NO:2021.07

CHINT ELECTRICS

NA1 Series
3M/3H type intelligent controller

User Instruction

Standard: IEC 60947-2

⚠ Safety Warning

1. Only professional technicians are allowed for installation and maintenance.
2. It is strictly prohibited to install in the environment containing inflammable, explosive gas and moist condensation.
3. Power must be turned off when the product is installed or maintained.
4. Please do not touch the conductive part of the product during working.

Catalog

1 Scope of Application

The NA1 multi-function intelligent controller (hereinafter referred to as the "controller") is the core component of the air circuit breaker and is suitable for 50-60 Hz grid. It is mainly used for power distribution, feed and power generation protection to protect line and power equipment from faults such as overload, short circuit, grounding/leakage, current imbalance, overvoltage, undervoltage, voltage imbalance, over-frequency, under-frequency, reverse-power. It realizes the reasonable operation of the power grid through functions such as load monitoring and zone interlocking. It is also used to measure grid parameters such as current, voltage, power, frequency, electrical energy and harmonics, and to record operation and maintenance parameters such as faults, alarms, operations, current historical maximum and switch contact wear conditions. When the power grid performs communication networking, the intelligent controller can be used to implement functions, such as telemetry, remote signaling, remote control and remote adjustment, of the remote terminals of the power automation network.

2 1Model Specifications and Designation

NA1– 3 H 3 – 2000 / 1600 / 3P T / E / S2 / F – AC220V

NA1	3	H	3	2000	1600	3P	T	E	S2	F	AC220V
Company product code	Design version number	Product function code	* Communication protocol type	Breaker frame current	Rated current	Breaker pole number	Ground protection mode	* Optional function code	* Zone interlock and signal output unit	* Potection type	Power supply type
NA1	3	Empty: none M: basic type H: commun-ication type	Empty: none 3:Modbus	Frame I -- 1000A Frame II -- 2000A Frame III -- 3200A 4000A Frame IV --6300A	I框--200A、400A、630A 800A、1000A II框--2000A : 630A、800A、1000A、1250A、1600A、2000A III框--3200A、4000A: 2000A、2500A、3200A、4000A IV框--6300A: 4000A、5000A、6300A V框--4000A	3P: tripolar 4P: quadrupole 3P+N: tripolar + N (external Phase N transformer)	T: Vector sum (difference) W: ground current E: leakage current	Empty: none U: voltage type E: energy type	Empty: none S1: 4DO, no zone interlocking function S2: 3DO, 1DI has zone interlocking function S3: 2DO, 2DI has zone interlocking function	Empty: power distribution protectin F: generator protection	AC380V (AC400V) AC220V (AC230V) DC220V DC110V DC24V

3 Function Configuration and Main Performance Parameters

3.1 Function Configuration

3.1.1 Basic Functions of Type 3M (U and F functions are optional)

Table 1 Basic function configuration of Type 3M

Protection Function	Measurement Function	Maintenance Function	Human Machine Interface
● Load monitoring (current mode) ● Multi-curve long-delay protection ● Short-delay inverse-time protection ● Short-delay definite-time protection ● Instantaneous protection ● MCR protection ● Current imbalance (phase failure) protection ● Grounding protection (Type T by default) ● Grounding alarm ● Neutral phase protection	● Four-phase current and ground current measurement ● Heat capacity	● 10 fault records ● 10 alarm records ● 10 displacement records ● Current historical peak ● Contact equivalent ● Number of operations ● Clock function ● Self diagnosis	● English graphic LCD display ● LED status indication ● Keyboard operation

3.1.2 Type 3H Function Configuration (including all Type 3M functions +E function + communication function by default)

Table 2 Type 3H function configuration

U	E
● Voltage measurement ● Frequency measurement ● Voltage imbalance rate measurement ● Phase sequence detection ● Overvoltage protection ● Undervoltage protection ● Voltage imbalance protection ● Over-frequency protection ● Under-frequency protection ● Phase sequence protection	● Include all Type U optional functions ● Power measurement ● Power factor measurement ● Electric energy measurement ● Harmonic measurement ● Reverse power protection

3.1.3 Selection of Zone Interlocking and Signal Unit

The "zone interlocking and signal unit" are optional. Type 3M/3H can select the function configuration of the signal unit. When the signal unit is selected as S2 or S3, the controller has the zone interlocking function.

3.2 Main Performance Parameters

3.2.1 Working Power Supply

The controller is powered by the auxiliary power supply and the power transformer at the same time, ensuring that the controller can work reliably with small load and short circuit conditions. The controller is powered by the following two methods:

a.CT power supply

When the three phases current of the main circuit＜ 80% In, in order to keep the intelligent controller working properly, the intelligent controller need to powered by auxiliary power supply.

b.Auxiliary power supply

Rated voltage: DC24 V, allowable range ±5%
AC220 V/AC230 V, allowable range ±15%
AC380 V/AC400 V, allowable range ±15%
DC110 V/DC220 V, allowable range ±15%

3.2.2 Input and Output

a.Digital contact output (DO) contact capacity (with RU-1 relay unit):

DC110 V 0.5 A Resistive;
AC250 V 5 A Resistive.

b.Digital contact input power supply requirements

Voltage level: DC110 V-130 V or AC110 V-250 V
Minimum turn-on voltage: 60 Vrms
Maximum turn-off voltage: 30 Vrms

3.2.3 Anti-interference Performance

After all the tests in Appendix F of IEC 60947-2, the EMC electromagnetic compatibility test parameters are shown in Table 3.

Table 3 EMC electromagnetic compatibility test parameters

Test Item	Parameters
Harmonics-caused non-sinusoidal current immunity	Current conduction time ≤42% Peak factor ≥2.1
Current sag and interruption immunity	
Fast transient burst immunity	Signal circuit and current circuit are both of level 4 Frequency: 5 kHz; common mode: 4 kV; differential mode: 2 kV
Surge immunity	Level: 4; common mode: 4kV; differential mode: 2kV
Electrostatic discharge	Level: 4; air discharge: 8 kV; contact discharge: 6 kV
RF electromagnetic field radiation immunity	Frequency: 80 MHz-1,000 MHz; field strength: 10 V/m
RF radiation emission test (30-1,000) MHz	(30-230) MHz 30 db(uV/m) (230-1,000) MHz 37 db(uV/m)

3.2.4 Protection Characteristics

Any kind of protection action will be recorded. The detailed parameters at the time of tripping and the exact tripping time can be obtained through information inquiry. Each kind of protection can be set to the corresponding digital output (DO).

3.2.4.1 Overload Long-delay Protection

The overload long-delay protection function is generally used to protect the cable overload and the current-based true RMS.

3.2.4.1.1 Setting of Tuning Parameters Related to Overload Protection

Table 4 Setting of Tuning Parameters Related to Overload Protection

Parameter Name	Tuning Range	Tuning Step	Remarks
Operating current setting value: Ir	OFF+(0.4~1.0) In	1A (Frame I, Frame II) 2A (Frame III, Frame IV, Frame V)	The upper limit is 1.0 In for power distribution protection and 1.2 In for power generation distribution; "OFF" indicates function exit.
Protection curve type selection	It: Fast inverse time limit I^2t: Express inverse time limit I^4t: High voltage fuse compatible		
Delay time setting (set value: Tr)	15s 30s 60s 120s 240s 480s		
Thermal memory time setting	Instantaneous, 10 minutes, 20 minutes, 30 minutes		

3.2.4.1.2 Overload Long-delay Protection Action Characteristics

Table 5 Overload long-delay protection action characteristics

Characteristics	Current Multiple (I/IR)	Appointed Tripping Time	Delay Tolerance
Non-action characteristics	< 1.05	> 2 h non-action	
Action characteristics	> 1.3	< 1 h action	
Action time-delay	≥1.3	See Table 6	±10% (inherent absolute error: ±40ms)

Table 6 Characteristic curve types and related parameters

Curve Type	Fault Current	Action Time						Remarks
		15s	30s	60s	120s	240s	480s	
It	1.5×Ir	15s	30s	60s	120s	240s	480s	t=(1.5Ir/I)×Tr(minimum: 0.8 s; maximum: 655 s)
	6×Ir	3.75s	7.5s	15s	30s	60s	120s	
	7.2×Ir	3.125s	6.25s	12.5s	25s	50s	100s	
I^2t	1.5×Ir	15s	30s	60s	120s	240s	480s	$t=(1.5Ir/I)^2$×Tr(minimum: 0.8 s; maximum: 655 s)
	6×Ir	0.94s	1.87s	3.75s	7.5s	15s	30s	
	7.2×Ir	0.8s	1.3s	2.6s	5.2s	10.41s	20.83s	
I^4t	1.5×Ir	15s	30s	60s	120s	240s	480s	$t=(1.5Ir/I)^4$×Tr(minimum: 0.8 s; maximum: 655 s)
	6×Ir	0.8s	0.8s	0.8s	0.8s	0.94s	1.87s	
	7.2×Ir	0.8s	0.8s	0.8s	0.8s	0.8s	0.904s	

3.2.4.1.3 Thermal Memory

To prevent unacceptable repeated or periodic overloads, the controller tracks and records the thermal effects of the load current. When the thermal effect accumulated by the load reaches a predetermined level, the controller will trip.

The way the heat capacity changes is determined by the selected curve.The heat capacity is increased only when the current measurement value is greater than 1.2 Ir. When the breaker trips due to an overload or inverse time short circuit fault or returns from an overload state to a non-overload state, the heat capacity is exponentially attenuated. The user can set the heat capacity cooling time to instantaneous, 10 minutes, 20 minutes or 30 minutes.

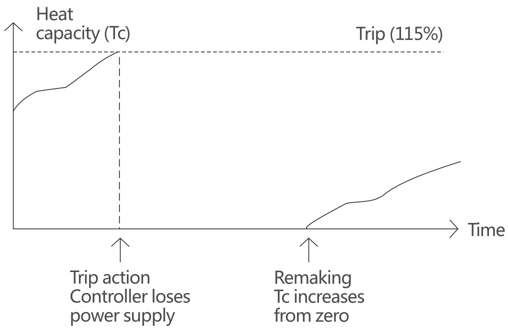


Figure 1 Thermal memory characteristics without auxiliary operating power supply

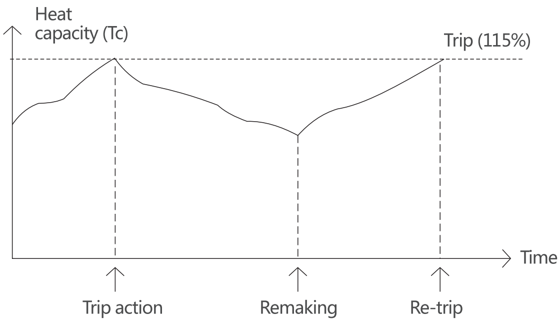


Figure 2 Thermal memory characteristics with auxiliary operating power supply

When the controller is not connected to the auxiliary power supply, if it makes immediately after the breaker is actuated, the heat capacity generated by the previous current will be ignored. That is, the remaking causes the controller to be powered on and reset again and the heat capacity is restored to zero.

When the controller is connected to the auxiliary power supply, if the heat capacity is reduced after the breaker is actuated, the heat capacity generated by the previous current will be memorized after the breaker makes. That is, the heat capacity is reduced after breaking, and continues to change with the current after remaking.

3.2.4.2 Short Circuit Short-delay Protection

The short-delay protection prevents the impedance short circuit of the power distribution system which is generally caused by the local short circuit fault of the line, in which case the current generally exceeds the overload range yet the short-circuit current is not very large. The trip delay for short circuit and short delay is for selective protection. The short-circuit delay protection is based on the current true RMS and is divided into two sections: the inverse time section and the definite time section. It further strengthens the coordination with lower-level protection devices.

The short delay protection can be equipped with the optional zone interlocking function, so that when a short-circuit fault occurs on the outlet side of the current-level breaker, the short circuit short delay will instantaneously trip the breaker, and when a short-circuit fault occurs on the outlet side of the next-level breaker of the current-level breaker, the short circuit short delay will trip the breaker after the set delay time. The implementation of this function requires the combined use of the digital input (DI) and digital output (DO). The DI is used to detect the zone interlocking signal of the next-level breaker and the DO is used to send the zone interlocking signal to the upper-level breaker.

3.2.4.2.1 Setting of Parameters Related to Short Delay Protection

Table 7 Setting of Parameters Related to Short Delay Protection

Parameter Name	Tuning Range	Tuning Step	Remarks
Inverse time operating current set value Isd	OFF+(1.5~15)Ir	I<10kA: 1A (Frame I, Frame II) 2A (Frame III, Frame IV, Frame V) I≥10kA: 10A (Frame I, Frame II) 20A (Frame III, Frame IV, Frame V)	Ir is the overload long-delay set value. When Ir=OFF, Ir in the formula is replaced with the rated current In.
Definite time operating current set value Isd	OFF+(1.5~15)Ir		Ir is the overload long-delay set value. When Ir=OFF, Ir in the formula is replaced with the rated current In.
delay time set value Tsd	Definite time (0.11,0.21,0.31,0.41) inverse-time (0.10,0.20,0.30,0.40)		
Zone short-circuit interlocking (ZSI)	1. At least one digital output(DO) is set to "zone interlocking" or "short-circuit interlocking". 2. At least one digital input (DI) is set to "zone interlocking" or "short-circuit interlocking".		The signal unit option must be S2 or S3. When the DI/DO is set to "zone interlocking", it acts on both "grounding zone interlocking" and "short-circuit zone interlocking"; when the DI/DO is set to "short-circuit interlocking", it only acts on "short-circuit zone interlocking". If the zone interlocking function will not work if the function is not set.

Note: When the controller is Frame III, V(NA1-3200, 4000), the maximum of the short-delay protection tuning value Isd is 40 kA; when the controller is Frame IV(NA1-6300), the maximum of the short-delay protection tuning value Isd is 50 KA.

3.2.4.2.2 Short-delay Inverse-time Action Characteristics

Table 8 Short-delay inverse-time action characteristics

Characteristics	Current Multiple (I/Is)	Appointed Tripping Time	Delay Tolerance
Non-action characteristics	< 0.9	Non-action	
Action characteristics	> 1.1	Action	
Action delay	≥ 1.1	Note	±15%, or the inherent absolute error ±40ms, taking the maximum value

Note: Short-delay inverse-time delay characteristics: I≥8 Ir for inverse time; $T=(8\ Ir/I)^2 \times Tsd$ (Isd×1.1<I<8 Ir).For example,

1. Long-delay set value: Ir; short-delay inverse-time set value: Isd =4Ir; fault current I=9Ir; at this time, the fault delay time is T=Tsd and the action type is short delay definite time.
2. Long-delay set value: Ir; short-delay inverse-time set value: Isd =2Ir; fault current I=3Ir; at this time, the fault delay time is $T=(8Ir/I)^2 \times Tsd$, and the action type is short-circuit short delay inverse time.

3.2.4.2.2 Short-delay Definite-time Action Characteristics

Table 9 Short-delay definite-time action characteristics

Characteristics	Current Multiple (I/Is)	Appointed Tripping Time	Delay Tolerance
Non-action characteristics	< 0.9	Non-action	
Action characteristics	> 1.1	Action	
Action delay	≥ 1.1	Definite time set delay time Tsd	±15%, or the inherent absolute error ±40 ms, taking the maximum value

3.2.4.3 Instantaneous Protection Characteristics

The instantaneous protection function prevents the solid short circuit of the power distribution system which is generally a phase-to-phase fault; the short-circuit current is large and needs to be quickly disconnected. This protection is based on the current true RMS or current peak.

3.2.4.3.1 Setting of Parameters Related to Instantaneous Protection

Table 10 Setting of Parameters Related to Instantaneous Protection

Parameter Name	Tuning Range	Tuning Step
Operating current set value Ii	OFF+(1.5-20)In	I < 10kA: 1A(Frame I, Frame Ⅱ) 2A (Frame Ⅲ, Frame Ⅳ, Frame Ⅴ) I≥10kA: 10A (Frame I, Frame Ⅱ) 20A (Frame Ⅲ, Frame Ⅳ, Frame Ⅴ)

Note: When the controller is Frame II (NA1-2000), the maximum of the instantaneous protection tuning value Ii is 50 kA; when the controller is Frame III (NA1-3200, 4000), the maximum of the instantaneous protection tuning value Ii is 65 kA; when the controller is Frame IV (NA1-6300), the maximum of the instantaneous protection tuning value Ii is 75 kA; when the controller is Frame V (NA1-4000), the maximum of the instantaneous protection tuning value Ii is 65 kA.

3.2.4.3.2 Instantaneous Protection Action Characteristics

Table 11 Instantaneous Protection Action Characteristics

Characteristics	Current Multiple (I/Ii)	Appointed Tripping Time
Non-action characteristics	< 0.85	Non-action
Action characteristics	> 1.15	Action
Action delay	≥ 1.15	≤ 0.2s

3.2.4.4 MCR Protection

The MCR protection is a high-speed instantaneous protection for the breaker itself. When the over-limit fault current is generated, the controller will issue a trip command within 10 ms. The MCR protection protects the turn-on ability of the breaker, preventing the breaker from turning on a current exceeding the turn-on limit capability and causing damage to the breaker. The protection acts during the breaking and making of the circuit breaker (within 100 ms).

3.2.4.4.1 Setting of Parameters Related to MCR Protection

Table 12 Setting of Parameters Related to MCR Protection

Product Model	MCR Tuning Value (IMCR: kA)
NA1-1000 frame	6.3(In=200A~400A), 12.6(In=400A~1000A)
NA1-2000 frame	16
NA1-3200 frame	26
NA1-4000 frame	26
NA1-6300 frame	26

Note: 1. This set of set values are generally set according to the breaking capacity of the breaker when the breaker is shipped. They cannot be adjusted by end users.
2. When the MCR protection function is selected, the user cannot close it. If there are special requirements (such as testing), please specify when ordering.

3.2.4.4.2 MCR Protection Action Characteristics

Table 13 MCR Protection Action Characteristics

Characteristics	Current Multiple (I/Ig)	Appointed Tripping Time
Non-action characteristics	< 0.85	Non-action
Action characteristics	> 1.15	Action
Action delay	≥ 1.15	≤ 0.2s

3.2.4.5 Neutral Line Protection

In practical applications, the cable and current characteristics of the neutral phase are often very different from other three phases. The NA1 multi-function intelligent controller implements different protections for the neutral phase for different applications. When the neutral line is thin, it can be protected by a half-fixed value method; when it is the same as other phases, it can be protected by a full-fixed value method. The neutral line protection is available for quadrupole (4P) and 3P+N products.

Table 14 Setting of parameters related to neutral Protection

Type of Neutral Line Protection	Description
50%	Half neutral line protection ● When a neutral phase overload fault occurs, the protection action point is equal to half of the set value. ● When a neutral phase short-circuit short-delay fault occurs, the protection action point is equal to half of the set value. ● When a neutral phase short-circuit instantaneous fault occurs, the protection action point is equal to half of the set value. ● When a neutral phase grounding fault occurs, the protection action point is equal to the set value.
100%	Full neutral line protection ● When a neutral phase overload fault occurs, the protection action point is equal to the set value. ● When a neutral phase short-circuit short-delay fault occurs, the protection action point is equal to the set value. ● When a neutral phase short-circuit instantaneous fault occurs, the protection action point is equal to the set value. ● When a neutral phase grounding fault occurs, the protection action point is equal to the set value.
OFF	

3.2.4.6 Ground Protection

For single-phase metallic ground protection, there are two modes: vector sum (differential) type (T) and ground current type (W). The T-Type detects the zero-sequence current, that is, take the vector sum of four-phase (3-phase 4-wire system) or three-phase (3-phase 3-wire system) currents for protection. The W-type directly detects the current of the grounding cable through a special external transformer and can protect the upper and lower grounding faults of the breaker at the same time. The maximum distance between the transformer and the breaker is less than 5 meters. Zone interlocking is possible for differential ground faults.

3.2.4.6.1 Setting of Parameters Related to Ground Protection

Table 15 Setting of Parameters Related to Ground Protection

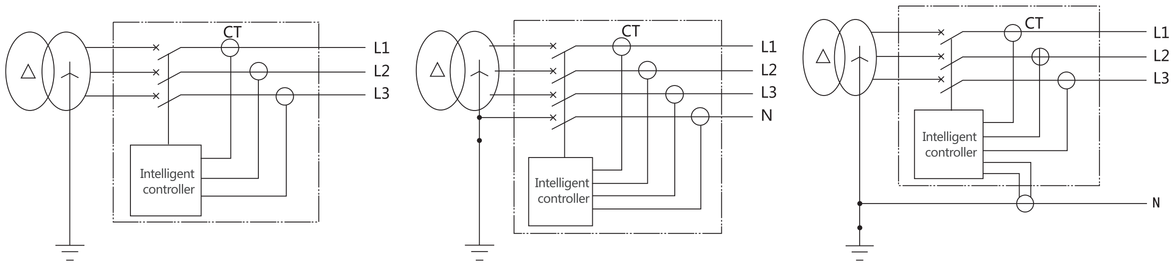
Parameter Name	Tuning Range	Tuning Step	Remarks
Operating current Set value Ig	OFF+(0.2~0.8)×In (Min=100A, Max=1200A)	Tuning Step 1A	1A (Frame I, Frame II)
	OFF+(500A~1200A)	Tuning Step 2A	2A (Frame III, Frame IV, Frame V)
Delay time Tg	(0.1~0.4) s	0.1 s	
Ground fault zone interlocking (for T type ground faults) (ZSI)	1. At least one digital output (DO) is set to "zone interlocking" or "ground interlocking". 2. At least one digital input (DI) is set to "zone interlocking" or "ground interlocking".		The signal unit option must be S2 or S3. When the DI/DO is set to "zone interlocking", it actson both grounding zone interlocking and short-circuit zone interlocking; when the DI/DO is set to "ground interlocking", it only acts on ground zone interlocking. If the zone interlocking function will not work if the function is not set.

3.2.4.6.2 Ground Fault Protection Characteristics

Table 16 Ground fault protection action characteristics

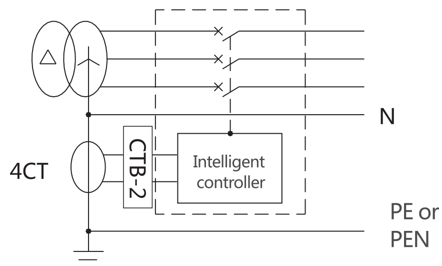
Characteristics	Current Multiple (I/Ig)	Appointed Tripping Time	Delay Tolerance
Non-action characteristics	< 0.9	Non-action	
Action characteristics	> 1.1	Action	
Action delay	≥1.1	Note	±15%, or the inherent absolute error ±40 ms, taking the maximum value

3.2.4.6.3 Detection Schematic



3PT mode   Figure 3-b 4PT mode   Figure 3-c (3P+N)T mode

Figure 3 Differential type grounding protection Principle



4CT: additional special transformer   CTB-2: ground current transformer module

Figure 4 Ground current type grounding protection detection principle

3.2.4.7 Leakage Protection (E)

It is suitable for leakage faults caused by equipment insulation damage or by human body exposure to exposed conductive parts. The leakage trip value I△n is directly expressed in amperes, irrelevant to the rated current of the circuit breaker. The signal is taken in a zero-sequence sampling mode, and a rectangular transformer is required. This sampling has high precision and high sensitivity and is suitable for protection of a small current.

3.2.4.7.1 Setting of Parameters Related to Leakage Protection

Table 17 Grounding protection parameter setting

Parameter Name	Tuning Range	Tuning Step
Operating current set value IΔn	(0.5~30.0)A	Step size 0.1 A
Delay time TΔn(s)	0.02, 0.06, 0.08, 0.17, 0.25, 0.33, 0.42, 0.5, 0.58, 0.67, 0.75, 0.83	
Execution mode	Trip / close	

3.2.4.7.2 Leakage Protection Action Characteristics

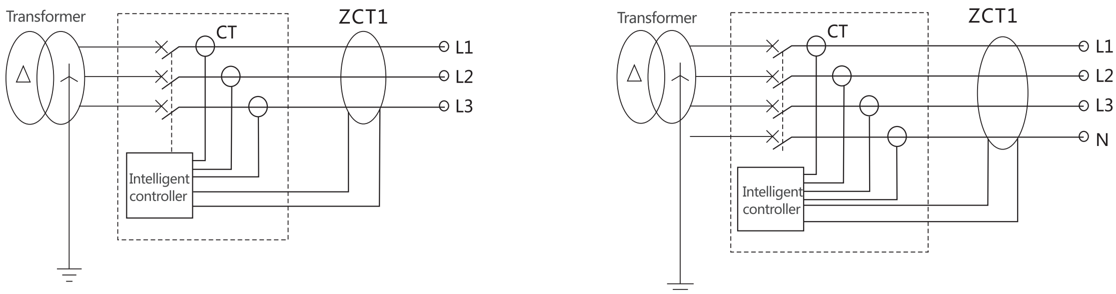
Table 18 Leakage protection action characteristics

Characteristics	Current multiple (I/I△n)	Appointed Tripping Time	Delay Tolerance
Non-action characteristics	< 0.8	Non-action	
Action characteristics	> 1.0	Action	
Action delay	≥1.0	See Table 19	±10% (inherent absolute error: ±40ms)

Table 19 Leakage protection action delay

Tuning Time (s)	0.06	0.08	0.17	0.25	0.33	0.42	0.5	0.58	0.67	0.75	0.83	0.02
Fault Current Multiple	Maximum Disconnection Time s											
I△n	0.36	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	0.04
2I△n	0.18	0.25	0.5	0.75	1	1.25	1.5	1.75	2	2.25	2.5	0.04
5I△n/10I△n	0.072	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1	0.04

3.2.4.7.3 Leakage Protection Detection Principle



ZCT1: rectangular leakage transformer

Note: ZCT1 can provide busbar traversing mode for frame Ⅰ (NA1-1000 tripolar and quadrupole products, and frame Ⅱ (NA1-2000) tripolar products, and is not suitable for frame Ⅱ (NA12000) quadrupole, Frame Ⅲ (NA1-3200, 4000)

Figure 5 ZCT1 rectangular leakage protection detection principle

3.2.4.8 Grounding Alarm

The grounding alarm function and the grounding protection function are independent of each other and exist at the same time, and they have their respective parameter settings.

3.2.4.8.1 Principle of Action

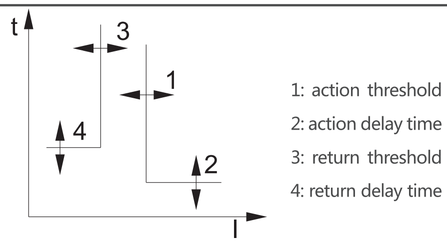


Figure 6 Alarm action principle

As shown in Figure 7: The protection starts the alarm according to the true RMS of the ground current. It starts the alarm delay when the ground current is greater than the action threshold (1) and issues an alarm when the action delay time (2) expires, and the grounding alarm DO acts. When the ground current is less than the return threshold (3), the protection starts the return delay, and removes the alarm when the return delay time (4) expires, and the grounding alarm DO returns. The return threshold must be less than or equal to the action threshold.

3.2.4.8.2 Setting of Parameters Related to Ground Alarm

Table 20 Grounding alarm parameter setting

Parameter Name	Tuning Range	Tuning Step	Remarks
Alarm starting current set value	OFF+(0.2~0.8)×In Same as ground protection table 15 OFF+(500A~1200)	1A	
Alarm action delay	(0.1~1.0) s	0.1 s	
Alarm return current set value	0.2In~starting value (max1200A)	1A	
Alarm return delay	(0.1~1.0) s	0.1 s	
Execution mode	Execution modeAlarm + closing		

3.2.4.8.3 Grounding Alarm Action Characteristics

Table 21 Grounding alarm action characteristics

Characteristics	Current Multiple (I/starting current)	Appointed Tripping Time	Delay Tolerance
Non-action characteristics	< 0.9	Non-action	
Action characteristics	> 1.1	Action	
Action delay	≥1.1	The definite time characteristics are equal to the set delay time	±10% (inherent absolute error: ±40ms)

3.2.4.8.4 Grounding Alarm Return Characteristics (available only when the execution mode is "alarm")

Table 22 Grounding alarm return characteristics

Characteristics	Current Multiple (I/starting current)	Appointed Tripping Time	Delay Tolerance
Non-return characteristics	> 1.1	Non-return	
Return characteristics	< 0.9	Return	
Return delay	≤0.9	The definite time characteristics are equal to the set delay time	±10% (inherent absolute error: ±40ms)

3.2.4.9 Leakage Alarm

The leakage alarm function and the leakage protection function are independent of each other and exist at the same time, and they have their respective parameter settings. The action principle, action characteristics and return characteristics are the same as those of grounding alarm. See Table 23 for the setting of leakage alarm-related parameters.

Table 23 Leakage alarm parameter setting

Parameter Name	Tuning Range	Tuning Step	Remarks
Alarm starting current set value	(0.5~30)A+OFF	0.1A	
Alarm action delay	(0.1~1.0) s	0.1 s	
Alarm return current set value	0.5A~starting value	0.1A	
Alarm return delay	(0.1~1.0) s	0.1 s	
Execution mode	Alarm + closing		

3.2.4.10 Current Imbalance Protection

The current imbalance protection protects phase-failure and three-phase current imbalance according to the imbalance rate between the three-phase currents. When the execution mode is "alarm", the action principle is the same as that of the ground protection.

Calculation method of the imbalance rate:

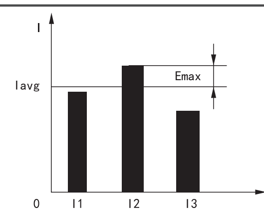


Figure 7 Current imbalance

$Iunbal=(|Emax|/Iavg)\times 100\%$

Where, Iavg: the average value of the three-phase current true RMS I1, I2, I3;

$Iavg=(I1+I2+I3)/3$;

Emax: the maximum difference between the each phase current and Iavg.

3.2.4.10.1 Setting of Parameters Related to Current Imbalance Protection

Table 24 Setting of Parameters Related to Current Imbalance Protection

Parameter Name	Tuning Range	Tuning Step	Remarks
Protection starting set value	5%~60%	1%	
Action delay time set value	(1~40) s	1 s	
Protection action return set value	5%~starting value	1%	This set value is only available when the execution mode is "alarm".
Protection return delay time	(10~200) s	1 s	
Alarm DO output	Set one DO of the signal unit to "I imbalance alarm". (Not required. If this item is not set, the alarm information can only be read from the controller display, no contact output.)		
Execution mode	Alarm / trip / close		

3.2.4.10.2 Current Imbalance Action Characteristics

Table 25 Current imbalance action characteristics

Characteristics	Actual Current Imbalance Rate / Starting Set Value	Appointed Tripping Time	Delay Tolerance
Non-action characteristics	< 0.9	Non-action	
Action characteristics	> 1.1	Action	
Action delay	≥1.1	The definite time characteristics are equal to the set delay time	±10% (inherent absolute error: ±40ms)

3.2.4.10.3 Current Imbalance Return Characteristics (available only when the execution mode is set to "alarm")

Table 26 Current imbalance return characteristics

Characteristics	Actual Current Imbalance Rate / Return Set Value	Appointed Tripping Time	Delay Tolerance
Non-return characteristics	> 1.1	Non-return	
Return characteristics	< 0.9	Return	
Return delay	≤0.9	The definite time characteristics are equal to the set delay time	±10% (inherent absolute error: ±40ms)

Note: When the main circuit current is too small, due to current fluctuation, if the current of any one or two phases is zero, and if the current imbalance rate protection is turned on, the imbalance rate will reach 100% and trip will occur regardless of the imbalance rate setting. Therefore, it is recommended to turn off the imbalance rate protection when the main circuit current is too small, so as not to cause malfunction.

3.2.4.11 Undervoltage Protection

The controller measures the true RMS of the primary circuit. When the three phase-phase voltages (line voltages) are all less than the set value, that is, the maximum value of the three line voltages is less than the undervoltage protection set value, the undervoltage protection will act. When the minimum value of the three line voltages is greater than the return value, the alarm action will return.

3.2.4.11.1 Undervoltage Protection Action Principle

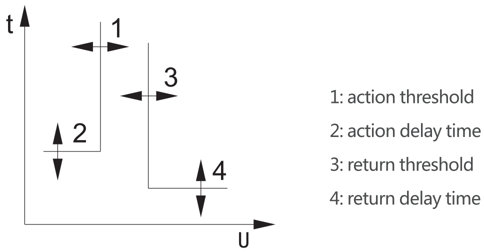


Figure 8 Undervoltage protection action principle

When the voltage maximum value is less than the action threshold (1), the alarm or trip delay is started; when the action delay time (2) expires, the alarm or trip signal is issued, and the undervoltage fault DO acts. When the voltage minimum value is greater than the return threshold (3), the return delay is started; when the return delay time (4) expires, the alarm is removed, and the undervoltage fault DO is returned.

3.2.4.11.2 Setting of Parameters Related to Undervoltage Protection

Table 27 Undervoltage protection parameter setting

Parameter Name	Tuning Range	Tuning Step	Remarks
Protection starting set value	(0.35~0.7) Ue	1V	
Protection action delay time set value	(1~5) s	0.1 s	
Protection action return set value	Starting value~0.85Ue	1V	This set value is only available when the execution mode is "alarm", and the starting value needs to be less than or equal to the return value.
Protection return delay time	(1~36) s	0.1 s	
Protection alarm DO output	Set one DO of the signal unit to "undervoltage alarm". (Not required. If this item is not set, the alarm information can only be read from the controller display, no contact output.)		
Protection execution mode	Alarm / trip / close		

3.2.4.11.3 Protection Action Characteristics

Table 28 Undervoltage protection action characteristics

Characteristics	Voltage Multiple (Umax/Action Set Value)	Appointed Tripping Time	Delay Tolerance
Non-action characteristics	> 1.1	Non-action	
Action characteristics	< 0.9	Action	
Action delay	≤0.9	The definite time characteristics are equal to the set delay time	±10% (inherent absolute error: ±40ms)

3.2.4.11.4 Undervoltage Protection Alarm Return Characteristics (available only when the execution mode is set to "alarm")

Table 29 Undervoltage protection alarm retun characteristics

Characteristics	Voltage Multiple (Umin/Action Set Value)	Appointed Tripping Time	Delay Tolerance
Non-return characteristics	< 0.9	Non-return	
Return characteristics	> 1.1	Return	
Return delay	≥1.1	The definite time characteristics are equal to the set delay time	±10% (inherent absolute error: ±40ms)

3.2.4.12 Overvoltage Protection

The controller measures the true RMS of the primary circuit. When the three phase-phase voltages (line voltages) are all greater than the set value, that is, the minimum value of the three line voltages is greater than the overvoltage protection set value, the overvoltage protection will function. When the maximum value of the three line voltages is less than the return value, the alarm action will return.

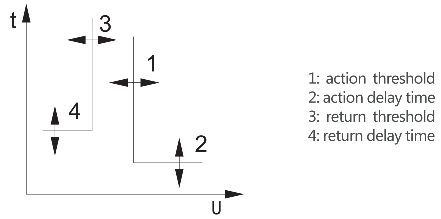


Figure 9 Overvoltage protection action principle

When the minimum line voltage is greater than the action threshold (1), the alarm or trip delay is started; when the action delay time (2) expires, the alarm or trip signal is issued, and the overvoltage fault DO acts. When the execution mode is "alarm", and when maximum line voltage is less than the return threshold (3) after the alarm action, the return delay is started; when the return delay time (4) expires, the alarm is removed, and the overvoltage fault DO is returned.

3.2.4.12.2 Setting of Parameters Related to Overvoltage Protection (overvoltage set value must be greater than undervoltage set value)

Table 30 Setting of parameters related to overvoltage protection

Parameter Name	Tuning Range	Tuning Step	Remarks
Protection starting set value	(1.1~1.3) Ue	1V	
Protection action delay time set value	(1~5) s	0.1 s	
Protection action return set value	1.1Ue~starting value	1V	This set value is only available when the execution mode is "alarm", and the starting value needs to be greater than or equal to the return value.
Protection return delay time	(1~36) s	0.1 s	
Protection alarm DO output	Set one DO of the signal unit to "overvoltage alarm". (Not required. If this item is not set, the alarm information can only be read from the controller display, no contact output.)		
Protection execution mode	Alarm / trip / close		

3.2.4.12.3 Overvoltage Protection Action Characteristics

Table 31 Overvoltage protection action characteristics

Characteristics	Voltage Multiple (Umin/Action Set Value)	Appointed Tripping Time	Delay Tolerance
Non-action characteristics	< 0.9	Non-action	
Action characteristics	> 1.1	Action	
Action delay	≥1.1	The definite time characteristics are equal to the set delay time	±10% (inherent absolute error: ±40ms)

3.2.4.8.4 Overvoltage Protection Alarm Return Characteristics (available only when the execution mode is set to "alarm")

Table 32 Overvoltage protection alarm retun characteristics

Characteristics	Voltage Multiple (Umax/Action Set Value)	Appointed Tripping Time	Delay Tolerance
Non-return characteristics	> 1.1	Non-return	
Return characteristics	< 0.9	Return	
Return delay	≤0.9	The definite time characteristics are equal to the set delay time	±10% (inherent absolute error: ±40ms)

3.2.4.13 Voltage Imbalance Protection

The voltage imbalance protection carries out protection according to the imbalance rate between the three line voltages. Its action principle is the same as that of voltage protection.

Calculation method of the imbalance rate:

Uunbal=(|Emax| / Uavg)×100%
Where, Uavg: the average value of the true RMS of the three phase voltages;
Uavg=(U12+U23+U31)/3;
Emax: the maximum difference between each line voltage and the average value.

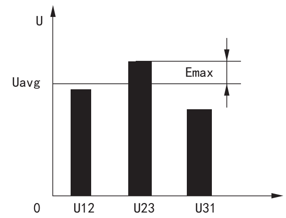


Figure 10 Voltage imbalance

3.2.4.13.1 Setting of Parameters Related to Voltage Imbalance Protection

Table 33 Setting of Parameters Related to Voltage Imbalance Protection

Parameter Name	Tuning Range	Tuning Step	Remarks
Protection starting set value	2%~30%	1%	
Action delay time set value	(0.2~60) s	0.1 s	
Protection action return set value	2%~starting value	1%	This set value is only available when the execution mode is "alarm" (the return value needs to be less than or equal to the starting value).
Protection return delay time	(0.2~60) s	0.1 s	
Protection alarm DO output	Set one DO of the signal unit to "Under voltage alarm". (Not required. If this item is not set, the alarm information can only be read from the controller display, no contact output.)		
Protection execution mode	Alarm / trip / close		

3.2.4.13.2 Voltage Imbalance Action Characteristics

Table 34 Voltage imbalance action characteristics

Characteristics	Actual Voltage Imbalance Rate / Starting Set Value	Appointed Tripping Time	Delay Tolerance
Non-action characteristics	< 0.9	Non-action	
Action characteristics	> 1.1	Action	
Action delay	≥1.1	The definite time characteristics are equal to the set delay time	±10% (inherent absolute error: ±40ms)

3.2.4.13.3 Voltage Imbalance Alarm Return Characteristics (available only when the execution mode is set to "alarm")

Table 35 Voltage imbalance alarm return characteristics

Characteristics	Actual Voltage Imbalance Rate / Return Set Value	Appointed Tripping Time	Delay Tolerance
Non-return characteristics	> 1.1	Non-return	
Return characteristics	< 0.9	Return	
Return delay	≤0.9	The definite time characteristics are equal to the set delay time	±10% (inherent absolute error: ±40ms)

3.2.4.14 Under-frequency and Over-frequency Protection

The controller detects the frequency of the system voltage and can protect the frequency from being too large or too small. The action principle and action characteristics of over-frequency and under-frequency are the same as those of overvoltage and undervoltage. Please refer to sections 3.2.4.11 and 3.2.4.12.

3.2.4.14.1 Setting of Parameters Related to Under-frequency Protection

Table 36 Under-frequency protection parameter setting

Parameter Name	Tuning Range	Tuning Step	Remarks
Protection starting set value	(46~60) Hz	0.1Hz	
Protection action delay time set value	(0.2~5) s	0.1 s	
Protection action return set value	Starting value ~60 Hz	0.1Hz	This set value is only available when the execution mode is "alarm" (the return value needs to be greater than or equal to the starting value).
Protection return delay time	(1~360) s	1 s	
Alarm DO output	Set one DO of the signal unit to "under-frequency alarm". (Not required. If this item is not set, the alarm information can only be read from the controller display, no contact output.)		
Execution mode	Execution modeAlarm / trip / close		

3.2.4.14.2 Setting of Parameters Related to Over-frequency Protection (over-frequency set value must be greater than under -frequency set value)

Table 37 Over-frequency protection parameter setting

Parameter Name	Tuning Range	Tuning Step	Remarks
Protection starting set value	(50~64) Hz	0.1Hz	
Protection action delay time set value	(0.2~5) s	0.1 s	
Protection action return set value	45Hz~starting value	0.1Hz	This set value is only available when the execution mode is "alarm" (the return value needs to be less than or equal to the starting value).
Protection return delay time	(1~360) s	1 s	
Protection alarm DO output	Set one DO of the signal unit to "over-frequency fault". (Not required. If this item is not set, the alarm information can only be read from the controller display, no contact output.)		
Protection execution mode	Alarm / trip / close		

3.2.4.15 Reverse Power Protection

The reverse power protection takes the sum of the three phase active powers. When the power flow direction is opposite to the user-set power direction and greater than the set value, the protection starts. The power direction and power incoming direction settings are in the "measurement table settings" menu and must be consistent with the actual application. Its action principle is the same as that of voltage protection.

3.2.4.15.1 Setting of Parameters Related to Reverse Power Protection

Table 38 Setting of parameters related to reverse power protection

Parameter Name	Tuning Range	Tuning Step	Remarks
Protection starting set value	(0.1~0.3)Pn	1kW	
Protection action delay time set value	(0.2~20) s	0.1 s	
Protection action return set value	0.1Pn~starting value	1kW	This set value is only available when the execution mode is "alarm" (the return value needs to be less than or equal to the starting value).
Protection return delay time	(1~360) s	1 s	
Protection alarm DO output	Set one DO of the signal unit to "reverse power fault". (Not required. If this item is not set, the alarm information can only be read from the controller display, no contact output.)		
Protection execution mode	Alarm / trip / close		

3.2.4.15.2 Reverse Power Action Characteristics

Table 39 Reverse power action characteristics

Characteristics	Reverse Power Value /Starting Set Value	Appointed Tripping Time	Delay Tolerance
Non-action characteristics	< 0.9	Non-action	
Action characteristics	> 1.1	Action	
Action delay	≥ 1.1	The definite time characteristics are equal to the set delay time	±10% (inherent absolute error: ±40ms)

3.2.4.15.3 Reverse Power Protection Alarm Return Characteristics

Table 40 Reverse power protection alarm return characteristics

Characteristics	Reverse Power Value /Return Set Value	Appointed Tripping Time	Delay Tolerance
Non-return characteristics	> 1.1	Non-return	
Return characteristics	< 0.9	Return	
Return delay	≤0.9	The definite time characteristics are equal to the set delay time	±10% (inherent absolute error: ±40ms)

3.2.4.16 Phase Sequence Protection

The phase sequence detection is taken from the primary voltage. When the phase sequence is detected to be the same as the set value set direction, the protection begins to function with instantaneous protection action. When one or more phase voltages do not exist, this function automatically exits.

Table 41 Phase sequence protection parameter setting

Parameter Name	Tuning Range	Remarks
Action phase sequence	ΔΦ: A, B, C / ΔΦ: A, C, B	
Protection alarm DO output	Set one DO of the signal unit to "phase sequence fault". (Not required. If this item is not set, the alarm information can only be read from the controller display, no contact output.)	
Protection execution mode	Alarm / trip / close	

3.2.4.17 Load Monitoring Protection Characteristics

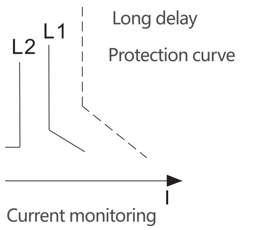
Load monitoring can be used for pre-alarms and for controlling branch loads. The action can be operated according to power or current. It is generally used to control the same branch load. When the running parameter exceeds the starting value, the "load monitoring I" DO delay action (the action can be in the pulse mode or level mode) will disconnect the branch load; if the running parameter value is lower than the return value after the disconnection, after the delay set time, the "load monitoring I" DO will return and the "load monitoring II" DO will act (in the level or pulse mode) to turn on the disconnected load and restore the system power supply.

3.2.4.17.1 Action Principle of Current-based Load Monitoring

The current is used as the running parameter. The action inverse time characteristics are the same as those of overload. The action value is set separately. The load recovery delay time is definite time.

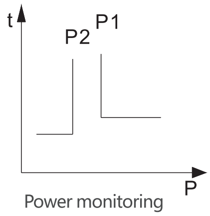
3.2.4.17.2 Action Principle of Active Power-based Load Monitoring

The system active power is used as the running parameter. The unloading and return delay time are all definite time.



Note: Starting value L1 ≥ return value L2.

Figure 11 Action principle of current -based load monitoring



Note: Starting value P1 ≥ return value P2.

Figure 12 Action principle of power -based load monitoring

3.2.4.17.3 Setting of Parameters Related to Load Monitoring

Table 42 Load monitoring parameter setting

Parameter Name	Load Monitoring Mode	Tuning Range	Tuning Step	Remarks
Starting unloading threshold	Current mode	(0.4~1)Ir	1A (Frame I, Frame I I) 2A (Frame III, Frame IV, Frame V)	Tr -- load long-delay action time; Ir -- overload long -delay actionset value.
	Power mode	(200~10000) kW	1kW	
Unloading delay	Current mode	(20~80)%Tr	1%	
	Power mode	(10~3600) s	1 s	
Return unloading threshold	Current mode	0.2Ir~unloading threshold	1A (Frame I, Frame I I) 2A (Frame III, Frame IV, Frame V)	
	Power mode	100 kW-starting unloading threshold	1kW	
Reclosing delay	Current mode	(10~600) s	1 s	
	Power mode	(10~3600) s	1 s	

3.2.5 Measurement Function

3.2.5.1 Real-time Value Measurement

3.2.5.1.1 Current

Measurement method: measuring the instantaneous current values (RMS), including I1, I2, I3 and IN, ground fault current Ig, leakage current IΔn, tracking the frequency change automatically, suitable for 50 Hz and 60 Hz grids.

Measurement range: I1, I2, I3 and IN, not less than 15In (breaker rated current).

Measurement accuracy: ±2% error within 2In and ±5% error above 2In.

Displayed in a bar graph: The controller displays the current values of A, B, C and neutral line (selected according to system type) in a bar graph, and indicates the percentage of each current relative to the overload set value (relative to the rated current when the overload is off).

3.2.5.1.2 Voltage

Measurement method: true RMS measurement, automatically tracking the grid frequency changes, suitable for 50 Hz and 60 Hz grids.

Measurement range: line voltage (phase-phase voltage): 0 V~600 V;

Phase voltage (measure the phase-neutral voltage): 0 V~300 V.

Measurement accuracy: ±1%

3.2.5.1.3 Phase Sequence

Display the sequence of phases. No phase detection when there is no voltage function.

3.2.5.1.4 Frequency

Measurement range: 45 Hz~65 Hz

Measurement accuracy: ±0.1 Hz

Note: The frequency signal is taken from the A phase voltage.

3.2.5.1.5 Power

Measurement method: true active and true reactive methods.

Measurement content: system active power and reactive power, and apparent power.
Split phase active power and reactive power, and apparent power (not suitable for three-phase three-wire systems)

Measurement range: active: -32768 kW~+32767 kw
Reactive: -32768 kvar~+32767 kvar
Apparent: 0 kVA~65535 kVA

Measurement accuracy: ±2.5%

33.2.5.1.6 Power Factor

Measurement content: system power factor

Measurement range: -0.6~+1.00

Measurement accuracy: ±0.04

3.2.5.1.7 Electric Energy

Measurement content: input active energy (EPin), input reactive energy (EQin)
Output active energy (EPout), output reactive energy (EQout)
Total active energy (EP), total reactive energy (EQ), total apparent energy (ES)

Measurement range: active: (0~4294967295) kWh
Reactive: (0~4294967295) kvarh
Apparent: (0~4294967295) kVAh

Measurement accuracy: ±2.5%

Note: 1. The of active power and reactive power symbols and energy input/output should be set to "upper incoming line" or "lower incoming line" In the "Incoming mode" option under the "Measurement table setting" according actual utilization.

2. The energy value is "total absolute value". Indicates the sum of power input and output values:
EP=∑EPin+∑EPout
EQ=∑EQin+∑EQout

3.2.5.2 Harmonic Measurement

3.2.5.2.1 About Harmonic

Harmonics are the most common problems encountered in modern electrical installations. When a harmonic occurs, the current or voltage waveform is distorted and is no longer an absolute sinusoid. The distorted current or voltage waveforms affect the distribution of electrical energy so that the power supply quality is not optimal.

Harmonics are caused by nonlinear loads. When the waveform of the current flowing in the load does not match the voltage waveform, the load is a nonlinear load.

Typical nonlinear loads are commonly used in power electronics, and their share in the consumer electronics market is increasing. Common nonlinear load include electric welders, arc furnaces, rectifiers, speed regulators for asynchronous or DC motors, computers, copiers, fax machines, televisions, microwave ovens, neon lights, UPS, etc. Nonlinear phenomena can also be caused by converters or other devices.

3.2.5.2.1.1 Definition of Harmonics

A signal consists of the following factors:

i. Original sinusoidal signal at fundamental frequency

ii. Other sinusoidal signals (harmonics), whose frequency is an integer multiple of the fundamental frequency

iii. DC component (in some cases)

Any signal can be expressed as: $y(t)= YO+ \sum Ynxsin(nt\omega-\Phi n)$

Where:

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

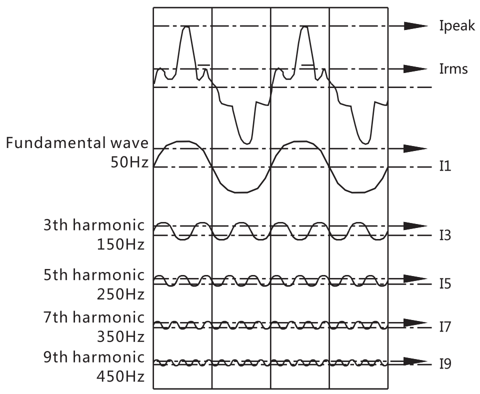


Figure 13 Harmonic waveform

The harmonic order n refers to the nth harmonic, which is a sinusoidal signal whose frequency is n times the fundamental frequency.

For example, current and voltage waveforms typically have the following characteristics:
Fundamental frequency is 50 Hz
The 2nd harmonic's frequency is 100 Hz;
The 3rd harmonic's frequency is 150 Hz;
......
The distorted waveform is the result of superimposing multiple harmonics on the fundamental waveform.

3.2.5.2.1.2 Harmonic Influence

Increase the current of the system, causing overload;

Excessive equipment loss and early aging;

Voltage harmonics affect the normal operation of the load;

Communication network is affected.

3.2.5.2.1.3 Acceptable Harmonic Level

Harmonic interference standards and regulations:

Public facility compatibility standard: Low voltage: IEC6000-2-2
Medium voltage: IEC6000-2-41

Electromagnetic compatibility (EMC) standard: IEC6000-3-2 for loads below 16A;
IEC6000-3-4 for loads above 16A

Some data has been developed internationally to estimate the typical harmonic values in the power distribution system. Below is a harmonic level table. The data listed in the table should not be exceeded in the application.

Table 43 Acceptable harmonic levels

Odd harmonic (not a multiple of 3)				Odd harmonic (a multiple of 3)				Even harmonic				Remarks
Order n	LV	MV	EHV	Order n	LV	MV	EHV	Order n	LV	MV	EHV	Low voltage (LV) systems Medium voltage (MV) systems Extra high voltage (EHV) systemsw
5	6	6	2	3	5	2.5	1.5	2	2	1.5	1.5	
7	5	5	2	9	1.5	1.5	1	4	1	1	1	
11	3.5	3.5	1.5	15	0.3	0.3	0.3	6	0.5	0.5	0.5	
13	3	3	1.5	21	0.2	0.2	0.2	8	0.5	0.2	0.2	
17	2	2	1	>21	0.2	0.2	0.2	10	0.5	0.2	0.2	
19	1.5	1.5	1					12	0.2	0.2	0.2	
23	1.5	1	0.7					>12	0.2	0.2	0.2	
25	1.5	1	0.7									

Note: harmonic capacity of nth harmonic is the percentage ratio value of fundamental wave. It can be read from the controller display.

3.2.5.2.1.4 The harmonic which we care about is the low frequency odd harmonic ,mainly the 3rd,5th,7th ,11th ,13th .

3.2.5.2.2 Harmonic Measurement Content

Purpose of harmonic measurement: Harmonic measurement is used as a precautionary measure to obtain system information and detect drift.

It is also used as a corrective measure to diagnose the effectiveness of the disturbance or detection scheme.

Fundamental measurement: current: Ia, Ib, Ic and In
Voltage: Uan, Ubn, Ucn

3.2.5.2.2.1 Total Harmonic Distortion THD and thd

Current:

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

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

When this value is less than 10%, it is regarded as normal and there is no risk of abnormal operation; when this value is between 10% and 50%, it indicates obvious harmonic interference which may cause temperature rise, and it is necessary to increase the cable. When this value is greater than 50%, it indicates significant harmonic interference which may affect the normal operation, and it is necessary to carry out in-depth analysis of the equipment.

Voltage:

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

The total distortion rate of the thd harmonics relative to the voltage RMS is the ratio of the square root of the sum of the squares of all second and higher-order harmonic currents and the RMS voltage.

When this value is less than 5%, it is regarded as normal and there is no risk of abnormal operation; when this value is between 5% and 8%, it indicates obvious harmonic interference which may cause temperature rise, and it is necessary to increase the cable. When this value is greater than 8%, it indicates significant harmonic interference which may affect the normal operation, and it is necessary to carry out in-depth analysis of the equipment.

The amplitude spectrum of the first 31 odd harmonics:

The controller can display the FFT amplitude of the 3rd to 31st harmonics. It displays the the harmonic amplitudes of different frequencies in rectangular diagram to form a spectrum analysis of the harmonics.

3.2.5.2.3 Waveform and Waveform Capture

The controller can capture current and voltage waveforms using digital sampling techniques similar to the applied oscilloscope technology. Waveform capture is a method of detecting weak points in the system and equipment. With the information displayed by waveform capture, the harmonic level, direction and amplitude can be determined and recorded on a single cycle.

Users of the NA1 Multi-function Intelligent Controller can manually view the following waveforms:

4 currents: Ia, Ib, Ic and In
3 phase voltages: Uan, Ubn and Ucn

3.2.6 Measurement Table Settings

3.2.6.1 System Type

3Φ3W3CT:
System type: three-phase three-wire
Breaker poles: three poles (3P)
3Φ4W3CT:
System type: three-phase four-wire
Breaker poles: three poles (3P)
3Φ4W4CT:
System type: four-phase four-wire
Breaker poles: four poles (4P) or three poles plus N phase (3P+N)

3.2.6.2 Incoming Mode

Upper incoming line: the power incoming line is on the upper side of the breaker
Lower incoming line: the power incoming line is on the lower side of the breaker

3.2.6.3 Power Direction

P+: power receiving, consuming power
P-: power generation, outputting power

3.2.7 Maintenance Function

3.2.7.1 Historical Peak

Current historical peak record content: the maximum value of I1, I2, I3 and IN, ground fault current Ig and leakage current IΔn since the operation. This value can be manually cleared

3.2.7.2 Contact Equivalent

The controller calculates and displays the contact wear condition i.e. the contact life, according to the contact mechanical life, breaking current and other parameters. When the controller leaves the factory, the contact life is 0%, which indicates no wear. When the displayed value reaches 100%, an alarm signal will be issued to remind the user to take timely maintenance measures. After the contact is replaced, the contact life can be restored to the initial value by the button operation, but the total life is still retained as the total consumed contact life of the breaker

3.2.7.3 Number of Operations The controller records the total number of operations of the breaker. This value can be manually cleared.

3.2.7.4 Fault Recording Function

a. The trip history can display the parameters measured at the last 10 trips at any time.

b. For each trip, the specific recorded parameter are:

Trip cause
Trip threshold
Delay time
Current or voltage value (not available for some fault types such as MCR trip, undervotage trip, etc.)
Fault time (year, month, day, hour, minute,second)

3.2.7.5 Alarm History recording

a. The alarm history can display the parameters measured at the last 10 alarms at any time.

b. For each alarm, the specific recorded parameter are:

Alarm cause
Alarm threshold
Fault time (year, month, day, hour, minute,second)

3.2.7.6 Displacement History

a. The displacement history can display the parameters measured at the last 10 displacements at any time.

b. For each displacement, the specific recorded parameter are:

Displacement type (closing, opening or tripping)
Displacement cause (local/remote operation, fault/test trip)
Displacement time (year, month, day, hour, minute,second)

3.2.7.7 Self-test Function

The controller can display an error message and issue an alarm signal when an EEPROM fault, setup parameter loss, AD sampling error, RAM error or ROM error occurs.

3.2.8 Communication Function

The Type 3H controller can realize remote data transmission functions such as telemetry, remote control, remote adjustment and remote communication through the communication port according to the specified protocol requirements. The output of the communication port is optically isolated and is suitable for the environment with strong electrical interference. For details on the communication, refer to the User Manual of NA1 Series Air Circuit Breaker Communication Protocol (Modbus-RTU).

Table 44 Communication parameter setting

Communication protocol	Modbus-RTU
Communication address	1~247
Baud rate (bit/S)	9.6k, 19.2k, 38.4k

3.2.8.1 Hardware Connection

The controller terminals 10 and 11 are connected to A+ and B- of converter RS232/RS485, which is then connected to computer RS232 or USB port with a maximum number of connections of 32.

3.2.8.2 Serial Port Settings

Select COM port (COM1, COM2...), 8 bits of serial port bytes, 2 stop bits, and no parity for parity bit (None) according to the computer serial port, and set the baud rate and address corresponding to the controller communication setting (9.6 Kbps baud rate and address 3 by default).

3.2.8.3 Communication command format

3.2.8.3.1 Read Command

Address (1 byte) + read command code (1 byte) + register start address (2 bytes) + number of read addresses (2 bytes) + 16-bit CRC check code (2 bytes, lower bit first).
Example 1: Reading the Phase A current value
Command format: 03 03 00 01 00 01 D4 28
[03(address)03(read command code)0001(Ia register address)0001(read a register address)D428(CRC check code)]
Example 2: Reading the Uan voltage value
Command format: 03 03 00 06 00 06 24 2B
[03(address)03(read command code)0006(Uan register address)0006(read six register addresses)242B(CRC check code)]

3.2.8.3.2 Write Command

Address (1 byte) + write command code (1 byte) + write register address (2 bytes) + write value (2 bytes) + CRC check code (2 bytes, lower bit first).
Example 3: Writing the long-delay current setting value
Command format: 03 06 20 07 07 D0 31 85

[03(address)06(write command code)2007(long-delay current setting value address)07D0(value2000)3185(CRC check code)]
Example 4: control breaker opening and closing
Opening command format: 03 06 28 00 01 00 80 18
Closing command format:03 06 28 00 02 00 80 E8

Note: 1. It could write a register every time for write command, It could use 16 band data for write value of number.
2.Register addresses are read-only (R), writable (W), or readable and writable (R/W). Read-only and writable registers can only be read or written individually.

3.2.9 DI/DO Function

3.2.9.1 DI Input Function

The controller can provide one or two sets of programmable optical switch inputs. when the signal unit is S2,S3

Table 45 Digital input (DI) parameter settings

Function setting	Fault trip, alarm, zone interlock, short-circuit interlock, ground interlock, close
DI input form	Normally open, normally closed

3.2.9.2 DO Output Function

The controller provides two to four sets of independent signal contact outputs (for use with the RU-1 relay unit).

Table 46 Digital output (DO) parameter settings

Function setting	See Table 47			
Execution mode	Normally open level	Normally closed level	Normally open pulse	Normally closed pulse
Pulse time	None	None	(1~360) s; step: 1 s	(1~360) s; step: 1 s

Table 47 DO function setting table

general	Alarm	Fault trip	Self-diagnosis alarm	Load monitoring I
Load monitoring II	Overload pre-alarm	Overload fault	Short-delay fault	Instantaneous fault
Ground fault	Voltage imbalance fault	Current imbalance fault	neutral phase fault	Undervoltage fault
Overvoltage fault	Zone interlock	Under-frequency fault	Over-frequency fault	Phase sequence fault
Reverse power fault	Ground interlock	Closing	Opening	
MCR fault		Short-circuit interlock		

3.2.9.3 I/O Status

Can view the current I/O status.

DO: "1" indicates that the output relay is in the closed state, and "0" indicates that the output relay is in the off state.

DI: "1" indicates an action, and '0' indicates a reset. (Relative to the setting of the DI execution mode.)

3.2.10 Zone Selective Interlocking Function (ZSI)

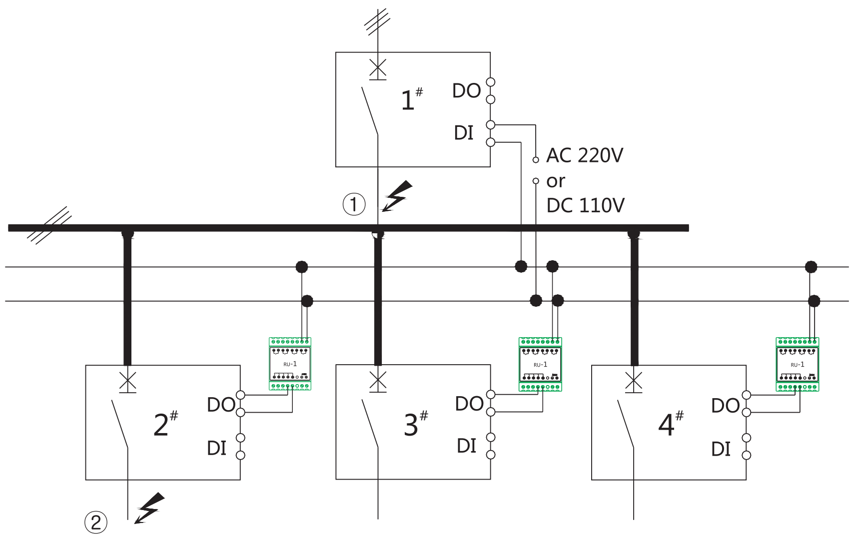


Figure 14 Schematic diagram of zone interlocking

Zone selective interlocking include short-circuit interlocking and ground interlocking. In the same power circuit with two or more breakers with upper and lower level association:

a. When the short-circuit or ground fault occurs at the outgoing side (position ②) of the lower-level breaker (2#-4# breakers), the lower-level breaker instantaneously trips and issues a zone interlocking trip signal to the upper-level breaker; after receiving the zone interlocking trip signal, the upper-level breaker (1# breaker) will delay according to the short-circuit or ground protection setting. If the fault current is eliminated during the delay of the upper-level breaker, the protection will return and the upper-level breaker will not operate. if the fault current is not eliminated after the lower-level breaker trips, the upper-level breaker will cut off the fault current according to the short-circuit ground protection setting.

b. When the short-circuit or ground fault occurs between the upper-level breaker (1# breaker) and the lower-level breaker (2#-4# breakers) (position ①), the upper-level breaker does not receive a zone interlocking signal, so it trips instantaneously and quickly cuts off the fault line. Parameter setting: At least one DI of the upper-level breaker is set to zone interlock detection, and at least one DO of the lower-level breaker is set to zone interlocking signal output.

3.2.11 Test & Lock Function

3.2.11.1 Test Trip

The test trip has three test modes: three-stage protection, ground/leakage fault, and mechanism action time. The first two modes are used to check the set value of the action characteristics.

Three-state protection test: Input the analog fault current to simulate the protection of the controller in case of overload, short circuit and instantaneous fault

Ground/leakage fault test: Input the analog ground/leakage fault current to simulate the protection of the controller in case of a ground/leakage fault

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

Table 48 Test parameter settings

Test type	Test parameter	Step	Test control	Action time
Three-stage protection	0A~131.0 kA	In≤2000A, (0~65.5) kA, step length 1A (when >10 kA, step length 0.1 kA); In>2000A,(0~131) kA, step length 2A (when >10 kA, step length 0.2kA)	Start + stop	Non
Ground	0A~131.0 kA			
Leakage	0A~655 A	(0~655)A, step length 0.01A (when>100A, step length 1A)		

3.2.11.2 Remote Lock

Lock: In the "locked" state, the controller will not respond to the remote command of the host.

Unlock: In the "unlocked" state, the controller responds to the remote opening, closing and resetting commands of the host.

3.2.11.3 Parameter Lock

Lock: In the "locked" state, the user cannot modify the parameter.

Unlock: In the "unlocked" state, the user can modify the parameter

Note: Before entering the "parameter lock" interface, the user password needs to be entered correctly. (The default password is: 0002)

4 Installation, Commissioning and Operation

4.1 Installation

The NA1 multi-function intelligent controller is specially designed for NA1 breakers (installed at the factory) and is divided into Frame I (NA1-1000), Frame II (NA1-2000), Frame III (NA1-3200, 4000), Frame IV (NA1-6300).

4.2 Input and Output Ports

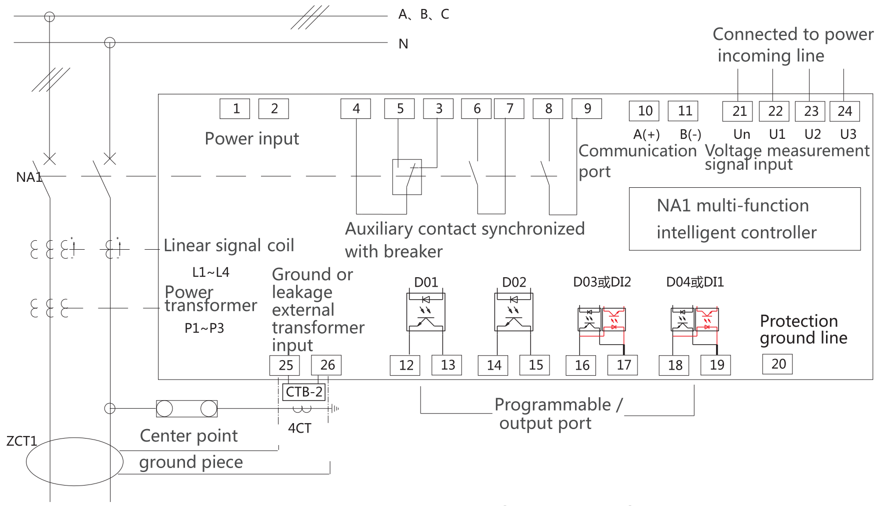


Figure 15 Input and output port of NA1 multi-function

Remark: If the NA1-1000 breaker needs an external transformer, the ports 6 and 7 are the external transformer connection terminals instead of the normally open contacts of the ports 6 and 7.

1) Communication output: 10# and 11# communication port output. When there is no communication function, 10# and 11# are empty.

2) Programmable input/output port: If no signal unit is selected, 12#~19# are empty. (DO: DC24V, 50mA. DI:DC110V~130V or AC110V~AC250V)

Table 49 Programmable input / output port type

Signal unit type	Programmable output/input port mode
S1 (4DO mode)	12# and 13#: programmable output contact 1 (DO1); 14# and 15#: programmable output contact 2 (DO2); 16# and 17#: programmable output contact 3 (DO3); 18# and 19#: programmable output contact 4 (DO4).
S2(3DO+1DI mode)	12# and 13#: programmable output contact 1 (DO1); 14# and 15#: programmable output contact 2 (DO2); 16# and 17#: programmable output contact 4 (DO3); 18# and 19#: programmable digital input 1 (DI1).
S3(2DO+2DI mode)	12# and 13#: programmable output contact 1 (DO1); 14# and 15#: programmable output contact 2 (DO2); 16# and 17#: programmable digital input 2 (DI2); 18# and 19#: programmable digital input 1 (DI1).

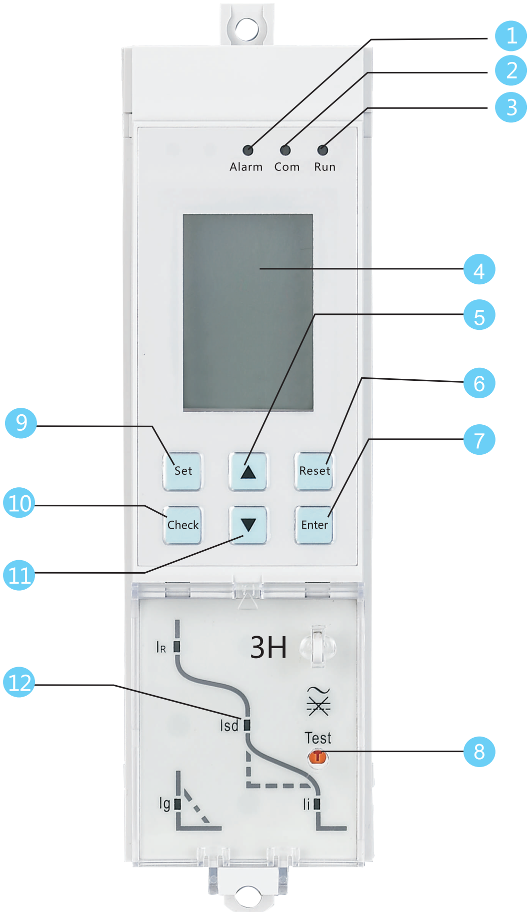
3) Protection ground wire: 20# is the ground wire of the controller

4) Voltage signal input: Pins 21#-24# are voltage signal input terminals. Note that they cannot be connected in the wrong order, and they should be connected to the incoming side of the power supply. This pin is empty when there is no voltage optional function

5) External transformer input: Pins 25# and 26# are used for external transformer input (NA1-2000-6300). When the grounding mode is ground current type (W), this pin is connected to the output of the external ground transformer 4CT. When the ground protection mode is leakage type, this pin is connected to the output of the external ZCT1 rectangular transformer. When the ground protection is (3P+N) differential type, this pin is connected to the external N-phase transformer.

4.3 Menu Operation Instructions

4.3.1 Display Operation Panel



1. Alarm LED
The LED is off during normal operation.
The LED is always on in case of an alarm.

2. Communication LED
The LED is off when there is no communication and flashes when there is communication

3. Running LED
The green LED flashes when the controller is working properly.

4. LCD interface display

5. Upward -- Move the menu contents upward from the current level, or upward change the selected parameter.

6. Return -- Exit the current level and enter the next upper level menu, or cancel the current selected parame

7. Confirm -- Enter the next lower level menu directed by the current item, or select the current parameter and store the modifications.

8. Test -- Press the button on the panel to trip in normal operation and test the tripping conditions.

9. Setting -- Function key 1.
Switch to the parameter setting menu or protection parameter setting menu

10. Query -- Function key 2, switch to the measurement menu or history and maintenance menu

11. Downward -- Move downward the menu contents from the current level, or change the selected parameter downward

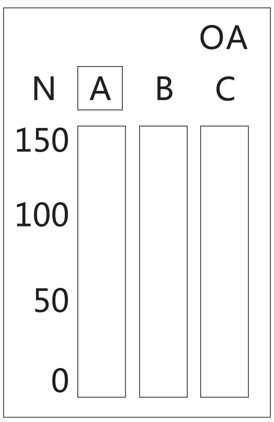
12. Curve LED
An LED indicator is hidden in the curve. The corresponding LED flashes to indicate the fault type when there is a fault trip; the LED is always on to indicate the current set item during protection parameter setting.

Figure 16 Multi-function intelligent controller user interface

4.3.2 Intelligent Controller Theme Menu

The intelligent controller provides four theme menus and one default interface;

4.3.2.1 Default Interface



The default interface is displayed when the controller is powered on

Press the RESET button under the theme menu or the corresponding theme button to return to the default

interface If there is no key operation for five minutes, the box cursor automatically indicates the current maximum phase

In the non-fault pop-up interface, the system will return to the default interface if there is no key operation for 30 minutes

Figure 17 Default interface

Press [CHECK] once to enter the measurement main menu

Press the [RESET] button to return to the default interface

- Current I
- Voltage U
- Frequency F
- Power P
- Electric energy E

- Harmonic H

Figure 18 "Measurement" menu

4.3.2.3 "History and Maintenance" Menu

Press [CHECK] twice

Press the [RESET] button to return to the default interface

- Current alarm
- Number of operations
- Contact wear
- Displacement record
- Tripping record

- Alarm record

Figure 19 "History and maintenance" menu

4.3.2.4 "System Settings" Menu

Press [SET] once

Press the [RESET] button to return to the default interface

- Clock setting
- Measurement table setting
- Test & lock
- Communication setting
- I/O setting

- Language setting

Figure 20 "System settings" menu

4.3.2.5 "Protection Parameter Setting" Menu

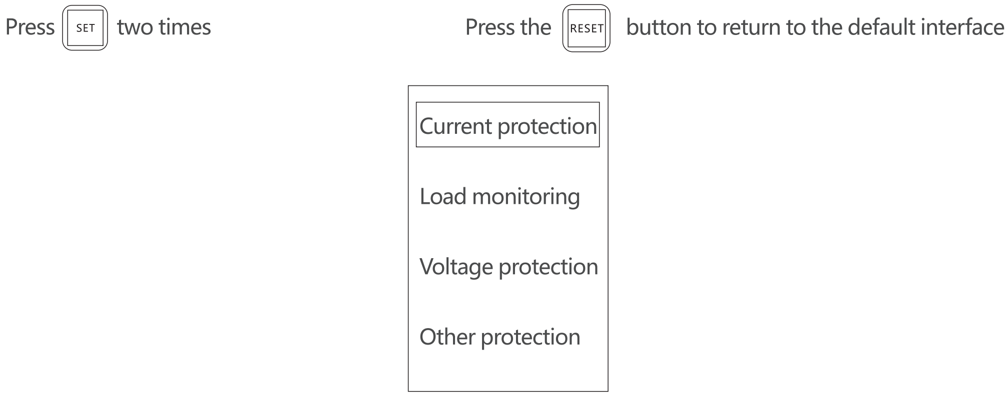


Figure 21 "Protection parameter setting" menu

4.3.2.6 Submenu Operation Example: Overload Long-delay Protection Setting

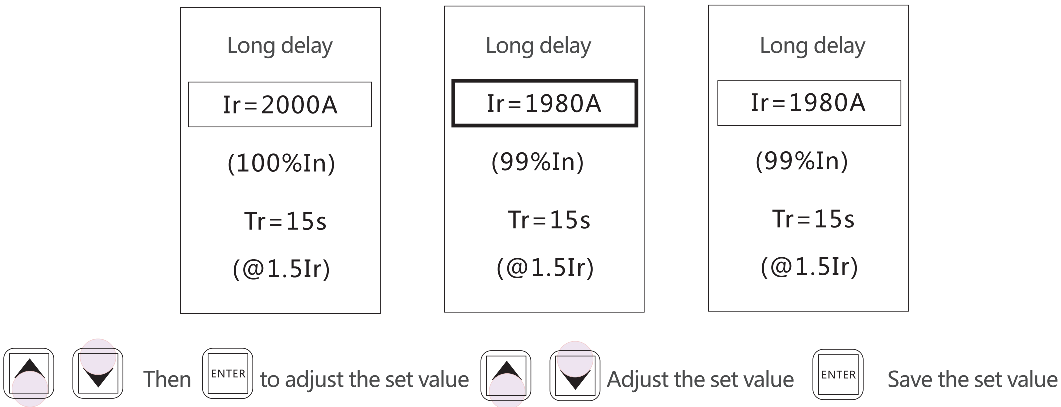


Figure 22 Overload long-delay protection setting

4.3.3 Intelligent Controller Menu Structure

The menu consists of the measurement menu, the parameter setting menu, the protection parameter setting menu, and the history record and maintenance menu. (The actual menu changes according to the different functions selected by users.)

4.3.3.1 Measurement Menu Structure

Table 50 Measurement menu

Level 1 menu	Level 2 menu	Level 3 menu	Level 4 menu	Level 5 menu
Current I	Instantaneous value	Ia, Ib, Ic, In	Ia=1000A	
			Ib=1001A	
			Ic=998A	
			In=0A	
			Ig=0A or I△n=0.00A	
		Maximum value	Ia=1300A	
			Ib=1400A	
			Ic=1380A	
			In=200A	
			Ig=0A or I△n=0.00A	
			Reset (+/-)	
		Imbalance rate	Ia=3%	
			Ib=5%	
			Ic=1%	
	Current heat capacity	100%		
Voltage U	Instantaneous value	Uab=380.0V		
		Ubc=380.0V		
		Uca=380.0V		
		Uan=220.0V		
		Ubn=220.0V		
		Ucn=220.0V		
	Average value	380.0V		
	Imbalance rate	0%		
	Phase sequence	A, B, C		
Frequency F	50Hz			
Energy E	Total energy	EP=200kWh		
		EQ=10kvarh		
		ES=200kVAh		
	Input power	EP=200kWh		
		EQ=200kvarh		
	Output power	EP=0kWh		
		EQ=0kvarh		
	Power reset	Yes/No		
Power P	Instantaneous value	P , Q , S	P=660kW	
			Q=0kvar	
			S=660kVA	
		Power factor	+1.00 capacitive	
			PFa=+1.00	
			PFb=+1.00	
			PFc=+1.00	
		Pa, Qa, Sa	Pa=220kW	
			Qa=0kvar	
			Sa=220kVA	

Continued table 50

Level 1 menu	Level 2 menu	Level 3 menu	Level 4 menu	Level 5 menu
Power P	Instantaneous value	Pb,Qb,Sb	Pb=220kW	
			Qb=0kvar	
			Sb=220kVA	
		Pc,Qc,Sc	Pc=220kW	
			Qc=0kvar	
			Sc=220kVA	
Harmonic H	Waveform	Ia,b,c ,N	Ia	
			Ib	
			Ic	
			In	
		Uan,bn ,cn	Uan	
			Ubn	
			Ucn	
	Fundamental wave	I(A)	Ia=1000A	
			Ib=1000A	
			Ic=1000A	
			In=1000A	
		U(V)	Uan=220.0V	
			Ubn=220.0V	
			Ucn=220.0V	
	THD	I(%)	Ia=0.0%	
			Ib=0.0%	
			Ic=0.0%	
			In=0.0%	
		U(%)	Uan=0.0%	
			Ubn=0.0%	
			Ucn=0.0%	
	thd	I(%)	Ia=0.0%	
			Ib=0.0%	
			Ic=0.0%	
			In=0.0%	
		U(%)	Uan=0.0%	
			Ubn=0.0%	
			Ucn=0.0%	
	FFT	I(3,5,7...31)	Ia(3,5,7...31)	Ia FFT THD= 0.0% 0.0% 3 5 7 9 11 ··· 31
			Ib(3,5,7...31)	Ib FFT THD= 0.0% 0.0% 3 5 7 9 11 ··· 31

Continued table 50

Level 1 menu	Level 2 menu	Level 3 menu	Level 4 menu	Level 5 menu
Harmonic H	FFT	I(3,5,7...31)	Ic(3,5,7...31)	Ic FFT THD= 0.0% 0.0% ↑ 3 5 7 9 11 ··· 31
			I_N(3,5,7...31)	I_N FFT THD= 0.0% 0.0% ↑ 3 5 7 9 11 ··· 31
		U(3,5,7...31)	Uan(3,5,7...31)	Uan FFT THD= 0.0% 0.0% ↑ 3 5 7 9 11 ··· 31
			Ubn(3,5,7...31)	Ubn FFT THD= 0.0% 0.0% ↑ 3 5 7 9 11 ··· 31
			Ucn(3,5,7...31)	Ucn FFT THD= 0.0% 0.0% ↑ 3 5 7 9 11 ··· 31

4.3.3.2 Parameter Setting Menu Structure

Table 51 Parameter setting menu

Level 1 menu	Level 2 menu	Level 3 menu	Level 4 menu	Level 5 menu
Clock setting	Date 2004/11/15 Time 19:50:35			
Measurement table settings	System type Incoming mode Power direction System voltage	=3Φ4W 4CT =upper incoming line =P + =400V		
Test & lock	Test trip	Test type Three-stage protection Test parameter 9999A Test control Start Test status Test over		
	Remote lock	Remote lock	=unlock	
	Parameter lock	Parameter locked (input) user password 0	Parameter lock lock user password (modify) 2	
Communication setting	Address 3 Baud rate 9.6K			

Continued table 51

Level 1 menu	Level 2 menu	Level 3 menu	Level 4 menu	Level 5 menu
I/O setting	Function setting	DO1 DO2 DO3 DO4	Example: DO1 function opening Execution mode normally open pulse 1 s	
	I/O status	DO1 1 DO2 1 DO3 1 DO4 1		
Language setting	Language setting=English			

4.3.3.3 Protection Parameter Setting Menu Structure

Table 52 Protection Parameter setting menu

Level 1 menu	Level 2 menu	Level 3 menu	Level 4 menu	Level 5 menu
Current protection	Long delay	Action current	For example: =2000A=100%In	
		Delay time	For example: =15s@1.5Ir	
		Heat dissipation time	For example: =10min	
		Curve Type	For example: =I²t	
	Short delay	Operating current	For example: =16000A (8.0×IR)	
		Delay time	For example: =0.10,0.20,0.30,0.40 (definite time + inverse time) 0.11,0.21,0.31,0.41 (definite time)	
	Instantaneous	Operating current	For example: =40000A=20.0×In	
		Peak action	For example: =OFF	
	Current Imbalance	Execution mode	For example: = alarm	
		Starting value	For example: =30%	
		Starting time	For example: =1s	
		Return value	For example: =10%	
		Return time	For example: =10s	
	Neutral phase protection	Neutral phase protection	For example: =100%	
	Ground protection	Operating current	For example: =1200A（0.6×In）	
		Delay time	For example: =0.1,0.2,0.3,0.4 (definite time)	
	Grounding alarm	Starting current	For example: =600A	
		Starting time	For example: =0.1s	
		Return current	For example: =100A	
		Return time	For example: =0.1s	
	Leakage protection	Operating current	For example: =8.0A	
		Set delay time	For example: =0.75s	
	Leakage alarm	Starting current	For example: =5.0A	
		Starting time	For example: =0.1s	
		Return current	For example: =4.0A	
		Return time	For example: =0.1s	

Continued table 52

Level 1 menu	Level 2 menu	Level 3 menu	Level 4 menu	Level 5 menu
Load monitoring	Execution mode	For example: =current monitoring		
	Starting value	For example: =160A, 80% TR		
	Return value	For example: =32A, 12s		
	Execution mode	For example: =power monitoring		
	Starting value	For example: =10000kW, 360s		
	Return value	For example: =100kW, 360s		
Voltage protection	Undervoltage	Execution mode	For example: = alarm	
		Starting value	For example: =200V	
		Starting time	For example: =0.2s	
		Return value	For example: =320V	
		Return time	For example: =60.0s	
	Overvoltage	Execution mode	For example: = alarm	
		Starting value	For example: =480V	
		Starting time	For example: =1s	
		Return value	For example: =400V	
		Return time	For example: =60.0s	
	voltage imbalance	Execution mode	For example: = alarm	
Voltage protection	voltage imbalance	Starting value	For example: =10%	
		Starting time	For example: =1s	
		Return value	For example: =5%	
		Return time	For example: =60.0s	
Other protection	Under-frequency	Execution mode	For example: = alarm	
		Starting value	For example: =48.0Hz	
		Starting time	For example: =0.2s	
		Return value	For example: =50.0Hz	
		Return time	For example: =36.0s	
	Over-frequency	Execution mode	For example: = alarm	
		Starting value	For example: =52.0Hz	
		Starting time	For example: =0.2s	
		Return value	For example: =50.0Hz	
		Return time	For example: =36.0s	
	Phase sequence	Execution mode	For example: =trip	
		Timeout value	For example: =A, B, C	
	Reverse power	Execution mode	For example: = alarm	
		Starting value	For example: =500kW	
		Starting time	For example: =0.2s	
		Return value	For example: =50kW	
		Return time	For example: =360s	
	Communication failure	Execution mode	For example: = alarm	
		Timeout value	For example: =4s	

4.3.3.4 History record and Maintenance Menu Structure

Table 53 History record and maintenance menu

Level 1 menu	Level 2 menu	Level 3 menu	Level 4 menu	Level 5 menu
Current alarm	For example: phase sequence alarm, reverse power alarm, over-frequency alarm...			
Number of operations	Total number of times	For example: 300		
	Number of operations	For example: 219 (reset +/-)		
Contact wear	Total wear	For example: 50%		
	Contact wear	For example: 20% (reset +/-)		
Displacement record	For example: 1 local closing 2002/06/18	Local closing 2002/06/18 9:30:56		
	...	...		
	For example: 10 test trip 2002/06/15	Test trip 2002/06/15 10:30:20		
Trip record	For example: 1 undervoltage 2004/06/17	Undervoltage trip T=0.20S Umax=0V 2000/01/09 09:56:38		
		Ua=0V Ub=0V Uc=0V (remark; Ua, Ub, Uc mean line voltage)		
	...	...		
	For example: 10 short-circuit definite 2004/05/30	A phase short-circuit definite T=0.4S I=4300A 15:28:25 5/30		
		Ia=4300A Ib=4200A Ic=4000A In=150A		
Alarm record	For example: 1 DI input alarm 2004/07/16	DI input alarm DI1 2004/07/16 20:38:45		
	...	...		
	For example: 10 undervoltage alarm 2004/06/20	Undervoltage alarm Umax=0V 2004/06/20 22:29:40		

5 Maintenance, inspection

5.1 Maintenance Precautions

1) The controller should have the door panel covered during normal operation.

2) The solidity of each joint should be checked regularly (for whether the screws in each part are loose).

3) The ambient temperature and humidity of the application must comply with the relevant provisions of the product manual.

4) In order to ensure that the circuit can be cut off safely and reliably in the event of a circuit failure, the current setting of the controller should be periodically verified.

5.2 Inspection of intelligent controller

- 1. Press "Set button" to enter the parameter setting "Pro"
- 2. Press "Confirm button" to enter the protection parameter setting interface
- 3. Select the "▼" or "▲" button to select to display the details of protection parameters in return
- 4. Press "Return button" to return to the next upper level menu or exit the interface

Figure 23 Parameter settings meet site requirements

• Press "Test button" to simulate the trip test

24-a Simulation test

• Press the orange "Reset" button on the cover to return to normal

24-b Reset operation

Figure 24 Simulation test of tripping function

6 Appendix

6.1 PSU-1 Power Supply

The PSU-1 power module can provide DC 24 V power with a power of 9.6 W. It can output two sets of terminals and input AC or DC power. It can be used as the power supply for the RU-1 relay unit. The product adopts the 35 mm standard rail mounting method. The shape and installation dimensions are shown in Figure 25.

Figure 25 PSU-1 power module

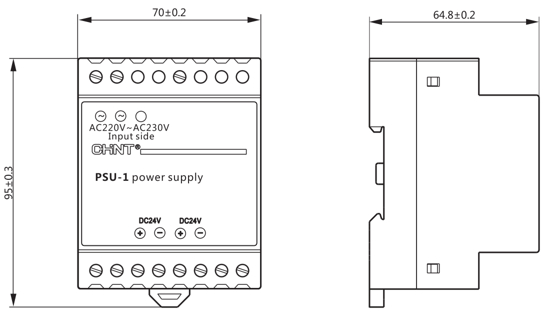


Figure 26 PSU-1 power module installation structure

6.2 RU-1 Relay Unit

The signal unit output by the controller is generally used for fault alarm or indication. When it is used to control the opening and closing of the circuit breaker or the load capacity is large, it needs to be controlled after converted by the RU-1 relay unit. The capacity of the RU-1 contact is AC250 V, 10 A; DC28 V, 10 A. Its appearance and installation dimensions are the same as those of the PSU-1 power unit.

Figure 27 RU-1 Relay Unit

6.3 4CT Ground Transformer (Ground Current W Mode) Dimensions

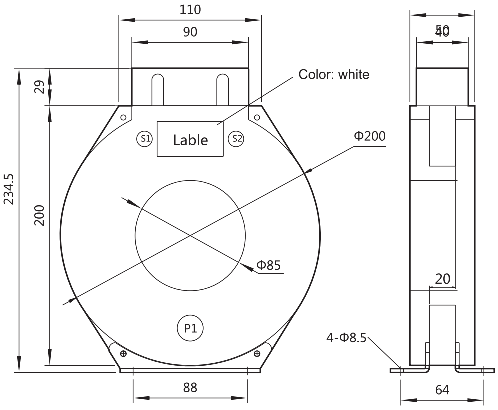


Figure 28 4CT Ground Transformer Dimensions

6.4 CTB-2 ground current transformer module

When the grounding mode is the ground current (W), the installation dimensions of the external special transformer are shown in Figure 29.

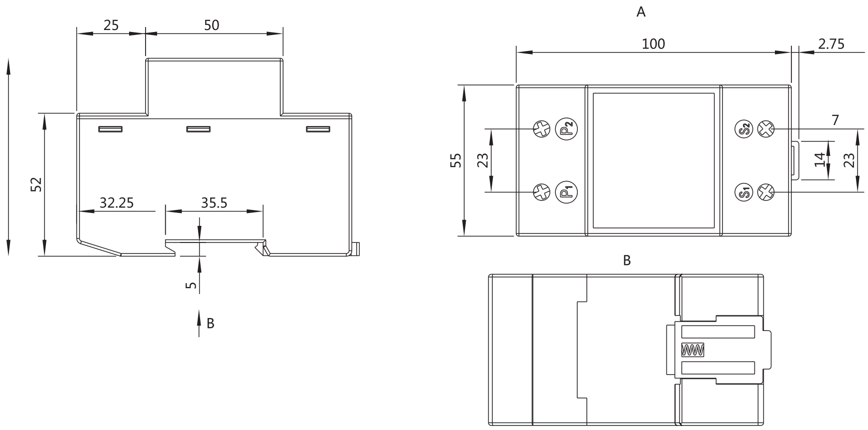


Figure 29 CTB-2 ground current transformer module

6.5 Appearance and Installation Dimensions of External Leakage Transformer (E Mode)

When the grounding protection mode is the leakage type (E), the installation dimensions of the external special rectangular transformer are shown in Figure 30.

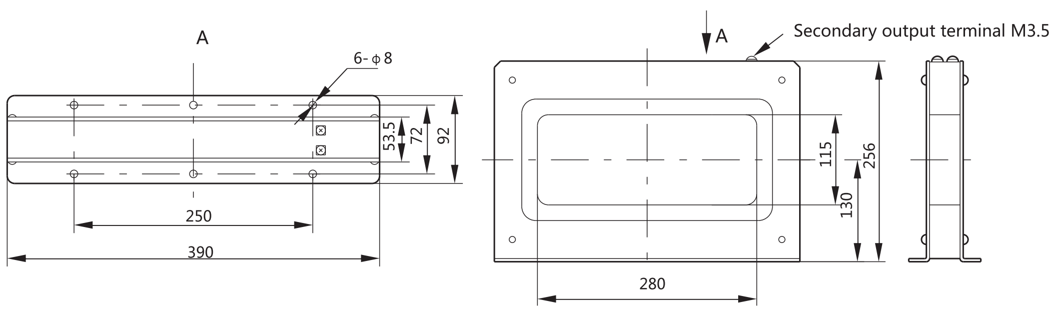


Figure 30 ZCT1 rectangular leakage transformer

Note: The ZCT1 provides the busbar pass-through mode only for NXA16(3P/4P) products and NXA20(3P), not suitable for NXA20(4P)and NXA20~63 products .

NA1 Series
3M/3H type intelligent controller
User Instruction

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