TOSHIBA

GR-200 Series

GRZ 200

Distance Protection IED

GR-200 series -

The GR-200 Series is Toshiba's next generation of protection and control IED's, designed for transmission/distribution networks and providing a platform for distributed and renewable energy systems and railway applications. Flexible adaptation is enabled using extensive hardware and modular software combinations facilitating an application oriented solution.

Meeting your needs -

Extensive hardware and modular software combinations provide the flexibility to meet your application and engineering requirements.

Future upgrade paths and minor modifications are readily achievable on demand.

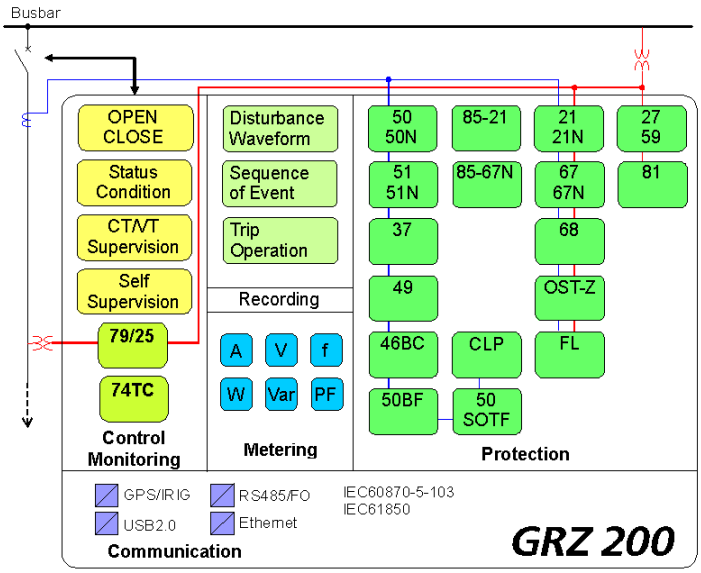
Powerful and wide application -

In addition to protection & control, GR-200 has been designed to meet the challenges and take advantage of developments in information & communications technology.

APPLICATION

GRZ200 distance protection is implemented on Toshiba's next generation GR-200 series IED platform and has been designed to provide distance protection and control applications for transmission lines and distribution feeders in all types of network. This powerful and user-friendly IED will provide you with the flexibility to meet your application and engineering requirements in addition to offering good performance, the high quality and operational peace of mind.

- EHV/HV/MV applications including parallel lines and underground cables
- Backup protection for generators, transformers and reactors
- Advanced fault location function
- Bay control and monitoring functions
- Communications within substation automation system, IEC 61850-8-1 [Station bus], IEC 60870-5-103 and IEC62439/PRP/HSR



FEATURES

- **Application**
  - Transmission lines including parallel lines and underground cables of different voltage levels
  - Single-shot (single / three / single + three phase) or multi-shot (three phase) autoreclose for single breaker system and one-and-a half breaker system
  - Backup protection for generators, transformers and reactors
- **Functionality**
  - Eight settings groups
  - Automatic supervision
  - Metering and recording functions
  - Time synchronization by external clock such as IRIG-B and system network
- **Communication**
  - System interface - RS485, Fiber optic, 100BASE-TX/1000BASE-T, 100BASE-FX, 1000BASE-LX
  - Multi protocol - IEC 60870-5-103, IEC 61850 and IEC62439/PRP/HSR
- **Security**
  - Password protection
- **Flexibility**
  - Various models and hardware options for flexible application depending on system requirement and controlled object
  - Combined 1A / 5A current inputs
  - Multi range DC power supply: 24 to 60V / 110 to 250V
  - Configurable binary inputs and outputs
  - Programmable control, trip and alarm logic with PLC tool software
- **Human Machine Interface**
  - Graphical LCD and 26 LEDs
  - 7 configurable function keys
  - USB port for local PC connection
  - Direct control buttons for open/close (O/I) and control authority (43R/L)
  - Help key for supporting operation
  - Monitoring terminals for testing

FUNCTIONS

- **Protection**
  - Distance protection with six independent zones.
  - Command protection distance schemes (PUP, POP, BOP and UOP with weak infeed and current reversal logic)
  - Command protection non-directional and directional earth fault schemes (POP, BOP and UOP)
  - Switch-on-to-fault (SOTF) and stub protection
  - Power swing blocking
  - Out-of-step trip protection
  - Overcurrent guard scheme for distance protection
  - Circuit breaker failure protection
  - Non-directional and directional overcurrent protection for phase and earth faults
  - Non-directional and directional negative phase sequence overcurrent protection
  - Undercurrent protection
  - Thermal overload protection
  - Broken conductor detection
  - Phase to neutral and phase to phase overvoltage protection
  - Positive and negative sequence overvoltage protection
  - Earth fault overvoltage protection
  - Phase to neutral and phase to phase undervoltage protection
  - Positive phase sequence undervoltage protection
  - Under/overfrequency protection
  - Inrush current detector
  - Cold load protection
- **Control**
  - Single-shot (single / three / single + three phase) or multi-shot (three phase) autoreclose
  - Synchronism voltage check
  - Circuit breaker and isolator control
  - Switchgear interlock check
  - Programmable automatic sequence control
- **Monitoring**
  - VT failure detection
  - CT failure detection
  - Status and condition monitoring of primary apparatus

- Switchgear operation monitoring
- Plausibility check
- Measurement of I, V, P, Q, PF, f, Wh and varh
- Current and voltage circuit supervision
- Trip circuit supervision
- Fault locator

• HMI function

- Selection of HMI: Standard LCD / large LCD / Separate large LCD
- Large LCD supports single line diagram indication and touch-type operation
- 24 configurable tri-state LEDs selectable red/green/yellow
- 7 Programmable function keys for user demand operation

• Recording

- Fault record
- Event record
- Disturbance record

• Communication

- IEC 60870-5-103 / IEC 61850
- IEC62439 PRP/HSR

• General functions

- Eight settings groups
- Automatic supervision
- Metering and recording functions
- Time synchronization by external clock using IRIG-B or system network
- Password protection for settings and selection of local / remote control
- Checking internal circuit by forcible signal.
- Checking internal circuit using monitoring jacks.

APPLICATIONS

PROTECION

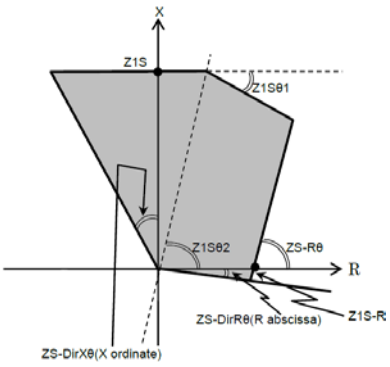
■ **Time-Stepped Distance Protection**

GRZ200 provides a maximum of six-zones of distance protection (Z1, Z1X, Z2, Z3, Z4, Z5). Each zone configurate blinder, reactance and directional (forward / reverse / non-directional) element can be individually set.

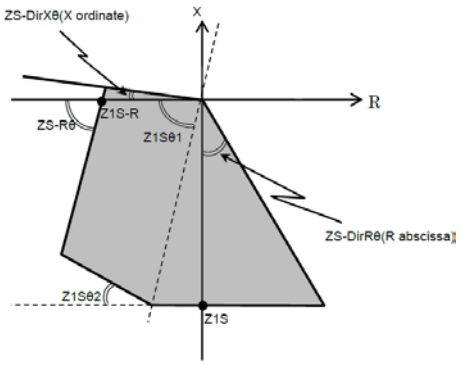
GRZ200 provides individual phase-fault measuring elements and earth-fault measuring elements for all types of fault. Directional measurement in GRZ200 is based on cross polarization with voltage memory to ensure dependable fault detection. GRZ200 uses an advanced distance measurement algorithm which achieves accurate fault impedance measurement over a wide range of frequencies.

GRZ200 provides measuring zones with quadrilateral characteristics or mho-based characteristics, as shown in Figures 1 and 2.

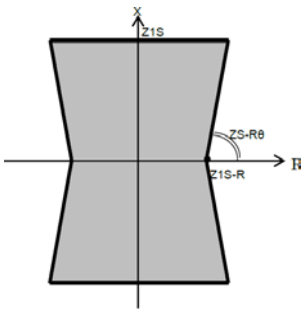
As shown in Figure 1, quadrilateral characteristics are composed of a reactance element, a directional element and a blinder element.



(a) Forward zone



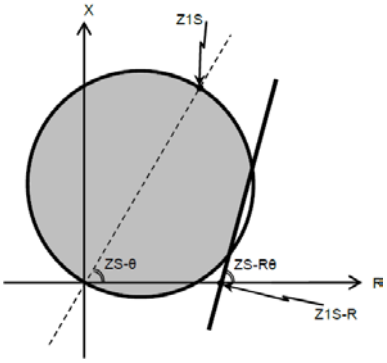
(b) Reverse zone



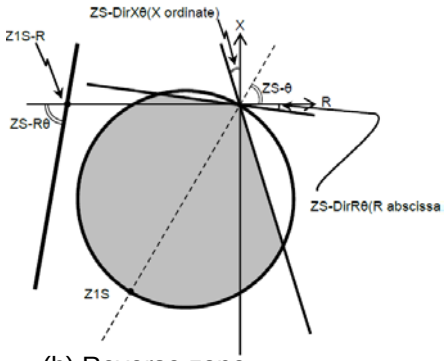
(c) Non directional zone

Figure 1 Quadrilateral Characteristics

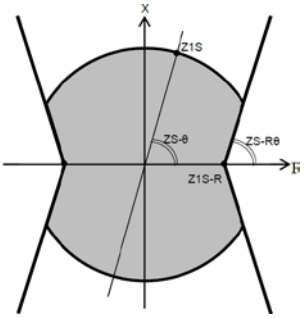
As shown in Figure 2, mho-based characteristics are composed of a mho element, an offset mho element, a reactance element, and a blinder element for phase fault protection and earth fault protection.



(a) Forward zone



(b) Reverse zone



(c) Non directional zone

Figure 2 Mho-based Characteristics

Forward zones can be configured such that the reactance line takes a negative gradient when the terminal is sending power, which prevents the forward zone from overreaching for remote end faults combined with high load current.

By combination of multiple forward zones, GRZ200 can provide time-stepped distance backup protection for remote end busbars and adjacent lines.

To ensure that GRZ200 can provide reliable time-delayed tripping for close-up three-phase faults, the phase fault elements are reverse offset.

Reverse zones are used for local back-up protection for busbar faults or transformer faults.

The non-directional zone is used for time delayed backup protection covering all zones.

■ Zone1 Extension

When telecommunications cannot be applied, a Zone 1 extension (Z1X) protection is provided for high-speed protection of any fault along the whole length of the protected line.

■ Earth Return and Mutual Coupling Compensation

Distance zone protection for earth fault protection adopts vectorial zero sequence current compensation to eliminate distance measuring errors due to the earth return of zero sequence current.

When GRZ200 is applied to a double circuit line, in order to eliminate the influences of zero sequence mutual coupling, the zero sequence current for the parallel line can be introduced. Reverse zones are not provided with zero sequence mutual coupling compensation for the parallel lines.

■ Load encroachment element characteristic

To prevent the unwanted operation of the distance protection during heavy load flow, GRZ200 provides a load encroachment element.

■ Application to Long and Short Lines

The large capacitance of a long transmission line can adversely affect the measurement of fault impedance. GRZ200 employs an advanced charging current compensation technique which gives significant improvement in impedance measurement for long transmission lines.

The suitability of a distance relay for application to short lines is not determined by its minimum setting but rather by its measuring accuracy for high SIR conditions. GRZ200 provides highly accurate measuring elements suitable to be applied to short lines.

■ Command Protection

The following four schemes are available for distance protection using telecommunication.

- Permissive Underreach Protection (PUP)
- Permissive Overreach Protection (POP)
- Unblocking Overreach Protection (UOP)
- Blocking Overreach Protection (BOP)

POP and UOP are equipped with echo logic and weak infeed tripping functions and can be used in the protection of lines with weak infeed or no infeed terminals. An undervoltage element is incorporated for the weak infeed tripping function.

GRZ200 provides dedicated distance zones (ZCSF, ZCSR) for command protection. ZCSF is applied for forward faults and ZCSR for reverse faults.

In case that GRZ200 is applied using integral digital communication channels by fibre-optic links, or by electrical interfaces to a digital communication network, phase-segregated command protection is supported.

■ Switch-on-to-fault Protection and Stub Protection

Switch-on-to-fault (SOTF) protection is provided in order to detect faults that are present when a line or busbar is energized.

For 500 ms following circuit breaker closure, this function is effective to protect against any switch-on-to-fault. A non-directional overcurrent element and/or distance measuring elements perform the SOTF protection.

Stub protection operates for a fault in a stub zone using an overcurrent element.

■ Power Swing Blocking

GRZ200 provides a power swing blocking (PSB) function to prevent false tripping by distance measuring elements during a power swing.

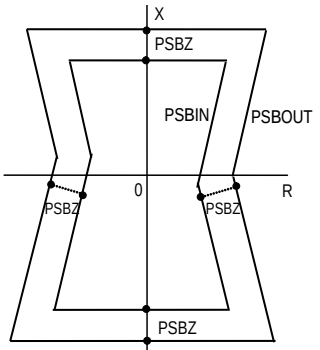
When a power swing is detected, all distance protection zones and protection using telecommunications can be blocked independently.

When a zone is set to non-directional, the zone is not blocked.

A power swing condition is detected using two PSB elements with quadrilateral characteristics shown in Figure 3. The outer PSB element PSBOUT encloses the inner element PSBIN, the two elements being separated by a width of PSBZ. Further, GRZ200 provides PSBSZ and PSBGZ for phase fault measuring elements and earth fault measuring elements respectively. Their functions and characteristics are identical. PSBGZ provides phase-segregated characteristics.

If the impedance locus enters the PSBZ zone for more than a predetermined time (20 to 100ms), the PSB function will block the selected zones. The PSB function is reset after 500 ms when the impedance locus has moved outside the PSB elements.

GRZ200 can provide high speed tripping for faults which occur during a power swing condition, by utilising a well-proven, dedicated negative sequence directional element and any of the PUP, POP, UOP and BOP command schemes.



PSBZ: Impedance setting of PSB element

Figure 3 Characteristics of power swing blocking element

■ OC guard scheme for distance protection

Each distance measuring element can be supervised by an independent overcurrent element.

■ Out-of-step Trip Protection

The out-of-step tripping function is used to execute power system separation at the optimum point when an out-of-step condition occurs.

An out-of-step condition is detected by using two impedance measuring elements with quadrilateral characteristics as shown in Figure 4. The element operates when the out-of-step locus passes from Zone A → Zone B → Zone C (or Zone C → Zone B → Zone A) and remains in Zones A and C for the detection time (TOST).

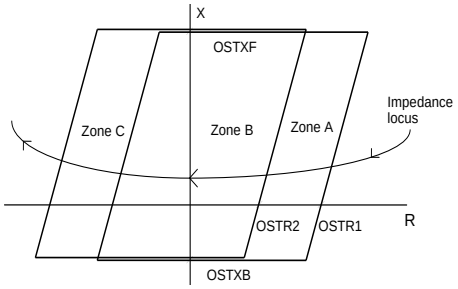


Figure 4 Characteristics of out-of-step trip element

■ Non-directional and Directional Overcurrent and Earth Fault Protection

GRZ200 provides non-directional and directional overcurrent protections with inverse time and definite time for both phase faults and earth faults.

Inverse time overcurrent protection consists of an IDMT (inverse definite minimum time) element. IDMT is available in conformity with the IEC 60255-151 standard which encompasses both the IEC and IEEE/ANSI standard characteristics. Alternatively, a user-configurable curve may be created.

The IDMT element has a programmable reset feature, selectable for instantaneous, definite time or dependent time operation. This feature can be used to protect against flashing/intermittent fault conditions, or to grade correctly with electromechanical overcurrent relays.

Definite time overcurrent protection is enabled by the instantaneous overcurrent element and pickup-delay timer.

Tripping by each element can be disabled by the scheme switches, and overcurrent backup protection can be blocked by a binary input signal.

GRZ200 can also provide non-directional and directional earth fault protection. Protection functionality is the same as for the phase fault elements.

The directional earth fault elements have a user selectable minimum voltage threshold.

GRZ200 can provide directional earth fault command protection by using two stage directional earth fault elements, one of which is for tripping and the other is

for blocking or for current reversal detection.

■ Non-Directional and Directional Sensitive Earth Fault Protection

GRZ200 provides non-directional and directional earth fault protection with more sensitive settings for use in applications where the fault current magnitude may be very low.

The sensitive earth fault element includes a digital filter which rejects all harmonics other than the fundamental power system frequency.

The sensitive earth fault quantity is measured directly, using a dedicated core balance earth fault CT.

■ Non-directional and Directional Negative Phase Sequence Overcurrent Protection

Negative phase sequence overcurrent (OCN) protection can be used in applications where certain fault conditions may not be detected by the normal phase and earth overcurrent protections, for example, in the case of a relay applied on the delta side of a delta-star transformer, to detect an earth fault on the star side. Alternatively, OCN can be used to protect a three phase motor against the severe overheating which results from operating with an unbalanced supply.

The negative phase sequence overcurrent elements can be directionalized by polarizing against the negative phase sequence voltage.

■ Phase Undercurrent Protection

Protection against loss of load is provided by the phase undercurrent protection. Two independent stages are provided, each with a programmable definite time delay.

■ Breaker Failure Protection

When an overcurrent element remains in operation longer than a pre-determined length of time following the output of a trip signal the associated circuit breaker is judged to have failed and adjacent circuit breakers can be tripped as a back-up measure.

Two independent timers are available, one of which can be used to control the RETRIP of the original circuit breaker(s). The second timer is used to control the back-tripping of adjacent circuit breakers.

For high-speed protection, an overcurrent element with high-speed reset time is used to prevent a spurious re-trip or back-trip following a successful trip or re-trip action.

■ Broken Conductor Detection

The unbalance condition caused by an open circuited conductor is detected by the broken conductor detection function. An unbalance threshold with programmable definite time delay is provided.

■ Thermal Overload Protection

The thermal overload feature provides protection for cables and other plant against the effects of prolonged operation under excess load conditions. A thermal replica algorithm is applied to create a model for the thermal characteristics of the protected plant. The characteristics are exponential functions according to functional standard IEC 60255-149 and take into account the I^2R losses due to the specific operational current and the simultaneous cooling effect of the coolant. In this way the tripping time during an overload condition takes the prior level of load current into consideration. An alarm can be set to operate before the tripping condition is reached.

Thermal image:

$$t = \tau \ln \frac{I^2 - I_p^2}{I^2 - (k\, I_B)^2}$$

where

t:	Operating time
τ:	Thermal time constant
I:	Overload current
I_B:	Thermal overload current setting
K:	Constant
I_p:	Specified load current before the overload occurs

■ Overvoltage Protection

GRZ200 provides two independent overvoltage protections for phase-to-neutral voltage input. GRZ200 also provides two independent overvoltage protections for phase-to-phase voltage input. All stages can be set for inverse time or definite time operation. In total, therefore, GRZ200 provides four independent overvoltage thresholds.

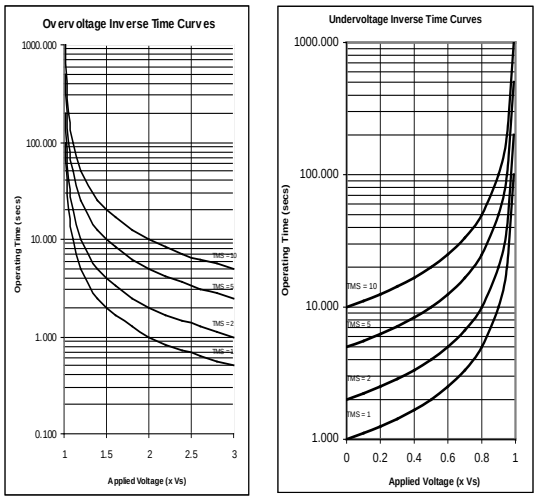


Figure 7 Inverse time characteristics

■ **Zero Phase Sequence Overvoltage (Neutral Voltage Displacement) Protection**

Neutral voltage displacement (NVD) protection is provided for detection of earth faults in high impedance earthed or isolated systems. NVD can be programmed with definite time delays, and one stage is also available with an inverse delay. The zero sequence voltage may be derived from the phase voltages, or directly measured. Suppression of superimposed 3rd harmonic components of the supply voltage is included.

■ **Negative Phase Sequence Overvoltage Protection**

For detection of unbalanced supply voltages, Negative Sequence OVN overvoltage thresholds are available, both of which can be programmed with definite time delays, and one is also available with an inverse delay.

■ **Positive Phase Sequence Overvoltage Protection**

To detect an overvoltage condition on a steady state, positive phase sequence overvoltage is provided. The overvoltage condition is observed for a light-loaded long transmission lines of which capacitance is large, and it is also recognized as so-called Ferranti-effect. Series reactors are normally installed for reducing the effect of capacitance, however, when the series reactor is not functioning, the network must be tripped for preventing further damages.

■ **Undervoltage Protection**

GRZ200 provides two-stage undervoltage protection for phase-to-phase voltage input and two-stage undervoltage protection for phase-to-neutral voltage input. The undervoltage protection is provided with an undervoltage blocking function to prevent undervoltage tripping in the case of a dead line.

■ **Positive Phase Sequence Undervoltage Protection**

GRZ200 provides positive phase sequence undervoltage protection element to detect steady-state and transient-state undervoltage conditions.

■ **Under/Overfrequency Protection**

GRZ200 provides over/under frequency protection and frequency rate-of-change protection.

These protections provide independent frequency protection stages. The over/under frequency protection is programmable for either under- or over-frequency operation, and each has an associated DTL timer. The frequency rate-of-change protection calculates the gradient of frequency change (df/dt).

■ **Inrush Current Detector**

The inrush current detector is used to prevent an incorrect operation of overcurrent protections from a magnetising inrush current during transformer energisation. Inrush current detector (ICD) detects second harmonic inrush current during transformer energisation.

■ **Cold Load Protection**

The cold load function modifies the overcurrent protection settings for a period after energising the system. This feature is used to prevent unwanted protection operation when closing on to the type of load which takes a high level of current for a period after energisation.

CONTROL

■ **Autoreclose**

Most faults on HV and EHV overhead transmission lines are transient faults, which are removed following line de-energization. After a short time, the hot gases disperse and the air de-ionizes. After clearing the fault and deionizing the fault arc, reclosing can be performed. GRZ200 provides two autoreclose schemes, single-shot autoreclose and multi-shot autoreclose.

GRZ200 autoreclose function can be initiated by any of the following high-speed protections.

- Protection using telecommunication
- Distance zone is set to zone 1 extension

■ Single-shot autoreclose

Single-shot reclosing can provide any of three auto-reclose modes; single-phase autoreclose, three-phase autoreclose, and single- and three-phase autoreclose.

In the single-phase autoreclose mode, only the faulted phase is tripped, and then reclosed if a single-phase earth fault occurs.

In the three-phase autoreclose mode, all three phases are tripped, and then reclosed regardless of the fault mode, whether a single-phase fault or a multi-phase fault has occurred.

In the single- and three-phase autoreclose mode, the single-phase is reclosed if a single-phase is tripped and the three phases are reclosed if three phases are tripped.

■ Multi-shot autoreclose

In multi-shot autoreclose, two- to four-shot reclosing can be selected. The first shot is selected from any of the four autoreclose modes available in the single-shot autoreclose scheme.

If reclosing by the first shot fails, three-phase tripping and reclosing is applied for the second to fourth shots.

■ Synchronism Check

For the correct operation of three-phase autoreclose, voltage and synchronism check are necessary. Characteristics of the synchronism check element are shown in Figure 8.

A detected slip cycle is determined by the following equation:

$$f = \frac{\theta}{180° \times TSYN}$$

where,

f: slip cycle

θ: synchronism check angle setting

TSYN: synchronism check timer setting

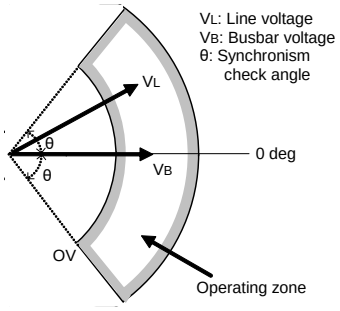


Figure 8 Synchronism check element

■ One-and-a-half Breaker Scheme

GRZ200 performs two-breaker autoreclose in a one-and- a-half breaker scheme.

Only single-shot autoreclose is available in a one-and-a-half breaker scheme. Single-phase autoreclose, three-phase autoreclose or single and three-phase autoreclose can be applied to the two circuit breakers.

■ Switchgear Control

GRZ200 provides functions for local control of switchgear from the HMI. Two-stepped operation (select-control) is applied for the control of circuit breakers, isolator switches and earthing switches.

Also, switchgear control commands from the station level can be performed through GRZ200 within the application of a substation automation control system.

■ Interlock check

The interlocking function blocks the operation of primary switching devices, for instance when an isolator switch is under load, in order to prevent equipment damage and/or accidental human injury.

Each switchgear control function has interlocking modules included for different switchyard arrangements, where each function handles interlocking for one bay. The interlocking function is distributed to each IED and is not dependent on any central function.

HMI FUNCTION

■ Front Panel

GRZ200 provides the following front panel options.

- Standard LCD
- Large LCD (optional separate LCD type is also available)

The standard LCD panel incorporates the user interfaces listed below. Setting the relay and viewing stored data are possible using the Liquid Crystal Display (LCD) and operation keys.

- 21 character, 8 line LCD with back light
- Support of English language

Figure 9 - HMI Panel (large LCD type)

The large LCD panel incorporates a touch type screen for control and navigation purposes.

- 40 character, 40 line LCD with back light

The local human machine interface includes an LCD which can display the single line diagram for the bay.

The local human machine interface is simple and easy to understand with the following facilities and indications.

- Status indication LEDs (IN SERVICE, ERROR and 24 configurable LEDs)
- 7 Function keys for control, monitoring, setting group change and screen jump functions of which operation is configurable by the user
- Test terminals which can monitor three different signals from the front panel without connection to the rear terminals.
- USB port

■ Local PC connection

The user can communicate with GRZ200 from a local PC via the USB port on the front panel. Using GR-200 series engineering tool software (called GR-TIEMS), the user can view, change settings and monitor real-time measurements.

MONITORING

■ Metering

The following power system data is measured continuously and can be displayed on the LCD on the relay fascia, and on a local or remotely connected PC.

- Measured analog voltages, currents, frequency, active- and reactive-power

The accuracy of analog measurement is ±0.5% for I, V, P, Q at rated input and ±0.03Hz for frequency measurement.

■ Status Monitoring

The open or closed status of each switchgear device and failure information concerning power apparatus and control equipment are monitored by GRZ200.

Both normally open and normally closed contacts are used to monitor the switchgear status. If an unusual status is detected, a switchgear abnormality alarm is generated.

RECORDING

■ Event Record

Continuous event-logging is useful for monitoring of the system from an overview perspective and is a complement to specific disturbance recorder functions. Up to 1,024 time-tagged events are stored with 1ms resolution.

■ Fault records

Information about the pre-fault and fault values for currents and voltages are recorded and displayed for trip event confirmation. The most recent 8 time-tagged faults with 1ms resolution are stored. Fault record items are as follows.

- Date and time
- Faulted phase
- Tripping phase
- Operating mode
- Pre-fault and post-fault current and voltage data (phase, phase to phase, symmetrical components)
- Autoreclose operation
- Fault location

  Fault location is initiated by relay tripping signals. It can also be started on receipt of a start signal from external relays.

  Fault location is indicated in km or mile and % for the whole length of the protected line. The fault location is highly accurate for parallel lines due to the implementation of zero-sequence mutual impedance compensation.

  The result of the fault location is stored as fault record data.

■ Disturbance records

The Disturbance Recorder function supplies fast, complete and reliable information for disturbances in the power system. It facilitates understanding of system behavior and performance of related primary and secondary equipment during and after a disturbance.

The Disturbance Recorder acquires sampled data from all selected analogue inputs and binary signals. The data is stored in COMTRADE format.

COMMUNICATION

■ Station bus

Ethernet port(s) for the substation communication standards IEC 61850 is provided for the station bus. GRZ200 also support Ethernet redundancy scheme protocols defined in the IEC 62439-3 standard: PRP.

■ Serial communication

Serial ports (RS485 and fiber optic) for communicating with legacy equipment or protection relays over IEC 60870-5-103 protocol are provided. The GRZ200 can function as a protocol converter to connect SAS.

GENERAL FUNCTION

■ Self supervision

Automatic self-supervision of internal circuits and software is provided. In the event of a failure being detected, the ALARM LED on the front panel is illuminated, the 'UNIT FAILURE' binary output operates, and the date and time of the failure is recorded in the event record.

■ Time synchronization

Current time can be provided with time synchronization via the station bus by SNTP (Simple Network Time Protocol) with the IEC 61850 protocol. IRIG-B port is also available as an option.

■ Setting groups

8 settings groups are provided, allowing the user to set one group for normal conditions, while the other groups may be set to cover alternative operating conditions.

■ Password protection

Password protection is available for the execution of setting changes, executing control, clearing records and switching between local/remote control.

■ Simulation and test

GRZ200 provides simulation and test functions to check control functions without modification to wiring provided by a dummy circuit breaker (virtual equipment), and the capability to test communication signals by forced signal status change.

The simulation and test can work in the Test mode only.

TOOLS & ACCESSORY

The PC interface GR-TIEMS allows users to access GRZ200 and other Toshiba GR-200 series IEDs from a local personal computer (PC) to view on-line or stored data, to change settings, to edit the LCD screen, to configure sequential logics and for other purposes.

■ REMOTE SETTING AND MONITORING

The engineering tool supports functions to change settings and to view and analyze fault and disturbance records stored in GRZ200. Waveform data in the disturbance records can be displayed, edited, measured and analyzed in detail. An advanced version of the engineering tool can provide additional and powerful analysis tools and setting calculation support functions.

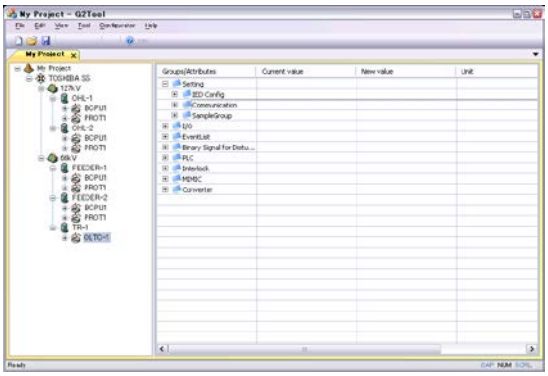


Figure 10 PC Display of GR-TIEMS

■ LCD CONFIGURATION

The user can configure and customize the MIMIC data displayed on the LCD of GRZ200 using GR-TIEMS software.

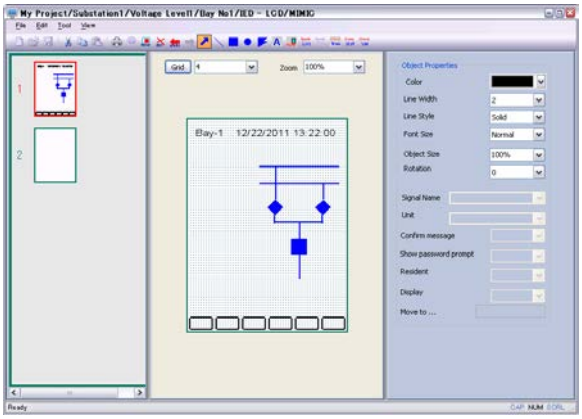


Figure 11 PC Display of MIMIC configuration

■ PROGRAMMABLE LOGIC EDITOR

The programmable logic capability allows the user to configure flexible logic for customized application and operation. Configurable binary inputs, binary outputs and LEDs are also programmed by the programmable logic editor. This complies with IEC61131-3 standard.

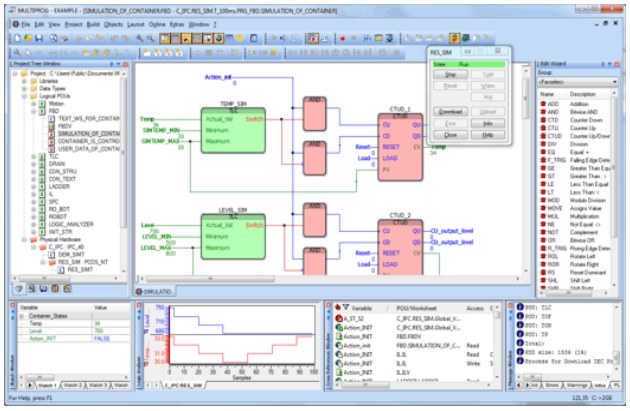


Figure 12 PC display of PLC editor

TECHNICAL DATA

HARDWARE	
Analog Inputs	
Rated current In	1A or 5A (selectable)
Rated voltage Vn	100V to 120V
Rated Frequency	50Hz or 60Hz (specified when order)
Overload Rating	
Current inputs	4 times rated current continuous 5 times rated current for 3 mins 6 times rated current for 2 mins 30 times rated current for 10 sec 100 times rated current for 1 second 250 times rated current for one power cycle (20 or 16.6ms)
Voltage inputs	2 times rated voltage continuous 2.5 times rated voltage for 1 second
Burden	
Phase current inputs	≤ 0.1VA at In = 1A, ≤ 0.2VA at In = 5A
Earth current inputs	≤ 0.3VA at In = 1A, ≤ 0.4VA at In = 5A
Sensitive earth fault inputs	≤ 0.3VA at In = 1A, ≤ 0.4VA at In = 5A
Voltage inputs	≤ 0.1VA at Vn
Power Supply	
Rated auxiliary voltage	24/48/60Vdc (Operative range: 19.2 – 72Vdc), 110/250Vdc or 100/220Vac (Operative range: 88 – 300Vdc or 80 – 230Vac) <Notes> 1) Binary inputs are intended for use with DC power source only. 2) The power supply supervision function is intended for use with DC power source only. It should be disabled when AC power supply is applied in order to prevent spurious alarms.
Superimposed AC ripple on DC supply	≤ 15%
Power supply interruption withstand period (IEC 60255-11)	24/48/60Vdc rating: 20ms 110/125Vdc rating: 50ms
Power consumption	≤ 15W (quiescent) ≤ 25W (maximum)
Binary Inputs	
Input circuit DC voltage	24/48/60Vdc (Operating range: 19.2 – 72Vdc), 110/125/220/250Vdc (Operating range: 88 – 300Vdc) Note: Pick-up setting is available in BI2 (Setting range: 18V to 222V)
Capacitive discharge immunity	10μF charged to maximum supply voltage and discharged into the input terminals, according to ENA TS 48-4 with an external resistor
Maximum permitted voltage	72Vdc for 24/48/60Vdc rating, 300Vdc for 110/250Vdc rating
Power consumption	≤ 0.5W per input at 220Vdc

Binary Outputs	
Fast operating contacts	
Make and carry	5A continuously
	30A, 290Vdc for 0.2s (L/R=5ms)
Break	0.15A, 290Vdc (L/R=40ms)
Operating time	Typically 3 ms
Semi-fast operating contacts	
Make and carry	8A continuously
	30A, 240Vdc for 1s (L/R=5ms)
Break	0.1A, 250Vdc (L/R=40ms)
	0.2A, 125Vdc (L/R=40ms)
Operating time	Typically 6 ms
Auxiliary contacts	
Make and carry	8A continuously
	30A, 240Vdc for 1s (L/R=5ms)
Break	0.1A, 250Vdc (L/R=40ms)
	0.2A, 125Vdc (L/R=40ms)
Operating time	Typically 8 ms
Hybrid contacts (10 A breaking)	
Make and carry	8A continuously
	10A, 220Vdc for 0.5s (L/R=5ms)
Break	10A, 220Vdc (L/R=20ms)
	10A, 110Vdc (L/R=40ms)
Operating time	1 ms
Durability	≥ 10,000 operations (loaded contact)
	≥ 100,000 operations (unloaded contact)
Measuring input capability	
Full scale	
Standard current input	≥ 60A (1A rating) or 300A (5A rating)
Sensitive current input	≥ 3A (1A rating) or 15 A (5A rating)
Voltage input	≥ 200V
Sampling rate	48 samples / cycle
Frequency response	< 5% deviation over range 16.7Hz to 600Hz
Mechanical Design	
Installation	Flush mounting
Weight	Approx. 12kg (1/2 size), 15kg (3/4 size), 25kg (1/1 size)
Case color	2.5Y7.5/1 (approximation to Munsell value)
LED	
Number	26 (Fixed for “In service” and “ERROR”)
Color	Red / Yellow / Green (configurable) except “In service” (green) and “Error” (red)
Function keys	
Number	7
Local Interface	
USB	Type B
Maximum cable length	2m (max.)
Terminal Block	
CT/VT input	M3.5 Ring terminal (ring lug type terminal only)
Binary input, Binary output	Compression plug type terminal

System Interface (rear port)	
100BASE-TX/1000BASE-T	For IEC 61850-8-1 and GR-TIEMS
Cable type	CAT5e STP cable - enhanced category 5 with Shielded Twisted Pair cable
Connector type	RJ-45
100BASE-FX	For IEC 61850-8-1
Cable type	Multimode fibre, 50/125 μ m or 62.5/125 μ m
Connector type	SC duplex
Wave length	1300nm
1000BASE-LX	For IEC 61850-8-1
Cable type	Single-mode fibre
Connector type	LC duplex
Wave length	1310nm
RS485	For IEC 60870-5-103
Cable type	Shielded twisted pair cable
Connector type	Push-in spring terminal (PCB connector)
Fiber optical (for serial communication)	For IEC 60870-5-103
Cable type	Multimode fibre, 50/120 μ m or 62.5/125 μ m
Connector type	ST
Wave length	820nm
IRIG-B (for time synchronization)	
Cable type	Shielded twisted pair cable
Connector type	Push-in spring terminal (PCB connector)

ENVIRONMENTAL PERFORMANCE

Atmospheric Environment		
Temperature	IEC 60068-2-1/2 IEC 60068-2-14	Operating range: -10°C to +55°C. Storage / Transit: -25°C to +70°C. Cyclic temperature test as per IEC 60068-2-14
Humidity	IEC 60068-2-30 IEC 60068-2-78	56 days at 40°C and 93% relative humidity. Cyclic temperature with humidity test as per IEC 60068-2-30
Enclosure Protection	IEC 60529	IP52 - Dust and Dripping Water Proof IP20 for rear panel
Mechanical Environment		
Vibration	IEC 60255-21-1	Response - Class 1 Endurance - Class 1
Shock and Bump	IEC 60255-21-2	Shock Response Class 1 Shock Withstand Class 1 Bump Class 1
Seismic	IEC 60255-21-3	Class 1
Electrical Environment		
Dielectric Withstand	IEC 60255-27	2kVrms for 1 minute between all terminals and earth. 2kVrms for 1 minute between independent circuits. 1kVrms for 1 minute across normally open contacts.
High Voltage Impulse	IEC 60255-27 IEEE C37.90	Three positive and three negative impulses of 5kV(peak), 1.2/50μs, 0.5J between all terminals and between all terminals and earth.
Voltage Dips, Interruptions, Variations and Ripple on DC supply	IEC 60255-11, IEC 61000-4-29, IEC 61000-4-17 IEC 60255-26 Ed 3	1. Voltage dips: 0 % residual voltage for 20 ms 40 % residual voltage for 200 ms 70 % residual voltage for 500 ms 2. Voltage interruptions: 0 % residual voltage for 5 s 3. Ripple: 15 % of rated d.c. value, 100 / 120 Hz 4. Gradual shut-down / start-up: 60 s shut-down ramp, 5 min power off, 60s start-up ramp 5. Reversal of d.c. power supply polarity: 1 min
Capacitive Discharge	ENA TS 48-4	10μF charged to maximum supply voltage and discharged into the input terminals with an external resistance

Electromagnetic Environment		
High Frequency Disturbance / Damped Oscillatory Wave	IEC 60255-22-1 Class 3, IEC 61000-4-18 IEC 60255-26 Ed 3	1 MHz burst in common / differential modes Auxiliary supply and I/O ports: 2.5 kV / 1 kV Communications ports: 1 kV / 0 kV
Electrostatic Discharge	IEC 60255-22-2 Class 4, IEC 61000-4-2 IEEE C37.90.3-2001 IEC 60255-26 Ed 3	Contact: 2, 4, 6, 8kV Air: 2, 4, 8, 15kV
Radiated RF Electromagnetic Disturbance	IEC 60255-22-3, IEC 61000-4-3 Level 3 IEC 60255-26 Ed 3	Sweep test ranges: 80 MHz to 1 GHz and 1.4 GHz to 2.7 GHz. Spot tests at 80, 160, 380, 450, 900, 1850 and 2150 MHz. Field strength: 10 V/m
	IEEE C37.90.2-1995	Field strength 35V/m for frequency sweep of 25MHz to 1GHz.
Fast Transient Disturbance	IEC 60255-22-4 IEC 61000-4-4 IEC 60255-26 Ed 3	5 kHz, 5/50ns disturbance Auxiliary supply and input / output ports: 4 kV Communications ports: 2 kV
Surge Immunity	IEC 60255-22-5 IEC 61000-4-5 IEC 60255-26 Ed 3	1.2/50µms surge in common/differential modes: Auxiliary supply and input / output ports: 4, 2, 1, 0.5 kV / 1, 0.5 kV Communications ports: up to 1, 0.5 kV / 0 kV
Surge Withstand	IEEE C37.90.1-2002	3kV, 1MHz damped oscillatory wave 4kV, 5/50ns fast transient
Conducted RF Electromagnetic Disturbance	IEC 60255-22-6 IEC 61000-4-6 IEC 60255-26 Ed 3	Sweep test range: 150 kHz to 80MHz Spot tests at 27 and 68 MHz. Voltage level: 10 V r.m.s
Power Frequency Disturbance	IEC 60255-22-7 IEC 61000-4-16 IEC 60255-26 Ed 3	50/60 Hz disturbance for 10 s in common / differential modes Binary input ports: 300 V / 150 V
Power Frequency Magnetic Field	IEC 61000-4-8 Class 4 IEC 60255-26 Ed 3	Field applied at 50/60Hz with strengths of: 30A/m continuously, 300A/m for 1 second.
Conducted and Radiated Emissions	IEC 60255-25 EN 55022 Class A, EN 61000-6-4 IEC 60255-26 Ed 3	Conducted emissions: 0.15 to 0.50MHz: <79dB (peak) or <66dB (mean) 0.50 to 30MHz: <73dB (peak) or <60dB (mean) Radiated emissions 30 to 230 MHz: < 40 dB(uV/m) 230 to 1000 MHz: < 47 dB(uV/m) Measured at a distance of 10 m

European Commission Directives		
CE	2014/30/EU	Compliance with the European Commission Electromagnetic Compatibility Directive is demonstrated according to EN 60255-26:2013.
	2014/35/EU	Compliance with the European Commission Low Voltage Directive for electrical safety is demonstrated according EN 60255-27:2014.

Performance and Functional Standards	
Category	**Standards**
General	
Common requirements	IEC 60255-1
Data Exchange	IEC 60255-24 / IEEE C37.111 (COMTRADE) IEEE C37.239 (COMFEDE)
Product Safety	IEC 60255-27

FUNCTIONAL DATA

Phase Fault Distance Measuring Element	
Z*-Mho.Reach, Z*-X.Reach and Z*-R.Reach (Z1S, Z1XS, Z2S, Z3S, Z4S, Z5S, ZCSF, ZCSR)	0.10 to 500.00Ω in 0.01Ω steps (1A rating) 0.01 to 100.00Ω in 0.01Ω steps (5A rating)
Characteristic angle Z*-Mho.Angle and Z*-R.Angle (Z1S, Z1XS, Z2S, Z3S, Z4S, Z5S, ZCSF, ZCSR)	30° to 90° in 1° steps
Z*- DirX.Angle and Z*-DirR.Angle (Z1S, Z1XS, Z2S, Z3S, Z4S, Z5S, ZCSF, ZCSR)	0° to 60° in 1° steps
ZSF-X.GrAngle1 and ZSR-X.GrAngle1	0° to 45°in 1° steps
ZSF-X.GrAngle2 and ZSR-X.GrAngle2	45° to 90° in 1° steps
Earth Fault Distance Measuring Element	
Z*-Mho.Reach, Z*-X.Reach and Z*-R.Reach (Z1G, Z1XG, Z2G, Z3G, Z4G, Z5G, ZCGF, ZCGR)	0.10 to 500.00Ω in 0.01Ω steps (1A rating) 0.01 to 100.00Ω in 0.01Ω steps (5A rating)
Characteristic angle Z*-Mho.Angle and Z*-R.Angle (Z1G, Z1XG, Z2G, Z3G, Z4G, Z5G, ZCGF, ZCGR)	30° to 90° in 1° steps
Z*- DirX.Angle and Z*-DirR.Angle (Z1G, Z1XG, Z2G, Z3G, Z4G, Z5G, ZCGF, ZCGR)	0° to 60° in 1° steps
ZGF-X.GrAngle1 and ZGR-X.GrAngle1	0° to 45°in 1° steps
ZGF-X.GrAngle2 and ZGR-X.GrAngle2	45° to 90° in 1° steps
Timer Setting	
Time setting of Z1S, Z1XS, Z2S, Z3S, Z4S, Z5S, Z1G, Z1XG, Z2G, Z3G, Z4G, Z5G	0.00 to 100.00s in 0.01steps
Overcurrent Element for Fail-safe	
Overcurrent elements Z*_OCFS for supervision distance measuring elements (Z1S, Z1XS, Z2S, Z3S, Z4S, Z5S, Z1G, Z1XG, Z2G, Z3G, Z4G, Z5G)	0.02 to 5.00A in 0.01A steps (1A rating) 0.10 to 25.00A in 0.01A steps (5A rating)
Command Protection Distance Scheme	
Time for current reverse block	0.00 to 10.00s in 0.01s steps
Coordination time for BOP scheme	0 to 50ms in 1ms steps
delayed drop-off timer	0.00 to 1.00s in 0.01s steps
Command Protection Earth Fault Scheme	
Time for delay trip	0.00 - 0.30s in 0.01s steps
Time for current reverse block	0.00 to 10.00s in 0.01s steps
Coordination time for BOP scheme	0 to 50ms in 1ms steps
delayed drop-off timer	0.00 to 1.00s in 0.01s steps
Power Swing Block	
Detection zone (PSBGS) Detection timer (TPSBS)	2.50 to 75.00Ω in 0.01Ω steps (1A rating) 0.50 to 15.00Ω in 0.01Ω steps (5A rating)
Load Encroachment	
Minimum load resistance (LESR, LESL)	0.10 to 500.00Ω in 0.01Ω steps (1A rating) 0.01 to 100.00Ω in 0.01Ω steps (5A rating)
Maximum load angle (LESR-Angle, LESL-Angle)	5° to 75° in 1° steps
Charging Current Compensation	
Charging current compensation for distance relay	0.00 to 1.00A in 0.01A steps (1A Rating) 0.00 to 5.00A in 0.01A steps (5A Rating)
Rated voltage for charging current compensation	100 to 120V in 1V steps

Minimum Operating Current	
Current	0.08A fixed (1A relay) 0.4A fixed (5A relay)
Earth fault current	0.10 to 1.00A in 0.01A steps(1A rating) 0.50 to 5.00A in 0.01A steps (5A rating)
Switch-on-to-fault Protection	
Overcurrent threshold	0.02 to.5.00A in 0.01A steps (1A rating) 0.10 to 15.00A in 0.01A steps (5A rating)
Stub Protection	
Overcurrent threshold	0.02 to 5.00A in 0.01A steps (1A rating) 0.10 to 15.00A in 0.01A steps (5A rating)
Out-of-step Protection	
Resistive reach (at Right side)	15.00 to 150.00Ω in 0.01Ω steps (1A rating) 3.000 to 30.000Ω in 0.01Ω steps (5A rating)
Resistive reach (at Left side)	5.00 to 50.00Ω in 0.01Ω steps (1A rating) 1.000 to 10.000Ω in 0.01Ω steps (5A rating)
Resistive reach (at Forward)	5.00 to 250.00Ω in 0.01Ω steps (1A rating) 1.000 to 50.000Ω in 0.001Ω steps (5A rating)
Resistive reach (at Backward)	1.0 to 50.00Ω in 0.01Ω steps (1A rating) 0.200 to 10.000Ω in 0.001Ω steps(5A rating)
Detection time	0.01 to 1.00s in 0.01s steps
Breaker Failure (BF) Protection	
Overcurrent element	0.1 to 2.0A in 0.1A steps (1A rating) 0.5 to 10.0A in 0.1A steps (5A rating)
BF timer for retry-trip of failed breaker	50 to 500ms in 1ms steps
BF timer for related breaker trip	50 to 500ms in 1ms steps
Non-directional and Directional Overcurrent Protection	
1st, 2nd, 3rd, 4th Definite time overcurrent threshold	0.02 to 50.00A in 0.01A steps (1A rating) 0.10 to 250.00A in 0.01A steps (5A rating)
1st, 2nd, 3rd, 4th Inverse time overcurrent threshold	0.02 to 5.00A in 0.01A steps (1A rating) 0.10 to 25.00A in 0.01A steps (5A rating)
Direction characteristic	Non Directional / Forward / Backward
Polarising voltage	1.0V (fixed)
Characteristic angle	0 – 180 degs in 1 deg steps
Delay type	DT / IEC-NI / IEC-VI / IEC-EI / UK-LTI / IEEE-MI / IEEE-VI / IEEE-EI / US-CO2 / US-CO8 / Original
Drop-out/pick-up ratio	10 to 100% in 1% steps
DTL delay	0.00 to 300.00s in 0.01s steps
IDMTL Time Multiplier Setting TMS	0.010 to 50.000 in 0.001 steps
Reset type	Definite Time or Dependent Time
Reset definite delay	0.00 to 300.00s in 0.01s steps
Reset Time Multiplier Setting RTMS	0.010 to 50.000 in 0.001 steps
Non-directional and Directional Earth Fault Protection	
1st, 2nd, 3rd, 4th Definite time earth fault threshold	0.02 to 50.00A in 0.01A steps (1A rating) 0.10 to 250.00A in 0.01A steps (5A rating)
1st, 2nd, 3rd, 4th Inverse time earth fault threshold	0.02 to 5.00A in 0.01A steps (1A rating) 0.10 to 25.00A in 0.01A steps (5A rating)
Direction characteristic	Non Directional / Forward / Backward
Characteristic angle	0 to 180° in 1° steps (3I0 lags for −3V0)
Polarising voltage (3V0)	0.5 to 100.0V in 0.1V steps
Delay type	DT / IEC-NI / IEC-VI / IEC-EI / UK-LTI / IEEE-MI / IEEE-VI / IEEE-EI / US-CO2 / US-CO8 / Original

Drop-out/pick-up ratio	10 to 100% in 1% steps
DTL delay	0.00 to 300.00s in 0.01s steps
IDMTL Time Multiplier Setting TMS	0.010 to 50.000 in 0.001 steps
Reset type	Definite Time or Dependent Time
Reset definite delay	0.00 to 300.00s in 0.01s steps
Reset Time Multiplier Setting RTMS	0.010 to 50.000 in 0.001 steps
Non-directional and Directional Negative Sequence Phase Overcurrent (NOC) Protection	
1st, 2nd, 3rd, 4th Definite time NOC threshold	0.02 to 50.00A in 0.01A steps (1A rating) 0.10 to 250.00A in 0.01A steps (5A rating)
1st, 2nd, 3rd, 4th Inverse time NOC threshold	0.02 to 5.00A in 0.01A steps (1A rating) 0.10 to 25.00A in 0.01A steps (5A rating)
Direction characteristic	Non Directional / Forward / Backward
Characteristic angle	0 to 180° in 1° steps (3I0 lags for −3V0)
Polarising voltage	0.5 to 25.0V in 0.1V steps
Delay type	DT / IEC-NI / IEC-VI / IEC-EI / UK-LTI / IEEE-MI / IEEE-VI / IEEE-EI / US-CO2 / US-CO8 / Original
Drop-out/pick-up ratio	10 to 100% in 1% steps
DTL delay	0.00 to 300.00s in 0.01s steps
IDMTL Time Multiplier Setting TMS	0.010 to 50.000 in 0.001 steps
Reset type	Definite Time or Dependent Time
Reset definite delay	0.00 to 300.00s in 0.01s steps
Reset Time Multiplier Setting RTMS	0.010 to 50.000 in 0.001 steps
Phase Undercurrent Protection	
Undercurrent 1st, 2nd threshold:	0.10 – 2.00A in 0.01A steps (1A rating) 0.5 – 10.0A in 0.1A steps (5A rating)
DTL delay	0.00 to 300.00s in 0.01s steps
Inrush Current Detection	
Second harmonic detection	10 to 50% in 1% steps
Inrush current thresholds	0.10 to 5.00A in 0.01A steps (1A rating) 0.5 to 25.0A in 0.1A steps (5A rating)
Thermal overload Protection	
Thermal setting (THM = k.IFLC)	0.40 – 2.00A in 0.01A steps (1A rating) 2.0 – 10.0A in 0.1A steps (5A rating)
Time constant (τ)	0.5 – 500.0mins in 0.1min steps
Thermal alarm	OFF, 50% to 100% in 1% steps
Pre-load current setting	0.00 – 1.00A in 0.01A steps (1A rating) 0.0 – 5.0A in 0.1A steps (5A rating)
Broken Conductor Detection	
Broken conductor threshold	0.10 to 1.00 in 0.01 steps
DTL delay	0.00 to 300.00s in 0.01s steps
Phase Overvoltage Protection	
1st, 2nd overvoltage threshold	1.0 to 220.0V in 0.1V steps
Delay type	DTL, IDMT, Original
Drop-out/pick-up ratio	10 to 100% in 1% steps
DTL delay	0.00 to 300.00s in 0.01s steps
IDMTL Time Multiplier Setting TMS	0.010 to 100.000 in 0.001 steps
Reset delay	0.0 to 300.0s in 0.1s steps

Phase to Phase Overvoltage Protection	
1st, 2nd overvoltage threshold	1.0 to 220.0V in 0.1V steps
Delay type	DTL, IDMT, Original
Drop-out/pick-up ratio	10 to 100% in 1% steps
DTL delay	0.00 to 300.00s in 0.01s steps
IDMTL Time Multiplier Setting TMS	0.010 to 100.000 in 0.001 steps
Reset delay	0.0 to 300.0s in 0.1s steps
Positive sequence phase overvoltage protection	
1st, 2nd POV thresholds:	1.0 – 220.0V in 0.1V steps
Drop-out/pick-up ratio	10 to 100% in 1% steps
DTL delay	0.00 to 300.00s in 0.01s steps
Negative sequence phase overvoltage protection	
1st, 2nd NOV thresholds:	1.0 – 220.0V in 0.1V steps
Delay type	DTL, IDMT, Original
Drop-out/pick-up ratio	10 to 100% in 1% steps
DTL delay	0.00 to 300.00s in 0.01s steps
IDMTL Time Multiplier Setting TMS	0.010 to 100.000 in 0.001 steps
Reset delay	0.0 to 300.0s in 0.1s steps
Phase Undervoltage Protection	
1st, 2nd undervoltage threshold	5.0 to 130.0V in 0.1V steps
Delay type	DTL, IDMT, Original
Drop-out/pick-up ratio	100 to 120% in 1% steps
DTL delay	0.00 to 300.00s in 0.01s steps
IDMTL Time Multiplier Setting TMS	0.010 to 100.000 in 0.001 steps
Reset delay	0.0 to 300.0s in 0.1s steps
Undervoltage block threshold	5.0 to 20.0V in 0.1V steps
Undervoltage block delay	0.00 to 300.00s in 0.01s steps
Phase to Phase Undervoltage Protection	
1st, 2nd undervoltage threshold	5.0 to 130.0V in 0.1V steps
Delay type	DTL, IDMT, Original
Drop-out/pick-up ratio	100 to 120% in 1% steps
DTL delay	0.00 to 300.00s in 0.01s steps
IDMTL Time Multiplier Setting TMS	0.010 to 100.000 in 0.001 steps
Reset delay	0.0 to 300.0s in 0.1s steps
Undervoltage block threshold	5.0 to 20.0V in 0.1V steps
Undervoltage block delay	0.00 to 300.00s in 0.01s steps
Under/Over Frequency Protection	
1st - 4th under/overfrequency threshold	(F_{nom} – 10.00Hz) – (F_{nom} + 10.00Hz) in 0.01Hz steps F_{nom}: nominal frequency
DTL delay:	0.00 – 300.00s in 0.01s steps
Frequency UV Block	40.0 – 100.0V in 0.1V steps
Autoreclose	
Number of shots	1 to 5 shots
Dead time for single-phase autoreclose	0.01 to 300.00s in 0.01s steps
Dead time for three-phase autoreclose	0.01 to 300.00s in 0.01s steps
Multi-shot dead line time	0.01 to 300.00s in 0.01s steps
Reclaim time	0.0 to 600.0s in 0.1s steps
Pulse width of reclosing signal output	0.01 to 10.00s in 0.01s steps
Autoreclose reset time	0.01 to 310.00s in 0.01s steps
Reset time for developing fault	0.01 to 300.00s in 0.01s steps

Synchronism check	
Synchronism check angle	0° to 75° in 1° steps
UV element	10 to 150V in 1V steps
OV element	10 to 150V in 1V steps
Busbar or line dead check	0 to 150V in 1V steps
Busbar or line live check	0 to 150V in 1V steps
Synchronism check time	0.01 to 100.00s in 0.01s steps
Voltage check time	0.01 to 100.00s in 0.01s steps
Voltage Transformer Failure Supervision	
Undervoltage element (phase-to-phase)	50 to 100V in 1V steps
Undervoltage element (phase-to-earth)	10 to 60V in 1V steps
Current change detection element	0.1A fixed (1A rating) 0.5A fixed (5A rating)
Residual voltage element	20V fixed
Residual current element	Common use with earth fault detection element
Fault Locator	
Line reactance and resistance setting	0.0 to 999.9Ω in 0.1Ω steps (1A rating) 0.00 to 199.99Ω in 0.01Ω steps (5A rating)
Line length	0.0 to 399.9km in 0.1km steps
Correction factor of impedance between lines	80 to 120% in 1% steps
Correction factor of impedance between in each phase	80 to 120% in 1% steps
Accuracy	±0.4km (up to 20km, without fault at near end) ±2% (up to 399.9km, without fault at near end)
Minimum measuring cycles	2.5 cycles
Metering Function	
AC Current	Accuracy ± 0.5% (at rating)
AC Voltage	Accuracy ± 0.5% (at rating)
Energy (Wh, varh)	Accuracy ± 1.0% (at rating)
Power (P, Q)	Accuracy ± 1.0% (at rating when power quantities being fed)
Frequency	Accuracy ± 0.03Hz
Time Synchronisation	
Protocol	SNTP

Accuracy	
Distance protection Distance measuring element Static accuracy Static angle accuracy Operating time	 ±5% at SIR < 30, ±10% at 30 < SIR < 50 ±5° of setting value Typically 25ms + BO operating time (*1)
Overcurrent protection Pick-ups Operating time with definite timer Operating time with inverse timer	 ±5% of setting value (at I ≥ 0.5pu) Typically 35ms + BO operating time (*1) IEC curve：±5% of theoretical value for 2 ≤ Multiple of threshold value ≤ 10 and TMS=1 IEEE curve: ±10% of theoretical value for 2 ≤ multiple of threshold value ≤ 10 and TMS=1
Earth Fault Protection Pick-ups Operating time with definite timer Operating time with inverse timer	 ±3% of setting value Typically 35ms + BO operating time (*1) IEC curve：±5% of theoretical value for 2 ≤ Multiple of threshold value ≤ 10 and TMS=1 IEEE curve: ±10% of theoretical value for 2 ≤ multiple of threshold value ≤ 10 and TMS=1
Over / under voltage protection Pick-ups Operating time	 ±5% of setting value Typically 35ms
Breaker Failure (BF) Protection Operating time of overcurrent element Resetting time of overcurrent element	 Typically 20ms Maximum ≤15ms
Thermal overload protection Pick-ups Operating time	 ±5% of setting value ±10% of setting value
Negative overcurrent protection Pick-ups Operating time	 ±5% of setting value (at I ≥ 0.5pu) Typically 35ms
Broken conductor protection Pick-ups Operating time	 ±5% of setting value (at I ≥ 0.5pu) Typically 35ms
Autoreclose Operating time of synchronism check element Operating time of UV and OV elements	 Typically 35ms Typically 35ms
Fail safe relay operating time	Typically 20ms

(*1)Typically 3～6ms

ORDERING INFORMATION

[Hardware selection]

[Hardware selection (1)]

Configurations	Positions																						
	-	7	8	-	9	A	B	-	C	D	-	E	F	-	G	H	-	J	K	L
	G	R	Z	2	0	0	-			-				-	0	0	-			-	3		-			0
Application of power system																							
Function for single breaker scheme (CT x 5, VT x 5)		1																					
DC rated voltage																							
110-250 Vdc or 100-220Vac (See (*1))			1																				
24-60 Vdc			3																				
System Frequency																							
50Hz																			1				
60Hz																			2				
AC rated current																							
1A																				1			
5A																				2			
Serial and/or Ethernet Communication and/or Time Sync Port(s)																							
Refer to Communication port Table (See (*3))																							
Outline																							
Standard LCD, 1/2 x 19" rack for flush mounting					2																		
Large LCD, 1/2 x 19" rack for flush mounting					6																		
Standard LCD, 1/2 x 19" rack for rack mounting (See (*2))					F																		
Large LCD, 1/2 x 19" rack for rack mounting (See (*2))					J																		
Terminal block for BIO and PWS																							
Compression plug type terminal																		0					
BI/BO module																							
Choice from BI/BO table						1×BIO module	1	*															
						2×BIO modules	2	*															
						3×BIO modules	3	*															
Terminal block for BIO and PWS																							
Ring type terminal																		1					
BI/BO module																							
Choice from BI/BO table						1×BIO modules	1	*															
						2×BIO modules	2	*															
Outline																							
Standard LCD, 3/4 x 19" rack for flush mounting					3																		
Large LCD, 3/4 x 19" rack for flush mounting					7																		
Standard LCD, 3/4 x 19" rack for rack mounting (See (*2))					G																		
Large LCD, 3/4 x 19" rack for rack mounting (See (*2))					K																		
Terminal block for BIO and PWS																							
Compression plug type terminal																		0					
BI/BO module																							
Choice from BI/BO table						1×BIO module	1	*															
						2×BIO modules	2	*															
						3×BIO modules	3	*															
						4×BIO modules	4	*															
						5×BIO modules	5	*															
						6×BIO modules	6	*															
Terminal block for BIO and PWS																							
Ring type terminal																		1					
BI/BO module																							
Choice from BI/BO table						1×BIO module	1	*															
						2×BIO modules	2	*															
						3×BIO modules	3	*															
						4×BIO modules	4	*															

Outline				
Standard LCD, 1/1 x 19" rack for flush/rack mounting		4		
Large LCD, 1/1 x 19" rack for flush/rack mounting		8		
Terminal block for BIO and PWS				
Compression plug type terminal				0
BI/BO module				
Choice from BI/BO table	1×BIO module	1	*	
	2×BIO modules	2	*	
	3×BIO modules	3	*	
	4×BIO modules	4	*	
	5×BIO modules	5	*	
	6×BIO modules	6	*	
	7×BIO modules	7	*	
	8×BIO modules	8	*	
Terminal block for BIO and PWS				
Ring type terminal				1
BI/BO module				
Choice from BI/BO table	1×BIO module	1	*	
	2×BIO modules	2	*	
	3×BIO modules	3	*	
	4×BIO modules	4	*	
	5×BIO modules	5	*	
	6×BIO modules	6	*	
	7×BIO modules	7	*	

Note:

(*1) Binary inputs are intended for use with DC power source only.
The power supply supervision function is intended for use with DC power source only. It should be disabled when AC power supply is applied in order to prevent spurious alarms.

(*2) For 19” rack panel mounting, accessories of joint kits are available. (See Figure 16)

(*3) For PRP/HSR/RSTP protocol with IEC 61850, choose “L” or “N” code at position E. For hot/standby configuration or single port configuration with IEC 61850, choose other codes at position E.

Please contact with our sales staffs when you require user configurable models that are not indicated in the ordering sheet above.

[Software selection]

Configurations	G	R	Z	2	0	0	-		0	3		-				-		E
								7	M	G	N		E	F	U		9	Q
Application of power system																		
Assignment on position “7”																		
Function Block																		
Refer to Function Table																		
Communication for Remote / Time Synch. (1)																		
Assignment on position “E”																		
Communication for Remote / Time Synch. (2)																		
Assignment on position “F”																		
Protocol																		
IEC60870-5-103 or IEC61850 (See (*1))															1			
IEC61850 (See (*1))															2			
Outline																		
Assignment on position “9”																		
Language																		
English																		E

Note:
(*1) For PRP/HSR/RSTP protocol with IEC 61850, choose “L” or “N” code at position E. For hot/standby configuration or single port configuration with IEC 61850, choose other codes at position E.

Number of BI/BO

BI/BO 1 x I/O module

Number of BI/BO							Ordering No. (Position "A" to "B")	Configuration
Independent BI	Independent BI (variable)	Common BI	Fast-BO	Semi-fast BO	BO	Hybrid BO		
7	-	-	-	6	4	-	**11**	1xBIO1
12	-	-	-	3	2	-	**12**	1xBIO2
8	-	-	6	-	2	-	**13**	1xBIO3
18	-	-	-	-	-	-	**15**	1xBI1
-	12	-	-	-	-	-	**16**	1xBI2
-	-	32	-	-	-	-	**17**	1xBI3
-	-	-	-	6	12	-	**18**	1xBO1

BI/BO 2 x I/O module

Number of BI/BO							Ordering No. (Position "A" to "B")	Configuration
Independent BI	Independent BI (variable)	Common BI	Fast-BO	Semi-fast BO	BO	Hybrid BO		
-	-	32	-	6	12	-	**21**	1xBI3+1xBO1
7	-	32	-	6	4	-	**22**	1xBI3+1xBIO1
12	-	32	-	3	2	-	**23**	1xBI3+1xBIO2
18	-	-	-	6	12	-	**24**	1xBI1+1xBO1
25	-	-	-	6	4	-	**25**	1xBI1+1xBIO1
30	-	-	-	3	2	-	**26**	1xBI1+1xBIO2
8	-	-	6	6	14	-	**27**	1xBO1+1xBIO3
15	-	-	6	6	6	-	**28**	1xBIO1+1xBIO3
7	-	-	-	12	16	-	**29**	1xBO1+1xBIO1
16	-	-	12	-	4	-	**2A**	2xBIO3
-	-	32	-	-	-	16	**2B**	1xBI3+1xBO2
-	12	-	-	6	12	-	**2C**	1xBI2 +1xBO1
20	-	-	6	3	4	-	**2E**	1xBIO2+1xBIO3
12	-	-	-	9	14	-	**2F**	1xBO1+1xBIO2
8	12	-	6	-	2	-	**2G**	1XBI2+1xBIO3

BI/BO 3 x I/O module

Number of BI/BO							Ordering No. (Position "A" to "B")	Configuration
Independent BI	Independent BI (variable)	Common BI	Fast-BO	Semi-fast BO	BO	Hybrid BO		
15	-	-	6	12	18	-	**31**	1xBO1+1xBIO1+1xBIO3
20	-	-	6	9	16	-	**32**	1xBO1+1xBIO2+1xBIO3
23	-	-	12	6	8	-	**33**	1xBIO1+2xBIO3
26	-	-	6	6	14	-	**34**	1xBI1+1xBO1+1xBIO3
8	-	32	6	6	14	-	**35**	1xBI3+1xBO1+1xBIO3
24	-	-	18	-	6	-	**36**	3xBIO3
25	-	-	-	12	16	-	**37**	1xBI1+1xBO1+1xBIO1
36	-	-	-	6	12	-	**39**	2xBI1+1xBO1
-	24	-	-	6	12	-	**3A**	2xBI2+1xBO1
7	-	32	-	6	4	16	**3C**	1xBI3+1xBIO1+1xBO2
7	-	32	-	12	16	-	**3D**	1xBI3+1xBO1+1xBIO1
-	-	32	-	6	12	16	**3E**	1xBI3+1xBO1+1xBO2
16	-	-	12	6	16	-	**3G**	1xBO1+2xBIO3
26	-	-	6	6	14	-	**3J**	1xBO1+1xBIO3+1xBI1 (*1)
-	-	64	-	6	12	-	**3K**	2xBI3+1xBO1
14	-	32	-	12	8	-	**3L**	1xBI3+2xBIO1
-	-	96	-	-	-	-	**3M**	3xBI3
8	12	-	6	6	14	-	**3N**	1xBI2+1xBO1+1xBIO3
-	-	32	-	12	24	-	**3P**	1xBI3 + 2xBO1
36	-	-	-	-	-	16	**3Q**	2xBI1 + 1xBO2
16	12	-	12	-	4	-	**3S**	1xBI2+2xBIO3
18	12	-	-	6	12	-	**3T**	1xBI1+1xBI2+1xBO1
12	-	32	-	9	14	-	**3U**	1xBI3+1xBO1+1xBIO2

Note:
(*1) module arrangement is different from 34

BI/BO 4 x I/O modules

Number of BI/BO							Ordering No. (Position "A" to "B")	Configuration
Independent BI	Independent BI (variable)	Common BI	Fast-BO	Semi-fast BO	BO	Hybrid BO		
26	-	-	6	12	26	-	**41**	1xBI1+2xBO1+1xBIO3
32	-	-	24	-	8	-	**42**	4xBIO3
8	-	32	6	12	26	-	**43**	1xBI3+2xBO1+1xBIO3
-	-	64	-	12	24	-	**44**	2xBI3+2xBO1
54	-	-	-	6	12	-	**46**	3xBI1+1xBO1
20	-	32	6	9	16	-	**47**	1xBI3+1xBO1+1xBIO2 +1xBIO3
26	-	-	6	12	26	-	**48**	1xBO1+1xBI1+1xBO1 +1xBIO3 (*3)
20			6	15	28		**49**	2xBO1+1xBIO2+1xBIO3
34	-	-	12	6	16	-	**4B**	1xBI1+1xBO1+2xBIO3
-	-	64	-	-	-	32	**4C**	2xBI3+2xBO2
21	-	32	-	18	12	-	**4D**	1xBI3+3xBIO1
-	-	128	-	-	-	-	**4E**	4xBI3
7		96		6	4		**4F**	3xBI3+1xBIO1
8	24	-	6	6	14	-	**4G**	2xBI2 +1xBO1 +1xBIO3
-	-	32	-	18	36	-	**4H**	1xBI3 + 3xBO1
26	12	-	6	6	14	-	**4J**	1xBI1 + 1xBI2 + 1xBO1 + 1xBIO3
24	-	32	-	12	16	-	**4K**	1xBI3+1xBO1+2xBIO2
15	-	-	6	18	30	-	**4L**	2xBO1+1xBIO1+1xBIO3
7	-	-	-	24	40	-	**4M**	3xBO1+1xBIO1
36	-	-	-	12	24	-	**4N**	2xBI1+2xBO1
8	-	64	6	6	14	-	**4P**	2xBI3+1xBO1+1xBIO3
36	-	-	-	6	12	16	**4Q**	2xBI1+1xBO1+1xBO2
44	-	-	6	6	14	-	**4R**	2xBI1+1xBO1+1x BIO3

BI/BO 5 x I/O modules

Number of BI/BO							Ordering No. (Position "A" to "B")	Configuration
Independent BI	Independent BI (variable)	Common BI	Fast-BO	Semi-fast BO	BO	Hybrid BO		
33	-	-	6	6	6	32	**51**	1xBI1+1xBIO1+1xBIO3 +2xBO2
44	-	-	6	12	26	-	**52**	2xBI1+2xBO1+1xBIO3
25	-	96	-	6	4	-	**53**	1xBI1+3xBI3+1xBIO1
8	-	96	6	6	14	-	**54**	3xBI3+1xBO1+1xBIO3
62	-	-	6	6	14	-	**56**	3xBI1+1xBO1+1xBIO3
-	-	96	-	12	24	-	**5B**	3xBI3+2xBO1
-	-	128	-	6	12	-	**5E**	4xBI3+1xBO1
-	-	160	-	-	-	-	**5F**	5xBI3
44	12	-	6	6	14	-	**5G**	2xBI1+1xBI2+1xBO1 +1xBIO3
15	-	-	6	24	42	-	**5H**	3xBO1+1xBIO1+1xBIO3
-	-	64	-	18	36	-	**5J**	2xBI3+3xBO1
-	-	-	-	30	60	-	**5L**	5xBO1
42	-	-	18	6	18	-	**5P**	1xBO1+1xBIO1+3xBIO3
41	-	-	12	12	20	-	**5Q**	1xBI1+1xBO1+1xBIO1 +2xBIO3
8	-	64	6	-	2	32	**5R**	2xBI3+1xBIO3+2xBO2
8	12	64	6	-	2	16	**5S**	1xBI2+2xBI3+1xBIO3 +1xBO2
38	24	-	-	6	12	-	**5U**	2xBI1+2xBI2+1xBO1

BI/BO 6 x I/O modules

Number of BI/BO							Ordering No. (Position "A" to "B")	Configuration
Independent BI	Independent BI (variable)	Common BI	Fast-BO	Semi-fast BO	BO	Hybrid BO		
51	-	-	6	18	30	-	**61**	2xBI1+2xBO1+1xBIO1 +1xBIO3
8	-	96	6	12	26	-	**62**	3xBI3+2xBO1+1xBIO3
-	-	128	-	12	24	-	**63**	4xBI3+2xBO1
8	-	128	6	6	14	-	**64**	4xBI3+1xBO1+1xBIO3
52	-	-	12	-	4	32	**69**	2xBI1+2xBIO3+2xBO2
52	-	-	12	12	28	-	**6A**	2xBI1+2xBO1+2xBIO3
36	-	-	-	24	48	-	**6B**	2xBI1+4xBO1
36	-	64	-	12	24	-	**6C**	2xBI1+2xBI3+2xBO1
44	-	-	6	18	38	-	**6D**	2xBI1+3xBO1+1xBIO3
-	-	160	-	6	12	-	**6E**	5xBI3+1xBO1
7	-	160	-	6	4	-	**6F**	5xBI3+1xBIO1
8	-	64	6	-	2	48	**6G**	2xBI3+1xBIO3+3xBO2
26	-	64	6	-	2	32	**6H**	1xBI1+2xBI3+1xBIO3 +2xBO2
8	12	64	6	6	14	16	**6J**	1xBI2+2xBI3+1xBO1 +1xBIO3+1xBO2

BI/BO 7 x I/O modules

Number of BI/BO							Ordering No. (Position "A" to "B")	Configuration
Independent BI	Independent BI (variable)	Common BI	Fast-BO	Semi-fast BO	BO	Hybrid BO		
80	-	-	6	12	26	-	**71**	4xBI1+2xBO1+1xBIO3
8	-	96	6	18	38	-	**73**	3xBI3+3xBO1+1xBIO3
-	60	-	-	6	12	16	**78**	5xBI2+1xBO1+1xBO2
-	-	160	-	12	24	-	**79**	5xBI3+2xBO1
54	-	64	-	12	24	-	**7B**	3xBI1 + 2xBI3 + 2xBO1
-	-	128	-	18	36	-	**7D**	4xBI3+3xBO1
7	-	160	-	12	16	-	**7E**	5xBI3+1xBO1+1xBIO1
-	-	192	-	6	12	-	**7F**	6xBI3+1xBO1
7	-	192	-	6	4	-	**7G**	6xBI3+1xBIO1
-	-	224	-	-	-	-	**7H**	7xBI3
8	-	96	6	-	2	48	**7L**	3xBI3+1xBIO3+3xBO2

BI/BO 8 x I/O modules

Number of BI/BO							Ordering No. (Position "A" to "B")	Configuration
Independent BI	Independent BI (variable)	Common BI	Fast-BO	Semi-fast BO	BO	Hybrid BO		
-	-	160	-	18	36	-	**83**	5xBI3+3xBO1
-	60	-	-	6	12	32	**87**	5xBI2+1xBO1+2xBO2
8	-	128	6	18	38	-	**88**	4xBI3+3xBO1+1xBIO3
-	-	256	-	-	-	-	**8C**	8xBI3
7	-	224	-	6	4	-	**8G**	7xBI3+1xBIO1
-	-	192	-	12	24	-	**8H**	6xBI3+2xBO1
7	-	192	-	12	16	-	**8J**	6xBI3+1xBO1+1xBIO1
7	-	96	-	30	52	-	**8M**	3xBI3+4xBO1+1xBIO1
-	-	128	-	24	48	-	**8N**	4xBI3+4xBO1

Communication port Table

Serial and/or Ethernet and/or Time Synch port						Ordering No. (Position “E” to “F”)	Remark
IEC60870-5-103		IEC61850-8-1					
RS485	Fiber optic (for serial)	100Base-FX (*1)	100Base-TX/ 1000Base-T	1000Base-LX	IRIG-B		
		1				14	
			1			1J	
				1		1K	
		1			1	34	
			1		1	3J	
				1	1	3K	
		2				46	Hot/standby
1		1				4C	
	1	1				4G	
			2			4L	Hot/standby
				2		4M	Hot/standby
1			1			4N	
1				1		4Q	
	1		1			4S	
	1			1		4U	
		2			1	66	Hot/standby
1		1			1	6C	
	1	1			1	6G	
			2		1	6L	Hot/standby
				2	1	6M	Hot/standby
1			1		1	6N	
1				1	1	6Q	
	1		1		1	6S	
	1			1	1	6U	
1		2				7D	Hot/standby
	1	2				7H	
1			2			7P	
1				2		7R	
	1		2			7T	
	1			2		7V	
1		2			1	9D	
	1	2			1	9H	
1			2		1	9P	
1				2	1	9R	
	1		2		1	9T	
	1			2	1	9V	
		2				L6	For PRP/HSR/ RSTP
1		2				LD	
	1	2				LH	
			2			LL	
				2		LM	
1			2			LP	
1				2		LR	
	1		2			LT	
	1			2		LV	
		2			1	N6	
1		2			1	ND	
	1	2			1	NH	

Serial and/or Ethernet and/or Time Synch port						Ordering No. (Position “E” to “F”)	Remark
IEC60870-5-103		IEC61850-8-1					
RS485	Fiber optic (for serial)	100Base-FX (*1)	100Base-TX/ 1000Base-T	1000Base-LX	IRIG-B		
			2		1	NL	For PRP/HSR/ RSTP
				2	1	NM	
1			2		1	NP	
1				2	1	NR	
	1		2		1	NT	
	1			2	1	NV	

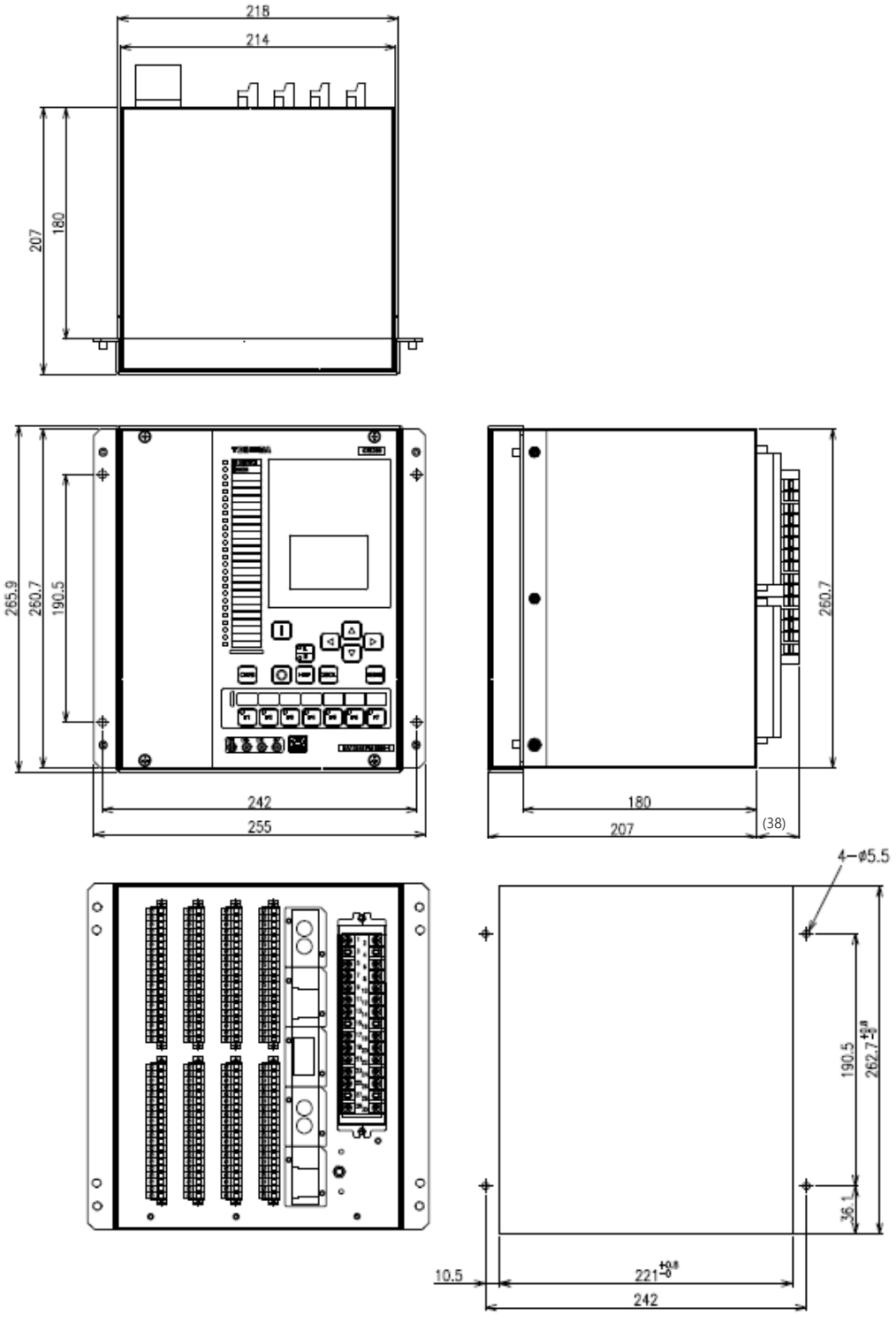
Note:

(*1) When 100Base-FX is selected, 2 slots out of 5 slots for communication ports are used regardless the number of 100Base-FX (1 or 2). Therefore, the total number for communication ports needs to be cared.

FUNCTION TABLE

Function Block	Protection function		Ordering No. (Position "G & N")	
			31	32
DISTANCE_ZS (6zone)	21	Distance protection(for phase fault) with 6zone	●	●
	68	Power swing block		
	50SOTF	Switch on to fault protection		
DISTANCE_ZG (6zone)	21N	Distance protection(for earth fault) with 6zone	●	●
	68	Power swing block		
	50SOTF	Switch on to fault protection		
DEFCAR	85-67N	Directional earth fault carrier command protection	●	●
DISCAR	85-21	Distance carrier command protection	●	●
OC	50/67	Non-directional / directional definite time over-current protection	●	●
	51/67	Non-directional / directional inverse time over-current protection		
EF	50N/67N	Non-directional / directional definite time earth fault over-current protection	●	●
	51N/67N	Non-directional / directional inverse time earth fault over-current protection		
OCN	46/67	Non-Directional / directional Negative sequence phase over-current protection	●	●
THM	49	Thermal overload protection	●	●
BCD	46BC	Broken conductor protection	●	●
CBF	50BF	Circuit breaker failure protection	●	●
STUB OC	50STUB	Stub protection	●	●
OV	59	Phase over-voltage protection	●	●
OVS	59	Phase-phase over-voltage protection	●	●
OVG	59N	Earth fault over-voltage protection	●	●
UV	27	Phase under-voltage protection	●	●
UVS	27	Phase-phase under-voltage protection	●	●
FRQ	81	Frequency protection	●	●
OSTZ	56Z	Out of step tripping by distance	●	●
ICD	ICD	Inrush current detection function	●	●
FS	FS	Fail-safe function	●	●
VTF	VTF	VTF detection function	●	●
CTF	CTF	CTF detection function	●	●
FL-Z	21FL	Fault locator	●	●
ARC	79	Autoreclosing function	●	●
VCHK	25	Voltage check for autoreclosing	●	●
TRC	94	Trip circuit	●	●
Gen Ctrl	LEDR	LED reset	●	●
	GCNT	Counter function for the general	●	●
	MDCTRL	Mode control function	●	●
Ctrl and Monitor	SPOS	Single position device function		●
	DPSY	Double position controller with synchronizing		●
	SOTFSW	Software switch controller		●
	OPTIM	Operation time reset		●
	TOTALTIM	Total time measurement		●
	SYNDIF	Synchronizing check for different network		●
	INTERLOCK	Software interlock		●
	DPOS	Double position device function		●
	TPOS	Three position device function		●
	GENBI	Event detection function for general BIs		●
	ASEQ	Automatic sequence control function		●
			Basic	Basic with Control

DIMENSION AND PANEL CUT-OUT (1/2 size)



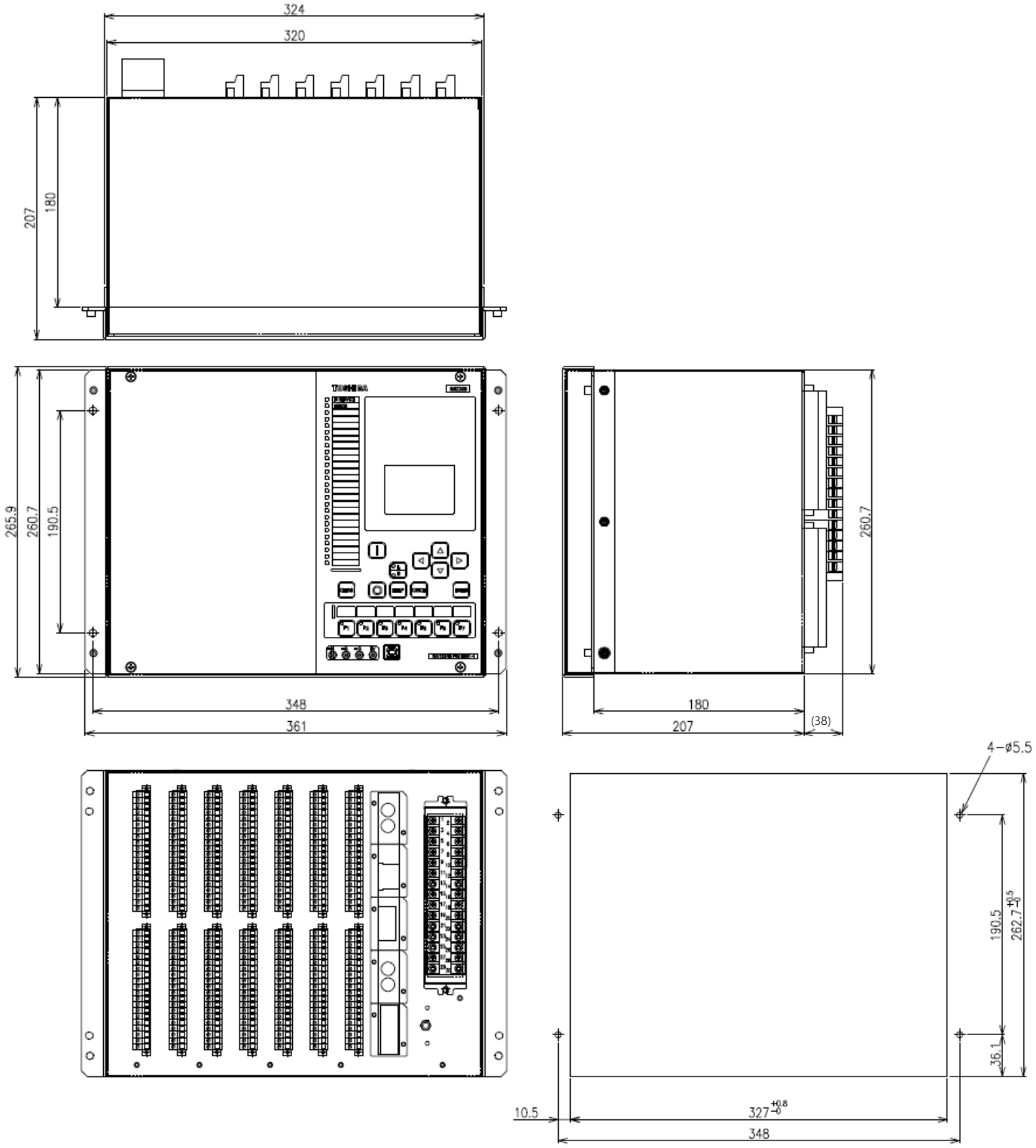
(Panel cut-out)

Note: For a rack mount unit, there are holes for joint kits assembling on top and bottom of the unit.

Figure 13 – Dimension and Panel Cut-out – 1/2 x 19'' case size

(when compression plug type terminals are applied)

DIMENSION AND PANEL CUT-OUT (3/4 size)



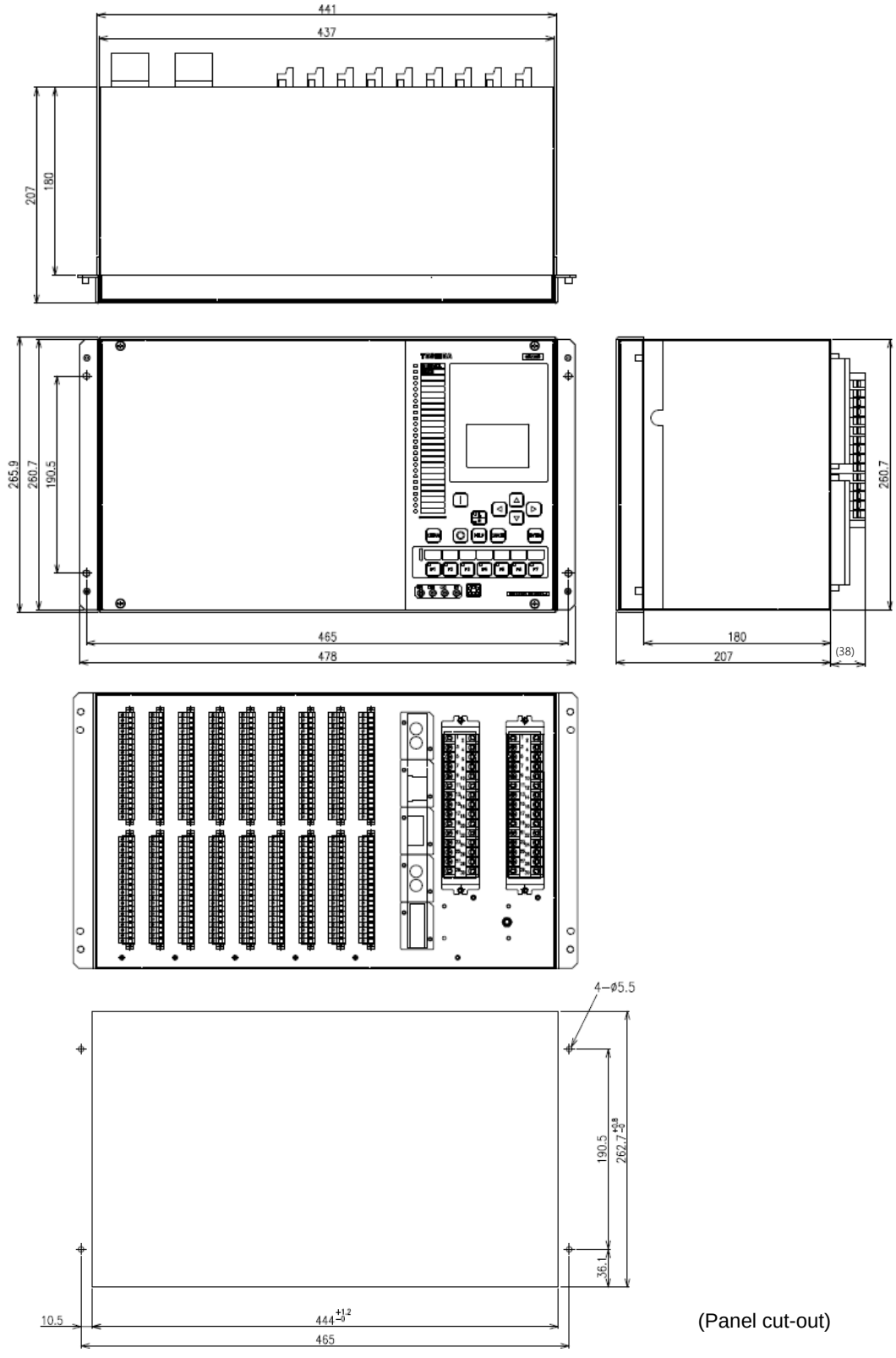
(Panel cut-out)

Note: For a rack mount unit, there are holes for joint kits assembling on top and bottom of the unit.

Figure 14 – Dimension and Panel Cut-out – 3/4 x 19'' case size for flush mounting type

(when compression plug type terminals are applied)

DIMENSION AND PANEL CUT-OUT (1/1 size)



(Panel cut-out)

Note: For a rack mount unit, there are holes for joint kits assembling on top and bottom of the unit.

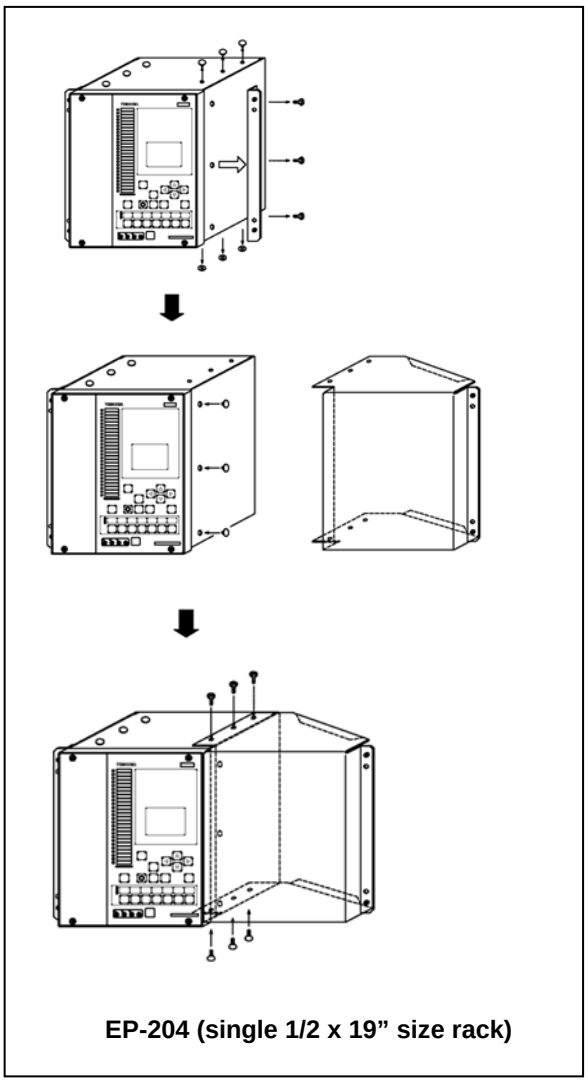
Figure 15 – Dimension and Panel Cut-out – 1/1 x 19” case size for flush mounting type

(when compression plug type terminals are applied)

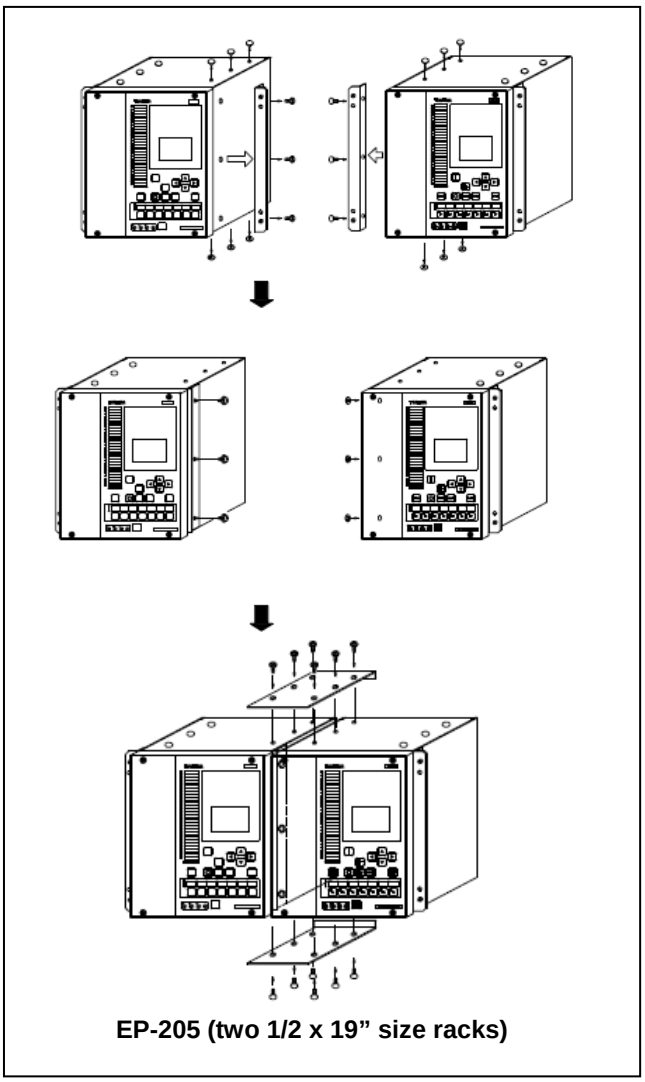
19” RACK MOUNTING JOINT KITS ATTACHMENT

<Panel mounting kits – only for compressed terminal type racks>

Name	Code
Joint kits for single 1/2 x 19” size rack	EP-204
Joint kits for two 1/2 x 19” size racks	EP-205
Joint kits for single 3/4 x 19” size rack	EP-206



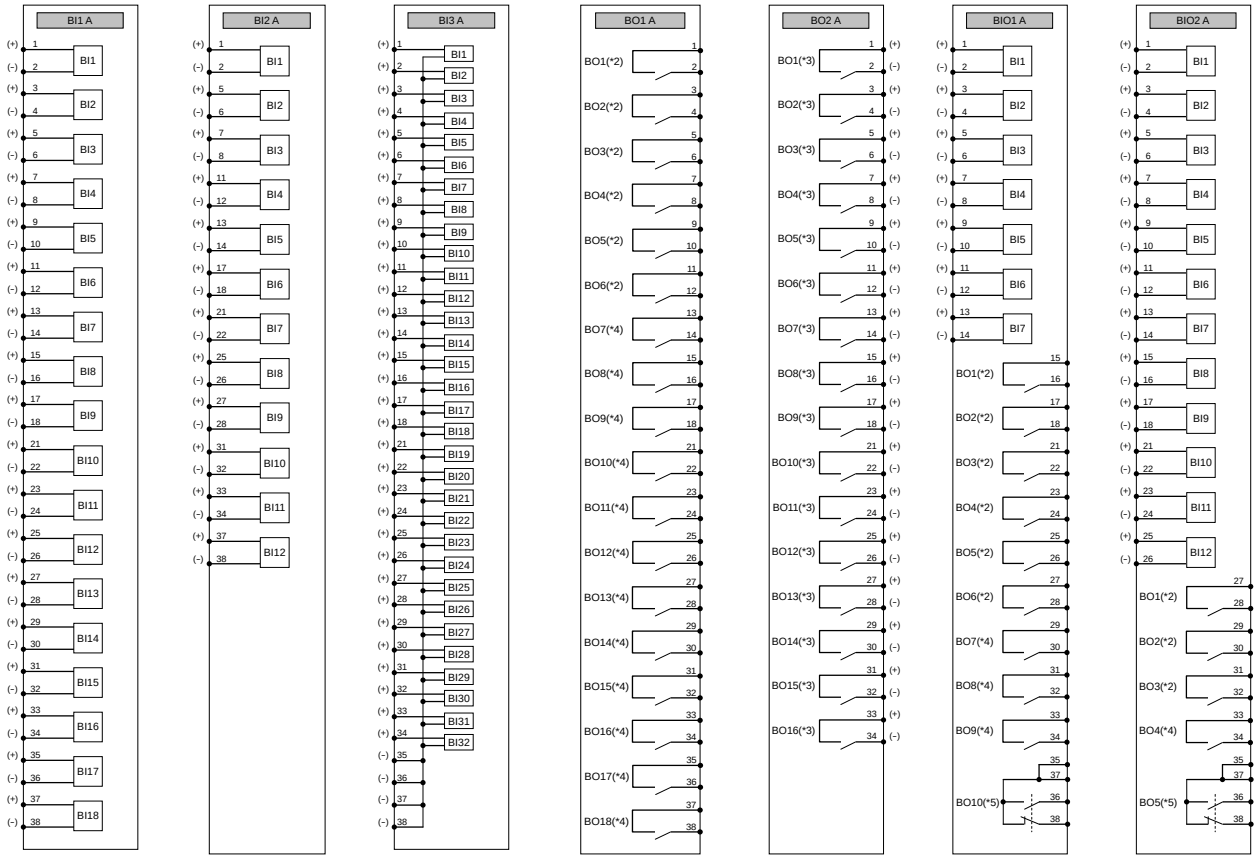
EP-204 (single 1/2 x 19” size rack)



EP-205 (two 1/2 x 19” size racks)

Figure 16 – Joint kits example for 19” rack panel mounting

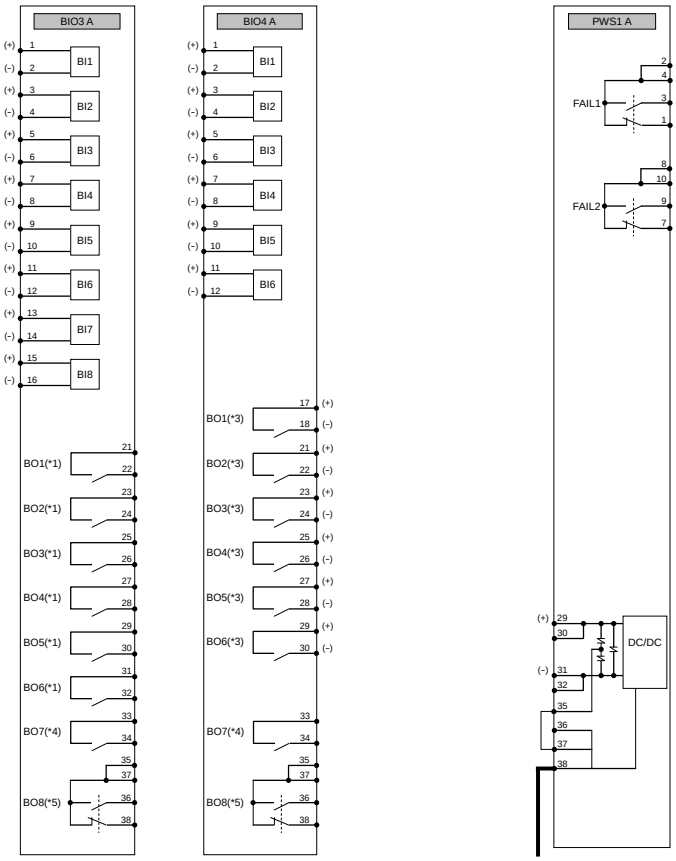
CONNECTIONS DIAGRAM



(*1) Fast BO
(*2) Semi-fast BO
(*3) Hybrid BO
(*4) Normal BO
(*5) Form-C BO

Figure 17 – Binary input board and binary output module for compression plug type

CONNECTIONS DIAGRAM

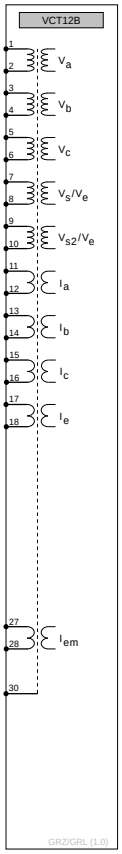


(*1) Fast BO
(*2) Semi-fast BO
(*3) Hybrid BO
(*4) Normal BO
(*5) Form-C BO

Figure 18 – Combined binary input and output module and DC power supply module for compression plug type

CONNECTIONS DIAGRAM

CT/VT module



Module no. 12
(CT x 5 + VT x 5)

Figure 19 – CT/VT module

EXTERNAL CONNECTION DIAGRAM

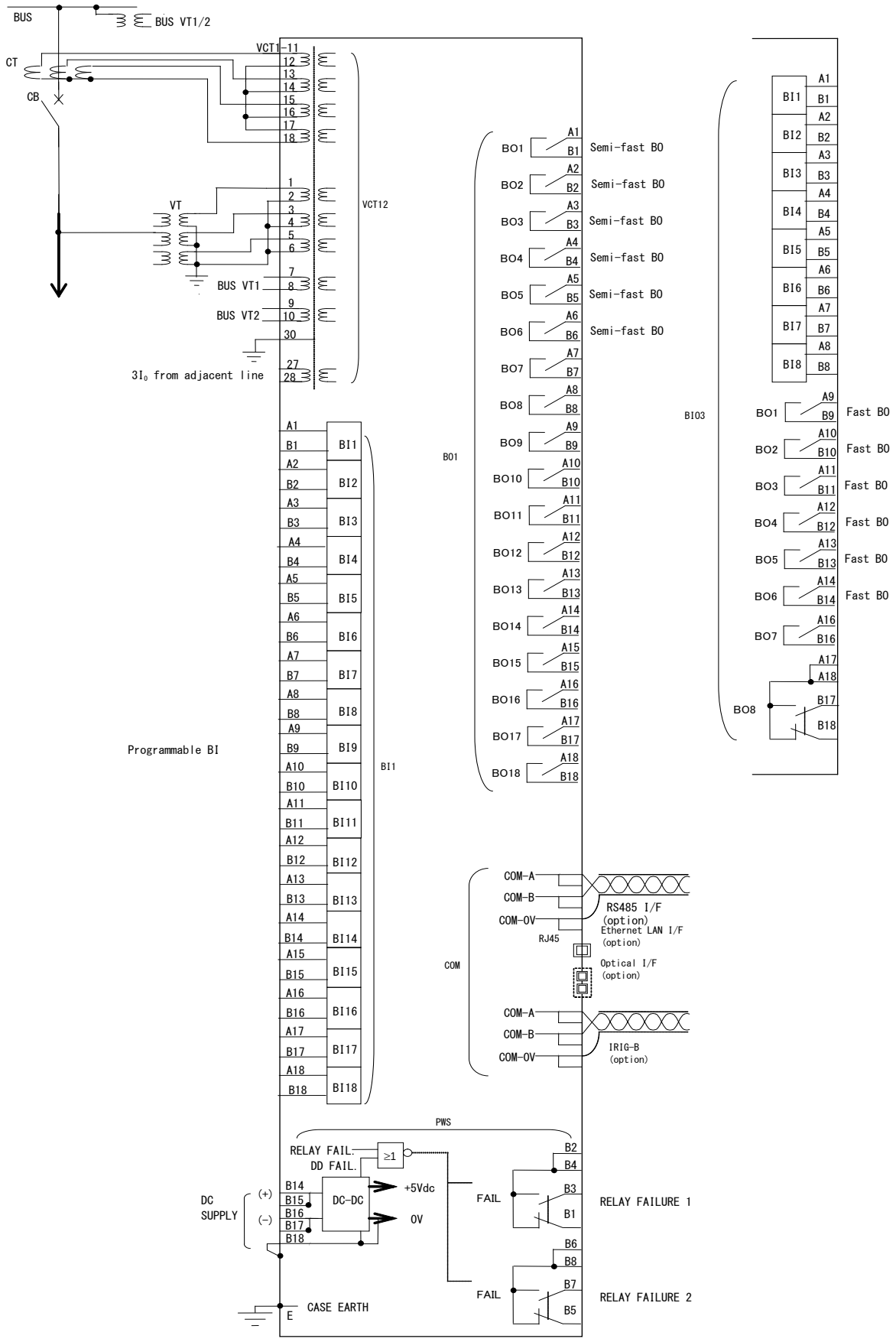


Figure 20 – Typical external connection diagram (PCT: No.12, IO: BI1, BO1 and BIO3)

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GKP-99-15016 Rev2.10