

TOSHIBA

Leading Innovation >>>

GR-200 Series
GBU 200
Bay Control 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.

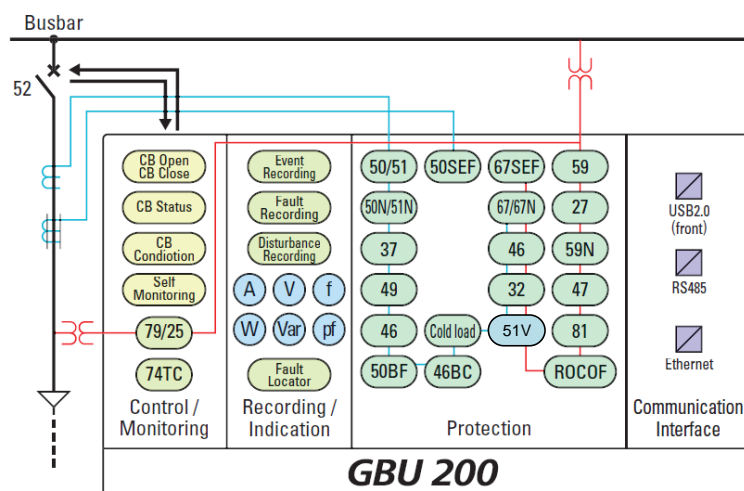
Powerful and wide application -

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

APPLICATION

GBU200 bay control is implemented on Toshiba's next generation GR-200 series IED platform and has been designed to provide bay control and protection 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.

- Control and monitoring of switchgear, transformers and other equipment or devices in EHV, HV, MV and LV substations
- Built-in feeder protection functions
- Applicable to single, double and one- and a half breaker arrangements and to both GIS and AIS switchgear
- Various models and hardware options for flexible application depending on system requirement and controlled object
- 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

- For control and monitoring of switchgear, transformers and other equipment or devices in EHV, HV, MV and LV substations
- Built-in feeder protection functions
- Applicable to single, double and one- and a half breaker arrangements and to both GIS and AIS switchgear

• Functionality

- Synchronization check and dead-line check function for single- or multi-breaker arrangements
- Analog measurement accuracy up to 0.5% for power, current and voltage
- Power quality measurement and monitoring (option)
- 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 by IEC 61850 and Modbus RTU

- Data communication 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

• Control

- Circuit breaker and isolator control
- Switchgear interlock check
- Transformer tap change control
- Synchronism voltage check
- Autoreclose (upto 5 shot)
- Programmable automatic sequence control
- Manual override

• 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 (for transducer input)
- DC analog output (for transducer output)
- Current and voltage circuit supervision
- Trip circuit supervision
- Fault locator

• Protection

- Directional or non-directional overcurrent and earth fault protection
- Sensitive directional or non-directional earth fault protection
- Directional or non-directional negative sequence overcurrent protection

- Undercurrent protection
- Negative sequence overvoltage protection
- Thermal overload protection
- Under- and over-voltage protection
- Under- and over-frequency protection
- Rate-of-change of frequency
- Directional power protection
- Broken conductor detection
- Circuit breaker fail
- Cold load protection
- High-impedance differential protection
- Switch-on-to fault protection
- Voltage controlled overcurrent

• **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

Control is performed remotely through the communication bus or locally from an HMI on the front panel showing the single line diagram for the bay or a menu. GBU200 can be applied in a standard configuration of one unit per bay, or alternatively one unit can be applied as a common device for several bays.

The GBU200 also provides protection features. Basic functions for feeder protection are equipped and configuration of addition/deletion of other protection functions is possible using professional version of the engineering tool (TOSHIBA IED Engineering & Monitoring Software).

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 GBU200 can operate as a control terminal within the substation automation system (SAS). The GBU200 can communicate with a server of the SAS by IEC 61850 or Modbus® RTU.

The GBU200 can 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, and the GBU200 can also function as a protocol converter to communicate with the SAS.

CONTROL

■ Switchgear Control

GBU200 provides functions for 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.

Also, switchgear control commands from the station level can be performed through GBU200 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.

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, GBU200 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 GBU200. 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.

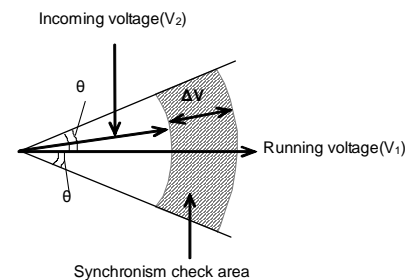
■ Split synchronism check

In case the circuit breaker closing command is received during an asynchronous network condition where frequencies are different between the line and bus sides, the split synchronism check mode automatically functions by detecting angle differences, instead of normal synchronism check mode.

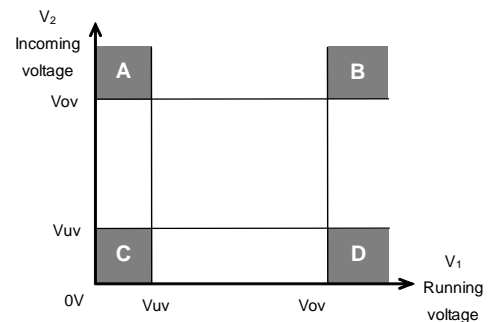
■ Characteristics of synchronism check

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 $\pm 0.5\%$ for I, V, P, Q at rated input and $\pm 0.03\text{Hz}$ 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 GBU200.

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.

■ Power Quality Measurement (option)

GBU200 provides power quality measurement features for the supervision of power system values. This function is available using an optional CT/PT card.

- Individual harmonic distortion from 2nd to 15th
- Total Harmonic Distortion (THD) and Total Demand Distortion (TDD) from 2nd to 15th
- Sag, Swell and Interruption

PROTECTION

■ Directional or non-directional phase overcurrent protection (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.

■ Directional or non-directional earth fault overcurrent protection (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.

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

This function provides two 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.

■ 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)

Two 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.

■ 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 energising the system. This feature is used to prevent unwanted protection operation when closing on to the type of load which takes a high level of current for a period after 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.

HMI FUNCTION

■ Front Panel

GBU200 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

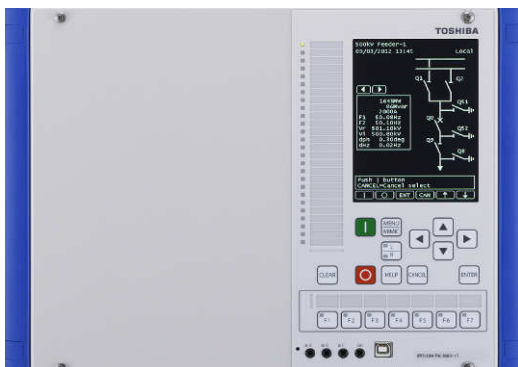


Figure 2 - HMI Panel (large LCD type)

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 panels 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 GBU200 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. The GBU200 can function as a protocol converter to connect SAS.

GENERAL FUNCTION

■ Self supervision

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

■ Time synchronization

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

■ Setting groups

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

■ Password protection

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

TOOLS & ACCESSORY

The PC interface GR-TIEMS allows users to access GBU200 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 GBU200. 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.

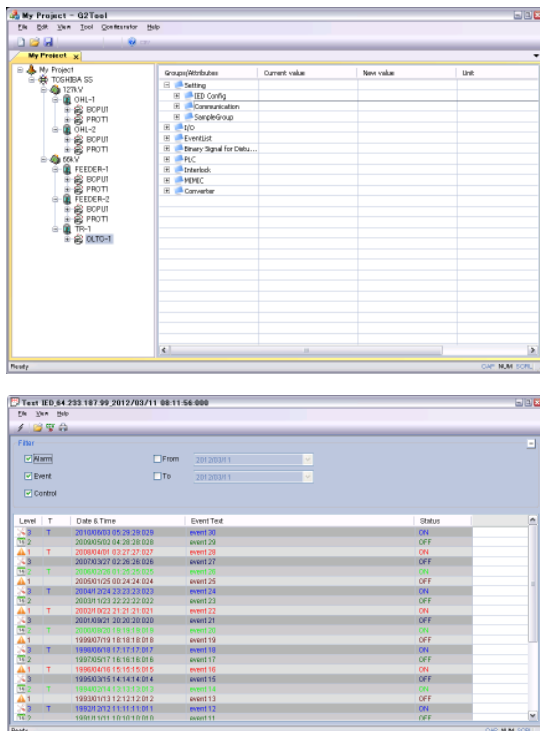


Figure 3 PC Display of GR-TIEMS

■ Simulation and test

GBU200 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.

■ LCD CONFIGURATION

The user can configure and customize the MIMIC data displayed on the LCD of GBU200 using GR-TIEMS software.

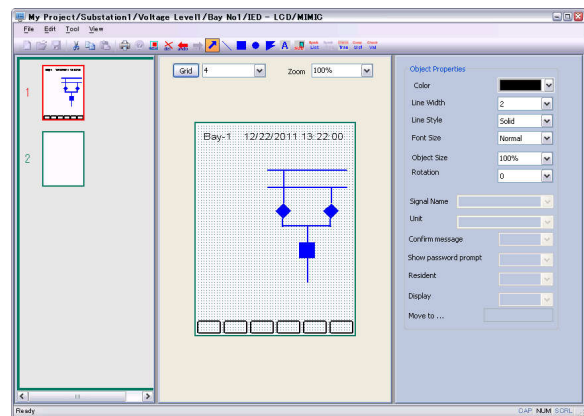


Figure 4 PC Display of MIMIC configuration

■ 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 compiled with IEC 61131-3.

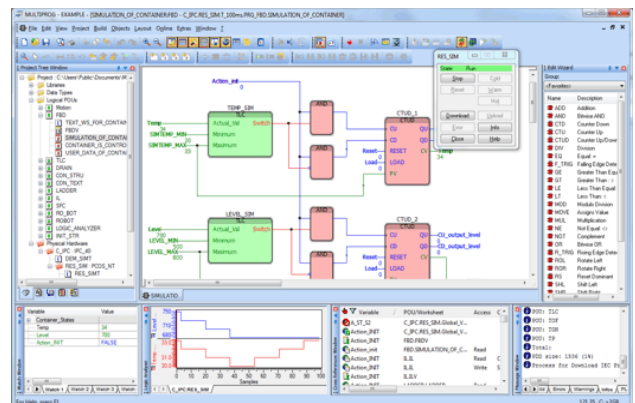


Figure 5 PC display of PLC editor

TECHNICAL DATA

HARDWARE	
Analog Inputs	
Rated current I_n	1A / 5A (selectable by user)
Rated voltage V_n	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
Voltage inputs	250 times rated current for one power cycle (20 or 16.6ms) 2 times rated voltage continuous 2.5 times rated voltage for 1 second
Burden	
Phase current inputs	$\leq 0.1VA$ at $I_n = 1A$, $\leq 0.2VA$ at $I_n = 5A$
Earth current inputs	$\leq 0.3VA$ at $I_n = 1A$, $\leq 0.4VA$ at $I_n = 5A$
Sensitive earth fault inputs	$\leq 0.3VA$ at $I_n = 1A$, $\leq 0.4VA$ at $I_n = 5A$
Voltage inputs	$\leq 0.1VA$ at V_n
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	$\leq 15\%$
Supply interruption	$\leq 20ms$ at 110Vdc
Restart time	$< 5ms$
Power consumption	$\leq 15W$ (quiescent) $\leq 25W$ (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	10 μ F 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	$\leq 0.5W$ 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

Break Operating time	10A, 110Vdc for 0.5s (L/R=5ms) 0.13A, 110Vdc (L/R=40ms) 4 ms
Auxiliary contacts Make and carry Break Operating time	8A continuously 10A, 110Vdc for 0.5s (L/R=5ms) 0.13A, 110Vdc (L/R=40ms) 9 ms
Hybrid contacts (10 A breaking) Make and carry Break Operating time	8A continuously 10A, 220Vdc for 0.5s (L/R=5ms) 10A, 220Vdc (L/R=20ms) 10A, 110Vdc (L/R=40ms) 1 ms
Durability	≥ 10,000 operations (loaded contact) ≥ 100,000 operations (unloaded contact)
DC-AI (analog inputs)	
Measurement range Accuracy Maximum permitted continuous current Input resistance	DC 0 ± 1mA, 0 ± 20mA, 4–20mA, 0–10mA, 0–20mA, ± 10mA DC -1 – 0 – +1V, -5 – 0 – +5V, -10 – 0 – +10V ± 0.5% of full scale 2 times for maximum measurement range 250 Ω (0 – ± 20mA), 3,000 Ω (0 ± 1mA)
DC-AO (analog outputs)	
Measurement range Accuracy	DC 0 – ± 20mA DC 0 – ± 10V ± 1% of full scale
Measuring input capability	
Full scale Standard current input Sensitive current input Voltage input Sampling rate Frequency response	≥ 60A (1A rating) or 300A (5A rating) ≥ 3A (1A rating) or 15 A (5A rating) ≥ 200V 48 samples / cycle < 5% deviation over range 16.7Hz to 600Hz
Mechanical Design	
Installation Weight Case color	Flush mounting Approx. 10kg (1/3 size), 12kg (1/2 size), 15kg (3/4 size), 25kg (1/1 size) 2.5Y7.5/1 (approximation to Munsell value)
LED	
Number Color	26 (Fixed for “In service” and “ERROR”) Red / Yellow / Green (configurable) except In service (green) and Error (red)
Function keys	
Number	7
Local Interface	
USB Maximum cable length	Type B 2m (max.)
System Interface (rear port)	
100BASE-TX Physical medium 100BASE-FX Physical medium	Fast Ethernet Twisted pair cable, RJ-45 connector Fast Ethernet 50/125 or 62.5/125µm fibre, SC connector

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

FUNCTIONIONAL DATA

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
Power Quality Measurement	
Current harmonic distortion (up to 15 th)	± 1.0% I _n , if I _m < 10% I _n ; ± 10 % I _m , if I _m >10% I _n
Voltage harmonic distortion (up to 15 th)	± 0.3% U _n , if U _m <3 % I _n ; ± 10 % U _m , if U _m >3% U _n
GPS Time Synchronisation	
Protocol	SNTP

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, IEC 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 – 50.00 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, IEC 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, IEC 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
1 st 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	
$I_{\theta} = k \cdot I_{FLC}$ (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.

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	<ol style="list-style-type: none"> 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	EN 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	1.2/50 μ s 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		
	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	B	U	2	0	0	-	-				-	0	0	-			-		0
Application of power system																				
No CT/VT module									0											
CT/VT module with sensitive CT input (51) – CT x 4, CTsef x 1, VT x 6 (for BCPU)									1											
CT/VT module (52) – CT x 4, VT x 5 (for BCU)									2											
CT/VT module for bus section or bus coupler bays (53) – CT x 4, VT x 7 (for BCU)									3											
CT/VT module (51) x 2 (for BCPU)									A											
CT/VT module (52) x 2 (for BCU)									B											
CT/VT module (53) x 2 (for BCU)									C											
System frequency																				
N/A (when code “7” = 0)																			0	
50Hz																			1	
60Hz																			2	
AC rating for phase currents																				
N/A (when code “7” = 0)																				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 (Function Block=09 only)									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, 1/2 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, 1/2 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, 1/2 x 19” rack for rack mounting									F											
Standard LCD, 3/4 x 19” rack for rack mounting									G											
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 (Function Block=09 only)									L											
Standard LCD, 1/2 x 19” rack for vertical flush mounting									M											

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

Configurations

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, 1/2 x 19" rack for vertical flush mounting	R																		
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 Selection

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) and/or usage of extension IO unit (GIO200)

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" and "L")

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” and “L”)

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+1xBIO2
7	-	32	-	-	12	16	-	-	3D	1xBI3+1xBO1+1xBIO1
-	-	32	-	-	6	12	16	-	3E	1xBI3+1xBO1+1xBIO2
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	B	U	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")				
		11	12	13	24	09
[Control function]						
Control	Select-control	●	●	●	●	
Interlock	Interlock	●	●	●	●	
AutoSEQ	Automatic sequential control	●	●	●	●	
Monitoring	Monitoring	●	●	●	●	
DCB	Double command blocking	●	●	●	●	
TAP	TAP control (BCD)	●	●	●	●	
DCAI	DC analog input measurement	○	○	○	○	
DCAO	DC analog output control	○	○	○	○	
SYNDIF	Synchrocheck between different network (e.g. between transmission line and generator plant)	●	●	●	●	
MNOVR	Manual override	●	●	●	●	
[Protection]						
50/67,51/67	Non-directional / directional phase overcurrent protection (4 steps)				●	
50 HS /51HS	High-speed overcurrent protection (1 step)				●	
50N/67N,51N/67N	Non-directional / directional earth fault overcurrent protection (4 steps)				●	
50NHS /51NHS	High-speed earth fault overcurrent protection (1 step)				●	
50SEF/51SEF	Non-directional / directional sensitive overcurrent protection (2 steps)				●	
46/67	Non-Directional / directional negative sequence phase over-current protection (2 steps)				●	
50BF	Circuit breaker failure protection (2 stages)				●	
37	Phase under-current protection (2 steps)				●	
46BC	Broken conductor protection				●	
49	Thermal overload protection				●	
32	Directional power protection				●	
59	Phase over-voltage protection (4 steps)				●	
59N	Earth fault over-voltage protection (4 steps)				●	
47	Negative sequence phase over-voltage protection (2 steps)				●	
27	Phase under-voltage protection (4 steps)				●	
81	Frequency protection (6 steps)				●	
ROCOF	Rate of change of frequency (df/dt) (6 steps)				●	
51V	Voltage controlled/restraint overcurrent				●	
85-50N/51N/67N	Command protection by OC/EF and DOC/DEF schemes				●	
50SOTF	Switch on to fault protection				●	
21FL	Fault locator				●	
ICD	Inrush current detection function				●	
CLP	Cold load protection function				●	
79	Autoreclosing function (upto 4 shots)				●	
25	Voltage check for autoreclosing				●	
[Common]						
TCS	Trip circuit supervision	●	●	●	●	
VTF	VTF detection function	●	●	●	●	
CTF	CTF detection function	●	●	●	●	
Event	Event and alarm	●	●	●	●	●
Measurement	Measurement	●	●	●	●	●
Load shedding	Load shedding		○		○	
PQRQTY	Power quality monitoring			○	○	
Counter	Counter	●	●	●	●	
PLC	Programmable logic controller	●	●	●	●	●
Communication	Remote communication	○	○	○	○	●
		Control	Control + option 1	Control + option 2	Control + Protection	Interface unit

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

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

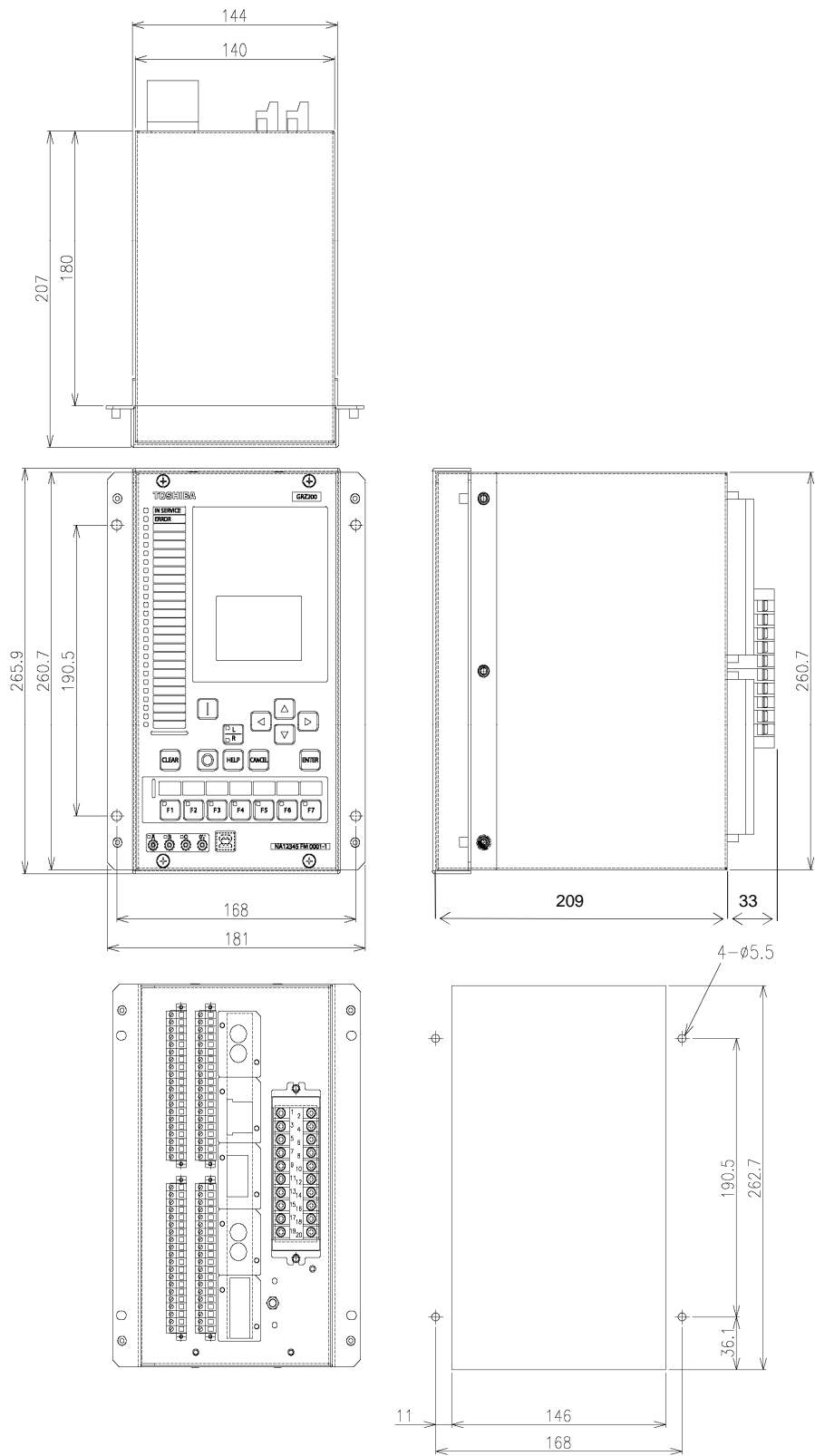


Figure 6 – Dimension and Panel Cut-out – 1/3 x 19” case size

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

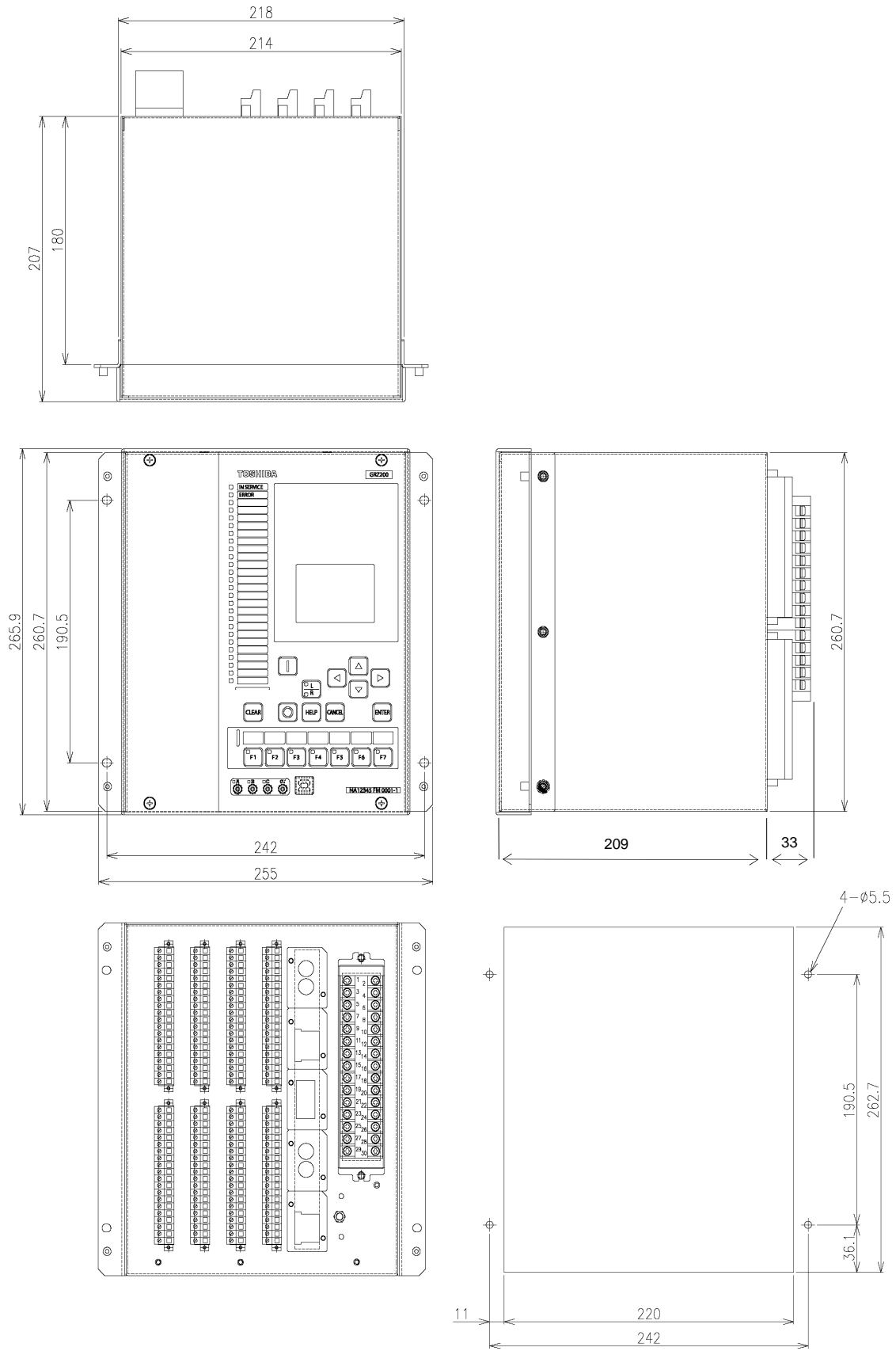


Figure 7 – Dimension and Panel Cut-out – 1/2 x 19” case size

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

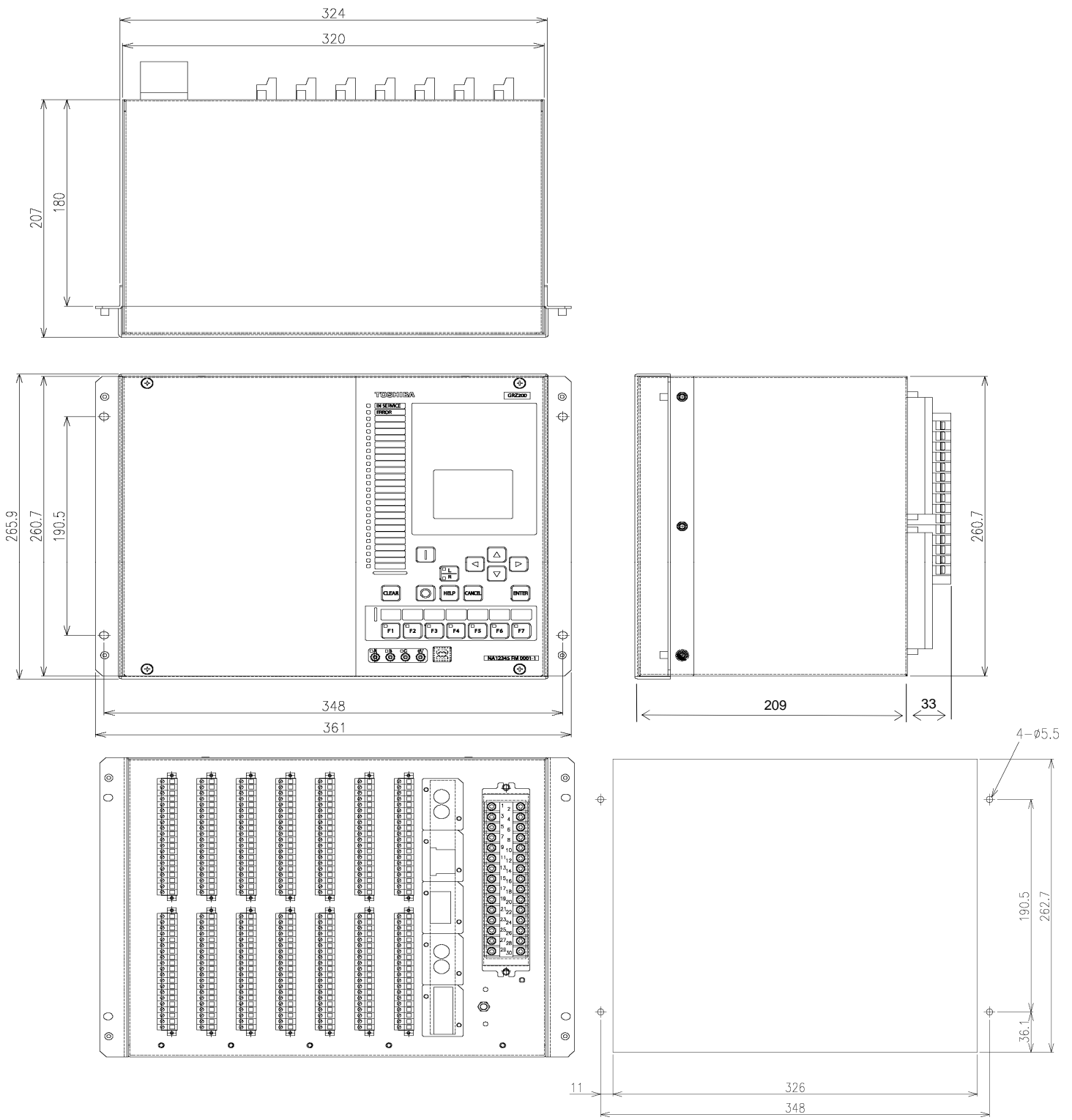


Figure 8 – Dimension and Panel Cut-out – 3/4 x 19" case size

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

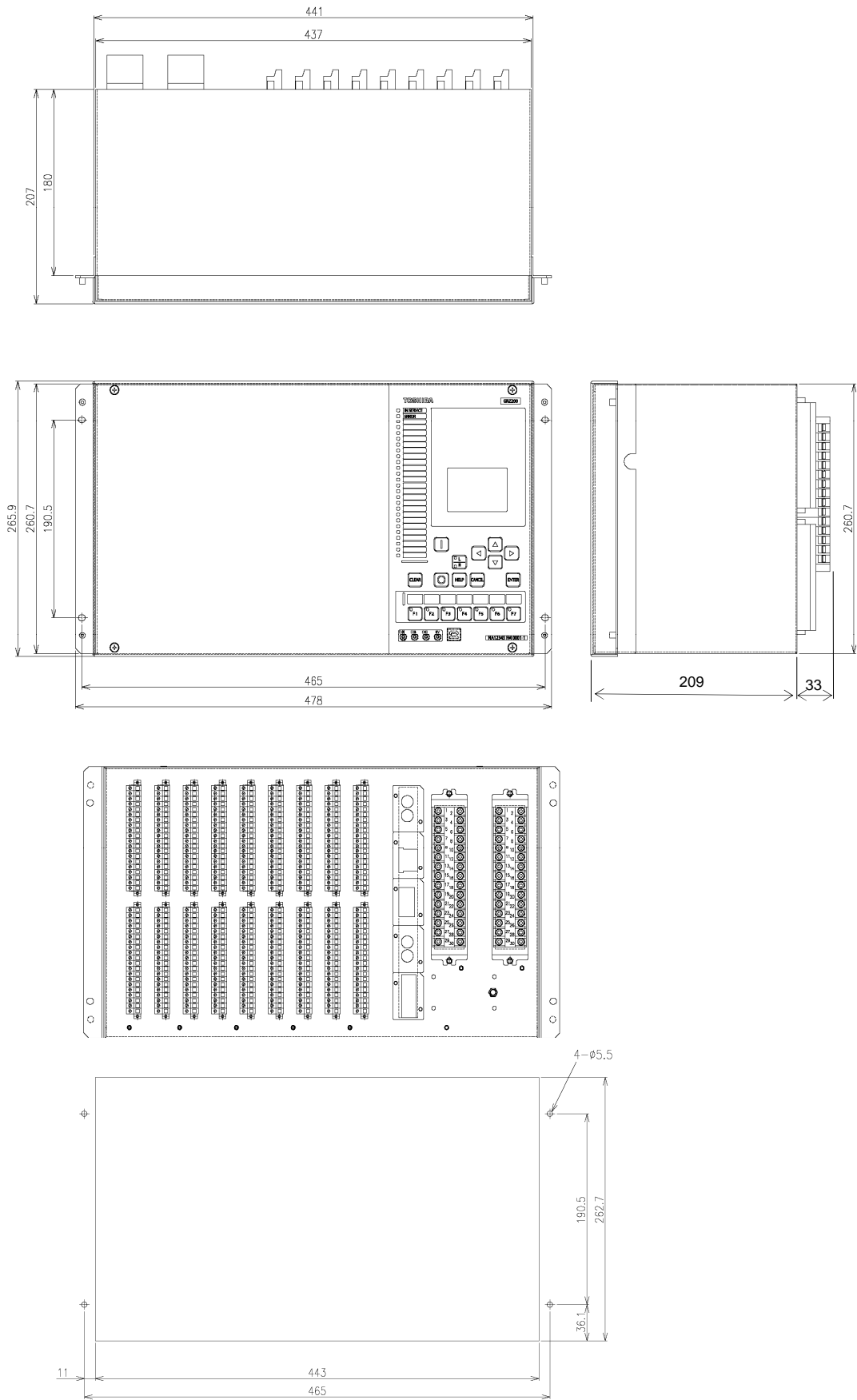
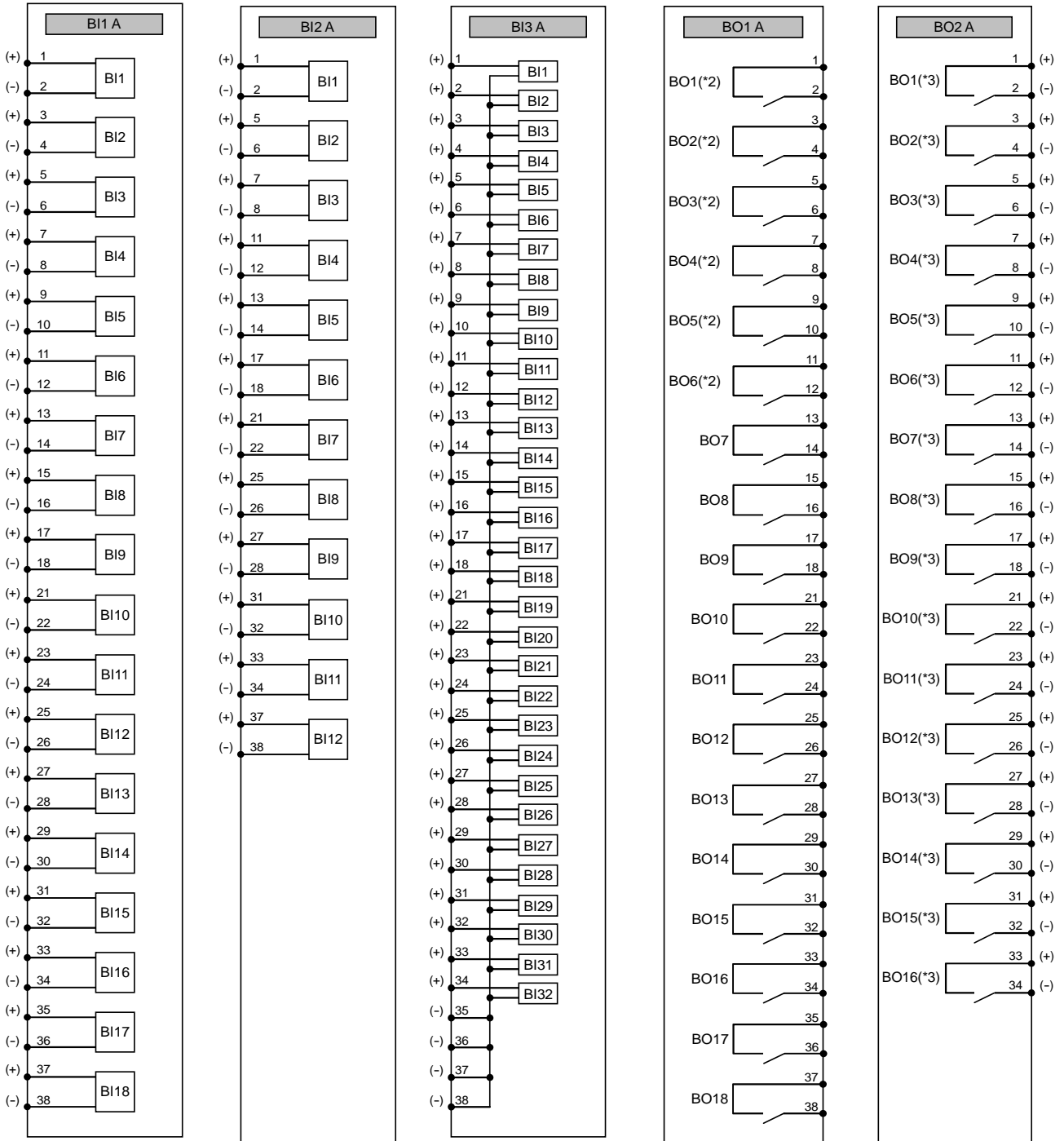


Figure 9 – Dimension and Panel Cut-out – 1/1 x 19" case size

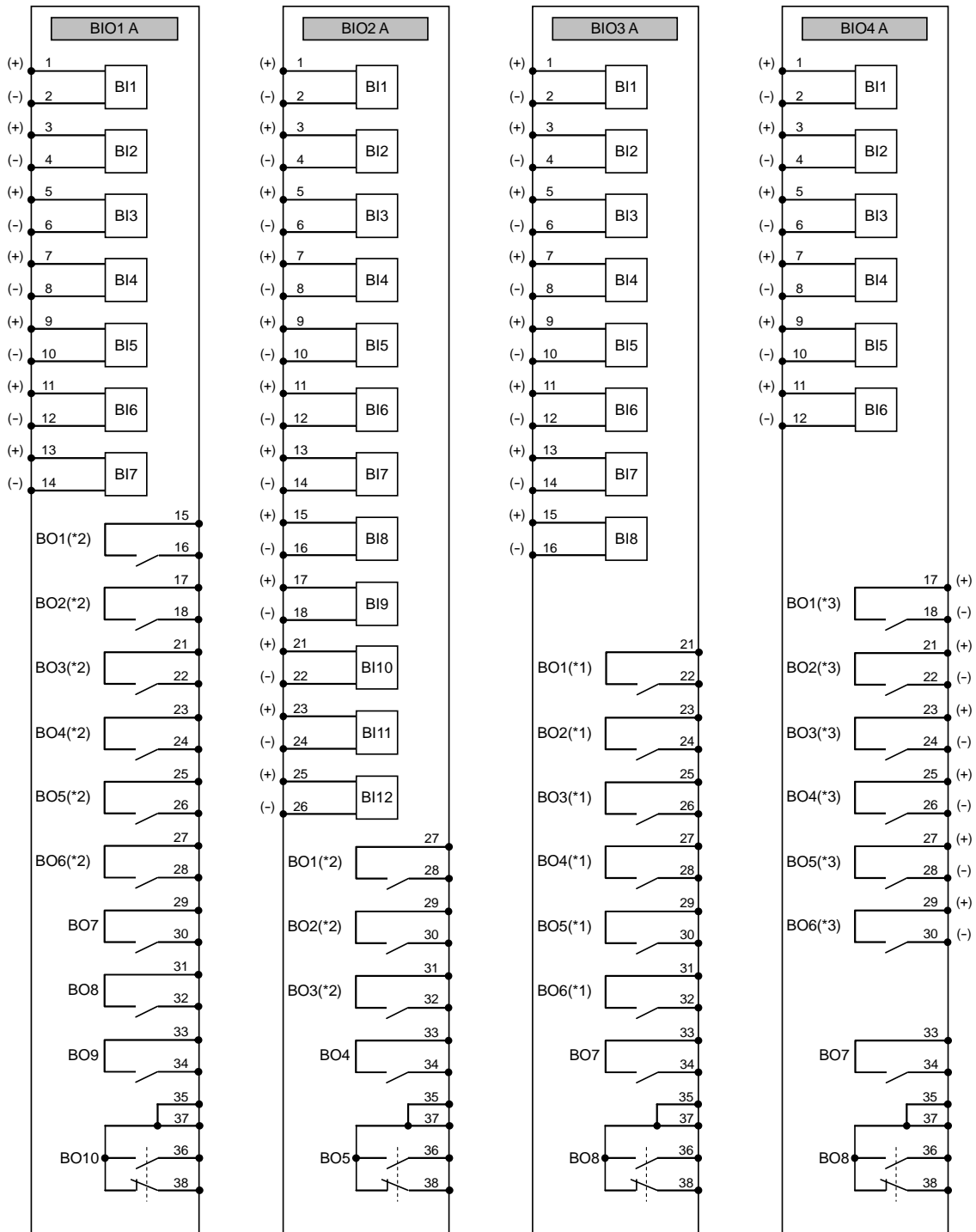
CONNECTIONS DIAGRAM



(*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

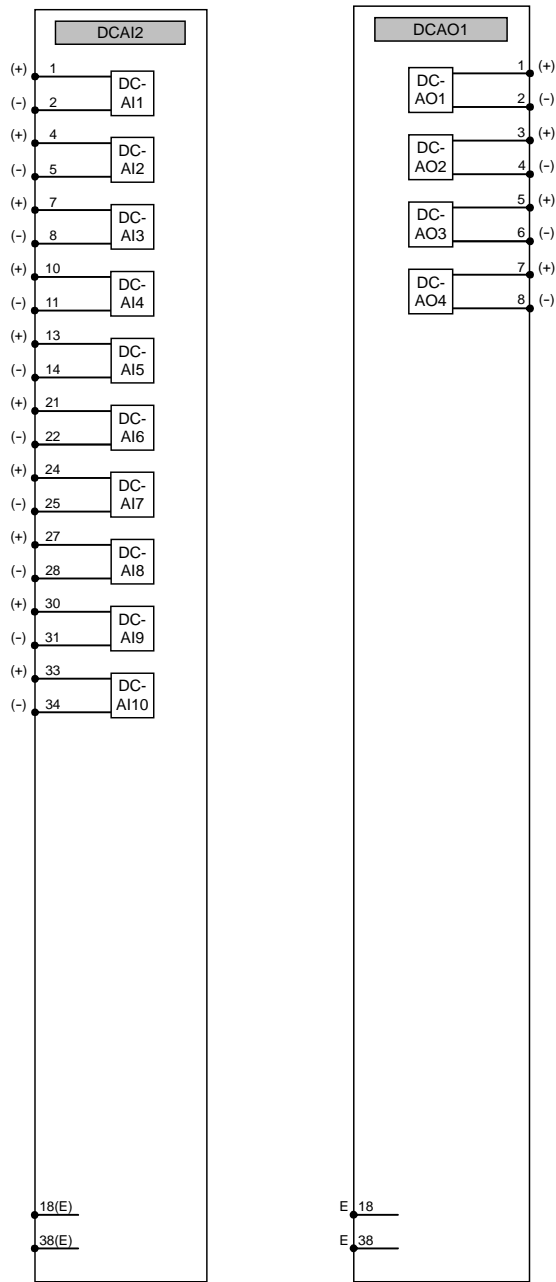
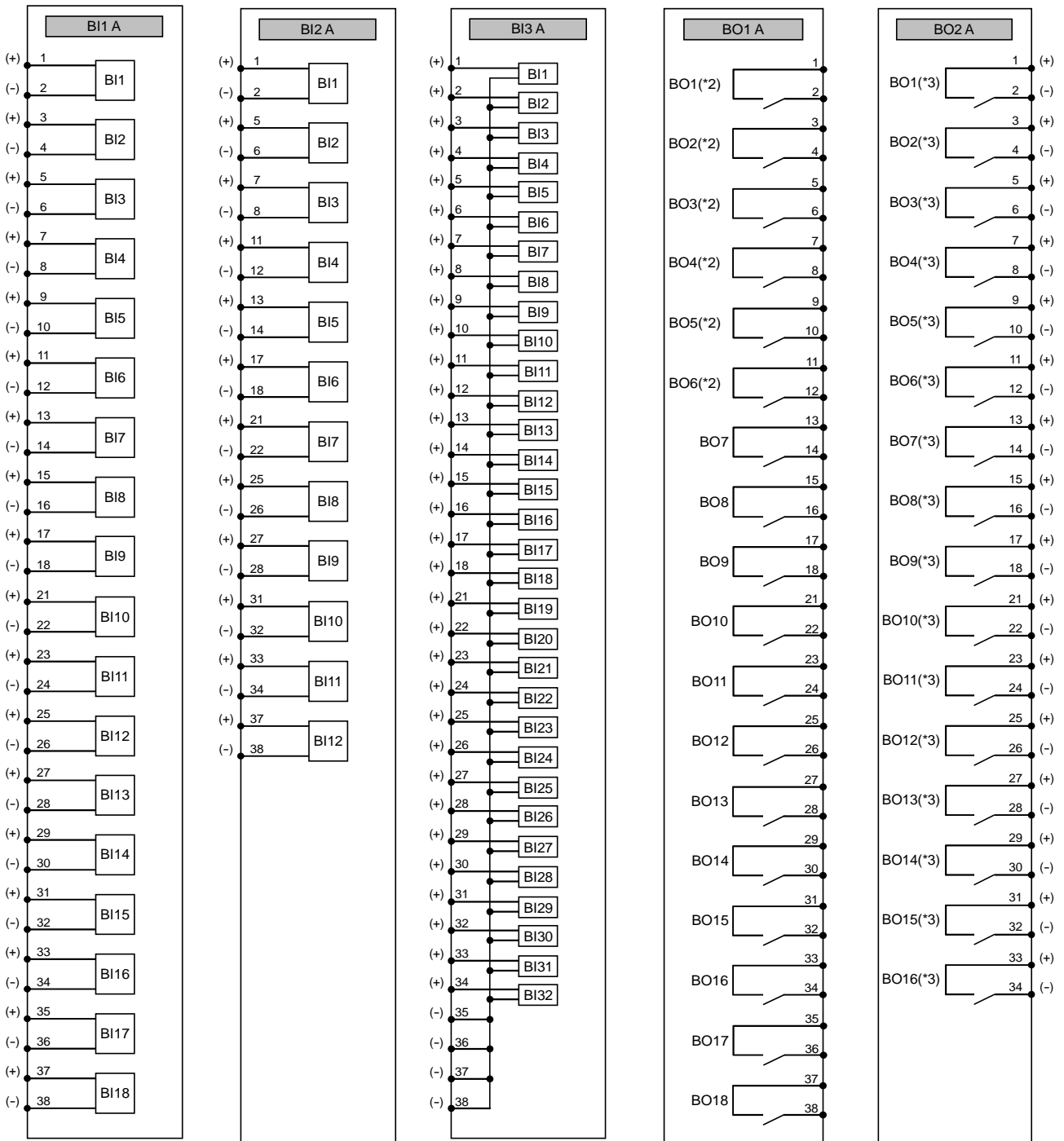


Figure 12 – DC-analogue input and output module (for compression plug type terminal)

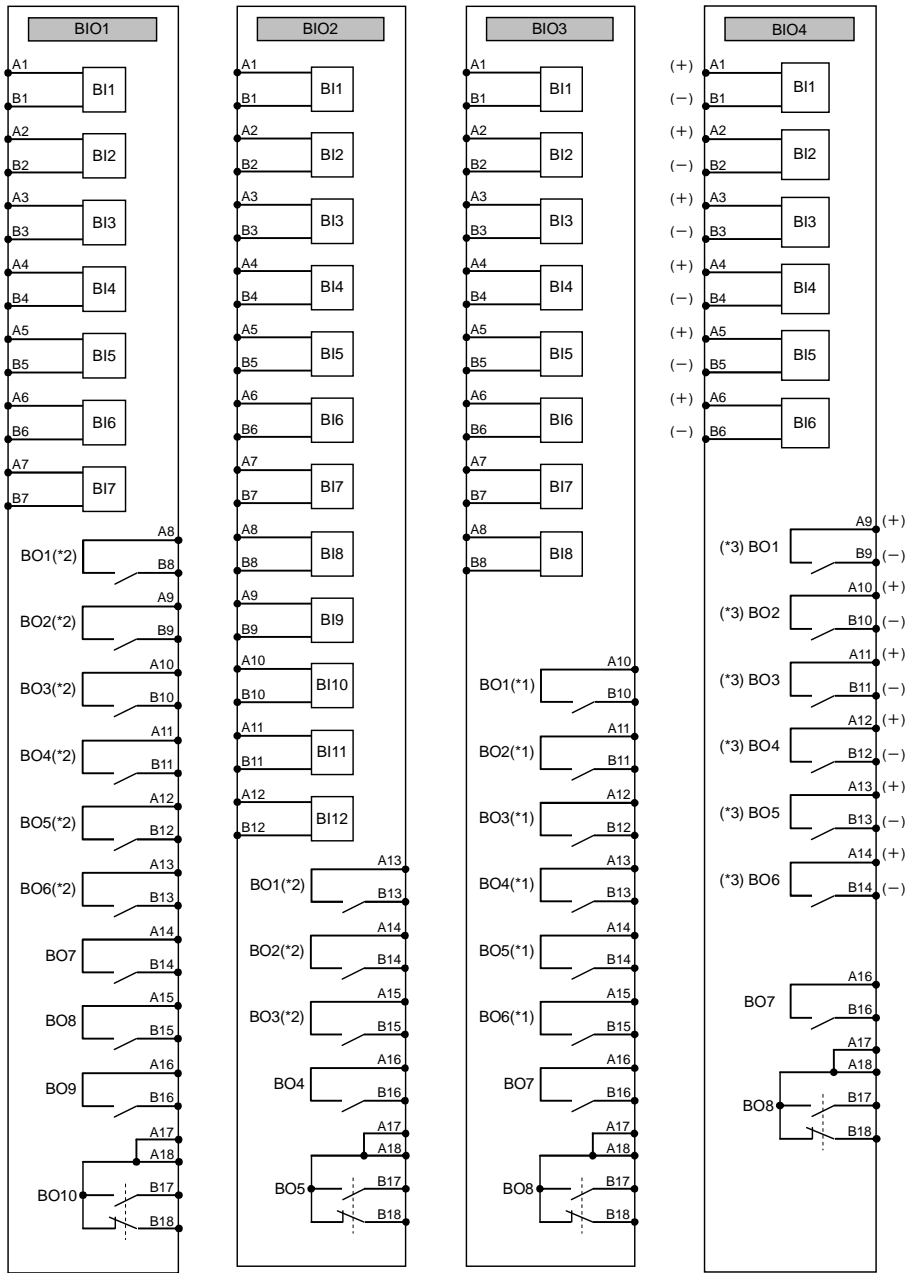
CONNECTIONS DIAGRAM



(*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)

CONNECTIONS DIAGRAM

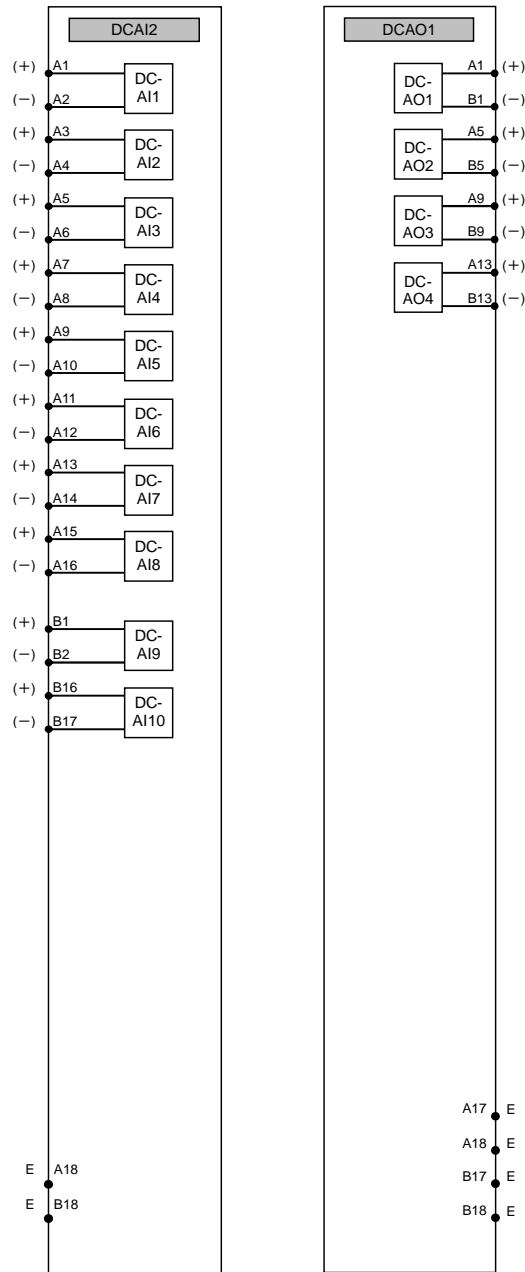
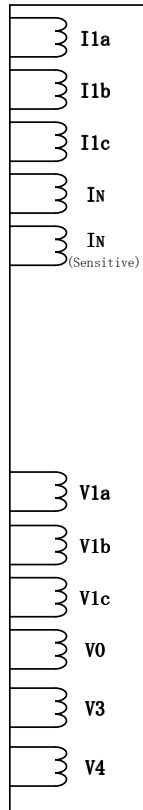


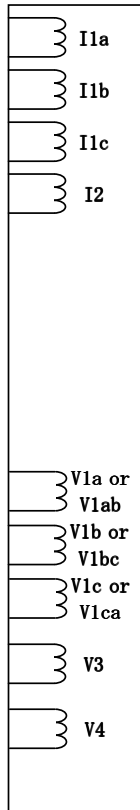
Figure 15 – DC-analogue input and output module (for ring type terminal)

CONNECTIONS DIAGRAM

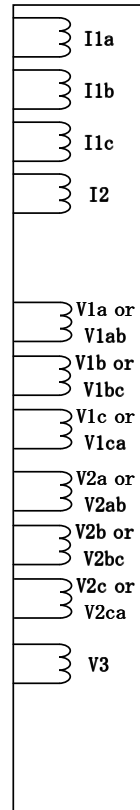
CT/VT module



Module no. 51
(CT x 5 + VT x 6)



Module no. 52
(CT x 4 + VT x 5)



Module no. 53
(CT x 4 + VT x 7)

Figure 16 – CT/VT module

EXTERNAL CONNECTIONS DIAGRAM

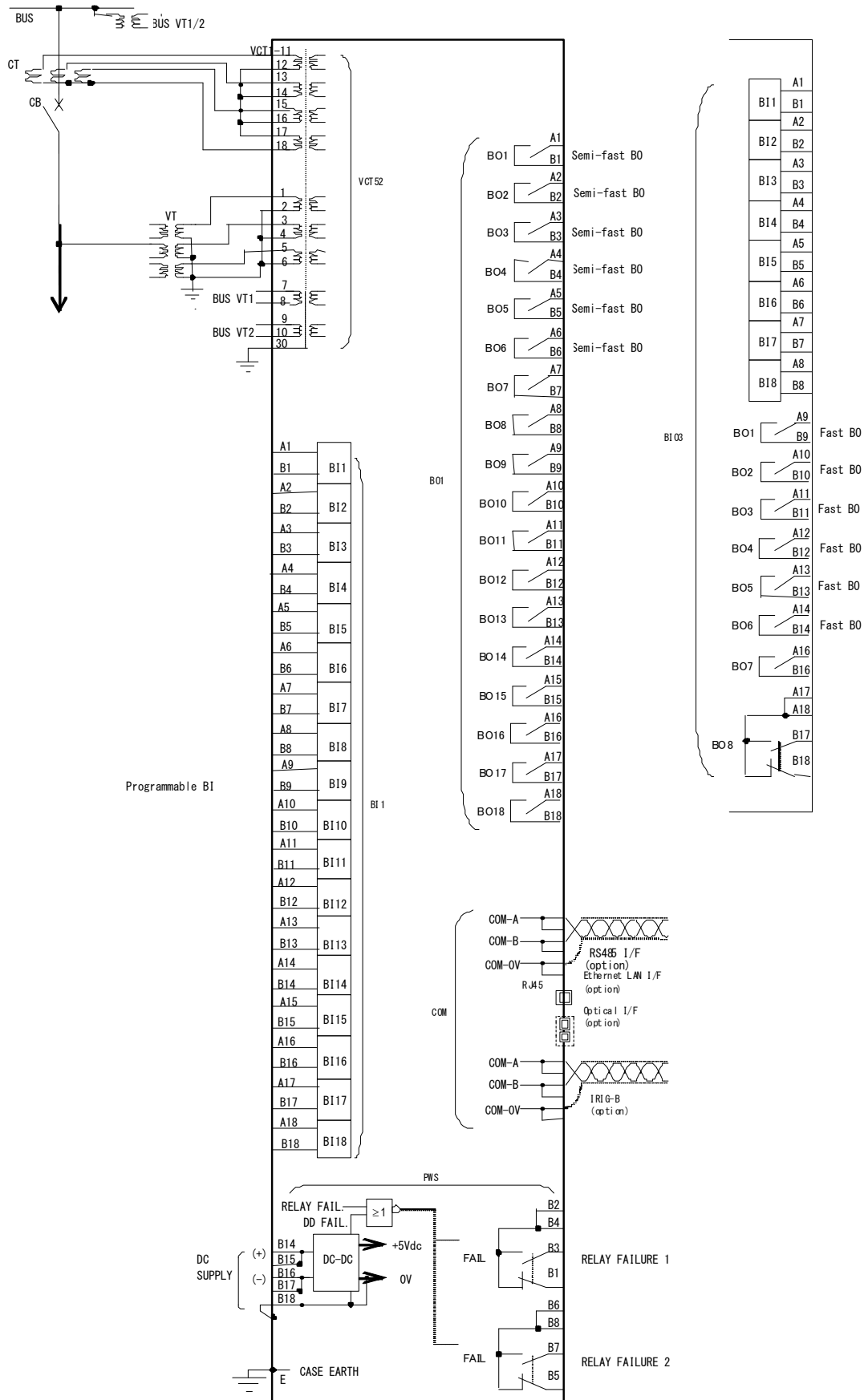


Figure 14 – Typical external connection diagram – ring terminal type (VCT: No.52, IO: BI1, BO1 and BIO3)

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