TOSHIBA

Leading Innovation

GR-200 Series

GRD 200

Multi Function 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.

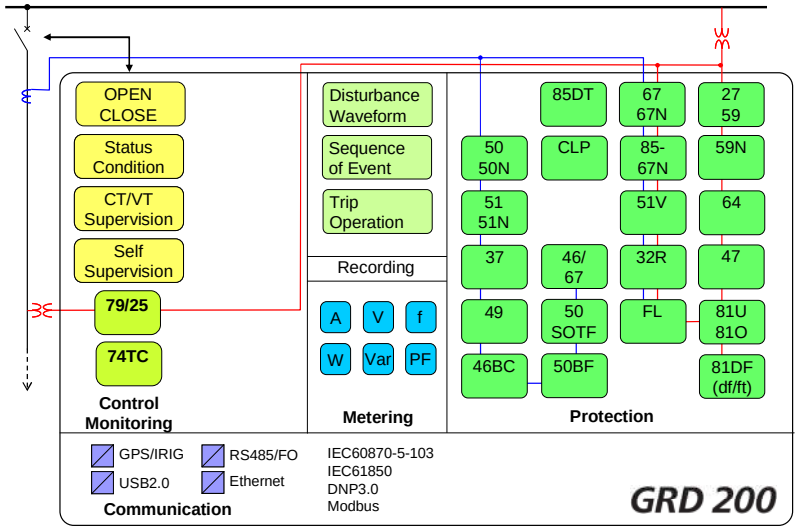
Powerful and wide application -

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

APPLICATION

GRD200, multi function protection IED is implemented on Toshiba's next generation GR-200 series IED platform and has been designed to provide comprehensive 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.

- Protection, control, metering and supervision of EHV, HV, MV and LV networks
- Typical feeder protection such as multiple, high accuracy overcurrent protection elements with inverse time and definite time delay functions which can be independently subject to directional control, thermal overload, under/overvoltage, under/over frequency, circuit breaker failure and voltage controlled overcurrent protections
- Various models and hardware options for flexible application depending on system requirement
- Communications within substation automation system or to a remote control centre, IEC 61850-8-1 [Station bus], Modbus® RTU protocol and IEC 60870-5-103



FEATURES

• Application

– Feeder protection functions or backup protection for machine, motor and transformer

– Several standard models line-up to cover, current-base, voltage-base and current- and voltage-base hardware configuration

– Optional simple control function which enables users to control primary equipment with PLC base interlocking scheme, or standard control function for bay control and monitoring functions

• Functionality

- Overcurrent and earth fault protection, over/under-voltage protection, directional overcurrent and earthfault protection in addition to backup comprehensive protection functions
- Optional sensitive earth fault protection is equipped for registered or non-earthened network
- Control from mimic display or key pads on the front panel for simple control, or standard control which functions as a bay control unit
- Autoreclose and synchronization check
- Analog measurement accuracy up to 0.5% for power, current and voltage
- Integrated disturbance and event recorder
- Time synchronization
- Self-supervision
- Parameters with password protection
- Simulation and test functions for communication, control and protection

• Communication

- Data communication for station bus IEC 61850 and Modbus RTU
- Data communication with client units by IEC 60870-5-103 and Modbus RTU
- Local setting and testing facility from a front USB port using an engineering tool software (TOSHIBA IED Engineering & Monitoring Software) on a laptop

• Security

- Password protection

• Flexibility

- Various models and hardware options for flexible application depending on system requirement and controlled object
- Programmable control, trip and alarm logic with PLC tool software
- Simple engineering on configurable function-base platform

• Human Machine Interface

- LCD (large or standard) and 26 LEDs for local human-machine interface
- Single line diagram indication and touch-type operation on LCD (large LCD only)
- Configurable 7 function keys and direct control buttons for open/close (O/I) and control authority (43R/L).

FUNCTIONS

• Protection

- Directional or non-directional overcurrent and earth fault protection
- Sensitive directional or non-directional earth fault protection
- Undercurrent protection
- Directional or non-directional negative sequence overcurrent protection
- Negative sequence overvoltage protection
- Thermal overload protection
- Under- and over-voltage protection
- Under- and over-frequency protection
- Rate-of-change of frequency
- Reverse power protection
- Broken conductor detection
- Circuit breaker fail
- Cold load protection
- Voltage controlled overcurrent

• Control
- Autoreclose (upto 5 shot)
- Synchronism voltage check
- Circuit breaker and isolator control ("simple control" function is equipped with this only.)
- Switchgear interlock check
- Transformer tap change control (standard control function)
- Programmable automatic sequence control (standard control function)
- Manual override (standard control function)

• Monitoring
- Status and condition monitoring of primary apparatus
- Switchgear operation monitoring
- Plausibility check
- Measurement of I, V, P, Q, PF, f, Wh and varh
- Measurement and supervision of individual and total harmonic up to 15th, sag, swell, interruption (option)
- DC analog input (transducer input) - option
- DC analog output (transducer output) - option
- 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 or multi-language option
- 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
- Modbus® RTU / Modbus® TCP/IP

• 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

The GRD200 provides protection features. Basic functions for feeder protection are equipped in several model line-ups.

Control is performed locally from an HMI on the front panel showing the single line diagram for the bay or a key pads on the front panel, or remotely through the communication bus.

Printed circuit boards for binary inputs/outputs, CT/PT modules, DCAI/DCAO modules and communication modules are configurably selectable upon users' requirement and applications, and configured by simple engineering work with the engineering tool software.

The GRD200 can operate as a control terminal within the substation automation system (SAS) when a "standard control function" is equipped. The GRD200 can communicate with a server of the SAS by IEC 61850 or Modbus® RTU. The GRD200 can also communicate with conventional equipment such as legacy relays by hard-wiring and other protection relays or control units over IEC 61850-5-103 or Modbus RTU.

PROTECTION

- **Directional or non-directional phase overcurrent protection (DOC/OC)**

Four steps of three-phase overcurrent functions have definite time or inverse time characteristics in which all IEC, ANSI and user-defined characteristics are available.

The function can be set to be directional or non-directional characteristics independently when current- and voltage-base model is selected.

- **Directional or non-directional earth fault overcurrent protection (DEF/EF)**

Four steps of earth fault overcurrent protection have definite time or inverse time characteristics in which all IEC, ANSI and optional user-defined characteristics are available.

The function can be set to be directional or non-directional characteristics independently when current- and voltage-base model is selected.

- **Sensitive directional or non-directional earth fault overcurrent protection (SEF) (Option)**

This function provides four steps of earth fault overcurrent protection with more sensitive settings for use in applications where the fault current magnitude may be very low.

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

The function can be set to be directional or non-directional independently when current- and voltage-base model is selected.

- **Thermal overload protection (THM)**

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. Tripping times depend not only on the level of overload current, but also on the level of prior load current, the thermal replica providing 'memory' of previous conditions.

- **Under and over voltage protection (UV/OV)**

Both undervoltage and overvoltage protection schemes are provided. Each scheme can be programmed with definite or inverse time delay.

- **Frequency protection (FRQ)**

6 independent frequency stages are provided. Each is programmable for either under-frequency or over-frequency operation, and each has an associated DTL timer. The underfrequency function can be applied to implement load-shedding schemes.

- **Negative sequence overcurrent protection (OCN)**

Four steps of negative sequence overcurrent protection have definite time or inverse time characteristics. The function can be set to be directional or non-directional characteristics independently when current- and voltage-base model is selected.

- **Voltage controlled protection**

Voltage controlled or voltage restraint inverse overcurrent protection is equipped so that the relay can issue a trip signal in response to certain fault types on the lower voltage side of a transformer when the fault current may be lower than the nominal value. The user can select either the voltage controlled OCI or the voltage restraint OCI function in addition to the normal OCI function. When voltage controlled OCI is used, only when an input voltage is lower than a setting, the OCI element functions. When voltage restraint OCI is used, the sensitivity of OCI is proportionally adjusted by the voltage input value between 20 and 100% of the voltage setting.

- **Broken Conductor Protection**

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

- **Circuit Breaker Fail Protection (CBF)**

Two stage CBF protection provides outputs for re-tripping of the local circuit breaker and/or back-tripping to upstream circuit breakers. The CBF functions can also be initiated by external protections via a binary input if required.

- **Cold Load Protection**

The cold load function modifies the overcurrent protection settings by changing the setting group for a period after energizing 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 energization. This is achieved by a 'Cold Load Settings Group' in which the user can program alternative settings. Normally the user will

choose higher current settings and/or longer time delays and/or disable elements altogether within this group.

- **Auto Reclose (ARC)**

Four independent sequences are provided. Each protection trip such as phase fault, earth fault or an external trip signal is programmable for instantaneous or delayed operation and each ARC shot has a programmable dead time. Either simple ARC shot or normal ARC shot with synchronization check for three-phase autoreclose is settable for the first sequence.

CONTROL

- **Switchgear Control**

GRD200 provides functions for optional local control of switchgear from the HMI. Two-stepped operation (select-control) or direct control operation is applied for the control of circuit breakers, isolator switches and earthing switches. Simple control function which enable users to control from the front panel (keypads and/or mimic display) with PLC-base interlocking scheme, or standard control which functions as a bay control unit with comprehensive control and monitoring functions can be equipped.

Also, switchgear control commands from the station level can be performed through GRD200 within the application of a SAS.

- **Interlock check**

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

For simple control function, hard-wired interlocking signals will be implemented into the GRD200, and the binary input signal and PLC logic can configure the interlock check scheme.

For standard control function, 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.

For station-level interlocking scheme, GRD200 communicates via the station bus or by hard-wiring. The interlocking conditions depend on the circuit configuration and apparatus position status at any given time. For easy and safe implementation of the interlocking function, standard software interlocking logic is provided in GRD200 when the standard control function is equipped. The interlocking logic and conditions can be modified to satisfy the specific requirements by means of the graphical configuration tool.

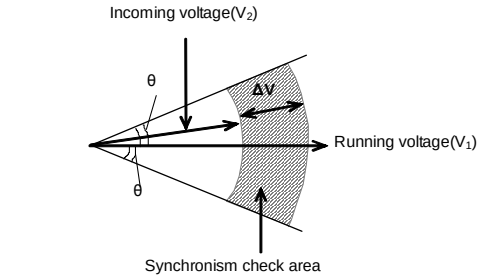
- **Synchronism and voltage check**

When the circuit breaker closing selection command is received, the integrated synchronism and voltage check function is performed to check feeder synchronization.

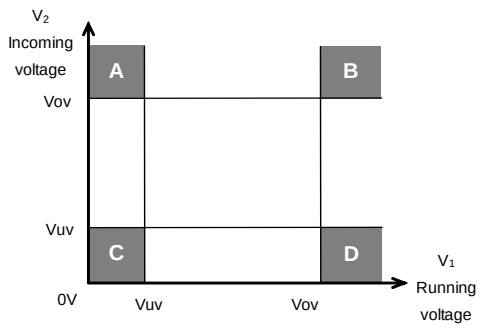
- **Characteristics of synchronism check**

The synchronism check scheme is shown in Figure 1.

The function includes a built-in voltage selection scheme for double bus and one- and a half or ring busbar arrangements.



(a) Synchronism check zone



A, C, D: Voltage check

B: Synchronism check

(b) Voltage and synchronism check zone

Figure 1 - Synchronism check characteristic

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 GRD200.

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.

■ DC analog inputs and outputs (option)

The DC analog inputs provide monitoring and supervision of measurement and process signals from measuring transducers. Many monitoring devices used in substation apparatus represent various parameters such as temperature, GIS gas pressure and DC battery voltage as low current values.

These transducer inputs are also monitored on the local HMI or SAS.

HMI FUNCTION

■ Front Panel

GRD200 provides the following front panel options.

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

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

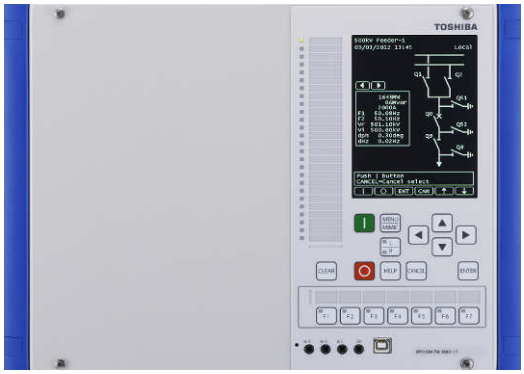


Figure 2 - HMI Panel (large LCD type)

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

- 40 character, 40 line LCD with back light
- Support of multi language
  (20 character and 26 line LCD for multi-language)

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 GRD200 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.

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 can be stored in COMTRADE format.

COMMUNICATION

■ Station bus

Ethernet port(s) for the substation communication standards IEC 61850 and Modbus® RTU are provided for the station bus.

■ Serial communication

Serial port for communicating with legacy equipment or protection relays over IEC 60870-5-103 or Modbus® RTU protocol are provided.

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

GRD200 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.

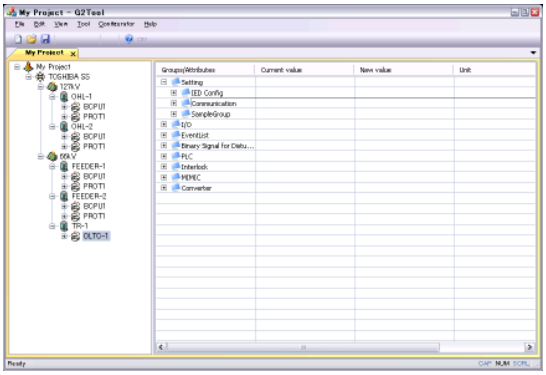
The simulation and test can work in the Test mode only.

TOOLS & ACCESSORY

The PC interface GR-TIEMS allows users to access GRD200 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 GRD200. 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.



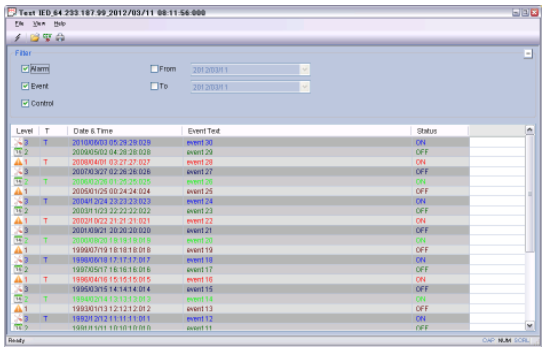


Figure 3 PC Display of GR-TIEMS

■ LCD CONFIGURATION

The user can configure and customize the MIMIC data displayed on the LCD of GRD200 using GR-TIEMS software.

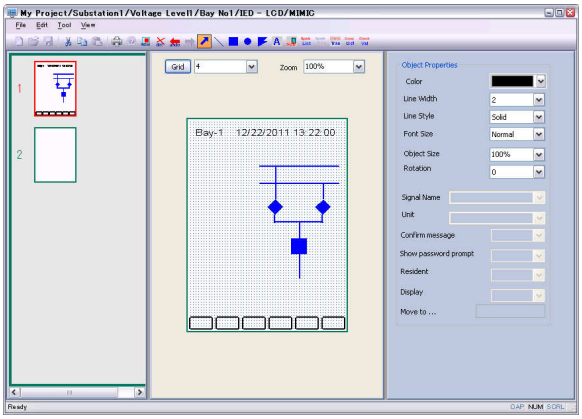


Figure 4 PC Display of MIMIC configuration

■ 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 which is complied with IEC 61131-3.

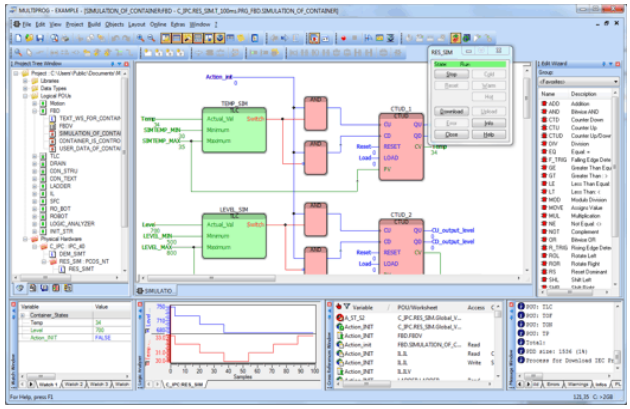


Figure 5 PC display of PLC editor

TECHNICAL DATA

HARDWARE	
Analog Inputs	
Rated current In	1A / 5A (selectable by user)
Rated voltage Vn	100V to 120V
Rated Frequency	50Hz / 60Hz (selectable by user)
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), 48/110Vdc (Operative range: 38.4 – 132Vdc), 110/250Vdc or 100/220Vac (Operative range: 88 – 300Vdc or 80 – 230Vac)
Superimposed AC ripple on DC supply	≤ 15%
Supply interruption	≤ 20ms at 110Vdc
Restart time	< 5ms
Power consumption	≤ 15W (quiescent) ≤ 25W (maximum)
Binary Inputs	
Input circuit DC voltage	24/48/60Vdc (Operating range: 19.2 – 72Vdc), 48/110Vdc (Operative range: 38.4 – 132Vdc), 110/125/220/250Vdc (Operating range: 88 – 300Vdc) Note: Variable threshold settings are available for BI2 and BIO4 from 14V to 154V in various steps.
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	2 ms
Semi-fast operating contacts	
Make and carry	8A continuously

	10A, 110Vdc for 0.5s (L/R=5ms)
Break	0.13A, 110Vdc (L/R=40ms)
Operating time	4 ms
Auxiliary contacts	
Make and carry	8A continuously
	10A, 110Vdc for 0.5s (L/R=5ms)
Break	0.13A, 110Vdc (L/R=40ms)
Operating time	9 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)
DC-AI (analog inputs)	
Measurement range	DC 0±1mA, 0±20mA, 4–20mA , 0–10mA, 0–20mA, ±10mA
	DC –1 – 0 – +1V, –5 – 0 – +5V, –10 – 0 – +10V
Accuracy	±0.5% of full scale
Maximum permitted continuous current	2 times for maximum measurement range
Input resistance	250Ω(0 –±20mA), 3,000Ω(0±1mA)
DC-AO (analog outputs)	
Measurement range	DC 0 – ±20mA
	DC 0 – ±10V
Accuracy	±1% of full scale
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. 10kg (1/3 size), 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.)
System Interface (rear port)	
100BASE-TX	Fast Ethernet
Physical medium	Twisted pair cable, RJ-45 connector
100BASE-FX	Fast Ethernet
Physical medium	50/125 or 62.5/125μm fibre, SC connector

Protocol	IEC61850 or DNP3 or Modbus® RTU
Serial communication (rear port)	
RS485	Protocol IEC 60870-5-103 or DNP3 or Modbus® RTU
Fiber optical	Protocol IEC 60870-5-103
Terminal Block	
CT/VT input	M3.5 Ring terminal
Binary input, Binary output	M3.5 terminal with 15mm stripping length (for compression type terminal) M3.5 Ring terminal (for ring lug type terminal)

FUNCTIONIONAL DATA

PROTECTION

Directional Phase Overcurrent Protection	
IDMTL Overcurrent threshold:	0.02 – 5.00A in 0.01A steps (1A rating) 0.10 – 25.00A in 0.01A steps (5A rating)
DTL Overcurrent threshold:	0.02 – 50.00A in 0.01A steps (1A rating) 0.10 – 250.00A in 0.01A steps (5A rating)
DO/PU ratio:	10 – 100% in 1% steps
Delay type:	DT, IEC NI, IEC VI, IEC EI, UK LTI, IEEE MI, IEEE VI, IEEE EI, US CO2 STI, US CO8 I
IDMTL Time Multiplier Setting TMS:	0.010 – 50.000 in 0.001 steps
DTL delay:	0.00 – 300.00s in 0.01s steps
Reset Type:	Definite Time or Dependent Time.
Reset Definite Delay:	0.00 – 300.00s in 0.01s steps
Reset Time Multiplier Setting RTMS:	0.010 – 50.000 in 0.001 steps
Directional Characteristic Angle:	0° to 180° in 1° steps
Directional Earth Fault Protection	
IDMTL Overcurrent threshold:	0.02 – 5.00A in 0.01A steps (1A rating) 0.10 – 25.00A in 0.01A steps (5A rating)
DTL Overcurrent threshold:	0.02 – 50.00A in 0.01A steps (1A rating) 0.10 – 250.00A in 0.01A steps (5A rating)
DO/PU ratio:	10 – 100% in 1% steps
Delay type:	DT, IEC NI, IEC VI, IEC EI, UK LTI, IEEE MI, IEEE VI, IEEE EI, US CO2 STI, US CO8 I
IDMTL Time Multiplier Setting TMS:	0.010 – 50.000 in 0.001 steps
DTL delay:	0.00 – 300.00s in 0.01s steps
Reset Type:	Definite Time or Dependent Time.
Reset Definite Delay:	0.00 – 300.00s in 0.01s steps
Reset Time Multiplier Setting RTMS:	0.010 – 50.000 in 0.001 steps
Directional Characteristic Angle:	0° to 180° in 1° steps
Directional Characteristic Polarising Voltage threshold:	0.5 – 100.0V in 0.1V steps
Directional Sensitive Earth Fault Protection	
Overcurrent threshold:	0.002 – 0.200A in 0.001A steps (1A rating) 0.010 – 1.000A in 0.001A steps (5A rating)
Delay Type:	DT, IEC NI, IEC VI, IEC EI, UK LTI, IEEE MI, IEEE VI, IEEE EI, US CO2 STI, US CO8 I
IDMTL Time Multiplier Setting TMS:	0.010 – 50.000 in 0.001 steps
DTL delay:	0.00 – 300.00s in 0.01s steps
Reset Type:	Definite Time or Dependent Time

Reset Definite Delay:	0.00 – 300.00s in 0.01s steps
Reset Time Multiplier Setting RTMS:	0.010 – 50.000 in 0.001 steps
Directional Characteristic angle:	0° to 180° in 1° steps
Directional Characteristic Boundary of operation:	±87.5°
Directional Characteristic Voltage threshold:	0.5 – 100.0V in 0.1V steps
Residual power threshold:	0.00 – 20.00W in 0.05W (1A rating) 0.00 – 100.00W in 0.25W (5A rating)
Overvoltage Protection	
Overvoltage (OV) thresholds:	1.0 – 220.0V in 0.1V steps
OV delay type:	DTL, IDMTL
OV IDMTL Time Multiplier Setting TMS:	0.010 – 100.000 in 0.001 steps
OV DTL delay:	0.00 – 300.00s in 0.01s steps
DO/PU ratio:	10 – 100% in 1% steps
1st OV Reset Delay:	0.0 – 300.0s in 0.1s steps
Undervoltage Protection	
Undervoltage (UV) thresholds:	5.0 – 130.0V in 0.1V steps
UV delay type:	DTL, IDMTL
UV IDMTL Time Multiplier Setting TMS:	0.010 – 100.000 in 0.001 steps
UV DTL delay:	0.00 – 300.00s in 0.01s steps
UV Reset Delay:	0.0 – 300.0s in 0.1s steps
Under/Over Frequency Protection	
Under/Over frequency threshold:	-10.00 – +10.00Hz in 0.01Hz steps
DTL delay:	0.00 – 300.00s in 0.01s steps
Undervoltage block:	40.0 – 100.0V in 0.1V steps
Voltage Restraint Protection (51V)	
Voltage threshold	10.0 to 120.0V in 0.1V steps
Sensitivity range	20 to 100% of voltage threshold
Thermal Overload Protection	
$I_\theta = k.I_{FLC}$ (Thermal setting):	0.40 – 2.00A in 0.01A steps (1A rating) 2.00 – 10.00A in 0.01A steps (5A rating)
Time constant (τ):	0.5 - 500.0 mins in 0.1min steps
Thermal alarm:	50 - 100% in 1% steps
Accuracy	
IDMTL Overcurrent Pick-up:	Setting value ± 2%
All Other Overcurrent Pick-ups:	Setting value ± 5%
Overcurrent PU/DO ratio:	≥95%
Undercurrent Pick-up:	Setting value ± 2%
Undercurrent PU/DO ratio:	≤105%
IDMTL Overvoltage Pick-up:	Setting value ± 2%
All Other Overvoltage Pick-ups:	Setting value ± 5%
Inverse Time Delays:	± 5% or 30ms (1.5 to 30 times setting)
Definite Time Delays:	± 1% (for more than 50ms setting) or 10ms
Transient Overreach for instant. elements:	< –5% for X/R = 100.

CONTROL

Synchronism Check Function	
Synchronism check angle:	0 – 75° in 1° steps
Frequency difference check:	0.01– 2.00Hz in 0.01Hz steps
Voltage difference check:	1.0 – 150.0V in 0.1V steps
Voltage dead check:	5 – 50V in 1V steps
Voltage live check:	10 – 100V in 1V steps
Metering Function	
Current	Accuracy ± 0.5% (at rating)
Voltage	Accuracy ± 0.5% (at rating)
Power (P, Q)	Accuracy ± 0.5% (at rating)
Energy (Wh, varh)	Accuracy ± 1.0% (at rating)
Frequency	Accuracy ± 0.03Hz
GPS Time Synchronisation	
Protocol	SNTP

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 60255-5	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 60255-5 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
Radiated RF Electromagnetic Disturbance	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	1.2/50µs 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

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		
Synchronizing		IEC 60255-125
Under/Over Voltage Protection		IEC 60255-127
Under/Over Power Protection		IEC 60255-132
Thermal Protection		IEC 60255-149
Over/Under Current Protection		IEC 60255-151
Directional Current Protection		IEC 60255-167
Reclosing		IEC 60255-179
Frequency Protection		IEC 60255-181
Teleprotection		IEC 60255-185
European Commission Directives		
CE	2004/108/EC	Compliance with the European Commission Electromagnetic Compatibility Directive is demonstrated according to generic EMC standards EN 61000-6-2 and EN 61000-6-4, and product standard IEC 60255-26.
	2006/95/EC	Compliance with the European Commission Low Voltage Directive for electrical safety is demonstrated according EN 60255-27.

ORDERING SHEET

[Hardware selection]

	1	2	3	4	5	6		7	8		9	A	B		C	D		E	F		G	H		J	K	L
Configurations	**G**	**R**	**D**	**2**	**0**	**0**	**-**			**-**				**-**	**0**	**0**	**-**			**-**			**-**			**0**

Application of power system	
Function for current element protection(CTx5 for 1/3 rack)	1
Function for voltage element protection(VTx5 for 1/3 rack)	2
Function for current and voltage element protection (CTx5,VTx3 for 1/3 rack)	3
Function for current and voltage element protection (CTx6,VTx5 for 1/2, 3/4 or 1/1 racks)	4
System frequency	
50Hz	1
60Hz	2
AC rating for phase currents	
N/A (when code "7" = 2)	0
1A	1
5A	2
DC Rating	
110-250 Vdc or 100-220Vac	1
48-110 Vdc	2
24- 48 Vdc	3
Outline	
Standard LCD, 1/3 x 19'' rack for flush mounting	1
Standard LCD, 1/2 x 19'' rack for flush mounting	2
Standard LCD, 3/4 x 19'' rack for flush mounting	3
Standard LCD, 1/1 x 19'' rack for flush/rack mounting	4
Large LCD, 1/3 x 19'' rack for flush mounting	5
Large LCD, 1/2 x 19'' rack for flush mounting	6
Large LCD, 3/4 x 19'' rack for flush mounting	7
Large LCD, 1/1 x 19'' rack for flush/rack mounting	8
Separate Large LCD, 1/3 rack for flush mounting	A
Separate Large LCD, 1/2 rack for flush mounting	B
Separate Large LCD, 3/4 rack for flush mounting	C
Separate Large LCD, 1/1 rack for flush/rack mounting	D
Standard LCD, 1/3 x 19'' rack for rack mounting	E
Standard LCD, 1/2 x 19'' rack for rack mounting	F
Standard LCD, 3/4 x 19'' rack for rack mounting	G
Large LCD, 1/3 x 19'' rack for rack mounting	H
Large LCD, 1/2 x 19'' rack for rack mounting	J
Large LCD, 3/4 x 19'' rack for rack mounting	K
Standard LCD, 1/3 x 19'' rack for vertical flush mounting	L
Standard LCD, 1/2 x 19'' rack for vertical flush mounting	M
Standard LCD, 3/4 x 19'' rack for vertical flush mounting	N
Standard LCD, 1/1 x 19'' rack for vertical flush mounting	P
Large LCD, 1/3 x 19'' rack for vertical flush mounting	Q
Large LCD, 1/2 x 19'' rack for vertical flush mounting	R

	1	2	3	4	5	6		7	8		9	A	B		C	D		E	F		G	H		J	K	L
Configurations	**G**	**R**	**D**	**2**	**0**	**0**	**-**			**-**				**-**	**0**	**0**	**-**			**-**			**-**			**0**
Large LCD, 3/4 x 19'' rack for vertical flush mounting											S															
Large LCD, 1/1 x 19'' rack for vertical flush mounting											T															
BI/BO Module																										
Refer to Number of BI/BO Table																										
BI/BO Terminal Type																										
Compression plug type terminal																							0			
Ring lug type terminal																							1			
Number of Serial and/or Ethernet Communication and/or Time Synch Port(s)																										
1CH																		1								
1CH + IRIG-B																		3								
2CH																		4								
2CH + IRIG-B																		6								
3CH																		7								
3CH + IRIG-B																		9								
1CH + connection terminal for external I/O unit (GIO200)																		B								
1CH + IRIG-B + connection terminal for external I/O unit (GIO200)																		D								
2CH + connection terminal for external I/O unit (GIO200)																		E								
2CH + IRIG-B + connection terminal for external I/O unit (GIO200)																		G								
3CH + connection terminal for external I/O unit (GIO200)																		H								
3CH + IRIG-B + connection terminal for external I/O unit (GIO200)																		K								
Selection of Serial and/or Ethernet Communication Port(s)																										
100/1000Base-TX x 1 port (When position E = 1 - 3 and B – D)																			3							
100/1000Base-FX x 1 port (When position E = 1 - 3 and B – D)																			4							
100/1000Base-TX x 2 ports (When position E = 4 - 6 and E – G)																			5							
100/1000Base-FX x 2 ports (When position E = 4 - 6 and E – G)																			6							
RS485 x 1 port + 100/1000Base-TX x 1 port (When position E = 4 - 6 and E – G)																			A							
RS485 x 1 port + 100/1000Base-TX x 2 ports (When position E = 7 - 9 and H – K)																			B							
RS485 x 1 port + 100/1000Base-FX x 1 port (When position E = 4 - 6 and E – G)																			C							
RS485 x 1 port + 100/1000Base-FX x 2 ports (When position E = 7 - 9 and H – K)																			D							
Fiber optic (for serial) x 1 port + 100/1000Base-TX x 1 port (When position E = 4 - 6 and E – G)																			E							
Fiber optic (for serial) x 1 port + 100/1000Base-TX x 2 ports (When position E = 7 - 9 and H – K)																			F							
Fiber optic (for serial) x 1 port + 100/1000Base-FX x 1 port (When position E = 4 - 6 and E – G)																			G							
Fiber optic (for serial) x 1 port + 100/1000Base-FX x 2 ports (When position E = 7 - 9 and H – K)																			H							
Function Block (linked with software selection)																										
See function table of software selection																										

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

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	DC-AI	Fast-BO	Semi-fast BO	BO	Heavy duty BO	DC-AO		
7	-	-	-	-	6	4	-	-	**11**	1xBIO1
12	-	-	-	-	3	2	-	-	**12**	1xBIO2
8	-	-	-	6	-	2	-	-	**13**	1xBIO3
-	6	-	-	-	-	2	6	-	**14**	1xBIO4
18	-	-	-	-	-	-	-	-	**15**	1xBI1
-	12	-	-	-	-	-	-	-	**16**	1xBI2
-	-	32	-	-	-	-	-	-	**17**	1xBI3
Other Configuration									**ZZ**	To be specified at ordering

BI/BO 2 x I/O module (Set code position "9" to other than "1", "5", "A", "E", "H", "L" and "Q")

Number of BI/BO									Ordering No. (Position "A" to "B")	Configuration
Independent BI	Independent BI (variable)	Common BI	DC-AI	Fast-BO	Semi-fast BO	BO	Heavy duty BO	DC-AO		
-	-	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
Other Configuration									**ZZ**	To be specified at ordering

BI/BO 3 x I/O module (Set code position "9" to other than "1", "5", "A", "E", "H", "L" and "Q")

Number of BI/BO									Ordering No. (Position "A" to "B")	Configuration
Independent BI	Independent BI (variable)	Common BI	DC-AI	Fast-BO	Semi-fast BO	BO	Heavy duty BO	DC-AO		
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
-	-	32	10	-	6	12	-	-	**38**	1xBI3+1xDCAI2+1xBO1
36	-	-	-	-	6	12	-	-	**39**	2xBI1+1xBO1
-	24	-	-	-	6	12	-	-	**3A**	2xBI2+1xBO1
18	6	-	-	-	6	14	6	-	**3B**	1xBI1+1xBO1+1xBIO4
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
18	-	-	10	-	6	12	-	-	**3F**	1xBI1+1xDCAI2+1xBO1
16	-	-	-	12	6	16	-	-	**3G**	1xBO1+2xBIO3
-	6	32	-	-	6	14	6	-	**3H**	1xBI3+1xBO1+1xBIO4
26	-	-	-	6	6	14	-	-	**3J**	1xBO1+1xBIO3+1xBI1
-	-	62	-	-	6	12	-	-	**3K**	2xBI3+1xBO1
Other Configuration									**ZZ**	To be specified at ordering

BI/BO 4 x I/O modules (Set code position "9" to "3", "4", "7", "8", "C", "D", "G", "K", "N", "P", "S" or "T")

Number of BI/BO									Ordering No. (Position "A" to "B")	Configuration
Independent BI	Independent BI (variable)	Common BI	DC-AI	Fast-BO	Semi-fast BO	BO	Heavy duty BO	DC-AO		
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
8	-	32	10	6	6	14	-	-	**45**	1xBI3+1xDCAI2+1xBO1+ 1xBIO3
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
20				6	15	28			**49**	2xBO1+1xBIO2+1xBIO3
-	-	64	10	-	6	12	-	-	**4A**	2xBI3+1xDCAI2+1xBO1
Other Configuration									**ZZ**	To be specified at ordering

BI/BO 5 x I/O modules (Set code position "9" to "3", "4", "7", "8", "C", "D", "G", "K", "N", "P", "S" or "T")

Number of BI/BO									Ordering No. (Position "A" to "B")	Configuration
Independent BI	Independent BI (variable)	Common BI	DC-AI	Fast-BO	Semi-fast BO	BO	Heavy duty BO	DC-AO		
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
-	-	64	10	-	12	24	-	-	**55**	2xBI3+1xDCAI2+2xBO1
62	-	-	-	6	6	14	-	-	**56**	3xBI1+1xBO1+1xBIO3
54	6	-	-	-	6	14	6	-	**57**	3xBI1+1xBO1+1xBIO4
54	-	-	10	-	6	12	-	-	**58**	3xBI1+1xDCAI2+1xBO1
36	-	-	10	-	12	24	-	-	**59**	2xBI1+1xDCAI2+2xBO1
20	-	32	-	6	9	16	-	-	**5A**	1xBI3+1xDCAI2+1xBO1 +1xBIO2+1xBIO3
-	-	96	-	-	12	24	-	-	**5B**	3xBI3+2xBO1
-	-	96	10	-	6	12	-	-	**5C**	3xBI3+1xDCAI2+1xBO1
Other Configuration									**ZZ**	To be specified at ordering

BI/BO 6 x I/O modules (Set code position "9" to "3", "4", "7", "8", "C", "D", "G", "K", "N", "P", "S" or "T")

Number of BI/BO									Ordering No. (Position "A" to "B")	Configuration
Independent BI	Independent BI (variable)	Common BI	DC-AI	Fast-BO	Semi-fast BO	BO	Heavy duty BO	DC-AO		
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
8	-	96	10	6	6	14	-	-	**65**	3xBI3+1xDCAI2+1xBO1 +1xBIO3
54	6	-	10	-	6	14	6	-	**66**	3xBI1+1xDCAI2+1xBO1 +1xBIO4
-	-	128	10	-	6	12	-	-	**67**	4xBI3+1xDCAI2+1xBO1
-	-	96	10	-	12	24	-	-	**68**	3xBI3+1xDCAI2+2xBO1
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
Other Configuration									**ZZ**	To be specified at ordering

BI/BO 7 x I/O modules (Set code position "9" to "4", "8", "D", "P" or "T")

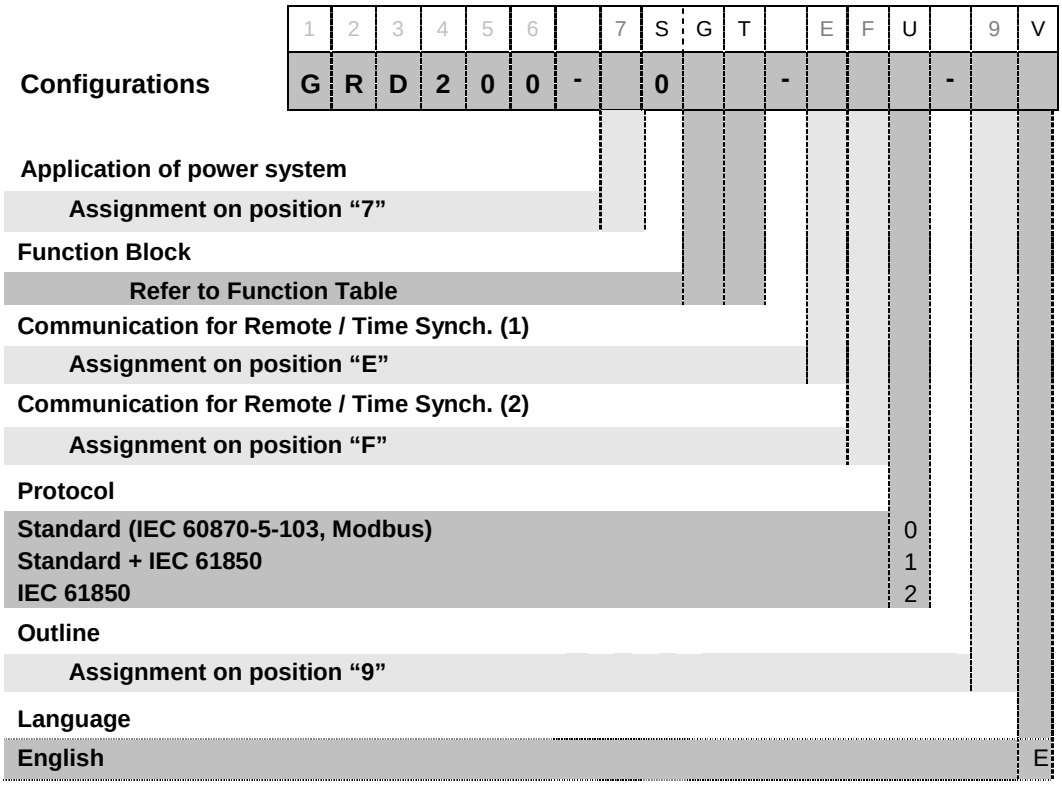
Number of BI/BO									Ordering No. (Position "A" to "B")	Configuration
Independent BI	Independent BI (variable)	Common BI	DC-AI	Fast-BO	Semi-fast BO	BO	Heavy duty BO	DC-AO		
80	-	-	-	6	12	26	-	-	**71**	4xBI1+2xBO1+1xBIO3
72	6	-	-	-	12	26	6	-	**72**	4xBI1+2xBO1+1xBIO4
8	-	96	-	6	18	38	-	-	**73**	3xBI3+3xBO1+1xBIO3
-	6	96	-	-	18	38	6	-	**74**	3xBI3+3xBO1+1xBIO4
36	12	-	10	-	-	4	44	-	**75**	2xBI1+1xDCAI2+2xBIO4 +2xBO2
-	-	96	20	-	12	24	-	-	**76**	3xBI3+2xDCAI2+2xBO1
7	-	64	20	-	6	4	32	-	**77**	2xBI3+2xDCAI2+1xBIO1 +2xBO2
-	60	-	-	-	6	12	16	-	**78**	5xBI2+1xBO1+1xBO2
-	-	160	-	-	12	24	-	-	**79**	5xBI3+2xBO1
52	-	-	10	12	12	28	-	-	**7A**	2xBI1+1xDCAI2+2xBIO3 +2XBO1
54	-	64	-	-	12	24	-	-	**7B**	3xBI1 + 2xBI3 + 2xBO1
18	-	96	10	-	12	24	-	-	**7C**	1xBI1+3xBI3+1xDCAI2 +2xBO1
-	-	128	-	-	18	36	-	-	**7D**	4xBI3+3xBO1
Other Configuration									**ZZ**	To be specified at ordering

BI/BO 8 x I/O modules (Set code position "9" to "4", "8", "D", "P" or "T")

Number of BI/BO									Ordering No. (Position "A" to "B")	Configuration
Independent BI	Independent BI (variable)	Common BI	DC-AI	Fast-BO	Semi-fast BO	BO	Heavy duty BO	DC-AO		
-	-	128	10	-	18	36	-	-	**81**	4xBI3+1xDCAI2+3xBO1
54	12	-	10	-	-	4	44	-	**82**	3xBI1+1xDCAI2+2xBIO4 +2xBO2
-	-	160	-	-	18	36	-	-	**83**	5xBI3+3xBO1
-	-	160	20	-	6	12	-	-	**84**	5xBI3+2xDCAI2+1xBO1
-	-	192	10	-	6	12	-	-	**85**	6xBI3+1xDCAI2+1xBO1
-	-	96	10	-	24	48	-	-	**86**	3xBI3+1xDCAI2+4xBO1
-	60	-	-	-	6	12	32	-	**87**	5xBI2+1xBO1+2xBO2
8	-	128	-	6	18	38	-	-	**88**	4xBI3+3xBO1+1xBIO3
14	-	96	30	-	12	8	-	-	**89**	3xBI3+3xDCAI2+2xBIO1
-	-	128	20	-	12	24	-	-	**8A**	4xBI3+2xDCAI2+2xBO1
-	-	192	20	-	-	-	-	-	**8B**	6xBI3+2xDCAI2
-	-	256	-	-	-	-	-	-	**8C**	8xBI3
36	-	64	20	-	12	24	-	-	**8D**	2xBI1+2xBI3+2xDCAI2 +2xBO1
18	-	96	10	-	18	36	-	-	**8E**	1xBI1+3xBI3+1xDCAI2 +3xBO1
Other Configuration									**ZZ**	To be specified at ordering

Please contact with our sales staffs when you require "other configuration (number: ZZ)" that is not indicated in the ordering sheet above.

[Software selection]



	1	2	3	4	5	6		7	S	G	T		E	F	U		9	V
Configurations	**G**	**R**	**D**	**2**	**0**	**0**	**-**		**0**			**-**				**-**		

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	
Standard (IEC 60870-5-103, Modbus)	0
Standard + IEC 61850	1
IEC 61850	2
Outline	
Assignment on position "9"	
Language	
English	E

Note: Software selection codes "1" to "7", "E", "F" and "9" are common with hardware selection codes.

FUNCTION TABLE

Function Block	Description	Ordering No. (Position "G & T")										
		10	11	12	13	14	15	16	17	18	19	1C
[VCT module and rack size]												
Code "7" = 1	5 x CT (VCT module No.32) and 1/3 x 19"	●	●	●								●
Code "7" = 2	5 x VT (VCT module No.33) and 1/3 x 19"				●	●					●	
Code "7" = 3	5 x CT + 3 x VT (VCT module No.34) and 1/3 x 19"						●	●				
Code "7" = 4	6 x CT + 5 x VT (VCT module No.31) and 1/2, 3/4 or 1/1 x 19"								●	●		
[Protection]												
50/51	Non-directional phase overcurrent protection (4 steps)	●	●	●								
50N/51N	Non-directional earth fault overcurrent protection (4 steps)	●	●	●								
50/67,51/67	Non-directional / directional phase overcurrent protection (4 steps)						●	●	●	●		
50N/67N,51N/67N	Non-directional / directional earth fault overcurrent protection (4 steps)						●	●	●	●		
ICD	Inrush current (2nd harmonic) detection function	●	●	●			●	●	●	●		
50N/51N	Non-directional / directional sensitive overcurrent protection (4 steps)	●	●									
51N/67N	Directional sensitive earthfault protection (4 steps)								●	●		
50BF	Circuit breaker failure protection (2 stages)	●	●	●			●	●	●	●		●
37	Phase under-current protection (2 steps)	●	●	●			●	●	●	●		
46	Negative sequence phase over-current protection (2 steps)	●	●	●								
46/67	Non-Directional / directional negative sequence phase over-current protection (4 steps)						●	●	●	●		
49	Thermal overload protection	●	●	●			●	●	●	●		
CLP	Cold load protection function	●	●				●	●	●	●		
46BC	Broken conductor protection (1 step)	●	●	●			●	●	●	●		
59	Phase over-voltage protection (4 steps)				●	●	●	●	●	●		
59N	Earth fault over-voltage protection (2 steps)				●	●	●	●	●	●		
47	Negative sequence phase over-voltage protection (2 steps)				●	●	●	●	●	●		
27	Phase under-voltage protection (4 steps)				●	●	●	●	●	●		
80-50N/51N/67N	Command protection by OC/EF and DOC/DEF schemes	●	●				●	●	●	●		
81	Frequency protection (6 steps)				●	●	●	●	●	●		
ROCOF	Rate of change of freqnency (df/dt) (6 steps)				●	●	●	●	●	●		
32R	Reverse power protection (2 steps)						●	●	●	●		
51V	Voltage controlled/restraint overcurrent (2 steps)						●	●	●	●		
21FL	Fault locator						●	●	●	●		
[Control function]												
79	Autoreclosing function (upto 4 shots)	●	●	●			●	●	●	●		
25	Voltage check for autoreclosing / synchrocheck				●	●			●	●	●	
Simple control	Equipment control and interlock	●			●		●		●	●		
Control	Standard control function for bay control and monitoring									●		
[Common]												
TCS	Trip circuit supervision	●	●	●	●	●	●	●	●	●		●
VTF	VTF detection function						●	●	●	●		
CTF	CTF detection function						●	●	●	●		
Event	Event and alarm	●	●	●	●	●	●	●	●	●	●	●

Function Block	Description	Ordering No. (Position "G & T")										
		10	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**1C**
Measurement	Measurement	●	●	●	●	●	●	●	●	●	●	●
PLC	Programmable logic controller	●	●	●	●	●	●	●	●	●	●	●
Communication	Remote communication	○	○	○	○	○	○	○	○	○	○	○
		3OC+EF (Simple control)	3OC+EF (No control)	3OC+EF (No control)	OV/UV with 25 (Simple control)	OV/UV with 25 (No control)	DOC+DEF (Simple control)	DOC+DEF (No control)	DOC+DEF with 25 (Simple control)	DOC+DEF with 25 (Control)	Synchrocheck	Circuit breaker fail protection

●: Standard, ○: Equipped depending on the hardware configuration

DIMENSION AND PANEL CUT-OUT (1/3 size)

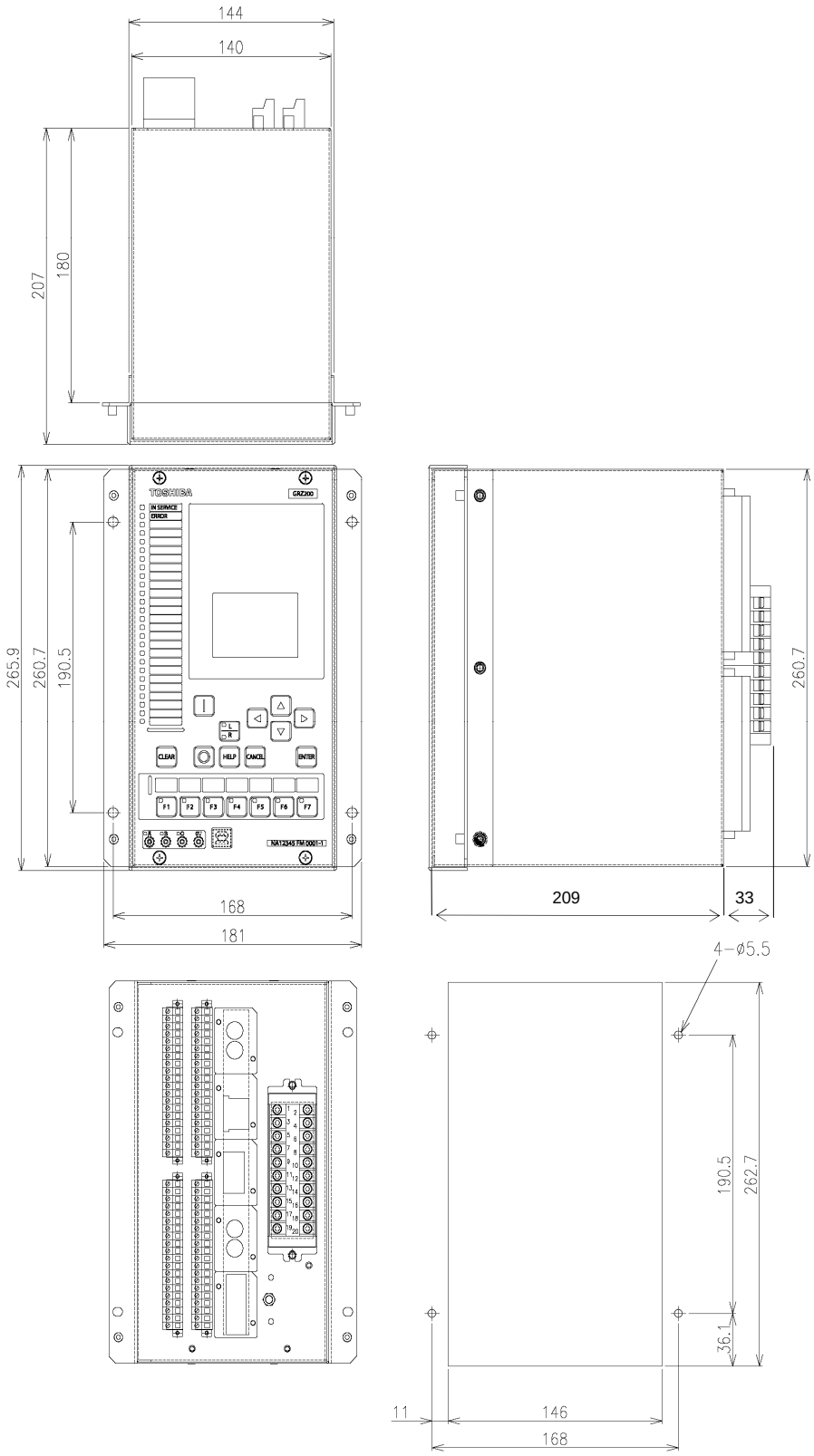


Figure 6 – Dimension and Panel Cut-out – 1/3 x 19'' case size

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

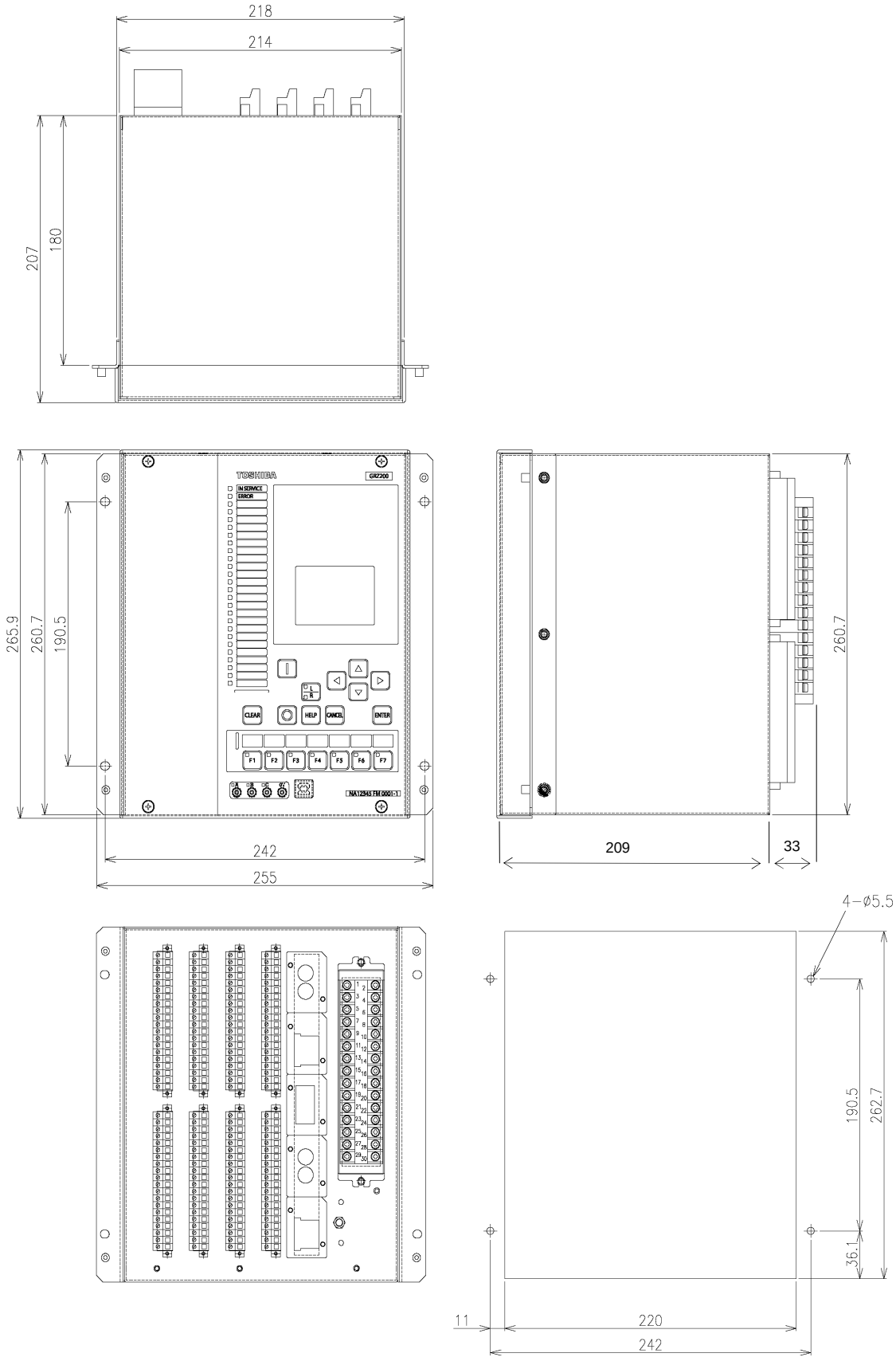


Figure 7 – Dimension and Panel Cut-out – 1/2 x 19'' case size

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

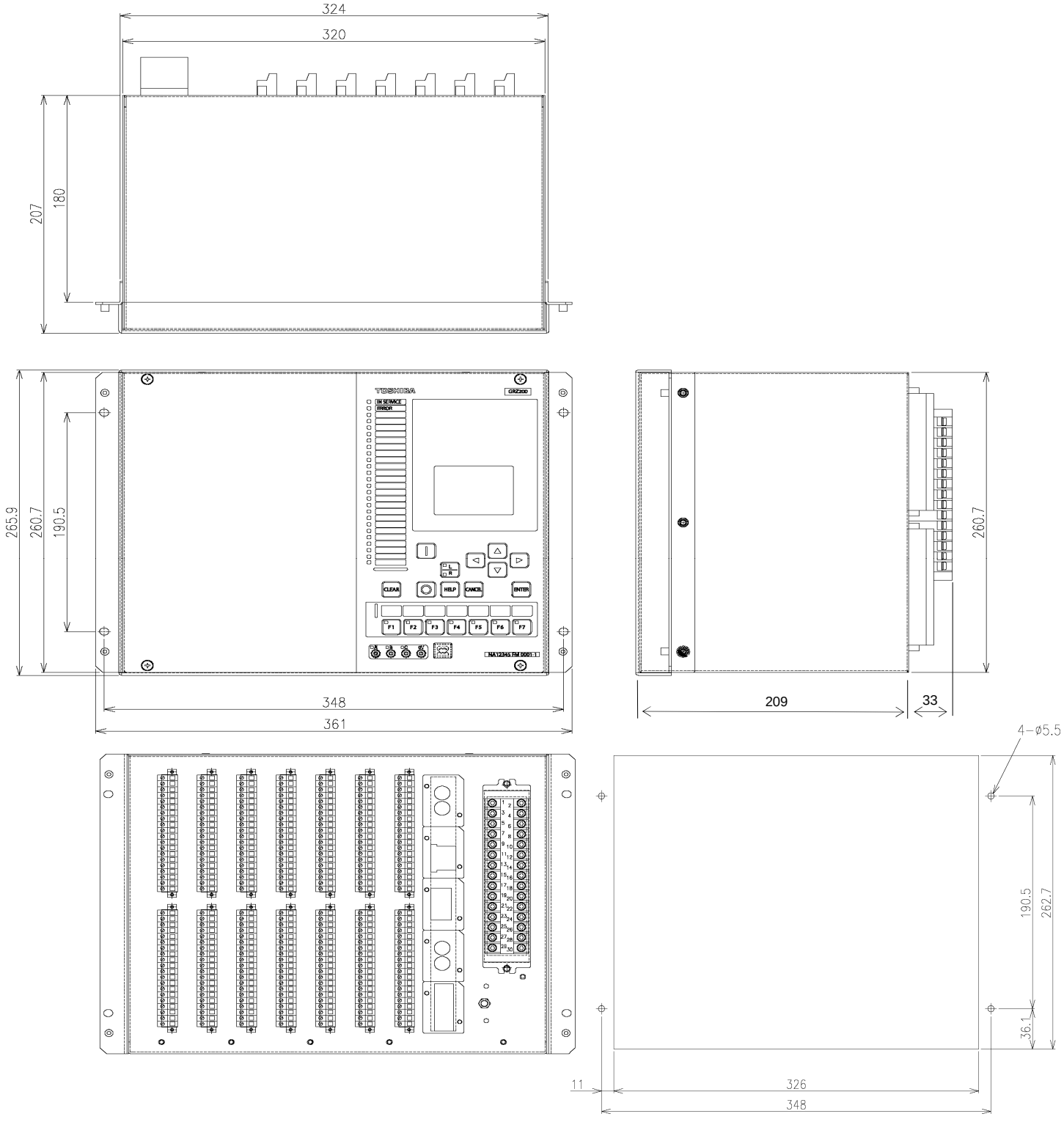


Figure 8 – Dimension and Panel Cut-out – 3/4 x 19'' case size

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

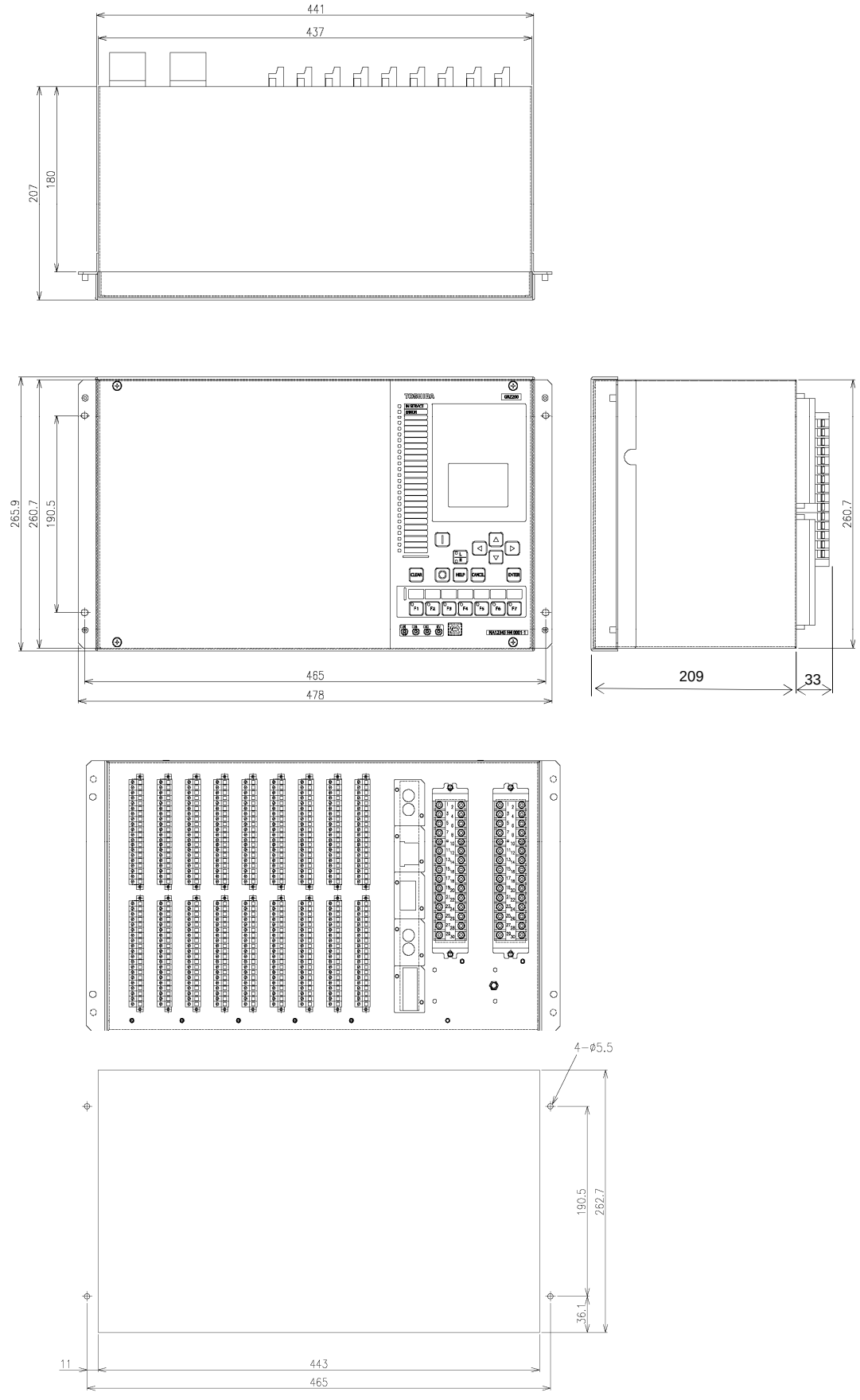
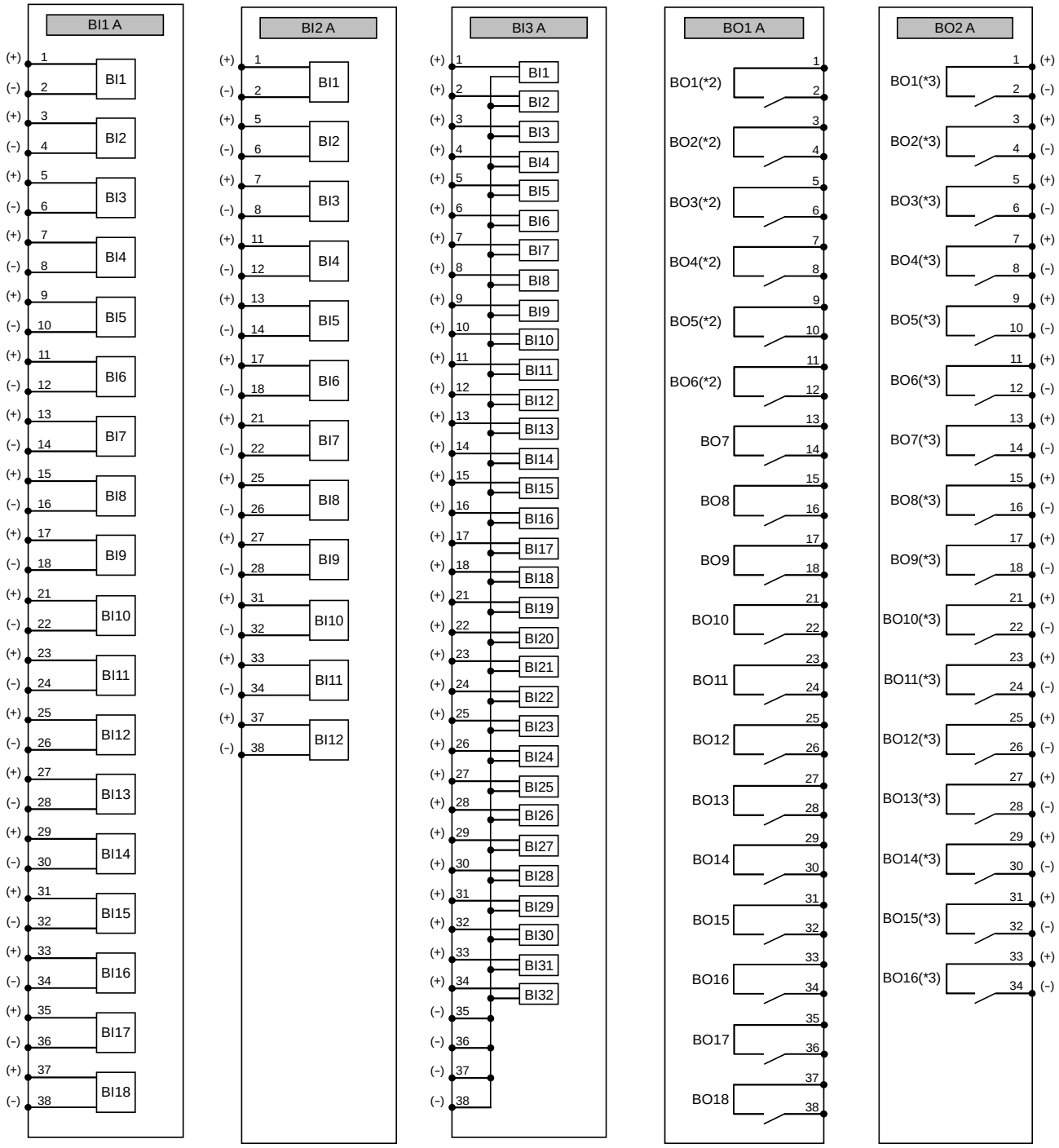


Figure 9 – Dimension and Panel Cut-out – 1/1 x 19” case size

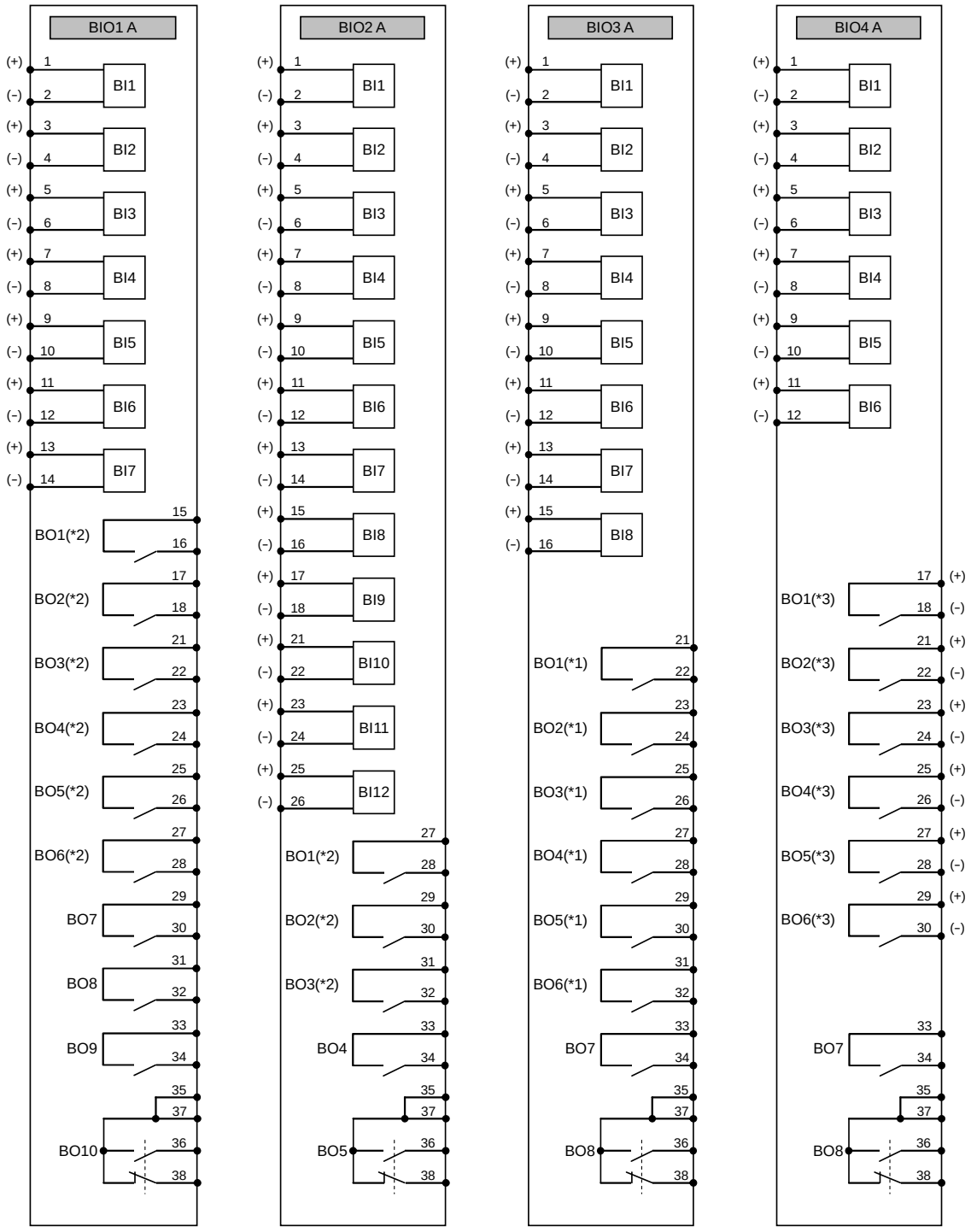
CONNECTIONS DIAGRAM



(*2) Semi-fast BO
(*3) Hybrid BO

Figure 10 – Binary input board and binary output module (for compression plug type terminal)

CONNECTIONS DIAGRAM



(*1) Fast BO
(*2) Semi-fast BO
(*3) Hybrid BO

Figure 11 – Combined binary input and output module (for compression plug type terminal)

CONNECTIONS DIAGRAM

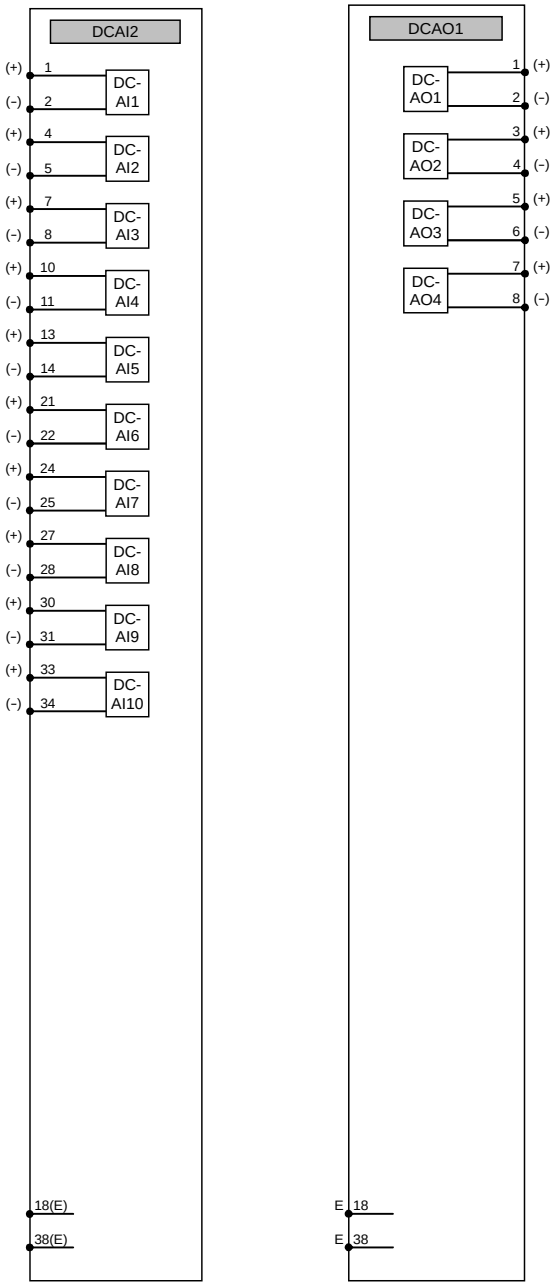
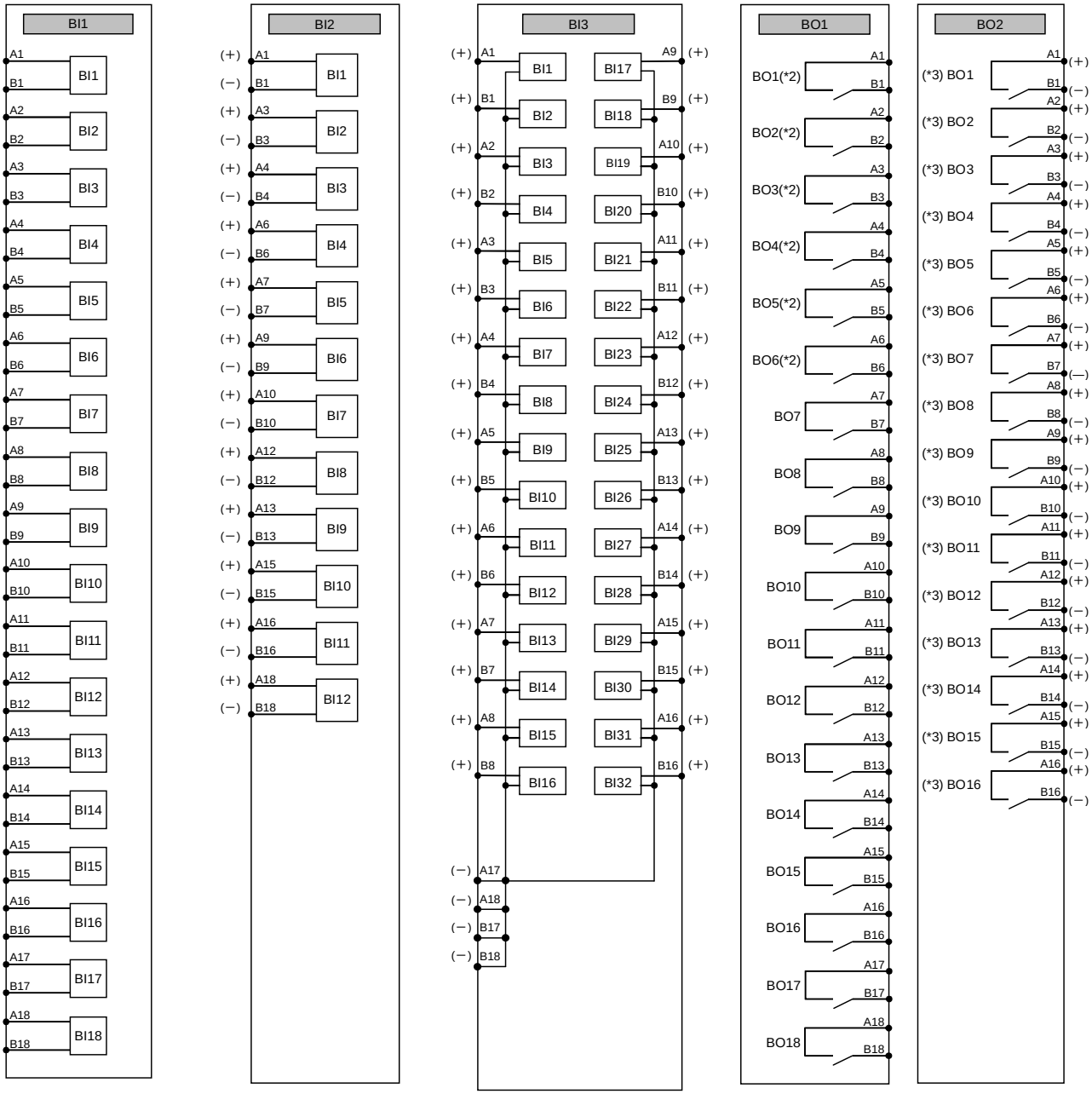


Figure 12 – DC-analogue input and output module (for compression plug type terminal)

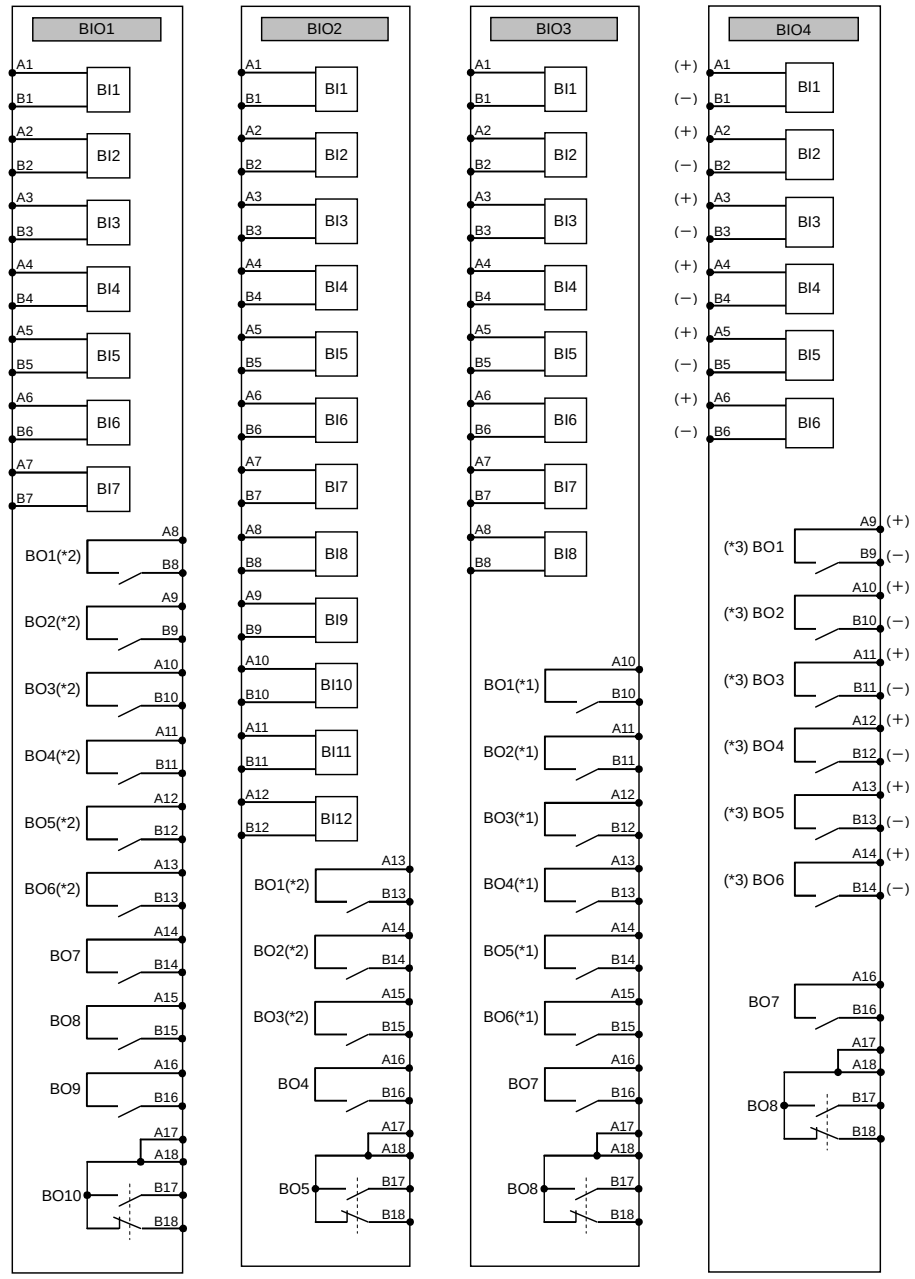
CONNECTIONS DIAGRAM



(*2) Semi-fast BO
(*3) Hybrid BO

Figure 13 – Binary input board and binary output module (for ring type terminal)

CONNECTIONS DIAGRAM



(*1) Fast BO
(*2) Semi-fast BO
(*3) Hybrid BO

Figure 14 – Combined binary input and output module (for ring type terminal)

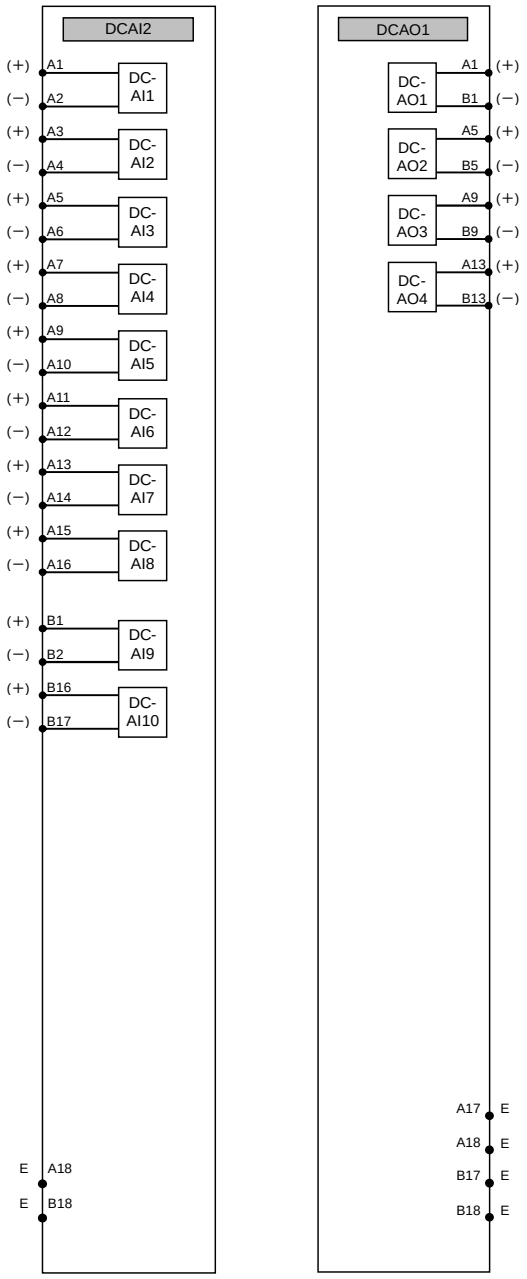
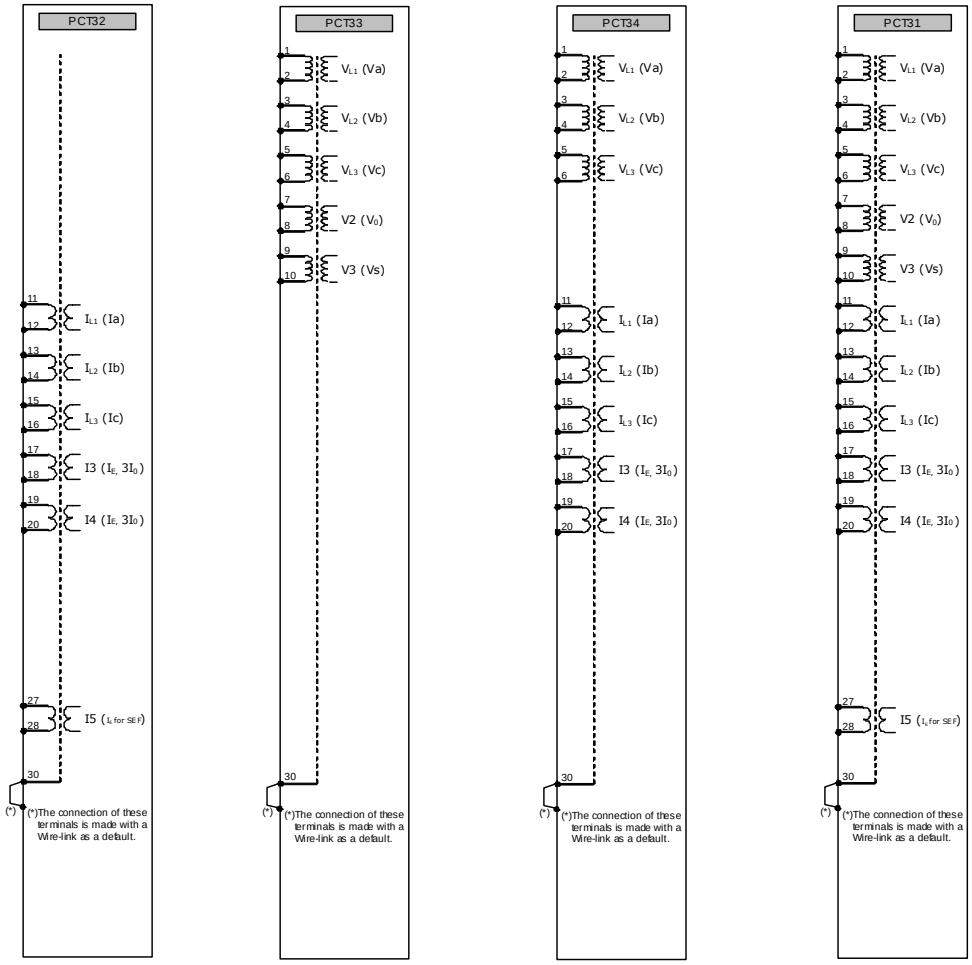


Figure 15 – DC-analogue input and output module (for ring type terminal)

CONNECTIONS DIAGRAM

CT/VT module



Module no. 32
(CT x 5)
Only for 1/3 rack

Module no. 33
(VT x 5)
Only for 1/3 rack

Module no. 34
(CT x 5 + VT x 3)
Only for 1/3 rack

Module no. 31
(CT x 6 + VT x 5)
For 1/2, 3/4 and 1/1 rack

Figure 16 – CT/VT module

EXTERNAL CONNECTIONS DIAGRAM

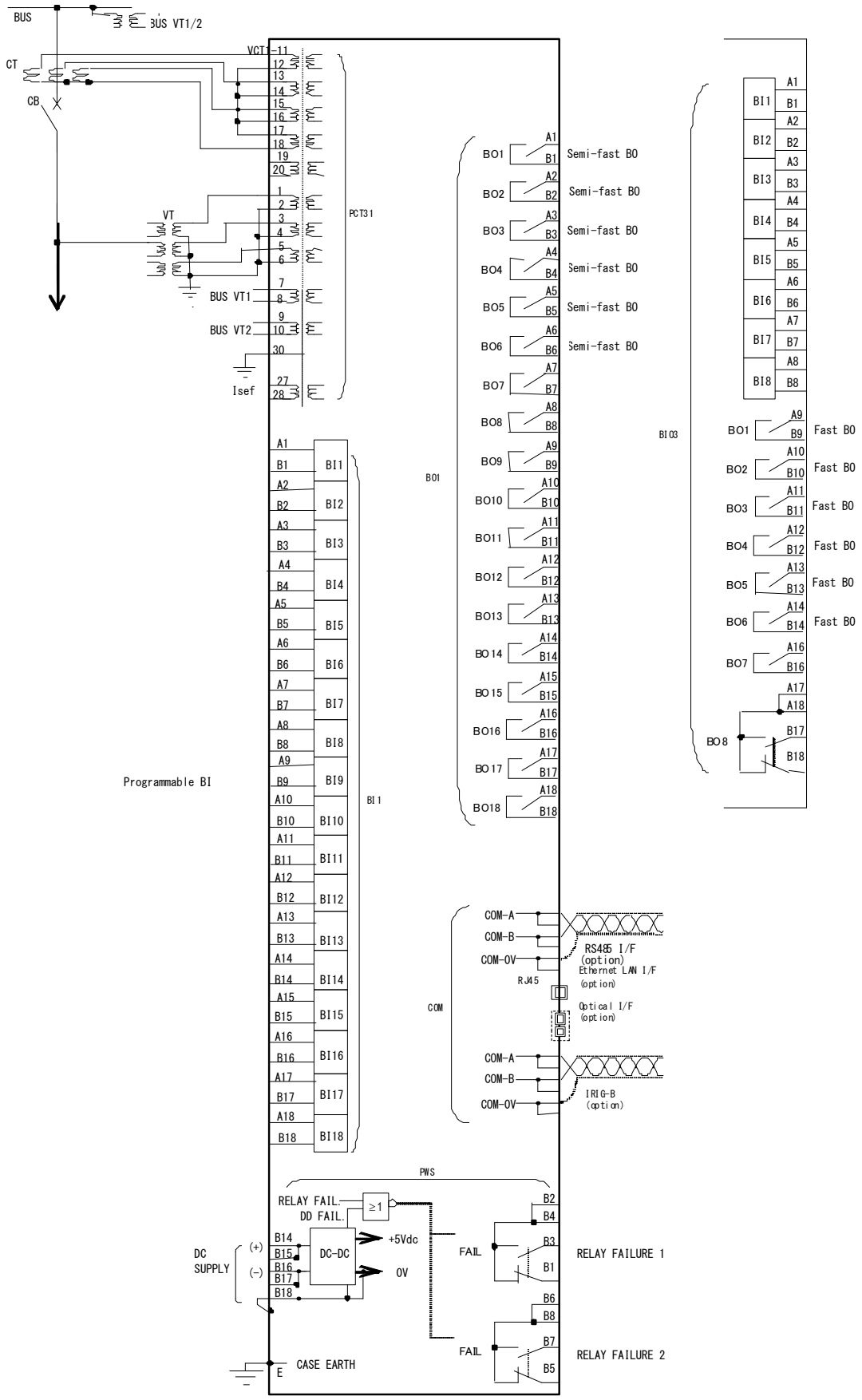


Figure 17 – Typical external connection diagram – ring terminal type (PCT: No.31, IO: BI1, BO1 and BIO3)

TOSHIBA

TOSHIBA CORPORATION

Social Infrastructure Systems Company

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

- The information given in this catalog is subject to change without notice.
- The information given in this catalog is as of 20 June 2014.
- The information given in this catalog is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA for any infringements of patents or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of TOSHIBA or others.
- TOSHIBA products should not be embedded to the downstream products which are prohibited to be produced and sold, under any law and regulations.
- Toshiba does not take any responsibility for incidental damage (including loss of business profit, business interruption, loss of business information and other pecuniary damage) arising out of the use or disability to use the products.

GKP-99-12036 Rev0.7