0.00 kWh;		
Electric		EQ 0.00 kVarh		
energy		ES 0.00 kVAh		
measurement		Input electrical		
	Input electric	energy		
	energy	EP 0.00 kWh;		
		EQ 0.00 kVarh		



Level 1 menu	Level 2 Menu	Level 3 Menu	Level 4 Menu	Level 5 Menu
	Output electric energy	Output electrical energy EP 0.00 kWh; EQ 0.00 kVarh		
	Electric energy reset	Electric energy reset Electric energy reset: Yes		
		Fundamental wave	Fundamental wave IA 0.0 A IB 0.0 A IC 0.0 A IN 0.0 A	
Harmonics measurement	Current harmonics	THD	THD IA 0.0% IB 0.0% IC 0.0% IN 0.0%	
		thd	thd IA 0.0% IB 0.0% IC 0.0% IN 0.0%	
			IA	1AFFT 60 30 0 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
	Current harmonics	FFT	IB	1B FFT 60 30 37 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
Harmonic measurement			IC	1CFFT 60 30 37 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
			IN	0
	Voltage harmonics	Fundamental wave	Fundamental wave: Uan: 0.0 V; Ubn: 0.0 V; Ucn: 0.0 V;	
		THD	THD Uan: 0.0%	

Level 1 menu	Level 2 Menu	Level 3 Menu	Level 4 Menu	Level 5 Menu
			Ubn: 0.0%	
			Ucn: 0.0%	
			thd	
		thd	Uan: 0.0%	
		tria	Ubn: 0.0%	
			Ucn: 0.0%	
				Uan FFT
			Uan	30
		FFT	Ubn	Ubn FFT 60 30 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
			Ucn	Ucn FFT 60 30 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
	Temperature			
	measurement			
	Controller			
Temperature measurement	temperature: 33.5			
	°C			
casarement	Bus temp. A: 0.0°C			
	Bus temp. B: 0.0°C			
	Bus temp. C: 0.0°C;			
	Bus temp. N: 0.0°C			



3.3.3.5 System Menu

Table 91 System Menu

Level 1 menu	Level 2 Menu		Level 3 Menu		Level 4 Menu	Level 5 Menu
	14:30:17					
	Time					
Clock setting	(hour/minute/second)					
	2022-06-22					
	Date (yyyy/mm/dd)					
		Quick View				
		Current meas	surement C)		
		Current prote	ection parame	ter 🚺		
		Health Diagn	ostic Informa	tion		
	Quick View Settings		surement 🕡			
		Power measu	_			
		Polling interv				
		3.0s ⊞ ⊟				
Mode		Trip test	Trip test	Trip test		
Settings		Test type:	Test Type:	Test Type:		
		three-zone	Mechanism	Grounding		
	Trip test	protection	Trip	Test		
	mp test	Test current:	Test time: 0	current:		
		2000A	ms	2000A		
		Test Start:				
		Stop	Stop	Stop		
	ERMS (Maintenance		enance mode)		
	mode)	Switch:				
	Measurement table					
	Settings Frequency setting:					
	50Hz					
	Rated voltage: 400V					
	System type:					
	3P4W4CT					
	Line incoming mode:					
Measurement	upper					
table Settings	Active power					
	direction: P+					
	Reactive power					
	direction: Q+					
	Demand current					
	selection time: 5					
	minutes					
	Demand power					

Level 1 menu	Level 2 Menu	Level 3 Menu	Level 4 Menu	Level 5 Menu
	selection time: 5			
I/O Settings	DO/DI Settings	DO1: Break Normally open pulse 1s DO2: alarm Normally open level DO3: Break Normally open pulse 1s DO4: commen purpose Normally open level		
	I/O Status	DO1: disconnected DO2: disconnected DO3: disconnected DO4: disconnected		
Authority Settings	Login Account No.: 10000 Password: 000000 OK	Authority management My account number: 10000 Authority management: Assign authority Change Password Logout	Account Measurement table ⊞New	Authority management Operator: 10001 Authority: Low Authority scope: View Parameter View Record Basic Protection Settings Other Protection Settings System Settings Delete
Language Settings	Language Settings English			
Recover ex-factory settings	Recover ex-factory settings Yes			
Version Information	Version Information Program version: V1.04. 003 Hardware version:			



Level 1 menu	Level 2 Menu	Level 3 Menu	Level 4 Menu	Level 5 Menu
	V1.00. 000			
	Interactive version:			
	V1.00. 001			

3.3.3.6 Communications menu

Table 92 Communication Menu

Level 1 menu	Level 2 Menu	Level 3 Menu
Modbus-RTU	Modbus-RTU Correspondence address: 3	
	Baud rate: 9600 ⊞ ⊟	
	Stop bit: 1.0 🕀 🖃 Check bit: no check	
	DL/T645	
DL/T645	Correspondence address: 3	
	Baud rate: 9600 ⊞ ⊟	
	Port Settings	698 Port Settings
		Baud rate: 9600 ⊞ ⊡
		Stop bit: 1.5 ⊞ ⊟
		Check bit: even check
		698 Parameter Settings
		Address Type: single address 99999999999999999999999999999999999
DL/T698	698 Parameter Settings	Logical Address: 3
		Client Address: 0
		Service Priority: General
		Service start sequence number: 0
		Heartbeat cycle: 60
		Whether to use time label:
		Allowed Transmission Delay Unit: second
		Allowed transmission delay time: 10

3.3.3.7 Keyboard and Save Page

Table 93 Keyboard and Save Pages

Keyboard input	Save Modifications
T 8 9 ESC 4 5 6 3 1 2 3 OK	L. *** ① B B B B B B B B B B B B B B B B B

Note: Please enter the value according to the range indicated on top of the keyboard. Press confirm key "—" to save. If exceeding the range, the saving will fail.

4 Precautions for maintenance and storage period

4.1 Maintenance considerations

- 1) During normal operation, the door panel of the controller should be coverd.
- 2) The controller should be tested regularly for normal trip.
- 3) The ambient temperature and humidity of the place of use must comply with the recommendations in the product manual.
- 4) In order to ensure that the circuit can be cut off safely and reliably when a fault occurs, the current setting value of the controller should be checked regularly.
- 4.2 Inspection of the intelligent controller



- 1. Press home key " once to enter the main menu
- 2. Touch the image area " once to enter the protection menu
- 3. Click "♥♠" to view each protection setting parameters
- 4. Press return key "◀" to return to the previous menu or exit the page

Figure 32 Parameter settings meet field use requirements



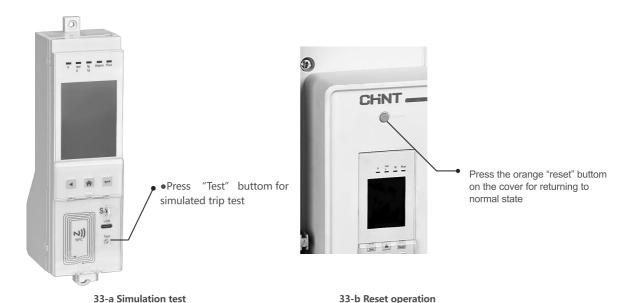


Figure 33 Simulated test tripping function

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NA8 Series Air Circuit Breaker S-type Intelligent Controller User Instruction

Zhejiang Chint Electrics Co., Ltd.

Add: No.1, CHINT Road, CHINT Industrial Zone,North Baixiang, Yueqing, Zhejiang 325603,P.R.China E-mail: global-sales@chint.com







