TOSHIBA

GR-200 Series

GRL 200

Line Differential 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.

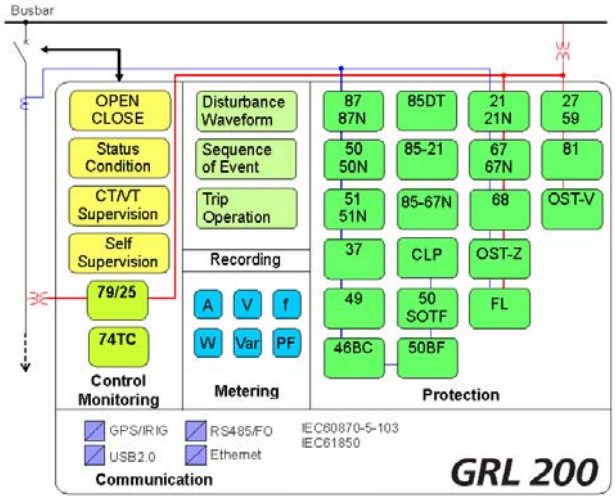
Powerful and wide application -

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

APPLICATION

GRL200 line differential protection is implemented on Toshiba's next generation GR-200 Series IED platform and has been designed to provide phase-segregated current differential protection using digital telecommunications, together with control applications. This powerful and user-friendly IED will provide you with the flexibility to meet your application and engineering requirements in addition to offering excellent performance, the high quality and operational peace of mind.

- Complete EHV/HV Transmission Line Protection package
  - Overhead lines or underground cables
  - Line differential protection for up to 3 terminals
  - Integrated Distance, Directional OC/EF and other voltage/current protections
  - Single or parallel lines
  - Lines with heavy load current
  - Short or long distance lines
  - Lines with weak or no in-feed
  - Single/three/multiphase tripping facilitating all auto-reclose schemes
- Communications
  - Line differential and teleprotection, direct optical fiber, ITU-T X.21, ITU-T G.703, IEEE Std. C37.94 and Ethernet packet-based communications
  - Within substation automation system, IEC 61850-8-1 [Station bus], IEC 60870-5-103 and IEC62439/PRP/HSR



FEATURES

• Application

GRL200 can be applied in various EHV/HV network configurations.

- Overhead lines or underground cables
- Two to three-terminal lines
- Lines with weak or no-infeed
- Single or parallel lines
- Lines with heavy load current
- Short or long distance lines

• Functionality

- Eight settings groups
- Automatic supervision
- Metering and recording functions
- Time synchronization by external clock using IRIG-B or 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 / 48 to 125 V / 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
- Configurable 7 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

- Phase-segregated differential protection
- Zero-sequence current differential protection for high resistance earth faults
- Charging current compensation
- Distance protection with four independent zones
- Backup non-directional and directional earth fault command protection
- Non-directional and directional Overcurrent backup protection
- Non-directional and directional negative phase sequence overcurrent protection
- Thermal overload protection
- Broken conductor detection
- Circuit breaker failure protection
- Switch-on-to-fault (SOTF) protection
- Stub fault protection for one-and-a-half breaker system
- Phase to neutral and phase to phase under/overvoltage protection
- Under/overfrequency protection
- Out-of-step protection
- Power swing blocking function
- Inrush Current Detector
- Direct transfer trip
- Fail-safe overcurrent scheme

• Control

- Single-shot (single / three / single + three phase / multi-phase) or multi-shot (three phase) autoreclose
- Synchronism voltage check
- Circuit breaker and isolator control
- Switchgear interlock check
- Programmable automatic sequence control

• Monitoring and Metering

- VT failure detection
- CT failure detection
- Relay address monitoring
- 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

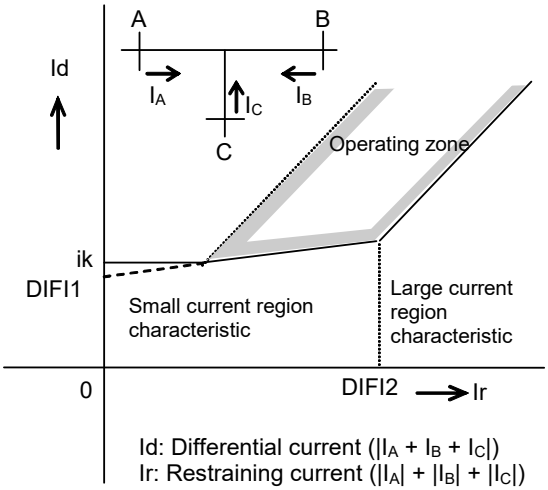
- Eight settings groups
- Automatic supervision
- Metering and recording functions
- Time synchronization by external clock using IRIG-B or system network
- Password protection for settings and selection of local / remote control
- Checking internal circuit manually.
- Checking internal circuit using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

APPLICATIONS

PROTECTION

■ Phase-segregated Current Differential Protection

GRL200 provides high-speed phase-segregated current differential protection for both phase-to-phase faults and phase-to-earth faults. The phase-segregated current differential protection exhibits high selectivity and sensitivity for all types of faults. It applies a percentage ratio differential characteristic as shown in Figure 1.



Id: Differential current ($|I_A + I_B + I_C|$)
Ir: Restraining current ($|I_A| + |I_B| + |I_C|$)
DIFI1: Setting of small current region
DIFI2: Setting of large current region
ik: Minimum operating current

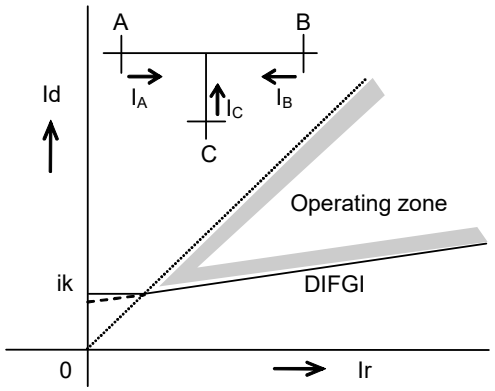
Figure 1 Percentage ratio differential element

The characteristic is composed of a small current region and a large current region. When the fault current is large, a large ratio is employed in the large current region of the characteristic, providing stability in the case of external faults accompanied by CT saturation.

Since a high level of sensitivity can be attained with the current differential relay, it can also detect high impedance faults provided that the load current is not too large.

■ Zero-sequence Current Differential Protection for High Impedance Earth Faults

Zero-sequence current differential protection can detect high impedance earth faults even with heavy load current. It applies the percentage ratio differential characteristic shown in Figure 2. As the restraining current is the scalar sum of the zero-sequence current at each terminal, the relay sensitivity is not affected by load current. When the zero-sequence current differential protection operates, it performs time-delayed three- phase tripping.



Id: Differential current ($|I_A + I_B + I_C|$)
Ir: Restraining current ($|I_A| + |I_B| + |I_C|$)
DIFGI: Setting value
ik: Minimum operating current

Figure 2 Zero-phase current differential element

■ Charging Current Compensation

When current differential protection is applied to underground cables or long-distance overhead lines, the charging current should be taken into account. It appears as an erroneous differential current in the no-fault condition and under external fault conditions. Charging current can be included within the relay setting, but the fault detection sensitivity for an internal fault is reduced as a consequence.

To suppress the effect of the charging current while at the same time maintaining its high fault detection sensitivity, GRL200 has a charging current compensation function which derives the charging current component from the phase current.

The amplitude of the charging current varies with that of the line voltage. If the value of charging current (DIFIC) at the rated line voltage is input, GRL200 calculates and compensates for the charging current at the measured line voltage.

Thus, instead of the phase current Ia, a compensated current I = Ia - DIFIC is used for protection at all terminals.

■ Dual Communication

Dual communication mode can be applied to protection of two-terminal lines. Using dual communication mode, it is possible to maintain

continuous operation of the current differential protection in the event of failure of one of the communication channels.

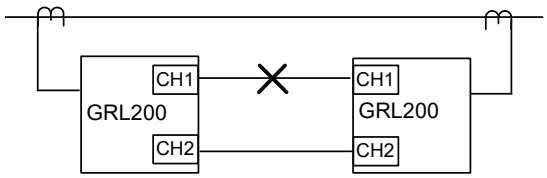


Figure 3 Dual Communication

■ Countermeasure for Through-Fault Current

As shown in Figure 4, for an external fault on a one-and-a-half breaker system, a large fault current IA flows through CT1A and CT2A. If the saturation levels of CT1A and CT2A are different, an erroneous differential current may occur between IA1 and IA2 as a result of CT saturation.

This may cause terminal B to operate incorrectly if it is a weak infeed terminal and the restraining current is small.

To cope with the through-fault current, GRL200 can be set to output tripping commands under the condition that the differential protection operates at both terminals. As the remote current is sent by the result of DIF or each value of CT1 and CT2, GRL200 provide appropriate measurement on basis of CT's configuration.

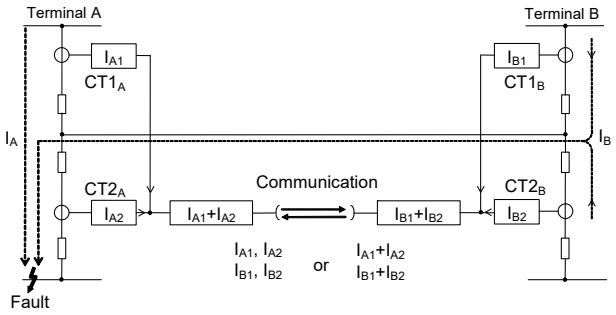


Figure 4 Through-fault current on one-and-a-half breaker system

■ Stub Protection

Stub protection operates for a fault in a stub zone on a breaker-and-a-half breaker system. With the auxiliary contact of the line disconnector open, only the local terminal current is used as the operating quantity by setting the remote terminal current data to zero.

■ Transfer Trip Function

GRL200 provides a transfer trip function which receives a trip signal from the remote terminal and outputs a trip command. Two transfer trip commands are provided. The sending signal is configured by PLC function. If the sending signal is assigned on a per phase basis by PLC, single-phase tripping is available.

■ Out-of-Step Protection

By transmitting the phase information of the local voltage to the remote terminal, the out-of-step protection can measure the phase difference between the terminals of a transmission line as illustrated in Figure 5. It detects an out-of-step condition when the difference in the phase angle exceeds 180°, and trips both terminals.

The out-of-step protection can detect an out-of-step condition even with a high rate of slip.

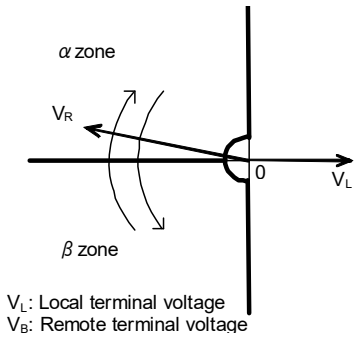


Figure 5 Out-of-step protection element

■ Non-directional and Directional Overcurrent and Earth Fault Protection

GRL200 provides non-directional and directional overcurrent protections with inverse time and definite time characteristics 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 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 scheme switches, and overcurrent backup protection can be blocked by a binary input signal.

GRL200 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.

GRL200 can provide directional earth fault command protection by using two-stage directional earth fault elements, of which one is for tripping and the other is for blocking or for current reversal detection.

■ Non-Directional and Directional Sensitive Earth Fault Protection

GRL200 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 directionalised by polarising against the negative phase sequence voltage.

■ 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:

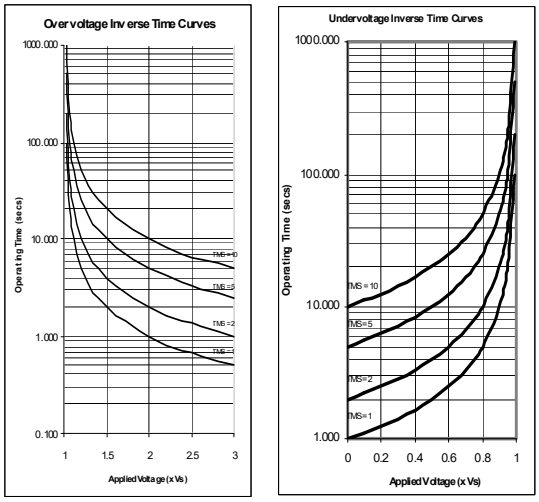
$$t = \tau \ln \frac{I^2 - I_p^2}{I^2 - (k\, I_B)^2}$$

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

GRL200 provides overvoltage protections for both phase-to-phase voltage input and phase-to-neutral voltage input. All stages can be set for inverse time or definite time operation. In total, therefore, GRL200 provides four independent overvoltage thresholds.



$$t = \frac{1}{\left(\frac{V}{Vs}\right) - 1} \times TMS \qquad t = \frac{1}{1 - \left(\frac{V}{Vs}\right)} \times TMS$$

Figure 7 Inverse time characteristics

■ Undervoltage Protection

GRL200 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.

■ Under/Overfrequency Protection

GRL200 provides over/under frequency protection and frequency rate-of-change protection.

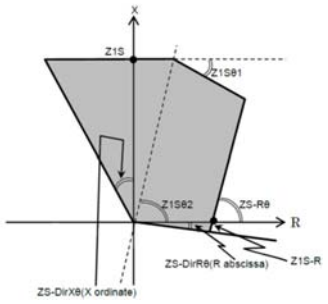
These protections provide independent frequency protection stages. The over/under frequency protection is programmable for either under- or over-frequency operation, and each has an associated DTL timer. The frequency rate-of-change protection calculates the gradient of frequency change (df/dt).

■ Inrush Current Detector

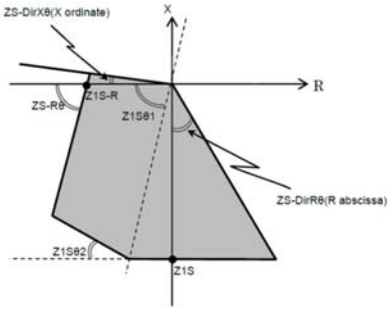
The inrush current detector is used to prevent an incorrect operation of overcurrent protections from a magnetising inrush current during transformer energisation. Inrush current detector (ICD) detects second harmonic inrush current during transformer energisation.

■ Distance Protection

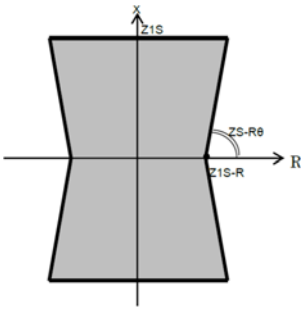
GRL200 provides a distance protection scheme, so realizing a complete line protection capability within a single package It provides six independent distance protection zones, the characteristics of which are shown in the Figure 8 and 9. Individual measurement zones are provided for phase-fault and earth-fault.



(a) Forward zone

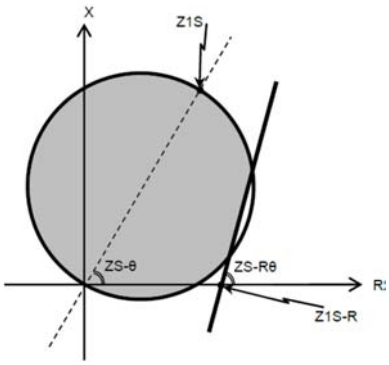


(b) Reverse zone

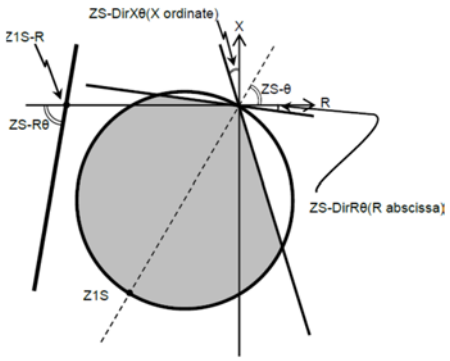


(c) Non directional zone

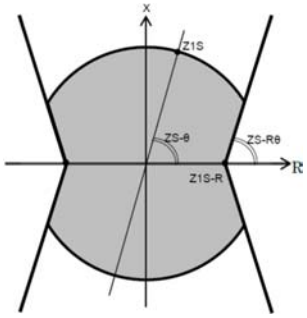
Figure 8 Quadrilateral Characteristics



(a) Forward zone



(b) Reverse zone



(c) Non directional zone

Figure 9 Mho-based Characteristics

■ OC/UV and EF Guard Schemes

GRL200 provides OC, OCD, UV, UVS, UVD and EFD elements as additional fault detection criteria to prevent unwanted operation in the unlikely event that a communication failure should go undetected. OC is a phase overcurrent element, OCD is a phase current change detection element, UV is a phase undervoltage element, UVS is phase to phase undervoltage element, UVD is phase voltage change detection element and EFD is a zero-sequence current change detection element.

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 de-ionizing the fault arc, reclosing can be performed. GRL200 provides two autoreclose schemes, single-shot autoreclose and multi-shot autoreclose.

GRL200's 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, single-and three-phase autoreclose and multi-phase autoreclose.

In the single-phase autoreclose mode, only a 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-phase autoreclose mode can be applied to double-circuit lines. In this mode, only the faulted phases are tripped and reclosed when the terminals of double-circuit lines are interconnected during the dead time through at least two or three different phases.

■ Multi-shot autoreclose

In a multi-shot autoreclose, two- to five-shot reclosing can be selected. The first shot is selected from any of the five 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 fifth shots.

■ Synchronism Check

For the correct operation of three-phase autoreclose, voltage and synchronism check are necessary. The characteristics of the synchronism check element are shown in Figure 10.

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

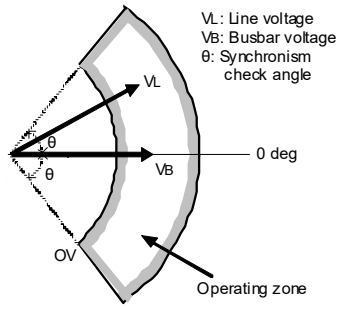


Figure 10 Synchronism check element

■ One-and-a-half Breaker Scheme

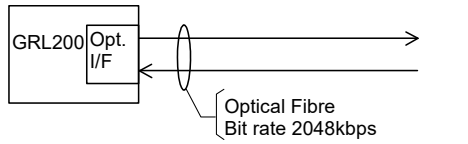
GRL200 performs two-breaker autoreclose in a one-and- a-half breaker scheme.

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.

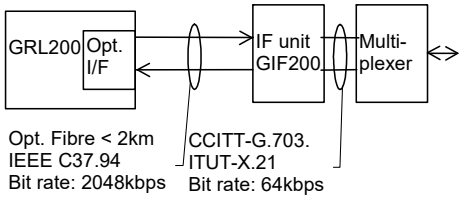
■ Interfaces with Telecommunication Systems

Current data sampled at the local terminal is transmitted to the remote terminal(s) via the telecommunication system.

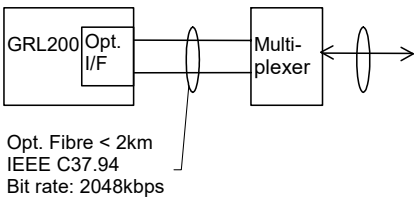
GRL200 can be provided with the following interface(s) and linked to a dedicated optical fibre communication circuit or multiplexed communication circuit (multiplexer) shown in Figure 11.



a) Optical interface



b) Optical interface using multiplexer



c) Optical interface using multiplexer

Figure 11 Telecommunication system

■ Switchgear Control

GRL200 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 GRL200 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

GRL200 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

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

- 40 character, 40 line LCD with back light

Figure 12 - HMI Panel

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 GRL200 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 can be monitored by GRL200.

Both normally open and normally closed contacts are used to monitor 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, 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 input 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. GRL200 also support Ethernet redundancy scheme protocols defined in the IEC 62439-3 standard: PRP/HSR.

■ 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 GRL200 can function as a protocol converter to connect to 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

GRL200 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 GRL200 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 GRL200. 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.

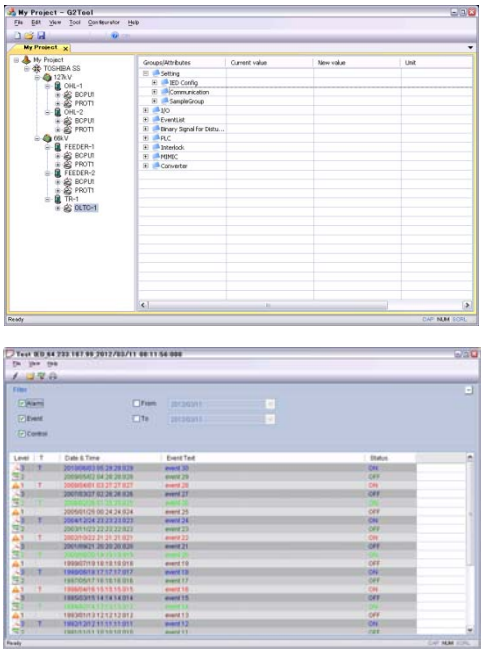


Figure 13 PC Display of GR-TIEMS

■ LCD CONFIGURATION

The user can configure and customize the MIMIC data displayed on the LCD of GRL200 using GR-TIEMS software.

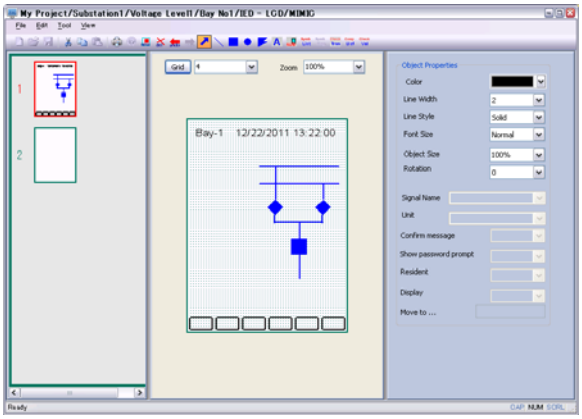


Figure 14 PC Display of MIMIC configuration

■ 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.

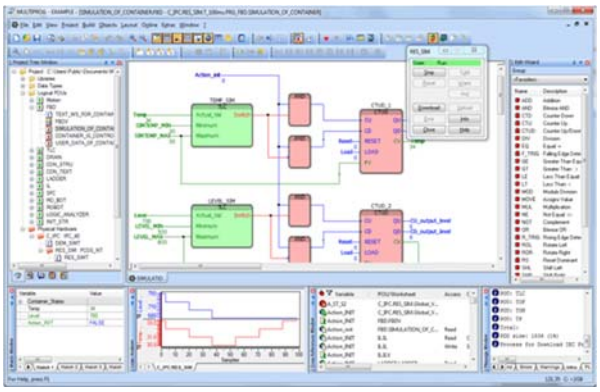


Figure 15 PC display of PLC editor

TECHNICAL DATA

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: Threshold setting is available to BI2 (Setting range: 14V to 154V)
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
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)
Telecommunication Interface for Protection Signalling	
Optical interface (2 km class)	
Type of fibre	Graded-index multi-mode 50/125μm or 62.5/125μm
Connector type	ST type
Wave length	820nm
Optical transmitter	LED, more than −19dBm(50/125μm), −16dBm(62.5/125μm)
Optical receiver	PIN diode, less than −24dBm
Optical interface (30 km class)	
Type of fibre	Single mode 10/125μm
Connector type	Duplex LC
Wave length	1310nm
Optical transmitter	Laser, more than −13dBm
Optical receiver	PIN diode, less than −30dBm
Optical interface (80 km class)	
Type of fibre	DSF 8/125μm
Connector type	Duplex LC
Wave length	1550nm
Optical transmitter	Laser, more than −5dBm
Optical receiver	PIN diode, less than −34dBm

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

Interface Converter GIF200

Ratings		
Power supply: Burden:		24Vdc - 250Vdc (Operative range: 19.2 - 300Vdc) less than 8W
Interface		
Communication interface: Operative Range: Wavelength: Connector type: Fibre type:		ITU-T G.703 (64kbps, co-directional) ITU-T G.703 (64kbps, contra-directional or centralized clock) less than 2km 820nm ST 62.5/125μm GI fibre
Atmospheric Environment		
Temperature Humidity Enclosure Protection	IEC60068-2-1/2 IEC60068-2-78 IEC60529	Operating range: -10°C to +55°C. Storage / Transit: -25°C to +70°C. 56 days at 40°C and 93% relative humidity. IP20

FUNCTIONAL DATA

Phase-segregated Current Differential Protection	
DIFI1 (Small current region)	0.10 to 2.00A in 0.01A steps (1A rating) 0.50 to 10.00A in 0.01A steps (5A rating)
DIFI2 (Large current region)	0.6 to 60.0A in 0.1A steps (1A rating) 3.0 to 300.0A in 0.1A steps (5A rating)
DIFL-Slop1 (Small current region)	10 to 50 %
DIFL-Slop2 (Large current region)	50 to 100 %
Time setting for DIF	0.00 to 100.00s in 0.01s steps
Reference voltage	100 to 120V in 1V step
Operating time	Less than 1 cycle at 300% of DIFI1
Resetting time	Less than 110 ms (for tripping output) Less than 40 ms (for signal output)
Zero-sequence Current Differential Protection for high-resistance earth	
DIFGI	0.05 to 1.00A in 0.01A steps (1A rating) 0.25 to 5.00A in 0.01A steps (5A rating)
DIFG-Slop	10 to 50 %
Timer	0.00 to 300.00s in 0.01s steps
Operating time	less than 45ms
Resetting time	less than 100ms
Charging Current Compensation	
DIFL-IcC	0.00 to 1.00A in 0.01A steps (1A rating) 0.00 to 5.00A in 0.01A steps (5A rating)
Differential Current Supervision	
DIFSV	0.05 to 2.00A in 0.01A steps (1A rating) 0.25 to 10.00A in 0.01A steps (5A rating)
Timer	0 to 300s in 1s steps
DIF Guard characteristic	
Overcurrent threshold	0.02 to 50.00A in 0.01A steps (1A rating) 0.10 to 250.00A in 0.01A steps (5A rating)
Rate of Overcurrent change threshold	0.05 to 0.20A in 0.01A steps (1A rating) 0.25 to 1.00A in 0.01A steps (5A rating)
Phase sequence Undervoltage threshold	5.0 to 130.0V in 0.1V steps
Phase to Phase Undervoltage threshold	5.0 to 130.0V in 0.1V steps
Rate of voltage change threshold	1 to 20V in 1steps
DIFG Guard characteristic	
Rate of Earth fault change threshold	0.02 to 50.00A in 0.01A steps (1A rating) 0.10 to 250.00A in 0.01A steps (5A rating)
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 Guard	
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 (Out of step tripping (voltage phase comparison)	
Out-of-step trip	OFF / TRIP / BO(separated from other trip signals)
Out-of-step Protection (impedance locus)	
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	1.0 V (fixed)
Characteristic angle	0 to 180 deg 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
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

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
Autoreclosing	
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
Follower breaker autoreclose delay time	0.01 to 300.00s in 0.01s steps
Voltage and 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	10 to 150V in 1V steps
Busbar or line live check	10 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
GPS Time Synchronisation	
Protocol	SNTP

ORDERING INFORMATION

1. Line Differential protection relay

[Hardware selection]

[Hardware selection (1)]

Configurations	Positions																			
	-	7	8	-	9	A	B	-	C	D	-	E	F	-	G	H	-	J	K	L
GRL200	-			-				-			-			-	3		-			0

Application of power system

Function for 1CB scheme (CT x 5, VT x 5)	1
Function for 1.5CB scheme (CT x 9, VT x 5)	2

↓ Hardware selection (2)

DC rated voltage

110-250 Vdc or 100-220Vac (See (*1))	1
24-60 Vdc	3

↓ Hardware selection (2)

System Frequency

50Hz	1
60Hz	2

AC rated current

1A	1
5A	2

Communication & time-synch ports (1)

1CH	1

Protection communication

Single protection signaling module in GI 2km Class (C37.94)	1
Single protection signaling module in SM 30km Class	2
Single protection signaling module in DSF 80km Class	3

System communication & time-synch

Choice from Communication Port Table (See (*2))	*	*

Communication & time-synch ports (2)

2CH	2

Protection communication

Double protection signalling modules in GI 2km Class (C37.94)	1
Double Protection signalling modules in SM 30km Class	2
Double Protection signalling modules in DSF 80km Class	3
Protection signalling module in GI 2km Class (C37.94) and Protection signalling module in SM 30km Class	4
Protection signalling module in GI 2km Class (C37.94) and Protection signalling module in DSF 80km Class	5
Protection signalling module in SM 30km Class and Protection signalling module in DSF 80km Class x1ch	6

System communication & time-synch

Choice from Communication Port Table (See (*2))	*	*

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 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.

[Hardware selection (2)]

Configurations	Positions																						
	-	7	8	-	9	A	B	-	C	D	-	E	F	-	G	H	-	J	K	L
GRL200	-			-				-			-			-	3		-			0

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 (*3))		F
Large LCD, 1/2 x 19" rack for rack mounting (See (*3))		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 (*3))		G
Large LCD, 3/4 x 19" rack for rack mounting (See (*3))		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	*

(*3) For 19” rack panel mounting, accessories of joint kits are available. (See Figure 20)
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	L	2	0	0	-	7	M	G	N	E	F	U	9	Q
									0	3	-			-		E
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

(*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.

Note: Software selection codes “7”, “E”, “F” and “9” are common with hardware selection codes.

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

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 (*1)
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) The difference between '34' and '3J' is the implementation location.

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 (*2)
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 (*2)
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

Note:
(*2) The difference between '41' and '48' is the implementation location.

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**	1xBI1+1xBO1+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
36	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 Table

1CH Communication for Protection (Position "C" is set to "1")

Communication Type	Ordering No. (Position "D")
Protection signal GI 2km Class (C37.94)	**1**
Protection signal SM 30km Class	**2**
Protection signal DSF 80km Class	**3**

2CH Communication for Protection (Position "C" is set to "2")

Communication Type	Ordering No. (Position "D")
Protection signal GI 2km Class (C37.94) x2ch	**1**
Protection signal SM 30km Class x2ch	**2**
Protection signal DSF 80km Class x2ch	**3**
Protection signal GI 2km Class (C37.94) x1ch Protection signal SM 30km Class x1ch	**4**
Protection signal GI 2km Class (C37.94) x1ch Protection signal DSF 80km Class x1ch	**5**
Protection signal SM 30km Class x1ch Protection signal DSF 80km Class x1ch	**6**

Communication Port Table

When the code [C] = 1 (Number of protection signalling = 1)

Serial and/or Ethernet and/or Time Synch port						Ordering No. (Position "E" to "F")	Remark
IEC 60870-5-103		IEC 61850-8-1					
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	
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	

Serial and/or Ethernet and/or Time Synch port						Ordering No. (Position “E” to “F”)	Remark
IEC 60870-5-103		IEC 61850-8-1					
RS485	Fiber optic (for serial)	100Base-FX (*1)	100Base-TX/ 1000Base-T	1000Base-LX	IRIG-B		
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	
			2		1	NL	
				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.

When the code [C] = 2 (Number of protection signalling = 2)

Serial and/or Ethernet and/or Time Synch port						Ordering No. (Position "E" to "F")	Remark
IEC 60870-5-103		IEC 61850-8-1					
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	
1			1			4N	
1				1		4Q	
	1		1			4S	
	1			1		4U	
		2			1	66	Hot/Standby
			2		1	6L	
				2	1	6M	
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	
		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	
			2		1	NL	
				2	1	NM	

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

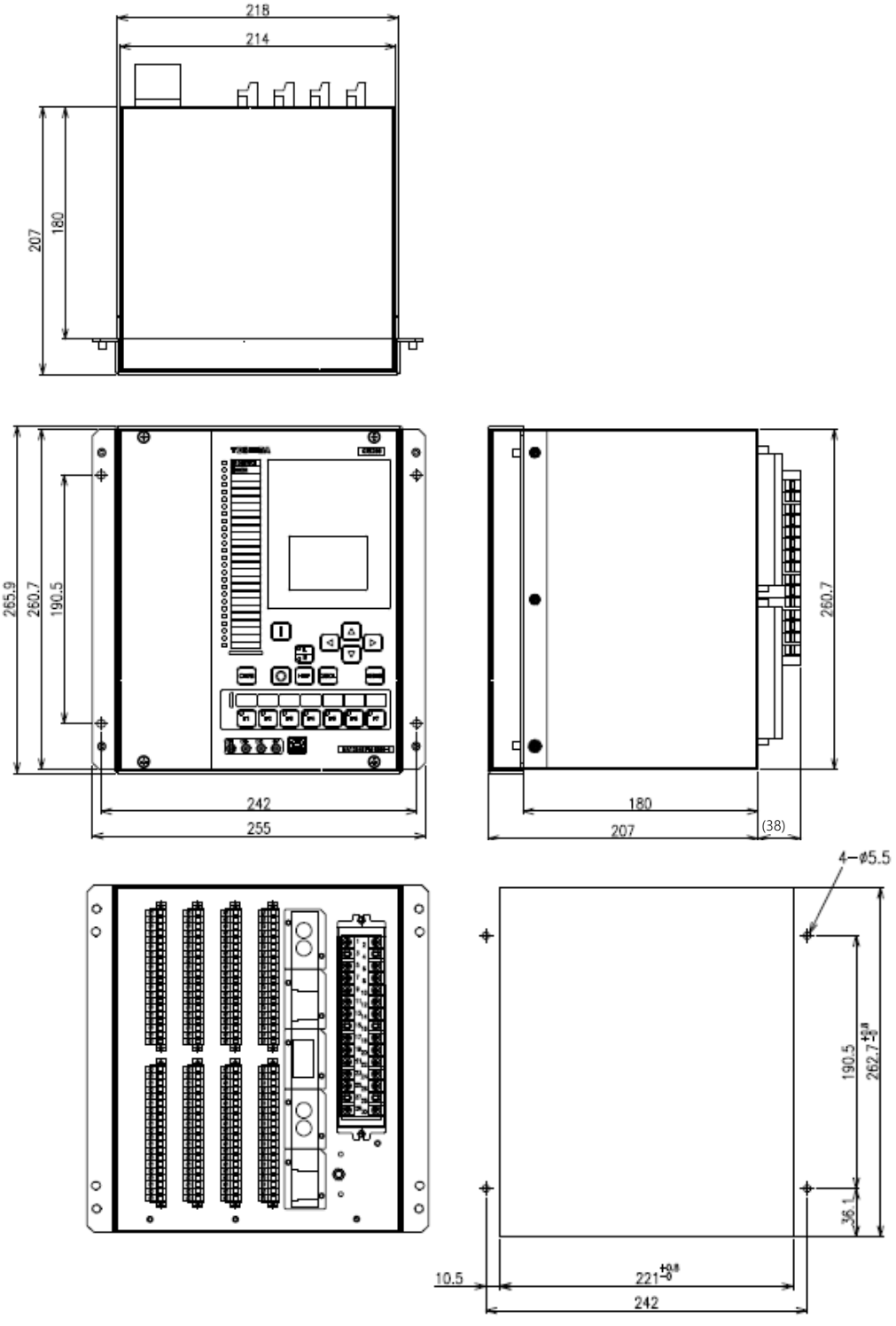
Function Block	Protection function		Ordering No. (Position "G & N")	
			33	37
DIFL	87	Phase-segregated current differential protection	●	●
	50 FS	Fail safe OC		
	27 FS	Fail safe UV		
	CCC	Charging current compensation		
	CTF	CT failure detection by Id		
	87R	Remote differential trip		
	THC	Through-fault current countermeasure	●	●
	50STUB	Stub protection		
DIFG	87N	Zero phase current differential protection	●	●
	50N/51N FS	Fail safe EF		
	CCC	Charging current compensation		
	87R	Remote differential trip		
	THC	Through-fault current countermeasure	●	●
	50STUB	Stub protection		
DTT	DTT	Direct transfer trip function(*1)	●	●
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	●	●
SOTF-OC	50SOTF	Switch on to fault 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	●	●
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	●	●
			Basic	Basic with control

Function Block	Protection function		Ordering No. (Position “G & N”)	
			33	37
FRQ	81	Frequency protection	●	●
OSTV	56V	Out of step tripping by voltage(*1)	●	●
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	●	●
FL-A	FL	Fault locator	●	●
TRC	94	Trip circuit	●	●
ARC	79	Autoreclosing function	●	●
VCHK	25	Voltage check for autoreclosing	●	●
General Control	LEDR	LED reset	●	●
	GCNT	Counter function for the general	●	●
	MDCTRL	Mode control function	●	●
Control 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

2. Interface Converter

Configurations	G	I	F	2	0	0	-		
Electrical interface protocol									
ITU-T G.703 (64kbps, co-directional)								0	1
ITU-T G.703 (64kbps, contra-directional or centralized clock)								0	2

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



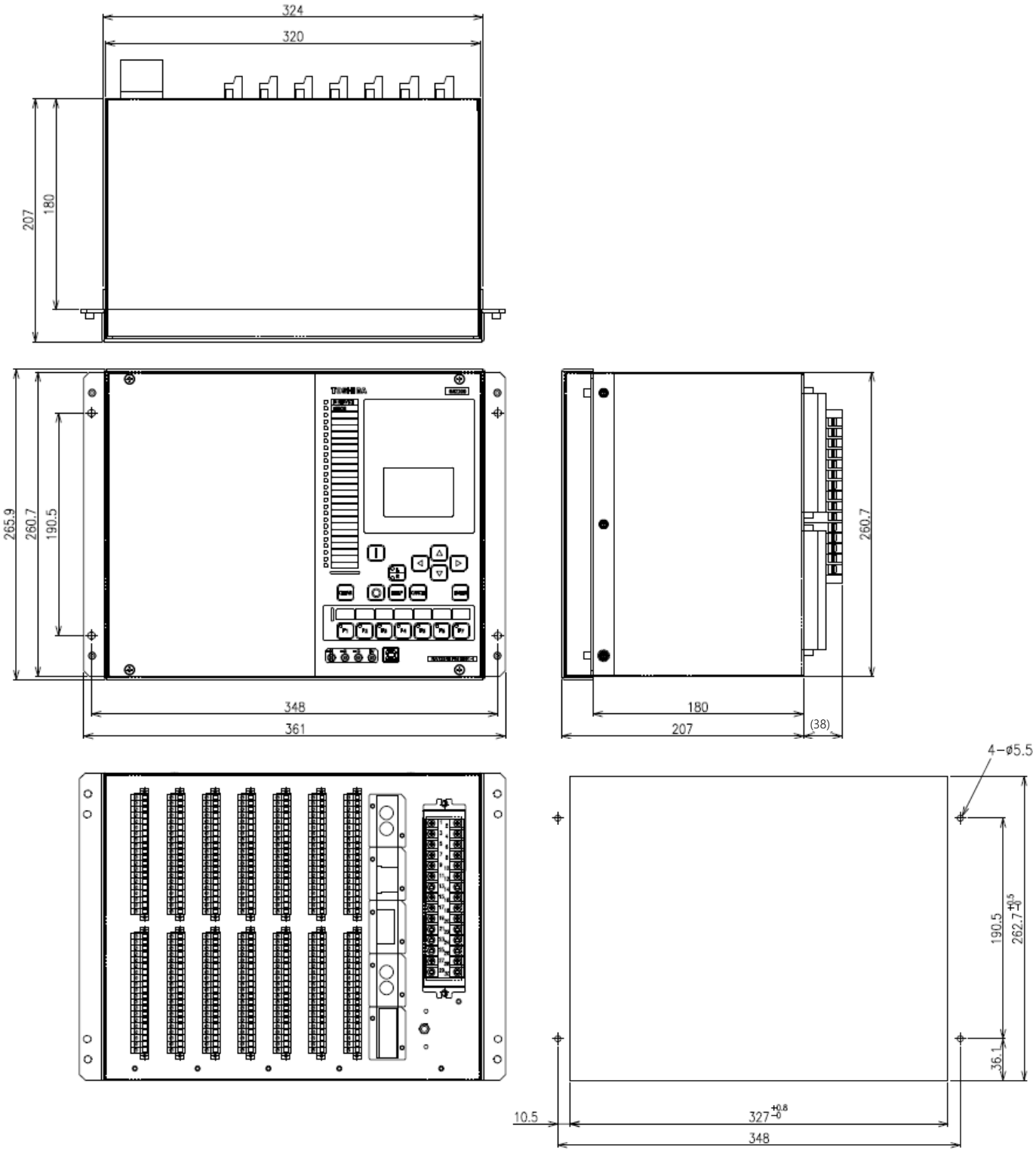
(Panel cut-out)

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

Figure 16 – 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)

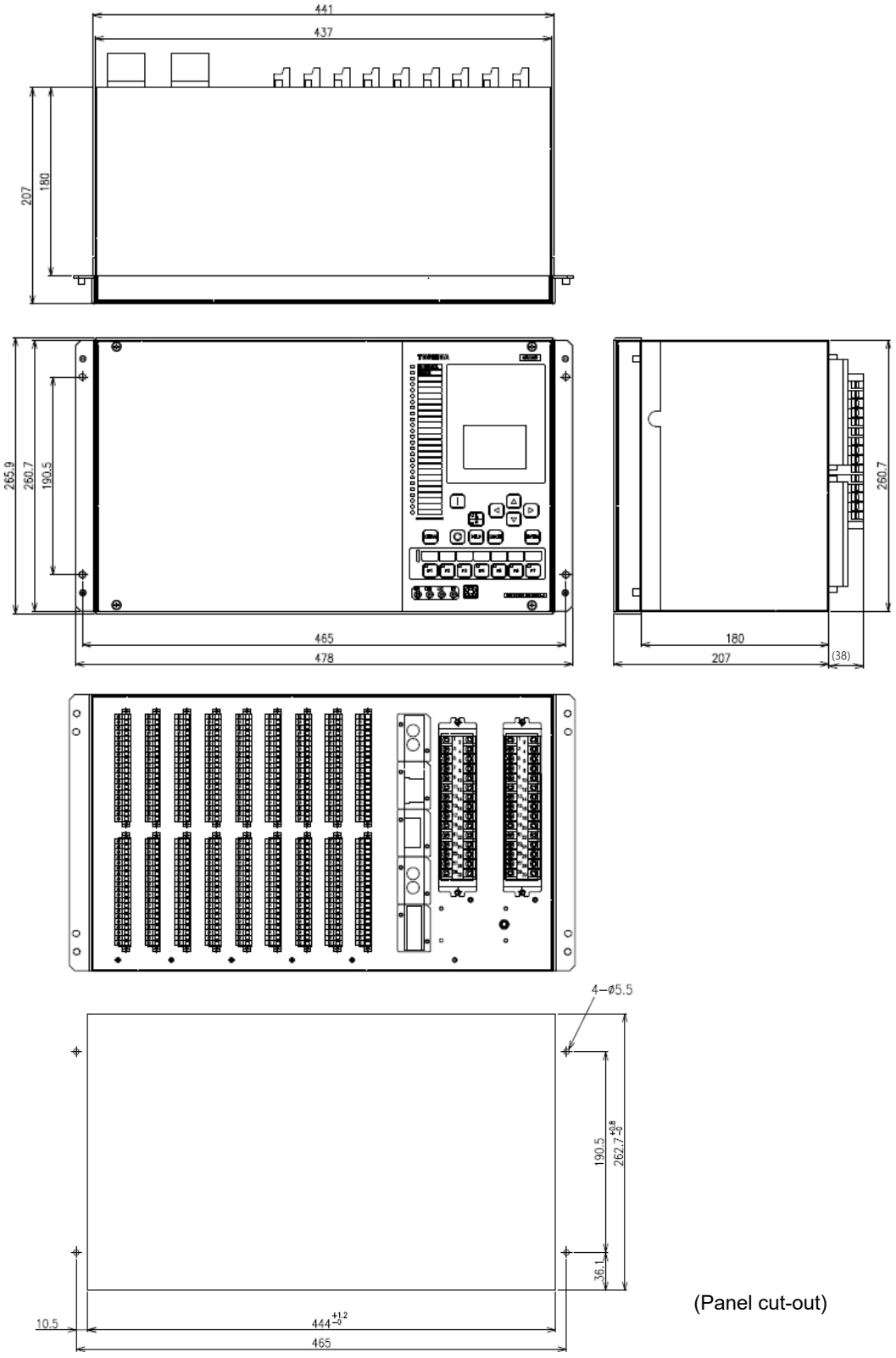


(Panel cut-out)

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

Figure 17 – 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)



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

Figure 18 – Dimension and Panel Cut-out – 1/1 x 19” case size for flush mounting type (when compression plug type terminals are applied)

DIMENSION AND PANEL CUT-OUT (Interface Converter)

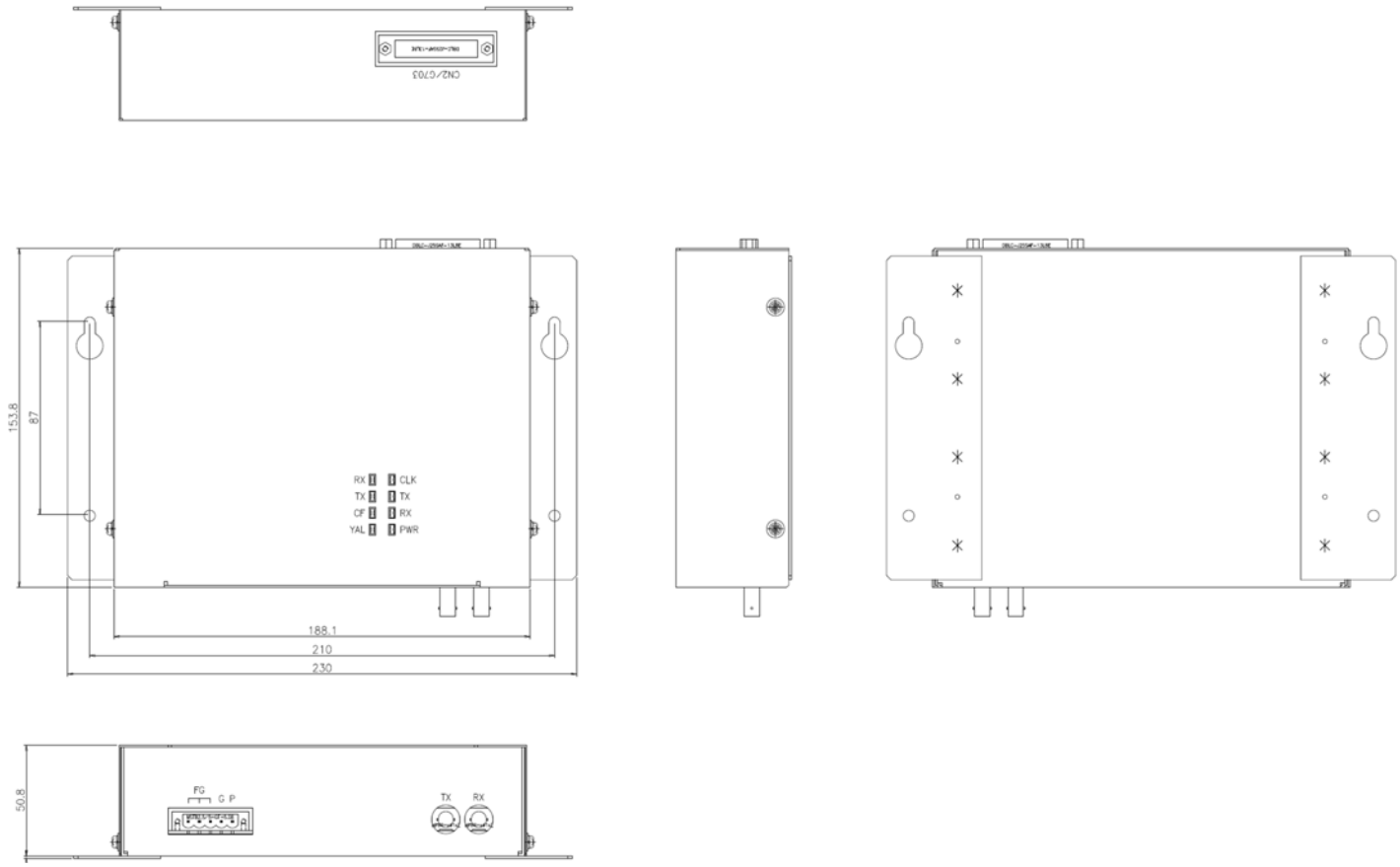
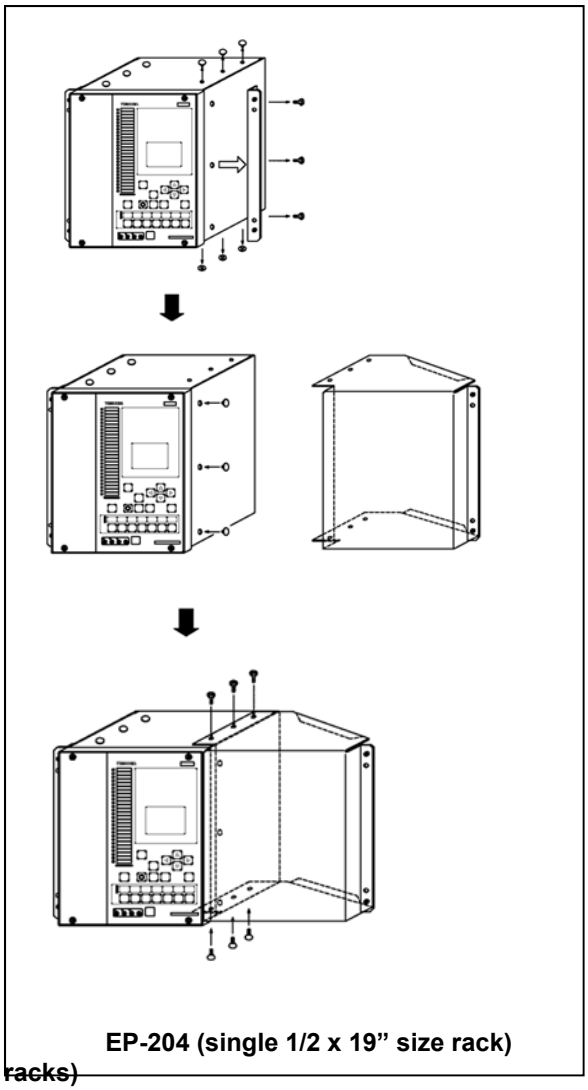


Figure 19 – Outline of Interface Converter GIF200

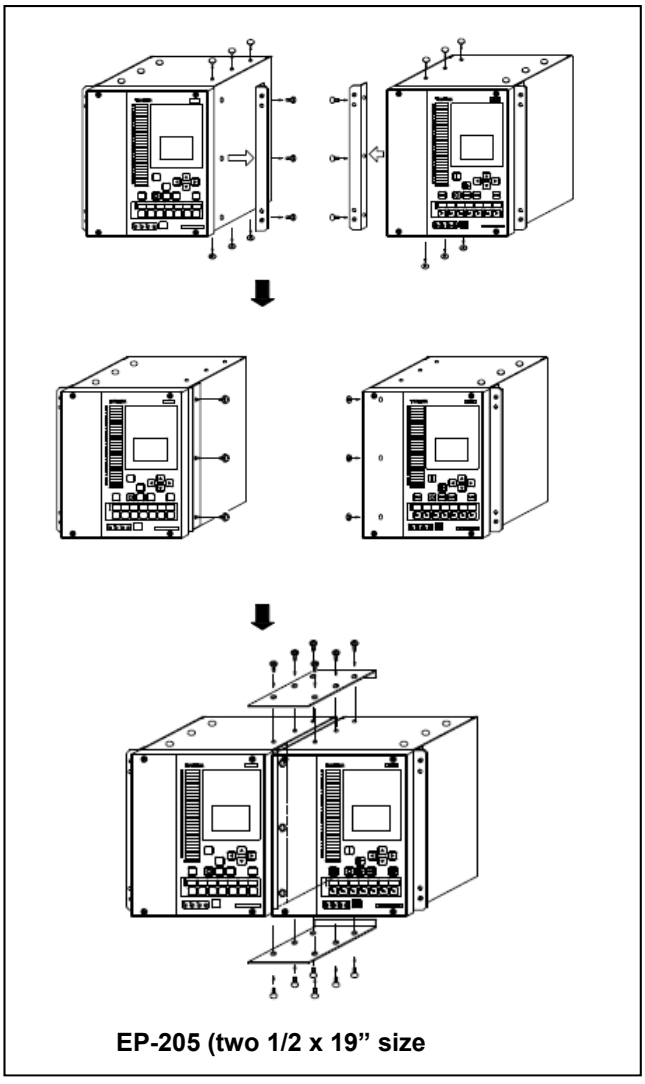
19” RACK MOUNTING JOINT KITS ATTACHMENT

<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



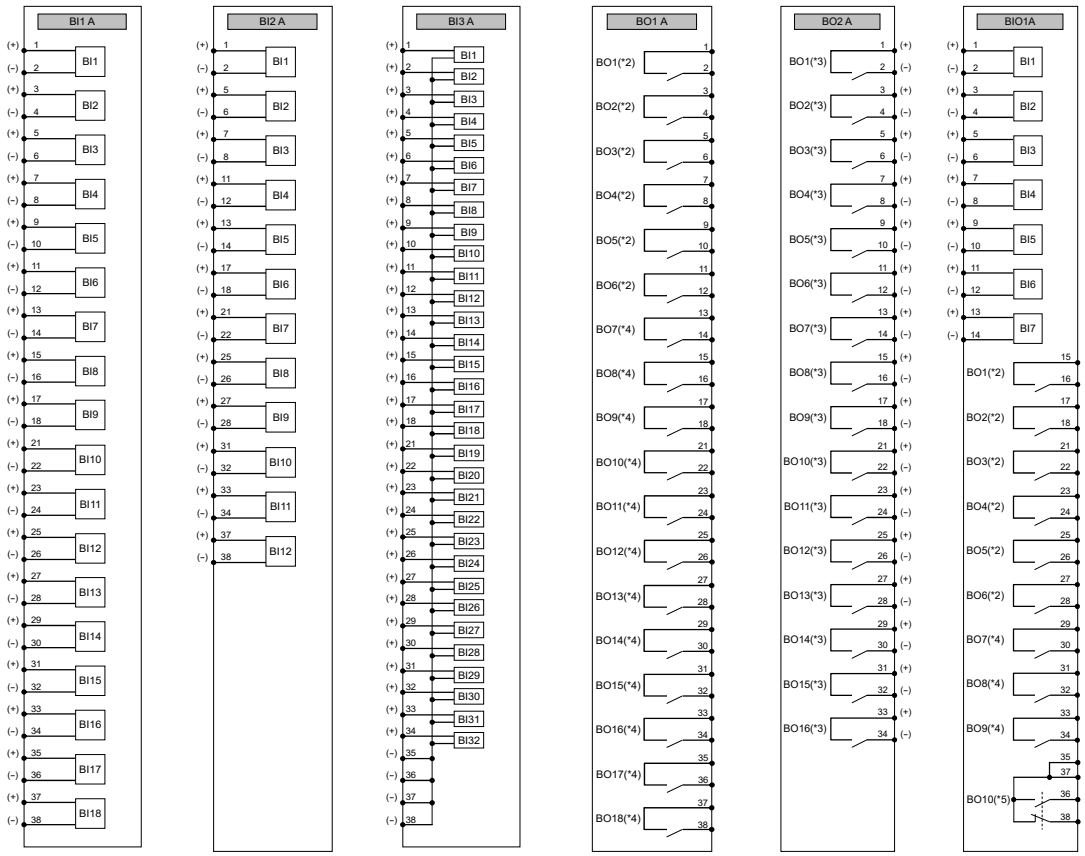
EP-204 (single 1/2 x 19” size rack)



EP-205 (two 1/2 x 19” size racks)

Figure 20 – Joint kits example for 19” rack panel mounting

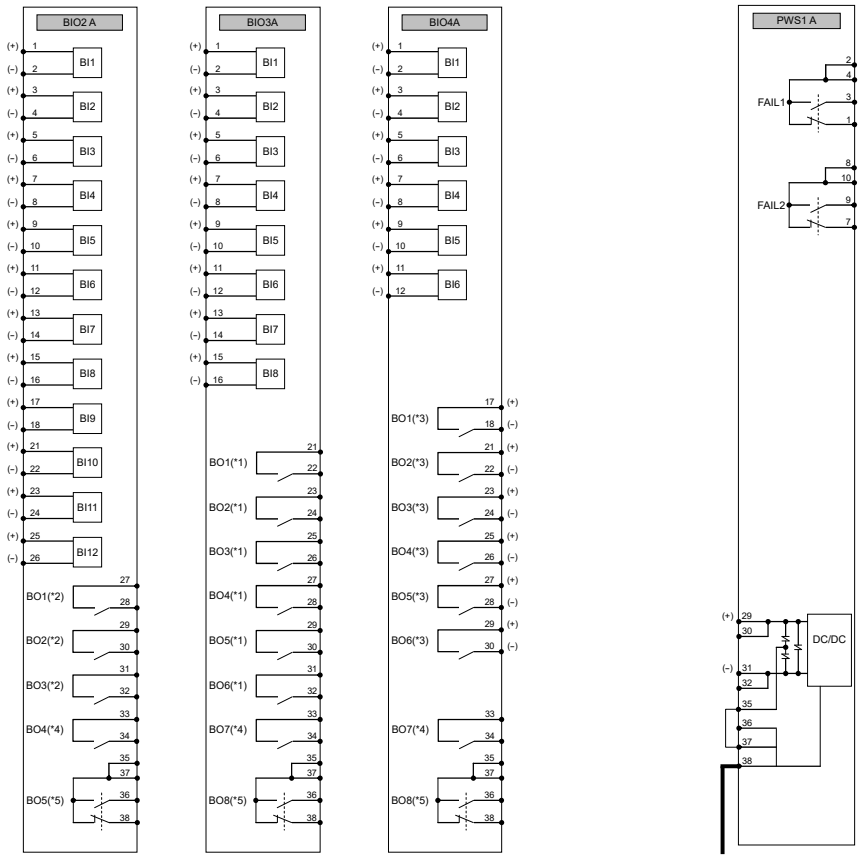
CONNECTIONS DIAGRAM



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

Figure 21 – Binary input board and binary output module for compression plug type

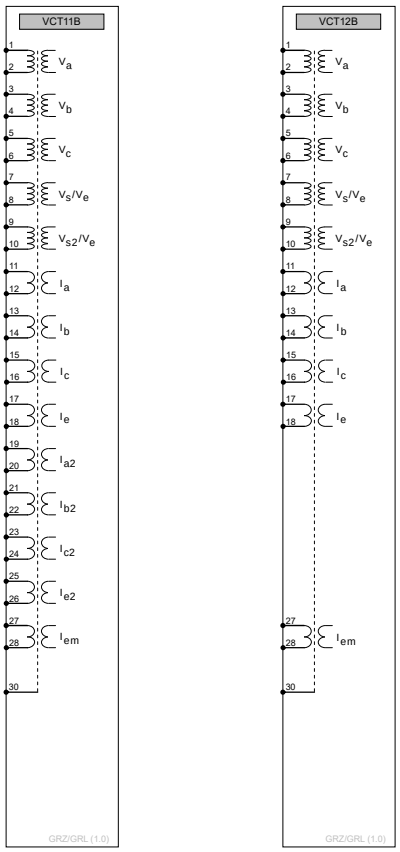
CONNECTIONS DIAGRAM



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

Figure 22 – Combined binary input and output module and DC power supply module for compression plug type

CT/VT module



Module no. 11 (CT x 9 + VT x 5)

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

Figure 23 – CT/VT module

EXTERNAL CONNECTIONS DIAGRAM

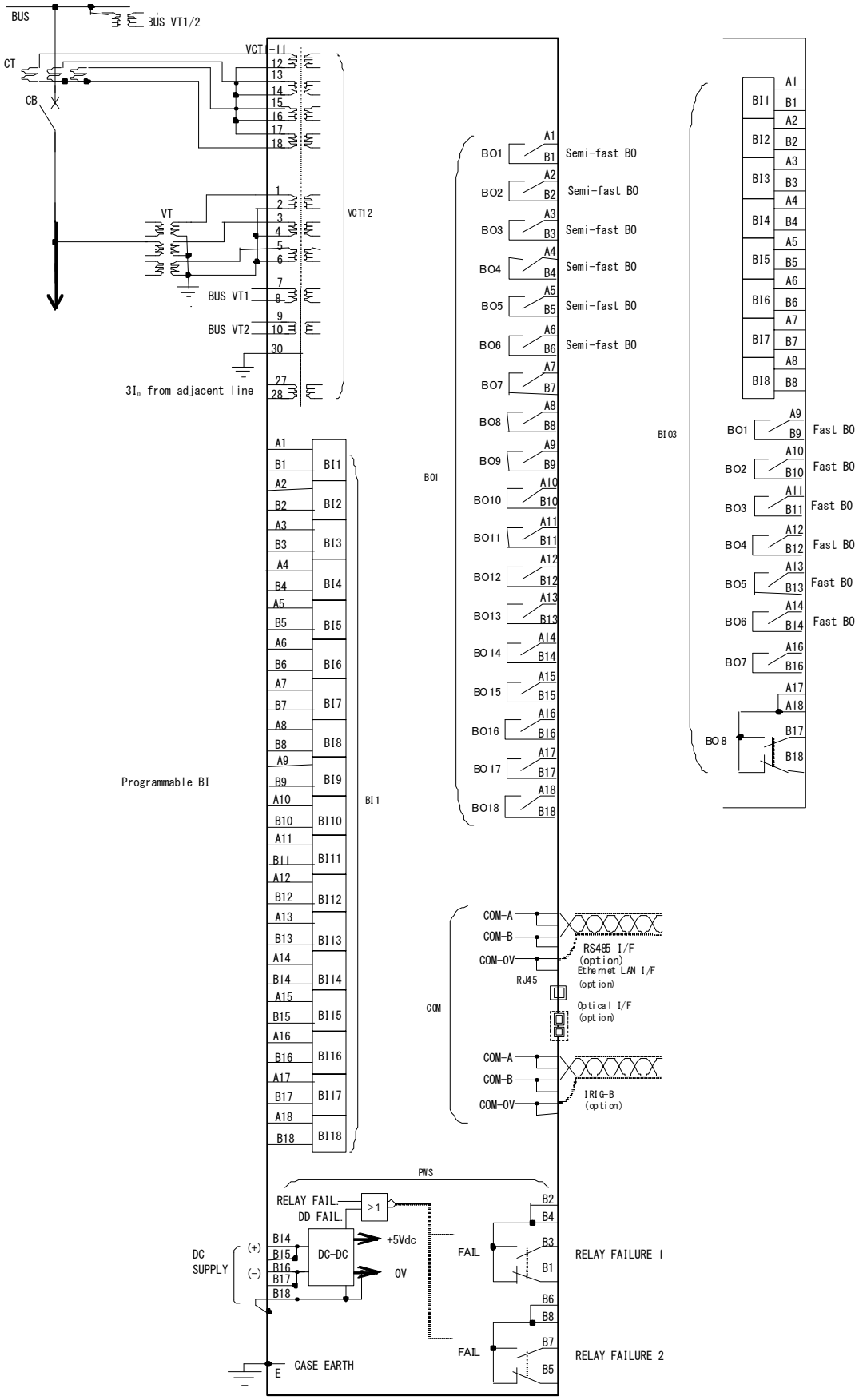


Figure 24 – Typical external connection diagram (PCT: No.12, IO: BI1, BO1 and BIO3)

TOSHIBA

TOSHIBA ENERGY SYSTEMS & SOLUTIONS CORPORATION

72-34, Horikawa-cho, Saiwai-Ku, Kawasaki 212-8585, Japan

Tel +81-44-331-1462 Fax +81-44-548-9540
http://www.toshiba-relays.com

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