CSC-237

Motor Protection IED

Product Guide

BEIJING SIFANG AUTOMATION CO., LTD.

Version：V1.00

Issued Date：2025.10

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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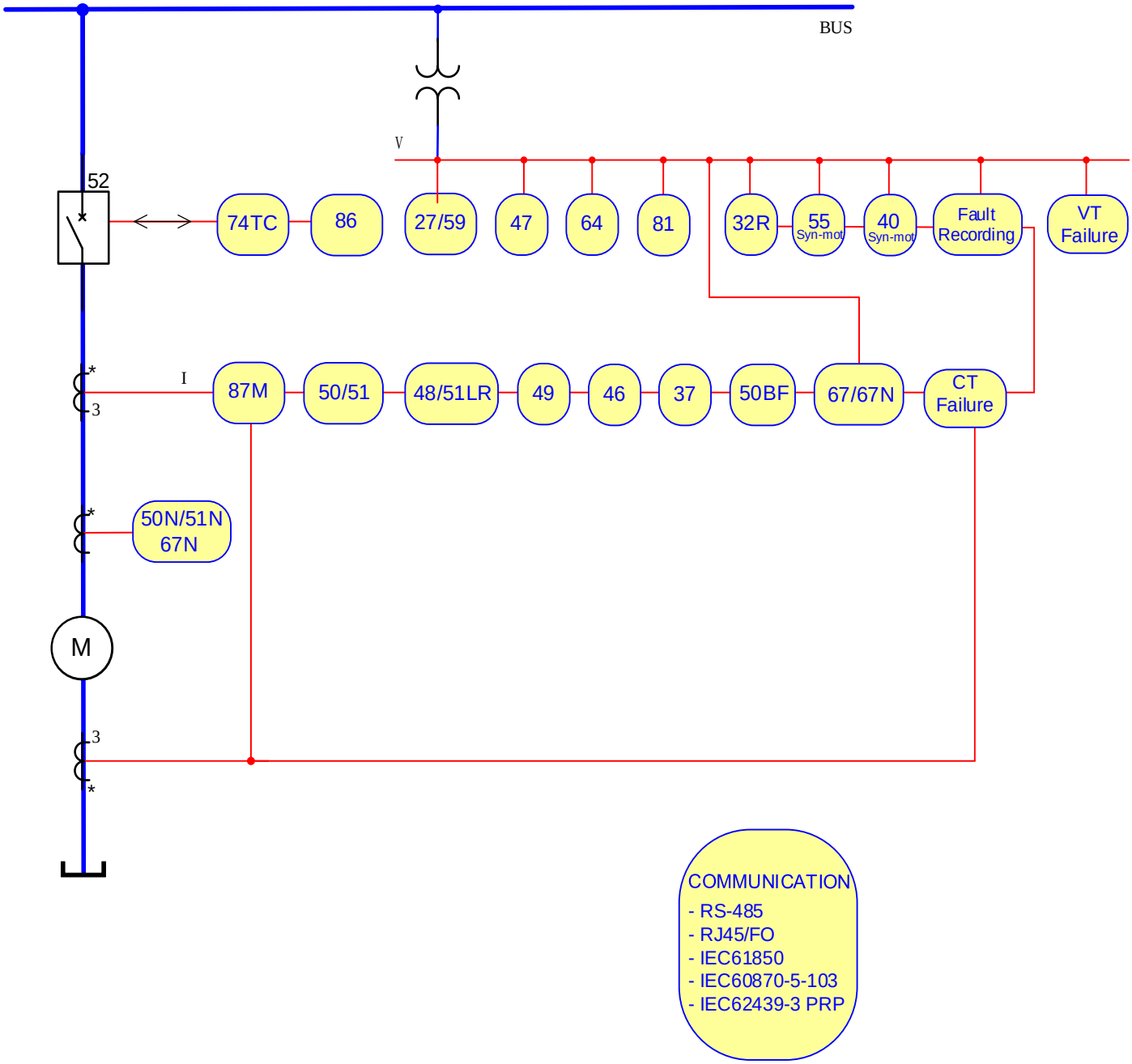
换照片

CSC-237 is an integrated solution for the complete protection, control and monitoring of 6~35kV medium and large rating induction and synchronous motors. CSC-237 provides advanced functionality such as current differential protection, magnetic balance protection, locked-rotor protection, etc., programmable logic, and advanced motor monitoring.

- Powerful capability to meet various applications:
- Comprehensive functionality including current differential or magnetic balance protection, overcurrent and earth overcurrent protection, voltage protection, frequency protection, breaker failure protection, thermal overload protection, phase reversal, locked-rotor, etc.
- Embedded TCS and lockout relays, or optional operating module.
- Wide range of supported protocols IEC 61850, IEC 60870-5-103, DNP3.0 and Modbus. And redundant communications with zero downtime using PRP protocol
- Robust hardware with excellent EMC performance and IP54 protection under -40℃ to 70℃ operating temperature

Application



Function

Function	ANSI Code	Qty.	Description
Motor differential protection	87M	1	Low-impedance current differential protection with biased characteristic, detection of CT saturation
Magnetic balance overcurrent protection (only one activated alongside 87M)		1	2 stages, An alternative self-balance winding differential using IA2, IB2, IC2 set of CT's
Prolonged start protection	48	1	1 stage, start time >TstaSet
Stall protection / Locked rotor protection	51LR	1	1 stage, Imax > StallCurrSet & t >StallTime
t_E Time Protection		1	For Type 'e' Increased Safety motors, tETime for alarm and trip
F-C overcurrent blocking		1	For motors controlled by F-C (High-Voltage Fuse-Contactor) combinations, Imax > F-C OCBlkCurrSet
Reverse phase sequence protection		1	Check the phase sequence of current accessed of side 1 and side 2, delay 15s alarm
Instantaneous overcurrent protection	50, 67	1	2 stages, Forward/reverse/non-directional, Definite time (DT) characteristic
Overcurrent protection	51	1	1 stage; Definite time/ Inverse time characteristic
Directional earth fault protection	50N, 51N, 67N	1	1 stage; Forward/reverse/non-directional; Definite time / Inverse time characteristic; 3 phase current inputs or single current input
Sensitive directional earth fault protection	50Ns, 51Ns, 67Ns	1	1 stage; Forward/reverse/non-directional; Definite time / Inverse time characteristic; single sensitive current input
Negative sequence overcurrent protection	46	1	2 stages for alarm and trip; Forward/reverse/non-directional; Definite time/ Inverse time characteristic
Undercurrent protection	37	1	1 stage, 0.04A <Imax< UCCurrSet
Thermal overload protection	49	1	2 stages for alarm and trip, Temperature model (low temperature curve or high temperature curve) is from IEC60255-8 standard.
Overvoltage protection	59	1	2 stages for alarm and trip; Definite time characteristic;
Zero sequence overvoltage protection	64	1	1 stage; Definite time characteristic; 3 phase voltage inputs or single voltage input
Negative sequence overvoltage protection	47	1	2 stages; Definite time characteristic
Undervoltage protection	27	1	2 stages for alarm and trip; Definite time characteristic;
Low power protection	32F	1	1 stage for alarm, 1W <P< LowPowerProtPowerSet
Reverse power protection	32R	1	2 stages for alarm and trip,
Low load protection		1	1 stage for trip, 0.05Ir <Imax< LowLoadCurrCoef

Function

Out-of-step protection on synchronous motor	55	1	1 stage for trip, φset <φm< 180° -φset
Loss-of-field protection on synchronous motor	40	1	1 stage for trip, AsychronousImpedZb <ℤ< AsychronousImpedZa
Asynchronous impact protection on synchronous motor		1	1 stage for trip, 0 <P< LowPowerset, or -P> RvsPowerSet
Breaker failure protection	50BF	1	2 stages , re-tripping and busbar tripping in sequence
Under frequency protection	81U	1	1 stage;
Over frequency protection	81O	1	1 stage;
Frequency change of rate protection	81DF	1	1 stage;
Load shedding by undervoltage	27LS	1	1 stage;
Load shedding by overload	50LS	1	1 stage;
External inputs		1	4 BIs for alarm and trip
CT secondary circuit supervision		1	1 stage for alarm, 1 stage for enable/ disable blocking differential protection
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	1	
4~20mA analog intput		1	Optional, using for temperature indication of the motor
4~20mA analog output		3	Optional, using for analog indication for an RTU or DCS
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.

communication

- Support MMS, GOOSE service of station layer and bay layer application in accordance with IEC61850-8-1
- 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

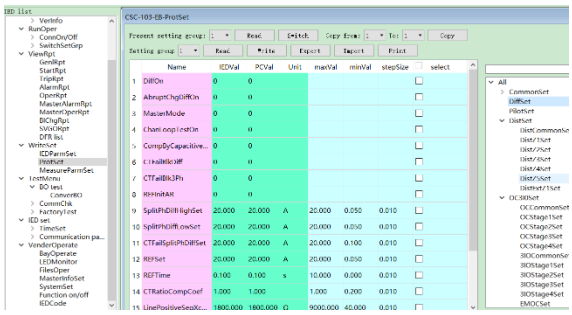
Hardware

AESP tools

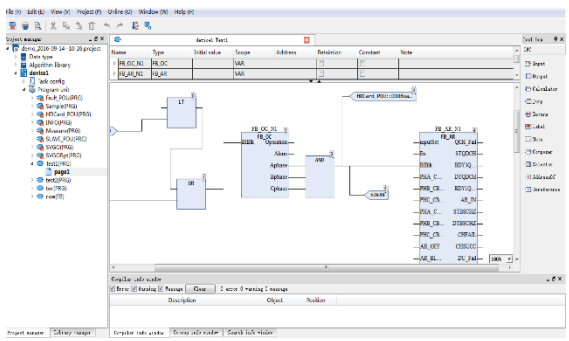
AESP is the user-friendly engineering and commissioning software. The software is applicable to all protection and BCU IEDs of Sifang. It provides integrated configuration and monitoring functions.

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



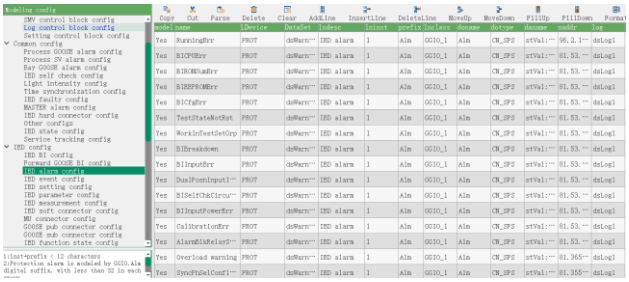
Setting and parameter



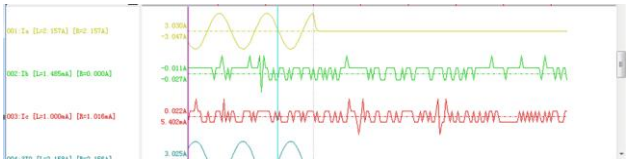
Graphic programmable logic

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

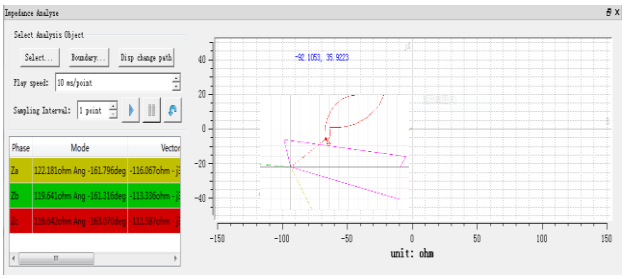


IED 61850 configurator



Fault recorder analysis

Fault recorder analysis



Impedance analysis

- Up to 11 AC current inputs and 4 voltage inputs, 1A/5A settable;

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- Up to 18 binary inputs;
- Up to 16 binary output relays, with 1 switchable NO/NC contact
- Up to 3 4~20mA analog output and 1 4~20mA analog input
- Up to 3 RJ45 Ethernet ports or 2 LC optical Ethernet ports 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 key, 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

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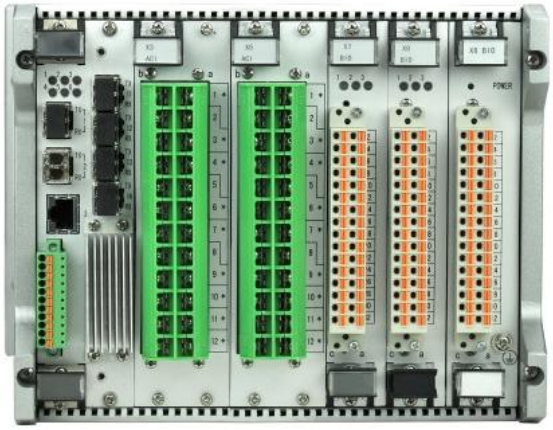
Front view of the 4U 1/2 19” case



Rear view of the 4U 1/2 19” case

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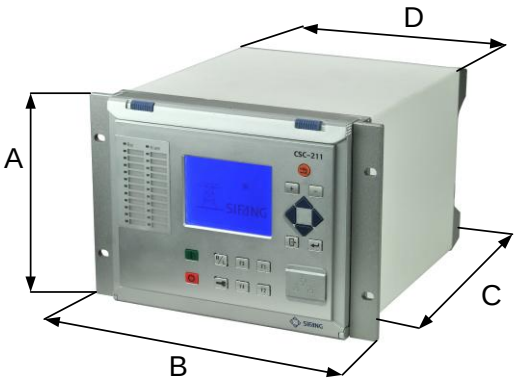
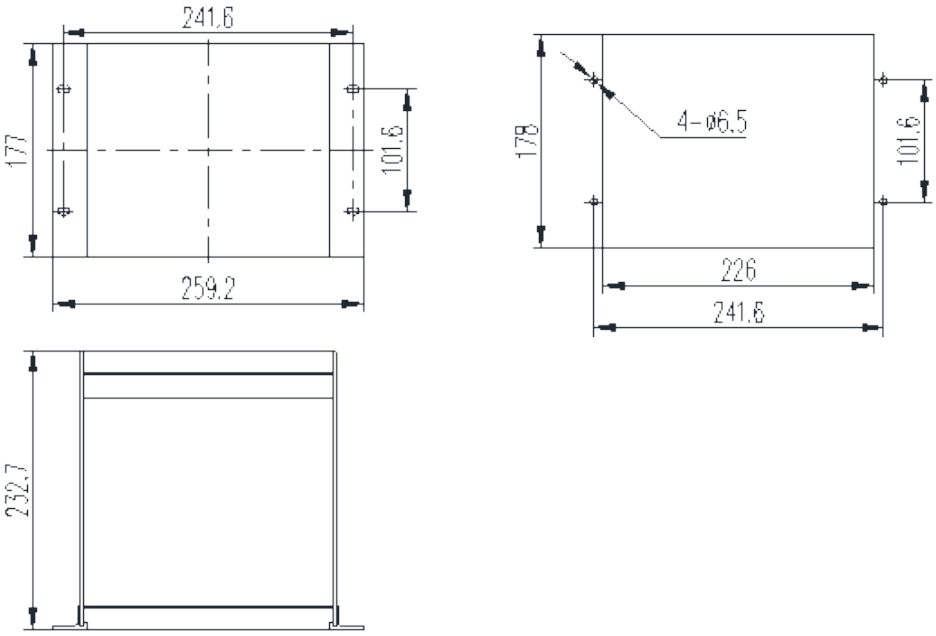


A	177
B	259.2
C	286
D	226
Unit	mm

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

Hardware



CSC-237 installation size

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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 or 0.005～1.000A,
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

Specification

	Power relay: 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

AO 4~20mA parameters list

Item	4mA	20mA(5A CT)	20mA(1A CT)
Ia	0	6A	1.2A
Ib	0	6A	1.2A
Ic	0	6A	1.2A
Ua	0	120V	120V
Ub	0	120V	120V
Uc	0	120V	120V
Uab	0	200V	200V
Ubc	0	200V	200V
Uca	0	200V	200V
P	0	2500W	2500W
Q	0	2500W	2500W
Pa	0	750W	750W
Pb	0	750W	750W
Pc	0	750W	750W
Qa	0	750W	750W
Qb	0	750W	750W
Qc	0	750W	750W

Auxiliary power

Item	Data
Rated voltage V$_{r.aux}$ IEC60255-1	110V to 250V$_{dc/ac}$ 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 61850 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

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Specification

	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: IP52Rear: 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; 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;

Specification

	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 IEC60255-22 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
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 IEC 60255-1 EN 60255-21-2	Class 1
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)

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Specification

87M, Motor differential protection

Item	Data
Differential current threshold	0.05 I_r to 20.00 I_r ⩽ ±3% setting or ±0.02 I_r
Restraint factor, k1	0.2 - 0.7
2nd harmonic restraint factor, k2zd	0.07 - 0.5
Operating time	⩽ 20ms at 200% setting
Reset time	60ms

Magnetic balance overcurrent protection

Item	Data
Current inputs	IA2, IB2, IC2
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 100.00s, step 0.01s ⩽ ±1% setting or ⩽ +40ms, at 200% setting
Reset time	40ms
Drop-off ratio	0.95 at I/I_r>0.5

48, Prolong start protection

Item	Data
Time delay	1.00s to 100.00s, step 0.01s ⩽ ±1% setting or ⩽ +40ms
Reset time	30ms

51LR, Shall / Locked rotor protection

Item	Data
Definite time characteristic	
Current	0.08 I_r to 40.00 I_r ⩽ ±3% setting or ±0.02 I_r
Time delay of definite time characteristic	0.10s to 100.00s, step 0.01s ⩽ ±1% setting or ⩽ +40ms, at 200% setting
Reset time	40ms
Drop-off ratio	0.95 at I/I_r>0.5

50, 67, Instantaneous overcurrent protection

Item	Data
Definite time characteristic	
Current	0.05 I_r to 20.00 I_r ⩽ ±2.5% setting or ±0.02 I_r
Time delay of definite time characteristic	0.00s to 100.00s, step 0.01s ⩽ ±1% setting or ⩽ +40ms, at 200% setting
Reset time	40ms
Drop-off ratio	0.95 at I/I_r>0.5
Directional element	
Characteristic angle	0° to 90°, step 1° ⩽ ±3°, at phase to phase voltage >2V

51, 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 100.00s, 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	$t = \left[\frac{A}{\left[\frac{I_\Phi}{Iset}\right]^P - 1} + B\right] \cdot T$ ⩽ ±5% setting or ⩽ + 40ms, at 2 <$I/I_{SETTING}$ < 20
Time factor of characteristic, A	0.001 to 1000.0s, step 0.001s

Specification

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	100ms
Reset time	Instantaneous

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 100.00s, 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
Time delay user-defined inverse IEC 60255-151	$t=\left[\frac{A}{\left[\frac{3I_0}{3I_0 set}\right]^P-1}+B\right]\cdot T$ ⩽ ±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
Minimum inverse operating time	100ms
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 6.000 A or 0.005～1.000A,, step 0.001 A, ⩽ ±2.5 % setting or 1 mA
Time delay of definite time characteristic	0.00s to 100.00, step 0.01 s ⩽ ±1.5 % setting or ⩽ +40ms, at 200% setting
Drop-off ratio	0.95 at I/I_r>0.5
Reset time	40ms
Inverse time characteristic	
Current for sensitive CT input	0.005 to 6.000 A , or 0.005～1.000A,, 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;

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	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; ⩽ ±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
Drop-off 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	$t=\left[\frac{A}{\left[\frac{I_2}{I_2\text{set}}\right]^{P}-1}+B\right]\cdot T$ ⩽ ±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	0.00s to 100.00s, step 0.01s

Specification

characteristic, B	
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)
Characteristic angle Φ_SEFChar	0° to 90°, step 1° ⩽ ±3°, at 3U2⩾2V
Operating area range	160°, ⩽ ±3°, at 3U2⩾2V

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

59, Overvoltage protection

Item	Data
Voltage input	Phase to phase voltage or phase to earth voltage
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
Drop-off 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

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
Drop-off 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; 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;

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Specification

	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
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
Drop-off ratio	0.95

27, Undervoltage protection

Item	Data
Voltage input	Phase to phase voltages or phase to earth voltages
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
Drop-off 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

32F, Low Power protection

Item	Data
Power	0W to 1000W, step 0.01W ⩽ ±3% setting or ±0.5P
Reset time	⩽ 55ms

32R, Reverse Power protection

Item	Data
Power	8W to 1000W, step 0.01W ⩽ ±3% setting or ±0.5P_r
Reset time	⩽ 55ms

Low Load protection

Item	Data
Current coefficient	0.06 to 1.00A, step 0.01A, ⩽ ±3% setting or 0.02I_r
Time delay	0.20s to 6000.00 s, step 0.01s ⩽ ±1% setting or ⩽ +50 ms, at 80% setting
Drop-off radio	1
Reset time	⩽ 60ms

55 Out-of-step protection on synchronous motor

Item	Data
Out-of-step power factor angle φset	0° to 60°, step 0.01°, at ⩽ ±2.5% setting or ±2°
Out-of-step current block setting	0.05 I_r to 20.00 I_r, step 0.01A, ⩽ ±2.5% setting or ±0.02I_r
Time delay	0.10s to 100.00 s, step 0.01s
Static impedance Zt	0.10Ω to 100.00Ω, step 0.01Ω

Specification

40 Loss-of-field protection on synchronous motor

Item	Data
Asynchronous impedance	0.10Ω to 100.00Ω, step 0.01Ω, at ⩽ ±2.5% setting

Asynchronous Impact protection on synchronous motor

Item	Data
Power	0.1W to 1000W, step 0.01W ⩽ ±3% setting or ±0.5P
Time delay	0.10s to 100.00s, step 0.01s ⩽ ±1% setting or ⩽ +40ms, at 200% setting

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
Drop-off ratio	0.95
Reset time	⩽ 20ms

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,
Blocking elements	
Change of rate Δf/Δt	0.1 to 20Hz/s, step 0.01Hz/s⩽±0.5Hz/s
Blocking voltage	10 to 120V, step 0.01V ⩽±2.5% setting or ± 1V
Blocking current	0.05 to 10I_r, step 0.01A ⩽±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 elements	
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	0.3 to 20Hz/s, step 0.01Hz/s ⩽±0.5Hz/s
Time delay	0.1s to 100.00s, step 0.01s ⩽ ±1.5% setting or ⩽ +60 ms
Blocking elements	
Upper limit of frequency change rate	0 to 50Hz/s, step 0.01Hz/s ⩽±0.5Hz/s
Lower limit of frequency change rate	0 to 50Hz/s, step 0.01Hz/s ⩽±0.5Hz/s
Blocking voltage	30 to 120V, step 0.01V ⩽±2.5% setting or ± 1V

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Specification

27LS, Load shedding by undervoltage

Item	Data
Voltage input	Phase to phase voltages or phase to earth voltages
Voltage	50V to 120 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 elements	
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, step 0.01A ⩽ ±3% setting or ±0.02 I_r
Time delay	0.10s to 100.00s, step 0.01s ⩽ ±1.5% setting or ⩽ +60ms
Blocking elements	
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

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
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