CSC-211

Multifunction Protection IED

Product Guide

BEIJING SIFANG AUTOMATION CO., LTD.

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Note: the company reverses the right to amend the instruction. If equipment does not agree with the instruction at anywhere, please contact our company in time. We will provide you with corresponding service.

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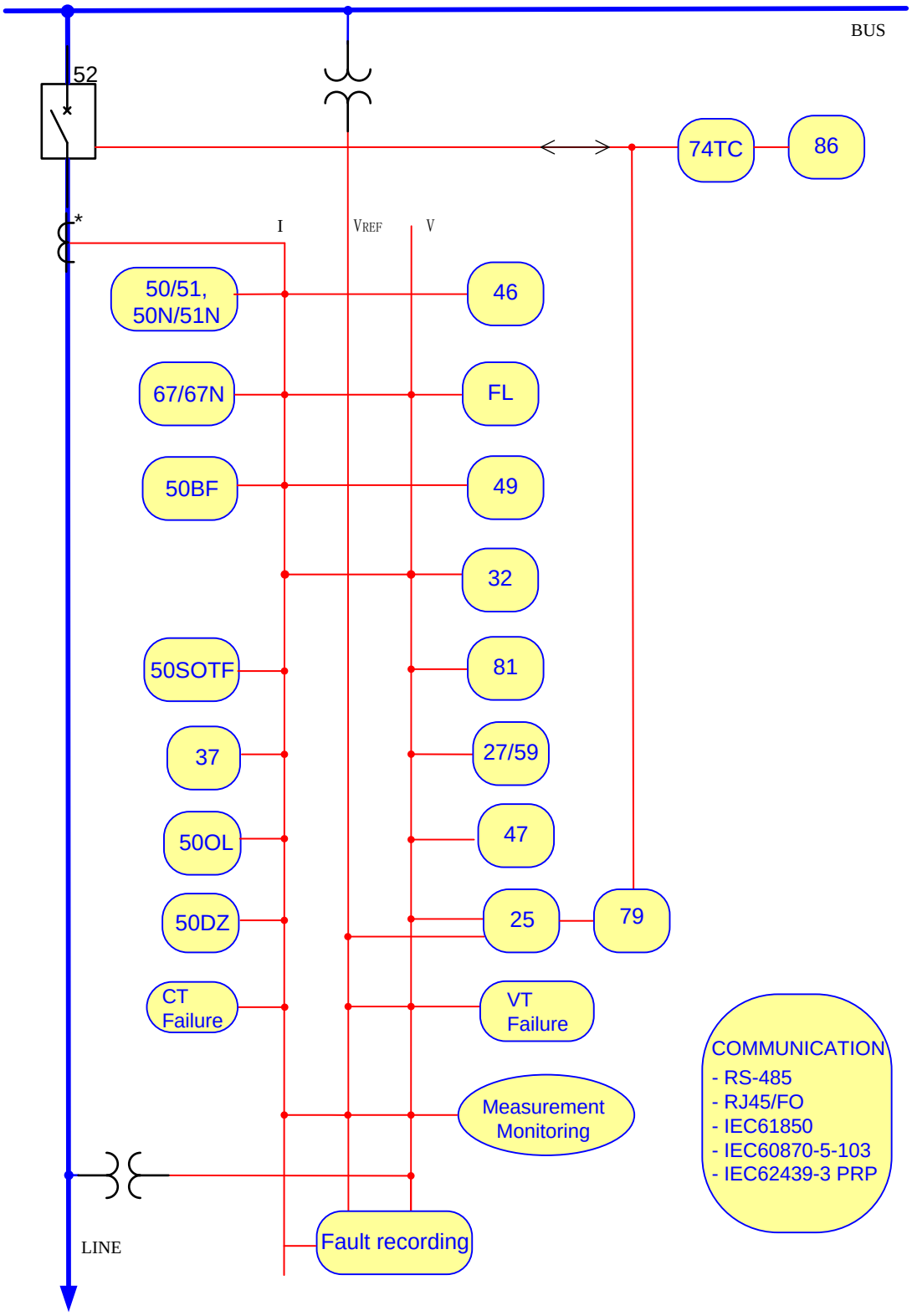
CSC-211 Multifunction Protection IED

CSC-211 is an integrated solution for the complete protection, control and monitoring of 6~66Kv overhead lines, underground cables, capacitors, bus-sections, bus-couplers and station transformers, etc. or working as backup protection IED for transmission lines and transformers in the conventional substations or smart digital substations. It is a selective, reliable and high speed protection IED with rich functions.

- Powerful capability to meet various applications:
- Comprehensive functionality including forward/ reverse/ directional overcurrent and earth overcurrent protection, sensitive earth fault protection, voltage protection, frequency protection, breaker failure protection, dead zone protection, synchrocheck, auto-reclose, load-shadding, etc.
- Embedded TCS and lockout relays, or optional operating module.
- Wide range of supported protocols IEC 61850-8-1, IEC 60870-5-103, DNP3.0 and Modbus. And redundant communications with zero downtime using PRP protocol
- Mixable Binary inputs & output relays / GOOSE inputs /outputs
- Robust hardware with excellent EMC performance and IP54 protection under -40℃ to 70℃ operating temperature

Application



Function

Function	ANSI Code	Qty.	Description
Overcurrent protection	50,51,67	1	4 stages: forward/reverse/directional, definite time/ 12 IEC and ANSI standard curves of inverse time characteristic, harmonic and compound voltage block
Earth fault protection	50N, 51N, 67N	1	4 stages: forward/reverse/ directional, definite time / 12 IEC and ANSI standard curves of inverse time characteristic, inrush block, 3 phase current inputs or single current input
Sensitive earth fault protection	50Ns, 51Ns, 67Ns	1	4 stages; Forward/reverse/non-directional; Definite time / Inverse time characteristic; special single current input
Negative sequence overcurrent protection	46	1	4 stages; Definite time/ 12 IEC and ANSI standard curves of inverse time characteristic
Undercurrent protection	37	1	1 stage
Thermal overload	49	1	3 stages, 2 stages for alarm, IEC 60255-8 temperature model
Overvoltage protection	59	1	4 stages; Definite time / 12 IEC and ANSI standard curves of inverse time characteristic;
Undervoltage protection	27	1	4 stages; Definite time / 4 curves of inverse time characteristic; Current and circuit breaker status block
Negative sequence overvoltage protection	47	1	4 stages; Definite time / 12 IEC and ANSI standard curves of inverse time characteristic
Zero sequence overvoltage protection	64	1	3 stages; Definite time / 12 IEC and ANSI standard curves of inverse time characteristic; $3U_0$ deriving from3 phase voltage inputs or single voltage input
Unbalanced voltage protection	59NU	1	For capacitor bank; 1 stage; 3 voltage inputs
Unbalanced current protection	60NU	1	For capacitor bank;1 stage; 3 crrents inputs
Power protection	32	1	2 stages, forward/ reverse direction
Underfrequency protection	81U	1	4 stages, $\Delta f/\Delta t$, voltage and current block
Overfrequency protection	81O	1	4 stages, voltage block
Rate of frequency change protection	81DF	1	4 stages
Check synchronising	25	1	For autoreclosing and manual closing. Synchro-check mode, energizing check mode and override mode
Three-pole auto-reclosing	79	1	4 shots
Auto-reclosing based on load shedding by underfrequency	79-81ULS	1	4 stages
Three-pole breaker failure protection	50BF	1	2 stages, re-tripping and busbar tripping in sequence, and DTT at 2nd stage

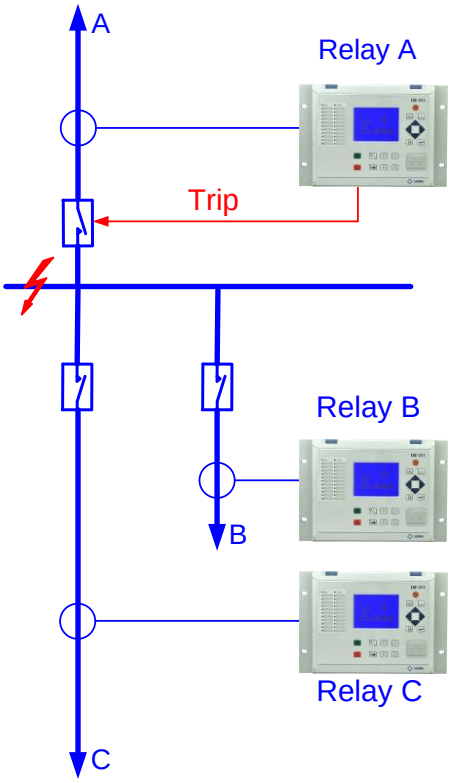
Function

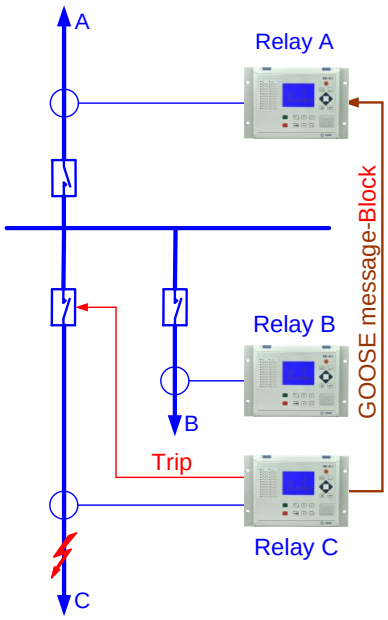
Dead zone protection	50DZ	1	1 stage, DTT
Broken conductor protection	46BC	1	1 stage
Stub-bus overcurrent protection	50STUB	1	1 stage
Switch-on-to-fault protection	50SOTF	1	1 stage overcurrent, 1 stage zero sequence current
Load shedding by undervoltage	27LS	1	1 stage;
Load shedding by overload	50LS	1	1 stage;
Simple busbar protection scheme	50BB	1	1 stage;
Over-excitation protection	24	1	For transformer, 4 stage; Definite time/ Inverse time characteristic
External inputs		1	4 BIs for tripping
CT secondary circuit supervision		1	1 stage for alarm
VT secondary circuit supervision	97FF	1	
Disturbance recording		1	Maximum 5s in 1 recording, up to 32 recordings
Fault locator		1	
Trip circuit supervision	74TC	1	
Lockout	86		
Programmable logic			
Measurements			Primary or secondary values, V, I, f, P, Q, COSφ
Self diagnostic			
Time synchronization			IRIG-B, IEEE1588, SNTP, PPS, PPM

Note 1: the number in "Qty." column is the maximum quantity of function module is able to offer.

50BB Simple busbar protection scheme

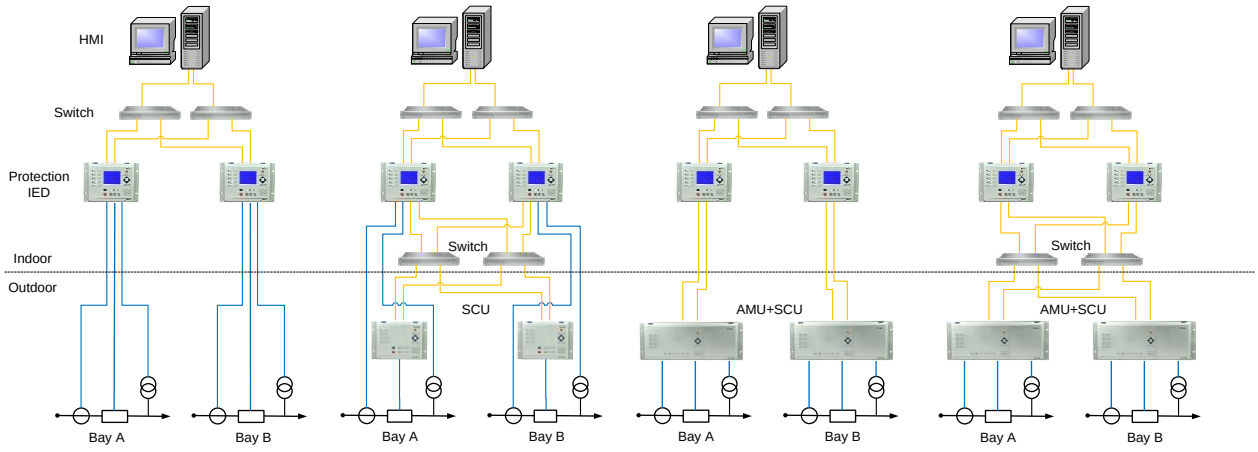
- Based on coordination among protection IEDs of all feeders connected with the busbar;
- When fault on the outgoing feeders, IEC61850 GOOSE message interlocking between the protection IEDs of incoming feeders and outgoing feeders;
- Clear busbar fault in a short time if without dedicated busbar protection IED





Communication

- Support SV, GOOSE service of process layer application in accordance with IEC 61850-8-1, IEC 61850-9-2, IEC 61850-9-2LE
- Support MMS, GOOSE service of station layer and bay layer application in accordance with IEC 61850-8-1
- 3 100Base-TX copper Ethernet ports, or 2 100Base-FX optical Ethernet ports and 1 100Base-TX copper Ethernet port
- 2 RS-485 serial ports, 1 RS-232 print port
- Support all main protocols, include:
  - IEC 61850-8-1
  - DNP 3.0
  - MODBUS
  - IEC 60870-5-103
  - Redundancy protocol IEC 62439-3 PRP
- Support several time synchronizing way, include:
  - IRIG-B modulated electrical/optical
  - PPS, PPM
  - SNTP
  - IEEE 1588
- Proven technology from thousands of operated digital substations;



Station layer: MMS/GOOSE; PRP;
Bay layer: GOOSE; PRP;

Station layer: MMS/GOOSE; PRP;
Bay layer: GOOSE; PRP;
Process layer: Process bus, GOOSE; PRP;

Station layer: MMS/GOOSE; PRP;
Bay layer: GOOSE; PRP;
Process layer: SV/GOOSE; PRP;

Station layer: MMS/GOOSE; PRP;
Bay layer: GOOSE; PRP;
Process layer: Process bus, SV/GOOSE; PRP;

AESP tools

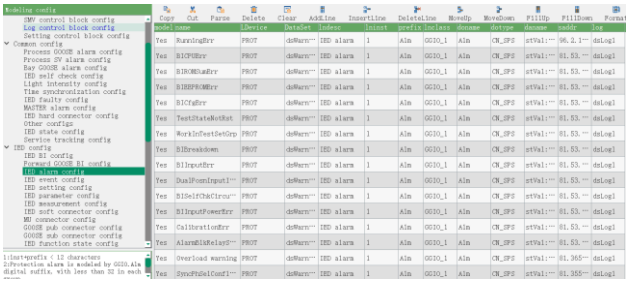
AESP is the user-friendly engineering and commissioning software. The software is applicable to all protection and BCU IEDs of Sifang. It provides integrated configuration and monitoring functions.

Functions

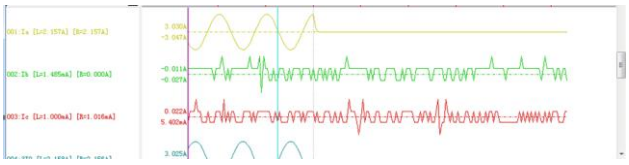
- Setting and parameter
- Single line diagram visualization
- Disturbance extraction and analysis
- Real-time measurement visualization
- Programmable logic editor
- IED 61850 configurator
- IED configuration by IO matrix;
- Online test
- Project archiving, export, and import

Features

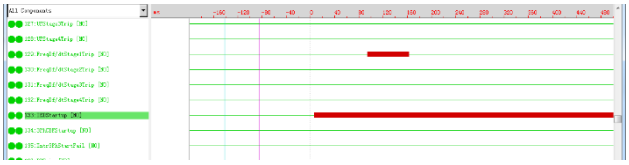
- 1 software for all tasks, 1 software for all IEDs
- Easy management of relays in project
- Flexible graphic programmable logic instead of programming
- Powerful fault record analysis with standard Comtrade file



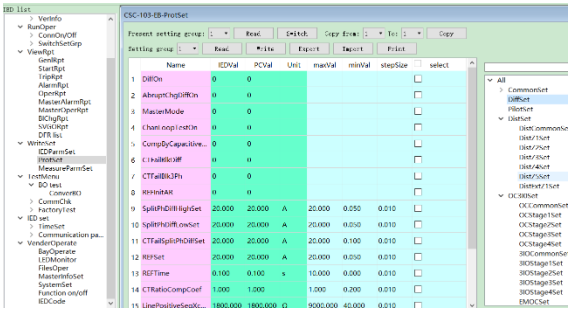
IED 61850 configurator



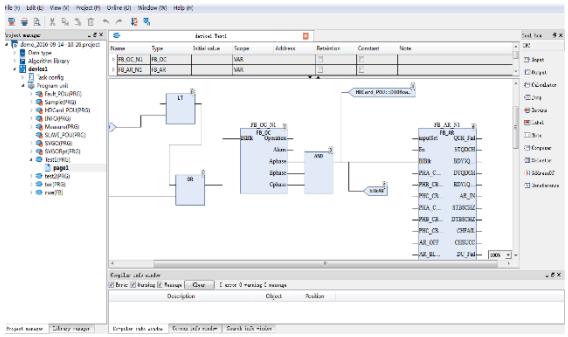
Fault recorder analysis



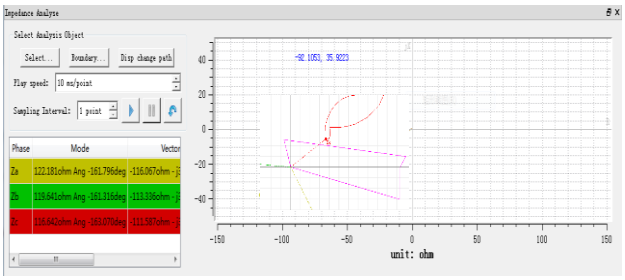
Fault recorder analysis



Setting and parameter



Graphic programmable logic

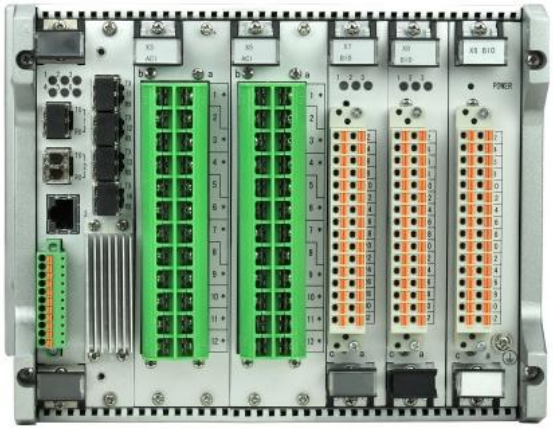


Impedance analysis

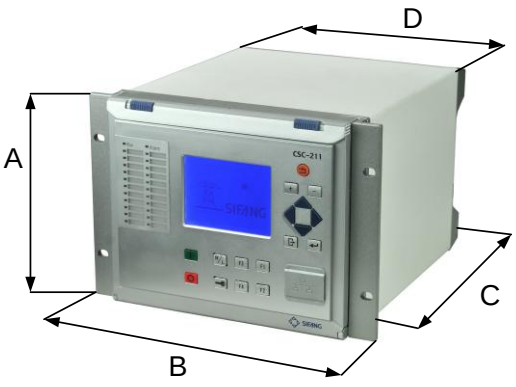
Hardware

- Up to 8 AC current inputs and 4 voltage inputs, 1A/5A compatible
- Up to 35 binary inputs;
- Up to 48 binary output relays, with 4 switchable NO/NC contacts
- Up to 7 Ethernet optical ports, for SV, GOOSE, MMS and other automation services
- Up to 3 RJ45 Ethernet ports or 2 LC optical Ethernet ports in master unit for SAS
- Up to 2 RS-485 ports and 1 RS-232 print port;
- 1 IRIG-B / Pulse time synchronization port;
- 1 front RJ45 for debugging
- 4.2-inch LCD, 320x240 pixels
- 22 programmable LED
- Up to 4 customer defined function keys, and remote/local key, circuit breaker open/ close keys;
- 4U 1/2 19” case, easy to install in the switchgear;
- Weight in full hardware scheme, 8.5kg

Front view of the 4U 1/2 19” case

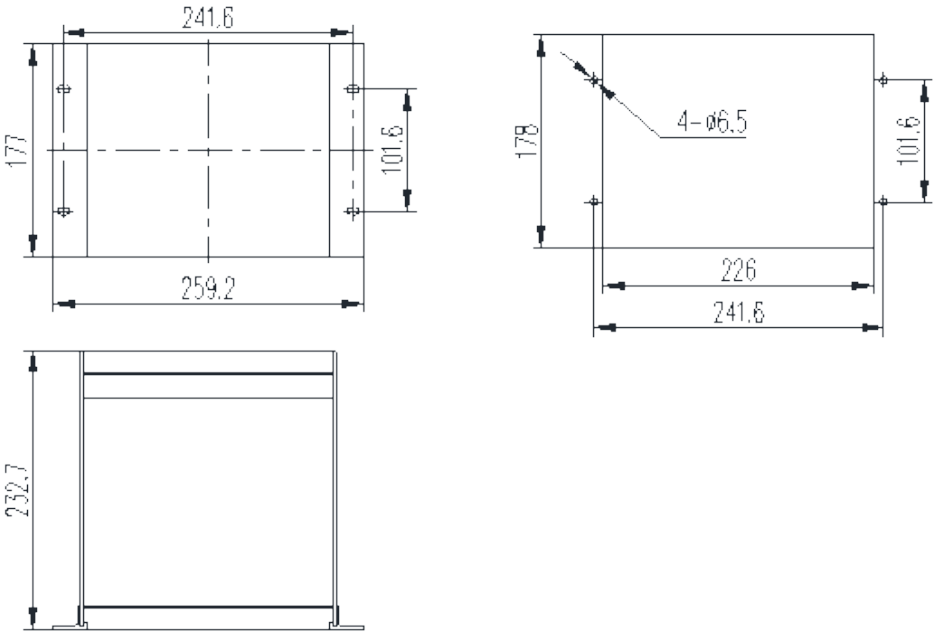


Rear view of the 4U 1/2 19” case



A	177
B	259.2
C	286
D	226
Unit	mm

Dimension of case of the 4U 1/2 19” case



CSC-211 installation size

Specification

AC current measurement

Item	Data
Rated current I_r IEC60255-1	1/5 A, settable
Measuring range of protection CT	(0.05 ~ 40) I_r
Measuring range for measurement CT	(0.05 ~ 2) I_r
Measurement range for high sensitive CT	0.005A ~ 6.000A
Burden for CT (per phase) IEC60255-27	≤0.05VA at I_r=1A; ≤0.25VA at I_r=5A
Thermal withstand of protection CT (per phase) IEC60255-27	4 I_r continuously; **30 I_r for 30s** 100 I_r for 1s
Thermal withstand of high sensitive CT IEC60255-27	2A continuously; 80A for 1s

AC voltage measurement

Item	Data
Rated voltage $V_{r.ph-ph}$ IEC60255-1	100V~120 V_{ac}, settable
Measuring range of VT V_{ph-e}	0.4V ~ 180V
Burden for VT (per phase) IEC60255-27	≤ 0.05VA, at $V_{r.\ ph-ph}$ = 110V
Thermal withstand of VT (per phase) IEC60255-27	200V, continuously; 400V for 60s.

Other measurement

Item	Data
Rated frequency	50/60 Hz, settable
Measuring range of frequency	(0.9 ~ 1.1) F_r

Binary inputs

Item	Data
Rated voltage $V_{r.aux}$ IEC60255-1	110/125/220/250 V_{dc}, settable; or 24/48V_{dc} settable;
Operating threshold IEC60255-1	≥70% $V_{r.aux}$, guarantee operating ≤55% $V_{r.aux}$, guarantee not to operating
Maximum permissible voltage IEC60255-1	286V, at $V_{r.aux}$=110/125/220/250 V_{dc}; 62V, at $V_{r.aux}$ =24/48 V_{dc};
Burden for binary input IEC60255-1	Typical ≤0.15 W, at $V_{r.aux}$=110V_{dc} ≤0.6W, at $V_{r.aux}$=220V_{dc}

Output relay

Item	Data
Maximum contact voltage IEC60255-1	250V_{dc} / 400V_{ac}
Current carrying capacity IEC60255-1	General relay: 5A continuous, 30A, 200ms on,15s off Power relay: 10A continuous, 30A, 200ms on,15s off
Making capacity IEC60255-1	General relay: ⩾1100W(DC), L/R=40ms 1000VA(AC) Power relay: ⩾1250W(DC), L/R=40ms 240W(DC) 2000VA(AC) ,
Breaking capacity IEC60255-1	General relay: ⩾30W(DC), L/R=40ms 220V(DC), 0.15A, L/R⩽40ms; 110V(DC), 0.3A, L/R⩽40ms; Power relay: ⩾55W(DC), L/R=40ms
Electrical life IEC60255-1	General relay: 50,000,000 times at 3Hz Power relay:

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Specification

	100,000 times, resistive load
Mechanical endurance IEC60255-1	Load, making ≥ 1000 times Load, breaking ≥ 1000 times
Contact resistance IEC60255-1	30mΩ
Contact insulation test (AC dielectric voltage) IEC60255-1	1kV$_{ac}$, 1min

Auxiliary power

Item	Data
Rated voltage $V_{r.aux}$ IEC60255-1	110V to 250$V_{dc/ac}$ 24/48V_{dc}
Input voltage range IEC60255-1	(0.8 ~ 1.2) $V_{r.aux}$
Burden for power supply unit IEC60255-1	≤20W, at quiescent ≤30W, at maximum load
AC ripple voltage IEC 60255-26 IEC 61000-4-17	**≤15% of the nominal auxiliary voltage**

Ethernet communication

Item	Data
Max. ports number	3
Electrical Ethernet port type	RJ45
Maximum transmission distance of Ethernet cable	100M
Optical Ethernet port type	LC
Fiber optic cable type	Multi-mode
Optic wavelength	1310 nm
Maximum transmission distance of optical cable	2km
Transmission rate for IEC 60870-5-103 or DNP3.0	100Mbit/s

Serial communication

Item	Data
Number	2
Port type	RS-485
Maximum transmission distance	1.0km
Voltage withstand test	500V AC voltage to earth
Transmission rate for IEC60870-5-103 or Modbus	Default setting 9600 bps; Minimum: 1200bps; maximum: 19200bps

Time synchronization

Item	Data
Synchronization mode	SNTP IRIG-B time sync Minute or second pulse IEEE 1588
IRIG-B signal format	IRIG-B000
IRIG-B Port type	Twisted-pair connection or multi-mode optical fiber
IRIG-B signal voltage level	Differential signal input/ modulated

Product safety test

Item	Data
Degree of protection (IP) IEC60255-27 IEC60529	Front: IP54 Top, bottom, left, right: IP52 Rear: IP30
Power frequency insulation voltage withstand test IEC60255-5 EN60255-5 ANSI/IEEE C37.90 GB/T15145-2017 DL/T478-2013	2kV, 50Hz, at rated voltage > 63V, Tested between : Auxiliary power supply port; Current and voltage transformer ports; Input and output ports; Enclosure earth port; 500V, 50Hz, at rated voltage ≤63V, Tested on: Communication ports; Time port;

Specification

	Enclosure earth port;
Impulse voltage IEC60255-27 EN60255-5 ANSI/IEEE C37.90 GB/T15145-2017 DL/T478-2013	5kV(1.2/50μs, 0.5J), at rated voltage>60V, 1kV, at rated voltage≤60V, Tested between : Auxiliary power supply port; Current and voltage transformer ports; Input and output ports; Communication ports; Time port; Enclosure earth port;
Insulation resistance IEC60255-5 IEC60255-27 EN60255-5 ANSI/IEEE C37.90 GB/T15145-2017 DL/T478-2013	≥550 MΩ, 500 V_{dc}
Protective bonding resistance IEC60255-27	≤0.1Ω
Fire withstand/flammability IEC60255-27	Class V1

EMC test

Item	Data
Pulse immunity test (1MHz) IEC60255-26 IEC61000-4-18 ANSI/IEEE C37.90	Class III 2.5 kV, CM 1.0 kV, DM
Electrostatic discharge immunity test IEC60255-22 IEC61000-4-2	Class IV; ±8kV contact discharge; ±15kV air gap discharge;
Radiated interference radio-frequency electromagnetic field immunity test IEC60255-22	Class IV; 10 V/m, Frequency sweep: 80 MHz ~1 GHz; 1.4 GHz ~2.7 GHz
Electrical fast transient/burst immunity test IEC60255-26 IEC61000-4-4 ANSI/IEEE C37.90	Class IV; 4kV peak voltage; Tested on: Auxiliary power supply port; Current and voltage transformer ports; Input and output ports; 2kV peak voltage; Tested on: Communication ports;
Surge (impact) immunity test IEC60255-22 IEC61000-4-5	Class IV 4.0kV, CM 2.0kV, DM
Test for immunity to conducted disturbances, induced by radio-frequency fields IEC60255-26 IEC61000-4-6	10 V/m, 80% AM (1 kHz) Frequency sweep: 150kHz–80MHz Spot frequencies: 27MHz and 68MHz;
Power frequency immunity test IEC60255-22	Class A 300V, CM; 150V, DM;
Power frequency magnetic field immunity test IEC61000-4-8	Class V 100 A/m Continuous; 1000 A/m 3s;
Pulse immunity test (100KHz) IEC61000-4-18	Class III 4 kV Tested on: Auxiliary power supply port; Current and voltage transformer ports; Input and output ports; 2 kV Tested on: Communication ports
Damped oscillation magnetic field immunity test IEC61000-4-10	Class V 100A/m

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Specification

Pulse magnetic field immunity test IEC61000-4-9	Class V 1000A/m
Conducted emission IEC60255-1, CISPR22	Class A; 0.15MHz to 30MHz;
Radiated emission IEC 60255-1, CISPR22	Class A; 30MHz to 1GHz;

Mechanical test

Item	Data
Vibration response test IEC 60255-1 EN 60255-21-1	Class 1
Vibration endurance test IEC 60255-1 EN 60255-21-1	Class 1
Shock response test IEC 60255-1 EN 60255-21-2	Class 1
Shock withstand test IEC 60255-1 EN 60255-21-2	Class 1
Bump test	Class 1
IEC 60255-1 EN 60255-21-2	
Seismic test IEC 60255-21-3	Class 1

Environmental test

Item	Data
Temperature test	-40°C~+70°C, relay energized
Storage test	-40°C~+70°C, relay non-energized
Humidity test	95% r.h. no condensation
Pollution degree	**2**
Altitude	**＜3000m**

CE Certification

Item	Data
EMC	EN 60255-26 (Directive 2014/30/EU)
LVD	EN 60255-27 (Directive 2014/35/EU)

50, 51, 67, Directional overcurrent protection

Item	Data
Definite time characteristic	
Current	0.05 I_r to 40.00 I_r ≤ ±2.5% setting or ±0.02 I_r
Time delay of definite time characteristic	0.00s to 300.00s, step 0.01s ≤ ±1% setting or ≤ +40ms, at 200% setting
Inverse time characteristic	
Current	0.05 I_r to 40.00 I_r ≤ ±2.5% setting or ±0.02I_r
Time delay IEC Inverse IEC 60255-151	Normal inverse; Very inverse; Extremely inverse; Short time inverse; Long time inverse ≤ ±5% or ≤ +40ms , at 2 <$I/I_{SETTING}$ < 20
Time delay IEEE/ ANSI Inverse IEEE/ ANSI C37.112	Inverse; Short time inverse; Long time inverse; Moderately inverse; Very inverse; Extremely inverse; Definite time inverse ≤ ±5% setting or ≤ +40ms, at 2 <$I/I_{SETTING}$ < 20
Time delay user-defined inverse IEC 60255-151	$t=\left[\frac{A}{\left[\frac{I_\Phi}{I\text{set}}\right]^P-1}+B\right]\cdot T$ ≤ ±5% setting or ≤ + 40ms, at 2 <$I/I_{SETTING}$ < 20
Time factor of characteristic, A	0.001 to 1000.0s, step 0.001s
Time delay of characteristic, B	0.00s to 100.00s, step 0.01s
Index of characteristic, P	0.01 to 10.00, step 0.01
Time constant of characteristic, T	0.025 to 1.50, step 0.001
Minimum inverse operating time	20ms
Reset time	Instantaneous
Directional element	
Angle range of operating area	170° ≤ ±3°, at phase to phase voltage >2V
Characteristic angle	0° to 90°, step 1° ≤ ±3°, at phase to phase voltage >2V
Inrush current blocking element	
Max. current setting without inrush current blocking	0.05 I_r to 40.00 I_r ≤ ±2.5% setting or ±0.02I_r
Ratio of second harmonics to fundamental current	0.07 to 0.50, step 0.01
Time period of cross phases blocking	0.00s to 100.00s, step 0.01s ≤ ±1% setting or ≤+40ms

50N, 51N, 67N Directional earth fault protection

Item	Data
Current inputs	Three phase currents or single current
Definite time characteristic	
Current	0.05 I_r to 40.00 I_r ≤ ±2.5% setting or ±0.02 I_r
Time delay of definite time inverse	0.00s to 300.00s, step 0.01s ≤ ±1% setting or ≤ +40ms, at 200% setting
Inverse time characteristic	
Current	0.05 I_r to 40.00 I_r ≤ ±2.5% setting or ±0.02I_r
Time delay IEC Inverse IEC 60255-151	Normal inverse; Very inverse; Extremely inverse; Short time inverse Long time inverse ≤ ±5% setting or ≤ + 40ms, at 2 <$3I_0/3I_{0SETTING}$ < 20
Time delay IEEE/ANSI inverse IEEE/ANSI C37.112	Inverse; Short time inverse; Long time inverse; Moderately inverse; Very inverse; Extremely inverse; Definite inverse ≤ ±5% setting or ≤ + 40ms, at 2 <$3I_0/3I_{0SETTING}$ < 20

Specification

Time delay user-defined inverse IEC 60255-151	$t=\left[\frac{A}{\left[\frac{3I_0}{3I_0\text{set}}\right]^P-1}+B\right]\cdot T$ ≤ ±5% setting or ≤ + 40ms, at $2<3I_0/3I_{0SETTING}<20$
Time factor of characteristic, A	0.001 to 1000.0s, step 0.001s
Time delay of characteristic, B	0.00s to 100.00s, step 0.01s
Index of characteristic, P	0.01 to 10.00, step 0.01
Time constant of characteristic, T	0.025 to 1.500, step 0.001
Reset time	Instantaneous
Zero sequence directional element	
Operating area range	160°, step 1° ≤ ±3°, at 3U0≥1V
Characteristic angle	0° to 90°, step 1° ≤ ±3°, at 3U0≥1V
Negative sequence directional element	
Operating area range	160°, step 1° ≤ ±3°, at 3U2≥2V
Characteristic angle	0° to 90°, step 1° ≤ ±3°, at 3U2≥2V

50Ns, 51Ns, 67Ns, Sensitive directional earth fault protection

Item	Data
Current input	From sensitive CT or cable type CT
Definite time characteristic	
Current for sensitive CT input	0.005 to 5.000 A , step 0.001 A ≤ ±2.5 % setting or 1 mA
Time delay of definite time characteristic	0.00s to 300.00, step 0.01 s ≤ ±1.5 % setting or ≤ +40ms, at 200% setting
Reset ratio	0.95 at $I/I_r>0.4$
Reset time	40ms
Inverse time characteristic	
Current for sensitive CT input	0.005 to 5.000 A , step 0.001 A ≤ ±2.5 % setting or 1 mA
Inverse time characteristic in accordance with IEC60255-151	Normal inverse; Very inverse; Extremely inverse; Short time inverse; Long inverse ≤ ±5% setting or ≤ + 40ms, at $2<I_{s0}/I_{s0}\text{set}<20$
Inverse time characteristic in accordance with ANSI/IEEE C37.112	Inverse; Short inverse; Long inverse; Moderately inverse; Very inverse; Extremely inverse; Definite inverse ≤ ±5% setting or ≤ + 40ms, at $2<I_{s0}/I_{s0}\text{set}<20$
User-defined characteristic in accordance with IEC60255-151	$t=\left[\frac{A}{\left[\frac{I_{s0}}{I_{s0}\text{set}}\right]^P-1}+B\right]\cdot T$ ≤ ±5% setting or ≤ + 40ms, at $2<I_{s0}/I_{s0}\text{set}<20$
Time factor of characteristic, A	0.001 to 1000.000s, step 0.001s
Tine Delay of characteristic, B	0.00s to 100.00s, step 0.01s
Index of characteristic, P	0.01 to 10.00, step 0.01
Time constant of characteristic, T	0.025 to 1.500, step 0.001
Minimum inverse operating time	100ms
Reset time	40ms
Directional element	
Principles	I_{S0} cos Φ and Φ (V0 / I0)
Direction measurement	VE measured or 3U0 calculated
3U0 Minimum voltage threshold	2.00V to 100.00 V, step 0.01 V ≤ ±3 % setting for measured voltage;

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	≤ ±5 % setting for calculated voltage
Characteristic angle Φ_SEFChar	0° to 90°, step 1° ≤ ±3°
Operating area range	160°, ≤ ±3°

46, Negative sequence overcurrent protection

Item	Data
Definite time characteristic	
Current	0.05 I_r to 40.00 I_r ≤ ±2.5% setting or ±0.02I_r
Time delay of definite time characteristic	0.00s to 100.00s, step 0.01s ≤ ±1% setting or ≤ +40ms, at 200% setting
Reset ratio	0.95 at I/I_r>0.5
Reset time	40ms
Inverse time characteristic	
Current	0.05 I_r to 40.00 I_r ≤ ±2.5% setting or ±0.02I_r
Time delay IEC Inverse IEC 60255-151	Normal inverse; Very inverse; Extremely inverse; Short time inverse Long time inverse ≤ ±5% setting or ≤+ 40ms, at 2 <$I_2/I_{2SETTING}$ < 20
Time delay IEEE/ANSI inverse IEEE/ANSI C37.112	Inverse; Short time inverse; Long time inverse; Moderately inverse; Very inverse; Extremely inverse; Definite inverse ≤ ±5% setting or ≤ +40ms, at 2 < $I_2/I_{2SETTING}$ < 20,
Time delay user-defined inverse IEC 60255-151	$t=\left[\frac{A}{\left[\frac{I_2}{I_2 set}\right]^P}+B\right]\cdot T$ ≤ ±5% setting or ≤ + 40ms, at 2 < $I_2/I_{2SETTING}$ < 20
Time factor of characteristic, A	0.001 to 1000.0s, step 0.001s
Time delay of characteristic, B	0.00s to 100.00s, step 0.01s
Index of characteristic, P	0.01 to 10.00, step 0.01
Time constant of characteristic, T	0.025 to 1.500, step 0.001
Minimum inverse operating time	100ms
Reset time	40ms

37, Undercurrent protection

Item	Data
Current	0.05 I_r to 40.00 I_r ≤ ±2.5% setting or ±0.02I_r
Time delay of definite time characteristic	0.00s to 100.00s, step 0.01s ≤ ±1% setting or ≤ +40ms, at 50% setting

49, Thermal overload protection

Item	Data
Current	0.05 I_r to 40.00 I_r ≤ ±2.5% setting or ±0.02I_r
Heating time constant	6s to 9999 s
Cooling coefficient	0.1 to10
IEC low temperature curve IEC 60255-8	$t=\tau\ln\left\{\frac{I_{eq}^2}{I_{eq}^2-I_\theta^2}\right\}$ ≤ ±5% setting or ≤+40ms
IEC high temperature curve IEC 60255-8	$t=\tau\ln\left\{\frac{I_{eq}^2-I_P^2}{I_{eq}^2-I_\theta^2}\right\}$ ≤ ±5% setting or ≤+40ms

24, Over-excitation protection

Item	Data
Reference voltage Un	10V to 120V ≤ ±3% setting or ±1V
Definite time characteristic	
Ratio	1.00 to 1.70 ≤ ±2.5% setting or ±0.01
Time delay of definite time characteristic	0.10s to 9999.00s, step 0.01s ≤ ±5% setting or +70ms
Reset ratio	⩾0.96
Reset time	70ms

Specification

Inverse time characteritic	
Time delay of inverse time characteristic	0.10s to 9999.00s, step 0.01s ≤ ±5% setting or ≤ +70ms
V/F characteristic value	1.05 /1.10 /1.15 /1.20 /1.25 /1.30 /1.35 /1.40 /1.45 /1.50 /1.55 /1.60 /1.65 /1.7 ≤ ±5% setting or ≤ ±70ms
Reset ratio	≥ 0.96
Reset time	70ms

59, Overvoltage protection

Item	Data
Voltage input	Phase to phase voltage or phase to earth voltage
Definite time characteristic	
phase-to-earth voltages	40.0V to 100.0 V, step 0.01 V ≤ ±2.5% setting or ± 1V
Phase to phase voltage	80.0V to 200.0 V, step 0.01 V ≤ ± 2.5% setting or ± 1V
Reset ratio	0.95 to 1, step 0.01 ≤ ±3 % setting
Time delay of definite time characteristic	0.00s to 120.00s, step 0.01s ≤ ±1 % setting or ≤ +60ms, at 120% setting
Reset time	40ms
Inverse time characteristic	
phase-to-earth voltages	40.0V to 100.0 V, step 0.01 V ≤ ±2.5% setting or ± 1V
Phase to phase voltage	80.0V to 200.0 V, step 0.01 V ≤ ±2.5% setting or ± 1V
Time delay IEC Inverse	Normal inverse; Very inverse; Extremely inverse; Short time inverse; Long time inverse; ≤ ±5% setting or ≤ + 60ms, at 2 <U/U_{set} < 20
Time delay IEEE/ANSI inverse	Inverse; Short time inverse; Long time inverse; Moderately inverse; Very inverse; Extremely inverse; Definite inverse ≤ ±5% setting or ≤ +60ms, at 2 <U/U_{set} < 20
Time delay user-defined inverse IEC60255-151	$t = \left[\frac{A}{\left[\frac{U_\Phi}{\text{Uset}} \right]^P + B} \right] \cdot T$ at 2 <U/U_{set} < 20.
Time factor of characteristic, A	0.001s to 1000.000s, step 0.001s
Time delay of characteristic, B	0.00s to 100.00s, step 0.01s
Index of characteristic, P	0.01 to 10.00, step 0.01
Time constant of characteristic, T	0.025 to 1.500, step 0.001
Minimum inverse operating time	100ms
Reset time	40ms

64, Zero sequence overvoltage protection

Item	Data
Voltage input	Calculated from 3 phase to earth voltages
Definite time characteristic	
Voltage	2 to 100 V, step 0.01 V ≤ ±5% setting or ± 1V
Time delay of definite time characteristic	0.00s to 120.00s, step 0.01s ≤ ±1 % setting or ≤ +60ms at 120% setting
Reset ratio	0.95
Inverse time characteristic	
Voltage	2 to 100 V, step 0.01 V ≤ ±5% setting or ± 1V
IEC standard curve	Normal inverse; Very inverse;

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	Extremely inverse; Short time inverse; Long time inverse; ≤ ±5% setting or ≤+60ms, at $2<3U_0/3U_0\text{set}<20$
ANSI standard curve	Inverse; Short time inverse; Long time inverse; Moderately inverse; Very inverse; Extremely inverse; Definite inverse ≤ ±5% setting or ≤ +60ms, at $2<3U_0/3U_0\text{set}<20$
Time delay user-defined inverse IEC60255-151	$t=\left[\frac{A}{\left[\frac{3U_0}{3U_0\text{set}}\right]^P-1}+B\right]\cdot T$ at $2<3U_0/3U_0\text{set}<20$
Time factor of characteristic, A	0.001s to 1000.000s, step 0.001s
Tine Delay of characteristic, B	0.00s to 100.00s, step 0.01s
Index of characteristic, P	0.01 to 10.00, step 0.01
Time constant of characteristic, T	0.025 to 1.500, step 0.001
Minimum inverse operating time	100ms
Reset time	40ms

47, Negative sequence overvoltage protection

Item	Data
Voltage input	Calculated from 3 phase to earth voltages
Definite time characteristic	
Voltage	40 to 100 V, step 0.01 V ≤ ±5% setting or ± 1V
Time delay of definite time characteristic	0.00s to 100.00s, step 0.01s ≤ ±1 % setting or ≤ +60ms, at 120% voltage setting
Reset ratio	0.95

Inverse time characteritic	
Voltage	40 to 100 V, step 0.01 V ≤ ±5% setting or ± 1V
Time delay IEC Inverse	Normal inverse; Very inverse; Extremely inverse; Short time inverse; Long time inverse; ≤ ±5% setting or ≤ + 60ms, at 2 <U_2/U_{2set} < 20
Time delay IEEE/ANSI inverse	Inverse; Short time inverse; Long time inverse; Moderately inverse; Very inverse; Extremely inverse; Definite inverse ≤ ±5% setting or ≤ + 60ms, at 2 <U_2/U_{2set} < 20
Time delay user-defined inverse IEC60255-151	$t=\left[\frac{A}{\left[\frac{U_2}{U_2\text{set}}\right]^P-1}+B\right]\cdot T$ at 2 <U_2/U_{2set} < 20
Time factor of characteristic, A	0.001s to 1000.000s, step 0.001s
Time delay of characteristic, B	0.00s to 100.00s, step 0.01s
Index of characteristic, P	0.01 to 10.00, step 0.01
Time constant of characteristic, T	0.025 to 1.500, step 0.001
Minimum inverse operating time	100ms
Reset time	40ms

27, Undervoltage protection

Item	Data
Voltage input	Phase to phase voltages or phase to earth voltages
Definite time characteristic	
phase-to-earth voltages	5.0 to 75.0 V, step 0.01 V ≤ ±2.5% setting or ± 1 V

Specification

Phase to phase voltage	10.0 to 150.0 V, step 0.01 V ≤ ±2.5% setting or ±1 V
Reset ratio	1.0 to 1.05, step 0.01 ≤ ±3% setting
Time delay of definite time characteristic	0.00s to 120.00s, step 0.01s ≤ ±1 % setting or ≤ +60ms，at 80% setting
Reset time	≤ 50ms
Inverse time characteritic	
phase-to-earth voltages	5.0 to 75.0 V, step 0.01 V ≤ ±2.5% setting or ± 1 V
Phase to phase voltage	10.0 to 150.0 V, step 0.01 V ≤ ±2.5% setting or ±1 V
Time delay IEC Inverse IEC 60255-127	Curve 1 Curve 2 Curve 3 ≤ ±5 % setting or ≤ +60ms，at 0.05<U/U_{set}t<0.5
Time delay user-defined curve IEC60255-151	$t=\left[\frac{A}{1-\left[\frac{U}{Uset}\right]^{P}}+B\right]\cdot T$ ≤ ±5 % setting or ≤ +60ms，at 0.05<U/U_{set}t<0.5
Time factor of characteristic, A	0.001s to 1000.000s, step 0.001s
Time delay of characteristic, B	0.00s to 100.00s, step 0.01s
Index of characteristic, P	0.010 to 10.000, step 0.01
Time constant of characteristic, T	0.025 to 1.500, step 0.001
Minimum inverse operating time	100ms
Reset time	40ms

59NU, Unbalanced voltage protection

Item	Data
Voltage input	Phase to phase voltage
voltage	1.00 to 100.00 V, step 0.01V ≤ ±2.5% setting or ± 1V
Time delay	0.00s to 100.00s, step 0.01s ≤ ±1% setting or ≤ +60ms, at
	120% setting
Reset ratio	0.95
Reset time	≤ 40ms

60NU, Unbalanced current protection

Item	Data
Current	0.05 I_r to 40.00 I_r ≤ ±2.5% setting or ±0.02 I_r
Time setting	0.00s to 100.00s, step 0.01s ≤ ±1% setting or ≤ +40 ms, at 200% operating setting
Reset ratio	0.95 at I/I_r>0.5
Reset time	40ms

32, Power protection

Item	Data
Power	0W to 500W ≤ ±3% setting or ±0.5P_r
Reset time	≤ 55ms

50BF, Breaker failure protection

Item	Data
Phase current Negative sequence current Zero sequence current	0.05 I_r to 40.00 I_r ≤ ±2.5% setting or ±0.02I_r
Time delay of stage 1	0.00s to 100.00 s, step 0.01s ≤ ±1% setting or ≤ +40 ms, at 200% setting
Time delay of stage 2	0.00s to 100.00 s, step 0.01s ≤ ±1% setting or ≤ +40 ms, at 200% setting
Reset ratio	0.95 at I/I_r>0.4
Reset time	≤ 30ms

50DZ, Dead zone protection

Item	Data
Current	0.05 I_r to 40.00 I_r ≤ ±2.5% setting or ±0.02I_r

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Time delay	0.00s to 100.00s, step 0.01s ≤ ±1% setting or ≤ +40 ms, at 200% setting
Reset ratio	0.95

50STUB, STUB protection

Item	Data
Current	0.05 I_r to 40.00 I_r ≤ ±2.5% setting or ±0.02I_r
Time setting	0.00s to 100.00s, step 0.01s ≤ ±1% setting or ≤ +40 ms, at 200% setting

46BC, Broken conductor detection

Item	Data
Current	0.05 I_r to 40.00 I_r ≤ ±2.5% setting or ±0.02I_r
Time setting	0.00s to 100.00s, step 0.01s ≤ ±1% setting or ≤ +40 ms, at 200% setting

81U, Under frequency protection

Item	Data
Frequency	45.00 to 50.00Hz, step 0.01Hz at F_r = 50Hz 54.00 to 60.00Hz, step 0.01Hz at F_r = 60Hz ≤ ± 20mHz
Time delay	0.1s to 100.00 s, step 0.01s ≤ ±1.5% setting or ≤+60 ms,
Change of rate Δf/Δt	0.3 to 20Hz/s ≤±0.5Hz/s
Blocking voltage	10 to 120V, step 0.01V ≤±2.5% setting or ± 1V
Blocking current	0 to 10I_r ≤±2.5% setting or +0.01I_r

81O, Over frequency protection

Item	Data
Frequency	50.00 to 55.00Hz, step 0.01Hz at F_r = 50Hz 60.00 to 66.00Hz, step 0.01Hz at F_r = 60Hz ≤ ± 20mHz
Time delay	0.1s to 100.00 s, step 0.01s ≤ ±1.5% setting or ≤ +60 ms,
Blocking voltage	10 to 120V, step 0.01V ≤±2.5% setting or ± 1V

81DF, Frequency change rate protection

Item	Data
Change of rate Δf/Δt	0.1 to 20Hz/s ≤±0.5Hz/s
Time delay	0.1s to 100.00s, step 0.01s ≤ ±1.5% setting or ≤ +60 ms
Upper limit of frequency change rate	0 to 20Hz/s ≤±0.5Hz/s
Lower limit of frequency change rate	0 to 20Hz/s ≤±0.5Hz/s
Blocking voltage	30 to 120V, step 0.01V ≤±2.5% setting or ± 1V

50SOTF, Switch-on-to-fault protection

Item	Data
Current	0.05 I_r to 40.00 I_r ≤ ±2.5% setting or ±0.01I_r
Time delay	0.00s to 100.00s, step 0.01s ≤ ±1% setting or ≤ +40 ms, at 200% setting
Reset ratio	0.95 at I/I_r>0.5
Reset time	40ms

25, Synchro-check & energizing check

Item	Data
Modes of Synchro-check	▪ Synchronization check ▪ Energizing check, and synchronous check after energizing check failure

Specification

	▪ Override
Modes of Energizing check	▪ Dead line & dead bus ▪ Live line & dead bus ▪ Dead line & live bus
Maximum dead voltage setting at energizing check mode (Phase to earth voltage)	10V to 50 V, step 0.01 V ≤ ±3% setting or ± 1V
Minimum live voltage setting at synchronization check mode (Phase to earth voltage)	30V to 65 V, step 0.01 V ≤ ±3% setting or ± 1V
ΔV- voltage difference (Phase to earth voltage)	1V to 40 V, step 0.01 V ≤ ±1V
Δf- frequency difference (f2>f1; f2<f1)	0.02 to 2.00Hz, step 0.01Hz ≤ ±20mHz
Δα- angle difference (α2>α1; α2<α1)	1 ° to 10 °, step of 0.01 ° ≤ ±3°
Disable synchronization check time	0.02s to 100.00 s, step 0.01s ≤ ±1.5% setting or ≤ +60 ms
Maximum synchronous check broadening time	0.05s to 100.00 s, step 0.01s ≤ ±1% setting or ≤ +50 ms

79, Auto reclosing

Item	Data
Shots of reclosing	1 to 4
Reclosing initiated inputs	Internal protection startups External binary input
Time delay for each shot of reclosing	0.05s~600.00s, step of 0.01 s ≤ ±1.5% setting or ≤ +60 ms
Reclosing confirmation time	0.10 s~100.00s, step of 0.01 s ≤±1.5% setting or ≤ +60 ms
Reclosing charging time	0.05 s~100.00s, step of 0.01 s ≤ ±1.5% setting or ≤ +60 ms
Disable synchronization check time	0.05s to 100.00 s, step 0.01s ≤ ±1.5% setting or ≤ +60 ms

27LS, Load shedding by undervoltage

Item	Data
Voltage input	Phase to phase voltages or phase to earth voltages
Voltage	50V to 110 V, step 0.01 V
	≤ ±3% setting or ± 1V
Time delay	0.1s to 100.00s, step 0.01s ≤ ±1.5 % setting or ≤ +60ms
Blocking element	
Voltage change rate, Δu/Δt	2V/s~200V/s, step 0.01V/s ≤ ±3% setting or ±1V/s
Blocking voltage	10V to 120V, step 0.01V ≤±3% setting or ± 1V

50LS, Load shedding by overload

Item	Data
Current	0.05 I_r to 40.00 I_r ≤ ±3% setting or ±0.02 I_r
Time delay	0.10s to 100.00s, step 0.01s ≤ ±1.5% setting or ≤ +60ms
Blocking element	
Frequency changing rate Δf/Δt	0.3Hz/s~20Hz/s, step 0.01Hz/s ≤±0.5Hz/s
Voltage change rate, Δu/Δt	2V/s~200V/s, step 0.01V/s ≤ ±3% setting or ±1V/s
Blocking voltage	10V to 120V, step 0.01V ≤±3% setting or ± 1V

79-81ULS, Auto-reclosing based on load shedding by underfrequency

Item	Data
Frequency	45.00 to 50.00Hz, step 0.01Hz at F_r = 50Hz 54.00 to 60.00Hz, step 0.01Hz at F_r = 60Hz ≤ ± 20mHz
Time setting	0.10s to 100.00 s, step 0.01s ≤ ±1.5% setting or ≤ +60 ms

97FF, VT secondary circuit supervision

Item	Data
Phase current	0.05 I_r to 40.0 I_r, step 0.01A ≤ ±3% setting or ±0.02 I_r
Zero or negative sequence current	0.05 I_r to 40.0 I_r, step 0.01A ≤ ±5% setting or ±0.02 I_r

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Phase to earth voltage	5.0V to 20.0V, step 0.01V ≤ ±3% setting or ± 1 V
Phase to phase voltage	10.0V to 30.0V, step 0.01V ≤ ±3% setting or ± 1 V

Reset phase to earth voltage or phase to phase voltage	40.0V to 120.0V, step 0.01V ≤ ±3% setting or ± 1 V