

PCS-9611S Feeder Relay

DataSheet

About This Document

The manual describes the control, protection, measurement and supervision functions with the information of relevant hardware for PCS-9611S Feeder Relay.

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Document Revision History

PN: ZL_PCS-9611S_X_DataSheet_EN_Overseas General_X

Current version: R1.05

Corresponding Version		Release Date	Description of change
Document	Software		
R1.00	R1.10	2019-01-31	<ul style="list-style-type: none">● Form the original manual.
R1.01	R1.10	2019-04-19	<ul style="list-style-type: none">● Control functions are modified
R1.02	R1.11	2019-07-19	<ul style="list-style-type: none">● Thermal overload protection and arc flash protection are added;● GOOSE & SV communication related contents are added;● Voltage selection function is modified.
R1.03	R1.12	2019-11-21	<ul style="list-style-type: none">● Broken conductor protection is added;● The VT circuit supervision function is modified.
R1.04	R1.12	2020-01-08	<ul style="list-style-type: none">● The technical data is modified
R1.05	R1.14	2020-03-27	<ul style="list-style-type: none">● Voltage selection function is modified;● The typical wiring is modified.

Overview



The PCS-9611S feeder relay is a protection, control and monitoring unit for various primary equipments (such as overhead line, underground cable, capacitor and transformer etc.) on solidly grounded, impedance grounded, Peterson coil grounded and ungrounded system. With its flexibility and the powerful PCS-Studio configuration tool, the PCS-9611S offers future-oriented system solutions with high investment security and low operating costs.

The PCS-9611S is widely adopted not only for conventional substations, but also for digital substations. It supports IEC 61850 Editions 1 and 2 and provides GOOSE and SV network interfaces with high real-time performance. The process level network supports peer-to-peer (P2P) mode and networking mode, including single network mode and dual network mode. The station level network can also receive and send MMS messages (such as interlocking signals) or process level GOOSE messages (such as circuit breakers or disconnectors positions and trip signals).

Highlights

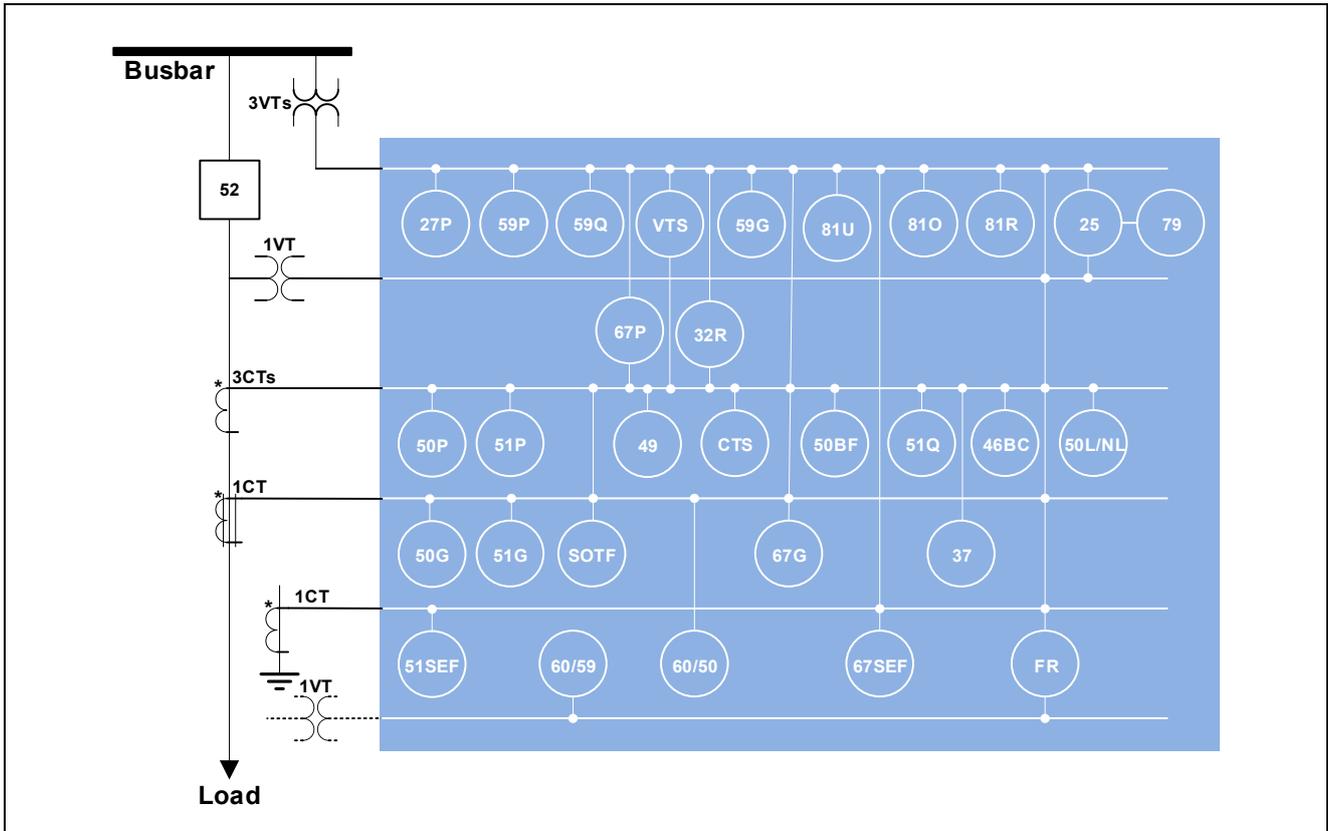
- Unified software and hardware platform, comprehensive power grid solutions of protection, control, measurement and monitoring, easy to use and maintain.
- High reliability and redundancy design for drive systems of the sampling and the output circuit ensure that the overall reliability of the device is high. Real-time sampling based on dual AD can mutually check and detect the potential abnormality in the sampling circuit in time. The control power supply of the output relay is independent with the control circuit of trigger signals, which can prevent from undesired operation caused by the abnormality of drive circuit of output relays.
- Various function modules can satisfy various situations according to the different requirements of users. Flexible and universal logic programming, user-defined configuration of BI/BOs, buttons and LEDs and powerful analogue programming are supported.
- Modularized hardware design makes the device be easily upgraded or repaired by a qualified service person. It can be combined with different I/O modules, with online self-check and monitoring function, and the device can be restored from abnormal operation only need to replace a single abnormal module.
- Support memory check and error correction function, ensure high reliability and safety.
- Support the internet communication protocol of native PRP/HSR and RSTP.
- Fully compatible with IEC 61850 edition 1 & edition 2, support MMS service, IEC 62351 communication service, GOOSE communication in station level & process level, SV communication with multi-sampling rate.
- Fully comply with cyber security standards, including IEC62443, IEC62351, IEEE1686, NERC-CIP, support role based access control (RBAC), security audit, security encryption communication and security tool, improve the cyber security capability of devices.
- Powerful COMTRADE fault and disturbance recording function is supported. The whole recording time is automatically configurable by the fault duration, which is convenient to fault analysis and replay. The recording sample rate is up to 9.6kHz.
- Settable secondary rated current (1A/5A) and settable voltage threshold of binary input
- Support small size and large size LCD, control and multifunction button
- Support flush mounting, semi-flush mounting, surface mounting, wall mounting and other mounting methods.
- Cross screw IO, CT/VT terminals can support AWG12 specification connector and 4mm² lead
- Multiple variants with case size 1/2 or 1/3 × 19"
- Protection class of front side is up to IP54

- PCS-Studio engineering tool is the application software on the user's PC to interface with PCS S series devices providing all the related functionality. It ranges from device configuration to entire substation design of bay integration.
- Support IEEE1588, IRIG-B clock synchronization
- Support actual system phase sequence, either ABC or ACB, incorrect connection of actual phase sequence can automatically be verified and relevant protection functions can be blocked.
- Equipped with high-speed large capacity output relay, its operation speed is less than 1ms and its break capacity is up to 10A. The real-time supervision for output drive circuit can detect the abnormality in advance.
- Support setup up to 40 users and allow each user to own different password and access authority.

Features

- Fully integrates multi functions into one device and can realize the protection and monitoring function of feeder and capacitor etc.
- Comprehensive functionality includes phase overcurrent protection, earth fault overcurrent protection, negative-sequence overcurrent protection, sensitive earth fault protection, overvoltage protection, undervoltage protection, frequency protection, reverse power protection, undercurrent protection, breaker failure protection etc. The breaker failure, reclosing, measuring, monitoring and control function are supported. The high sampling rate of recording is up to 9.6kHz.
- The overcurrent protection is combined with harmonic blocking and cold load pickup logic, which can prevent mal-operation affected by inrush current while the transformer is no-load energized.
- Selectable IEC, ANSI inverse-time characteristic curves that can be defined by users, and the inverse-time drop-out curve selection is supported.
- Overvoltage and undervoltage protection support single phase and three phase operation criteria setting, phase voltage and phase-to-phase voltage measurement mode are selectable, which can be for various applications.
- Complete event recording function is provided: 64 latest protection operation reports, 1024 latest supervision records, 1024 latest control operation records, 1024 latest user operation records and 1024 latest records of time tagged sequence of event (SOE) can be recorded.

Functions Overview



Protection Functions

ANSI	Protection Functions	Remark
67P 50/51P	Phase overcurrent protection	<ul style="list-style-type: none"> ✧ Up to 6 stages with independent logic ✧ Voltage control element for each stage ✧ Optional direction element for each stage, including forward direction, reverse direction and non-direction ✧ Optional definite-time characteristic and inverse-time characteristic for each stage ✧ Selectable trip purpose or alarm purpose for each stage ✧ Harmonic control element for each stage

<p>67G 50/51G</p>	<p>Earth fault protection</p>	<ul style="list-style-type: none"> ✧ Up to 6 stages with independent logic ✧ Optional direction element for each stage, including forward direction, reverse direction and non-direction ✧ Optional measured zero-sequence current or calculated zero-sequence current ✧ Optional definite-time characteristic and inverse-time characteristic for each stage ✧ Selectable trip purpose or alarm purpose for each stage ✧ Harmonic control element for each stage
<p>A.67G A.50/51G</p>	<p>Another group of earth fault overcurrent protection</p>	<ul style="list-style-type: none"> ✧ Only measured zero-sequence current is supported ✧ Up to 6 stages with independent logic ✧ Optional definite-time characteristic and inverse-time characteristic for each stage ✧ Selectable trip purpose or alarm purpose for each stage
<p>50/51Q</p>	<p>Negative sequence overcurrent protection</p>	<ul style="list-style-type: none"> ✧ Up to 2 stages with independent logic ✧ Optional direction element for each stage, including forward direction, reverse direction and non-direction ✧ Optional definite-time characteristic and inverse-time characteristic for each stage ✧ Selectable trip purpose or alarm purpose for each stage
<p>46BC</p>	<p>Broken conductor protection</p>	<ul style="list-style-type: none"> ✧ Adopt the ratio of negative-sequence current to positive-sequence current (I_2/I_1) to detect the broken conductor.
<p>50/51SEF</p>	<p>Sensitive earth fault protection</p>	<ul style="list-style-type: none"> ✧ The measured zero-sequence current from the high-precision CT is adopted ✧ Up to 6 stages with independent logic ✧ Optional direction element for each stage, including forward direction, reverse direction and non-direction ✧ Optional definite-time characteristic and inverse-time characteristic for each stage ✧ Selectable trip purpose or alarm purpose for each stage

50/51R	RMS overcurrent protection	<ul style="list-style-type: none"> ✧ Up to 2 stages with independent logic ✧ Full-current RMS value includes 2nd~11th harmonic components ✧ Selectable trip purpose or alarm purpose for each stage
37	Undercurrent protection	<ul style="list-style-type: none"> ✧ Optional blocking condition, including CB position and current criterion ✧ Selectable trip purpose or alarm purpose for each stage
50BF	Breaker failure protection	<ul style="list-style-type: none"> ✧ Breaker failure protection and re-trip function ✧ Optional current criterion (phase overcurrent element, zero-sequence overcurrent element, negative-sequence overcurrent element) ✧ It can be initiated by current, circuit breaker position or external binary input ✧ Two time delays
50PSOTF 50GSOTF	Switch-on-to-fault protection	<ul style="list-style-type: none"> ✧ One stage of phase overcurrent SOTF protection ✧ One stage of earth fault overcurrent SOTF protection ✧ Harmonic control element ✧ Voltage control element for phase overcurrent SOTF protection
59P	Overvoltage protection	<ul style="list-style-type: none"> ✧ Up to 2 stages with independent logic ✧ Optional definite-time characteristic and inverse-time characteristic for each stage ✧ Optional phase voltage or phase-to-phase voltage ✧ Optional “1-out-of-3” logic or “3-out-of-3” logic ✧ Selectable trip purpose or alarm purpose for each stage

27P	Undervoltage protection	<ul style="list-style-type: none"> ✧ Up to 2 stages with independent logic ✧ Optional definite-time characteristic and inverse-time characteristic for each stage ✧ Optional phase voltage or phase-to-phase voltage ✧ Optional “1-out-of-3” logic or “3-out-of-3” logic ✧ Check mode using circuit breaker position and current criterion ✧ Blocked by instantaneous VT circuit failure ✧ Selectable trip purpose or alarm purpose for each stage
59Q	Negative sequence overvoltage protection	<ul style="list-style-type: none"> ✧ Up to 2 stages with independent logic ✧ Selectable trip purpose or alarm purpose for each stage
59Pos	Positive-sequence overvoltage protection	<ul style="list-style-type: none"> ✧ One stage of positive-sequence overvoltage protection ✧ Selectable trip purpose or alarm purpose
59G	Residual overvoltage protection	<ul style="list-style-type: none"> ✧ Up to 2 stages with independent logic ✧ Optional measured zero-sequence voltage or calculated zero-sequence voltage ✧ Selectable trip purpose or alarm purpose for each stage
81O	Overfrequency protection	<ul style="list-style-type: none"> ✧ Up to 6 stages with independent logic ✧ Voltage control element
81U	Underfrequency protection	<ul style="list-style-type: none"> ✧ Up to 6 stages with independent logic ✧ Voltage control element
81R	Rate of change of frequency protection	<ul style="list-style-type: none"> ✧ Up to 6 stages with independent logic ✧ Voltage control element
32R	Reverse power protection	<ul style="list-style-type: none"> ✧ Up to 2 stages with independent logic ✧ Selectable trip purpose or alarm purpose for each stage
60/50	Current unbalance protection	<ul style="list-style-type: none"> ✧ Up to 2 stages with independent logic ✧ Selectable trip purpose or alarm purpose for each stage

60/59	Voltage unbalance protection	<ul style="list-style-type: none"> ◇ Up to 2 stages with independent logic ◇ Selectable trip purpose or alarm purpose for each stage
CLP	Cold load pickup	<ul style="list-style-type: none"> ◇ It can be triggered by on-load signal or circuit breaker position ◇ Short resetting is supported
25	Synchro-check	<ul style="list-style-type: none"> ◇ Independent logic for auto-reclosing and manually closing
49	Thermal overload protection	<ul style="list-style-type: none"> ◇ Two stages of thermal overload protection, one stage for alarm purpose and the other stage for trip purpose
50L/NL	Arc flash protection	<ul style="list-style-type: none"> ◇ The arc flash signal is acquired by an arc sensor ◇ It is combined with the auxiliary fault current criterion
79	Auto-reclosing	<ul style="list-style-type: none"> ◇ One shot or multi-shot ◇ 3-pole AR ◇ It can be triggered by protection operation signal or external binary input signal ◇ Supports synchronism check or dead charge check

Control Functions

- Circuit breaker & disconnecter control (Remote/local)
- Synchronism check for remote and manual closing

Measurement Functions

- Energy metering (active and reactive energy are calculated in import respectively export direction)
- Power (Apparent/Real/Reactive)
- Power Factor
- Frequency
- Event Recorder including 1024 disturbance items, 1024 binary events, 1024 supervision events, 256 control logs and 1024 device logs.
- Disturbance recorder including 64 disturbance records with waveforms (The file format of disturbance recorder is compatible with international COMTRADE file.)

Supervision Functions

- VT circuit supervision
- CT circuit supervision
- Trip/Close coil supervision
- Self-diagnostic
- DC power supply supervision
- System frequency supervision

Digital Interface

- Support IEC 61850 MMS Server via extendable electrical or optical Ethernet port
- Support IEC 61850-8-1 GOOSE via extendable electrical or optical Ethernet port
- Support IEC 61850-9-2LE SV via extendable electrical or optical Ethernet port

Communication Functions

- Up to four 10Base-T/100Base-TX copper Ethernet ports using IEC 61850, DNP3.0 or IEC 60870-5-103 over TCP/IP
- Up to four 100Base-FX optical Ethernet ports using IEC 61850, DNP3.0 or IEC 60870-5-103 over TCP/IP
- Two RS-485 serial ports using IEC 60870-5-103 or Modbus
- One RS-485 serial port for clock synchronization
- Support GOOSE communication module using IEC 61850-8-1 GOOSE
- Full compatibility between IEC 61850 Editions 1 and 2
- Redundancy protocols PRP and HSR
- One front RJ45 port for debugging

User Interfaces

- Friendly HMI interface with LCD, easy-to-use keypad aids simple navigation and set-point adjustment
- Push buttons for open/close, switch for selection between local and remote control, and user's login and logout authority management
- 4 Programmable operator push-buttons with user-configurable labels
- Up to 15/18 (6U, 1/3 × 19" or 6U, 1/2 × 19" chassis) programmable target LEDs with

user-configurable labels

- 1 RS-485 rear ports for printer
- Language switchover—English+ selected language
- Auxiliary software—PCS-Studio

Additional Functions

- User programmable logic
- Fault location
- Fault phase selection
- System phase sequences rotation function (ABC or ACB)
- Clock synchronization
 - ✧ IRIG-B: IRIG-B via RS-485 differential level or TTL level
 - ✧ PPS: Pulse per second (PPS) via RS-485 differential level or binary input
 - ✧ PPM: Pulse per minute (PPM) via RS-485 differential level or binary input
 - ✧ IEEE1588: Clock message based on IEEE1588 via optical fibre interface
 - ✧ SNTP (PTP): Unicast (point-to-point) SNTP mode via Ethernet network
 - ✧ SNTP (BC): Broadcast SNTP mode via Ethernet network
 - ✧ Message (IEC103/Modbus/DNP3.0): Clock messages through IEC103 protocol, Modbus protocol and DNP3.0 protocol
- Cyber security
 - ✧ NERC CIP
 - ✧ IEC 62351
 - ✧ IEC 62443
 - ✧ IEEE 1686

Protection Functions

Phase Overcurrent Protection (50/51P)

The device can provide six stages of phase overcurrent protection with independent logic. Each stage can be independently set as definite-time characteristics or inverse-time characteristics. The dropout characteristics can be set as immediate dropout, definite-time dropout or inverse-time dropout. Users can choose whether it is blocked by the voltage control element, direction control element, or harmonic control element, users can also choose whether it is controlled by cold load pickup. The direction control element can be set as no direction, forward direction and reverse direction. The phase overcurrent protection picks up when the current exceeds the current threshold value, and operates after a certain time delay, once the fault disappears, the phase overcurrent protection will dropout.

Earth Fault Overcurrent Protection (50/51G)

The device can provide six stages of earth fault overcurrent protection with independent logic. Each stage can be independently set as definite-time characteristics or inverse-time characteristics. The dropout characteristics can be set as immediate dropout, definite-time dropout or inverse-time dropout. Users can choose whether it is blocked by the direction control element or the harmonic control element, users can also choose whether it is controlled by cold load pickup. The direction control element can be set as no direction, forward direction and reverse direction. The zero-sequence current used by earth fault overcurrent protection can be calculated zero-sequence current or the measured zero-sequence current, it can operate to trip or alarm, and it can be enabled or blocked by the external binary input.

Another Group of Earth Fault Overcurrent Protection

The device can provide six stages of another group of earth fault overcurrent protection with independent logic. Each stage can be independently set as definite-time characteristics or inverse-time characteristics. The dropout characteristics can be set as immediate dropout, definite-time dropout or inverse-time dropout. The protection fixedly adopts the measured residual current, the calculated residual current is not supported. It can operate to trip or alarm, it can be enabled or blocked by the external binary input.

Negative-sequence Overcurrent Protection (50/51Q)

The device can provide two stages of negative-sequence overcurrent protection with independent logic. Each stage can be independently set as definite-time characteristics or inverse-time characteristics. The dropout characteristics can be set as immediate dropout, definite-time dropout or inverse-time dropout. For a double-circuit or a ring network line, the negative-sequence fault current may have different flow direction. Considering the protection selectivity, the negative-sequence overcurrent protection can be blocked by the direction control element. Negative-sequence overcurrent current can operate to trip or alarm, it can be enabled or blocked by the external binary input.

Broken Conductor Protection (46BC)

Broken-conductor fault mainly is single-phase broken or two-phases broken. According to the ratio of negative-sequence current to positive-sequence current (I_2/I_1), it is used to judge whether there is a broken-conductor fault. Negative-sequence current under normal operating condition (i.e. unbalance current) is due to CT error and unbalance load, so the ratio of negative-sequence current to positive-sequence current (amplitude) is relative steady. The value with margin can then be used as the setting of broken conductor protection. It is mainly used to detect broken-conductor fault and CT circuit failure as well.

Sensitive Earth Fault Protection (50/51SEF)

The device can provide six stages of sensitive earth fault protection with independent logic. Each stage can be independently set as definite-time characteristics or inverse-time characteristics. The dropout characteristics can be set as immediate dropout, definite-time dropout or inverse-time dropout. Users can choose whether it is blocked by the direction control element. The direction control element can be set as no direction, forward direction and reverse direction. The zero-sequence current used by sensitive earth fault protection is the measured zero-sequence current from the high-precision CT. Sensitive earth fault protection can operate to trip or alarm, it can be enabled or blocked by the external binary input.

RMS Overcurrent Protection (50/51R)

The device can provide two stages of RMS overcurrent protection with independent logic. When the fault current with more harmonic components is generated in the system, the amplitude is larger than the current threshold of RMS overcurrent protection, the RMS overcurrent protection will operate.

The operating characteristics of RMS overcurrent protection is definite-time characteristics. The dropout characteristics can be set as immediate dropout or definite-time dropout. RMS overcurrent current can operate to trip or alarm, it can be enabled or blocked by the external binary input.

Phase Overvoltage Protection (59P)

The device can provide two stages of phase overvoltage protection with independent logic. When a high voltage occurs in the system, it is greater than the voltage threshold, phase overvoltage protection will operate to remove the device from the system after a time delay. In addition, the overvoltage protection also provides the alarm function, prompting the overvoltage of the system, it allows users to find the cause timely, and preventing further deterioration of the fault. Each stage of phase overvoltage protection can be independently set as definite-time characteristics or inverse-time characteristics. The dropout characteristics can be set as immediate dropout and definite-time dropout.

Users can select phase voltage or phase-to-phase voltage for the protection calculation.

“1-out-of-3” or “3-out-of-3” logic can be selected for the protection criterion. (1-out-of-3 means any of three phase voltages, 3-out-of-3 means all three phase voltages).

Residual Overvoltage Protection (59G)

The device can provide two stages of residual overvoltage protection with independent logic. When the residual voltage is greater than the voltage threshold, the residual overvoltage protection will operate to remove the device from the system after a time delay. In addition, the residual overvoltage protection also provides the alarm function, it prompts that there is an earth fault leading to residual voltage generation, it allows users to find the cause timely, and preventing further deterioration of the fault. The dropout characteristics of residual overvoltage protection can be set as immediate dropout and definite-time dropout.

Negative-sequence Overvoltage Protection (59Q)

This device provides two stages of negative-sequence overvoltage protection. If the negative-sequence voltage is larger than the predefined setting, this protection will operate. The negative-sequence overvoltage protection can operate with a definite-time limit, and the supported dropout characteristics include instantaneous dropout and definite-time dropout.

Positive-sequence Overvoltage Protection (59Pos)

This device provides one stage of positive-sequence overvoltage protection. If the positive-sequence voltage is larger than the pre-defined setting, this protection will operate. The positive-sequence overvoltage protection can operate with a definite-time limit, and the supported dropout characteristics include instantaneous dropout and definite-time dropout.

Phase Undervoltage Protection (27P)

The device can provide two stages of phase undervoltage protection with independent logic. When the voltage drops in the system and it is lower than the voltage threshold, phase undervoltage protection will operate.

Taking into account that the role of undervoltage protection is to remove the running device from the system, but in order to prevent that undervoltage protection is always operating when it is not charged, the breaker closed position check criterion is added, users can choose to detect the breaker position, current or no-check as the releasing condition for the protection.

In addition, the undervoltage protection also provides the alarm function, prompting the voltage drop of the system, it allows users to find the cause timely, and preventing further deterioration of the fault. Each stage of phase undervoltage protection can be independently set as definite-time characteristics or inverse-time characteristics. The dropout characteristics can be set as instantaneous dropout and definite-time dropout.

Users can select phase voltage or phase-to-phase voltage for the protection calculation.

“1-out-of-3” or “3-out-of-3” logic can be selected for the protection criterion. (1-out-of-3 means any of three phase voltages, 3-out-of-3 means all three phase voltages).

Overfrequency Protection (81O)

This device can provide six stages of overfrequency protection. If the system frequency is greater than the predefined setting, this protection will operate for removing some part of active power supplies from the system. The overfrequency protection is with independent definite time delay characteristic and with instantaneous dropout characteristic.

Underfrequency Protection (81U)

This device provides six stages of underfrequency protection. If the system frequency is less than the predefined setting, this protection will operate for shedding some part of loads from the system. The underfrequency protection is with independent definite time delay characteristic and with instantaneous dropout characteristic.

Frequency Rate-of-change Protection (81R)

This device can provide six stages of frequency rate-of-change protection. If the system frequency rate-of-change is greater than the predefined setting, this protection will operate. The frequency rate-of-change protection is with independent definite time delay characteristic and with instantaneous dropout characteristic.

Reverse Power Protection (32R)

This device can provide two stages of reverse power protection. If the reverse power is detected and it is greater than the predefined setting, the reverse power protection will operate. The reverse power protection is with independent definite time delay characteristic and with definite time delay or instantaneous dropout characteristic.

Cold Load Pickup Logic (CLP)

The cold load pickup (CLP) logic which is included within this relay serves to either inhibit the selected protective elements for an appointed duration, or to raise the settings of the selected protective elements. Therefore, it allows the protection settings to be set closer to the load profile by automatically increasing them following circuit energization. The CLP logic thus provides stability, whilst maintaining protection during starting.

If the CLP logic is operated, the CLP settings are enabled for the overcurrent protection and the zero sequence overcurrent protection respectively. After the dropout time delay of the CLP logic has elapsed, the normal protection settings are applied. And if a fast resetting signal is received, the normal protection settings are applied after the predefined short resetting time delay.

Undercurrent Protection (37)

The device can provide one stage of undercurrent protection for tripping purpose or alarm purpose. For different protected equipment, the single-phase criterion or three-phase criterion can be selected. The position of circuit breaker, the load current also can be taken as the enabling conditions for the

undercurrent protection. The undercurrent protection is with definite-time operation characteristic and instantaneous dropout characteristic. Undercurrent protection can operate to trip or alarm, it can be enabled or blocked by the external binary input.

Breaker Failure Protection (50BF)

According to the tripping information from the device and the auxiliary information (the current and the position) of target circuit breaker, breaker failure protection constitutes the criterion to discriminate whether the target circuit fails to open. If the criterion is confirmed, breaker failure protection will operate to trip the target circuit breaker with the re-trip time delay, trip it again with the first time delay and trip the adjacent circuit breakers with the second time delay. As a special backup protection, breaker failure protection can quickly isolate the fault, reduce the affected range by the fault, keep system stability and prevent generators, transformers and other primary equipments from seriously damaged.

Switch-on-to-Fault Protection (SOTF)

The device can provide one stage of phase overcurrent SOTF protection and one stage of earth fault overcurrent SOTF protection. The SOTF protection is with definite time delay characteristic and instantaneous dropout characteristic, users can choose whether it is blocked by the harmonic control element.

The SOTF protection must be initiated by auto-reclosing signal or the condition that the circuit breaker is open, the initiating time can be set by the setting. After the acceleration condition is satisfied, the SOTF protection will operate with a time delay.

In order to improve the reliability, phase overcurrent SOTF protection can select phase voltage element, phase-to-phase voltage element, zero-sequence voltage element and negative-sequence voltage element as auxiliary criterion.

Thermal Overload Protection (49)

The device provides two stages of thermal overload protection, one stage for alarm purpose and the other stage for trip purpose.

The device provides two thermal overload calculation methods: 1) only calculated by current; 2) for the scenario with oil temperature measurement function, calculate the temperature difference between the equipment (such as transformer windings) and the oil, and then plus the oil temperature measured by the sensor, to obtain the final temperature.

Arc Flash Protection (50L/NL)

Arc protection is used to protect the medium and low voltage switchgear cabinet. Due to the compact structure and narrow space of the switchgear cabinet, when two-phase or three-phase short-circuit fault occurs, it is often accompanied by a strong arcing phenomenon. The arc flash signal is acquired by an arc sensor installed in the switchgear cabinet, it is combined with the auxiliary fault current criterion, then the arc flash protection can operate to trip to isolate the fault.

Current Unbalance Protection (60/50)

This device can provide two stages of current unbalance protection. If the unbalance current is greater than the predefined setting, this protection will operate. The current unbalance protection is with independent definite time delay characteristic and with definite time delay or instantaneous dropout characteristic.

Voltage Unbalance Protection (60/59)

This device can provide two stages of voltage unbalance protection. If the unbalance voltage is greater than the predefined setting, this protection will operate. The voltage unbalance protection is with independent definite time delay characteristic and with definite time delay or instantaneous dropout characteristic.

Automatic Reclosure (79)

AR can be used with either integrated device or external device. When AR is used with integrated device, the internal protection logic can initiate AR, moreover, a tripping contact from external device can be connected to the device via input signal to initiate integrated AR.

When AR is used as an independent device, it can be initiated by operating signal of protections. The device can output some configurable output signals (such as, contact signals or digital signal, for example, GOOSE signal) to initiate external AR or block external AR. The contact signals includes tripping signal, blocking AR signal and protection operating signal, etc,. According to requirement, these contacts can be selectively connected to external AR and the device can be set as one-shot or multi-shot AR.

Control Functions

Switchgear Control

The switchgear control function is mainly used to realize operation of primary equipments such as circuit breaker (CB), disconnect switch (DS) and earthing switch (ES). This function can be divided into remote control and local control according to the control source location. A remote control mainly refers to remote control commands from substation automation system (SAS) or network control centre (NCC). However, a control triggered manually from the device LCD, by a terminal contact or by a panel handle is a local control. The switchgear control function is closely related to interlocking, double point status (DPS), remote/local control mode switching and tripping statistics.

A control command can realize various control signals such as the CB/DS/ES opening/closing. In order to ensure the reliability of the control output, a locking circuit is added to each control object. The operation is strictly in accordance with the selection, check and execution steps, to ensure that the control operation can be safely and reliably implemented. In addition, the device has a hardware self-checking and blocking function to prevent hardware damage from mal-operation output.

The switchgear control function can cooperate with functions such as synchronism check and interlocking criteria calculation to complete the output of the corresponding operation command. It can realize the normal control output in one bay and the interlocking and programmable logic configuration between bays.

This device supports the following functional control module:

Module	Description
CSWI	Control of circuit breaker (CB), disconnect switch (DS) or earthing switch (ES)
RMTLOC	Remote or local control mode
XCBR	Synthesis of CB position, three-phase or phase separated
XSWI	Synthesis of DS/ES position
SXCBR/SCSWI	Trip counter of CB/DS/ES
RSYN	Synchronism check for CB closing
CILO	Interlocking logic for CB/DS/ES control
MCSWI	Manual control of CB/DS/ES
CHKPOS	Position verification for switchgear control

Remote/Local Control Mode Switch

When the device is in the remote control mode, the control command may be sent via communication protocol; when it is in the local control mode, the local operation may be performed on the device LCD or

panel handle.

The remote/local control mode switch function determines whether the device is in the remote or the local control permission state through the configuration of terminal contact, function key, or binary signal. Each control object provides a remote/local input, and the control module determines the current control authority to be remote or local according to the input value. By default, if the input is not configured, any control operation is blocked.

Double Point Status

A double point status (DPS), which usually indicates switchgear status, can be derived from 2 ordinary binary inputs. The unit also supports the DPS synthesis through switchgear opening and closing positions after jittering processing. The synthetic DPS contains original SOE timestamp. The CB control function supports phase-separated position inputs and can synthesize these inputs into general position.

Trip Counter

The trip statistics function takes the opening position as input count the trip times. For CB, this device supports phase-separated and general trip statistics. The tripping statistics function is triggered by DPS change. The statistics result is stored in non-volatile memory for power-off holding.

Use the clear command from the menu in local LCD to reset the trip statistics.

Manual Closing Synchronism Check

The purpose of synchronism check is to ensure two systems are synchronous before they are going to be connected.

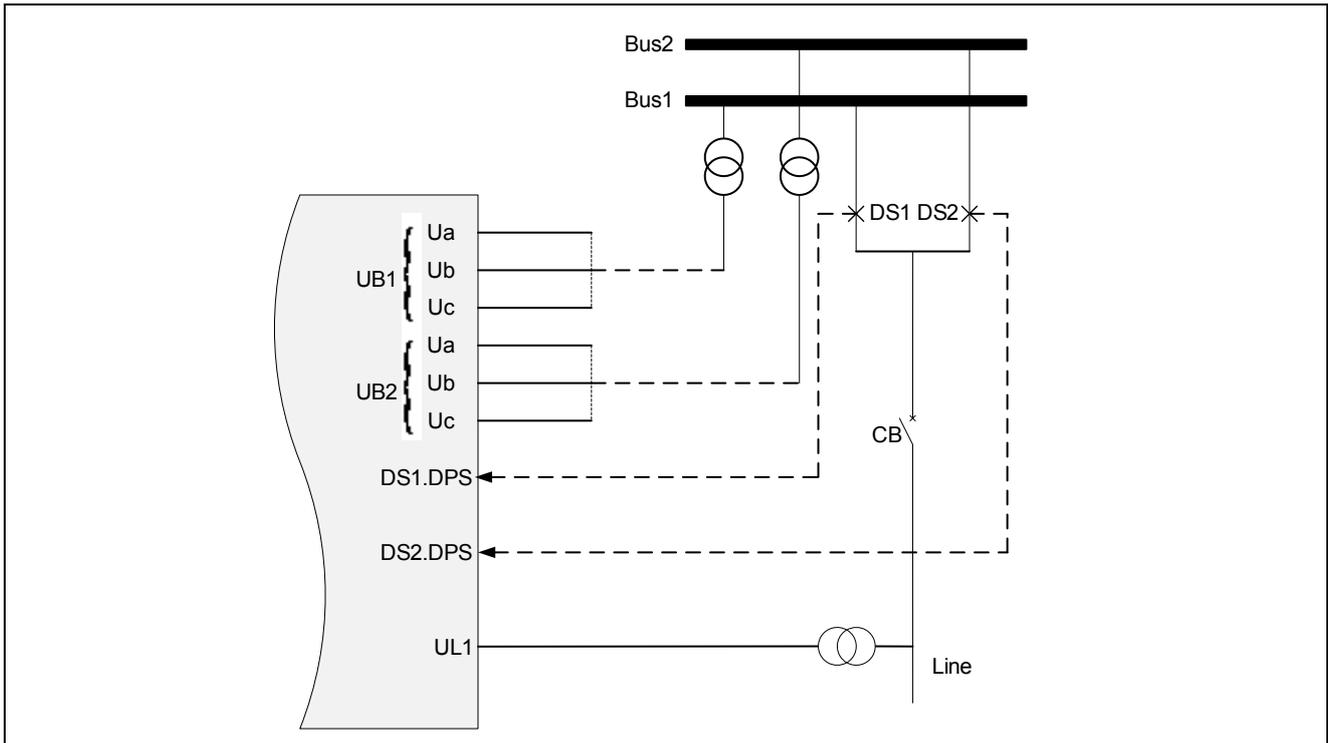
When two asynchronous systems are connected together, due to phase difference between the two systems, larger impact will be led to the system during closing. Thus closing operation is applied with the synchronism check to avoid this situation and maintain the system stability. The synchronism check includes synchro-check and dead charge check.

Voltage Selection

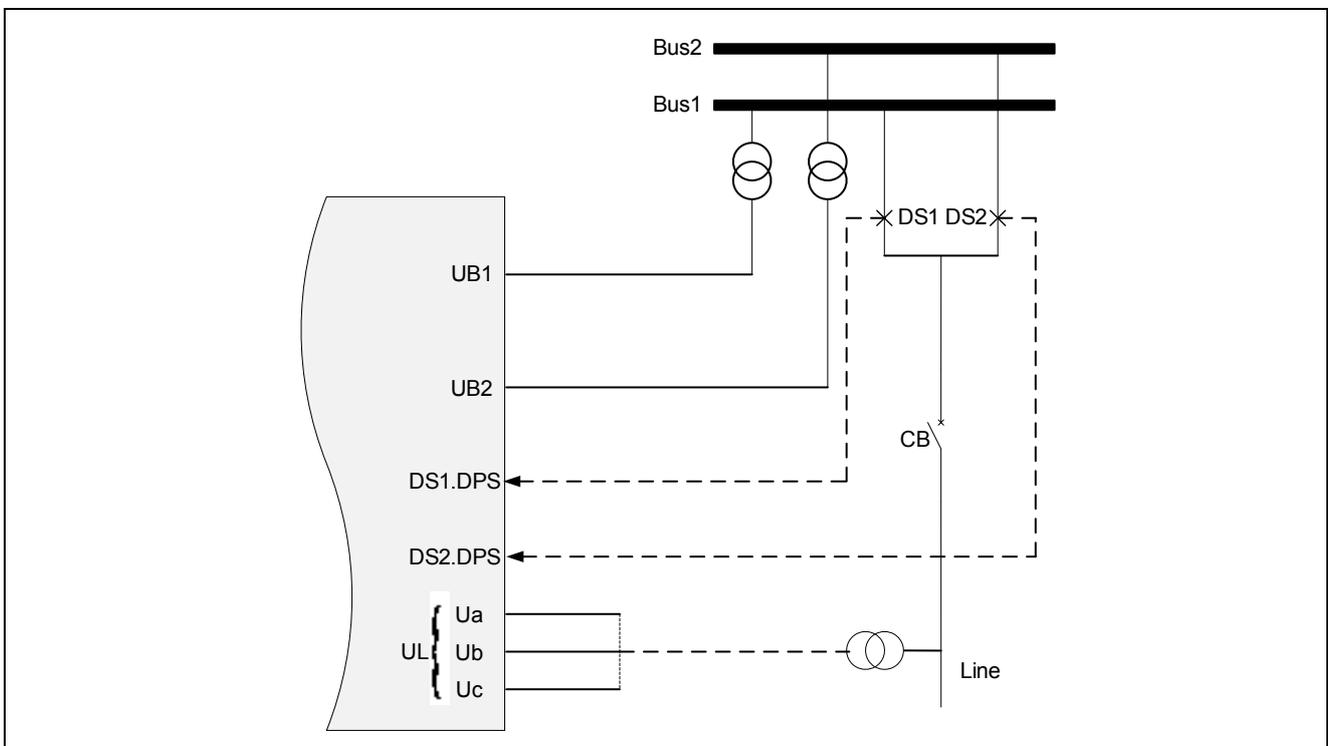
The voltage selection function can be used to switch between two groups of three-phase voltage or two groups of single-phase voltage (it can be configured via the configuration tool PCS-Studio). The "Near priority" principle is adopted by default, and the user interface for programmable switching logic is also reserved.

The voltage selection module is used in the following scenarios:

- For some double busbars arrangement, three-phases voltages from Bus1 VT and Bus2 VT via switching is used for protection calculations or measurements and meanwhile used as reference side of synchronism check. Single-phase voltage from line VT is used as synchronizing side of synchronism check. Selection approach is as follows.



- For other busbar arrangements, single-phase voltages from Bus1 VT and Bus2 VT via switching is used for protection calculations or measurements and meanwhile used as the reference side of synchronism check. Three-phase voltage from line VT is used as the synchronizing side of synchronism check. Selection approach is as follows.



Monitoring Functions

VT Circuit Supervision (VTS)

VT circuit supervision can detect failure of single-phase, two-phase and three-phase on protection VT. Under normal condition, the device continuously supervises input voltage from VT, VT circuit failure signal will be activated if residual voltage exceeds the threshold value, or negative voltage exceeds the threshold value or positive-sequence voltage is lower than the threshold value. If the specific current protection (such as breaker failure protection) operates to pick up, the time delay count-down of VT supervision alarm shall be paused until the protection returns to normal state.

VT (secondary circuit) MCB auxiliary contact can be connected to the binary input circuit of the device as a binary signal. If the MCB has been opened, the device will consider that the VT circuit is in a bad condition and issue an alarm without a time delay. If the auxiliary contact is not connected to the device, VT circuit supervision will be issued with time delay as mentioned in previous paragraph.

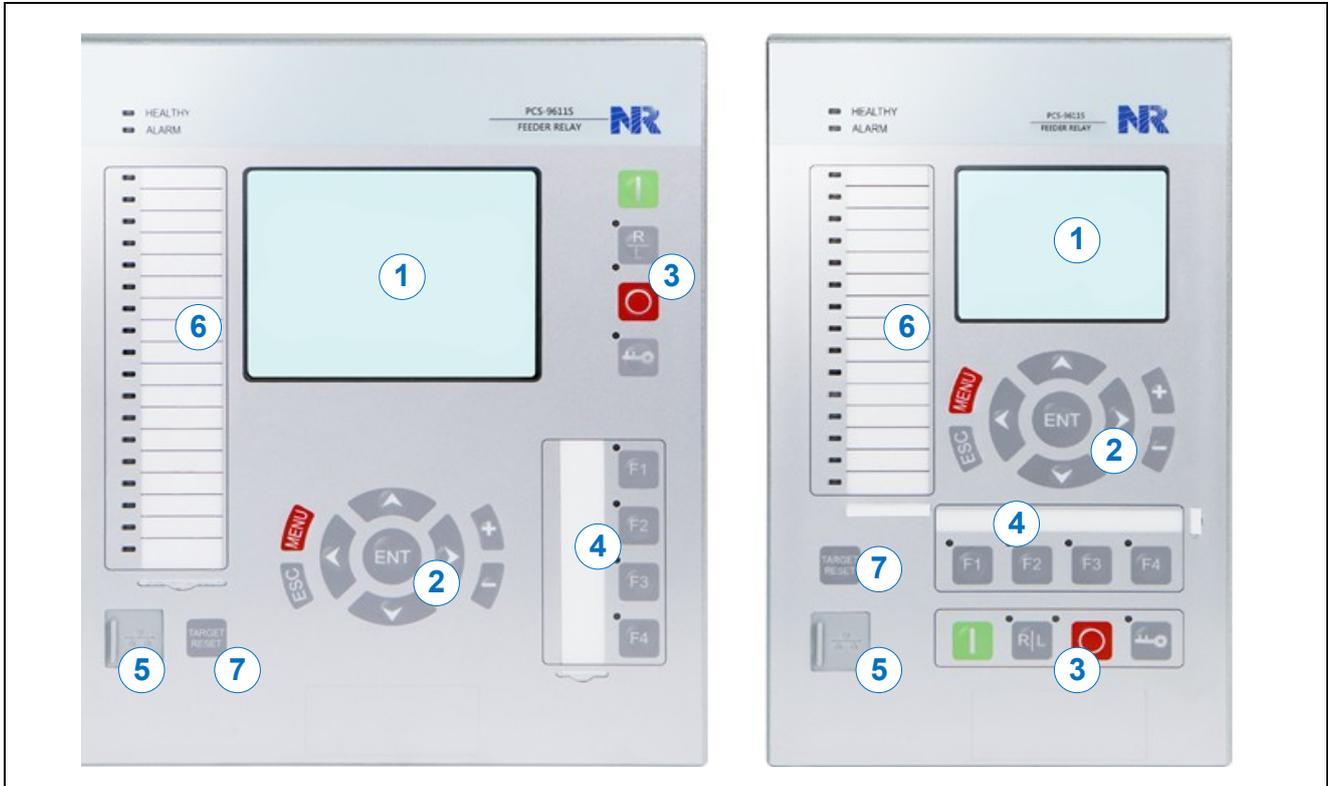
CT Circuit Supervision (CTS)

The purpose of the CT circuit supervision is to detect any abnormality on CT secondary circuit. When CT secondary circuit is abnormal, the current acquired by the device is not accurate, which will affect protection functions related to the current. Therefore, it is necessary to monitor the CT abnormal condition. When CT abnormality is detected, the device shall issue an alarm signal and block the relevant protection functions.

Under normal conditions, CT secondary signal is continuously supervised by detecting the residual current and voltage. If residual current is larger than a settable setting, whereas residual voltage is less than a settable setting, and any phase current is less than $0.04I_n$, CT circuit failure is considered.

Hardware

Front Panel



1. Front-panel status indication and control of switches
2. Easy-to-use keypad aids simple navigation and set-point adjustment
3. Push buttons for open/close, switch for selection between local and remote control, and user's login and logout authority management
4. Programmable operator push-buttons with user-configurable labels
5. RJ45 Interface
6. Up to 18 (6U, 1/2 × 19")/15 (6U, 1/3 × 19") programmable target LEDs with user-configurable labels
7. Target reset

Rear Panel

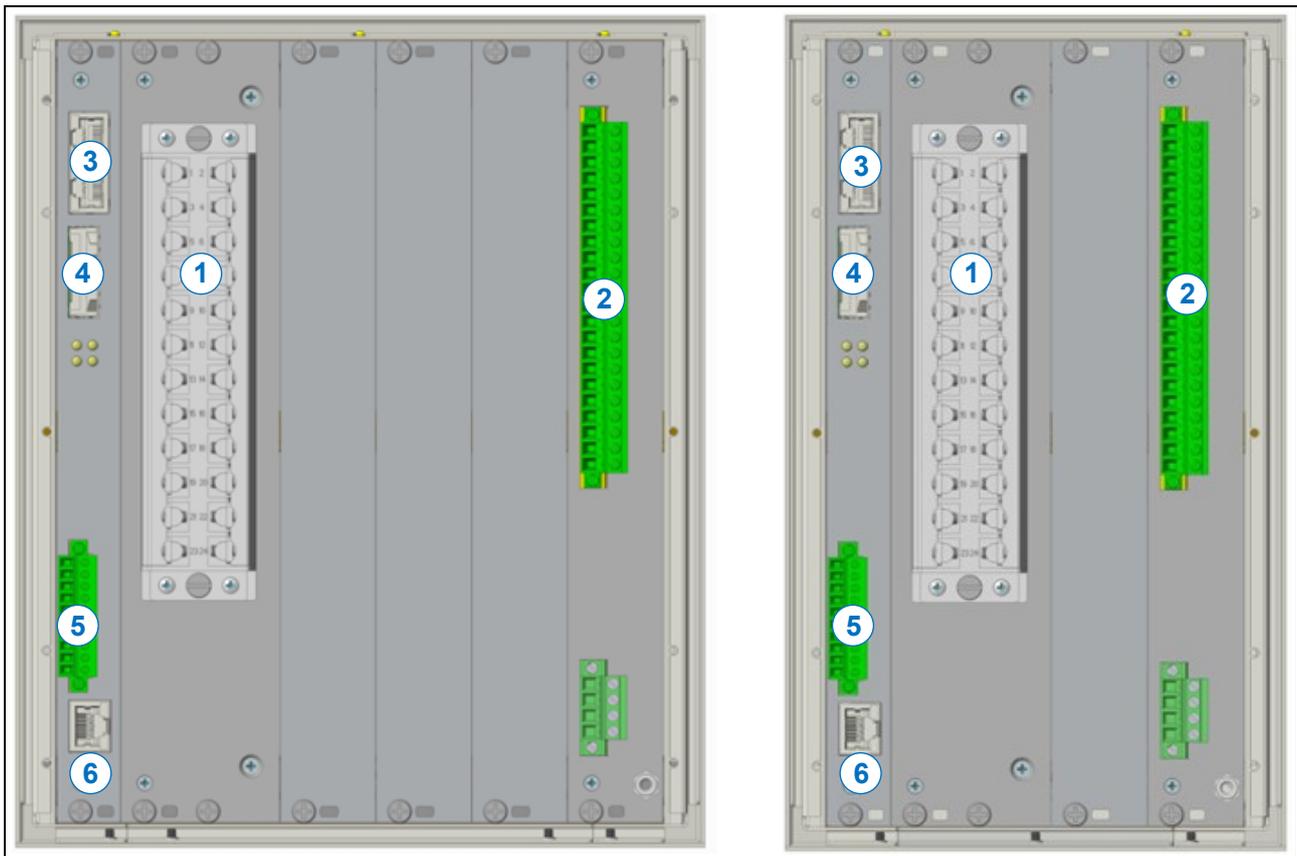


Figure 2 Typical rear view of this device (pin-ferrule-terminal modules)

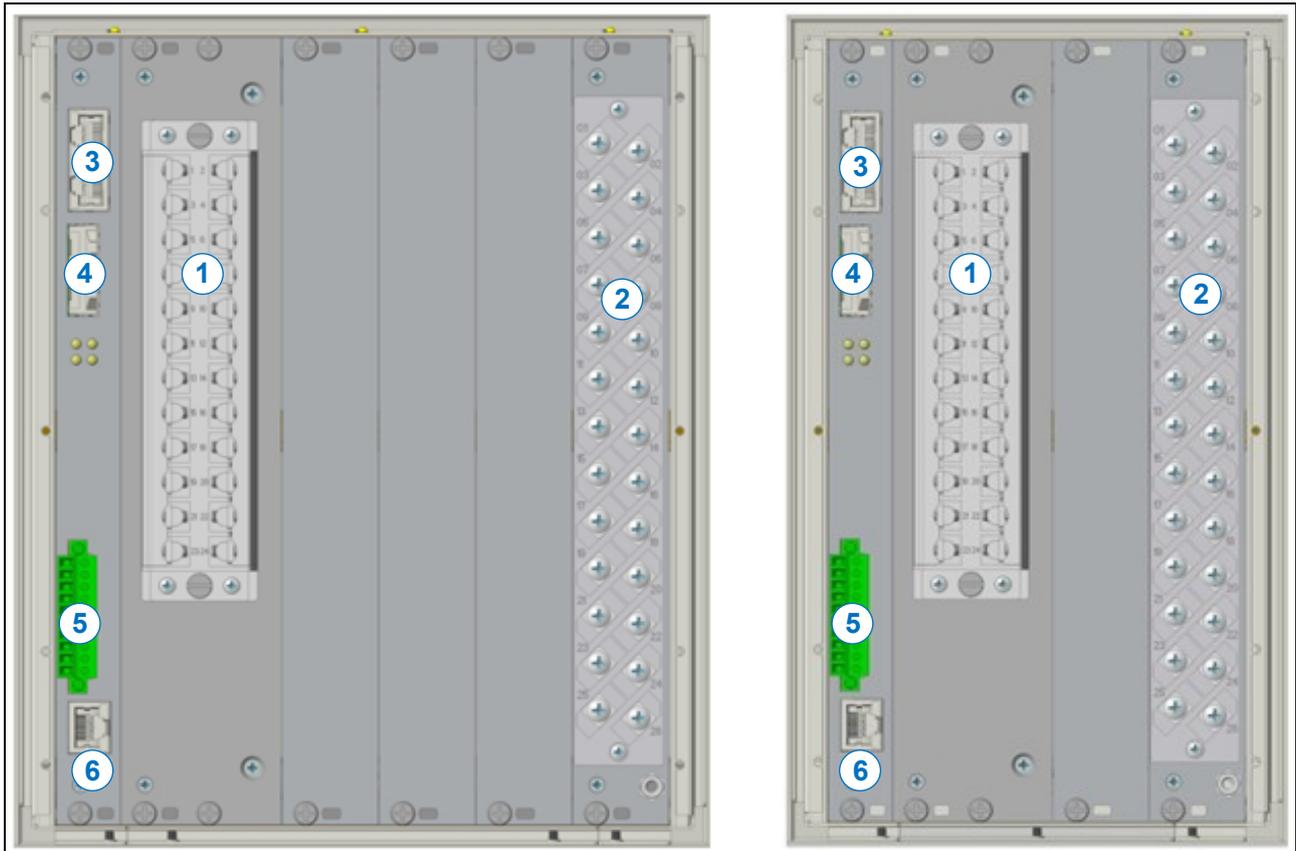


Figure 3 Typical rear view of this device (ring-ferrule-terminal modules)

1. Current and voltage analog inputs
2. Power supply and binary I/O
3. Copper Ethernet port
4. Fiber-optic Ethernet port
5. RS-232 or RS-485 serial port
6. Debug port

Typical Wiring

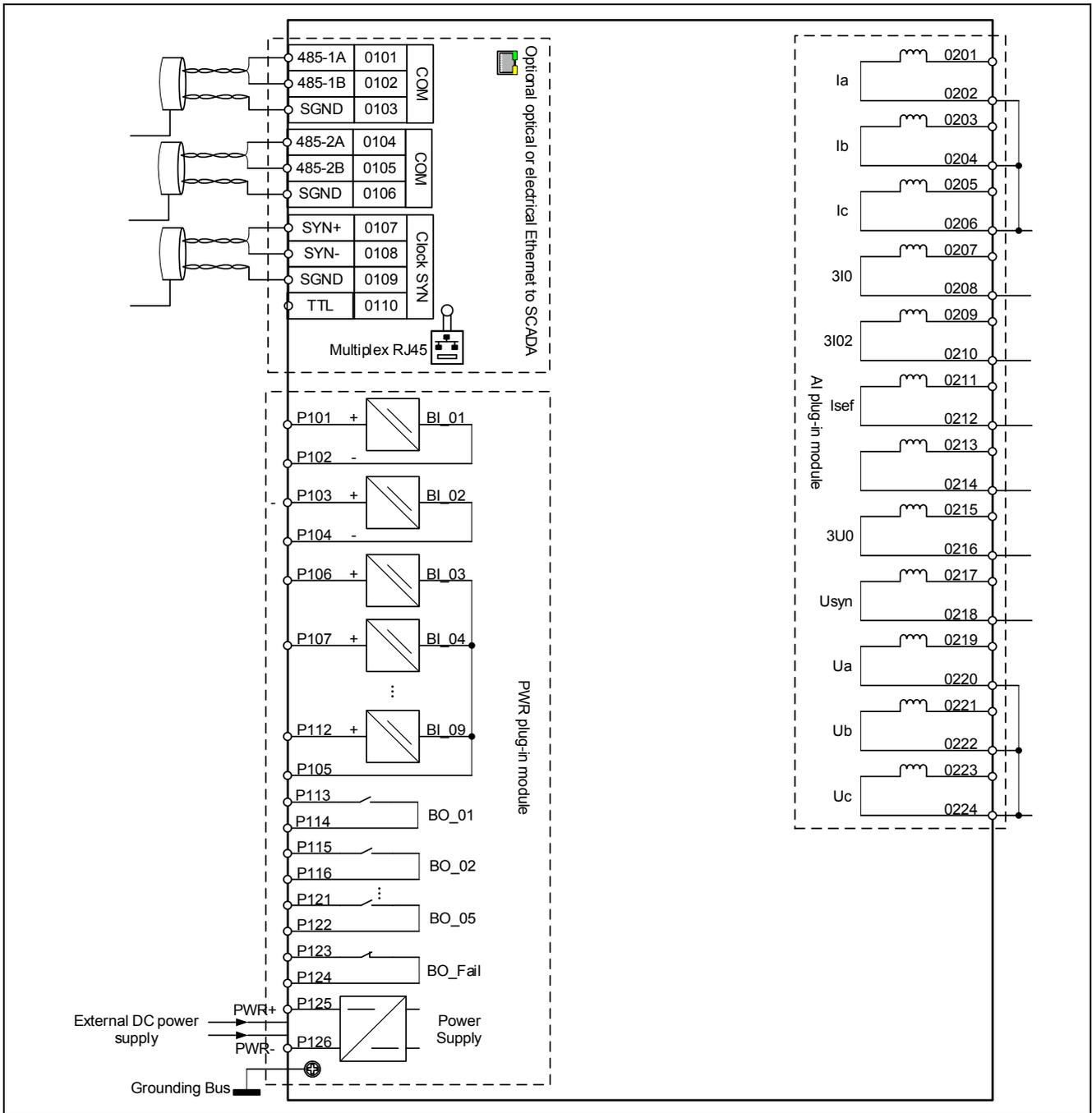


Figure 4 Typical wiring 1 (pin-ferrule-terminal modules)

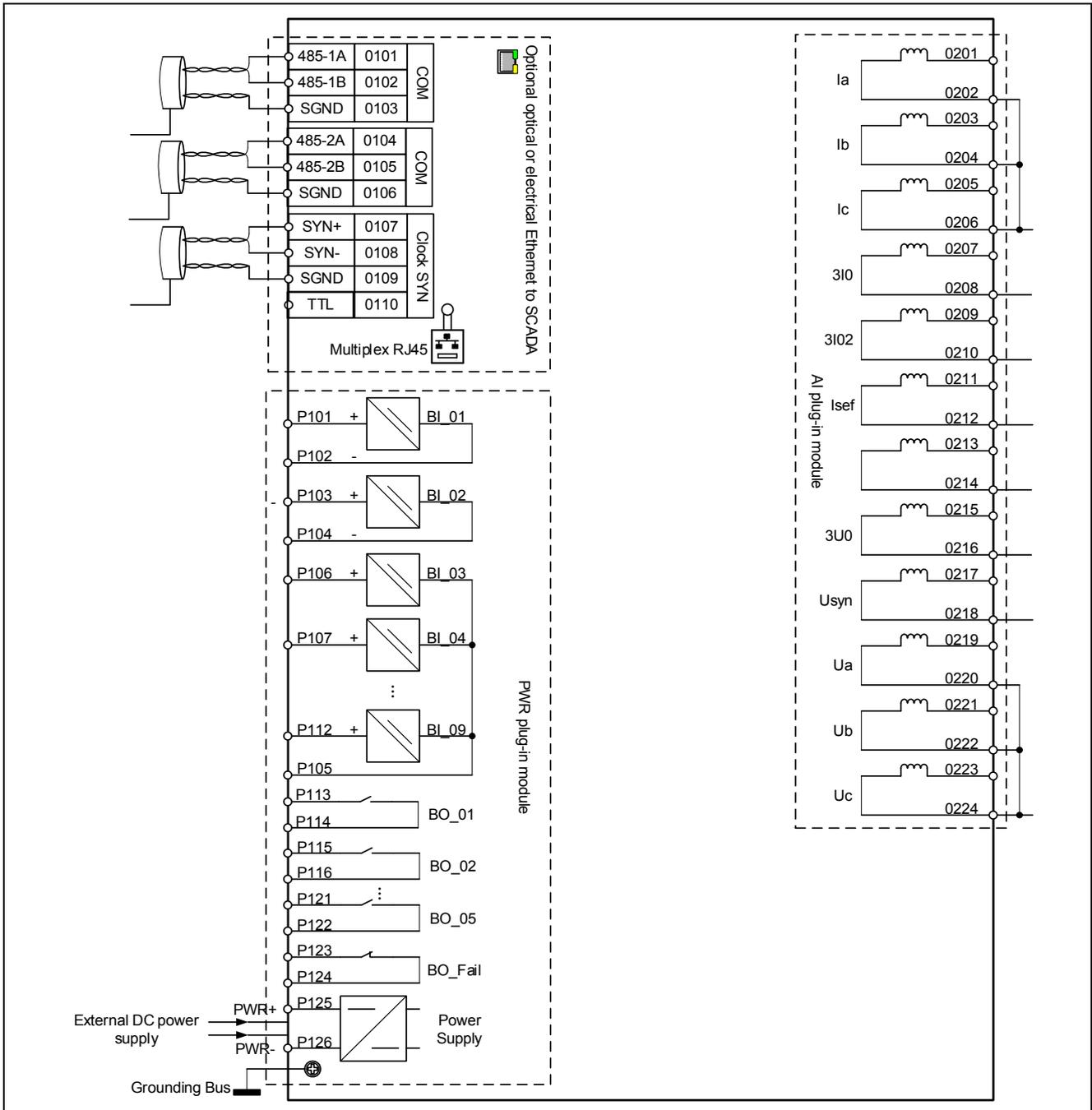
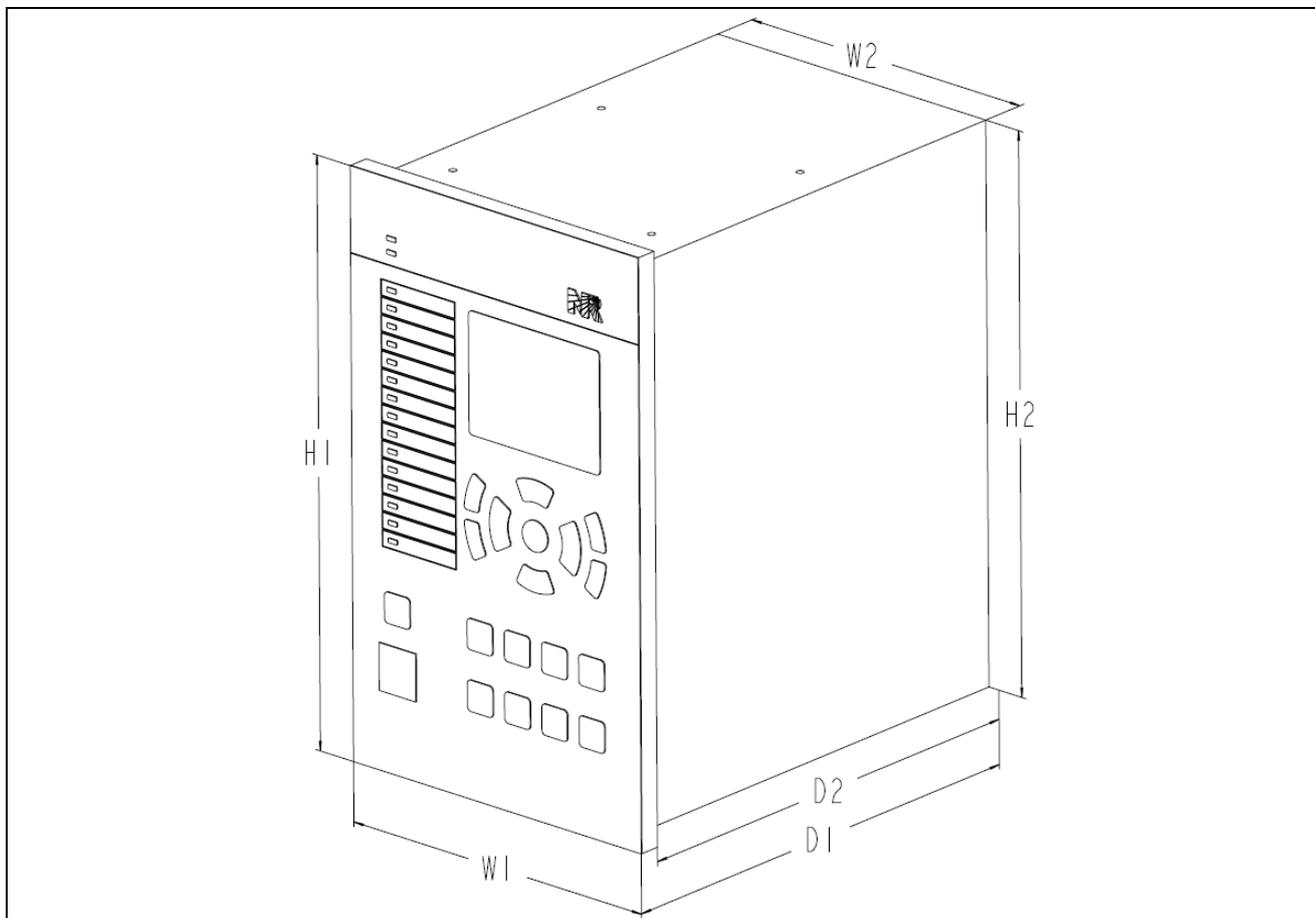


Figure 5 Typical wiring 2 (ring-ferrule-terminal modules)

Installation

Dimensions



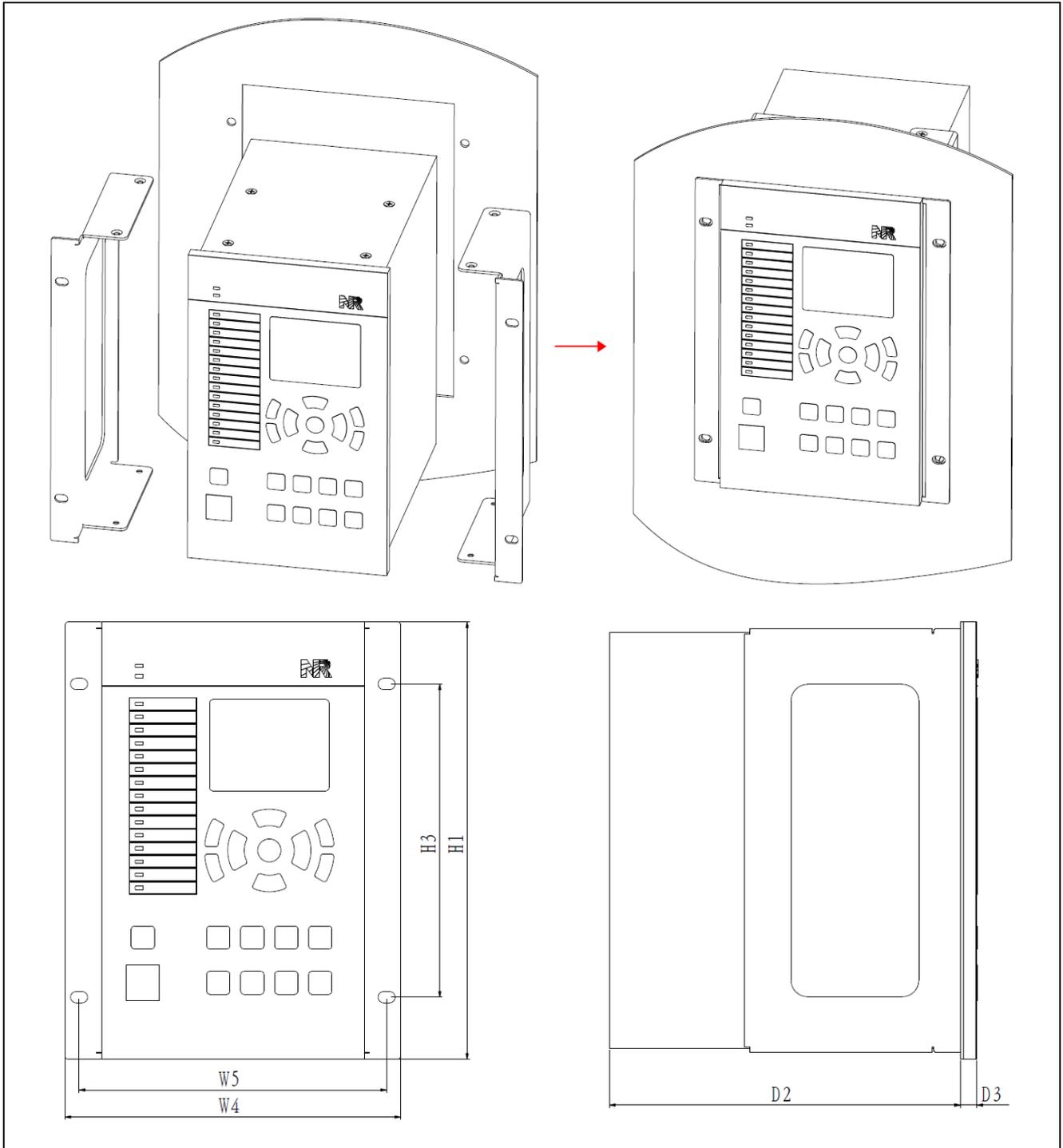
The device includes two kinds of case sizes.

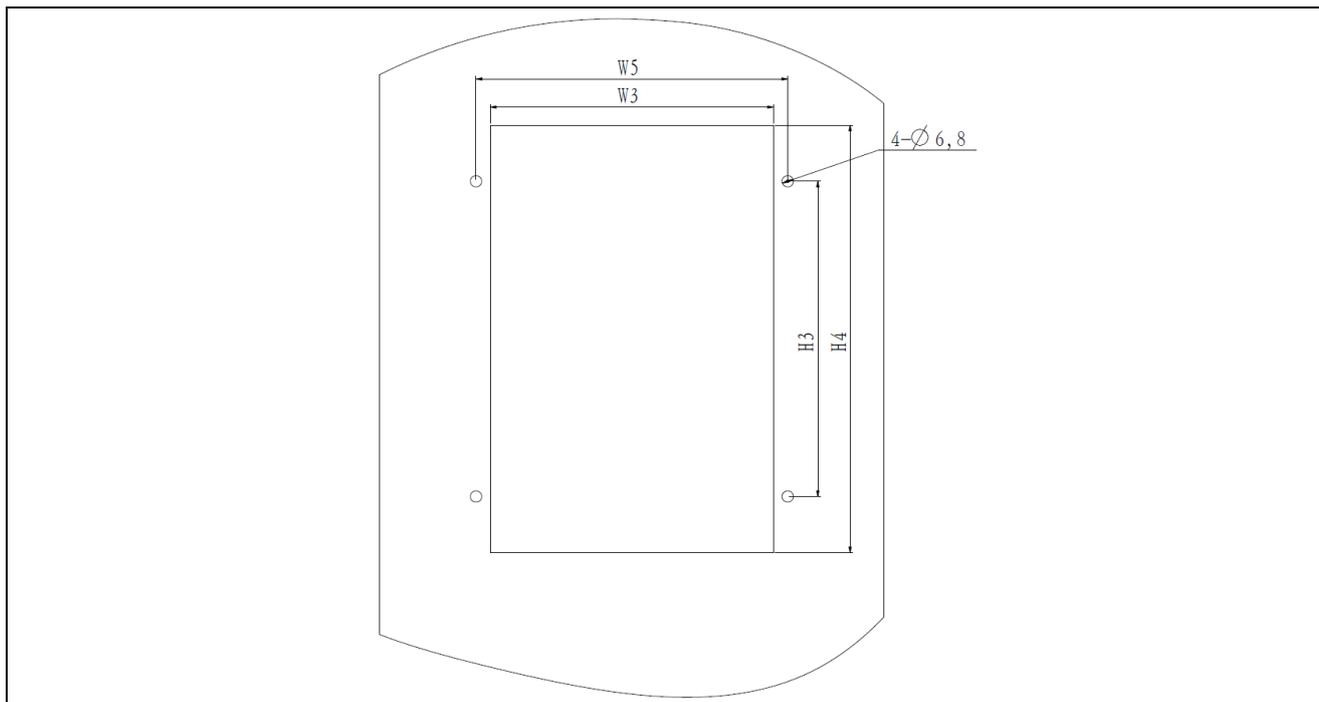
Case size (mm)	H1	H2	D1	D2	W1	W2
6U, 1/3 × 19"	265.9	253	243	233.5	158.4	147.4
6U, 1/2 × 19"	265.9	253	243	233.5	219.4	208.4

Note: The dimensions of device depth include the dimension of terminal connector without wire harness 22mm.

Certain mounting method needs special mounting accessory for support.

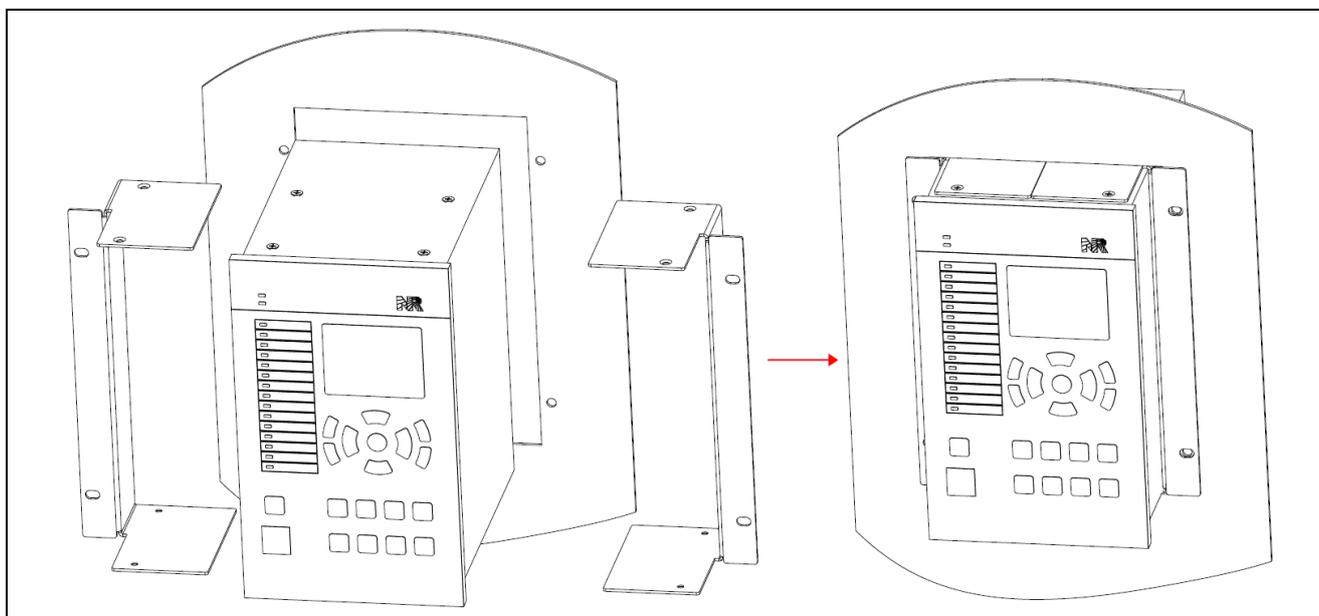
Flush Mounting

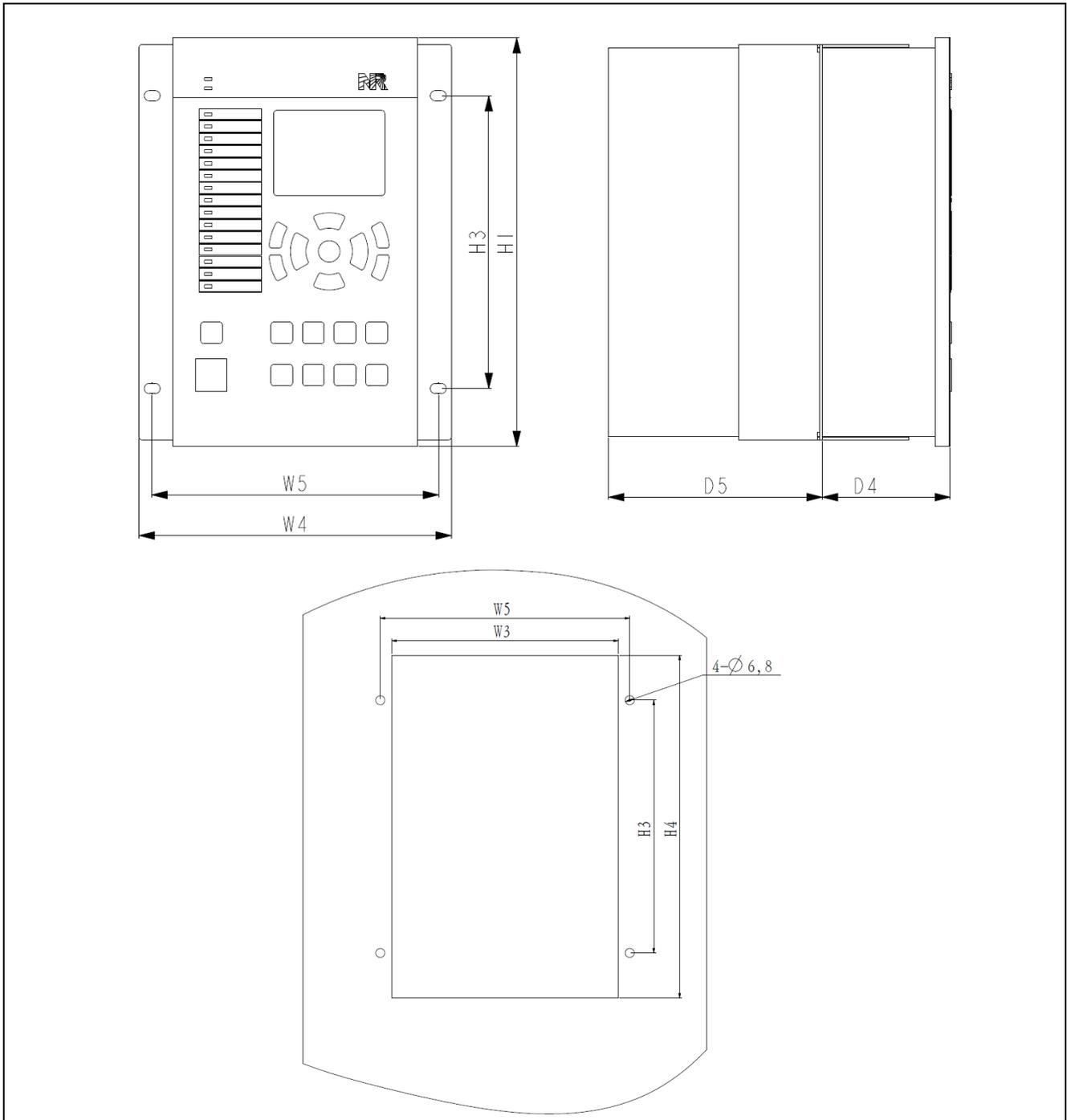




Case size (mm)	H3	H4	D2	D3	W3	W4	W5
6U, 1/3 × 19"	190.5	259	233.5	9.5	168.4	202.4	185.4
6U, 1/2 × 19"	190.5	259	233.5	9.5	229.4	263.4	246.4

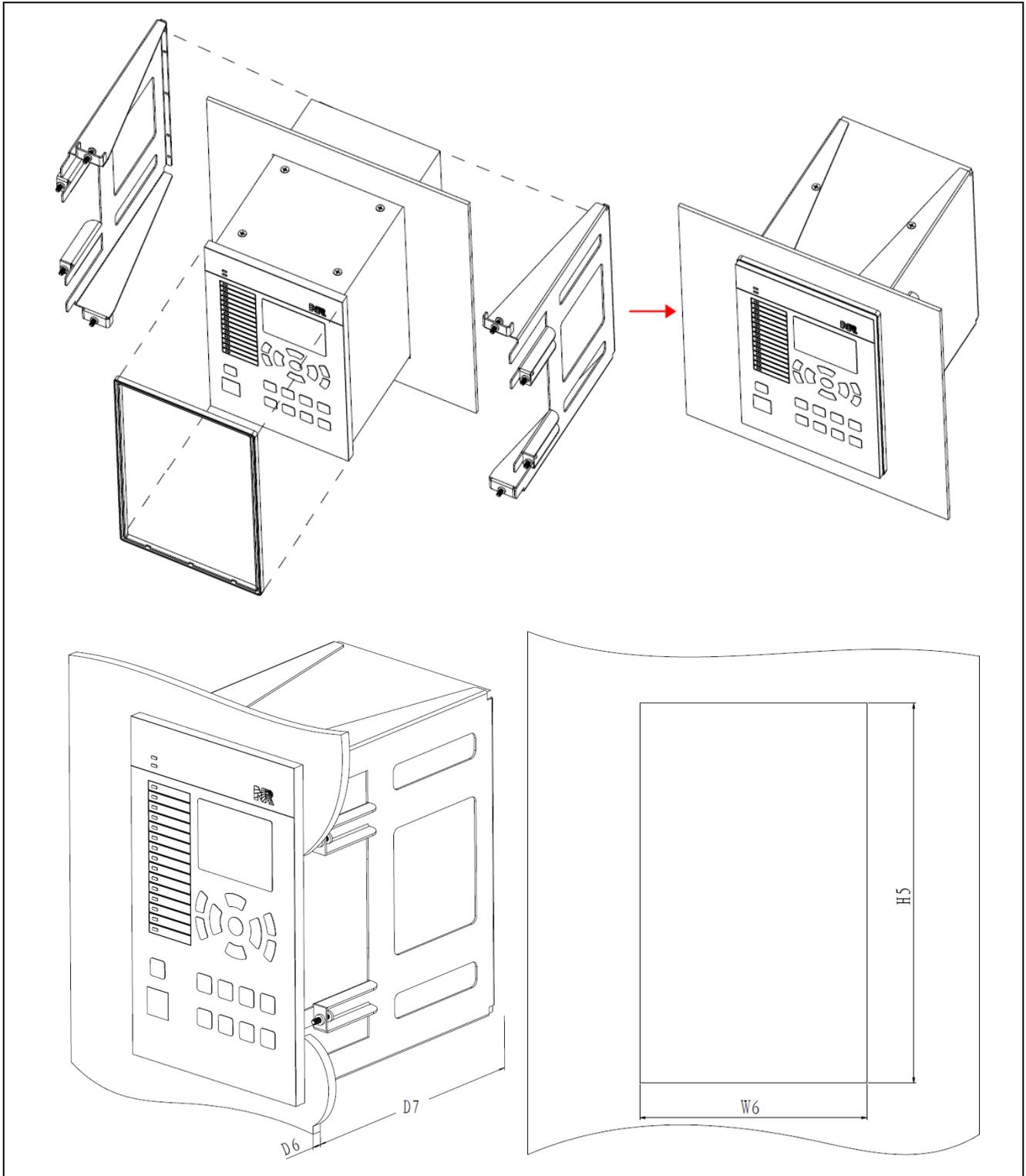
Semi-flush Mounting





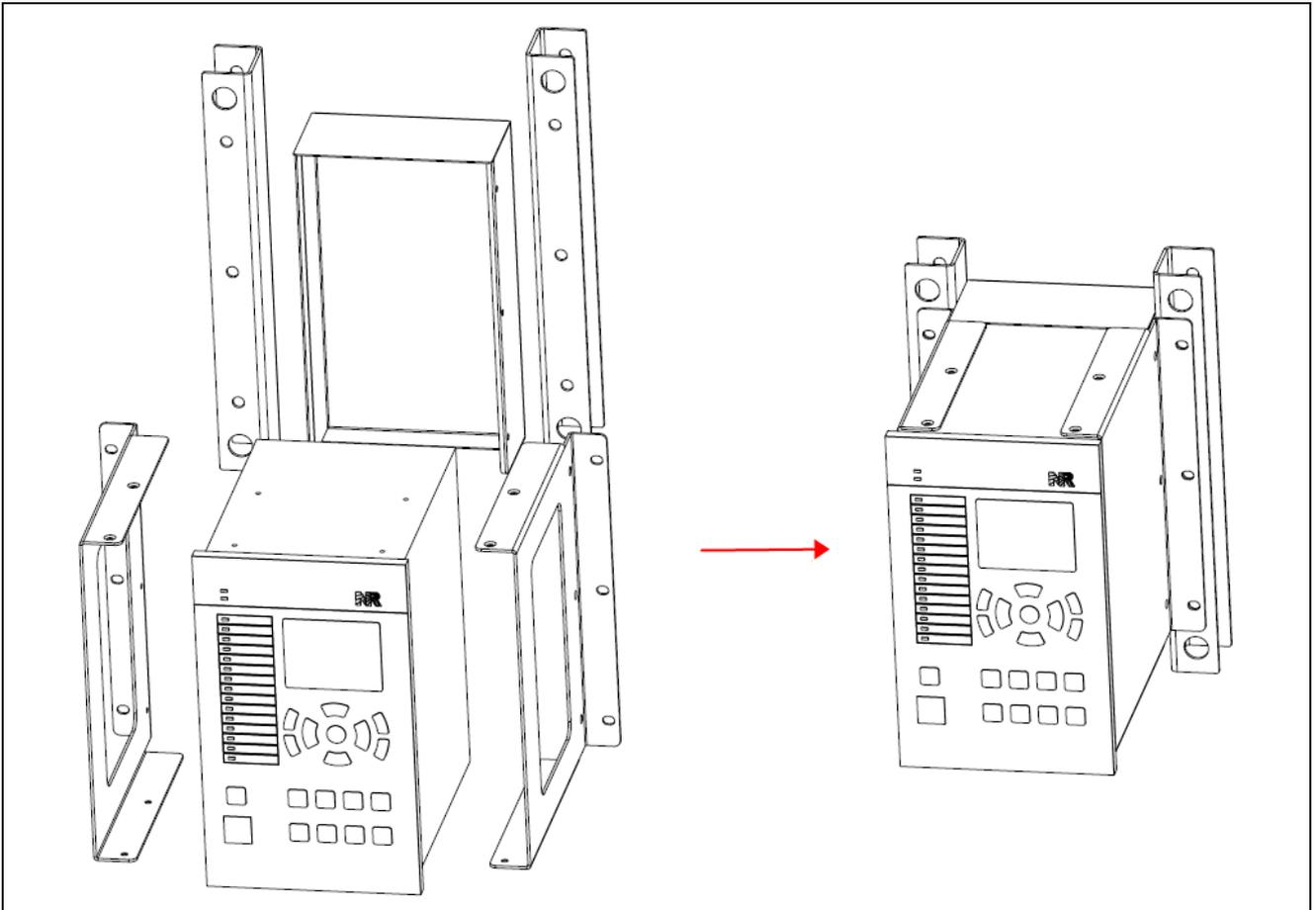
Case size (mm)	H3	H4	D4	D5	W3	W4	W5
6U, 1/3 × 19"	190.5	259	82.5	160.5	168.4	202.4	185.4
6U, 1/2 × 19"	190.5	259	82.5	160.5	229.4	263.4	246.4

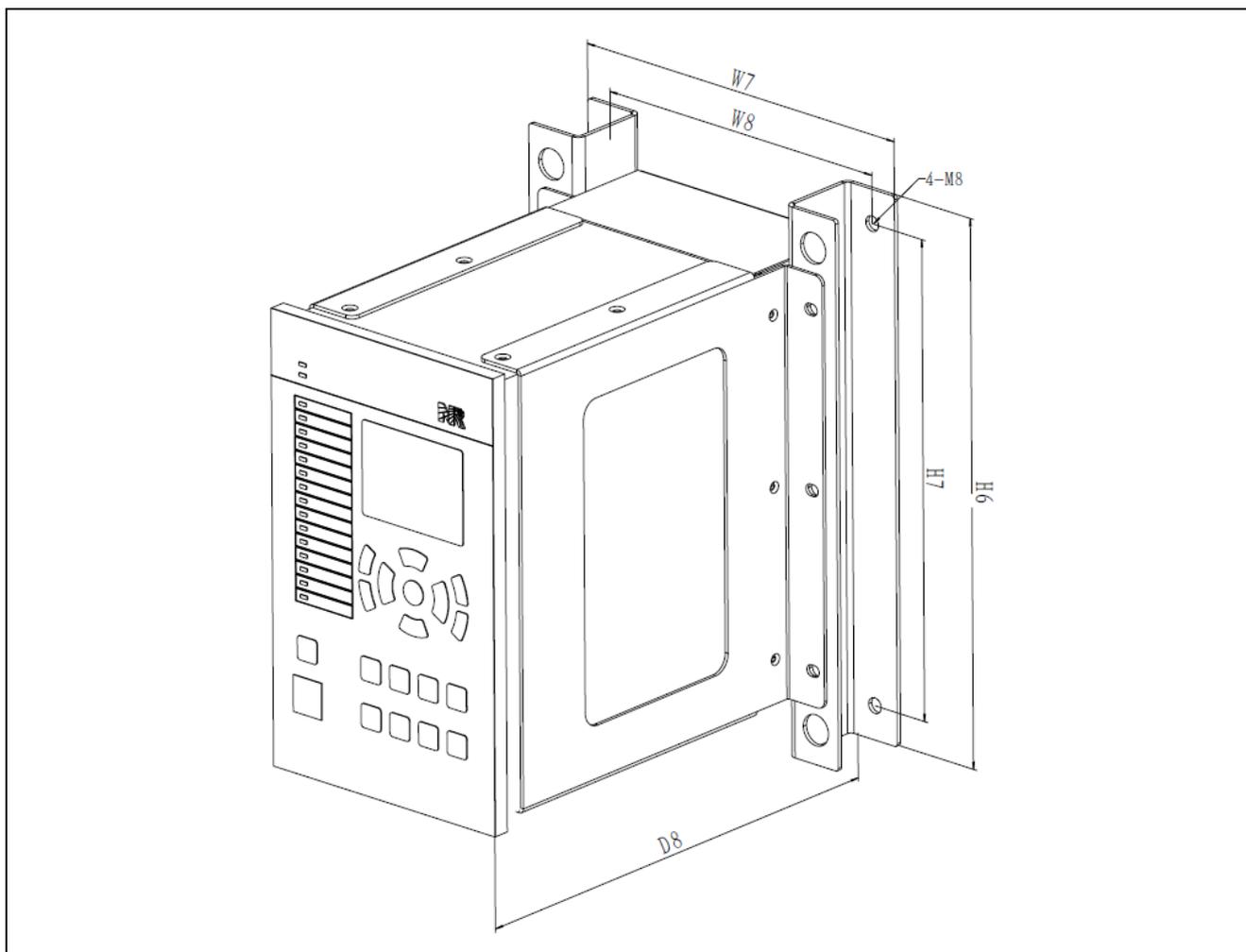
Surface Mounting



Case size (mm)	D6	D7	H5	W6
6U, 1/3 × 19"	4~10	243—D6	254.5	151.4
6U, 1/2 × 19"	4~10	243—D6	254.5	212.4

Wall Mounting



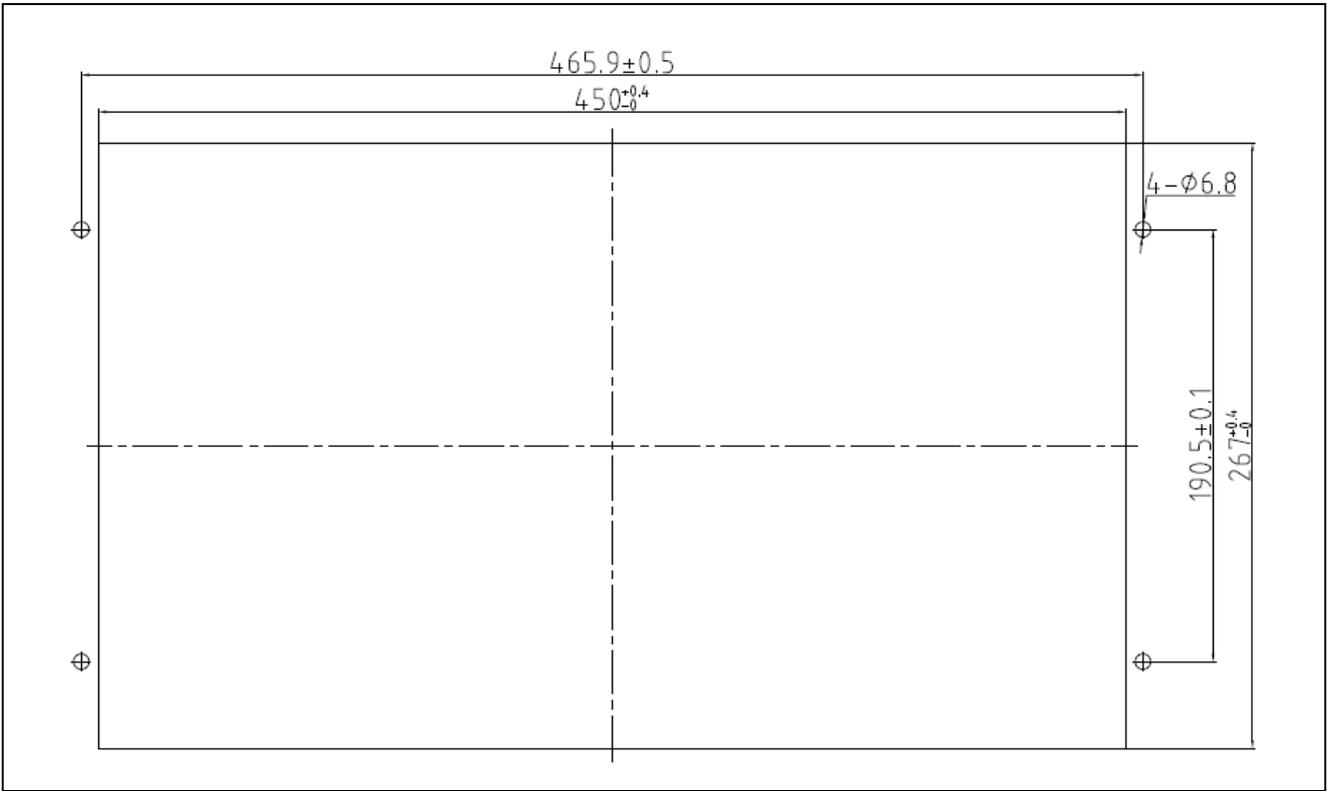


Case size (mm)	D8	W7	W8	H6	H7
6U, 1/3 × 19"	292	219.4	187.4	320	280
6U, 1/2 × 19"	292	280.4	248.4	320	280

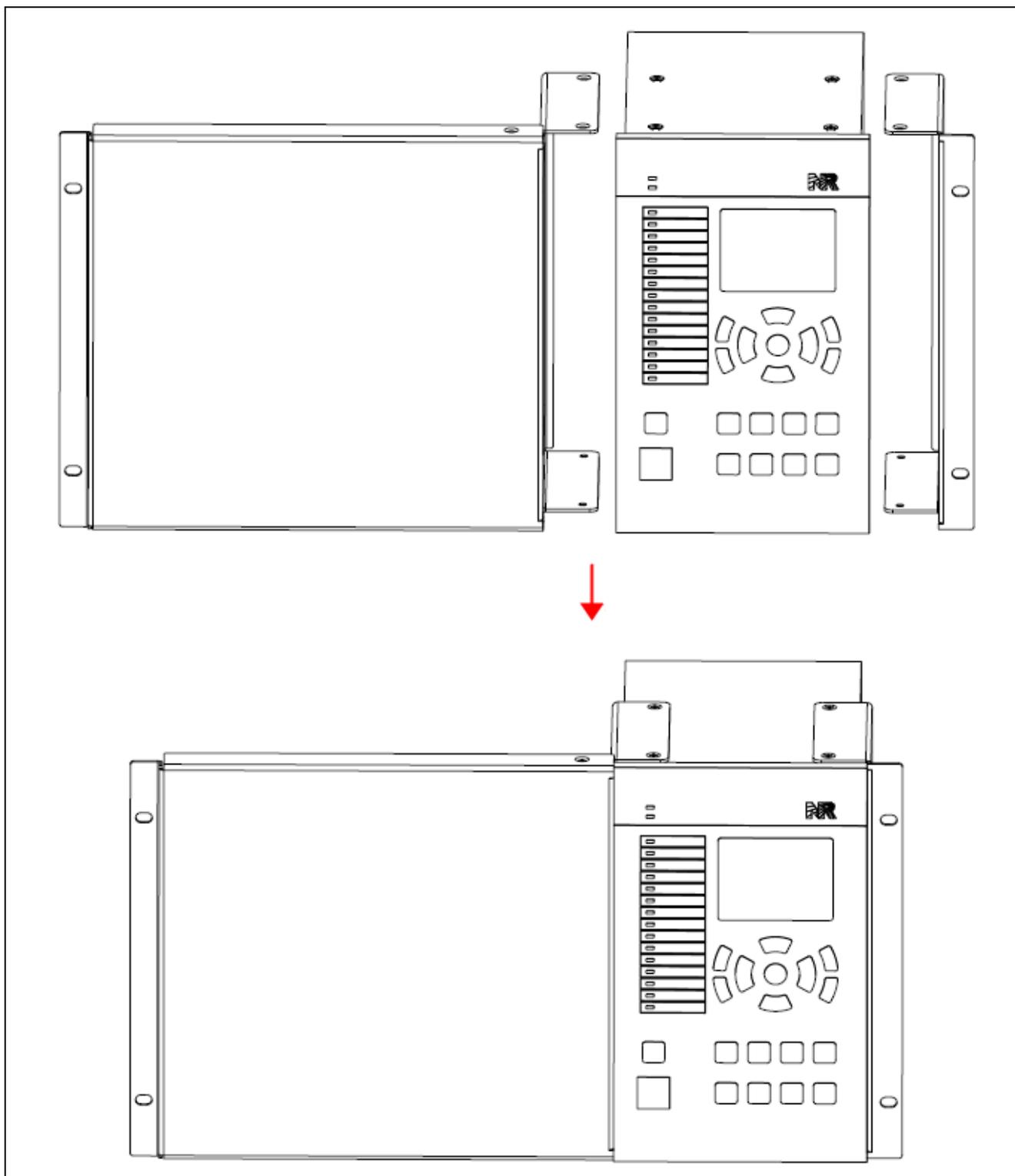
Note: The wall mounting method needs special mounting accessory for wall support.

Rack Mounting

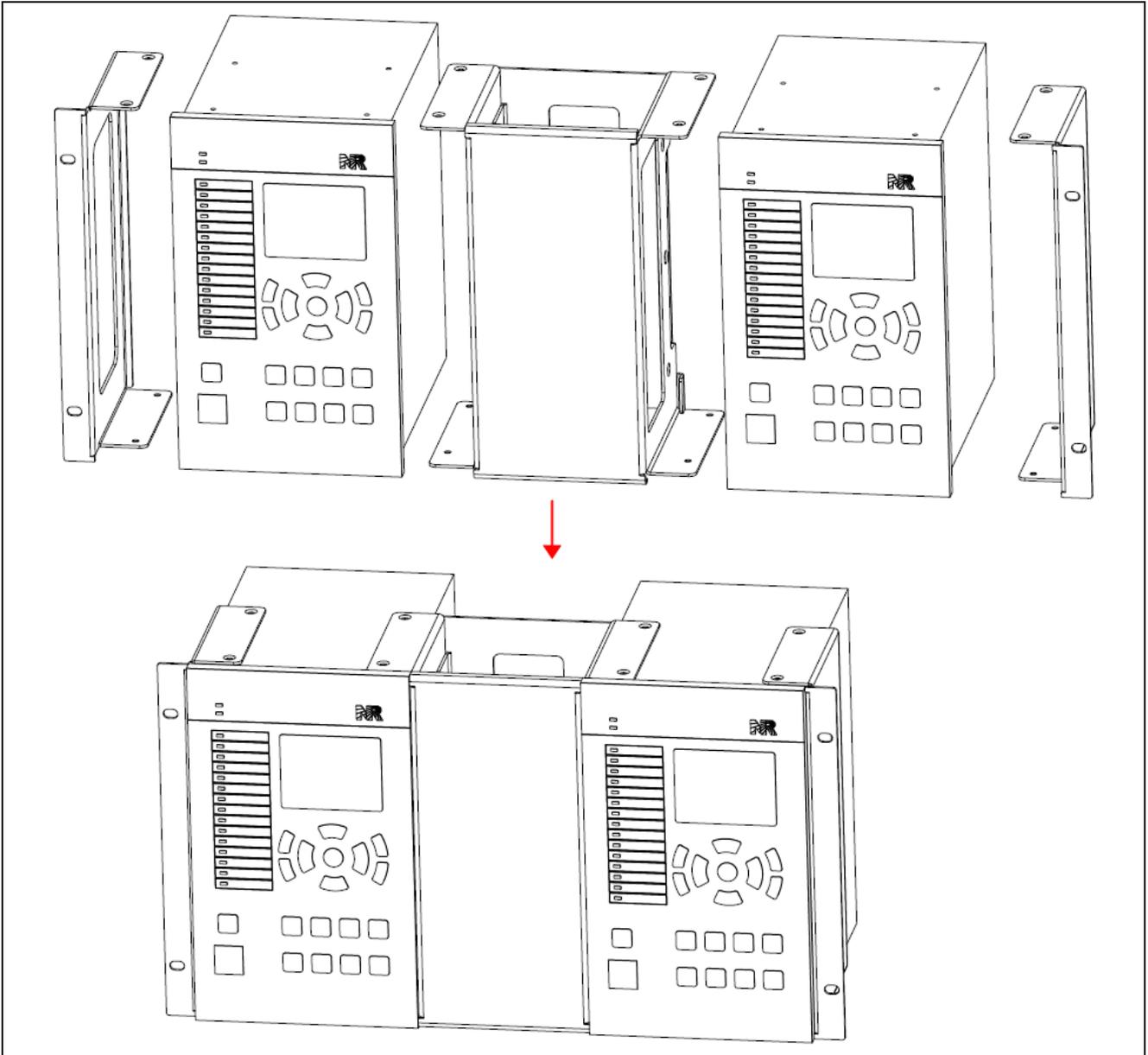
- Cut-out



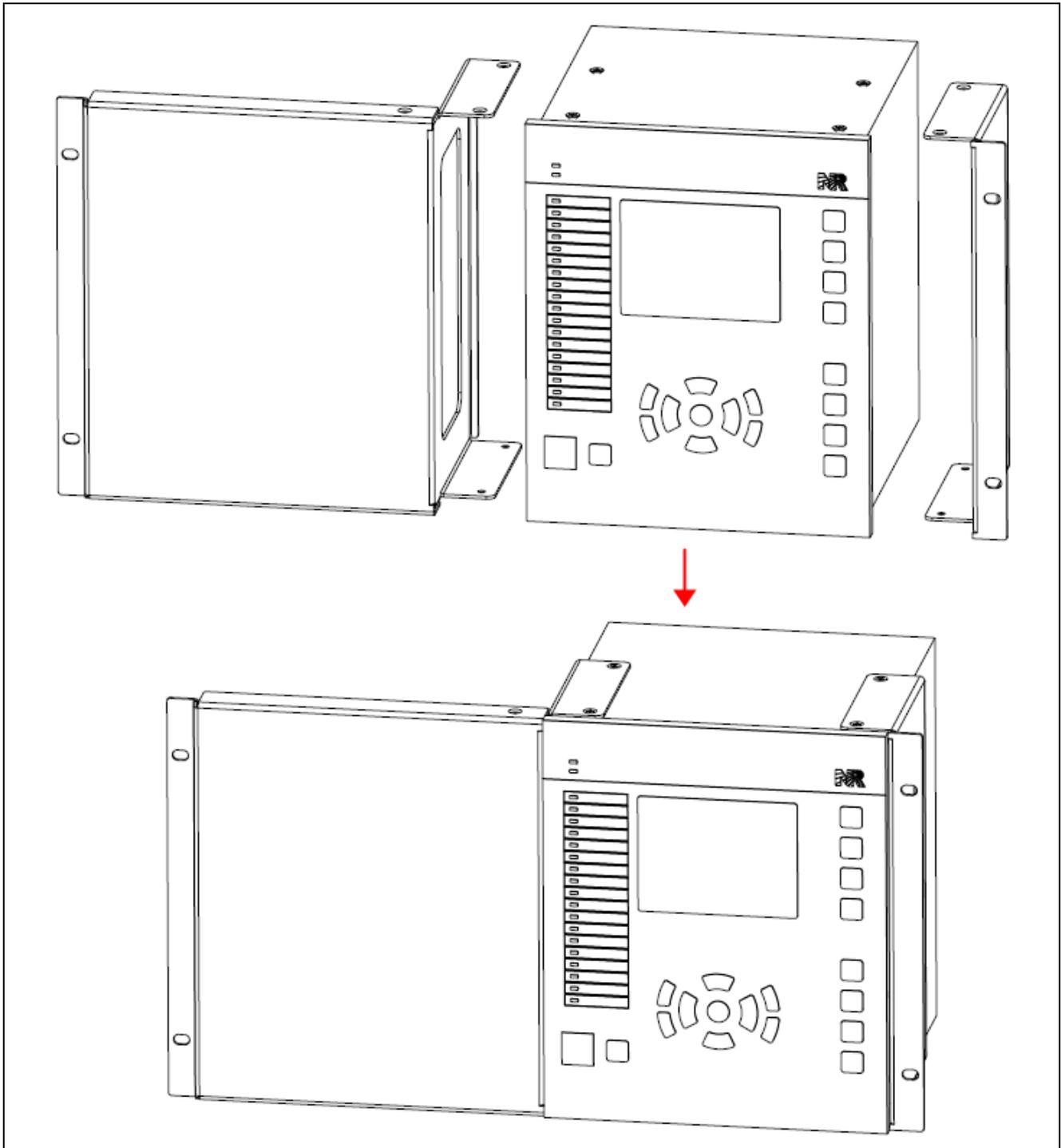
- Single 6U, 1/3 × 19"



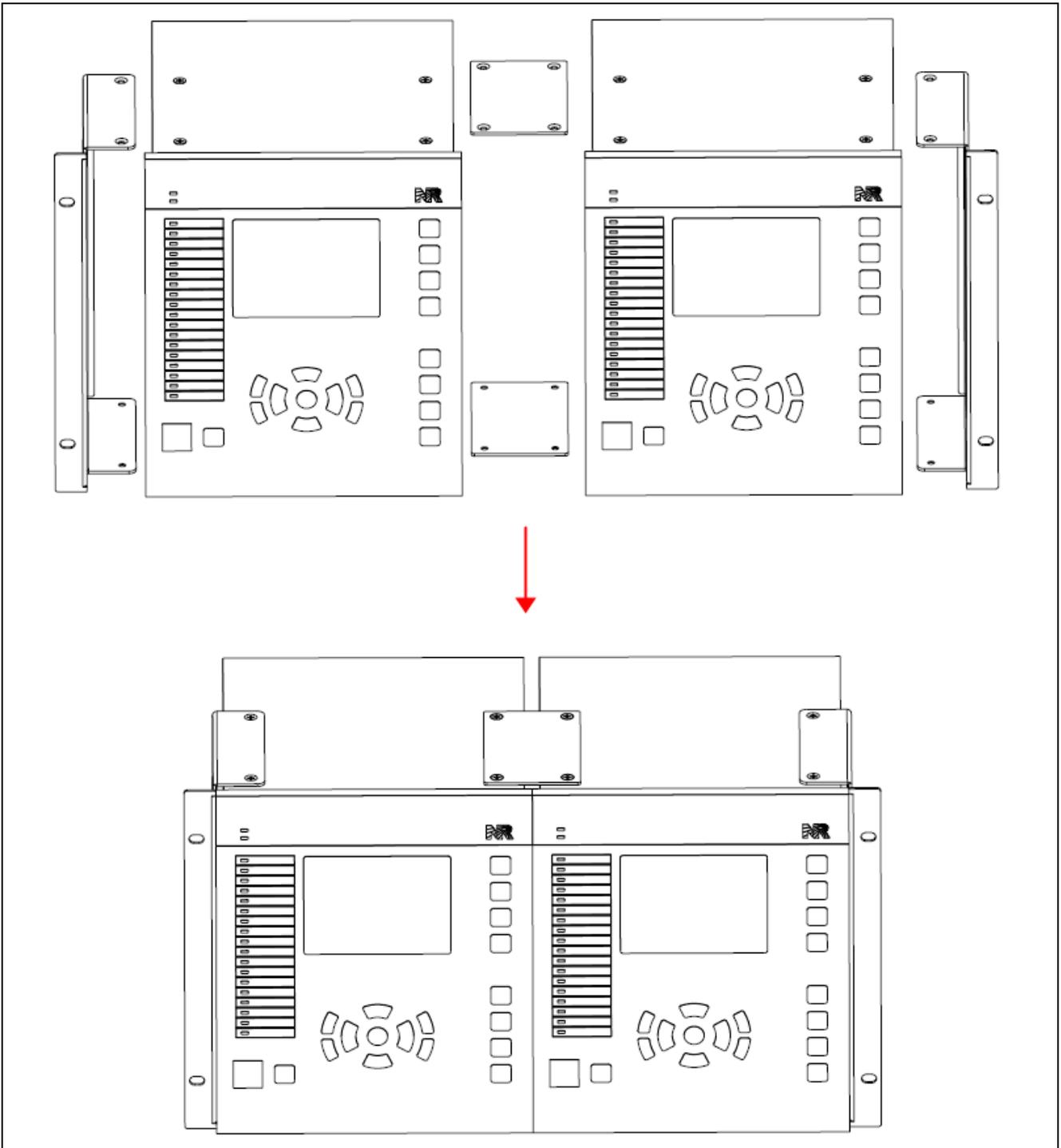
- Dual 6U, 1/3 × 19", side-by-side



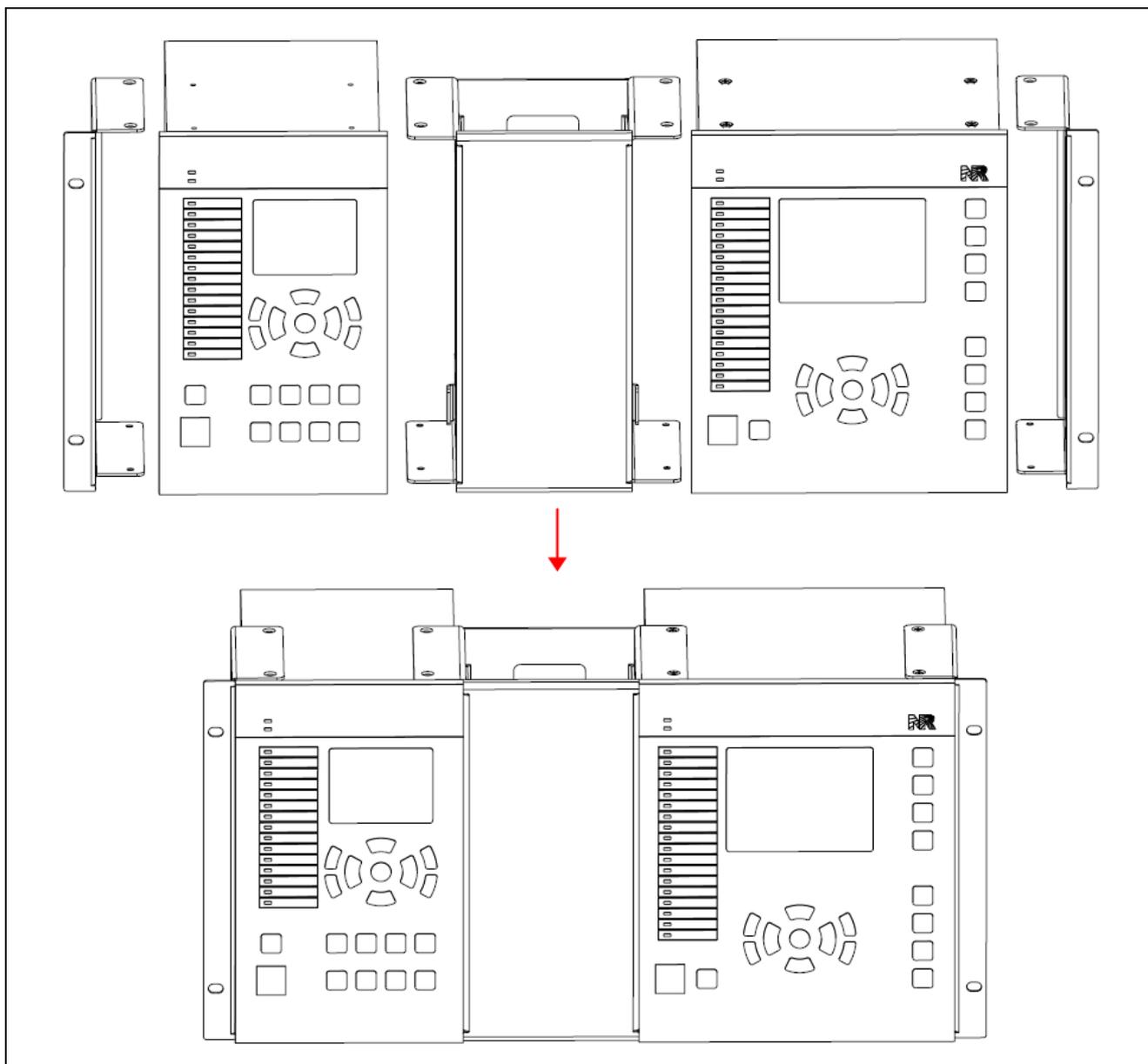
- Single 6U, 1/2 × 19"



- Dual 6U, 1/2 × 19", side-by-side



- Single 6U, 1/3 × 19" + Single 6U, 1/2 × 19", side-by-side



Technical Data

Electrical Specifications

AC Current Input (Conventional AC current input)	
Phase rotation	ABC or ACB
Nominal frequency (fn)	50Hz, 60Hz
Rated current (In)	1A/5A (settable)
Linear to	0.05In ~ 40In
Thermal withstand	
-continuously	4In
-for 10s	30In
-for 1s	100In
-for half a cycle	250In
Burden	<0.05VA/phase @1A or <0.25VA/phase @5A

AC Current Input (AC current input for sensitive earth fault protection)	
Rated current (In)	1A
Linear to	0.01A~5A
Thermal withstand	
-continuously	20A
-for 10s	100A
-for 1s	300A
-for half a cycle	750A
Burden	<0.15VA/phase @1A

AC Voltage Input	
Phase rotation	ABC or ACB
Nominal frequency (fn)	50Hz, 60Hz

Rated voltage (Un)	100V ~ 130V (phase-to-phase voltage)	
Linear to	1V~300V	
Thermal withstand	Phase-to-ground	Phase-to-phase
-continuously	300V	519V
-10s	600V	1038V
-1s	660V	1141V
Burden at rated	< 0.10VA / phase	

Power Supply			
Standard	IEC 61000-4-29:2000		
Rated voltage	110Vdc/125Vdc/ 220Vdc/250Vdc	100Vac/110Vac/115Vac 120Vac/127Vac/220Vac 230Vac/240Vac/250Vac	24Vdc/30Vdc 48Vdc/60Vdc
Permissible voltage range	88~300Vdc	80~275Vac	18~72Vdc
Permissible AC ripple voltage	≤15% of the nominal auxiliary voltage		
Burden	Quiescent condition	<15W (Default hardware configuration)	
	Additional for each energized SFP	0.25W ~ 0.35W	
	Additional for each BI module	Quiescent condition : <1W Additional for each energized binary input: 0.004W @ 24VDC 0.008W @ 48VDC 0.015W @ 110VDC 0.32W @ 220VDC 0.41W @ 250VDC	
	Additional for each BO module	Quiescent condition: <0.1W Additional for each energized binary output: <0.44W	
	Additional module for SV sampling	<7W	

Binary Input: Settable pickup voltage and drop-out voltage				
Rated voltage	110Vdc	125Vdc	220Vdc	250Vdc

Rated current drain	0.73mA	0.83mA	1.47mA	1.67mA
On value (default set)	69.3~132Vdc	78.75~160Vdc	138.6~264Vdc	157.5~300Vdc
Off value (default set)	<55V	<62.5V	<110Vdc	<125Vdc
Maximum permissible voltage	300Vdc			
Withstand voltage	2000Vac, 2800Vdc (1 min)			

Binary Input: Settable pickup voltage and drop-out voltage		
Rated voltage	110Vac	220Vac
Rated current drain	0.73mA	1.47mA
On value (default set)	69.3~132Vac	138.6~264Vdc
Off value (default set)	<55Vac	<110Vac
Maximum permissible voltage	300Vdc	
Withstand voltage	2000Vac, 2800Vdc (1 min)	

Binary Input: Settable pickup voltage and drop-out voltage		
Rated voltage	24Vdc	48Vdc
Rated current drain	0.16mA	0.32mA
On value (default set)	15.12~28.8Vdc	30.24~57.6Vdc
Off value (default set)	<12Vdc	<24Vdc
Maximum permissible voltage	300Vdc	
Withstand voltage	2000Vac, 2800Vdc (1 min)	

Binary Output: Tripping/signalling contact	
Output mode	Potential free contact
Maximum system voltage	250Vac, 300Vdc
Continuous carry	10A
Pickup time (Typical value)	<5ms

Drop-off time (Resistive load)	<6ms
Breaking capacity (L/R=40ms)	0.5A@48Vdc L/R=40ms 0.35A@110Vdc L/R=40ms 0.30A@125Vdc L/R=40ms 0.20A@220Vdc L/R=40ms 0.15A@250Vdc L/R=40ms
Cyclic capacity (2.5 cycle/second, L/R=40ms)	0.5A@48Vdc L/R=40ms 0.35A@110Vdc L/R=40ms 0.30A@125Vdc L/R=40ms 0.20A@220Vdc L/R=40ms 0.15A@250Vdc L/R=40ms
Short duration current	30A@3s 50A@1s
Durability (Loaded contact)	10000 operations

Binary Output: Heavy-capacity tripping contact	
Output mode	Potential free contact
MOV Protection (Maximum voltage)	350Vdc, 275Vac
Continuous carry	10A
Pickup time (Typical value)	<1ms
Drop-off time (Resistive load)	<10ms
Breaking capacity (L/R=40ms)	10A@48V 10A@110V 10A@125V 10A@250V
Cyclic Capacity (4cycles in 1 second, followed by 2 minutes idle for thermal dissipation)	10A@48V L/R=40ms 10A@110V L/R=40ms 10A@125V L/R=40ms

	10A@250V L/R=20ms
Short duration current	30A@3s 50A@1s
Durability (Loaded contact)	10000 operations

Mechanical Specifications

Chassis color	Silver grey
Weight per device	Approx. 8.66kg (6U, 1/2 × 19") Approx. 6.93kg (6U, 1/3 × 19")
Chassis material	Aluminum alloy
Location of terminal	Rear panel of the device
Device structure	Plug-in modular type @ rear side, integrated front plate
Protection Class	
Standard	IEC60529-2013
Front side	IP52 IP54 (valid for surface mounting mode of 6U, 1/3 × 19" or 6U, 1/2 × 19" case with sealing strip)
Other sides	IP50
Rear side, connection terminals	IP20

Ambient Temperature and Humidity Range

Standard	IEC 60255-1:2009
Operating temperature	-40°C to +80°C (Readability of display may be impaired below -20°C or above 70°C)
Transport and storage temperature range	-40°C to +80°C
Permissible humidity	5%-95%, without condensation
Pollution degree	II
Altitude	<3000m

Communication Port

EIA-485 Port	
Baud rate	4.8kbit/s, 9.6kbit/s, 19.2kbit/s, 38.4kbit/s, 57.6kbit/s, 115.2kbit/s
Protocol	IEC 60870-5-103:1997 or Modbus
Maximum capacity	32
Maximum transmission distance	500m
Safety level	Isolation to ELV level
Twisted pair	Screened twisted pair cable

Ethernet Port		
Connector type	RJ45	LC
Transmission rate	100Mbit/s	
Transmission standard	100Base-TX	100Base-FX
Maximum transmission distance	100m	2km (1310nm)
Protocol	IEC 60870-5-103:1997, DNP 3.0 or IEC 61850	
Safety level	Isolation to ELV level	

Optical Fibre Port: For Station Level and Process Level	
Characteristic	Glass optical fiber
Connector type	LC
Fibre type	Multi mode
Maximum transmission distance	2km
Wave length	1310nm
Minimum transmission power	50µm: -24dBm 62.5µm: -20dBm
Minimum receiving power	-31.0dBm
Margin	50µm: -7dBm 62.5µm: -9dBm

For Arc-Flash Sensor	
Characteristics	Glass optical fiber
Connector type	ST
Sensor type	Point sensor
Operating temperature	-40°C ~ +70°C
Optical fiber length	Optional: 10m, 20m or 30m (Default: 10m)
Minimum permissible bend radius	15mm
Wave length	350nm~1100nm

Print Port	
Type	RS-232
Baud rate	4.8kbit/s, 9.6kbit/s, 19.2kbit/s, 38.4kbit/s, 57.6kbit/s, 115.2kbit/s
Printer type	EPSON® 300K printer
Safety level	Isolation to ELV level

Clock Synchronization Port	
Type	Serial port
Input	Demodulated IRIG-B or PPS
Nominal voltage	5Vdc+10%
Maximum voltage	5.5Vdc
Input impedance	2.5kΩ
Isolation	500Vdc

Type Tests

Environmental Tests	
Dry cold test	IEC60068-2-1:2007
Dry heat test	IEC60068-2-2:2007

Damp heat test, cyclic	IEC60068-2-30:2005
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Mechanical Tests	
Vibration	IEC 60255-21-1:1988 Class I
Shock and bump	IEC 60255-21-2:1988 Class I

Electrical Tests	
Standard	IEC 60255-27:2013
Dielectric tests	Test voltage 2kV, 50Hz, 1min
Impulse voltage tests	Test voltage 5kV
Overvoltage category	III
Insulation resistance measurements	Isolation resistance > 100MΩ@500VDC

Electromagnetic Compatibility	
1MHz burst disturbance test	IEC 60255-26:2013
	Common mode: class III 2.5kV
	Differential mode: class III 1.0kV
Electrostatic discharge test	IEC 61000-4-2-2008
	For contact discharge: 8kV
	For air discharge: 15kV
Radio frequency interference tests	IEC 60255-26:2013 class III
	Frequency sweep
	Radiated amplitude-modulated
	10V/m (rms), f=80~1000MHz, 1400~2700MHz
Fast transient disturbance tests	Spot frequency
	Radiated amplitude-modulated
	10V/m (rms), f=80MHz/160MHz/450MHz/900MHz
Fast transient disturbance tests	IEC 60255-26:2013

	Power supply, I/O, Earth: class IV, 4kV, 5kHz, 5/50ns	
	Communication terminals: class IV, 2kV, 5kHz, 5/50ns	
Surge immunity test	IEC 60255-26:2013	
	Power supply, AC input, I/O port: class IV, 1.2/50 μ s	
	Common mode: 4kV Differential mode: 2kV	
Conducted RF electromagnetic disturbance	IEC 60255-26:2013	
	Power supply, AC, I/O, Comm. Terminal: Class III, 10V (rms), 150 kHz~80MHz	
	Spot frequency 10V (rms), f=27MHz/68MHz	
Power frequency magnetic field immunity	IEC 61000-4-8:2009	
	Class V, 100A/m for 1min, 1000A/m for 3s	
Pulse magnetic field immunity	IEC 61000-4-9:2016	
	Class V, 6.4/16 μ s, 1000A/m for 3s	
Damped oscillatory magnetic field immunity	IEC 61000-4-10:2016	
	Class V, 100kHz & 1MHz~100A/m	
Conducted emission	IEC 60255-26:2013	
	0.15MHz ~ 0.50MHz: 79dB(μ V) quasi peak, 66dB(μ V) average	
	0.50MHz ~ 30MHz: 73dB(μ V) quasi peak, 60dB(μ V) average	
Radiated emission	IEC 60255-26:2013	
	Below 1GHz	30MHz ~ 230MHz: 40dB(μ V/m) quasi peak @10m, 50dB(μ V/m) quasi peak @3m 230MHz ~ 1000MHz: 47dB(μ V/m) quasi peak @10m, 57dB(μ V/m) quasi peak @3m
	Above 1GHz	1GHz ~ 3GHz: 56dB(μ V/m) average, 76dB(μ V/m) peak @3m 3GHz ~ 6GHz: 60dB(μ V/m) average, 80dB(μ V/m) peak @3m

Auxiliary power supply performance	IEC 60255-26:2013	
	Voltage dips	Up to 200ms for dips to 40% of rated voltage without reset
	Voltage short interruptions	50ms for interruption without rebooting without energy storage board (Typical configuration) 500ms for interruption without rebooting with energy storage board (Typical configuration)

Liquid Crystal Display (LCD)

Type	Resolution
Large size	320x240 pixels
Small size	240x160 pixels

Terminals

Ring Ferrule			
Connection Type	Wire Size	Screw Type	Torque
AC current	Screw terminals, 1.5~4mm ² lead	M4	1.6~1.8 N•m
AC voltage	Screw terminals, 0.8~4mm ² lead	M4	1.6~1.8 N•m
Power supply	Screw terminals, 0.8~4mm ² lead	M4	0.8~1.4 N•m
Contact I/O	Screw terminals, 0.8~4mm ² lead	M4	0.8~1.4 N•m
Grounding (Earthing) Connection	BVR type, 0.8~4mm ² lead	M3	0.6~0.8 N•m

Pin Ferrule			
Connection Type	Wire Size	Screw Type	Torque
Power supply	Screw terminals, 0.3~3.3mm ² lead	M2.5	0.4~0.6 N•m
Contact I/O	Screw terminals, 0.3~3.3mm ² lead	M2.5	0.4~0.6 N•m

Measurement Scope and Accuracy

Item	Range	Accuracy
Phase range	0° ~ 360°	≤±1°

Frequency	$f_n \pm 3 \text{ Hz}$	$\leq 0.01 \text{ Hz}$
Currents from protection measurement current transformers		
Current	0.05~4.00I _n	$\leq 1.0\%$ of rating (0.05~1.00I _n) $\leq 0.5\%$ of applied quantities (1.00~4.00I _n)
Voltage	0.05~1.50U _n	$\leq 1.0\%$ of rating (0.05~1.00U _n) $\leq 0.5\%$ of applied quantities (1.00~1.50U _n)
Active power (W)	0.05~1.50U _n 0.05~4.00I _n	$\leq 2.0\%$ of rating (0.05~1.00I _n , 0.05~1.00U _n) $\leq 1.0\%$ of applied quantities (1.00~4.00I _n , 1.00~1.50U _n)
Reactive power (VAr)	0.05~1.50U _n 0.05~4.00I _n	$\leq 2.0\%$ of rating (0.05~1.00I _n , 0.05~1.00U _n) $\leq 1.0\%$ of applied quantities (1.00~4.00I _n , 1.00~1.50U _n)
Apparent power (VA)	0.05~1.50U _n 0.05~4.00I _n	$\leq 2.0\%$ of rating (0.05~1.00I _n , 0.05~1.00U _n) $\leq 1.0\%$ of applied quantities (1.00~4.00I _n , 1.00~1.50U _n)
Energy (Wh)	0.05~1.50U _n 0.05~4.00I _n	$\leq 2.0\%$ of rating (0.05~1.00I _n , 0.05~1.00U _n) $\leq 1.0\%$ of applied quantities (1.00~4.00I _n , 1.00~1.50U _n)
Energy (VAh)	0.05~1.50U _n 0.05~4.00I _n	$\leq 2.0\%$ of rating (0.05~1.00I _n , 0.05~1.00U _n) $\leq 1.0\%$ of applied quantities (1.00~4.00I _n , 1.00~1.50U _n)

Management Function

Clock Performance	
Real time clock accuracy	$\leq 1 \text{ s/day}$
Accuracy of GPS synchronization	$\leq 1 \text{ ms}$
External time synchronization	IRIG-B (200-98), PPS, IEEE1588 or SNTP protocol

Fault and Disturbance Recording	
Duration & Recording position	Settable pre-disturbance, post-disturbance and maximum recorded duration
Sampling rate	Up to 9.6kHz

Binary Input Signal	
Resolution of binary input signal	≤1ms
Binary input mode	Potential-free contact

Communication Functions

GOOSE Function	
Receiving Control Block (RCB)	Max. 64 (Typical configuration: 50×FCD+200×BOOL+16×FLOAT)
Sending Control Block (SCB)	Max. 16 (Typical configuration: 100×BOOL)
Receiving route delay	Max. 2ms
Sending route delay	Max. 3ms

SV Function	
Receiving Control Block (RCB)	Max. 12
Receiving route delay	Max. 2ms



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