TOSHIBA

GR Series Relay

Numerical Relay

GRB100

BUSBAR PROTECTION

FEATURES

GRB100 is a numerical low impedance differential relay for busbar protection.

GRB100 provides the following features.

- Discriminating zone and Check zone protection
- Maximum four zones
- Percentage restraint characteristic ensures stability for external faults
- Countermeasure for CT saturation
- Available for busbar with different CT ratio
- High sensitivity, high speed operation (less than 1 cycle)
- Dynamic bus replica
- Circuit breaker failure protection
- End-fault and blind-spot protection
- Independent voltage check element (option)
- Easily extended for future feeders (Up to 32 feeders)
- Configurable binary inputs and outputs
- Programmable logic for I/O configuration, alarms, indications, recording, etc.
- Automatic self-supervision with advanced features
- Menu-driven user interfaces
- IRIG-B port for external clock
- Front panel display and keypad, RS232C port for a local PC, and RS485 or Fibre optic serial port for a remote PC
- Communication interface (IEC 60870-5-103)
- Fault records, metering, event and disturbance recording for all feeders

APPLICATION

GRB100 can be applied for various busbar systems.

- Single busbar
- Double busbar
- One and a half busbar
- Four buscoupler busbar
- Ring busbar
- Busbar with transfer bus

GRB100 has a Central Unit (CU) and Bay Unit (BU).

The CU performs the protection calculations, scheme logic processing, recording, relay setting and display. The BU is a terminal used to acquire analog data from each CT which is converted to digital data for transmission to the CU via optical cable. It also receives the trip command from the CU and performs tripping of the circuit breaker.

The CU can be provided with an optional voltage check element.

GRB100 can be applied using one BU with two channels catering for two bays or one BU per bay provided with one channel.

A system installation using one BU per bay is shown in Figure 1.

The CU and BUs are linked via fibre optic cable with connector, type GHEV4002.

System installation

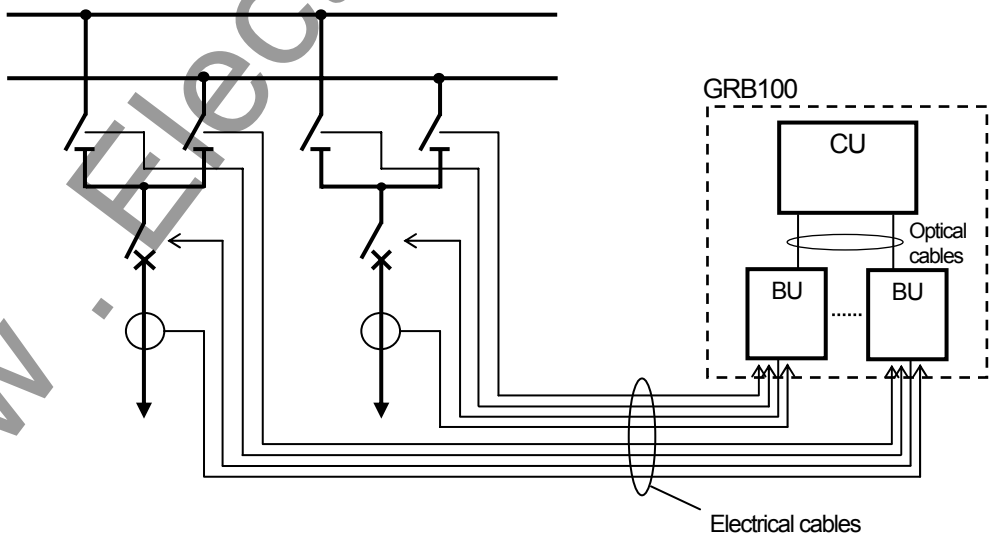


Figure 1 System Installation

GRB100 provides the following protection schemes.

- Busbar protection
- Circuit breaker failure protection
- End-fault and blind-spot protection

The busbar protection utilises two current differential elements.

a) Discriminating zone element to discriminate the faulted busbar. (four zone elements provided)

b) Check zone element covers the whole of the substation to detect faults on any busbar section.

By using these two elements, the GRB100 ensures a very reliable protection for various types of busbar system.

Figure 2 shows a typical application to a double busbar system. DIFCH is the check zone element which covers all busbars. DIFZA and DIFZB are the discriminating zone elements for busbars A and B respectively.

The voltage elements UVSFA, UVSFB, UVGFA, UVGFB, OVGFA and OVGFB can be provided for each busbar as fault detection elements (optional).

In this application, a faulted busbar section is confirmed by operation of the check zone element, a discriminating zone element and an undervoltage element.

A CT or CT secondary circuit failure will not cause a false operation.

GRB100 provides the following metering and recording functions.

- Metering
- Fault record
- Event record
- Disturbance record

GRB100 provides the following user interfaces for relay setting or viewing of stored data.

- Relay front panel (CU): LEDs, LCD display and keypad
- Local PC
- Remote PC

A local PC can be connected via the RS232C port on the front panel of the CU. A remote PC can also be connected through the RS485 or Fibre optic port at the rear of the CU.

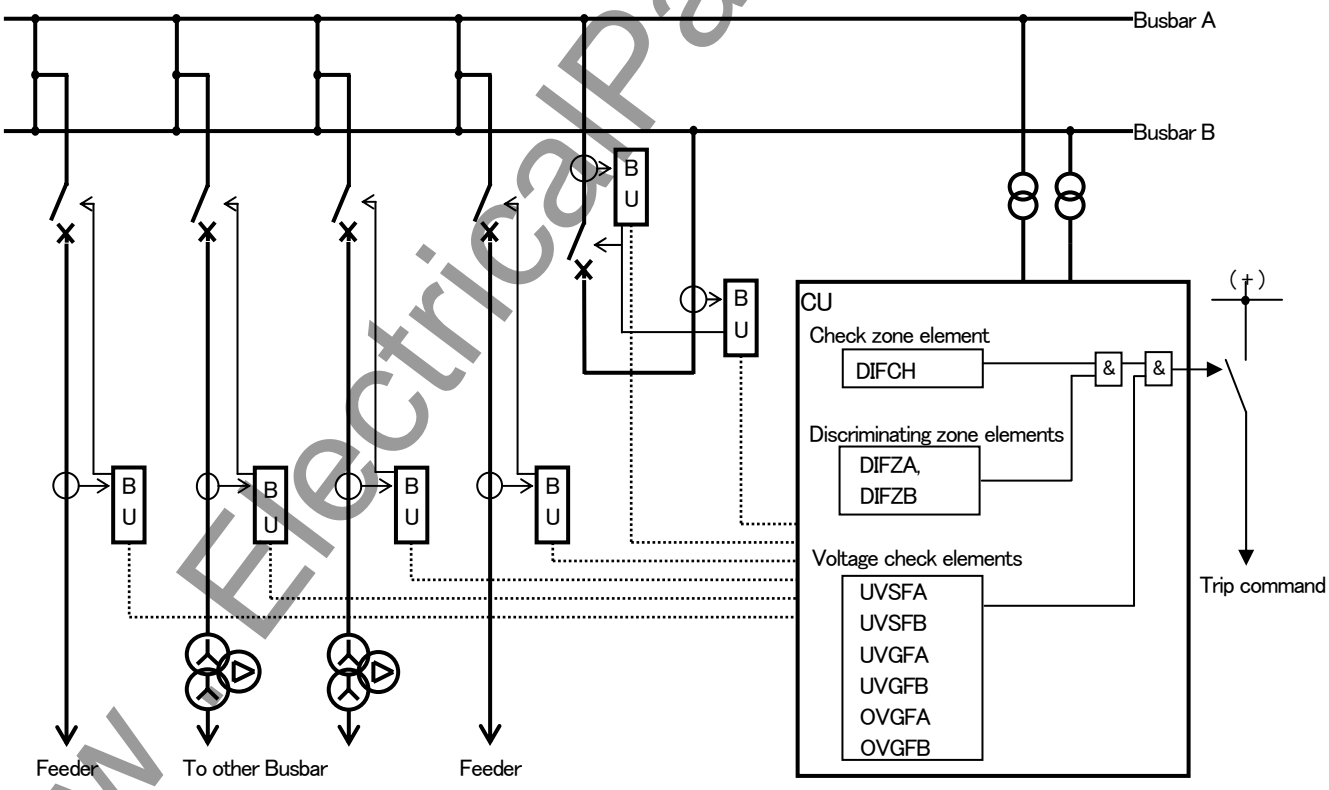


Figure 2 Application to Double Busbar System

RELAY FUNCTIONS

Discriminating Zone and Check Zone Elements

The check zone element (DIFCH) and discriminating zone elements (DIFZA - DIFZD) are based on the current differential principle and has a differential characteristic for the small current region and a percentage restraint characteristic for the large current region as shown in Figure 3.

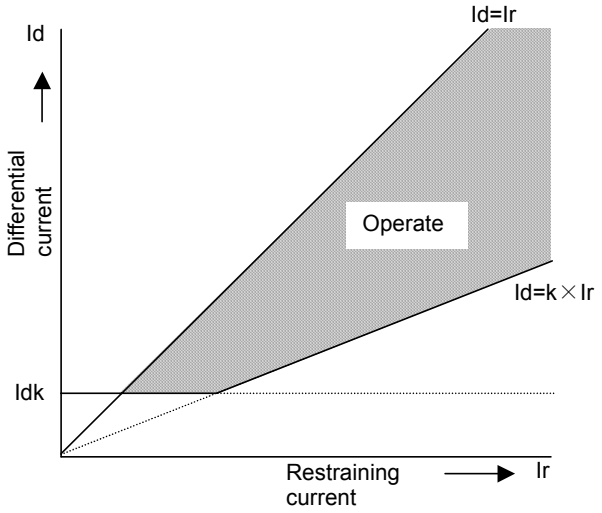


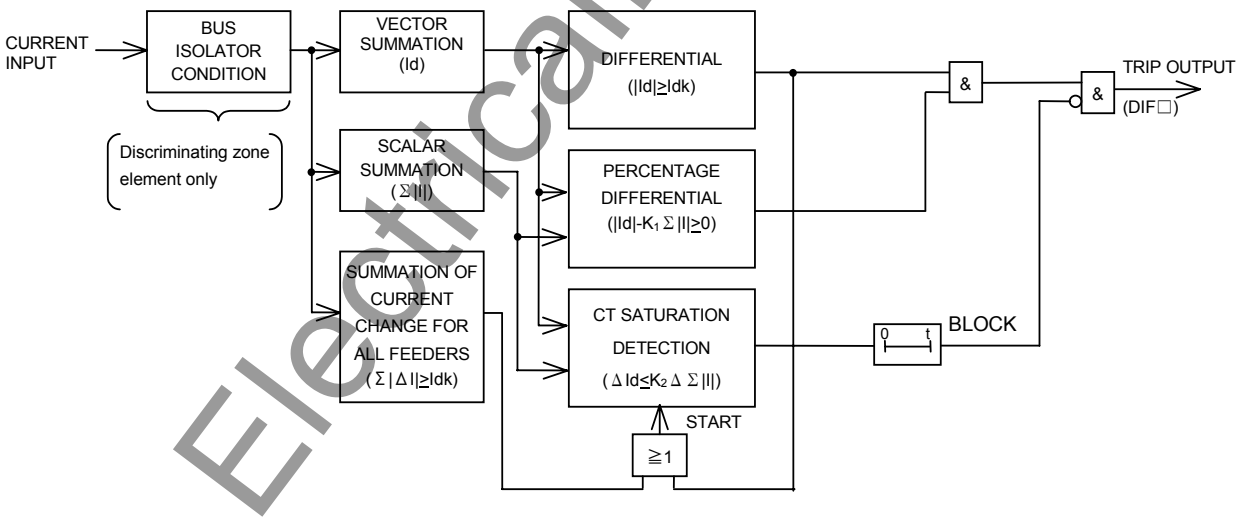
Figure 3 Characteristic of Current Differential Element

The percent slope of the restraint characteristic in the large current region is variable.

CT saturation under external fault conditions can be a serious problem for busbar protection. GRB100 overcomes the CT saturation problem by using a "CT saturation detection" function. When an external fault occurs, a very large erroneous current may be caused by CT saturation. However, once the CT saturates, there is a short period of several milliseconds of non-saturation between the saturation periods in a cycle. By detecting this non-saturation period, the current differential element can be blocked to prevent false operation arising from CT saturation.

Figure 4 shows the block diagram for the current differential element.

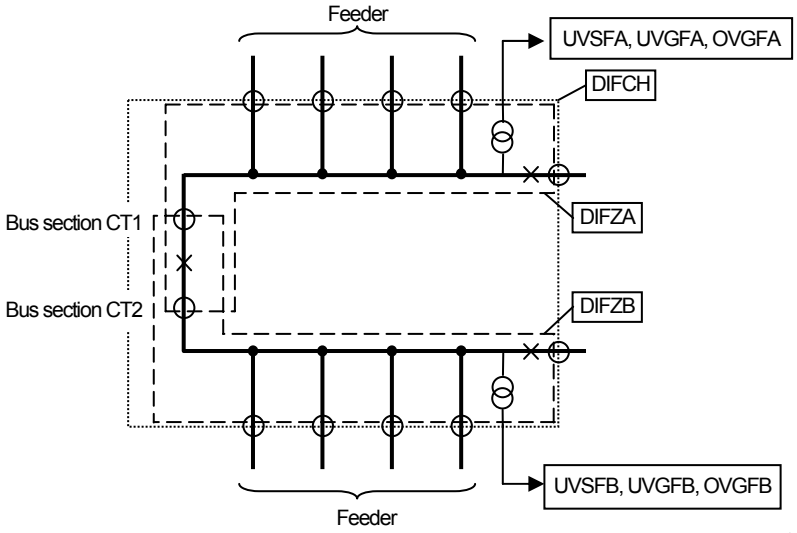
Figure 5 shows the scheme logic with check zone, discriminating zone and voltage check element for a double busbar system.



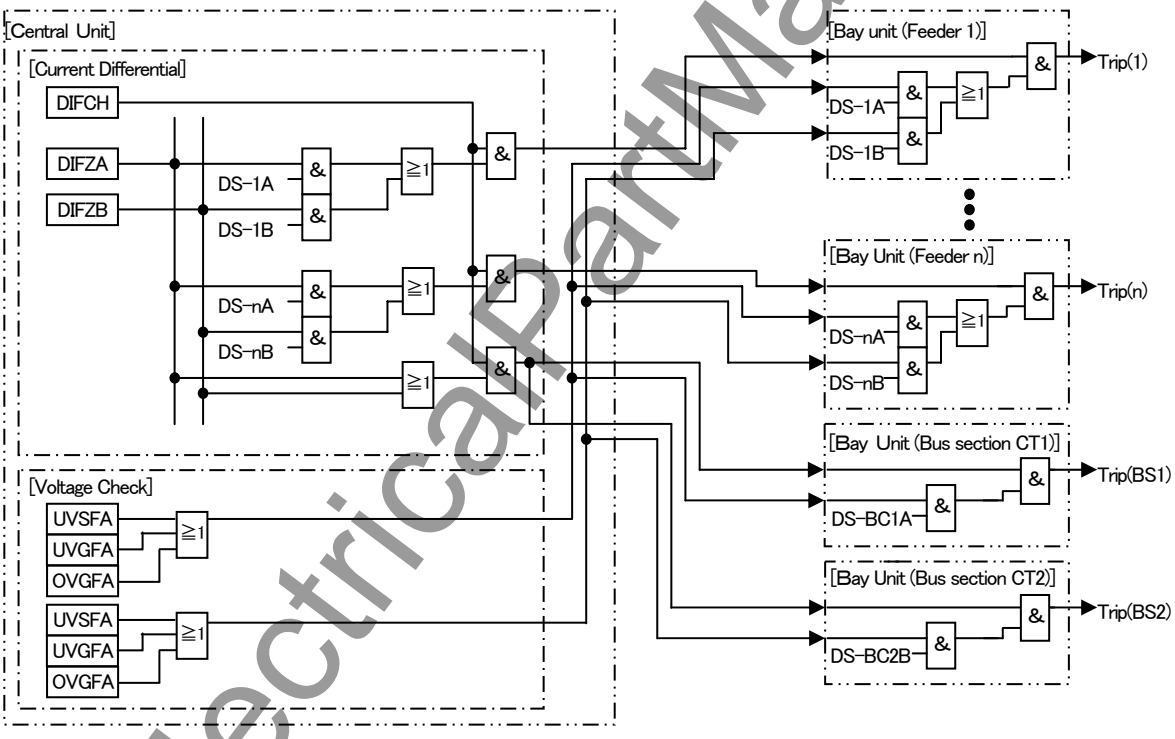
Percentage differential element : $|Id|-K_1\Sigma|I|\geq 0$
Id : Differential current
$\Sigma|I|$: Scalar summation (restraining quantity)
K_1 : Restraining factor (% slope)
K_2 : Constant
Idk : Minimum operating current
CT Saturation detection : $\Delta Id \leq K_2 \Delta\Sigma|I|$

Figure 4 Block Diagram of Current Differential Element

Busbar system



Scheme logic



DS-nA : Disconnector condition - busbar A side
DS-nB : Disconnector condition - busbar B side
DS-BS** : Disconnector condition - bus section

Trip Output

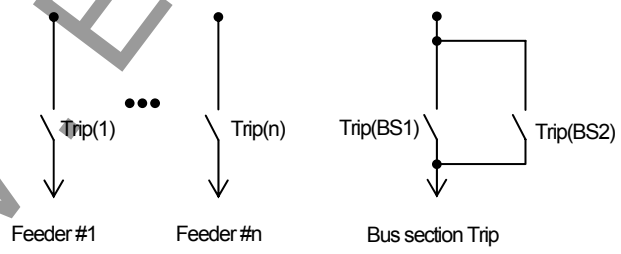


Figure 5 Scheme Logic with Check Zone, Discriminating Zone and Voltage Check

Breaker Failure Protection

Phase-segregated breaker failure protection is provided for each bay and can be initiated by either an internal or external signal.

When an overcurrent element remains in operation after a tripping signal has been issued the breaker is judged to have failed and a 2 stage CBF sequence is initiated. The first stage issues a re-trip command to the circuit breaker. If this also fails then the command to backtrip adjacent circuit breakers is excuted. The overcurrent element has a high-speed reset time.

GRB100 has two kinds of timer for Breaker Failure Protection. One timer is used for re-trip, the other timer is used for CBF trip.

A remote transfer trip is provided for feeder circuits.

End-Fault and Blind-Spot Protection

This function is provided to cater for circumstances when a dead zone or blind-spot is created between the CB and the associated CT.

End fault protection detects a fault located between the CB and the associated CT when the CB is open. Depending on the location of the CT, either the busbar section CB is tripped or an inter trip is sent to the CB at the remote end of the line.

Blind-spot protection is used to detect and trip for faults located between the bus-section CB and the associated CT for the arrangement when the CT is installed on one side of the CB only.

BU Out-of-Service Function

GRB100 provides a BU out-of-service function for maintenance purposes.

Voltage Check Function (option)

GRB100 can enhance security against false tripping due to a failure in a CT or CT secondary circuits by the provision of a voltage check element in the form of a check relay with circuits that are independent from other circuits:

The voltage check function incorporates the following elements.

- Undervoltage element for earth fault detection
- Undervoltage element for phase fault detection
- Zero-phase overvoltage element for earth fault detection
- Undervoltage change detection element for circuit breaker failure protection

Current Transformer Requirements

The GRB100 does not require the use of dedicated CTs nor the use of CTs with an identical ratio. The GRB100 can share CTs with other protections and different ratios can be adjusted by setting.

The general CT requirements are determined for through-fault stability which caters for the condition when CTs saturate for very large through-fault currents. To ensure correct operation of the GRB100 for such through-fault currents, the factor Ks for each CT is required to satisfy the following conditions:

$Ks \geqq 1$ when $Tc \leqq 200ms$ or
$Ks \geqq 2$ when $Tc \leqq 250ms$

where,

Ks = ratio of CT knee point voltage to CT secondary voltage predicted under the maximum through-fault current
$= Vk / \{(R_{CT} + R_L + R_B + R_O)(I_F max / CT\ ratio)\}$
Tc = d.c. time constant of primary circuit
Vk = knee point voltage of CT
R_{CT} = resistance of CT secondary winding
R_L = loop resistance of cable between CT and relay
R_B = ohmic load of GRB100 bay unit (i.e. 0.1 ohm for 1A rating and 0.012 ohm for 5A rating)
R_O = ohmic load of other series-connected relays (if any)
$I_F max$ = maximum through-fault current

For example, if the following parameters are given:

Vk = 800 V, CT ratio = 1200/1, R_{CT} = 5.0 ohm, R_L = 3.0 ohm, R_B = 0.1 ohm,
R_O = 0 ohm (i.e. no series-connected relays) and $I_F max$ = 40kA

Then the factor Ks is calculated as:

$Ks = 800/\{(5.0 + 3.0 + 0.1) \times (40000/1200)\}$
$= 800/270$
$= 3.0$

This shows that the GRB100 will operate correctly for all faults under the condition that the d.c. time constant of the primary circuit is less than 250ms.

METERING AND RECORDING

Metering and Monitoring

The following data is continuously available on the relay fascia LCD and at a local or remote PC.

- Currents (phase, symmetrical components)
- Differential current
- Voltages (phase, symmetrical components: option)
- Frequency (option)
- Relay element output status
- Binary input/output status

Currents, voltages and differential current can be displayed as primary or secondary values.

Event Record

Records are stored for the 480 most recent events, time-tagged to 1ms resolution. The event record is available on the relay fascia LCD and at a local or remote PC. Events recorded are as follows.

- Tripping operations
- Alarms
- Change of state of binary inputs/outputs
- Change of relay setting
- Failure detected by automatic supervision

Fault Record

A relay trip initiates fault recording. Records are stored for the 8 most recent faults, time-tagged to 1ms resolution. Fault record items are as follows.

- Date and time of trip operation
- Faulted phase
- Tripping mode
- Current and voltage data, pre-fault and post-fault (phase, symmetrical components)

Disturbance Record

The relay can record up to 108 analog signals and 128 binary signals. The disturbance recorder is initiated by operation of the current differential element or relay tripping.

In respect to analog data, the three-phase voltages of each zone and three-phase currents of each channel are recorded.

Pre-fault recording time is fixed at 300ms. Post-fault recording time can be set from 100ms to 500ms. The maximum number of records that can be stored depends upon the post-fault recording time.

Calendar and Time

A calendar and time are provided for the time-tagging of recorded data. Synchronization with the GPS (Global Positioning system) is possible using either the IRIG-B port or when using the Relay Setting and Monitoring (RSM) software with a PC connected via a rear mounted RS485 terminal.

USER INTERFACE

Relay Front Panel

A user friendly interface is provided on the relay front panel. A menu-based system provides for easy programming of relay functions and access to real-time and stored data. The front panel includes the following features:

- 40 character, 4 line LCD with back light
- 8 Light Emitting Diodes (LED) including 4 that are configurable
- Keypad
- RS232C serial port for connection of local PC
- Monitoring jacks

Figure 6 shows the central unit front panel.

Figure 6 Central Unit Front Panel

The following items are displayed on the LCD.

- Settings
- Metering
- Event record
- Fault record
- Number of disturbance record
- Failures detected by automatic supervision

Password protection can be provided from the setting menu on the LCD to provide security for relay setting changes. After the password has been set, the password must be entered to access the setting menu from a local or remote PC as well as on the LCD.

The contents of metering, fault records, and relay failures can be monitored by pressing the VIEW key. The VIEW key can be pressed without removing the relay front cover.

Arbitrary signals can be assigned to the four user configurable LEDs.

Two monitoring jacks are operable when the test mode is selected in the LCD window. An oscilloscope can be connected to the relay through these jacks. Selection of output signals on the monitoring jacks can be set from the LCD menu.

Local PC Connection

The user can communicate with the GRB100 from a local PC via the RS232C port on the central unit front panel. Using RSM100 software, the user can view and modify settings, monitor real-time metering and analyse recorded data.

Relay Setting and Monitoring (RSM)

GRB100 can be connected to the RSM system via the RS485 interface or fibre-optic port at the rear of the central unit. The user can operate the central unit from a remote PC in the same way as from a local PC.

Figure 7 shows the configuration of the RSM system via the protocol converter G1PR2 (option). The G1PR2 can be provided with maximum 8 ports and each port supports 32 relays addressing.

A maximum of 32 × 8 relays can be connected to the remote PC in multi-drop mode, via the protocol converter.

The RSM100 software is also used to communicate with the relay and to view or analyse disturbance records on the remote PC.

The data transmission rate between relays and the protocol converter is 64kbps.

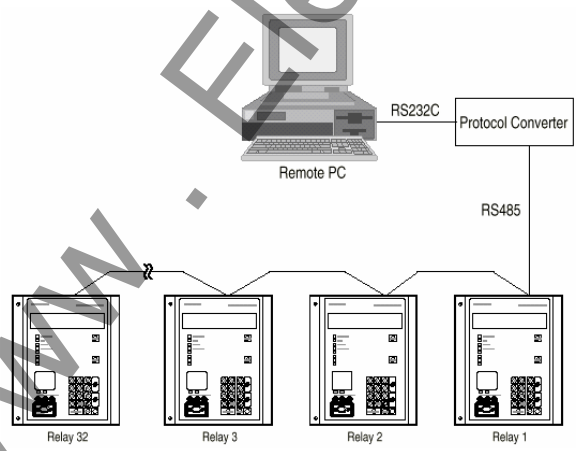


Figure 7 Relay Setting and Monitoring System

IEC60870-5-103 Communication

The relay can support the IEC60870-5-103 communication protocol. This protocol is used for communication with a substation control system and is used to transfer measurand data, status data and general commands between the relay and the control system.

Relay Setting

The user can modify relay settings using either the front panel keyboard or the RSM100 software from a local or remote PC.

Password protection is available for added security.

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

Using the RSM100 software, the user can create a settings file on a PC (without being connected to a relay), and store the file ready for download to a relay at a later date.

Configurable Binary Output Contacts

GRB100 is provided with user configurable binary output contacts used for indication and alarm. The number of outputs varies according to the relay model.

Configurable Binary Inputs

GRB100 is provided with user configurable binary inputs. The number of inputs varies according to the relay model.

The binary input circuits are provided with a logic level inversion function.

PLC Function

GRB100 is provided with a PLC (Programmable Logic Control) function allowing user-configurable sequence logic on binary signals. Configurable binary inputs, binary outputs and LEDs are programmed using the PLC function. The PLC data produced using the PLC tool software can be downloaded and uploaded to GRB100 via the PC communication port (RS232C).

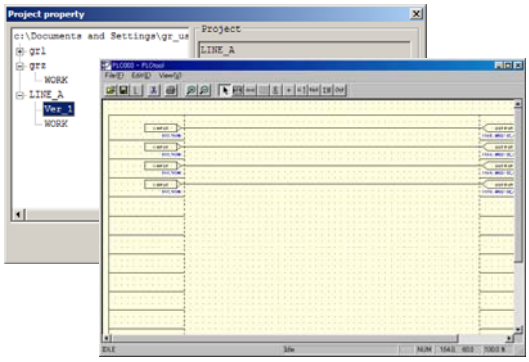


Figure 8 PC Display of PLC Tool

AUTOMATIC MONITORING

Automatic Self-Supervision

The self-supervision function will detect failures, should they occur, that might cause unwanted operation. The items monitored include the following:

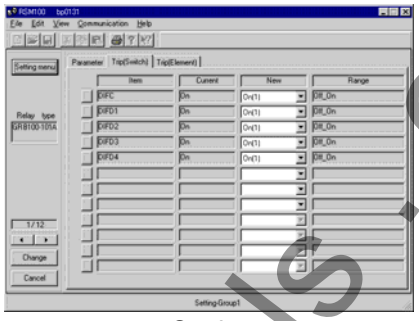
- Disconnector circuits
- CT circuits
- Analog input circuits
- Analog-to-digital converter
- Watchdog Timer
- DC power supply circuits
- Communication circuit to bay units
- CPU

Alarm

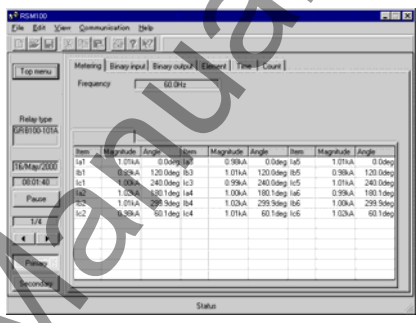
In the unlikely event that a relay failure should occur, this is detected by automatic monitoring and the LED ALARM on the relay fascia is illuminated. A binary “RELAY FAILURE” output is simultaneously operated and the date/time of any such failure would be stored in the event record.

PC DISPLAY

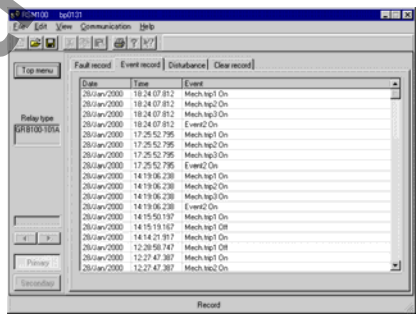
RSM100 provides the following screens.



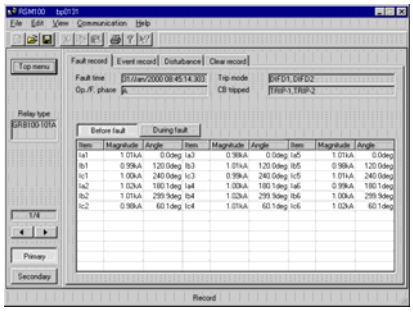
Setting



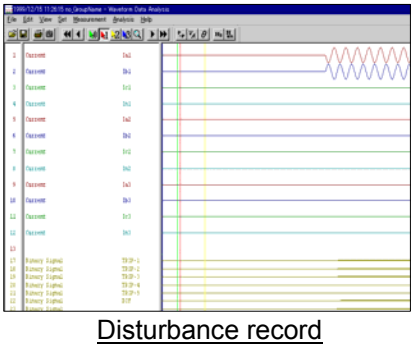
Metering



Event record



Fault record



Disturbance record

TECHNICAL DATA

GRB100:

Ratings	
AC current I_n:	1A or 5A
AC voltage V_n:	100V, 110V, 115V, 120V
Frequency:	50Hz or 60Hz
DC power supply:	110Vdc/125Vdc (Operative range: 88 - 150Vdc), 220Vdc/250Vdc (Operative range: 176 - 300Vdc), 48Vdc/54Vdc/60Vdc (Operative range: 38.4 - 72Vdc)
AC ripple on DC supply IEC60255-11	maximum 12%
DC supply interruption IEC60255-11 Permissive duration of DC supply voltage interruption to maintain normal operation: Restart time:	 less than 50ms at 110V less than 10s
Binary input circuit DC voltage	110Vdc/125Vdc, 220Vdc/250Vdc, 48Vdc/54Vdc/60Vdc
Overload Ratings	
AC current input	4 times rated continuous 100 times rated for 1s
AC voltage input	2 times rated continuous 2.5 times rated for 1s
Burden	
Central unit (CU): AC voltage circuit: DC power supply:	 0.1VA (at rated voltage) less than 50W (quiescent)
Bay unit (BU): AC current circuit: DC power supply: 1 BU per 1bay: 1 BU per 2 bays: Binary input circuit:	 0.3VA per phase (at rated 5A) 0.1VA per phase (at rated 1A) less than 8W (quiescent) less than 12W (operating) less than 8W (quiescent) less than 17W (operating) ≤ 0.5W/input at 110Vdc
Current Differential Protection	
Minimum operating current (DIFCH, DIFZ):	500 to 3000A in 1A steps (CT primary amps)
% slope (SLPCH, SLPZ):	0.30 to 0.90 in 0.1 steps
Primary rating of CT:	100 to 10000A in 1A steps
Operating Time and Accuracy of Current Differential Element	
Typical operating time:	Typical 1 cycle
Accuracy:	±5% (±7% at I < 0.3×In)
Breaker Failure (BF) Protection	
Overcurrent element (OCB):	0.1 to 2.0 times of current rating in 0.1 steps
BF timer for retrip of failed breaker:	0 to 500ms in 1ms steps
BF timer for related breaker trip:	50 to 500ms in 1ms steps
Operating time of overcurrent element	less than 20ms at 50Hz or less than 17ms at 60Hz
Resetting time of overcurrent element	less than 15ms at 50Hz or less than 13ms at 60Hz
Accuracy of overcurrent element:	±5% (±10% at I < 0.5×In)
DO/PU ratio:	0.8
Voltage Check Function	
Undervoltage element (UVGF):	20 to 60V in 1V steps
Undervoltage element (UVSF):	60 to 100V in 1V steps
Zero-phase overvoltage element (OVGF):	0.1 to 10.0V in 0.1V steps
Undervoltage change detection element (UVDF)	0.07 times voltage before fault
Disturbance Record Initiation	
Overcurrent element:	0.1 to 10.0 times of current rating in 0.1 steps

CU to BU communication	
Type:	Fibre optics
Connector:	GHEV4002
Cable with connector and length	Specify the length when ordering.
Communication Port of Central Unit for RSM or IEC60870-5-103	
RS485 I/F:	
Transmission data rate for RSM system	64kbps
Connection	Multidrop mode (max. 32 relays)
Connector	Screw terminals
Cable and length	Twisted pair cable, max. 1200m
Isolation	2kVac for 1min.
Fibre optic I/F:	ST connector, graded-index multi-mode 50/125μm or 62.5/125μm type optical fibres
IRIG-B Port on Central Unit	
Connection	BNC connector
Input voltage	4Vp-p to 16Vp-p
Cable type	50 ohm coaxial cable
Binary Inputs	
Operating voltage	Typical 74Vdc(min.70Vdc) for 110V/125Vdc rating Typical 138Vdc(min.125Vdc) for 220V/250Vdc rating Typical 31Vdc(min.28Vdc) for 48V/54V/60Vdc rating
Contact Ratings	
Trip contacts (heavy duty contacts)	
Make and carry	5A continuously, 30A, 290Vdc for 0.5s (L/R=10ms)
Break	0.15A, 290Vdc (L/R=40ms)
Auxiliary contacts	
Make and carry	4A continuously, 10A, 220Vdc for 0.5s (L/R≧5ms)
Break	0.1A, 220Vdc (L/R=40ms)
Mechanical design	
Weight	
Central Unit	11kg
Bay Unit	9.5kg
Case colour	Munsell No. 10YR8/0.5
Installation	Flush mounting or rack mounting

ENVIRONMENTAL PERFORMANCE CLAIMS

Test	Standards	Details
Atmospheric Environment		
Temperature	IEC60068-2-1/2	Operating range: -10°C to +55°C. Storage / Transit: -25°C to +70°C.
Humidity	IEC60068-2-78	56 days at 40°C and 93% relative humidity.
Enclosure Protection	IEC60529	IP51 (Rear: IP20)
Mechanical Environment		
Vibration	IEC60255-21-1	Response - Class 1 Endurance - Class 1
Shock and Bump	IEC60255-21-2	Shock Response Class 1 Shock Withstand Class 1 Bump Class 1
Seismic	IEC60255-21-3	Class 1
Electrical Environment		
Dielectric Withstand	IEC60255-5	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	IEC60255-5	Three positive and three negative impulses of 5kV(peak), 1.2/50μs, 0.5J between all terminals and between all terminals and earth.
Electromagnetic Environment		
High Frequency Disturbance / Damped Oscillatory Wave	IEC60255-22-1 Class 3, IEC61000-4-12 / EN61000-4-12	1MHz 2.5kV applied to all ports in common mode. 1MHz 1.0kV applied to all ports in differential mode.
Electrostatic Discharge	IEC60255-22-2 Class 3, IEC61000-4-2 / EN61000-4-2	6kV contact discharge, 8kV air discharge.
Radiated RF Electromagnetic Disturbance	IEC60255-22-3 Class 3, IEC61000-4-3 / EN61000-4-3	Field strength 10V/m for frequency sweeps of 80MHz to 1GHz and 1.7GHz to 2.2GHz. Additional spot tests at 80, 160, 450, 900 and 1890MHz.
Fast Transient Disturbance	IEC60255-22-4, IEC61000-4-4 / EN61000-4-4	4kV, 2.5kHz, 5/50ns applied to all inputs.
Surge Immunity	IEC60255-22-5, IEC61000-4-5 / EN61000-4-5	1.2/50μs surge in common/differential modes: HV ports: 2kV/1kV (peak) PSU and I/O ports: 2kV/1kV (peak) RS485 port: 1kV (peak)
Conducted RF Electromagnetic Disturbance	IEC60255-22-6 Class 3, IEC61000-4-6 / EN61000-4-6	10Vrms applied over frequency range 150kHz to 100MHz. Additional spot tests at 27 and 68MHz.
Power Frequency Disturbance	IEC60255-22-7, IEC61000-4-16 / EN61000-4-16	300V 50Hz for 10s applied to ports in common mode. 150V 50Hz for 10s applied to ports in differential mode. Not applicable to AC inputs.
Conducted and Radiated Emissions	IEC60255-25, EN55022 Class A, IEC61000-6-4 / EN61000-6-4	Conducted emissions: 0.15 to 0.50MHz: <79dB (peak) or <66dB (mean) 0.50 to 30MHz: <73dB (peak) or <60dB (mean) Radiated emissions (at 30m): 30 to 230MHz: <30dB 230 to 1000MHz: <37dB
CE	89/336/EEC	Compliance with the European Commission Electromagnetic Compatibility Directive is demonstrated according to EN 61000-6-2 and EN 61000-6-4.
	73/23/EEC	Compliance with the European Commission Low Voltage Directive is demonstrated according to EN 50178 and EN 60255-5.

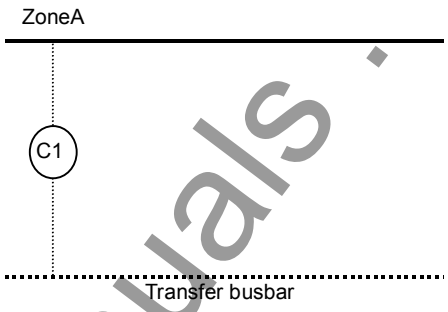
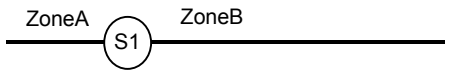
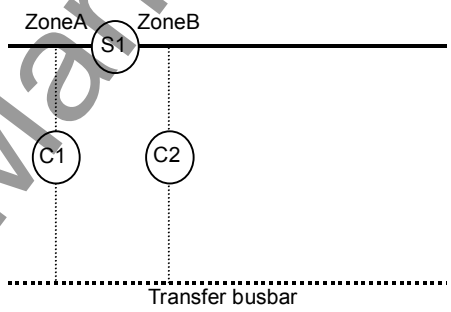
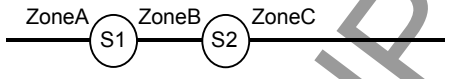
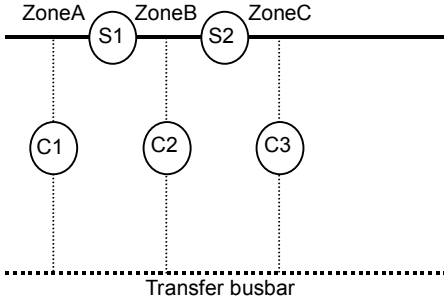
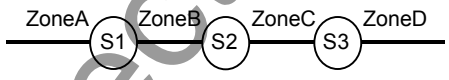
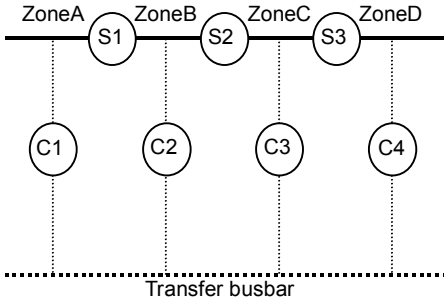
Protocol Converter G1PR2 (Option):

Ratings			
Power supply:	110Vdc/100Vac	Operative range:	88 - 150Vdc of 110Vdc rated voltage 80 - 120Vac of 100Vac rated voltage
	220Vdc/200Vac	Operative range:	170 - 300Vdc of 220Vdc rated voltage 200 - 240Vac of 200Vac rated voltage
	48Vdc	Operative range:	38.4 - 72Vdc
Burden:	less than 20W		
Communication port			
RS232C interface			
Connector type	RS232C 9-pin D-subminiature connector female		
Cable type	Multi-core (straight)		
RS485 interface			
Connector	Screw terminals (Phoenix Contact, FRONT type)		
Cable type	Twisted pair cable		
Optical interface			
Operative Range:	less than 1.2km with 62.5/125μm GI fibre (3dB/km)		
Wavelength:	820nm		
Connector type:	ST		
Fibre type:	62.5/125μm glass fibre		
IRIG-B			
Input voltage	4Vp-p to 16Vp-p		
Connector	Screw terminals (Phoenix Contact, FRONT-MSTB type)		
Mechanical design			
Weight	5 kg		
Installation	Flush mounting		

ENVIRONMENTAL PERFORMANCE CLAIMS FOR G1PR2

Test	Standards	Details
Atmospheric Environment		
Temperature	IEC60068-2-1/2	Operating range: -10°C to +55°C. Storage / Transit: -25°C to +70°C.
Humidity	IEC60068-2-78	56 days at 40°C and 93% relative humidity.
Enclosure Protection	IEC60529	IP20
Mechanical Environment		
Vibration	IEC60255-21-1	Response - Class 1 Endurance - Class 1
Shock and Bump	IEC60255-21-2	Shock Response Class 1 Shock Withstand Class 1 Bump Class 1
Seismic	IEC60255-21-3	Class 1
Electrical Environment		
Dielectric Withstand	IEC60255-5	2kVrms for 1 minute between PSU terminals and earth. 2kVrms for 1 minute between contact terminals and earth.
High Voltage Impulse	IEC60255-5	Three positive and three negative impulses of 5kV(peak), 1.2/50μs, 0.5J between PSU terminals and earth.
Electromagnetic Environment		
High Frequency Disturbance / Damped Oscillatory Wave	IEC60255-22-1 Class 3, IEC61000-4-12 / EN61000-4-12	1MHz 2.5kV applied to all ports in common mode. 1MHz 1.0kV applied to all ports in differential mode.
Electrostatic Discharge	IEC60255-22-2 Class 3, IEC61000-4-2 / EN61000-4-2	6kV contact discharge, 8kV air discharge.
Radiated RF Electromagnetic Disturbance	IEC60255-22-3 Class 3, IEC61000-4-3 / EN61000-4-3	Field strength 10V/m for frequency sweeps of 80MHz to 1GHz and 1.7GHz to 2.2GHz. Additional spot tests at 80, 160, 450, 900 and 1890MHz.
Fast Transient Disturbance	IEC60255-22-4, IEC61000-4-4 / EN61000-4-4	4kV, 2.5kHz, 5/50ns applied to all inputs.
Surge Immunity	IEC60255-22-5, IEC61000-4-5 / EN61000-4-5	1.2/50μs surge in common/differential modes: PSU and I/O ports: 2kV/1kV (peak) RS485 port: 1kV (peak)
Conducted RF Electromagnetic Disturbance	IEC60255-22-6 Class 3, IEC61000-4-6 / EN61000-4-6	10Vrms applied over frequency range 150kHz to 100MHz. Additional spot tests at 27 and 68MHz.
Power Frequency Disturbance	IEC60255-22-7, IEC61000-4-16 / EN61000-4-16	300V 50Hz for 10s applied to ports in common mode. 150V 50Hz for 10s applied to ports in differential mode. Not applicable to AC inputs.
Conducted and Radiated Emissions	IEC60255-25, EN55022 Class A, IEC61000-6-4 / EN61000-6-4	Conducted emissions: 0.15 to 0.50MHz: <79dB (peak) or <66dB (mean) 0.50 to 30MHz: <73dB (peak) or <60dB (mean) Radiated emissions (at 30m): 30 to 230MHz: <30dB 230 to 1000MHz: <37dB
CE	89/336/EEC	Compliance with the European Commission Electromagnetic Compatibility Directive is demonstrated according to EN 61000-6-2 and EN 61000-6-4.
	73/23/EEC	Compliance with the European Commission Low Voltage Directive is demonstrated according to EN 50178 and EN 60255-5.

■ Applicable busbar configuration

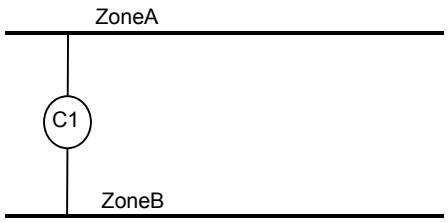
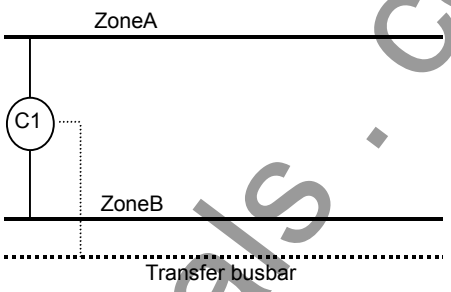
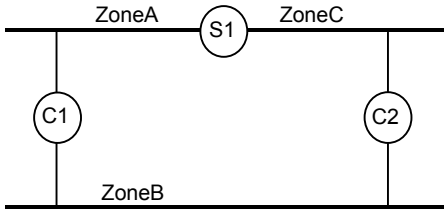
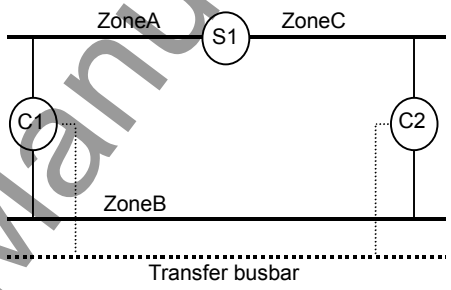
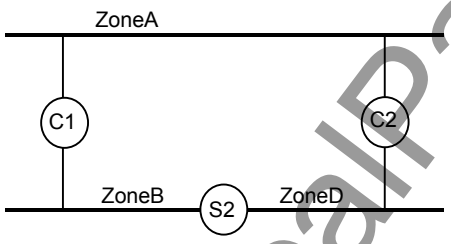
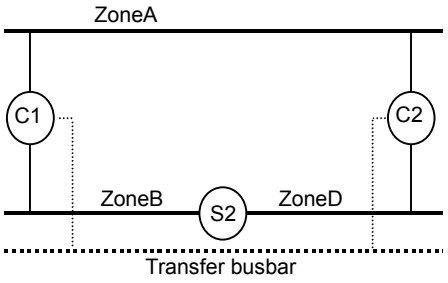
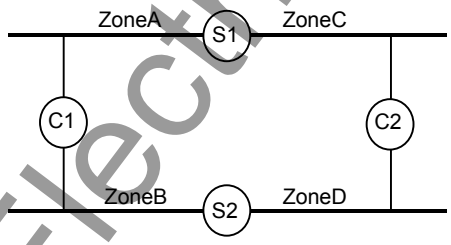
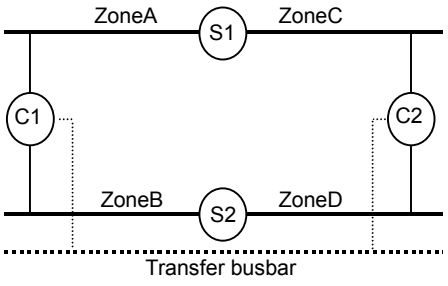
Model No.	Single-busbar	Single-busbar with a transfer busbar
1		
2		
3		
4		

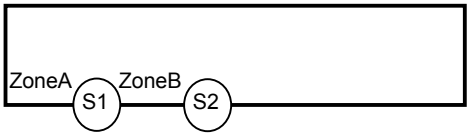
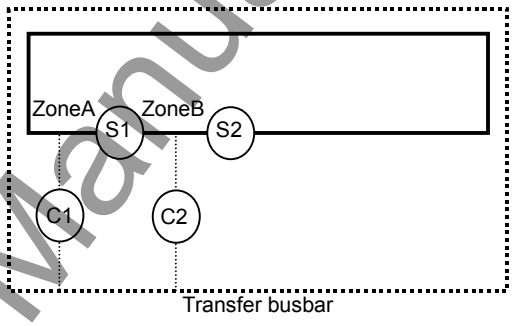
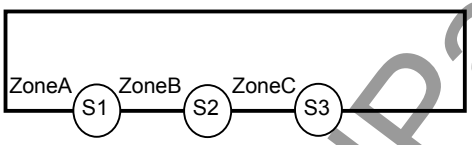
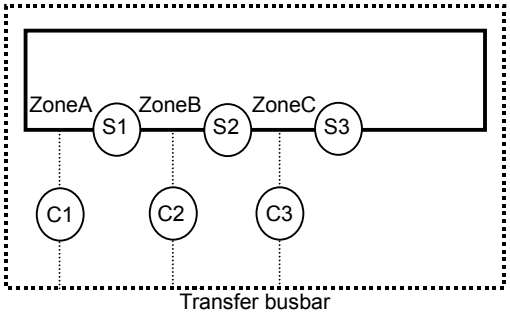
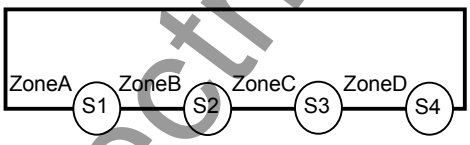
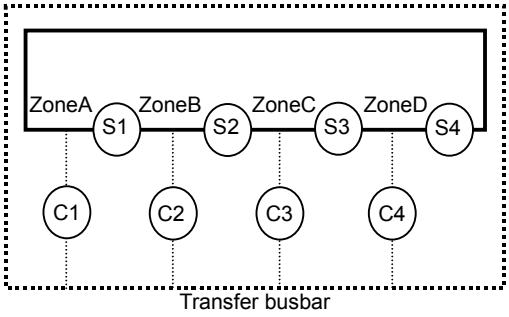
Note: Symbols display the following circuits.

(S1) - (S4) : Bus-section

(C1) - (C4) : Bus-coupler

Feeder circuits are omitted in the figure.

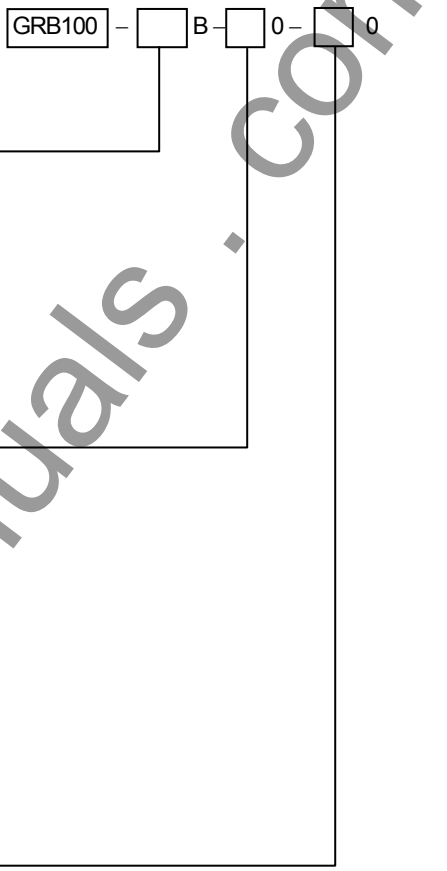
Model No.	Double-busbar (including to double as a transfer busbar)	Double-busbar with a transfer bus
1		
2		
3		
4		

Model No.	Ring-busbar	Ring-busbar with a transfer busbar
1		
2		
3		
4		

ORDERING

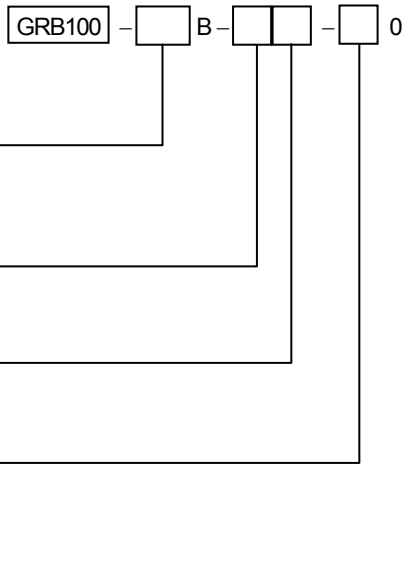
1. One BU provided with one channel:

(1) Central Unit (CU)



Relay type:	
Busbar protection relay	GRB100
CU Model:	
-Model C310: max. 8 channels	C310
-Model C320: max. 16 channels	C320
-Model C330: max. 24 channels	C330
-Model C340: max. 32 channels	C340
-Model C410: max. 8 channels / With voltage inputs	C410
-Model C420: max.16 channels / With voltage inputs	C420
-Model C430: max.24 channels / With voltage inputs	C430
-Model C440: max.32 channels / With voltage inputs	C440
Ratings:	
1A, 50Hz, 110V/125Vdc	1
1A, 60Hz, 110V/125Vdc	2
5A, 50Hz, 110V/125Vdc	3
5A, 60Hz, 110V/125Vdc	4
1A, 50Hz, 220V/250Vdc	5
1A, 60Hz, 220V/250Vdc	6
5A, 50Hz, 220V/250Vdc	7
5A, 60Hz, 220V/250Vdc	8
1A, 50Hz, 48V/54V/60Vdc	A
1A, 60Hz, 48V/54V/60Vdc	B
5A, 50Hz, 48V/54V/60Vdc	C
5A, 60Hz, 48V/54V/60Vdc	D
Communications for RSM or IEC60870-5-103:	
RS485	1
Fibre Optic	2
Dual RS485	3
Dual Fibre Optic	4

(2) Bay Unit (BU)



Relay type:	
Busbar protection relay	GRB100
BU Model:	
- Model B300: 1 channel provided. (2 heavy duty contacts)	B300
- Model B310: 1 channel provided. (6 heavy duty contacts)	B310
CT rating:	
1A	1
5A	2
Frequency:	
50Hz	1
60Hz	2
DC power supply rating:	
110V/125Vdc	1
220V/250Vdc	2
48V/54V/60Vdc	3

Note:

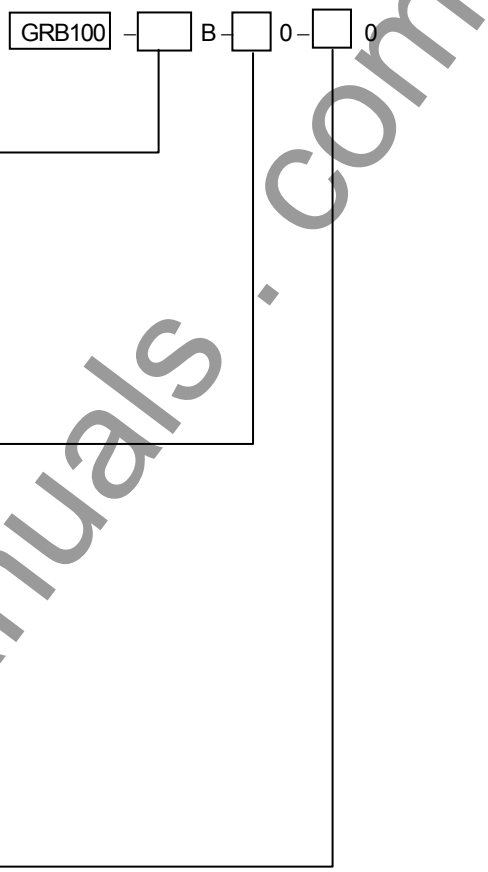
Please inform us which is ordered panel surface mount type or 19-inch rack mount type.

In 19 inch rack mount type, please order attachment kit.

- for BU: attachment kit: EP-101, EP-103(used for linking two units together)
- for CU: attachment kit: EP-102

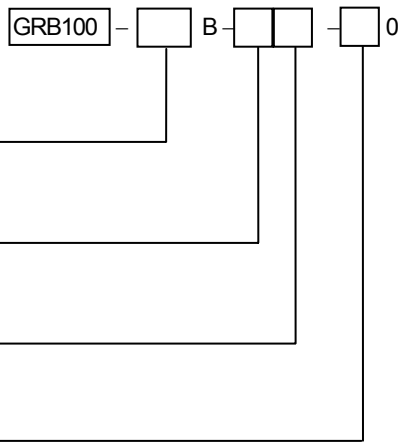
2. One BU provided with two channels:

(1) Central Unit (CU)



Relay type:	
Busbar protection relay	GRB100
CU Model:	
-Model C110: max. 8 channels	C110
-Model C120: max. 16 channels	C120
-Model C130: max. 24 channels	C130
-Model C140: max. 32 channels	C140
-Model C210: max. 8 channels / With voltage inputs	C210
-Model C220: max.16 channels / With voltage inputs	C220
-Model C230: max.24 channels / With voltage inputs	C230
-Model C240: max.32 channels / With voltage inputs	C240
Ratings:	
1A, 50Hz, 110V/125Vdc	1
1A, 60Hz, 110V/125Vdc	2
5A, 50Hz, 110V/125Vdc	3
5A, 60Hz, 110V/125Vdc	4
1A, 50Hz, 220V/250Vdc	5
1A, 60Hz, 220V/250Vdc	6
5A, 50Hz, 220V/250Vdc	7
5A, 60Hz, 220V/250Vdc	8
1A, 50Hz, 48V/54V/60Vdc	A
1A, 60Hz, 48V/54V/60Vdc	B
5A, 50Hz, 48V/54V/60Vdc	C
5A, 60Hz, 48V/54V/60Vdc	D
Communications for RSM or IEC60870-5-103:	
RS485	1
Fibre Optic	2
Dual RS485	3
Dual Fibre Optic	4

(2) Bay Unit (BU)



Relay type:	
Busbar protection relay	GRB100
BU Model:	
-Model B100: 2 channels provided. (2 heavy duty contacts / channel)	B100
-Model B110: 2 channels provided. (6 heavy duty contacts / channel)	B110
CT rating:	
1A	1
5A	2
Frequency:	
50Hz	1
60Hz	2
DC power supply rating:	
110V/125Vdc	1
220V/250Vdc	2
48V/54V/60Vdc	3

Note: Please inform us which is ordered panel surface mount type or 19-inch rack mount type.
In 19 inch rack mount type, please order attachment kit.
- for BU: attachment kit: EP-101, EP-103(used for linking two units together)
- for CU: attachment kit: EP-102

3. Optical cable with connector for connection between CU and BUs (Option)

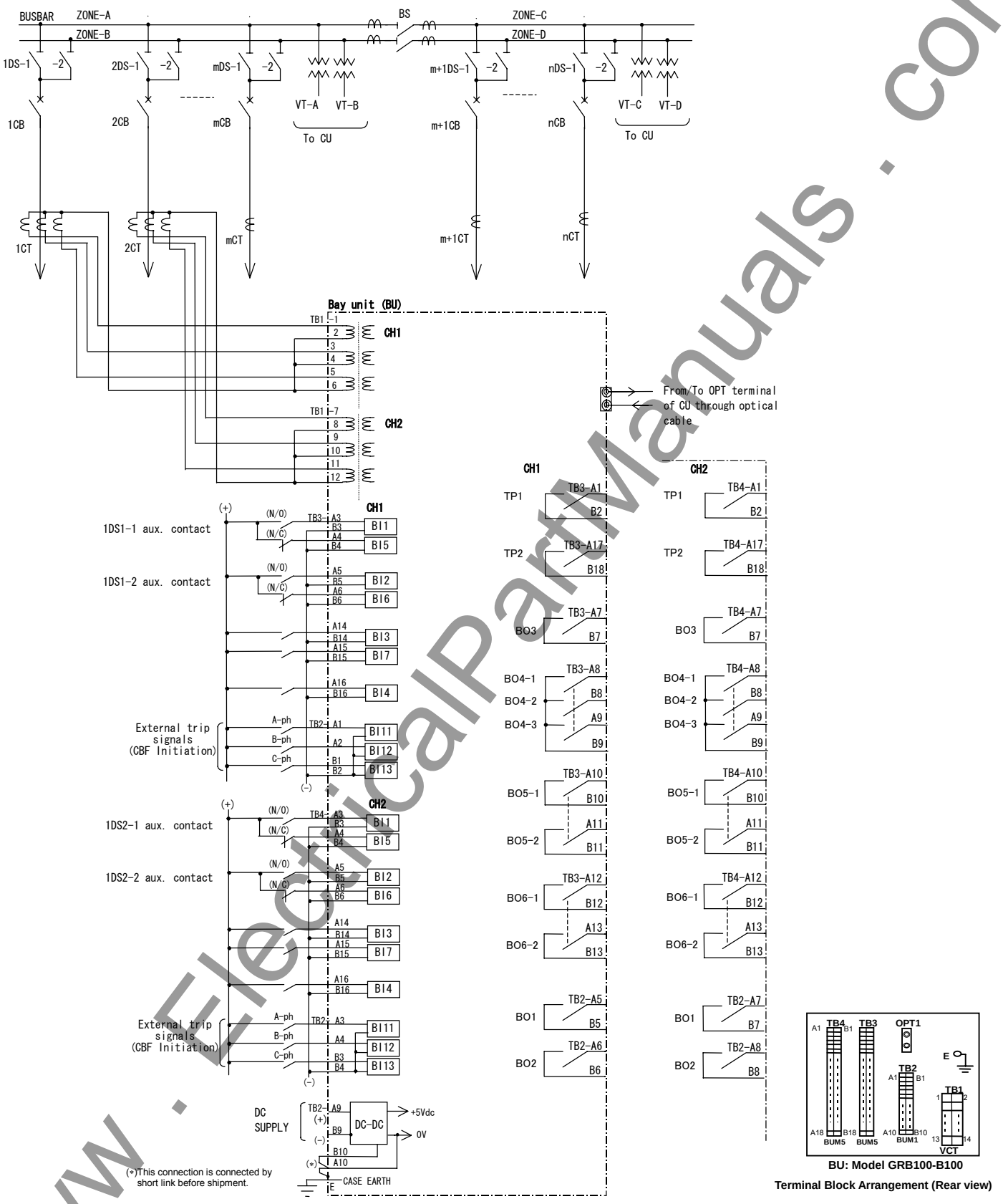
Please inform us of the number and length of optical cables. The following length of optical cable are available.

- 1 to 8m in 1m steps

3. Protocol Converter (Option)

Type:	
Protocol converter	G1PR2
Model:	
1 port, Electrical signal (RS485)	101
4 ports, Electrical signal (RS485)	104
8 ports, Electrical signal (RS485)	108
8 ports, Electrical signal (RS485): Max. 8, Optical signal: Max. 1	118
8 ports, Electrical signal (RS485): Max. 8, Optical signal: Max. 4	148
8 ports, Electrical signal (RS485): Max. 4, Optical signal: Max. 8	184
1 port, Electrical signal (RS485) or Optical signal	111
1 port, Optical signal	110
4 ports, Optical signal	140
8 ports, Optical signal	180
Auxiliary power supply rating:	
DC 110V / AC 100V	10
DC 220V / AC 200V	50
DC 48V	A0
External time synchronisation:	
None.	00
IRIG-B port	10

EXTERNAL CONNECTION DIAGRAM



BU: Model GRB100-B100

Terminal Block Arrangement (Rear view)

Figure 10 Typical External Connections for GRB100-B100

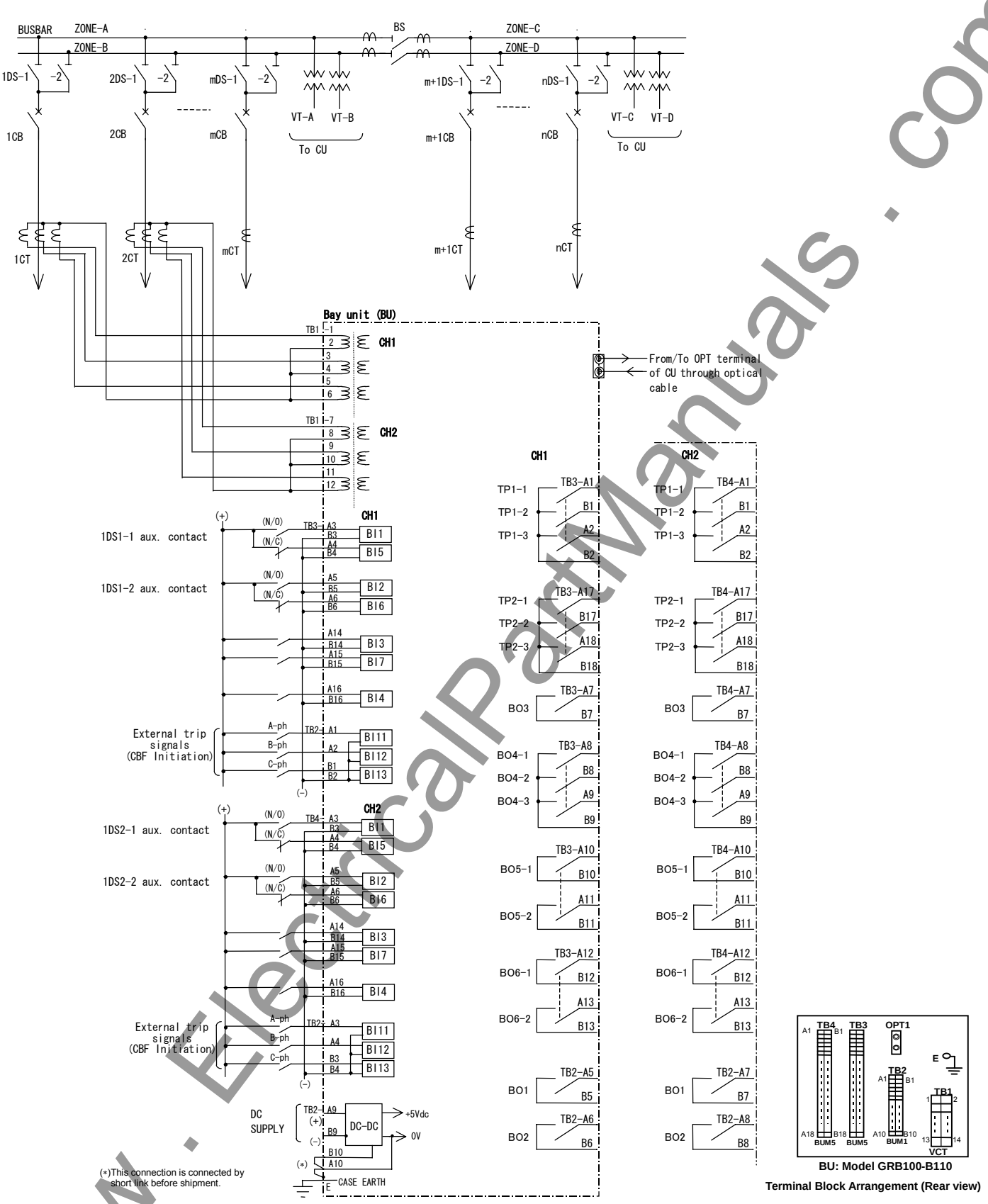
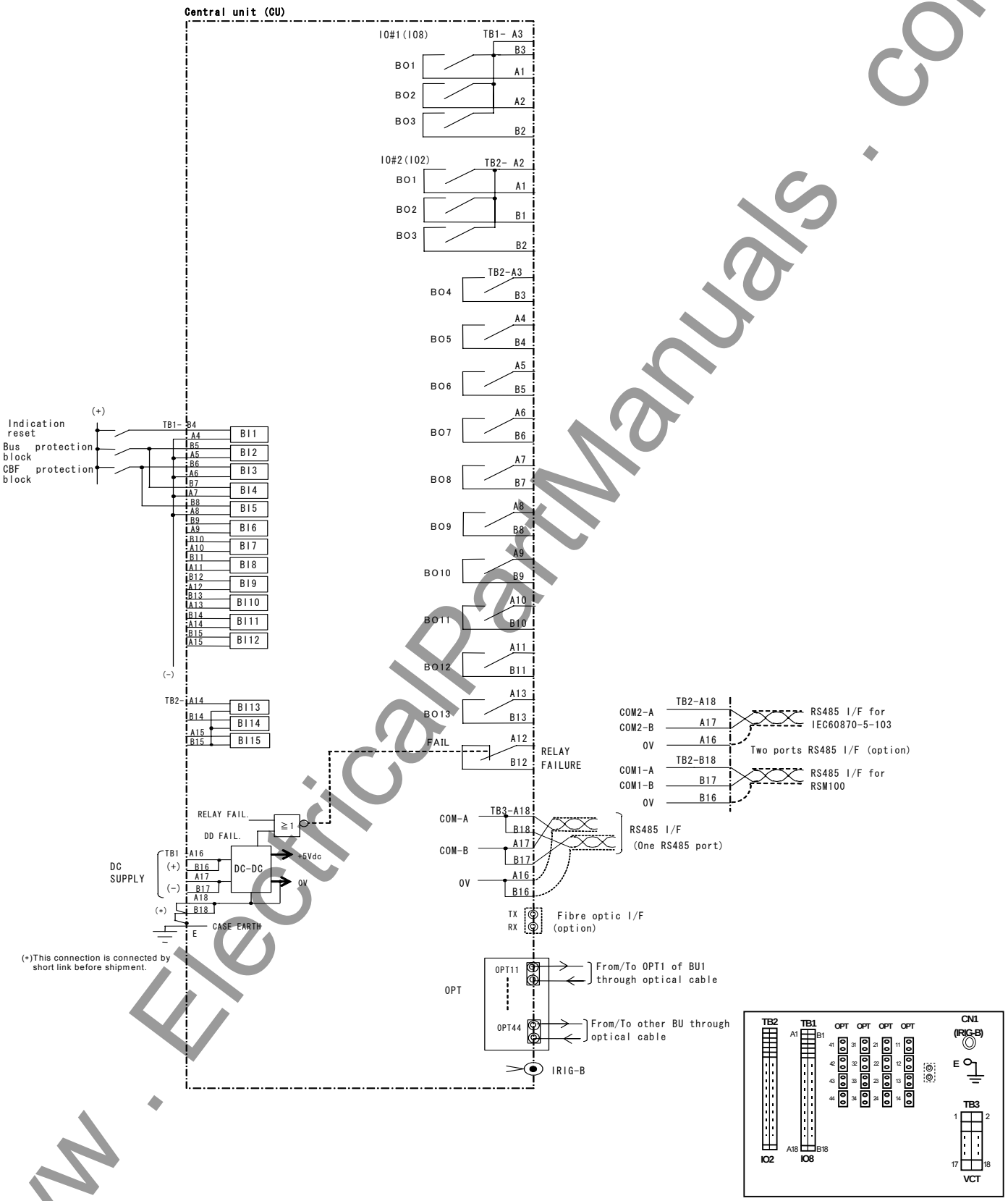


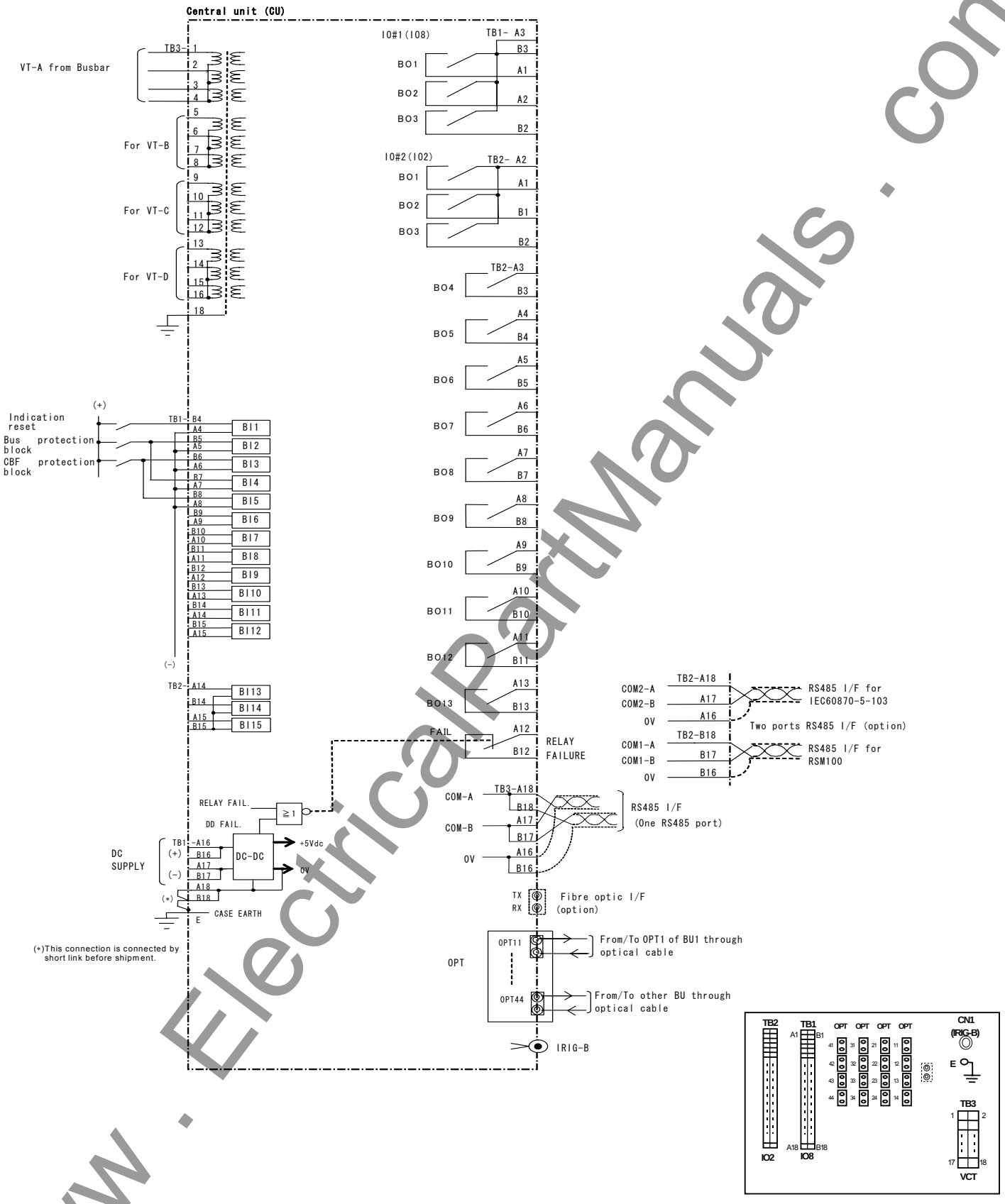
Figure 11 Typical External Connections for GRB100-B110



CU: Model GRB100-C1*0

Terminal Block Arrangement (Rear view)

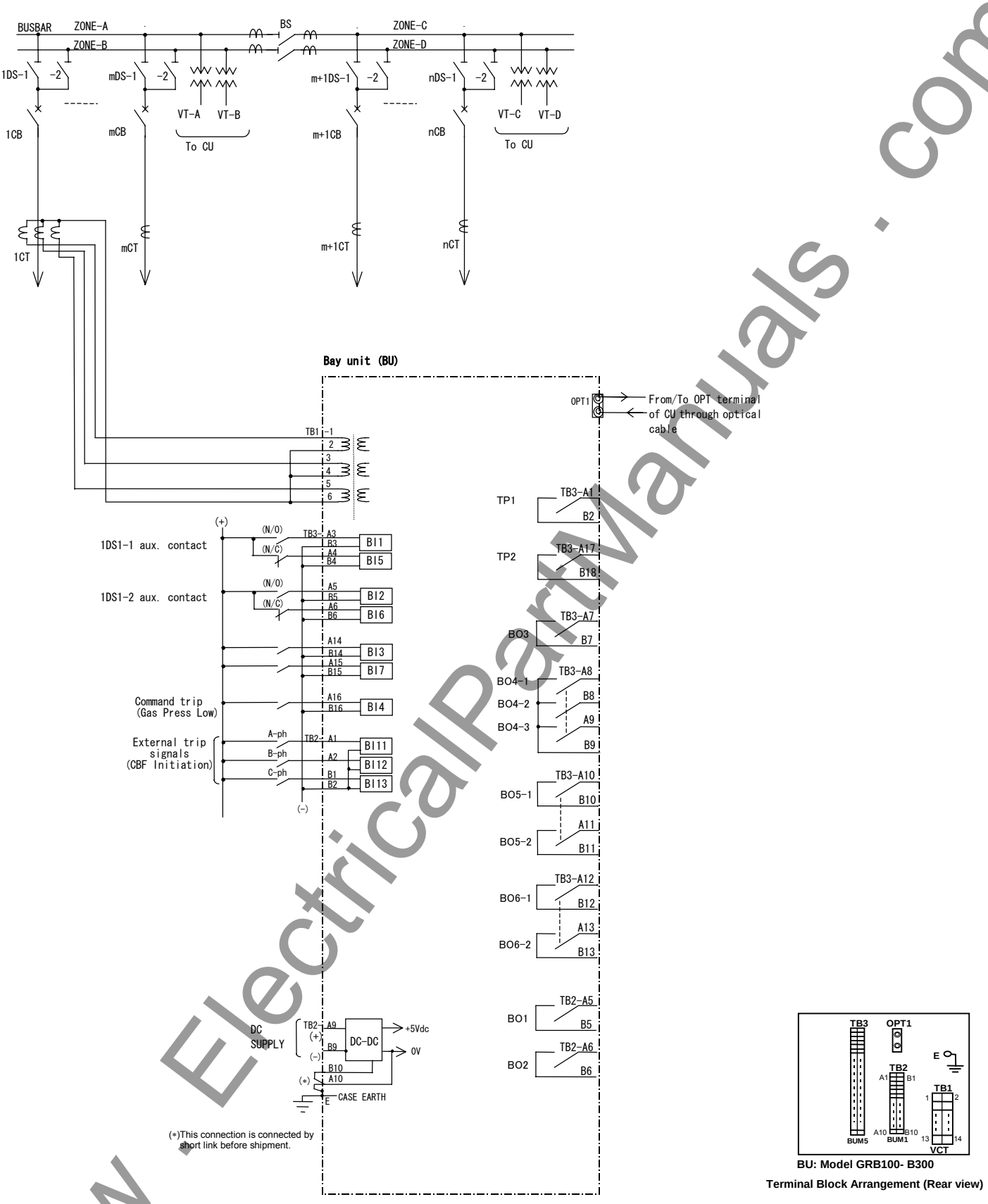
Figure 12 Typical External Connections for GRB100- C1*0



CU: Model GRB100-C2*0

Terminal Block Arrangement (Rear view)

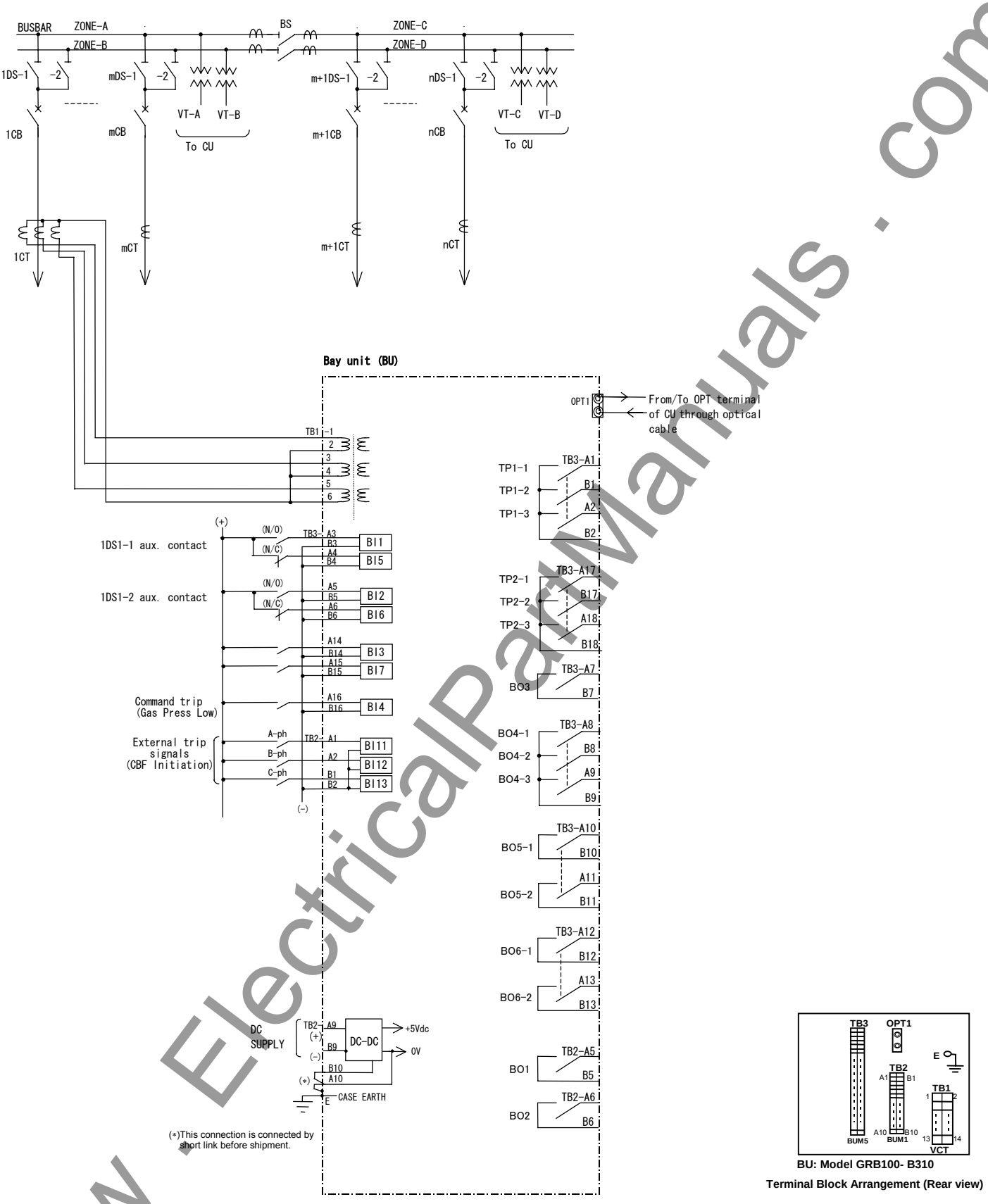
Figure 13 Typical External Connections for GRB100-C2*0



BU: Model GRB100- B300

Terminal Block Arrangement (Rear view)

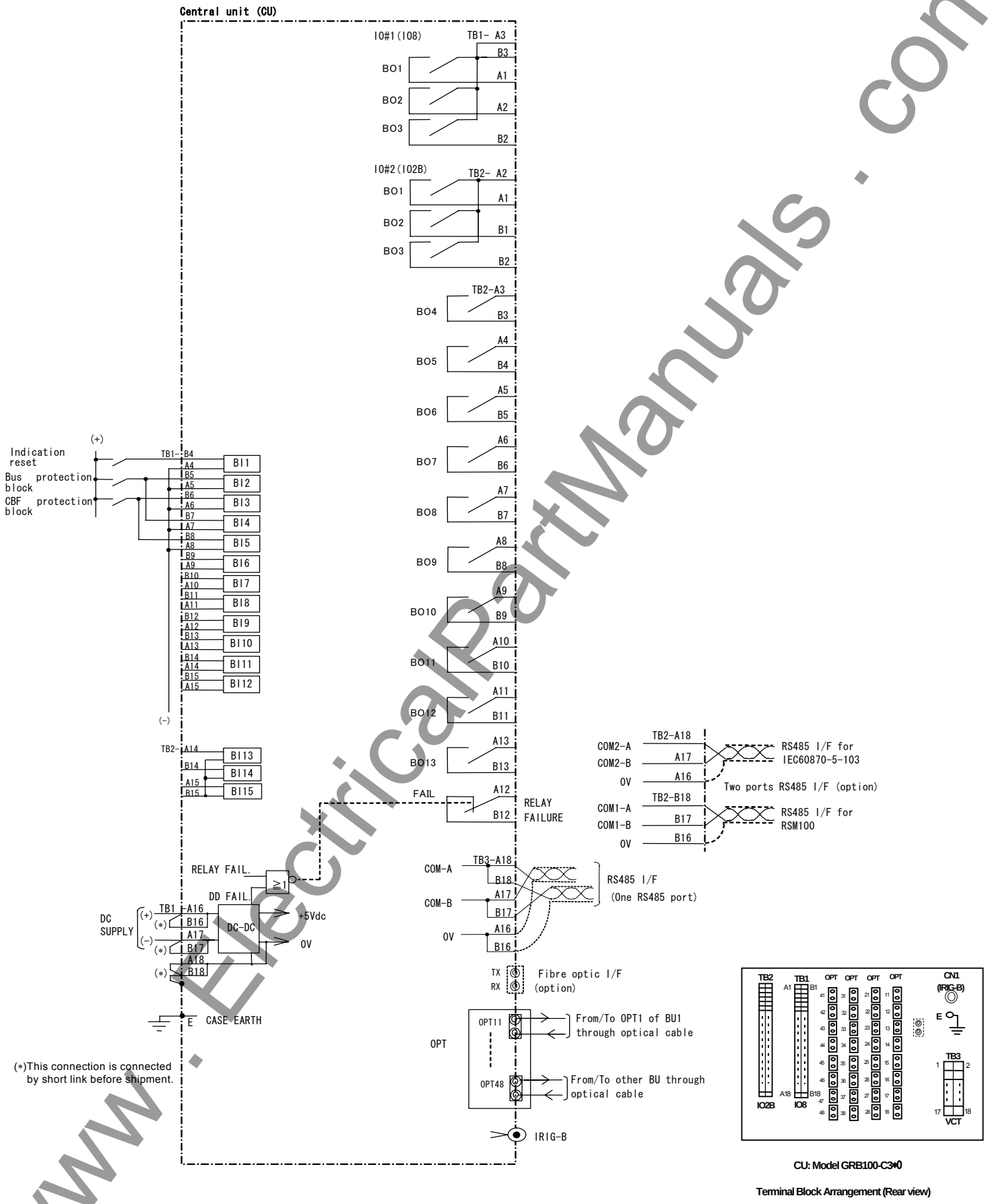
Figure 14 Typical External Connections for GRB100-B300



BU: Model GRB100- B310

Terminal Block Arrangement (Rear view)

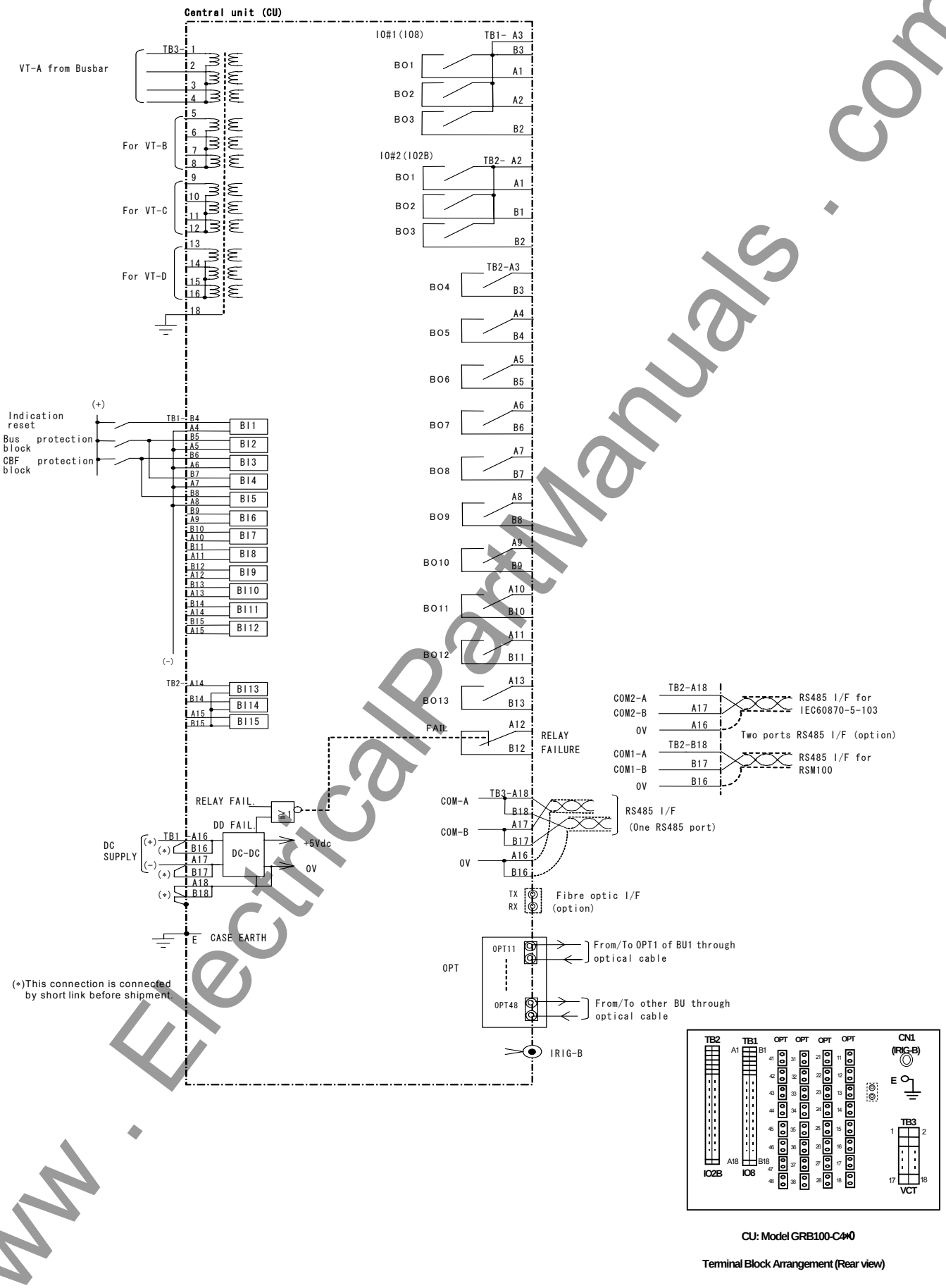
Figure 15 Typical External Connections for GRB100-B310



CU: Model GRB100-C3*0

Terminal Block Arrangement (Rear view)

Figure 16 Typical External Connections for GRB100-C3*0



CU: Model GRB100-C4*0

Terminal Block Arrangement (Rear view)

Figure 17 Typical External Connections for GRB100-C4*0

RELAY OUTLINE

Panel Surface Mount

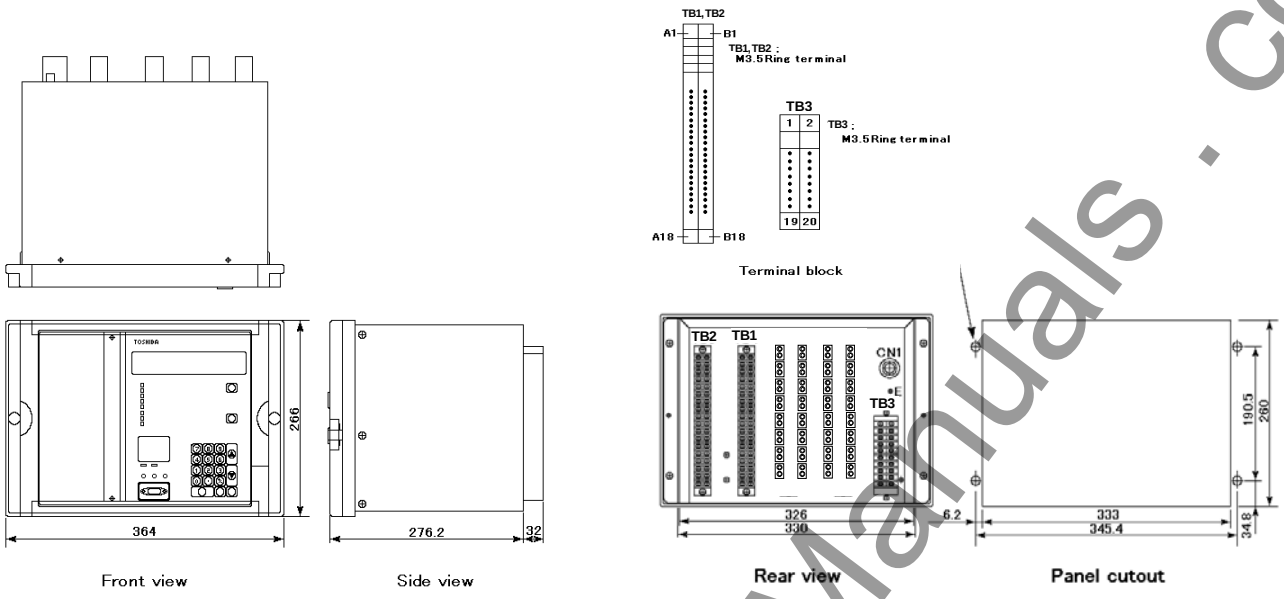


Figure 18 Outline of Central Unit (CU)

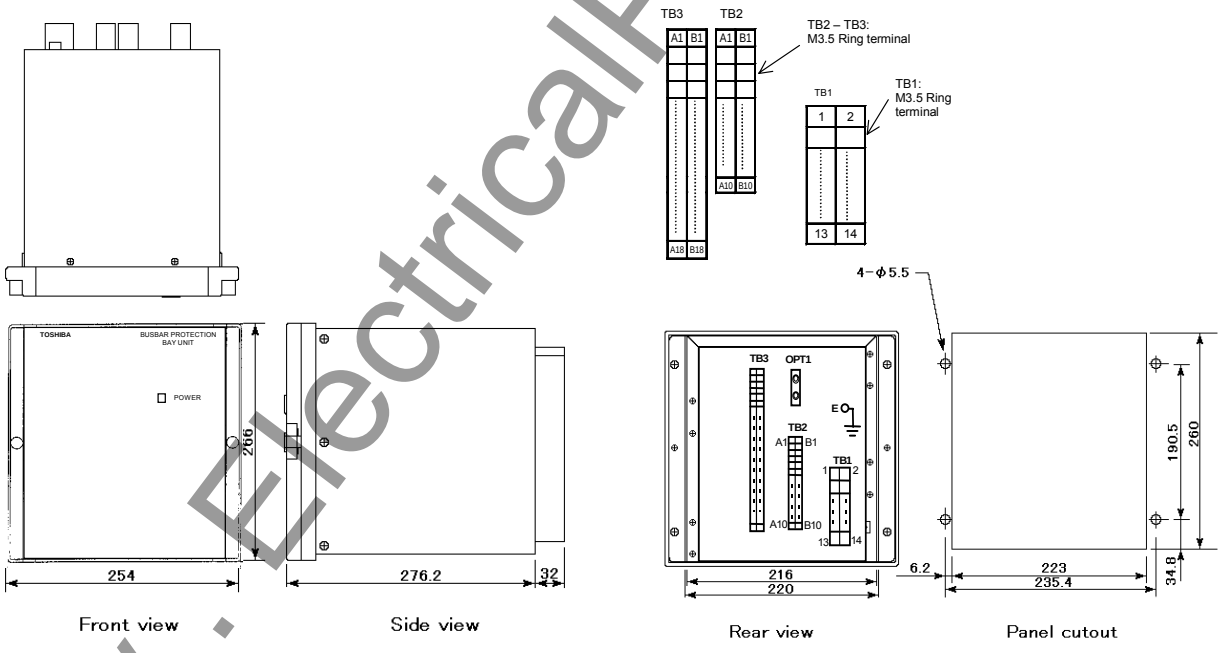


Figure 19 Outline of Bay Unit (BU)

19-inch Rack Mount

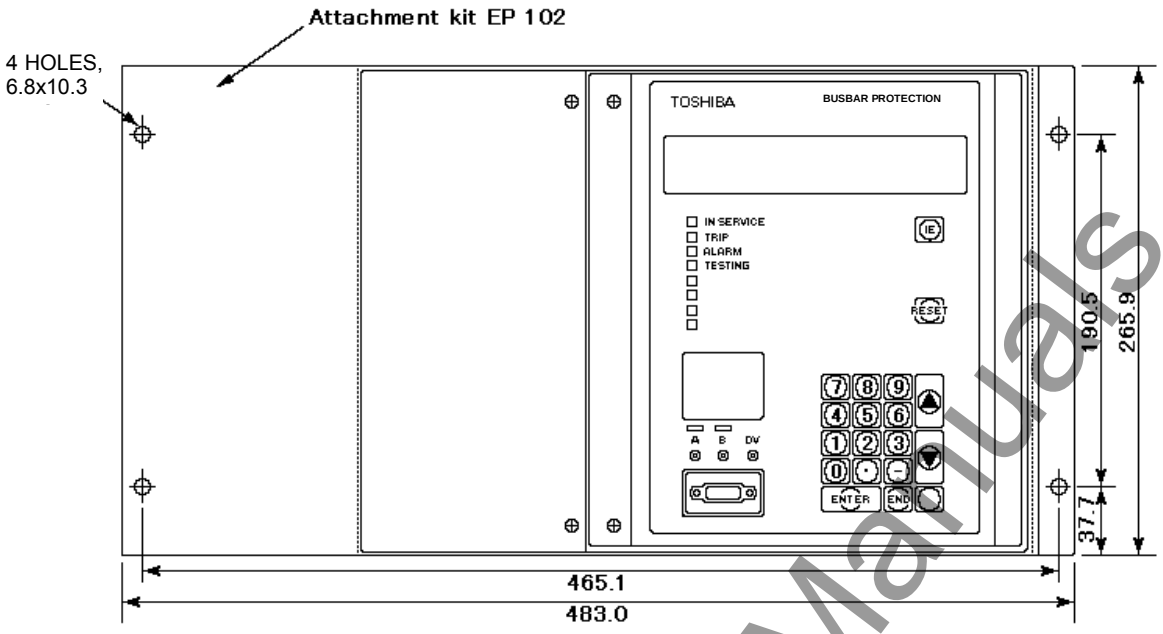


Figure 20 Outline of Central Unit (CU)

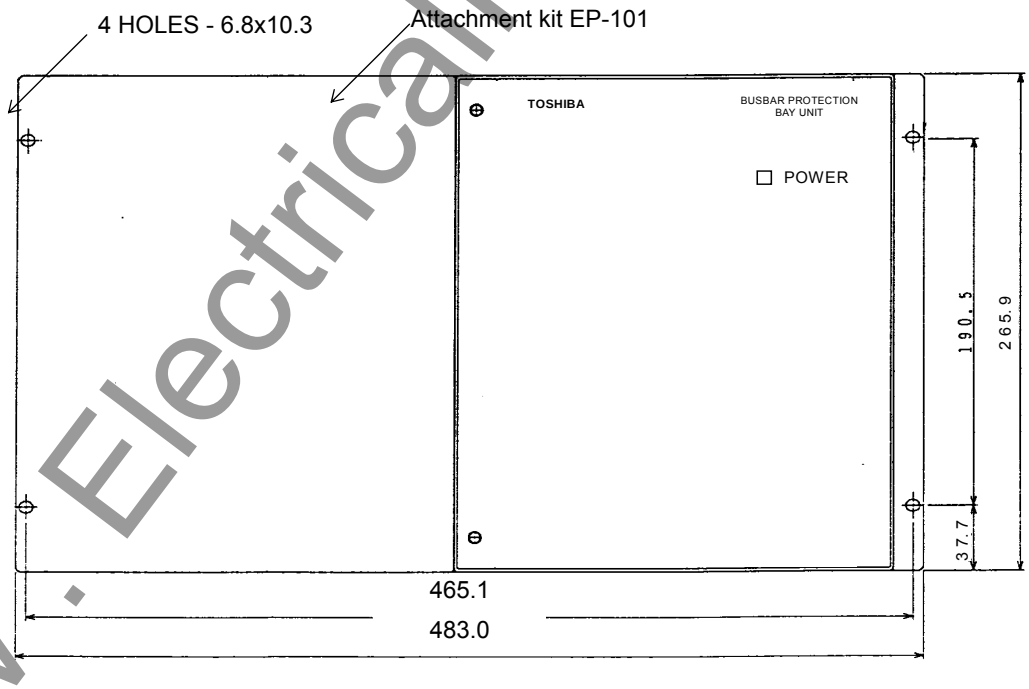


Figure 21 Outline of Bay Unit (BU)

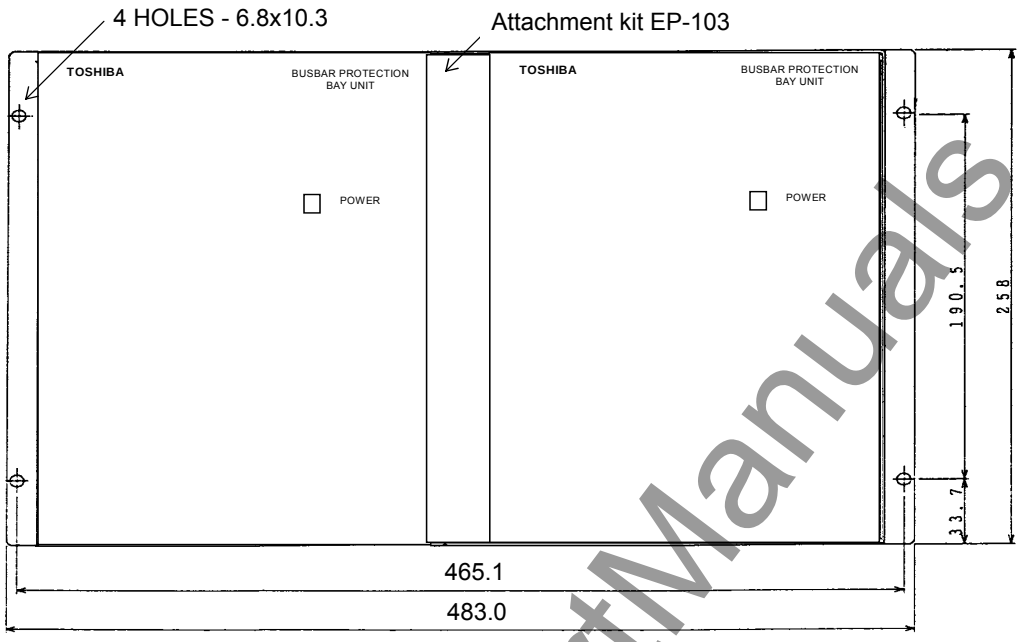


Figure 22 Outline of BU (linking two units together)

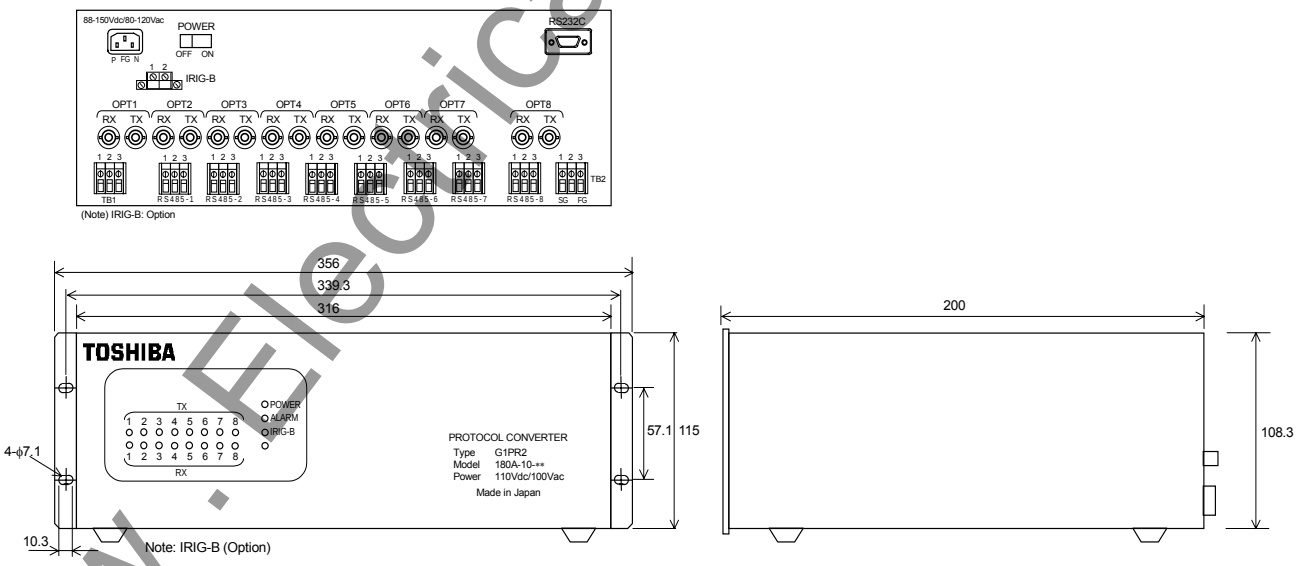


Figure 23 Outline of Protocol Converter G1PR2

Numerical Relay

GRB100

BUSBAR PROTECTION

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