TOSHIBA

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.

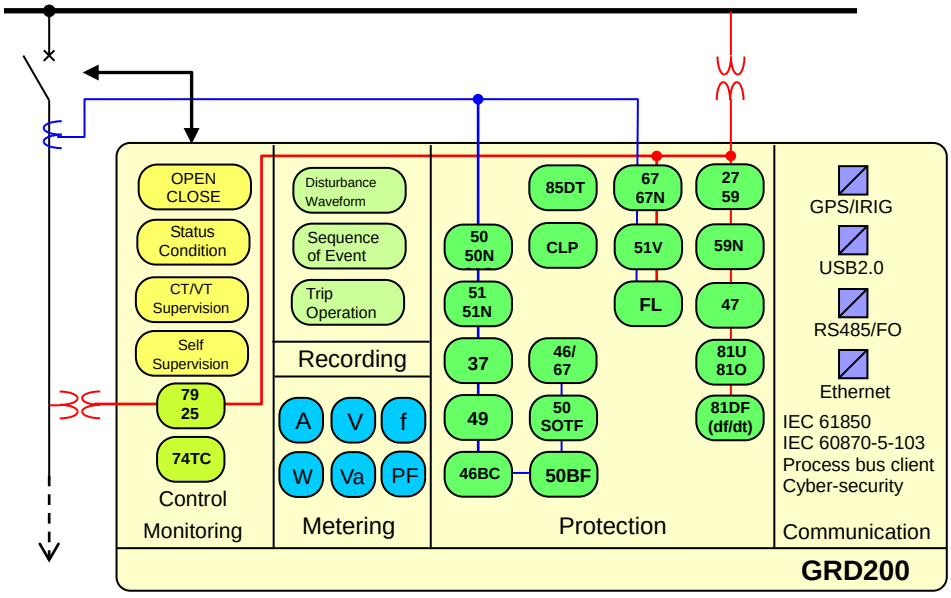
Powerful and wide application -

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 outstanding performance, high quality and operational peace of mind.

- Protection, control, metering and supervision of EHV, HV, MV and LV networks
- Feeder protection functions such as multiple high-accuracy overcurrent protection elements with inverse time and definite time delay which can be independently subject to directional control, in addition to 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
- Communication with substation automation systems via IEC 61850-8-1, IEC 60870-5-103 and Ethernet redundancy protocol IEC 62439-3 PRP/HSR.
- Communication with process level equipment (Merging Unit) via IEC 61850-9-2 and IEC 62439-3 PRP/HSR.



FEATURES

• Application

- Feeder protection functions or backup protection for machine, motor and transformer
- Several standard models providing current-based, voltage-based and current- & voltage-based hardware configurations
- Optional control function which enables users to control primary equipment with PLC-based interlocking scheme

• Functionality

- Directional or non-directional overcurrent and earth fault protection, over/under-voltage protection, and a comprehensive range of backup protection functions
- Optional directional sensitive earth fault protection for detection of high-resistance earth faults and for protection of impedance earthed or isolated networks
- Operation as a bay control unit with control from mimic display or keypad on the front panel
- Auto-reclose and synchronization check
- Analog measurement accuracy up to 0.5% for power, current and voltage
- Integrated disturbance and event recorder
- Time synchronization with external clock by SNTP, IEEE 1588, and IRIG-B
- Self-supervision
- Parameters with password protection
- Simulation and test functions for communication, control and protection

• Communication

- System interface - RS485, Fiber optic, 100BASE-TX/1000BASE-T, 100BASE-FX, 1000BASE-LX
- Multi-protocol - IEC 60870-5-103, IEC 61850 (Station-bus & Process-bus), IEC 62439-3 PRP/HSR

• Cyber Security

Extensive cyber-security functionality, such as port and protocol control for IEC 61850 communication, complex password for user login, logging security-related events, encryption of communication between GR-TIEMS and IED, role-based access control (RBAC), based on NERC-CIP, IEC 62351 and IEEE 1686.

• 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-based platform

• Human Machine Interface

- Graphical LCD and 26 LEDs
- 7 configurable function keys
- USB port for local PC connection
- Direct control buttons for open/close (O/I) and control authority (43R/L)
- Help key for supporting operation
- Monitoring terminals for testing

FUNCTIONS

• **Protection**
- 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
- Broken conductor detection
- Circuit breaker fail
- Cold load protection
- Voltage controlled overcurrent
- Inrush current detection (2^{nd} harmonic inrush current)

• **Control**
- Auto-reclose (up to 5 shots)
- Synchronism voltage check
- Circuit breaker, isolator and earthing control
- Switchgear interlock check
- Programmable automatic sequence control

• **Monitoring**
- Status and condition monitoring of primary apparatus
- Switchgear operation monitoring
- Plausibility check
- Measurement of I, V, P, Q, PF, f, Wh and Varh
- Current and voltage circuit supervision
- Trip circuit supervision
- Fault locator

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

• **Recording**
- Fault record
- Event record
- Disturbance record

• **Communication**
- IEC 61850-8-1/ IEC 61850-9-2
- IEC 60870-5-103
- IEC 62439-3 PRP/HSR

• **Cyber Security**
- Port and protocol control for IEC 61850
- Complex password for user authentication
- Security events log
- Encrypted communication between GR-TIEMS and IED (Optional)
- Role-based Access Control (RBAC), based on NERC-CIP, IEC 62351 and IEEE 1686 (Optional)

• **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

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. Each step can be independently set to be directional or non-directional when a 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. Each step can be independently set to be directional or non-directional.

- **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. Each step can be independently set to be directional or non-directional.

- **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 under-voltage and over-voltage protection schemes are provided. Each scheme can be programmed with definite or inverse time delay.

- **Frequency protection (FRQ)**

Either 6 or 8 independent frequency stages are provided. Each is programmable for either under-frequency or over-frequency operation, and each has an associated DTL timer. The under-frequency 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. Each step can be independently set to be directional or non-directional a 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 (BCD)**

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.

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. The function enables users to control equipment from the front panel (keypads and/or mimic display) with a PLC-based interlocking scheme.

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 an isolator switch is under load, in order to prevent material damage and/or accidental human injury. Hard-wired interlocking signals are implemented into the GRD200, and the binary input signals and PLC logic can configure the interlock check scheme.

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 a 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. The interlocking logic and conditions can be modified to satisfy the specific requirements by means of the graphical configuration tool.

■ Inrush Current Detection (ICD)

Inrush current detector ICD detects second harmonic inrush current during transformer energization and can block OC, EF, SEF, OCN and BCD elements.

■ Auto-reclose (ARC)

Five independent sequences are provided. Each protection function 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 auto-reclose is settable for the first sequence.

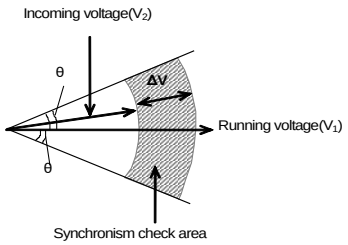
■ Synchronism and voltage check

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

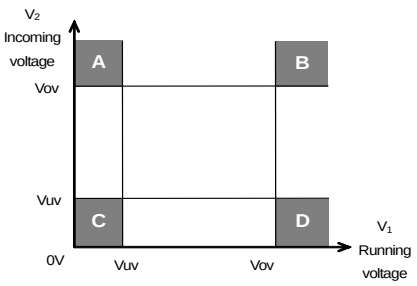
■ Characteristics of synchronism check

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 breaker or ring busbar arrangements.



(a) Synchronism check zone



(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.

HMI FUNCTION

■ Front Panel

GRD200 provides the following front panel options.

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

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

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

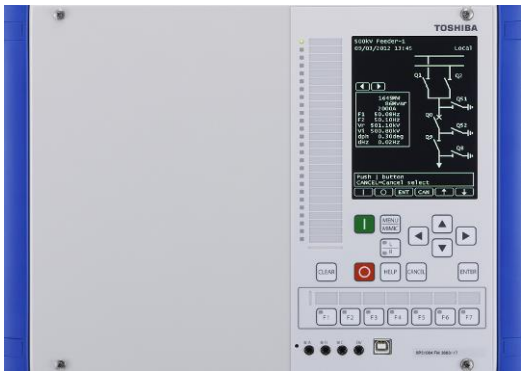


Figure 2 - HMI Panel (large LCD type)

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

- 40 characters, 40 lines LCD with back light

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

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

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

■ Local PC connection

The user can communicate with 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
- Auto-reclose operation
- Fault location

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

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

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

■ Disturbance records

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

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

COMMUNICATION

■ IEC 61850 Station-bus & Process-bus

GRD200 is equipped with a communication interface that complies with substation communication international standard IEC 61850. It supports both station-bus and process-bus applications that ensures smooth and reliable communication with Substation Automation System (SAS) and Merging Unit equipment.

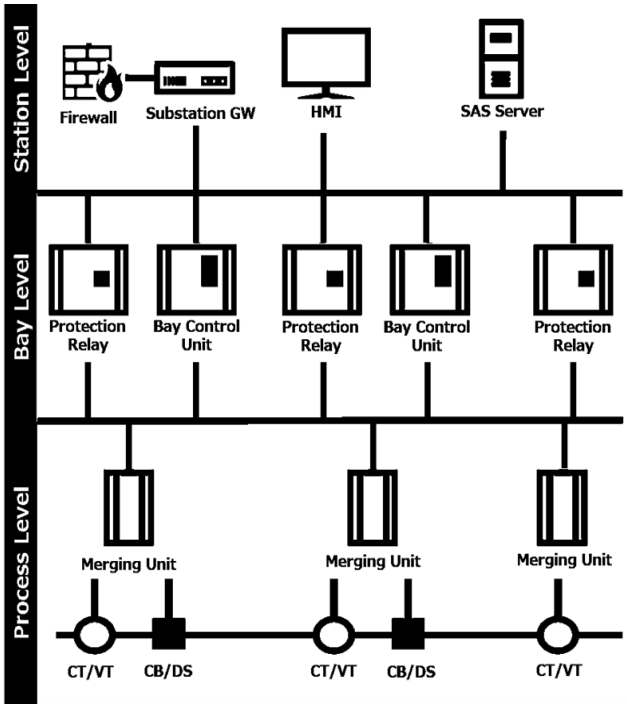


Figure 3 – Example of Typical Digital Substation Configuration

GRD200 also supports Ethernet redundancy scheme protocol based on IEC 62439-3 PRP/HSR.

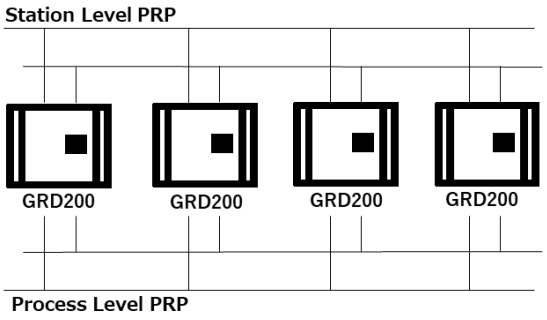


Figure 4 – GRD200 with PRP Network Configuration Example

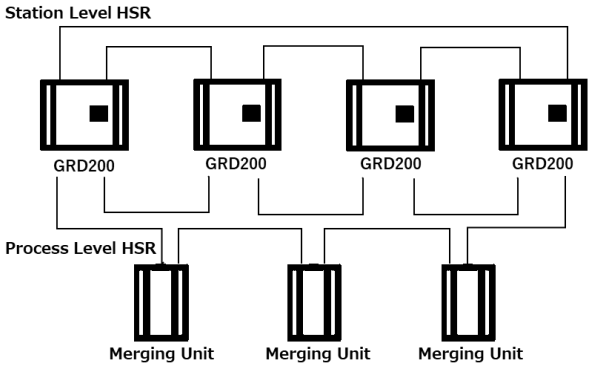


Figure 5 – GRD200 with HSR Network Configuration Example

■ Serial communication

Serial ports (RS485 and fiber optic) for communicating with legacy equipment or protection relays over IEC 60870-5-103 protocol are provided. GRD200 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.

■ Cyber Security

Electric power systems are increasingly exposed to cyberattacks. The shift towards open protocols and standards for communicating data over networks is one of the driving factors. Nowadays, many power utility companies have adopted next-generation TCP/IP network based Intelligent Electronic Devices (IEDs) and remote access has become one of the standard features for most of these IEDs.

This trend drives the need to further strengthen security measures for power grid protection and control IEDs to minimize the risks of malicious cyberattacks. In order to safely operate the IEDs, the following state-of-the-art cyber security functions are incorporated into Toshiba GR-200 series.

- Unused ports and protocols can be disabled
- Complex password for user authentication
- Logging of security-relevant events via Syslog in a non−erasable security buffer on the device
- Digital certificate for IED authentication
- TLS- based encrypted communication between GR-TIEMS and IED with the optional dedicated user management tool (GR-AIM)
- Role-Based Access Control (RBAC) with the optional dedicated user management tool (GR-AIM)

■ Time synchronization

Time synchronization is provided via the station bus by SNTP (Simple Network Time Protocol) with the IEC 61850 protocol. AN 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.

■ Simulation and test

GRD200 provides the capability to test communication signals by forced signal status change. The test can work in the Test mode only.

TOOLS & ACCESSORY

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, 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. The engineering tool can also provide powerful analysis and setting calculation support functions.

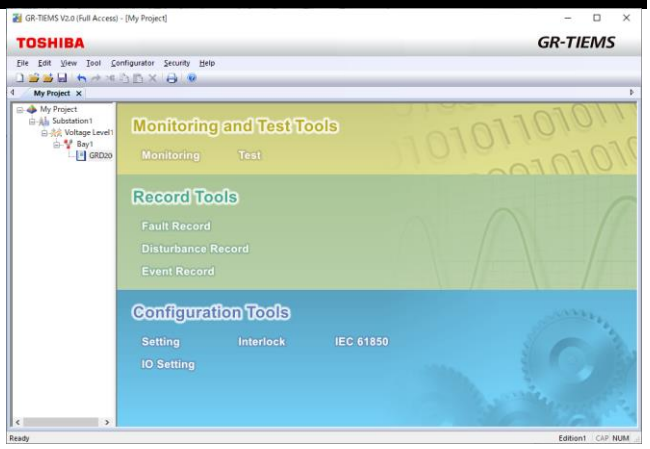


Figure 6 – PC Display of GR-TIEMS

■ LCD CONFIGURATION

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

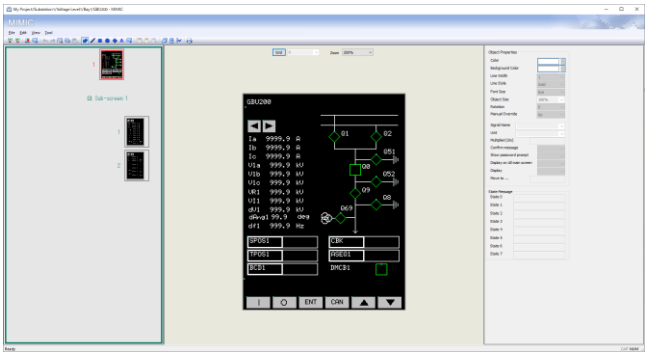


Figure 7 – PC Display of MIMIC configuration

■ PROGRAMMABLE LOGIC EDITOR

The programmable logic capability allows 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 that complied with IEC 61131-3.

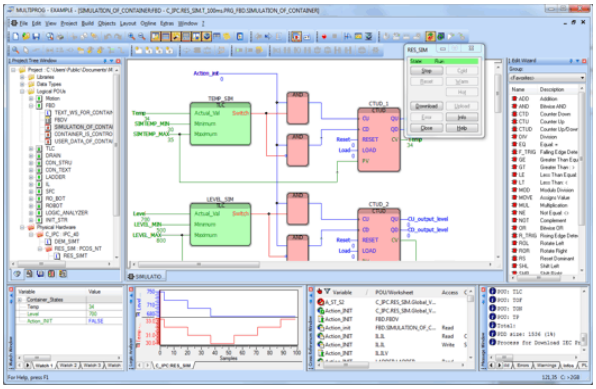


Figure 8 – PC display of PLC editor

TECHNICAL DATA

HARDWARE	
Analog Inputs	
Rated current In	1A or 5A (selectable)
Rated voltage Vn	100V to 120V
Rated Frequency	50Hz / 60Hz (specified when ordering)
Overload Rating	
Current inputs	4 times rated current continuous 5 times rated current for 3 minutes 6 times rated current for 2 minutes 30 times rated current for 10 second 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), 48/125Vdc (Operative range: 38.4 – 150Vdc), 110/250Vdc or 100/220Vac (Operative range: 88 – 300Vdc or 80 – 230Vac) <Notes> 1) Binary inputs are intended for use with DC power source only. 2) The power supply supervision function is intended for use with DC power source only. It should be disabled when AC power supply is applied in order to prevent spurious alarms.
Superimposed AC ripple on DC supply	≤ 15%
Power supply interruption withstand period (IEC 60255-11)	24/48/60Vdc rating: 20ms 48/125Vdc rating: 35ms 110/125Vdc rating: 50ms
Power consumption	≤ 15W (quiescent) ≤ 25W (maximum)
Binary Inputs	
Input circuit DC voltage	24/48/60Vdc (Operating range: 19.2 – 72Vdc), 48/125Vdc (Operative range: 38.4 – 150Vdc), 110/125/220/250Vdc (Operating range: 88 – 300Vdc) Note: Pick-up setting is available in BI2 and BIO4 (Setting range: 18V to 222V)
Capacitive discharge immunity	10μF charged to maximum supply voltage and discharged into the input terminals, according to ENA TS 48-4 with an external resistor
Maximum permitted voltage	72Vdc for 24/48/60Vdc rating, 300Vdc for 110/250Vdc rating
Power consumption	≤ 0.5W per input at 220Vdc

Binary Outputs	
Fast operating contacts	
Make and carry	5A continuously 30A, 290Vdc for 0.2s (L/R=5ms)
Break	0.15A, 290Vdc (L/R=40ms)
Operating time	Typically 3 ms
Semi-fast operating contacts	
Make and carry	8A continuously 30A, 240Vdc for 1s (L/R=5ms)
Break	0.1A at 250Vdc (L/R=40ms) 0.2A at 110Vdc (L/R=40ms)
Operating time	Typically 6 ms
Auxiliary contacts	
Make and carry	8A continuously 30A, 240Vdc for 1s (L/R=5ms)
Break	0.1A at 250Vdc (L/R=40ms) 0.2A at 110Vdc (L/R=40ms)
Operating time	Typically 8 ms
Hybrid contacts (10 A breaking)	
Make and carry	8A continuously 10A, 220Vdc for 0.5s (L/R=5ms)
Break	10A, 220Vdc (L/R=20ms) 10A, 110Vdc (L/R=40ms)
Operating time	1 ms
Durability	≥ 10,000 operations (loaded contact) ≥ 100,000 operations (unloaded contact)
Measuring input capability	
Full scale	
Standard current input	≥ 60A (1A rating) or 300A (5A rating)
Sensitive current input	≥ 3A (1A rating) or 15 A (5A rating)
Voltage input	≥ 200V
Sampling rate	48 samples / cycle
Frequency response	< 5% deviation over range 16.7Hz to 600Hz
Mechanical Design	
Installation	Flush mounting
Weight	Approx. 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/1000BASE-T	For IEC 61850-8-1 or IEC 61850-9-2 or local engineering connection
Cable type	CAT5e STP cable - enhanced category 5 with Shielded Twisted Pair cable
Connector type	RJ-45
100BASE-FX	For IEC 61850-8-1 or IEC 61850-9-2
Cable type	Multimode fibre, 50/125 or 62.5/125μm
Connector type	SC duplex type
Wave length	1300nm
1000BASE-LX	For IEC 61850-8-1 or IEC 61850-9-2
Cable type	Single-mode fibre
Connector type	LC duplex connector
Wave length	1310nm
RS485	For IEC 60870-5-103
Cable type	Shielded twisted pair cable
Connector type	Push-in spring terminal (PCB connector)
Fiber optical (for serial communication)	For IEC 60870-5-103
Cable type	Multimode fibre, 50/120 μ m or 62.5/125 μ m
Connector type	ST type
Wave length	820nm
IRIG-B (for time synchronization)	
Cable type	Shielded twisted pair cable
Connector type	Push-in spring terminal (PCB connector)
Process Bus (Client)	
Supported Sample Value Stream	4800Hz ASDU 2 (60Hz x 80sp or 50Hz x 96sp) 4800Hz ASDU 1 (50Hz x 96sp) 4000Hz ASDU 1 (50Hz x 80sp)
Max. number of analog channels per stream	8
Max. number of streams	4
Max. number of Process Bus communication ports per IED	Max. 2 ports (redundancy options: PRP/HSR)
Terminal Block	
CT/VT input	M3.5 Ring terminal (ring lug type terminal only)
Binary input, Binary output	Compression plug type terminal

FUNCTIONAL 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

Under-voltage Protection	
Under-voltage (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
Under-voltage 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
Inrush Current Detector	
Second harmonic ratio setting (I_{2f}/I_{1f}):	10 – 50% in 1%
Overcurrent thresholds:	1.00 – 5.00A in 0.01A steps (1A rating) 5.00 – 25.00A in 0.01A steps (5A rating)
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
Time Synchronisation	
Protocol	SNTP, PTP

CYBER SECURITY FUNCTION

Cyber Security function	Detail	Related standards
Control/monitor unused communication ports and services	Unused port and protocol can be disabled	NERC CIP-007, IEEE 1686
Complex password for user authentication	Setting for password complexity, setting for password expiration, blocking due to multiple authentication failures, prohibition of reuse of used passwords, automatic user logout due to time limit	NERC CIP-007, IEEE 1686
Security logging	Logging of security-relevant events, Syslog	NERC CIP-007, IEEE 1686, IEC 62351-14
Digital certificate for IED authentication	Digital certificate stored in IED	IEC 62351-3, IEC 62351-9
GR-TIEMS encrypted communication*	TLS1.2 encrypted communications between GR-TIEMS and IED	IEC 62351-3
Role Based Access Control (RBAC)*	RBAC (User certificate issued by GR-AIM)	IEC 62351-8

* Optional dedicated user management tool, GR-AIM, is required for activation.

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

ORDERING SHEET

[Hardware selection]

Large case (1/2 size or more) with Software†1 '3D' or '4D' (Current and Voltage relay)

	Positions																						
	-	7	8	-	9	A	B	-	C	D	-	E	F	-	G	H	-	J	K	L
Configurations	G R D 2 0 0	-	4		-				-	0	0	-			-			-			0
Application of power system																					
VCT31B: 6xCTs,5xVTs designed for 1/2, 3/4 or 1/1 cases		4																			
DC rated voltage																					
110-250 Vdc or 100-220Vac			1																		
24-60 Vdc			3																		
Function Block																					
Standard Model															3						
Advanced Model with Process Bus & Cyber-security															4						
System Frequency																					
50Hz																		1			
60Hz																		2			
AC rated current																					
1A																			1		
5A																			2		
Outline																					
Standard LCD, 1/2 x 19" rack for flush mounting					2																
Large LCD, 1/2 x 19" rack for flush mounting					6																
Standard LCD, 1/2 x 19" rack for rack mounting†2					F																
Large LCD, 1/2 x 19" rack for rack mounting†2					J																
Terminal block for BIO and PWS																					
Compression plug type terminal																0					
BI/BO module																					
Choice from BI/BO table	1×BIO module					1	*														
	2×BIO modules					2	*														
	3×BIO modules					3	*														
Terminal block for BIO and PWS																					
Ring type terminal																1					
BI/BO module																					
Choice from BI/BO table	1×BIO modules					1	*														
	2×BIO modules					2	*														
Outline																					
Standard LCD, 3/4 x 19" rack for flush mounting					3																
Large LCD, 3/4 x 19" rack for flush mounting					7																
Standard LCD, 3/4 x 19" rack for rack mounting†2					G																
Large LCD, 3/4 x 19" rack for rack mounting†2					K																
Terminal block for BIO and PWS																					
Compression plug type terminal																0					
BI/BO module																					
Choice from BI/BO table	1×BIO module					1	*														
	2×BIO modules					2	*														
	3×BIO modules					3	*														
	4×BIO modules					4	*														
	5×BIO modules					5	*														
	6×BIO modules					6	*														
Terminal block for BIO and PWS																					
Ring type terminal																1					
BI/BO module																					
Choice from BI/BO table	1×BIO module					1	*														
	2×BIO modules					2	*														
	3×BIO modules					3	*														
	4×BIO modules					4	*														

[Hardware selection]

Large case (1/2 size or more) with Software†1 '3D' or '4D' (Current and Voltage relay)

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

Outline

Standard LCD, 1/1 x 19" rack for flush/rack mounting			4
Large LCD, 1/1 x 19" rack for flush/rack mounting			8

Terminal block for BIO and PWS

Compression plug type terminal			0
BI/BO module			
Choice from BI/BO table	1×BIO module	1	*
	2×BIO modules	2	*
	3×BIO modules	3	*
	4×BIO modules	4	*
	5×BIO modules	5	*
	6×BIO modules	6	*
	7×BIO modules	7	*
	8×BIO modules	8	*

Terminal block for BIO and PWS

Ring type terminal			1
BI/BO module			
Choice from BI/BO table	1×BIO module	1	*
	2×BIO modules	2	*
	3×BIO modules	3	*
	4×BIO modules	4	*
	5×BIO modules	5	*
	6×BIO modules	6	*
	7×BIO modules	7	*

Number of Serial and/or Ethernet Communication and/or Time Synch Port(s)

See the tables 'Communication port'

Note:

†1Software selection will be limited when code '4' is placed at positon '7'. Select 3D or 4D for software code.

†2Mounting kits for 19-inch rack are available. (See *Optional accessories selections*)

[Software selection]

	Positions																					
							-	7	S	G	T		E	F	U		-	9	V
Configurations	**G**	**R**	**D**	**2**	**0**	**0**	**-**	**4**		**3 / 4**	**D**	**-**					**-**		

Check pages 31-33 for details of software selection.

[Hardware selection]

Small case (1/3 size) with Software†1 '3E', '4E', '3F' (Current and Voltage relay)

	Positions																				
	-	7	8	-	9	A	B	-	C	D	-	E	F	-	G	H	-	J	K	L
Configurations	G R D 2 0 0	-	5		-			-	0	0	-			-			-			0
Application of power system																				
VCT36B: 5xCTs,4xVTs designed for 1/3 case		5																		
DC rated voltage																				
110-250 Vdc or 100-220Vac			1																	
24-60 Vdc			3																	
Function Block																				
Standard Model															3					
Advanced Model with Process Bus & Cyber-security															4					
System Frequency																				
50Hz																		1		
60Hz																		2		
AC rated current																				
1A																			1	
5A																			2	
Outline																				
Standard LCD, 1/3 x 19" rack for flush mounting					1															
Large LCD, 1/3 x 19" rack for flush mounting					5															
Standard LCD, 1/3 x 19" rack for rack mounting†2					E															
Large LCD, 1/3 x 19" rack for rack mounting†2					H															
Terminal block for BIO and PWS																				
Compression plug type terminal																0				
BI/BO module																				
Choice from BI/BO table — 1×BIO module						1	*													
Number of Serial and/or Ethernet Communication and/or Time Synch Port(s)																				
See the tables 'Communication port'																				

Note:

†1Software selection will be limited when code '5' is placed at positon '7'. Select the 3E, 4E or 3F for software code.

†2Mounting kits for 19-inch rack are available. (See *Optional accessories selections*)

[Software selection]

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

Check pages 31-33 for details of software selection.

[Hardware selection]

Small case (1/3 size) with Software†1 '30' or '32' (Current relay)

	Positions																				
	-	7	8	-	9	A	B	-	C	D	-	E	F	-	G	H	-	J	K	L
Configurations	G R D 2 0 0	-	1		-				-	0	0	-				-	3		-			0
Application of power system																					
VCT32B: 6xCTs designed for 1/3 case		1																			
DC rated voltage																					
110-250 Vdc or 100-220Vac			1																		
24-60 Vdc			3																		
System Frequency																					
50Hz																		1			
60Hz																		2			
AC rated current																					
1A																			1		
5A																			2		
Outline																					
Standard LCD, 1/3 x 19" rack for flush mounting					1																
Large LCD, 1/3 x 19" rack for flush mounting					5																
Standard LCD, 1/3 x 19" rack for rack mounting†2					E																
Large LCD, 1/3 x 19" rack for rack mounting†2					H																
Terminal block for BIO and PWS																					
Compression plug type terminal																0					
BI/BO module																					
Choice from BI/BO table — 1×BIO module						1	*														
Number of Serial and/or Ethernet Communication and/or Time Synch Port(s)																					
See the tables 'Communication port'																					

Note:

†1Software selection will be limited when code '1' is placed at positon '7'. Select the 30 or 32 for software code.

†2Mounting kits for 19-inch rack are available. (See *Optional accessories selections*)

[Software selection]

	Positions																				
								7	S	G	T		E	F	U		9	V			
Configurations	**G**	**R**	**D**	**2**	**0**	**0**	**-**	**1**		**3**	**0 / 2**	**-**				**-**					

Check pages 31, 34 and 35 for details of software selection.

[Hardware selection]

Small case (1/3 size) with Software†1 '39' (Reclosing relay)

Positions	-	7	8	-	9	A	B	-	C	D	-	E	F	-	G	H	-	J	K	L
Configurations	G	R	D	2	0	0	-	2		-				-	0	0	-			-	3		-			0

Application of power system

VCT33B: 5xVTs designed for 1/3 case	2

DC rated voltage

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

System Frequency

50Hz	1
60Hz	2

AC rated current

Not Applicable (N/A)	0

Outline

Standard LCD, 1/3 x 19" rack for flush mounting	1
Large LCD, 1/3 x 19" rack for flush mounting	5
Standard LCD, 1/3 x 19" rack for rack mounting†2	E
Large LCD, 1/3 x 19" rack for rack mounting†2	H

Terminal block for BIO and PWS

Compression plug type terminal	0

BI/BO module

Choice from BI/BO table	1×BIO module	1	*

Number of Serial and/or Ethernet Communication and/or Time Synch Port(s)

See the tables 'Communication port'

Note:

†1Software selection will be limited when code '2' is placed at positon '7'. Select the 39 for software code.

†2Mounting kits for 19-inch rack are available. (See *Optional accessories selections*)

[Software selection]

Positions		7	S	G	T		E	F	U		9	V
Configurations	**G R D 2 0 0 -**	**2**		**3**	**9**	**-**				**-**		

Check pages 31, 34 and 35 for details of software selection.

[Hardware selection]

Large case (1/2 size or more) with Software†1 '36' (Reclosing relay with CBF, SOTF, etc)

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

Application of power system

VCT31B: 3xCTs,5xVTs designed for 1/2, 3/4 or 1/1 cases	6	

DC rated voltage

110-250 Vdc or 100-220Vac	1
24-60 Vdc	3

System Frequency

50Hz	1	
60Hz	2	

AC rated current

1A	1	
5A	2	

Outline

Standard LCD, 1/2 x 19" rack for flush mounting	2
Large LCD, 1/2 x 19" rack for flush mounting	6
Standard LCD, 1/2 x 19" rack for rack mounting†2	F
Large LCD, 1/2 x 19" rack for rack mounting†2	J

Terminal block for BIO and PWS

Compression plug type terminal			0
BI/BO module			
Choice from BI/BO table	1×BIO module	1	*
	2×BIO modules	2	*
	3×BIO modules	3	*

Terminal block for BIO and PWS

Ring type terminal			1
BI/BO module			
Choice from BI/BO table	1×BIO modules	1	*
	2×BIO modules	2	*

Outline

Standard LCD, 3/4 x 19" rack for flush mounting	3
Large LCD, 3/4 x 19" rack for flush mounting	7
Standard LCD, 3/4 x 19" rack for rack mounting†2	G
Large LCD, 3/4 x 19" rack for rack mounting†2	K

Terminal block for BIO and PWS

Compression plug type terminal			0
BI/BO module			
Choice from BI/BO table	1×BIO module	1	*
	2×BIO modules	2	*
	3×BIO modules	3	*
	4×BIO modules	4	*
	5×BIO modules	5	*
	6×BIO modules	6	*

Terminal block for BIO and PWS

Ring type terminal			1
BI/BO module			
Choice from BI/BO table	1×BIO module	1	*
	2×BIO modules	2	*
	3×BIO modules	3	*
	4×BIO modules	4	*

[Hardware selection]

Large case (1/2 size or more) with Software†1 '36' (Reclosing relay with CBF, SOTF, etc)

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

Outline				
Standard LCD, 1/1 x 19" rack for flush/rack mounting		4		
Large LCD, 1/1 x 19" rack for flush/rack mounting		8		
Terminal block for BIO and PWS				
Compression plug type terminal				0
BI/BO module				
Choice from BI/BO table	1×BIO module	1	*	
	2×BIO modules	2	*	
	3×BIO modules	3	*	
	4×BIO modules	4	*	
	5×BIO modules	5	*	
	6×BIO modules	6	*	
	7×BIO modules	7	*	
	8×BIO modules	8	*	
Terminal block for BIO and PWS				
Ring type terminal				1
BI/BO module				
Choice from BI/BO table	1×BIO module	1	*	
	2×BIO modules	2	*	
	3×BIO modules	3	*	
	4×BIO modules	4	*	
	5×BIO modules	5	*	
	6×BIO modules	6	*	
	7×BIO modules	7	*	
Number of Serial and/or Ethernet Communication and/or Time Synch Port(s)				
See the tables 'Communication port'				

Note:

†1Software selection will be limited when code '6' is placed at positon '7'. Select the 36 for software code.

†2Mounting kits for 19-inch rack are available. (See *Optional accessories selections*)

[Software selection]

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

Check pages 31, 34 and 35 for details of software selection.

Number of BI/BO

BI/BO 1 x I/O module

Number of circuits on a module							Ordering No.†1	Selection of modules
Binary input circuits (BI)			Binary output circuits (BO)					
Independent circuit type	Independent type & variable thresholds	Common circuit type	Fast operating type	Semi-fast operating type	Auxiliary (normal) or Form C type	Hybrid type		
7	-	-	-	6	4	-	**11**	1xBIO1
12	-	-	-	3	2	-	**12**	1xBIO2
8	-	-	6	-	2	-	**13**	1xBIO3
18	-	-	-	-	-	-	**15**	1xBI1
-	12	-	-	-	-	-	**16**	1xBI2
-	-	32	-	-	-	-	**17**	1xBI3
-	-	-	-	6	12	-	**18**	1xBO1

Note

†1 Ordering No. will be set at A & B positions in 'Hardware selection'.

BI/BO 2 x I/O module

Number of circuits on a module							Ordering No.†1	Selection of modules
Binary input circuits (BI)			Binary output circuits (BO)					
Independent circuit type	Independent type & variable thresholds	Common circuit type	Fast operating type	Semi-fast operating type	Auxiliary (normal) or Form C type	Hybrid type		
-	-	32	-	6	12	-	**21**	1xBI3+1xBO1
7	-	32	-	6	4	-	**22**	1xBI3+1xBIO1
12	-	32	-	3	2	-	**23**	1xBI3+1xBIO2
18	-	-	-	6	12	-	**24**	1xBI1+1xBO1
25	-	-	-	6	4	-	**25**	1xBI1+1xBIO1
30	-	-	-	3	2	-	**26**	1xBI1+1xBIO2
8	-	-	6	6	14	-	**27**	1xBO1+1xBIO3
15	-	-	6	6	6	-	**28**	1xBIO1+1xBIO3
7	-	-	-	12	16	-	**29**	1xBO1+1xBIO1
16	-	-	12	-	4	-	**2A**	2xBIO3
-	-	32	-	-	-	16	**2B**	1xBI3+1xBO2
-	12	-	-	6	12	-	**2C**	1xBI2 +1xBO1
20	-	-	6	3	4	-	**2E**	1xBIO2+1xBIO3
12	-	-	-	9	14	-	**2F**	1xBO1+1xBIO2
8	12	-	6	-	2	-	**2G**	1XBI2+1xBIO3

Note

‡1 Ordering No. will be set at A & B positions in 'Hardware selection'. The Ordering No. herein cannot be chosen when the IED case size is 1/3.

BI/BO 3 x I/O module

Number of circuits on a module							Ordering No.†1	Selection of modules
Binary input circuits (BI)			Binary output circuits (BO)					
Independent circuit type	Independent type & variable thresholds	Common circuit type	Fast operating type	Semi-fast operating type	Auxiliary (normal) or Form C type	Hybrid type		
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** ‡2	1xBI1+1xBO1+1xBIO3
8	-	32	6	6	14	-	**35**	1xBI3+1xBO1+1xBIO3
24	-	-	18	-	6	-	**36**	3xBIO3
25	-	-	-	12	16	-	**37**	1xBI1+1xBO1+1xBIO1
36	-	-	-	6	12	-	**39**	2xBI1+1xBO1
-	24	-	-	6	12	-	**3A**	2xBI2+1xBO1
7	-	32	-	6	4	16	**3C**	1xBI3+1xBIO1+1xBO2
7	-	32	-	12	16	-	**3D**	1xBI3+1xBO1+1xBIO1
-	-	32	-	6	12	16	**3E**	1xBI3+1xBO1+1xBO2
16	-	-	12	6	16	-	**3G**	1xBO1+2xBIO3
26	-	-	6	6	14	-	**3J** ‡2	1xBO1+1xBIO3+1xBI1
-	-	64	-	6	12	-	**3K**	2xBI3+1xBO1
14	-	32	-	12	8	-	**3L**	1xBI3+2xBIO1
-	-	96	-	-	-	-	**3M**	3xBI3
8	12	-	6	6	14	-	**3N**	1xBI2+1xBO1+1xBIO3
-	-	32	-	12	24	-	**3P**	1xBI3 + 2xBO1
36	-	-	-	-	-	16	**3Q**	2xBI1 + 1xBO2
16	12	-	12	-	4	-	**3S**	1xBI2+2xBIO3
18	12	-	-	6	12	-	**3T**	1xBI1+1xBI2+1xBO1
12	-	32	-	9	14	-	**3U**	1xBI3+1xBO1+1xBIO2

Note

†1 Ordering No. will be set at A & B positions in ‘Hardware selection’. The Ordering No. herein cannot be chosen when the IED case size is 1/3.

‡2 The difference between ‘34’ and ‘3J’ is the implementation location.

BI/BO 4 x I/O modules

Number of circuits on a module							Ordering No.†1	Selection of modules
Binary input circuits (BI)			Binary output circuits (BO)					
Independent circuit type	Independent type & variable thresholds	Common circuit type	Fast operating type	Semi-fast operating type	Auxiliary (normal) or Form C type	Hybrid type		
26	-	-	6	12	26	-	**41** ‡2	1xBI1+2xBO1+1xBIO3
32	-	-	24	-	8	-	**42**	4xBIO3
8	-	32	6	12	26	-	**43**	1xBI3+2xBO1+1xBIO3
-	-	64	-	12	24	-	**44**	2xBI3+2xBO1
54	-	-	-	6	12	-	**46**	3xBI1+1xBO1
20	-	32	6	9	16	-	**47**	1xBI3+1xBO1+1xBIO2+1xBIO3
26	-	-	6	12	26	-	**48** ‡2	1xBO1+1xBI1+1xBO1+1xBIO3
20			6	15	28		**49**	2xBO1+1xBIO2+1xBIO3
34	-	-	12	6	16	-	**4B**	1xBI1+1xBO1+2xBIO3
-	-	64	-	-	-	32	**4C**	2xBI3+2xBO2
21	-	32	-	18	12	-	**4D**	1xBI3+3xBIO1
-	-	128	-	-	-	-	**4E**	4xBI3
7		96		6	4		**4F**	3xBI3+1xBIO1
8	24	-	6	6	14	-	**4G**	2xBI2+1xBO1+1xBIO3
-	-	32	-	18	36	-	**4H**	1xBI3+3xBO1
26	12	-	6	6	14	-	**4J**	1xBI1+1xBI2+1xBO1+1xBIO3
24	-	32	-	12	16	-	**4K**	1xBI3+1xBO1+2xBIO2
15	-	-	6	18	30	-	**4L**	2xBO1+1xBIO1+1xBIO3
7	-	-	-	24	40	-	**4M**	3xBO1+1xBIO1
36	-	-	-	12	24	-	**4N**	2xBI1+2xBO1
8	-	64	6	6	14	-	**4P**	2xBI3+1xBO1+1xBIO3
36	-	-	-	6	12	16	**4Q**	2xBI1+1xBO1+1xBO2
44	-	-	6	6	14	-	**4R**	2xBI1+1xBO1+1xBIO3

Note

†1 Ordering No. will be set at A & B positions in ‘Hardware selection’. The Ordering No. herein cannot be chosen when the IED case size is 1/3 or 1/2.

‡2 The difference between ‘41’ and ‘48’ is the implementation location.

BI/BO 5 x I/O modules

Number of circuits on a module							Ordering No.†1	Selection of modules
Binary input circuits (BI)			Binary output circuits (BO)					
Independent circuit type	Independent type & variable thresholds	Common circuit type	Fast operating type	Semi-fast operating type	Auxiliary (normal) or Form C type	Hybrid type		
33	-	-	6	6	6	32	**51**	1xBI1+1xBIO1+1xBIO3+2xBO2
44	-	-	6	12	26	-	**52**	2xBI1+2xBO1+1xBIO3
25	-	96	-	6	4	-	**53**	1xBI1+3xBI3+1xBIO1
8	-	96	6	6	14	-	**54**	3xBI3+1xBO1+1xBIO3
62	-	-	6	6	14	-	**56**	3xBI1+1xBO1+1xBIO3
-	-	96	-	12	24	-	**5B**	3xBI3+2xBO1
-	-	128	-	6	12	-	**5E**	4xBI3+1xBO1
-	-	160	-	-	-	-	**5F**	5xBI3
44	12	-	6	6	14	-	**5G**	2xBI1+1xBI2+1xBO1+1xBIO3
15	-	-	6	24	42	-	**5H**	3xBO1+1xBIO1+1xBIO3
-	-	64	-	18	36	-	**5J**	2xBI3+3xBO1
-	-	-	-	30	60	-	**5L**	5xBO1
42	-	-	18	6	18	-	**5P**	1xBI1+1xBO1+3xBIO3
41	-	-	12	12	20	-	**5Q**	1xBI1+1xBO1+1xBIO1+2xBIO3
8	-	64	6	-	2	32	**5R**	2xBI3+1xBIO3+2xBO2
8	12	64	6	-	2	16	**5S**	1xBI2+2xBI3+1xBIO3+1xBO2
36	24	-	-	6	12	-	**5U**	2xBI1+2xBI2+1xBO1

Note

†1 Ordering No. will be set at A & B positions in 'Hardware selection'. The Ordering No. herein cannot be chosen when the IED case size is 1/3 or 1/2.

BI/BO 6 x I/O modules

Number of circuits on a module							Ordering No.†1	Selection of modules
Binary input circuits (BI)			Binary output circuits (BO)					
Independent circuit type	Independent type & variable thresholds	Common circuit type	Fast operating type	Semi-fast operating type	Auxiliary (normal) or Form C type	Hybrid type		
51	-	-	6	18	30	-	**61**	2xBI1+2xBO1+1xBIO1+1xBIO3
8	-	96	6	12	26	-	**62**	3xBI3+2xBO1+1xBIO3
-	-	128	-	12	24	-	**63**	4xBI3+2xBO1
8	-	128	6	6	14	-	**64**	4xBI3+1xBO1+1xBIO3
52	-	-	12	-	4	32	**69**	2xBI1+2xBIO3+2xBO2
52	-	-	12	12	28	-	**6A**	2xBI1+2xBO1+2xBIO3
36	-	-	-	24	48	-	**6B**	2xBI1+4xBO1
36	-	64	-	12	24	-	**6C**	2xBI1+2xBI3+2xBO1
44	-	-	6	18	38	-	**6D**	2xBI1+3xBO1+1xBIO3
-	-	160	-	6	12	-	**6E**	5xBI3+1xBO1
7	-	160	-	6	4	-	**6F**	5xBI3+1xBIO1
8	-	64	6	-	2	48	**6G**	2xBI3+1xBIO3+3xBO2
26	-	64	6	-	2	32	**6H**	1xBI1+2xBI3+1xBIO3+2xBO2
8	12	64	6	6	14	16	**6J**	1xBI2+2xBI3+1xBO1+1xBIO3+1xBO2

Note

†1 Ordering No. will be set at A & B positions in 'Hardware selection'. The Ordering No. herein cannot be chosen when the IED case size is 1/3 or 1/2.

BI/BO 7 x I/O modules

Number of circuits on a module							Ordering No.†1	Selection of modules
Binary input circuits (BI)			Binary output circuits (BO)					
Independent circuit type	Independent type & variable thresholds	Common circuit type	Fast operating type	Semi-fast operating type	Auxiliary (normal) or Form C type	Hybrid type		
80	-	-	6	12	26	-	**71**	4xBI1+2xBO1+1xBIO3
8	-	96	6	18	38	-	**73**	3xBI3+3xBO1+1xBIO3
-	60	-	-	6	12	16	**78**	5xBI2+1xBO1+1xBO2
-	-	160	-	12	24	-	**79**	5xBI3+2xBO1
54	-	64	-	12	24	-	**7B**	3xBI1 + 2xBI3 + 2xBO1
-	-	128	-	18	36	-	**7D**	4xBI3+3xBO1
7	-	160	-	12	16	-	**7E**	5xBI3+1xBO1+1xBIO1
-	-	192	-	6	12	-	**7F**	6xBI3+1xBO1
7	-	192	-	6	4	-	**7G**	6xBI3+1xBIO1
-	-	224	-	-	-	-	**7H**	7xBI3
8	-	96	6	-	2	48	**7L**	3xBI3+1xBIO3+3xBO2

Note

†1 Ordering No. will be set at A & B positions in 'Hardware selection'. The Ordering No. herein cannot be chosen when the IED case size is 1/3, 1/2 or 3/4.

BI/BO 8 x I/O modules

Number of circuits on a module							Ordering No.†1	Selection of modules
Binary input circuits (BI)			Binary output circuits (BO)					
Independent circuit type	Independent type & variable thresholds	Common circuit type	Fast operating type	Semi-fast operating type	Auxiliary (normal) or Form C type	Hybrid type		
-	-	160	-	18	36	-	**83**	5xBI3+3xBO1
-	60	-	-	6	12	32	**87**	5xBI2+1xBO1+2xBO2
8	-	128	6	18	38	-	**88**	4xBI3+3xBO1+1xBIO3
-	-	256	-	-	-	-	**8C**	8xBI3
7	-	224	-	6	4	-	**8G**	7xBI3+1xBIO1
-	-	192	-	12	24	-	**8H**	6xBI3+2xBO1
7	-	192	-	12	16	-	**8J**	6xBI3+1xBO1+1xBIO1
7	-	96	-	30	52	-	**8M**	3xBI3+4xBO1+1xBIO1
-	-	128	-	24	48	-	**8N**	4xBI3+4xBO1

Note

†1 Ordering No. will be set at A & B positions in 'Hardware selection'. The Ordering No. herein can be only chosen when the IED case size is 1/1.

Communication port Table

[Hardware selection]								Positions																						
									7	8	-	9	A	B	-	C	D	-	E	F	-	G	H	-	J	K	L
Configurations	G	R	D	2	0	0	-																						

Positions									
E	F	Serial ports, and/or Ethernet ports, and/or Time Synch ports							
		IEC 60870-5-103		IEC 68150-8-1 or IEC 61850-9-2			IRIG-B	Remark	
		RS485	Fiber optical	100Base-FX	100Base-TX/ 1000Base-TX	1000Base- LX			
1	4	–	–	1	–	–	–		
3	4	–	–	1	–	–	1		
4	6	–	–	2	–	–	–	Hot/Standby	
6	6	–	–	2	–	–	1		
L	6	–	–	2	–	–	–	PRP/HSP/RSTP	
N	6	–	–	2	–	–	1		
L	8	–	–	3	–	–	–	PRP/HSR + SAN	
N	8	–	–	3	–	–	1		
M	6	–	–	4	–	–	–	Dual PRP/HSR	
M	M	–	–	4	–	–	1		
4	C	1	–	1	–	–	–		
6	C	1	–	1	–	–	1		
7	D	1	–	2	–	–	–	Hot/Standby	
9	D	1	–	2	–	–	1		
L	D	1	–	2	–	–	–	PRP/HSP/RSTP	
N	D	1	–	2	–	–	1		
4	G	–	1	1	–	–	–		
6	G	–	1	1	–	–	1		
7	H	–	1	2	–	–	–	Hot/Standby	
9	H	–	1	2	–	–	1		
L	H	–	1	2	–	–	–	PRP/HSP/RSTP	
N	H	–	1	2	–	–	1		
1	J	–	–	–	1	–	–		
3	J	–	–	–	1	–	1		
4	L	–	–	–	2	–	–	Hot/Standby	
6	L	–	–	–	2	–	1		
L	L	–	–	–	2	–	–	PRP/HSP/RSTP	
N	L	–	–	–	2	–	1		
L	9	–	–	–	3	–	–	PRP/HSR + SAN	
N	9	–	–	–	3	–	1		
Q	6	–	–	–	4	–	–	Dual PRP/HSR	
Q	M	–	–	–	4	–	1		
4	N	1	–	–	1	–	–		
6	N	1	–	–	1	–	1		
7	P	1	–	–	2	–	–	Hot/Standby	
9	P	1	–	–	2	–	1		
L	P	1	–	–	2	–	–	PRP/HSP/RSTP	
N	P	1	–	–	2	–	1		
4	S	–	1	–	1	–	–		
6	S	–	1	–	1	–	1		
7	T	–	1	–	2	–	–	Hot/Standby	
9	T	–	1	–	2	–	1		
L	T	–	1	–	2	–	–	PRP/HSP/RSTP	
N	T	–	1	–	2	–	1		
1	K	–	–	–	–	1	–		
3	K	–	–	–	–	1	1		
4	M	–	–	–	–	2	–	Hot/Standby	
6	M	–	–	–	–	2	1		
L	M	–	–	–	–	2	–	PRP/HSP/RSTP	
N	M	–	–	–	–	2	1		
L	A	–	–	–	–	3	–	PRP/HSR + SAN	
N	A	–	–	–	–	3	1		
M	L	–	–	–	–	4	–	Dual PRP/HSR	
M	7	–	–	–	–	4	1		
4	Q	1	–	–	–	1	–		

Positions								
E	F	Serial ports, and/or Ethernet ports, and/or Time Synch ports						
		IEC 60870-5-103		IEC 68150-8-1 or IEC 61850-9-2			IRIG-B	Remark
		RS485	Fiber optical	100Base-FX	100Base-TX/ 1000Base-TX	1000Base- LX		
6	Q	1	–	–	–	1	1	
7	R	1	–	–	–	2	–	Hot/Standby
9	R	1	–	–	–	2	1	
L	R	1	–	–	–	2	–	PRP/HSP/RSTP
N	R	1	–	–	–	2	1	
4	U	–	1	–	–	1	–	
6	U	–	1	–	–	1	1	
7	V	–	1	–	–	2	–	Hot/Standby
9	V	–	1	–	–	2	1	
L	V	–	1	–	–	2	–	PRP/HSP/RSTP
N	V	–	1	–	–	2	1	

[Software selection]

								7	S	G	T		E	F	U		9	V
Configurations	**G**	**R**	**D**	**2**	**0**	**0**	**-**		**0**			**-**				**-**		**E**

Application of power system

Assignment at the '7' position

Function block

Refer to Function table (See (*1))

Communication for Remote / Time Synch. (1)

Assignment at the 'E' position (See (*2))

Communication for Remote / Time Synch. (2)

Assignment at the 'F' position (See (*2))

Protocol

IEC 60870-5-103 + IEC 61850	1
IEC 61850	2

Outline

Assignment at the '9' position

Language

English	E

(*1) See the 'Functional table'.
(*2) For PRP/HSR/RSTP protocol with IEC 61850, choose "L" or "N" code at position E. For hot/standby configuration or single port configuration with IEC 61850, choose other codes at position E.

FUNCTION TABLE FOR SOFTWARE 3D, 3E, 3F (Current and Voltage Relay)

Function Block		Description		Ordering No. (Position "G & T")		
				3D	3E	3F
[VCT type; available IED case sizes]						
4 at position "7"		VCT31B	6 × CTs + 5 × VTs designed for 1/2, 3/4, and 1/1 cases	●		
5 at position "7"		VCT36B	5 × CTs + 4 × VTs designed for 1/3 case		●	●
[Relay application]						
50/67,51/67	OC	Overcurrent protection (4 steps; non-directional / directional phase)		●	●	●
50N/67N,51N/67N	EF	Earth fault overcurrent protection(4 steps; non-directional/ directional)		●	●	●
--	ICD	Inrush current detection function (2nd harmonic)		●	●	●
50N/51N	SEF	Sensitive earth fault protection (4 steps; non-directional/ directional)		●	●	●
50SOTF	SOTF-OC	Switch on to fault protection		●	●	●
50BF	CBF	Circuit breaker fail protection (1 stage)		●	●	●
37	UC	Under-current protection (2 stages)		●	●	●
46/67	OCN	Negative sequence over-current protection (4 stages; phase; non-directional/ directional)		●	●	●
49	THM	Thermal overload protection		●	●	●
--	CLP	Cold load protection		●	●	●
46BC	BCD	Broken conductor protection		●	●	●
59	OV	Over-voltage protection (4 steps; phase-to-neutral)		●	●	●
59	OVS	Over-voltage protection (4 steps; phase-to-phase)		●	●	●
59N	OVG	Earth fault over-voltage protection (4 steps)		●	●	●
47	OVN	Negative-sequence over-voltage protection (4 steps)		●	●	●
85-50/51/67N	DEFCAR	Command protection by EF and directional-EF schemes			●	●
27	UV	Under-voltage protection (4 steps; phase-to-neutral)		●	●	●
27	UVS	Under-voltage protection (4 steps; phase-to-phase)		●	●	●
81	FRQ	Frequency protection (6 steps)		●		
	FRQ	Frequency protection (8 steps) plus rapid change detection			●	●
ROCOF	DFRQ	Rate of change of frequency (df/dt) (6 steps)		●		
	DFRQ	Rate of change of frequency (df/dt) (8 steps)			●	●
51V	OCV	Voltage-dependent overcurrent protection (4 steps)		●	●	●
21FL	FL	Fault locator (single-end)		●	●	●
79	ARC	Auto-reclose (reclosing relay in three-phase; up to five trials)		●	●	●
25	VCHK	Synchronism check relay (1 element for 2 AC circuits)		●	●	●
94	TRC	Three-phase trip circuit (for single CB)		●	●	●
--	VTF	VT failure detection		●	●	●
--	CTF	CT failure detection		●	●	●
--	PROT-COMMON	Protection common switches/gears with relay applications		●	●	●
[General controls]						
General ctrl.	CMNCTRL	Common controls		●	●	●
	LEDR	LED reset		●	●	●
	GCNT	Counter function for the general		●	●	●
	MDCTRL	Mode control function		●	●	●
	L/R	Local and remote control		●	●	●

●: Applied, Blank: Not applied.

FUNCTION TABLE FOR SOFTWARE 3D, 3E, 3F (Current and Voltage Relay) - continued

Function Block		Description	Ordering No. (Position "G & T")		
			3D	3E	3F
[Control and monitoring application]					
Basic ctrl.	SPOS	Single position device control	●	●	
	DPSY	Double position control with synchronizing-checking	●	●	
	SOFTSW	Software switch control	●	●	
	OPTR	Operate timer reset	●	●	
	TOTALTIM	Total time measurement	●	●	
	SYNCHK	Synchronizing check for different network	●	●	
	ILK	Software interlock	●	●	
	DPOS	Double position device control	●	●	
	TPOS	Three position device control	●	●	
	GENBI	Event detection function for general BIs	●	●	
	ASEQ	Automatic sequence control	●	●	
[Monitoring]					
--	MES	Measurement	●	●	●
--	Demand	Demand metering	●	●	●
--	Statistics	Statistics displaying	●	●	●
[Recording]					
--	DRT	Disturbance recorder	●	●	●
[Automatic supervision]					
--	TCS	TRC supervision	●	●	●
--	Sigma Iy	Alarming for interruption capability on CB	●	●	●
			Current and Voltage relays with Basic controls	Current and Voltage relays with Basic controls	Current and Voltage relays without Basic controls

●: Applied, Blank: Not applied.

FUNCTION TABLE FOR SOFTWARE 30, 32 (Current Relay) / 36, 39 (Reclosing Relay)

Function Block		Description		Ordering No. (Position "G & T")			
				30	32	36	39
[VCT type; available IED case sizes]							
1 at position "7"		VCT32B	6 × CTs designed for 1/3 case	●	●		
6 at position "7"		VCT31B	3 × CTs + 5 × VTs designed for 1/2, 3/4, and 1/1 cases			●	
2 at position "7"		VCT33B	5 × VTs designed for 1/3 case				●
[Relay application]							
50,51	OC	Overcurrent protection (4 steps; non-directional)		●	●		
50N,51N	EF	Earth fault overcurrent protection(4 steps; non-directional)		●	●		
--	ICD	Inrush current detection function (2nd harmonic)		●	●	●	
50N/51N	SEF	Sensitive earth fault protection (4 steps; non-directional)		●	●		
50SOTF	SOTF-OC	Switch on to fault protection		●	●	●	
50BF	CBF	Circuit breaker fail protection (1 stage)		●	●	●	
37	UC	Under-current protection (2 stages)		●	●		
46	OCN	Negative sequence OC protection (4 stages; phase; non-directional)		●	●		
49	THM	Thermal overload protection		●	●		
--	CLP	Cold load protection		●	●		
46BC	BCD	Broken conductor protection		●	●		
59	OV	Over-voltage protection (4 steps; phase-to-neutral)				●	
59	OVS	Over-voltage protection (4 steps; phase-to-phase)				●	
59N	OVG	Earth fault over-voltage protection (4 steps)				●	
47	OVN	Negative-sequence over-voltage protection (4 steps)				●	
27	UV	Under-voltage protection (4 steps; phase-to-neutral)				●	
27	UVS	Under-voltage protection (4 steps; phase-to-phase)				●	
81	FRQ	Frequency protection (8 steps) plus rapid change detection				●	
ROCOF	DFRQ	Rate of change of frequency (df/dt) (8 steps)				●	
79	ARC	Auto-reclose (reclosing relay in three-phase; up to five shots)		●	●		
		Auto-reclose (reclosing relay in segregated-phase; up to five shots)				●	●
25	VCHK	Synchronism check relay (Double elements for triple AC circuits)				●	●
94	TRC	Three-phase trip circuit (for single CB)		●	●		
		Segregated-phase Trip circuit (for double CBs)				●	●
--	PROT-COMMON	Common relays for switch gears		●	●	●	●
[General controls]							
General ctrl.	CMNCTRL	Common controls		●	●	●	●
	LEDR	LED reset		●	●	●	●
	GCNT	Counter function for the general		●	●	●	●
	MDCTRL	Mode control function		●	●	●	●
	L/R	Local and remote control		●	●	●	●

●: Applied, Blank: Not applied.

FUNCTION TABLE FOR SOFTWARE 30, 32 (Current Relay) / 36, 39 (Reclosing Relay) - continued

Function Block		Description	Ordering No. (Position "G & T")			
			30	32	36	39
[Control and monitoring application]						
Basic ctrl.	SPOS	Single position device control	●			
	SOFTSW	Software switch control	●			
	OPTR	Operate timer reset	●			
	TOTALTIM	Total time measurement	●			
	ILK	Software interlock	●			
	DPOS	Double position device control	●			
	TPOS	Three position device control	●			
	GENBI	Event detection function for general BIs	●			
	ASEQ	Automatic sequence control	●			
[Monitoring]						
--	MES	Measurement	●	●	●	●
--	Demand	Demand control metering	●	●	●	●
--	Statistics	Statistics displaying	●	●	●	●
[Recording]						
--	DRT	Disturbance recorder	●	●	●	●
[Automatic supervision]						
--	TCS	TRC supervision	●	●	●	
--	Sigma Iy	Alarming for interruption capability on CB	●	●	●	
			Voltage relay with Basic controls	Voltage relay without Basic controls	Reclosing relay w/ CBF& SOTF etc., w/o Basic controls	Reclosing relay without Basic controls

●: Applied, Blank: Not applied.

FUNCTION TABLE FOR SOFTWARE 4D, 4E (Current & Voltage Relay with Process Bus Client + Cybersecurity)

Function Block		Description		Ordering No. (Position "G & T")	
				4D	4E
[VCT type; available IED case sizes]					
4 at position "7"		VCT31B	6 × CTs + 5 × VTs designed for 1/2, 3/4, and 1/1 cases	●	
5 at position "7"		VCT36B	5 × CTs + 4 × VTs designed for 1/3 case		●
[Relay application]					
50/67,51/67	OC	Overcurrent protection (4 steps; non-directional / directional phase)		●	●
50N/67N,51N/67N	EF	Earth fault overcurrent protection(4 steps; non-directional/ directional)		●	●
--	ICD	Inrush current detection function (2nd harmonic)		●	●
50N/51N	SEF	Sensitive earth fault protection (4 steps; non-directional/ directional)		●	●
50SOTF	SOTF-OC	Switch on to fault protection		●	●
50BF	CBF	Circuit breaker fail protection (1 stage)		●	●
37	UC	Under-current protection (2 stages)		●	●
46/67	OCN	Negative sequence over-current protection (4 stages; phase; non-directional/ directional)		●	●
49	THM	Thermal overload protection		●	●
--	CLP	Cold load protection		●	●
46BC	BCD	Broken conductor protection		●	●
59	OV	Over-voltage protection (4 steps; phase-to-neutral)		●	●
59	OVS	Over-voltage protection (4 steps; phase-to-phase)		●	●
59N	OVG	Earth fault over-voltage protection (4 steps)		●	●
47	OVN	Negative-sequence over-voltage protection (4 steps)		●	●
85-50/51/67N	DEFCAR	Command protection by EF and directional-EF schemes			●
27	UV	Under-voltage protection (4 steps; phase-to-neutral)		●	●
27	UVS	Under-voltage protection (4 steps; phase-to-phase)		●	●
81	FRQ	Frequency protection (6 steps)		●	
	FRQ	Frequency protection (8 steps) plus rapid change detection			●
ROCOF	DFRQ	Rate of change of frequency (df/dt) (6 steps)		●	
	DFRQ	Rate of change of frequency (df/dt) (8 steps)			●
51V	OCV	Voltage-dependent overcurrent protection (4 steps)		●	●
21FL	FL	Fault locator (single-end)		●	●
79	ARC	Auto-reclose (reclosing relay in three-phase; up to five trials)		●	●
25	VCHK	Synchronism check relay (1 element for 2 AC circuits)		●	●
94	TRC	Three-phase trip circuit (for single CB)		●	●
--	VTF	VT failure detection		●	●
--	CTF	CT failure detection		●	●
--	PROT-COMMON	Protection common switches/gears with relay applications		●	●
[General controls]					
General ctrl.	CMNCTRL	Common controls		●	●
	LEDR	LED reset		●	●
	GCNT	Counter function for the general		●	●
	MDCTRL	Mode control function		●	●
	L/R	Local and remote control		●	●

●: Applied, Blank: Not applied.

FUNCTION TABLE FOR SOFTWARE 4D, 4E - continued

Function Block		Description	Ordering No. (Position "G & T")	
			4D	4E
[Control and monitoring application]				
Basic ctrl.	SPOS	Single position device control	●	●
	DPSY	Double position control with synchronizing-checking	●	●
	SOFTSW	Software switch control	●	●
	OPTR	Operate timer reset	●	●
	TOTALTIM	Total time measurement	●	●
	SYNCHK	Synchronizing check for different network	●	●
	ILK	Software interlock	●	●
	DPOS	Double position device control	●	●
	TPOS	Three position device control	●	●
	GENBI	Event detection function for general BIs	●	●
	ASEQ	Automatic sequence control	●	●
[Monitoring]				
--	MES	Measurement	●	●
--	Demand	Demand metering	●	●
--	Statistics	Statistics displaying	●	●
[Recording]				
--	DRT	Disturbance recorder	●	●
[Automatic Supervision]				
--	TCS	TRC supervision	●	●
--	Sigma Iy	Alarming for interruption capability on CB	●	●
[Advanced Function]				
Process Bus Application (*1)			●	●
Cybersecurity Application			●	●
			Current & Voltage Relays with PB Client & Cybersecurity	Current & Voltage Relays with PB Client & Cybersecurity

●: Applied, Blank: Not applied.

(*1) Station bus and process bus application required at least 2 communication ports.

FUNCTION TABLE for CONTROL

Function Block	Description	GRD200 Basic Control
SPOS	Single position device control	●
DPSY	Double position control with synchrocheck	●
SOFTSW	Software switch control	●
OPTR	Operate time reset	●
TOTALTIM	Total time measurement	●
SYNDIF	Synchrocheck between different networks	●
INTERLOCK	Software interlock	●
DPOS	Double position device control	●
TPOS	Three position device control	●
GENBI	BI alarm detection	●
ASEQ	Automatic sequence control	●

Maximum device number for control

Function Block	Number
DPSY	2
DPOS	72
SPOS	20
TPOS	24
TAPBCD	4

Note: DPSY is provided to control a device to “Closed” or “Open” with synchro-check such as a CB.
: SOFTSW is used for bypassing the control process, blocking, interlock process and others.
: DPOS is applied to control a device such as DS or an ES.

Ordering information
Optional accessory selections

[Label sheet]

Accessory names	Quantity per order	Codes
Pocket sheet label for LEDs(White)	10	EP-211-00
Pocket sheet label for function keys(White)	10	EP-212-00

[Rating jumpers]

Accessory names	Quantity per order	Codes
Jumpers to change rated current	20	EP-221

[Monitoring plugs]

Accessory names	Quantity per order	Codes
Plugs for monitoring jacks on the front	4	EP-222

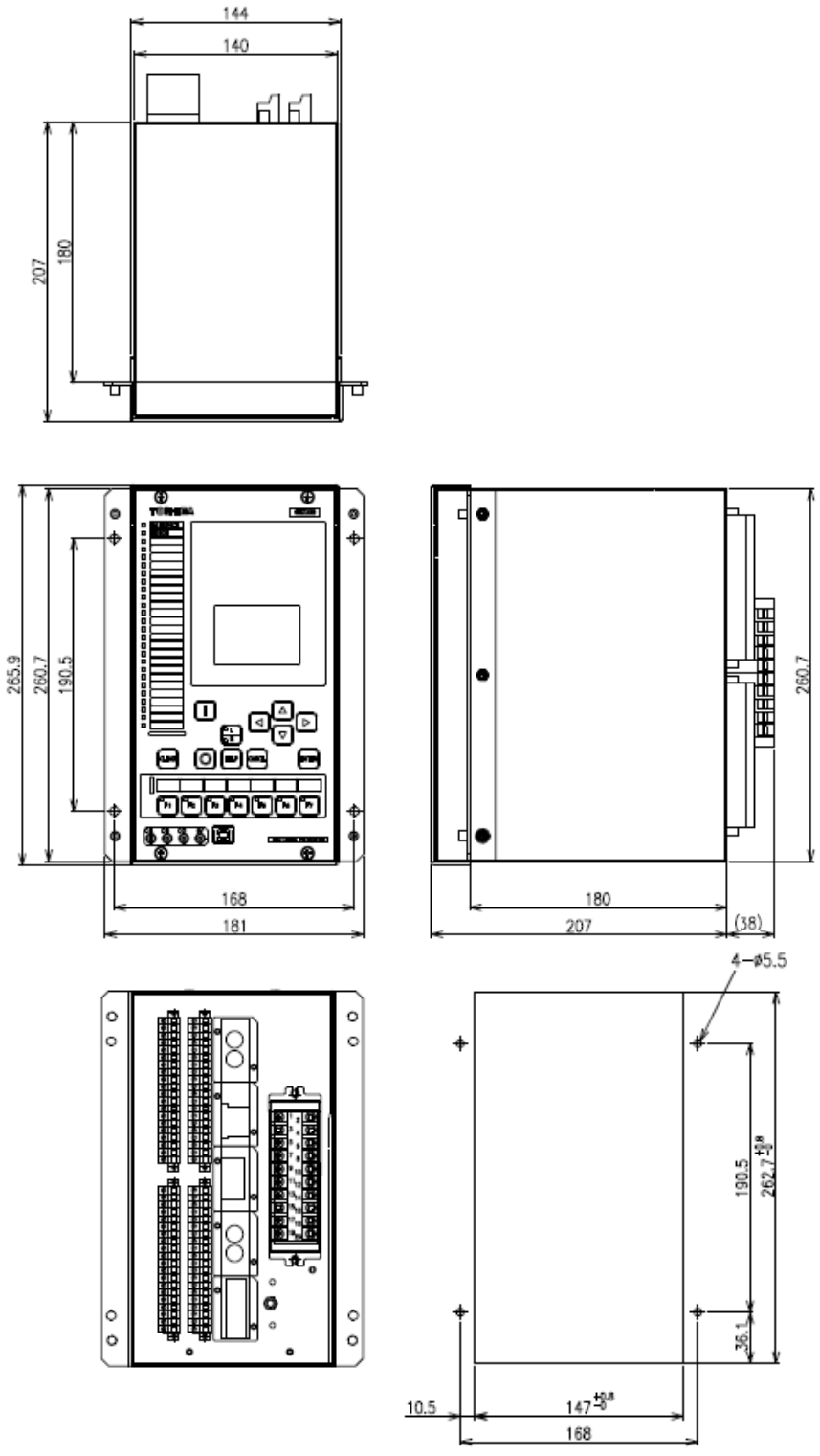
[Rear terminal remover]

Accessory names	Quantity per order	Codes
Hook tool for detaching rear terminal	1	EP-235

[Mounting kits for 19” size rack]

Accessory names	Quantity per order	Codes
Joint kits for single 1/3 case	1 set	EP-201
Joint kits for two 1/3 cases	1 set	EP-202
Joint kits for three 1/3 cases	1 set	EP-203
Joint kits for single 1/2 case	1 set	EP-204
Joint kits for two 1/2 case	1 set	EP-205
Joint kits for single 3/4 case	1 set	EP-206

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



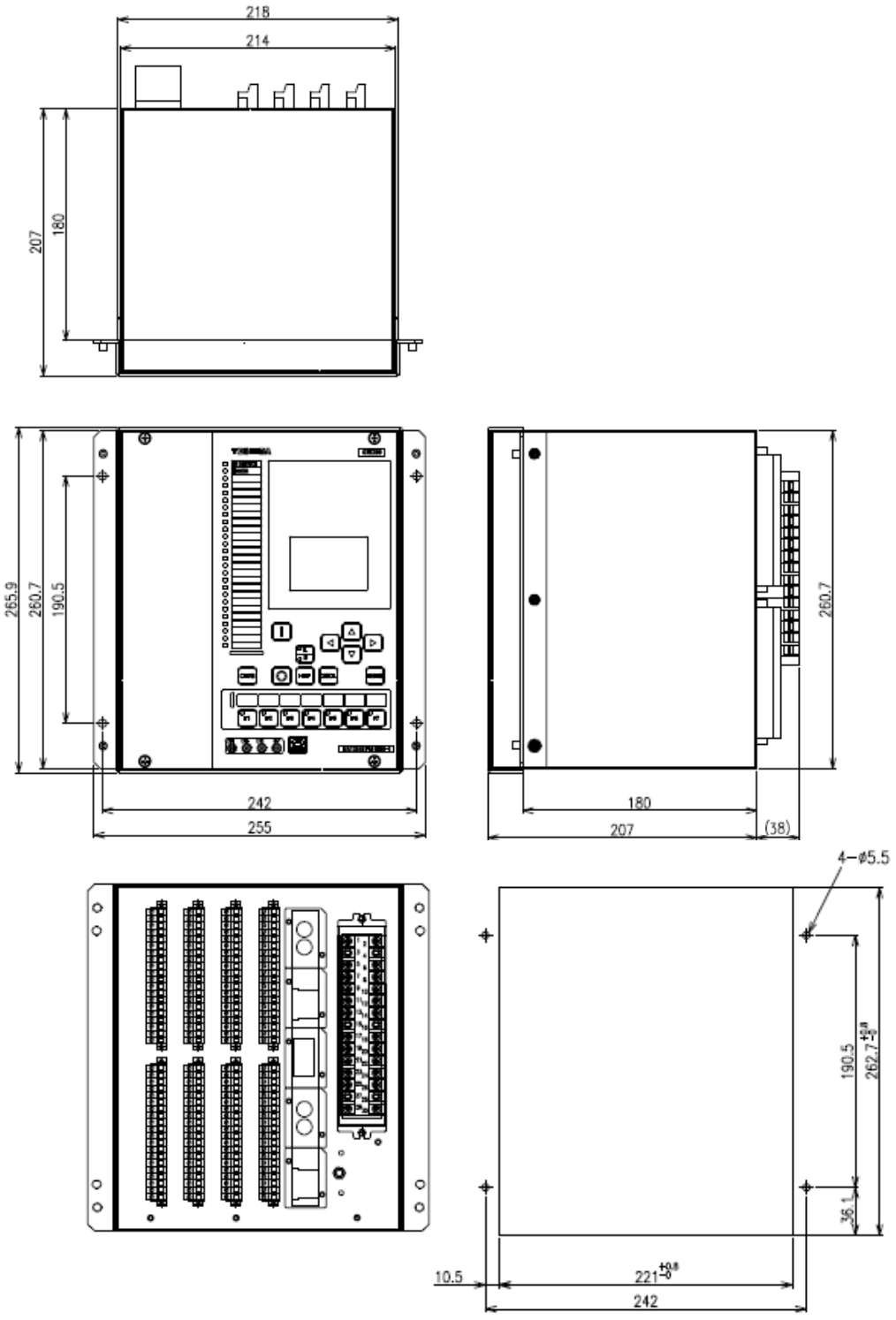
(Panel cut-out)

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

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

(38)

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

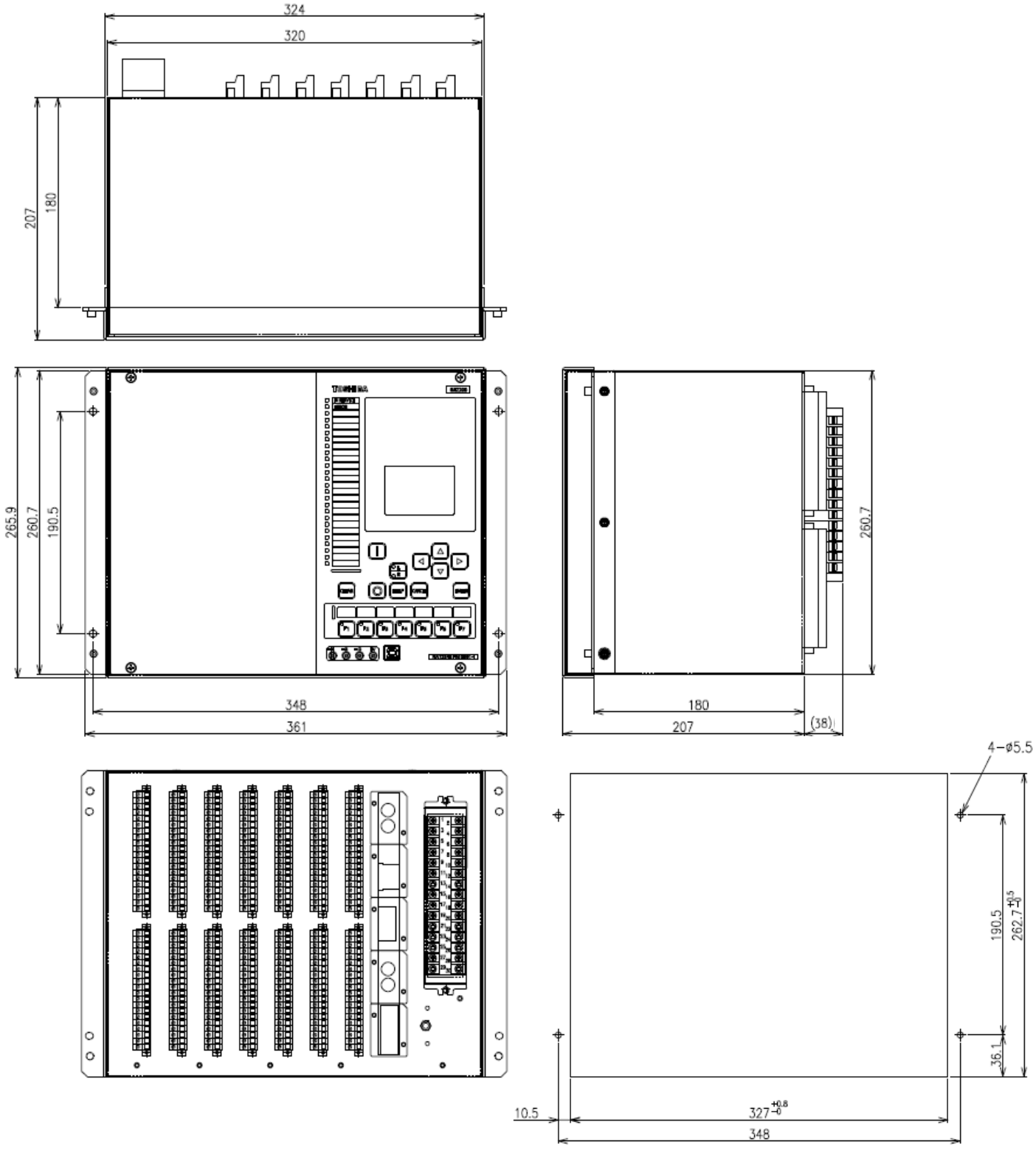


(Panel cut-out)

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

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

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

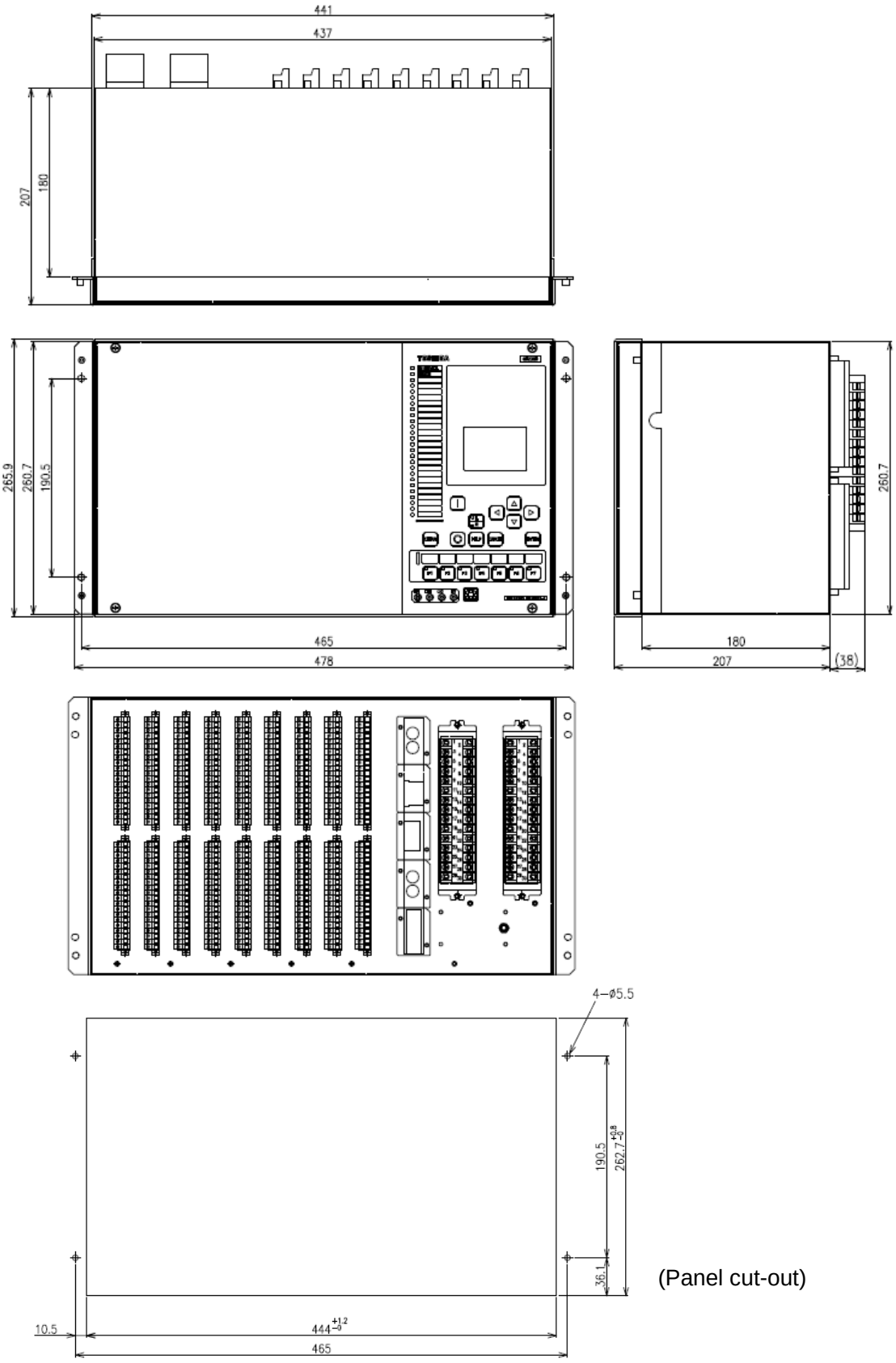


(Panel cut-out)

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

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

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



(Panel cut-out)

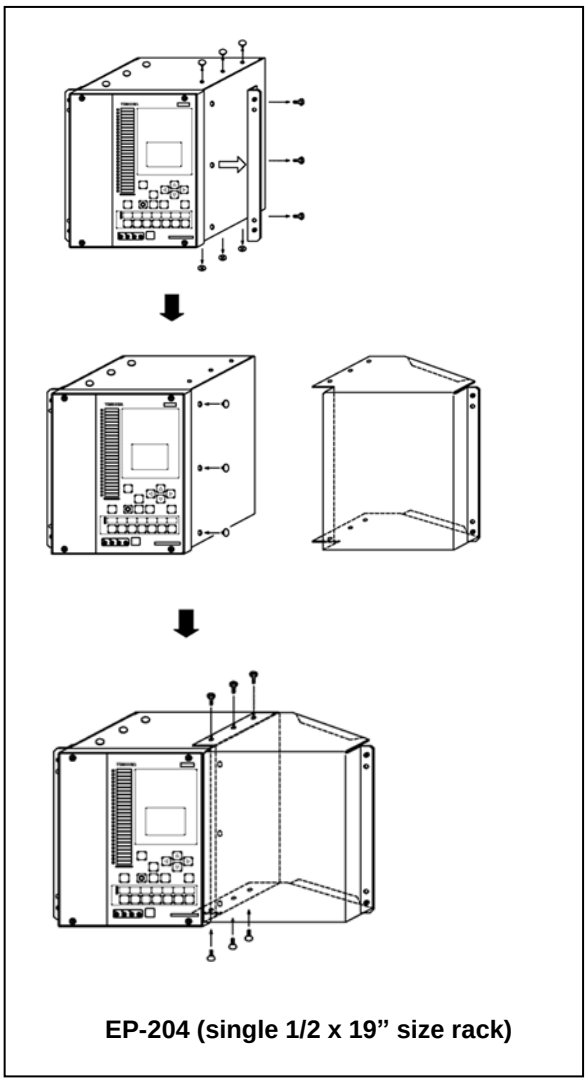
Note: For a rack mount unit, there are holes for joint kits assembling on top and bottom of the unit.

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

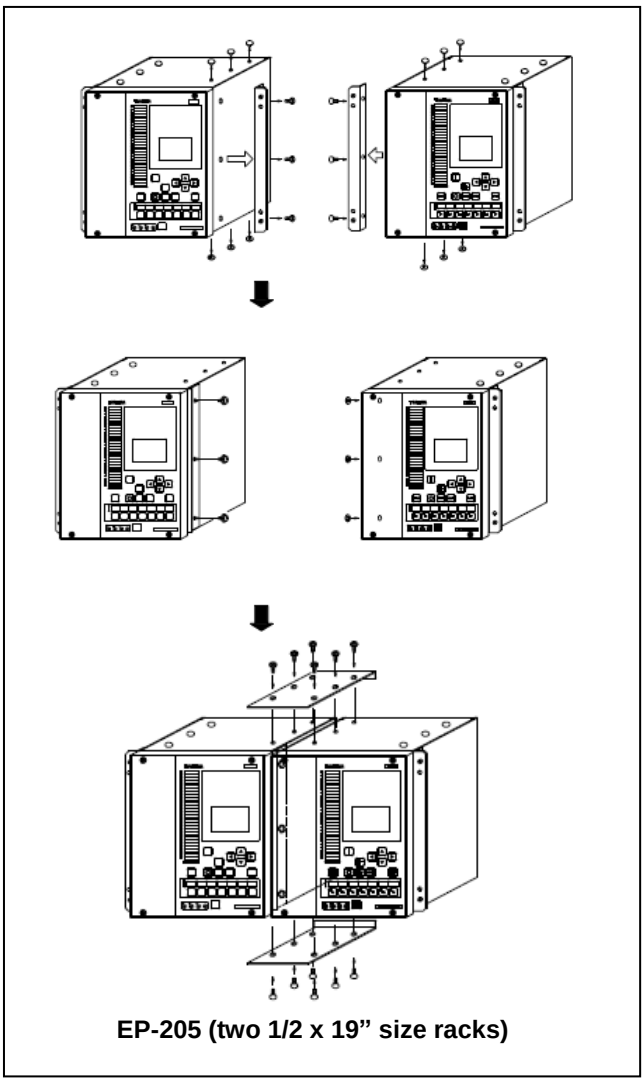
19” RACK MOUNTING JOINT KITS ATTACHMENT

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

Name	Code
Joint kits for single 1/3 x 19” size rack	EP-201
Joint kits for two 1/3 x 19” size racks	EP-202
Joint kits for three 1/3 x 19” size racks	EP-203
Joint kits for single 1/2 x 19” size rack	EP-204
Joint kits for two 1/2 x 19” size racks	EP-205
Joint kits for single 3/4 x 19” size rack	EP-206



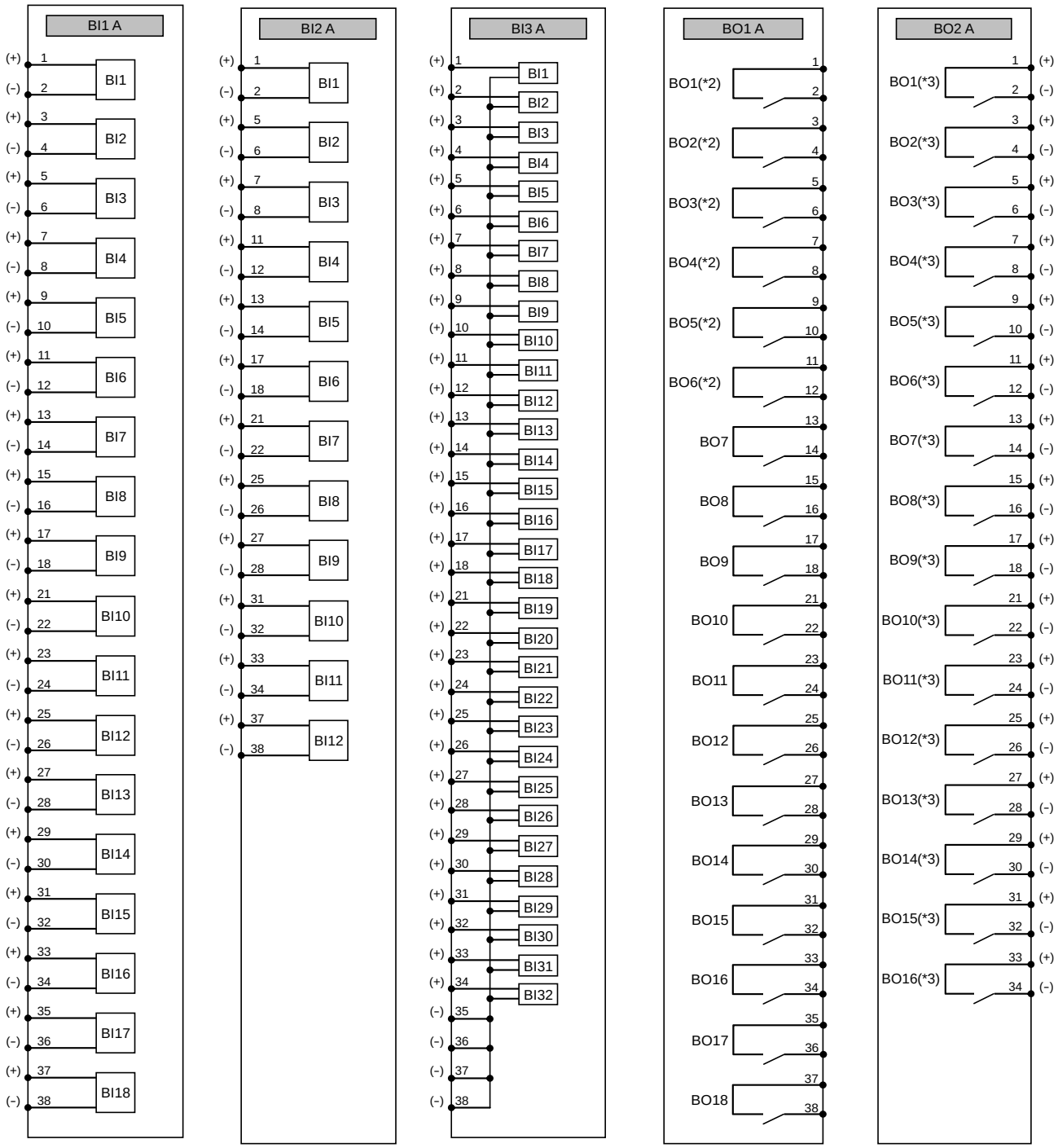
EP-204 (single 1/2 x 19” size rack)



EP-205 (two 1/2 x 19” size racks)

Figure 10 – Joint kits example for 19” rack panel mounting

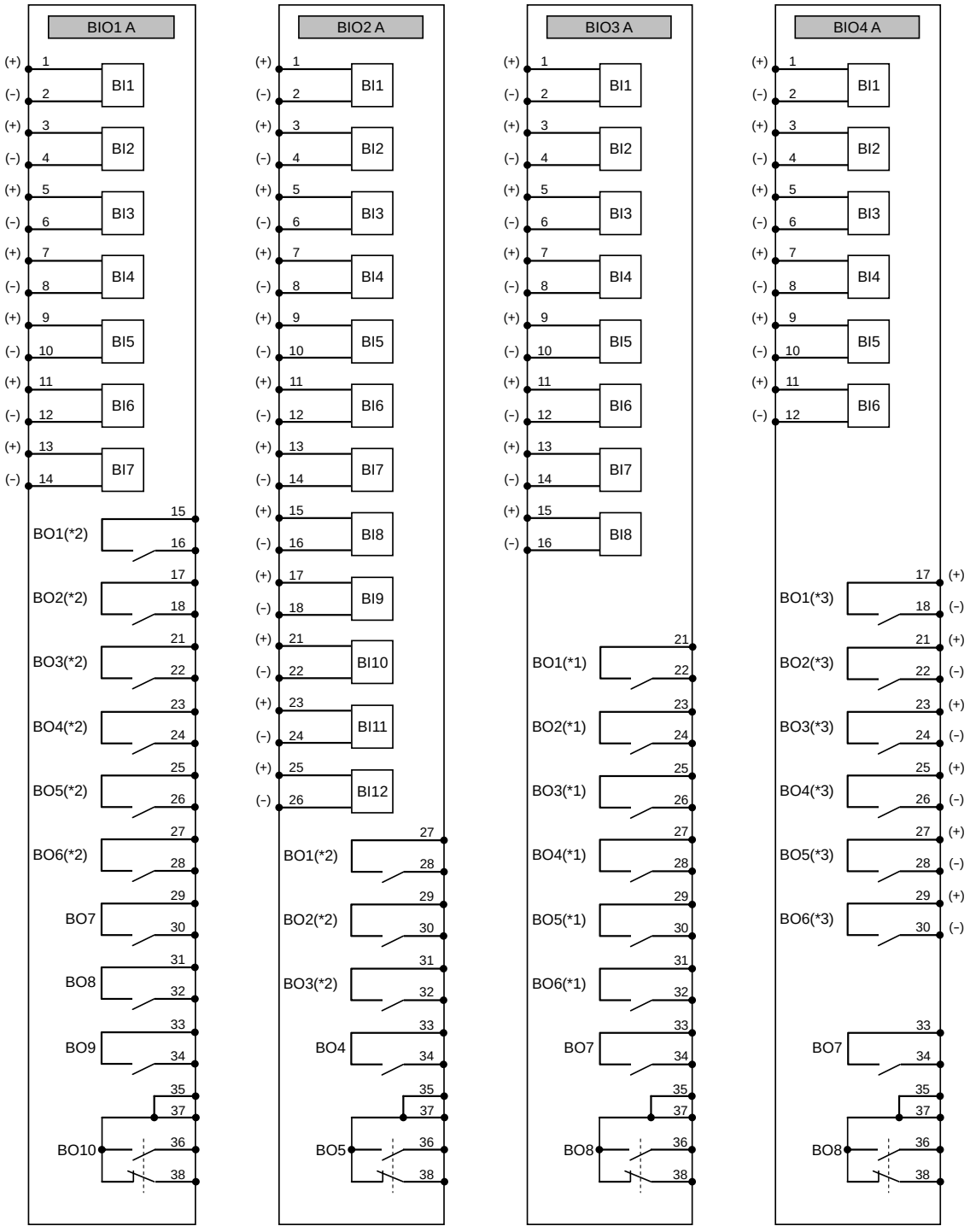
CONNECTIONS DIAGRAM (COMPRESSION PLUG TYPE)



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

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

CONNECTIONS DIAGRAM (COMPRESSION PLUG TYPE)



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

Figure 12 – Combined binary input and output module (for compression plug type terminal)

CONNECTIONS DIAGRAM (COMPRESSION PLUG TYPE)

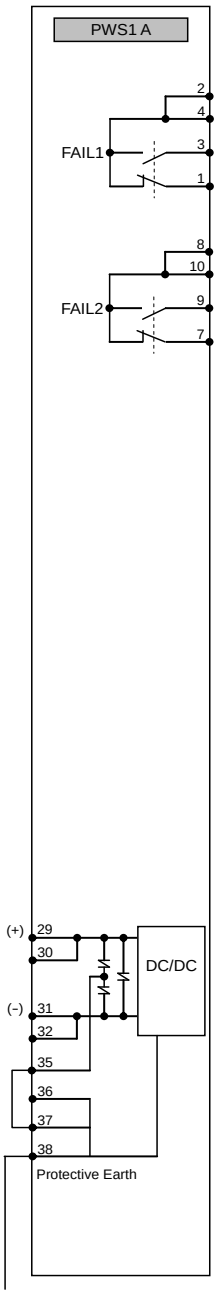
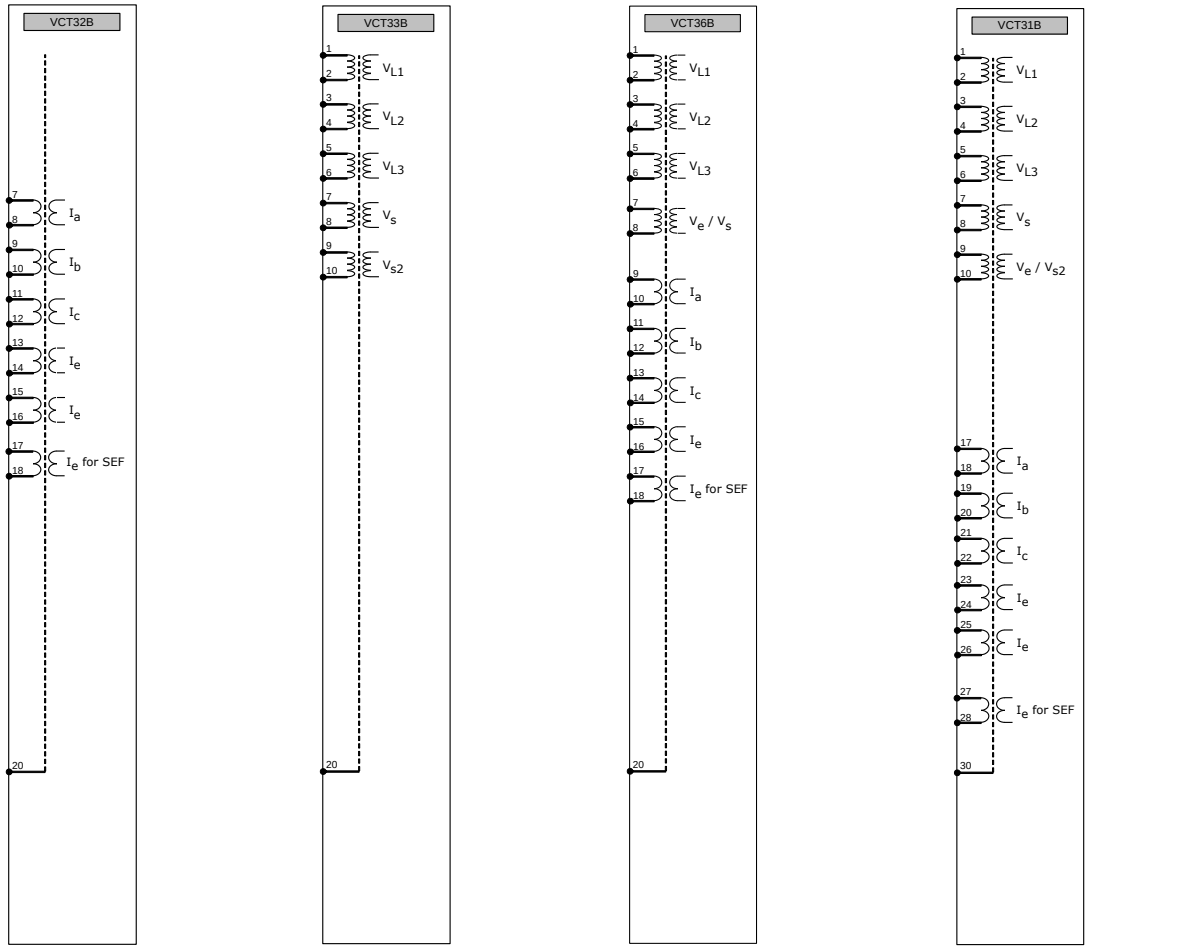


Figure 13 - DC/DC module

(for compression plug type terminal)

CONNECTIONS DIAGRAM

CT/VT module



Module no. 32
(CT x 6)
Only for 1/3 rack

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

Module no. 36
(CT x 5 + VT x 4)
Only for 1/3 rack

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

Figure 14 – CT/VT module

EXTERNAL CONNECTIONS DIAGRAM

Example: GRD200-41-224-00-9T-30-110 (Current and Voltage relay - Software "3D")

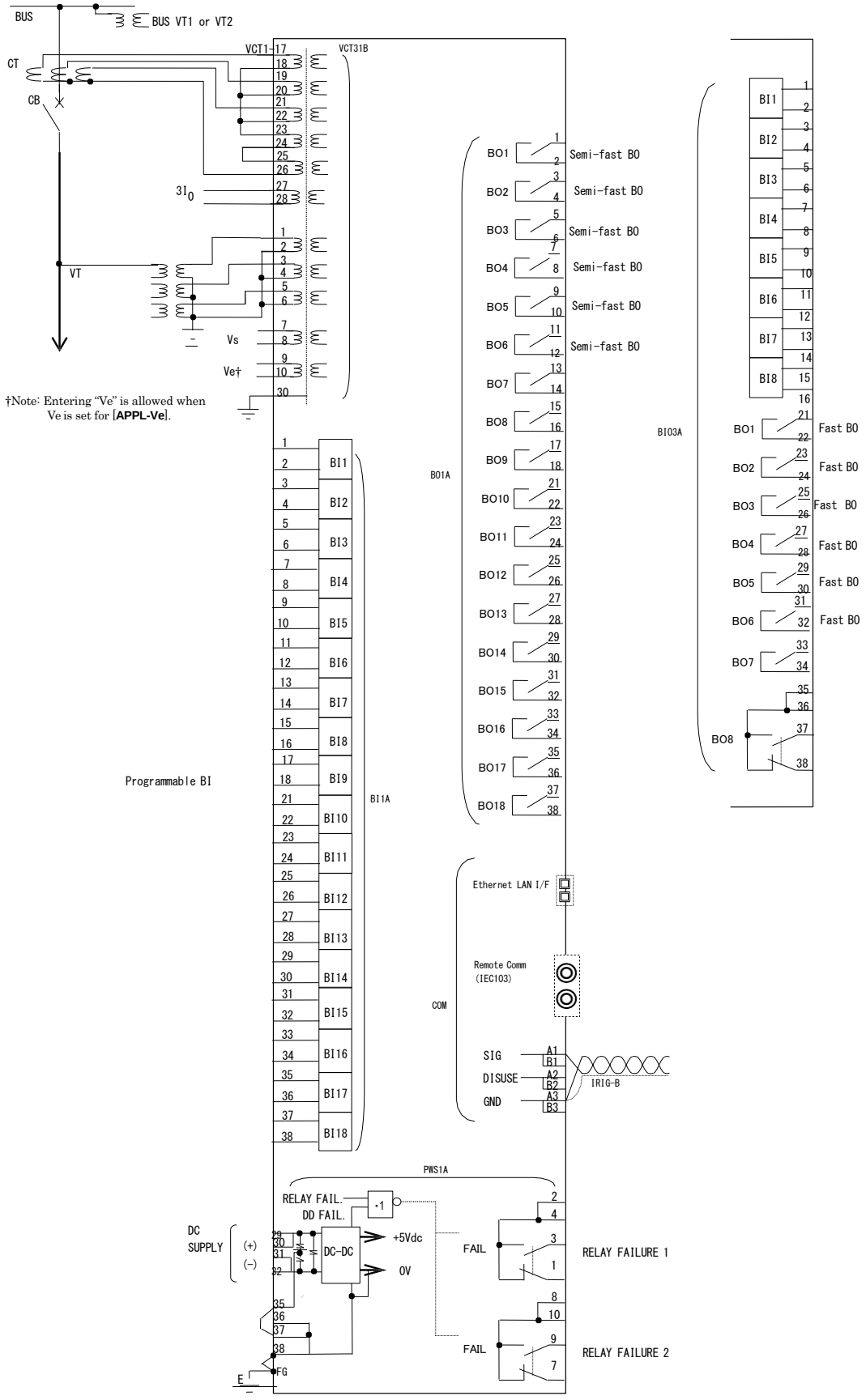


Figure 15 – Typical external connection diagram for VCT31B, IO: BI1A, BO1A

Example: GRD200-11-113-00-9T-30-110 (Current relay - Software "30" or "32")

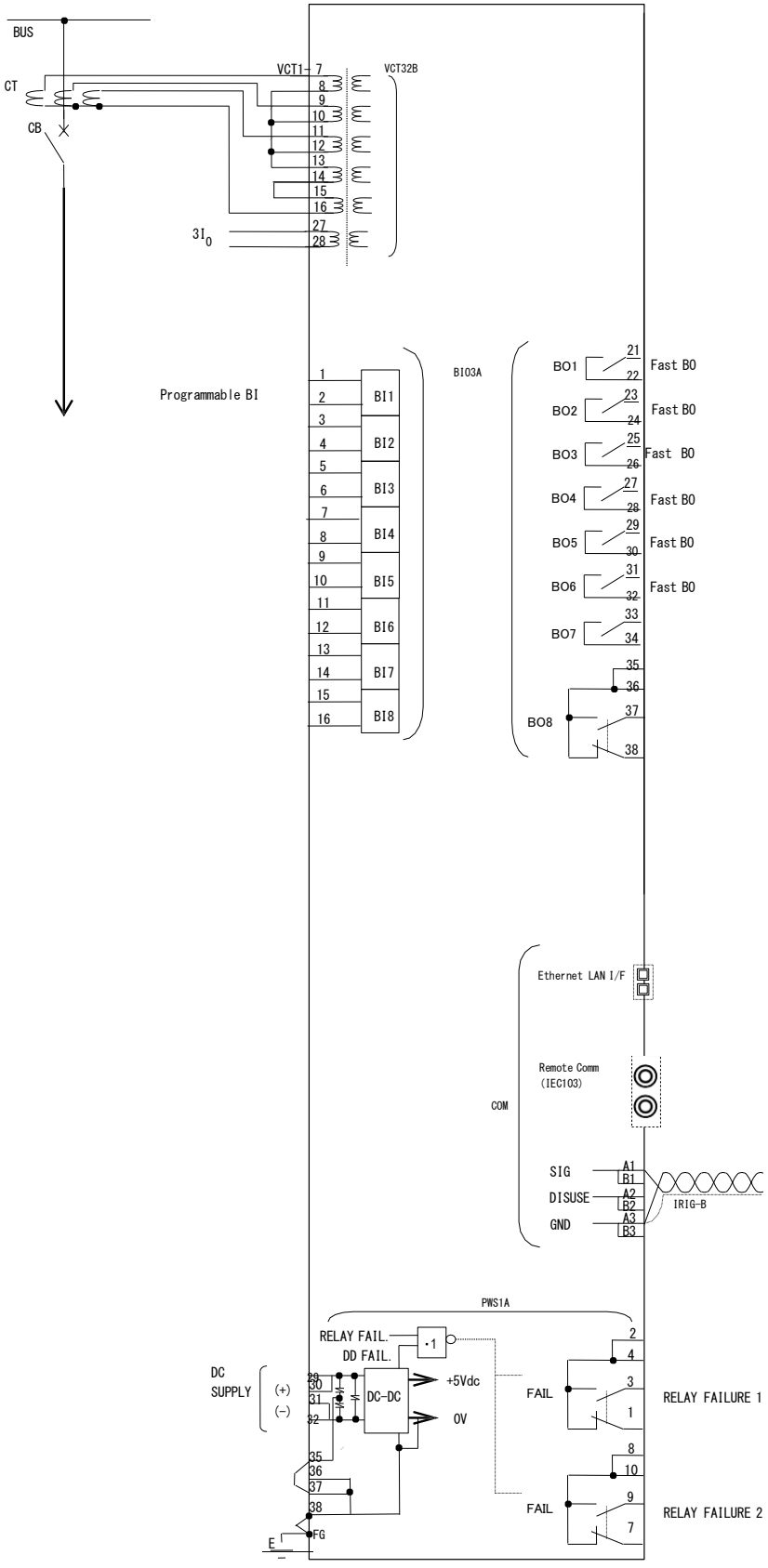


Figure 16 – Typical external connection diagram for VCT32B, IO: BIO3A

Example: GRD200-21-113-00-9T-30-110 (Reclosing relay - Software "39")

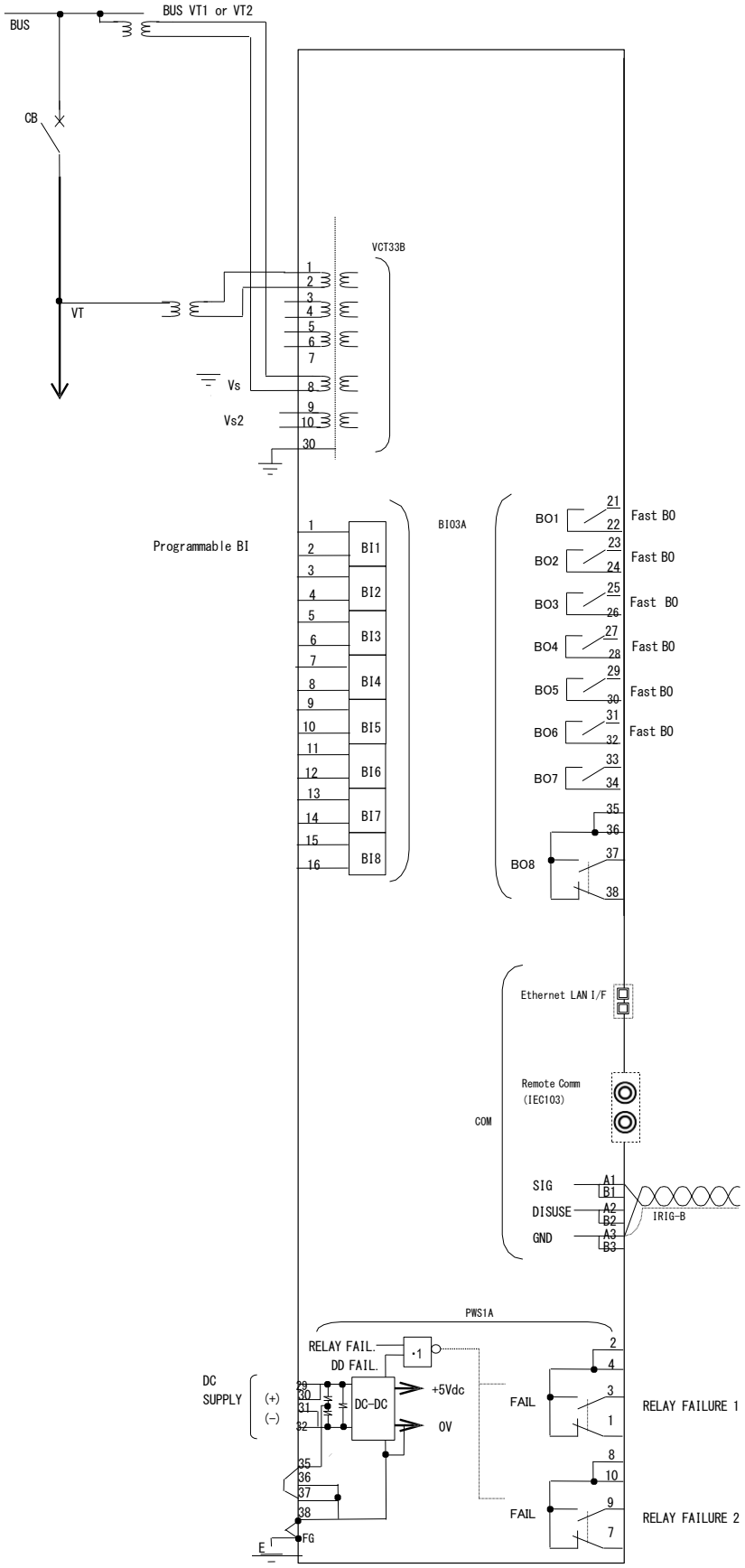


Figure 17 – Typical external connection diagram for VCT33B, IO: BIO3A

Example: GRD200-51-113-00-9T-30-110 (Current and Voltage relay - Software "3E" & "3F")

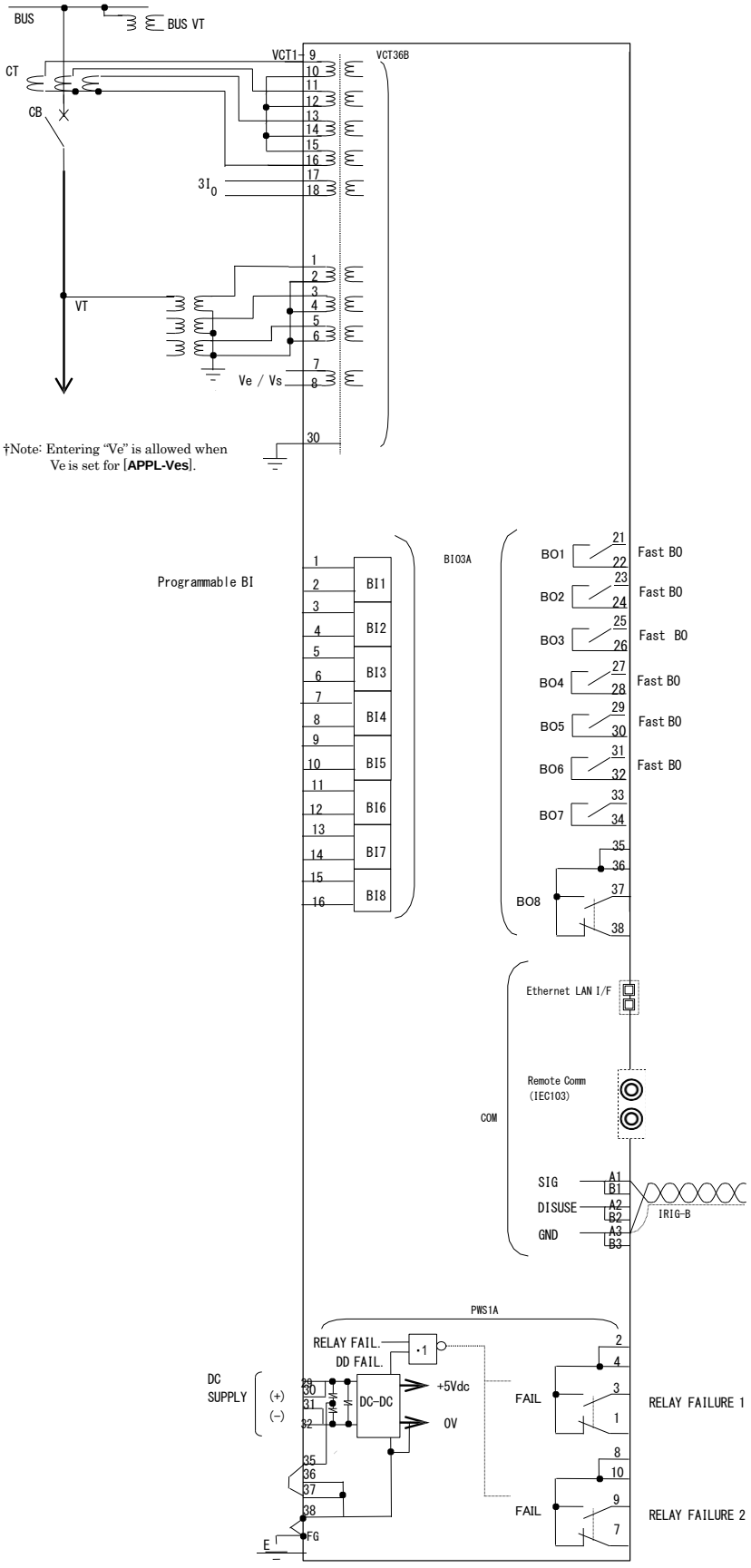


Figure 18 – Typical external connection diagram for VCT36B, IO: BIO3A

TOSHIBA

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