

INSTRUCTION MANUAL

BUSBAR PROTECTION RELAY

GRB100 - **B**

(2 Channel/1 BU)

TOSHIBA CORPORATION

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(Ver. 1.6)

Safety Precautions

Before using this product, be sure to read this chapter carefully.

This chapter describes safety precautions recommended when using the GRB100. Before installing and using the equipment, this chapter must be thoroughly read and understood.

Explanation of symbols used

Signal words such as DANGER, WARNING, and two kinds of CAUTION, will be followed by important safety information that must be carefully reviewed.

 DANGER	Indicates an imminently hazardous situation which will result in death or serious injury if you do not follow instructions.
 WARNING	Indicates a potentially hazardous situation which could result in death or serious injury if you do not follow instructions.
 CAUTION	Indicates a potentially hazardous situation which if not avoided, may result in minor injury or moderate injury.
CAUTION	Indicates a potentially hazardous situation which if not avoided, may result in property damage.

⚠ DANGER

- **Current transformer circuit**

Never allow the current transformer (CT) secondary circuit connected to this equipment to be opened while the primary system is live. Opening the CT circuit will produce a dangerously high voltage.

⚠ WARNING

- **Exposed terminals**

Do not touch the terminals of this equipment while the power is on, as the high voltage generated is dangerous.

- **Residual voltage**

Hazardous voltage can be present in the DC circuit just after switching off the DC power supply. It takes approximately 30 seconds for the voltage to discharge.

- **Fibre optic**

Do not look directly at the optical beam when connecting this equipment via an optical fibre, as this could injure the eyes.

⚠ CAUTION

- **Earth**

The earthing terminal of the equipment must be securely earthed.

CAUTION

- **Operating environment**

The equipment must only be used within the range of ambient temperature, humidity and dust as detailed in the specification and in an environment free of abnormal vibration.

- **Ratings**

Before applying AC voltage and current or the DC power supply to the equipment, check that they conform to the equipment ratings.

- **Printed circuit board**

Do not attach and remove printed circuit boards when the DC power to the equipment is on, as this may cause the equipment to malfunction.

- **External circuit**

When connecting the output contacts of the equipment to an external circuit, carefully check the supply voltage used in order to prevent the connected circuit from overheating.

- **Connection cable**

Carefully handle the connection cable without applying excessive force.

- **Modification**

Do not modify this equipment, as this may cause the equipment to malfunction.

- **Wire link**

Do not remove a wire link which is mounted at the terminal block on the rear of the relay before shipment, as this may cause the performance of this equipment such as withstand voltage, etc., to reduce.

- **Disposal**

When disposing of this equipment, do so in a safe manner according to local regulations.

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■ The data given in this manual are subject to change without notice. (Ver.1.6)

1. Introduction

The GRB100 is a numerical low-impedance busbar differential relay whose main principle is percentage differential characteristics. It is widely applicable to various busbar configurations such as single, double and one-and-a-half busbar and also solidly earthed networks.

The GRB100 is a member of the G-series family of numerical relays which utilizes common hardware modules with the following common features:

- Human interfaces on the relay front panel, and local and remote PCs
4 × 40 character LCD and keypad
RS232C and RS485 communication port
- Metering and recording of events, faults and disturbance
- IRIG-B time synchronization
- Automatic supervision
- User configurable binary inputs/outputs

The GRB100 provides Central Unit (CU) and Bay Unit (BU). The GRB100 is composed of one Central Unit (CU) and numbers of Bay Unit (BU) depending on the required number of channels for the busbar configuration. The CU and BU have the following model series:

Relay Type and Model

CU Model:
- GRB100 • Model C110B; Applicable to max. 8 channels, 4 zones • Model C120B; Applicable to max. 16 channels, 4 zones • Model C130B; Applicable to max. 24 channels, 4 zones • Model C140B; Applicable to max. 32 channels, 4 zones • Model C210B; Applicable to max. 8 channels, 4 zones / With voltage input • Model C220B; Applicable to max. 16 channels, 4 zones / With voltage input • Model C230B; Applicable to max. 24 channels, 4 zones / With voltage input • Model C240B; Applicable to max. 32 channels, 4 zones / With voltage input
BU Model:
- GRB100 • Model B100B; 2 channel provided. (2 high-speed contacts) • Model B110B; 2 channel provided. (6 high-speed contacts)

2. Application Notes

2.1 Application

The GRB100 provides high-speed, selective and reliable busbar protection for MV, HV and EHV busbars and is used for the following busbar systems to handle various busbar replicas as shown in Appendix A:

- Single busbars with/without transfer busbar
- Double busbars with/without transfer busbar
- Ring busbars with/without transfer busbar
- One-and-a-half breaker busbars

The protection detects phase and earth faults on the busbar by employing a phase segregated current differential scheme. The current differential scheme employed can distinguish correctly between internal and external faults in the event of CT saturation.

The GRB100 can input a maximum of 32 three-phase currents from feeders, bus-sections and bus-couplers.

The GRB100 also provides circuit breaker failure protection and end zone fault protection.

Circuit breaker failure protection can be applied to all the breakers of feeders, bus-sections and bus-couplers.

The GRB100 provides the following metering and recording functions.

- Metering
- Fault record
- Event record
- Disturbance record

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

- Relay front panel: LCD, LED display and operation keys
- Local PC
- Remote PC

The relay can be integrated with a local PC or a remote PC through a communication port. A local PC can be connected via the RS232C port on the front panel of the relay. A remote PC can also be connected through the RS485 port on the rear panel of the relay.

2.2 System Configuration

The GRB100 incorporates a single central unit (CU) and bay-based local units (BUs). The CU performs current differential protection and breaker failure protection with the currents acquired by the BUs. The CU also performs metering and recording functions and controls local and remote human interfaces. The CU can link with up to 16 BUs.

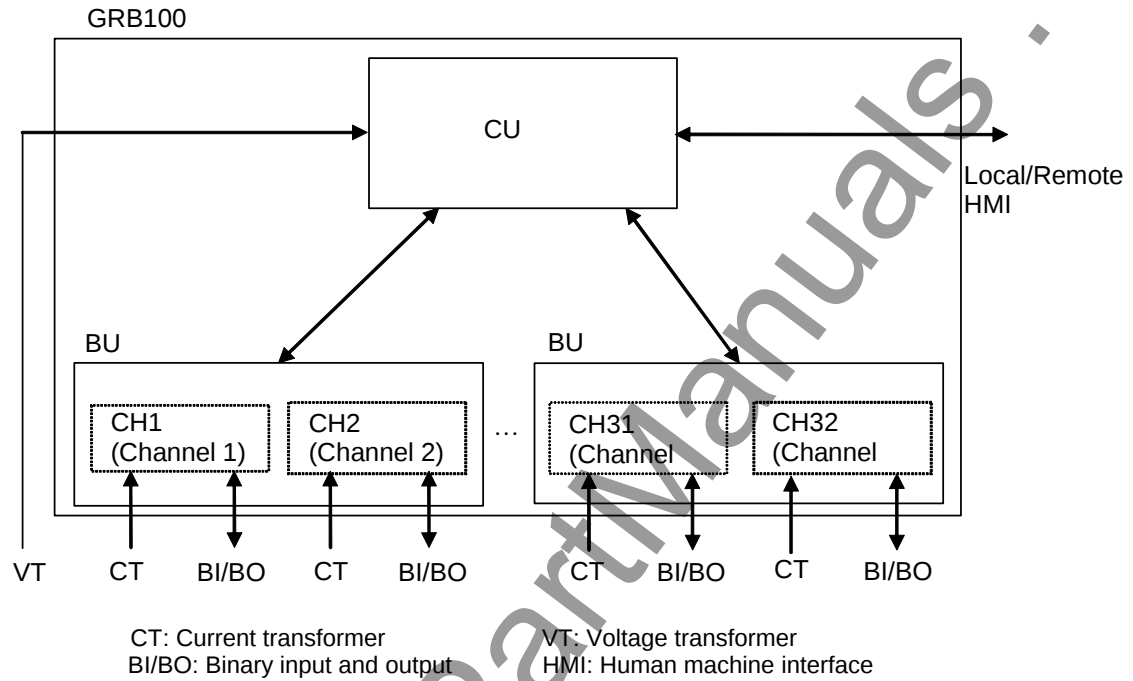


Figure 2.2.1 System Configuration

GRB100 Model C200 series has independent undervoltage elements for fault detectors. The busbar voltage of each zone is supplied directly to the central unit.

The BUs interface with the primary power system. They input the currents of feeders, bus-sections and bus-couplers and binary signals such as disconnector open/close status signals, and they output the trip signal of busbar protection and breaker failure protection to the breaker of each bay. The local current is sampled at every 7.5 electrical degrees and converted into a 16-bit digital signal. The sampling timing is synchronized at all BUs based on the sampling signal sent from the CU.

The high-frequency component and DC component in the input current are removed with an analogue filter in the BU and a digital filter in the CU respectively.

One BU has two data channels and each channel can acquire three-phase currents and binary signals from each bay. So one BU takes two feeder bays or one bus-section or bus-coupler bay which has two CTs. If the bus-section or bus-coupler bay is the one CT type, one channel can be used for the other bay.

The CU identifies the BUs by the address which is set in each BU and transmitted to the CU along with other data.

Data Link between CU and BUs

The CU and BUs are linked via fibre optic cables with 2.5Mbps data transmission speed. One BU includes two channels and the data for two channels are transmitted in series between the CU and BU.

The per-channel data transmitted from BU to CU are as follows:

Three-phase currents (Ia, Ib, Ic)

Binary input signals (Disconnecter N/O and N/C contacts, Breaker contact, Breaker failure protection initiation signal)

BU address

The per-channel data transmitted from CU to BU are as follows:

Synchronizing signal

Trip command of busbar protection

Trip command of breaker failure protection

Programmable signals, e.g. transfer trip command of breaker failure protection

BU out-of-service function

The GRB100 provides the BU out-of-service function for maintenance such as replacement of a BU if failed. This function is available by LCD setting or PLC setting.

- For the LCD setting, see Section 4.2.7.5.
- For the PLC setting, the BU is out-of-service condition when the PLC output command BU*-OUT (No.2272 – No.2303) is established.

Caution: After restoration, remember to reset above to the original setting.

When a BU is out-of-service condition, the relay response is as follows:

- CBF initiation from the BU is blocked.
- Failure related to the BU is not detected.
- The power system quantities related to the BU are displayed as “0” at fault recording and at metering.
- The BU-OUT signal (No. 1433) is “ON” while any BU is out-of-service.
- The assigned BO can be forcibly operated though the BU is out-of-service.

2.3 Current Differential Protection

2.3.1 Operation of Current Differential Protection

Current differential protection calculates the differential current I_d and restraining current I_r employing the incoming and outgoing currents of the protected zone. The calculation is performed on a per-phase basis.

I_d is a vector sum of incoming and outgoing currents and I_r is obtained by summing the absolute value of incoming and outgoing currents.

$$I_d = I_1 + I_2 + \cdots + I_n$$

$$I_r = |I_1| + |I_2| + \cdots + |I_n|$$

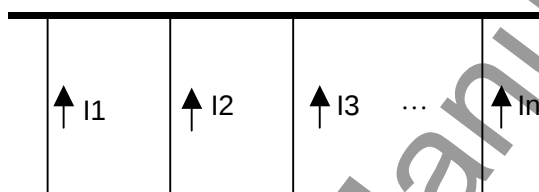


Figure 2.3.1 Current Differential Protection

I_d takes zero in case of the no-fault or through-fault condition and represents the fault current in case of internal faults. This applies strictly to the primary circuit; it does not apply to the secondary circuit mainly due to CT measurement error.

In case of internal faults, I_d is equal to I_r if all the currents are in-phase, and is smaller than I_r if the phases are different.

The GRB100 adopts a percentage restraining differential protection which has a non-restraint characteristic for the small current region and a restraint characteristic in the large current region to cope with erroneous differential current caused by a through-fault current.

The characteristics are shown in Figure 2.3.2. The minimum operating current is set by DIF and the restraining factor k can be set 0.30 to 0.90.

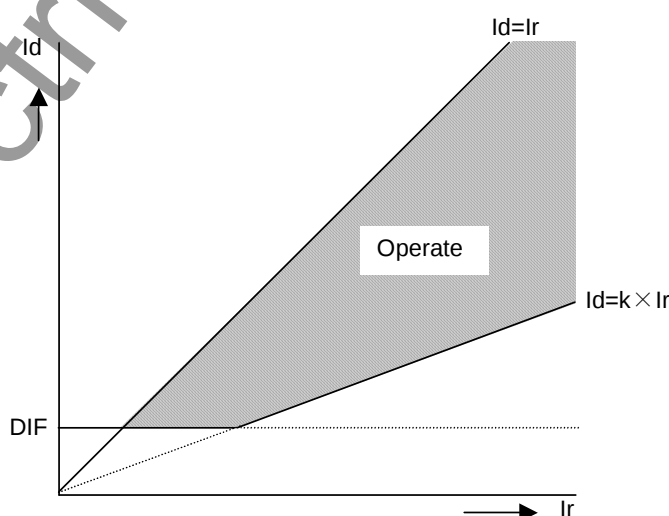


Figure 2.3.2 Percentage Restraining Characteristic

2.3.2 Discriminating Zone and Check Zone Protection

The GRB100 applies the current differential protection to each individual busbar zone which is sectioned by the bus-section and bus-coupler switches (described hereafter as **discriminating zone protection**) as well as to the overall busbar system (described hereafter as **check zone protection**).

Figure 2.3.3 shows the protection application in case of a double-busbar system. The discriminating zone protections for Zone A and Zone B are overlapped across the bus-coupler breaker.

Discriminating zone protection

The discriminating zone protection inputs currents and disconnector position signals from feeders, transformer banks, bus-sections and bus-couplers which are connected to the protected zone and outputs trip signals to all the circuit breakers of the zone.

The zone covered by the discriminating zone protection depends on the busbar configuration and varies with the open/close status of the disconnectors. The GRB100 introduces a replica setting which identifies which circuit is connected to which zone and follows changes in busbar operation. Up to four zone protections are enabled by employing relevant input currents and disconnector signals and outputting trip signals to the relevant channels.

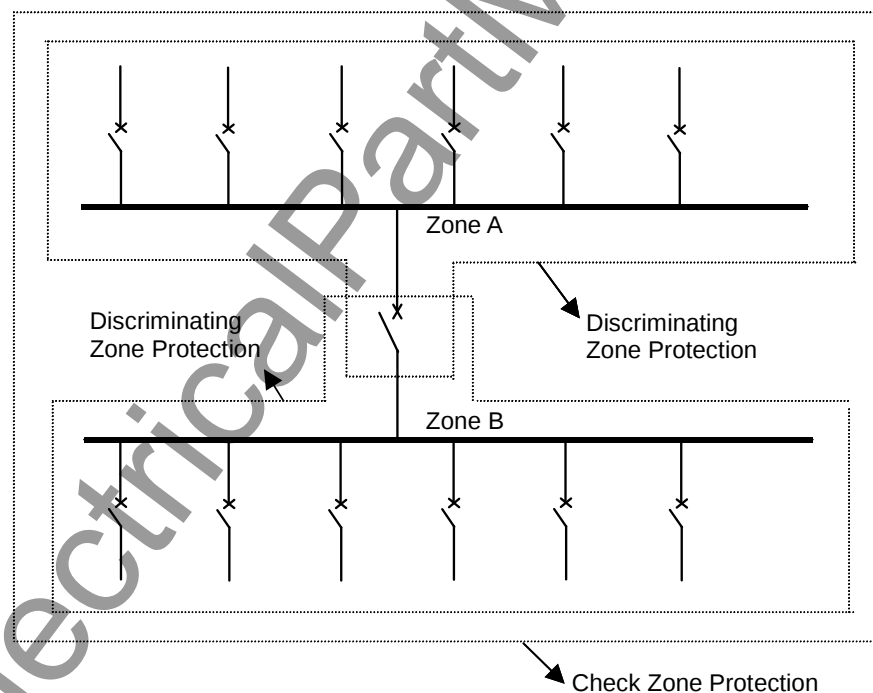


Figure 2.3.3 Check Zone and Discriminating Zone Protection

Figure 2.3.4 shows the flow of input signals to the discriminating zone protection elements DIFZA to DIFZD.

The current and binary input (BI) signals of each channel are normally transmitted to one of the zone protections (Zone A to Zone D) through the replica setting, but when the bus zones are bridged, they are transmitted to more than two zone protections. For the zone bridge, see Section 2.3.3.

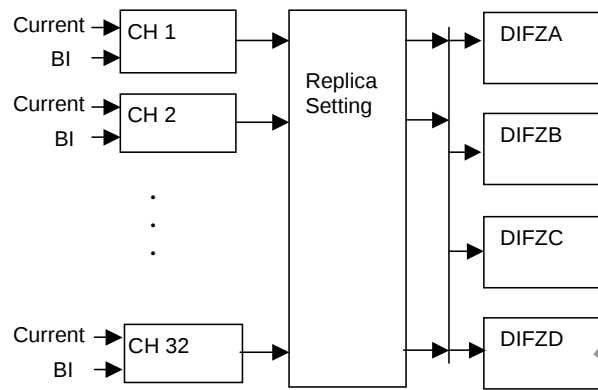


Figure 2.3.4 Input Signal Flow in Discriminating Zone Protection

Switching disconnectors under normal busbar operation may turn a load current into a false differential current transiently and the discriminating zone protection may operate if the operating or resetting time of the disconnector is not coordinated between the main and auxiliary contacts. The GRB100 provides very selective discriminating zone protection in combination with the check zone protection described below, hence the time coordination of the main and auxiliary disconnector contacts need not be considered.

Note: Time coordination of disconnector main and auxiliary contacts is difficult in practice. The zone discriminating protection is not used independently.

Check zone protection

The check zone protection inputs currents from all feeder bays and transformer bays, performs the overall differential protection for the entire busbar system and outputs trip signals to all the circuit breakers of the feeders and transformers. As the protection does not use the disconnector position signals, the check zone protection is very secure against such false operation in the no-fault and through-fault conditions.

The characteristic of check zone protection can be changed to the non-restraint characteristic shown in Figure 2.3.5 by PLC(*) input (Signal No. 2069: DIFCH_CHARA) to ensure the operation of the check zone protection in case of busbar configuration with a large outgoing current.

Note (*) PLC: Programmable Logic Controller. See Section 3.2.3 in detail function.

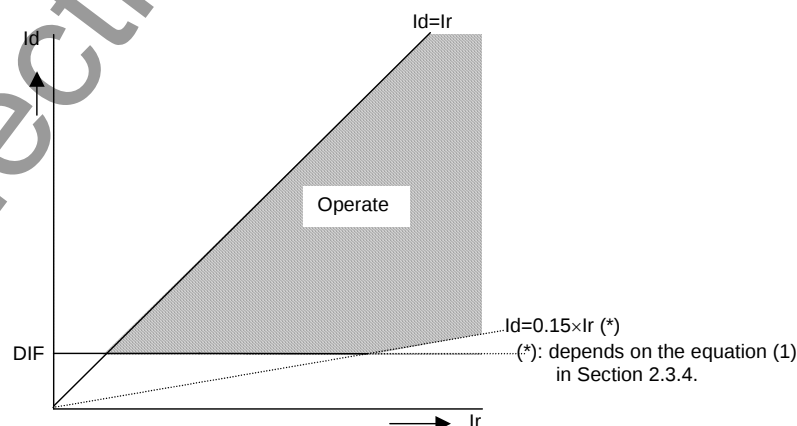


Figure 2.3.5 DIFCH Characteristic after PLC Input

For example, the check zone protection with restraint characteristic will not operate under a unique condition such as a fault at Zone B in the busbar configuration shown in Figure 2.3.6,

because the outgoing current is over half of the incoming current according to the load and fault current condition. In this case, therefore, the characteristic is changed to non-restraint characteristic when two out of four disconnectors, which are two bus-sections and two bus-couplers, are opened. The check zone protection can operate surely.

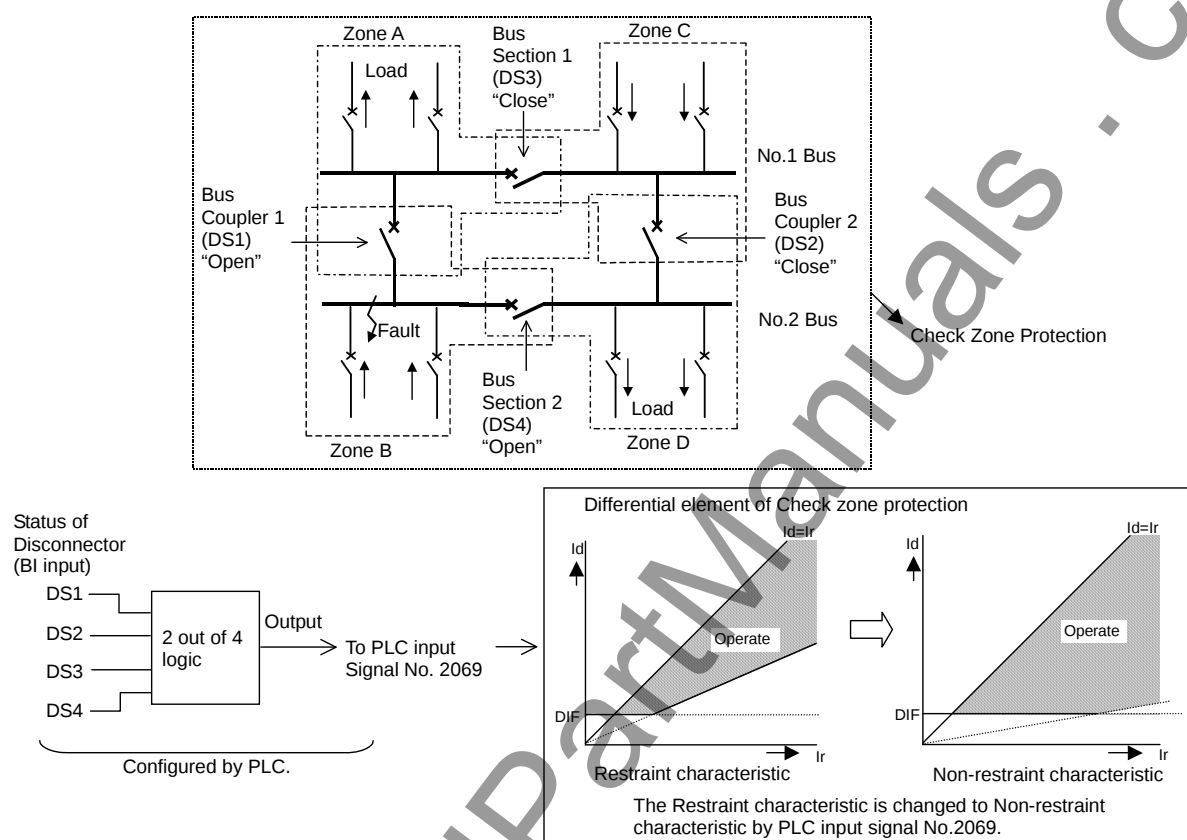


Figure 2.3.6 Check Zone Protection under Unique Busbar Configuration

2.3.3 Scheme Logic

The GRB100 provides one of the following three protection schemes by the replica setting.

Note: The replica setting will be performed by the panel builder before shipping to the end user.

- 'Check zone protection': The tripping command is transmitted to all bays except bus-section and bus-coupler bays when the check zone protection element operates.
- 'Discriminating zone protection': The tripping command is transmitted to all bays in the faulty zone when the discriminating zone protection element operates.
- 'Discriminating zone and check zone protection': The tripping command is transmitted to all bays in the faulty zone only when both of the discriminating zone protection and check zone protection operate.

Note: 'Discriminating zone protection' is applied only to protect a busbar that has duplicated GRB100s (for example, to protect a very important busbar system): one of the GRB100s is set for 'Discriminating zone protection' and the other for 'Check zone protection'.

In the 'Check zone protection', overall protecting current differential element DIFCH outputs trip signals to all the feeder bays and transformer bays. The trip signals can be blocked with the binary input signals (busbar protection block: BP_BLOCK-A and BP_BLOCK-B). If there is any discrepancy between both input signals, the previous value is hold as shown in Figure 2.3.7.

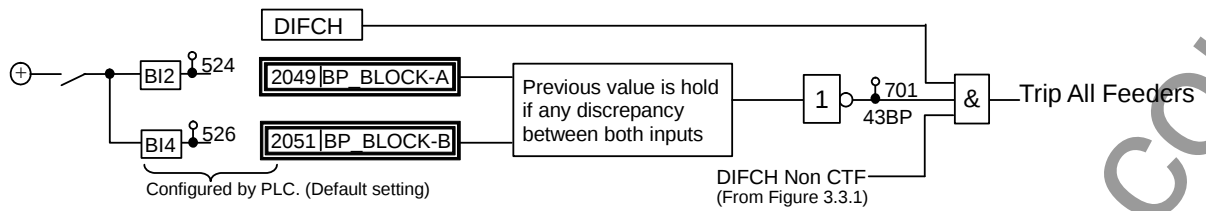


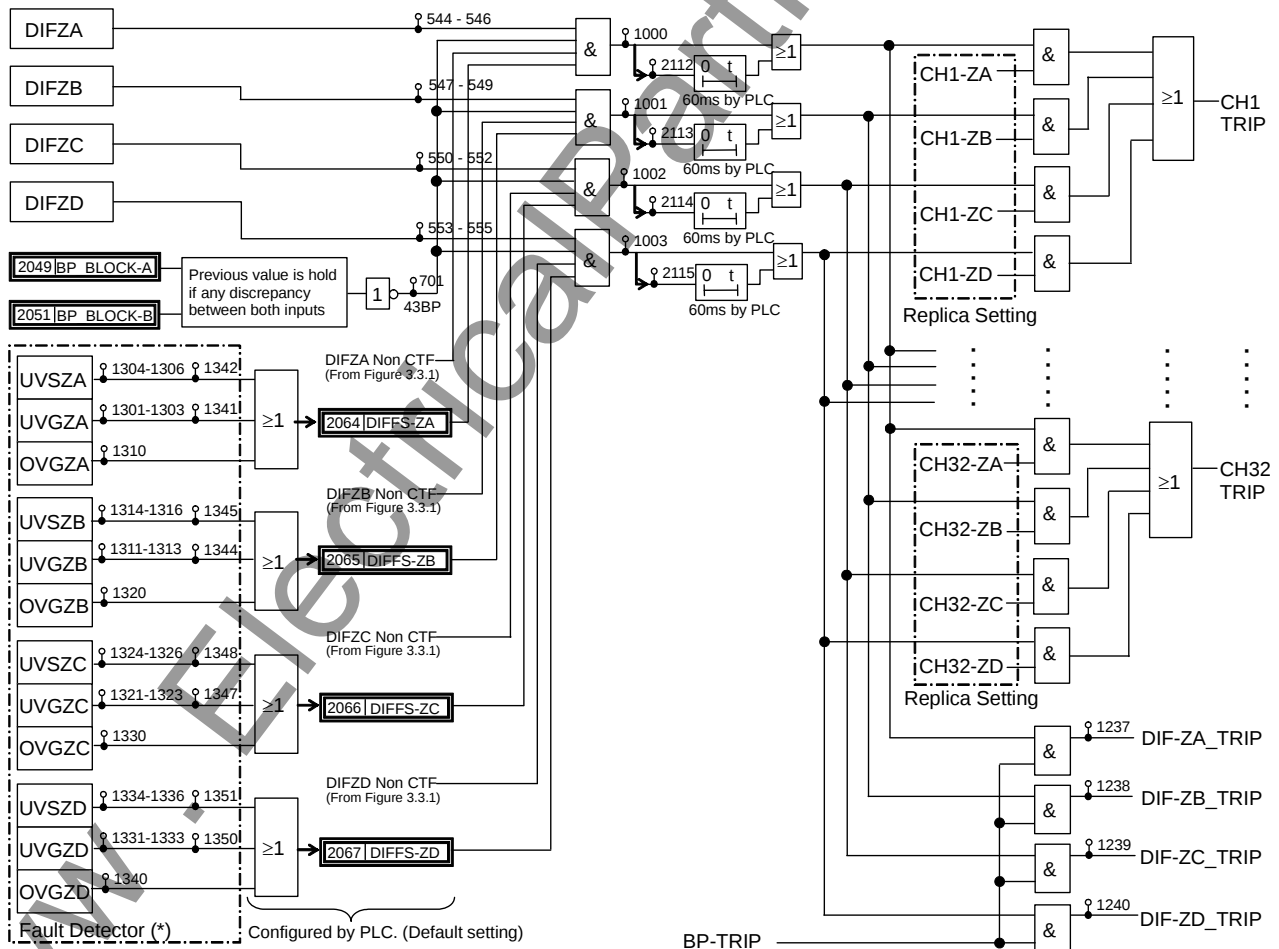
Figure 2.3.7 Check Zone Protection

In the 'Discriminating zone protection', up to four zone protecting current differential elements DIFZA to DIFZD are provided. Each channel outputs the trip signal by checking which zone the channel is connected to.

For example, if CH1 is connected to Zone A, then CH1-ZA=1 and CH1-ZB=CH1-ZC=CH1-ZD=0. The CH1 outputs the trip signal only when DIFZA operates.

Thus the zone elements DIFZA to DIFZD output trip signals to the feeder, bus-section and bus-coupler channels which are connected to Zone A to Zone D respectively. The trip signals are blocked with the binary input signals BP_BLOCK-A and -B.

In the 'Discriminating zone and check zone protection', the trip signals are transmitted to the feeder, bus-section and bus-coupler channels connected to the faulty zone when both of the discriminating zone and check zone protection elements operate. The channel is selected in the discriminating zone protection. The trip signals are blocked with the BP_BLOCK-A and -B.



Note (*): Fault detector is provided in Model 200 series and composed by PLC. See Section 2.7.

Figure 2.3.8 Discriminating Zone Protection

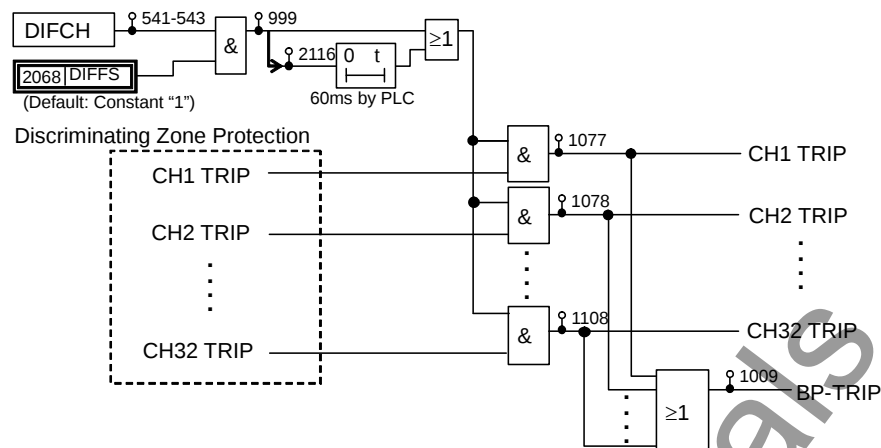


Figure 2.3.9 Discriminating Zone and Check Zone Protection

In the following busbar replica and disconnector contact status, two zones are treated as bridged and all the feeder currents are sent to both discriminating zone protections and all feeders in both zones are tripped for a fault in either zone.

- The bus-section has no breaker and the disconnector in the bus-section is closed.

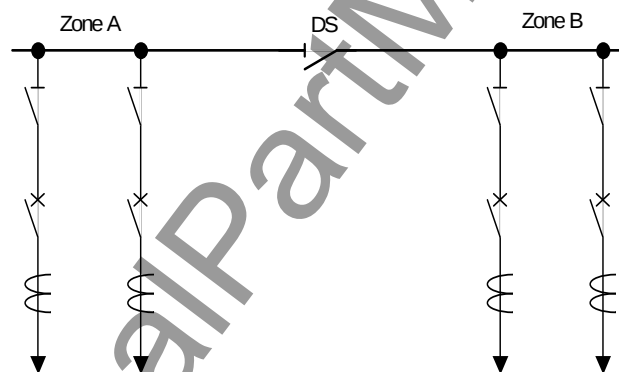


Figure 2.3.10 Bus-section without Breaker

- The bus-section has a breaker but it is by-passed by a disconnector in a closed status.

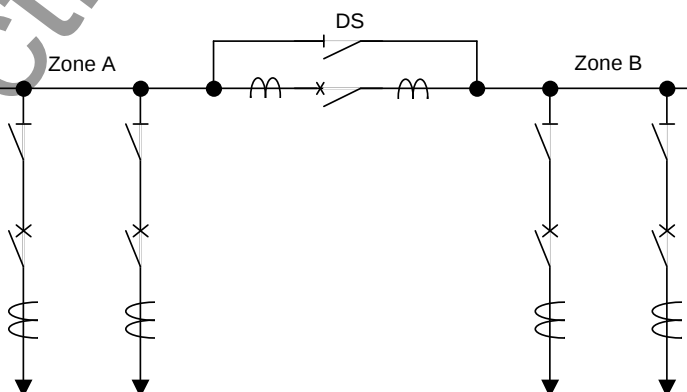


Figure 2.3.11 Busbar with By-pass Disconnector

2.3.4 Stabilizing for CT Saturation in Through-fault Current

For current differential protection of busbars, a counter measure against CT saturation is

essential. If any CTs saturate due to a large through-fault current, an apparent differential current is generated in the differential circuit and causes false operation of the differential protection.

Operation Principle

Even when any CTs saturate under very large primary currents, the waveform of the saturated CT secondary current has two periods in each cycle: a non-saturation period and a saturation period. The GRB100 utilizes this phenomenon and provides very secure operation for external faults with a large through-fault current.

Figure 2.3.15 shows a block diagram of a CT saturation countermeasure (CTSC). CTSC has a waveform discriminating element (WDE) and starting element (SE). WDE operates if a change in the instantaneous value of the differential current is less than a specified percentage of a change in the instantaneous value of the restraining current. In the CT non-saturation period, the differential current is theoretically zero for through-fault currents. This element operates in this period.

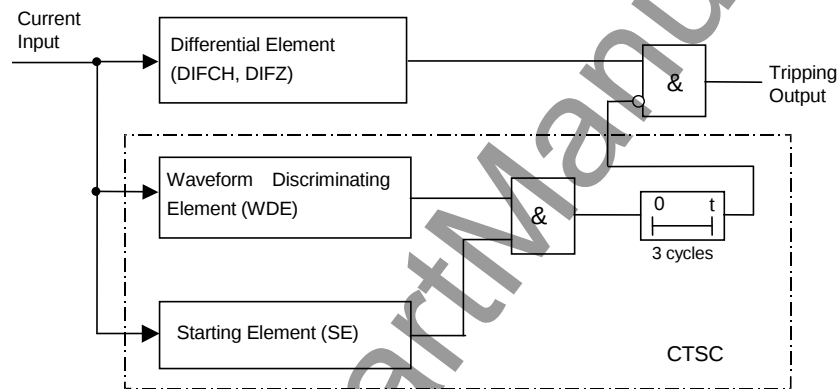


Figure 2.3.15 Differential Element with CT Saturation Countermeasure

The algorithm of this element is given by equations (1) to (3):

$$\Delta I_d < 0.15 \times (\Delta I_p + \Delta I_n) \quad (1)$$

$$\Delta I_d = |I_{dm} - I_{dm-1}| + |I_{dm-1} - I_{dm-2}| \quad (2)$$

$$\begin{aligned} \Delta I_p + \Delta I_n = & |I_{pm} - I_{pm-1}| + |I_{pm-1} - I_{pm-2}| \\ & + |I_{nm} - I_{nm-1}| + |I_{nm-1} - I_{nm-2}| \end{aligned} \quad (3)$$

where,

ΔI_d : Change in the differential current I_d

$(\Delta I_p + \Delta I_n)$: Change in the restraining current in the positive and negative cycles

I_d : Differential current

I_p : Sum of positive input currents

I_n : Sum of negative input currents

$m, m-1, m-2$: Sampling timing

SE operates when the sum of absolute values of difference between instantaneous values of current data at each channel part from one cycle is greater than a specified percentage of a minimum operating current setting DIF.

$$\sum_{j=1}^n |i_{jm} - i_{j(m-24)}| > 0.5 \times \text{DIF}$$

where,

I_j : Current from # j channel

DIF : DIFCH and DIFZ setting in check zone and discriminating zone protection

n : Number of channels

SE discriminates the power system in the faulty state from that in the normal service state and blocks the output of WDE which may operate in the normal service condition.

Figure 2.3.16 shows CT secondary current waveforms of the incoming terminal and the outgoing terminal current and the differential current at the time of an external fault with outgoing terminal CT saturation.

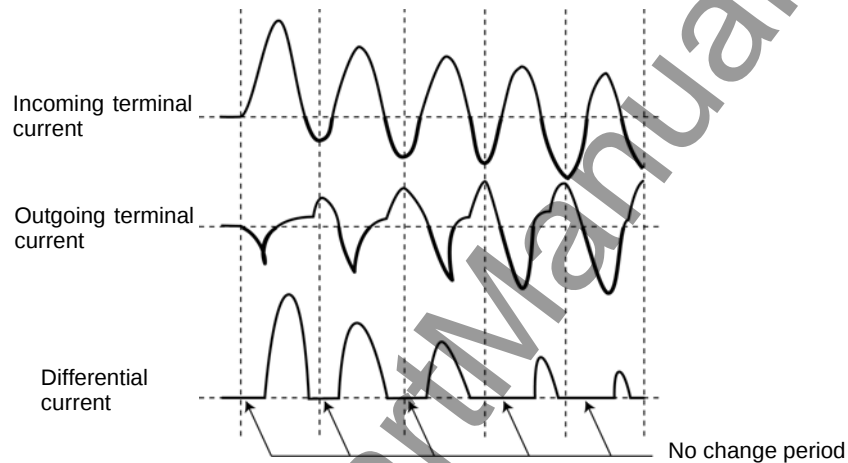


Figure 2.3.16 CT Secondary Current Waveforms and Differential Current for an External Fault with CT Saturation

From the inception of a fault until the CT secondary current at the outgoing terminal saturates, the differential current I_d is zero and the change in the differential current ΔI_d obtained from equation (2) is also zero. However, the change in the restraining current given by equation (3) is a sufficiently large positive value, so equation (1) is met and WDE operates.

SE detects changes in the terminal currents and rapidly operates, producing an AND output with WDE. After this, since there is a period during which equation (1) is not satisfied, a certain time delay is inserted to reliably block the operation of the differential element.

If, during an internal fault, there is a period during which the change in the instantaneous value of the differential current is small due to CT saturation, WDE will not operate because the change in the restraining current is also small during that period. Thus, during an internal fault, operation of the differential element is not blocked falsely.

2.3.5 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 the CTs with other protections and the different ratios are adjusted by setting.

The general CT requirements are set for the through-fault stability which comes up when any CTs saturate under very large through-fault currents. To ensure correct operation of the GRB100 for such through-fault currents, the factor K_s of each CT is required to satisfy the following conditions:

$$K_s \geq 1 \text{ when } T_c \leq 200\text{ms}$$

or

$$K_s \geq 2 \text{ when } T_c \leq 250\text{ms}$$

where,

K_s = ratio of CT knee point voltage to CT secondary probable voltage under the maximum through-fault current

$$= V_k / \{(R_{CT} + R_L + R_B + R_O)(I_{Fmax} / \text{CT ratio})\}$$

T_c = d.c. time constant of primary circuit

V_k = 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_{Fmax} = maximum through-fault current

For example, if the following parameters are given:

$V_k = 800 \text{ V}$, CT ratio = 1,200/1, $R_{CT} = 5.0 \text{ ohm}$, $R_L = 3.0 \text{ ohm}$, $R_B = 0.1 \text{ ohm}$,

$R_O = 0 \text{ ohm}$ (i.e. no series-connected relays) and $I_{Fmax} = 40\text{kA}$

then the factor K_s is calculated as:

$$\begin{aligned} K_s &= 800 / \{(5.0 + 3.0 + 0.1) \times (40,000 / 1,200)\} \\ &= 800 / 270 \\ &= 3.0 \end{aligned}$$

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

2.3.6 Setting

The following shows the setting elements necessary for the current differential protection and their setting ranges.

Element	Range	Step	Default	Remarks
DIFCH	500 – 3,000A	1A	2000A	Minimum operating current of check zone protection in primary circuit value
DIFZ	500 – 3,000A	1A	2000A	Minimum operating current of discriminating zone protection in primary circuit value
SLPCH	0.30 – 0.90	0.01	0.30	Restraining factor of check zone protection
SLPZ	0.30 – 0.90	0.01	0.30	Restraining factor of discriminating zone protection
1CT to 32CT	100 – 10,000A	1A	2000A	CT ratio setting with primary rating of up to 32 CTs
C.TP	BLK / Trip		BLK	Coupler CB tripped or not under bridge condition

DIF setting

The discriminating zone protection has up to four zones but the minimum operating current setting is common to each zone with DIFZ setting.

The setting of DIF (DIFCH and DIFZ) is determined from the minimum fault I_{Fmin} current that

can occur on the busbar fault. For example;

$$\text{DIF setting} < 0.8 \times I_{F\min}$$

The setting is based on the primary circuit value, so $I_{F\min}$ is a primary value. The CT ratios or the difference of the CT ratios between the channels can be disregarded in the setting.

If the minimum operating current is set too low when the CT primary rating is high, the operation error of the differential element is increased as shown in Figure 2.3.17. If it is required to keep the accuracy of minimum operating current less than 5%, the following condition must be checked for the DIFCH and DIFZ setting obtained above depending on the total number of channels.

$0.40 \times \text{CT primary rating} < \text{DIF setting}$ for 25 - 32 channels

$0.34 \times \text{CT primary rating} < \text{DIF setting}$ for 17- 24 channels

$0.28 \times \text{CT primary rating} < \text{DIF setting}$ for 9 - 16 channels

$0.23 \times \text{CT primary rating} < \text{DIF setting}$ for 1 - 8 channels

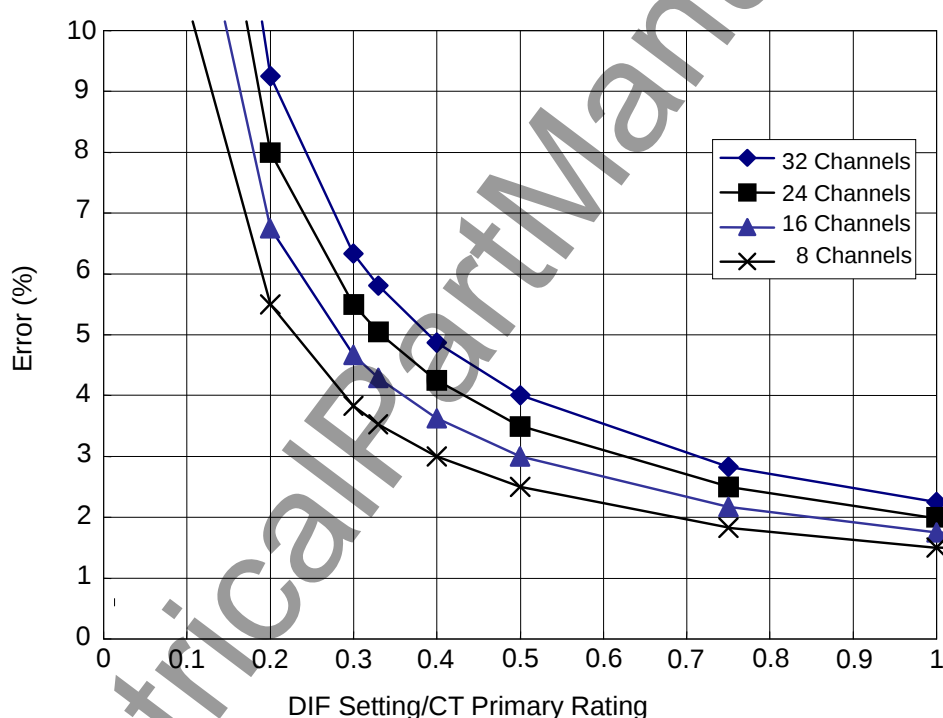


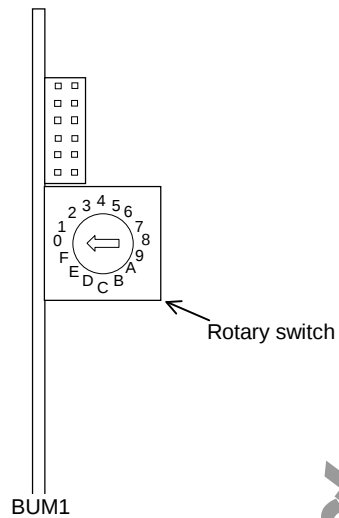
Figure 2.3.17 Accuracy Check

CT setting

CT settings are set for each channel with a primary rating.

BU address setting

BU address setting is to define the channel number. The channel number can be set the range of CH 1 to CH32 with the rotary switch and jumper pin JP6 of BU. For details, see the section 5.5.2.



2.4 Busbar System Replicas and Disconnecter Signals

2.4.1 Busbar Replicas Covered by GRB100

The GRB100 can be applied to single-, double- and ring-busbar systems with or without a transfer busbar. Application to the one-and-a-half breaker busbar system takes the same format as application to the single-busbar system.

The busbar system replicas which the GRB100 covers are shown in Appendix A. (Feeders and transformer banks connected to the busbars are abbreviated in the figures.)

The busbar can be sectioned into up to four zones, Zone A to Zone D with bus-section switches S1 to S4 and bus-coupler switches C1 to C4.

E1 to E4 show the end of busbars and are used to expand the busbar system and protection system.

Single-busbar

The replicas can be with or without a transfer busbar and have up to three bus-sections S1 to S3 and four bus-couplers C1 to C4 for a transfer busbar.

When the replica has a transfer busbar, the transfer busbar is connected to any of the busbar zones through one of the bus-couplers.

Double-busbar

The replicas can be with or without a transfer busbar and have up to two bus-sections S1 and S2 and two bus-couplers C1 and C2.

When the replica has no transfer busbar, either of the busbars can double as a transfer busbar.

When the replica has an independent transfer busbar, the transfer busbar is connected to any of the busbar zones through one of the bus-couplers.

Ring-busbar

The replicas can be with or without a transfer busbar and have up to four bus-sections S1 to S4 and four bus-couplers C1 to C4 for a transfer busbar connection.

When the replica has no transfer busbar, the busbar can be sectioned into two to four zones with bus-sections S1 to S4.

When the replica has a transfer busbar, the transfer busbar is connected to any of the busbar zones through one of the bus-couplers.

2.4.2 Disconnecter Signals

Disconnecter open/closed position signals are required to determine the busbar replica.

One normally open (N/O) and one normally closed (N/C) auxiliary contacts are required to evaluate the disconnector position. Figure 2.4.1 and Table 2.4.1 show the disconnector position evaluation. In Figure 2.4.1, the logic levels of N/O contact signal DS-NO, N/C contact signal DS-NC and evaluated disconnector position signal DS are “1” for the closed position and “0” for the open position.

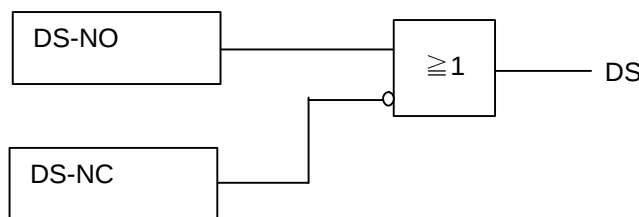


Figure 2.4.1 Disconnector Evaluation Logic

Table 2.4.1 DS Position Evaluation

DS-NO (N/O Contact)	DS-NC (N/C Contact)	DS Position Evaluation
Open	Closed	Open
Closed	Open	Closed
Open	Open	Closed and Failure Alarm
Closed	Closed	Closed and Failure Alarm

When both of the N/O and N/C contacts are simultaneously in the open or closed position, the disconnector is evaluated to be in the closed position and a failure alarm is issued by the monitoring function. (See Section 3.3.5.)

If the disconnector fails, the evaluation above operates as follows:

If the N/O contact is in the closed position or the N/C contact is in the open position incorrectly when the main contact is open, the main contact is evaluated to be in the closed position, differing with the actual position.

In single- and ring-busbars, the zone protection introduces the current of the failed disconnector, but incorrect operation is not caused because the main contact is open and the current is zero. In double-busbars, the zone protection regards the busbars as bridged. If busbar faults occur in this period, both zone protections operate and trip all the feeders. The zone protections do not operate for the load current or external faults.

If the N/O contact is in the open position or the N/C contact is in the closed position incorrectly when the main contact is closed, the main contact evaluation accords with the actual position, so incorrect operation is not caused.

Note: If only one of the N/O and N/C auxiliary contacts is transmitted, the main contact evaluation and monitoring is invalid. The main contact position is evaluated with the input N/O or N/C signal. Failure of an auxiliary contact may cause an incorrect operation of the discriminating zone protection.

The N/O and N/C auxiliary contact signals are sent to the BU and evaluated in the CU. For the disconnector signal input, refer to Section 3.2.1 and Appendix I.

2.5 Breaker Failure Protection

When a fault remains uncleared due to a breaker failure, the breaker failure protection (CBF) clears the fault by tripping the local adjacent breakers or a breaker at a remote line end.

If the current continues to flow following the output of a trip command, the CBF judges it as a breaker failure. The existence of the current is detected by an overcurrent element OCBF provided for each phase and each primary circuit. For high-speed operation of the CBF, a high-speed reset overcurrent element is used.

The GRB100 covers three patterns:

- When a feeder breaker fails to trip for a busbar fault, the CBF sends a transfer trip signal to a breaker at the remote end of the line, after retripping the original breaker.

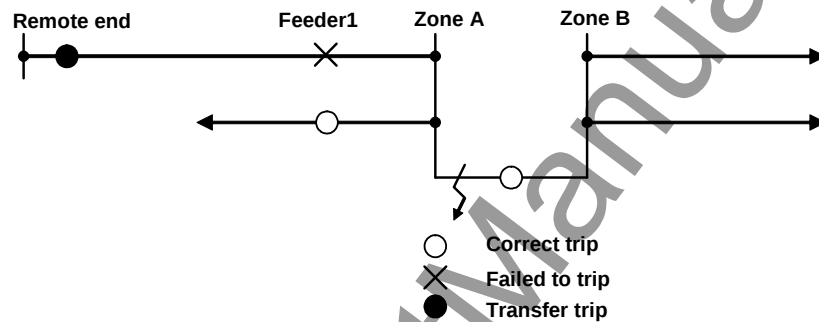


Figure 2.5.1 Busbar Fault with Feeder Breaker Failure

- When a feeder breaker fails to trip for a line fault, the CBF is initiated by a trip signal from the external line protection equipment and trips adjacent breakers connected to the zone to which the faulty breaker is connected, after retripping the original breaker.

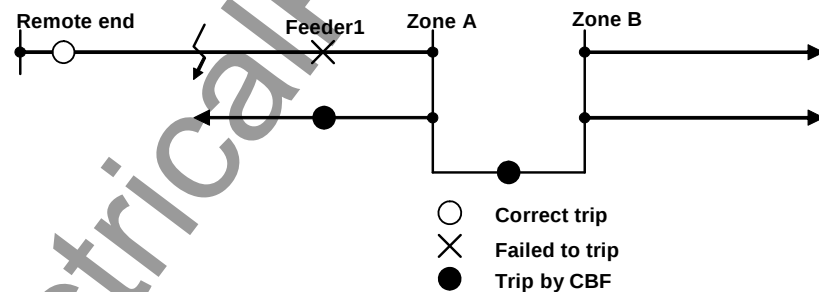


Figure 2.5.2 Feeder Fault with Feeder Breaker Failure

- When a bus-section or bus-coupler breaker fails to trip for a busbar fault, the CBF trips feeder breakers, bus-section breaker and bus-coupler breaker in the adjacent zone.

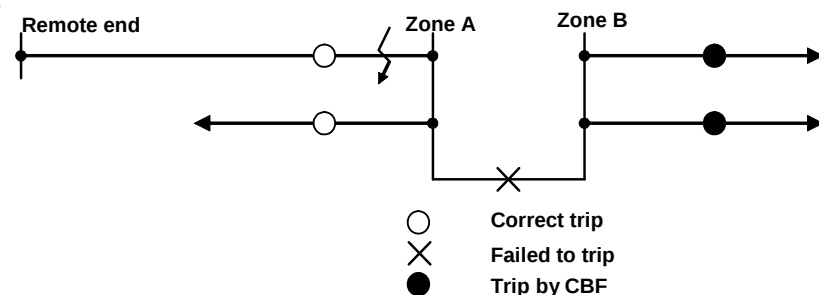


Figure 2.5.3 Busbar Fault with Bus-selection Breaker Failure

2.5.1 CBF Scheme logic

GRB100 provides the following two CBF scheme logics:

- Parallel initiation of the retrip timer (TnB1) and backtrip timer (TnB2)
- Series initiation of the retrip timer (TnB1) and backtrip timer (TnB2)

The parallel initiation (BF1) or the series initiation (BF2) can be selected by the scheme switch [BFLOGIC] setting.

Parallel initiation (BF1)

The CBF scheme logic is provided for each channel. Figure 2.5.4 shows the scheme logic for one channel. The BF1 scheme is available when the [BFLOGIC]=BF1 setting.

The CBF is performed on an individual phase basis and initiated by a trip signal nEXT-TRIP A (B, C) from an external protection or an internal trip signal BP TRIP. Starting with an external trip signal can be disabled by the scheme switch [nBFEXT]. These trip signals must be present as long as the fault persists.

The signal nCBF-TRIP to trip the adjacent breakers is initiated if the overcurrent element nOCBF operates continuously for the setting time of the delayed pick-up timer TnB2 after the start-up. Tripping of the adjacent breakers can be blocked with the scheme switch [nBF2].

The signal CBF-TRIP in a feeder channel is valid when the CBF is initiated with an external trip signal.

There are two kinds of mode of the retrip signal to the original breaker RETRIP: the mode in which RETRIP is controlled by the overcurrent element nOCBF, and the direct trip mode in which RETRIP is not controlled. The retrip mode together with the trip block can be selected with the scheme switch [nBF1].

The remote terminal transfer trip signal CHn-CBF.TR is provided in feeder channels and bus-coupler channels. The signal in a bus-coupler channel is available only when the transfer busbar is in service.

Note: “n” shows the channel number which is 1 to 32.

The remote circuit breaker can be tripped after the stage-1 timer TnB1 not waiting the stage-2 timer by the scheme switch [BFTRIO].

The concerned bus zone tripping and the remote CB tripping are carried out without a time delay by the binary input signal CHn-CBFIO (e.g. under pressure relays of SF6 etc.).

The trip signals are blocked with the binary input signals (CBF protection block: CBF_BLOCK-A and CBF_BLOCK-B).

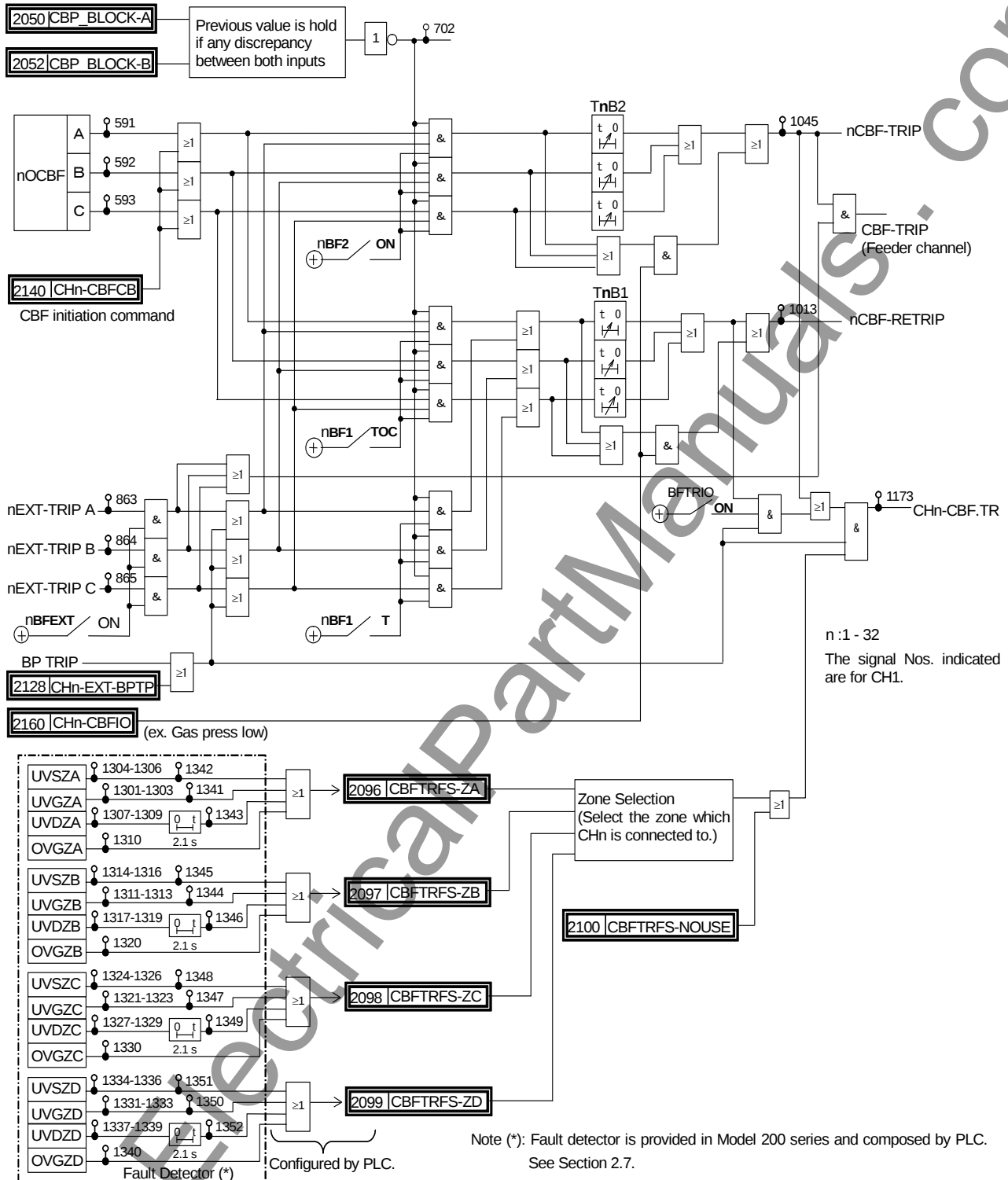


Figure 2.5.4 Scheme Logic of Breaker Failure Protection BF1

Figure 2.5.5 shows a sequence diagram of the CBF when a retrip and backtrip are used. If the breaker trips normally, the nOCBF is reset before timer TnB1 or TnB2 is picked up and the CBF is reset.

If the nOCBF continues operating, a retrip command is given to the original breaker after the setting time of TB1. Unless the breaker fails, the nOCBF is reset by the retrip. The TnB2 is not picked up and the CBF is reset. This may happen when the CBF is started by mistake and unnecessary tripping of the original breaker is unavoidable.

If the original breaker fails, retrip has no effect and the nOCBF continues operating and the TnB2 is picked up finally. A trip command nCBF-TRIP is issued to the adjacent breakers and the CBF is completed.

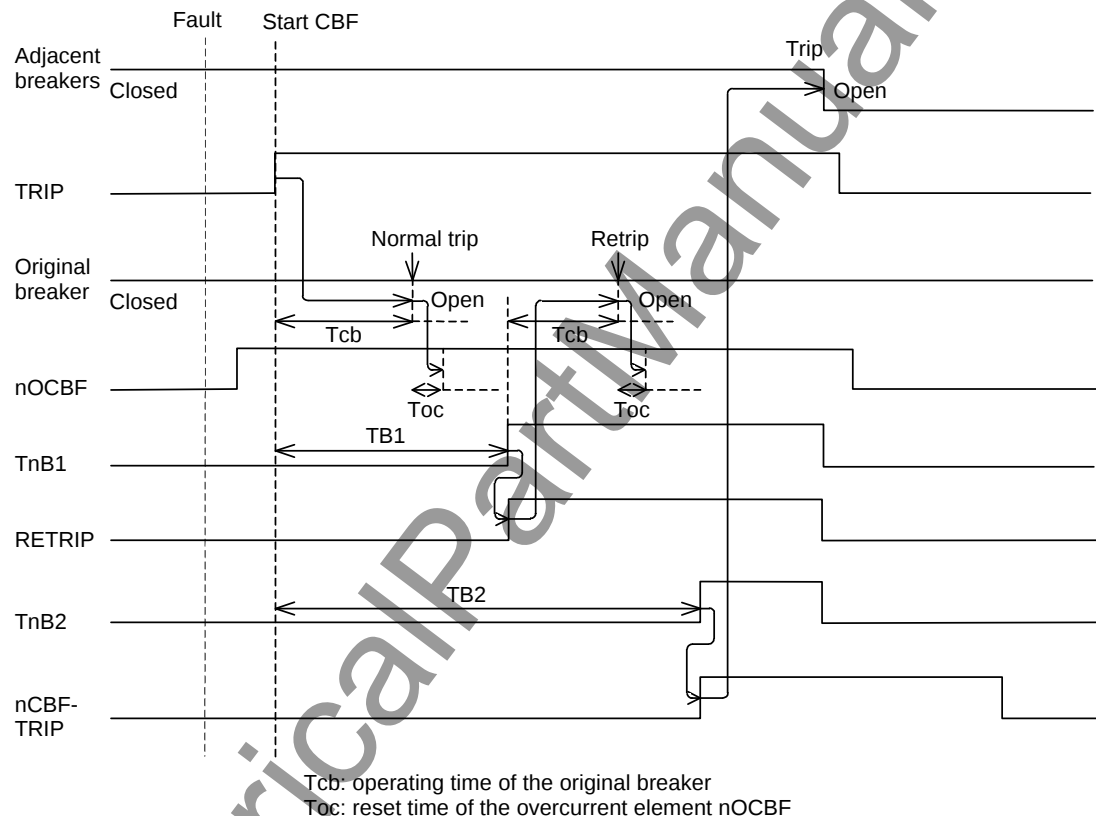


Figure 2.5.5 Sequence Diagram of BF1

Series initiation (BF2)

The BF2 scheme is available when the [BFLOGIC]=BF2 setting.

In the series initiation BF2 logic, the retrip timer (TnB1) and backtrip timer (TnB2) are initiated in series from a trip signal as shown in Figure 2.5.6.

When the CBF is initiated by feeder protection trip (external trip signal), the TnB1 and TnB2 are energized in series. The TnB2 starts after the set time of TnB1 has elapsed, and the nCBF-TRIP is output.

When the CBF is initiated by busbar protection trip, only the TnB2 is energised and the nCBF-TRIP is output after the set time of the TnB2.

When the BF2 scheme is used, the [BFTRIO] setting should be "OFF".

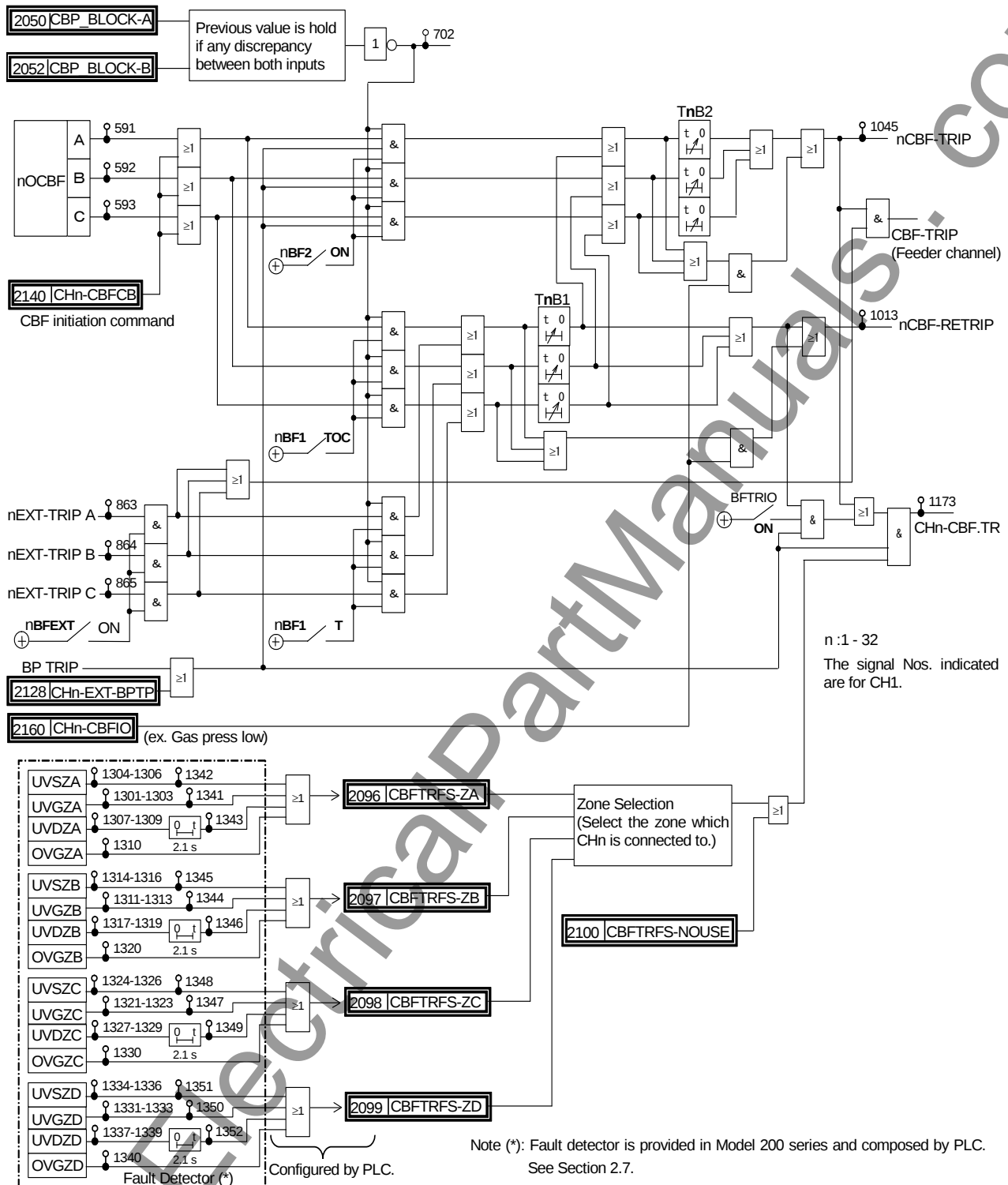


Figure 2.5.6 Scheme Logic of Breaker Failure Protection BF2

Figure 2.5.7 shows a sequence diagram of the BF2 scheme.

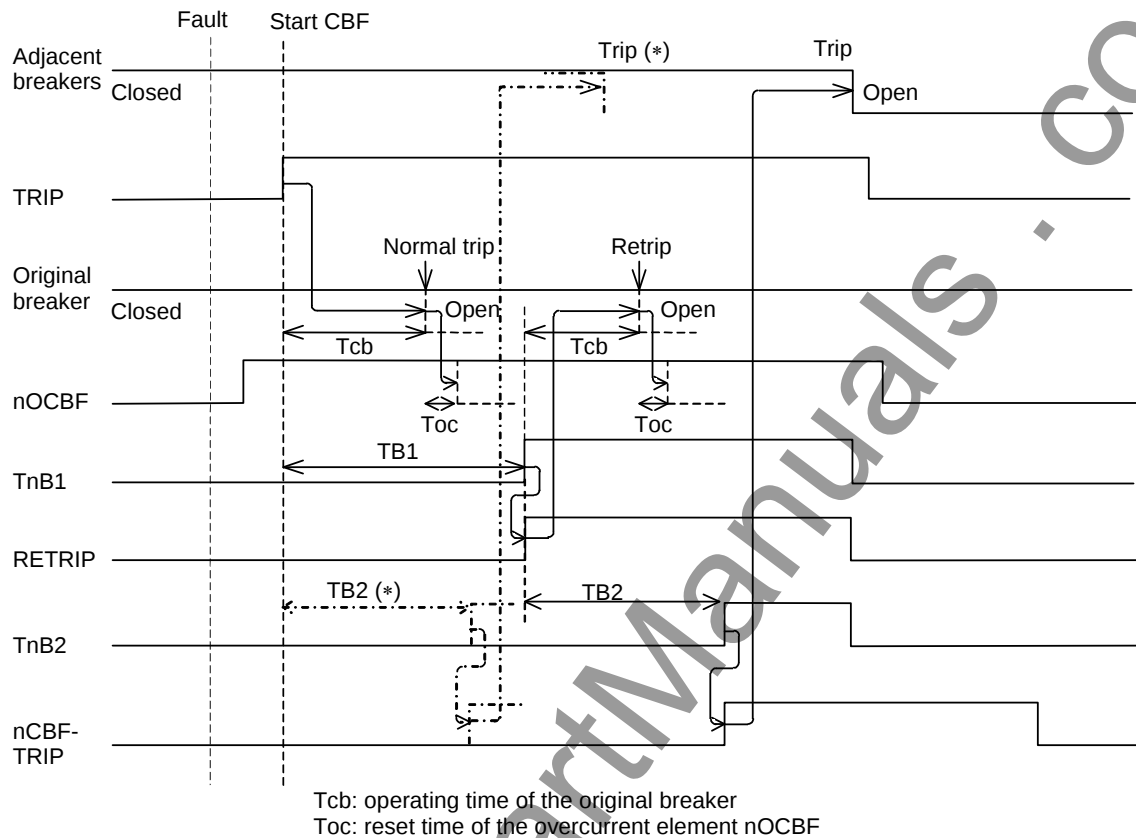


Figure 2.5.7 Sequence Diagram of BF2

The CBF-TRIP signal is output not only to all the channels of the original zone but also to adjacent zones if the original zone and adjacent zone(s) are bridged as follows:

- Bus-section is connected with a disconnector and has no circuit breaker.
- Bus-section has a breaker but it is by-passed by a disconnector.
- Busbars are bridged with disconnectors in the double-busbar system.

Figure 2.5.8 shows the CBF-TRIP signal distribution logic. The CBF of each channel outputs a trip signal nCBF-TRIP (n=1 to 32) to the original zone according to the replica setting. Thus the tripping zone(s) is fixed.

For example, if Zone A is connected to channel 1 and Zone A and Zone B are bridged, then ZA-CH1=1 and ZB-CH1=1. The CBF of channel 1 generates Zone A and Zone B trip signals ZA-TRIP and ZB-TRIP.

Each channel outputs the trip signal by checking which zone the channel is connected to.

For example, if channel 1 is connected Zone A, then CH1-ZA=1 and CH1-ZB=CH1-ZC=CH1-ZD=0. Channel 1 outputs the trip signal only when the signal ZA-TRIP is generated.

Fault detectors (undervoltage elements UVSZ*, UVGZ* and UVDZ*) as fail-safe can be connected the signals CBFFS-Z* by PLC function.



Inter trip scheme at busbar fault

If the busbar protection fails to trip the circuit breaker, the remote circuit breaker is tripped after the stage-1 timer TnB1 not waiting the stage-2 timer. This function can be available by the setting of [BFTRIO].

Command tripping (Gas pressure low inter tripping)

The lockout function of the respective circuit breaker (e.g. under pressure relays of SF6 etc.) is introduced in GRB100 relay and sets to zero both stage-1 (TnB1) and stage-2 (TnB2) timers. The concerned bus zone tripping and the remote CB tripping are carried out without a time delay by the binary input signal CHn-CBFIO. The actual tripping logic of command tripping is shown in Figure 2.5.4.

2.5.2 Setting

The setting elements necessary for the breaker failure protection and their setting ranges are as follows. The setting is required for each channel excluding the TBFDO and [BFTRIO].

Element	Range	Step	Default	Remarks
nOCB	0.1 – 2.0	0.1	0.8	OCBF overcurrent setting (multiples of secondary rated current)
TnB1	0 – 500ms	1ms	150ms	Retrip (stage-1) timer
TnB2	0 – 500ms	1ms	200ms	Backtrip (stage-2) timer
TBFDO	0.00 – 10.00s	0.01s	0.10s	CBF operation drop-off timer
[BFLOGIC]	BF1/BF2		BF1	CBF logic option
[nBFEXT]	ON/OFF		OFF	External start
[nBF1]	T/TOC/OFF		OFF	Retrip mode
[nBF2]	ON/OFF		OFF	Adjacent breaker trip
[BFTRIO]	ON/OFF		OFF	Remote trip operating time control

n: 1 – 32 (depends on the model)

The overcurrent element nOCBF checks that the breaker has opened and the current has disappeared. Therefore, since it is allowed to respond to the load current, it can be set from 10 to 200% of the rated current.

The settings of TnB1 and TnB2 are determined by the opening time of the original breaker (Tcb in Figure 2.5.5) and the reset time of the overcurrent element (Toc in Figure 2.5.5). The timer setting example can be obtained as follows.

$$\begin{aligned}
 \text{Setting of TnB1} &= \text{Breaker opening time} + \text{nOCBF reset time} + \text{Margin} \\
 &= 40\text{ms} + 15\text{ms} + 20\text{ms} \\
 &= 75\text{ms}
 \end{aligned}$$

$$\begin{aligned}
 \text{Setting of TnB2} &= \text{Output relay operating time} + \text{Breaker opening time} \\
 &\quad + \text{nOCBF reset time} + \text{Margin} \\
 &= 10\text{ms} + 40\text{ms} + 15\text{ms} + 10\text{ms} \\
 &= 75\text{ms}
 \end{aligned}$$

2.6 Miscellaneous Protection

2.6.1 Protection during Busbar Bridging

- Two busbars are bridged during switching a feeder in the double-busbar system. The bridge is detected with the N/O and N/C contacts of the two disconnectors.

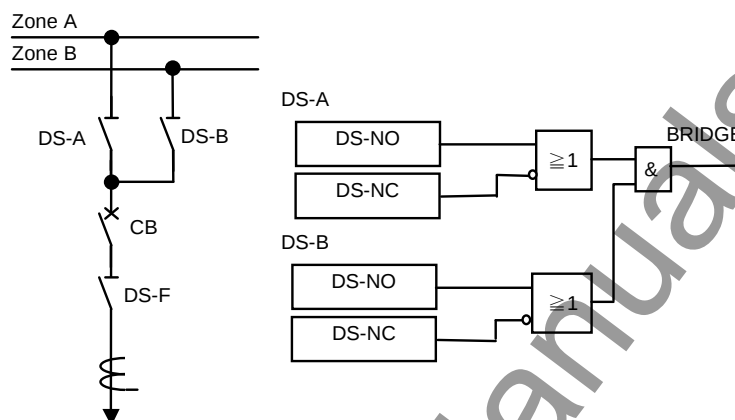


Figure 2.6.1 Bridging in Double-busbar System

During this bridging, tripping of the bus-coupler breaker is enabled or disabled by setting the switch [C.TP]. The switch [C.TP] is applied to both busbar protection and CBF protection.

2.6.1.1 Discriminating zone protection during bridging

In case of zones during bridging, the zones are treated as one zone and the discriminating zone protection range is expanded to be able to continue the protection. In Figure 2.6.2, for example, the discriminating zone protection expands the protective range. Zone A is expanded to cover Zone B while Zone A and Zone B are bridged. Zone B is also expanded to cover Zone A.

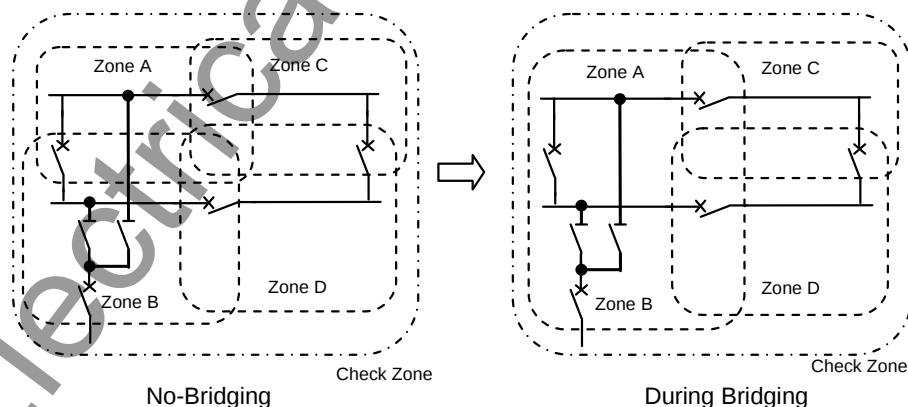


Figure 2.6.2 Discriminating Zone Protection during Bridging

2.6.2 Command tripping

GRB100 provides the command tripping function which executes a tripping by a trip signal from an external protection panel, etc. If applied, the trip signal is assigned to the trip command initiation signal CHn-COM.TP by PLC function. The command trip function can be disabled by the scheme switch [COMTP].

Note: “n” shows the channel number which is 1 to 32.

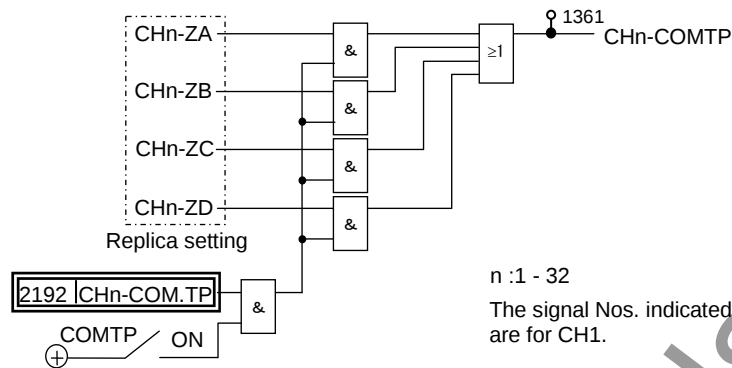


Figure 2.6.3 Command Tripping

2.6.4 Blind Zone Protection

In the bus-section and bus-coupler, it is normal to arrange two CTs, one on either side of the breaker so as two discriminating zone protections to overlap across the breaker.

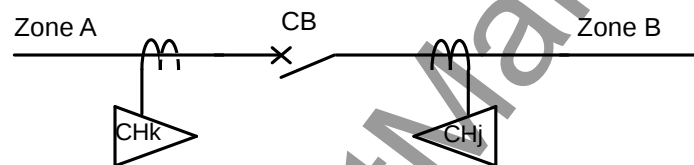


Figure 2.6.4 Normal CT Arrangement in Bus-section or Bus-coupler

If CTs are arranged on one side of the breaker or one CT is used for both zones, the protection zones do not overlap across the breaker and so the zone between the CTs and the breaker remains as a blind zone. One of the discriminating zone protections (Zone A in the example shown below) operates for the fault in the blind zone but the other (Zone B protection) does not and the fault is not cleared.

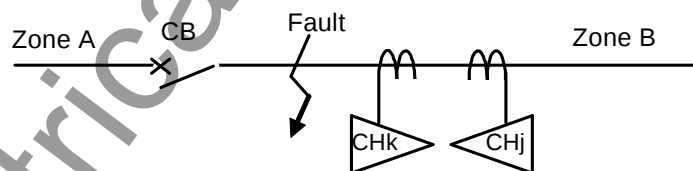


Figure 2.6.5 CT Arrangement Leaving Blind Zone

The GRB100 provides a backup protection for blind zone faults. It controls the current of the bus-section or bus-coupler where the blind zone exists to zero in the discriminating zone protection after the breaker is tripped by one of the discriminating zone protections and makes the protection of the other zone operate.

Zero ampere control for the bus-section and bus-coupler current continues one second after the breaker is opened.

One normally open auxiliary contact of the breaker is required for this protection and the auxiliary contact operation is assumed not to be more than 25ms earlier than the main contact operation. If the auxiliary contact operation is earlier than the main contact operation by more than 25 ms, the zero ampere control may function before the main contact opens and the discriminating zone protection may operate incorrectly to faults in the adjacent zone.

If the contact signal is not initiated, the function is disabled.

Note: The setting for this function will be performed by the panel builder.

Protection in Operating Busbar with Bus-section Open

If the busbar is operated with a bus-section open as shown in Figure 2.6.6, Zone A protection operates unnecessarily for a fault between the breaker and the CT. To avoid this unnecessary operation, the GRB100 provides a function to control the bus-section current to zero in the discriminating zone protection and to enable only the faulted zone protection to operate.

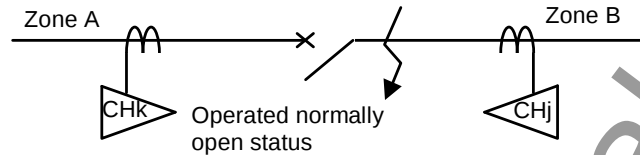


Figure 2.6.6 Operation with Bus-section Open

Figure 2.6.7 shows the bus-section current control logic and its time-chart. The zero ampere control is continuous. Therefore to keep security, the function requires both of the normally open (N/O) and normally closed (N/C) auxiliary contacts of the breaker. The main contact is evaluated to be open only when the N/O contact is open in three phases as well as when the N/C contact is closed in three phases. When both of the N/O and N/C contacts are simultaneously in the open or closed position, a failure alarm is issued.

The zero ampere control must be reset before the breaker main contact closes and establishes after the main contact opens. To fulfill this requirement, the N/O and N/C contacts must have the following time characteristics for the main contact:

- Normally open contact closes or normally closed contact opens before the main contact closes.(*)

Note (*): The "CB close command" is useful for an improvement in requirements of high-speed normally open contact or normally closed contact. See Figure 2.6.8.

- Normally open contact opens or normally closed contact closes after the main contact opens.

This function is valid for the blind zone protection too.

Note: The setting for this function will be performed by the panel builder.

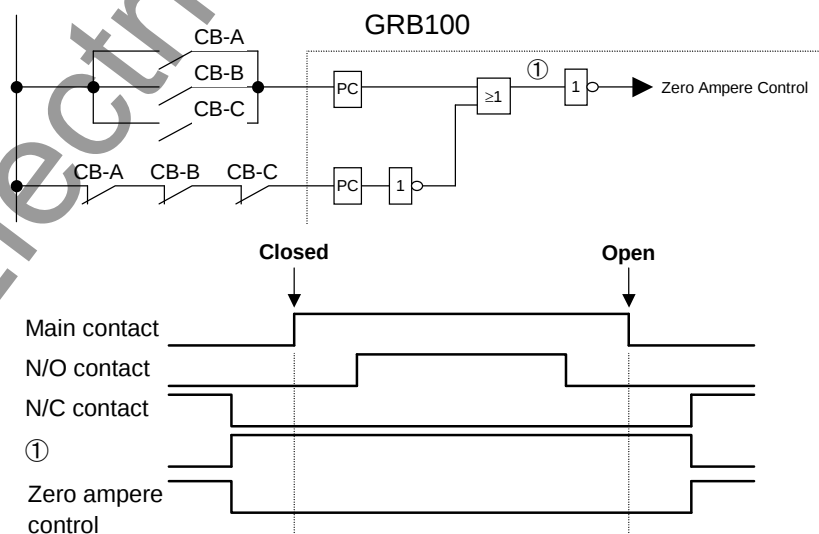


Figure 2.6.7 Zero Ampere Control Logic and Time Chart

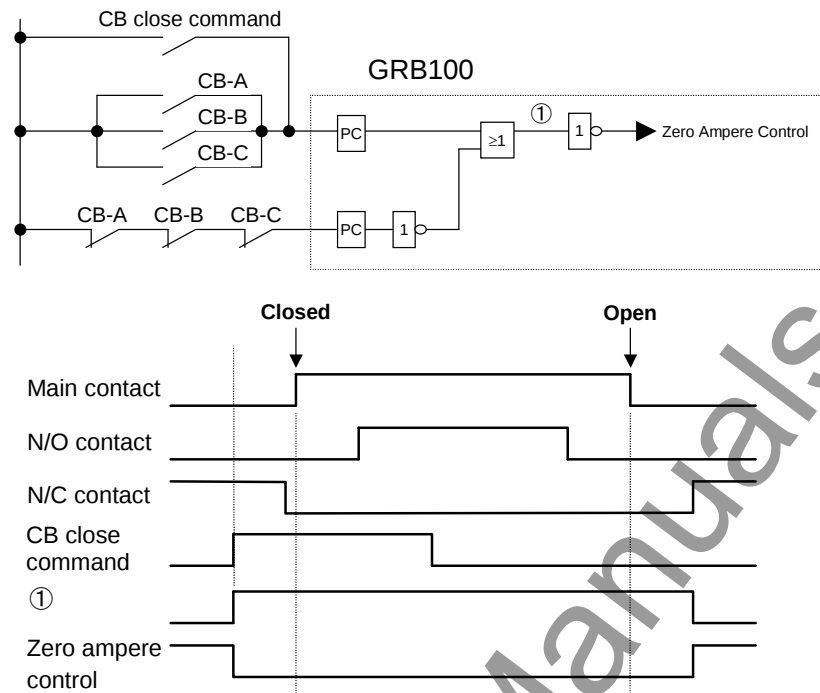


Figure 2.6.8 Zero Ampere Control Logic and Time-chart by Using CB Close Command

2.6.5 End Zone Fault Protection

GRB100 provides the function of the end fault protection to protect the zone between the CT (Current Transformer) and the CB (Circuit Breaker) when the CB is open.

If a fault occurs between CB-A and CT in the CT location of the busbar protection as shown in Figure 2.6.9, the busbar differential relay cannot operate normally. In this case, the fault can be cleared by the end zone fault protection. The end zone fault protection clears the fault by controlling this CHn bay current I_{CHn} to zero under CB-A open to enable the busbar differential relay to operate and by tripping the circuit breaker CB-B. The condition of CB-A must be input by the binary input signal (PLC signal).

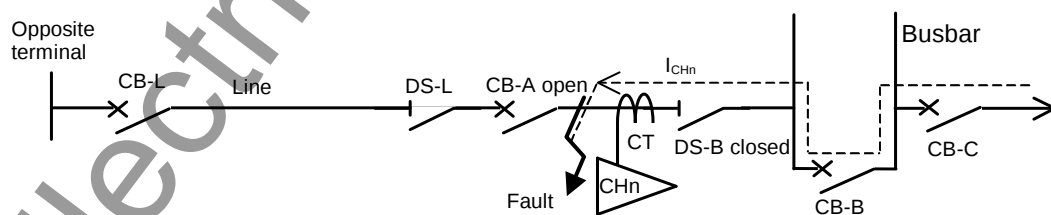


Figure 2.6.9 End Zone Fault Protection (1)

If a fault occurs between CB-A and CT in the CT location of the busbar protection as shown in Figure 2.6.10, the end zone fault protection prevents the busbar differential relay from operating by controlling this CHn bay current I_{CHn} to zero under CB-A open, and issues a transfer trip command to the circuit breaker CB-L at the opposite end and clears the fault.

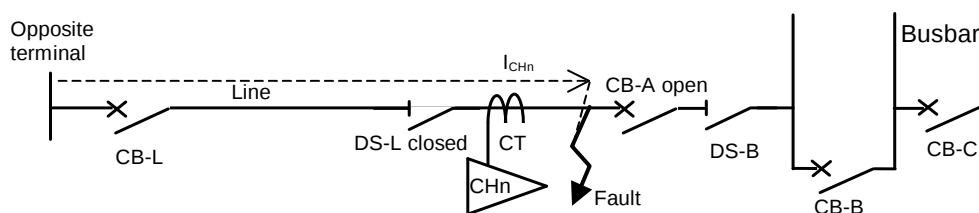


Figure 2.6.10 End Zone Fault Protection (2)

Figure 2.6.11 shows the scheme logic. When 1OCBF element operates under open of CH1 CB, the relay issues a transfer trip command CH1 EFP-TR and trips the opposite end CB. The timer TCBO is used to make sure the CB open and its default setting is 1.00s. To enable the function of end zone fault protection, the signal CH1 EFP-TR ON is assigned by PLC function. The function of other channels CH2 to CH32 are same as CH1.

OCBF elements are shared with the breaker failure protection (CBF).

The end zone fault protection for all channels is disabled by the scheme switch EFPTR.

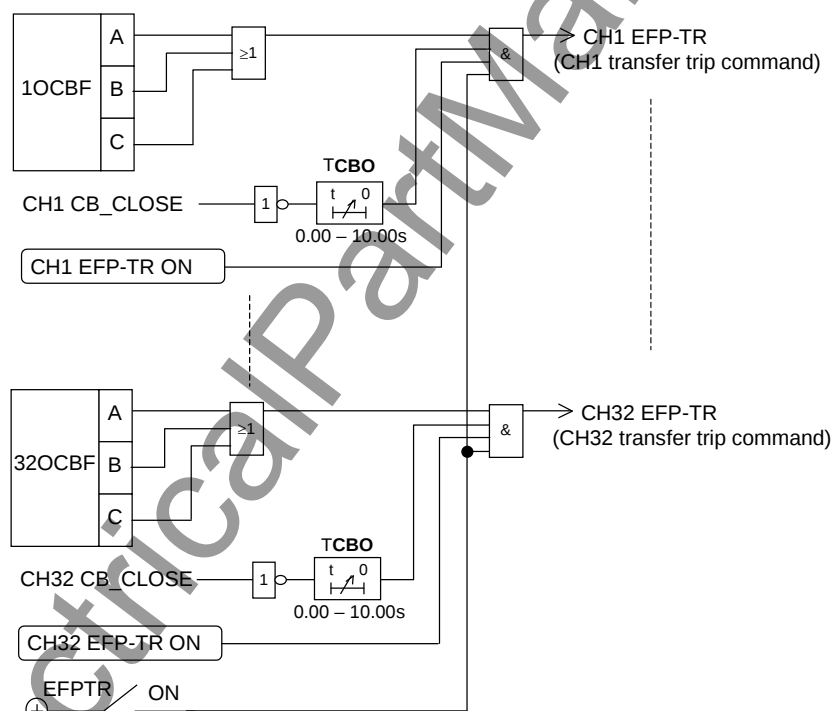


Figure 2.6.11 Scheme logic of End Zone Fault Protection (2)

Setting

The setting elements necessary for the end zone fault protection and their setting ranges are as follows.

Element	Range	Step	Default	Remarks
nOCB	0.1 – 2.0	0.1	0.8	OCBF overcurrent setting (multiples of secondary rated current)
TCBO	0.00 – 10.00s	0.01s	1.00s	
EFPTR	OFF / ON		OFF	

2.7 Fault Detector

GRB100 Model C200s is provided with a fault detector (FD) which functions as a check relay for tripping and enhances security against non-power system fault tripping.

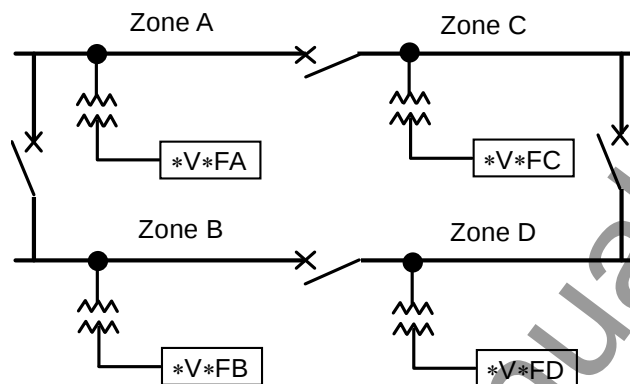


Figure 2.8.1 FD Available Busbar Replicas

The FD incorporates the phase fault and earth fault detecting undervoltage elements UVSF (UVSZA - UVSZD) and UVGF (UVGZA - UVGZD) and undervoltage change detection elements UVDF (UVDZA - UVDZD) and earth fault overvoltage elements OVGf. The elements are allocated to each busbar zone shown in Figure 2.8.1. UVSF, UVGF and OVGf are used for the differential protection and UVDF for the breaker failure protection.

Tripping output circuit

Figure 2.3.8 shows the tripping logic circuit of discriminating zone protection when the FD is in service. Figure 2.5.6 shows the tripping logic of CBF protection when the FD is in service.

Setting

The FD element setting ranges are shown in the table below.

Element	Range	Step	Default	Remarks
UVSF	60 - 100V	1V	80V	
UVGF	20 - 60V	1V	46V	
OVGF	0.1 - 10.0V	0.1V	10.0V	
VTA to VTD	1 - 20000	1	2000	VT ratio

2.8 Characteristics of Measuring Elements

2.8.1 Current Differential Elements DIFCH, DIFZ and DIFSV

The segregated-phase current differential elements used for discriminating zone (DIFZ) and check zone protections (DIFCH) have the non-restraint characteristic for the small current region and the percentage restraint characteristic for the large current region. The non-restraint characteristic defines the minimum sensitivity (operating current).

Figure 2.8.1 shows the characteristics on the differential current (I_d) and restraining current (I_r) plane. I_d and I_r are the vector and scalar summations of all input currents, respectively.

The non-restraint characteristic of the DIF (DIFCH or DIFZ) element is expressed by the following equation:

$$I_d \geq \text{DIF}$$

where DIF is a setting and defines the minimum operating current.

The percentage restraint characteristic is expressed by the following equation:

$$I_d \geq k \times I_r \quad (k = 0.30 \text{ to } 0.90)$$

The latter characteristic has stronger restraint and prevents the element from operating falsely in response to the erroneous differential current that is caused by saturation or transient errors of the CT during an external fault.

The characteristic of DIFCH can be changed to the characteristic shown in Figure 2.8.2 by PLC input (Signal No. 2069: DIFCH_CHARA) to ensure the operation of the check zone protection in case of the busbar configuration with a large outgoing current. (See Section 2.3.1.)

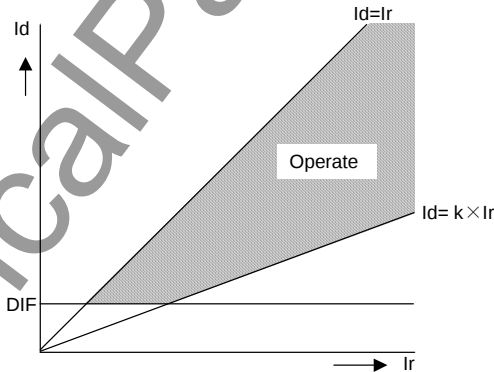


Figure 2.8.1 Current Differential Element (I_r - I_d Plane)

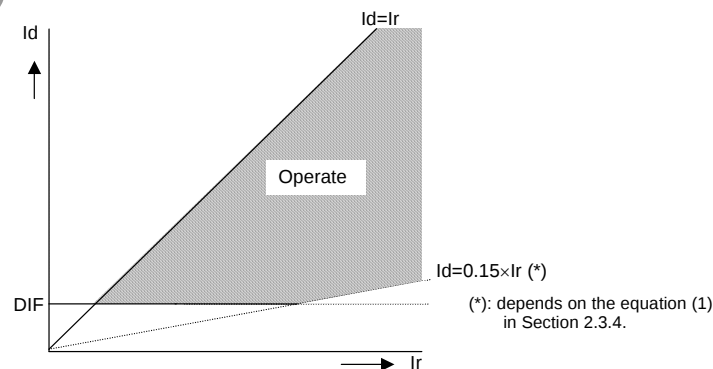


Figure 2.8.2 DIFCH Characteristic after PLC Input

The same characteristic can be represented on the outgoing current (I_{out}) and incoming current (I_{in}) plane as shown in Figure 2.8.3. This representation is useful when testing the percentage restraint characteristic by inputting the outgoing and incoming simulating currents.

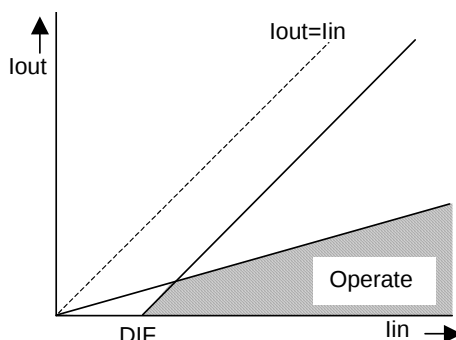


Figure 2.8.3 Current Differential Element (lin-Iout Plane)

The non-restraint characteristic is expressed by

$$I_{out} \leq I_{in} - DIFI$$

The percentage restraint characteristic is expressed by

$$I_{out} \leq \{(1-k)/(1+k)\} I_{in}$$

The supervisory element DIFSV used for differential current monitoring has a non-restraint characteristic.

2.8.2 Overcurrent element OCBF

The OCBF measures three-phase currents. This element is used for the breaker failure protection.

2.8.3 Overcurrent element ΣIZ

The ΣIZ measures the restraining current I_r of each zone.

This element is prepared for each zone, and its operating sensitivity is fixed to 20% of DIFZ setting.

2.8.4 Fault Detector Elements

The fault detector incorporates the following three fault detection elements.

Undervoltage change detection element UVDF

The UVDF operates if a voltage drops by 7% compared to that of two cycles before. Therefore, the operating sensitivity of this element is related not to the rated voltage but to the running voltage. The UVDF can detect the voltage drop in the system condition $SIR \geq 0.1$ as a fault detector for CBF initiation. (SIR: Source Impedance Ratio, see Appendix O.)

Undervoltage element UVSF and UVGF

The UVSF measures a phase-to-phase voltage while the UVGF measures a phase-to-earth voltage.

Overvoltage element OVGf

The OVGf measures zero-sequence voltage for detecting an earth fault.

2.9 Tripping Output

Figure 2.9.1 shows the tripping output circuit. The trip signal generated in the central unit is delivered to up to 32 channels, though only CH1 is expressed in the figure. The figure shows the case when 'Discriminating zone and check zone protection' is selected.

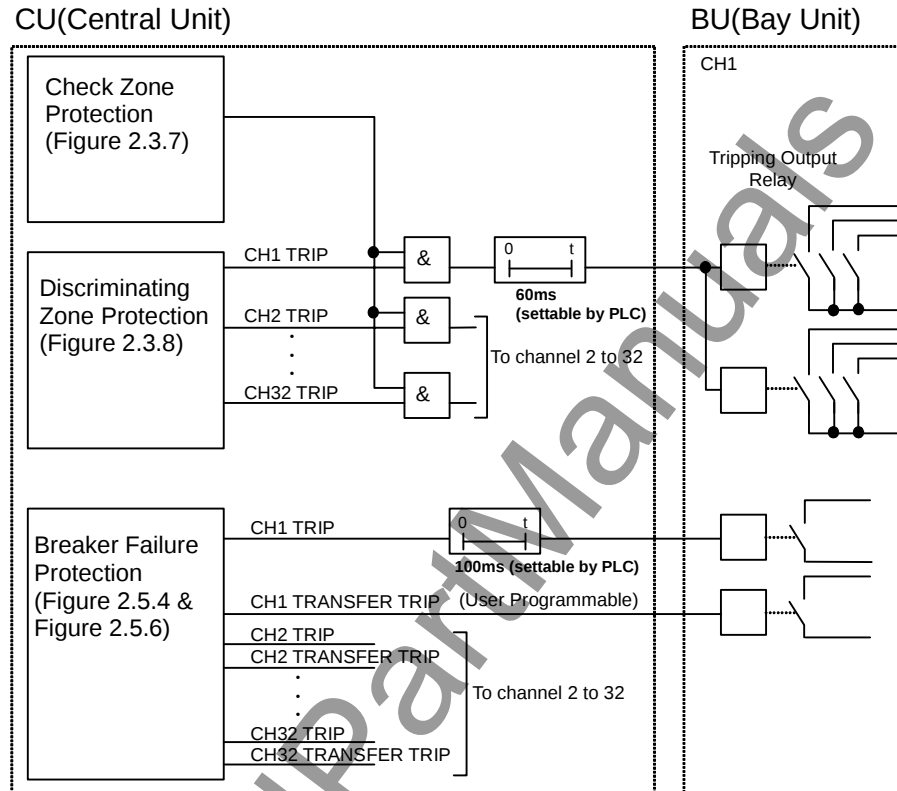


Figure 2.9.1 Tripping Output Circuit for CH1

The trip signal of busbar protection drives high-speed tripping output relays. The tripping output relays reset 60ms after the trip signal disappears by clearing the fault. The tripping circuit must be opened with the auxiliary contact of the breaker prior to reset of the tripping relay to prevent the tripping relay from directly interrupting the tripping current of the breaker.

The trip signal of breaker failure protection drives tripping output relays. The output relay resets 100ms after the trip signal disappears by clearing the fault.

3. Technical Description

3.1 Hardware Description

The GRB100 is composed of one Central Unit (CU) and numbers of Bay Unit (BU) depending on the required channels. The CU and BU are housed in individual cases.

3.1.1 Central Unit

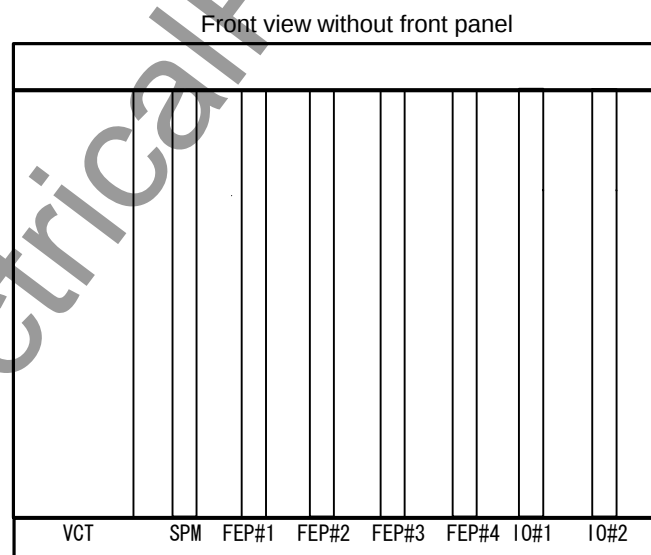
3.1.1.1 Outline of Hardware Modules

Case outline of the Central Unit (CU) is shown in Appendix H.

The hardware structure of the CU is shown in Figure 3.1.1. The front view shows the equipment without the human machine interface module.

The CU consists of the following hardware modules. The human machine interface module is provided with the front panel.

- Transformer module (VCT)
- Signal processing module (SPM)
- Front-end processing module (FEP)
- Binary input and output module 1 (IO#1)
- Binary input and output module 2 (IO#2)
- Human machine interface module (HMI)



Note: The FEP module is incorporated in models as follows:

C*10 model: FEP#1

C*20 model: FEP#1, FEP#3

C*30 model: FEP#1, FEP#2, FEP#4

C*40 model: FEP#1, FEP#2, FEP#3, FEP#4

Figure 3.1.1 Hardware Structure

The hardware block diagrams of the CU using these modules are shown in Figure 3.1.2.

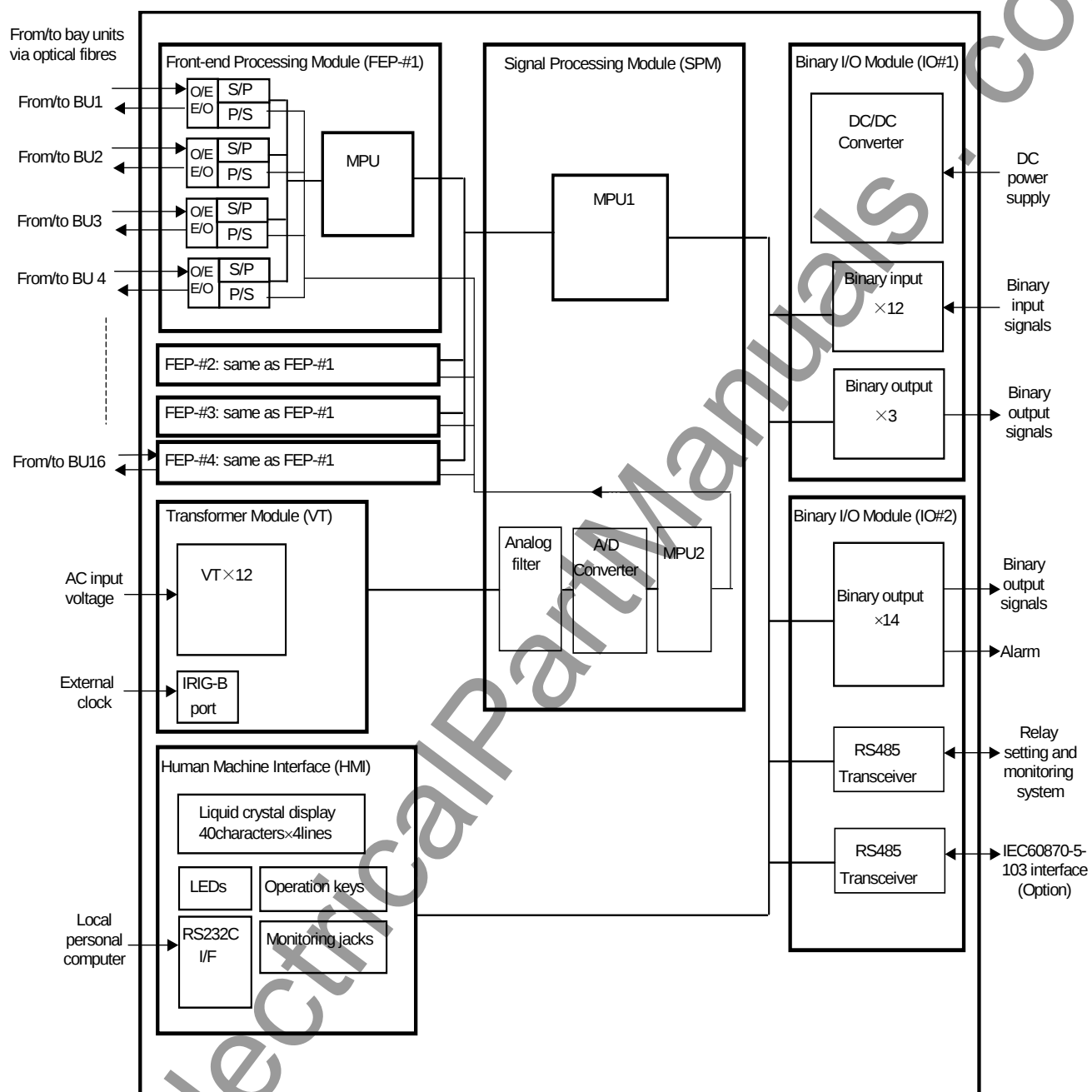


Figure 3.1.2 Hardware Block Diagram of CU

3.1.1.2 Transformer Module

The transformer module (VT module) insulates between the internal and external circuits through an auxiliary transformer and transforms the magnitude of AC input signals to suit the electronic circuits for the relay model with FD elements.

There are 6 or 12 auxiliary VTs mounted in the transformer module depending on the relay model. (For the correspondence between the relay model and number of AC input signals, see Table 3.2.1.)

The transformer module is also provided with an IRIG-B port. This port collects the serial IRIG-B format data from the external clock for synchronization of the relay calendar clock. The IRIG-B port is insulated from the external circuit by a photo-coupler. A BNC connector is used as the input connector.

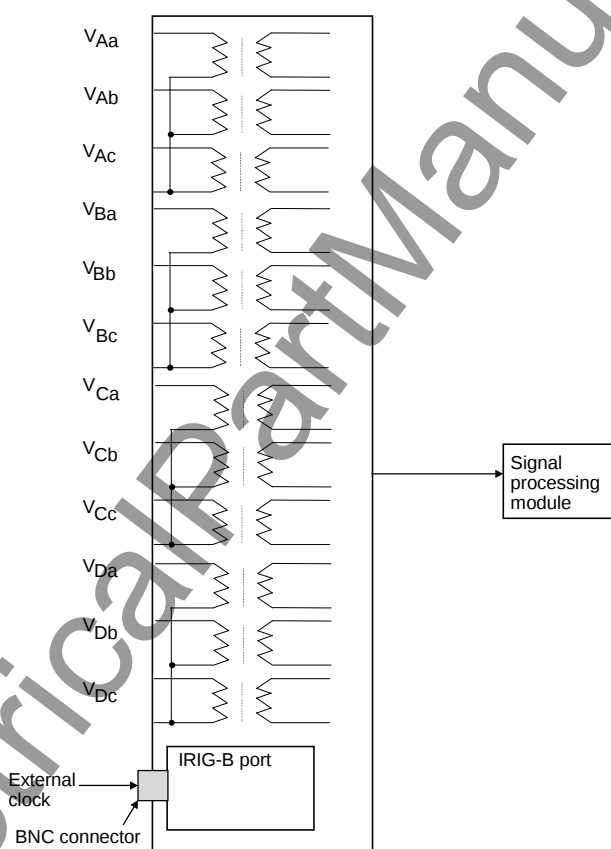


Figure 3.1.3 Transformer Module of CU

3.1.1.3 Signal Processing Module

The signal processing module (SPM) consists of RAM, ROM main processing units (MPU1 and MPU2), etc., and executes all kinds of processing such as protection, measurement, recording and display. The MPU1 and MPU2 implement 60 MIPS and use a RISC (Reduced Instruction Set Computer) type 32-bit microprocessor.

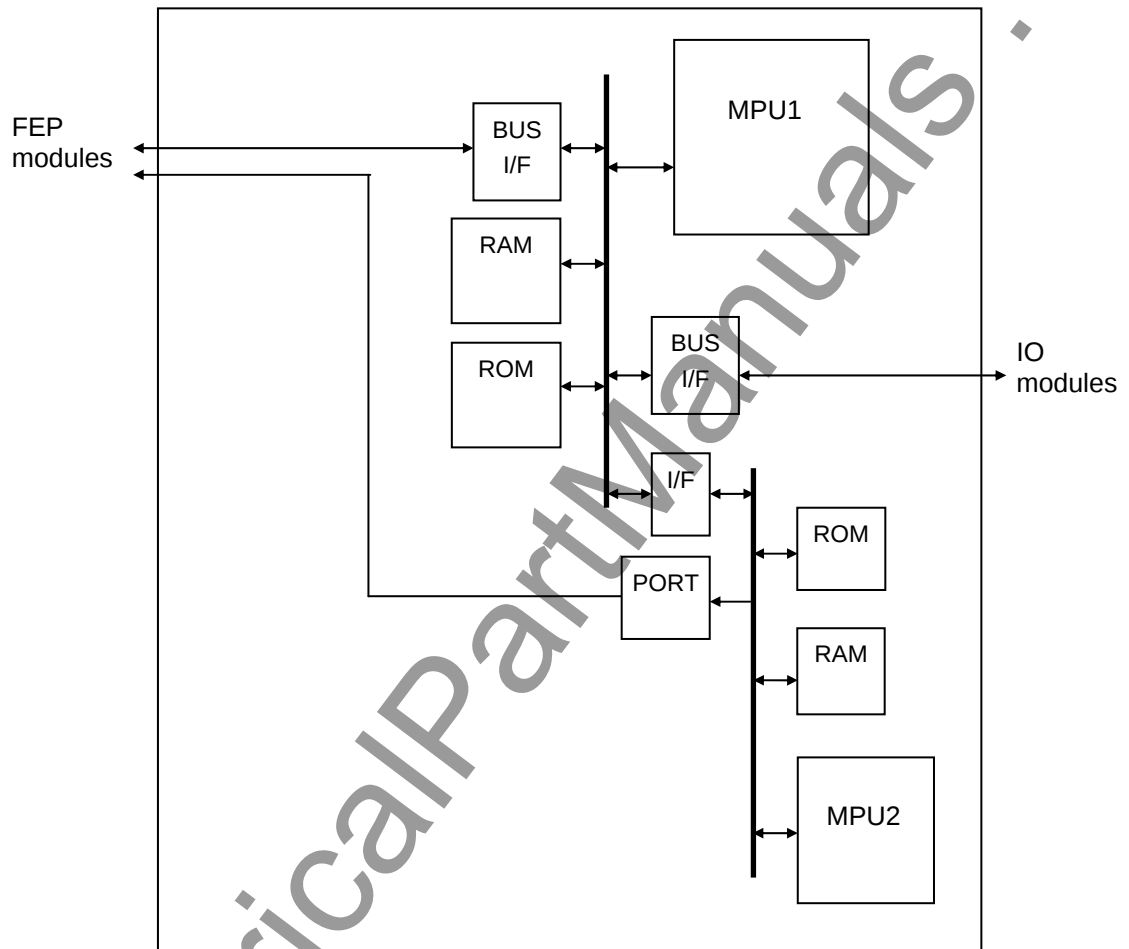


Figure 3.1.4 Signal Processing Module

3.1.1.4 Front-End Processing Module

The front-end processing module (FEP) incorporates front-end processing and communication control circuits.

The FEP consists of an MPU executing control processing of received data, memories (RAM and ROM), parallel-to-serial (P/S) and serial-to-parallel (S/P) data converter, and electrical-to-optical (E/O) and optical-to-electrical (O/E) converter.

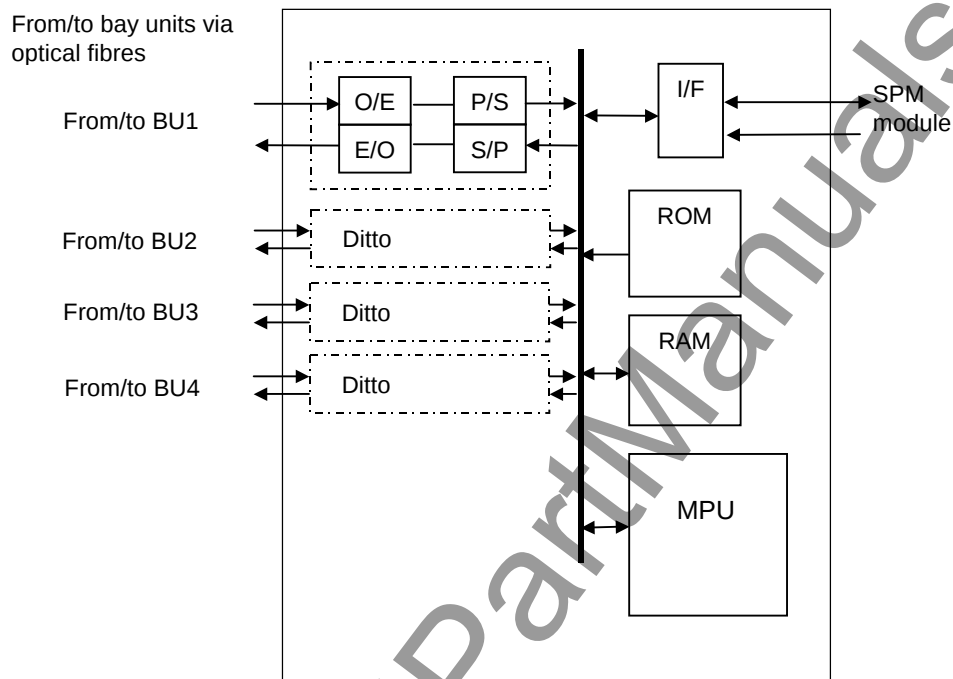


Figure 3.1.5 FEP Module

3.1.1.5 Binary Input and Output Module of CU

There are two types of binary input and output module (IO module): IO#1(IO8) and IO#2(IO2B).

IO#1(IO8) Module

The IO8 module incorporates a DC/DC converter, 12 photo-coupler circuits (BI1-BI12) for binary input signals and 3 auxiliary relays (BO1 – BO3) for binary output signals.

The input voltage rating of the DC/DC converter is 48/60V, 110V/125V or 220V/250V. The normal range of input voltage is -20% to $+20\%$.

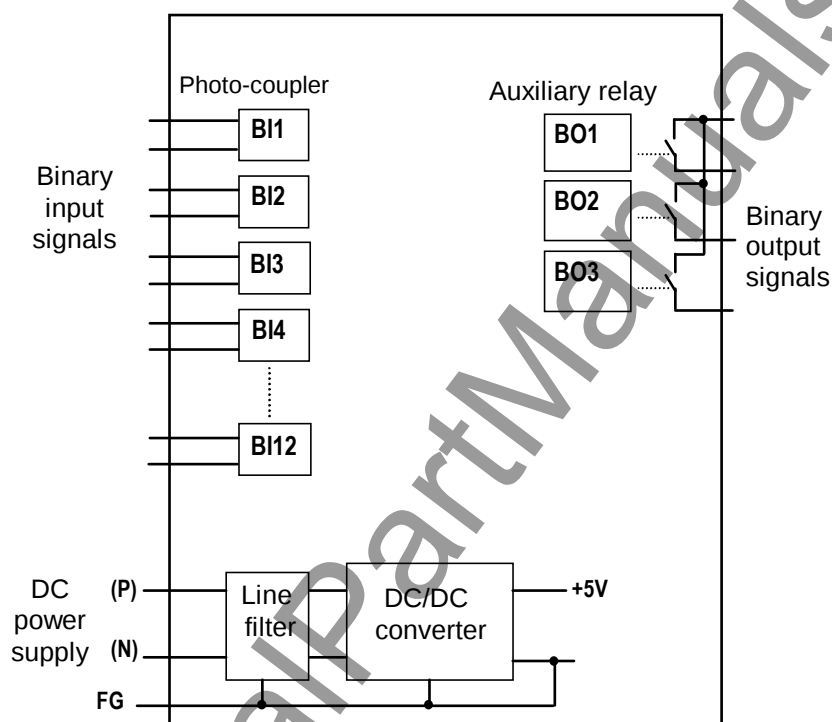


Figure 3.1.6 IO#1(IO8) Module

IO#2(IO2B) Module

The IO2B module incorporates 3 photo-coupler circuits (BI13-BI15) for binary input signals, 14 auxiliary relays (BO1-BO13 and FAIL) for binary output signals and two RS485 transceivers.

The auxiliary relay FAIL has one normally closed contact, and operates when a relay failure or abnormality in the DC circuit is detected. BO1 to BO13 each have one normally open contact.

The RS485 transceivers are used for the link with the relay setting and monitoring (RSM) system, and substation control and monitoring system by communication protocol IEC 60870-5-103. The external signal is insulated from the relay internal signal.

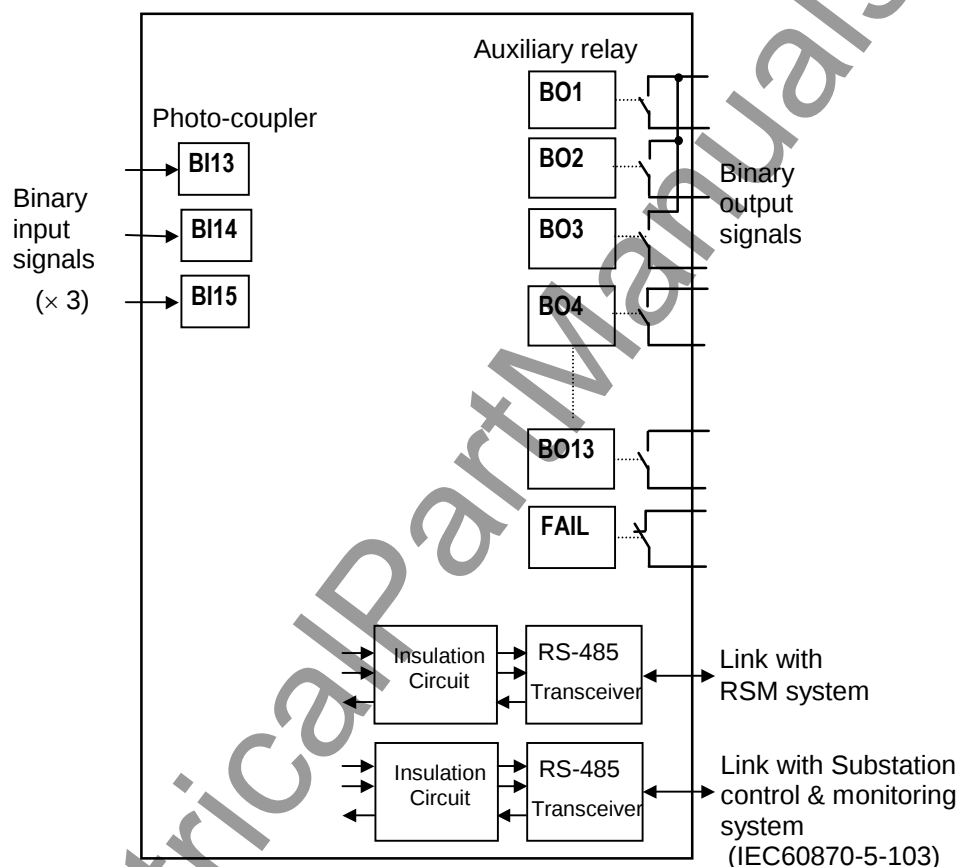


Figure 3.1.7 IO#2(IO2B) Module

3.1.1.6 Human Machine Interface (HMI) Module

The operator can access the GRB100 via the human machine interface (HMI) module of the central unit (CU). As shown in Figure 3.1.8, the HMI module has a liquid crystal display (LCD), light emitting diodes (LED), view and reset keys, operation keys, testing jacks and an RS232C connector on the front panel.

The LCD consists of 40 columns by 4 rows with a backlight and displays record, status and setting data.

There are a total of 8 LED indicators and their signal labels and LED colors are defined as follows:

Label	Color	Remarks
IN SERVICE	Green	Lit when relay is in service.
TRIP	Red	Lit when trip command is issued.
ALARM	Red	Lit when failure is detected.
TESTING	Red	Lit when test condition is set.
(LED1)	Red	
(LED2)	Red	
(LED3)	Red	
(LED4)	Red	

LED1 to LED4 are user-configurable and no label is sealed there.

Once it has started operating, the TRIP LED continues to operate even after the trip command disappears. Pressing the RESET key resets it. Other LEDs operate as long as a signal is present. The RESET key is ineffective for these LEDs.

The VIEW key starts the LCD indication and switches between windows. The **RESET** key clears the LCD indication and turns off the LCD backlight.

The operation keys are used to display the record, status and setting data on the LCD, input the settings or change the settings.

The monitoring jacks and two pairs of LEDs, A and B, on top of the jacks can be used while the test mode is selected in the LCD window. Signals can be displayed on LED A or LED B by selecting the signal to be observed from the "Signal List" or "Variable Timer List" and setting it in the window and the signals can be transmitted to an oscilloscope via the monitoring jacks. (For the "Signal List" or "Variable Timer List", see Appendix C or D.)

The RS232C connector is a 9-way D-type connector for serial RS232C connection. This connector is used for connection with a local personal computer.

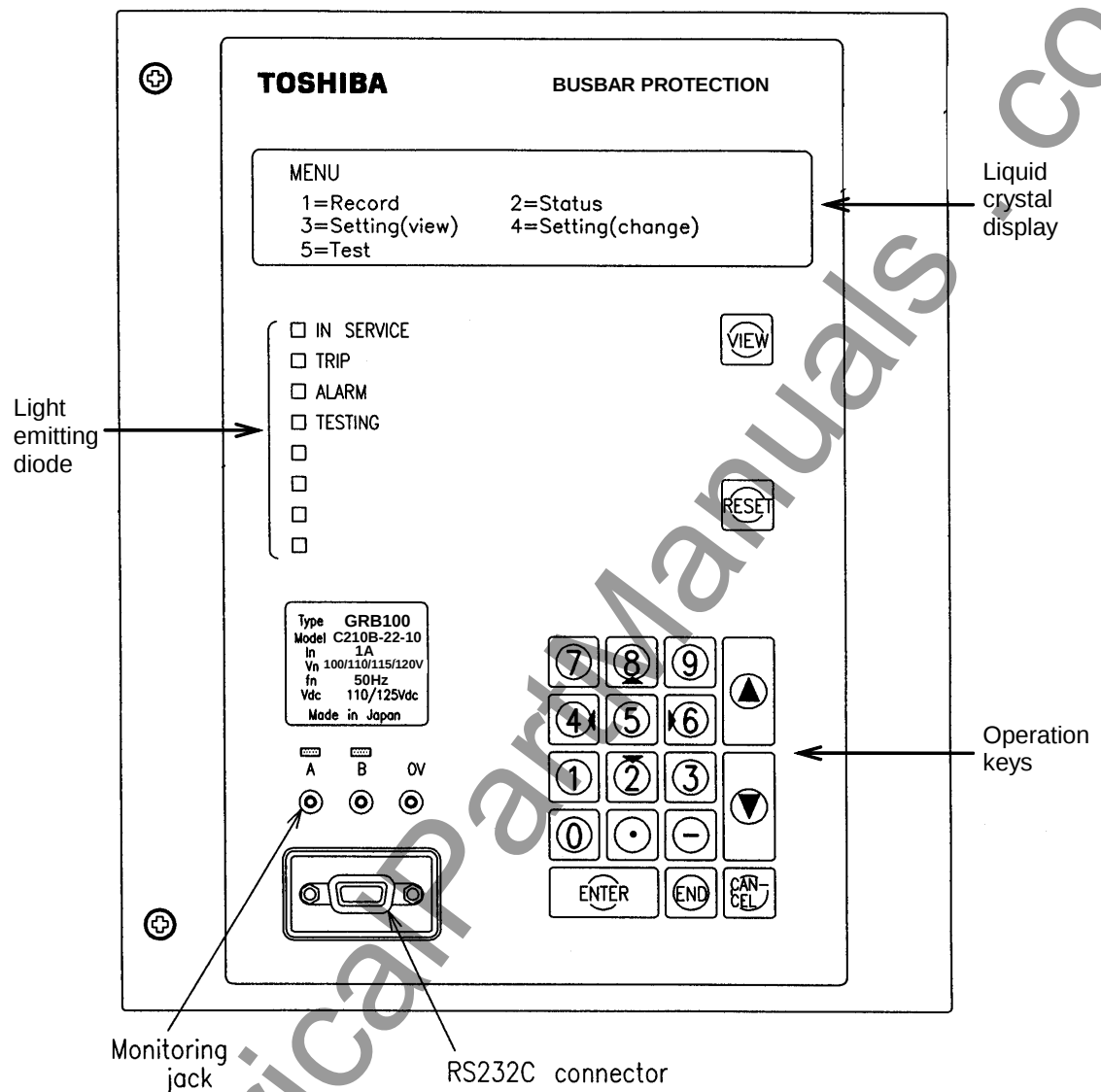


Figure 3.1.8 HMI of CU (Front Panel)

3.1.2 Bay Unit

3.1.2.1 Outline of Hardware Modules

The hardware structure of the BU is shown in Figure 3.1.9. The front view shows the equipment without the front panel.

The BU consists of the following hardware modules.

- Transformer module (CT)
- Bay unit module 1 (BUM1)
- Bay unit module 2 (BUM5)
- Front panel

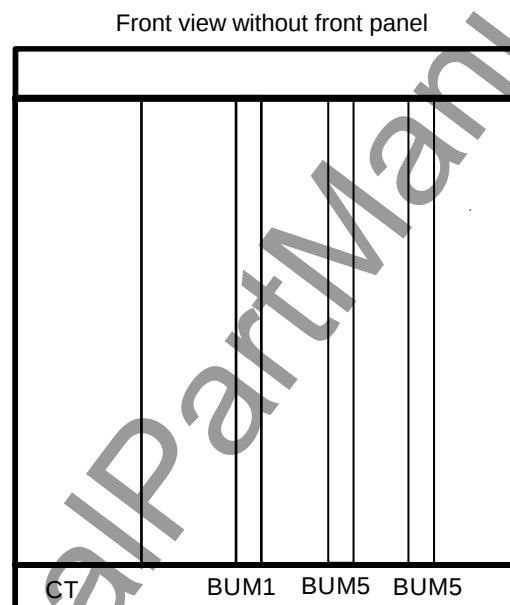


Figure 3.1.9 Hardware Structure of BU

Case outline of the Bay Unit (BU) is shown in Appendix H.

The hardware block diagrams of the BU using these modules are shown in Figure 3.1.10.

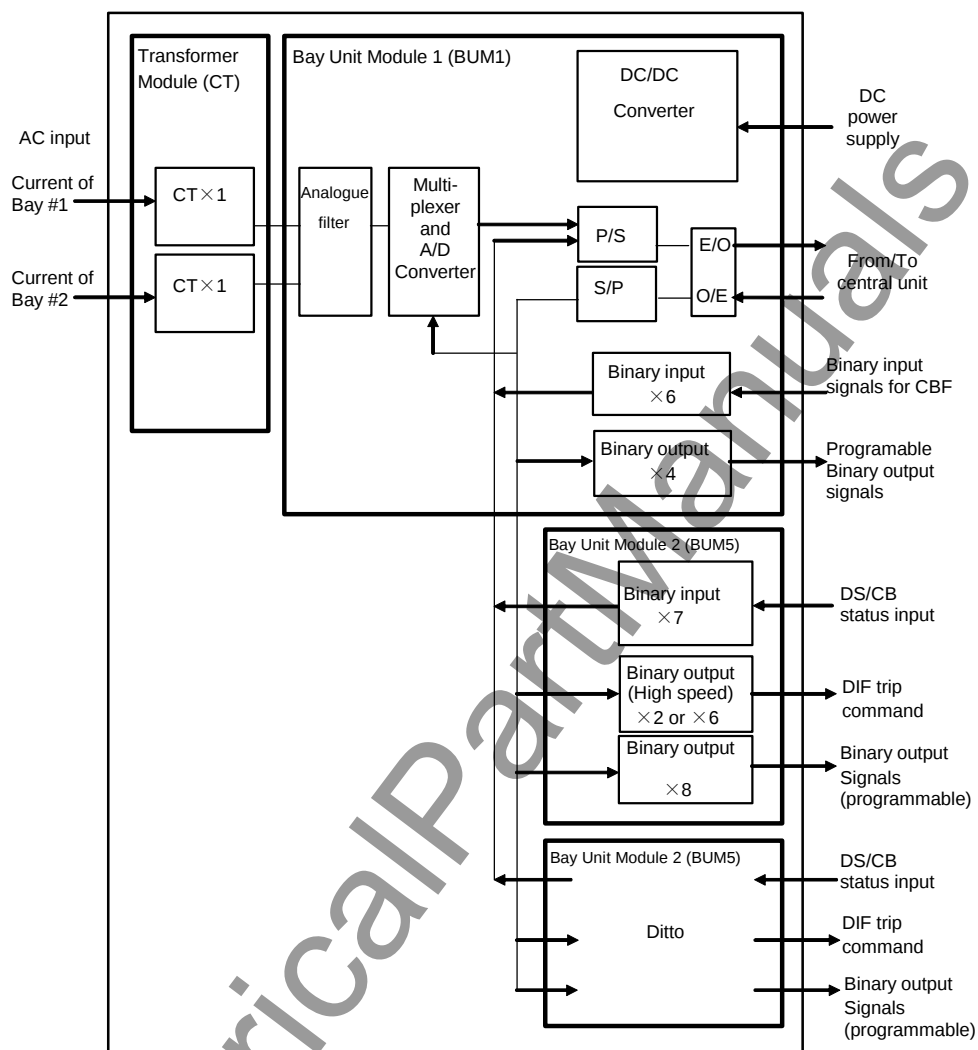


Figure 3.1.10 Hardware Block Diagram of BU

3.1.2.2 Transformer Module CT

The transformer module (CT module) insulates between the internal and external circuits through an auxiliary transformer and transforms the magnitude of AC input signals to suit the electronic circuits. The AC input signals are phase currents for two-circuits CH1 and CH2.

Figure 3.1.11 shows a block diagram of the transformer module. There are 3 auxiliary CTs mounted in the transformer module.

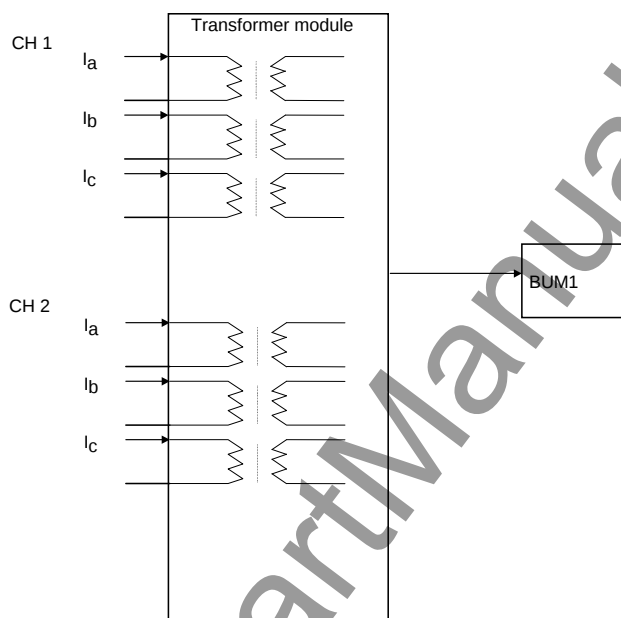


Figure 3.1.11 Transformer Module of BU

3.1.2.3 Bay Unit Module

There are three types of module: BUM1 and BUM5.

BUM1 Module

The bay unit module 1 (BUM1) consists of an analogue filter, multiplexer, analogue to digital (A/D) converter, DC/DC converter, photo-coupler circuits (BI11 to BI13) for binary input signals and 4 auxiliary relays.

The analogue filter performs low-pass filtering for the corresponding current and voltage signals.

The A/D converter has a resolution of 16 bits and samples input signals at sampling frequencies of 2400 Hz (at 50 Hz) and 2880 Hz (at 60 Hz).

The input voltage rating of the DC/DC converter is 48V/60V, 110V/125V or 220V/250V. The normal range of input voltage is -20% to $+20\%$.

The auxiliary relays BO1 and BO2 have one normally open contact.

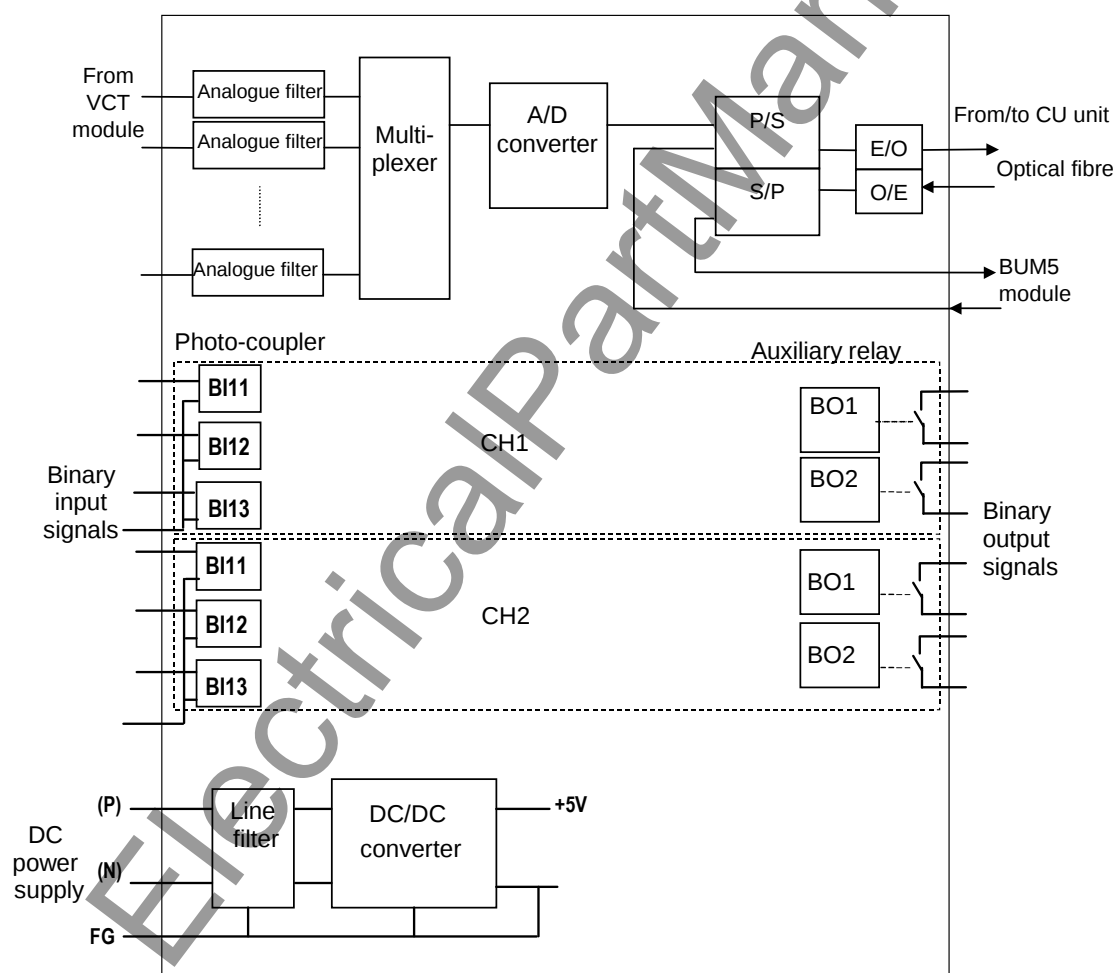


Figure 3.1.12 BUM1 Module

BUM5 Module

The bay unit module BUM5 incorporates 7 photo-coupler circuits (BI1-BI7) for binary input signals, 8 auxiliary relays and 2 or 6 high-speed auxiliary relays for tripping command.

The tripping command auxiliary relays are the high-speed operation type and have one normally open output contact.

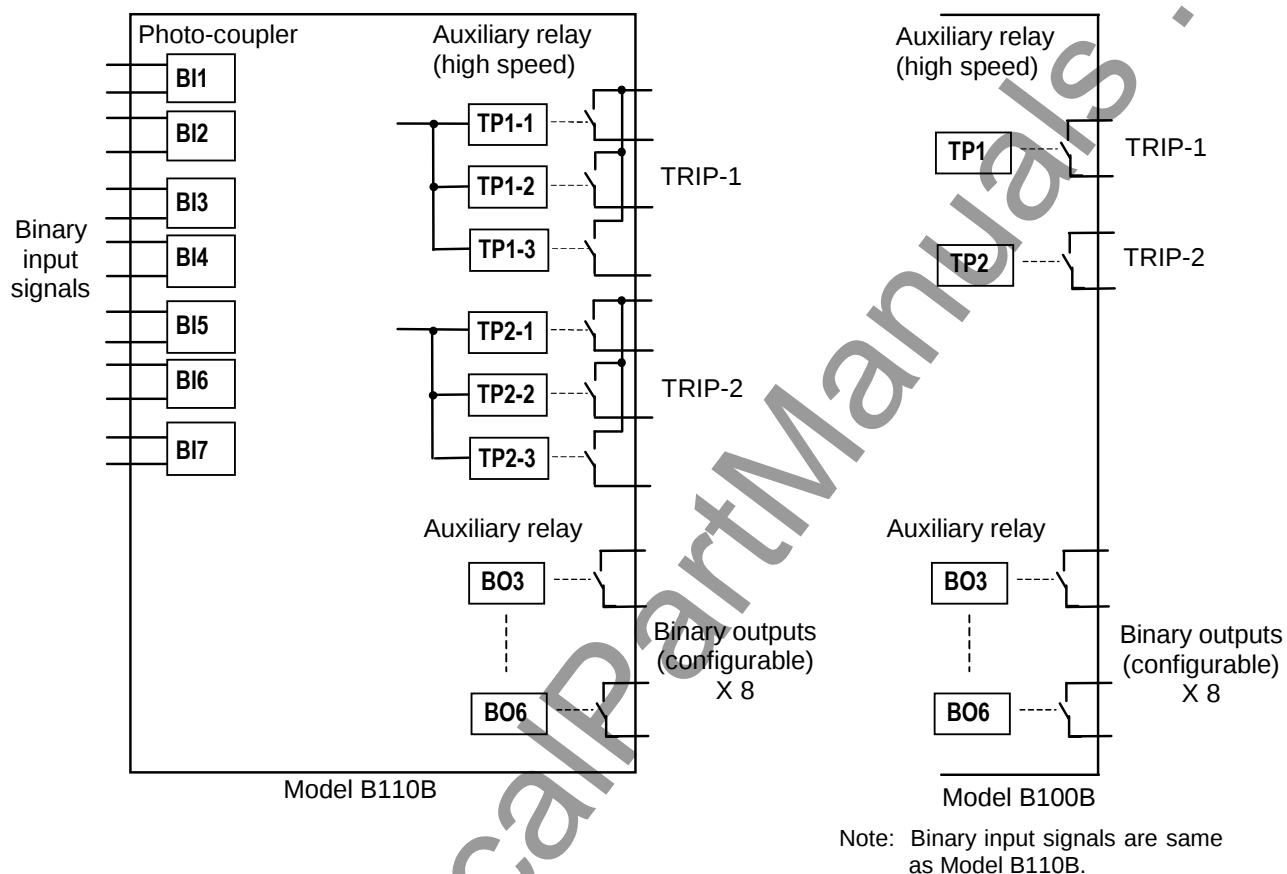


Figure 3.1.13 BUM5 Module

3.1.2.4 Front Panel of Bay Unit

The front panel provides a green LED. The LED is lit when DC power is supplied.

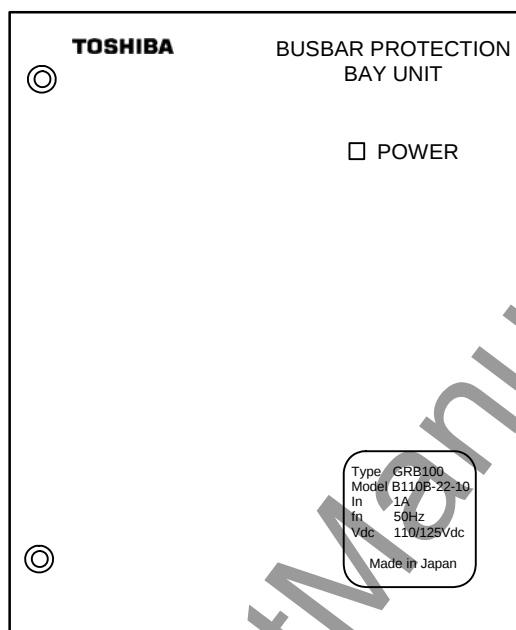


Figure 3.1.14 Front Panel of BU

3.2 Input and Output Signals

3.2.1 Input Signals

AC input signals

Table 3.2.1 shows the AC input signals applied to the CU and BU of the GRB100 and their respective input terminal numbers. AC voltage input signals are provided only for the models with FD elements. The model 100series and 200series provide four zones, Zone A to Zone D. See Appendix I for external connections.

Table 3.2.1 (a) AC Input Signals of CU (Models with FD elements)

Terminal No. of TB3	Signals	Terminal No. of TB3	Signals
1	Zone A A phase voltage	9	Zone C A phase voltage
2	B phase voltage	10	B phase voltage
3	C phase voltage	11	C phase voltage
4	Neutral	12	Neutral
5	Zone B A phase voltage	13	Zone D A phase voltage
6	B phase voltage	14	B phase voltage
7	C phase voltage	15	C phase voltage
8	Neutral	16	Neutral
		18	(earth)

Table 3.2.1 (b) AC Input Signals of BU

Terminal No. of TB1	Signals
1-2	A-phase current of the first channel
3-4	B-phase current of the first channel
5-6	C-phase current of the first channel
7-8	A-phase current of the second channel
9-10	B-phase current of the second channel
11-12	C-phase current of the second channel
14	(earth)

Binary input signals

Table 3.2.2 shows the binary input signals available in the GRB100. See Appendix I for external connections.

The binary input circuit of the CU is provided with a logic level inversion function as shown in Figure 3.2.1. Each input circuit has a binary switch BISW which can be used to select either normal or inverted operation.

Further, all binary input functions are programmable by PLC (Programmable Logic Circuit) function.

If a signal is not input, the function concerned is disabled.

The operating voltage of binary input signal is typical 74V DC at 110V/125V DC rating and 138V DC at 220/250V DC. The minimum operating voltage is 70V DC at 110/125V DC rating and 125V DC at 220/250V DC.

Table 3.2.2 (a) Binary Input Signals in CU

Signal Name	Contents	BI No. (default setting)
Indication reset	Reset TRIP LED indication externally.	BI1
Bus protection block-A(*)	Block bus protection externally.	BI2
CBF protection block-A(*)	Block breaker failure protection.	BI3
Bus protection block-B(*)	Block bus protection externally.	BI4
CBF protection block-B(*)	Block breaker failure protection.	BI5
		BI6
		BI7
		:
		:
		:
		BI14
		BI15

(*): These signals are duplicated with two BIs.

- BUS protection block: BI2 & BI4

- CBF protection block: BI3 & BI5

See Appendix I.

Table 3.2.2 (b) Binary Input Signals in BU (each channel CH)

Signal Name	Contents	BI No. (default setting)
DS1 contact (N/O)	Detect disconnector condition. (Closed when disconnector closed.)	BI1
DS1 contact (N/C)	Detect disconnector condition. (Open when disconnector closed.)	BI5
DS2 contact (N/O)	Detect disconnector condition. (Closed when disconnector closed.)	BI2
DS2 contact (N/C)	Detect disconnector condition. (Open when disconnector closed.)	BI6
		BI3
		BI7
Command trip (Gas press. low)	Initiate command tripping.	BI4
External trip signal (A-phase)	Initiate CBF protection.	BI11
External trip signal (B-phase)	Initiate CBF protection	BI12
External trip signal (C-phase)	Initiate CBF protection	BI13

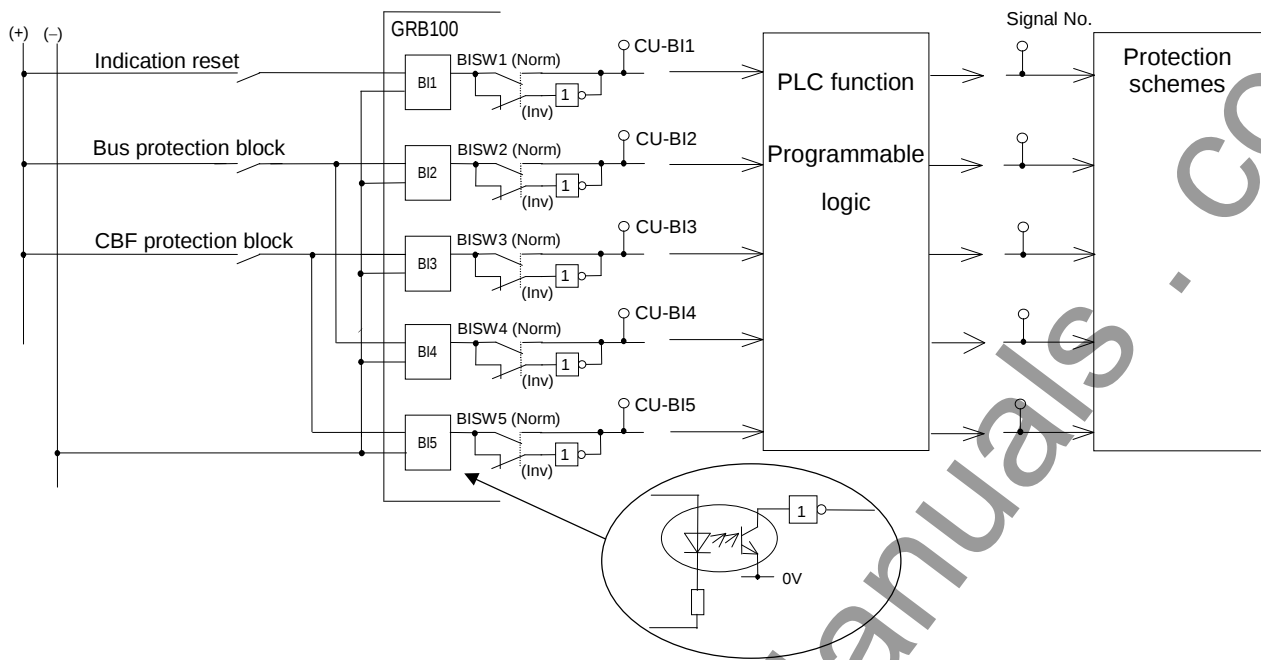


Figure 3.2.1 Logic Level Inversion

3.2.2 Binary Output Signals

The number of binary output signals and their output terminals vary depending on the relay models. See Appendix I for details. For all models, all outputs except the relay failure signal can be configured.

The signals shown in the signal list in Appendix C can be assigned to the output relay individually or in arbitrary combinations. Signals can be combined using either an AND circuit or OR circuit with 6 gates each as shown in Figure 3.2.2. The output circuit can be configured according to the setting menu. Appendix E shows the factory default settings.

A 0.2s delayed drop-off timer can be attached to these assigned signals. The delayed drop-off time is disabled by the scheme switch [BOTD].

The relay failure contact closes when a relay defect or abnormality in the DC power supply circuit is detected.

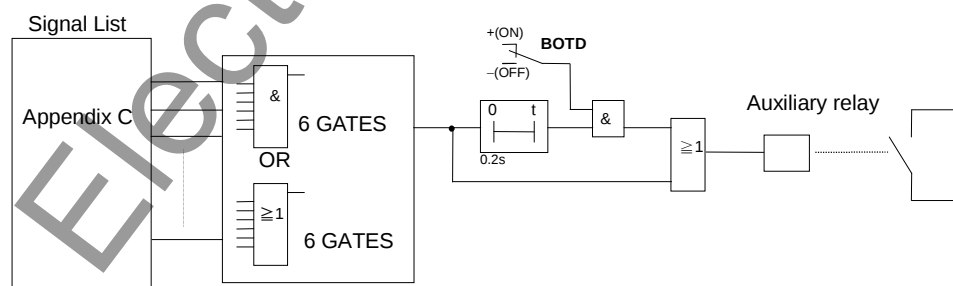


Figure 3.2.2 Configurable Output

The binary outputs TP1, TP2, BO3 to BO6 for each BU (CH1 – CH32) are programmed by PLC function.

3.2.3 PLC (Programmable Logic Control) Function

GRB100 is provided with a PLC function allowing user-configurable sequence logics on binary signals. The sequence logics with timers, flip-flops, AND, OR, NOT logics, etc. can be produced by using the PC software “PLC tool” and linked to signals corresponding to relay elements or binary circuits.

Configurable binary inputs, binary outputs and LEDs, and the initiation trigger of disturbance record are programmed by the PLC function. Temporary signals are provided for complicated logics or for using a user-configured signal in many logic sequences.

PLC logic is assigned to protection signals by using the PLC tool. For PLC tool, refer to PLC tool instruction manual.

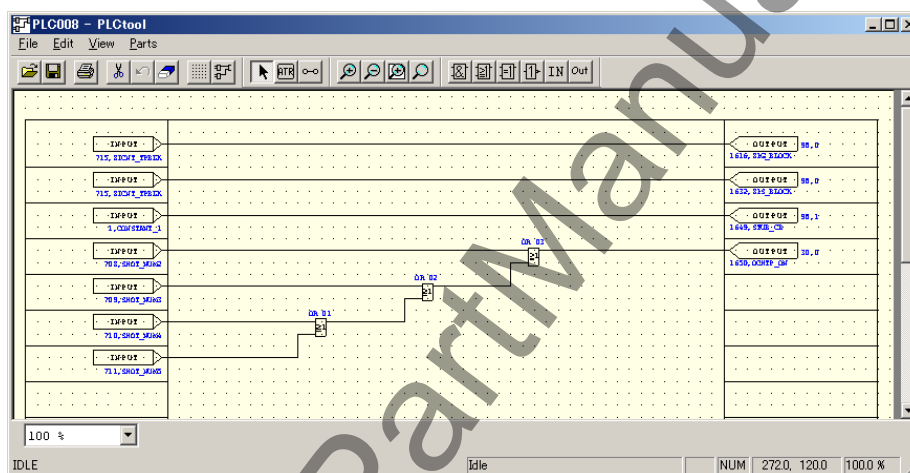


Figure 3.2.3 Sample Screen of PLC Tool

3.3 Automatic Supervision

3.3.1 Basic Concept of Supervision

Though the protection system is in the non-operating state under normal conditions, it is waiting for a power system fault to occur at any time and must operate for the fault without fail. Therefore, the automatic supervision function, which checks the health of the protection system during normal operation by itself, plays an important role. Numerical relays based on the microprocessor operations are suitable for implementing this automatic supervision function of the protection system. The GRB100 implements the automatic supervision function by taking advantage of this feature under the following principles:

- The supervision function should not affect protection performance.
- Supervision must be performed with no omissions wherever possible.
- When a failure occurs, the failure location should be easy to identify.

Note: The automatic supervision function includes an automatic monitor function and automatic test function. For the terminology, refer to IEC IEC 60448.

3.3.2 Relay Monitoring

The relay is supervised with the following items.

AC input imbalance monitoring

The AC current input is monitored and if the following equation is satisfied the health of the AC input circuit is checked.

- CT circuit current monitoring

$$\text{Max}(|I_a|, |I_b|, |I_c|) - 4 \times \text{Min}(|I_a|, |I_b|, |I_c|) \geq k_0$$

where,

$\text{Max}(|I_a|, |I_b|, |I_c|)$ = Maximum amplitude among I_a , I_b and I_c

$\text{Min}(|I_a|, |I_b|, |I_c|)$ = Minimum amplitude among I_a , I_b and I_c

k_0 = 20% of rated current

The CT circuit current monitoring (AISV) allows high sensitivity detection of failures that have occurred in the AC input circuit.

If the AISV detects an AC input imbalance, it blocks the busbar protection trip by blocking the binary outputs and issues an alarm when the [AISV]="ALM&BLK" setting. It issues only alarm when the [AISV]="ALM" setting.

The AISV is blocked by setting the scheme switch [AISV] to OFF.

Furthermore, for models with FD elements, the AC voltage input is monitored and if the following equations are satisfied the health of the AC input circuit is checked.

- Zero sequence voltage monitoring
- Negative sequence voltage monitoring

$$|V_a + V_b + V_c| / 3 \geq 6.35 \text{ (V)}$$

$$|V_a + a^2 V_b + a V_c| / 3 \geq 6.35 \text{ (V)}$$

where,

$a = \text{Phase shifter of } 120^\circ$

These zero sequence monitoring and negative sequence monitoring allow high-sensitivity detection of failures that have occurred in the AC input circuits.

The negative sequence voltage monitoring allows high sensitivity detection of failures in the voltage input circuit, and it is effective for detection particularly when cables have been connected with the incorrect phase sequence.

The AC voltage input monitoring is blocked by setting the scheme switch [AIFDSV] to OFF.

Setting

Element	Range	Step	Default	Remarks
[AISV]	Off / ALM&BLK / ALM		ALM&BLK	Alarm and/or blocking
[AIFDSV]	Off / ALM&BLK / ALM		ALM	Alarm and/or blocking

A/D accuracy checking

An analogue reference voltage is input to a prescribed channel in the analogue-to-digital (A/D) converter, and the system checks that the data after A/D conversion is within a prescribed range and that the A/D conversion characteristics are correct.

Memory monitoring

The memories are monitored as follows depending on the type of memory, and the system also checks that the memory circuits are healthy:

- Random access memory monitoring: Writes/reads prescribed data and checks the storage function.
- Program memory monitoring: Checks the checksum value of the written data.
- Setting value monitoring: Checks for any discrepancy between the setting values stored in duplicate.

Watchdog timer

A hardware timer which is cleared periodically by software is provided, and used to check that the software is running normally.

DC supply monitoring

The secondary voltage level of the built-in DC/DC converter is monitored, and the system checks that the DC voltage is within a prescribed range.

The DC supply failure of BU is detected by the communication monitoring. See Section 3.3.5.

Binary input circuit monitoring

The binary input signals for the "Breaker failure protection initiation", "Busbar protection block" and "CBF protection block" are monitored. The monitoring checks the discrepancy between the signals of the input circuits provided in duplicate.

3.3.3 CT Circuit Failure Detection

If a failure occurs in a CT circuit, the differential elements may operate incorrectly. GRB100 incorporates a CT failure detection function (CTF) against such incorrect operation. The CTF is provided with each Zone (Check zone and Zone A to D). When the CTF detects a CT failure, it can block the DIF trip.

The CTF is enabled or disabled by the scheme switch [CTFEN] as follows:

- “Off”: Disabled.
- “On”: Enabled. If once CTF is detected, the CTF function cannot be reset until CTFID is reset.
- “OPT-On”: Enabled. After CTF is detected, the CTF function is reset if CTFUV, CTFDV or OVG operates.

The DIF trip is blocked or not by the scheme switch [CTFCNT].

- “NA”: No block the DIF trip
- “BLK”: Block the DIF trip of the detected zone

This function is available for Model 200 series.

Detection logic

Figure 3.3.1 shows the CTF detection logic for Check zone and Zone A. The logic for Zone B, C and D is same as that for Zone A.

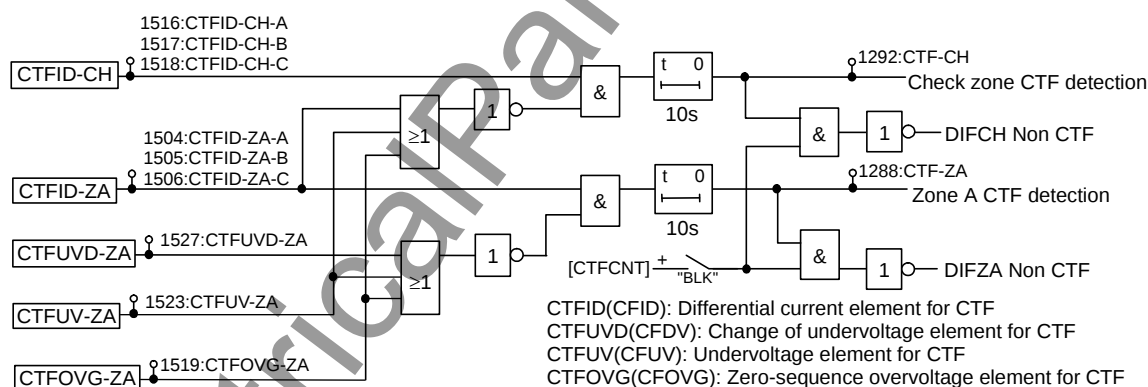


Figure 3.3.1 CTF Detection Logic

Setting

The setting elements necessary for the CTF and their setting ranges are as follows:

Element	Range	Step	Default	Remarks
CFID	50 - 3000 A	1 A	200 A	Id current level
CFUV	20 - 60 V	1 V	20 V	
CFDV	1 - 10 %	1 %	7 %	% of rated voltage
CFOVG	0.1 - 10.0 V	0.1 V	1.0 V	Zero-sequence voltage
[CTFEN]	Off/On/OPT-On		Off	CTF enabled or not
[CTFCNT]	NA / BLK		NA	Control by CTF detection

3.3.4 Differential Current Monitoring

The supervisory element DIFSV is provided to check the health of the CT circuit. The DIFSV element detects the erroneous differential current that appears in the case of a CT circuit failure. The DIFSV is provided with each Zone (Check zone and Zone A to D). The DIFSV has a non-restraint current differential characteristic.

Detection logic

Figure 3.3.2 shows the erroneous differential current detection (DIFSV) logic for Check zone and Zone A. The logic for Zone B, C and D is same as that for Zone A.

If the DIFSV detects an erroneous differential current, it blocks the busbar protection trip by blocking the binary outputs and issues an alarm when the [IDSV]="ALM&BLK" setting. It issues only alarm when the [IDSV]="ALM" setting. The monitoring is blocked by setting the [IDSV] to OFF.

Setting

Element	Range	Step	Default	Remarks
DIFSV	20 – 3000A	1A	200A	Min. operating current
TIDSV	0 – 60s	1s	10s	Timer for DIFSV
[IDSV]	Off / ALM&BLK / ALM		ALM	Control by IDSV monitoring

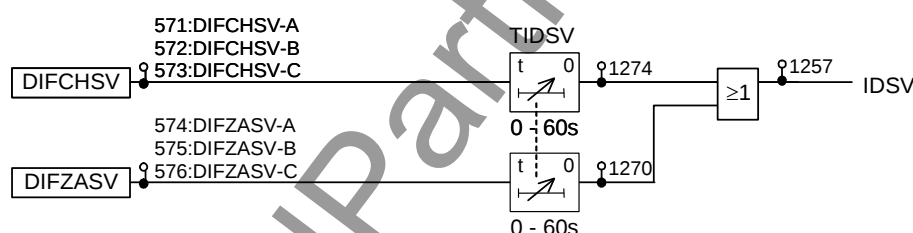


Figure 3.3.2 DIFSV Logic

The DIFSV setting is determined from the erroneous differential current which is generated during normal service condition due to errors between CTs.

Maximum erroneous differential current < DIFSV < DIFCH and DIFZ settings

3.3.5 Disconnecter and Circuit Breaker Monitoring

The disconnecter and circuit breaker are monitored to prevent unwanted operation in case of their failure. The scheme logics are shown in Figures 3.3.3 and 3.3.4.

To monitor the disconnecter (DS) and circuit breaker (CB), a normally open contact and a normally closed contact are introduced. The failure is detected when the normally open contact and normally closed contact are simultaneously in the open or closed state for the prescribed period. If the DSSV or CBSV detects a DS fail or CB fail, it can block the busbar protection and issues an alarm when the [DSSV] or [CBSV]="ALM&BLK" setting or can issue only alarm when the [DSSV] or [CBSV]="ALM" setting. In the case of DS fail, the discriminating zone protection including the DS failed is blocked. The monitoring is blocked by setting the switch [DSSV] and [CBSV] to OFF. The default settings of these switches are OFF to prevent false failure detection when their contacts are not introduced.

Setting

Element	Range	Step	Default	Remarks
TDSSV	0 – 60s	1s	60s	Timer for DSSV
TCBSV	0 – 60s	1s	10s	Timer for CBSV
[DSSV]	Off / ALM&BLK / ALM		ALM	Control by DSSV monitoring
[CBSV]	Off / ALM&BLK / ALM		ALM	Alarm and/or blocking



Figure 3.3.3 DSSV Logic



Figure 3.3.4 CBSV Logic

3.3.6 Communication Monitoring

The communication signal between CU and BU is monitored per channel at both the CU and BU by employing a cyclic redundancy check of the received data.

If a data failure or interruption is detected, an alarm is displayed on the LCD of the CU.

3.3.7 BU Address Monitoring

The BU address is set with the rotary switch. If the setting is changed, it is possible that the data could be communicated to the wrong BU. To avoid this, the BU address is monitored at the CU.

If a failure is detected, the failure alarm "BU**: Address err" is displayed on the LCD of the CU.

Note: BU** means the BU number.

3.3.8 Failure Alarms

When a failure is detected by the automatic supervision, it is followed with the LCD display, LED indication, external alarm issuance and event recording. Table 3.3.1 summarizes the supervision items and alarms.

The LCD messages are shown on the "Auto-supervision" screen which is displayed automatically when a failure is detected by pressing the **VIEW** key. The event record messages are shown on the "Event record" screen by opening the "Record" sub-menu.

Those alarms are retained until the failure is recovered.

Those alarms can be disabled collectively by setting the scheme switch [AMF] to OFF. The setting is used to block unnecessary alarm issuance during commissioning testing or maintenance.

When the Watchdog Timer detects that the software is not running normally, the LCD display and event recording of the failure may not function.

Table 3.3.1 Supervision Items and Alarms

Supervision Item	LCD Message	LED "IN SERVICE"	LED "ALARM"	Ext. alarm	Event record Message
AC input imbalance monitoring	(1)	On/Off (2)	On	Operate/ No operate (5)	CT err, V0 err, V2 err
A/D accuracy check	(1)	Off	On	(4)	Relay fail
Memory monitoring					
Watchdog Timer	----	Off	On	(4)	----
DC supply monitoring	----	Off	(3)	(4)	Relay fail
Binary input circuit monitoring	BU*: DIO err	Off	On	(4)	Relay fail
Differential current monitoring	Id-Z* err Id err	On/Off (2)	On	Operate/ No operate (5)	Id err
DS and CB monitoring	DS* err DS-Z* err CB* err	On/Off (2)	On	Operate/ No operate (5)	DS fail, CB fail
Communication monitoring	(1)	Off	On	(4)	Relay fail
BU address monitoring	BU**: Address err	Off	On	(4)	Relay fail
CTF monitoring	CT fail, CT-ZA fail to CT-ZD fail	On	On	No operate (6)	CTF, CTF-ZA to CTF-ZD

DS: disconnector, CB: circuit breaker

(1): Various messages are provided as expressed with "---fail" or "---err" in the Table in Section 6.7.2.

(2): The LED is on when the related scheme switch [AISV], [AIFDSV], [IDSV], [DSSV] or [CBSV] is set to "ALM" and off when set to "ALM & BLK" (refer to Section 3.3.9).

(3): Whether the LED is lit or not depends on the degree of the voltage drops.

(4): The binary output relay "FAIL" operates.

(5): When the setting is "ALM & BLK", the relay "FAIL" operates. When "ALM" setting is used, the relay "FAIL" does not operate, but an Ext. alarm is possible by assigning the programmable BO (signal No. 1258).

(6): The user-configurable binary output relays operate if the signal assigned.

3.3.9 Bridge Alarm

When a bridge condition is retained for the TBRDG setting, the BRIDGE ALARM is issued.

Setting

Element	Range	Step	Default	Remarks
TBRDG	0 – 60s	1s	60s	Busbar bridge time

3.3.10 Trip Blocking

When a failure is detected by the following supervision items, the trip function is blocked for as long as the failure exists and is restored when the failure is removed:

- A/D accuracy check
- Memory monitoring
- Watchdog Timer
- DC supply monitoring

When a failure is detected by AC input imbalance monitoring, differential current monitoring, disconnector monitoring or circuit breaker monitoring, the scheme switch [AISV], [AIFDSV], [IDSV], [DSSV] or [CBSV] setting can be used to determine if both tripping is blocked and an alarm is output, or, if only an alarm is output.

3.4 Recording Function

The GRB100 is provided with the following recording functions:

- Fault recording
- Event recording
- Disturbance recording

These records are displayed on the LCD of the relay front panel or on the local or remote PC.

3.4.1 Fault Recording

Fault recording is started by a tripping command of the GRB100 and the following items are recorded for one fault:

- Date and time of fault occurrence
- Faulted phase
- Tripping channel
- Tripping mode
- Power system quantities

Up to the 4 most-recent faults are stored as fault records. If a new fault occurs when 4 faults have been stored, the record of the oldest fault is deleted and the record of the latest fault is then stored.

Date and time of fault occurrence

The time resolution is 1 ms using the relay internal clock.

To be precise, this is the time at which a tripping command has been initiated, and thus it is approximately 10 ms after the occurrence of the fault.

Faulted phase

The faulted phase is indicated by a differential element operating phase.

Tripping mode

This shows the protection scheme that initiated the tripping command.

DIF, DIF-ZA, DIF-ZB, DIF-ZC, DIF-ZD: DIF protection trip

(Note) DIF: check zone protection trip only,

DIF-ZA to DIF-ZD: check zone protection trip and discriminating zone protection trip, or discriminating zone protection trip only

CBF-trip: Breaker failure protection backup trip

CBF-retrip: Breaker failure protection retrip

Tripped channel

The tripped channel is expressed with the status "1". (See Section 4.2.1)

Power system quantities

The following power system quantities in pre-faults and faults are recorded.

(However, the power system quantities are not recorded for evolving faults.)

- Magnitude of phase differential current of check zone and discriminating zone protection (I_{da} , I_{db} , I_{dc} , I_{daA} , I_{dbA} , I_{dcA} up to I_{daD} , I_{dbD} , I_{dcD})
- Magnitude and phase angle of phase voltage of check zone and discriminating zone protection (V_{aA} , V_{bA} , V_{cA} up to V_{aD} , V_{bD} , V_{cD})
- Magnitude and phase angle of symmetrical component voltage of check zone and discriminating zone protection (V_{1A} , V_{2A} , V_{0A} up to V_{1D} , V_{2D} , V_{0D})
- Magnitude and phase angle of phase current of each channel (I_a , I_b , I_c)
- Magnitude and phase angle of symmetrical component current of each channel (I_1 , I_2 , I_0)

The differential currents of check zone and discriminating zone protection are displayed in percent of DIFCH and DIFZ setting respectively. The voltages are recorded in Model 200s. Phase angles above are expressed taking that of positive sequence voltage as a reference phase angle. The leading phase angles are expressed plus.

If no voltage input, the positive sequence current of CH1 is taken as a reference phase angle. Therefore, it is recommended that the CH1 should be assigned for a feeder. If the current of CH1 is small, the current of the next channel is used as a reference phase angle.

3.4.2 Event Recording

The events shown in Table 3.4.1 are recorded with the 1 ms resolution time-tag when the status changes. The user can select the recording items.

Up to 480 records can be stored. If an additional event occurs when 480 records have been stored, the oldest event record is deleted and the latest event record is then stored.

Table 3.4.1 Event Record Items

Event	LCD Indication	
Zone A trip command output or reset	ZA trip	On or Off
Zone B trip command output or reset	ZB trip	On or Off
Zone C trip command output or reset	ZC trip	On or Off
Zone D trip command output or reset	ZD trip	On or Off
Busbar trip command output or reset	Trip	On or Off
CBF retrip command output or reset	CBF-retrip	On or Off
CBF trip command output or reset	CBF-trip	On or Off
CBF transfer trip signal output or reset	CBF-TR	On or Off
Busbar bridge operate or reset	Bus bridge	On or Off
Transfer bus operate or reset	Trans. bus	On or Off
Busbar protection blocking external command input or reset	BP block	On or Off
Circuit breaker failure protection blocking external command input or reset	CBF block	On or Off
Indication reset input or reset	Ind. reset	On or Off
Relay failure detected or restored	Relay fail	On or Off
CT current circuit failure detected or restored	CT err	On or Off
Differential current monitoring error or restored	Id err	On or Off
CTF detected or restored	CTF	On or Off

Event	LCD Indication	
Disconnecter failed or restored	DS fail	On or Off
CB failed or restored	CB fail	On or Off
nDS1 N/C contact open or closed (*)	nDS1 N/C	On or Off
nDS1 N/O contact open or closed (*)	nDS1 N/O	On or Off
nDS2 N/C contact open or closed (*)	nDS2 N/C	On or Off
nDS2 N/O contact open or closed (*)	nDS2 N/O	On or Off
Command trip	COM-trip	On or Off
n External trip A-phase signal for CBF initiation (*)	nExt. trip A	On or Off
n External trip B-phase signal for CBF initiation (*)	nExt. trip B	On or Off
n External trip C-phase signal for CBF initiation (*)	nExt. trip C	On or Off
System setting changed (**)	Sys. set change	
Relay setting changed (**)	Rly. set change	
Group setting changed (**)	Grp. set change	

(*): "n" expresses the channel number and it is up to 32. These events are set in a block by the channel.

(**): The event of a setting change is classified into three events. The event "System setting changed" corresponds to all the setting changes except setting changes in the sub-menu "Protection". (See section 4.2.6 for changing the settings). The event "Relay setting changed" corresponds to setting change of measuring elements and timers in the sub-menu "Protection". The event "Group setting changed" corresponds to other setting changes in the sub-menu "Protection".

Setting

One of the following four modes is selectable.

Modes	Setting
Not to record the event.	None
To record the event when the status changes to "operate".	Operate
To record the event when the status changes to "reset".	Reset
To record the event when the status changes both to "operate" and "reset".	Both

For the setting, see the Section 4.2.6.5. The default setting is "Both" for all events except those marked with (*) in Table 3.4.1. The events marked with (*) have a default setting of "Operate".

3.4.3 Disturbance Recording

The disturbance records include 108 analogue signals, which are phase currents of each channel and phase voltages of zones A to D, and 128 binary signals listed in Appendix F and the dates and times at which recording started.

The LCD display only shows the dates and times of disturbance records stored. Details can be displayed on the PC. For how to obtain disturbance records on the PC, see the PC software instruction manual.

The pre-fault recording time is fixed at 0.3s and post-fault recording time can be set between 0.1 and 2.0s.

The number of records stored depends on the post-fault recording time. The approximate relationship between the post-fault recording time and the number of records stored is shown in Table 3.4.2.

Note: If the recording time setting is changed, all previously recorded data is deleted.

Table 3.4.2 Number of Records

CU Model	Frequency (Hz)	Post fault recording time				
		0.1s	0.5s	1.0s	1.5s	2.0s
210	50	28	14	8	6	5
	60	24	12	7	5	4
220	50	16	8	5	3	2
	60	13	6	4	3	2
230	50	11	5	3	2	2
	60	9	4	2	2	1
240	50	8	4	2	1	1
	60	7	3	2	1	1

Settings

The elements necessary for starting disturbance recording and their setting ranges are shown in the table below.

Element	Range	Step	Default	Remarks
1OCG	0.1 - 10.0(*)	0.1	1.0	Residual overcurrent element
1OCS	0.1 - 10.0(*)	0.1	2.0	Phase overcurrent element
2OCG	0.1 - 10.0(*)	0.1	1.0	Residual overcurrent element
2OCS	0.1 - 10.0(*)	0.1	2.0	Phase overcurrent element
:				
:				
32OCG	0.1 - 10.0(*)	0.1	1.0	Residual overcurrent element
32OCS	0.1 - 10.0(*)	0.1	2.0	Phase overcurrent element

(*) : Multiplier of CT rated current

Starting the disturbance recording by a tripping command or the starter elements listed above is enabled or disabled by setting the following scheme switches with identical names with the starter elements except the switch [TRIP].

Element	Range	Step	Default	Remarks
[TRIP]	Off / On		On	Start by tripping command
[OCG]	Off / On		Off	Start by OCG operation
[OCS]	Off / On		Off	Start by OCS operation

3.5 Metering Function

The GRB100 performs continuous measurement of the analogue input quantities. The measurement data shown below is displayed on the LCD of the relay front panel or on the local or remote PC.

- Magnitude of phase differential current of check zone and discriminating zone protection (I_{da} , I_{db} , I_{dc} , I_{daA} , I_{dbA} , I_{dcA} up to I_{daD} , I_{dbD} , I_{dcD})
- Magnitude of restraint current of check zone and discriminating zone protection (I_{ra} , I_{rb} , I_{rc} , I_{raA} , I_{rbA} , I_{rcA} up to I_{raD} , I_{rbD} , I_{rcD})
- Magnitude and phase angle of phase voltage of check zone and discriminating zone protection (V_{aA} , V_{bA} , V_{cA} up to V_{aD} , V_{bD} , V_{cD})
- Magnitude and phase angle of symmetrical component voltage of check zone and discriminating zone protection (V_{1A} , V_{2A} , V_{0A} up to V_{1D} , V_{2D} , V_{0D})
- Magnitude and phase angle of phase current of each channel (I_a , I_b , I_c)
- Magnitude and phase angle of symmetrical component current of each channel (I_1 , I_2 , I_0)
- Frequency (only for Model 200s)

The differential currents of check zone and discriminating zone protection are displayed in current (A) and percent (%) of DIFCH and DIFZ setting respectively. The voltages and frequency are recorded in Model 200s. The differential currents of check zone and discriminating zone protection are displayed in percent of DIFCH and DIFZ setting respectively. Phase angles above are expressed taking that of positive sequence voltage as a reference phase angle. The leading phase angles are expressed plus.

If no voltage input, the positive sequence current of CH1 is taken as a reference phase angle. Therefore, it is recommended that the CH1 should be assigned for a feeder. If the current of CH1 is small, the current of the next channel is used as a reference phase angle.

The above system quantities except the phase differential currents are displayed in values on the primary side or on the secondary side of the CT and VT by the setting. (See Section 4.2.6.6.) To display accurate values, it is necessary to set the each VT ratio too. For the setting method, see "Setting the busbar parameters" in 4.2.6.7. The phase differential currents show the percentage to DIFCH and DIFZ setting values.

4. User Interface

4.1 Outline of User Interface

The user can access the relay from the front panel of the CU.

Local communication with the relay is also possible using a personal computer (PC) with the RSM (Relay Setting and Monitoring) software via an RS232C port. Furthermore, remote communication is also possible using a PC with the RSM via an RS485 and the protocol converter G1PR2.

This section describes the front panel configuration and the basic configuration of the menu tree of the local human machine communication ports and HMI (Human Machine Interface).

4.1.1 Front Panel

As shown in Figure 3.1.8, the front panel of the central unit is provided with a liquid crystal display (LCD), light emitting diode (LED), operation keys, **VIEW** and **RESET** keys, monitoring jack and RS232C connector.

LCD

The LCD screen, provided with a 4-line, 40-character back-light, displays detailed information of the relay interior such as records, status and setting. The LCD screen is normally unlit, but pressing the **VIEW** key will display the digest screen and pressing any key other than **VIEW** and **RESET** will display the menu screen.

These screens are turned off by pressing the **RESET** key or **END** key. If any display is left for 5 minutes or longer without operation, the back-light will go off.

LED

There are 8 LED displays. The signal labels and LED colors are defined as follows:

Label	Color	Remarks
IN SERVICE	Green	Lit when the relay is in service.
TRIP	Red	Lit when a trip command is issued.
ALARM	Red	Lit when a failure is detected.
TESTING	Red	Lit when test condition is set.
(LED1)	Red	
(LED2)	Red	
(LED3)	Red	
(LED4)	Red	

LED1 to LED4 are configurable and no label is sealed there.

The TRIP LED lights up once the relay is operating and remains lit even after the trip command goes off. The TRIP LED can be turned off by pressing the **RESET** key. Other LEDs are lit as long as a signal is present and the **RESET** key is invalid while the signal is maintained.

Operation keys

The operation keys are used to display records, status, and set values on the LCD, as well as to input or change set values. The function of each key is as follows:

- ① 0-9, -: Used to enter a selected number, numerical values and text strings.
- ② ▼, ▲: Used to move between lines displayed on a screen
Keys 2, 4, 6 and 8 marked with ▼, ◀, ▶ and ▲ are also used to enter text strings.
- ③ **CANCEL**: Used to cancel entries and return to the upper screen.
- ④ **END**: Used to end entry operation, return to the upper screen or turn off the display.
- ⑤ **ENTER**: Used to store or establish entries.

VIEW and **RESET** keys

Pressing **VIEW** key displays digest screens such as "Metering", "Latest fault" and "Auto-supervision".

Pressing **RESET** key turns off the display.

Monitoring jacks

The two monitoring jacks A and B and their respective LEDs can be used when the test mode is selected on the LCD screen. By selecting the signal to be observed from the "Signal List" and setting it on the screen, the signal can be displayed on LED A or LED B, or sent to an oscilloscope via a monitoring jack.

RS232C connector

The RS232C connector is a 9-way D-type connector for serial RS232C connection with a local personal computer.

4.1.2 Communication Ports

The following three interfaces are provided with the central unit as communication ports:

- RS232C port
- RS485 port (Two ports)
- IRIG-B port

RS232C port

This connector is a standard 9-way D-type connector (straight type) for serial port RS232C transmission and is mounted on the front panel of central unit. By connecting a personal computer to this connector, setting and display functions can be performed from the personal computer.

RS485 port

Two RS485 ports can be provided.

One RS485 port (PORT-1: COM1) is used to connect between relays and between the relay and the protocol converter G1PR2 to construct a network communication system. (For the system configuration, see Figure 4.4.2 in Section 4.4.2) The other port (PORT-2: COM2) is used to communicate substation control and monitoring system (Protocol: IEC 60870-5-103).

This port is on the back of the central unit, as shown in Figure 4.1.1.

IRIG-B port

The IRIG-B port is mounted on the transformer module, and collects serial IRIG-B format data from the external clock to synchronize the relay calendar clock. The IRIG-B port is isolated from the external circuit by a photo-coupler. A BNC connector is used as the input connector.

This port is on the back of the central unit, as shown in Figure 4.1.1.

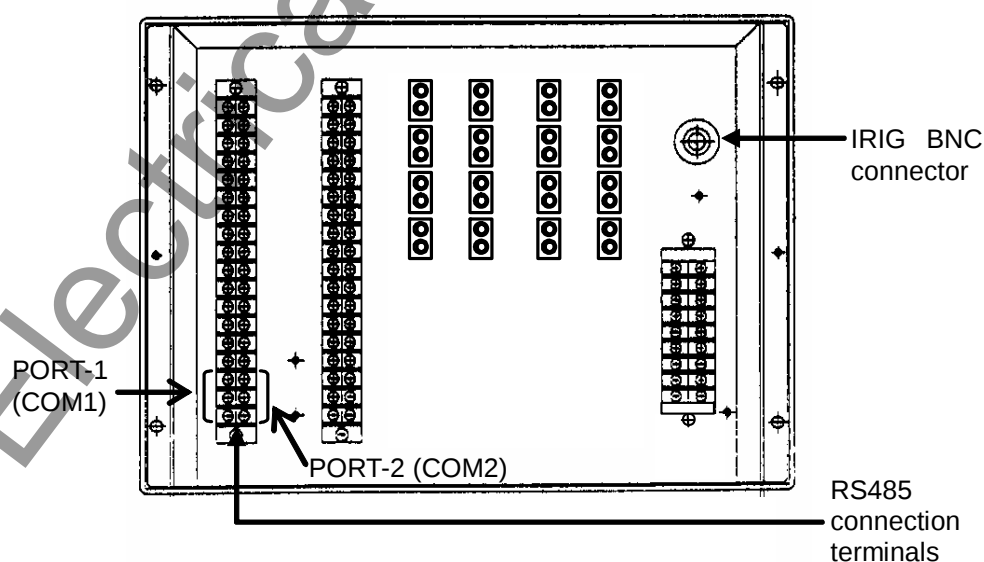


Figure 4.1.1 Locations of RS485 Port and IRIG Port

4.2 Operation of the User Interface

The user can access such functions as recording, measurement, relay setting and testing with the LCD display and operation keys.

4.2.1 LCD and LED Displays

Displays during normal operation

When the GRB100 is operating normally, the green "IN SERVICE" LED is lit and the LCD is off.

Press the **VIEW** key when the LCD is off to display the "Metering 1", "Metering 2", "Metering 3", "Metering 4", "Latest fault" and "Auto-supervision" screens in turn. The "Latest fault" and "Auto-supervision" screens are displayed only when there is some data. The following are the digest screens and can be displayed without entering the menu screens.

Metering 1

I d a	*****	%	I d b	*****	%	I d c	*****	%
-------	-------	---	-------	-------	---	-------	-------	---

Note: Ida, Idb and Idc are the phase differential current of the check zone protection and show the percentage to DIFCH setting value.

I d a A	*****	%	I d b A	*****	%	I d c A	*****	%
I d a B	*****	%	I d b B	*****	%	I d c B	*****	%
I d a C	*****	%	I d b C	*****	%	I d c C	*****	%
I d a D	*****	%	I d b D	*****	%	I d c D	*****	%

Note: Idax, Idbx and Idcx are the phase differential current of the discriminating zone and show the percentage to DIFZ setting value. ("x"= A, B, C, D)
IdyA to IdyD are displayed depend on applied zones. ("y"= a, b, c)

When the discriminating zone protection provides up to three zone protections, two screens above are displayed in one screen as follows:

I d a	*****	%	I d b	*****	%	I d c	*****	%
I d a A	*****	%	I d b A	*****	%	I d c A	*****	%
I d a B	*****	%	I d b B	*****	%	I d c B	*****	%
I d a C	*****	%	I d b C	*****	%	I d c C	*****	%

Metering 2

V a A	***. * k V	V b A	***. * k V	V c A	***. * k V
V a B	***. * k V	V b B	***. * k V	V c B	***. * k V
V a C	***. * k V	V b C	***. * k V	V c C	***. * k V
V a D	***. * k V	V b D	***. * k V	V c D	***. * k V

Note: Vax, Vbx and Vcx for the phase voltage of the discriminating zone.
("x"= A, B, C, D)
VyA to VyD are displayed depend on applied zones. ("y"= a, b, c)

Metering 3

CH 1	*****				
I a	** . ** k A	I b	** . ** k A	I c	** . ** k A
CH 2	*****				
I a	** . ** k A	I b	** . ** k A	I c	** . ** k A

"Metering 3" is displayed repeatedly as many as the number of channels.

Metering 4

```
Metering          08/Dec/1997   18:13
***. *Hz
```

Latest fault

```
Latest fault      16/Oct/1997   18:13:45.160
Phase   ABC
DIF-ZA
BP 11111100 00000000 00000000 00000000
```

Status of tripping command

Note: Tripped channel is expressed with the status "1".

Auto-supervision

```
Auto-supervision  08/Dec/1997   22:56
DIO err
```

Press the **RESET** key to turn off the LCD.

For any display, the back-light is automatically turned off after five minutes.

Displays in tripping

If a fault occurs and a tripping command is initiated when the LCD is off, the "Latest fault" screen is displayed on the LCD automatically and the red "TRIP" LED lights.

Press the **VIEW** key to display the digest screens in turn including the "Metering" and "Auto-supervision" screens.

Press the **RESET** key to turn off the LEDs and LCD display.

If the tripping command is initiated when any of the screens is displayed, the current screen remains displayed and the red "TRIP" LED lights.

When any of the menu screens is displayed, the **VIEW** and **RESET** keys do not function. To return to the digest screen, do the following:

- Return to the top screen of the menu by repeatedly pressing the **END** key.
- Press the **END** key to turn off the LCD.
- Press the **VIEW** key to display the "Latest fault" screen.
- Press the **RESET** key to turn off the "TRIP" LED and LCD.

Displays in automatic supervision operation

If the automatic supervision function detects a failure while the LCD is off, the "Auto-supervision" screen is displayed automatically, showing the location of the failure and the "ALARM" LED lights.

Press the **VIEW** key to display other digest screens in turn including the "Metering" and "Latest fault" screens.

Press the **RESET** key to turn off the LCD display. However, if the failure continues, the "ALARM" LED remains lit.

After recovery from a failure, the "ALARM" LED and "Auto-supervision" display turn off automatically.

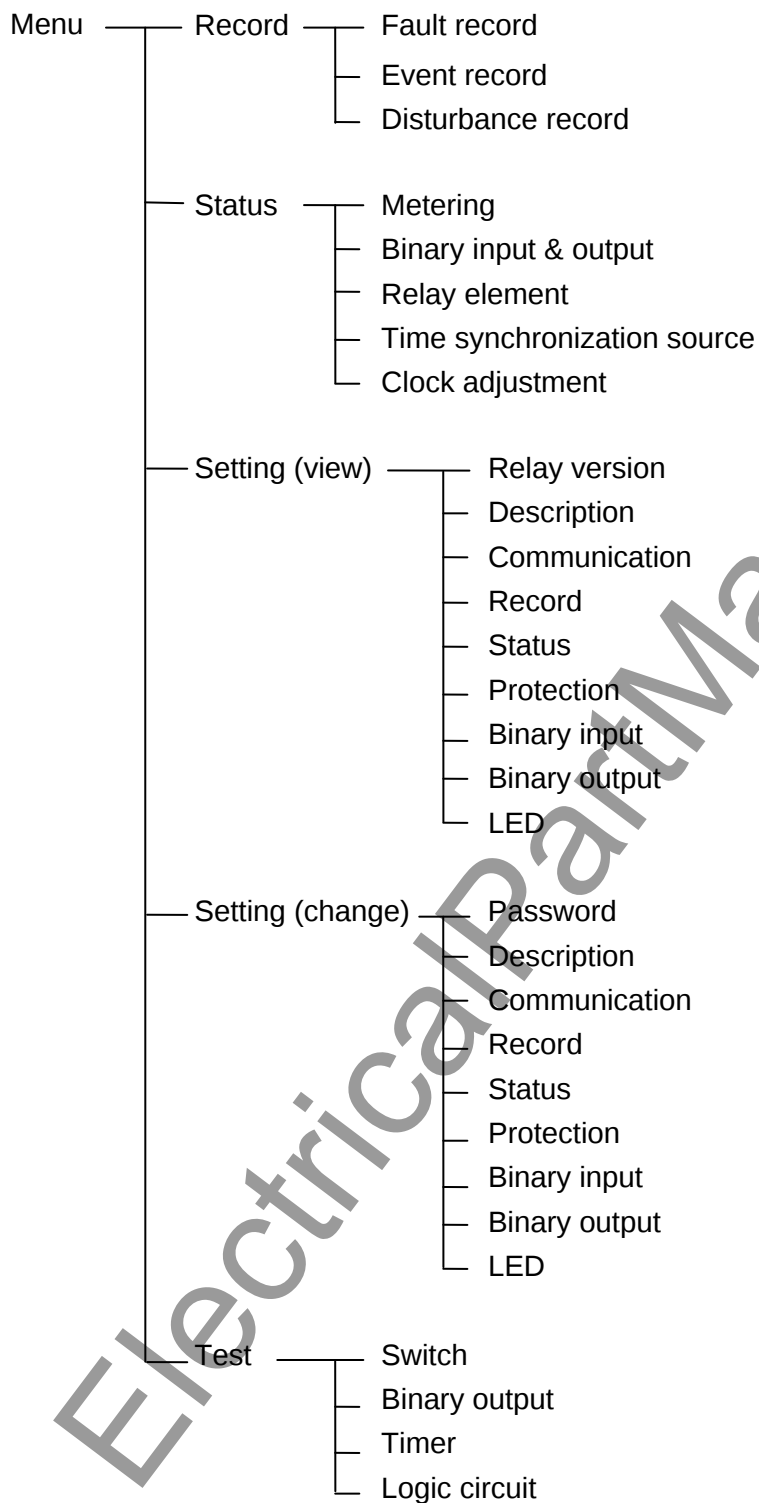
If a failure is detected while any of the screens is displayed, the current screen remains displayed and the "ALARM" LED lights.

While any of the menu screens is displayed, the **VIEW** and **RESET** keys do not function. To return to the digest "Auto-supervision" screen, do the following:

- Return to the top screen of the menu by repeatedly pressing the **END** key.
- Press the **END** key to turn off the LCD.
- Press the **VIEW** key to display the digest screen.
- Press the **RESET** key to turn off the LCD.

4.2.2 Relay Menu

Figure 4.2.1 shows the menu hierarchy in the GRB100. The main menu has five sub-menus, "Record", "Status", "Setting (view)", "Setting (change)", and "Test". For details of the menu hierarchy, see Appendix G.

**Figure 4.2.1 Relay Menu**

Record

In the "Record" menu, the fault records, event records and disturbance records are displayed or erased.

Status

The "Status" menu displays the power system quantities, binary input and output status, relay measuring element status, signal source for time synchronization (IRIG-B, RSM or IEC) and adjusts the clock.

Setting (view)

The "Setting (view)" menu displays the relay version, plant name and the current settings of relay address and RS232C baud rate in communication, record, status, protection, configurable binary inputs and outputs, and configurable LEDs.

Setting (change)

The "Setting (change)" menu is used to set or change the settings of password, plant name, relay address and RS232C baud rate in communication, record, status, protection, configurable binary inputs and outputs, and configurable LEDs.

Since this is an important menu and is used to set or change settings related to relay tripping, it has password security protection.

Test

The "Test" menu is used to set testing switches, to forcibly operate binary output relays, to measure variable timer time and to observe the binary signals in the logic circuit.

When the LCD is off, press any key other than the **VIEW** and **RESET** keys to display the top "MENU" screen and then proceed to the relay menus.

M E N U	
1 = R e c o r d	2 = S t a t u s
3 = S e t t i n g (v i e w)	4 = S e t t i n g (c h a n g e)
5 = T e s t	

To display the "MENU" screen when the digest screen is displayed, press the **RESET** key to turn off the LCD, then press any key other than the **VIEW** and **RESET** keys.

Press the **END** key when the top screen is displayed to turn off the LCD.

An example of the sub-menu screen is shown below. The top line shows the hierarchical layer of the screen, screen title and total number of lines of the screen. The last item is not displayed for all the screens. "/2" displayed on the far left means that the screen is in the second hierarchical layer, while 1/5 displayed on the far right means that the screen has five lines excluding the top line and that the cursor is on the first line.

To move the cursor downward or upward for setting or for viewing other lines not displayed on the window, use the ▼ and ▲ keys.

/ 2	12 / Feb / 1998	22 : 56 : 19	[Local]	1 / 5
Minute (	0 -	59) :	41	-
Hour (	0 -	23) :	22	
Day (	1 -	31) :	12	
Month (	1 -	12) :	2	
Year (	1990 -	2089) :	1998	

To move to the lower screen or move from the left-side screen to the right-side screen in Appendix G, select the appropriate number on the screen. To return to the higher screen or move from the right-side screen to the left-side screen, press the **END** key.

The **CANCEL** key can also be used to return to the higher screen but it must be used carefully because it may cancel entries made so far.

To move between screens of the same hierarchical depth, first return to the higher screen and then move to the lower screen.

4.2.3 Displaying Records

The sub-menu of "Record" is used to display fault records, event records and disturbance records.

4.2.3.1 Displaying Fault Records

To display fault records, do the following:

- Open the top "MENU" screen by pressing any keys other than the **VIEW** and **RESET** keys.
- Select 1 (= Record) to display the "Record" sub-menu.

```

/ 1 Record
1 = Fault record      2 = Event record
3 = Disturbance record

```

- Select 1 (= Fault record) to display the "Fault record" screen.

```

/ 2 Fault Record
1 = Display      2 = Clear

```

- Select 1 (= Display) to display the dates and times of fault records stored in the relay from the top in new-to-old sequence.

```

/ 3 Fault record                                     1 / 4
#1  16 / Oct / 1997  18 : 13 : 57 . 031
#2  20 / Sep / 1997  15 : 29 : 22 . 463
#3  04 / Jul / 1997  11 : 54 : 53 . 977

```

- Move the cursor to the fault record line to be displayed using the ▲ and ▼ keys and press the **ENTER** key to display the details of the fault record.

		/4 Fault Record #1				3/**	
Date and Time	→	16/Oct/1997 18:13:57.031					
Fault phase	→	Phase ABC					
Tripping mode	→	DIF-ZA					
Tripping signal output channels		BP	[11111100	00000000	00000000	00000000]	
		RE	[00000000	00000000	00000000	00000000]	
		CBF	[00000000	00000000	00000000	00000000]	
		TR	[00000000	00000000	00000000	00000000]	
		COM	[00000000	00000000	00000000	00000000]	
		ETR	[00000000	00000000	00000000	00000000]	
		I d a	****	%			
		I d b	****	%			
		I d c	****	%			
		I d a A	****	%		I d a B	**** %
Power system quantities →		I d b A	****	%		I d b B	**** %
		I d c A	****	%		I d c B	**** %
		I d a C	****	%		I d a D	**** %
		I d b C	****	%		I d b D	**** %
		I d c C	****	%		I d c D	**** %
		Fault values					
		V a A	***. *kV	***. °	V 1 A	***. *kV	***. °
		V b A	***. *kV	***. °	V 2 A	***. *kV	***. °
		V c A	***. *kV	***. °	V 0 A	***. *kV	***. °
		V a B	***. *kV	***. °	V 1 B	***. *kV	***. °
		V b B	***. *kV	***. °	V 2 B	***. *kV	***. °
		V c B	***. *kV	***. °	V 0 B	***. *kV	***. °
		V a C	***. *kV	***. °	V 1 C	***. *kV	***. °
		V b C	***. *kV	***. °	V 2 C	***. *kV	***. °
		V c C	***. *kV	***. °	V 0 C	***. *kV	***. °
		V a D	***. *kV	***. °	V 1 D	***. *kV	***. °
		V b D	***. *kV	***. °	V 2 D	***. *kV	***. °
		V c D	***. *kV	***. °	V 0 D	***. *kV	***. °
	CH1	*****					
	I a	***. **kA	***. °	I 1	***. **kA	***. °	
	I b	***. **kA	***. °	I 2	***. **kA	***. °	
	I c	***. **kA	***. °	I 0	***. **kA	***. °	
	CH2	*****					
	I a	***. **kA	***. °	I 1	***. **kA	***. °	
	I b	***. **kA	***. °	I 2	***. **kA	***. °	
	I c	***. **kA	***. °	I 0	***. **kA	***. °	
	CH32	*****					
	I a	***. **kA	***. °	I 1	***. **kA	***. °	
	I b	***. **kA	***. °	I 2	***. **kA	***. °	
	I c	***. **kA	***. °	I 0	***. **kA	***. °	
	Prefault values						
	V a A	***. *kV	***. °	V 1 A	***. *kV	***. °	
	V b A	***. *kV	***. °	V 2 A	***. *kV	***. °	
	V c A	***. *kV	***. °	V 0 A	***. *kV	***. °	
	CH2	*****					
	I a	***. **kA	***. °	I 1	***. **kA	***. °	
	I b	***. **kA	***. °	I 2	***. **kA	***. °	
	I c	***. **kA	***. °	I 0	***. **kA	***. °	
	CH32	*****					
	I a	***. **kA	***. °	I 1	***. **kA	***. °	
	I b	***. **kA	***. °	I 2	***. **kA	***. °	
	I c	***. **kA	***. °	I 0	***. **kA	***. °	

Note: The phase differential currents show the percentage to DIFCH and DIFZ setting values.

IdyA to IdyD and VyA to VyD are displayed depend on applied zones. ("y"= a, b, c, 1, 2, 0)
 In the phase angle indication, the reference phase angle is indicated as "0.0°" at V1A. Phase angles above are expressed taking that of positive sequence voltage as a reference phase angle. The leading phase angles are expressed plus. If no voltage input, the positive sequence current of CH1 is taken as a reference phase angle. If the current of CH1 is small, the current of the next channel is used as a reference phase angle. Therefore, the channel current as a reference phase angle may change to a different channel current after fault.

The lines which are not displayed in the window can be displayed by pressing the ▲ and ▼ keys.

The display format of tripping signal output channels is shown below.

	[■ ■ ■ ■ ■ ■	-- -- -- --	■ ■ ■ ■ ■ ■]
BP	CH1 CH2 CH3 CH4 CH5 CH6	-- -- -- --	CH27 CH28 CH29 CH30 CH31 CH32
RE	CH1 CH2 CH3 CH4 CH5 CH6	-- -- -- --	CH27 CH28 CH29 CH30 CH31 CH32
CBF	CH1 CH2 CH3 CH4 CH5 CH6	-- -- -- --	CH27 CH28 CH29 CH30 CH31 CH32
TR	CH1 CH2 CH3 CH4 CH5 CH6	-- -- -- --	CH27 CH28 CH29 CH30 CH31 CH32
COM	CH1 CH2 CH3 CH4 CH5 CH6	-- -- -- --	CH27 CH28 CH29 CH30 CH31 CH32
ETR	CH1 CH2 CH3 CH4 CH5 CH6	-- -- -- --	CH27 CH28 CH29 CH30 CH31 CH32

Line "BP" shows the tripping signal output channels of the discriminating zone or check zone protection. Line "RE" shows the re-tripping tripping signal output channels of the breaker failure protection. Line "CBF" shows the backup signal output channels of the breaker failure protection. Line "TR" the transfer tripping signal output channels of the breaker failure protection. Line "COM" the command trip signal output channels. Line "ETR" the transfer tripping signal output channels of the end zone fault protection. The tripping signal output channel is displayed with the status "1".

To clear all the fault records, do the following:

- Open the "Record" sub-menu.
- Select 1 (= Fault record) to display the "Fault record" screen.
- Select 2 (= Clear) to display the following confirmation screen.

```

/2 Fault record
Clear all fault records?
      ENTER=Yes      CANCEL=No
  
```

- Press the **ENTER** (= Yes) key to clear all the fault records stored in non-volatile memory.

If all fault records have been cleared, the "Latest fault" screen of the digest screens is not displayed.

4.2.3.2 Displaying Event Records

To display events records, do the following:

- Open the top "MENU" screen by pressing any keys other than the **VIEW** and **RESET** keys.
- Select 1 (= Record) to display the "Record" sub-menu.
- Select 2 (= Event record) to display the "Event record" screen.

```

/ 2 Event Record
1 = Display      2 = Clear

```

- Select 1 (= Display) to display the events with date and time from the top in new-to-old sequence.

```

/ 3 Event record                                     2 / 48
16 / Oct / 1998  23 : 18 : 04 . 294      Trip      Off
16 / Oct / 1998  23 : 18 : 03 . 913      Trip      On
12 / Feb / 1998  03 : 51 : 37 . 622      Rly. set change

```

The lines which are not displayed in the window can be displayed by pressing the ▲ and ▼ keys.

To clear all the event records, do the following:

- Open the "Record" sub-menu.
- Select 2 (= Event record) to display the "Event record" screen.
- Select 2 (= Clear) to display the following confirmation screen.

```

/ 2 Event record
Clear all event records?
      ENTER = Yes      CANCEL = No

```

- Press the **ENTER** (= Yes) key to clear all the event records stored in non-volatile memory.

4.2.3.3 Displaying Disturbance Records

Details of the disturbance records can be displayed on the PC screen only (*); the LCD displays only the recorded date and time for all disturbances stored in the relay. To display them, do the following:

(*) For the display on the PC screen, refer to RSM100 manual.

- Open the top "MENU" screen by pressing any keys other than the **VIEW** and **RESET** keys.
- Select 1 (= Record) to display the "Record" sub-menu.
- Select 3 (= Disturbance record) to display the "Disturbance record" screen.

```

/ 2 Disturbance record
1 = Display      2 = Clear

```

- Select 1 (= Display) to display the date and time of the disturbance records from the top in new-to-old sequence.

```

/ 3 Disturbance record                                     3 / 12
#1   16 / Oct / 1997  18 : 13 : 57 . 031
#2   20 / Sep / 1997  15 : 29 : 22 . 463
#3   04 / Jul / 1997  11 : 54 : 53 . 977

```

The lines which are not displayed in the window can be displayed by pressing the ▲ and ▼ keys.

To clear all the disturbance records, do the following:

- Open the "Record" sub-menu.
- Select 3 (= Disturbance record) to display the "Disturbance record" screen.
- Select 2 (= Clear) to display the following confirmation screen.

```

/ 2 Disturbance record
Clear all disturbance records?
      ENTER=Yes      CANCEL=No
  
```

- Press the **ENTER** (= Yes) key to clear all the disturbance records stored in non-volatile memory.

4.2.4 Displaying the Status

From the sub-menu of "Status", the following statuses can be displayed on the LCD:

Metering data of the protected busbar

Status of binary inputs and outputs

Status of measuring elements output

Status of time synchronization source

The data is renewed every second.

This sub-menu is also used to adjust the time of the internal clock.

4.2.4.1 Displaying Metering Data

To display metering data on the LCD, do the following.

- Select 2 (= Status) on the top "MENU" screen to display the "Status" screen.

```

/ 1 Status
1=Metering           2=Binary I/O
3=Relay element     4=Time sync source
5=Clock adjustment
  
```

- Select 1 (= Metering) to display the "Metering" screen.

2 Metering			16/Oct/1997			18:13 3/***		
I d a	*****	%	*****	A	I r a	*****	A	
I d b	*****	%	*****	A	I r b	*****	A	
I d c	*****	%	*****	A	I r c	*****	A	
I d a A	*****	%	*****	A	I r a A	*****	A	
I d b A	*****	%	*****	A	I r b A	*****	A	
I d c A	*****	%	*****	A	I r c A	*****	A	
I d a B	*****	%	*****	A	I r a B	*****	A	
I d b B	*****	%	*****	A	I r b B	*****	A	
I d c B	*****	%	*****	A	I r c B	*****	A	
I d a C	*****	%	*****	A	I r a C	*****	A	
I d b C	*****	%	*****	A	I r b C	*****	A	
I d c C	*****	%	*****	A	I r c C	*****	A	
I d a D	*****	%	*****	A	I r a D	*****	A	
I d b D	*****	%	*****	A	I r b D	*****	A	
I d c D	*****	%	*****	A	I r c D	*****	A	
V a A	***. *kV	***. °	V 1 A	***. *kV	***. °			
V b A	***. *kV	***. °	V 2 A	***. *kV	***. °			
V c A	***. *kV	***. °	V 0 A	***. *kV	***. °			
V a B	***. *kV	***. °	V 1 B	***. *kV	***. °			
V b B	***. *kV	***. °	V 2 B	***. *kV	***. °			
V c B	***. *kV	***. °	V 0 B	***. *kV	***. °			
V a C	***. *kV	***. °	V 1 C	***. *kV	***. °			
V b C	***. *kV	***. °	V 2 C	***. *kV	***. °			
V c C	***. *kV	***. °	V 0 C	***. *kV	***. °			
V a D	***. *kV	***. °	V 1 D	***. *kV	***. °			
V b D	***. *kV	***. °	V 2 D	***. *kV	***. °			
V c D	***. *kV	***. °	V 0 D	***. *kV	***. °			
CH 1	*****							
I a	***. *kA	***. °	I 1	***. *kA	***. °			
I b	***. *kA	***. °	I 2	***. *kA	***. °			
I c	***. *kA	***. °	I 0	***. *kA	***. °			
CH 2	*****							
I a	***. *kA	***. °	I 1	***. *kA	***. °			
I b	***. *kA	***. °	I 2	***. *kA	***. °			
I c	***. *kA	***. °	I 0	***. *kA	***. °			
CH 3 2	*****							
I a	***. *kA	***. °	I 1	***. *kA	***. °			
I b	***. *kA	***. °	I 2	***. *kA	***. °			
I c	***. *kA	***. °	I 0	***. *kA	***. °			
F r e q u e n c y								

Note: The phase differential currents Idy* show the current and the percentage to DIFCH and DIFZ setting values. Iry* show the restraining current. IdyA to IdyD and VyA to VyD are displayed depend on applied zones. ("y"= a, b, c, 1, 2, 0)

In the phase angle indication, the reference phase angle is indicated as "0.0°" at V1A. Phase angles above are expressed taking that of positive sequence voltage as a reference phase angle. The leading phase angles are expressed plus. If no voltage input, the positive sequence current of CH1 is taken as a reference phase angle. If the current of CH1 is small, the current of the next channel is used as a reference phase angle.

Metering data except for the phase differential currents is expressed as primary values or secondary values depending on the setting. For setting, see Section 4.2.6.6.

4.2.4.2 Displaying the Status of Binary Inputs and Outputs

To display the binary input and output status, do the following:

- Select 2 (= Status) on the top "MENU" screen to display the "Status" screen.
- Select 2 (= Binary I/O) to display the binary input and output status.

/ 2 Binary input & output										3 / 6 8
Input (CU-IO#1)	[	0	0	0	0	0	0	0	0	]
Input (CU-IO#2)	[	0	0	0						]
Input (BU-CH1)	[	0	0	0	0	0	0	0		]
Input (BU-CH2)	[	0	0	0	0	0	0	0		]
⋮										
Input (BU-CH32)	[	0	0	0	0	0	0	0		]
Output (CU-IO#1)	[	0	0	0						]
Output (CU-IO#2)	[	0	0	0	0	0	0	0	0	]
Output (BU-CH1)	[	0	0	0	0					]
Output (BU-CH2)	[	0	0	0	0					]
⋮										
Output (BU-CH32)	[	0	0	0	0	0				]

The display format is shown below.

	[	■	■	■	■	■	■	■	■	■	■	■	■	■	■	]
Input (CU-IO#1)	BI1	BI2	BI3	BI4	BI5	BI6	BI7	BI8	BI9	BI10	BI11	BI12	—	—	—	
Input (CU-IO#2)	BI1	BI2	BI3													
Input (BU-CH1)	BI1	BI5	BI2	BI6	BI3	BI7	BI4	BI11	BI12	BI13	—	—	—	—	—	
Input (BU-CH2)	BI1	BI5	BI2	BI6	BI3	BI7	BI4	BI11	BI12	BI13	—	—	—	—	—	
⋮																
⋮																
Input (BU-CH32)	BI1	BI5	BI2	BI6	BI3	BI7	BI4	BI11	BI12	BI13	—	—	—	—	—	
Output (CU-IO#1)	BO1	BO2	BO3													
Output (CU-IO#2)	BO1	BO2	BO3	BO4	BO5	BO6	BO7	BO8	BO9	BO10	BO11	BO12	FAIL	BO13	—	
Output (BU-CH1)	TP1	TP2	BO1	BO2	BO3	BO4	BO5	BO6	—	—	—	—	—	—	—	
Output (BU-CH2)	TP1	TP2	BO1	BO2	BO3	BO4	BO5	BO6	—	—	—	—	—	—	—	
⋮																
⋮																
Output (BU-CH32)	TP1	TP2	BO1	BO2	BO3	BO4	BO5	BO6	—	—	—	—	—	—	—	

Line 1 shows the binary input status of the central unit. BI1 to BI5 correspond to each binary input signal. For details of the binary input signals, see Appendix I. The status is expressed with logical level "1" or "0" at the photo-coupler output circuit.

Lines "Input (BU-CH1)" to "Input (BU-CH32)" show the binary input status of the bay units. BI1 to BI10 of each channel correspond to each binary input signal. The status is expressed with logical level "1" or "0" at the photo-coupler output circuit. CU-IO#1, CU-IO#2 and BU-CH1 to BU-CH32 in the table indicate the name of the module containing the binary input circuits.

Line "Output (CU-IO#2)" shows the binary output status of the central unit. FAIL of "Output (CU-IO#2)" corresponds to the relay failure output. Other outputs expressed with BO1 to BO13 of CU-IO#2 are configurable.

The status of these outputs is expressed with logical level "1" or "0" at the input circuit of the output relay driver. That is, the output relay is energized when the status is "1".

To display all the lines, press the ▲ and ▼ keys.

To display the status of measuring elements on the LCD, do the following:

- Select 2 (= Status) on the top "MENU" screen to display the "Status" screen.
- Select 3 (= Relay element) to display the status of the relay elements.

/2 Relay element	3 / 13
D I F C H	[0 0 0 0 0 0
D I F Z A	[0 0 0 0 0 0
D I F Z B	[0 0 0 0 0 0
D I F Z C	[0 0 0 0 0 0
D I F Z D	[0 0 0 0 0 0
O C 1	[0 0 0 0 0 0 0 0 0 0
O C 2	[0 0 0 0 0 0 0 0 0 0
⋮	⋮
O C 8	[0 0 0 0 0 0 0 0 0 0

The display format is as shown below.

	[	■	■	■	■	■	■	■	■	■	■	■	■	■	■	]
DIFCH	A	B	C	A	B	C	—	—	—	—	—	—	—	—	—	—
	DIFCH			DIFCHSV												
DIFZA	A	B	C	A	B	C	—	—	—	—	—	—	—	—	—	—
	DIFZA			DIFZASV												
DIFZB	A	B	C	A	B	C	—	—	—	—	—	—	—	—	—	—
	DIFZB			DIFZBSV												
DIFZC	A	B	C	A	B	C	—	—	—	—	—	—	—	—	—	—
	DIFZC			DIFZCSV												
DIFZD	A	B	C	A	B	C	—	—	—	—	—	—	—	—	—	—
	DIFZD			DIFZDSV												
OC1	A	B	C	A	B	C	A	B	C	A	B	C	—	—	—	—
	1OCBF			2OCBF			3OCBF			4OCBF						
OC2	A	B	C	A	B	C	A	B	C	A	B	C	—	—	—	—
.	5OCBF			6OCBF			7OCBF			8OCBF						
:																
OC8	A	B	C	A	B	C	A	B	C	A	B	C	—	—	—	—
	29OCBF			30OCBF			31OCBF			32OCBF						

Lines 1 to 5 show the operation status of current differential elements DIF**and their supervisory elements DIF**SV. Lines below 6 show the status of overcurrent elements nOCBF for breaker failure protection. The number of these overcurrent elements is the same as that of the applied channels (circuits).

The status of each element is expressed with logical level "1" or "0". Status "1" means the element is in operation.

To display all the lines on the LCD, press the ▲ and ▼ keys.

4.2.4.4 Displaying the Status of the Time Synchronization Source

The internal clock of the GRB100 can be synchronized with external clocks such as the IRIG-B time standard signal clock, RSM (relay setting and monitoring system) clock, or IEC60870-5-103. To display on the LCD whether these clocks are active or inactive and which clock the relay is synchronized with, do the following:

- Select 2 (= Status) on the top "MENU" screen to display the "Status" screen.
- Select 4 (= Time sync source) to display the status of time synchronization sources.

/ 2	Time synchronization source	1 / 3
* I R I G :	A c t i v e	
R S M :	I n a c t i v e	
I E C :	I n a c t i v e	

The asterisk on the far left shows that the internal clock is synchronized with the marked source clock. If the marked source clock is inactive, the internal clock runs locally.

For details of the setting time synchronization, see Section 4.2.6.6.

4.2.4.5 Adjusting the Time

To adjust the clock when the internal clock is running locally, do the following:

- Select 2 (= Status) on the top "MENU" screen to display the "Status" screen.
- Select 5 (= Clock adjustment) to display the setting screen.

/ 2	12 / Feb / 1998	22 : 56 : 19	[l o c a l]	1 / 5
M i n u t e (	0 - 59)	:	41	-
H o u r (	0 - 23)	:	22	
D a y (	1 - 31)	:	12	
M o n t h (	1 - 12)	:	2	
Y e a r (	1990 - 2089)	:	1998	

Line 1 shows the current date, time and time synchronization source with which the internal clock is synchronized. The time can be adjusted only when [Local] is indicated on the top line, showing that the clock is running locally. When [IRIG] or [RSM] or [IEC] is indicated, the following adjustment is invalid.

- Enter a numerical value within the specified range for each item and press the **ENTER** key.
- Press the **END** key to adjust the internal clock to the set hours without fractions and return to the previous screen.

If a date which does not exist in the calendar is set and **END** is pressed, "Error: Incorrect date" is displayed on the top line and the adjustment is discarded. Adjust again.

4.2.5 Viewing the Settings

The sub-menu "Setting (view)" is used to view the settings made using the sub-menu "Setting (change)" except for the relay version.

The following items are displayed:

- Relay version
- Description
- Communication (Relay address and baud rate in the RSM or IEC60870-5-103)
- Recording setting
- Status setting
- Protection setting
- Binary input setting
- Binary output setting
- LED setting

Enter a number on the LCD to display each item as described in the previous sections.

4.2.5.1 Relay Version

To view the relay version, do the following.

- Press 3 (= Setting (view)) on the main "MENU" screen to display the "Setting (view)" screen.

```

/1 Setting (view)
1=Version      2=Description    3=Comm.
4=Record       5=Status        6=Protection
7=Binary input 8=Binary output  9=LED
  
```

- Press 1 (= Version) on the "Setting (view)" screen and the "Relay version" screen appears.

```

/2 Relay version
Relay type:
Serial No.:
Main software:
FD software:
FEP1 software:
FEP2 software:
FEP3 software:
FEP4 software:
PLC data:
IEC103 data:
  
```

Note: The FD software is displayed for Model 200s. The FEP2 to FEP4 software depend on the relay model, and the FEP2, FEP3 and FEP4 are displayed for Models *20 to *40, Models *30 and *40, and Model *40 respectively.

4.2.5.2 Settings

The "Description", "Comm.", "Record", "Status", "Protection", "Binary input", "Binary output" and "LED" screens display the current settings entered using the "Setting (change)" sub-menu.

4.2.6 Changing the Settings

The "Setting (change)" sub-menu is used to make or change settings for the following items:

Password
Description
Communication (Relay address and baud rate in the RSM or IEC60870-5-103)
Recording
Status
Protection
Binary input
Binary output
LED

All of the above settings except the password can be seen using the "Setting (view)" sub-menu.

4.2.6.1 Setting Method

There are three setting methods as follows.

- To enter a selective number
- To enter numerical values
- To enter a text string

To enter a selected number

If a screen as shown below is displayed, perform the setting as follows:

The number to the left of the cursor shows the current setting or default setting set at shipment. The cursor can be moved to the upper or lower lines within the screen by pressing the ▲ and ▼ keys. If a setting (change) is not required, skip the line with the ▲ and ▼ keys.

/6	Scheme switch			1 / 108
C . T P	0 = B L K	1 = T r i p		0 -
I D S V	0 = 0 f f	1 = A L M & B L K	2 = A L M	2
A I S V	0 = 0 f f	1 = A L M & B L K	2 = A L M	1
A I F D S V	0 = 0 f f	1 = A L M & B L K	2 = A L M	0
D S S V	0 = 0 f f	1 = A L M & B L K	2 = A L M	0
C B S V	0 = 0 f f	1 = A L M & B L K	2 = A L M	1
B F L O G I C	0 = B F 1	1 = B F 2		0
1 B F 1	0 = 0 f f	1 = T	2 = T O C	0
1 B F 2	0 = 0 f f	1 = 0 n		0
1 B F E X T	0 = 0 f f	1 = 0 n		1
2 B F 1	0 = 0 f f	1 = T	2 = T O C	0
	⋮			
3 2 B F 1	0 = 0 f f	1 = T	2 = T O C	0
3 2 B F 2	0 = 0 f f	1 = 0 n		0
3 2 B F E X T	0 = 0 f f	1 = 0 n		1
B F T R I O	0 = 0 f f	1 = 0 n		0
C O M T P	0 = 0 f f	1 = 0 n		0
E F P T R	0 = 0 f f	1 = 0 n		0
C T F E N	0 = 0 f f	1 = 0 n	2 = 0 P T - 0 n	0
C T F C N T	0 = N A	1 = B L K		0

- Move the cursor to a setting line.
- Enter the selected number. (Numbers other than those displayed cannot be entered.)
- Press the **ENTER** key to confirm the entry and the cursor will move to the next line below. (On the lowest line, the entered number blinks.)
- After completing the setting on the screen, press the **END** key to return to the upper menu.

To correct the entered number, do the followings.

- If it is before pressing the **ENTER** key, press the **CANCEL** key and enter the new number.
- If it is after pressing the **ENTER** key, move the cursor to the correcting line by pressing the **▲** and **▼** keys and enter the new number.

Note: If the **CANCEL** key is pressed after any of the entry is confirmed by pressing the **ENTER** key, all the entries performed so far on the screen concerned are canceled and the screen returns to the upper one.

When the screen shown below is displayed, perform the settings as follows:

The number to the right of "Current No. =" shows the current setting.

```

/3 Change active group (Active group = *)
1=Group1  2=Group2  3=Group3  4=Group4

Current No. = *          Select No. = _

```

- Enter a number to the right of "Select No. =". (Numbers other than those displayed cannot be entered.)
- Press the **ENTER** key to confirm the entry and the entered number blinks.
- After completing the setting on the screen, press the **END** key to return to the upper screen.

To correct the entered number, do the following.

- If it is before pressing the **ENTER** key, press the **CANCEL** key and enter the new number.
- If it is after pressing the **ENTER** key, enter the new number.

To enter numerical values

When the screen shown below is displayed, perform the setting as follows:

The number to the left of the cursor shows the current setting or default setting set at shipment. The cursor can be moved to upper or lower lines within the screen by pressing the **▲** and **▼** keys. If a setting (change) is not required, skip the line with the **▲** and **▼** keys.

/7 DIF				1/45
DIFCH (	500 -	3000)	: 3000 -	A
DIFZ (	500 -	3000)	: 3000	A
SLPCH (	0.30 -	0.90)	: 0.30	
SLPZ (	0.30 -	0.90)	: 0.30	
DIFSV (	20 -	3000)	: 1000	A
TIDSV (	0 -	60)	: 20	S
TBRDG (	0 -	60)	: 60	S
TDDSV (	0 -	60)	: 60	S
TCBSV (	0 -	60)	: 10	S
1CT (	100 -	10000)	: 1000	A
2CT (	100 -	10000)	: 1000	A
⋮				
32CT (	100 -	10000)	: 1000	A
CFID (	50 -	3000)	: 50	A
CFUV (	20 -	60)	: 20	V
CFDV (	1 -	10)	: 7	%
CFOVG (	0.1 -	10.0)	: 1.0	V

- Move the cursor to a setting line.
- Enter the numerical value.
- Press the **ENTER** key to confirm the entry and the cursor will move to the next line below. (If a numerical value outside the displayed range is entered, "Error: Out of range" appears on the top line and the cursor remains on the line. Press the **CANCEL** key to clear the entry.)
- After completing the setting on the screen, press the **END** key to return to the upper screen.

To correct the entered numerical value, do the following.

- If it is before pressing the **ENTER** key, press the **CANCEL** key and enter the new numerical value.
- If it is after pressing the **ENTER** key, move the cursor to the correct line by pressing the ▲ and ▼ keys and enter the new numerical value.

Note: If the **CANCEL** key is pressed after any entry is confirmed by pressing the **ENTER** key, all the entries made so far on the screen concerned are canceled and the screen returns to the upper one.

To enter a text string

Text strings are entered in the bracket under the "Plant name" or "Description" screen.

To select a character, use keys 2, 4, 6 and 8 to move the blinking cursor down, left, right and up. "→" and "←" on each of lines 2 to 4 indicate a space and backspace, respectively. A maximum of 22 characters can be entered within the brackets.

/3 Plant name [	_	]	
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z	() [] @ _		←→
a b c d e f g h i j k l m n o p q r s t u v w x y z	{ } * / + - < = >		←→
0 1 2 3 4 5 6 7 8 9 ! " # \$ % & ' : ; , . ^ `			←→

- Set the cursor position in the bracket by selecting "→" or "←" and pressing the **ENTER** key.
- Move the blinking cursor to select a character.

- Press the **ENTER** to enter the blinking character at the cursor position in the brackets.
- Press the **END** key to confirm the entry and return to the upper screen.

To correct the entered character, do either of the following.

- Discard the character by selecting "←" and pressing the **ENTER** key and enter the new character.
- Discard the whole entry by pressing the **CANCEL** key and restart the entry from the first.

To complete the setting

Enter after making entries on each setting screen by pressing the **ENTER** key, the new settings are not yet used for operation, though stored in the memory. To validate the new settings, take the following steps.

- Press the **END** key to the upper screen. Repeat this until the confirmation screen shown below is displayed. The confirmation screen is displayed just before returning to the "Setting (change)" sub-menu.

```
/ 2 *****
Change settings?
      ENTER=Yes   CANCEL=No
```

- When the screen is displayed, press the **ENTER** key to start operation using the new settings, or press the **CANCEL** key to correct or cancel entries. In the latter case, the screen turns back to the setting screen to enable reentries. Press the **CANCEL** key to cancel entries made so far and to turn to the "Setting (change)" sub-menu.

4.2.6.2 Password

For the sake of security of changing the settings, password protection can be set as follows;

- Press 4 (= Setting (change)) on the main "MENU" screen to display the "Setting (change)" screen.

```
/ 1 Setting (change)
1=Password   2=Description   3=Comm.
4=Record     5=Status       6=Protection
7=Binary input 8=Binary output 9=LED
```

- Press 1 (= Password) to display the "Password" screen.

```
/ 2 Password
      Input new password  [ _ ]
      Retype new password [   ]
```

- Enter a 4-digit number within the brackets after "Input new password" and press the **ENTER** key.
- For confirmation, enter the same 4-digit number in the brackets after "Retype new password" and press the **ENTER** key.

- Press the **END** key to display the confirmation screen. If the retyped number is different from that first entered, the following message is displayed on the bottom of the "Password" screen before returning to the upper screen.

"Mismatch-password unchanged."

Reentry is then requested.

Password trap

After the password has been set, the password must be entered in order to enter the setting change screens.

If 4 (= Setting (change)) is entered on the top "MENU" screen, the password trap screen "Password" is displayed. If the password is not entered correctly, it is not possible to move to the "Setting (change)" sub-menu screens.

Password Input password [_]

Canceling or changing the password

To cancel the password protection, enter "0000" in the two brackets on the "Password" screen. The "Setting (change)" screen is then displayed without having to enter a password.

The password can be changed by entering a new 4-digit number on the "Password" screen in the same way as the first password setting.

If you forget the password

Press **CANCEL** and **RESET** together for one second on the top "MENU" screen. The screen disappears, and the password protection of the GRB100 is canceled. Set the password again.

4.2.6.3 Description

To enter the plant name and other data, do the following. These data are attached to records.

- Press 4 (= Setting (change)) on the main "MENU" screen to display the "Setting (change)" screen.
- Press 2 (= Description) to display the "Description" screen.

/2 Description 1=Plant name 2=Description

- To enter the plant name, select 1 (= Plant name) on the "Description" screen.

/3 Plant name [_] A B C D E F G H I J K L M N O P Q R S T U V W X Y Z () [] @ _ ←→ a b c d e f g h i j k l m n o p q r s t u v w x y z { } * / + - < = > ←→ 0 1 2 3 4 5 6 7 8 9 ! " # \$ % & ' : ; , . ^ ` ←→
--

- To enter special items, select 2 (= Description) on the "Description" screen.

```

/3 Description [ _ ]
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z ( ) [ ] @ _ <-->
a b c d e f g h i j k l m n o p q r s t u v w x y z { } * / + - < = > <-->
0 1 2 3 4 5 6 7 8 9 ! " # $ % & ' : ; , . ^ ` <-->

```

- Enter the text string.

4.2.6.4 Communication

If the relay is linked with RSM (relay setting and monitoring system) or IEC60870-5-103, the relay address must be set. Do this as follows:

- Press 4 (= Setting (change)) on the main "MENU" screen to display the "Setting (change)" screen.
- Press 3 (= Comm.) to display the "Communication" screen.

```

/2 Communication
1 = Address
2 = Switch

```

- Press 1 (= Address) to enter the relay address number.

```

/3 Address 1 / 2
H D L C ( 1 - 3 2 ) : 1 _
I E C ( 0 - 2 5 4 ) : 2

```

- Enter the address number on "HDLC" column for RSM and "IEC" column for IEC60870-5-103 and press the **ENTER** key.

CAUTION: Do not overlap the relay address number.

- Press 2 (= Switch) on the "Communication" screen to select the protocol and transmission speed (baud rate), etc., of the RSM or IEC60870-5-103.

```

/3 Switch 1 / 3
2 3 2 C 1 = 9 . 6 2 = 1 9 . 2 3 = 3 8 . 4 4 = 5 7 . 6 1 _
I E C B R 1 = 9 . 6 2 = 1 9 . 2 2
I E C B L K 1 = N o r m a l 2 = B l o c k e d 1

```

- Select the number corresponding to the system and press the **ENTER** key.

<232C>

This line is to select the RS-232C baud rate when the RSM system applied.

Note: The default setting of the 232C is 9.6kbps. The 57.6kbps setting, if possible, is recommended to serve user for comfortable operation. The setting of RSM100 is also set to the same baud rate.

<IECBR>

This line is to select the baud rate when the IEC60870-5-103 system applied.

<IECBLK>

Select 2 (=Blocked) to block the monitor direction in the IEC60870-5-103 communication.

4.2.6.5 Setting the Recording

To set the recording function as described in Section 4.2.3, do the following:

- Press 4 (= Setting (change)) on the main "MENU" screen to display the "Setting (change)" screen.
- Press 4 (= Record) to display the "Record" screen.

```

/ 2 Record
1=Event record
2=Disturbance record
  
```

Setting the event recording

- Press 1 (= Event record) to display the "Event record" screen.

/ 3 Event record		0=None	3= Both	1/**
ZA trip	1=Operate	2=Reset	3_	
ZB trip	1=Operate	2=Reset	3	
ZC trip	1=Operate	2=Reset	3	
ZC trip	1=Operate	2=Reset	3	
Trip	1=Operate	2=Reset	3	
CBF-retrip	1=Operate	2=Reset	3	
CBF-trip	1=Operate	2=Reset	3	
CBF-TR	1=Operate	2=Reset	3	
COM-trip	1=Operate	2=Reset	3	
EFPTR	1=Operate	2=Reset	3	
Bus bridge	1=Operate	2=Reset	3	
Trans. bus	1=Operate	2=Reset	3	
BP block	1=Operate	2=Reset	3	
CBF block	1=Operate	2=Reset	3	
Ind. reset	1=Operate	2=Reset	3	
Relay fail	1=Operate	2=Reset	3	
CT err	1=Operate	2=Reset	3	
V0 err	1=Operate	2=Reset	3	
V2 err	1=Operate	2=Reset	3	
Id err	1=Operate	2=Reset	3	
DS fail	1=Operate	2=Reset	3	
CB fail	1=Operate	2=Reset	3	
CTF	1=Operate	2=Reset	3	
CH1 BI	1=Operate	2=Reset	3	
.....				
CH32 BI	1=Operate	2=Reset	3	
Sys. set change	1=Operate		1	
Rly. set change	1=Operate		1	
Grp. set change	1=Operate		1	

- Enter 0 or 1 or 2 or 3 and press the **ENTER** key. Repeat this for all events.
 Enter 0 (= None) not to record the event.
 Enter 1 (= Operate) to record the event when the status changes to "operate".
 Enter 2 (= Reset) to record the event when the status changes to "reset".
 Enter 3 (= Both) to record the event when the status changes both to "operate" and "reset".

Setting the disturbance recording

- Press 2 (= Disturbance record) to display the "Disturbance record" screen.

```

/3 Disturbance record
1=Record time & starter
2=Scheme switch

```

- Press 1 (= Record time & starter) to display the "Record time & starter" screen.

```

/4 Record time & starter 1/**
Time ( 0.1- 2.0): 2.0 _ s
10CG ( 0.1- 10.0): 10.0
10CS ( 0.1- 10.0): 10.0
20CG ( 0.1- 10.0): 10.0
20CS ( 0.1- 10.0): 10.0
  |
320CG ( 0.1- 10.0): 10.0
320CS ( 0.1- 10.0): 10.0

```

- Enter the recording time and starter element settings.

To set the starters, do the following:

- Press 2 (= Scheme switch) on the "Disturbance record" screen to display the "Scheme switch" screen.

```

/4 Scheme switch 1/ 3
TRIP 0=0ff 1=0n 1 -
0CG 0=0ff 1=0n 1
0CS 0=0ff 1=0n 1

```

- Enter 1 to use as a starter or enter 0 if not to use. Repeat this for all items.

4.2.6.6 Status

To set the status display described in Section 4.2.4, do the following.

Press 5 (= Status) on the "Setting (change)" sub-menu to display the "Status" screen.

```

/2 Status
1=Metering
2=Time synchronization
3=Time zone

```

Setting the metering

- Press 1 (= Metering) to display the "Metering" screen.

```

/3 Metering 1/ 1
Display value 1=Primary 2=Secondary 1 _

```

- Enter the selected number and press the **ENTER** key. Repeat this for all items.

Setting the time synchronization

The calendar clock can run locally or be synchronized with the external IRIG-B time standard signal, RSM or IEC clock. This is selected by setting as follows.

- Press 2 (= Time synchronization) to display the "Time synchronization" screen.

```

/ 3 Time synchronization          1 / 1
Sync 0=0ff 1=IRIG 2=RSM 3=IEC    1 _
  
```

- Enter the selected number and press the **ENTER** key.

Note: When to select IRIG-B, RSM or IEC, check that they are active on the "Time synchronization source" screen in "Status" sub-menu. If it is set to an inactive IRIG-B, RSM or IEC, the calendar clock runs locally.

Setting the time zone

When the calendar clock is synchronized with the IRIG-B time standard signal, it is possible to transfer GMT to the local time.

- Press 3 (= Time zone) to display the "Time zone" screen.

```

/ 3 Time zone                      1 / 1
GMT ( -12- +12 ) : +9 _ hrs
  
```

- Enter the difference between GMT and local time and press the **ENTER** key.

4.2.6.7 Protection

The GRB100 can have four setting groups for protection according to the change of power system operation, one of which is assigned to be active. To set protection, do the following:

- Press 6 (= Protection) on the "Setting (change)" screen to display the "Protection" screen.

```

/ 2 Protection
1=Change active group
2=Change setting
3=Copy group
  
```

Changing the active group

- Press 1 (= Change active group) to display the "Change active group" screen.

```

/ 3 Change active group (Active group = *)
1=Group1 2=Group2 3=Group3 4=Group4

Current No. = *      Select No. = _
  
```

- Enter the selected number and press the **ENTER** key.

Changing the settings

Almost all the setting items have default values that are set when the product GRB100 was

shipped. For the default values, see Appendix E and J. To change the settings, do the following:

- Press 2 (= Change setting) to display the "Change setting" screen.

```
/3 Change setting      (Active group = *)
1=Group1   2=Group2   3=Group3   4=Group4
```

- Press the group number to change the settings and display the "Protection" screen.

```
/4 Protection          (Group *)
1=Busbar parameter
2=Trip
```

Settings are required for transformer parameter and protection functions.

Setting the busbar parameters

Enter the CH name and VT ratio as follows:

<CH name>

If the CH name is set, the set name is displayed on the digest screen (electric quantity), the fault record screen and the metering screen.

- Press 1 (= Busbar parameter) on the "Protection" screen to display the "Busbar parameter" screen.

```
/5 Busbar parameter    (Group *)
1=CH name
2=VT ratio
```

Note: "2 = VT ratio" is displayed for Model 200s.

- Press 1 (CH name) to display the "CH name" screen.

```
/6 CH name
Select CH              ( 1 - 32 )

                        Select No. = _
```

- Enter the CH number and press the **ENTER** key.

```
/7 CH1 name [ _ ]
ABCDEFGHIJKLMNOPQRSTUVWXYZ ( ) [ ] @ _  ←→
abcdefghijklmnopqrstuvwxyz { } * / + - < = > ←→
0123456789 ! " # $ % & ' : ; , . ^ ` ←→
```

- Enter the text string.

<VT ratio>

This setting is applied for Model 200s.

- Press 2 (VT ratio) on the "Busbar parameter" screen to display the "VT ratio" screen.

/6 VT ratio	1 / 4
VT A (1 - 20000) :	2000 -
VT B (1 - 20000) :	2000
VT C (1 - 20000) :	2000
VT D (1 - 20000) :	2000

- Enter the VT ratio and press the **ENTER** key.
- Press the **END** key to return the display to the "Busbar parameter" screen.

Setting the protection function

To set the protection schemes, scheme switches and protection elements, do the following. Protection elements are measuring elements and timers.

Note: Depending on the selected protection scheme and scheme switch setting, some of the scheme switches and protection elements are not used and so need not be set. The protection function setting menu of the GRB100 does not display unnecessary setting items. Therefore, start by setting the protection scheme, then set the scheme switch, then the protection elements.

As a result of the above, note that some of the setting items described below may not appear in the actual setting.

- Press 2 (= Trip) on the "Protection" screen to display the "Trip" screen.

/5 Trip	(Group *)
1 = Scheme switch	
2 = Protection element	

Setting the scheme switch

- Press 1 (= Scheme switch) to display the "Scheme switch" screen.

/6 Scheme switch				1 / 108
C . TP	0 = BLK	1 = Trip		0 -
IDS V	0 = 0 f f	1 = ALM & BLK	2 = ALM	2
AIS V	0 = 0 f f	1 = ALM & BLK	2 = ALM	1
AIFDS V	0 = 0 f f	1 = ALM & BLK	2 = ALM	0
DSS V	0 = 0 f f	1 = ALM & BLK	2 = ALM	0
CBS V	0 = 0 f f	1 = ALM & BLK	2 = ALM	1
BFL O G I C	0 = BF 1	1 = BF 2		0
1BF 1	0 = 0 f f	1 = T	2 = T O C	0
1BF 2	0 = 0 f f	1 = 0 n		0
1BFEXT	0 = 0 f f	1 = 0 n		1
2BF 1	0 = 0 f f	1 = T	2 = T O C	0
	⋮			
3 2BF 1	0 = 0 f f	1 = T	2 = T O C	0
3 2BF 2	0 = 0 f f	1 = 0 n		0
3 2BFEXT	0 = 0 f f	1 = 0 n		1
BFTRIO	0 = 0 f f	1 = 0 n		0
COMTP	0 = 0 f f	1 = 0 n		0
EFPTR	0 = 0 f f	1 = 0 n		0
CTFEN	0 = 0 f f	1 = 0 n	2 = 0PT - 0 n	0
CTFCNT	0 = NA	1 = BLK		0

- Enter the number corresponding to the switch status to be set and press the **ENTER** key for

each switch.

- After setting all switches, press the **END** key to return to the "Trip" screen.

Setting the protection elements

- Press 2 (= Protection element) to display the "Protection element" screen.

/6 Protection element (Group = *)		
1 = D I F	2 = O C	3 = F D

<DIF>

- Press 1 (= DIF) to display the "DIF" screen. The measuring elements used in the current differential protection and CT circuit failure detection are set using this screen.
- Enter the numerical value and press the **ENTER** key for each element.

Note: Set DIFCH, DIFZ and DIFSV with CT primary circuit value and 1CT to 32CT with CT primary rating.

- After setting all elements, press the **END** key to return to the "Protection element" menu.

/7 D I F				1 / 45
D I F C H (	500 -	3000)	: 3000 -	A
D I F Z (	500 -	3000)	: 3000	A
S L P C H (	0.30 -	0.90)	: 0.30	
S L P Z (	0.30 -	0.90)	: 0.30	
D I F S V (	20 -	3000)	: 1000	A
T I D S V (	0 -	60)	: 20	s
T B R D G (	0 -	60)	: 60	s
T D D S V (	0 -	60)	: 60	s
T C B S V (	0 -	60)	: 10	s
1 C T (	100 -	10000)	: 1000	A
2 C T (	100 -	10000)	: 1000	A
⋮				
32 C T (	100 -	10000)	: 1000	A
C F I D (	50 -	3000)	: 50	A
C F U V (	20 -	60)	: 20	V
C F D V (	1 -	10)	: 7	%
C F O V G (	0.1 -	10.0)	: 1.0	V

<OC>

- Press 2 (= OC) to display the "OC" screen. The overcurrent elements and timers are set using this screen.
 - Enter the numerical value and press the **ENTER** key for each element.
- Note: Set OCB with multiples of CT secondary rating value.
- After setting all elements, press the **END** key to return to the "Protection element" menu.

/ 7 0 C					1 / 9 8
1 0 C B	(	0 . 1 -	2 . 0) :	0 . 5 -	
T 1 B 1	(	0 -	5 0 0) :	5 0	m s
T 1 B 2	(	0 -	5 0 0) :	1 5 0	m s
2 0 C B	(	0 . 1 -	2 . 0) :	0 . 5	
T 2 B 1	(	0 -	5 0 0) :	5 0	m s
T 2 B 2	(	0 -	5 0 0) :	1 5 0	m s
⋮					
3 2 0 C B	(	0 . 1 -	2 . 0) :	0 . 5	
T 3 2 B 1	(	0 -	5 0 0) :	5 0	m s
T 3 2 B 2	(	0 -	5 0 0) :	1 5 0	m s
T B F D 0	(	0 . 0 0 -	1 0 . 0 0) :	0 . 1 0	s
T C B 0	(	0 . 0 0 -	1 0 . 0 0) :	1 . 0 0	s

<FD>

- Press 3 (= FD) to display the "FD" screen. The measuring elements used in the fault detector are set using this screen.
- Enter the numerical value and press the **ENTER** key for each element.
- After setting all elements, press the **END** key to return to the "Protection element" menu.

/ 7 F D					1 / 3
U V S F	(	6 0 -	1 0 0) :	8 0 -	V
U V G F	(	2 0 -	6 0) :	4 6	V
O V G F	(	0 . 1 -	1 0 . 0) :	1 0 . 0	V

4.2.6.8 Binary Input

The logic level of binary input signals can be inverted by setting before entering the scheme logic. Inversion is used when the input contact cannot meet the conditions described in Table 3.2.2.

- Press 7 (= Binary input) on the "Setting (change)" sub-menu to display the "Binary input" screen.

/ 2 B i n a r y i n p u t	1 = N o r m	2 = I n v	1 / 1 5
B I S W 1			1 -
B I S W 2			1
B I S W 3			1
B I S W 4			1
:			:
B I S W 1 5			1

- Enter 1 (= Normal) or 2 (= Inverted) and press the **ENTER** key for each binary input.

4.2.6.9 Binary Output

All the binary outputs of the GRB100 except the relay failure signal are user-configurable. It is possible to assign one signal or up to six ANDing or ORing signals to one output relay. Available signals are listed in Appendix C.

Note: The binary outputs TP1, TP2, BO3 to BO6 for each BU (CH1 – CH32) are programmed by

PLC function.

It is also possible to attach a drop-off delay time of 0.2 seconds to these signals. The drop-off delay time is disabled by the scheme switch [BOTD].

Appendix E shows the factory default settings.

To configure the binary output signals, do the following:

Selection of output module

- Press 8 (= Binary output) on the "Setting (change)" screen to display the "Binary output" screen. The available output module(s) will be shown.

```

/2 Binary output
1=CU-IO#1 2=CU-IO#2 4=BU-B01 5=BU-B02
  
```

- Press the number corresponding to the selected output module to display the "Binary output" screen.

When "1" or "2" selected,

```

/3 Binary output (*****)
Select B0 (1-**)
Select No. = _
  
```

When "3" or "4" selected,

```

/3 Binary output (BU-B**)
Select CH (1-32)
Select No. = _
  
```

Note: The setting is required for all the binary outputs. If any of the binary outputs are not to be used, enter 0 for the logic gates #1 to #6 when assigning signals.

Selecting the output relay

- Enter the output relay number on the "Binary output" screen and press the **ENTER** key to display the "Setting" screen.

```

/4 Setting (B0** of ****)
1=Logic gate type & delay timer
2=Input to logic gate
  
```

or

```

/4 Setting (B01 of CH**)
1=Logic gate type & delay timer
2=Input to logic gate
  
```

Setting the logic gate type and timer

- Press 1 on the "Setting" screen to display the "Logic gate type & delay timer" screen.

/5	Logic gate type & delay timer	1 / 2
Logic	1 = OR 2 = AND	1 -
BOTD	0 = off 1 = On	1

- Enter 1 or 2 to use an OR gate or AND gate and press the **ENTER** key.
- Enter 0 or 1 to add 0.2s drop-off delay time to the output relay or not and press the **ENTER** key.
- Press the **END** key to return to the "Setting" screen.

Assigning signals

- Press 2 on the "Setting" screen to display the "Input to logic gate" screen.

/5	Input to logic gate	1 / 6
In #1 (	0 - 3071) :	21 -
In #2 (	0 - 3071) :	4
In #3 (	0 - 3071) :	67
In #4 (	0 - 3071) :	0
In #5 (	0 - 3071) :	0
In #6 (	0 - 3071) :	0

- Assign signals to gates (In #1 to #6) by entering the number corresponding to each signal referring to Appendix C.

Note: If signals are not assigned to all the gates #1 to #6, enter 0 for the unassigned gate(s).

Repeat this process for the outputs to be configured.

4.2.6.10 LEDs

Four LEDs from the bottom of the front panel are user-configurable. One of the signals listed in Appendix C can be assigned to each LED as follows:

- Press 9 (= LED) on the "Setting (change)" screen to display the "LED" screen.

/2	LED	1 / 4
LED 1 (	0 - 3071) :	21 -
LED 2 (	0 - 3071) :	4
LED 3 (	0 - 3071) :	67
LED 4 (	0 - 3071) :	0

- Enter the number corresponding to a signal to assign signals to each LED.

If an LED is not used, enter "0" or the default value will be assigned.

4.2.7 Testing

The sub-menu "Test" provides such functions as setting of testing switches, forced operation of binary outputs, time measurement of the variable setting timer, logic signal observation and BU out-of-service function.

4.2.7.1 Setting the switches

The automatic monitor function (A.M.F.) can be disabled by setting the switch [A.M.F] to "OFF".

Disabling the A.M.F. prevents tripping from being blocked even in the event of a failure in the items being monitored by this function. It also prevents failures from being displayed on the "ALARM" LED and LCD described in Section 4.2.1. No events related to A.M.F. are recorded, either.

Disabling A.M.F. is useful for blocking the output of unnecessary alarms output during testing.

Note: Set the switch [A.M.F] to "Off" before applying the test inputs, when the A.M.F is disabled.

The switches [1DS1] to [32DS4] and [1CB] to [32CB] are used to simulate the contact condition of the disconnectors and circuit breakers for relay inputs to "Open" or "Close" forcibly for testing.

While the switch [A.M.F] is set to "Off" or [1DS1] to [32DS4] and [1CB] to [32CB] are set to "Open" or "Close", the red "TESTING" LED is lit for alarm indication.

Caution: Be sure to restore these switches after the tests are completed.

Disabling automatic monitoring

- Press 5 (= Test) on the top "MENU" screen to display the "Test" screen.

/ 1 Test	
1 = Switch	2 = Binary output
3 = Timer	4 = Logic circuit
5 = BU out	

- Press 1 (= Switch) to display the "Switch" screen.

/ 2 Switch				1 / ***
A.M.F.	0 = Off	1 = On		1 -
IECTST	0 = Off	1 = On		0
1DS1	0 = Normal	1 = Open	2 = Close	0
1DS2	0 = Normal	1 = Open	2 = Close	0
1DS3	0 = Normal	1 = Open	2 = Close	0
1DS4	0 = Normal	1 = Open	2 = Close	0
1CB	0 = Normal	1 = Open	2 = Close	0
...				
32DS1	0 = Normal	1 = Open	2 = Close	0
32DS2	0 = Normal	1 = Open	2 = Close	0
32DS3	0 = Normal	1 = Open	2 = Close	0
32DS4	0 = Normal	1 = Open	2 = Close	0
32CB	0 = Normal	1 = Open	2 = Close	0

↑ Indicates CH number. See Appendix I.

- Enter 0 for A.M.F to disable the A.M.F. and press the **ENTER** key.
- Enter 1(=On) for IECTST to transmit 'test mode' to the control system by IEC60870-5-103 communication when testing the local relay, and press the **ENTER** key.

Setting the contact condition of disconnectors and circuit breakers (**DS*, **CB)

- Enter 1 (= Open) to set the contact condition to "Open".

- Enter 2 (= Close) to set the contact condition to "Close".
- Press the **ENTER** key.

Repeat this for all items.

- Press the **END** key to return to the "Test" screen.

4.2.7.2 Binary Output Relay

It is possible to forcibly operate all binary output relays for checking connections with the external devices. Forced operation can be performed on one or more binary outputs at a time for each module.

- Press 2 (= Binary output) on the "Test" screen to display the "Binary output" screen.

```

/ 2 B i n a r y   o u t p u t
1 = C U - I O # 1    2 = C U - I O # 2    3 = B U

```

- Enter the selected number corresponding to each module to be operated. Then the LCD displays the name of the module, the name of the output relay, the name of the terminal block and the terminal number to which the relay contact is connected.

When "1" selected,

```

/ 3 B 0                ( 0 = D i s a b l e   1 = E n a b l e )   1 / 3
I O # 1   B 0 1                1   -
I O # 1   B 0 2                1
I O # 1   B 0 3                1

```

When "2" selected,

```

/ 3 B 0                ( 0 = D i s a b l e   1 = E n a b l e )   1 / 1 4
I O # 2   B 0 1                1   -
I O # 2   B 0 2                1
I O # 2   B 0 3                1
I O # 2   B 0 4                0
I O # 2   B 0 5                0
I O # 2   B 0 6                0
I O # 2   B 0 7                0
I O # 2   B 0 8                0
I O # 2   B 0 9                0
I O # 2   B 0 1 0              0
I O # 2   B 0 1 1              0
I O # 2   B 0 1 2              0
I O # 2   F A I L              0
I O # 2   B 0 1 3              0

```

When "3" selected,

/3	B0	(0=Disable 1=Enable)	1/***
CH1	TP1		1 -
CH1	TP2		0
CH1	B01		0
CH1	B02		0
CH1	B03		0
CH1	B04		0
CH1	B05		0
CH1	B06		0
...			
CH32	TP1		0
CH32	TP2		0
CH32	B01		0
CH32	B02		0
CH32	B03		0
CH32	B04		0
CH32	B05		0
CH32	B06		0

- Enter 1 and press the **ENTER** key.
- After completing the entries, press the **END** key. Then the LCD displays the screen shown below.

```

/3 B0
Keep pressing 1 to operate.

Press CANCEL to cancel.

```

- Keep pressing **1** key to operate the output relays forcibly.
- Release the press of **1** key to reset the operation.

4.2.7.3 Timer

The pick-up or drop-off delay time of the variable timer used in the scheme logic can be measured with monitoring jacks A and B. Monitoring jacks A and B are used to observe the input signal and output signal to the timer respectively.

- Press 3 (=Timer) on the "Test" screen to display the "Timer" screen.

```

/2 Timer 1 / 1
Timer ( 1 - 100 ) : 1 -

```

- Enter the number corresponding to the timer to be observed and press the **ENTER** key. The timers and related numbers are listed in Appendix D.
- Press the **END** key to display the following screen.

```

/2 Timer                                     1 / 1
Press ENTER to operate.
Press CANCEL to cancel.

```

- Press the **ENTER** key to operate the timer. The "TESTING" LED turns on, and the timer is initiated and the following display appears. The input and output signals of the timer can be observed at monitoring jacks A and B respectively. The LEDs above monitoring jacks A or B are also lit if the input or output signal exists.

```

/2 Timer                                     1 / 1
Operating...
Press END to reset.
Press CANCEL to cancel.

```

- Press the **END** key to reset the input signal to the timer. The "TESTING" LED turns off.
- Press **CANCEL** key to test other timers. Repeat the above testing.

4.2.7.4 Logic Circuit

It is possible to observe the binary signal level on the signals listed in Appendix C with monitoring jacks A and B.

- Press 4 (= Logic circuit) on the "Test" screen to display the "Logic circuit" screen.

```

/2 Logic circuit                             1 / 2
Term A ( 0 - 3 0 7 1 ) :          1 -
Term B ( 0 - 3 0 7 1 ) :          4 8

```

- Enter a signal number to be observed at monitoring jack A and press the **ENTER** key.
- Enter the other signal number to be observed at monitoring jack B and press the **ENTER** key.

After completing the setting, the signals can be observed by the binary logic level at monitoring jacks A and B or by the LEDs above the jacks.

On screens other than the above screen, observation with the monitoring jacks is disabled.

4.2.7.5 BU out-of-service

The GRB100 provides the BU out-of-service function for maintenance such as replacement of a BU if failed.

Caution: This function is provided for the temporary operation. Therefore, the replica setting should be changed for a long-term operation or permanent operation.

- Press 5 (= BU out) on the "Test" screen to display the "BU out" screen.

/ 2	BU	out	1 / **
BU1	0=0 u t	1=I n	1 -
BU2	0=0 u t	1=I n	1
BU3	0=0 u t	1=I n	1
BU4	0=0 u t	1=I n	1
⋮		⋮	⋮
BU32	0=0 u t	1=I n	1

- Enter 0(=Out of service) or 1(=In service) for each BU, and press the **ENTER** key. The default setting is “1” for all BUs.

Note: Though a BU (CH) is out-of-service, the assigned BO can be forcibly operated in section 4.2.7.2.

4.3 Personal Computer Interface

The relay can be operated from a personal computer using an RS232C port on the front panel. On the personal computer, the following analysis and display of the fault voltage and current are available in addition to the items available on the LCD screen.

- Display of voltage and current waveform: Oscillograph, vector display
- Symmetrical component analysis: On arbitrary time span
- Harmonic analysis: On arbitrary time span
- Frequency analysis: On arbitrary time span

For the details, see the separate instruction manual "PC INTERFACE RSM100".

4.4 Communication Interface

4.4.1 Relay Setting and Monitoring System

The Relay Setting and Monitoring (RSM) system is a system that retrieves and analyses the data on power system quantities, fault and event records and views or changes settings in individual relays via a telecommunication network using a remote PC.

Figure 4.4.1 shows the typical configuration of the RSM system via a protocol converter G1PR2. The relays are connected through twisted pair cables, and the maximum 256 relays can be connected since the G1PR2 can provide up to 8 ports. The total length of twisted pair wires should not exceed 1200 m. Relays are mutually connected using an RS485 port on the relay rear panel and connected to a PC RS232C port via G1PR2. Terminal resistor (150 ohms) is connected the last relay. The transmission rate used is 64 kbits/s.

In case of the optional fiber optic interface (option), the relays are connected through graded-index multi-mode 50/125 μ m or 62.5/125 μ m type optical fiber using ST connector at the rear of the relay.

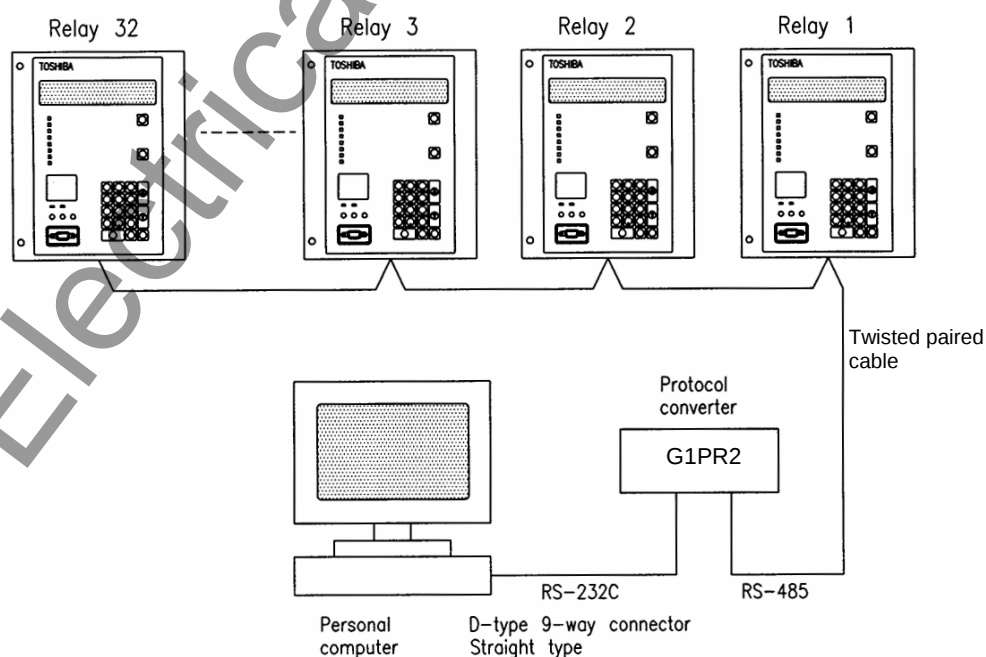


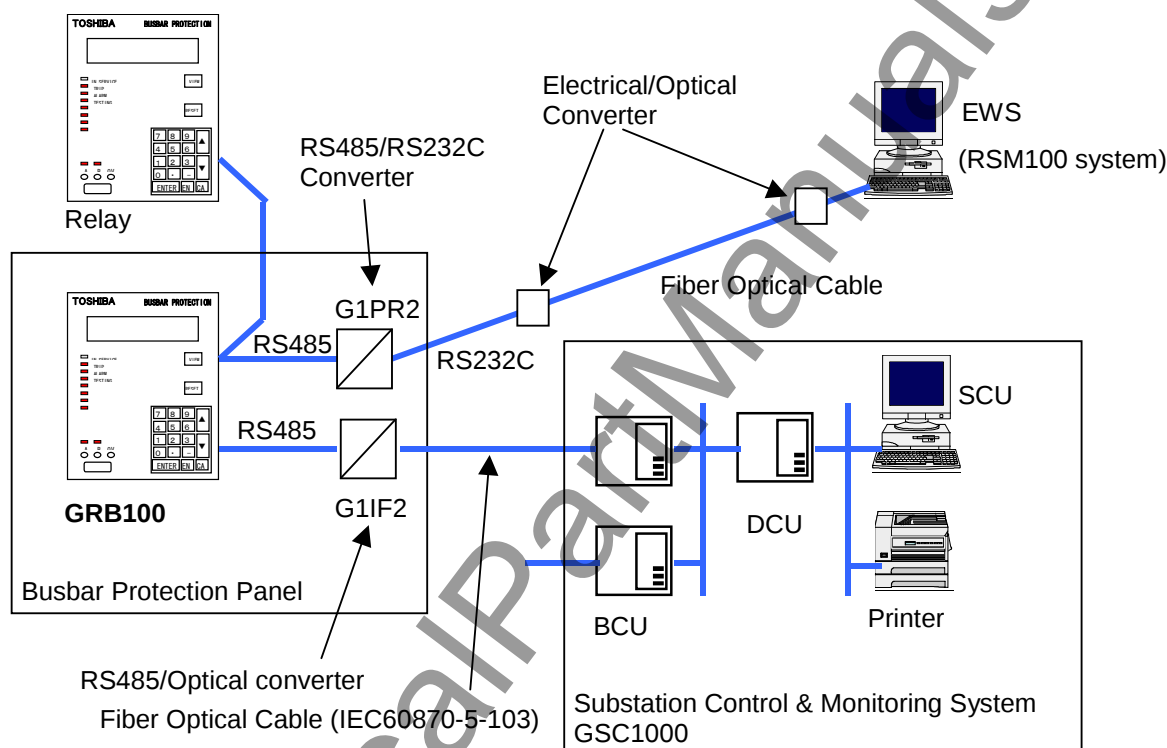
Figure 4.4.1 Relay Setting and Monitoring System

4.4.2 Substation Control and Monitoring System

The relay has two communication ports for Relay Setting & Monitoring System RSM100 and Substation Control & Monitoring System (SCMS). The communication interface of SCMS complies with IEC standard protocol IEC60870-5-103.

Figure 4.4.2 shows the typical configuration of the communication interface for SCMS and RSM100 system.

The relays are connected through RS485/Optical converter G1IF2 to the SCMS, and connected through RS485/RS232C converter and Electrical/Optical converter to the RSM100 system.



Note: All devices except GRB100, and cables are option.

Figure 4.4.2 Communication Interface for SCMS and RSM100 System

4.5 IEC 60870-5-103 Interface

The GRB100 can support the IEC60870-5-103 communication protocol. This protocol is mainly used when the relay communicates with a control system and is used to transfer the following measurand, status data and general command from the relay to the control system.

- Measurand data: current
- Status data: events, fault indications, etc.

The IEC60870-5-103 function in the relay can be customized with the original software “IEC103 configurator”. It runs on a personal computer (PC) connected to the relay, and can help setting of Time-tagged messages, General command, Metering, etc. For details of the setting method, refer to “IEC103 configurator” manual. For the default setting of IEC60870-5-103, see Appendix P.

The protocol can be used through the RS485 port on the relay rear panel and can be also used through the optional fibre optical interface.

The relay supports two baud-rates 9.6kbps and 19.2kbps.

The data transfer from the relay can be blocked by the setting.

For the settings, see the Section 4.2.6.4.

4.6 Clock Function

The clock function (Calendar clock) is used for time-tagging for the following purposes:

- Event records
- Disturbance records
- Fault records
- Metering
- Automatic supervision
- Display of the fault records on the digest screen
- Display of the automatic monitoring results on the digest screen

The calendar clock can run locally or be synchronized with the external IRIG-B time standard signal, RSM or IEC clock. This can be selected by setting.

If it is necessary to synchronize with the IRIG-B time standard signal, it is possible to transform GMT to the local time by setting.

When the relays are connected to the RSM system as shown in Figure 4.4.1, the calendar clock of each relay is synchronized with the RSM clock. If the RSM clock is synchronized with the external time standard (GPS clock etc.), then all the relay clocks are synchronized with the external time standard.

5. Installation

5.1 Receipt of Relays

When relays are received, carry out the acceptance inspection immediately. In particular, check for damage during transportation, and if any is found, contact the vendor.

Check that the following accessories are attached.

- 3 pins for the monitoring jack, packed in a plastic bag.
- An attachment kit required for rack-mounting, if ordered. (See Appendix H.)

EP-101 or EP102:

- 1 large bracket with 5 round head screws, spring washers and washers (M4×10)
- 1 small bracket with 3 countersunk head screws (M4×6)
- 2 bars with 4 countersunk head screws (M3×8)

EP-103 (for linking two relays):

- 1 spacer with 3 round head screws, spring washers and washers (M4×10)
- 2 small brackets with 3 countersunk head screws (M4×6)
- 1 link panel for the rear with 8 round head screws, spring washers and washers (M4×10)
- 1 link panel for the bottom with 6 round head screws, spring washers and washers (M4×10)
- 2 bars with 4 countersunk head screws (M3×8)

- Optical fibre cables (type RFA4012GV) to connect the CU and BUs (if ordered)

Always store the relays in a clean, dry environment.

5.2 Relay Mounting

Either a rack or flush mounting relay is delivered as designated by the customer. Appendix H shows the case outlines.

If the customer requires a rack-mounting relay, support metal fittings necessary to mount it in a 19-inch rack are also supplied with the relay.

When mounting the relay in a rack, detach the original brackets fixed on both sides of the relay and seals on the top and bottom of the relay. Attach the larger bracket and smaller bracket on the left and right sides of the relay respectively and the two bars on the top and bottom of the relay.

When linking two relays together for housing in one rack, detach the original brackets fixed on both sides of the relay and seals on the top and bottom of the relay. Link two relays by using two panels after mounting the spacer between two relays, and attach the small brackets on the left and right sides of the linked relay respectively and the two bars on the top and bottom of the linked relay.

For details on how to mount the attachment kit, see Appendix H.

The dimensions of the attachment kits EP-101, EP-102 and EP-103 are also shown in Appendix H.

5.3 Electrostatic Discharge

▲CAUTION

Do not take any modules out of the relay case since electronic components on the modules are very sensitive to electrostatic discharge. If it is absolutely essential to take the modules out of the case, do not touch the electronic components or terminals with your bare hands. Additionally, always put the module in a conductive anti-static bag when storing it.

5.4 Handling Precautions

A person's normal movements can easily generate electrostatic potential of several thousand volts. Discharge of these voltages into semiconductor devices when handling electronic circuits can cause serious damage, which often may not be immediately apparent but the reliability of the circuit will have been compromised.

The electronic circuits are completely safe from electrostatic discharge when housed in the case. Do not expose them to risk of damage by withdrawing modules unnecessarily.

Each module incorporates the highest practicable protection for its semiconductor devices. However, if it becomes necessary to withdraw a module, precautions should be taken to preserve the high reliability and long life for which the equipment has been designed and manufactured.

▲CAUTION

- Before removing a module, ensure that you are at the same electrostatic potential as the equipment by touching the case.
- Handle the module by its front plate, frame or edges of the printed circuit board. Avoid touching the electronic components, printed circuit board or connectors.
- Do not pass the module to another person without first ensuring you are both at the same electrostatic potential. Shaking hands achieves equipotential.
- Place the module on an anti-static surface, or on a conducting surface which is at the same potential as yourself.
- Do not place modules in polystyrene trays.

It is strongly recommended that detailed investigations on electronic circuitry should be carried out in a Special Handling Area such as described in IEC 60747.

5.5 External Connections

External connections are shown in Appendix I.

5.5.1 Connection between CU and BUs

The connection between CU and BUs is carried out with the optical fibre cable with connectors (type RFA4012GV).

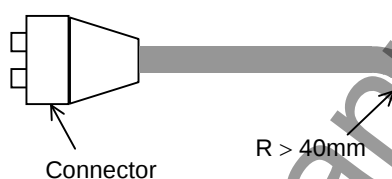
Special precautions are required when using an optical fibre cable with optical connectors.

▲WARNING

When connecting this equipment via an optical fibre cable, do not look directly at the optical beam.

CAUTION

- Do not put a heavy object on an optical fibre cable.
- Be sure to attach and remove an optical connector to/from an optical transceiver module by holding the connector. Never do it by holding the optical fibre cable itself.
- Make sure that the terminal surface of an optical connector does not become dirty. While an optical fibre cable is not connected, cover the optical connector with the protective cap.
- Because optical connectors are designed so that they cannot be attached to an optical transceiver module the wrong way around, attach the connector after confirming it is in the correct attitude.
- Do not bend an optical fibre cable to a radius of less than 40mm.



Connect the terminal OPT11 of CU and the terminal OPT1 of BU1 by the optical fibre cable with connectors as follows:

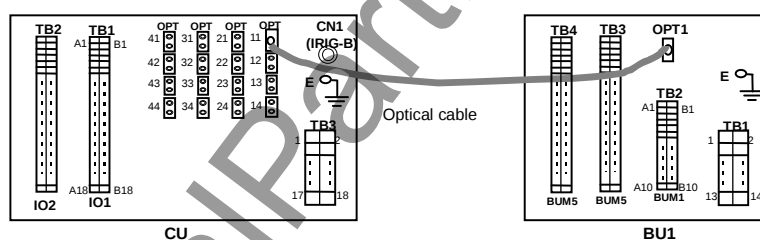


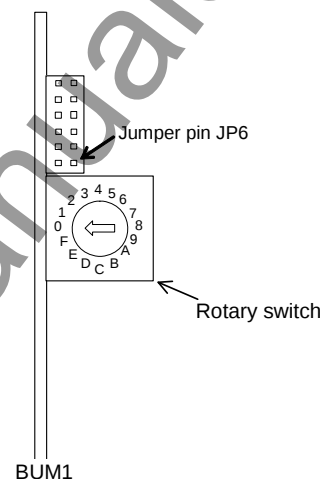
Figure 5.5.1 Connection between CU and BU

5.5.2 Setting of BU

BU address setting is to define the channel number. The channel number can be set the range of CH 1 to CH32 with the rotary switch and jumper pin JP6 of BU. The channel number (CH No.) is set as shown in Table 5.5.1.

Table 5.5.1 BU Setting

BU (CH No.)	BU Setting		Connection Terminal (OPT) of CU			
	JP6	Rotary switch	Model C*1*	Model C*2*	Model C*3*	Model C*4*
BU (CH1)	Open	0	11	11	11	11
BU (CH2)		1	12	12	12	12
BU (CH3)		2	13	13	13	13
BU (CH4)		3	14	14	14	14
BU (CH5)		4	15	15	15	15
BU (CH6)		5	16	16	16	16
BU (CH7)		6	17	17	17	17
BU (CH8)		7	18	18	18	18
BU (CH9)		8	--	31	21	21
BU (CH10)		9	--	32	22	22
BU (CH11)		A	--	33	23	23
BU (CH12)		B	--	34	24	24
BU (CH13)		C	--	35	25	25
BU (CH14)		D	--	36	26	26
BU (CH15)		E	--	37	27	27
BU (CH16)		F	--	38	28	28
BU (CH17)	Close	0	--	--	41	31
BU (CH18)		1	--	--	42	32
BU (CH19)		2	--	--	43	33
BU (CH20)		3	--	--	44	34
BU (CH21)		4	--	--	45	35
BU (CH22)		5	--	--	46	36
BU (CH23)		6	--	--	47	37
BU (CH24)		7	--	--	48	38
BU (CH25)		8	--	--	--	41
BU (CH26)		9	--	--	--	42
BU (CH27)		A	--	--	--	43
BU (CH28)		B	--	--	--	44
BU (CH29)		C	--	--	--	45
BU (CH30)		D	--	--	--	46
BU (CH31)		E	--	--	--	47
BU (CH32)		F	--	--	--	48



Connect OPT1 of a BU to OPT11 of CU by the optical fibre. Open the front panel of the BU, and open the jumper pin J6 and set the rotary switch position mounted on the BUM1 module to "0". Then the CU recognizes the BU as CH1.

Set other BUs the same as above.

6. Commissioning and Maintenance

6.1 Outline of Commissioning Tests

The GRB100 is fully numerical and the hardware is continuously monitored.

Commissioning tests can be kept to a minimum and need only include hardware tests and conjunctive tests. The function tests are at the user's discretion.

In these tests, user interfaces on the front panel of the relay or local PC can be fully applied.

Test personnel must be familiar with general relay testing practices and safety precautions to avoid personal injuries or equipment damage.

Hardware tests

These tests are performed for the following hardware to ensure that there is no hardware defect. Defects of hardware circuits other than the following can be detected by monitoring which circuits function when the DC power is supplied.

- User interfaces
- Binary input circuits and output circuits
- AC input circuits

Function tests

These tests are performed for the following functions that are fully software-based. Tests of the protection schemes require a dynamic test set.

- Measuring elements
- Timers
- Metering and recording

Conjunctive tests

The tests are performed after the relay is connected with the primary equipment and other external equipment.

The following tests are included in these tests:

- On load test: phase sequence check and polarity check
- Tripping circuit test
- Primary injection test

6.2 Cautions

6.2.1 Safety Precautions

▲CAUTION

- The relay rack is provided with an earthing terminal.
Before starting the work, always make sure the relay rack is earthed.
- When connecting the cable to the back of the relay, firmly fix it to the terminal block and attach the cover provided on top of it.
- Before checking the interior of the relay, be sure to turn off the power.

Failure to observe any of the precautions above may cause electric shock or malfunction.

6.2.2 Cautions on Tests

▲CAUTION

- While the power is on, do not connect/disconnect the flat cable on the front of the printed circuit board (PCB).
- While the power is on, do not mount/dismount the PCB.
- Before turning on the power, check the following:
 - Make sure the polarity and voltage of the power supply are correct.
 - Make sure the CT circuit is not open.
 - Make sure the VT circuit is not short-circuited.
- Be careful that the transformer module is not damaged due to an overcurrent or overvoltage.
- If settings are changed for testing, remember to reset them to the original settings.

Failure to observe any of the precautions above may cause damage or malfunction of the relay.

Before mounting/dismounting the PCB, take antistatic measures such as wearing an earthed wristband.

6.3 Preparations

Test equipment

The following test equipment is required for the commissioning tests.

- 1 Three-phase voltage source or 1 Single-phase voltage source
- 2 Single-phase current sources
- 1 DC power supply
- 1 DC voltmeter
- 1 AC voltmeter
- 1 Phase angle meter
- 2 AC ammeters
- 1 Time counter, precision timer
- 1 PC (not essential)
- 1 Primary injection test set

Relay settings

Before starting the tests, it must be specified whether the tests will use the user's settings or the default settings.

For the default settings, see the following appendixes:

- Appendix E Binary Output Default Setting List
- Appendix J Relay Setting Sheet

Visual inspection

After unpacking the product, check for any damage to the relay case. If there is any damage, the internal module might also have been affected. Contact the vendor.

Relay ratings

Check that the items described on the nameplate on the front of the relay conform to the user's specification. The items are: relay type and model, AC voltage, current and frequency ratings, and auxiliary DC supply voltage rating.

Local PC

When using a local PC, connect it with the relay via the RS232C port on the front of the relay. RSM100 software is required to run the PC.

For the details, see the separate instruction manual "PC INTERFACE RSM100".

6.4 Hardware Tests

The tests can be performed without external wiring, but a DC power supply, AC voltage and two AC current sources are required.

6.4.1 User Interfaces

This test ensures that the LCD, LEDs and keys function correctly.

LCD display

- Apply the rated DC voltage and check that the LCD is off.
Note: If there is a failure, the LCD displays the "Auto-supervision" screen when the DC voltage is applied.
- Press the **RESET** key for one second and check that black dots appear on the whole screen.

LED display

- Apply the rated DC voltage and check that the "IN SERVICE" LED is lit in green.
- Press the **RESET** key for one second and check that seven LEDs under the "IN SERVICE" LED and two LEDs for monitoring jacks A and B are lit in red.

VIEW and RESET keys

- Press the **VIEW** key when the LCD is off and check that the "Metering" screen is displayed on the LCD.
- Press the **RESET** key and check that the LCD turns off.

Keypad

- Press any key on the keypad when the LCD is off and check that the LCD displays the "MENU" screen. Press the **END** key to turn off the LCD.
- Repeat this for all keys.

6.4.2 Binary Input Circuit

The testing circuit is shown in Figure 6.4.1.

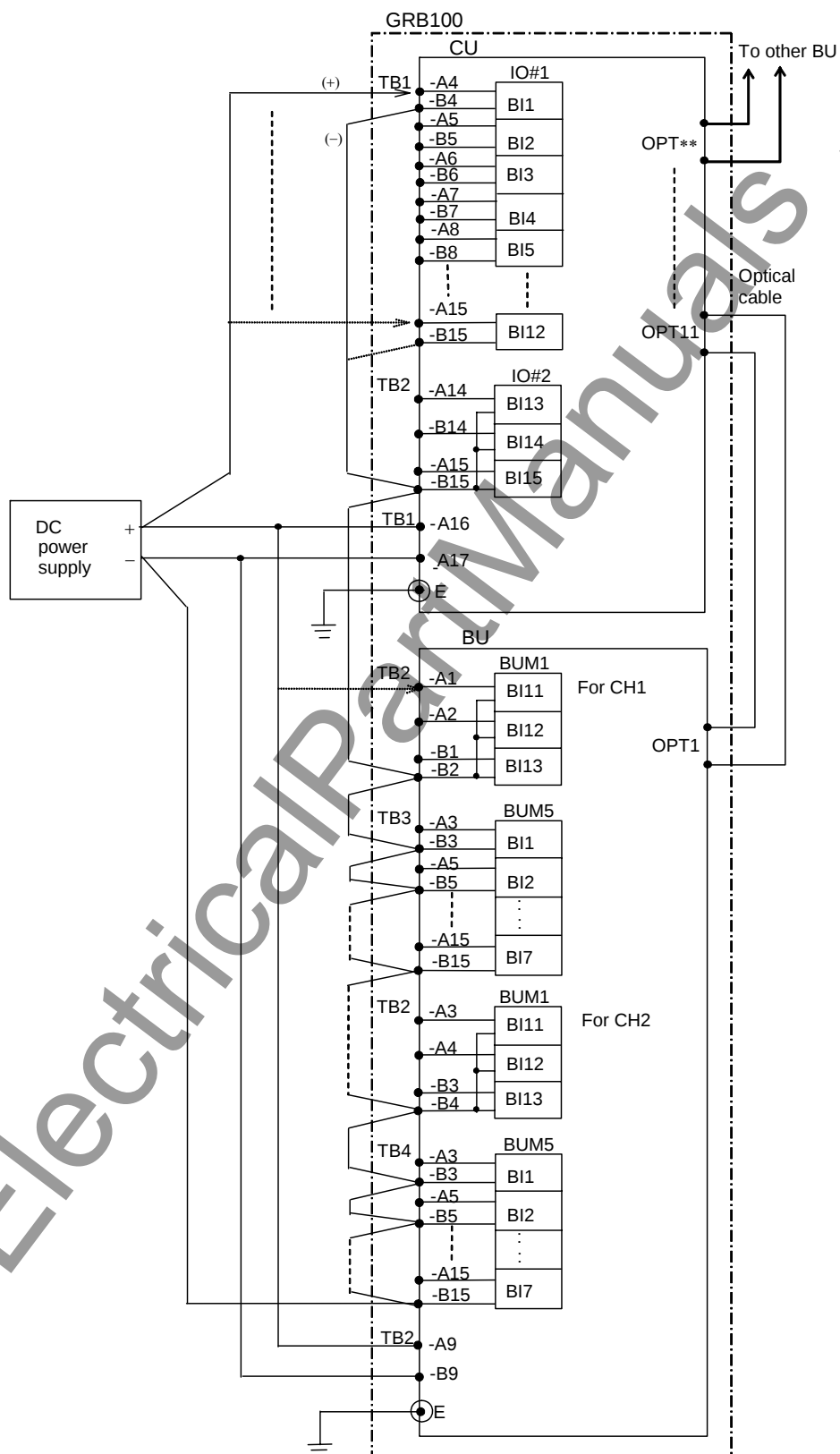


Figure 6.4.1 Testing Binary Input Circuit

- Display the "Binary input & output" screen from the "Status" sub-menu.

/2 Binary input & output	3 / 6 7
Input (CU-IO#1)	[000 000 000 000]
Input (BU-CH1)	[000 000 000 0]
Input (BU-CH2)	[000 000 000 0]
Input (BU-CH32)	[000 000 000 0]
Output (CU-IO#1)	[000]
Output (CU-IO#2)	[000 000 000 000 00]
Output (BU-CH1)	[000 000 00]
Output (BU-CH2)	[000 000 00]
Output (BU-CH32)	[000 000 00]

- Apply the rated DC voltage to terminals of terminal block TB1 and TB2 of CU, and terminal block TB2, TB3 and TB4 of BU.

Check that the status display corresponding to the input signal changes from 0 to 1. (For details of the binary input status display, see Section 4.2.4.2.)

Note: The number of BU and CH depends on the model.

Test the binary input circuits of other BUs same as above.

The user will be able to perform this test for one terminal to another or for all the terminals at once.

6.4.3 Binary Output Circuit

This test can be performed by using the "Test" sub-menu and forcibly operating the relay drivers and output relays. Operation of the output contacts is monitored at the output terminal. The output contact and corresponding terminal number are shown in Appendix I.

- Press 2 (= Binary output) on the "Test" screen to display the "Binary output" screen. The LCD displays the output modules mounted depending on the model.

/2 Binary output
1 = CU-IO#1 2 = CU-IO#2 3 = BU

- Enter the selected number corresponding to each module to be operated. Then the LCD displays the name of the module and the name of the output relay to which the relay contact is connected.

When "1" selected,

/3 B0	(0 = Disable 1 = Enable)	1 / 3
IO#1 B01		1 -
IO#1 B02		1
IO#1 B03		1

When "2" selected,

/3	B0	(0=Disable 1=Enable)	1/14
IO#2	B01		1 -
IO#2	B02		1
IO#2	B03		1
IO#2	B04		0
IO#2	B05		0
IO#2	B06		0
IO#2	B07		0
IO#2	B08		0
IO#2	B09		0
IO#2	B010		0
IO#2	B011		0
IO#2	B012		0
IO#2	FAIL		0
IO#2	B013		0

When "3" selected,

/3	B0	(0=Disable 1=Enable)	1/**
CH1	TP1		1 -
CH1	TP2		0
CH1	B01		0
CH1	B02		0
CH1	B03		0
CH1	B04		0
CH1	B05		0
CH1	B06		0
...			
CH32	TP1		0
CH32	TP2		0
CH32	B01		0
CH32	B02		0
CH32	B03		0
CH32	B04		0
CH32	B05		0
CH32	B06		0

- Enter 1 and press the **ENTER** key.
- After completing the entries, press the **END** key. Then the LCD displays the screen shown below. If 1 is entered for the output relays, the following forcible operation can be performed collectively.

```

/3 B0
Keep pressing 1 to operate.

Press CANCEL to cancel.

```

- Keep pressing the **1** key to operate the output relays forcibly.
- Check that the output contacts operate at the terminal.

- Release pressing the 1 key to reset the operation.

6.4.4 AC Input Circuits

This test can be performed by applying the checking voltages and currents to the AC input circuits and verifying that the values applied coincide with the values displayed on the LCD screen.

The testing circuit is shown in Figure 6.4.2. A three-phase voltage source and a single-phase current source are required. The three-phase voltage source is required for the models with FD elements.

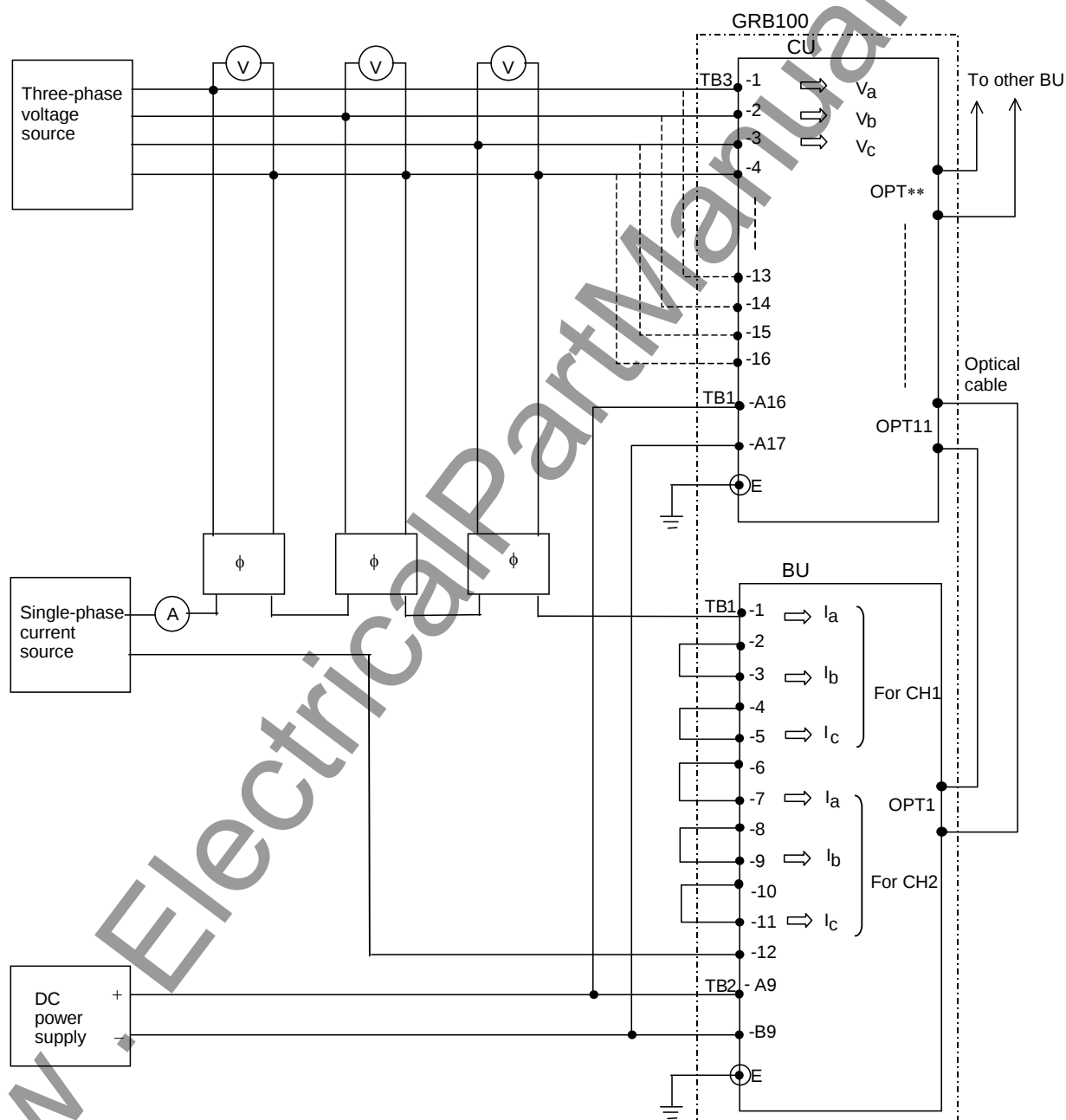


Figure 6.4.2 Testing AC Input Circuit

- Check that the metering data is set to be expressed as secondary values (Display value = 2) on

the "Metering" screen.

"Setting (view)" sub-menu → "Status" setting screen → "Metering" screen

If the setting is Primary (Display value = 1), change the setting in the "Setting (change)" sub-menu. Remember to reset it to the initial setting after the test is finished. (See Section 4.2.6.6.)

- Open the "Metering" screen in the "Status" sub-menu.
"Status" sub-menu → "Metering" screen
- Apply the rated AC voltages and current and check that the displayed values are within $\pm 5\%$ of the input values.

6.5 Function Test

6.5.1 Measuring Element

Measuring element characteristics are realized by the software, so it is possible to verify the overall characteristics by checking representative points.

Operation of the element under test is observed by the binary output signal at monitoring jacks A or B or by the LED indications above the jacks. In any case, the signal number corresponding to each element output must be set on the "Logic circuit" screen of the "Test" sub-menu.

/ 2 Logic circuit				1 / 2	
Term A (	0 -	1 5 0 0) :	1	-	
Term B (	0 -	1 5 0 0) :	48		

When a signal number is entered for the TermA line, the signal is observed at monitoring jack A and when entered for the TermB line, observed at monitoring jack B.

Note: The voltage level at the monitoring jacks is $+15V \pm 3V$ for logic level "1" and less than 0.1V for logic level "0".

CAUTION

- Use the testing equipment with more than $1k\Omega$ of internal impedance when observing the output signal at the monitoring jacks.
- Do not apply an external voltage to the monitoring jacks.
- Do not leave the A or B terminal shorted to 0V terminal for a long time.

In case of a three-phase element, it is enough to test for a representative phase. A-phase element is selected for hereafter.

6.5.1.1 Current differential elements

The current differential elements are checked on the following items

- Operating current value
- Percentage restraining characteristic
- Operating time

Note: Set all the CT settings (1CT to nCT) to the same value or select a BU with the same value setting in the testing described in Figure 6.5.1, because the operating value depends on the settings.

In the testing, it is enough to test the DIFCH element for a representative element.

Operating current value

Minimum operating current value is checked by simulating one-end infeed. Figure 6.5.1 shows a test circuit.

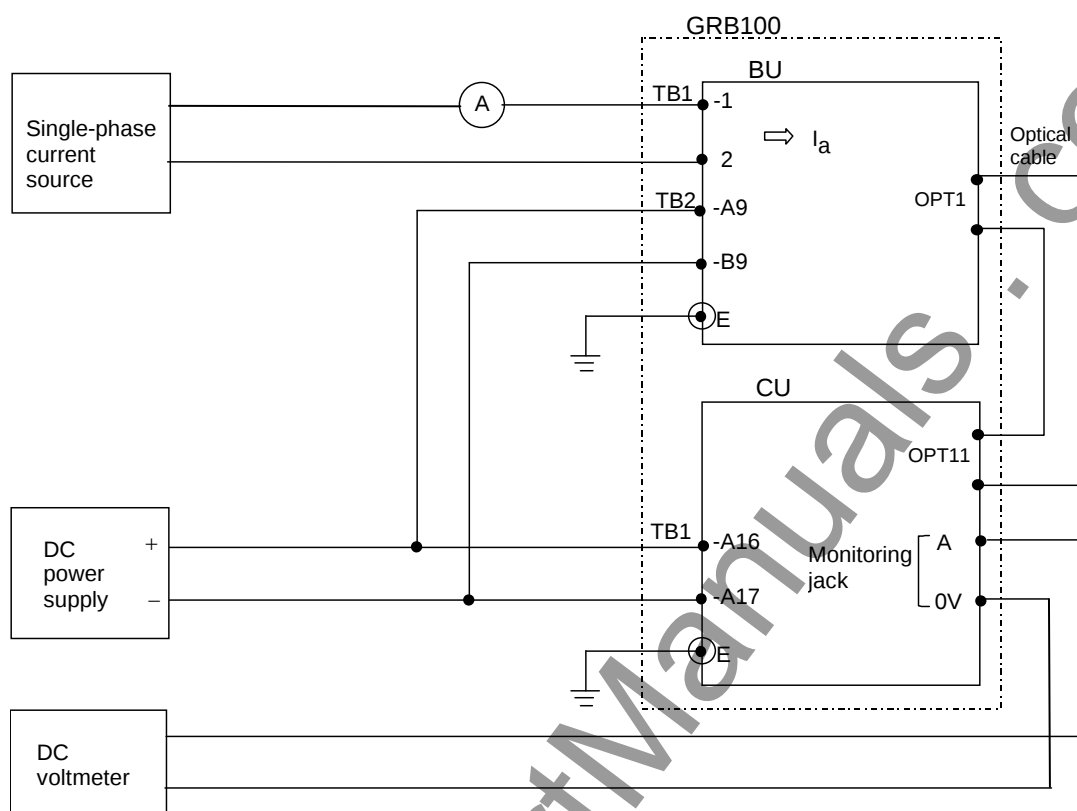


Figure 6.5.1 Operating Current Value Test Circuit

The output signal numbers of the elements are as follows:

Element	Signal number
DIFCH-A	541
DIFCH-B	542
DIFCH-C	543

- Press 4 (= Logic circuit) on the "Test" sub-menu screen to display the "Logic circuit" screen.
- Enter a signal number to observe the DIFCH-A operation at monitoring jack A and press the **ENTER** key.
- Apply a test current to A-phase current terminals of bay unit and change the magnitude of the current applied and measure the value at which the element DIFCH-A operates. Check that the measured value is within 5% of the theoretical operating value.

$$\text{Theoretical operating value} = (\text{DIFCH setting}) / (\text{CT setting}) \times (\text{CT secondary rating})$$

Percentage restraining characteristics

The percentage restraining characteristic DF2 is tested on the outflow current (I_{out}) and infeed current (I_{in}) plane as shown in Figure 6.5.2. The characteristic shown in Figure 6.5.2 is equivalent to the one on the differential current (I_d) and restraining current (I_r) plane shown in Figure 2.8.1.

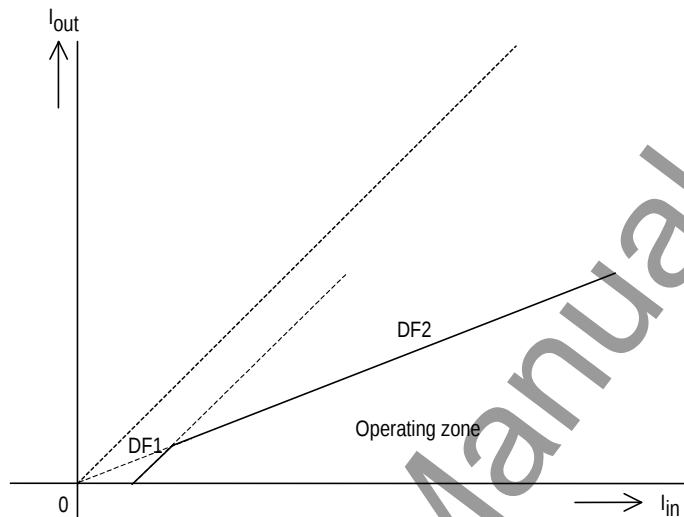


Figure 6.5.2 Current Differential Element (I_{out} - I_{in} Plane)

The characteristic test is enough to test for two representative channels.

Figure 6.5.3 shows a testing circuit simulating infeed from the channel CH1 and outflow from CH2.

The characteristic DF2, in the case of $k=0.3$, is expressed by the following equation,

$$I_{out} \leq (7/13) I_{in}$$

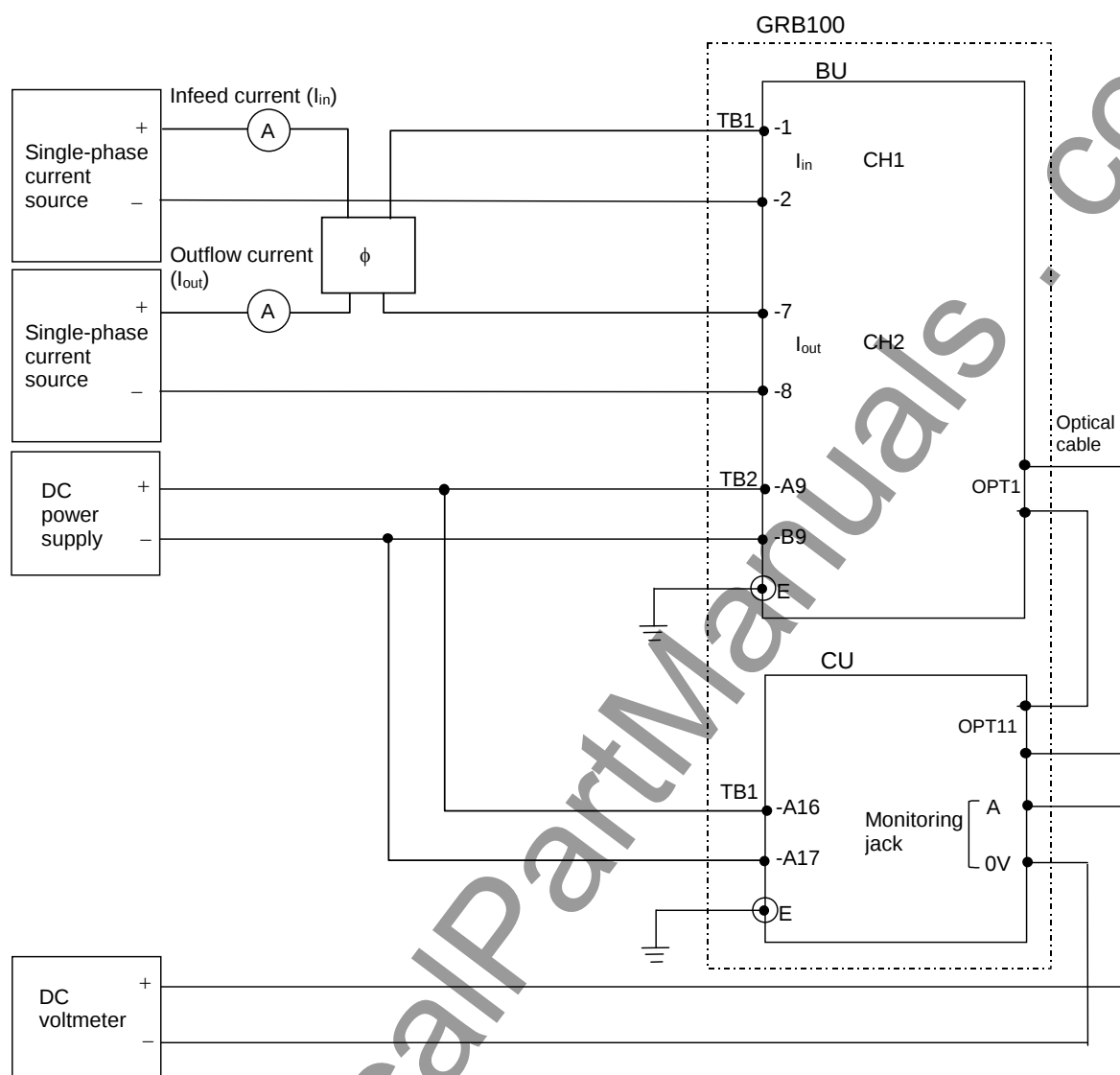


Figure 6.5.3 Percentage Restraining Characteristic Test of DIF

- Press 4 (= Logic circuit) on the "Test" sub-menu screen to display the "Logic circuit" screen.
- Enter a signal number to observe the DIFCH-A output at monitoring jack A and press the **ENTER** key.
- Apply an infeed current to terminal TB1-1 and -2 of the BU.
When the infeed current applied is larger than three times the (DIFCH setting) / (CT ratio),
- Apply an outflow current of the same magnitude and counterphase with the infeed current to terminal TB1-7 and 8 of the BU.
- Decrease the out flow current in magnitude and measure the values at which the element operates.
- Check that the measured values are within 5% of the theoretical values obtained above equation.

The testing circuit is shown in Figure 6.5.4.

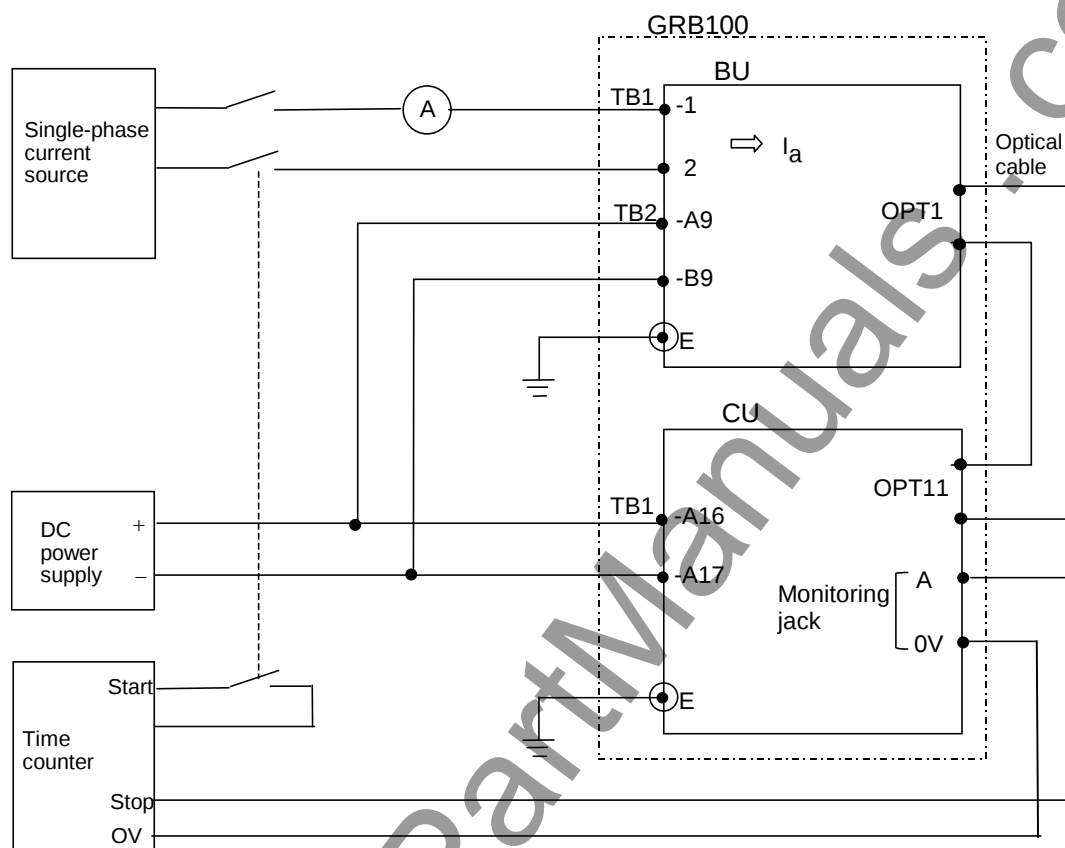


Figure 6.5.4 Operating Time Test

- Press 4 (= Logic circuit) on the "Test" sub-menu screen to display the "Logic circuit" screen.
- Enter a signal number to observe the DIFCH-A operation at monitoring jack A and press the **ENTER** key.
- Set a test current to 3 times of the operating current.
- Apply the test current and measure the operating time.
- Check that the operating time is 1 cycle or less.

6.5.1.2 Overcurrent element OCBF

The testing circuit is shown in Figure 6.5.5.

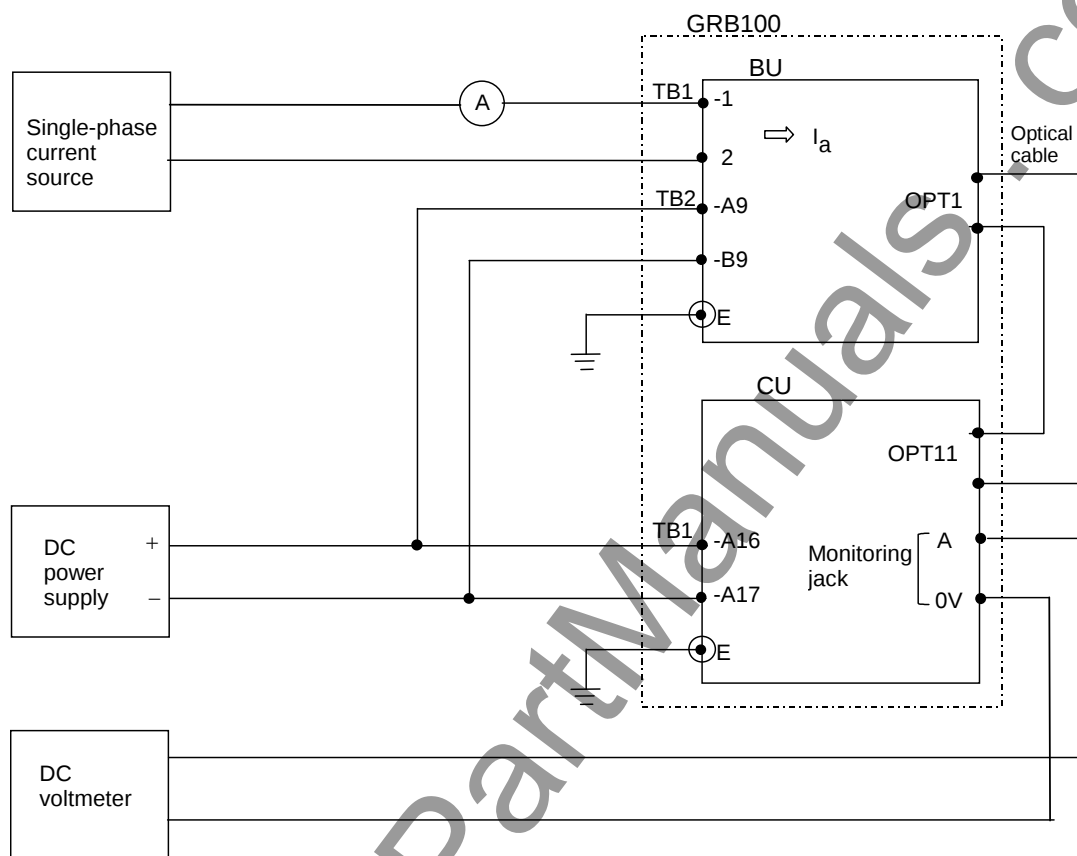


Figure 6.5.5 Testing OCBF elements

The output signal numbers of the OCBF elements are as follows:

Element	Signal number	Element	Signal number	Element	Signal number
1OCBF-A	591	13OCBF-A	627	25OCBF-A	663
2OCBF-A	594	14OCBF-A	630	26OCBF-A	666
3OCBF-A	597	15OCBF-A	633	27OCBF-A	669
4OCBF-A	600	16OCBF-A	636	28OCBF-A	672
5OCBF-A	603	17OCBF-A	639	29OCBF-A	675
6OCBF-A	606	18OCBF-A	642	30OCBF-A	678
7OCBF-A	609	19OCBF-A	645	31OCBF-A	681
8OCBF-A	612	20OCBF-A	648	32OCBF-A	684
9OCBF-A	615	21OCBF-A	651		
10OCBF-A	618	22OCBF-A	654		
11OCBF-A	621	23OCBF-A	657		
12OCBF-A	624	24OCBF-A	660		

The testing procedure is as follows:

- Press 4 (= Logic circuit) on the "Test" sub-menu screen to display the "Logic circuit" screen.
- Enter a signal number to observe the OCBF at monitoring jack A and press the **ENTER** key.
- Apply a test current and change the magnitude of the current applied and measure the value at which the element operates.

Check that the measured value is within $\pm 5\%$ of the theoretical operating value.

$$\text{Theoretical operating value} = (\text{CT secondary rated current}) \times (\text{OCBF setting})$$

6.5.1.3 FD elements UVGFA, UVGFB, UVGFC, UVGFD, UVSFA, UVSFB, UVSFC and UVSFD

The testing circuit is shown in Figure 6.5.6.

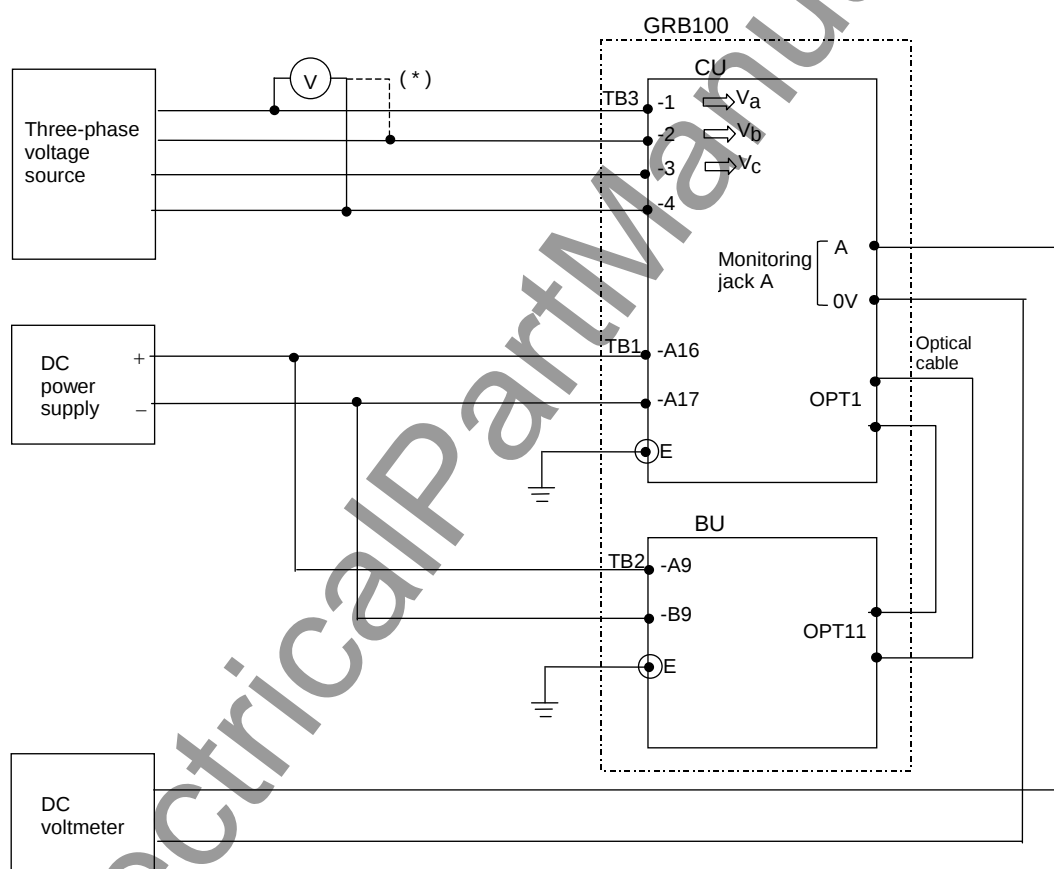


Figure 6.5.6 Testing FD elements

The output signal numbers of the FD elements are as follows:

Element	Signal number
UVGFA-A	1301
UVGFB-A	1304
UVGFC-A	1307
UVGFD-A	1310
UVSFA-A	1313

Element	Signal number
UVSFB-A	1316
UVSFC-A	1319
UVSFD-A	1322

The testing procedure is as follows:

- Press 4 (= Logic circuit) on the "Test" sub-menu screen to display the "Logic circuit" screen.
- Enter a signal number to observe the UVGF□ or UVSF□ output at monitoring jack A and press the **ENTER** key.
- Apply a rated voltage and change the magnitude of the voltage applied, and measure the value at which the element operates. Check that the measured value is within 5% of the setting value.

6.5.2 Timer Test

The pick-up delay time of the variable timer can be measured by connecting the monitoring jacks A and B to a time counter as shown in Figure 6.5.7. Jacks A and B are used to observe the input signal and output signal of the timer, respectively.

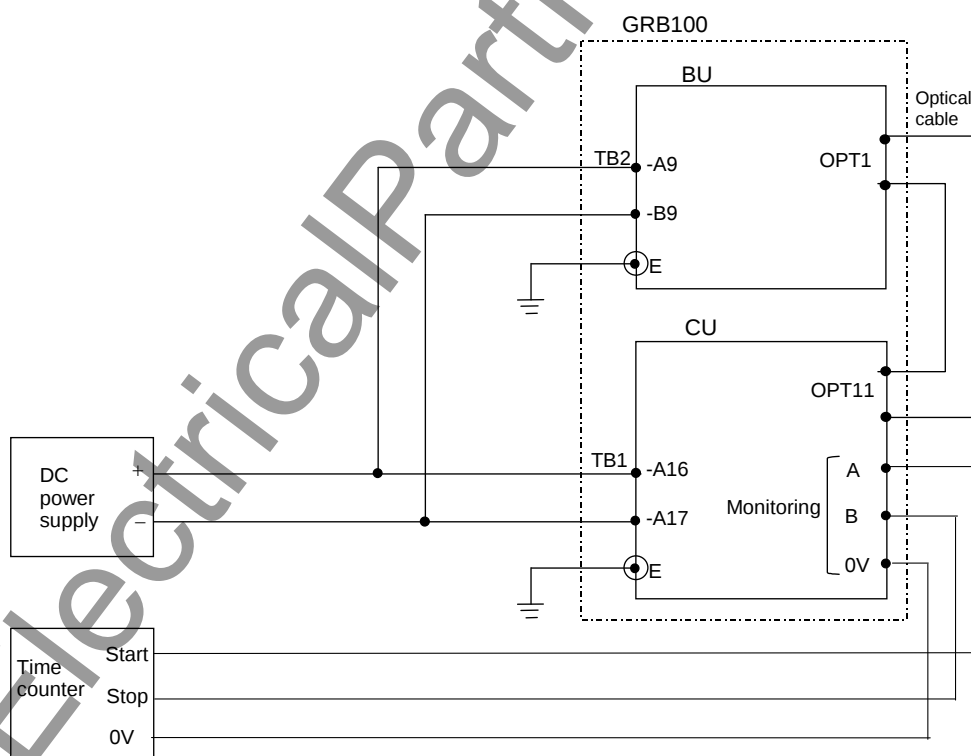


Figure 6.5.7 Testing Variable Timer

- Press 3 (= Timer) on the "Test" sub-menu screen to display the "Timer" screen.
- Enter the number corresponding to the timer to be observed. The timers and assigned numbers are listed in Appendix D.
- Press the **END** key to display the following screen.

```
/2 Timer 1 / 1
Press ENTER to operate.
Press CANCEL to cancel.
```

- Press the **ENTER** key to operate the timer. The "TESTING" LED turns on, and the timer is initiated and the following display appears. The input and output signals of the timer can be observed at monitoring jacks A and B respectively. The LEDs above monitoring jacks A or B are also lit if the input or output signal exists.

```
/2 Timer 1 / 1
Operating...
Press END to reset.
Press CANCEL to cancel.
```

- Press the **END** key to reset the input signal to the timer. The "TESTING" LED turns off. Press **CANCEL** key to test other timers. Repeat the above testing.

6.5.3 Protection Scheme

In the protection scheme tests, a dynamic test set with the three-phase voltage source and current source is required to simulate power system pre-fault, fault and post-fault conditions.

Tripping is observed with the tripping command output relays TP-1 and -2 of each BU.

Check that the indications and recordings are correct.

Differential tripping

The tripping should be checked for the test current, which is two times or larger than the minimum operating current of DIFCH and DIFZA to DIFZD, and for the test voltage which is smaller than the operating voltage of UVSF and UVGF. Set the contact condition of all disconnectors and circuit breakers applied to the related channels to simulate the in-service condition before applying the test current and voltage. (See section 4.2.7.)

Operating time is measured by the operating time of the tripping command output relay. It will typically be 1 cycle.

Check that the indications and recordings are correct.

Circuit breaker failure tripping

Set the scheme switches [nBF1] to "T" or "TOC" and [nBF2] to "ON".

Apply a fault and retain it. Check that the adjacent breaker tripping output relay operates after the time setting of the TnB2.

Check that the indications and recordings are correct.

6.5.4 Metering and Recording

The metering function can be checked while testing the AC input circuit. See Section 6.4.4.

Fault recording can be checked while testing the protection schemes. Open the "Fault record" screen and check that the descriptions are correct for the applied fault.

Recording events are listed in Table 3.4.1. The events BP block, CBF block, Ind. reset, nDS1 N/C to nExt. trip C are external events and others are internal events. Event recording on the external events can be checked by changing the status of binary input signals. Change the status in the same way as the binary input circuit test (see Section 6.4.2) and check that the description displayed on the "Event Record" screen is correct.

Note: The record option can be set for each event. Change the status of the binary input signal after confirming that the related event is set to record. (The default setting enables all the events to be recorded.)

Some of the internal events can be checked in the protection scheme tests.

Disturbance recording can be checked while testing the protection schemes. The LCD display only shows the date and time when a disturbance is recorded. Open the "Disturbance record" screen and check that the descriptions are correct.

Details can be displayed on the PC. Check that the descriptions on the PC are correct. For details on how to obtain disturbance records on the PC, see the RSM100 Manual.

6.6 Conjunctive Tests

6.6.1 On Load Test

With the relay connected to the line which is carrying a load current, it is possible to check the polarity of the voltage transformer and current transformer and the phase rotation with the metering displays on the LCD screen.

- Open the following "Metering" screen from the "Status" sub-menu.

/2 Metering			16/Oct/1997			18:13 3/***		
I d a	*****	%	*****	A	I r a	*****	A	
I d b	*****	%	*****	A	I r b	*****	A	
I d c	*****	%	*****	A	I r c	*****	A	
I d a A	*****	%	*****	A	I r a A	*****	A	
I d b A	*****	%	*****	A	I r b A	*****	A	
I d c A	*****	%	*****	A	I r c A	*****	A	
I d a B	*****	%	*****	A	I r a B	*****	A	
I d b B	*****	%	*****	A	I r b B	*****	A	
I d c B	*****	%	*****	A	I r c B	*****	A	
I d a C	*****	%	*****	A	I r a C	*****	A	
I d b C	*****	%	*****	A	I r b C	*****	A	
I d c C	*****	%	*****	A	I r c C	*****	A	
I d a D	*****	%	*****	A	I r a D	*****	A	
I d b D	*****	%	*****	A	I r b D	*****	A	
I d c D	*****	%	*****	A	I r c D	*****	A	
V a A	***.	kV	***.	°	V 1 A	***.	kV	***.
V b A	***.	kV	***.	°	V 2 A	***.	kV	***.
V c A	***.	kV	***.	°	V 0 A	***.	kV	***.
V a B	***.	kV	***.	°	V 1 B	***.	kV	***.
V b B	***.	kV	***.	°	V 2 B	***.	kV	***.
V c B	***.	kV	***.	°	V 0 B	***.	kV	***.
V a C	***.	kV	***.	°	V 1 C	***.	kV	***.
V b C	***.	kV	***.	°	V 2 C	***.	kV	***.
V c C	***.	kV	***.	°	V 0 C	***.	kV	***.
V a D	***.	kV	***.	°	V 1 D	***.	kV	***.
V b D	***.	kV	***.	°	V 2 D	***.	kV	***.
V c D	***.	kV	***.	°	V 0 D	***.	kV	***.
CH 1	*****							
I a	***.	kA	***.	°	I 1	***.	kA	***.
I b	***.	kA	***.	°	I 2	***.	kA	***.
I c	***.	kA	***.	°	I 0	***.	kA	***.
CH 2	*****							
I a	***.	kA	***.	°	I 1	***.	kA	***.
I b	***.	kA	***.	°	I 2	***.	kA	***.
I c	***.	kA	***.	°	I 0	***.	kA	***.
...								
CH 3 2	*****							
I a	***.	kA	***.	°	I 1	***.	kA	***.
I b	***.	kA	***.	°	I 2	***.	kA	***.
I c	***.	kA	***.	°	I 0	***.	kA	***.
F r e q u e n c y	***. * H z							

Note: The magnitude of voltage and current can be set in values on the primary side or on the secondary side by the setting. (The default setting is the primary side.)

The phase differential currents show the percentage to DIFCH and DIFZ setting values. IdyA to IdyD and VyA to VyD are displayed depend on applied zones. ("y"=a, b, c, 1, 2, 0)

In the phase angle indication, the reference phase angle is indicated as "0.0°" at V1. Phase angles above are expressed taking that of positive sequence voltage as a reference phase angle. The leading phase angles are expressed plus. If no voltage input, the positive sequence current of CH1 is taken as a reference phase angle. If the current of CH1 is small, the current

of the next channel is used as a reference phase angle.

- Check that the phase rotation is correct.
- Verify the phase relation between voltage and current with a known load current direction.

6.6.2 Tripping Circuit Test

The tripping circuit including the circuit breaker is checked by forcibly operating the output relay and monitoring the breaker that is tripped. Forcible operation of the output relay is performed on the "Binary output" screen of the "Test" sub-menu as described in Section 6.4.3.

Tripping circuit

- Set the breaker to be closed.
- Press 2 (= Binary output) on the "Test" sub-menu screen to display the "Binary output" screen. The LCD displays the output modules mounted.

```

/2 Binary output
1 = CU-IO#1   2 = CU-IO#2   3 = BU
  
```

- Enter 3 to select the BU, then the LCD displays the screen shown below.

/3	B0	(0=Disable 1=Enable)	1/**
CH1	TP1		1 -
CH1	TP2		0
CH1	B01		0
CH1	B02		0
CH1	B03		0
CH1	B04		0
CH1	B05		0
CH1	B06		0
CH2	TP1		0
CH2	TP2		0
CH2	B01		0
CH2	B02		0
CH3	TP1		0
CH3	TP2		0
CH3	B01		0
CH3	B02		0

TP1 of each CH is an output relay with one normally open contact.

- Enter 1 for TP1 of CH1 and press the **ENTER** key.
- Press the **END** key. Then the LCD displays the screen shown below.

```

/3 B0
Keep pressing 1 to operate.

Press CANCEL to cancel.

```

- Keep pressing the **1** key to operate the output relay TP1 of CH1 and check that the No. 1 breaker is tripped.
- Release pressing the **1** key to reset the operation.
- Repeat the above for other output relays.

6.6.3 Primary injection test

This test is a protection stability check (through fault stability) carried out for all feeders before the busbar is energized.

For this test, the tripping circuit has to be opened.

Protection Stability Check

Inject a current from a primary injection test set (recommended : 25%CT rated current) into two feeders (reference feeder and one other feeder, see Figure 6.6.1.)

Check that the relay does not operate.

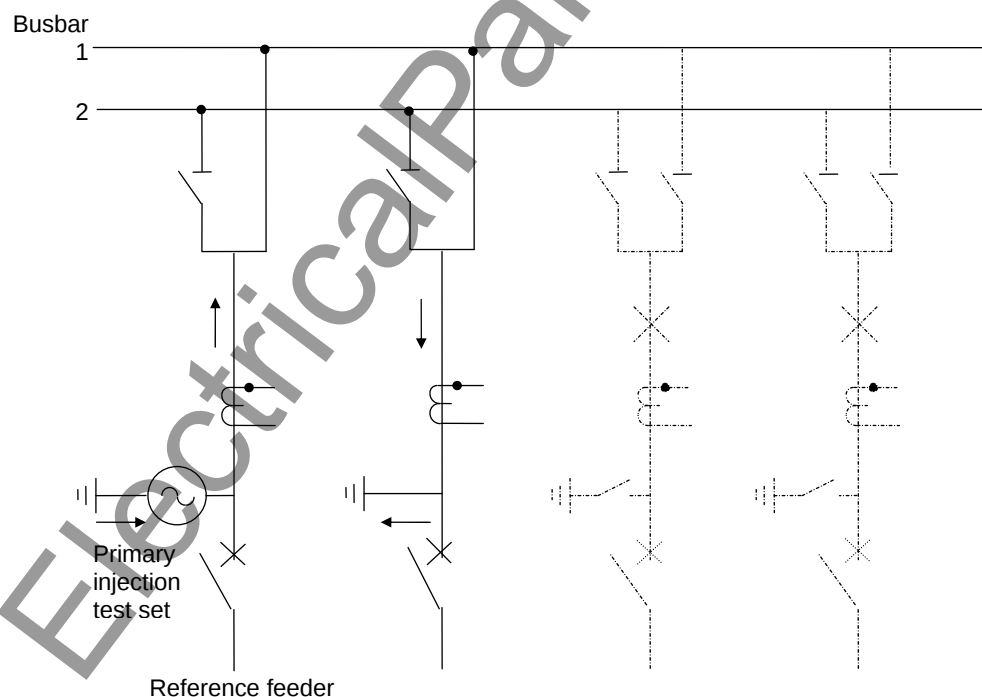


Figure 6.6.1 Primary Injection Test

6.7 Maintenance

6.7.1 Regular Testing

The relay is almost completely self-supervised. The circuits which cannot be supervised are binary input and output circuits and human interfaces.

Therefore regular testing can be minimized to checking the unsupervised circuits. The test procedures are the same as described in Sections 6.4.1, 6.4.2 and 6.4.3.

6.7.2 Failure Tracing and Repair

Failures will be detected by automatic supervision or regular testing.

When a failure is detected by supervision, a remote alarm is issued with the binary output signal of FAIL and the failure is indicated on the front panel with LED indicators or LCD display. It is also recorded in the event record.

Failures detected by supervision are traced by checking the "Auto-supervision" screen on the LCD.

If any messages are shown on the LCD, the failed module or failed external circuits can be located by referring to Table 6.7.1.

This table shows the relationship between messages displayed on the LCD and estimated failure location. Locations marked with (1) have a higher probability than locations marked with (2) and (3). Locations marked with (2) have a higher probability than locations marked with (3). The monitoring of BU is performed by FEP module in CU. The monitoring result is displayed on LCD by SPM module. If an FEP module fails, therefore, the result displayed on the LCD may be incorrect. The relationship between the FEP module number and the monitored BUs is as follows:

FEP Module No.	BU			
	Model C*1*	Model C*2*	Model C*3*	Model C*4*
FEP1	X	X	X	X
FEP2			X	X
FEP3		X		X
FEP4			X	X

As shown in the table, some of the messages cannot identify the fault location definitely but suggest plural possible failure locations. In these cases, the failure location is identified by replacing the suggested failed modules with spare modules one by one until the "ALARM" LED is turned off.

The replacement or investigation should be performed first for the module or circuit with higher probability in the table.

If there is a failure and the LCD is not working such as a screen is frozen or not displayed, the failure location is any one of SPM, FEP and HMI module.

Table 6.7.1 LCD Message and Failure Location

Message or Operation	Failure location												
	CU						BU			AC cable	Optic. cable	DS or CB	AC inputs
	VCT	FEP	SPM	IO#1	IO#2	HMI	VCT	BUM1	BUM5				
Checksum err			×										
ROM-RAM err			×										
SRAM err			×										
BU-RAM err			×										
DPRAM err			×										
EEPROM err			×										
SUB stopped			×										
A/D err			×										
V0 err	×		×							×			×
V2 err	×		×							×			×
Sampling err			×										
DIO err			×	×	×								
LCD err			×			×							
Sub:checksum err			×										
Sub:ROM/RAM err			×										
Sub:SRAM err			×										
Sub:DPRAM err			×										
Sub:A/D err			×										
FEP*: checksum err		×											
FEP*: ROM-RAM err		×											
FEP*: SRAM err		×											
FEP*: DPRAM err		×											
FEP*: stopped		×											
BU*: COM err		×						×			×		
BU*: A/D err		×					×	×			×		
BU*: DIO err		×						×	×		×		
BU*: Address err		×						×			×		
BU*: EEPROM err		×						×					
BU*: AI err		×					×	×		×			
CT* err							×	×		×			×
DS* err									×				
CB* err									×				
Id-** err							×	×		×			×
Id err							×	×		×			×
CT fail, CT-ZA fail to CT-ZD fail							×	×		×			×
No-working of LCD		×	×			×							

Note *: The monitoring of BU is performed by FEP module in CU. The monitoring result is displayed on LCD by SPM module. If an FEP module fails, therefore, the result displayed on the LCD may be incorrect.

If there is a failure and no message is shown on the LCD in the CU, it means that the failure location is either in the DC power supply circuit or in the microprocessors mounted on the SPM module. In this case, check the "ALARM" LED. If it is off, the failure is in the DC power supply circuit. If it is lit, open the relay front panel and check the LEDs mounted on the SPM module. If the LED is off, the failure is in the DC power supply circuit. If the LED is lit, the failure is in the microprocessors.

In the former case, check if the correct DC voltage is applied to the relay. If it is, replace the IO#1 module mounting the DC/DC converter and confirm that the "ALARM" LED is turned off. In the latter case, replace the SPM module mounting the processors and confirm that the "ALARM" LED is turned off.

When the "POWER" LED in the BU is off, check if the correct DC voltage is applied to the BU. If it is, replace the BUM1 module mounting the DC/DC converter and confirm that the "POWER" LED is turned on.

When a failure is detected during regular testing, it will not be difficult to identify the failed module to be replaced.

Note: When a failure or an abnormality is detected during the regular test, confirm the following first:

- Test circuit connections are correct.
- Modules are securely inserted in position.
- Correct DC power voltage with correct polarity is applied and connected to the correct terminals.
- Correct AC inputs are applied and connected to the correct terminals.
- Test procedures comply with those stated in the manual.

6.7.3 Replacing Failed Modules

If the failure is identified to be in the relay module and the user has spare modules, the user can recover the protection by replacing the failed modules.

Repair at the site should be limited to module replacement. Maintenance at the component level is not recommended.

Check that the replacement module has an identical module name (VCT, FEP, SPM, IO#1, IO#2, etc.) and hardware type-form as the removed module. Furthermore, the SPM module should have the same software name.

The module name is indicated on the bottom front of the relay case. The hardware type-form is indicated on the module in the following format:

Unit	Module name	Hardware type-form
CU	VCT	G1PC1-□□□□
	FEP	G1FE1-□□□□
	SPM	G1SP7-□□□□
	IO#1	G1IO8-□□□□
	IO#2	G1IO2-□□□□
	HMI	-----
BU	VCT	G1PC1-□□□□
	BUM1	G1BM1-□□□□
	BUM5	G1BM5-□□□□

The software name is indicated on the memory device on the module with eight letters such as GS1BM1***, GS1BF2***, GS1BK1***, etc.

⚠ CAUTION When handling a module, take anti-static measures such as wearing an earthed wrist band and placing modules on an earthed conductive mat. Otherwise, many of the electronic components could suffer damage.

CAUTION After replacing the SPM module, check all of the settings including the data related the PLC and IEC103, etc. are restored the original settings.

The initial replacement procedure is as follows:

- Switch off the DC power supply.

⚠ WARNING Hazardous voltage may remain in the DC circuit just after switching off the DC power supply. It takes approximately 30 seconds for the voltage to discharge.

- Disconnect the trip outputs.
- Short circuit all AC current inputs and disconnect all AC voltage inputs.
- Unscrew the relay front cover.

Replacing the Human Machine Interface (HMI) Module (Front Panel) of CU

- Open the front panel of the relay by unscrewing the binding screw located on the left side of the front panel.
- Unplug the ribbon cable on the front panel by pushing the catch outside.
- Remove the two retaining screws and one earthing screw on the relay case side, then detach the front panel from the relay case.
- Attach the replacement module in the reverse procedure.

Replacing the Transformer (VT) Module of CU

- Open the right-side front panel (HMI module) by unscrewing the two binding screws located on the left side of the panel.
- Open the left-side front panel (blind panel) by unscrewing the two binding screws located on the right side of the panel.
- Detach the module holding bar by unscrewing the binding screw located on the left side of the bar.
- Unplug the ribbon cable on the other module by nipping the catch.
- Remove the metal cover by unscrewing the binding screw located at the top and bottom of the cover.
- Pull out the module by grasping the handles.
- Insert the replacement module in the reverse procedure.

Replacing other modules of CU

- Open the right-side front panel (HMI module) by unscrewing the two binding screws located on the left side of the panel.
- Open the left-side front panel (blind panel) by unscrewing the two binding screws located on the right side of the panel.

- Detach the module holding bar by unscrewing the binding screw located on the left side of the bar.
- Unplug the ribbon cable running among the modules by nipping the catch (black connector) and by pushing the catch outside (gray connector) on the connector.
- Unplug the cable connector behind the case when replacing the FEP module.
- Pull out the module by pulling up or down the top and bottom levers.
- Insert the replacement module in the reverse procedure.
- After replacing the SPM module, input the user setting values again.

Replacing the Transformer (CT) Module of BU

- Open the front panel by pulling the two knobs located on the left side of the panel.
- Detach the module holding bar by unscrewing the binding screw located on the left side of the bar.
- Unplug the ribbon cable on the other module by nipping the catch.
- Remove the metal cover by unscrewing the binding screw located at the top and bottom of the cover.
- Pull out the module by grasping the handles.
- Insert the replacement module in the reverse procedure.

Replacing other modules of BU

- Open the front panel by pulling the two knobs located on the left side of the panel.
- Detach the module holding bar by unscrewing the binding screw located on the left side of the bar.
- Unplug the ribbon cable running among the modules by nipping the catch (black connector) and by pushing the catch outside (gray connector) on the connector.
- Unplug the cable connector behind the case when replacing the BUM1 module.
- Pull out the module by pulling up or down the top and bottom levers.
- Insert the replacement module in the reverse procedure.
- After replacing the BUM1 module, set the BU address setting again. (See Section 5.5.2.)

For failed module tracing and its replacement, see Appendix Q.

6.7.4 Resumption of Service

After replacing the failed module or repairing failed external circuits, take the following procedures for the relay to restore into service.

- Switch on the DC power supply and confirm that the "IN SERVICE" green LED is lit and the "ALARM" red LED is not lit.

Note: Supply DC power after checking that all the modules are in their original positions and the ribbon cables are plugged in.

- Supply the AC inputs and reconnect the trip outputs.

6.7.5 Storage

The spare relay or module should be stored in a dry and clean room. Based on IEC Standard 60255-6 the storage temperature should be -25°C to $+70^{\circ}\text{C}$, but the temperature of 0°C to $+40^{\circ}\text{C}$ is recommended for long-term storage.

7. Putting Relay into Service

The following procedure must be adhered to when putting the relay into service after finishing commissioning or maintenance tests.

- Check that all external connections are correct.
- Check the setting of all measuring elements, timers, scheme switches, recordings and clock are correct.

In particular, when settings are changed temporarily for testing, be sure to restore them.

- Clear any unnecessary records on faults, events and disturbances which are recorded during the tests.
- Press the **VIEW** key and check that no failure message is displayed on the "Auto-supervision" screen.
- Check that the green "IN SERVICE" LED is lit and no other LEDs are lit on the front panel.

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Appendix A

Busbar Replica

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Zone number	Single-busbar	Single-busbar with a transfer busbar
1		
2		
3		
4		

Note: Symbols display the following circuits.

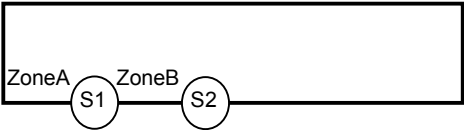
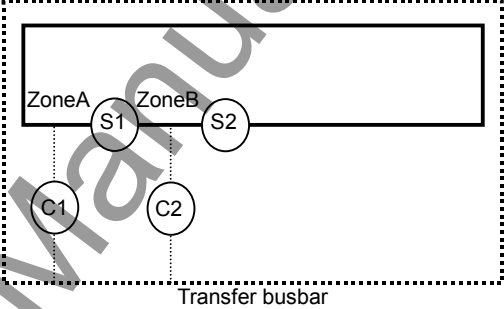
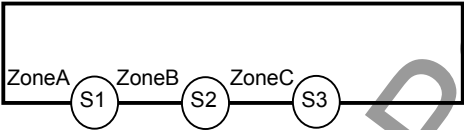
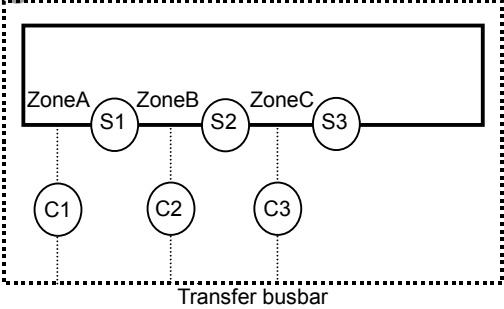
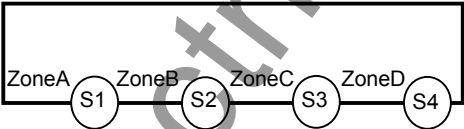
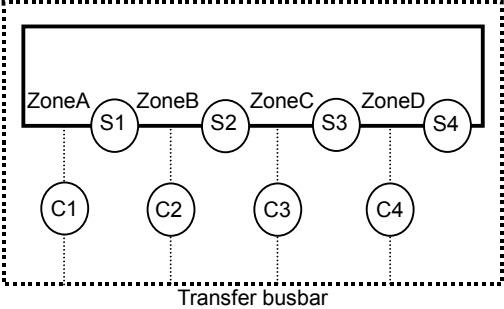
⊙E1 - ⊙E4 : End of bus-section

⊙S1 - ⊙S4 : Bus-section

⊙C1 - ⊙C4 : Bus-coupler

Feeder circuits are omitted in the figure.

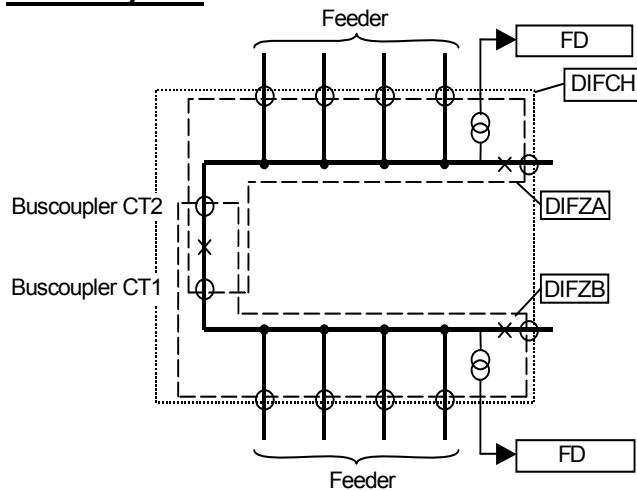
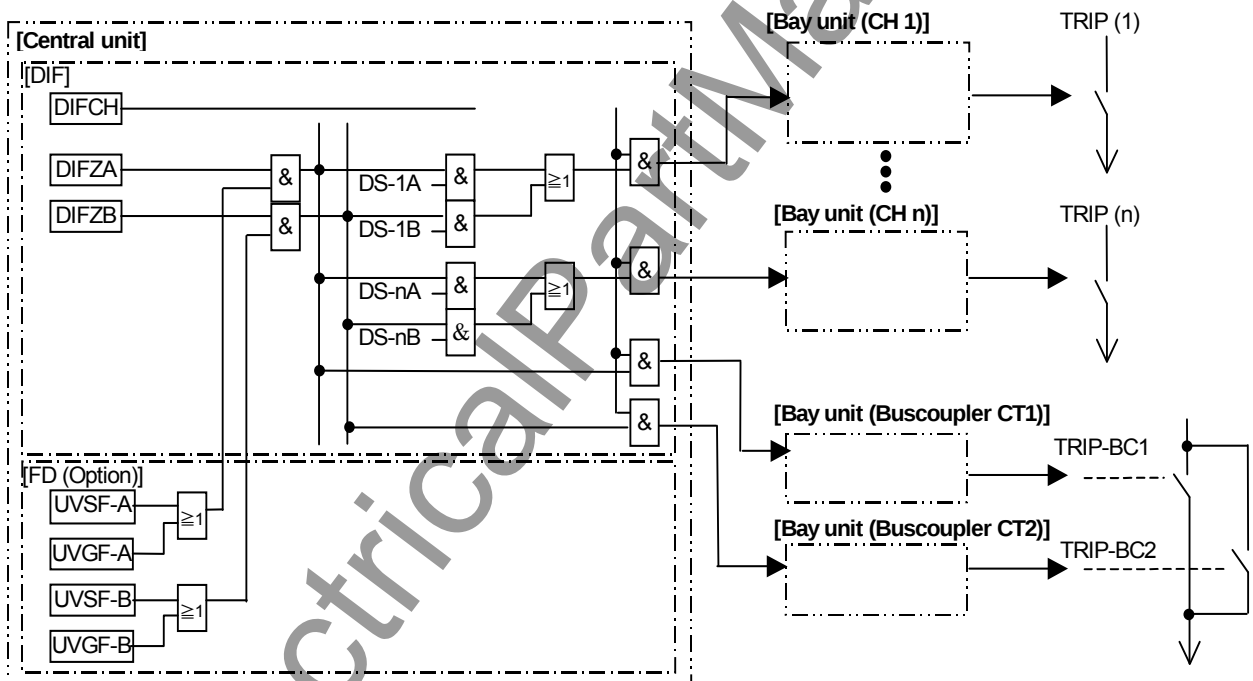
Zone number	Double-busbar (including to double as a transfer busbar)	Double-busbar with a transfer bus
1		
2		
3		
4		

Zone number	Ring-busbar	Ring-busbar with a transfer busbar
1		
2		
3		
4		

Appendix B

Block Diagram

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Busbar system**Scheme logic**

DS-nA : Disconnecter condition of Busbar A side
 DS-nB : Disconnecter condition of Busbar B side
 DS-BC** : Disconnecter condition of Buscoupler

Typical Block Diagram

Appendix C

Signal List

Signal list		
No.	Signal Name	Contents
0	CONSTANT_0	constant 0
1	CONSTANT_1	constant 1
2		
3		
4		
5		
6		
7		
8		
9		
10		
11	CH1-DS1-N/O	Binary input signal CH1 DS1 normaly open contact
12	CH1-DS1-N/C	Binary input signal CH1 DS1 normaly close contact
13	CH1-BI2	Binary input signal CH1 BI2
14	CH1-BI6	Binary input signal CH1 BI6
15	CH1-BI3	Binary input signal CH1 BI3
16	CH1-BI7	Binary input signal CH1 BI7
17	CH1-BI4	Binary input signal CH1 BI4
18	CH1-EFP.TR	End-fault-protection transfer trip signal
19	1OCBF-OR	OCBF relay element (3ph OR signal)
20		
21	CH1-EXTTP-A1	Binary input signal CH1 External trip A-phase
22	CH1-EXTTP-A2	Binary input signal CH1 External trip A-phase
23	CH1-EXTTP-B1	Binary input signal CH1 External trip B-phase
24	CH1-EXTTP-B2	Binary input signal CH1 External trip B-phase
25	CH1-EXTTP-C1	Binary input signal CH1 External trip C-phase
26	CH1-EXTTP-C2	Binary input signal CH1 External trip C-phase
27	CH2-DS1-N/O	Binary input signal CH2 DS1 normaly open contact
28	CH2-DS1-N/C	Binary input signal CH2 DS1 normaly close contact
29	CH2-BI2	Binary input signal CH2 BI2
30	CH2-BI6	Binary input signal CH2 BI6
31	CH2-BI3	Binary input signal CH2 BI3
32	CH2-BI7	Binary input signal CH2 BI7
33	CH2-BI4	Binary input signal CH2 BI4
34	CH2-EFP.TR	End-fault-protection transfer trip signal
35	2OCBF-OR	OCBF relay element (3ph OR signal)
36		
37	CH2-EXTTP-A1	Binary input signal CH2 External trip A-phase
38	CH2-EXTTP-A2	Binary input signal CH2 External trip A-phase
39	CH2-EXTTP-B1	Binary input signal CH2 External trip B-phase
40	CH2-EXTTP-B2	Binary input signal CH2 External trip B-phase
41	CH2-EXTTP-C1	Binary input signal CH2 External trip C-phase
42	CH2-EXTTP-C2	Binary input signal CH2 External trip C-phase
43	CH3-DS1-N/O	Binary input signal CH3 DS1 normaly open contact
44	CH3-DS1-N/C	Binary input signal CH3 DS1 normaly close contact
45	CH3-BI2	Binary input signal CH3 BI2
46	CH3-BI6	Binary input signal CH3 BI6
47	CH3-BI3	Binary input signal CH3 BI3
48	CH3-BI7	Binary input signal CH3 BI7
49	CH3-BI4	Binary input signal CH3 BI4
50	CH3-EFP.TR	End-fault-protection transfer trip signal
51	3OCBF-OR	OCBF relay element (3ph OR signal)
52		
53	CH3-EXTTP-A1	Binary input signal CH3 External trip A-phase
54	CH3-EXTTP-A2	Binary input signal CH3 External trip A-phase
55	CH3-EXTTP-B1	Binary input signal CH3 External trip B-phase
56	CH3-EXTTP-B2	Binary input signal CH3 External trip B-phase
57	CH3-EXTTP-C1	Binary input signal CH3 External trip C-phase
58	CH3-EXTTP-C2	Binary input signal CH3 External trip C-phase
59	CH4-DS1-N/O	Binary input signal CH4 DS1 normaly open contact
60	CH4-DS1-N/C	Binary input signal CH4 DS1 normaly close contact
61	CH4-BI2	Binary input signal CH4 BI2
62	CH4-BI6	Binary input signal CH4 BI6
63	CH4-BI3	Binary input signal CH4 BI3
64	CH4-BI7	Binary input signal CH4 BI7
65	CH4-BI4	Binary input signal CH4 BI4
66	CH4-EFP.TR	End-fault-protection transfer trip signal
67	4OCBF-OR	OCBF relay element (3ph OR signal)
68		
69	CH4-EXTTP-A1	Binary input signal CH4 External trip A-phase
70	CH4-EXTTP-A2	Binary input signal CH4 External trip A-phase

Signal list (Output)		
No.	Signal Name	Contents
71	CH4-EXTTP-B1	Binary input signal CH4 External trip B-phase
72	CH4-EXTTP-B2	Binary input signal CH4 External trip B-phase
73	CH4-EXTTP-C1	Binary input signal CH4 External trip C-phase
74	CH4-EXTTP-C2	Binary input signal CH4 External trip C-phase
75	CH5-DS1-N/O	Binary input signal CH5 DS1 normaly open contact
76	CH5-DS1-N/C	Binary input signal CH5 DS1 normaly close contact
77	CH5-BI2	Binary input signal CH5 BI2
78	CH5-BI6	Binary input signal CH5 BI6
79	CH5-BI3	Binary input signal CH5 BI3
80	CH5-BI7	Binary input signal CH5 BI7
81	CH5-BI4	Binary input signal CH5 BI4
82	CH5-EFP.TR	End-fault-protection transfer trip signal
83	5OCBF-OR	OCBF relay element (3ph OR signal)
84		
85	CH5-EXTTP-A1	Binary input signal CH5 External trip A-phase
86	CH5-EXTTP-A2	Binary input signal CH5 External trip A-phase
87	CH5-EXTTP-B1	Binary input signal CH5 External trip B-phase
88	CH5-EXTTP-B2	Binary input signal CH5 External trip B-phase
89	CH5-EXTTP-C1	Binary input signal CH5 External trip C-phase
90	CH5-EXTTP-C2	Binary input signal CH5 External trip C-phase
91	CH6-DS1-N/O	Binary input signal CH6 DS1 normaly open contact
92	CH6-DS1-N/C	Binary input signal CH6 DS1 normaly close contact
93	CH6-BI2	Binary input signal CH6 BI2
94	CH6-BI6	Binary input signal CH6 BI6
95	CH6-BI3	Binary input signal CH6 BI3
96	CH6-BI7	Binary input signal CH6 BI7
97	CH6-BI4	Binary input signal CH6 BI4
98	CH6-EFP.TR	End-fault-protection transfer trip signal
99	6OCBF-OR	OCBF relay element (3ph OR signal)
100		
101	CH6-EXTTP-A1	Binary input signal CH6 External trip A-phase
102	CH6-EXTTP-A2	Binary input signal CH6 External trip A-phase
103	CH6-EXTTP-B1	Binary input signal CH6 External trip B-phase
104	CH6-EXTTP-B2	Binary input signal CH6 External trip B-phase
105	CH6-EXTTP-C1	Binary input signal CH6 External trip C-phase
106	CH6-EXTTP-C2	Binary input signal CH6 External trip C-phase
107	CH7-DS1-N/O	Binary input signal CH7 DS1 normaly open contact
108	CH7-DS1-N/C	Binary input signal CH7 DS1 normaly close contact
109	CH7-BI2	Binary input signal CH7 BI2
110	CH7-BI6	Binary input signal CH7 BI6
111	CH7-BI3	Binary input signal CH7 BI3
112	CH7-BI7	Binary input signal CH7 BI7
113	CH7-BI4	Binary input signal CH7 BI4
114	CH7-EFP.TR	End-fault-protection transfer trip signal
115	7OCBF-OR	OCBF relay element (3ph OR signal)
116		
117	CH7-EXTTP-A1	Binary input signal CH7 External trip A-phase
118	CH7-EXTTP-A2	Binary input signal CH7 External trip A-phase
119	CH7-EXTTP-B1	Binary input signal CH7 External trip B-phase
120	CH7-EXTTP-B2	Binary input signal CH7 External trip B-phase
121	CH7-EXTTP-C1	Binary input signal CH7 External trip C-phase
122	CH7-EXTTP-C2	Binary input signal CH7 External trip C-phase
123	CH8-DS1-N/O	Binary input signal CH8 DS1 normaly open contact
124	CH8-DS1-N/C	Binary input signal CH8 DS1 normaly close contact
125	CH8-BI2	Binary input signal CH8 BI2
126	CH8-BI6	Binary input signal CH8 BI6
127	CH8-BI3	Binary input signal CH8 BI3
128	CH8-BI7	Binary input signal CH8 BI7
129	CH8-BI4	Binary input signal CH8 BI4
130	CH8-EFP.TR	End-fault-protection transfer trip signal
131	8OCBF-OR	OCBF relay element (3ph OR signal)
132		
133	CH8-EXTTP-A1	Binary input signal CH8 External trip A-phase
134	CH8-EXTTP-A2	Binary input signal CH8 External trip A-phase
135	CH8-EXTTP-B1	Binary input signal CH8 External trip B-phase
136	CH8-EXTTP-B2	Binary input signal CH8 External trip B-phase
137	CH8-EXTTP-C1	Binary input signal CH8 External trip C-phase
138	CH8-EXTTP-C2	Binary input signal CH8 External trip C-phase
139	CH9-DS1-N/O	Binary input signal CH9 DS1 normaly open contact
140	CH9-DS1-N/C	Binary input signal CH9 DS1 normaly close contact

Signal list		
No.	Signal Name	Contents
141	CH9-BI2	Binary input signal CH9 BI2
142	CH9-BI6	Binary input signal CH9 BI6
143	CH9-BI3	Binary input signal CH9 BI3
144	CH9-BI7	Binary input signal CH9 BI7
145	CH9-BI4	Binary input signal CH9 BI4
146	CH9-EFP.TR	End-fault-protection transfer trip signal
147	9OCBF-OR	OCBF relay element (3ph OR signal)
148		
149	CH9-EXTTP-A1	Binary input signal CH9 External trip A-phase
150	CH9-EXTTP-A2	Binary input signal CH9 External trip A-phase
151	CH9-EXTTP-B1	Binary input signal CH9 External trip B-phase
152	CH9-EXTTP-B2	Binary input signal CH9 External trip B-phase
153	CH9-EXTTP-C1	Binary input signal CH9 External trip C-phase
154	CH9-EXTTP-C2	Binary input signal CH9 External trip C-phase
155	CH10-DS1-N/O	Binary input signal CH10 DS1 normally open contact
156	CH10-DS1-N/C	Binary input signal CH10 DS1 normally close contact
157	CH10-BI2	Binary input signal CH10 BI2
158	CH10-BI6	Binary input signal CH10 BI6
159	CH10-BI3	Binary input signal CH10 BI3
160	CH10-BI7	Binary input signal CH10 BI7
161	CH10-BI4	Binary input signal CH10 BI4
162	CH10-EFP.TR	End-fault-protection transfer trip signal
163	10OCBF-OR	OCBF relay element (3ph OR signal)
164		
165	CH10-EXTTP-A1	Binary input signal CH10 External trip A-phase
166	CH10-EXTTP-A2	Binary input signal CH10 External trip A-phase
167	CH10-EXTTP-B1	Binary input signal CH10 External trip B-phase
168	CH10-EXTTP-B2	Binary input signal CH10 External trip B-phase
169	CH10-EXTTP-C1	Binary input signal CH10 External trip C-phase
170	CH10-EXTTP-C2	Binary input signal CH10 External trip C-phase
171	CH11-DS1-N/O	Binary input signal CH11 DS1 normally open contact
172	CH11-DS1-N/C	Binary input signal CH11 DS1 normally close contact
173	CH11-BI2	Binary input signal CH11 BI2
174	CH11-BI6	Binary input signal CH11 BI6
175	CH11-BI3	Binary input signal CH11 BI3
176	CH11-BI7	Binary input signal CH11 BI7
177	CH11-BI4	Binary input signal CH11 BI4
178	CH11-EFP.TR	End-fault-protection transfer trip signal
179	11OCBF-OR	OCBF relay element (3ph OR signal)
180		
181	CH11-EXTTP-A1	Binary input signal CH11 External trip A-phase
182	CH11-EXTTP-A2	Binary input signal CH11 External trip A-phase
183	CH11-EXTTP-B1	Binary input signal CH11 External trip B-phase
184	CH11-EXTTP-B2	Binary input signal CH11 External trip B-phase
185	CH11-EXTTP-C1	Binary input signal CH11 External trip C-phase
186	CH11-EXTTP-C2	Binary input signal CH11 External trip C-phase
187	CH12-DS1-N/O	Binary input signal CH12 DS1 normally open contact
188	CH12-DS1-N/C	Binary input signal CH12 DS1 normally close contact
189	CH12-BI2	Binary input signal CH12 BI2
190	CH12-BI6	Binary input signal CH12 BI6
191	CH12-BI3	Binary input signal CH12 BI3
192	CH12-BI7	Binary input signal CH12 BI7
193	CH12-BI4	Binary input signal CH12 BI4
194	CH12-EFP.TR	End-fault-protection transfer trip signal
195	12OCBF-OR	OCBF relay element (3ph OR signal)
196		
197	CH12-EXTTP-A1	Binary input signal CH12 External trip A-phase
198	CH12-EXTTP-A2	Binary input signal CH12 External trip A-phase
199	CH12-EXTTP-B1	Binary input signal CH12 External trip B-phase
200	CH12-EXTTP-B2	Binary input signal CH12 External trip B-phase
201	CH12-EXTTP-C1	Binary input signal CH12 External trip C-phase
202	CH12-EXTTP-C2	Binary input signal CH12 External trip C-phase
203	CH13-DS1-N/O	Binary input signal CH13 DS1 normally open contact
204	CH13-DS1-N/C	Binary input signal CH13 DS1 normally close contact
205	CH13-BI2	Binary input signal CH13 BI2
206	CH13-BI6	Binary input signal CH13 BI6
207	CH13-BI3	Binary input signal CH13 BI3
208	CH13-BI7	Binary input signal CH13 BI7
209	CH13-BI4	Binary input signal CH13 BI4
210	CH13-EFP.TR	End-fault-protection transfer trip signal

Signal list		
No.	Signal Name	Contents
211	13OCBF-OR	OCBF relay element (3ph OR signal)
212		
213	CH13-EXTTP-A1	Binary input signal CH13 External trip A-phase
214	CH13-EXTTP-A2	Binary input signal CH13 External trip A-phase
215	CH13-EXTTP-B1	Binary input signal CH13 External trip B-phase
216	CH13-EXTTP-B2	Binary input signal CH13 External trip B-phase
217	CH13-EXTTP-C1	Binary input signal CH13 External trip C-phase
218	CH13-EXTTP-C2	Binary input signal CH13 External trip C-phase
219	CH14-DS1-N/O	Binary input signal CH14 DS1 normally open contact
220	CH14-DS1-N/C	Binary input signal CH14 DS1 normally close contact
221	CH14-BI2	Binary input signal CH14 BI2
222	CH14-BI6	Binary input signal CH14 BI6
223	CH14-BI3	Binary input signal CH14 BI3
224	CH14-BI7	Binary input signal CH14 BI7
225	CH14-BI4	Binary input signal CH14 BI4
226	CH14-EFP.TR	End-fault-protection transfer trip signal
227	14OCBF-OR	OCBF relay element (3ph OR signal)
228		
229	CH14-EXTTP-A1	Binary input signal CH14 External trip A-phase
230	CH14-EXTTP-A2	Binary input signal CH14 External trip A-phase
231	CH14-EXTTP-B1	Binary input signal CH14 External trip B-phase
232	CH14-EXTTP-B2	Binary input signal CH14 External trip B-phase
233	CH14-EXTTP-C1	Binary input signal CH14 External trip C-phase
234	CH14-EXTTP-C2	Binary input signal CH14 External trip C-phase
235	CH15-DS1-N/O	Binary input signal CH15 DS1 normally open contact
236	CH15-DS1-N/C	Binary input signal CH15 DS1 normally close contact
237	CH15-BI2	Binary input signal CH15 BI2
238	CH15-BI6	Binary input signal CH15 BI6
239	CH15-BI3	Binary input signal CH15 BI3
240	CH15-BI7	Binary input signal CH15 BI7
241	CH15-BI4	Binary input signal CH15 BI4
242	CH15-EFP.TR	End-fault-protection transfer trip signal
243	15OCBF-OR	OCBF relay element (3ph OR signal)
244		
245	CH15-EXTTP-A1	Binary input signal CH15 External trip A-phase
246	CH15-EXTTP-A2	Binary input signal CH15 External trip A-phase
247	CH15-EXTTP-B1	Binary input signal CH15 External trip B-phase
248	CH15-EXTTP-B2	Binary input signal CH15 External trip B-phase
249	CH15-EXTTP-C1	Binary input signal CH15 External trip C-phase
250	CH15-EXTTP-C2	Binary input signal CH15 External trip C-phase
251	CH16-DS1-N/O	Binary input signal CH16 DS1 normally open contact
252	CH16-DS1-N/C	Binary input signal CH16 DS1 normally close contact
253	CH16-BI2	Binary input signal CH16 BI2
254	CH16-BI6	Binary input signal CH16 BI6
255	CH16-BI3	Binary input signal CH16 BI3
256	CH16-BI7	Binary input signal CH16 BI7
257	CH16-BI4	Binary input signal CH16 BI4
258	CH16-EFP.TR	End-fault-protection transfer trip signal
259	16OCBF-OR	OCBF relay element (3ph OR signal)
260		
261	CH16-EXTTP-A1	Binary input signal CH16 External trip A-phase
262	CH16-EXTTP-A2	Binary input signal CH16 External trip A-phase
263	CH16-EXTTP-B1	Binary input signal CH16 External trip B-phase
264	CH16-EXTTP-B2	Binary input signal CH16 External trip B-phase
265	CH16-EXTTP-C1	Binary input signal CH16 External trip C-phase
266	CH16-EXTTP-C2	Binary input signal CH16 External trip C-phase
267	CH17-DS1-N/O	Binary input signal CH17 DS1 normally open contact
268	CH17-DS1-N/C	Binary input signal CH17 DS1 normally close contact
269	CH17-BI2	Binary input signal CH17 BI2
270	CH17-BI6	Binary input signal CH17 BI6
271	CH17-BI3	Binary input signal CH17 BI3
272	CH17-BI7	Binary input signal CH17 BI7
273	CH17-BI4	Binary input signal CH17 BI4
274	CH17-EFP.TR	End-fault-protection transfer trip signal
275	17OCBF-OR	OCBF relay element (3ph OR signal)
276		
277	CH17-EXTTP-A1	Binary input signal CH17 External trip A-phase
278	CH17-EXTTP-A2	Binary input signal CH17 External trip A-phase
279	CH17-EXTTP-B1	Binary input signal CH17 External trip B-phase
280	CH17-EXTTP-B2	Binary input signal CH17 External trip B-phase

Signal list		
No.	Signal Name	Contents
281	CH17-EXTTP-C1	Binary input signal CH17 External trip C-phase
282	CH17-EXTTP-C2	Binary input signal CH17 External trip C-phase
283	CH18-DS1-N/O	Binary input signal CH18 DS1 normally open contact
284	CH18-DS1-N/C	Binary input signal CH18 DS1 normally close contact
285	CH18-BI2	Binary input signal CH18 BI2
286	CH18-BI6	Binary input signal CH18 BI6
287	CH18-BI3	Binary input signal CH18 BI3
288	CH18-BI7	Binary input signal CH18 BI7
289	CH18-BI4	Binary input signal CH18 BI4
290	CH18-EFP.TR	End-fault-protection transfer trip signal
291	18OCBF-OR	OCBF relay element (3ph OR signal)
292		
293	CH18-EXTTP-A1	Binary input signal CH18 External trip A-phase
294	CH18-EXTTP-A2	Binary input signal CH18 External trip A-phase
295	CH18-EXTTP-B1	Binary input signal CH18 External trip B-phase
296	CH18-EXTTP-B2	Binary input signal CH18 External trip B-phase
297	CH18-EXTTP-C1	Binary input signal CH18 External trip C-phase
298	CH18-EXTTP-C2	Binary input signal CH18 External trip C-phase
299	CH19-DS1-N/O	Binary input signal CH19 DS1 normally open contact
300	CH19-DS1-N/C	Binary input signal CH19 DS1 normally close contact
301	CH19-BI2	Binary input signal CH19 BI2
302	CH19-BI6	Binary input signal CH19 BI6
303	CH19-BI3	Binary input signal CH19 BI3
304	CH19-BI7	Binary input signal CH19 BI7
305	CH19-BI4	Binary input signal CH19 BI4
306	CH19-EFP.TR	End-fault-protection transfer trip signal
307	19OCBF-OR	OCBF relay element (3ph OR signal)
308		
309	CH19-EXTTP-A1	Binary input signal CH19 External trip A-phase
310	CH19-EXTTP-A2	Binary input signal CH19 External trip A-phase
311	CH19-EXTTP-B1	Binary input signal CH19 External trip B-phase
312	CH19-EXTTP-B2	Binary input signal CH19 External trip B-phase
313	CH19-EXTTP-C1	Binary input signal CH19 External trip C-phase
314	CH19-EXTTP-C2	Binary input signal CH19 External trip C-phase
315	CH20-DS1-N/O	Binary input signal CH20 DS1 normally open contact
316	CH20-DS1-N/C	Binary input signal CH20 DS1 normally close contact
317	CH20-BI2	Binary input signal CH20 BI2
318	CH20-BI6	Binary input signal CH20 BI6
319	CH20-BI3	Binary input signal CH20 BI3
320	CH20-BI7	Binary input signal CH20 BI7
321	CH20-BI4	Binary input signal CH20 BI4
322	CH20-EFP.TR	End-fault-protection transfer trip signal
323	20OCBF-OR	OCBF relay element (3ph OR signal)
324		
325	CH20-EXTTP-A1	Binary input signal CH20 External trip A-phase
326	CH20-EXTTP-A2	Binary input signal CH20 External trip A-phase
327	CH20-EXTTP-B1	Binary input signal CH20 External trip B-phase
328	CH20-EXTTP-B2	Binary input signal CH20 External trip B-phase
329	CH20-EXTTP-C1	Binary input signal CH20 External trip C-phase
330	CH20-EXTTP-C2	Binary input signal CH20 External trip C-phase
331	CH21-DS1-N/O	Binary input signal CH21 DS1 normally open contact
332	CH21-DS1-N/C	Binary input signal CH21 DS1 normally close contact
333	CH21-BI2	Binary input signal CH21 BI2
334	CH21-BI6	Binary input signal CH21 BI6
335	CH21-BI3	Binary input signal CH21 BI3
336	CH21-BI7	Binary input signal CH21 BI7
337	CH21-BI4	Binary input signal CH21 BI4
338	CH21-EFP.TR	End-fault-protection transfer trip signal
339	21OCBF-OR	OCBF relay element (3ph OR signal)
340		
341	CH21-EXTTP-A1	Binary input signal CH21 External trip A-phase
342	CH21-EXTTP-A2	Binary input signal CH21 External trip A-phase
343	CH21-EXTTP-B1	Binary input signal CH21 External trip B-phase
344	CH21-EXTTP-B2	Binary input signal CH21 External trip B-phase
345	CH21-EXTTP-C1	Binary input signal CH21 External trip C-phase
346	CH21-EXTTP-C2	Binary input signal CH21 External trip C-phase
347	CH22-DS1-N/O	Binary input signal CH22 DS1 normally open contact
348	CH22-DS1-N/C	Binary input signal CH22 DS1 normally close contact
349	CH22-BI2	Binary input signal CH22 BI2
350	CH22-BI6	Binary input signal CH22 BI6

Signal list		
No.	Signal Name	Contents
351	CH22-BI3	Binary input signal CH22 BI3
352	CH22-BI7	Binary input signal CH22 BI7
353	CH22-BI4	Binary input signal CH22 BI4
354	CH22-EFP.TR	End-fault-protection transfer trip signal
355	22OCBF-OR	OCBF relay element (3ph OR signal)
356		
357	CH22-EXTTP-A1	Binary input signal CH22 External trip A-phase
358	CH22-EXTTP-A2	Binary input signal CH22 External trip A-phase
359	CH22-EXTTP-B1	Binary input signal CH22 External trip B-phase
360	CH22-EXTTP-B2	Binary input signal CH22 External trip B-phase
361	CH22-EXTTP-C1	Binary input signal CH22 External trip C-phase
362	CH22-EXTTP-C2	Binary input signal CH22 External trip C-phase
363	CH23-DS1-N/O	Binary input signal CH23 DS1 normally open contact
364	CH23-DS1-N/C	Binary input signal CH23 DS1 normally close contact
365	CH23-BI2	Binary input signal CH23 BI2
366	CH23-BI6	Binary input signal CH23 BI6
367	CH23-BI3	Binary input signal CH23 BI3
368	CH23-BI7	Binary input signal CH23 BI7
369	CH23-BI4	Binary input signal CH23 BI4
370	CH23-EFP.TR	End-fault-protection transfer trip signal
371	23OCBF-OR	OCBF relay element (3ph OR signal)
372		
373	CH23-EXTTP-A1	Binary input signal CH23 External trip A-phase
374	CH23-EXTTP-A2	Binary input signal CH23 External trip A-phase
375	CH23-EXTTP-B1	Binary input signal CH23 External trip B-phase
376	CH23-EXTTP-B2	Binary input signal CH23 External trip B-phase
377	CH23-EXTTP-C1	Binary input signal CH23 External trip C-phase
378	CH23-EXTTP-C2	Binary input signal CH23 External trip C-phase
379	CH24-DS1-N/O	Binary input signal CH24 DS1 normally open contact
380	CH24-DS1-N/C	Binary input signal CH24 DS1 normally close contact
381	CH24-BI2	Binary input signal CH24 BI2
382	CH24-BI6	Binary input signal CH24 BI6
383	CH24-BI3	Binary input signal CH24 BI3
384	CH24-BI7	Binary input signal CH24 BI7
385	CH24-BI4	Binary input signal CH24 BI4
386	CH24-EFP.TR	End-fault-protection transfer trip signal
387	24OCBF-OR	OCBF relay element (3ph OR signal)
388		
389	CH24-EXTTP-A1	Binary input signal CH24 External trip A-phase
390	CH24-EXTTP-A2	Binary input signal CH24 External trip A-phase
391	CH24-EXTTP-B1	Binary input signal CH24 External trip B-phase
392	CH24-EXTTP-B2	Binary input signal CH24 External trip B-phase
393	CH24-EXTTP-C1	Binary input signal CH24 External trip C-phase
394	CH24-EXTTP-C2	Binary input signal CH24 External trip C-phase
395	CH25-DS1-N/O	Binary input signal CH25 DS1 normally open contact
396	CH25-DS1-N/C	Binary input signal CH25 DS1 normally close contact
397	CH25-BI2	Binary input signal CH25 BI2
398	CH25-BI6	Binary input signal CH25 BI6
399	CH25-BI3	Binary input signal CH25 BI3
400	CH25-BI7	Binary input signal CH25 BI7
401	CH25-BI4	Binary input signal CH25 BI4
402	CH25-EFP.TR	End-fault-protection transfer trip signal
403	25OCBF-OR	OCBF relay element (3ph OR signal)
404		
405	CH25-EXTTP-A1	Binary input signal CH25 External trip A-phase
406	CH25-EXTTP-A2	Binary input signal CH25 External trip A-phase
407	CH25-EXTTP-B1	Binary input signal CH25 External trip B-phase
408	CH25-EXTTP-B2	Binary input signal CH25 External trip B-phase
409	CH25-EXTTP-C1	Binary input signal CH25 External trip C-phase
410	CH25-EXTTP-C2	Binary input signal CH25 External trip C-phase
411	CH26-DS1-N/O	Binary input signal CH26 DS1 normally open contact
412	CH26-DS1-N/C	Binary input signal CH26 DS1 normally close contact
413	CH26-BI2	Binary input signal CH26 BI2
414	CH26-BI6	Binary input signal CH26 BI6
415	CH26-BI3	Binary input signal CH26 BI3
416	CH26-BI7	Binary input signal CH26 BI7
417	CH26-BI4	Binary input signal CH26 BI4
418	CH26-EFP.TR	End-fault-protection transfer trip signal
419	26OCBF-OR	OCBF relay element (3ph OR signal)
420		

Signal list		
No.	Signal Name	Contents
421	CH26-EXTTP-A1	Binary input signal CH26 External trip A-phase
422	CH26-EXTTP-A2	Binary input signal CH26 External trip A-phase
423	CH26-EXTTP-B1	Binary input signal CH26 External trip B-phase
424	CH26-EXTTP-B2	Binary input signal CH26 External trip B-phase
425	CH26-EXTTP-C1	Binary input signal CH26 External trip C-phase
426	CH26-EXTTP-C2	Binary input signal CH26 External trip C-phase
427	CH27-DS1-N/O	Binary input signal CH27 DS1 normally open contact
428	CH27-DS1-N/C	Binary input signal CH27 DS1 normally close contact
429	CH27-BI2	Binary input signal CH27 BI2
430	CH27-BI6	Binary input signal CH27 BI6
431	CH27-BI3	Binary input signal CH27 BI3
432	CH27-BI7	Binary input signal CH27 BI7
433	CH27-BI4	Binary input signal CH27 BI4
434	CH27-EFP.TR	End-fault-protection transfer trip signal
435	27OCBF-OR	OCBF relay element (3ph OR signal)
436		
437	CH27-EXTTP-A1	Binary input signal CH27 External trip A-phase
438	CH27-EXTTP-A2	Binary input signal CH27 External trip A-phase
439	CH27-EXTTP-B1	Binary input signal CH27 External trip B-phase
440	CH27-EXTTP-B2	Binary input signal CH27 External trip B-phase
441	CH27-EXTTP-C1	Binary input signal CH27 External trip C-phase
442	CH27-EXTTP-C2	Binary input signal CH27 External trip C-phase
443	CH28-DS1-N/O	Binary input signal CH28 DS1 normally open contact
444	CH28-DS1-N/C	Binary input signal CH28 DS1 normally close contact
445	CH28-BI2	Binary input signal CH28 BI2
446	CH28-BI6	Binary input signal CH28 BI6
447	CH28-BI3	Binary input signal CH28 BI3
448	CH28-BI7	Binary input signal CH28 BI7
449	CH28-BI4	Binary input signal CH28 BI4
450	CH28-EFP.TR	End-fault-protection transfer trip signal
451	28OCBF-OR	OCBF relay element (3ph OR signal)
452		
453	CH28-EXTTP-A1	Binary input signal CH28 External trip A-phase
454	CH28-EXTTP-A2	Binary input signal CH28 External trip A-phase
455	CH28-EXTTP-B1	Binary input signal CH28 External trip B-phase
456	CH28-EXTTP-B2	Binary input signal CH28 External trip B-phase
457	CH28-EXTTP-C1	Binary input signal CH28 External trip C-phase
458	CH28-EXTTP-C2	Binary input signal CH28 External trip C-phase
459	CH29-DS1-N/O	Binary input signal CH29 DS1 normally open contact
460	CH29-DS1-N/C	Binary input signal CH29 DS1 normally close contact
461	CH29-BI2	Binary input signal CH29 BI2
462	CH29-BI6	Binary input signal CH29 BI6
463	CH29-BI3	Binary input signal CH29 BI3
464	CH29-BI7	Binary input signal CH29 BI7
465	CH29-BI4	Binary input signal CH29 BI4
466	CH29-EFP.TR	End-fault-protection transfer trip signal
467	29OCBF-OR	OCBF relay element (3ph OR signal)
468		
469	CH29-EXTTP-A1	Binary input signal CH29 External trip A-phase
470	CH29-EXTTP-A2	Binary input signal CH29 External trip A-phase
471	CH29-EXTTP-B1	Binary input signal CH29 External trip B-phase
472	CH29-EXTTP-B2	Binary input signal CH29 External trip B-phase
473	CH29-EXTTP-C1	Binary input signal CH29 External trip C-phase
474	CH29-EXTTP-C2	Binary input signal CH29 External trip C-phase
475	CH30-DS1-N/O	Binary input signal CH30 DS1 normally open contact
476	CH30-DS1-N/C	Binary input signal CH30 DS1 normally close contact
477	CH30-BI2	Binary input signal CH30 BI2
478	CH30-BI6	Binary input signal CH30 BI6
479	CH30-BI3	Binary input signal CH30 BI3
480	CH30-BI7	Binary input signal CH30 BI7
481	CH30-BI4	Binary input signal CH30 BI4
482	CH30-EFP.TR	End-fault-protection transfer trip signal
483	30OCBF-OR	OCBF relay element (3ph OR signal)
484		
485	CH30-EXTTP-A1	Binary input signal CH30 External trip A-phase
486	CH30-EXTTP-A2	Binary input signal CH30 External trip A-phase
487	CH30-EXTTP-B1	Binary input signal CH30 External trip B-phase
488	CH30-EXTTP-B2	Binary input signal CH30 External trip B-phase
489	CH30-EXTTP-C1	Binary input signal CH30 External trip C-phase
490	CH30-EXTTP-C2	Binary input signal CH30 External trip C-phase

Signal list		
No.	Signal Name	Contents
491	CH31-DS1-N/O	Binary input signal CH31 DS1 normally open contact
492	CH31-DS1-N/C	Binary input signal CH31 DS1 normally close contact
493	CH31-BI2	Binary input signal CH31 BI2
494	CH31-BI6	Binary input signal CH31 BI6
495	CH31-BI3	Binary input signal CH31 BI3
496	CH31-BI7	Binary input signal CH31 BI7
497	CH31-BI4	Binary input signal CH31 BI4
498	CH31-EFP.TR	End-fault-protection transfer trip signal
499	31OCBF-OR	OCBF relay element (3ph OR signal)
500		
501	CH31-EXTTP-A1	Binary input signal CH31 External trip A-phase
502	CH31-EXTTP-A2	Binary input signal CH31 External trip A-phase
503	CH31-EXTTP-B1	Binary input signal CH31 External trip B-phase
504	CH31-EXTTP-B2	Binary input signal CH31 External trip B-phase
505	CH31-EXTTP-C1	Binary input signal CH31 External trip C-phase
506	CH31-EXTTP-C2	Binary input signal CH31 External trip C-phase
507	CH32-DS1-N/O	Binary input signal CH32 DS1 normally open contact
508	CH32-DS1-N/C	Binary input signal CH32 DS1 normally close contact
509	CH32-BI2	Binary input signal CH32 BI2
510	CH32-BI6	Binary input signal CH32 BI6
511	CH32-BI3	Binary input signal CH32 BI3
512	CH32-BI7	Binary input signal CH32 BI7
513	CH32-BI4	Binary input signal CH32 BI4
514	CH32-EFP.TR	End-fault-protection transfer trip signal
515	32OCBF-OR	OCBF relay element (3ph OR signal)
516		
517	CH32-EXTTP-A1	Binary input signal CH32 External trip A-phase
518	CH32-EXTTP-A2	Binary input signal CH32 External trip A-phase
519	CH32-EXTTP-B1	Binary input signal CH32 External trip B-phase
520	CH32-EXTTP-B2	Binary input signal CH32 External trip B-phase
521	CH32-EXTTP-C1	Binary input signal CH32 External trip C-phase
522	CH32-EXTTP-C2	Binary input signal CH32 External trip C-phase
523	CU-BI1	Binary input signal CU BI1
524	CU-BI2	Binary input signal CU BI2
525	CU-BI3	Binary input signal CU BI3
526	CU-BI4	Binary input signal CU BI4
527	CU-BI5	Binary input signal CU BI5
528	CU-BI6	Binary input signal CU BI6
529	CU-BI7	Binary input signal CU BI7
530	CU-BI8	Binary input signal CU BI8
531	CU-BI9	Binary input signal CU BI9
532	CU-BI10	Binary input signal CU BI10
533	CU-BI11	Binary input signal CU BI11
534	CU-BI12	Binary input signal CU BI12
535	CU-BI13	Binary input signal CU BI13
536	CU-BI14	Binary input signal CU BI14
537	CU-BI15	Binary input signal CU BI15
538		
539		
540		
541	DIFCH-A	DIFCH-A relay element output
542	DIFCH-B	-B relay element output
543	DIFCH-C	-C relay element output
544	DIFZA-A	DIFZA-A relay element output
545	DIFZA-B	-B relay element output
546	DIFZA-C	-C relay element output
547	DIFZB-A	DIFZB-A relay element output
548	DIFZB-B	-B relay element output
549	DIFZB-C	-C relay element output
550	DIFZC-A	DIFZC-A relay element output
551	DIFZC-B	-B relay element output
552	DIFZC-C	-C relay element output
553	DIFZD-A	DIFZD-A relay element output
554	DIFZD-B	-B relay element output
555	DIFZD-C	-C relay element output
556	DIFCH-BLK-A	DIFCH-BLK-A relay element output
557	DIFCH-BLK-B	-B relay element output
558	DIFCH-BLK-C	-C relay element output
559	DIFZA-BLK-A	DIFZA-BLK-A relay element output
560	DIFZA-BLK-B	-B relay element output

Signal list		
No.	Signal Name	Contents
561	DIFZA-BLK-C	-C relay element output
562	DIFZB-BLK-A	DIFZB-BLK-A relay element output
563	DIFZB-BLK-B	-B relay element output
564	DIFZB-BLK-C	-C relay element output
565	DIFZC-BLK-A	DIFZC-BLK-A relay element output
566	DIFZC-BLK-B	-B relay element output
567	DIFZC-BLK-C	-C relay element output
568	DIFZD-BLK-A	DIFZD-BLK-A relay element output
569	DIFZD-BLK-B	-B relay element output
570	DIFZD-BLK-C	-C relay element output
571	DIFCHSV-A	DIFCHSV-A relay element output
572	DIFCHSV-B	-B relay element output
573	DIFCHSV-C	-C relay element output
574	DIFZASV-A	DIFZASV-A relay element output
575	DIFZASV-B	-B relay element output
576	DIFZASV-C	-C relay element output
577	DIFZBSV-A	DIFZBSV-A relay element output
578	DIFZBSV-B	-B relay element output
579	DIFZBSV-C	-C relay element output
580	DIFZCSV-A	DIFZCSV-A relay element output
581	DIFZCSV-B	-B relay element output
582	DIFZCSV-C	-C relay element output
583	DIFZDSV-A	DIFZDSV-A relay element output
584	DIFZDSV-B	-B relay element output
585	DIFZDSV-C	-C relay element output
586		
587		
588		
589		
590		
591	1OCBF-A	1OCBF-A relay element output
592	1OCBF-B	-B relay element output
593	1OCBF-C	-C relay element output
594	2OCBF-A	2OCBF-A relay element output
595	2OCBF-B	-B relay element output
596	2OCBF-C	-C relay element output
597	3OCBF-A	3OCBF-A relay element output
598	3OCBF-B	-B relay element output
599	3OCBF-C	-C relay element output
600	4OCBF-A	4OCBF-A relay element output
601	4OCBF-B	-B relay element output
602	4OCBF-C	-C relay element output
603	5OCBF-A	5OCBF-A relay element output
604	5OCBF-B	-B relay element output
605	5OCBF-C	-C relay element output
606	6OCBF-A	6OCBF-A relay element output
607	6OCBF-B	-B relay element output
608	6OCBF-C	-C relay element output
609	7OCBF-A	7OCBF-A relay element output
610	7OCBF-B	-B relay element output
611	7OCBF-C	-C relay element output
612	8OCBF-A	8OCBF-A relay element output
613	8OCBF-B	-B relay element output
614	8OCBF-C	-C relay element output
615	9OCBF-A	9OCBF-A relay element output
616	9OCBF-B	-B relay element output
617	9OCBF-C	-C relay element output
618	10OCBF-A	10OCBF-A relay element output
619	10OCBF-B	-B relay element output
620	10OCBF-C	-C relay element output
621	11OCBF-A	11OCBF-A relay element output
622	11OCBF-B	-B relay element output
623	11OCBF-C	-C relay element output
624	12OCBF-A	12OCBF-A relay element output
625	12OCBF-B	-B relay element output
626	12OCBF-C	-C relay element output
627	13OCBF-A	13OCBF-A relay element output
628	13OCBF-B	-B relay element output
629	13OCBF-C	-C relay element output
630	14OCBF-A	14OCBF-A relay element output

Signal list		
No.	Signal Name	Contents
631	14OCBF-B	-B relay element output
632	14OCBF-C	-C relay element output
633	15OCBF-A	15OCBF-A relay element output
634	15OCBF-B	-B relay element output
635	15OCBF-C	-C relay element output
636	16OCBF-A	16OCBF-A relay element output
637	16OCBF-B	-B relay element output
638	16OCBF-C	-C relay element output
639	17OCBF-A	17OCBF-A relay element output
640	17OCBF-B	-B relay element output
641	17OCBF-C	-C relay element output
642	18OCBF-A	18OCBF-A relay element output
643	18OCBF-B	-B relay element output
644	18OCBF-C	-C relay element output
645	19OCBF-A	19OCBF-A relay element output
646	19OCBF-B	-B relay element output
647	19OCBF-C	-C relay element output
648	20OCBF-A	20OCBF-A relay element output
649	20OCBF-B	-B relay element output
650	20OCBF-C	-C relay element output
651	21OCBF-A	21OCBF-A relay element output
652	21OCBF-B	-B relay element output
653	21OCBF-C	-C relay element output
654	22OCBF-A	22OCBF-A relay element output
655	22OCBF-B	-B relay element output
656	22OCBF-C	-C relay element output
657	23OCBF-A	23OCBF-A relay element output
658	23OCBF-B	-B relay element output
659	23OCBF-C	-C relay element output
660	24OCBF-A	24OCBF-A relay element output
661	24OCBF-B	-B relay element output
662	24OCBF-C	-C relay element output
663	25OCBF-A	25OCBF-A relay element output
664	25OCBF-B	-B relay element output
665	25OCBF-C	-C relay element output
666	26OCBF-A	26OCBF-A relay element output
667	26OCBF-B	-B relay element output
668	26OCBF-C	-C relay element output
669	27OCBF-A	27OCBF-A relay element output
670	27OCBF-B	-B relay element output
671	27OCBF-C	-C relay element output
672	28OCBF-A	28OCBF-A relay element output
673	28OCBF-B	-B relay element output
674	28OCBF-C	-C relay element output
675	29OCBF-A	29OCBF-A relay element output
676	29OCBF-B	-B relay element output
677	29OCBF-C	-C relay element output
678	30OCBF-A	30OCBF-A relay element output
679	30OCBF-B	-B relay element output
680	30OCBF-C	-C relay element output
681	31OCBF-A	31OCBF-A relay element output
682	31OCBF-B	-B relay element output
683	31OCBF-C	-C relay element output
684	32OCBF-A	32OCBF-A relay element output
685	32OCBF-B	-B relay element output
686	32OCBF-C	-C relay element output
687	SGM_IZA-A	Zone A differential current (Phase A)
688	SGM_IZA-B	Zone A differential current (Phase B)
689	SGM_IZA-C	Zone A differential current (Phase C)
690	SGM_IZB-A	Zone B differential current (Phase A)
691	SGM_IZB-B	Zone B differential current (Phase B)
692	SGM_IZB-C	Zone B differential current (Phase C)
693	SGM_IZC-A	Zone C differential current (Phase A)
694	SGM_IZC-B	Zone C differential current (Phase B)
695	SGM_IZC-C	Zone C differential current (Phase C)
696	SGM_IZD-A	Zone D differential current (Phase A)
697	SGM_IZD-B	Zone D differential current (Phase B)
698	SGM_IZD-C	Zone D differential current (Phase C)
699		
700		

Signal list		
No.	Signal Name	Contents
701	43BP	Bus protection in service
702	43CBF	Breaker failuer protection in service
703	CH1-DS1	CH1 DS1 close
704	CH1-DS2	CH1 DS2 close
705	CH1-DS3	CH1 DS3 close
706	CH1-DS4	CH1 DS4 close
707	CH2-DS1	CH2 DS1 close
708	CH2-DS2	CH2 DS2 close
709	CH2-DS3	CH2 DS3 close
710	CH2-DS4	CH2 DS4 close
711	CH3-DS1	CH3 DS1 close
712	CH3-DS2	CH3 DS2 close
713	CH3-DS3	CH3 DS3 close
714	CH3-DS4	CH3 DS4 close
715	CH4-DS1	CH4 DS1 close
716	CH4-DS2	CH4 DS2 close
717	CH4-DS3	CH4 DS3 close
718	CH4-DS4	CH4 DS4 close
719	CH5-DS1	CH5 DS1 close
720	CH5-DS2	CH5 DS2 close
721	CH5-DS3	CH5 DS3 close
722	CH5-DS4	CH5 DS4 close
723	CH6-DS1	CH6 DS1 close
724	CH6-DS2	CH6 DS2 close
725	CH6-DS3	CH6 DS3 close
726	CH6-DS4	CH6 DS4 close
727	CH7-DS1	CH7 DS1 close
728	CH7-DS2	CH7 DS2 close
729	CH7-DS3	CH7 DS3 close
730	CH7-DS4	CH7 DS4 close
731	CH8-DS1	CH8 DS1 close
732	CH8-DS2	CH8 DS2 close
733	CH8-DS3	CH8 DS3 close
734	CH8-DS4	CH8 DS4 close
735	CH9-DS1	CH9 DS1 close
736	CH9-DS2	CH9 DS2 close
737	CH9-DS3	CH9 DS3 close
738	CH9-DS4	CH9 DS4 close
739	CH10-DS1	CH10 DS1 close
740	CH10-DS2	CH10 DS2 close
741	CH10-DS3	CH10 DS3 close
742	CH10-DS4	CH10 DS4 close
743	CH11-DS1	CH11 DS1 close
744	CH11-DS2	CH11 DS2 close
745	CH11-DS3	CH11 DS3 close
746	CH11-DS4	CH11 DS4 close
747	CH12-DS1	CH12 DS1 close
748	CH12-DS2	CH12 DS2 close
749	CH12-DS3	CH12 DS3 close
750	CH12-DS4	CH12 DS4 close
751	CH13-DS1	CH13 DS1 close
752	CH13-DS2	CH13 DS2 close
753	CH13-DS3	CH13 DS3 close
754	CH13-DS4	CH13 DS4 close
755	CH14-DS1	CH14 DS1 close
756	CH14-DS2	CH14 DS2 close
757	CH14-DS3	CH14 DS3 close
758	CH14-DS4	CH14 DS4 close
759	CH15-DS1	CH15 DS1 close
760	CH15-DS2	CH15 DS2 close
761	CH15-DS3	CH15 DS3 close
762	CH15-DS4	CH15 DS4 close
763	CH16-DS1	CH16 DS1 close
764	CH16-DS2	CH16 DS2 close
765	CH16-DS3	CH16 DS3 close
766	CH16-DS4	CH16 DS4 close
767	CH17-DS1	CH17 DS1 close
768	CH17-DS2	CH17 DS2 close
769	CH17-DS3	CH17 DS3 close
770	CH17-DS4	CH17 DS4 close

Signal list		
No.	Signal Name	Contents
771	CH18-DS1	CH18 DS1 close
772	CH18-DS2	CH18 DS2 close
773	CH18-DS3	CH18 DS3 close
774	CH18-DS4	CH18 DS4 close
775	CH19-DS1	CH19 DS1 close
776	CH19-DS2	CH19 DS2 close
777	CH19-DS3	CH19 DS3 close
778	CH19-DS4	CH19 DS4 close
779	CH20-DS1	CH20 DS1 close
780	CH20-DS2	CH20 DS2 close
781	CH20-DS3	CH20 DS3 close
782	CH20-DS4	CH20 DS4 close
783	CH21-DS1	CH21 DS1 close
784	CH21-DS2	CH21 DS2 close
785	CH21-DS3	CH21 DS3 close
786	CH21-DS4	CH21 DS4 close
787	CH22-DS1	CH22 DS1 close
788	CH22-DS2	CH22 DS2 close
789	CH22-DS3	CH22 DS3 close
790	CH22-DS4	CH22 DS4 close
791	CH23-DS1	CH23 DS1 close
792	CH23-DS2	CH23 DS2 close
793	CH23-DS3	CH23 DS3 close
794	CH23-DS4	CH23 DS4 close
795	CH24-DS1	CH24 DS1 close
796	CH24-DS2	CH24 DS2 close
797	CH24-DS3	CH24 DS3 close
798	CH24-DS4	CH24 DS4 close
799	CH25-DS1	CH25 DS1 close
800	CH25-DS2	CH25 DS2 close
801	CH25-DS3	CH25 DS3 close
802	CH25-DS4	CH25 DS4 close
803	CH26-DS1	CH26 DS1 close
804	CH26-DS2	CH26 DS2 close
805	CH26-DS3	CH26 DS3 close
806	CH26-DS4	CH26 DS4 close
807	CH27-DS1	CH27 DS1 close
808	CH27-DS2	CH27 DS2 close
809	CH27-DS3	CH27 DS3 close
810	CH27-DS4	CH27 DS4 close
811	CH28-DS1	CH28 DS1 close
812	CH28-DS2	CH28 DS2 close
813	CH28-DS3	CH28 DS3 close
814	CH28-DS4	CH28 DS4 close
815	CH29-DS1	CH29 DS1 close
816	CH29-DS2	CH29 DS2 close
817	CH29-DS3	CH29 DS3 close
818	CH29-DS4	CH29 DS4 close
819	CH30-DS1	CH30 DS1 close
820	CH30-DS2	CH30 DS2 close
821	CH30-DS3	CH30 DS3 close
822	CH30-DS4	CH30 DS4 close
823	CH31-DS1	CH31 DS1 close
824	CH31-DS2	CH31 DS2 close
825	CH31-DS3	CH31 DS3 close
826	CH31-DS4	CH31 DS4 close
827	CH32-DS1	CH32 DS1 close
828	CH32-DS2	CH32 DS2 close
829	CH32-DS3	CH32 DS3 close
830	CH32-DS4	CH32 DS4 close
831	CH1-CB	CH1 CB close
832	CH2-CB	CH2 CB close
833	CH3-CB	CH3 CB close
834	CH4-CB	CH4 CB close
835	CH5-CB	CH5 CB close
836	CH6-CB	CH6 CB close
837	CH7-CB	CH7 CB close
838	CH8-CB	CH8 CB close
839	CH9-CB	CH9 CB close
840	CH10-CB	CH10 CB close

Signal list		
No.	Signal Name	Contents
841	CH11-CB	CH11 CB close
842	CH12-CB	CH12 CB close
843	CH13-CB	CH13 CB close
844	CH14-CB	CH14 CB close
845	CH15-CB	CH15 CB close
846	CH16-CB	CH16 CB close
847	CH17-CB	CH17 CB close
848	CH18-CB	CH18 CB close
849	CH19-CB	CH19 CB close
850	CH20-CB	CH20 CB close
851	CH21-CB	CH21 CB close
852	CH22-CB	CH22 CB close
853	CH23-CB	CH23 CB close
854	CH24-CB	CH24 CB close
855	CH25-CB	CH25 CB close
856	CH26-CB	CH26 CB close
857	CH27-CB	CH27 CB close
858	CH28-CB	CH28 CB close
859	CH29-CB	CH29 CB close
860	CH30-CB	CH30 CB close
861	CH31-CB	CH31 CB close
862	CH32-CB	CH32 CB close
863	CH1-EXTTP-A	CH1 External trip command A-phase
864	CH1-EXTTP-B	CH1 External trip command B-phase
865	CH1-EXTTP-C	CH1 External trip command C-phase
866	CH2-EXTTP-A	CH2 External trip command A-phase
867	CH2-EXTTP-B	CH2 External trip command B-phase
868	CH2-EXTTP-C	CH2 External trip command C-phase
869	CH3-EXTTP-A	CH3 External trip command A-phase
870	CH3-EXTTP-B	CH3 External trip command B-phase
871	CH3-EXTTP-C	CH3 External trip command C-phase
872	CH4-EXTTP-A	CH4 External trip command A-phase
873	CH4-EXTTP-B	CH4 External trip command B-phase
874	CH4-EXTTP-C	CH4 External trip command C-phase
875	CH5-EXTTP-A	CH5 External trip command A-phase
876	CH5-EXTTP-B	CH5 External trip command B-phase
877	CH5-EXTTP-C	CH5 External trip command C-phase
878	CH6-EXTTP-A	CH6 External trip command A-phase
879	CH6-EXTTP-B	CH6 External trip command B-phase
880	CH6-EXTTP-C	CH6 External trip command C-phase
881	CH7-EXTTP-A	CH7 External trip command A-phase
882	CH7-EXTTP-B	CH7 External trip command B-phase
883	CH7-EXTTP-C	CH7 External trip command C-phase
884	CH8-EXTTP-A	CH8 External trip command A-phase
885	CH8-EXTTP-B	CH8 External trip command B-phase
886	CH8-EXTTP-C	CH8 External trip command C-phase
887	CH9-EXTTP-A	CH9 External trip command A-phase
888	CH9-EXTTP-B	CH9 External trip command B-phase
889	CH9-EXTTP-C	CH9 External trip command C-phase
890	CH10-EXTTP-A	CH10 External trip command A-phase
891	CH10-EXTTP-B	CH10 External trip command B-phase
892	CH10-EXTTP-C	CH10 External trip command C-phase
893	CH11-EXTTP-A	CH11 External trip command A-phase
894	CH11-EXTTP-B	CH11 External trip command B-phase
895	CH11-EXTTP-C	CH11 External trip command C-phase
896	CH12-EXTTP-A	CH12 External trip command A-phase
897	CH12-EXTTP-B	CH12 External trip command B-phase
898	CH12-EXTTP-C	CH12 External trip command C-phase
899	CH13-EXTTP-A	CH13 External trip command A-phase
900	CH13-EXTTP-B	CH13 External trip command B-phase
901	CH13-EXTTP-C	CH13 External trip command C-phase
902	CH14-EXTTP-A	CH14 External trip command A-phase
903	CH14-EXTTP-B	CH14 External trip command B-phase
904	CH14-EXTTP-C	CH14 External trip command C-phase
905	CH15-EXTTP-A	CH15 External trip command A-phase
906	CH15-EXTTP-B	CH15 External trip command B-phase
907	CH15-EXTTP-C	CH15 External trip command C-phase
908	CH16-EXTTP-A	CH16 External trip command A-phase
909	CH16-EXTTP-B	CH16 External trip command B-phase
910	CH16-EXTTP-C	CH16 External trip command C-phase

Signal list		
No.	Signal Name	Contents
911	CH17-EXTTP-A	CH17 External trip command A-phase
912	CH17-EXTTP-B	CH17 External trip command B-phase
913	CH17-EXTTP-C	CH17 External trip command C-phase
914	CH18-EXTTP-A	CH18 External trip command A-phase
915	CH18-EXTTP-B	CH18 External trip command B-phase
916	CH18-EXTTP-C	CH18 External trip command C-phase
917	CH19-EXTTP-A	CH19 External trip command A-phase
918	CH19-EXTTP-B	CH19 External trip command B-phase
919	CH19-EXTTP-C	CH19 External trip command C-phase
920	CH20-EXTTP-A	CH20 External trip command A-phase
921	CH20-EXTTP-B	CH20 External trip command B-phase
922	CH20-EXTTP-C	CH20 External trip command C-phase
923	CH21-EXTTP-A	CH21 External trip command A-phase
924	CH21-EXTTP-B	CH21 External trip command B-phase
925	CH21-EXTTP-C	CH21 External trip command C-phase
926	CH22-EXTTP-A	CH22 External trip command A-phase
927	CH22-EXTTP-B	CH22 External trip command B-phase
928	CH22-EXTTP-C	CH22 External trip command C-phase
929	CH23-EXTTP-A	CH23 External trip command A-phase
930	CH23-EXTTP-B	CH23 External trip command B-phase
931	CH23-EXTTP-C	CH23 External trip command C-phase
932	CH24-EXTTP-A	CH24 External trip command A-phase
933	CH24-EXTTP-B	CH24 External trip command B-phase
934	CH24-EXTTP-C	CH24 External trip command C-phase
935	CH25-EXTTP-A	CH25 External trip command A-phase
936	CH25-EXTTP-B	CH25 External trip command B-phase
937	CH25-EXTTP-C	CH25 External trip command C-phase
938	CH26-EXTTP-A	CH26 External trip command A-phase
939	CH26-EXTTP-B	CH26 External trip command B-phase
940	CH26-EXTTP-C	CH26 External trip command C-phase
941	CH27-EXTTP-A	CH27 External trip command A-phase
942	CH27-EXTTP-B	CH27 External trip command B-phase
943	CH27-EXTTP-C	CH27 External trip command C-phase
944	CH28-EXTTP-A	CH28 External trip command A-phase
945	CH28-EXTTP-B	CH28 External trip command B-phase
946	CH28-EXTTP-C	CH28 External trip command C-phase
947	CH29-EXTTP-A	CH29 External trip command A-phase
948	CH29-EXTTP-B	CH29 External trip command B-phase
949	CH29-EXTTP-C	CH29 External trip command C-phase
950	CH30-EXTTP-A	CH30 External trip command A-phase
951	CH30-EXTTP-B	CH30 External trip command B-phase
952	CH30-EXTTP-C	CH30 External trip command C-phase
953	CH31-EXTTP-A	CH31 External trip command A-phase
954	CH31-EXTTP-B	CH31 External trip command B-phase
955	CH31-EXTTP-C	CH31 External trip command C-phase
956	CH32-EXTTP-A	CH32 External trip command A-phase
957	CH32-EXTTP-B	CH32 External trip command B-phase
958	CH32-EXTTP-C	CH32 External trip command C-phase
959	SECTION1-DS	Section1 DS close
960	SECTION2-DS	Section2 DS close
961	SECTION3-DS	Section3 DS close
962	SECTION4-DS	Section4 DS close
963	COUPLER1-DS	Coupler1 DS close
964	COUPLER1-DSB1	Coupler1 DS-B1 close
965	COUPLER1-DSB2	Coupler1 DS-B2 close
966	COUPLER1-DST	Coupler1 DS-T close
967	COUPLER2-DS	Coupler2 DS close
968	COUPLER2-DSB1	Coupler2 DS-B1 close
969	COUPLER2-DSB2	Coupler2 DS-B2 close
970	COUPLER2-DST	Coupler2 DS-T close
971	COUPLER3-DS	Coupler3 DS close
972	COUPLER3-DST	Coupler3 DS-T close
973	COUPLER4-DS	Coupler4 DS close
974	COUPLER4-DST	Coupler4 DS-T close
975	SECTION1-CB	Section1 CB close
976	SECTION2-CB	Section2 CB close
977	SECTION3-CB	Section3 CB close
978	SECTION4-CB	Section4 CB close
979	COUPLER1-CB	Coupler1 CB close
980	COUPLER2-CB	Coupler2 CB close

Signal list		
No.	Signal Name	Contents
981	E.SEC1-CB	End of section1 CB close
982	E.SEC2-CB	End of section2 CB close
983	E.SEC3-CB	End of section3 CB close
984	E.SEC4-CB	End of section4 CB close
985	C1-TRANS.-ZA	Coupler1 : transfer-bus connected with ZoneA applicable condition
986	C1-TRANS.-ZB	Coupler1 : transfer-bus connected with ZoneB applicable condition
987	C2-TRANS.-ZA	Coupler2 : transfer-bus connected with ZoneA applicable condition
988	C2-TRANS.-ZB	Coupler2 : transfer-bus connected with ZoneB applicable condition
989	TRANS.-ZA	Transfer-bus connctcted with ZoneA condition
990	TRANS.-ZB	Transfer-bus connctcted with ZoneB condition
991	TRANS.-ZC	Transfer-bus connctcted with ZoneC condition
992	TRANS.-ZD	Transfer-bus connctcted with ZoneD condition
993	TRANSFER	Transfer-bus applicable condition
994	BRIDGE-ZA-ZB	Busbar bridge condition ZoneA and ZoneB
995	BRIDGE-ZB-ZC	Busbar bridge condition ZoneB and ZoneC
996	BRIDGE-ZA-ZD	Busbar bridge condition ZoneA and ZoneD
997	BRIDGE-ZC-ZD	Busbar bridge condition ZoneC and ZoneD
998	BRIDGE	Busbar bridge condition
999	DIFCH-OPERATE	DIFCH operation
1000	DIFZA-OPERATE	DIFZA operation
1001	DIFZB-OPERATE	DIFZB operation
1002	DIFZC-OPERATE	DIFZC operation
1003	DIFZD-OPERATE	DIFZD operation
1004	CBFCH-OPERATE	CBF for check zone operation
1005	CBFZA-OPERATE	CBF for zone A operation
1006	CBFZB-OPERATE	CBF for zone B operation
1007	CBFZC-OPERATE	CBF for zone C operation
1008	CBFZD-OPERATE	CBF for zone D operation
1009	BP-TRIP	Bus protection trip
1010	CBF-RETRIP	Breaker failuer protecion retrip
1011	CBF-TRIP	Breaker failuer protecion trip
1012	CBF-TRANSFER	Breaker failuer protecion transfer trip
1013	1CBF-RETRIP	CH1 CBF retrip pick-up signal
1014	2CBF-RETRIP	CH2 CBF retrip pick-up signal
1015	3CBF-RETRIP	CH3 CBF retrip pick-up signal
1016	4CBF-RETRIP	CH4 CBF retrip pick-up signal
1017	5CBF-RETRIP	CH5 CBF retrip pick-up signal
1018	6CBF-RETRIP	CH6 CBF retrip pick-up signal
1019	7CBF-RETRIP	CH7 CBF retrip pick-up signal
1020	8CBF-RETRIP	CH8 CBF retrip pick-up signal
1021	9CBF-RETRIP	CH9 CBF retrip pick-up signal
1022	10CBF-RETRIP	CH10 CBF retrip pick-up signal
1023	11CBF-RETRIP	CH11 CBF retrip pick-up signal
1024	12CBF-RETRIP	CH12 CBF retrip pick-up signal
1025	13CBF-RETRIP	CH13 CBF retrip pick-up signal
1026	14CBF-RETRIP	CH14 CBF retrip pick-up signal
1027	15CBF-RETRIP	CH15 CBF retrip pick-up signal
1028	16CBF-RETRIP	CH16 CBF retrip pick-up signal
1029	17CBF-RETRIP	CH17 CBF retrip pick-up signal
1030	18CBF-RETRIP	CH18 CBF retrip pick-up signal
1031	19CBF-RETRIP	CH19 CBF retrip pick-up signal
1032	20CBF-RETRIP	CH20 CBF retrip pick-up signal
1033	21CBF-RETRIP	CH21 CBF retrip pick-up signal
1034	22CBF-RETRIP	CH22 CBF retrip pick-up signal
1035	23CBF-RETRIP	CH23 CBF retrip pick-up signal
1036	24CBF-RETRIP	CH24 CBF retrip pick-up signal
1037	25CBF-RETRIP	CH25 CBF retrip pick-up signal
1038	26CBF-RETRIP	CH26 CBF retrip pick-up signal
1039	27CBF-RETRIP	CH27 CBF retrip pick-up signal
1040	28CBF-RETRIP	CH28 CBF retrip pick-up signal
1041	29CBF-RETRIP	CH29 CBF retrip pick-up signal
1042	30CBF-RETRIP	CH30 CBF retrip pick-up signal
1043	31CBF-RETRIP	CH31 CBF retrip pick-up signal
1044	32CBF-RETRIP	CH32 CBF retrip pick-up signal
1045	1CBF-TRIP	CH1 CBF trip pick-up signal
1046	2CBF-TRIP	CH2 CBF trip pick-up signal
1047	3CBF-TRIP	CH3 CBF trip pick-up signal
1048	4CBF-TRIP	CH4 CBF trip pick-up signal
1049	5CBF-TRIP	CH5 CBF trip pick-up signal
1050	6CBF-TRIP	CH6 CBF trip pick-up signal

Signal list		
No.	Signal Name	Contents
1051	7CBF-TRIP	CH7 CBF trip pick-up signal
1052	8CBF-TRIP	CH8 CBF trip pick-up signal
1053	9CBF-TRIP	CH9 CBF trip pick-up signal
1054	10CBF-TRIP	CH10 CBF trip pick-up signal
1055	11CBF-TRIP	CH11 CBF trip pick-up signal
1056	12CBF-TRIP	CH12 CBF trip pick-up signal
1057	13CBF-TRIP	CH13 CBF trip pick-up signal
1058	14CBF-TRIP	CH14 CBF trip pick-up signal
1059	15CBF-TRIP	CH15 CBF trip pick-up signal
1060	16CBF-TRIP	CH16 CBF trip pick-up signal
1061	17CBF-TRIP	CH17 CBF trip pick-up signal
1062	18CBF-TRIP	CH18 CBF trip pick-up signal
1063	19CBF-TRIP	CH19 CBF trip pick-up signal
1064	20CBF-TRIP	CH20 CBF trip pick-up signal
1065	21CBF-TRIP	CH21 CBF trip pick-up signal
1066	22CBF-TRIP	CH22 CBF trip pick-up signal
1067	23CBF-TRIP	CH23 CBF trip pick-up signal
1068	24CBF-TRIP	CH24 CBF trip pick-up signal
1069	25CBF-TRIP	CH25 CBF trip pick-up signal
1070	26CBF-TRIP	CH26 CBF trip pick-up signal
1071	27CBF-TRIP	CH27 CBF trip pick-up signal
1072	28CBF-TRIP	CH28 CBF trip pick-up signal
1073	29CBF-TRIP	CH29 CBF trip pick-up signal
1074	30CBF-TRIP	CH30 CBF trip pick-up signal
1075	31CBF-TRIP	CH31 CBF trip pick-up signal
1076	32CBF-TRIP	CH32 CBF trip pick-up signal
1077	CH1-BPTP	CH1 Busbar protection trip
1078	CH2-BPTP	CH2 Busbar protection trip
1079	CH3-BPTP	CH3 Busbar protection trip
1080	CH4-BPTP	CH4 Busbar protection trip
1081	CH5-BPTP	CH5 Busbar protection trip
1082	CH6-BPTP	CH6 Busbar protection trip
1083	CH7-BPTP	CH7 Busbar protection trip
1084	CH8-BPTP	CH8 Busbar protection trip
1085	CH9-BPTP	CH9 Busbar protection trip
1086	CH10-BPTP	CH10 Busbar protection trip
1087	CH11-BPTP	CH11 Busbar protection trip
1088	CH12-BPTP	CH12 Busbar protection trip
1089	CH13-BPTP	CH13 Busbar protection trip
1090	CH14-BPTP	CH14 Busbar protection trip
1091	CH15-BPTP	CH15 Busbar protection trip
1092	CH16-BPTP	CH16 Busbar protection trip
1093	CH17-BPTP	CH17 Busbar protection trip
1094	CH18-BPTP	CH18 Busbar protection trip
1095	CH19-BPTP	CH19 Busbar protection trip
1096	CH20-BPTP	CH20 Busbar protection trip
1097	CH21-BPTP	CH21 Busbar protection trip
1098	CH22-BPTP	CH22 Busbar protection trip
1099	CH23-BPTP	CH23 Busbar protection trip
1100	CH24-BPTP	CH24 Busbar protection trip
1101	CH25-BPTP	CH25 Busbar protection trip
1102	CH26-BPTP	CH26 Busbar protection trip
1103	CH27-BPTP	CH27 Busbar protection trip
1104	CH28-BPTP	CH28 Busbar protection trip
1105	CH29-BPTP	CH29 Busbar protection trip
1106	CH30-BPTP	CH30 Busbar protection trip
1107	CH31-BPTP	CH31 Busbar protection trip
1108	CH32-BPTP	CH32 Busbar protection trip
1109	CH1-CBFRETP	CH1 CBF retrip
1110	CH2-CBFRETP	CH2 CBF retrip
1111	CH3-CBFRETP	CH3 CBF retrip
1112	CH4-CBFRETP	CH4 CBF retrip
1113	CH5-CBFRETP	CH5 CBF retrip
1114	CH6-CBFRETP	CH6 CBF retrip
1115	CH7-CBFRETP	CH7 CBF retrip
1116	CH8-CBFRETP	CH8 CBF retrip
1117	CH9-CBFRETP	CH9 CBF retrip
1118	CH10-CBFRETP	CH10 CBF retrip
1119	CH11-CBFRETP	CH11 CBF retrip
1120	CH12-CBFRETP	CH12 CBF retrip

Signal list		
No.	Signal Name	Contents
1121	CH13-CBFRETP	CH13 CBF retrip
1122	CH14-CBFRETP	CH14 CBF retrip
1123	CH15-CBFRETP	CH15 CBF retrip
1124	CH16-CBFRETP	CH16 CBF retrip
1125	CH17-CBFRETP	CH17 CBF retrip
1126	CH18-CBFRETP	CH18 CBF retrip
1127	CH19-CBFRETP	CH19 CBF retrip
1128	CH20-CBFRETP	CH20 CBF retrip
1129	CH21-CBFRETP	CH21 CBF retrip
1130	CH22-CBFRETP	CH22 CBF retrip
1131	CH23-CBFRETP	CH23 CBF retrip
1132	CH24-CBFRETP	CH24 CBF retrip
1133	CH25-CBFRETP	CH25 CBF retrip
1134	CH26-CBFRETP	CH26 CBF retrip
1135	CH27-CBFRETP	CH27 CBF retrip
1136	CH28-CBFRETP	CH28 CBF retrip
1137	CH29-CBFRETP	CH29 CBF retrip
1138	CH30-CBFRETP	CH30 CBF retrip
1139	CH31-CBFRETP	CH31 CBF retrip
1140	CH32-CBFRETP	CH32 CBF retrip
1141	CH1-CBFFTP	CH1 CBF trip
1142	CH2-CBFFTP	CH2 CBF trip
1143	CH3-CBFFTP	CH3 CBF trip
1144	CH4-CBFFTP	CH4 CBF trip
1145	CH5-CBFFTP	CH5 CBF trip
1146	CH6-CBFFTP	CH6 CBF trip
1147	CH7-CBFFTP	CH7 CBF trip
1148	CH8-CBFFTP	CH8 CBF trip
1149	CH9-CBFFTP	CH9 CBF trip
1150	CH10-CBFFTP	CH10 CBF trip
1151	CH11-CBFFTP	CH11 CBF trip
1152	CH12-CBFFTP	CH12 CBF trip
1153	CH13-CBFFTP	CH13 CBF trip
1154	CH14-CBFFTP	CH14 CBF trip
1155	CH15-CBFFTP	CH15 CBF trip
1156	CH16-CBFFTP	CH16 CBF trip
1157	CH17-CBFFTP	CH17 CBF trip
1158	CH18-CBFFTP	CH18 CBF trip
1159	CH19-CBFFTP	CH19 CBF trip
1160	CH20-CBFFTP	CH20 CBF trip
1161	CH21-CBFFTP	CH21 CBF trip
1162	CH22-CBFFTP	CH22 CBF trip
1163	CH23-CBFFTP	CH23 CBF trip
1164	CH24-CBFFTP	CH24 CBF trip
1165	CH25-CBFFTP	CH25 CBF trip
1166	CH26-CBFFTP	CH26 CBF trip
1167	CH27-CBFFTP	CH27 CBF trip
1168	CH28-CBFFTP	CH28 CBF trip
1169	CH29-CBFFTP	CH29 CBF trip
1170	CH30-CBFFTP	CH30 CBF trip
1171	CH31-CBFFTP	CH31 CBF trip
1172	CH32-CBFFTP	CH32 CBF trip
1173	CH1-CBF.TR	CH1 CBF transfer trip
1174	CH2-CBF.TR	CH2 CBF transfer trip
1175	CH3-CBF.TR	CH3 CBF transfer trip
1176	CH4-CBF.TR	CH4 CBF transfer trip
1177	CH5-CBF.TR	CH5 CBF transfer trip
1178	CH6-CBF.TR	CH6 CBF transfer trip
1179	CH7-CBF.TR	CH7 CBF transfer trip
1180	CH8-CBF.TR	CH8 CBF transfer trip
1181	CH9-CBF.TR	CH9 CBF transfer trip
1182	CH10-CBF.TR	CH10 CBF transfer trip
1183	CH11-CBF.TR	CH11 CBF transfer trip
1184	CH12-CBF.TR	CH12 CBF transfer trip
1185	CH13-CBF.TR	CH13 CBF transfer trip
1186	CH14-CBF.TR	CH14 CBF transfer trip
1187	CH15-CBF.TR	CH15 CBF transfer trip
1188	CH16-CBF.TR	CH16 CBF transfer trip
1189	CH17-CBF.TR	CH17 CBF transfer trip
1190	CH18-CBF.TR	CH18 CBF transfer trip

Signal list		
No.	Signal Name	Contents
1191	CH19-CBF.TR	CH19 CBF transfer trip
1192	CH20-CBF.TR	CH20 CBF transfer trip
1193	CH21-CBF.TR	CH21 CBF transfer trip
1194	CH22-CBF.TR	CH22 CBF transfer trip
1195	CH23-CBF.TR	CH23 CBF transfer trip
1196	CH24-CBF.TR	CH24 CBF transfer trip
1197	CH25-CBF.TR	CH25 CBF transfer trip
1198	CH26-CBF.TR	CH26 CBF transfer trip
1199	CH27-CBF.TR	CH27 CBF transfer trip
1200	CH28-CBF.TR	CH28 CBF transfer trip
1201	CH29-CBF.TR	CH29 CBF transfer trip
1202	CH30-CBF.TR	CH30 CBF transfer trip
1203	CH31-CBF.TR	CH31 CBF transfer trip
1204	CH32-CBF.TR	CH32 CBF transfer trip
1205	CH1-CBF/RE	CH1 CBF retrip/trip
1206	CH2-CBF/RE	CH2 CBF retrip/trip
1207	CH3-CBF/RE	CH3 CBF retrip/trip
1208	CH4-CBF/RE	CH4 CBF retrip/trip
1209	CH5-CBF/RE	CH5 CBF retrip/trip
1210	CH6-CBF/RE	CH6 CBF retrip/trip
1211	CH7-CBF/RE	CH7 CBF retrip/trip
1212	CH8-CBF/RE	CH8 CBF retrip/trip
1213	CH9-CBF/RE	CH9 CBF retrip/trip
1214	CH10-CBF/RE	CH10 CBF retrip/trip
1215	CH11-CBF/RE	CH11 CBF retrip/trip
1216	CH12-CBF/RE	CH12 CBF retrip/trip
1217	CH13-CBF/RE	CH13 CBF retrip/trip
1218	CH14-CBF/RE	CH14 CBF retrip/trip
1219	CH15-CBF/RE	CH15 CBF retrip/trip
1220	CH16-CBF/RE	CH16 CBF retrip/trip
1221	CH17-CBF/RE	CH17 CBF retrip/trip
1222	CH18-CBF/RE	CH18 CBF retrip/trip
1223	CH19-CBF/RE	CH19 CBF retrip/trip
1224	CH20-CBF/RE	CH20 CBF retrip/trip
1225	CH21-CBF/RE	CH21 CBF retrip/trip
1226	CH22-CBF/RE	CH22 CBF retrip/trip
1227	CH23-CBF/RE	CH23 CBF retrip/trip
1228	CH24-CBF/RE	CH24 CBF retrip/trip
1229	CH25-CBF/RE	CH25 CBF retrip/trip
1230	CH26-CBF/RE	CH26 CBF retrip/trip
1231	CH27-CBF/RE	CH27 CBF retrip/trip
1232	CH28-CBF/RE	CH28 CBF retrip/trip
1233	CH29-CBF/RE	CH29 CBF retrip/trip
1234	CH30-CBF/RE	CH30 CBF retrip/trip
1235	CH31-CBF/RE	CH31 CBF retrip/trip
1236	CH32-CBF/RE	CH32 CBF retrip/trip
1237	DIF-ZA_TRIP	DIF-ZA trip
1238	DIF-ZB_TRIP	DIF-ZB trip
1239	DIF-ZC_TRIP	DIF-ZC trip
1240	DIF-ZD_TRIP	DIF-ZD trip
1241	IEC_MDBLK	monitor direction blocked
1242	IEC_TESTMODE	IEC61870-5-103 test mode
1243	GROUP1_ACTIVE	group1 active
1244	GROUP2_ACTIVE	group2 active
1245	GROUP3_ACTIVE	group3 active
1246	GROUP4_ACTIVE	group4 active
1247		
1248		
1249		
1250		
1251	RLY_FAIL	RELAY FAILURE
1252	RLY_OP_BLK	RELAY OUTPUT BLOCK
1253	AMF_OFF	SV BLOCK
1254	DSSV	DS failure signal
1255	CBSV	CB failure signal
1256	BISV	BI failure signal
1257	IDSV	ID failure signal
1258	RELAY_FAIL-A	
1259	OPSV	
1260		

Signal list		
No.	Signal Name	Contents
1261	TRIP-H	Trip signal hold
1262		
1263		
1264		
1265		
1266	BRIDGE_ALARM	Bridge alarm signal
1267	CT_ERR	
1268	V0_ERR	
1269	V2_ERR	
1270	IDSV-ZA	ID fail signal(Discriminating zone A)
1271	IDSV-ZB	ID fail signal(Discriminating zone B)
1272	IDSV-ZC	ID fail signal(Discriminating zone C)
1273	IDSV-ZD	ID fail signal(Discriminating zone D)
1274	IDSV-CH	ID fail signal(Chack zone)
1275	DSSV_DS1	DS1 failure signal
1276	DSSV_DS2	DS2 failure signal
1277	DSSV_DS3	DS3 failure signal
1278	DSSV_DS4	DS4 failure signal
1279	GEN_PICKUP	General start/pick-up
1280	GEN_TRIP	General trip
1281	DSSV_ZA	ZoneA DS failure signal
1282	DSSV_ZB	ZoneB DS failure signal
1283	DSSV_ZC	ZoneC DS failure signal
1284	DSSV_ZD	ZoneD DS failure signal
1285		
1286		
1287		
1288	CTF-ZA	CTF detection
1289	CTF-ZB	ditto
1290	CTF-ZC	ditto
1291	CTF-ZD	ditto
1292	CTF-CH	ditto
1293	CTF-ZA_ALARM	CTF alarm
1294	CTF-ZB_ALARM	ditto
1295	CTF-ZC_ALARM	ditto
1296	CTF-ZD_ALARM	ditto
1297	CTF-CH_ALARM	ditto
1298	CTF_ALARM	ditto
1299		
1300	EFP-TRANSFER	End-fault-protection transfer trip signal
1301	UVGZA-A	UVGZA-A relay element output
1302	UVGZA-B	-B relay element output
1303	UVGZA-C	-C relay element output
1304	UVSZA-AB	UVSZA-AB relay element output
1305	UVSZA-BC	-BC relay element output
1306	UVSZA-CA	-CA relay element output
1307	UVDZA-A	UVDZA-A relay element output
1308	UVDZA-B	-B relay element output
1309	UVDZA-C	-C relay element output
1310	OVGZA	OVGZA relay element output
1311	UVGZB-A	UVGZB-A relay element output
1312	UVGZB-B	-B relay element output
1313	UVGZB-C	-C relay element output
1314	UVSZB-AB	UVSZB-AB relay element output
1315	UVSZB-BC	-BC relay element output
1316	UVSZB-CA	-CA relay element output
1317	UVDZB-A	UVDZB-A relay element output
1318	UVDZB-B	-B relay element output
1319	UVDZB-C	-C relay element output
1320	OVGZB	OVGZB relay element output
1321	UVGZC-A	UVGZC-A relay element output
1322	UVGZC-B	-B relay element output
1323	UVGZC-C	-C relay element output
1324	UVSZC-AB	UVSZC-AB relay element output
1325	UVSZC-BC	-BC relay element output
1326	UVSZC-CA	-CA relay element output
1327	UVDZC-A	UVDZC-A relay element output
1328	UVDZC-B	-B relay element output
1329	UVDZC-C	-C relay element output
1330	OVGZC	OVGZC relay element output

Signal list		
No.	Signal Name	Contents
1331	UVGZD-A	UVGZD-A relay element output
1332	UVGZD-B	-B relay element output
1333	UVGZD-C	-C relay element output
1334	UVSZD-AB	UVSZD-AB relay element output
1335	UVSZD-BC	-BC relay element output
1336	UVSZD-CA	-CA relay element output
1337	UVDZD-A	UVDZD-A relay element output
1338	UVDZD-B	-B relay element output
1339	UVDZD-C	-C relay element output
1340	OVGZD	OVGZD relay element output
1341	UVGZA	UVGZA-A,B,C relay element output (3phase OR)
1342	UVSZA	UVSZA-A,B,C relay element output (3phase OR)
1343	UVDZA	UVDZA-A,B,C relay element output (3phase OR with del-timer)
1344	UVGZB	UVGZB-A,B,C relay element output (3phase OR)
1345	UVSZB	UVSZB-A,B,C relay element output (3phase OR)
1346	UVDZB	UVDZB-A,B,C relay element output (3phase OR with del-timer)
1347	UVGZC	UVGZC-A,B,C relay element output (3phase OR)
1348	UVSZC	UVSZC-A,B,C relay element output (3phase OR)
1349	UVDZC	UVDZC-A,B,C relay element output (3phase OR with del-timer)
1350	UVGZD	UVGZD-A,B,C relay element output (3phase OR)
1351	UVSZD	UVSZD-A,B,C relay element output (3phase OR)
1352	UVDZD	UVDZD-A,B,C relay element output (3phase OR with del-timer)
1353		
1354		
1355	C1_S1_OPEN	Coupler1 opened and Section1 opened
1356	C1_S2_OPEN	Coupler1 opened and Section2 opened
1357	C2_S1_OPEN	Coupler2 opened and Section1 opened
1358	C2_S2_OPEN	Coupler2 opened and Section2 opened
1359	C1_C2_OPEN	Coupler1 opened and Coupler2 opened
1360	S1_S2_OPEN	Section1 opened and Section2 opened
1361	CH1-COMTP	CH1 command trip
1362	CH2-COMTP	CH2 command trip
1363	CH3-COMTP	CH3 command trip
1364	CH4-COMTP	CH4 command trip
1365	CH5-COMTP	CH5 command trip
1366	CH6-COMTP	CH6 command trip
1367	CH7-COMTP	CH7 command trip
1368	CH8-COMTP	CH8 command trip
1369	CH9-COMTP	CH9 command trip
1370	CH10-COMTP	CH10 command trip
1371	CH11-COMTP	CH11 command trip
1372	CH12-COMTP	CH12 command trip
1373	CH13-COMTP	CH13 command trip
1374	CH14-COMTP	CH14 command trip
1375	CH15-COMTP	CH15 command trip
1376	CH16-COMTP	CH16 command trip
1377	CH17-COMTP	CH17 command trip
1378	CH18-COMTP	CH18 command trip
1379	CH19-COMTP	CH19 command trip
1380	CH20-COMTP	CH20 command trip
1381	CH21-COMTP	CH21 command trip
1382	CH22-COMTP	CH22 command trip
1383	CH23-COMTP	CH23 command trip
1384	CH24-COMTP	CH24 command trip
1385	CH25-COMTP	CH25 command trip
1386	CH26-COMTP	CH26 command trip
1387	CH27-COMTP	CH27 command trip
1388	CH28-COMTP	CH28 command trip
1389	CH29-COMTP	CH29 command trip
1390	CH30-COMTP	CH30 command trip
1391	CH31-COMTP	CH31 command trip
1392	CH32-COMTP	CH32 command trip
1393	COMTP-ZA	Command trip of zone A
1394	COMTP-ZB	Command trip of zone B
1395	COMTP-ZC	Command trip of zone C
1396	COMTP-ZD	Command trip of zone D
1397	COM-TRIP	Command trip
1398	FAULT_PHA_A	fault_phase_A
1399	FAULT_PHA_B	fault_phase_B
1400	FAULT_PHA_C	fault_phase_C

Signal list		
No.	Signal Name	Contents
1401	LOCAL_OP_ACT	local operation active
1402	REMOTE_OP_ACT	remote operation active
1403	NORM_LED_ON	IN-SERVICE LED ON
1404	ALM_LED_ON	ALARM LED ON
1405	TRIP_LED_ON	TRIP LED ON
1406	TEST_LED_ON	TEST LED ON
1407		
1408		
1409	LED_RESET	TRIP LED RESET
1410		
1411		IEC103 communication command (reserved)
1412		IEC103 communication command (reserved)
1413	PROT_COM_ON	IEC103 communication command
1414	PRG_LED1_ON	PROGRAMMABLE LED1 ON
1415	PRG_LED2_ON	PROGRAMMABLE LED2 ON
1416	PRG_LED3_ON	PROGRAMMABLE LED3 ON
1417	PRG_LED4_ON	PROGRAMMABLE LED4 ON
1418		PROGRAMMABLE LED5 ON (reserved)
1419		PROGRAMMABLE LED6 ON (reserved)
1420		PROGRAMMABLE LED7 ON (reserved)
1421		PROGRAMMABLE LED8 ON (reserved)
1422		PROGRAMMABLE LED9 ON (reserved)
1423		PROGRAMMABLE LED10 ON (reserved)
1424		PROGRAMMABLE LED11 ON (reserved)
1425		PROGRAMMABLE LED12 ON (reserved)
1426		PROGRAMMABLE LED13 ON (reserved)
1427		PROGRAMMABLE LED14 ON (reserved)
1428		PROGRAMMABLE LED15 ON (reserved)
1429		PROGRAMMABLE LED16 ON (reserved)
1430		
1431		
1432		
1433	BU-OUT	Any BU out of service condition
1434	F.Record_DONE	fault location completed
1435	F.Record_CLR	Fault record clear
1436	E.Record_CLR	Event record clear
1437	D.Record_CLR	Disturbance record clear
1438		
1439		
1440		
1441		
1442		
1443		
1444		
1445	PLC_data_CHG	PLC data change
1446		
1447		
1448	Sys.set_change	System setting change
1449	Rly.set_change	Relay setting change
1450	Grp.set_change	Group setting change
1451		
1452		
1453		
1454		
1455		
1456	KEY-VIEW	VIEW key status (1:pressed)
1457	KEY-RESET	RESET key status (2:pressed)
1458	KEY-ENTER	ENTER key status (3:pressed)
1459	KEY-END	END key status (4:pressed)
1460	KEY-CANCEL	CANCEL key status (5:pressed)
1461		
1462		
1463		
1464		
1465		
1466		
1467		
1468		
1469		
1470		

Signal list

No.	Signal Name	Contents
1471		
1472	SUM_err	Program ROM checksum error
1473		(reserved for supervision)
1474	SRAM_err	SRAM memory monitoring error
1475	BU-RAM_err	BU-RAM memory monitoring error
1476	DP-RAM_err	DP-RAM memory monitoring error
1477	EEPROM_err	EEPROM memory monitoring error
1478	SUB-CPU_err	Sub-CPU stopped
1479	A/D_err	A/D accuracy checking error
1480		(reserved for supervision)
1481		(reserved for supervision)
1482		(reserved for supervision)
1483		(reserved for supervision)
1484	DIO_err	DIO card connection error
1485		(reserved for supervision)
1486	LCD_err	LCD panel connection error
1487	ROM_data_err	Data ROM checksum error
1488	FEP1 SUM_err	FEP#1 Program ROM checksum error
1489	FEP1 SRAM_err	FEP#1 SRAM memory monitoring error
1490	FEP1 DPRAM_err	FEP#1 DP-RAM memory monitoring error
1491	FEP1 stopped	FEP#1 stopped
1492	FEP2 SUM_err	FEP#2 Program ROM checksum error
1493	FEP2 SRAM_err	FEP#2 SRAM memory monitoring error
1494	FEP2 DPRAM_err	FEP#2 DP-RAM memory monitoring error
1495	FEP2 stopped	FEP#2 stopped
1496	FEP3 SUM_err	FEP#3 Program ROM checksum error
1497	FEP3 SRAM_err	FEP#3 SRAM memory monitoring error
1498	FEP3 DPRAM_err	FEP#3 DP-RAM memory monitoring error
1499	FEP3 stopped	FEP#3 stopped
1500	FEP4 SUM_err	FEP#4 Program ROM checksum error
1501	FEP4 SRAM_err	FEP#4 SRAM memory monitoring error
1502	FEP4 DPRAM_err	FEP#4 DP-RAM memory monitoring error
1503	FEP4 stopped	FEP#4 stopped
1504	CTFID_ZA-A	Id element for CTF detection (Zone A)
1505	CTFID_ZA-B	ditto
1506	CTFID_ZA-C	ditto
1507	CTFID_ZB-A	Id element for CTF detection (Zone B)
1508	CTFID_ZB-B	ditto
1509	CTFID_ZB-C	ditto
1510	CTFID_ZC-A	Id element for CTF detection (Zone C)
1511	CTFID_ZC-B	ditto
1512	CTFID_ZC-C	ditto
1513	CTFID_ZD-A	Id element for CTF detection (Zone D)
1514	CTFID_ZD-B	ditto
1515	CTFID_ZD-C	ditto
1516	CTFID_CH-A	Id element for CTF detection (Check zone)
1517	CTFID_CH-B	ditto
1518	CTFID_CH-C	ditto
1519	CTFOVG_ZA	OVG element for CTF detection
1520	CTFOVG_ZB	ditto
1521	CTFOVG_ZC	ditto
1522	CTFOVG_ZD	ditto
1523	CTFUV_ZA	UV element for CTF detection
1524	CTFUV_ZB	ditto
1525	CTFUV_ZC	ditto
1526	CTFUV_ZD	ditto
1527	CTFUVD_ZA	UVD element for CTF detection
1528	CTFUVD_ZB	ditto
1529	CTFUVD_ZC	ditto
1530	CTFUVD_ZD	ditto
1531		
1532		
1533		
1534		
1535		

Signal list (Input for PLC)		
No.	Signal Name	Contents
1536		
1537		
1538	CH1-DS2_N/O	CH1 DS2 normaly open contact
1539	CH1-DS2_N/C	CH1 DS2 normaly close contact
1540	CH1-DS3_N/O	CH1 DS3 normaly open contact
1541	CH1-DS3_N/C	CH1 DS3 normaly close contact
1542	CH1-DS4_N/O	CH1 DS4 normaly open contact
1543	CH1-DS4_N/C	CH1 DS4 normaly close contact
1544	CH1-CB_N/O	CH1 CB normaly open contact
1545	CH1-CB_N/C	CH1 CB normaly close contact
1546		
1547		
1548		
1549		
1550		
1551		
1552		
1553		
1554	CH2-DS2_N/O	CH2 DS2 normaly open contact
1555	CH2-DS2_N/C	CH2 DS2 normaly close contact
1556	CH2-DS3_N/O	CH2 DS3 normaly open contact
1557	CH2-DS3_N/C	CH2 DS3 normaly close contact
1558	CH2-DS4_N/O	CH2 DS4 normaly open contact
1559	CH2-DS4_N/C	CH2 DS4 normaly close contact
1560	CH2-CB_N/O	CH2 CB normaly open contact
1561	CH2-CB_N/C	CH2 CB normaly close contact
1562		
1563		
1564		
1565		
1566		
1567		
1568		
1569		
1570	CH3-DS2_N/O	CH3 DS2 normaly open contact
1571	CH3-DS2_N/C	CH3 DS2 normaly close contact
1572	CH3-DS3_N/O	CH3 DS3 normaly open contact
1573	CH3-DS3_N/C	CH3 DS3 normaly close contact
1574	CH3-DS4_N/O	CH3 DS4 normaly open contact
1575	CH3-DS4_N/C	CH3 DS4 normaly close contact
1576	CH3-CB_N/O	CH3 CB normaly open contact
1577	CH3-CB_N/C	CH3 CB normaly close contact
1578		
1579		
1580		
1581		
1582		
1583		
1584		
1585		
1586	CH4-DS2_N/O	CH4 DS2 normaly open contact
1587	CH4-DS2_N/C	CH4 DS2 normaly close contact
1588	CH4-DS3_N/O	CH4 DS3 normaly open contact
1589	CH4-DS3_N/C	CH4 DS3 normaly close contact
1590	CH4-DS4_N/O	CH4 DS4 normaly open contact
1591	CH4-DS4_N/C	CH4 DS4 normaly close contact
1592	CH4-CB_N/O	CH4 CB normaly open contact
1593	CH4-CB_N/C	CH4 CB normaly close contact
1594		
1595		
1596		
1597		
1598		
1599		
1600		

Signal list (Input for PLC)

No.	Signal Name	Contents
1601		
1602	CH5-DS2_N/O	CH5 DS2 normaly open contact
1603	CH5-DS2_N/C	CH5 DS2 normaly close contact
1604	CH5-DS3_N/O	CH5 DS3 normaly open contact
1605	CH5-DS3_N/C	CH5 DS3 normaly close contact
1606	CH5-DS4_N/O	CH5 DS4 normaly open contact
1607	CH5-DS4_N/C	CH5 DS4 normaly close contact
1608	CH5-CB_N/O	CH5 CB normaly open contact
1609	CH5-CB_N/C	CH5 CB normaly close contact
1610		
1611		
1612		
1613		
1614		
1615		
1616		
1617		
1618	CH6-DS2_N/O	CH6 DS2 normaly open contact
1619	CH6-DS2_N/C	CH6 DS2 normaly close contact
1620	CH6-DS3_N/O	CH6 DS3 normaly open contact
1621	CH6-DS3_N/C	CH6 DS3 normaly close contact
1622	CH6-DS4_N/O	CH6 DS4 normaly open contact
1623	CH6-DS4_N/C	CH6 DS4 normaly close contact
1624	CH6-CB_N/O	CH6 CB normaly open contact
1625	CH6-CB_N/C	CH6 CB normaly close contact
1626		
1627		
1628		
1629		
1630		
1631		
1632		
1633		
1634	CH7-DS2_N/O	CH7 DS2 normaly open contact
1635	CH7-DS2_N/C	CH7 DS2 normaly close contact
1636	CH7-DS3_N/O	CH7 DS3 normaly open contact
1637	CH7-DS3_N/C	CH7 DS3 normaly close contact
1638	CH7-DS4_N/O	CH7 DS4 normaly open contact
1639	CH7-DS4_N/C	CH7 DS4 normaly close contact
1640	CH7-CB_N/O	CH7 CB normaly open contact
1641	CH7-CB_N/C	CH7 CB normaly close contact
1642		
1643		
1644		
1645		
1646		
1647		
1648		
1649		
1650	CH8-DS2_N/O	CH8 DS2 normaly open contact
1651	CH8-DS2_N/C	CH8 DS2 normaly close contact
1652	CH8-DS3_N/O	CH8 DS3 normaly open contact
1653	CH8-DS3_N/C	CH8 DS3 normaly close contact
1654	CH8-DS4_N/O	CH8 DS4 normaly open contact
1655	CH8-DS4_N/C	CH8 DS4 normaly close contact
1656	CH8-CB_N/O	CH8 CB normaly open contact
1657	CH8-CB_N/C	CH8 CB normaly close contact
1658		
1659		
1660		
1661		
1662		
1663		
1664		
1665		
1666	CH9-DS2_N/O	CH9 DS2 normaly open contact
1667	CH9-DS2_N/C	CH9 DS2 normaly close contact
1668	CH9-DS3_N/O	CH9 DS3 normaly open contact
1669	CH9-DS3_N/C	CH9 DS3 normaly close contact
1670	CH9-DS4_N/O	CH9 DS4 normaly open contact

Signal list (Input for PLC)		
No.	Signal Name	Contents
1671	CH9-DS4_N/C	CH9 DS4 normaly close contact
1672	CH9-CB_N/O	CH9 CB normaly open contact
1673	CH9-CB_N/C	CH9 CB normaly close contact
1674		
1675		
1676		
1677		
1678		
1679		
1680		
1681		
1682	CH10-DS2_N/O	CH10 DS2 normaly open contact
1683	CH10-DS2_N/C	CH10 DS2 normaly close contact
1684	CH10-DS3_N/O	CH10 DS3 normaly open contact
1685	CH10-DS3_N/C	CH10 DS3 normaly close contact
1686	CH10-DS4_N/O	CH10 DS4 normaly open contact
1687	CH10-DS4_N/C	CH10 DS4 normaly close contact
1688	CH10-CB_N/O	CH10 CB normaly open contact
1689	CH10-CB_N/C	CH10 CB normaly close contact
1690		
1691		
1692		
1693		
1694		
1695		
1696		
1697		
1698	CH11-DS2_N/O	CH11 DS2 normaly open contact
1699	CH11-DS2_N/C	CH11 DS2 normaly close contact
1700	CH11-DS3_N/O	CH11 DS3 normaly open contact
1701	CH11-DS3_N/C	CH11 DS3 normaly close contact
1702	CH11-DS4_N/O	CH11 DS4 normaly open contact
1703	CH11-DS4_N/C	CH11 DS4 normaly close contact
1704	CH11-CB_N/O	CH11 CB normaly open contact
1705	CH11-CB_N/C	CH11 CB normaly close contact
1706		
1707		
1708		
1709		
1710		
1711		
1712		
1713		
1714	CH12-DS2_N/O	CH12 DS2 normaly open contact
1715	CH12-DS2_N/C	CH12 DS2 normaly close contact
1716	CH12-DS3_N/O	CH12 DS3 normaly open contact
1717	CH12-DS3_N/C	CH12 DS3 normaly close contact
1718	CH12-DS4_N/O	CH12 DS4 normaly open contact
1719	CH12-DS4_N/C	CH12 DS4 normaly close contact
1720	CH12-CB_N/O	CH12 CB normaly open contact
1721	CH12-CB_N/C	CH12 CB normaly close contact
1722		
1723		
1724		
1725		
1726		
1727		
1728		
1729		
1730	CH13-DS2_N/O	CH13 DS2 normaly open contact
1731	CH13-DS2_N/C	CH13 DS2 normaly close contact
1732	CH13-DS3_N/O	CH13 DS3 normaly open contact
1733	CH13-DS3_N/C	CH13 DS3 normaly close contact
1734	CH13-DS4_N/O	CH13 DS4 normaly open contact
1735	CH13-DS4_N/C	CH13 DS4 normaly close contact
1736	CH13-CB_N/O	CH13 CB normaly open contact
1737	CH13-CB_N/C	CH13 CB normaly close contact
1738		
1739		
1740		

Signal list (Input for PLC)		
No.	Signal Name	Contents
1741		
1742		
1743		
1744		
1745		
1746	CH14-DS2_N/O	CH14 DS2 normaly open contact
1747	CH14-DS2_N/C	CH14 DS2 normaly close contact
1748	CH14-DS3_N/O	CH14 DS3 normaly open contact
1749	CH14-DS3_N/C	CH14 DS3 normaly close contact
1750	CH14-DS4_N/O	CH14 DS4 normaly open contact
1751	CH14-DS4_N/C	CH14 DS4 normaly close contact
1752	CH14-CB_N/O	CH14 CB normaly open contact
1753	CH14-CB_N/C	CH14 CB normaly close contact
1754		
1755		
1756		
1757		
1758		
1759		
1760		
1761		
1762	CH15-DS2_N/O	CH15 DS2 normaly open contact
1763	CH15-DS2_N/C	CH15 DS2 normaly close contact
1764	CH15-DS3_N/O	CH15 DS3 normaly open contact
1765	CH15-DS3_N/C	CH15 DS3 normaly close contact
1766	CH15-DS4_N/O	CH15 DS4 normaly open contact
1767	CH15-DS4_N/C	CH15 DS4 normaly close contact
1768	CH15-CB_N/O	CH15 CB normaly open contact
1769	CH15-CB_N/C	CH15 CB normaly close contact
1770		
1771		
1772		
1773		
1774		
1775		
1776		
1777		
1778	CH16-DS2_N/O	CH16 DS2 normaly open contact
1779	CH16-DS2_N/C	CH16 DS2 normaly close contact
1780	CH16-DS3_N/O	CH16 DS3 normaly open contact
1781	CH16-DS3_N/C	CH16 DS3 normaly close contact
1782	CH16-DS4_N/O	CH16 DS4 normaly open contact
1783	CH16-DS4_N/C	CH16 DS4 normaly close contact
1784	CH16-CB_N/O	CH16 CB normaly open contact
1785	CH16-CB_N/C	CH16 CB normaly close contact
1786		
1787		
1788		
1789		
1790		
1791		
1792		
1793		
1794	CH17-DS2_N/O	CH17 DS2 normaly open contact
1795	CH17-DS2_N/C	CH17 DS2 normaly close contact
1796	CH17-DS3_N/O	CH17 DS3 normaly open contact
1797	CH17-DS3_N/C	CH17 DS3 normaly close contact
1798	CH17-DS4_N/O	CH17 DS4 normaly open contact
1799	CH17-DS4_N/C	CH17 DS4 normaly close contact
1800	CH17-CB_N/O	CH17 CB normaly open contact
1801	CH17-CB_N/C	CH17 CB normaly close contact
1802		
1803		
1804		
1805		
1806		
1807		
1808		
1809		
1810	CH18-DS2_N/O	CH18 DS2 normaly open contact

Signal list (Input for PLC)

No.	Signal Name	Contents
1811	CH18-DS2_N/C	CH18 DS2 normaly close contact
1812	CH18-DS3_N/O	CH18 DS3 normaly open contact
1813	CH18-DS3_N/C	CH18 DS3 normaly close contact
1814	CH18-DS4_N/O	CH18 DS4 normaly open contact
1815	CH18-DS4_N/C	CH18 DS4 normaly close contact
1816	CH18-CB_N/O	CH18 CB normaly open contact
1817	CH18-CB_N/C	CH18 CB normaly close contact
1818		
1819		
1820		
1821		
1822		
1823		
1824		
1825		
1826	CH19-DS2_N/O	CH19 DS2 normaly open contact
1827	CH19-DS2_N/C	CH19 DS2 normaly close contact
1828	CH19-DS3_N/O	CH19 DS3 normaly open contact
1829	CH19-DS3_N/C	CH19 DS3 normaly close contact
1830	CH19-DS4_N/O	CH19 DS4 normaly open contact
1831	CH19-DS4_N/C	CH19 DS4 normaly close contact
1832	CH19-CB_N/O	CH19 CB normaly open contact
1833	CH19-CB_N/C	CH19 CB normaly close contact
1834		
1835		
1836		
1837		
1838		
1839		
1840		
1841		
1842	CH20-DS2_N/O	CH20 DS2 normaly open contact
1843	CH20-DS2_N/C	CH20 DS2 normaly close contact
1844	CH20-DS3_N/O	CH20 DS3 normaly open contact
1845	CH20-DS3_N/C	CH20 DS3 normaly close contact
1846	CH20-DS4_N/O	CH20 DS4 normaly open contact
1847	CH20-DS4_N/C	CH20 DS4 normaly close contact
1848	CH20-CB_N/O	CH20 CB normaly open contact
1849	CH20-CB_N/C	CH20 CB normaly close contact
1850		
1851		
1852		
1853		
1854		
1855		
1856		
1857		
1858	CH21-DS2_N/O	CH21 DS2 normaly open contact
1859	CH21-DS2_N/C	CH21 DS2 normaly close contact
1860	CH21-DS3_N/O	CH21 DS3 normaly open contact
1861	CH21-DS3_N/C	CH21 DS3 normaly close contact
1862	CH21-DS4_N/O	CH21 DS4 normaly open contact
1863	CH21-DS4_N/C	CH21 DS4 normaly close contact
1864	CH21-CB_N/O	CH21 CB normaly open contact
1865	CH21-CB_N/C	CH21 CB normaly close contact
1866		
1867		
1868		
1869		
1870		
1871		
1872		
1873		
1874	CH22-DS2_N/O	CH22 DS2 normaly open contact
1875	CH22-DS2_N/C	CH22 DS2 normaly close contact
1876	CH22-DS3_N/O	CH22 DS3 normaly open contact
1877	CH22-DS3_N/C	CH22 DS3 normaly close contact
1878	CH22-DS4_N/O	CH22 DS4 normaly open contact
1879	CH22-DS4_N/C	CH22 DS4 normaly close contact
1880	CH22-CB_N/O	CH22 CB normaly open contact

Signal list (Input for PLC)		
No.	Signal Name	Contents
1881	CH22-CB_N/C	CH22 CB normaly close contact
1882		
1883		
1884		
1885		
1886		
1887		
1888		
1889		
1890	CH23-DS2_N/O	CH23 DS2 normaly open contact
1891	CH23-DS2_N/C	CH23 DS2 normaly close contact
1892	CH23-DS3_N/O	CH23 DS3 normaly open contact
1893	CH23-DS3_N/C	CH23 DS3 normaly close contact
1894	CH23-DS4_N/O	CH23 DS4 normaly open contact
1895	CH23-DS4_N/C	CH23 DS4 normaly close contact
1896	CH23-CB_N/O	CH23 CB normaly open contact
1897	CH23-CB_N/C	CH23 CB normaly close contact
1898		
1899		
1900		
1901		
1902		
1903		
1904		
1905		
1906	CH24-DS2_N/O	CH24 DS2 normaly open contact
1907	CH24-DS2_N/C	CH24 DS2 normaly close contact
1908	CH24-DS3_N/O	CH24 DS3 normaly open contact
1909	CH24-DS3_N/C	CH24 DS3 normaly close contact
1910	CH24-DS4_N/O	CH24 DS4 normaly open contact
1911	CH24-DS4_N/C	CH24 DS4 normaly close contact
1912	CH24-CB_N/O	CH24 CB normaly open contact
1913	CH24-CB_N/C	CH24 CB normaly close contact
1914		
1915		
1916		
1917		
1918		
1919		
1920		
1921		
1922	CH25-DS2_N/O	CH25 DS2 normaly open contact
1923	CH25-DS2_N/C	CH25 DS2 normaly close contact
1924	CH25-DS3_N/O	CH25 DS3 normaly open contact
1925	CH25-DS3_N/C	CH25 DS3 normaly close contact
1926	CH25-DS4_N/O	CH25 DS4 normaly open contact
1927	CH25-DS4_N/C	CH25 DS4 normaly close contact
1928	CH25-CB_N/O	CH25 CB normaly open contact
1929	CH25-CB_N/C	CH25 CB normaly close contact
1930		
1931		
1932		
1933		
1934		
1935		
1936		
1937		
1938	CH26-DS2_N/O	CH26 DS2 normaly open contact
1939	CH26-DS2_N/C	CH26 DS2 normaly close contact
1940	CH26-DS3_N/O	CH26 DS3 normaly open contact
1941	CH26-DS3_N/C	CH26 DS3 normaly close contact
1942	CH26-DS4_N/O	CH26 DS4 normaly open contact
1943	CH26-DS4_N/C	CH26 DS4 normaly close contact
1944	CH26-CB_N/O	CH26 CB normaly open contact
1945	CH26-CB_N/C	CH26 CB normaly close contact
1946		
1947		
1948		
1949		
1950		

Signal list (Input for PLC)

No.	Signal Name	Contents
1951		
1952		
1953		
1954	CH27-DS2_N/O	CH27 DS2 normaly open contact
1955	CH27-DS2_N/C	CH27 DS2 normaly close contact
1956	CH27-DS3_N/O	CH27 DS3 normaly open contact
1957	CH27-DS3_N/C	CH27 DS3 normaly close contact
1958	CH27-DS4_N/O	CH27 DS4 normaly open contact
1959	CH27-DS4_N/C	CH27 DS4 normaly close contact
1960	CH27-CB_N/O	CH27 CB normaly open contact
1961	CH27-CB_N/C	CH27 CB normaly close contact
1962		
1963		
1964		
1965		
1966		
1967		
1968		
1969		
1970	CH28-DS2_N/O	CH28 DS2 normaly open contact
1971	CH28-DS2_N/C	CH28 DS2 normaly close contact
1972	CH28-DS3_N/O	CH28 DS3 normaly open contact
1973	CH28-DS3_N/C	CH28 DS3 normaly close contact
1974	CH28-DS4_N/O	CH28 DS4 normaly open contact
1975	CH28-DS4_N/C	CH28 DS4 normaly close contact
1976	CH28-CB_N/O	CH28 CB normaly open contact
1977	CH28-CB_N/C	CH28 CB normaly close contact
1978		
1979		
1980		
1981		
1982		
1983		
1984		
1985		
1986	CH29-DS2_N/O	CH29 DS2 normaly open contact
1987	CH29-DS2_N/C	CH29 DS2 normaly close contact
1988	CH29-DS3_N/O	CH29 DS3 normaly open contact
1989	CH29-DS3_N/C	CH29 DS3 normaly close contact
1990	CH29-DS4_N/O	CH29 DS4 normaly open contact
1991	CH29-DS4_N/C	CH29 DS4 normaly close contact
1992	CH29-CB_N/O	CH29 CB normaly open contact
1993	CH29-CB_N/C	CH29 CB normaly close contact
1994		
1995		
1996		
1997		
1998		
1999		
2000		
2001		
2002	CH30-DS2_N/O	CH30 DS2 normaly open contact
2003	CH30-DS2_N/C	CH30 DS2 normaly close contact
2004	CH30-DS3_N/O	CH30 DS3 normaly open contact
2005	CH30-DS3_N/C	CH30 DS3 normaly close contact
2006	CH30-DS4_N/O	CH30 DS4 normaly open contact
2007	CH30-DS4_N/C	CH30 DS4 normaly close contact
2008	CH30-CB_N/O	CH30 CB normaly open contact
2009	CH30-CB_N/C	CH30 CB normaly close contact
2010		
2011		
2012		
2013		
2014		
2015		
2016		
2017		
2018	CH31-DS2_N/O	CH31 DS2 normaly open contact
2019	CH31-DS2_N/C	CH31 DS2 normaly close contact
2020	CH31-DS3_N/O	CH31 DS3 normaly open contact

Signal list (Input for PLC)

No.	Signal Name	Contents
2021	CH31-DS3_N/C	CH31 DS3 normally close contact
2022	CH31-DS4_N/O	CH31 DS4 normally open contact
2023	CH31-DS4_N/C	CH31 DS4 normally close contact
2024	CH31-CB_N/O	CH31 CB normally open contact
2025	CH31-CB_N/C	CH31 CB normally close contact
2026		
2027		
2028		
2029		
2030		
2031		
2032		
2033		
2034	CH32-DS2_N/O	CH32 DS2 normally open contact
2035	CH32-DS2_N/C	CH32 DS2 normally close contact
2036	CH32-DS3_N/O	CH32 DS3 normally open contact
2037	CH32-DS3_N/C	CH32 DS3 normally close contact
2038	CH32-DS4_N/O	CH32 DS4 normally open contact
2039	CH32-DS4_N/C	CH32 DS4 normally close contact
2040	CH32-CB_N/O	CH32 CB normally open contact
2041	CH32-CB_N/C	CH32 CB normally close contact
2042		
2043		
2044		
2045		
2046		
2047		
2048	IND.RESET	Indication reset command
2049	BP_BLOCK-A	BP function block command-A
2050	CBF_BLOCK-A	CBF function block command-A
2051	BP_BLOCK-B	BP function block command-B
2052	CBF_BLOCK-B	CBF function block command-B
2053		
2054		
2055		
2056		
2057		
2058		
2059		
2060		
2061		
2062		
2063		
2064	DIFFS-ZA	DIF-ZA protection fail-safe command
2065	DIFFS-ZB	DIF-ZB protection fail-safe command
2066	DIFFS-ZC	DIF-ZC protection fail-safe command
2067	DIFFS-ZD	DIF-ZD protection fail-safe command
2068	DIFFS	DIF(check zone) protection fail-safe command
2069	DIFCH_CHARA	DIFCH characteristic changing command
2070		
2071		
2072		
2073		
2074		
2075		
2076		
2077		
2078		
2079		
2080	CBFFS-ZA	CBF protection zone-A fail-safe command
2081	CBFFS-ZB	CBF protection zone-B fail-safe command
2082	CBFFS-ZC	CBF protection zone-C fail-safe command
2083	CBFFS-ZD	CBF protection zone-D fail-safe command
2084	CBFFS-NOUSE	CBF fail-safe not used command
2085		
2086		
2087		
2088	COMTP-ZA_COM	Command trip forcibly trip
2089	COMTP-ZB_COM	ditto
2090	COMTP-ZC_COM	ditto

Signal list (Input for PLC)		
No.	Signal Name	Contents
2091	COMTP-ZD_COM	ditto
2092	CTF_BLOCK	CTF block command
2093		
2094		
2095		
2096	CBFTRFS-ZA	CBF transfer zone-A fail-safe command
2097	CBFTRFS-ZB	CBF transfer zone-B fail-safe command
2098	CBFTRFS-ZC	CBF transfer zone-C fail-safe command
2099	CBFTRFS-ZD	CBF transfer zone-D fail-safe command
2100	CBFTRFS-NOUSE	CBF transfer fail-safe not used command
2101		
2102		
2103		
2104		
2105		
2106		
2107		
2108		
2109		
2110		
2111		
2112	DIFZA_DELAY	Trip command delay timer setting
2113	DIFZB_DELAY	Trip command delay timer setting
2114	DIFZC_DELAY	Trip command delay timer setting
2115	DIFZD_DELAY	Trip command delay timer setting
2116	DIF_DELAY	Trip command delay timer setting
2117		
2118		
2119		
2120	C1-CUR.BLK_S	Coupler1 current block command for single-bus with transfer
2121	C2-CUR.BLK_S	Coupler2 current block command for single-bus with transfer
2122	C3-CUR.BLK_S	Coupler3 current block command for single-bus with transfer
2123	C4-CUR.BLK_S	Coupler4 current block command for single-bus with transfer
2124		
2125		
2126		
2127		
2128	CH1-EXT-BPTP	CH1 external bus protection trip command
2129	CH2-EXT-BPTP	CH2 external bus protection trip command
2130	CH3-EXT-BPTP	CH3 external bus protection trip command
2131	CH4-EXT-BPTP	CH4 external bus protection trip command
2132	CH5-EXT-BPTP	CH5 external bus protection trip command
2133	CH6-EXT-BPTP	CH6 external bus protection trip command
2134	CH7-EXT-BPTP	CH7 external bus protection trip command
2135	CH8-EXT-BPTP	CH8 external bus protection trip command
2136	CH9-EXT-BPTP	CH9 external bus protection trip command
2137	CH10-EXT-BPTP	CH10 external bus protection trip command
2138	CH11-EXT-BPTP	CH11 external bus protection trip command
2139	CH12-EXT-BPTP	CH12 external bus protection trip command
2140	CH13-EXT-BPTP	CH13 external bus protection trip command
2141	CH14-EXT-BPTP	CH14 external bus protection trip command
2142	CH15-EXT-BPTP	CH15 external bus protection trip command
2143	CH16-EXT-BPTP	CH16 external bus protection trip command
2144	CH17-EXT-BPTP	CH17 external bus protection trip command
2145	CH18-EXT-BPTP	CH18 external bus protection trip command
2146	CH19-EXT-BPTP	CH19 external bus protection trip command
2147	CH20-EXT-BPTP	CH20 external bus protection trip command
2148	CH21-EXT-BPTP	CH21 external bus protection trip command
2149	CH22-EXT-BPTP	CH22 external bus protection trip command
2150	CH23-EXT-BPTP	CH23 external bus protection trip command
2151	CH24-EXT-BPTP	CH24 external bus protection trip command
2152	CH25-EXT-BPTP	CH25 external bus protection trip command
2153	CH26-EXT-BPTP	CH26 external bus protection trip command
2154	CH27-EXT-BPTP	CH27 external bus protection trip command
2155	CH28-EXT-BPTP	CH28 external bus protection trip command
2156	CH29-EXT-BPTP	CH29 external bus protection trip command
2157	CH30-EXT-BPTP	CH30 external bus protection trip command
2158	CH31-EXT-BPTP	CH31 external bus protection trip command
2159	CH32-EXT-BPTP	CH32 external bus protection trip command
2160	CH1-CBFIO	CH1 CBF instantly operation command

Signal list (Input for PLC)

No.	Signal Name	Contents
2161	CH2-CBFIO	CH2 CBF instantly operation command
2162	CH3-CBFIO	CH3 CBF instantly operation command
2163	CH4-CBFIO	CH4 CBF instantly operation command
2164	CH5-CBFIO	CH5 CBF instantly operation command
2165	CH6-CBFIO	CH6 CBF instantly operation command
2166	CH7-CBFIO	CH7 CBF instantly operation command
2167	CH8-CBFIO	CH8 CBF instantly operation command
2168	CH9-CBFIO	CH9 CBF instantly operation command
2169	CH10-CBFIO	CH10 CBF instantly operation command
2170	CH11-CBFIO	CH11 CBF instantly operation command
2171	CH12-CBFIO	CH12 CBF instantly operation command
2172	CH13-CBFIO	CH13 CBF instantly operation command
2173	CH14-CBFIO	CH14 CBF instantly operation command
2174	CH15-CBFIO	CH15 CBF instantly operation command
2175	CH16-CBFIO	CH16 CBF instantly operation command
2176	CH17-CBFIO	CH17 CBF instantly operation command
2177	CH18-CBFIO	CH18 CBF instantly operation command
2178	CH19-CBFIO	CH19 CBF instantly operation command
2179	CH20-CBFIO	CH20 CBF instantly operation command
2180	CH21-CBFIO	CH21 CBF instantly operation command
2181	CH22-CBFIO	CH22 CBF instantly operation command
2182	CH23-CBFIO	CH23 CBF instantly operation command
2183	CH24-CBFIO	CH24 CBF instantly operation command
2184	CH25-CBFIO	CH25 CBF instantly operation command
2185	CH26-CBFIO	CH26 CBF instantly operation command
2186	CH27-CBFIO	CH27 CBF instantly operation command
2187	CH28-CBFIO	CH28 CBF instantly operation command
2188	CH29-CBFIO	CH29 CBF instantly operation command
2189	CH30-CBFIO	CH30 CBF instantly operation command
2190	CH31-CBFIO	CH31 CBF instantly operation command
2191	CH32-CBFIO	CH32 CBF instantly operation command
2192	CH1-COM.TP	CH1 command trip initiation command
2193	CH2-COM.TP	CH2 command trip initiation command
2194	CH3-COM.TP	CH3 command trip initiation command
2195	CH4-COM.TP	CH4 command trip initiation command
2196	CH5-COM.TP	CH5 command trip initiation command
2197	CH6-COM.TP	CH6 command trip initiation command
2198	CH7-COM.TP	CH7 command trip initiation command
2199	CH8-COM.TP	CH8 command trip initiation command
2200	CH9-COM.TP	CH9 command trip initiation command
2201	CH10-COM.TP	CH10 command trip initiation command
2202	CH11-COM.TP	CH11 command trip initiation command
2203	CH12-COM.TP	CH12 command trip initiation command
2204	CH13-COM.TP	CH13 command trip initiation command
2205	CH14-COM.TP	CH14 command trip initiation command
2206	CH15-COM.TP	CH15 command trip initiation command
2207	CH16-COM.TP	CH16 command trip initiation command
2208	CH17-COM.TP	CH17 command trip initiation command
2209	CH18-COM.TP	CH18 command trip initiation command
2210	CH19-COM.TP	CH19 command trip initiation command
2211	CH20-COM.TP	CH20 command trip initiation command
2212	CH21-COM.TP	CH21 command trip initiation command
2213	CH22-COM.TP	CH22 command trip initiation command
2214	CH23-COM.TP	CH23 command trip initiation command
2215	CH24-COM.TP	CH24 command trip initiation command
2216	CH25-COM.TP	CH25 command trip initiation command
2217	CH26-COM.TP	CH26 command trip initiation command
2218	CH27-COM.TP	CH27 command trip initiation command
2219	CH28-COM.TP	CH28 command trip initiation command
2220	CH29-COM.TP	CH29 command trip initiation command
2221	CH30-COM.TP	CH30 command trip initiation command
2222	CH31-COM.TP	CH31 command trip initiation command
2223	CH32-COM.TP	CH32 command trip initiation command
2224		
2225		
2226	S1-ZAC.RESET	Section1 zero ampere control reset command
2227	S2-ZAC.RESET	Section2 zero ampere control reset command
2228	S3-ZAC.RESET	Section3 zero ampere control reset command
2229	S4-ZAC.RESET	Section4 zero ampere control reset command
2230	C1-ZAC.RESET	Coupler1 zero ampere control reset command

Signal list (Input for PLC)		
No.	Signal Name	Contents
2231	C2-ZAC.RESET	Coupler2 zero am pere control reset command
2232		
2233		
2234	E1-ZAC.RESET	End of section1 zero am pere control reset command
2235	E2-ZAC.RESET	End of section2 zero am pere control reset command
2236	E3-ZAC.RESET	End of section3 zero am pere control reset command
2237	E4-ZAC.RESET	End of section4 zero am pere control reset command
2238		
2239		
2240	CH1-CBFCB	CH1 CB for CBF initiation command
2241	CH2-CBFCB	CH2 CB for CBF initiation command
2242	CH3-CBFCB	CH3 CB for CBF initiation command
2243	CH4-CBFCB	CH4 CB for CBF initiation command
2244	CH5-CBFCB	CH5 CB for CBF initiation command
2245	CH6-CBFCB	CH6 CB for CBF initiation command
2246	CH7-CBFCB	CH7 CB for CBF initiation command
2247	CH8-CBFCB	CH8 CB for CBF initiation command
2248	CH9-CBFCB	CH9 CB for CBF initiation command
2249	CH10-CBFCB	CH10 CB for CBF initiation command
2250	CH11-CBFCB	CH11 CB for CBF initiation command
2251	CH12-CBFCB	CH12 CB for CBF initiation command
2252	CH13-CBFCB	CH13 CB for CBF initiation command
2253	CH14-CBFCB	CH14 CB for CBF initiation command
2254	CH15-CBFCB	CH15 CB for CBF initiation command
2255	CH16-CBFCB	CH16 CB for CBF initiation command
2256	CH17-CBFCB	CH17 CB for CBF initiation command
2257	CH18-CBFCB	CH18 CB for CBF initiation command
2258	CH19-CBFCB	CH19 CB for CBF initiation command
2259	CH20-CBFCB	CH20 CB for CBF initiation command
2260	CH21-CBFCB	CH21 CB for CBF initiation command
2261	CH22-CBFCB	CH22 CB for CBF initiation command
2262	CH23-CBFCB	CH23 CB for CBF initiation command
2263	CH24-CBFCB	CH24 CB for CBF initiation command
2264	CH25-CBFCB	CH25 CB for CBF initiation command
2265	CH26-CBFCB	CH26 CB for CBF initiation command
2266	CH27-CBFCB	CH27 CB for CBF initiation command
2267	CH28-CBFCB	CH28 CB for CBF initiation command
2268	CH29-CBFCB	CH29 CB for CBF initiation command
2269	CH30-CBFCB	CH30 CB for CBF initiation command
2270	CH31-CBFCB	CH31 CB for CBF initiation command
2271	CH32-CBFCB	CH32 CB for CBF initiation command
2272	BU1-OUT	BU1 out of service command
2273	BU2-OUT	BU2 out of service command
2274	BU3-OUT	BU3 out of service command
2275	BU4-OUT	BU4 out of service command
2276	BU5-OUT	BU5 out of service command
2277	BU6-OUT	BU6 out of service command
2278	BU7-OUT	BU7 out of service command
2279	BU8-OUT	BU8 out of service command
2280	BU9-OUT	BU9 out of service command
2281	BU10-OUT	BU10 out of service command
2282	BU11-OUT	BU11 out of service command
2283	BU12-OUT	BU12 out of service command
2284	BU13-OUT	BU13 out of service command
2285	BU14-OUT	BU14 out of service command
2286	BU15-OUT	BU15 out of service command
2287	BU16-OUT	BU16 out of service command
2288	BU17-OUT	BU17 out of service command
2289	BU18-OUT	BU18 out of service command
2290	BU19-OUT	BU19 out of service command
2291	BU20-OUT	BU20 out of service command
2292	BU21-OUT	BU21 out of service command
2293	BU22-OUT	BU22 out of service command
2294	BU23-OUT	BU23 out of service command
2295	BU24-OUT	BU24 out of service command
2296	BU25-OUT	BU25 out of service command
2297	BU26-OUT	BU26 out of service command
2298	BU27-OUT	BU27 out of service command
2299	BU28-OUT	BU28 out of service command
2300	BU29-OUT	BU29 out of service command

Signal list (Input for PLC)		
No.	Signal Name	Contents
2301	BU30-OUT	BU30 out of service command
2302	BU31-OUT	BU31 out of service command
2303	BU32-OUT	BU32 out of service command
2304		
2305		
2306		
2307		
2308		
2309		
2310		
2311		
2312		
2313		
2314		
2315		
2316		
2317		
2318		
2319		
2320		
2321		
2322		
2323		
2324		
2325		
2326		
2327		
2328	CH1-TP1	Binary output signal of CH1-TP1
2329	CH1-TP2	TP2
2330		
2331		
2332	CH1-BO3	BO3
2333	CH1-BO4	BO4
2334	CH1-BO5	BO5
2335	CH1-BO6	BO6
2336	CH2-TP1	Binary output signal of CH2-TP1
2337	CH2-TP2	TP2
2338		
2339		
2340	CH2-BO3	BO3
2341	CH2-BO4	BO4
2342	CH2-BO5	BO5
2343	CH2-BO6	BO6
2344	CH3-TP1	Binary output signal of CH3-TP1
2345	CH3-TP2	TP2
2346		
2347		
2348	CH3-BO3	BO3
2349	CH3-BO4	BO4
2350	CH3-BO5	BO5
2351	CH3-BO6	BO6
2352	CH4-TP1	Binary output signal of CH4-TP1
2353	CH4-TP2	TP2
2354		
2355		
2356	CH4-BO3	BO3
2357	CH4-BO4	BO4
2358	CH4-BO5	BO5
2359	CH4-BO6	BO6
2360	CH5-TP1	Binary output signal of CH5-TP1
2361	CH5-TP2	TP2
2362		
2363		
2364	CH5-BO3	BO3
2365	CH5-BO4	BO4
2366	CH5-BO5	BO5
2367	CH5-BO6	BO6
2368	CH6-TP1	Binary output signal of CH6-TP1
2369	CH6-TP2	TP2
2370		

Signal list (Input for PLC)		
No.	Signal Name	Contents
2371		
2372	CH6-BO3	BO3
2373	CH6-BO4	BO4
2374	CH6-BO5	BO5
2375	CH6-BO6	BO6
2376	CH7-TP1	Binary output signal of CH7-TP1
2377	CH7-TP2	TP2
2378		
2379		
2380	CH7-BO3	BO3
2381	CH7-BO4	BO4
2382	CH7-BO5	BO5
2383	CH7-BO6	BO6
2384	CH8-TP1	Binary output signal of CH8-TP1
2385	CH8-TP2	TP2
2386		
2387		
2388	CH8-BO3	BO3
2389	CH8-BO4	BO4
2390	CH8-BO5	BO5
2391	CH8-BO6	BO6
2392	CH9-TP1	Binary output signal of CH9-TP1
2393	CH9-TP2	TP2
2394		
2395		
2396	CH9-BO3	BO3
2397	CH9-BO4	BO4
2398	CH9-BO5	BO5
2399	CH9-BO6	BO6
2400	CH10-TP1	Binary output signal of CH10-TP1
2401	CH10-TP2	TP2
2402		
2403		
2404	CH10-BO3	BO3
2405	CH10-BO4	BO4
2406	CH10-BO5	BO5
2407	CH10-BO6	BO6
2408	CH11-TP1	Binary output signal of CH11-TP1
2409	CH11-TP2	TP2
2410		
2411		
2412	CH11-BO3	BO3
2413	CH11-BO4	BO4
2414	CH11-BO5	BO5
2415	CH11-BO6	BO6
2416	CH12-TP1	Binary output signal of CH12-TP1
2417	CH12-TP2	TP2
2418		
2419		
2420	CH12-BO3	BO3
2421	CH12-BO4	BO4
2422	CH12-BO5	BO5
2423	CH12-BO6	BO6
2424	CH13-TP1	Binary output signal of CH13-TP1
2425	CH13-TP2	TP2
2426		
2427		
2428	CH13-BO3	BO3
2429	CH13-BO4	BO4
2430	CH13-BO5	BO5
2431	CH13-BO6	BO6
2432	CH14-TP1	Binary output signal of CH14-TP1
2433	CH14-TP2	TP2
2434		
2435		
2436	CH14-BO3	BO3
2437	CH14-BO4	BO4
2438	CH14-BO5	BO5
2439	CH14-BO6	BO6
2440	CH15-TP1	Binary output signal of CH15-TP1

Signal list (Input for PLC)		
No.	Signal Name	Contents
2441	CH15-TP2	TP2
2442		
2443		
2444	CH15-BO3	BO3
2445	CH15-BO4	BO4
2446	CH15-BO5	BO5
2447	CH15-BO6	BO6
2448	CH16-TP1	Binary output signal of CH16-TP1
2449	CH16-TP2	TP2
2450		
2451		
2452	CH16-BO3	BO3
2453	CH16-BO4	BO4
2454	CH16-BO5	BO5
2455	CH16-BO6	BO6
2456	CH17-TP1	Binary output signal of CH17-TP1
2457	CH17-TP2	TP2
2458		
2459		
2460	CH17-BO3	BO3
2461	CH17-BO4	BO4
2462	CH17-BO5	BO5
2463	CH17-BO6	BO6
2464	CH18-TP1	Binary output signal of CH18-TP1
2465	CH18-TP2	TP2
2466		
2467		
2468	CH18-BO3	BO3
2469	CH18-BO4	BO4
2470	CH18-BO5	BO5
2471	CH18-BO6	BO6
2472	CH19-TP1	Binary output signal of CH19-TP1
2473	CH19-TP2	TP2
2474		
2475		
2476	CH19-BO3	BO3
2477	CH19-BO4	BO4
2478	CH19-BO5	BO5
2479	CH19-BO6	BO6
2480	CH20-TP1	Binary output signal of CH20-TP1
2481	CH20-TP2	TP2
2482		
2483		
2484	CH20-BO3	BO3
2485	CH20-BO4	BO4
2486	CH20-BO5	BO5
2487	CH20-BO6	BO6
2488	CH21-TP1	Binary output signal of CH21-TP1
2489	CH21-TP2	TP2
2490		
2491		
2492	CH21-BO3	BO3
2493	CH21-BO4	BO4
2494	CH21-BO5	BO5
2495	CH21-BO6	BO6
2496	CH22-TP1	Binary output signal of CH22-TP1
2497	CH22-TP2	TP2
2498		
2499		
2500	CH22-BO3	BO3
2501	CH22-BO4	BO4
2502	CH22-BO5	BO5
2503	CH22-BO6	BO6
2504	CH23-TP1	Binary output signal of CH23-TP1
2505	CH23-TP2	TP2
2506		
2507		
2508	CH23-BO3	BO3
2509	CH23-BO4	BO4
2510	CH23-BO5	BO5

Signal list (Input for PLC)		
No.	Signal Name	Contents
2511	CH23-BO6	BO6
2512	CH24-TP1	Binary output signal of CH24-TP1
2513	CH24-TP2	TP2
2514		
2515		
2516	CH24-BO3	BO3
2517	CH24-BO4	BO4
2518	CH24-BO5	BO5
2519	CH24-BO6	BO6
2520	CH25-TP1	Binary output signal of CH25-TP1
2521	CH25-TP2	TP2
2522		
2523		
2524	CH25-BO3	BO3
2525	CH25-BO4	BO4
2526	CH25-BO5	BO5
2527	CH25-BO6	BO6
2528	CH26-TP1	Binary output signal of CH26-TP1
2529	CH26-TP2	TP2
2530		
2531		
2532	CH26-BO3	BO3
2533	CH26-BO4	BO4
2534	CH26-BO5	BO5
2535	CH26-BO6	BO6
2536	CH27-TP1	Binary output signal of CH27-TP1
2537	CH27-TP2	TP2
2538		
2539		
2540	CH27-BO3	BO3
2541	CH27-BO4	BO4
2542	CH27-BO5	BO5
2543	CH27-BO6	BO6
2544	CH28-TP1	Binary output signal of CH28-TP1
2545	CH28-TP2	TP2
2546		
2547		
2548	CH28-BO3	BO3
2549	CH28-BO4	BO4
2550	CH28-BO5	BO5
2551	CH28-BO6	BO6
2552	CH29-TP1	Binary output signal of CH29-TP1
2553	CH29-TP2	TP2
2554		
2555		
2556	CH29-BO3	BO3
2557	CH29-BO4	BO4
2558	CH29-BO5	BO5
2559	CH29-BO6	BO6
2560	CH30-TP1	Binary output signal of CH30-TP1
2561	CH30-TP2	TP2
2562		
2563		
2564	CH30-BO3	BO3
2565	CH30-BO4	BO4
2566	CH30-BO5	BO5
2567	CH30-BO6	BO6
2568	CH31-TP1	Binary output signal of CH31-TP1
2569	CH31-TP2	TP2
2570		
2571		
2572	CH31-BO3	BO3
2573	CH31-BO4	BO4
2574	CH31-BO5	BO5
2575	CH31-BO6	BO6
2576	CH32-TP1	Binary output signal of CH32-TP1
2577	CH32-TP2	TP2
2578		
2579		
2580	CH32-BO3	BO3

Signal list (Input for PLC)		
No.	Signal Name	Contents
2581	CH32-BO4	BO4
2582	CH32-BO5	BO5
2583	CH32-BO6	BO6
2584		
2585		
2586		
2587		
2588		
2589		
2590		
2591		
2592		
2593		
2594		
2595		
2596		
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2599		
2600		
2601		
2602		
2603		
2604		
2605		
2606		
2607		
2608		
2609		
2610		
2611		LED1 lit output (reserved)
2612		LED2 lit output (reserved)
2613		LED3 lit output (reserved)
2614		LED4 lit output (reserved)
2615		LED5 lit output (reserved)
2616		LED6 lit output (reserved)
2617		LED7 lit output (reserved)
2618		LED8 lit output (reserved)
2619		
2620		
2621		
2622		
2623		
2624	F.RECORD1	Fault record stored command 1
2625		2 (reserved)
2626		3 (reserved)
2627		4 (reserved)
2628	F.RCD_MODE	Fault record mode command (COM trip)
2629		
2630		
2631		
2632	D.RECORD1	Disturbance record stored command 1
2633	D.RECORD2	2
2634	D.RECORD3	3
2635	D.RECORD4	4
2636		5 (reserved)
2637		6 (reserved)
2638		7 (reserved)
2639		8 (reserved)
2640	SET.GROUP1	Active setting group changed command (Change to group 1)
2641	SET.GROUP2	2
2642	SET.GROUP3	3
2643	SET.GROUP4	4
2644		5 (rsv)
2645		6 (rsv)
2646		7 (rsv)
2647		8 (rsv)
2648		Clock synchronized command (reserved)
2649		
2650		

Signal list (Input for PLC)		
No.	Signal Name	Contents
2651		
2652		
2653		
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2663		
2664		
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2680		
2681		
2682		
2683		
2684		Auto-recloser inactivate command received (reserved)
2685		Teleprotection inactivate command received (reserved)
2686	PROT_COM_RECV	protection inactivate command received
2687		
2688	TPLED_RST_RCV	TRIP LED RESET command received
2689		
2690		
2691		
2692		
2693		
2694		
2695		
2696		
2697		
2698		
2699		
2700		
2701		
2702		
2703		
2704		
2705		
2706		
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2718		
2719		
2720		

Signal list (Input for PLC)		
No.	Signal Name	Contents
2721		
2722		
2723		
2724		
2725		
2726		
2727		
2728		
2729		
2730		
2731		
2732		
2733		
2734		
2735		
2736		
2737		
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2743		
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2745		
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2748		
2749		
2750		
2751		
2752	CH1-EFPTR_R	Required condition for EFP transfer trip
2753	CH2-EFPTR_R	ditto
2754	CH3-EFPTR_R	ditto
2755	CH4-EFPTR_R	ditto
2756	CH5-EFPTR_R	ditto
2757	CH6-EFPTR_R	ditto
2758	CH7-EFPTR_R	ditto
2759	CH8-EFPTR_R	ditto
2760	CH9-EFPTR_R	ditto
2761	CH10-EFPTR_R	ditto
2762	CH11-EFPTR_R	ditto
2763	CH12-EFPTR_R	ditto
2764	CH13-EFPTR_R	ditto
2765	CH14-EFPTR_R	ditto
2766	CH15-EFPTR_R	ditto
2767	CH16-EFPTR_R	ditto
2768	CH17-EFPTR_R	ditto
2769	CH18-EFPTR_R	ditto
2770	CH19-EFPTR_R	ditto
2771	CH20-EFPTR_R	ditto
2772	CH21-EFPTR_R	ditto
2773	CH22-EFPTR_R	ditto
2774	CH23-EFPTR_R	ditto
2775	CH24-EFPTR_R	ditto
2776	CH25-EFPTR_R	ditto
2777	CH26-EFPTR_R	ditto
2778	CH27-EFPTR_R	ditto
2779	CH28-EFPTR_R	ditto
2780	CH29-EFPTR_R	ditto
2781	CH30-EFPTR_R	ditto
2782	CH31-EFPTR_R	ditto
2783	CH32-EFPTR_R	ditto
2784	CH1-EFPTR_ON	EFP transfer trip enable command
2785	CH2-EFPTR_ON	ditto
2786	CH3-EFPTR_ON	ditto
2787	CH4-EFPTR_ON	ditto
2788	CH5-EFPTR_ON	ditto
2789	CH6-EFPTR_ON	ditto
2790	CH7-EFPTR_ON	ditto

Signal list (Input for PLC)

No.	Signal Name	Contents
2791	CH8-EFPTR_ON	ditto
2792	CH9-EFPTR_ON	ditto
2793	CH10-EFPTR_ON	ditto
2794	CH11-EFPTR_ON	ditto
2795	CH12-EFPTR_ON	ditto
2796	CH13-EFPTR_ON	ditto
2797	CH14-EFPTR_ON	ditto
2798	CH15-EFPTR_ON	ditto
2799	CH16-EFPTR_ON	ditto
2800	CH17-EFPTR_ON	ditto
2801	CH18-EFPTR_ON	ditto
2802	CH19-EFPTR_ON	ditto
2803	CH20-EFPTR_ON	ditto
2804	CH21-EFPTR_ON	ditto
2805	CH22-EFPTR_ON	ditto
2806	CH23-EFPTR_ON	ditto
2807	CH24-EFPTR_ON	ditto
2808	CH25-EFPTR_ON	ditto
2809	CH26-EFPTR_ON	ditto
2810	CH27-EFPTR_ON	ditto
2811	CH28-EFPTR_ON	ditto
2812	CH29-EFPTR_ON	ditto
2813	CH30-EFPTR_ON	ditto
2814	CH31-EFPTR_ON	ditto
2815	CH32-EFPTR_ON	ditto
2816	TEMP001	
2817	TEMP002	
2818	TEMP003	
2819	TEMP004	
2820	TEMP005	
2821	TEMP006	
2822	TEMP007	
2823	TEMP008	
2824	TEMP009	
2825	TEMP010	
2826	TEMP011	
2827	TEMP012	
2828	TEMP013	
2829	TEMP014	
2830	TEMP015	
2831	TEMP016	
2832	TEMP017	
2833	TEMP018	
2834	TEMP019	
2835	TEMP020	
2836	TEMP021	
2837	TEMP022	
2838	TEMP023	
2839	TEMP024	
2840	TEMP025	
2841	TEMP026	
2842	TEMP027	
2843	TEMP028	
2844	TEMP029	
2845	TEMP030	
2846	TEMP031	
2847	TEMP032	
2848	TEMP033	
2849	TEMP034	
2850	TEMP035	
2851	TEMP036	
2852	TEMP037	
2853	TEMP038	
2854	TEMP039	
2855	TEMP040	
2856	TEMP041	
2857	TEMP042	
2858	TEMP043	
2859	TEMP044	
2860	TEMP045	

Signal list (Input for PLC)		
No.	Signal Name	Contents
2861	TEMP046	
2862	TEMP047	
2863	TEMP048	
2864	TEMP049	
2865	TEMP050	
2866	TEMP051	
2867	TEMP052	
2868	TEMP053	
2869	TEMP054	
2870	TEMP055	
2871	TEMP056	
2872	TEMP057	
2873	TEMP058	
2874	TEMP059	
2875	TEMP060	
2876	TEMP061	
2877	TEMP062	
2878	TEMP063	
2879	TEMP064	
2880	TEMP065	
2881	TEMP066	
2882	TEMP067	
2883	TEMP068	
2884	TEMP069	
2885	TEMP070	
2886	TEMP071	
2887	TEMP072	
2888	TEMP073	
2889	TEMP074	
2890	TEMP075	
2891	TEMP076	
2892	TEMP077	
2893	TEMP078	
2894	TEMP079	
2895	TEMP080	
2896	TEMP081	
2897	TEMP082	
2898	TEMP083	
2899	TEMP084	
2900	TEMP085	
2901	TEMP086	
2902	TEMP087	
2903	TEMP088	
2904	TEMP089	
2905	TEMP090	
2906	TEMP091	
2907	TEMP092	
2908	TEMP093	
2909	TEMP094	
2910	TEMP095	
2911	TEMP096	
2912	TEMP097	
2913	TEMP098	
2914	TEMP099	
2915	TEMP100	
2916	TEMP101	
2917	TEMP102	
2918	TEMP103	
2919	TEMP104	
2920	TEMP105	
2921	TEMP106	
2922	TEMP107	
2923	TEMP108	
2924	TEMP109	
2925	TEMP110	
2926	TEMP111	
2927	TEMP112	
2928	TEMP113	
2929	TEMP114	
2930	TEMP115	

Signal list (Input for PLC)		
No.	Signal Name	Contents
2931	TEMP116	
2932	TEMP117	
2933	TEMP118	
2934	TEMP119	
2935	TEMP120	
2936	TEMP121	
2937	TEMP122	
2938	TEMP123	
2939	TEMP124	
2940	TEMP125	
2941	TEMP126	
2942	TEMP127	
2943	TEMP128	
2944	TEMP129	
2945	TEMP130	
2946	TEMP131	
2947	TEMP132	
2948	TEMP133	
2949	TEMP134	
2950	TEMP135	
2951	TEMP136	
2952	TEMP137	
2953	TEMP138	
2954	TEMP139	
2955	TEMP140	
2956	TEMP141	
2957	TEMP142	
2958	TEMP143	
2959	TEMP144	
2960	TEMP145	
2961	TEMP146	
2962	TEMP147	
2963	TEMP148	
2964	TEMP149	
2965	TEMP150	
2966	TEMP151	
2967	TEMP152	
2968	TEMP153	
2969	TEMP154	
2970	TEMP155	
2971	TEMP156	
2972	TEMP157	
2973	TEMP158	
2974	TEMP159	
2975	TEMP160	
2976	TEMP161	
2977	TEMP162	
2978	TEMP163	
2979	TEMP164	
2980	TEMP165	
2981	TEMP166	
2982	TEMP167	
2983	TEMP168	
2984	TEMP169	
2985	TEMP170	
2986	TEMP171	
2987	TEMP172	
2988	TEMP173	
2989	TEMP174	
2990	TEMP175	
2991	TEMP176	
2992	TEMP177	
2993	TEMP178	
2994	TEMP179	
2995	TEMP180	
2996	TEMP181	
2997	TEMP182	
2998	TEMP183	
2999	TEMP184	
3000	TEMP185	

Signal list (Input for PLC)

No.	Signal Name	Contents
3001	TEMP186	
3002	TEMP187	
3003	TEMP188	
3004	TEMP189	
3005	TEMP190	
3006	TEMP191	
3007	TEMP192	
3008	TEMP193	
3009	TEMP194	
3010	TEMP195	
3011	TEMP196	
3012	TEMP197	
3013	TEMP198	
3014	TEMP199	
3015	TEMP200	
3016	TEMP201	
3017	TEMP202	
3018	TEMP203	
3019	TEMP204	
3020	TEMP205	
3021	TEMP206	
3022	TEMP207	
3023	TEMP208	
3024	TEMP209	
3025	TEMP210	
3026	TEMP211	
3027	TEMP212	
3028	TEMP213	
3029	TEMP214	
3030	TEMP215	
3031	TEMP216	
3032	TEMP217	
3033	TEMP218	
3034	TEMP219	
3035	TEMP220	
3036	TEMP221	
3037	TEMP222	
3038	TEMP223	
3039	TEMP224	
3040	TEMP225	
3041	TEMP226	
3042	TEMP227	
3043	TEMP228	
3044	TEMP229	
3045	TEMP230	
3046	TEMP231	
3047	TEMP232	
3048	TEMP233	
3049	TEMP234	
3050	TEMP235	
3051	TEMP236	
3052	TEMP237	
3053	TEMP238	
3054	TEMP239	
3055	TEMP240	
3056	TEMP241	
3057	TEMP242	
3058	TEMP243	
3059	TEMP244	
3060	TEMP245	
3061	TEMP246	
3062	TEMP247	
3063	TEMP248	
3064	TEMP249	
3065	TEMP250	
3066	TEMP251	
3067	TEMP252	
3068	TEMP253	
3069	TEMP254	
3070	TEMP255	
3071	TEMP256	

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Appendix D

Variable Timer List

Variable Timer List

Timer	Timer No.	Contents	Timer	Timer No.	Contents
T1BF1	1	CH1 BF retrip	T26BF1	51	CH26 BF retrip
T1BF2	2	CH1 BF trip	T26BF2	52	CH26 BF trip
T2BF1	3	CH2 BF retrip	T27BF1	53	CH27 BF retrip
T2BF2	4	CH2 BF trip	T27BF2	54	CH27 BF trip
T3BF1	5	CH3 BF retrip	T28BF1	55	CH28 BF retrip
T3BF2	6	CH3 BF trip	T28BF2	56	CH28 BF trip
T4BF1	7	CH4 BF retrip	T29BF1	57	CH29 BF retrip
T4BF2	8	CH4 BF trip	T29BF2	58	CH29 BF trip
T5BF1	9	CH5 BF retrip	T30BF1	59	CH30 BF retrip
T5BF2	10	CH5 BF trip	T30BF2	60	CH30 BF trip
T6BF1	11	CH6 BF retrip	T31BF1	61	CH31 BF retrip
T6BF2	12	CH6 BF trip	T31BF2	62	CH31 BF trip
T7BF1	13	CH7 BF retrip	T32BF1	63	CH32 BF retrip
T7BF2	14	CH7 BF trip	T32BF2	64	CH32 BF trip
T8BF1	15	CH8 BF retrip	TIDSV	65	Id err detected time
T8BF2	16	CH8 BF trip	TBRDG	66	Busbar bridge alarm time
T9BF1	17	CH9 BF retrip		67	
T9BF2	18	CH9 BF trip		68	
T10BF1	19	CH10 BF retrip		69	
T10BF2	20	CH10 BF trip		70	
T11BF1	21	CH11 BF retrip		71	
T11BF2	22	CH11 BF trip		72	
T12BF1	23	CH12 BF retrip		73	
T12BF2	24	CH12 BF trip		74	
T13BF1	25	CH13 BF retrip		75	
T13BF2	26	CH13 BF trip		76	
T14BF1	27	CH14 BF retrip		77	
T14BF2	28	CH14 BF trip		78	
T15BF1	29	CH15 BF retrip		79	
T15BF2	30	CH15 BF trip		80	
T16BF1	31	CH16 BF retrip		81	
T16BF2	32	CH16 BF trip		82	
T17BF1	33	CH17 BF retrip		83	
T17BF2	34	CH17 BF trip		84	
T18BF1	35	CH18 BF retrip		85	
T18BF2	36	CH18 BF trip		86	
T19BF1	37	CH19 BF retrip		87	
T19BF2	38	CH19 BF trip		88	
T20BF1	39	CH20 BF retrip		89	
T20BF2	40	CH20 BF trip		90	
T21BF1	41	CH21 BF retrip		91	
T21BF2	42	CH21 BF trip		92	
T22BF1	43	CH22 BF retrip		93	
T22BF2	44	CH22 BF trip		94	
T23BF1	45	CH23 BF retrip		95	
T23BF2	46	CH23 BF trip		96	
T24BF1	47	CH24 BF retrip		97	
T24BF2	48	CH24 BF trip		98	
T25BF1	49	CH25 BF retrip		99	
T25BF2	50	CH25 BF trip		100	

Appendix E

Binary Output Default Setting List

Binary Output Default Setting List

Relay Model	Module Name	BO No.	Terminal No.	Signal Name	Contents	Setting		
						Signal No.	LOGIC (OR:1, AND:2)	BOTD (OFF:0, ON:1)
C***	CU-IO#1	BO1						
		BO2						
		BO3						
	CU-IO#2	BO1		ZONE-A TRIP		1237	1	1
		BO2		ZONE-B TRIP		1238	1	1
		BO3		ZONE-C TRIP		1239	1	1
		BO4		ZONE-D TRIP		1240	1	1
		BO5		BP-TRIP		1009	1	1
		BO6		BP-TRIP		1009	1	1
		BO7		CBF-RETRIP		1010	1	1
		BO8		CBF-RETRIP		1010	1	1
		BO9		CBF-TRIP		1011	1	1
		BO10		CBF-TRIP		1011	1	1
		BO11		CBF-TRANSFER		1012	1	1
		BO12		CBF-TRANSFER		1012	1	1
		BO13		RLY FAIL-A		1258	1	1
							--	--
B***	CH1	BO1		CH1-CBF, TR		1173	1	1
		BO2		CH1-BPTP, CH1-CBFRETP, CH1-CBFTP		1077, 1109 1141	1	1
		BO3						
		BO4						
		BO5						
		BO6						
	CH2	BO1		CH2-CBF, TR		1174	1	1
		BO2		CH2-BPTP, CH2-CBFRETP, CH2-CBFTP		1078, 1110 1142	1	1
		BO3						
		BO4						
		BO5						
		BO6						
	CH3	BO1		CH3-CBF, TR		1175	1	1
		BO2		CH3-BPTP, CH3-CBFRETP, CH3-CBFTP		1079, 1111 1143	1	1
		BO3						
		BO4						
		BO5						
		BO6						
	CH4	BO1		CH4-CBF, TR		1176	1	1
		BO2		CH4-BPTP, CH4-CBFRETP, CH4-CBFTP		1080, 1112 1144	1	1
		BO3						
		BO4						
		BO5						
		BO6						
	CH5	BO1		CH5-CBF, TR		1177	1	1
		BO2		CH5-BPTP, CH5-CBFRETP, CH5-CBFTP		1081, 1113 1145	1	1
		BO3						
		BO4						
		BO5						
		BO6						
	CH6	BO1		CH6-CBF, TR		1178	1	1
		BO2		CH6-BPTP, CH6-CBFRETP, CH6-CBFTP		1082, 1114 1146	1	1
		BO3						
		BO4						
		BO5						
		BO6						

CH7	BO1 BO2 BO3 BO4 BO5 BO6	CH7-CBF, TR CH7-BPTP, CH7-CBFRETP, CH7-CBFTP		1179 1083, 1115 1147	1 1	1 1
CH8	BO1 BO2 BO3 BO4 BO5 BO6	CH8-CBF, TR CH8-BPTP, CH8-CBFRETP, CH8-CBFTP		1180 1084, 1116 1148	1 1	1 1
CH9	BO1 BO2 BO3 BO4 BO5 BO6	CH9-CBF, TR CH9-BPTP, CH9-CBFRETP, CH9-CBFTP		1181 1085, 1117 1149	1 1	1 1
CH10	BO1 BO2 BO3 BO4 BO5 BO6	CH10-CBF, TR CH10-BPTP, CH10-CBFRETP, CH10-CBFTP		1182 1086, 1118 1150	1 1	1 1
CH11	BO1 BO2 BO3 BO4 BO5 BO6	CH11-CBF, TR CH11-BPTP, CH11-CBFRETP, CH11-CBFTP		1183 1087, 1119 1151	1 1	1 1
CH12	BO1 BO2 BO3 BO4 BO5 BO6	CH12-CBF, TR CH12-BPTP, CH12-CBFRETP, CH12-CBFTP		1184 1088, 1120 1152	1 1	1 1
CH13	BO1 BO2 BO3 BO4 BO5 BO6	CH13-CBF, TR CH13-BPTP, CH13-CBFRETP, CH13-CBFTP		1185 1089, 1121 1153	1 1	1 1
CH14	BO1 BO2 BO3 BO4 BO5 BO6	CH14-CBF, TR CH14-BPTP, CH14-CBFRETP, CH14-CBFTP		1186 1090, 1122 1154	1 1	1 1
CH15	BO1 BO2 BO3 BO4 BO5 BO6	CH15-CBF, TR CH15-BPTP, CH15-CBFRETP, CH15-CBFTP		1187 1091, 1123 1155	1 1	1 1

CH16	BO1 BO2 BO3 BO4 BO5 BO6	CH16-CBF, TR CH16-BPTP, CH16-CBFRETP, CH16-CBFTP		1188 1092, 1124 1156	1 1	1 1
CH17	BO1 BO2 BO3 BO4 BO5 BO6	CH17-CBF, TR CH17-BPTP, CH17-CBFRETP, CH17-CBFTP		1189 1093, 1125 1157	1 1	1 1
CH18	BO1 BO2 BO3 BO4 BO5 BO6	CH18-CBF, TR CH18-BPTP, CH18-CBFRETP, CH18-CBFTP		1190 1094, 1126 1158	1 1	1 1
CH19	BO1 BO2 BO3 BO4 BO5 BO6	CH19-CBF, TR CH19-BPTP, CH19-CBFRETP, CH19-CBFTP		1191 1095, 1127 1159	1 1	1 1
CH20	BO1 BO2 BO3 BO4 BO5 BO6	CH20-CBF, TR CH20-BPTP, CH20-CBFRETP, CH20-CBFTP		1192 1096, 1128 1160	1 1	1 1
CH21	BO1 BO2 BO3 BO4 BO5 BO6	CH21-CBF, TR CH21-BPTP, CH21-CBFRETP, CH21-CBFTP		1193 1097, 1129 1161	1 1	1 1
CH22	BO1 BO2 BO3 BO4 BO5 BO6	CH22-CBF, TR CH22-BPTP, CH22-CBFRETP, CH22-CBFTP		1194 1098, 1130 1162	1 1	1 1
CH23	BO1 BO2 BO3 BO4 BO5 BO6	CH23-CBF, TR CH23-BPTP, CH23-CBFRETP, CH23-CBFTP		1195 1099, 1131 1163	1 1	1 1
CH24	BO1 BO2 BO3 BO4 BO5 BO6	CH24-CBF, TR CH24-BPTP, CH24-CBFRETP, CH24-CBFTP		1196 1100, 1132 1164	1 1	1 1

CH25	BO1	CH25-CBF, TR CH25-BPTP, CH25-CBFRETP, CH25-CBFTP		1197 1101, 1133 1165	1 1	1 1
	BO2					
	BO3					
	BO4					
	BO5					
	BO6					
CH26	BO1	CH26-CBF, TR CH26-BPTP, CH26-CBFRETP, CH26-CBFTP		1198 1102, 1134 1166	1 1	1 1
	BO2					
	BO3					
	BO4					
	BO5					
	BO6					
CH27	BO1	CH27-CBF, TR CH27-BPTP, CH27-CBFRETP, CH27-CBFTP		1199 1103, 1135 1167	1 1	1 1
	BO2					
	BO3					
	BO4					
	BO5					
	BO6					
CH28	BO1	CH28-CBF, TR CH28-BPTP, CH28-CBFRETP, CH28-CBFTP		1200 1104, 1136 1168	1 1	1 1
	BO2					
	BO3					
	BO4					
	BO5					
	BO6					
CH29	BO1	CH29-CBF, TR CH29-BPTP, CH29-CBFRETP, CH29-CBFTP		1201 1105, 1137 1169	1 1	1 1
	BO2					
	BO3					
	BO4					
	BO5					
	BO6					
CH30	BO1	CH30-CBF, TR CH30-BPTP, CH30-CBFRETP, CH30-CBFTP		1202 1106, 1138 1170	1 1	1 1
	BO2					
	BO3					
	BO4					
	BO5					
	BO6					
CH31	BO1	CH31-CBF, TR CH31-BPTP, CH31-CBFRETP, CH31-CBFTP		1203 1107, 1139 1171	1 1	1 1
	BO2					
	BO3					
	BO4					
	BO5					
	BO6					
CH32	BO1	CH32-CBF, TR CH32-BPTP, CH32-CBFRETP, CH32-CBFTP		1204 1108, 1140 1172	1 1	1 1
	BO2					
	BO3					
	BO4					
	BO5					
	BO6					

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Appendix F

Disturbance Record Signal List

Analog signals

No.	Name	Contents	No.	Name	Contents	No.	Name	Contents
1	VaA	A-phase voltage of ZoneA	37	9la	A-phase current of CH9			
2	VbA	B-phase voltage of ZoneA	38	9lb	B-phase current of CH9			
3	VcA	C-phase voltage of ZoneA	39	9lc	C-phase current of CH9			
4	VaB	A-phase voltage of ZoneB	40	10la	A-phase current of CH10			
5	VbB	B-phase voltage of ZoneB	41	10lb	B-phase current of CH10			
6	VcB	C-phase voltage of ZoneB	42	10lc	C-phase current of CH10			
7	VaC	A-phase voltage of ZoneC	43	11la	A-phase current of CH11			
8	VbC	B-phase voltage of ZoneC	44	11lb	B-phase current of CH11			
9	VcC	C-phase voltage of ZoneC	45	11lc	C-phase current of CH11			
10	VaD	A-phase voltage of ZoneD	46	12la	A-phase current of CH12			
11	VbD	B-phase voltage of ZoneD	47	12lb	B-phase current of CH12			
12	VcD	C-phase voltage of ZoneD	48	12lc	C-phase current of CH12			
13	1la	A-phase current of CH1	49	13la	A-phase current of CH13			
14	1lb	B-phase current of CH1	50	13lb	B-phase current of CH13			
15	1lc	C-phase current of CH1	51	13lc	C-phase current of CH13			
16	2la	A-phase current of CH2	52	14la	A-phase current of CH14			
17	2lb	B-phase current of CH2	53	14lb	B-phase current of CH14			
18	2lc	C-phase current of CH2	54	14lc	C-phase current of CH14			
19	3la	A-phase current of CH3	55	15la	A-phase current of CH15			
20	3lb	B-phase current of CH3	56	15lb	B-phase current of CH15			
21	3lc	C-phase current of CH3	57	15lc	C-phase current of CH15			
22	4la	A-phase current of CH4	58	16la	A-phase current of CH16			
23	4lb	B-phase current of CH4	59	16lb	B-phase current of CH16			
24	4lc	C-phase current of CH4	60	16lc	C-phase current of CH16			
25	5la	A-phase current of CH5	61	17la	A-phase current of CH17			
26	5lb	B-phase current of CH5	62	17lb	B-phase current of CH17			
27	5lc	C-phase current of CH5	63	17lc	C-phase current of CH17			
28	6la	A-phase current of CH6	64	18la	A-phase current of CH18			
29	6lb	B-phase current of CH6	65	18lb	B-phase current of CH18			
30	6lc	C-phase current of CH6	66	18lc	C-phase current of CH18			
31	7la	A-phase current of CH7	67	19la	A-phase current of CH19			
32	7lb	B-phase current of CH7	68	19lb	B-phase current of CH19			
33	7lc	C-phase current of CH7	69	19lc	C-phase current of CH19			
34	8la	A-phase current of CH8	70	20la	A-phase current of CH20			
35	8lb	B-phase current of CH8	71	20lb	B-phase current of CH20			
36	8lc	C-phase current of CH8	72	20lc	C-phase current of CH20			

Binary signals

No.	Name	Contents	No.	Name	Contents
1	DIFCH-A	A-phase output of DIFCH	65	CH1 TRIP	CH1 trip (OR output of BP trip, CBF retrip and CBF trip)
2	DIFCH-B	B-phase output of DIFCH	66	CH2 TRIP	CH2 trip (ditto)
3	DIFCH-C	C-phase output of DIFCH	67	CH3 TRIP	CH3 trip (ditto)
4	DIFZA-A	A-phase output of DIFZA	68	CH4 TRIP	CH4 trip (ditto)
5	DIFZA-B	B-phase output of DIFZA	69	CH5 TRIP	CH5 trip (ditto)
6	DIFZA-C	C-phase output of DIFZA	70	CH6 TRIP	CH6 trip (ditto)
7	DIFZB-A	A-phase output of DIFZB	71	CH7 TRIP	CH7 trip (ditto)
8	DIFZB-B	B-phase output of DIFZB	72	CH8 TRIP	CH8 trip (ditto)
9	DIFZB-C	C-phase output of DIFZB	73	CH9 TRIP	CH9 trip (ditto)
10	DIFZC-A	A-phase output of DIFZC	74	CH10 TRIP	CH10 trip (ditto)
11	DIFZC-B	B-phase output of DIFZC	75	CH11 TRIP	CH11 trip (ditto)
12	DIFZC-C	C-phase output of DIFZC	76	CH12 TRIP	CH12 trip (ditto)
13	DIFZD-A	A-phase output of DIFZD	77	CH13 TRIP	CH13 trip (ditto)
14	DIFZD-B	B-phase output of DIFZD	78	CH14 TRIP	CH14 trip (ditto)
15	DIFZD-C	C-phase output of DIFZD	79	CH15 TRIP	CH15 trip (ditto)
16			80	CH16 TRIP	CH16 trip (ditto)
17	ZA trip	Busbar protection Zone A trip	81	CH17 TRIP	CH17 trip (ditto)
18	ZB trip	Busbar protection Zone B trip	82	CH18 TRIP	CH18 trip (ditto)
19	ZC trip	Busbar protection Zone C trip	83	CH19 TRIP	CH19 trip (ditto)
20	ZD trip	Busbar protection Zone D trip	84	CH20 TRIP	CH20 trip (ditto)
21	CBF-retrip	CBF retrip (OR output of CH1 to CH32)	85		
22	CBF-trip	CBF trip (OR output of CH1 to CH32)	86		
23	CBF-TR	CBF transfer trip (OR output of CH1 to CH32)	87		
24	DIFCH-BLK-OR	OR output of DIFCH-BLK-A, -B and -C elements	88		
25	DIFZA-BLK-OR	OR output of DIFZA-BLK-A, -B and -C elements	89		
26	DIFZB-BLK-OR	OR output of DIFZB-BLK-A, -B and -C elements	90		
27	DIFZC-BLK-OR	OR output of DIFZC-BLK-A, -B and -C elements	91		
28	DIFZD-BLK-OR	OR output of DIFZD-BLK-A, -B and -C elements	92		
29	UV-ZA	OR output of UVG-ZA and UVS-ZA	93		
30	UV-ZB	OR output of UVG-ZB and UVS-ZB	94		
31	UV-ZC	OR output of UVG-ZC and UVS-ZC	95		
32	UV-ZD	OR output of UVG-ZD and UVS-ZD	96		
33	10CBF-OR	OR output of 10CBF-BLK-A, -B and -C elements	97	CH1 CBF-TR	CH1 CBF transfer signal
34	20CBF-OR	OR output of 20CBF-BLK-A, -B and -C elements	98	CH2 CBF-TR	CH2 CBF transfer signal
35	30CBF-OR	OR output of 30CBF-BLK-A, -B and -C elements	99	CH3 CBF-TR	CH3 CBF transfer signal
36	40CBF-OR	OR output of 40CBF-BLK-A, -B and -C elements	100	CH4 CBF-TR	CH4 CBF transfer signal
37	50CBF-OR	OR output of 50CBF-BLK-A, -B and -C elements	101	CH5 CBF-TR	CH5 CBF transfer signal
38	60CBF-OR	OR output of 60CBF-BLK-A, -B and -C elements	102	CH6 CBF-TR	CH6 CBF transfer signal
39	70CBF-OR	OR output of 70CBF-BLK-A, -B and -C elements	103	CH7 CBF-TR	CH7 CBF transfer signal
40	80CBF-OR	OR output of 80CBF-BLK-A, -B and -C elements	104	CH8 CBF-TR	CH8 CBF transfer signal
41	90CBF-OR	OR output of 90CBF-BLK-A, -B and -C elements	105	CH9 CBF-TR	CH9 CBF transfer signal
42	100CBF-OR	OR output of 100CBF-BLK-A, -B and -C elements	106	CH10 CBF-TR	CH10 CBF transfer signal
43	110CBF-OR	OR output of 110CBF-BLK-A, -B and -C elements	107	CH11 CBF-TR	CH11 CBF transfer signal
44	120CBF-OR	OR output of 120CBF-BLK-A, -B and -C elements	108	CH12 CBF-TR	CH12 CBF transfer signal
45	130CBF-OR	OR output of 130CBF-BLK-A, -B and -C elements	109	CH13 CBF-TR	CH13 CBF transfer signal
46	140CBF-OR	OR output of 140CBF-BLK-A, -B and -C elements	110	CH14 CBF-TR	CH14 CBF transfer signal
47	150CBF-OR	OR output of 150CBF-BLK-A, -B and -C elements	111	CH15 CBF-TR	CH15 CBF transfer signal
48	160CBF-OR	OR output of 160CBF-BLK-A, -B and -C elements	112	CH16 CBF-TR	CH16 CBF transfer signal
49	170CBF-OR	OR output of 170CBF-BLK-A, -B and -C elements	113	CH17 CBF-TR	CH17 CBF transfer signal
50	180CBF-OR	OR output of 180CBF-BLK-A, -B and -C elements	114	CH18 CBF-TR	CH18 CBF transfer signal
51	190CBF-OR	OR output of 190CBF-BLK-A, -B and -C elements	115	CH19 CBF-TR	CH19 CBF transfer signal
52	200CBF-OR	OR output of 200CBF-BLK-A, -B and -C elements	116	CH20 CBF-TR	CH20 CBF transfer signal
53			117		
54			118		
55			119		
56			120		
57	UVD-ZA	Output of UVD-ZA	121		
58	UVD-ZB	Output of UVD-ZB	122		
59	UVD-ZC	Output of UVD-ZC	123		
60	UVD-ZD	Output of UVD-ZD	124		
61			125		
62			126		
63			127		
64			128		

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Appendix G

Details of Relay Menu and LCD & Operation Button Instruction

MENU
1=Record 2=Status
3=Setting(view) 4=Setting(change)
5=Test

/1 Record
1=Fault record 2=Event record
3=Disturbance record

/2 Fault record
1=Display 2=Clear

/3 Fault record 2/4
#1 16/Oct/1998 23:18:03.913
#2 12/Feb/1998 03:51:37.622
#3 30/Jan/1997 15:06:11.835

/4 Fault record #1 3/34
16/Oct/1998 23:18:03.913
Phase BC
DIF

/2 Fault record
Clear all fault records?
ENTER=Yes CANCEL=No

/2 Event record
1=Display 2=Clear

/3 Event record 2/96
16/Oct/1998 23:18:04.294 BP block On
16/Oct/1998 23:18:03.913 BP block Off
12/Feb/1998 03:51:37.622 Rly.set change

/2 Event record
Clear all event records?
ENTER=Yes CANCEL=No

/2 Disturbance record
1=Display 2=Clear

/3 Disturbance record 1/ 11
#1 16/Oct/1998 23:18:03.913
#2 12/Feb/1998 03:51:37.622
#3 30/Jan/1997 15:06:11.835

/2 Disturbance record
Clear all disturbance records?
ENTER=Yes CANCEL=No

a-1

/1 Status
 1=Metering 2=Binary I/O
 3=Relay element 4=Time sync source
 5=Clock adjustment

/2 Metering 12/Feb/1998 22:56 3/150
 Ida ***** % ***** A Ira ***** A
 Idb ***** % ***** A Irb ***** A
 Idc ***** % ***** A Irc ***** A

/2 Binary input & output 3/ 68
 Input (CU-IO#1) [000 000 000 000]
 Input (CU-IO#2) [0000]
 Input (BU-CH1) [000 000 000 0]

/2 Relay element 3/ 13
 DIFCH [000 000]
 DIFZA [000 000]
 DIFZB [000 000]

/2 Time synchronization source 1/ 3
 *IRIG: Active
 RSM: Inactive
 IEC: Inactive

/2 12/Feb/1998 22:56:19 [local] 1/ 5
 Minute (0 - 59) : 56 _
 Hour (0 - 23) : 22
 Day (1 - 31) : 12

/1 Setting(view)
 1=Version 2=Description 3=Comm
 4=Record 5=Status 6=Protection
 7=Binary input 8=Binary output 9=LED

/2 Relay version
 Relay Type: *****
 Serial No.: *****
 Main software: *****

/2 Description 2/ 2
 Plant name: *****
 Description: *****

/2 Communication
 1=Address
 2=Switch

/3 Address 1/ 1
 HDLC (1) IEC (2)

/3 Switch 3/ 3
 232C 1=9.6 2=19.2 3=38.4 4=57.6 1
 IECBR 1=9.6 2=19.2 2
 IECBLK 1=Normal 2=Blocked 1

/2 Record
 1=Event record
 2=Disturbance record

/3 Event record 0=None 3=Both 3/**
 ZA trip 1=Operate 2=Reset 3
 ZB trip 1=Operate 2=Reset 3
 ZC trip 1=Operate 2=Reset 3

/3 Disturbance record
 1=Record time & starter
 2=Scheme switch

/4 Record time & starter 3/**
 Time (2.0 s) 10CG (10.0)
 10CS (10.0) 20CG (10.0)
 20CS (10.0) 30CG (10.0)

/2 Status
 1=Metering
 2=Time Synchronization
 3=Time zone

/3 Metering 1/ 1
 Display value 1=Primary 2=Secondary 1

/4 Scheme switch 3/ 3
 TRIP 0=Off 1=On 0
 OCG 0=Off 1=On 0
 OCS 0=Off 1=On 0

/3 Time synchronization 1/ 1
 Sync 0=Off 1=IRIG 2=RSM 3=IEC 1

/3 Time zone 1/ 1
 GMT (+9 hrs)

a-1, b-1

a-1 b-1

/2 Protection (Active group= *)
1=Group1 2=Group2 3=Group3 4=Group4

/3 Protection (Group 1)
1=Busbar parameter
2=Trip

/4 Busbar parameter (Group 1)
1=CH name
2=VT ratio

/5 CH name 3/**
CH1 name : *****
CH2 name : *****
CH3 name : *****

/5 VT ratio 2/ 2
VTA (2000) VTB (2000)
VTC (2000) VTD (2000)

/4 Trip (Group 1)
1=Scheme switch
2=Protection element

/5 Scheme switch 3/**
C.TP 0=BLK 1=Trip 0
IDSV 0=Off 1=ALM&BLK 2=ALM 2
AISV 0=Off 1=ALM&BLK 2=ALM 1

/5 Protection element (Group 1)
1=DIF 2=OC

/6 DIF 3/**
DIFCH (3000 A) DIFZ (3000 A)
DIFSV (1000 A) TIDSV (20 s)
1CT (1000 A) 2CT (1000 A)

/6 OC 3/**
1OCB (0.5) T1B1 (50 ms)
T1B2 (100 ms) 2OCB (0.5)
T2B1 (50 ms) T2B2 (100 ms)

/3 Protection (Group 2)
1=Busbar parameter
2=Trip

/3 Protection (Group 4)
1=Busbar parameter
2=Trip

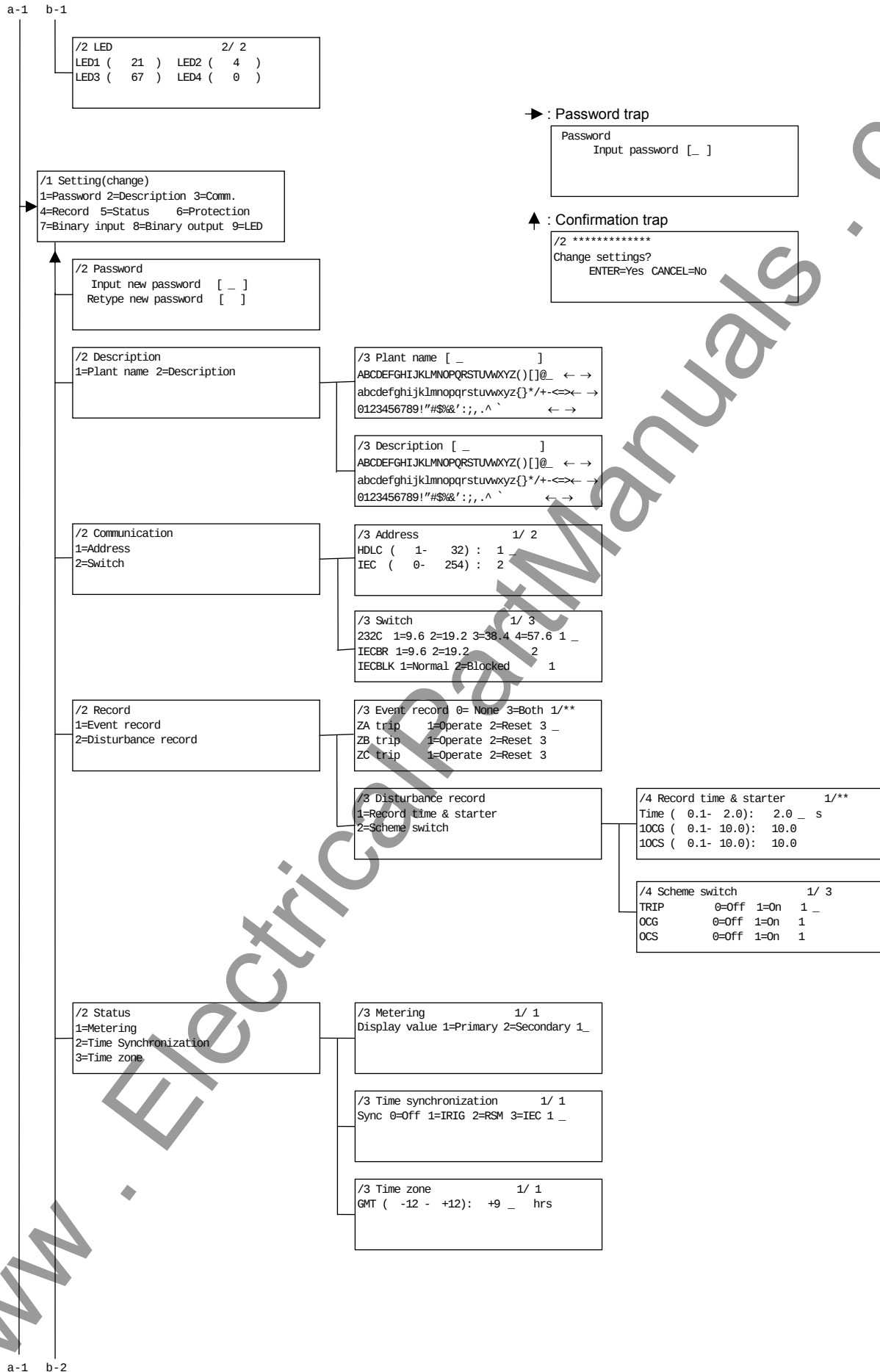
/2 Binary input 1=Norm 2=Inv 3/ 3
BISW 1 1
BISW 2 1
BISW 3 1

/2 Binary output
1=CU-I0#1 2=CU-I0#2 3=BU-B01 4=BU-B02

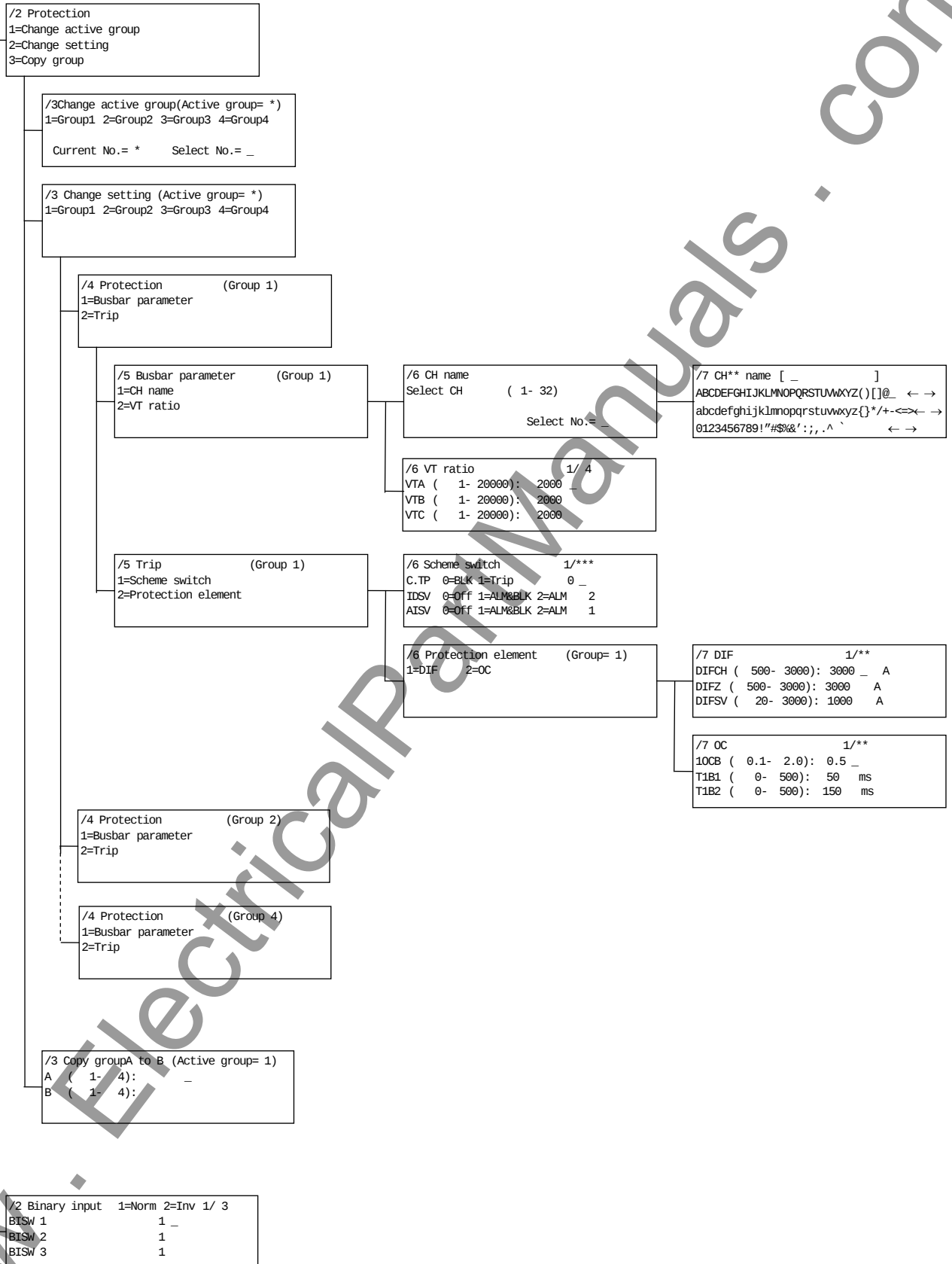
/3 Binary output CU-I0#1) 3/13
B01 (1, 100, 0, 0, 0, 0)AND,
B02 (0, 0, 0, 0, 0, 0)OR,
B03 (1, 2, 3, 4, 5, 6)OR,D

/3 Binary output (BU-B02) 3/32
CH1 (1, 100, 0, 0, 0, 0)AND,
CH2 (0, 0, 0, 0, 0, 0)OR,
CH3 (1, 2, 3, 4, 5, 6)OR,D

a-1 b-1

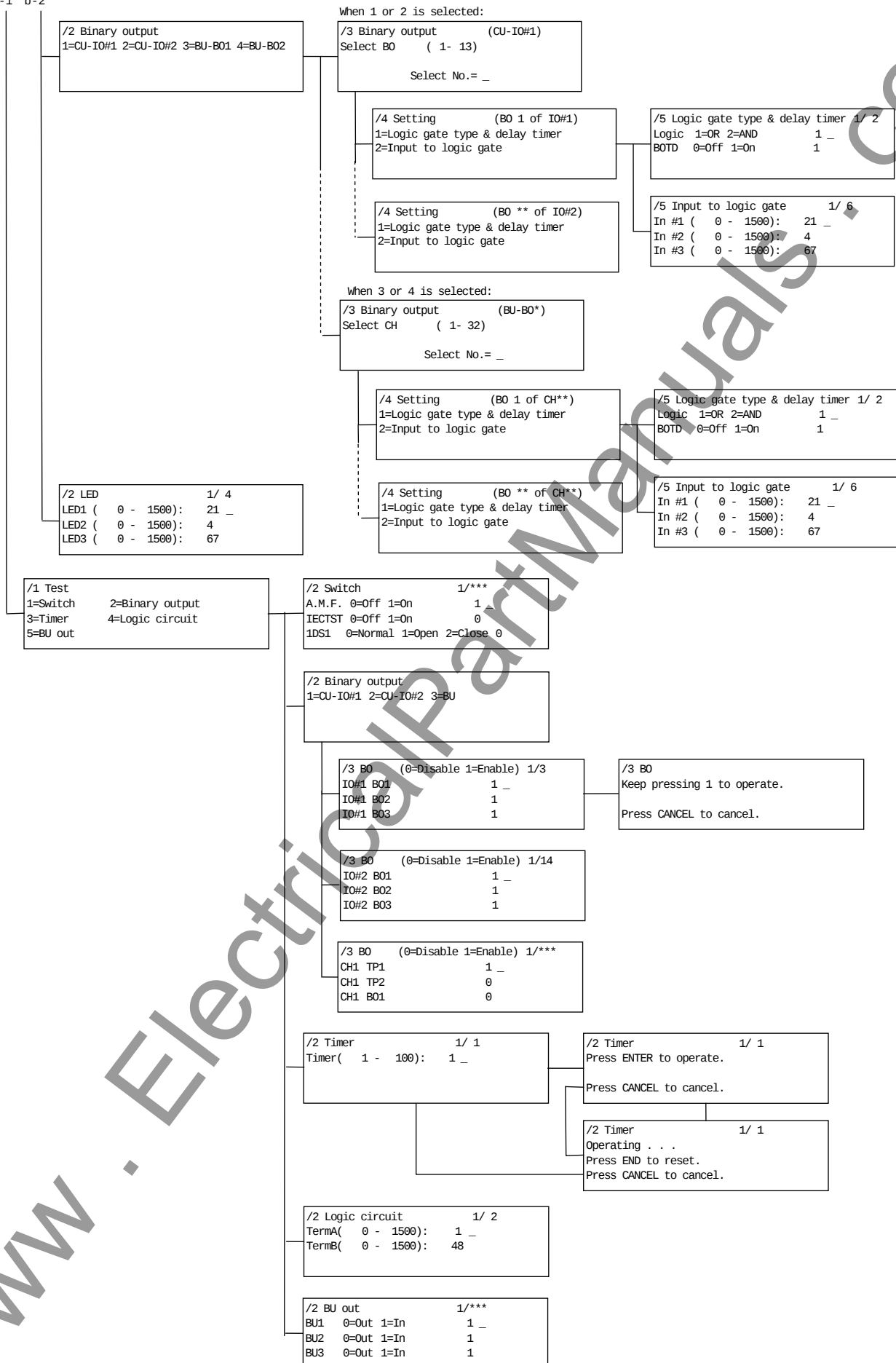


a-1 b-2

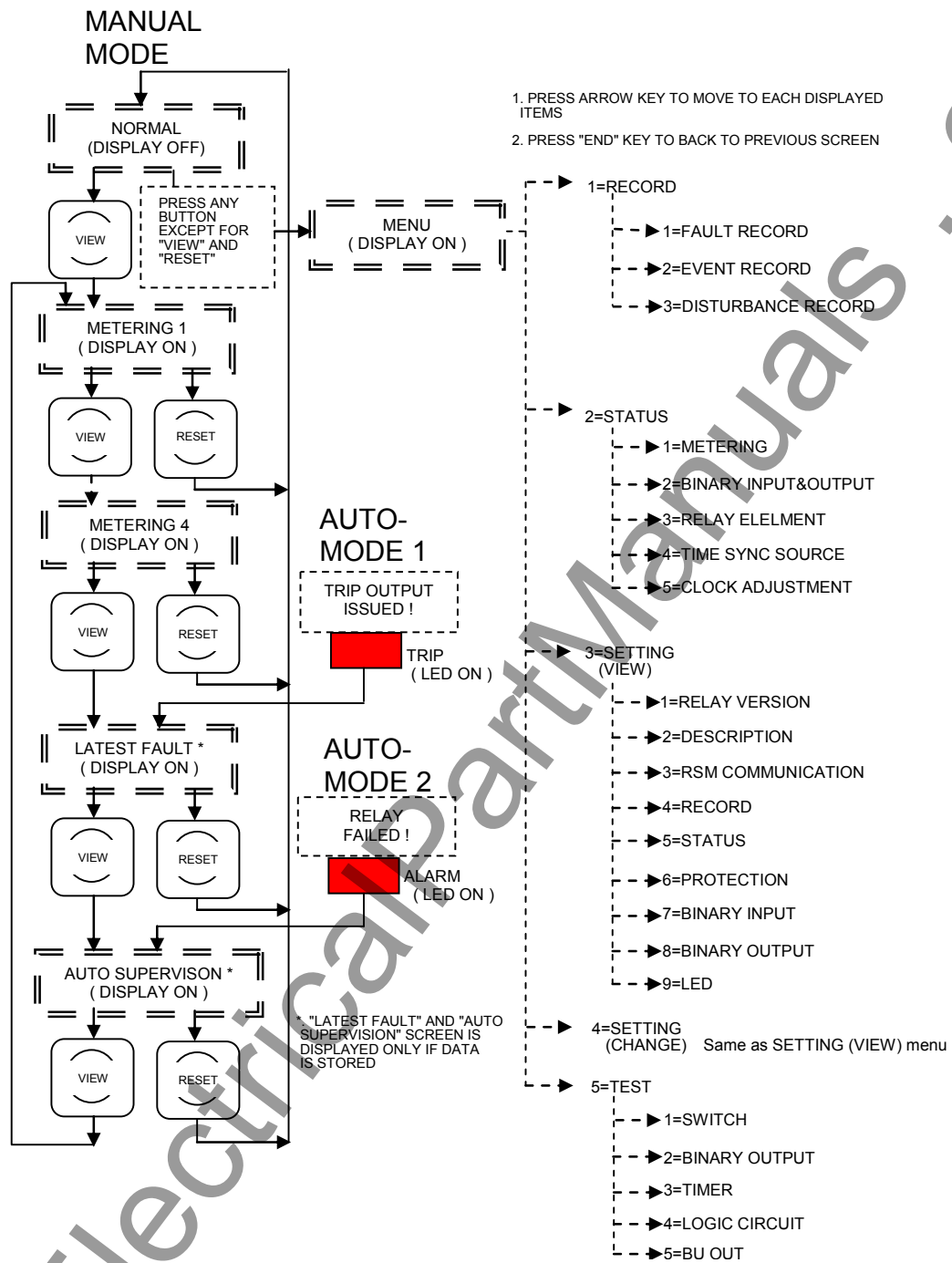


a-1 b-2

a-1 b-2



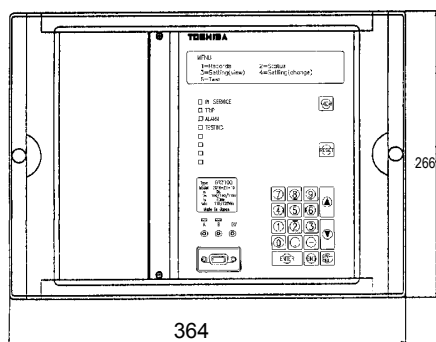
LCD AND BUTTON OPERATION INSTRUCTION



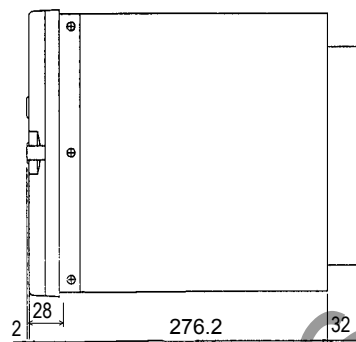
Appendix H

Case Outline and Rack Mounting

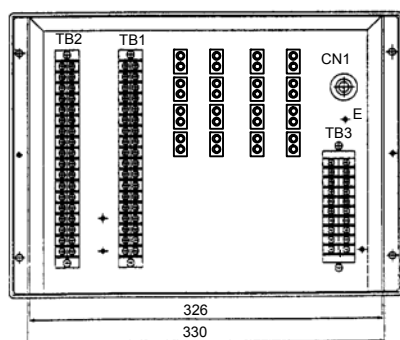
- Central unit
- Bay unit for centralized installation
- How to mount attachment kit for rack-mounting



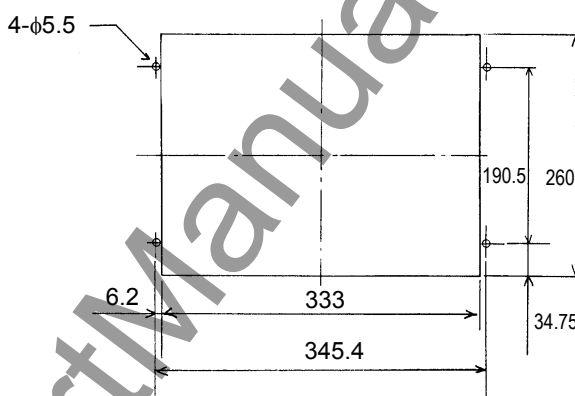
Front View



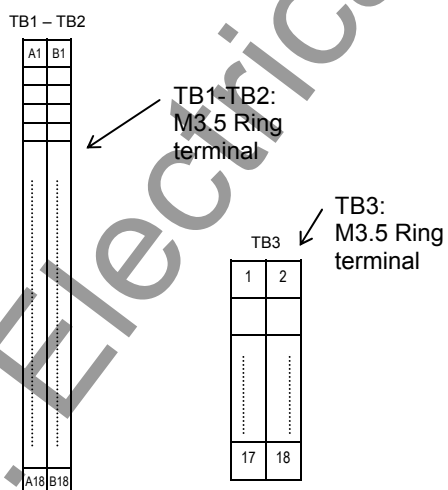
Side view



Rear View

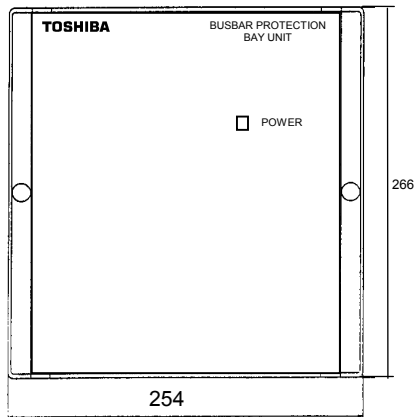


Panel Cutout

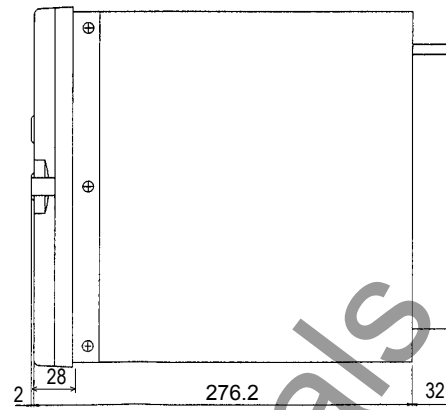


Terminal Block

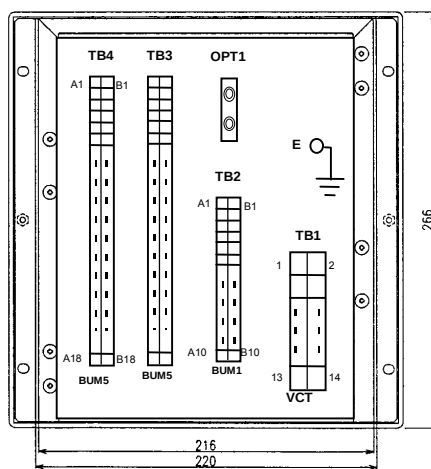
Case Outline : Central unit



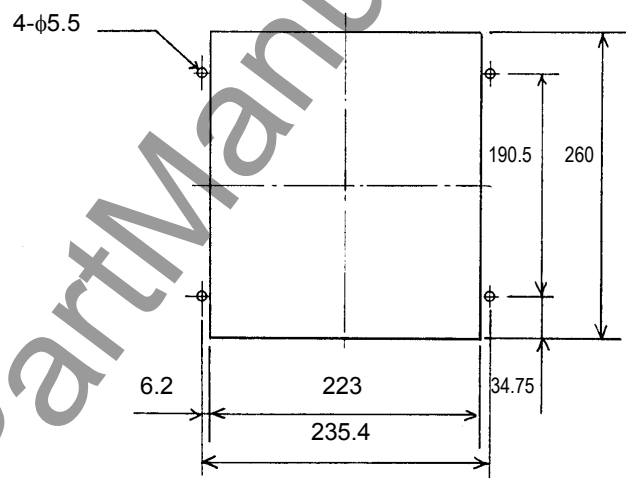
Front View



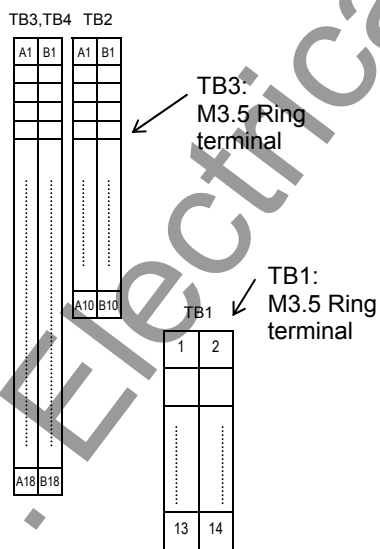
Side view



Rear view

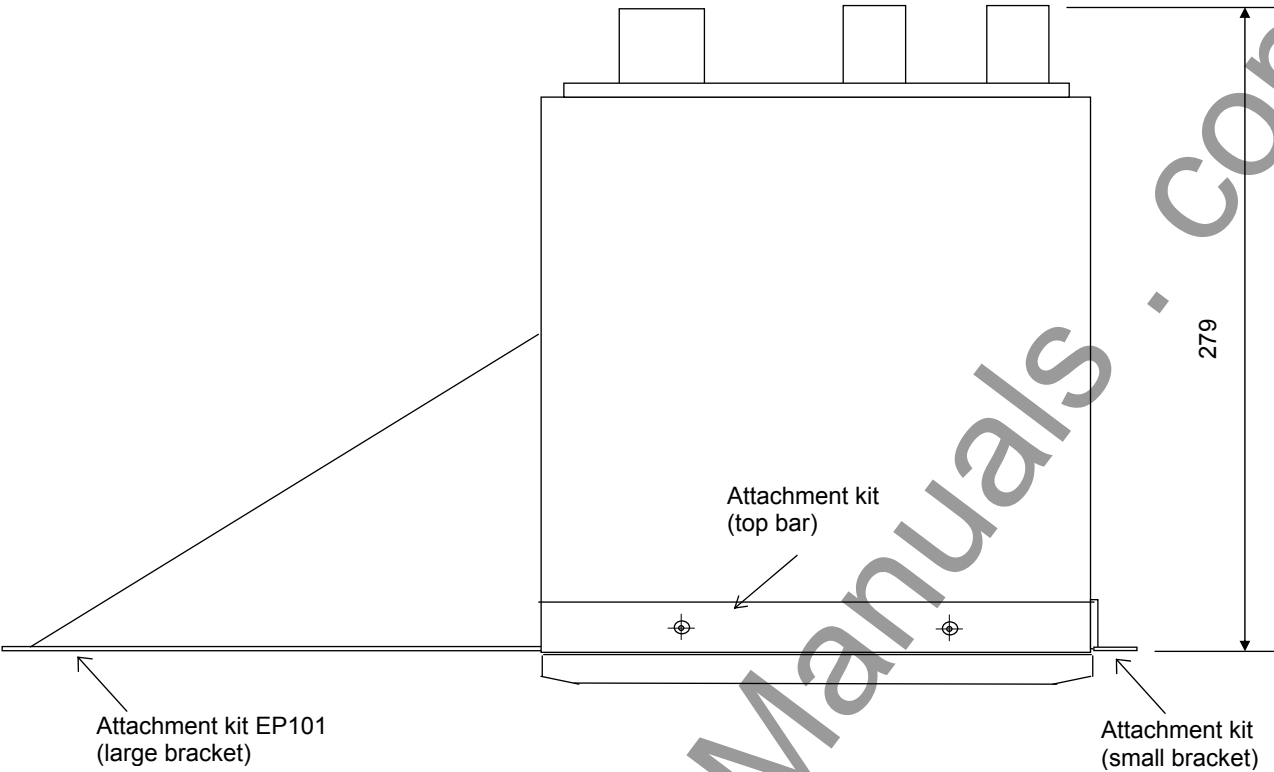


Panel cut-out

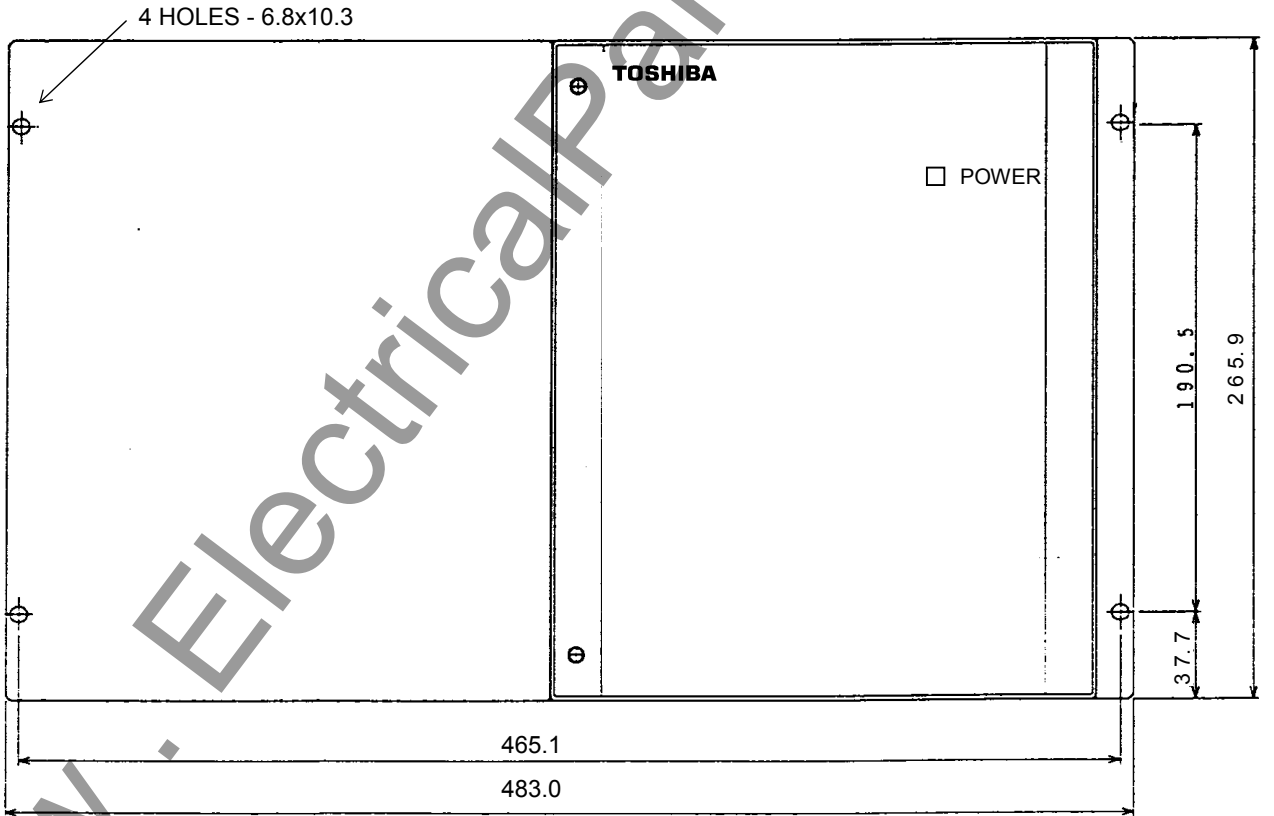


Terminal block

Case Outline: Bay unit

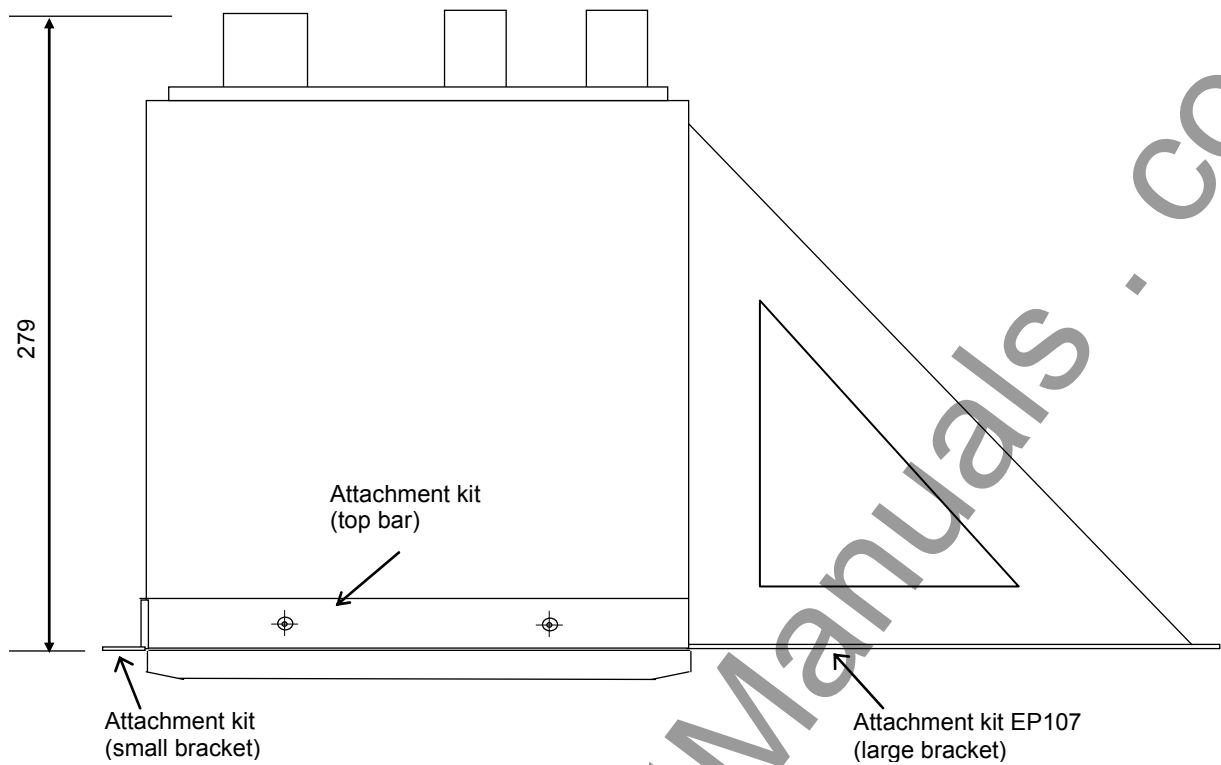


Top View

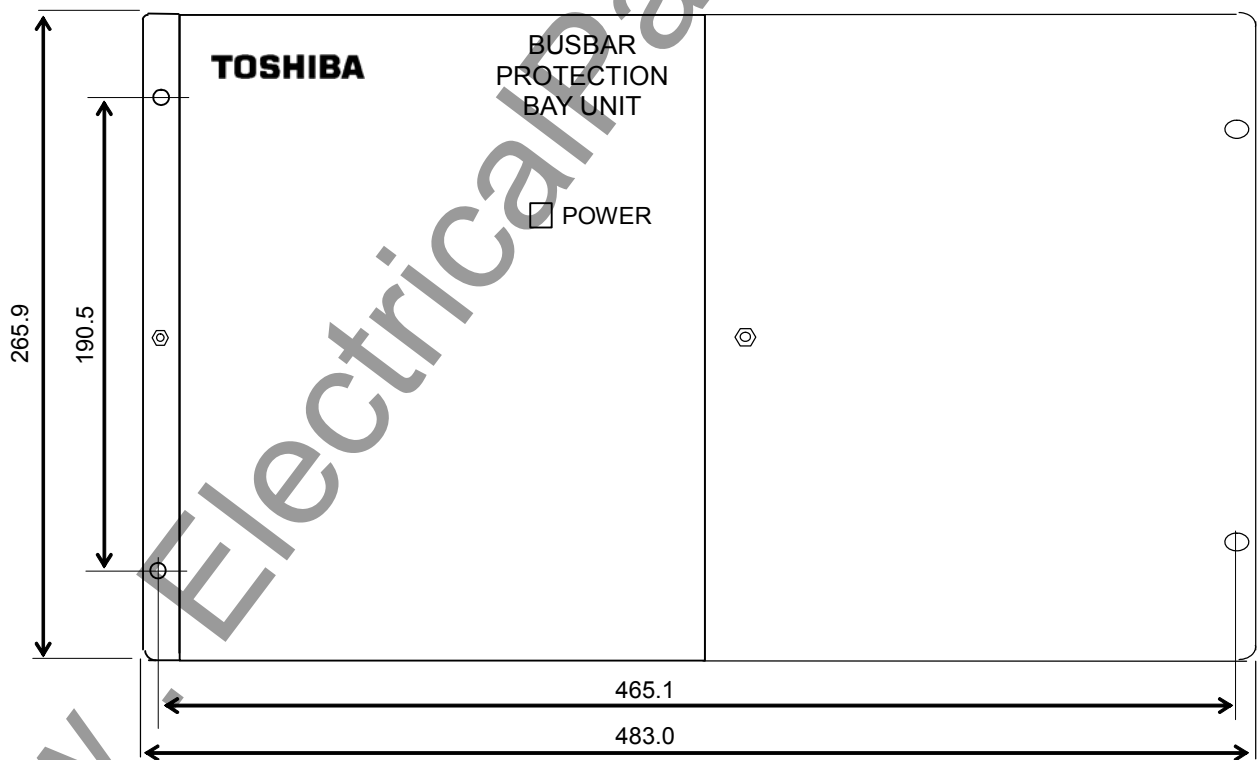


Front View

Case Outline: Rack Mount for BU

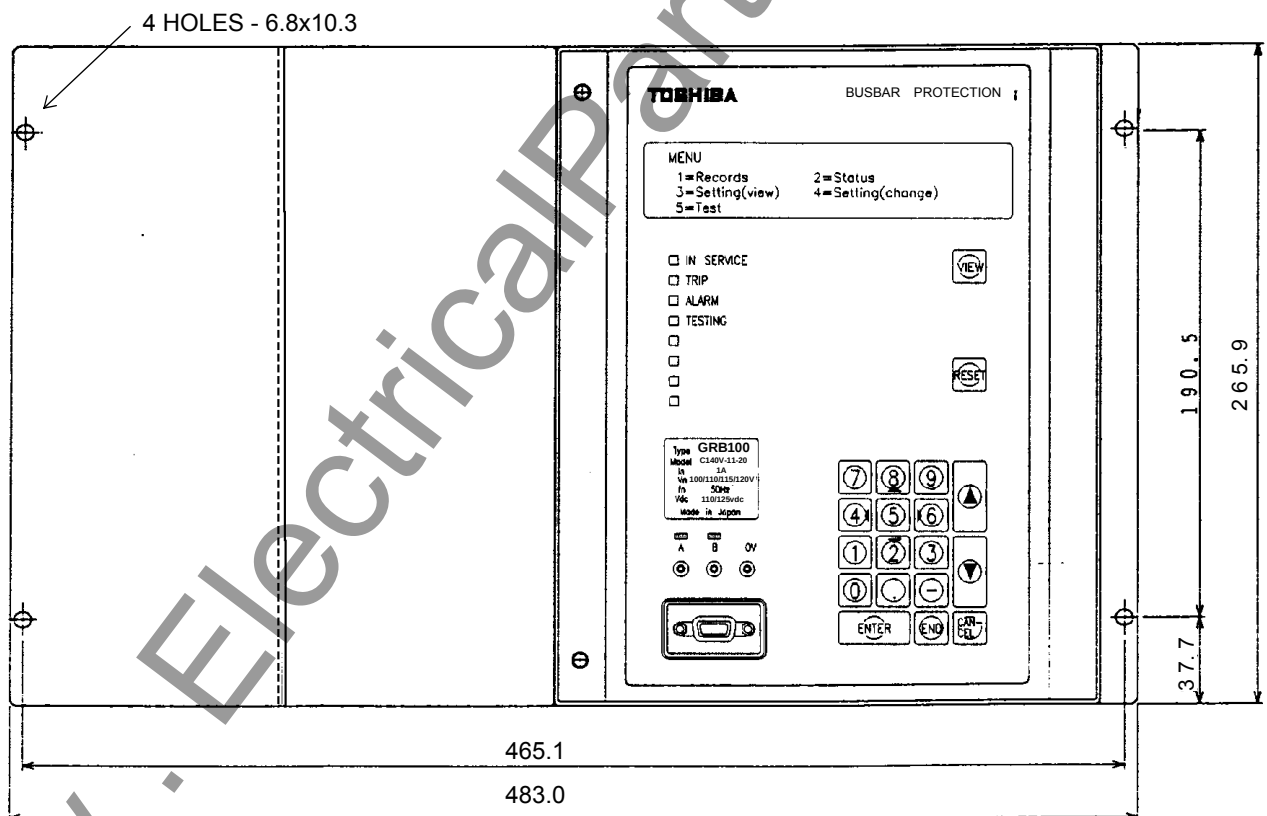
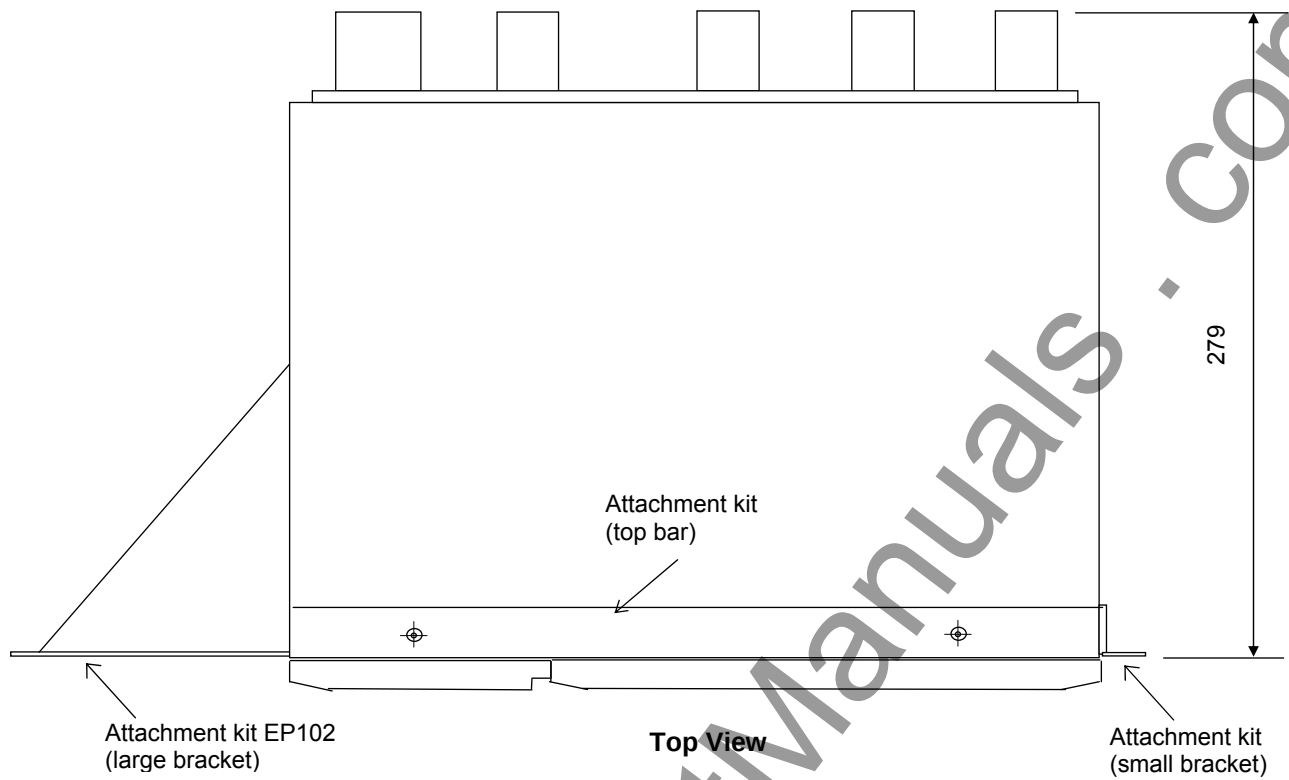


Top View



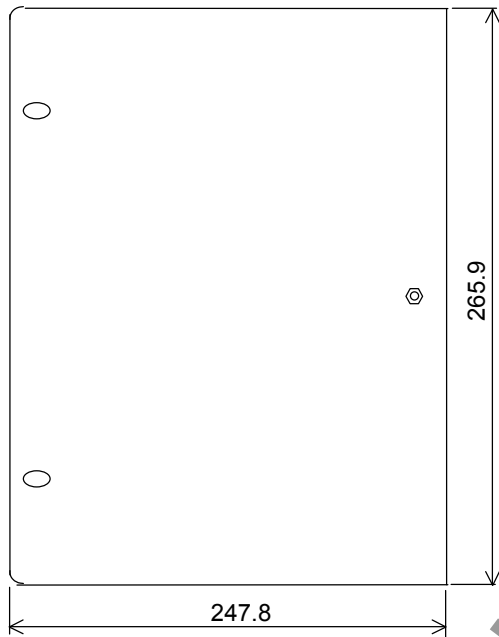
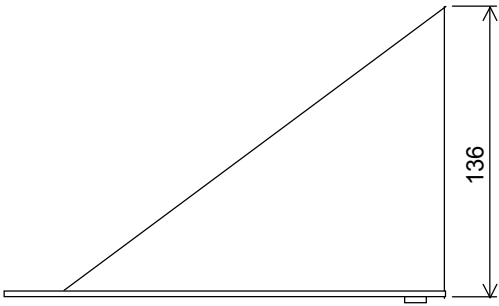
Front View

Case Outline: Rack Mount for BU

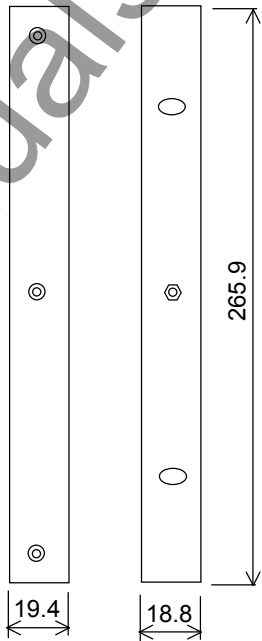
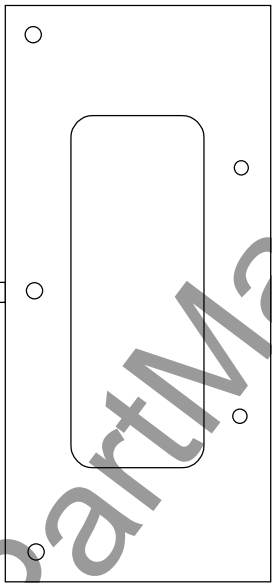


Front View

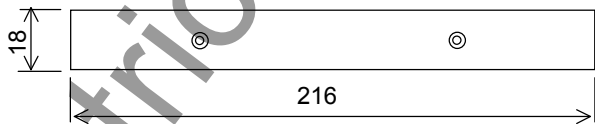
Case Outline: Rack Mount for CU



(a) Large Bracket



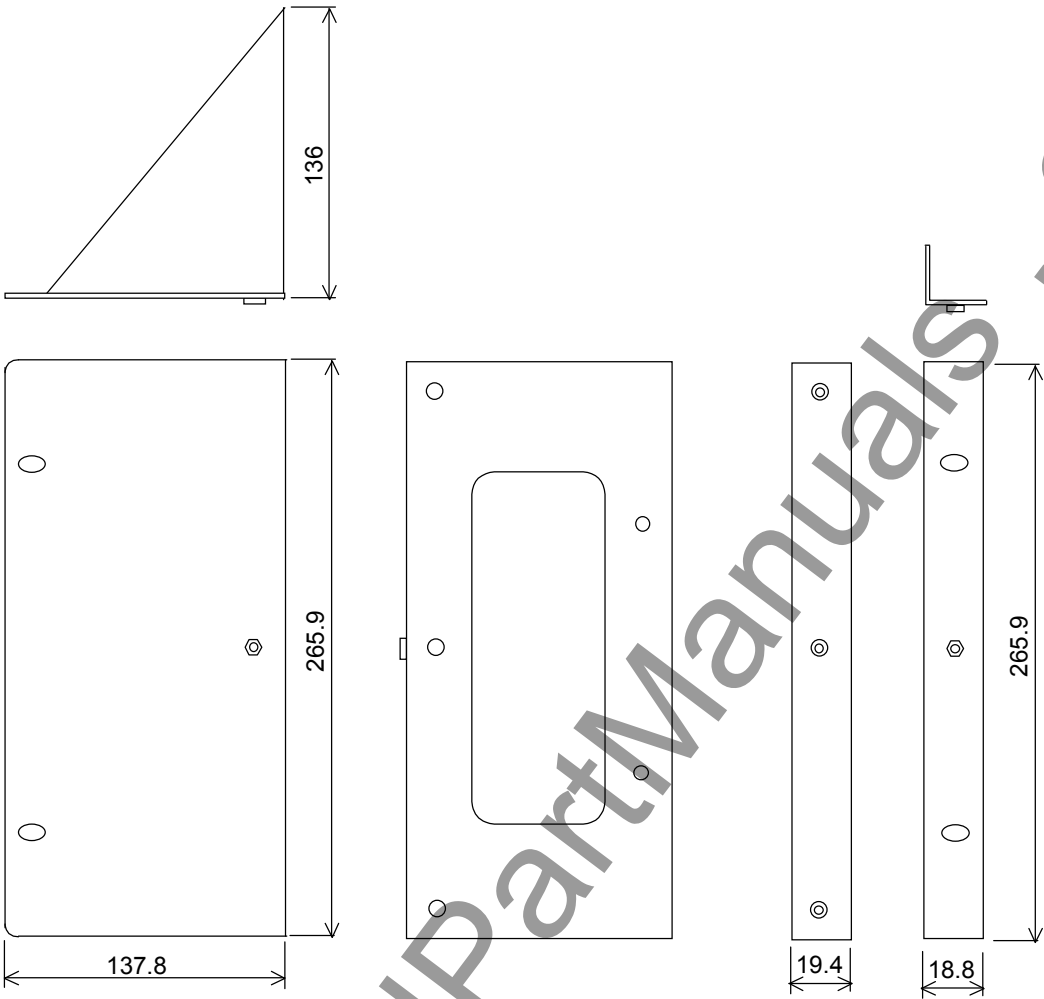
(b) Small Bracket



(c) Bar for Top and Bottom of Relay

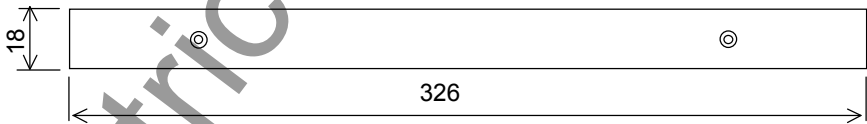
Parts	
(a)	1 Large bracket, 5 Round head screws with spring washers and washers (M4x10)
(b)	1 Small bracket, 3 Countersunk head screws (M4x6)
(c)	2 Bars, 4 Countersunk head screws (M3x8)

Dimensions of Attachment Kit EP-101



(a) Large Bracket

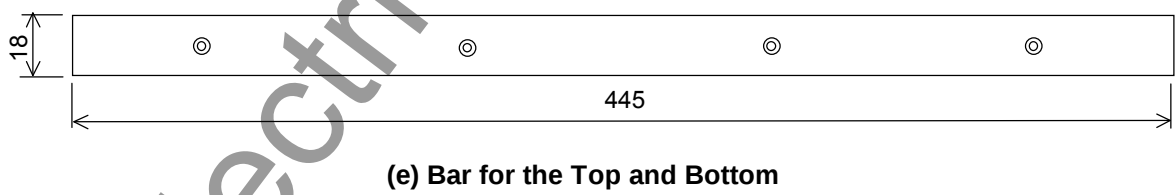
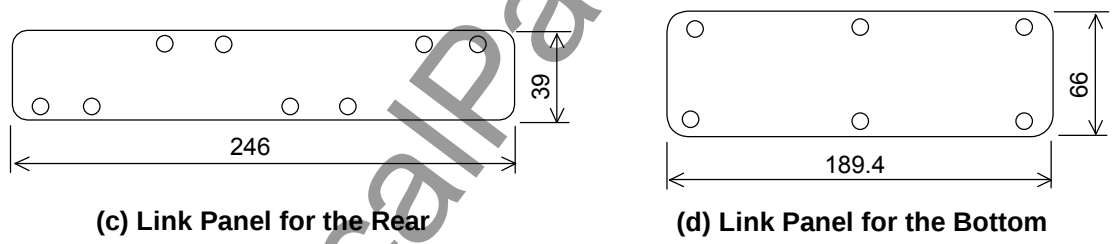
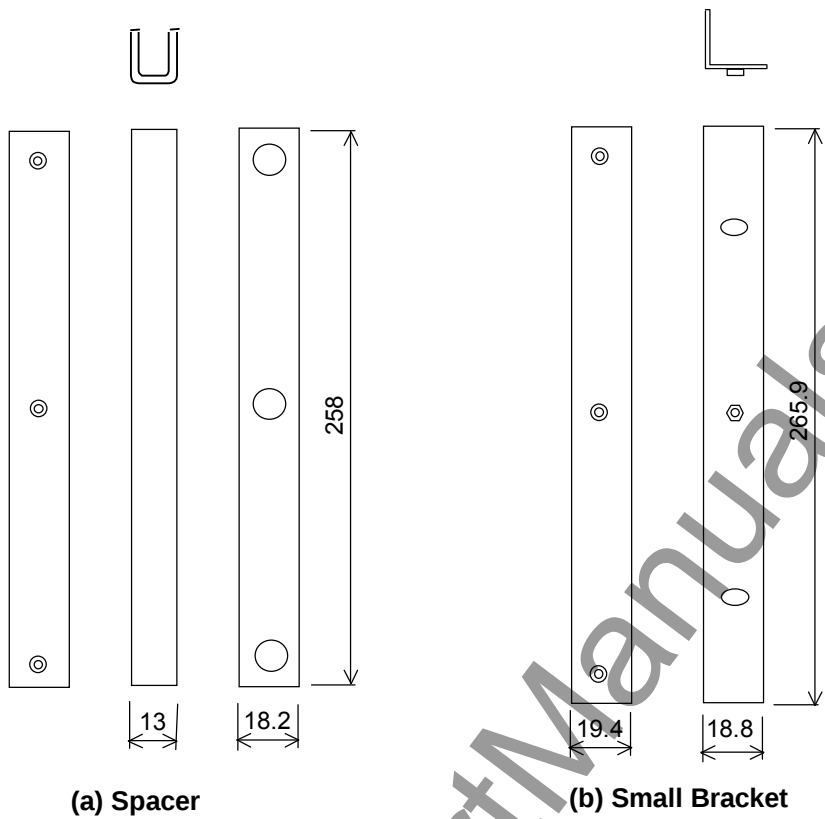
(b) Small Bracket



(c) Bar for Top and Bottom of Relay

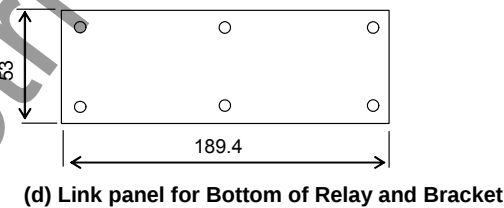
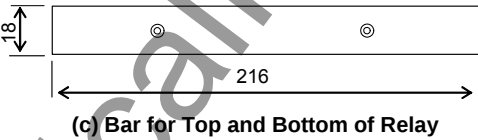
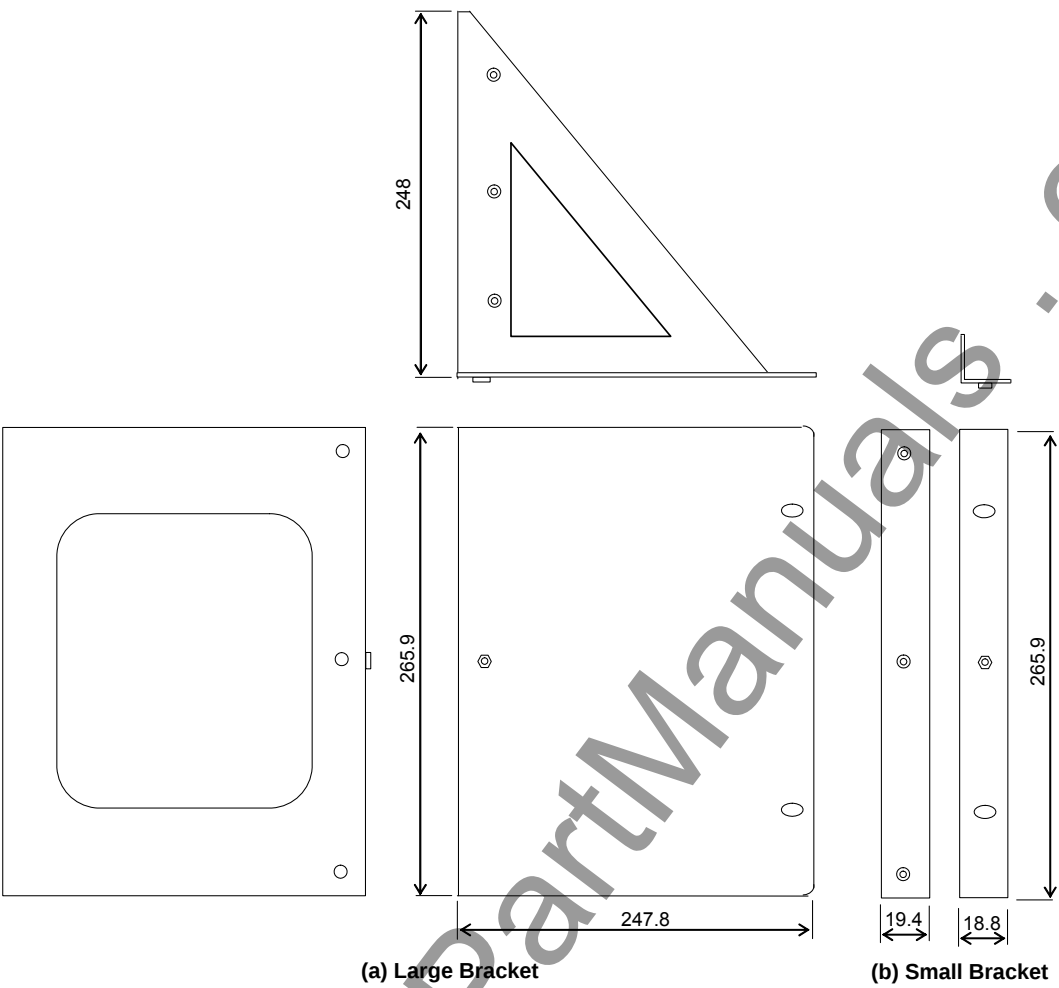
Parts	
(a)	1 Large bracket, 5 Round head screws with spring washers and washers (M4x10)
(b)	1 Small bracket, 3 Countersunk head screws (M4x6)
(c)	2 Bars, 4 Countersunk head screws (M3x8)

Dimensions of Attachment Kit EP-102



Parts	
(a)	1 Spacer, 3 Round head screws with spring washers and washers (M4x10)
(b)	2 Small bracket, 6 Countersunk head screws (M4x6)
(c)	1 Link panel for the rear, 8 Round head screws with spring washers and washers (M4x10)
(d)	1 Link panel for the bottom, 6 Round head screws with spring washers and washers (M4x10)
(e)	2 Bars, 8 Countersunk head screws (M3x8)

Dimensions of Attachment Kit EP-103 for Linking Two relays



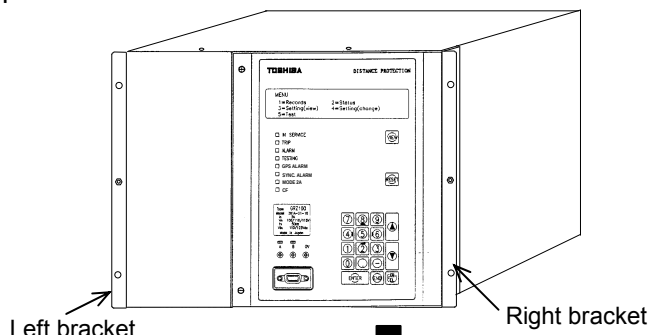
	Parts
(a)	1 Large bracket, 3 Countersunk head screws (M4x6)
(b)	1 Small bracket, 3 Countersunk head screws (M4x6)
(c)	2 Bars, 4 Countersunk head screws (M3x8)
(d)	1 Link, 6 Round head screws with spring washers and washers (M4x10)

Dimensions of Attachment Kit EP-107

How to Mount Attachment Kit for Rack-Mounting

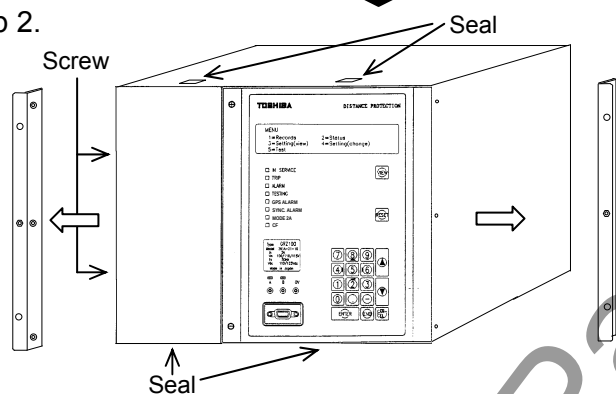
Caution: Be careful that the relay modules or terminal blocks, etc., are not damage while mounting.
Tighten screws to the specified torque according to the size of screw.

Step 1.



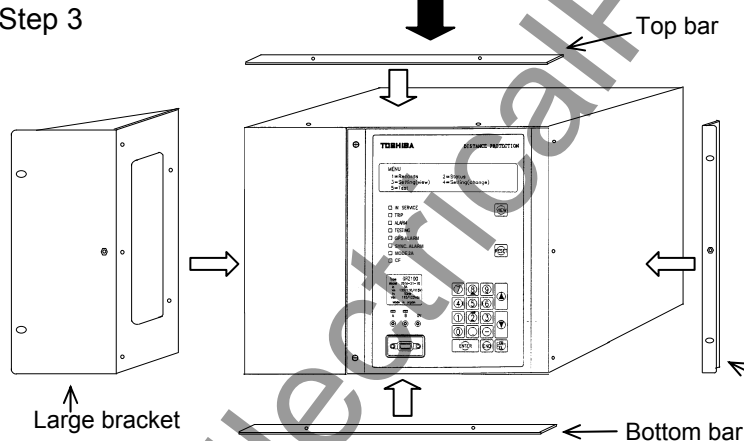
Remove case cover.

Step 2.



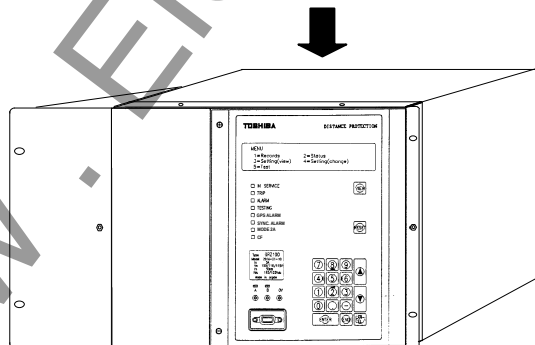
Remove the left and right brackets by unscrewing the three screws respectively, then remove two screws on left side of the relay.
And then, remove four seals on the top and bottom of the relay.

Step 3



Mount the small bracket by screwing three countersunk head screws(M4x6) and apply adhesives to the screws to prevent them from loosening.
Mount the large bracket by five round head screws(M4x10) with washer and spring washer.
And then, mount the top and bottom bars by two countersunk head screws(M3x8) respectively.

Step 4

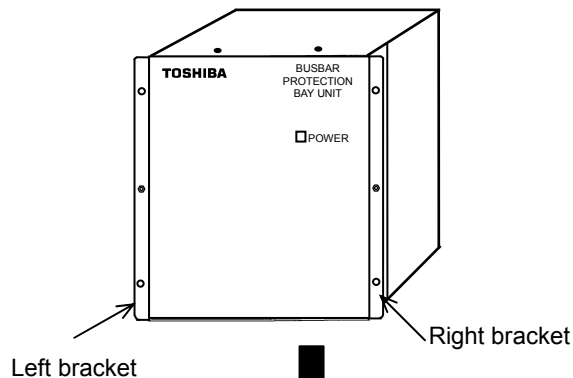


Completed.

How to link two relays (units) together for rack-mounting

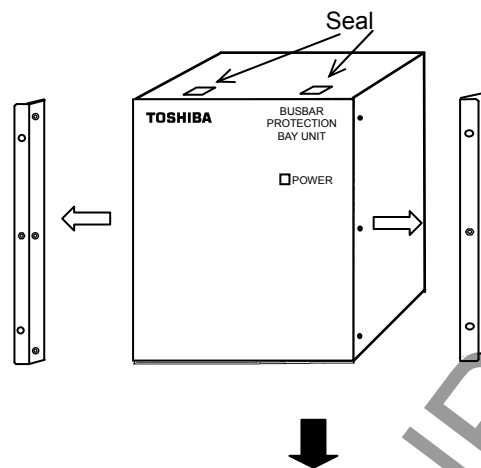
Two relays (units) with 1/2 size (type A case size) can be housed in one rack to be linked together.

Step 1.



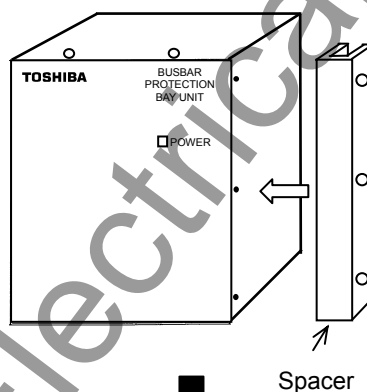
Remove case cover.

Step 2.



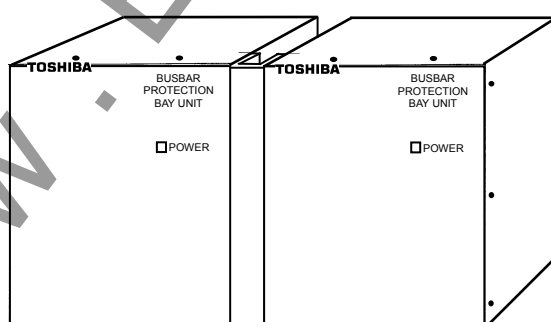
Remove the left and right brackets by unscrewing the three screws respectively, in both relays.
And then, remove four seals on the top and bottom of the relay.

Step 3.

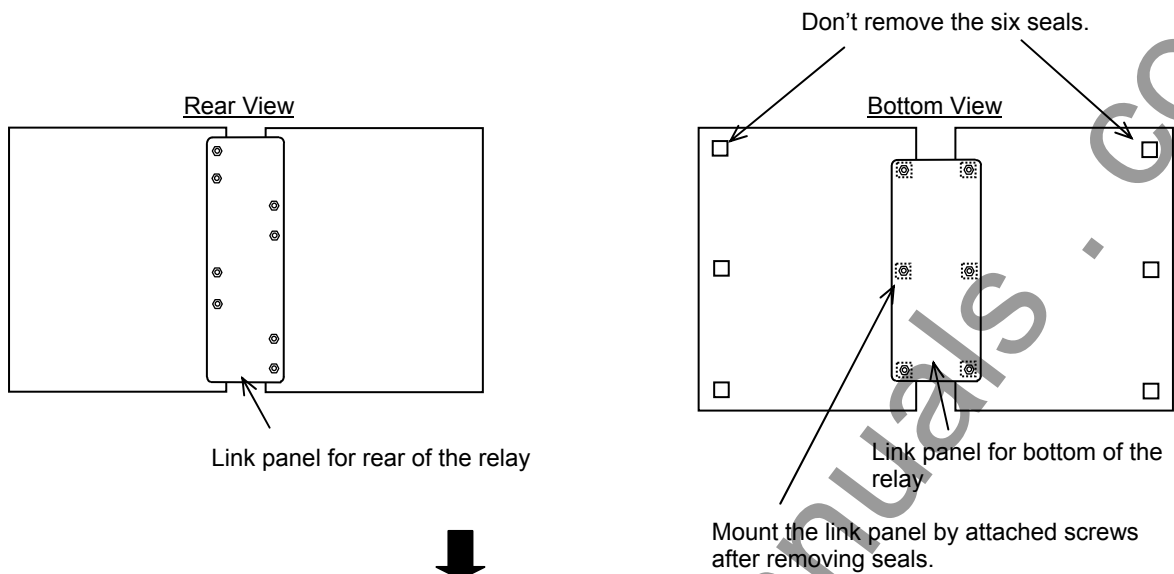


Mount the spacer on one relay by screwing three round head screws (M4x10) with spring washer and washer.

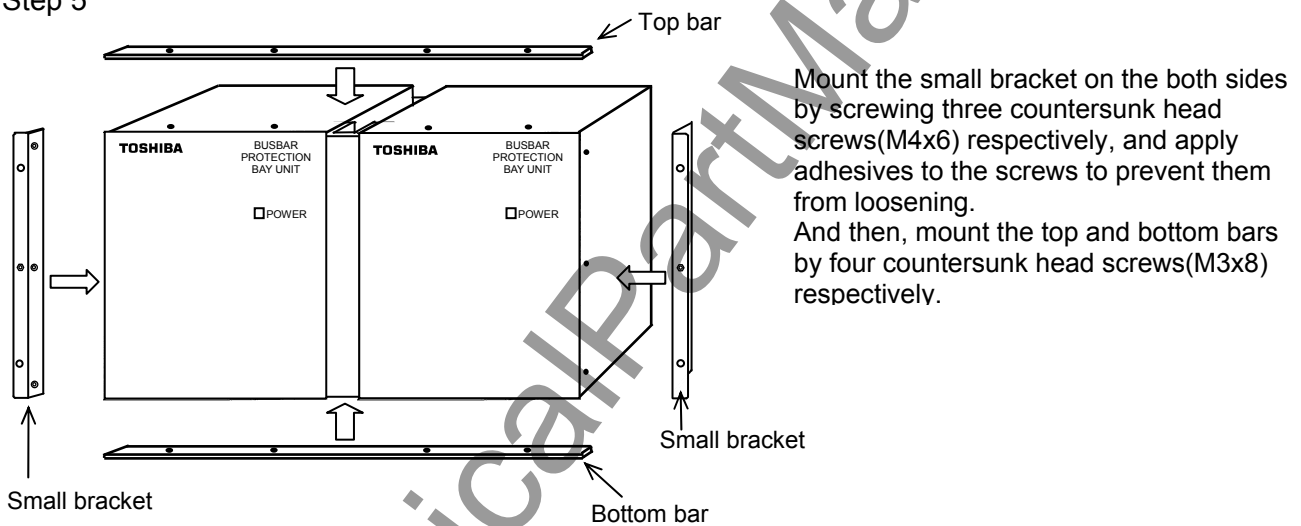
Step 4



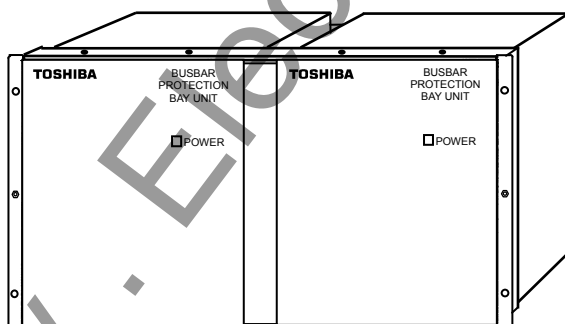
Place another relay next to the relay.
And then, mount the link panel on the rear of relays by eight round head screws (M4x10) with washer and spring washer, and also mount the link panel on the bottom of relays by six round head screws (M4x10) with washer and spring washer after removing six seals as follows.



Step 5



Step 6

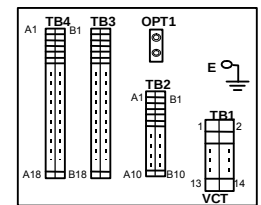
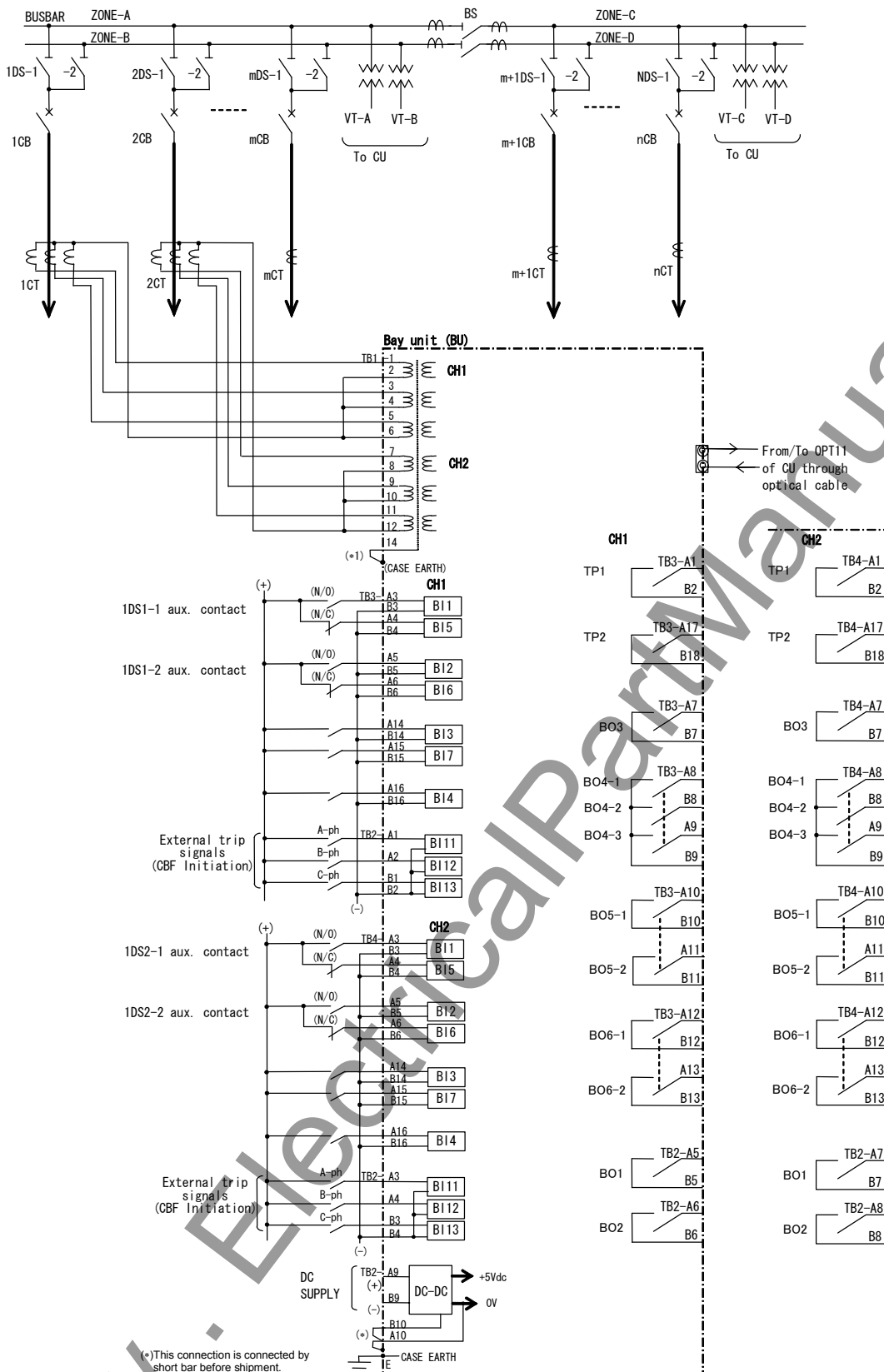


Completed.

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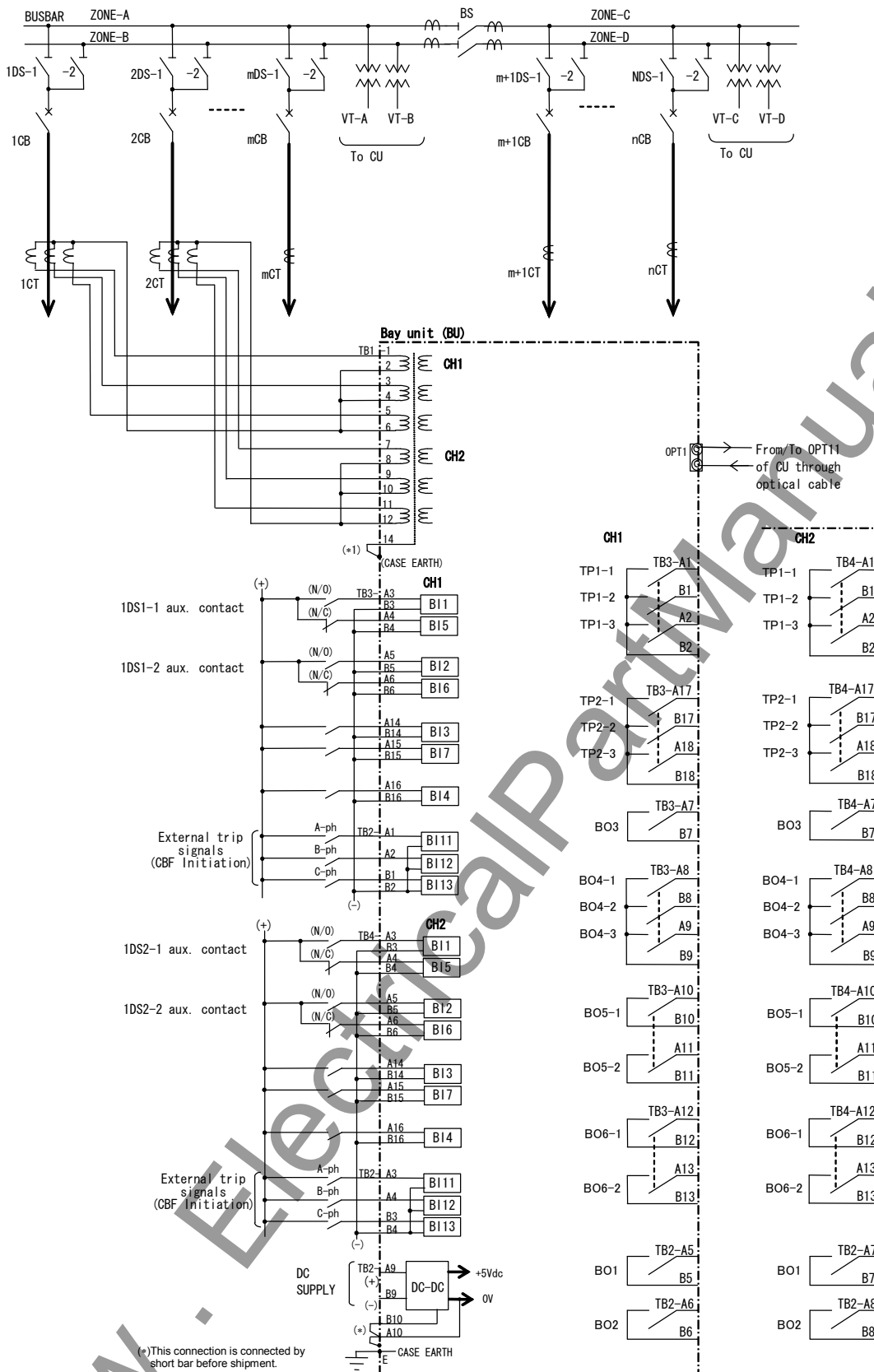
Appendix I

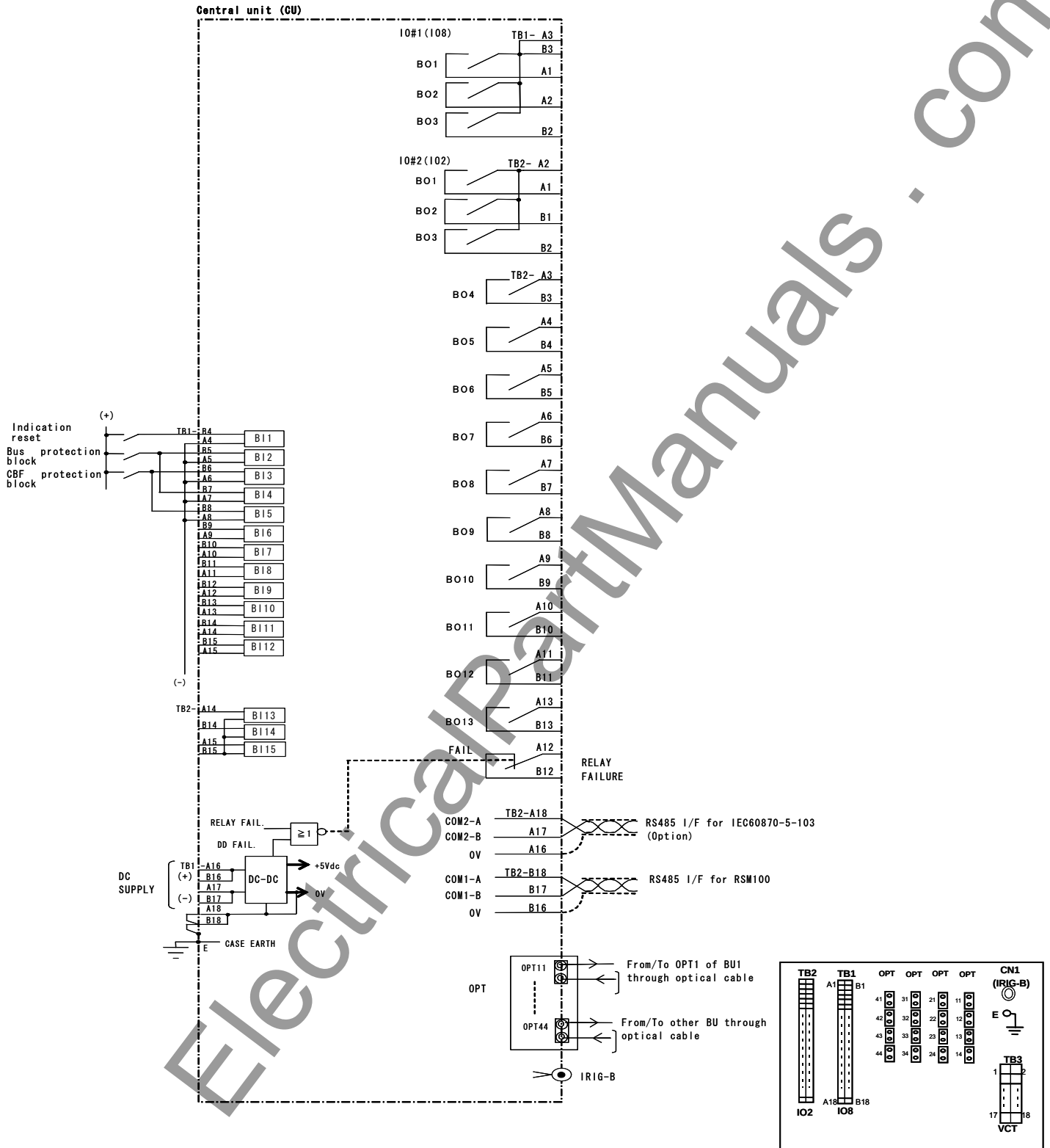
Typical External Connections



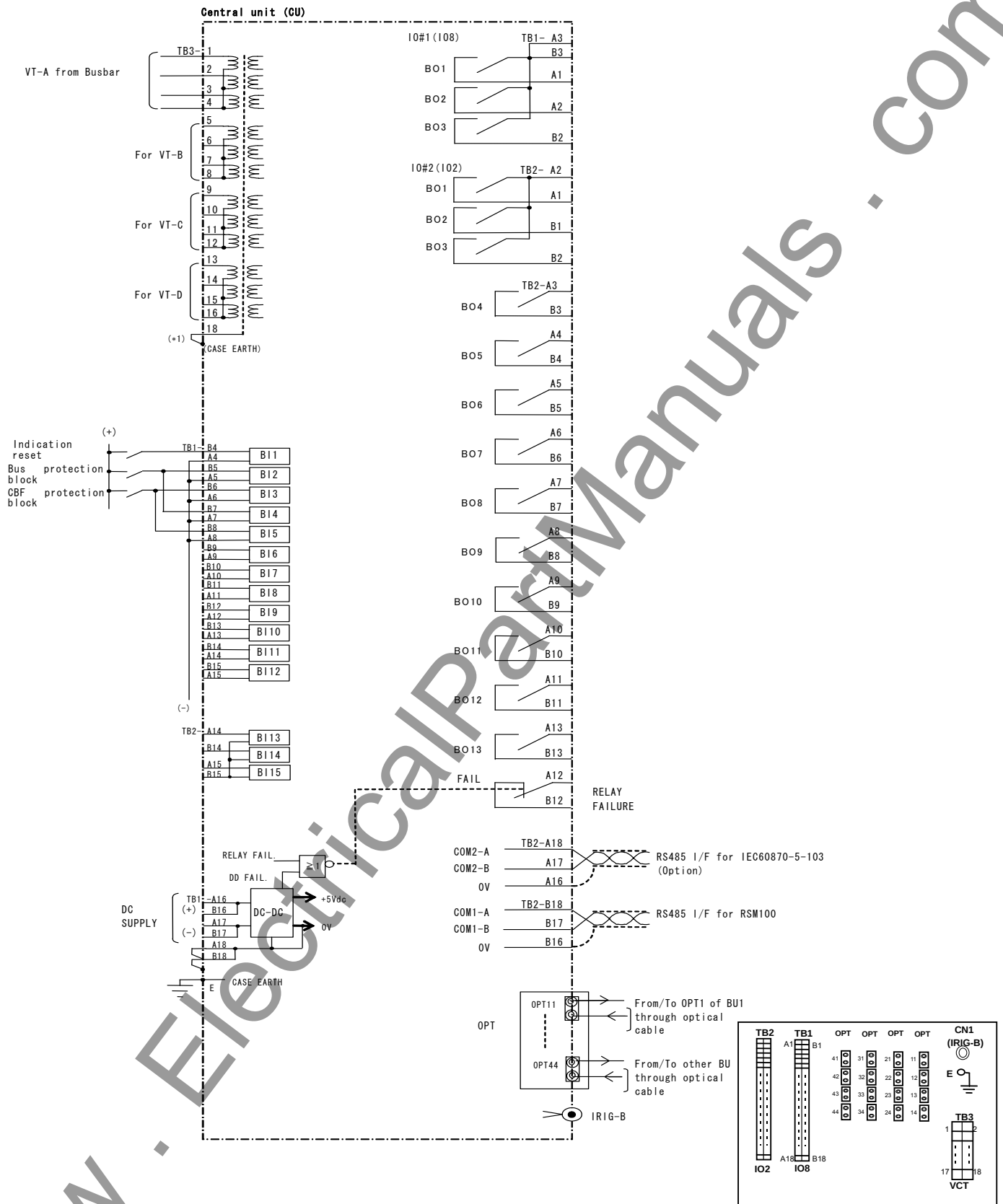
BU: Model GRB100-B100B
Terminal Block Arrangement (Rear view)

Typical External Connections for GRB100-B100B





Typical External Connections for GRB100-C1*0B



Typical external connections for GRB100-C2*0B

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Appendix J

Relay Setting Sheet

1. Relay Identification
2. Contacts Setting
3. Relay and Protection Scheme Setting Sheet

Relay Setting Sheets

1. Relay Identification

Date:

Relay type	_____
Frequency	_____
VT rating	_____
Password	_____
Active setting group	_____

Serial Number	_____
CT rating	_____
dc supply voltage	_____

2. Contacts Setting

(1) CU-IO#1	BO1	_____
	BO2	_____
	BO3	_____
(2) CU-IO#2	BO1	_____
	BO2	_____
	BO3	_____
	BO4	_____
	BO5	_____
	BO6	_____
	BO7	_____
	BO8	_____
	BO9	_____
	BO10	_____
(3) BU-CHn	BO1	_____
	BO2	_____
	BO3	_____
	BO4	_____
	BO5	_____
	BO6	_____

3. Relay and Protection Scheme Setting Sheet

Relay and Protection Scheme Setting Sheet

Relay and Protection Scheme Setting Sheet					Default Setting of Relay Series(5A rating / 1A rating)								User Setting	
№	Name	Range		Units	Contents	No voltage				With voltage				
						FEP×1	FEP×2	FEP×3	FEP×4	FEP×1	FEP×2	FEP×3		FEP×4
		5A rating	1A rating			110	120	130	140	210	220	230		240
1	Active group	1 - 4		—	Active setting group	1								
2	CH1 name	Specified by user		—	CH name	Specified by user								
3	CH2 name	Specified by user		—	ditto	Specified by user								
4	CH3 name	Specified by user		—	ditto	Specified by user								
5	CH4 name	Specified by user		—	ditto	Specified by user								
6	CH5 name	Specified by user		—	ditto	Specified by user								
7	CH6 name	Specified by user		—	ditto	Specified by user								
8	CH7 name	Specified by user		—	ditto	Specified by user								
9	CH8 name	Specified by user		—	ditto	Specified by user								
10	CH9 name	Specified by user		—	ditto	—	Specified by user		—	Specified by user		Specified by user		
11	CH10 name	Specified by user		—	ditto	—	Specified by user		—	Specified by user		Specified by user		
12	CH11 name	Specified by user		—	ditto	—	Specified by user		—	Specified by user		Specified by user		
13	CH12 name	Specified by user		—	ditto	—	Specified by user		—	Specified by user		Specified by user		
14	CH13 name	Specified by user		—	ditto	—	Specified by user		—	Specified by user		Specified by user		
15	CH14 name	Specified by user		—	ditto	—	Specified by user		—	Specified by user		Specified by user		
16	CH15 name	Specified by user		—	ditto	—	Specified by user		—	Specified by user		Specified by user		
17	CH16 name	Specified by user		—	ditto	—	Specified by user		—	Specified by user		Specified by user		
18	CH17 name	Specified by user		—	ditto	—	Specified by user		—	Specified by user		Specified by user		
19	CH18 name	Specified by user		—	ditto	—	Specified by user		—	Specified by user		Specified by user		
20	CH19 name	Specified by user		—	ditto	—	Specified by user		—	Specified by user		Specified by user		
21	CH20 name	Specified by user		—	ditto	—	Specified by user		—	Specified by user		Specified by user		
22	CH21 name	Specified by user		—	ditto	—	Specified by user		—	Specified by user		Specified by user		
23	CH22 name	Specified by user		—	ditto	—	Specified by user		—	Specified by user		Specified by user		
24	CH23 name	Specified by user		—	ditto	—	Specified by user		—	Specified by user		Specified by user		
25	CH24 name	Specified by user		—	ditto	—	Specified by user		—	Specified by user		Specified by user		
26	CH25 name	Specified by user		—	ditto	—	Specified by user		—	Specified by user		Specified by user		
27	CH26 name	Specified by user		—	ditto	—	Specified by user		—	Specified by user		Specified by user		
28	CH27 name	Specified by user		—	ditto	—	Specified by user		—	Specified by user		Specified by user		
29	CH28 name	Specified by user		—	ditto	—	Specified by user		—	Specified by user		Specified by user		
30	CH29 name	Specified by user		—	ditto	—	Specified by user		—	Specified by user		Specified by user		
31	CH30 name	Specified by user		—	ditto	—	Specified by user		—	Specified by user		Specified by user		
32	CH31 name	Specified by user		—	ditto	—	Specified by user		—	Specified by user		Specified by user		
33	CH32 name	Specified by user		—	ditto	—	Specified by user		—	Specified by user		Specified by user		
34	VTA	1 - 20000		—	VT primary value of zone A	—				2000				
35	VTB	1 - 20000		—	VT primary value of zone B	—				2000				
36	VTC	1 - 20000		—	VT primary value of zone C	—				2000				
37	VTD	1 - 20000		—	VT primary value of zone D	—				2000				
38	C.TP	BLK - Trip		—	Under brige condition, coupler CB tripped or not	BLK								
39	IDSV	Off - ALM&BLK - ALM		—	Id monitoring control	ALM								
40	AISV	Off - ALM&BLK - ALM		—	AC input imbalance monitoring	ALM&BLK								
41	AIFDSV	Off - ALM&BLK - ALM		—	AC input imbalance of F-D monitoring control	—				ALM				
42	DSSV	Off - ALM&BLK - ALM		—	DS monitoring control	ALM								
43	CBSV	Off - ALM&BLK - ALM		—	CB monitoring control	ALM								
44	BFLOGIC	BF1 - BF2		—	CBF logic option	BF1								
45	1 BF1	Off - T - TOC		—	CBF re-trip	Off								
46	1 BF2	Off - On		—	CBF related trip	Off								
47	1 BFEXT	Off - On		—	CBF initiation by ext. trip	Off								
48	2 BF1	Off - T - TOC		—	CBF re-trip	Off								
49	2 BF2	Off - On		—	CBF related trip	Off								
50	2 BFEXT	Off - On		—	CBF initiation by ext. trip	Off								
51	3 BF1	Off - T - TOC		—	CBF re-trip	Off								
52	3 BF2	Off - On		—	CBF related trip	Off								
53	3 BFEXT	Off - On		—	CBF initiation by ext. trip	Off								
54	4 BF1	Off - T - TOC		—	CBF re-trip	Off								
55	4 BF2	Off - On		—	CBF related trip	Off								
56	4 BFEXT	Off - On		—	CBF initiation by ext. trip	Off								
57	5 BF1	Off - T - TOC		—	CBF re-trip	Off								
58	5 BF2	Off - On		—	CBF related trip	Off								
59	5 BFEXT	Off - On		—	CBF initiation by ext. trip	Off								
60	6 BF1	Off - T - TOC		—	CBF re-trip	Off								
61	6 BF2	Off - On		—	CBF related trip	Off								
62	6 BFEXT	Off - On		—	CBF initiation by ext. trip	Off								
63	7 BF1	Off - T - TOC		—	CBF re-trip	Off								
64	7 BF2	Off - On		—	CBF related trip	Off								
65	7 BFEXT	Off - On		—	CBF initiation by ext. trip	Off								
66	8 BF1	Off - T - TOC		—	CBF re-trip	Off								
67	8 BF2	Off - On		—	CBF related trip	Off								
68	8 BFEXT	Off - On		—	CBF initiation by ext. trip	Off								
69	9 BF1	Off - T - TOC		—	CBF re-trip	—	Off		—	Off		Off		
70	9 BF2	Off - On		—	CBF related trip	—	Off		—	Off		Off		

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No	Name	Range		Units	Contents	Default Setting of Relay Series(5A rating / 1A rating)								User Setting
		5A rating	1A rating			No voltage				With voltage				
						FEP×1	FEP×2	FEP×3	FEP×4	FEP×1	FEP×2	FEP×3	FEP×4	
						110	120	130	140	210	220	230	240	
71	9 BFEXT	Off - On	—	—	CBF initiation by ext. trip	—	—	Off	—	—	Off	—	—	
72	10 BF1	Off - T - TOC	—	—	CBF re-trip	—	—	Off	—	—	Off	—	—	
73	10 BF2	Off - On	—	—	CBF related trip	—	—	Off	—	—	Off	—	—	
74	10 BFEXT	Off - On	—	—	CBF initiation by ext. trip	—	—	Off	—	—	Off	—	—	
75	11 BF1	Off - T - TOC	—	—	CBF re-trip	—	—	Off	—	—	Off	—	—	
76	11 BF2	Off - On	—	—	CBF related trip	—	—	Off	—	—	Off	—	—	
77	11 BFEXT	Off - On	—	—	CBF initiation by ext. trip	—	—	Off	—	—	Off	—	—	
78	12 BF1	Off - T - TOC	—	—	CBF re-trip	—	—	Off	—	—	Off	—	—	
79	12 BF2	Off - On	—	—	CBF related trip	—	—	Off	—	—	Off	—	—	
80	12 BFEXT	Off - On	—	—	CBF initiation by ext. trip	—	—	Off	—	—	Off	—	—	
81	13 BF1	Off - T - TOC	—	—	CBF re-trip	—	—	Off	—	—	Off	—	—	
82	13 BF2	Off - On	—	—	CBF related trip	—	—	Off	—	—	Off	—	—	
83	13 BFEXT	Off - On	—	—	CBF initiation by ext. trip	—	—	Off	—	—	Off	—	—	
84	14 BF1	Off - T - TOC	—	—	CBF re-trip	—	—	Off	—	—	Off	—	—	
85	14 BF2	Off - On	—	—	CBF related trip	—	—	Off	—	—	Off	—	—	
86	14 BFEXT	Off - On	—	—	CBF initiation by ext. trip	—	—	Off	—	—	Off	—	—	
87	15 BF1	Off - T - TOC	—	—	CBF re-trip	—	—	Off	—	—	Off	—	—	
88	15 BF2	Off - On	—	—	CBF related trip	—	—	Off	—	—	Off	—	—	
89	15 BFEXT	Off - On	—	—	CBF initiation by ext. trip	—	—	Off	—	—	Off	—	—	
90	16 BF1	Off - T - TOC	—	—	CBF re-trip	—	—	Off	—	—	Off	—	—	
91	16 BF2	Off - On	—	—	CBF related trip	—	—	Off	—	—	Off	—	—	
92	16 BFEXT	Off - On	—	—	CBF initiation by ext. trip	—	—	Off	—	—	Off	—	—	
93	17 BF1	Off - T - TOC	—	—	CBF re-trip	—	—	Off	—	—	Off	—	—	
94	17 BF2	Off - On	—	—	CBF related trip	—	—	Off	—	—	Off	—	—	
95	17 BFEXT	Off - On	—	—	CBF initiation by ext. trip	—	—	Off	—	—	Off	—	—	
96	18 BF1	Off - T - TOC	—	—	CBF re-trip	—	—	Off	—	—	Off	—	—	
97	18 BF2	Off - On	—	—	CBF related trip	—	—	Off	—	—	Off	—	—	
98	18 BFEXT	Off - On	—	—	CBF initiation by ext. trip	—	—	Off	—	—	Off	—	—	
99	19 BF1	Off - T - TOC	—	—	CBF re-trip	—	—	Off	—	—	Off	—	—	
100	19 BF2	Off - On	—	—	CBF related trip	—	—	Off	—	—	Off	—	—	
101	19 BFEXT	Off - On	—	—	CBF initiation by ext. trip	—	—	Off	—	—	Off	—	—	
102	20 BF1	Off - T - TOC	—	—	CBF re-trip	—	—	Off	—	—	Off	—	—	
103	20 BF2	Off - On	—	—	CBF related trip	—	—	Off	—	—	Off	—	—	
104	20 BFEXT	Off - On	—	—	CBF initiation by ext. trip	—	—	Off	—	—	Off	—	—	
105	21 BF1	Off - T - TOC	—	—	CBF re-trip	—	—	Off	—	—	Off	—	—	
106	21 BF2	Off - On	—	—	CBF related trip	—	—	Off	—	—	Off	—	—	
107	21 BFEXT	Off - On	—	—	CBF initiation by ext. trip	—	—	Off	—	—	Off	—	—	
108	22 BF1	Off - T - TOC	—	—	CBF re-trip	—	—	Off	—	—	Off	—	—	
109	22 BF2	Off - On	—	—	CBF related trip	—	—	Off	—	—	Off	—	—	
110	22 BFEXT	Off - On	—	—	CBF initiation by ext. trip	—	—	Off	—	—	Off	—	—	
111	23 BF1	Off - T - TOC	—	—	CBF re-trip	—	—	Off	—	—	Off	—	—	
112	23 BF2	Off - On	—	—	CBF related trip	—	—	Off	—	—	Off	—	—	
113	23 BFEXT	Off - On	—	—	CBF initiation by ext. trip	—	—	Off	—	—	Off	—	—	
114	24 BF1	Off - T - TOC	—	—	CBF re-trip	—	—	Off	—	—	Off	—	—	
115	24 BF2	Off - On	—	—	CBF related trip	—	—	Off	—	—	Off	—	—	
116	24 BFEXT	Off - On	—	—	CBF initiation by ext. trip	—	—	Off	—	—	Off	—	—	
117	25 BF1	Off - T - TOC	—	—	CBF re-trip	—	—	Off	—	—	Off	—	—	
118	25 BF2	Off - On	—	—	CBF related trip	—	—	Off	—	—	Off	—	—	
119	25 BFEXT	Off - On	—	—	CBF initiation by ext. trip	—	—	Off	—	—	Off	—	—	
120	26 BF1	Off - T - TOC	—	—	CBF re-trip	—	—	Off	—	—	Off	—	—	
121	26 BF2	Off - On	—	—	CBF related trip	—	—	Off	—	—	Off	—	—	
122	26 BFEXT	Off - On	—	—	CBF initiation by ext. trip	—	—	Off	—	—	Off	—	—	
123	27 BF1	Off - T - TOC	—	—	CBF re-trip	—	—	Off	—	—	Off	—	—	
124	27 BF2	Off - On	—	—	CBF related trip	—	—	Off	—	—	Off	—	—	
125	27 BFEXT	Off - On	—	—	CBF initiation by ext. trip	—	—	Off	—	—	Off	—	—	
126	28 BF1	Off - T - TOC	—	—	CBF re-trip	—	—	Off	—	—	Off	—	—	
127	28 BF2	Off - On	—	—	CBF related trip	—	—	Off	—	—	Off	—	—	
128	28 BFEXT	Off - On	—	—	CBF initiation by ext. trip	—	—	Off	—	—	Off	—	—	
129	29 BF1	Off - T - TOC	—	—	CBF re-trip	—	—	Off	—	—	Off	—	—	
130	29 BF2	Off - On	—	—	CBF related trip	—	—	Off	—	—	Off	—	—	
131	29 BFEXT	Off - On	—	—	CBF initiation by ext. trip	—	—	Off	—	—	Off	—	—	
132	30 BF1	Off - T - TOC	—	—	CBF re-trip	—	—	Off	—	—	Off	—	—	
133	30 BF2	Off - On	—	—	CBF related trip	—	—	Off	—	—	Off	—	—	
134	30 BFEXT	Off - On	—	—	CBF initiation by ext. trip	—	—	Off	—	—	Off	—	—	
135	31 BF1	Off - T - TOC	—	—	CBF re-trip	—	—	Off	—	—	Off	—	—	
136	31 BF2	Off - On	—	—	CBF related trip	—	—	Off	—	—	Off	—	—	
137	31 BFEXT	Off - On	—	—	CBF initiation by ext. trip	—	—	Off	—	—	Off	—	—	
138	32 BF1	Off - T - TOC	—	—	CBF re-trip	—	—	Off	—	—	Off	—	—	
139	32 BF2	Off - On	—	—	CBF related trip	—	—	Off	—	—	Off	—	—	
140	32 BFEXT	Off - On	—	—	CBF initiation by ext. trip	—	—	Off	—	—	Off	—	—	

Relay and Protection Scheme Setting Sheet

№	Name	Range		Units	Contents	Default Setting of Relay Series(5A rating / 1A rating)								User Setting
		No voltage				With voltage								
		FEP×1	FEP×2			FEP×3	FEP×4	FEP×1	FEP×2	FEP×3	FEP×4			
		5A rating	1A rating			110	120	130	140	210	220	230	240	
141	BFRIO	Off - On	—	—	CBF transfer operating time	Off								
142	COMP	Off - On	—	—	Command trip enable	Off								
143	EFPTR	Off - On	—	—	End fault transfer trip enable	Off								
144	CTFEN	Off - On - OPT-On	—	—	CTF detect.function use or not	Off								
145	CTFCNT	NA - BLK	—	—	Control by CTF detection	NA								
146	DIFCH	500 - 3000	A	A	Minimum operating current of	2000								
147	DIFZ	500 - 3000	A	A	Minimum operating current of	2000								
148	SLPCH	0.30 - 0.90	-	-	Slope of DIFCH relay	0.30								
149	SLPZ	0.30 - 0.90	-	-	Slope of DIFDZ relay	0.30								
150	DIFSV	20 - 3000	A	A	Minimum operating current of	200								
151	TIDSV	0 - 60	s	s	Id err detected timer	10								
152	TBRDG	0 - 60	s	s	bridge timer	60								
153	TDSSV	0 - 60	s	s	DS failure detected timer	60								
154	TCBSV	0 - 60	s	s	CB failure detected timer	10								
155	1 CT	100 - 10000	A	A	CT primary value	2000								
156	2 CT	100 - 10000	A	A	ditto	2000								
157	3 CT	100 - 10000	A	A	ditto	2000								
158	4 CT	100 - 10000	A	A	ditto	2000								
159	5 CT	100 - 10000	A	A	ditto	2000								
160	6 CT	100 - 10000	A	A	ditto	2000								
161	7 CT	100 - 10000	A	A	ditto	2000								
162	8 CT	100 - 10000	A	A	ditto	2000								
163	9 CT	100 - 10000	A	A	ditto	—	2000	—	2000	—	2000	—	2000	
164	10 CT	100 - 10000	A	A	ditto	—	2000	—	2000	—	2000	—	2000	
165	11 CT	100 - 10000	A	A	ditto	—	2000	—	2000	—	2000	—	2000	
166	12 CT	100 - 10000	A	A	ditto	—	2000	—	2000	—	2000	—	2000	
167	13 CT	100 - 10000	A	A	ditto	—	2000	—	2000	—	2000	—	2000	
168	14 CT	100 - 10000	A	A	ditto	—	2000	—	2000	—	2000	—	2000	
169	15 CT	100 - 10000	A	A	ditto	—	2000	—	2000	—	2000	—	2000	
170	16 CT	100 - 10000	A	A	ditto	—	2000	—	2000	—	2000	—	2000	
171	17 CT	100 - 10000	A	A	ditto	—	2000	—	2000	—	2000	—	2000	
172	18 CT	100 - 10000	A	A	ditto	—	2000	—	2000	—	2000	—	2000	
173	19 CT	100 - 10000	A	A	ditto	—	2000	—	2000	—	2000	—	2000	
174	20 CT	100 - 10000	A	A	ditto	—	2000	—	2000	—	2000	—	2000	
175	21 CT	100 - 10000	A	A	ditto	—	2000	—	2000	—	2000	—	2000	
176	22 CT	100 - 10000	A	A	ditto	—	2000	—	2000	—	2000	—	2000	
177	23 CT	100 - 10000	A	A	ditto	—	2000	—	2000	—	2000	—	2000	
178	24 CT	100 - 10000	A	A	ditto	—	2000	—	2000	—	2000	—	2000	
179	25 CT	100 - 10000	A	A	ditto	—	2000	—	2000	—	2000	—	2000	
180	26 CT	100 - 10000	A	A	ditto	—	2000	—	2000	—	2000	—	2000	
181	27 CT	100 - 10000	A	A	ditto	—	2000	—	2000	—	2000	—	2000	
182	28 CT	100 - 10000	A	A	ditto	—	2000	—	2000	—	2000	—	2000	
183	29 CT	100 - 10000	A	A	ditto	—	2000	—	2000	—	2000	—	2000	
184	30 CT	100 - 10000	A	A	ditto	—	2000	—	2000	—	2000	—	2000	
185	31 CT	100 - 10000	A	A	ditto	—	2000	—	2000	—	2000	—	2000	
186	32 CT	100 - 10000	A	A	ditto	—	2000	—	2000	—	2000	—	2000	
187	TBDO	0.00 - 10.00	s	s	CBF operatin drop-off timer	0.10								
188	TCBO	0.00 - 10.00	s	s	CB opened timer for EFP-TR	1.00								
189	CFID	50 - 3000	A	A	Id level of CTF scheme	—								200
190	CFUV	20 - 60	V	V	UV level of CTF scheme	—								20
191	CFDV	1 - 10	%	%	UVD level of CTF scheme	—								7
192	CFOVG	0.1 - 10.0	V	V	Zero pahse overvoltage of CTF	—								1.0
193	1 OCB	0.1 - 2.0	—	—	Minimum operating current	0.8								
194	T1 B1	0 - 500	ms	ms	CBF timer for re-trip	150								
195	T1 B2	0 - 500	ms	ms	CBF timer for related trip	200								
196	2 OCB	0.1 - 2.0	—	—	Minimum operating current	0.8								
197	T2 B1	0 - 500	ms	ms	CBF timer for re-trip	150								
198	T2 B2	0 - 500	ms	ms	CBF timer for related trip	200								
199	3 OCB	0.1 - 2.0	—	—	Minimum operating current	0.8								
200	T3 B1	0 - 500	ms	ms	CBF timer for re-trip	150								
201	T3 B2	0 - 500	ms	ms	CBF timer for related trip	200								
202	4 OCB	0.1 - 2.0	—	—	Minimum operating current	0.8								
203	T4 B1	0 - 500	ms	ms	CBF timer for re-trip	150								
204	T4 B2	0 - 500	ms	ms	CBF timer for related trip	200								
205	5 OCB	0.1 - 2.0	—	—	Minimum operating current	0.8								
206	T5 B1	0 - 500	ms	ms	CBF timer for re-trip	150								
207	T5 B2	0 - 500	ms	ms	CBF timer for related trip	200								
208	6 OCB	0.1 - 2.0	—	—	Minimum operating current	0.8								
209	T6 B1	0 - 500	ms	ms	CBF timer for re-trip	150								
210	T6 B2	0 - 500	ms	ms	CBF timer for related trip	200								
211	7 OCB	0.1 - 2.0	—	—	Minimum operating current	0.8								
212	T7 B1	0 - 500	ms	ms	CBF timer for re-trip	150								
213	T7 B2	0 - 500	ms	ms	CBF timer for related trip	200								

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						110	120	130	140	210	220	230	240	
214	8 OCB	0.1 - 2.0	—	ms	Minimum operating current	0.8								
215	T8 B1	0 - 500	ms	ms	CBF timer for re-trip	150								
216	T8 B2	0 - 500	ms	ms	CBF timer for related trip	200								
217	9 OCB	0.1 - 2.0	—	ms	Minimum operating current	0.8								
218	T9 B1	0 - 500	ms	ms	CBF timer for re-trip	150								
219	T9 B2	0 - 500	ms	ms	CBF timer for related trip	200								
220	10 OCB	0.1 - 2.0	—	ms	Minimum operating current	0.8								
221	T10 B1	0 - 500	ms	ms	CBF timer for re-trip	150								
222	T10 B2	0 - 500	ms	ms	CBF timer for related trip	200								
223	11 OCB	0.1 - 2.0	—	ms	Minimum operating current	0.8								
224	T11 B1	0 - 500	ms	ms	CBF timer for re-trip	150								
225	T11 B2	0 - 500	ms	ms	CBF timer for related trip	200								
226	12 OCB	0.1 - 2.0	—	ms	Minimum operating current	0.8								
227	T12 B1	0 - 500	ms	ms	CBF timer for re-trip	150								
228	T12 B2	0 - 500	ms	ms	CBF timer for related trip	200								
229	13 OCB	0.1 - 2.0	—	ms	Minimum operating current	0.8								
230	T13 B1	0 - 500	ms	ms	CBF timer for re-trip	150								
231	T13 B2	0 - 500	ms	ms	CBF timer for related trip	200								
232	14 OCB	0.1 - 2.0	—	ms	Minimum operating current	0.8								
233	T14 B1	0 - 500	ms	ms	CBF timer for re-trip	150								
234	T14 B2	0 - 500	ms	ms	CBF timer for related trip	200								
235	15 OCB	0.1 - 2.0	—	ms	Minimum operating current	0.8								
236	T15 B1	0 - 500	ms	ms	CBF timer for re-trip	150								
237	T15 B2	0 - 500	ms	ms	CBF timer for related trip	200								
238	16 OCB	0.1 - 2.0	—	ms	Minimum operating current	0.8								
239	T16 B1	0 - 500	ms	ms	CBF timer for re-trip	150								
240	T16 B2	0 - 500	ms	ms	CBF timer for related trip	200								
241	17 OCB	0.1 - 2.0	—	ms	Minimum operating current	0.8								
242	T17 B1	0 - 500	ms	ms	CBF timer for re-trip	150								
243	T17 B2	0 - 500	ms	ms	CBF timer for related trip	200								
244	18 OCB	0.1 - 2.0	—	ms	Minimum operating current	0.8								
245	T18 B1	0 - 500	ms	ms	CBF timer for re-trip	150								
246	T18 B2	0 - 500	ms	ms	CBF timer for related trip	200								
247	19 OCB	0.1 - 2.0	—	ms	Minimum operating current	0.8								
248	T19 B1	0 - 500	ms	ms	CBF timer for re-trip	150								
249	T19 B2	0 - 500	ms	ms	CBF timer for related trip	200								
250	20 OCB	0.1 - 2.0	—	ms	Minimum operating current	0.8								
251	T20 B1	0 - 500	ms	ms	CBF timer for re-trip	150								
252	T20 B2	0 - 500	ms	ms	CBF timer for related trip	200								
253	21 OCB	0.1 - 2.0	—	ms	Minimum operating current	0.8								
254	T21 B1	0 - 500	ms	ms	CBF timer for re-trip	150								
255	T21 B2	0 - 500	ms	ms	CBF timer for related trip	200								
256	22 OCB	0.1 - 2.0	—	ms	Minimum operating current	0.8								
257	T22 B1	0 - 500	ms	ms	CBF timer for re-trip	150								
258	T22 B2	0 - 500	ms	ms	CBF timer for related trip	200								
259	23 OCB	0.1 - 2.0	—	ms	Minimum operating current	0.8								
260	T23 B1	0 - 500	ms	ms	CBF timer for re-trip	150								
261	T23 B2	0 - 500	ms	ms	CBF timer for related trip	200								
262	24 OCB	0.1 - 2.0	—	ms	Minimum operating current	0.8								
263	T24 B1	0 - 500	ms	ms	CBF timer for re-trip	150								
264	T24 B2	0 - 500	ms	ms	CBF timer for related trip	200								
265	25 OCB	0.1 - 2.0	—	ms	Minimum operating current	0.8								
266	T25 B1	0 - 500	ms	ms	CBF timer for re-trip	150								
267	T25 B2	0 - 500	ms	ms	CBF timer for related trip	200								
268	26 OCB	0.1 - 2.0	—	ms	Minimum operating current	0.8								
269	T26 B1	0 - 500	ms	ms	CBF timer for re-trip	150								
270	T26 B2	0 - 500	ms	ms	CBF timer for related trip	200								
271	27 OCB	0.1 - 2.0	—	ms	Minimum operating current	0.8								
272	T27 B1	0 - 500	ms	ms	CBF timer for re-trip	150								
273	T27 B2	0 - 500	ms	ms	CBF timer for related trip	200								
274	28 OCB	0.1 - 2.0	—	ms	Minimum operating current	0.8								
275	T28 B1	0 - 500	ms	ms	CBF timer for re-trip	150								
276	T28 B2	0 - 500	ms	ms	CBF timer for related trip	200								
277	29 OCB	0.1 - 2.0	—	ms	Minimum operating current	0.8								
278	T29 B1	0 - 500	ms	ms	CBF timer for re-trip	150								
279	T29 B2	0 - 500	ms	ms	CBF timer for related trip	200								
280	30 OCB	0.1 - 2.0	—	ms	Minimum operating current	0.8								
281	T30 B1	0 - 500	ms	ms	CBF timer for re-trip	150								
282	T30 B2	0 - 500	ms	ms	CBF timer for related trip	200								
283	31 OCB	0.1 - 2.0	—	ms	Minimum operating current	0.8								
284	T31 B1	0 - 500	ms	ms	CBF timer for re-trip	150								
285	T31 B2	0 - 500	ms	ms	CBF timer for related trip	200								
286	32 OCB	0.1 - 2.0	—	ms	Minimum operating current	0.8								
287	T32 B1	0 - 500	ms	ms	CBF timer for re-trip	150								
288	T32 B2	0 - 500	ms	ms	CBF timer for related trip	200								

Relay and Protection Scheme Setting Sheet

Only and Protection Scheme Setting Sheet					Default Setting of Relay Series(5A rating / 1A rating)								User Setting	
No	Name	Range		Units	Contents	No voltage				With voltage				
		5A rating	1A rating			FEP×1	FEP×2	FEP×3	FEP×4	FEP×1	FEP×2	FEP×3		FEP×4
						110	120	130	140	210	220	230		240
289	UVSF	60 - 100		V	Phase-to-phase undervoltage	--				80				
290	UVGF	20 - 60		V	Phase-to-earth undervoltage	--				46				
291	OVGF	0.1 - 10.0		V	Zero-phase overvoltage	--				10.0				
292	BISW 1	Norm - Inv	--		Binary input					Norm				
293	BISW 2	Norm - Inv	--		ditto					Norm				
294	BISW 3	Norm - Inv	--		ditto					Norm				
295	BISW 4	Norm - Inv	--		ditto					Norm				
296	BISW 5	Norm - Inv	--		ditto					Norm				
297	BISW 6	Norm - Inv	--		ditto					Norm				
298	BISW 7	Norm - Inv	--		ditto					Norm				
299	BISW 8	Norm - Inv	--		ditto					Norm				
300	BISW 9	Norm - Inv	--		ditto					Norm				
301	BISW 10	Norm - Inv	--		ditto					Norm				
302	BISW 11	Norm - Inv	--		ditto					Norm				
303	BISW 12	Norm - Inv	--		ditto					Norm				
304	BISW 13	Norm - Inv	--		ditto					Norm				
305	BISW 14	Norm - Inv	--		ditto					Norm				
306	BISW 15	Norm - Inv	--		ditto					Norm				
307	LED1	0 - 3071	--		Configurable LEDs					0				
308	LED2	0 - 3071	--		ditto					0				
309	LED3	0 - 3071	--		ditto					0				
310	LED4	0 - 3071	--		ditto					0				
311	Plant name	Specified by user		--	Plant name	Specified by user								
312	Description	ditto		--	Memorandum for user	Specified by user								
313	HDLC(LCD) Address(RSM)	1 - 32		--	Relay ID No. for RSM	1								
314	IEC(LCD) Address(RSM)	0 - 254		--	Relay ID No. for IEC103	2								
315	232C	9.6 - 19.2 - 38.4 - 57.6		--	Comm. speed for RSM	9.6								
316	IECBR	9.6 - 19.2		--	Comm. speed for IEC103	19.2								
317	IECBLK	Normal - Blocked		--	Comm. switch for IEC103	Normal								
318	ZA trip	None - Operate - Reset - Both		--	Event record trigger	Both								
319	ZB trip	None - Operate - Reset - Both		--	ditto	Both								
320	ZC trip	None - Operate - Reset - Both		--	ditto	Both								
321	ZD trip	None - Operate - Reset - Both		--	ditto	Both								
322	Trip	None - Operate - Reset - Both		--	ditto	Both								
323	CBF-retrip	None - Operate - Reset - Both		--	ditto	Both								
324	CBF-trip	None - Operate - Reset - Both		--	ditto	Both								
325	CBF-TR	None - Operate - Reset - Both		--	ditto	Both								
326	COM-trip	None - Operate - Reset - Both		--	ditto	Both								
327	EFP-TR	None - Operate - Reset - Both		--	ditto	Both								
328	Bus bridge	None - Operate - Reset - Both		--	ditto	Both								
329	Trans.bus	None - Operate - Reset - Both		--	ditto	Both								
330	BP block	None - Operate - Reset - Both		--	ditto	Both								
331	CBF block	None - Operate - Reset - Both		--	ditto	Both								
332	Ind. reset	None - Operate - Reset - Both		--	ditto	Both								
333	Relay fail	None - Operate - Reset - Both		--	ditto	Both								
334	CT err	None - Operate - Reset - Both		--	ditto	Both								
335	V0 err	None - Operate - Reset - Both		--	ditto					Both				
336	V2 err	None - Operate - Reset - Both		--	ditto	--				Both				
337	Id err	None - Operate - Reset - Both		--	ditto	Both								
338	DS fail	None - Operate - Reset - Both		--	ditto	Both								
339	CB fail	None - Operate - Reset - Both		--	ditto	Both								
340	CTF	None - Operate - Reset - Both		--	ditto	--				Both				
341	CH1 BI	None - Operate - Reset - Both		--	ditto					Both				
342	CH2 BI	None - Operate - Reset - Both		--	ditto					Both				
343	CH3 BI	None - Operate - Reset - Both		--	ditto					Both				
344	CH4 BI	None - Operate - Reset - Both		--	ditto					Both				
345	CH5 BI	None - Operate - Reset - Both		--	ditto					Both				
346	CH6 BI	None - Operate - Reset - Both		--	ditto					Both				
347	CH7 BI	None - Operate - Reset - Both		--	ditto					Both				
348	CH8 BI	None - Operate - Reset - Both		--	ditto					Both				
349	CH9 BI	None - Operate - Reset - Both		--	ditto	--				Both				
350	CH10 BI	None - Operate - Reset - Both		--	ditto	--				Both				
351	CH11 BI	None - Operate - Reset - Both		--	ditto	--				Both				
352	CH12 BI	None - Operate - Reset - Both		--	ditto	--				Both				
353	CH13 BI	None - Operate - Reset - Both		--	ditto	--				Both				
354	CH14 BI	None - Operate - Reset - Both		--	ditto	--				Both				
355	CH15 BI	None - Operate - Reset - Both		--	ditto	--				Both				
356	CH16 BI	None - Operate - Reset - Both		--	ditto	--				Both				
357	CH17 BI	None - Operate - Reset - Both		--	ditto	--				Both				
358	CH18 BI	None - Operate - Reset - Both		--	ditto	--				Both				

Relay and Protection Scheme Setting Sheet

№	Name	Range		Units	Contents	Default Setting of Relay Series(5A rating / 1A rating)								User Setting
						No voltage				With voltage				
		5A rating	1A rating			FEP×1 110	FEP×2 120	FEP×3 130	FEP×4 140	FEP×1 210	FEP×2 220	FEP×3 230	FEP×4 240	
359	CH19 BI	None - Operate - Reset - Both	—	ditto	—	—	Both	—	Both	—	Both	—		
360	CH20 BI	None - Operate - Reset - Both	—	ditto	—	—	Both	—	Both	—	Both	—		
361	CH21 BI	None - Operate - Reset - Both	—	ditto	—	—	Both	—	Both	—	Both	—		
362	CH22 BI	None - Operate - Reset - Both	—	ditto	—	—	Both	—	Both	—	Both	—		
363	CH23 BI	None - Operate - Reset - Both	—	ditto	—	—	Both	—	Both	—	Both	—		
364	CH24 BI	None - Operate - Reset - Both	—	ditto	—	—	Both	—	Both	—	Both	—		
365	CH25 BI	None - Operate - Reset - Both	—	ditto	—	—	Both	—	Both	—	Both	—		
366	CH26 BI	None - Operate - Reset - Both	—	ditto	—	—	Both	—	Both	—	Both	—		
367	CH27 BI	None - Operate - Reset - Both	—	ditto	—	—	Both	—	Both	—	Both	—		
368	CH28 BI	None - Operate - Reset - Both	—	ditto	—	—	Both	—	Both	—	Both	—		
369	CH29 BI	None - Operate - Reset - Both	—	ditto	—	—	Both	—	Both	—	Both	—		
370	CH30 BI	None - Operate - Reset - Both	—	ditto	—	—	Both	—	Both	—	Both	—		
371	CH31 BI	None - Operate - Reset - Both	—	ditto	—	—	Both	—	Both	—	Both	—		
372	CH32 BI	None - Operate - Reset - Both	—	ditto	—	—	Both	—	Both	—	Both	—		
373	Sys. set change	None - Operate	—	ditto	—	—	Operate	—	Operate	—	Operate	—		
374	Rly. set change	None - Operate	—	ditto	—	—	Operate	—	Operate	—	Operate	—		
375	Grp. set change	None - Operate	—	ditto	—	—	Operate	—	Operate	—	Operate	—		
376	Time	0.1 - 2.0	s	Disturbance record	—	—	1.0	—	—	—	1.0	—		
377	1 OCG	0.1 - 10.0	-	OC element for disturbance	—	—	1.0	—	—	—	1.0	—		
378	1 OCS	0.1 - 10.0	-	ditto	—	—	2.0	—	—	—	2.0	—		
379	2 OCG	0.1 - 10.0	-	ditto	—	—	1.0	—	—	—	1.0	—		
380	2 OCS	0.1 - 10.0	-	ditto	—	—	2.0	—	—	—	2.0	—		
381	3 OCG	0.1 - 10.0	-	ditto	—	—	1.0	—	—	—	1.0	—		
382	3 OCS	0.1 - 10.0	-	ditto	—	—	2.0	—	—	—	2.0	—		
383	4 OCG	0.1 - 10.0	-	ditto	—	—	1.0	—	—	—	1.0	—		
384	4 OCS	0.1 - 10.0	-	ditto	—	—	2.0	—	—	—	2.0	—		
385	5 OCG	0.1 - 10.0	-	ditto	—	—	1.0	—	—	—	1.0	—		
386	5 OCS	0.1 - 10.0	-	ditto	—	—	2.0	—	—	—	2.0	—		
387	6 OCG	0.1 - 10.0	-	ditto	—	—	1.0	—	—	—	1.0	—		
388	6 OCS	0.1 - 10.0	-	ditto	—	—	2.0	—	—	—	2.0	—		
389	7 OCG	0.1 - 10.0	-	ditto	—	—	1.0	—	—	—	1.0	—		
390	7 OCS	0.1 - 10.0	-	ditto	—	—	2.0	—	—	—	2.0	—		
391	8 OCG	0.1 - 10.0	-	ditto	—	—	1.0	—	—	—	1.0	—		
392	8 OCS	0.1 - 10.0	-	ditto	—	—	2.0	—	—	—	2.0	—		
393	9 OCG	0.1 - 10.0	-	ditto	—	—	1.0	—	—	—	1.0	—		
394	9 OCS	0.1 - 10.0	-	ditto	—	—	2.0	—	—	—	2.0	—		
395	10 OCG	0.1 - 10.0	-	ditto	—	—	1.0	—	—	—	1.0	—		
396	10 OCS	0.1 - 10.0	-	ditto	—	—	2.0	—	—	—	2.0	—		
397	11 OCG	0.1 - 10.0	-	ditto	—	—	1.0	—	—	—	1.0	—		
398	11 OCS	0.1 - 10.0	-	ditto	—	—	2.0	—	—	—	2.0	—		
399	12 OCG	0.1 - 10.0	-	ditto	—	—	1.0	—	—	—	1.0	—		
400	12 OCS	0.1 - 10.0	-	ditto	—	—	2.0	—	—	—	2.0	—		
401	13 OCG	0.1 - 10.0	-	ditto	—	—	1.0	—	—	—	1.0	—		
402	13 OCS	0.1 - 10.0	-	ditto	—	—	2.0	—	—	—	2.0	—		
403	14 OCG	0.1 - 10.0	-	ditto	—	—	1.0	—	—	—	1.0	—		
404	14 OCS	0.1 - 10.0	-	ditto	—	—	2.0	—	—	—	2.0	—		
405	15 OCG	0.1 - 10.0	-	ditto	—	—	1.0	—	—	—	1.0	—		
406	15 OCS	0.1 - 10.0	-	ditto	—	—	2.0	—	—	—	2.0	—		
407	16 OCG	0.1 - 10.0	-	ditto	—	—	1.0	—	—	—	1.0	—		
408	16 OCS	0.1 - 10.0	-	ditto	—	—	2.0	—	—	—	2.0	—		
409	17 OCG	0.1 - 10.0	-	ditto	—	—	1.0	—	—	—	1.0	—		
410	17 OCS	0.1 - 10.0	-	ditto	—	—	2.0	—	—	—	2.0	—		
411	18 OCG	0.1 - 10.0	-	ditto	—	—	1.0	—	—	—	1.0	—		
412	18 OCS	0.1 - 10.0	-	ditto	—	—	2.0	—	—	—	2.0	—		
413	19 OCG	0.1 - 10.0	-	ditto	—	—	1.0	—	—	—	1.0	—		
414	19 OCS	0.1 - 10.0	-	ditto	—	—	2.0	—	—	—	2.0	—		
415	20 OCG	0.1 - 10.0	-	ditto	—	—	1.0	—	—	—	1.0	—		
416	20 OCS	0.1 - 10.0	-	ditto	—	—	2.0	—	—	—	2.0	—		
417	21 OCG	0.1 - 10.0	-	ditto	—	—	1.0	—	—	—	1.0	—		
418	21 OCS	0.1 - 10.0	-	ditto	—	—	2.0	—	—	—	2.0	—		
419	22 OCG	0.1 - 10.0	-	ditto	—	—	1.0	—	—	—	1.0	—		
420	22 OCS	0.1 - 10.0	-	ditto	—	—	2.0	—	—	—	2.0	—		
421	23 OCG	0.1 - 10.0	-	ditto	—	—	1.0	—	—	—	1.0	—		
422	23 OCS	0.1 - 10.0	-	ditto	—	—	2.0	—	—	—	2.0	—		
423	24 OCG	0.1 - 10.0	-	ditto	—	—	1.0	—	—	—	1.0	—		
424	24 OCS	0.1 - 10.0	-	ditto	—	—	2.0	—	—	—	2.0	—		
425	25 OCG	0.1 - 10.0	-	ditto	—	—	1.0	—	—	—	1.0	—		
426	25 OCS	0.1 - 10.0	-	ditto	—	—	2.0	—	—	—	2.0	—		
427	26 OCG	0.1 - 10.0	-	ditto	—	—	1.0	—	—	—	1.0	—		
428	26 OCS	0.1 - 10.0	-	ditto	—	—	2.0	—	—	—	2.0	—		

Relay and Protection Scheme Setting Sheet

№	Name	Range		Units	Contents	Default Setting of Relay Series(5A rating / 1A rating)								User Setting
		5A rating	1A rating			No voltage				With voltage				
						FEP×1 110	FEP×2 120	FEP×3 130	FEP×4 140	FEP×1 210	FEP×2 220	FEP×3 230	FEP×4 240	
429	27 OCG	0.1 - 10.0	-	ditto	--	--	--	1.0	--	--	--	1.0		
430	27 OCS	0.1 - 10.0	-	ditto	--	--	--	2.0	--	--	--	2.0		
431	28 OCG	0.1 - 10.0	-	ditto	--	--	--	1.0	--	--	--	1.0		
432	28 OCS	0.1 - 10.0	-	ditto	--	--	--	2.0	--	--	--	2.0		
433	29 OCG	0.1 - 10.0	-	ditto	--	--	--	1.0	--	--	--	1.0		
434	29 OCS	0.1 - 10.0	-	ditto	--	--	--	2.0	--	--	--	2.0		
435	30 OCG	0.1 - 10.0	-	ditto	--	--	--	1.0	--	--	--	1.0		
436	30 OCS	0.1 - 10.0	-	ditto	--	--	--	2.0	--	--	--	2.0		
437	31 OCG	0.1 - 10.0	-	ditto	--	--	--	1.0	--	--	--	1.0		
438	31 OCS	0.1 - 10.0	-	ditto	--	--	--	2.0	--	--	--	2.0		
439	32 OCG	0.1 - 10.0	-	ditto	--	--	--	1.0	--	--	--	1.0		
440	32 OCS	0.1 - 10.0	-	ditto	--	--	--	2.0	--	--	--	2.0		
441	TRIP	Off - On	—	Disturbance trigger				On						
442	OCG	Off - On	—	ditto				Off						
443	OCS	Off - On	—	ditto				Off						
444	Display value	Primary - Secondary	—	Metering				Primary						
445	Time sync	Off - IRIG - RSM	—	Time				Off						
446	GMT	-12 - +12	hrs	Time				0						

PLC Default Setting

Output		Timing				Logic expression		Delay Time / Flip Flop							
№	Signal	Cycle			Turn	Model 100s	Model 200s	Flip Flop			Timer				None
		30	90	User				Norm	Back Up	Release Signal	Off Delay	On Delay	One Shot	Time Value	
1536															
1537															
1538	CH1-DS2_N/O		X		0		[13]CH1-B12								X
1539	CH1-DS2_N/C		X		0		[14]CH1-B16								X
1540	CH1-DS3_N/O						--								
1541	CH1-DS3_N/C						--								
1542	CH1-DS4_N/O						--								
1543	CH1-DS4_N/C						--								
1544	CH1-CB_N/O		X		0		[15]CH1-B13								X
1545	CH1-CB_N/C		X		0		[16]CH1-B17								X
1546															
1547															
1548															
1549															
1550															
1551															
1552															
1553															
1554	CH2-DS2_N/O		X		1		[29]CH2-B12								X
1555	CH2-DS2_N/C		X		1		[30]CH2-B16								X
1556	CH2-DS3_N/O						--								
1557	CH2-DS3_N/C						--								
1558	CH2-DS4_N/O						--								
1559	CH2-DS4_N/C						--								
1560	CH2-CB_N/O		X		1		[31]CH2-B13								X
1561	CH2-CB_N/C		X		1		[32]CH2-B17								X
1562															
1563															
1564															
1565															
1566															
1567															
1568															
1569															
1570	CH3-DS2_N/O		X		2		[45]CH3-B12								X
1571	CH3-DS2_N/C		X		2		[46]CH3-B16								X
1572	CH3-DS3_N/O						--								
1573	CH3-DS3_N/C						--								
1574	CH3-DS4_N/O						--								
1575	CH3-DS4_N/C						--								
1576	CH3-CB_N/O		X		2		[47]CH3-B13								X
1577	CH3-CB_N/C		X		2		[48]CH3-B17								X
1578															
1579															
1580															
1581															
1582															
1583															
1584															
1585															
1586	CH4-DS2_N/O		X		0		[61]CH4-B12								X
1587	CH4-DS2_N/C		X		0		[62]CH4-B16								X
1588	CH4-DS3_N/O						--								
1589	CH4-DS3_N/C						--								
1590	CH4-DS4_N/O						--								
1591	CH4-DS4_N/C						--								
1592	CH4-CB_N/O		X		0		[63]CH4-B13								X
1593	CH4-CB_N/C		X		0		[64]CH4-B17								X
1594															
1595															
1596															
1597															
1598															
1599															
1600															
1601															
1602	CH5-DS2_N/O		X		1		[77]CH5-B12								X
1603	CH5-DS2_N/C		X		1		[78]CH5-B16								X

PLC Default Setting

Output		Timing				Logic expression		Delay Time / Flip Flop							
№	Signal	Cycle			Turn	Model 100s	Model 200s	Flip Flop				Timer			
		30	90	User				Norm	Back Up	Release Signal	Off Delay	On Delay	One Shot	Time Value	None
1604	CH5-DS3_N/O						--								
1605	CH5-DS3_N/C						--								
1606	CH5-DS4_N/O						--								
1607	CH5-DS4_N/C						--								
1608	CH5-CB_N/O		X		1		[79]CH5-BI3								X
1609	CH5-CB_N/C		X		1		[80]CH5-BI7								X
1610															
1611															
1612															
1613															
1614															
1615															
1616															
1617															
1618	CH6-DS2_N/O		X		2		[93]CH6-BI2								X
1619	CH6-DS2_N/C		X		2		[94]CH6-BI6								X
1620	CH6-DS3_N/O						--								
1621	CH6-DS3_N/C						--								
1622	CH6-DS4_N/O						--								
1623	CH6-DS4_N/C						--								
1624	CH6-CB_N/O		X		2		[95]CH6-BI3								X
1625	CH6-CB_N/C		X		2		[96]CH6-BI7								X
1626															
1627															
1628															
1629															
1630															
1631															
1632															
1633															
1634	CH7-DS2_N/O		X		0		[109]CH7-BI2								X
1635	CH7-DS2_N/C		X		0		[110]CH7-BI6								X
1636	CH7-DS3_N/O						--								
1637	CH7-DS3_N/C						--								
1638	CH7-DS4_N/O						--								
1639	CH7-DS4_N/C						--								
1640	CH7-CB_N/O		X		0		[111]CH7-BI3								X
1641	CH7-CB_N/C		X		0		[112]CH7-BI7								X
1642															
1643															
1644															
1645															
1646															
1647															
1648															
1649															
1650	CH8-DS2_N/O		X		1		[125]CH8-BI2								X
1651	CH8-DS2_N/C		X		1		[126]CH8-BI6								X
1652	CH8-DS3_N/O						--								
1653	CH8-DS3_N/C						--								
1654	CH8-DS4_N/O						--								
1655	CH8-DS4_N/C						--								
1656	CH8-CB_N/O		X		1		[127]CH8-BI3								X
1657	CH8-CB_N/C		X		1		[128]CH8-BI7								X
1658															
1659															
1660															
1661															
1662															
1663															
1664															
1665															
1666	CH9-DS2_N/O		X		2		[141]CH9-BI2								X
1667	CH9-DS2_N/C		X		2		[142]CH9-BI6								X
1668	CH9-DS3_N/O						--								
1669	CH9-DS3_N/C						--								
1670	CH9-DS4_N/O						--								
1671	CH9-DS4_N/C						--								

PLC Default Setting		Timing				Logic expression		Delay Time / Flip Flop							
№	Signal	Cycle			Turn	Model 100s	Model 200s	Flip Flop						Time Value	None
		30	90	User				Norm	Back Up	Release Signal	Off Delay	On Delay	One Shot		
1672	CH9-CB_N/O		X		2		[143]CH9-BI3								X
1673	CH9-CB_N/C		X		2		[144]CH9-BI7								X
1674															
1675															
1676															
1677															
1678															
1679															
1680															
1681															
1682	CH10-DS2_N/O		X		0		[157]CH10-BI2								X
1683	CH10-DS2_N/C		X		0		[158]CH10-BI6								X
1684	CH10-DS3_N/O						--								
1685	CH10-DS3_N/C						--								
1686	CH10-DS4_N/O						--								
1687	CH10-DS4_N/C						--								
1688	CH10-CB_N/O		X		0		[159]CH10-BI3								X
1689	CH10-CB_N/C		X		0		[160]CH10-BI7								X
1690															
1691															
1692															
1693															
1694															
1695															
1696															
1697															
1698	CH11-DS2_N/O		X		1		[173]CH11-BI2								X
1699	CH11-DS2_N/C		X		1		[174]CH11-BI6								X
1700	CH11-DS3_N/O						--								
1701	CH11-DS3_N/C						--								
1702	CH11-DS4_N/O						--								
1703	CH11-DS4_N/C						--								
1704	CH11-CB_N/O		X		1		[175]CH11-BI3								X
1705	CH11-CB_N/C		X		1		[176]CH11-BI7								X
1706															
1707															
1708															
1709															
1710															
1711															
1712															
1713															
1714	CH12-DS2_N/O		X		2		[189]CH12-BI2								X
1715	CH12-DS2_N/C		X		2		[190]CH12-BI6								X
1716	CH12-DS3_N/O						--								
1717	CH12-DS3_N/C						--								
1718	CH12-DS4_N/O						--								
1719	CH12-DS4_N/C						--								
1720	CH12-CB_N/O		X		2		[191]CH12-BI3								X
1721	CH12-CB_N/C		X		2		[192]CH12-BI7								X
1722															
1723															
1724															
1725															
1726															
1727															
1728															
1729															
1730	CH13-DS2_N/O		X		0		[205]CH13-BI2								X
1731	CH13-DS2_N/C		X		0		[206]CH13-BI6								X
1732	CH13-DS3_N/O						--								
1733	CH13-DS3_N/C						--								
1734	CH13-DS4_N/O						--								
1735	CH13-DS4_N/C						--								
1736	CH13-CB_N/O		X		0		[207]CH13-BI3								X
1737	CH13-CB_N/C		X		0		[208]CH13-BI7								X
1738															
1739															
1740															

PLC Default Setting															
Output		Timing				Logic expression		Delay Time / Flip Flop							
№	Signal	Cycle			Turn	Model 100s	Model 200s	Flip Flop			Timer				None
		30	90	User				Norm	Back Up	Release Signal	Off Delay	On Delay	One Shot	Time Value	
1741															
1742															
1743															
1744															
1745															
1746	CH14-DS2_N/O		X		1		[221]CH14-BI2								X
1747	CH14-DS2_N/C		X		1		[222]CH14-BI6								X
1748	CH14-DS3_N/O						--								
1749	CH14-DS3_N/C						--								
1750	CH14-DS4_N/O						--								
1751	CH14-DS4_N/C						--								
1752	CH14-CB_N/O		X		1		[223]CH14-BI3								X
1753	CH14-CB_N/C		X		1		[224]CH14-BI7								X
1754															
1755															
1756															
1757															
1758															
1759															
1760															
1761															
1762	CH15-DS2_N/O		X		2		[237]CH15-BI2								X
1763	CH15-DS2_N/C		X		2		[238]CH15-BI6								X
1764	CH15-DS3_N/O						--								
1765	CH15-DS3_N/C						--								
1766	CH15-DS4_N/O						--								
1767	CH15-DS4_N/C						--								
1768	CH15-CB_N/O		X		2		[239]CH15-BI3								X
1769	CH15-CB_N/C		X		2		[240]CH15-BI7								X
1770															
1771															
1772															
1773															
1774															
1775															
1776															
1777															
1778	CH16-DS2_N/O		X		0		[253]CH16-BI2								X
1779	CH16-DS2_N/C		X		0		[254]CH16-BI6								X
1780	CH16-DS3_N/O						--								
1781	CH16-DS3_N/C						--								
1782	CH16-DS4_N/O						--								
1783	CH16-DS4_N/C						--								
1784	CH16-CB_N/O		X		0		[255]CH16-BI3								X
1785	CH16-CB_N/C		X		0		[256]CH16-BI7								X
1786															
1787															
1788															
1789															
1790															
1791															
1792															
1793															
1794	CH17-DS2_N/O		X		1		[269]CH17-BI2								X
1795	CH17-DS2_N/C		X		1		[270]CH17-BI6								X
1796	CH17-DS3_N/O						--								
1797	CH17-DS3_N/C						--								
1798	CH17-DS4_N/O						--								
1799	CH17-DS4_N/C						--								
1800	CH17-CB_N/O		X		1		[271]CH17-BI3								X
1801	CH17-CB_N/C		X		1		[272]CH17-BI7								X
1802															
1803															
1804															
1805															
1806															
1807															
1808															
1809															

PLC Default Setting		Timing				Logic expression		Delay Time / Flip Flop							
№	Signal	Cycle			Turn	Model 100s	Model 200s	Flip Flop				Timer			
		30	90	User				Norm	Back Up	Release Signal	Off Delay	On Delay	One Shot	Time Value	None
1810	CH18-DS2_N/O		X		2		[285]CH18-BI2								X
1811	CH18-DS2_N/C		X		2		[286]CH18-BI6								X
1812	CH18-DS3_N/O						--								
1813	CH18-DS3_N/C						--								
1814	CH18-DS4_N/O						--								
1815	CH18-DS4_N/C						--								
1816	CH18-CB_N/O		X		2		[287]CH18-BI3								X
1817	CH18-CB_N/C		X		2		[288]CH18-BI7								X
1818															
1819															
1820															
1821															
1822															
1823															
1824															
1825															
1826	CH19-DS2_N/O		X		0		[301]CH19-BI2								X
1827	CH19-DS2_N/C		X		0		[302]CH19-BI6								X
1828	CH19-DS3_N/O						--								
1829	CH19-DS3_N/C						--								
1830	CH19-DS4_N/O						--								
1831	CH19-DS4_N/C						--								
1832	CH19-CB_N/O		X		0		[303]CH19-BI3								X
1833	CH19-CB_N/C		X		0		[304]CH19-BI7								X
1834															
1835															
1836															
1837															
1838															
1839															
1840															
1841															
1842	CH20-DS2_N/O		X		1		[317]CH20-BI2								X
1843	CH20-DS2_N/C		X		1		[318]CH20-BI6								X
1844	CH20-DS3_N/O						--								
1845	CH20-DS3_N/C						--								
1846	CH20-DS4_N/O						--								
1847	CH20-DS4_N/C						--								
1848	CH20-CB_N/O		X		1		[319]CH20-BI3								X
1849	CH20-CB_N/C		X		1		[320]CH20-BI7								X
1850															
1851															
1852															
1853															
1854															
1855															
1856															
1857															
1858	CH21-DS2_N/O		X		2		[333]CH21-BI2								X
1859	CH21-DS2_N/C		X		2		[334]CH21-BI6								X
1860	CH21-DS3_N/O						--								
1861	CH21-DS3_N/C						--								
1862	CH21-DS4_N/O						--								
1863	CH21-DS4_N/C						--								
1864	CH21-CB_N/O		X		2		[335]CH21-BI3								X
1865	CH21-CB_N/C		X		2		[336]CH21-BI7								X
1866															
1867															
1868															
1869															
1870															
1871															
1872															
1873															
1874	CH22-DS2_N/O		X		0		[349]CH22-BI2								X
1875	CH22-DS2_N/C		X		0		[350]CH22-BI6								X
1876	CH22-DS3_N/O						--								
1877	CH22-DS3_N/C						--								
1878	CH22-DS4_N/O						--								

PLC Default Setting															
Output		Timing				Logic expression		Delay Time / Flip Flop							
№	Signal	Cycle			Turn	Model 100s	Model 200s	Flip Flop			Timer				None
		30	90	User				Norm	Back Up	Release Signal	Off Delay	On Delay	One Shot	Time Value	
1879	CH22-DS4_N/C						--								
1880	CH22-CB_N/O		X		0		[351]CH22-BI3								X
1881	CH22-CB_N/C		X		0		[352]CH22-BI7								X
1882															
1883															
1884															
1885															
1886															
1887															
1888															
1889															
1890	CH23-DS2_N/O		X		1		[365]CH23-BI2								X
1891	CH23-DS2_N/C		X		1		[366]CH23-BI6								X
1892	CH23-DS3_N/O						--								
1893	CH23-DS3_N/C						--								
1894	CH23-DS4_N/O						--								
1895	CH23-DS4_N/C						--								
1896	CH23-CB_N/O		X		1		[367]CH23-BI3								X
1897	CH23-CB_N/C		X		1		[368]CH23-BI7								X
1898															
1899															
1900															
1901															
1902															
1903															
1904															
1905															
1906	CH24-DS2_N/O		X		2		[381]CH24-BI2								X
1907	CH24-DS2_N/C		X		2		[382]CH24-BI6								X
1908	CH24-DS3_N/O						--								
1909	CH24-DS3_N/C						--								
1910	CH24-DS4_N/O						--								
1911	CH24-DS4_N/C						--								
1912	CH24-CB_N/O		X		2		[383]CH24-BI3								X
1913	CH24-CB_N/C		X		2		[384]CH24-BI7								X
1914															
1915															
1916															
1917															
1918															
1919															
1920															
1921															
1922	CH25-DS2_N/O		X		0		[397]CH25-BI2								X
1923	CH25-DS2_N/C		X		0		[398]CH25-BI6								X
1924	CH25-DS3_N/O						--								
1925	CH25-DS3_N/C						--								
1926	CH25-DS4_N/O						--								
1927	CH25-DS4_N/C						--								
1928	CH25-CB_N/O		X		0		[399]CH25-BI3								X
1929	CH25-CB_N/C		X		0		[400]CH25-BI7								X
1930															
1931															
1932															
1933															
1934															
1935															
1936															
1937															
1938	CH26-DS2_N/O		X		1		[413]CH26-BI2								X
1939	CH26-DS2_N/C		X		1		[414]CH26-BI6								X
1940	CH26-DS3_N/O						--								
1941	CH26-DS3_N/C						--								
1942	CH26-DS4_N/O						--								
1943	CH26-DS4_N/C						--								
1944	CH26-CB_N/O		X		1		[415]CH26-BI3								X
1945	CH26-CB_N/C		X		1		[416]CH26-BI7								X
1946															
1947															

PLC Default Setting		Timing				Logic expression		Delay Time / Flip Flop							
№	Signal	Cycle			Turn	Model 100s	Model 200s	Flip Flop						Time Value	None
		30	90	User				Norm	Back Up	Release Signal	Off Delay	On Delay	One Shot		
1948															
1949															
1950															
1951															
1952															
1953															
1954	CH27-DS2_N/O		X		2		[429]CH27-BI2								X
1955	CH27-DS2_N/C		X		2		[430]CH27-BI6								X
1956	CH27-DS3_N/O						--								
1957	CH27-DS3_N/C						--								
1958	CH27-DS4_N/O						--								
1959	CH27-DS4_N/C						--								
1960	CH27-CB_N/O		X		2		[431]CH27-BI3								X
1961	CH27-CB_N/C		X		2		[432]CH27-BI7								X
1962															
1963															
1964															
1965															
1966															
1967															
1968															
1969															
1970	CH28-DS2_N/O		X		0		[445]CH28-BI2								X
1971	CH28-DS2_N/C		X		0		[446]CH28-BI6								X
1972	CH28-DS3_N/O						--								
1973	CH28-DS3_N/C						--								
1974	CH28-DS4_N/O						--								
1975	CH28-DS4_N/C						--								
1976	CH28-CB_N/O		X		0		[447]CH28-BI3								X
1977	CH28-CB_N/C		X		0		[448]CH28-BI7								X
1978															
1979															
1980															
1981															
1982															
1983															
1984															
1985															
1986	CH29-DS2_N/O		X		1		[461]CH29-BI2								X
1987	CH29-DS2_N/C		X		1		[462]CH29-BI6								X
1988	CH29-DS3_N/O						--								
1989	CH29-DS3_N/C						--								
1990	CH29-DS4_N/O						--								
1991	CH29-DS4_N/C						--								
1992	CH29-CB_N/O		X		1		[463]CH29-BI3								X
1993	CH29-CB_N/C		X		1		[464]CH29-BI7								X
1994															
1995															
1996															
1997															
1998															
1999															
2000															
2001															
2002	CH30-DS2_N/O		X		2		[477]CH30-BI2								X
2003	CH30-DS2_N/C		X		2		[478]CH30-BI6								X
2004	CH30-DS3_N/O						--								
2005	CH30-DS3_N/C						--								
2006	CH30-DS4_N/O						--								
2007	CH30-DS4_N/C						--								
2008	CH30-CB_N/O		X		2		[479]CH30-BI3								X
2009	CH30-CB_N/C		X		2		[480]CH30-BI7								X
2010															
2011															
2012															
2013															
2014															
2015															
2016															

PLC Default Setting																
Output		Timing				Logic expression		Delay Time / Flip Flop								
№	Signal	Cycle			Turn	Model	Model	Flip Flop				Timer				None
		30	90	User		100s	200s	Norm	Back Up	Release Signal	Off Delay	On Delay	One Shot	Time Value		
2017																
2018	CH31-DS2_N/O		X		0		[493]CH31-BI2								X	
2019	CH31-DS2_N/C		X		0		[494]CH31-BI6								X	
2020	CH31-DS3_N/O						--									
2021	CH31-DS3_N/C						--									
2022	CH31-DS4_N/O						--									
2023	CH31-DS4_N/C						--									
2024	CH31-CB_N/O		X		0		[495]CH31-BI3								X	
2025	CH31-CB_N/C		X		0		[496]CH31-BI7								X	
2026																
2027																
2028																
2029																
2030																
2031																
2032																
2033																
2034	CH32-DS2_N/O		X		1		[509]CH32-BI2								X	
2035	CH32-DS2_N/C		X		1		[510]CH32-BI6								X	
2036	CH32-DS3_N/O						--									
2037	CH32-DS3_N/C						--									
2038	CH32-DS4_N/O						--									
2039	CH32-DS4_N/C						--									
2040	CH32-CB_N/O		X		1		[511]CH32-BI3								X	
2041	CH32-CB_N/C		X		1		[512]CH32-BI7								X	
2042																
2043																
2044																
2045																
2046																
2047																
2048	IND_RESET		X		0		[523]CU-BI1								X	
2049	BP_BLOCK-A		X		1		[524]CU-BI2								X	
2050	CBF_BLOCK-A		X		2		[525]CU-BI3								X	
2051	BP_BLOCK-B		X		1		[526]CU-BI4								X	
2052	CBF_BLOCK-B		X		2		[527]CU-BI5								X	
2053																
2054																
2055																
2056																
2057																
2058																
2059																
2060																
2061																
2062																
2063																
2064	DIFFS-ZA		X			[1]CONSTANT_1	[1341]UVGZA + [1342]UVSZA + [1310]OVGZA								X	
2065	DIFFS-ZB		X			[1]CONSTANT_1	[1344]UVGZB + [1345]UVSZB + [1320]OVGZB								X	
2066	DIFFS-ZC		X			[1]CONSTANT_1	[1347]UVGZC + [1348]UVSZC + [1330]OVGZC								X	
2067	DIFFS-ZD		X			[1]CONSTANT_1	[1350]UVGZD + [1351]UVSZD + [1340]OVGZD								X	
2068	DIFFS		X				[1]CONSTANT_1								X	
2069	DIFCH_CHARA						--									
2070																
2071																
2072																
2073																
2074																
2075																
2076																
2077																
2078																
2079																
2080	CBFFS-ZA		X			[1]CONSTANT_1	[1341]UVGZA + [1342]UVSZA + [1343]UVDZA + [1310]OVGZA								X	
2081	CBFFS-ZB		X			[1]CONSTANT_1	[1344]UVGZB + [1345]UVSZB + [1346]UVDZB + [1320]OVGZB								X	
2082	CBFFS-ZC		X			[1]CONSTANT_1	[1347]UVGZC + [1348]UVSZC + [1349]UVDZC + [1330]OVGZC								X	
2083	CBFFS-ZD		X			[1]CONSTANT_1	[1350]UVGZD + [1351]UVSZD + [1352]UVDZD + [1340]OVGZD								X	
2084	CBFFS-NOUSE						--									
2085																

PLC Default Setting		Timing				Logic expression		Delay Time / Flip Flop							
Output		Cycle				Model		Flip Flop							
№	Signal					Model	Model								
		30	90	User	Turn			Norm	Back Up	Release Signal	Off Delay	On Delay	One Shot	Time Value	None
2086															
2087															
2088	COMP-ZA_COM						--								
2089	COMP-ZB_COM						--								
2090	COMP-ZC_COM						--								
2091	COMP-ZD_COM						--								
2092	CTF_BLOCK						--								
2093															
2094															
2095															
2096	CBFTRFS-ZA	X				[1]CONSTANT_1	[1341]UVGZA + [1342]UVSZA + [1343]UVDZA + [1310]OVGZA								X
2097	CBFTRFS-ZB	X				[1]CONSTANT_1	[1344]UVGZB + [1345]UVSZB + [1346]UVDZB + [1320]OVGZB								X
2098	CBFTRFS-ZC	X				[1]CONSTANT_1	[1347]UVGZC + [1348]UVSZC + [1349]UVDZC + [1330]OVGZC								X
2099	CBFTRFS-ZD	X				[1]CONSTANT_1	[1350]UVGZD + [1351]UVSZD + [1352]UVDZD + [1340]OVGZD								X
2100	CBFTRFS-NOUSE						--								
2101															
2102															
2103															
2104															
2105															
2106															
2107															
2108															
2109															
2110															
2111															
2112	DIFZA_DELAY	X			0		[1000]DIFZA-OPERATE			X				60 ms	
2113	DIFZB_DELAY	X			0		[1001]DIFZB-OPERATE			X				60 ms	
2114	DIFZC_DELAY	X			0		[1002]DIFZC-OPERATE			X				60 ms	
2115	DIFZD_DELAY	X			0		[1003]DIFZD-OPERATE			X				60 ms	
2116	DIF_DELAY	X			0		[999]DIFCH-OPERATE			X				60 ms	
2117															
2118															
2119															
2120	C1-CUR.BLK_S						--								
2121	C2-CUR.BLK_S						--								
2122	C3-CUR.BLK_S						--								
2123	C4-CUR.BLK_S						--								
2124															
2125															
2126															
2127															
2128	CH1-EXT-BPTP						--								X
2129	CH2-EXT-BPTP						--								X
2130	CH3-EXT-BPTP						--								X
2131	CH4-EXT-BPTP						--								X
2132	CH5-EXT-BPTP						--								X
2133	CH6-EXT-BPTP						--								X
2134	CH7-EXT-BPTP						--								X
2135	CH8-EXT-BPTP						--								X
2136	CH9-EXT-BPTP						--								X
2137	CH10-EXT-BPTP						--								X
2138	CH11-EXT-BPTP						--								X
2139	CH12-EXT-BPTP						--								X
2140	CH13-EXT-BPTP						--								X
2141	CH14-EXT-BPTP						--								X
2142	CH15-EXT-BPTP						--								X
2143	CH16-EXT-BPTP						--								X
2144	CH17-EXT-BPTP						--								X
2145	CH18-EXT-BPTP						--								X
2146	CH19-EXT-BPTP						--								X
2147	CH20-EXT-BPTP						--								X
2148	CH21-EXT-BPTP						--								X
2149	CH22-EXT-BPTP						--								X
2150	CH23-EXT-BPTP						--								X
2151	CH24-EXT-BPTP						--								X
2152	CH25-EXT-BPTP						--								X
2153	CH26-EXT-BPTP						--								X
2154	CH27-EXT-BPTP						--								X

PLC Default Setting																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
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PLC Default Setting															
Output		Timing				Logic expression		Delay Time / Flip Flop							
№	Signal	Cycle			Turn	Model 100s	Model 200s	Flip Flop			Timer				None
		30	90	User				Norm	Back Up	Release Signal	Off Delay	On Delay	One Shot	Time Value	
2224															
2225															
2226	S1-ZAC.RESET					--									X
2227	S2-ZAC.RESET					--									X
2228	S3-ZAC.RESET					--									X
2229	S4-ZAC.RESET					--									X
2230	C1-ZAC.RESET					--									X
2231	C2-ZAC.RESET					--									X
2232															
2233															
2234	E1-ZAC.RESET					--									X
2235	E2-ZAC.RESET					--									X
2236	E3-ZAC.RESET					--									X
2237	E4-ZAC.RESET					--									X
2238															
2239															
2240	CH1-CBFCB					--									
2241	CH2-CBFCB					--									
2242	CH3-CBFCB					--									
2243	CH4-CBFCB					--									
2244	CH5-CBFCB					--									
2245	CH6-CBFCB					--									
2246	CH7-CBFCB					--									
2247	CH8-CBFCB					--									
2248	CH9-CBFCB					--									
2249	CH10-CBFCB					--									
2250	CH11-CBFCB					--									
2251	CH12-CBFCB					--									
2252	CH13-CBFCB					--									
2253	CH14-CBFCB					--									
2254	CH15-CBFCB					--									
2255	CH16-CBFCB					--									
2256	CH17-CBFCB					--									
2257	CH18-CBFCB					--									
2258	CH19-CBFCB					--									
2259	CH20-CBFCB					--									
2260	CH21-CBFCB					--									
2261	CH22-CBFCB					--									
2262	CH23-CBFCB					--									
2263	CH24-CBFCB					--									
2264	CH25-CBFCB					--									
2265	CH26-CBFCB					--									
2266	CH27-CBFCB					--									
2267	CH28-CBFCB					--									
2268	CH29-CBFCB					--									
2269	CH30-CBFCB					--									
2270	CH31-CBFCB					--									
2271	CH32-CBFCB					--									
2272	BU1-OUT					--									
2273	BU2-OUT					--									
2274	BU3-OUT					--									
2275	BU4-OUT					--									
2276	BU5-OUT					--									
2277	BU6-OUT					--									
2278	BU7-OUT					--									
2279	BU8-OUT					--									
2280	BU9-OUT					--									
2281	BU10-OUT					--									
2282	BU11-OUT					--									
2283	BU12-OUT					--									
2284	BU13-OUT					--									
2285	BU14-OUT					--									
2286	BU15-OUT					--									
2287	BU16-OUT					--									
2288	BU17-OUT					--									
2289	BU18-OUT					--									
2290	BU19-OUT					--									
2291	BU20-OUT					--									
2292	BU21-OUT					--									

PLC Default Setting																
Output		Timing				Logic expression		Delay Time / Flip Flop								
№	Signal	Cycle			Turn	Model	Model	Flip Flop			Timer				None	
		30	90	User		100s	200s	Norm	Back Up	Release Signal	Off Delay	On Delay	One Shot	Time Value		
2293	BU22-OUT						--									
2294	BU23-OUT						--									
2295	BU24-OUT						--									
2296	BU25-OUT						--									
2297	BU26-OUT						--									
2298	BU27-OUT						--									
2299	BU28-OUT						--									
2300	BU29-OUT						--									
2301	BU30-OUT						--									
2302	BU31-OUT						--									
2303	BU32-OUT						--									
2304																
2305																
2306																
2307																
2308																
2309																
2310																
2311																
2312																
2313																
2314																
2315																
2316																
2317																
2318																
2319																
2320																
2321																
2322																
2323																
2324																
2325																
2326																
2327																
2328	CH1-TP1	X					[1077]CH1-BPTP									X
2329	CH1-TP2	X					[1205]CH1-CBF/RE									X
2330																
2331																
2332	CH1-BO3						--									
2333	CH1-BO4						--									
2334	CH1-BO5						--									
2335	CH1-BO6						--									
2336	CH2-TP1	X					[1078]CH2-BPTP									X
2337	CH2-TP2	X					[1206]CH2-CBF/RE									X
2338																
2339																
2340	CH2-BO3						--									
2341	CH2-BO4						--									
2342	CH2-BO5						--									
2343	CH2-BO6						--									
2344	CH3-TP1	X					[1079]CH3-BPTP									X
2345	CH3-TP2	X					[1207]CH3-CBF/RE									X
2346																
2347																
2348	CH3-BO3						--									
2349	CH3-BO4						--									
2350	CH3-BO5						--									
2351	CH3-BO6						--									
2352	CH4-TP1	X					[1080]CH4-BPTP									X
2353	CH4-TP2	X					[1208]CH4-CBF/RE									X
2354																
2355																
2356	CH4-BO3						--									
2357	CH4-BO4						--									
2358	CH4-BO5						--									
2359	CH4-BO6						--									
2360	CH5-TP1	X					[1081]CH5-BPTP									X
2361	CH5-TP2	X					[1209]CH5-CBF/RE									X

PLC Default Setting															
Output		Timing				Logic expression		Delay Time / Flip Flop							
№	Signal	Cycle			Turn	Model 100s	Model 200s	Flip Flop			Timer				None
		30	90	User				Norm	Back Up	Release Signal	Off Delay	On Delay	One Shot	Time Value	
2362															
2363															
2364	CH5-BO3						--								
2365	CH5-BO4						--								
2366	CH5-BO5						--								
2367	CH5-BO6						--								
2368	CH6-TP1	X					[1082]CH6-BPTP								X
2369	CH6-TP2	X					[1210]CH6-CBF/RE								X
2370															
2371															
2372	CH6-BO3						--								
2373	CH6-BO4						--								
2374	CH6-BO5						--								
2375	CH6-BO6						--								
2376	CH7-TP1	X					[1083]CH7-BPTP								X
2377	CH7-TP2	X					[1211]CH7-CBF/RE								X
2378															
2379															
2380	CH7-BO3						--								
2381	CH7-BO4						--								
2382	CH7-BO5						--								
2383	CH7-BO6						--								
2384	CH8-TP1	X					[1084]CH8-BPTP								X
2385	CH8-TP2	X					[1212]CH8-CBF/RE								X
2386															
2387															
2388	CH8-BO3						--								
2389	CH8-BO4						--								
2390	CH8-BO5						--								
2391	CH8-BO6						--								
2392	CH9-TP1	X					[1085]CH9-BPTP								X
2393	CH9-TP2	X					[1213]CH9-CBF/RE								X
2394															
2395															
2396	CH9-BO3						--								
2397	CH9-BO4						--								
2398	CH9-BO5						--								
2399	CH9-BO6						--								
2400	CH10-TP1	X					[1086]CH10-BPTP								X
2401	CH10-TP2	X					[1214]CH10-CBF/RE								X
2402															
2403															
2404	CH10-BO3						--								
2405	CH10-BO4						--								
2406	CH10-BO5						--								
2407	CH10-BO6						--								
2408	CH11-TP1	X					[1087]CH11-BPTP								X
2409	CH11-TP2	X					[1215]CH11-CBF/RE								X
2410															
2411															
2412	CH11-BO3						--								
2413	CH11-BO4						--								
2414	CH11-BO5						--								
2415	CH11-BO6						--								
2416	CH12-TP1	X					[1088]CH12-BPTP								X
2417	CH12-TP2	X					[1216]CH12-CBF/RE								X
2418															
2419															
2420	CH12-BO3						--								
2421	CH12-BO4						--								
2422	CH12-BO5						--								
2423	CH12-BO6						--								
2424	CH13-TP1	X					[1089]CH13-BPTP								X
2425	CH13-TP2	X					[1217]CH13-CBF/RE								X
2426															
2427															
2428	CH13-BO3						--								
2429	CH13-BO4						--								
2430	CH13-BO5						--								

PLC Default Setting		Timing				Logic expression		Delay Time / Flip Flop							
№	Signal	Cycle			Turn	Model 100s	Model 200s	Delay Time / Flip Flop							
		30	90	User				Flip Flop				Timer			
								Norm	Back Up	Release Signal	Off Delay	On Delay	One Shot	Time Value	None
2431	CH13-BO6						--								
2432	CH14-TP1	X					[1090]CH14-BPTP								X
2433	CH14-TP2	X					[1218]CH14-CBF/RE								X
2434															
2435															
2436	CH14-BO3						--								
2437	CH14-BO4						--								
2438	CH14-BO5						--								
2439	CH14-BO6						--								
2440	CH15-TP1	X					[1091]CH15-BPTP								X
2441	CH15-TP2	X					[1219]CH15-CBF/RE								X
2442															
2443															
2444	CH15-BO3						--								
2445	CH15-BO4						--								
2446	CH15-BO5						--								
2447	CH15-BO6						--								
2448	CH16-TP1	X					[1092]CH16-BPTP								X
2449	CH16-TP2	X					[1220]CH16-CBF/RE								X
2450															
2451															
2452	CH16-BO3						--								
2453	CH16-BO4						--								
2454	CH16-BO5						--								
2455	CH16-BO6						--								
2456	CH17-TP1	X					[1093]CH17-BPTP								X
2457	CH17-TP2	X					[1221]CH17-CBF/RE								X
2458															
2459															
2460	CH17-BO3						--								
2461	CH17-BO4						--								
2462	CH17-BO5						--								
2463	CH17-BO6						--								
2464	CH18-TP1	X					[1094]CH18-BPTP								X
2465	CH18-TP2	X					[1222]CH18-CBF/RE								X
2466															
2467															
2468	CH18-BO3						--								
2469	CH18-BO4						--								
2470	CH18-BO5						--								
2471	CH18-BO6						--								
2472	CH19-TP1	X					[1095]CH19-BPTP								X
2473	CH19-TP2	X					[1223]CH19-CBF/RE								X
2474															
2475															
2476	CH19-BO3						--								
2477	CH19-BO4						--								
2478	CH19-BO5						--								
2479	CH19-BO6						--								
2480	CH20-TP1	X					[1096]CH20-BPTP								X
2481	CH20-TP2	X					[1224]CH20-CBF/RE								X
2482															
2483															
2484	CH20-BO3						--								
2485	CH20-BO4						--								
2486	CH20-BO5						--								
2487	CH20-BO6						--								
2488	CH21-TP1	X					[1097]CH21-BPTP								X
2489	CH21-TP2	X					[1225]CH21-CBF/RE								X
2490															
2491															
2492	CH21-BO3						--								
2493	CH21-BO4						--								
2494	CH21-BO5						--								
2495	CH21-BO6						--								
2496	CH22-TP1	X					[1098]CH22-BPTP								X
2497	CH22-TP2	X					[1226]CH22-CBF/RE								X
2498															
2499															

PLC Default Setting		Timing				Logic expression		Delay Time / Flip Flop							
№	Signal	Cycle			Turn	Model 100s	Model 200s	Flip Flop							
		30	90	User				Norm	Back Up	Release Signal	Off Delay	On Delay	One Shot	Time Value	None
2500	CH22-BO3						--								
2501	CH22-BO4						--								
2502	CH22-BO5						--								
2503	CH22-BO6						--								
2504	CH23-TP1	X					[1099]CH23-BPTP								X
2505	CH23-TP2	X					[1227]CH23-CBF/RE								X
2506															
2507															
2508	CH23-BO3						--								
2509	CH23-BO4						--								
2510	CH23-BO5						--								
2511	CH23-BO6						--								
2512	CH24-TP1	X					[1100]CH24-BPTP								X
2513	CH24-TP2	X					[1228]CH24-CBF/RE								X
2514															
2515															
2516	CH24-BO3						--								
2517	CH24-BO4						--								
2518	CH24-BO5						--								
2519	CH24-BO6						--								
2520	CH25-TP1	X					[1101]CH25-BPTP								X
2521	CH25-TP2	X					[1229]CH25-CBF/RE								X
2522															
2523															
2524	CH25-BO3						--								
2525	CH25-BO4						--								
2526	CH25-BO5						--								
2527	CH25-BO6						--								
2528	CH26-TP1	X					[1102]CH26-BPTP								X
2529	CH26-TP2	X					[1230]CH26-CBF/RE								X
2530															
2531															
2532	CH26-BO3						--								
2533	CH26-BO4						--								
2534	CH26-BO5						--								
2535	CH26-BO6						--								
2536	CH27-TP1	X					[1103]CH27-BPTP								X
2537	CH27-TP2	X					[1231]CH27-CBF/RE								X
2538															
2539															
2540	CH27-BO3						--								
2541	CH27-BO4						--								
2542	CH27-BO5						--								
2543	CH27-BO6						--								
2544	CH28-TP1	X					[1104]CH28-BPTP								X
2545	CH28-TP2	X					[1232]CH28-CBF/RE								X
2546															
2547															
2548	CH28-BO3						--								
2549	CH28-BO4						--								
2550	CH28-BO5						--								
2551	CH28-BO6						--								
2552	CH29-TP1	X					[1105]CH29-BPTP								X
2553	CH29-TP2	X					[1233]CH29-CBF/RE								X
2554															
2555															
2556	CH29-BO3						--								
2557	CH29-BO4						--								
2558	CH29-BO5						--								
2559	CH29-BO6						--								
2560	CH30-TP1	X					[1106]CH30-BPTP								X
2561	CH30-TP2	X					[1234]CH30-CBF/RE								X
2562															
2563															
2564	CH30-BO3						--								
2565	CH30-BO4						--								
2566	CH30-BO5						--								
2567	CH30-BO6						--								
2568	CH31-TP1	X					[1107]CH31-BPTP								X

PLC Default Setting		Timing				Logic expression		Delay Time / Flip Flop							
№	Signal	Cycle			Turn	Model 100s	Model 200s	Flip Flop				Timer			None
		30	90	User				Norm	Back Up	Release Signal	Off Delay	On Delay	One Shot	Time Value	
2569	CH31-TP2	X					[1235]CH31-CBF/RE								X
2570															
2571															
2572	CH31-BO3						--								
2573	CH31-BO4						--								
2574	CH31-BO5						--								
2575	CH31-BO6						--								
2576	CH32-TP1	X					[1108]CH32-BPTP								X
2577	CH32-TP2	X					[1236]CH32-CBF/RE								X
2578															
2579															
2580	CH32-BO3						--								
2581	CH32-BO4						--								
2582	CH32-BO5						--								
2583	CH32-BO6						--								
2584															
2585															
2586															
2587															
2588															
2589															
2590															
2591															
2592															
2593															
2594															
2595															
2596															
2597															
2598															
2599															
2600															
2601															
2602															
2603															
2604															
2605															
2606															
2607															
2608															
2609															
2610															
2611															
2612															
2613															
2614															
2615															
2616															
2617															
2618															
2619															
2620															
2621															
2622															
2623															
2624	F.RECORD1	X					[1397]COM-TRIP								X
2625															
2626															
2627															
2628	F.RCD_MODE	X					[1397]COM-TRIP								X
2629															
2630															
2631															
2632	D.RECORD1						--								
2633	D.RECORD2						--								
2634	D.RECORD3						--								
2635	D.RECORD4						--								
2636															
2637															

PLC Default Setting																
Output		Timing				Logic expression		Delay Time / Flip Flop								
№	Signal	Cycle			Turn	Model		Flip Flop			Timer					None
		30	90	User		100s	200s	Norm	Back Up	Release Signal	Off Delay	On Delay	One Shot	Time Value		
2638																
2639																
2640	SET.GROUP1						--									
2641	SET.GROUP2						--									
2642	SET.GROUP3						--									
2643	SET.GROUP4						--									
2644																
2645																
2646																
2647																
2648																
2649																
2650																
2651																
2652																
2653																
2654																
2655																
2656																
2657																
2658																
2659																
2660																
2661																
2662																
2663																
2664																
2665																
2666																
2667																
2668																
2669																
2670																
2671																
2672																
2673																
2674																
2675																
2676																
2677																
2678																
2679																
2680																
2681																
2682																
2683																
2684																
2685																
2686	PROT_COM_RECV															
2687																
2688	TPLED_RST_RCV						--									
2689																
2690																
2691																
2692																
2693																
2694																
2695																
2696																
2697																
2698																
2699																
2700																
2701																
2702																
2703																
2704																
2705																
2706																

PLC Default Setting																
Output		Timing				Logic expression		Delay Time / Flip Flop								
№	Signal	Cycle			Turn	Model 100s	Model 200s	Flip Flop			Timer				None	
		30	90	User				Norm	Back Up	Release Signal	Off Delay	On Delay	One Shot	Time Value		
2707																
2708																
2709																
2710																
2711																
2712																
2713																
2714																
2715																
2716																
2717																
2718																
2719																
2720																
2721																
2722																
2723																
2724																
2725																
2726																
2727																
2728																
2729																
2730																
2731																
2732																
2733																
2734																
2735																
2736																
2737																
2738																
2739																
2740																
2741																
2742																
2743																
2744																
2745																
2746																
2747																
2748																
2749																
2750																
2751																
2752	CH1-EFPTR_R					--										
2753	CH2-EFPTR_R					--										
2754	CH3-EFPTR_R					--										
2755	CH4-EFPTR_R					--										
2756	CH5-EFPTR_R					--										
2757	CH6-EFPTR_R					--										
2758	CH7-EFPTR_R					--										
2759	CH8-EFPTR_R					--										
2760	CH9-EFPTR_R					--										
2761	CH10-EFPTR_R					--										
2762	CH11-EFPTR_R					--										
2763	CH12-EFPTR_R					--										
2764	CH13-EFPTR_R					--										
2765	CH14-EFPTR_R					--										
2766	CH15-EFPTR_R					--										
2767	CH16-EFPTR_R					--										
2768	CH17-EFPTR_R					--										
2769	CH18-EFPTR_R					--										
2770	CH19-EFPTR_R					--										
2771	CH20-EFPTR_R					--										
2772	CH21-EFPTR_R					--										
2773	CH22-EFPTR_R					--										
2774	CH23-EFPTR_R					--										
2775	CH24-EFPTR_R					--										

PLC Default Setting		Timing				Logic expression		Delay Time / Flip Flop							
№	Signal	Cycle			Turn	Model 100s	Model 200s	Flip Flop				Timer			None
		30	90	User				Norm	Back Up	Release Signal	Off Delay	On Delay	One Shot	Time Value	
2776	CH25-EFPTR_R						--								
2777	CH26-EFPTR_R						--								
2778	CH27-EFPTR_R						--								
2779	CH28-EFPTR_R						--								
2780	CH29-EFPTR_R						--								
2781	CH30-EFPTR_R						--								
2782	CH31-EFPTR_R						--								
2783	CH32-EFPTR_R						--								
2784	CH1-EFPTR_ON						--								
2785	CH2-EFPTR_ON						--								
2786	CH3-EFPTR_ON						--								
2787	CH4-EFPTR_ON						--								
2788	CH5-EFPTR_ON						--								
2789	CH6-EFPTR_ON						--								
2790	CH7-EFPTR_ON						--								
2791	CH8-EFPTR_ON						--								
2792	CH9-EFPTR_ON						--								
2793	CH10-EFPTR_ON						--								
2794	CH11-EFPTR_ON						--								
2795	CH12-EFPTR_ON						--								
2796	CH13-EFPTR_ON						--								
2797	CH14-EFPTR_ON						--								
2798	CH15-EFPTR_ON						--								
2799	CH16-EFPTR_ON						--								
2800	CH17-EFPTR_ON						--								
2801	CH18-EFPTR_ON						--								
2802	CH19-EFPTR_ON						--								
2803	CH20-EFPTR_ON						--								
2804	CH21-EFPTR_ON						--								
2805	CH22-EFPTR_ON						--								
2806	CH23-EFPTR_ON						--								
2807	CH24-EFPTR_ON						--								
2808	CH25-EFPTR_ON						--								
2809	CH26-EFPTR_ON						--								
2810	CH27-EFPTR_ON						--								
2811	CH28-EFPTR_ON						--								
2812	CH29-EFPTR_ON						--								
2813	CH30-EFPTR_ON						--								
2814	CH31-EFPTR_ON						--								
2815	CH32-EFPTR_ON						--								
2816	TEMP001						--								
2817	TEMP002						--								
2818	TEMP003						--								
2819	TEMP004						--								
2820	TEMP005						--								
2821	TEMP006						--								
2822	TEMP007						--								
2823	TEMP008						--								
2824	TEMP009						--								
2825	TEMP010						--								
2826	TEMP011						--								
2827	TEMP012						--								
2828	TEMP013						--								
2829	TEMP014						--								
2830	TEMP015						--								
2831	TEMP016						--								
2832	TEMP017						--								
2833	TEMP018						--								
2834	TEMP019						--								
2835	TEMP020						--								
2836	TEMP021						--								
2837	TEMP022						--								
2838	TEMP023						--								
2839	TEMP024						--								
2840	TEMP025						--								
2841	TEMP026						--								
2842	TEMP027						--								
2843	TEMP028						--								
2844	TEMP029						--								

PLC Default Setting

Output		Timing				Logic expression		Delay Time / Flip Flop							
No	Signal	Cycle			Turn	Model	Model	Flip Flop			Timer				None
		30	90	User		100s	200s	Norm	Back Up	Release Signal	Off Delay	On Delay	One Shot	Time Value	
2845	TEMP030						--								
2846	TEMP031						--								
2847	TEMP032						--								
2848	TEMP033						--								
2849	TEMP034						--								
2850	TEMP035						--								
2851	TEMP036						--								
2852	TEMP037						--								
2853	TEMP038						--								
2854	TEMP039						--								
2855	TEMP040						--								
2856	TEMP041						--								
2857	TEMP042						--								
2858	TEMP043						--								
2859	TEMP044						--								
2860	TEMP045						--								
2861	TEMP046						--								
2862	TEMP047						--								
2863	TEMP048						--								
2864	TEMP049						--								
2865	TEMP050						--								
2866	TEMP051						--								
2867	TEMP052						--								
2868	TEMP053						--								
2869	TEMP054						--								
2870	TEMP055						--								
2871	TEMP056						--								
2872	TEMP057						--								
2873	TEMP058						--								
2874	TEMP059						--								
2875	TEMP060						--								
2876	TEMP061						--								
2877	TEMP062						--								
2878	TEMP063						--								
2879	TEMP064						--								
2880	TEMP065						--								
2881	TEMP066						--								
2882	TEMP067						--								
2883	TEMP068						--								
2884	TEMP069						--								
2885	TEMP070						--								
2886	TEMP071						--								
2887	TEMP072						--								
2888	TEMP073						--								
2889	TEMP074						--								
2890	TEMP075						--								
2891	TEMP076						--								
2892	TEMP077						--								
2893	TEMP078						--								
2894	TEMP079						--								
2895	TEMP080						--								
2896	TEMP081						--								
2897	TEMP082						--								
2898	TEMP083						--								
2899	TEMP084						--								
2900	TEMP085						--								
2901	TEMP086						--								
2902	TEMP087						--								
2903	TEMP088						--								
2904	TEMP089						--								
2905	TEMP090						--								
2906	TEMP091						--								
2907	TEMP092						--								
2908	TEMP093						--								
2909	TEMP094						--								
2910	TEMP095						--								
2911	TEMP096						--								
2912	TEMP097						--								
2913	TEMP098						--								

PLC Default Setting																
Output		Timing				Logic expression		Delay Time / Flip Flop								
№	Signal	Cycle			Turn	Model 100s	Model 200s	Flip Flop			Timer				Time Value	None
		30	90	User				Norm	Back Up	Release Signal	Off Delay	On Delay	One Shot			
2914	TEMP099					--										
2915	TEMP100					--										
2916	TEMP101					--										
2917	TEMP102					--										
2918	TEMP103					--										
2919	TEMP104					--										
2920	TEMP105					--										
2921	TEMP106					--										
2922	TEMP107					--										
2923	TEMP108					--										
2924	TEMP109					--										
2925	TEMP110					--										
2926	TEMP111					--										
2927	TEMP112					--										
2928	TEMP113					--										
2929	TEMP114					--										
2930	TEMP115					--										
2931	TEMP116					--										
2932	TEMP117					--										
2933	TEMP118					--										
2934	TEMP119					--										
2935	TEMP120					--										
2936	TEMP121					--										
2937	TEMP122					--										
2938	TEMP123					--										
2939	TEMP124					--										
2940	TEMP125					--										
2941	TEMP126					--										
2942	TEMP127					--										
2943	TEMP128					--										
2944	TEMP129					--										
2945	TEMP130					--										
2946	TEMP131					--										
2947	TEMP132					--										
2948	TEMP133					--										
2949	TEMP134					--										
2950	TEMP135					--										
2951	TEMP136					--										
2952	TEMP137					--										
2953	TEMP138					--										
2954	TEMP139					--										
2955	TEMP140					--										
2956	TEMP141					--										
2957	TEMP142					--										
2958	TEMP143					--										
2959	TEMP144					--										
2960	TEMP145					--										
2961	TEMP146					--										
2962	TEMP147					--										
2963	TEMP148					--										
2964	TEMP149					--										
2965	TEMP150					--										
2966	TEMP151					--										
2967	TEMP152					--										
2968	TEMP153					--										
2969	TEMP154					--										
2970	TEMP155					--										
2971	TEMP156					--										
2972	TEMP157					--										
2973	TEMP158					--										
2974	TEMP159					--										
2975	TEMP160					--										
2976	TEMP161					--										
2977	TEMP162					--										
2978	TEMP163					--										
2979	TEMP164					--										
2980	TEMP165					--										
2981	TEMP166					--										
2982	TEMP167					--										

[illegible]

PLC Default Setting

Output		Timing				Logic expression		Delay Time / Flip Flop							
№	Signal	Cycle			Turn	Model	Model	Flip Flop			Timer				None
		30	90	User		100s	200s	Norm	Back Up	Release Signal	Off Delay	On Delay	One Shot	Time Value	
3052	TEMP237						--								
3053	TEMP238						--								
3054	TEMP239						--								
3055	TEMP240						--								
3056	TEMP241						--								
3057	TEMP242						--								
3058	TEMP243						--								
3059	TEMP244						--								
3060	TEMP245						--								
3061	TEMP246						--								
3062	TEMP247						--								
3063	TEMP248						--								
3064	TEMP249						--								
3065	TEMP250						--								
3066	TEMP251						--								
3067	TEMP252						--								
3068	TEMP253						--								
3069	TEMP254						--								
3070	TEMP255						--								
3071	TEMP256						--								

Appendix K

Commissioning Test Sheet (sample)

1. Relay identification
2. Preliminary check
3. Hardware check
 - 3.1 User interface check
 - 3.2 Binary input/binary output circuit check
 - 3.3 AC input circuit check
4. Function test
 - 4.1 Current differential element test
 - 4.2 Overcurrent element test
 - 4.3 FD element test
5. Protection scheme test
6. Metering and recording check

1. Relay identification

Type _____ Serial number _____
Model _____ System frequency _____
Station _____ Date _____
Circuit _____ Engineer _____
Protection scheme _____ Witness _____
Active settings group number _____

2. Preliminary check

Relay AC ratings ☐
DC power supply ☐
Wiring ☐
Calendar and clock ☐

3. Hardware check**User interface check**☐**Binary input/binary output circuit check**

Binary input circuit ☐
Binary output circuit ☐

3.3 AC input circuit check☐

4. Function test

4.1 Current differential element test

(1) Minimum operating value test

Element	Tap setting	Measured current
DIFCH		
DIFZA		
DIFZB		
DIFZC		
DIFZD		
DIFSV		

(2) Percentage restraining characteristic test

DIFCH

Tap setting	I	Measured current (I_{out})
	× Tap	
	× Tap	
	× Tap	

DIFZA

Tap setting	I	Measured current (I_{out})
	× Tap	
	× Tap	
	× Tap	

DIFZB

Tap setting	I	Measured current (I_{out})
	× Tap	
	× Tap	
	× Tap	

DIFZC

Tap setting	I	Measured current (I_{out})
	× Tap	
	× Tap	
	× Tap	

DIFZD

Tap setting	I	Measured current (I_{out})
	× Tap	
	× Tap	
	× Tap	

4.2 Overcurrent element test

Element	Tap setting	Measured current
10CBF		
20CBF		
30CBF		
40CBF		
50CBF		
60CBF		
70CBF		
80CBF		
90CBF		
100CBF		
110CBF		
120CBF		
130CBF		
140CBF		
150CBF		
160CBF		
170CBF		
180CBF		
190CBF		
200CBF		
210CBF		
220CBF		
230CBF		
240CBF		
250CBF		
260CBF		
270CBF		
280CBF		
290CBF		

30OCBF		
31OCBF		
32OCBF		

4.3 FD element test

Element	Measured value
UVSFA	
UVSFB	
UVSFC	
UVSFD	
UVGFA	
UVGFB	
UVGFC	
UVGFD	
OVGF	

5. Protection scheme test

6. Metering and recording check

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Appendix L

Return Repair Form

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Please fill in this form and return it to Toshiba Corporation with the GRB100 to be repaired.

Fuchu Complex

For: Power Systems Protection & Control Department

Quality Assurance Section

Type: GRB100 Model:_____

(Example: Type: GRB100 Model: C120B-30-10)

Serial No. :

Bay Unit

Type: GRB100 Model:

(Example: Type: GRB100 Model: B110B-21-10)

Serial No. :

1. Why the relay is being returned ?

- ☐ mal-operation
- ☐ does not operate
- ☐ increased error
- ☒ investigation
- ☐ others

2. Fault records, event records or disturbance records stored in the relay and relay settings are very helpful information to investigate the incident.

So please inform us the information concerned in the incident with Floppy Disk, or filling up the Fault Record sheet and Relay Setting sheet attached.

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Fault Record

Date/Month/Year Time / /
 / : : .
 (Example: 04/ Nov./ 2001 15:09:58.442)

Faulty phase:

Tripping mode:

Tripped channel:

Fault values	(VT ratio:	kV/:	V)	
Ida:	%			
Idb:	%			
Idc:	%			
IdaA:	%		IdaB:	%
IdbA:	%		IdbB:	%
IdcA:	%		IdcB:	%
IdaC:	%		IdaD:	%
IdbC:	%		IdbD:	%
IdcC:	%		IdcD:	%
VaA:	kV∠	°	V1A:	kV∠ °
VbA:	kV∠	°	V2A:	kV∠ °
VcA:	kV∠	°	V0A:	kV∠ °
VaB:	kV∠	°	V1B:	kV∠ °
VbB:	kV∠	°	V2B:	kV∠ °
VcB:	kV∠	°	V0B:	kV∠ °
VaC:	kV∠	°	V1C:	kV∠ °
VbC:	kV∠	°	V2C:	kV∠ °
VcC:	kV∠	°	V0C:	kV∠ °
VaD:	kV∠	°	V1D:	kV∠ °
VbD:	kV∠	°	V2D:	kV∠ °
VcD:	kV∠	°	V0D:	kV∠ °
CH1				
Ia:	kA or A∠	°	I1:	kA or A∠ °
Ib:	kA or A∠	°	I2:	kA or A∠ °
Ic:	kA or A∠	°	I0:	kA or A∠ °
CH2				
Ia:	kA or A∠	°	I1:	kA or A∠ °
Ib:	kA or A∠	°	I2:	kA or A∠ °
Ic:	kA or A∠	°	I0:	kA or A∠ °
CH3				
Ia:	kA or A∠	°	I1:	kA or A∠ °
Ib:	kA or A∠	°	I2:	kA or A∠ °
Ic:	kA or A∠	°	I0:	kA or A∠ °
CH3				
Ia:	kA or A∠	°	I1:	kA or A∠ °
Ib:	kA or A∠	°	I2:	kA or A∠ °
Ic:	kA or A∠	°	I0:	kA or A∠ °
CH4				
Ia:	kA or A∠	°	I1:	kA or A∠ °
Ib:	kA or A∠	°	I2:	kA or A∠ °
Ic:	kA or A∠	°	I0:	kA or A∠ °

CH5

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH6

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH7

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH8

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH9

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH10

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH11

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH12

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH13

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH14

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH15

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH16

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH17

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH18

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH19

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH20

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH21

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH22

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH23

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH22

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH23

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH24

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH25

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH26

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH27

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH28

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH29

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH30

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH31

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH32

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

Prefault values (VT ratio: kV/: V)

I _{da} :	%		I _{daB} :	%	
I _{db} :	%		I _{dbB} :	%	
I _{dc} :	%		I _{dcB} :	%	
I _{daA} :	%		I _{daD} :	%	
I _{dbA} :	%		I _{dbD} :	%	
I _{dcA} :	%		I _{dcD} :	%	
I _{daC} :	%				
I _{dbC} :	%				
I _{dcC} :	%				
V _{aA} :	kV/	°	V _{1A} :	kV/	°
V _{bA} :	kV/	°	V _{2A} :	kV/	°
V _{cA} :	kV/	°	V _{0A} :	kV/	°
V _{aB} :	kV/	°	V _{1B} :	kV/	°
V _{bB} :	kV/	°	V _{2B} :	kV/	°
V _{cB} :	kV/	°	V _{0B} :	kV/	°
V _{aC} :	kV/	°	V _{1C} :	kV/	°
V _{bC} :	kV/	°	V _{2C} :	kV/	°
V _{cC} :	kV/	°	V _{0C} :	kV/	°
V _{aD} :	kV/	°	V _{1D} :	kV/	°
V _{bD} :	kV/	°	V _{2D} :	kV/	°
V _{cD} :	kV/	°	V _{0D} :	kV/	°

CH1

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH2

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°
CH3					
I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°
CH3					
I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°
CH4					
I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°
CH5					
I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°
CH6					
I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°
CH7					
I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°
CH8					
I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°
CH9					
I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°
CH10					
I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°
CH11					
I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°
CH12					
I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH13

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH14

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH15

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH16

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH17

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH18

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH19

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH20

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH21

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH22

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH23

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH22

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH23

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH24

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH25

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH26

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH27

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH28

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH29

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH30

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH31

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

CH32

I _a :	kA or A/	°	I ₁ :	kA or A/	°
I _b :	kA or A/	°	I ₂ :	kA or A/	°
I _c :	kA or A/	°	I ₀ :	kA or A/	°

3. What was the message on the LCD display at the time of the incident.

4. Please write the detail of the incident.

5. Date of the incident occurred.

Day/ Month/ Year: / /

(Example: 10/ July/ 2001)

6. Please write any comments on the GRB100, including the document.

Customer

Name: _____

Company Name: _____

Address: _____

Telephone No.: _____

Facsimile No.: _____

Signature: _____

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Appendix M

Technical Data

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Technical Data

Ratings

AC current:	1A or 5A
Frequency:	50Hz or 60Hz
DC power supply:	110Vdc/125Vdc (Operative range: 88 to 150Vdc) 220Vdc/250Vdc (Operative range: 176 to 300Vdc) 48Vdc/54Vdc/60Vdc (Operative range: 38.4 to 72Vdc)

Overload Rating

AC current input:	4 times rated continuous 100 times rated for 1 second
AC voltage input:	2 times rated continuous

Binary input signal

Operating voltage:	Typical 74Vdc, minimum 70Vdc at 100Vdc/125Vdc rating Typical 138Vdc, minimum 125Vdc at 200Vdc/250Vdc rating Typical 31Vdc, minimum 28Vdc at 48Vdc/54Vdc/60Vdc rating
--------------------	--

Burden

Central unit:	
DC power supply:	less than 50W (quiescent)
Bay unit:	
AC current circuit:	less than 0.3VA per phase (at rated 5A) less than 0.1VA per phase (at rated 1A)
DC power supply:	less than 16W (quiescent)

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 0.01 steps
Primary rating of CT:	100 to 10000A in 1A steps

Operating time of current differential element

Typical operating time:	typical 1 cycle
Accuracy of current differential protection:	$\pm 5\%$ ($\pm 7\%$ at $I < 0.3 \times I_n$)

Breaker failure protection

Overcurrent element:	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:	0 to 500ms in 1ms steps
Accuracy of overcurrent element:	$\pm 5\%$ ($\pm 10\%$ at $I < 0.5 \times I_n$)
DO/PU ratio:	0.8

Fault Detector

Undervoltage element for phase fault	60 to 100V in 1V steps
Undervoltage element for earth fault	20 to 60V in 1V steps
Undervoltage change detection element	0.07 times voltage before fault
Overvoltage element for earth fault	0.1 to 10.0V in 0.1V steps

Disturbance Record Initiation

Overcurrent element	0.1 to 10.0 times of CT rated current in 0.1 steps
---------------------	--

Communication port

PORT-1 (RS485):	For RSM100
Connector:	Screw terminals
PORT-2 (RS485):	For substation control and monitoring system
Protocol:	IEC 60870-5-103
Connector:	Screw terminals

Contact ratings

Trip contacts (high-speed type):	
Make and carry:	5A continuously 30A, 290V DC for 0.5s (L/R = 10ms)
Break:	0.15A, 290Vdc (L/R = 40ms)
Auxiliary contacts:	
Make and carry:	4A continuously 10A, 220V DC for 0.2s (L/R $\geq$ 5ms)
Break:	0.1A, 220V DC (L/R = 40ms)
Durability	
Make and carry:	10,000 operations minimum
Break:	100,000 operations minimum

Mechanical design

Weight	
CU:	11 kg
BU:	9.5 kg
Case color:	2.5Y7.5/1(approximation to Munsell value)
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	IEC60068-2-3	56 days at 40°C and 93% relative humidity.
Enclosure Protection	IEC60529	IP51 (IP20 for terminals)
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
High Voltage 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	IEC60255-22-1 Class 3	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	6kV contact discharge. 8kV air discharge.
Radiated RF Electromagnetic Disturbance	IEC60255-22-3	Field strength 10V/m for frequency sweeps of 80MHz to 1GHz. Additional spot tests at 80, 160, 450, 900 and 1890MHz.
Fast Transient Disturbance	IEC60255-22-4 Class 4	4kV, 2.5kHz, 5/50ns applied to all inputs.

Appendix N

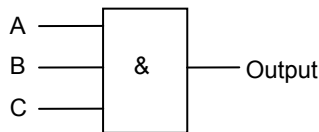
Symbols Used in Scheme Logic

Symbols used in the scheme logic and their meanings are as follows:

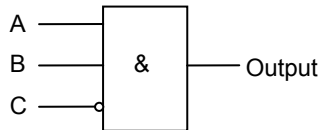
Signal names

- Marked with  : Measuring element output signal
- Marked with  : Binary signal input from or output to the external equipment
- Marked with [] : Scheme switch
- Marked with "  " : Scheme switch position
- Unmarked  : Internal scheme logic signal

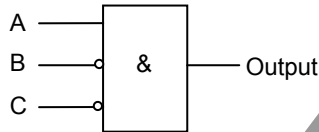
AND gates



A	B	C	Output
1	1	1	1
Other cases			0

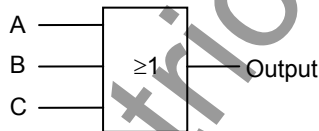


A	B	C	Output
1	1	0	1
Other cases			0

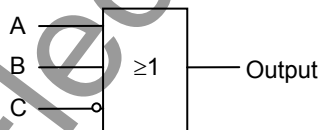


A	B	C	Output
1	0	0	1
Other cases			0

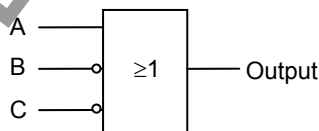
OR gates



A	B	C	Output
0	0	0	0
Other cases			1

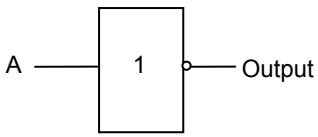


A	B	C	Output
0	0	1	0
Other cases			1



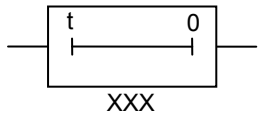
A	B	C	Output
0	1	1	0
Other cases			1

Signal inversion

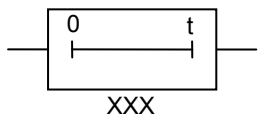


A	Output
0	1
1	0

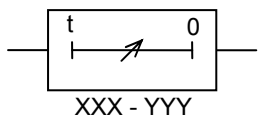
Timer



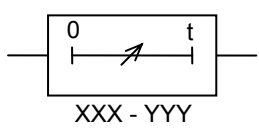
Delaye pick-up timer with fixed setting
XXX: Set time



Delayed drop-off timer with fixed setting
XXX: Set time

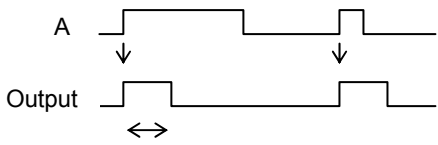
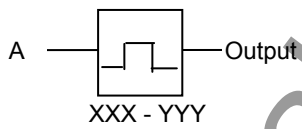


Delaye pick-up timer with variable setting
XXX - YYY: Setting range



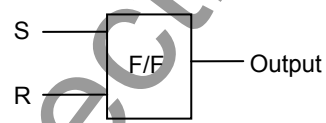
Delayed drop-off timer with variable setting
XXX - YYY: Setting range

One-shot timer



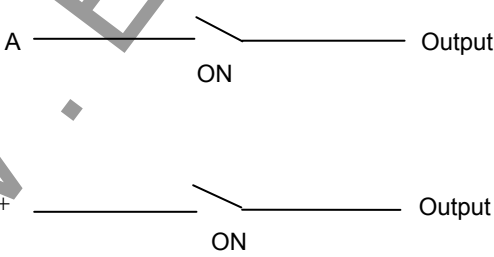
XXX - YYY: Setting range

Flip-flop



S	R	Output
0	0	No change
1	0	1
0	1	0
1	1	0

Scheme switch



A	Switch	Output
1	ON	1
Other cases		0

Switch	Output
ON	1
OFF	0

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Appendix O

Sample of Setting Calculation

1. Power System Data

Example

- VT Ratio: 154kV/115V
- CT Ratio: 2000A/5A
- Minimum fault current: 2000A (Assumption)
- Number of feeder : 8 feeders (10 channels)
10 feeders (12 channels)
12 feeders (14 channels)

2. Relay Setting

- Relay application:
Relay type: GRB100

3. Setting Calculation

3.1 DIF setting

The setting of DIF (DIFCH and DIFZ) is determined from the minimum fault I_{Fmin} current that can occur on the busbar fault.

$$\text{DIF setting} < 0.8 \times I_{Fmin}$$

0.8 : Margin

The setting is based on the primary circuit value, so I_{Fmin} is a primary value. The CT ratios or the difference of the CT ratios between the channels can be disregarded in the setting.

If the minimum operating current is set too low when the CT primary rating is high, the operation error of the differential element is increased as shown in Figure 3.1.1. If it is required to keep the accuracy of minimum operating current less than 5%, the following condition must be checked for the DIFCH and DIFZ setting obtained above depending on the total number of channels.

$$0.40 \times \text{CT primary rating} < \text{DIF setting for 25 - 32 channels}$$

$$0.34 \times \text{CT primary rating} < \text{DIF setting for 17- 24 channels}$$

$$0.28 \times \text{CT primary rating} < \text{DIF setting for 9 - 16 channels}$$

$$0.23 \times \text{CT primary rating} < \text{DIF setting for 1 - 8 channels}$$

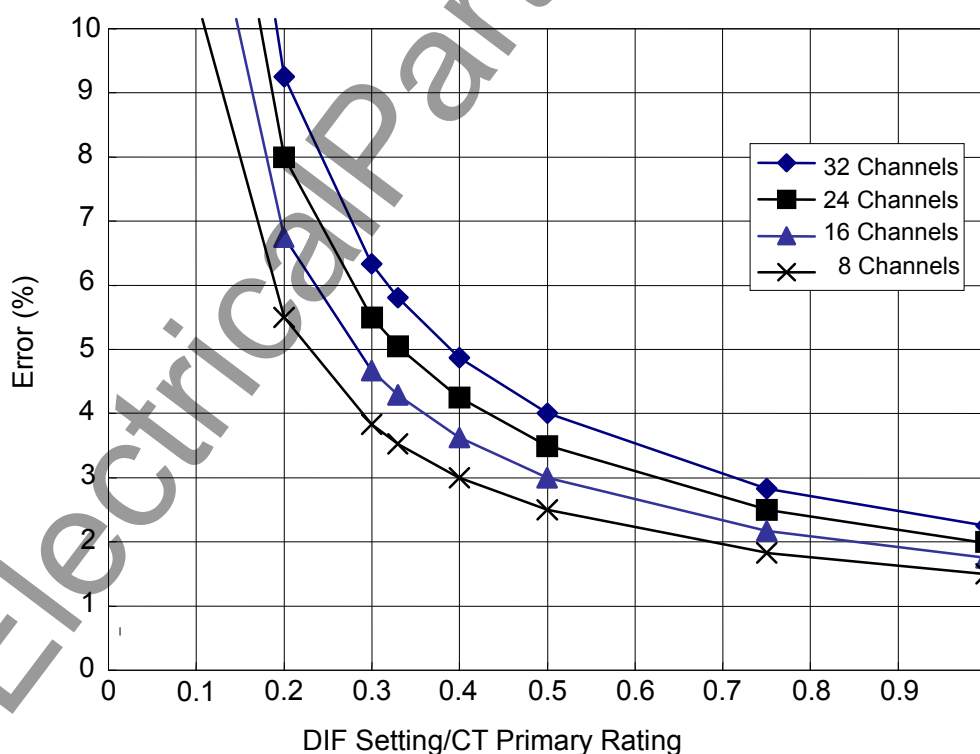


Figure 3.1.1 Accuracy Check

$$\begin{aligned}
 \text{DIFCH, DIFZ} &= 0.8 \times I_{F\min} \\
 &= 0.8 \times 2,000\text{A} \\
 &= 1,600\text{A}
 \end{aligned}$$

Checking for accuracy of minimum operating current less than 5%.

When the number of feeder is 8 – 12, the number of channel is 10 – 14 channels.

$$0.28 \times \text{CT primary rating} < \text{DIF setting for 9 – 16 channels}$$

$$0.28 \times 2,000\text{A} < 1,600\text{A}$$

$$560\text{A} < 1,600\text{A}$$

(Example)

Element	Setting
DIFCH	1,600A
DIFZ	1,600A

3.2 nOCBF setting

The overcurrent element nOCBF checks that the breaker has opened and the current has disappeared. Therefore, since it is allowed to respond to the load current, it can be set from 10 to 200% of the rated current.

The setting of TnB2 are determined by the opening time of the original breaker (Tcb in Figure 3.2.1) and the reset time of the overcurrent element (Toc in Figure 3.2.1).

$$\begin{aligned}
 \text{TnB2} &= \text{Breaker opening time} + \text{nOCBF reset time} + \text{Margin} \\
 &= 50\text{ms} + 10\text{ms} + 20\text{ms} \\
 &= 80\text{ms}
 \end{aligned}$$

(Example)

Element	Setting	Remark
nOCB	0.8	
TnB2	80ms	
nBFEXT	ON	
nBF1	OFF	Retrip is no used
nBF2	ON	

n: 1 to 32

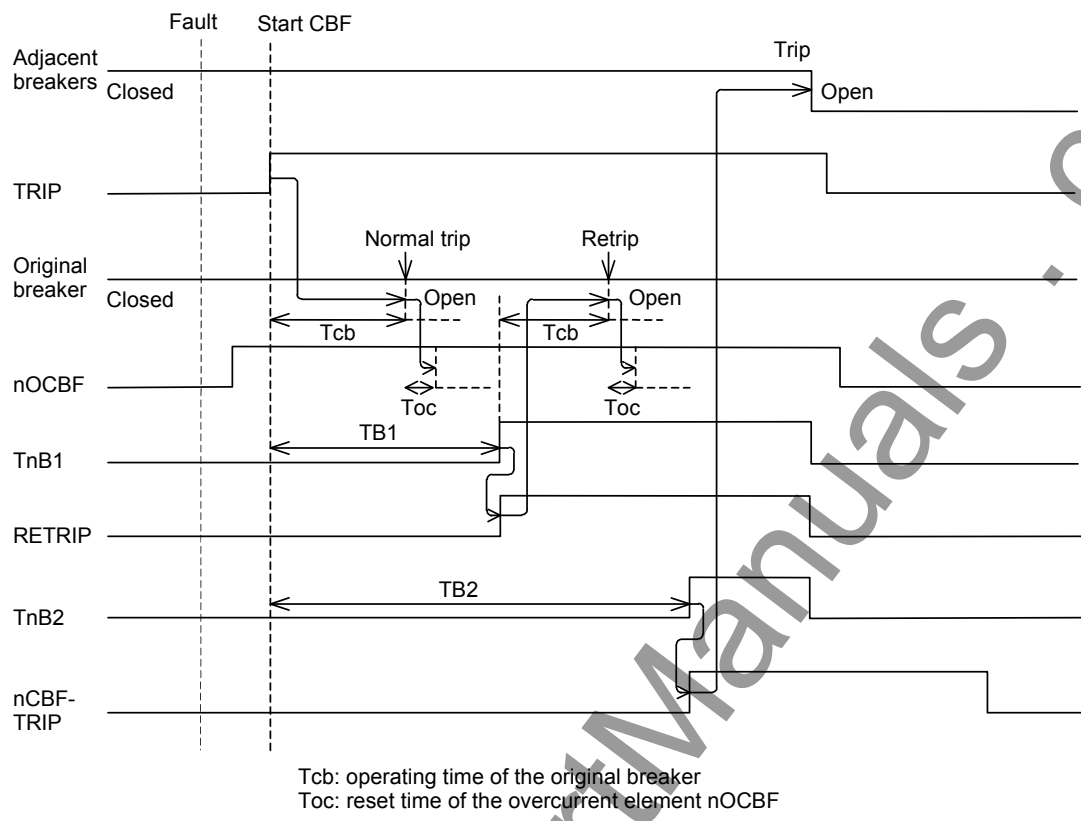


Figure 3.2.1 Sequence Diagram

3.3 Undervoltage elements setting

The undervoltage element (UVSF, UVGF) is set to about 70% of the rated voltage.

(Example)

Element	Setting
UVSF	80V
UVGF	46V

3.4 DIFSV setting

The setting of DIFSV for differential current monitoring is determined from the maximum erroneous differential current during normal service condition.

(Example 1)

DIFSV setting > maximum erroneous differential current

$$= \varepsilon \times \sqrt{n} \times I_{Lmax}$$

ε : CT error

n : Number of channel

I_{Lmax} : Maximum load current (assumed to be max. CT primary rating current)

$$\begin{aligned}
 \text{DIFSV} &= 1.2 \times 0.05 \times \sqrt{10} \times 2000\text{A} \\
 &= 1.2 \times 320\text{A} \\
 &= 384\text{A}
 \end{aligned}$$

$\varepsilon = 5\%$, $n = 10$, $I_{L\max} = 2000$ (Primary rating)

1.2 = Margin

Element	Setting
DIFSV	380A

(Example 2)

DIFSV setting = 1.2 × (2 times of the differential current measured in normal service condition)

1.2 = Margin

When the differential current measured in normal service condition is 10% of DIF setting,

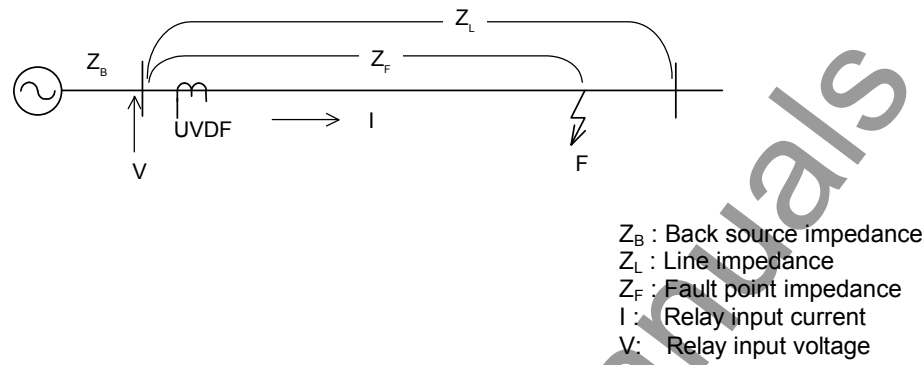
$$\begin{aligned}
 \text{DIFSV} &= 1.2 \times 1600\text{A} \times 0.1 \times 2 \\
 &= 1.2 \times 320\text{A} \\
 &= 384\text{A}
 \end{aligned}$$

Element	Setting
DIFSV	380A

3.5 UVDF setting

The sensitivity of UVDF is fixed. The UVDF operates if a voltage drops by 7% compared to that of two cycles before. The UVDF can detect the voltage drop in the system condition $SIR \geq 0.1$ as a fault detector for CBF initiation as described below.

(Description)



$$I = \frac{V}{Z_B + Z_F} = \frac{V}{\underbrace{Z_L(Z_B/Z_L + Z_F/Z_L)}_{SIR} \%}$$

SIR : Source Impedance Ratio

$$I = \frac{E}{Z_L(SIR + \%)} , \quad V = \frac{E}{SIR + \%}$$

E : Rated voltage

When $SIR = 0.1$ and $\% = 1 (Z_L = Z_F)$, the voltage drop V is as follows:

$$V = \frac{E}{0.1 + 1} = 0.91E$$

Therefore, the UVDF with 7% fixed setting can detect the voltage drop in the system condition $SIR \geq 0.1$.

The following table shows the voltage drop depending on SIR.

SIR	0.1	0.3	0.5	1
V (pu)	0.91	0.77	0.67	0.50

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Appendix P

IEC60870-5-103: Interoperability

IEC60870-5-103 Configurator

IEC103 configurator software is included in a same CD as RSM100, and can be installed easily as follows:

Installation of IEC103 Configurator

Insert the CD-ROM (RSM100) into a CDROM drive to install this software on a PC.

Double click the “Setup.exe” of the folder “¥IEC103Conf” under the root directory, and operate it according to the message.

When installation has been completed, the IEC103 Configurator will be registered in the start menu.

Starting IEC103 Configurator

Click [Start]→[Programs]→[IEC103 Configurator]→[IECConf] to the IEC103 Configurator software.

Note: The instruction manual of IEC103 Configurator can be viewed by clicking [Help]→[Manual] on IEC103 Configurator.

IEC60870-5-103: Interoperability

1. Physical Layer

1.1 Electrical interface: EIA RS-485

Number of loads, 32 for one protection equipment

1.2 Optical interface

Glass fibre (option)

ST type connector (option)

1.3 Transmission speed

User setting: 9600 or 19200 bit/s

2. Application Layer

COMMON ADDRESS of ASDU

One COMMON ADDRESS OF ASDU (identical with station address)

3. List of Information

The following items can be customized with the original software tool “IEC103 configurator”. (For details, refer to “IEC103 configurator” manual No.6F2S0839.)

- Items for “Time-tagged message”: Type ID(1/2), INF, FUN, Transmission condition(Signal number), COT
- Items for “Time-tagged measurands”: INF, FUN, Transmission condition(Signal number), COT, Type of measurand quantities
- Items for “General command”: INF, FUN, Control condition(Signal number)
- Items for “Measurands”: Type ID(3/9), INF, FUN, Number of measurand, Type of measurand quantities
- Common setting
 - Transmission cycle of Measurand frame
 - FUN of System function
 - Test mode, etc.

Note: To be effective the setting data written via the RS232C, turn off the DC supply of the relay and turn on again.

3.1 IEC60870-5-103 Interface

3.1.1 Spontaneous events

The events created by the relay will be sent using Function type (FUN) / Information numbers (INF) to the IEC60870-5-103 master station.

3.1.2 General interrogation

The GI request can be used to read the status of the relay, the Function types and Information numbers that will be returned during the GI cycle are shown in the table below.

For details, refer to the standard IEC60870-5-103 section 7.4.3.

3.1.3 Cyclic measurements

The relay will produce measured values using Type ID=3 or 9 on a cyclical basis, this can be read from the relay using a Class 2 poll. The rate at which the relay produces new measured values can be customized.

3.1.4 Commands

The supported commands can be customized. The relay will respond to non-supported commands with a cause of transmission (COT) of negative acknowledgement of a command.

For details, refer to the standard IEC60870-5-103 section 7.4.4.

3.1.5 Test mode

In test mode, both spontaneous messages and polled measured values, intended for processing in the control system, are designated by means of the CAUSE OF TRANSMISSION 'test mode'. This means that CAUSE OF TRANSMISSION = 7 'test mode' is used for messages normally transmitted with COT=1 (spontaneous) or COT=2 (cyclic).

For details, refer to the standard IEC60870-5-103 section 7.4.5.

3.1.6 Blocking of monitor direction

If the blocking of the monitor direction is activated in the protection equipment, all indications and measurands are no longer transmitted.

For details, refer to the standard IEC60870-5-103 section 7.4.6.

3.2 List of Information

The followings are the default settings.

List of Information

INF	Description	Contents	IEC103 Configurator Default setting						
			GI	Type ID	COT	FUN	DPI		
							Signal No.	OFF	ON
Standard Information numbers in monitor direction									
System Function									
0	End of General Interrogation	Transmission completion of GI items.	--	8	10	255	--	--	--
0	Time Synchronization	Time Synchronization ACK.	--	6	8	255	--	--	--
2	Reset FCB	Reset FCB(toggle bit) ACK	--	5	3	220	--	--	--
3	Reset CU	Reset CU ACK	--	5	4	220	--	--	--
4	Start/Restart	Relay start/restart	--	5	5	220	--	--	--
5	Power On	Relay power on.	Not supported				--	--	--
Status Indications									
16	Auto-recloser active	If it is possible to use auto-recloser, this item is set active, if impossible, inactive.	Not supported						
17	Teleprotection active	If protection using telecommunication is available, this item is set to active. If not, set to inactive.	Not supported						
18	Protection active	If the protection is available, this item is set to active. If not, set to inactive.	GI	1	1, 7, 9, 12, 20, 21	220	1413	1	2
19	LED reset	Reset of latched LEDs	--	1	1, 7, 11, 12, 20, 21	220	1409	--	2
20	Monitor direction blocked	Block the 103 transmission from a relay to control system. IECBLK: "Blocked" setting.	GI	1	9, 11	220	1241	1	2
21	Test mode	Transmission of testmode situation from a relay to control system. IECTST "ON" setting.	GI	1	9, 11	220	1242	1	2
22	Local parameter Setting	When a setting change has done at the local, the event is sent to control system.	Not supported						
23	Characteristic1	Setting group 1 active	GI	1	1, 7, 9, 11, 12, 20, 21	220	1243	1	2
24	Characteristic2	Setting group 2 active	GI	1	1, 7, 9, 11, 12, 20, 21	220	1244	1	2
25	Characteristic3	Setting group 3 active	GI	1	1, 7, 9, 11, 12, 20, 21	220	1245	1	2
26	Characteristic4	Setting group 4 active	GI	1	1, 7, 9, 11, 12, 20, 21	220	1246	1	2
27	Auxiliary input1	Binary input 1	No set						
28	Auxiliary input2	Binary input 2	No set						
29	Auxiliary input3	Binary input 3	No set						
30	Auxiliary input4	Binary input 4	No set						
Supervision Indications									
32	Measurand supervision I	Zero sequence current supervision	GI	1	1, 7, 9	220	1267	1	2
33	Measurand supervision V	Zero sequence voltage supervision	GI	1	1, 7, 9	220	1268	1	2
35	Phase sequence supervision	Negative sequence voltage supervision	GI	1	1, 7, 9	220	1269	1	2
36	Trip circuit supervision	Output circuit supervision	GI	1	1, 7, 9	220	1259	1	2
37	I>>backup operation		Not supported						
38	VT fuse failure	VT failure	Not supported						
39	Teleprotection disturbed	CF(Communication system Fail) supervision	Not supported						
46	Group warning	Only alarming	GI	1	1, 7, 9	220	1258	1	2

IEC103 Configurator Default setting									
INF	Description	Contents	GI	Type ID	COT	FUN	DPI		
							Signal NO.	OFF	ON
Fault Indications									
64	Start/pick-up L1	A phase, A-B phase or C-A phase element pick-up	No set						
65	Start/pick-up L2	B phase, A-B phase or B-C phase element pick-up	No set						
66	Start/pick-up L3	C phase, B-C phase or C-A phase element pick-up	No set						
67	Start/pick-up N	Earth fault element pick-up	Not supported						
68	General trip	Any trip	--	2	1, 7	220	1280	--	2
69	Trip L1	A phase, A-B phase or C-A phase trip	No set						
70	Trip L2	B phase, A-B phase or B-C phase trip	No set						
71	Trip L3	C phase, B-C phase or C-A phase trip	No set						
72	Trip I>>(back-up)	Back up trip	Not supported						
73	Fault location X In ohms	Fault location	Not supported						
74	Fault forward/line	Forward fault	Not supported						
75	Fault reverse/Busbar	Reverse fault	Not supported						
76	Teleprotection Signal transmitted	Carrier signal sending	Not supported						
77	Teleprotection Signal received	Carrier signal receiving	Not supported						
78	Zone1	Zone 1 trip	Not supported						
79	Zone2	Zone 2 trip	Not supported						
80	Zone3	Zone 3 trip	Not supported						
81	Zone4	Zone 4 trip	Not supported						
82	Zone5	Zone 5 trip	Not supported						
83	Zone6	Zone 6 trip	Not supported						
84	General Start/Pick-up	Any elements pick-up	No set						
85	Breaker Failure	CBF trip or CBF retrip	No set						
86	Trip measuring system L1		Not supported						
87	Trip measuring system L2		Not supported						
88	Trip measuring system L3		Not supported						
89	Trip measuring system E		Not supported						
90	Trip I>	Inverse time OC trip	Not supported						
91	Trip I>>	Definite time OC trip	Not supported						
92	Trip IN>	Inverse time earth fault OC trip	Not supported						
93	Trip IN>>	Definite time earth fault OC trip	Not supported						
Autoreclose indications									
128	CB 'ON' by Autoreclose	CB close command output	Not supported						
129	CB 'ON' by long-time Autoreclose		Not supported						
130	Autoreclose Blocked	Autoreclose block	Not supported						

INF	Description	Contents	IEC103 configurator Default setting				
			GI	Type ID	COT	FUN	Max. No.
Measurands							
144	Measurand I	<meaurand I>	No				0
145	Measurand I,V	<meaurand I>	No				0
146	Measurand I,V,P,Q	<meaurand I>	No				0
147	Measurand IN,VEN	<meaurand I>	No				0
148	Measurand IL1,2,3, VL1,2,3, P,Q,f	CH1-Ia, CH2-Ib, CH3-Ic, f measurand <meaurand II>	--	9	2, 7	220	9
Generic Function							
240	Read Headings		Not supported				
241	Read attributes of all entries of a group		Not supported				
243	Read directory of entry		Not supported				
244	Real attribute of entry		Not supported				
245	End of GGI		Not supported				
249	Write entry with confirm		Not supported				
250	Write entry with execute		Not supported				
251	Write entry aborted		Not supported				

Details of MEA settings in IEC103 configurator

INF	MEA	Tbl	Offset	Data type	Limit		Coeff
					Lower	Upper	
148	CH1-Ia	1	96	short	0	4096	4.266666
	CH1-Ib	1	100	short	0	4096	4.266666
	CH1-Ic	1	104	short	0	4096	4.266666
	(empty)						
	(empty)						
	(empty)						
	(empty)						
	(empty)						
	f	2	0	short	0	4096	0.0000833

INF	Description	Contents	IEC103 Configurator Default setting			
			Control direction	Type ID	COT	FUN
Selection of standard information numbers in control direction						
System functions						
0	Initiation of general interrogation		--	7	9	255
0	Time synchronization		--	6	8	255
General commands						
16	Auto-recloser on/off		Not supported			
17	Teleprotection on/off		Not supported			
18	Protection on/off	(*1)	ON/OFF	20	20	220
19	LED reset	Reset indication of latched LEDs.	ON	20	20	220
23	Activate characteristic 1	Setting Group 1	ON	20	20	220
24	Activate characteristic 2	Setting Group 2	ON	20	20	220
25	Activate characteristic 3	Setting Group 3	ON	20	20	220
26	Activate characteristic 4	Setting Group 4	ON	20	20	220
Generic functions						
240	Read headings of all defined groups		Not supported			
241	Read values or attributes of all entries of one group		Not supported			
243	Read directory of a single entry		Not supported			
244	Read values or attributes of a single entry		Not supported			
245	General Interrogation of generic data		Not supported			
248	Write entry		Not supported			
249	Write entry with confirmation		Not supported			
250	Write entry with execution		Not supported			

(*1) Note: While the relay receives the "Protection off" command, "IN SERVICE LED" is off.

Details of Command settings in IEC103 configurator

INF	DCO			
	Sig off	Sig on	Rev	Valid time
18	2686	2686	✓	0
19	0	2688		200
23	0	2640		1000
24	0	2641		1000
25	0	2642		1000
26	0	2643		1000

✓ : signal reverse

	Description	Contents	GRB100 supported	Comment
Basic application functions				
	Test mode		Yes	
	Blocking of monitor direction		Yes	
	Disturbance data		No	
	Generic services		No	
	Private data		Yes	
Miscellaneous				
	Measurand		Max. MVAL = rated value times	
	Current L1	Ia	Configurable	
	Current L2	Ib	Configurable	
	Current L3	Ic	Configurable	
	Voltage L1-E	Va	No set	
	Voltage L2-E	Vb	No set	
	Voltage L3-E	Vc	No set	
	Active power P	P	No set	
	Reactive power Q	Q	No set	
	Frequency f	f	Configurable	
	Voltage L1 - L2	Vab	No set	

Details of Common settings in IEC103 configurator

- Setting file's remark: GRB100_1.00
- Remote operation valid time [ms]: 4000
- Local operation valid time [ms]: 4000
- Measurand period [s]: 2
- Function type of System functions: 220
- Signal No. of Test mode: 1242
- Signal No. for Real time and Fault number: 1279

[Legend]

GI: General Interrogation (refer to IEC60870-5-103 section 7.4.3)

Type ID: Type Identification (refer to IEC60870-5-103 section 7.2.1)

- 1 : time-tagged message
- 2 : time-tagged message with relative time
- 3 : measurands I
- 4 : time-tagged measurands with relative time
- 5 : identification
- 6 : time synchronization
- 8 : general interrogation termination
- 9 : measurands II
- 10: generic data
- 11: generic identification
- 20: general command
- 23: list of recorded disturbances
- 26: ready for transmission for disturbance data
- 27: ready for transmission of a channel
- 28: ready for transmission of tags
- 29: transmission of tags
- 30: transmission of disturbance values
- 31: end of transmission

COT: Cause of Transmission (refer to IEC60870-5-103 section 7.2.3)

- 1: spontaneous
- 2: cyclic
- 3: reset frame count bit (FCB)
- 4: reset communication unit (CU)
- 5: start / restart
- 6: power on
- 7: test mode
- 8: time synchronization
- 9: general interrogation
- 10: termination of general interrogation
- 11: local operation
- 12: remote operation
- 20: positive acknowledgement of command
- 21: negative acknowledgement of command
- 31: transmission of disturbance data
- 40: positive acknowledgement of generic write command
- 41: negative acknowledgement of generic write command
- 42: valid data response to generic read command
- 43: invalid data response to generic read command
- 44: generic write confirmation

FUN: Function type (refer to IEC60870-5-103 section 7.2.5.1)

DPI: Double-point Information (refer to IEC60870-5-103 section 7.2.6.5)

DCO: Double Command (refer to IEC60870-5-103 section 7.2.6.4)

IEC103 setting data is recommended to be saved as follows:

(1) Naming for IEC103setting data

The file extension of IEC103 setting data is “.csv”. The version name is recommended to be provided with a revision number in order to be changed in future as follows:

First draft: *****_01.csv

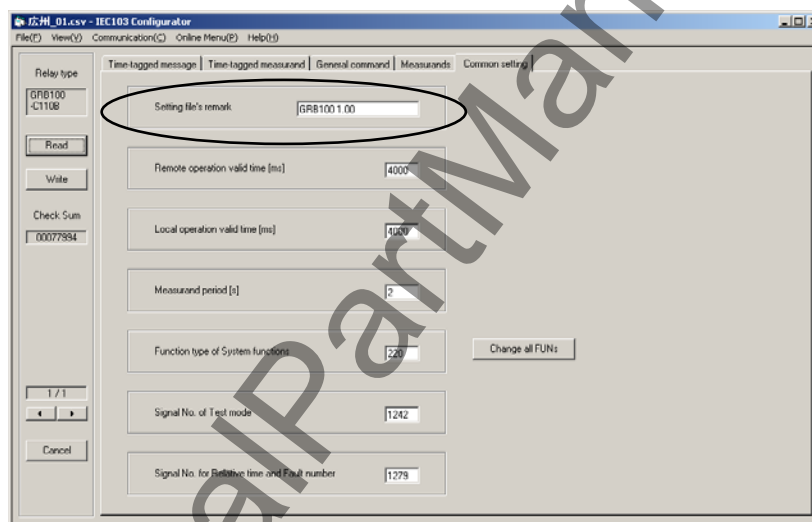
Second draft: *****_02.csv

Third draft: *****_03.csv



Revision number

The name “*****” is recommended to be able to discriminate the relay type such as GRZ100 or GRL100, etc. The setting files remark field of IEC103 is able to enter up to 12 one-byte characters. It is utilized for control of IEC103 setting data.



(2) Saving the IEC103 setting data

The IEC103 setting data is recommended to be saved in external media such as FD (floppy disk) or CD-R, not to remain in the folder.

Troubleshooting

No.	Phenomena	Supposed causes	Check / Confirmation										
			Object	Procedure									
1	Communication trouble (IEC103 communication is not available.)	Address setting is incorrect.	BCU RY	Match address setting between BCU and relay. Avoid duplication of address with other relay.									
		Transmission baud rate setting is incorrect.	BCU RY	Match transmission baud rate setting between BCU and relay.									
		Start bit, stop bit and parity settings of data that BCU transmits to relay is incorrect.	BCU	Go over the following settings by BCU. Relay setting is fixed as following settings. - Start bit: 1bit - Stop bit: 1bit - Parity setting: even									
		The PRTCL1 setting is incorrect. (The model with PRTCL1 setting.)	RY	Change the PRTCL1 setting. Relation between PRTCL1 setting and available transmission protocol is referred to the following table. <table><tr><td>RS485 port at the back of the relay</td><td>PRTCL1 =HDLC</td><td>PRTCL1 =IEC</td></tr><tr><td>COM1 (CH1)</td><td>HDLC</td><td>IEC</td></tr><tr><td>COM2 (CH2)</td><td>IEC</td><td>—</td></tr></table>	RS485 port at the back of the relay	PRTCL1 =HDLC	PRTCL1 =IEC	COM1 (CH1)	HDLC	IEC	COM2 (CH2)	IEC	—
		RS485 port at the back of the relay	PRTCL1 =HDLC	PRTCL1 =IEC									
		COM1 (CH1)	HDLC	IEC									
		COM2 (CH2)	IEC	—									
		RS485 or optical cable interconnection is incorrect.	Cable	- Check the connection port.(CH1/CH2) - Check the interconnection of RS485 A/B/COM - Check the send and received interconnection of optical cable.									
		The setting of converter is incorrect. (RS485/optic conversion is executed with the transmission channel, etc.)	Converter	In the event of using G1IF2, change the DIPSW setting in reference to INSTRUCTION MANUAL (6F2S0794).									
		The relationship between logical "0/1" of the signal and Sig.on/off is incorrect. (In the event of using optical cable)	BCU	Check the following; Logical0 : Sig.on Logical1:Sig.off									
Terminal resistor is not offered. (Especially when RS485 cable is long.)	cable	Impose terminal resistor (150[ohms]) to both ends of RS 485 cable.											
Relay cannot receive the requirement frame from BCU. (The timing coordination of sending and receiving switch control is irregular in half-duplex communication.)	BCU	Check to secure the margin more than 15ms between receiving the reply frame from the relay and transmitting the next requirement frame on BCU.											
The requirement frame from BCU and the reply frame from relay contend. (The sending and receiving timing coordination is irregular in half-duplex communication.)	BCU	Check to set the time-out of reply frame from the relay. Time-out setting: more than 100ms (acceptable value of response time 50ms plus margin)											

No.	Phenomena	Supposed causes	Check / Confirmation	
			Object	Procedure
2	HMI does not display IEC103 event on the SAS side.	The relevant event sending condition is not valid.	RY	Change the event sending condition (signal number) of IEC103 configurator if there is a setting error. When the setting is correct, check the signal condition by programmable LED, etc.
		The relevant event Information Number (INF) and/or Function Type (FUN) may be different between the relay and SAS.	RY SAS	Match the relevant event Information Number (INF) or Function Type (FUN) between the relay and SAS.
		The relay is not initialised after writing IEC103 configurator setting.	RY	Check the sum value of IEC103 setting data from the LCD screen. When differing from the sum value on IEC103 configurator, initialise the relay.
		It changes to the block mode.	RY	Change the IECBR settling to Normal.
3	Time can be synchronised with IEC103 communication.	BCU does not transmit the frame of time synchronisation.	BCU	Transmit the frame of time synchronisation.
		The settling of time synchronisation source is set to other than IEC.	RY	Change the settling of time synchronisation source to IEC.

(Note) BCU: Bay control unit, RY: Relay

Appendix Q

Ordering

www.ElectricalPartManuals.com

Central unit (CU)

Relay type:		GRB100	B	0	0	1
Busbar protection relay		GRB100				
CU Model:						
-Model C110: max. 8 channels, 4 zones		C110				
-Model C120: max. 16 channels, 4 zones		C120				
-Model C130: max. 24 channels, 4 zones		C130				
-Model C140: max. 32 channels, 4 zones		C140				
-Model C210: max. 8 channels, 4 zones / With voltage inputs		C210				
-Model C220: max. 16 channels, 4 zones / With voltage inputs		C220				
-Model C230: max. 24 channels, 4 zones / With voltage inputs		C230				
-Model C240: max. 32 channels, 4 zones / 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:						
RS485		1				
Fibre optic		2				
Dual RS485		3				
LED label:						
Standard		None				
Option: User configurable LED label		J				

Relay type:		
Busbar protection relay	GRB100	
BU Model:		
-Model B100B: 1 channel provided. (2 HS contacts)	B100B	
-Model B110B: 1 channel provided. (6 HS contacts)	B110B	
CT rating:		
1A	1	
5A	2	
Frequency:		
50Hz	1	
60Hz	2	
DC power supply rating:		
110V/125V	1	
220V/250V	2	
48V	3	

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

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

Optical cables for connection between CU and BUs:

- 1 to 8m in 1m steps

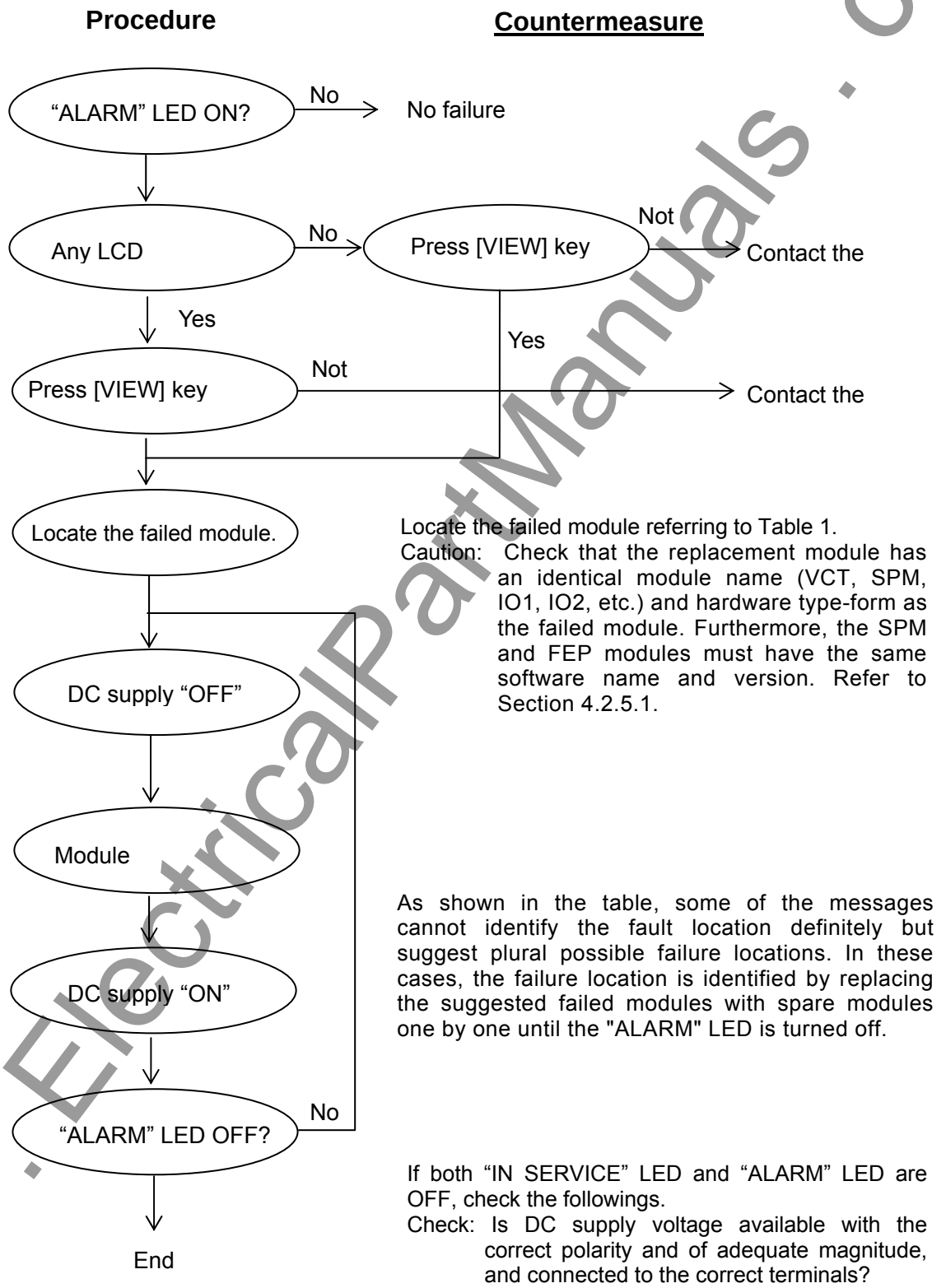
www.ElectricalPartManuals.com

Appendix R

Failed Module Tracing and Replacement

1. Failed module tracing and its replacement

If the “ALARM” LED is ON, the following procedure is recommended. If not repaired, contact the vendor.



If any messages are shown on the LCD, the failed module or failed external circuits can be located by referring to the following table.

This table shows the relationship between messages displayed on the LCD and estimated failure location. Locations marked with (1) have a higher probability than locations marked with (2) and (3). Locations marked with (2) have a higher probability than locations marked with (3). The monitoring of BU is performed by FEP module in CU. The monitoring result is displayed on LCD by SPM module. If an FEP module fails, therefore, the result displayed on the LCD may be incorrect. The relationship between the FEP module number and the monitored BUs is as follows:

FEP Module No.	BU			
	Model C*1*	Model C*2*	Model C*3*	Model C*4*
FEP1	x	x	x	x
FEP2			x	x
FEP3		x		x
FEP4			x	x

As shown in the table, some of the messages cannot identify the fault location definitely but suggest plural possible failure locations. In these cases, the failure location is identified by replacing the suggested failed modules with spare modules one by one until the "ALARM" LED is turned off.

The replacement or investigation should be performed first for the module or circuit with higher probability in the table.

If there is a failure and the LCD is not working such as a screen is frozen or not displayed, the failure location is any one of SPM, FEP and HMI module.

If there is a failure and no message is shown on the LCD in the CU, it means that the failure location is either in the DC power supply circuit or in the microprocessors mounted on the SPM module. In this case, check the "ALARM" LED. If it is off, the failure is in the DC power supply circuit. If it is lit, open the relay front panel and check the LEDs mounted on the SPM module. If the LED is off, the failure is in the DC power supply circuit. If the LED is lit, the failure is in the microprocessors.

In the former case, check if the correct DC voltage is applied to the relay. If it is, replace the IO#1 module mounting the DC/DC converter and confirm that the "ALARM" LED is turned off. In the latter case, replace the SPM module mounting the processors and confirm that the "ALARM" LED is turned off.

When the "POWER" LED in the BU is off, check if the correct DC voltage is applied to the BU. If it is, replace the BUM1 module mounting the DC/DC converter and confirm that the "POWER" LED is turned on.

LCD Message and Failure Location

Message or Operation	Failure location												
	CU						BU			AC cable	Optic. cable	DS or CB	AC inputs
	VCT	FEP	SPM	IO#1	IO#2	HMI	VCT	BUM1	BUM5				
Checksum err			×										
ROM-RAM err			×										
SRAM err			×										
BU-RAM err			×										
DPRAM err			×										
EEPROM err			×										
SUB stopped			×										
A/D err			×										
V0 err	×		×							×			×
V2 err	×		×							×			×
Sampling err			×										
DIO err			×	×	×								
LCD err			×			×							
Sub:checksum err			×										
Sub:ROM/RAM err			×										
Sub:SRAM err			×										
Sub:DPRAM err			×										
Sub:A/D err			×										
FEP*: checksum err		×											
FEP*: ROM-RAM err		×											
FEP*: SRAM err		×											
FEP*: DPRAM err		×											
FEP*: stopped		×											
BU*: COM err		×						×			×		
BU*: A/D err		×					×	×			×		
BU*: DIO err		×						×	×		×		
BU*: Address err		×						×			×		
BU*: EEPROM err		×						×					
BU*: AI err		×					×	×		×			
CT* err							×	×		×			×
DS* err									×				
CB* err									×				
Id-** err							×	×		×			×
Id err							×	×		×			×
CT fail, CT-ZA fail to CT-ZD fail							×	×		×			×
No-working of LCD		×	×			×							

Note *: The monitoring of BU is performed by FEP module in CU. The monitoring result is displayed on LCD by SPM module. If an FEP module fails, therefore, the result displayed on the LCD may be incorrect.

2. Methods of Replacing the Modules

⚠ CAUTION When handling a module, take anti-static measures such as wearing an earthed wrist band and placing modules on an earthed conductive mat. Otherwise, many of the electronic components could suffer damage.

CAUTION After replacing the SPM module, check all of the settings including the data related the PLC and IEC103, etc. are restored the original settings.

The initial replacement procedure is as follows:

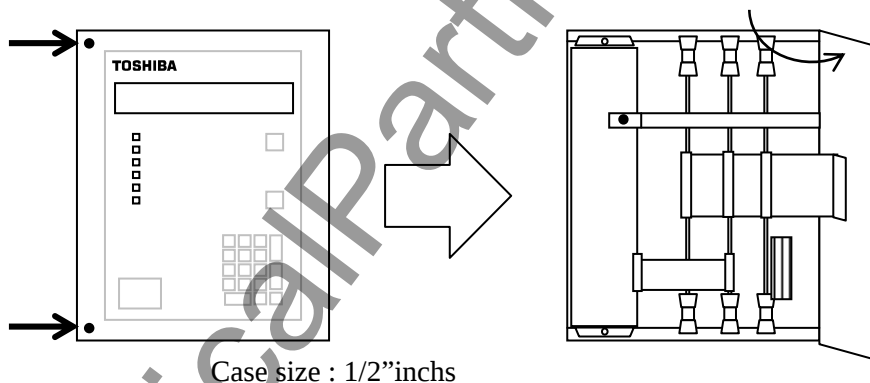
1). Switch off the DC power supply.

⚠ WARNING Hazardous voltage may remain in the DC circuit just after switching off the DC power supply. It takes about 30 seconds for the voltage to discharge.

2). Remove the front panel cover.

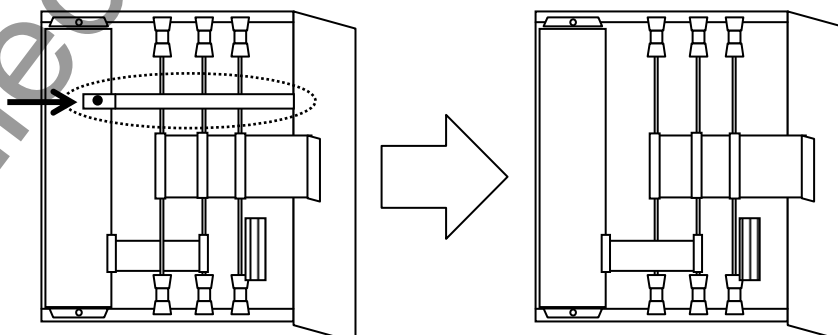
3). Open the front panel.

Open the front panel of the relay by unscrewing the binding screw located on the left side of the front panel.



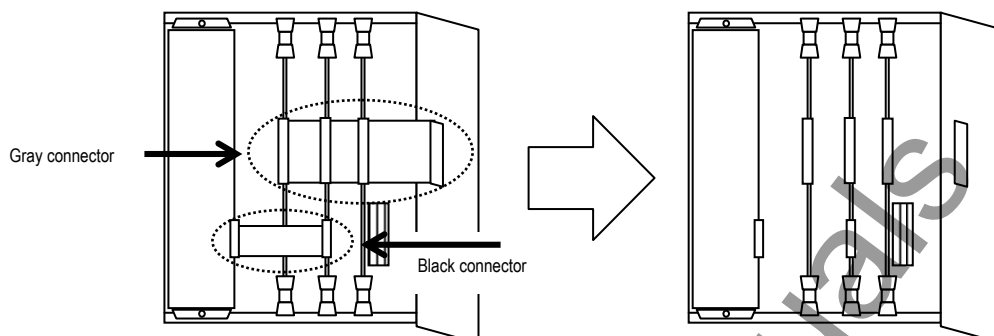
4). Detach the holding bar.

Detach the module holding bar by unscrewing the binding screw located on the left side of the bar.



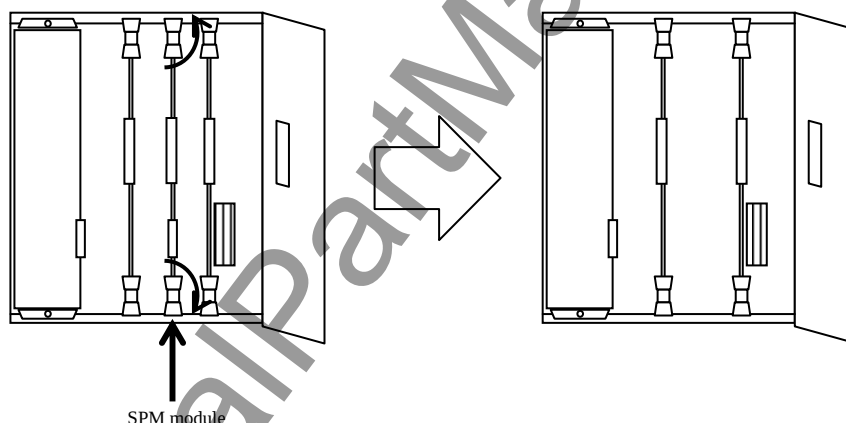
5). Unplug the cables.

Unplug the ribbon cable running among the modules by nipping the catch (in case of black connector) and by pushing the catch outside (in case of gray connector) on the connector.



6). Pull out the module.

Pull out the failure module by pulling up or down the top and bottom levers (white).



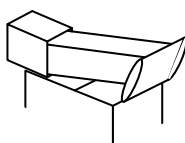
7). Insert the replacement module.

Insert the replacement module into the same slots where marked up.

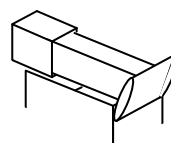
8). Do the No.5 to No.1 steps in reverse order.

▲ CAUTION Supply DC power after checking that all the modules are in their original positions and the ribbon cables are plugged in. If the ribbon cables are not plugged in enough (especially the gray connectors), the module could suffer damage.

Details of the gray connector on modules (top side)



× Not enough



○ Enough

9). Lamp Test

- **RESET** key is pushed 1 second or more by LCD display off.
 - It checks that all LCDs and LEDs light on.

10). Check the automatic supervision functions.

- LCD not display “Auto-supervision” screens in turn, and Event Records
- Checking the “IN SERVICE” LED light on and “ALARM LED” light off.

Version-up Records

Version No.	Date	Revised Section	Contents
0.0	Sep. 10, 2004	--	First issue
0.1	May. 20, 2005	2.1 2.7 3.1.2.1 3.1.2.4 4.2.3, 4.2.5, 4.2.6 Appendices	Modified the description of Section 2.1. Added the Section 2.7. Modified Figure 3.1.9. Modified the description, and added Figures 3.1.15 and 3.1.16, Table 3.1.1 and setting tables. Modified the samples of LCD screen. Modified the Appendix C, I, J, P and Q.
1.1	Jul. 22, 2005	2.3.1 2.3.2 2.3.3 2.3.6 2.5 2.8 2.9.1 2.9.4 3.2.1 3.3.3 3.3.8 3.4.2 4.2.6.7 Appendices	Modified the description and Figure 2.3.2. Modified the description of 'Check zone protection' and added Figure 2.3.5. Modified Figure 2.3.6. Modified the setting range table. Modified Figures 2.5.4 and 2.5.6. Modified the description (added OVGF). Modified the description and added Figure 2.9.2. Added Overvoltage element OVGF. Modified the description. Added Section 3.3.3. Modified Table 3.3.1 (added CTF). Modified Table 3.4.1 (added CTF). Modified the DIF LCD screen. Modified Appendix B, C, E, J, K and M.
1.2	Sep. 07, 2005	2.3.2 2.3.3 2.5	Modified the description of Check zone protection and added Figure 2.3.6. Modified Figures 2.3.8 and 2.3.9. Modified Figures 2.5.4 and 2.5.6.
1.3	Feb. 24, 2006	6.7.2 Appendices	Modified the description and Table 6.7.1. Modified Appendix R.
1.4	Jun. 12, 2007	1 3.1.2.1 3.1.2.3 3.5 4.2.1 4.2.4.2 4.4 Appendices	Modified the description. Modified the description and Figures 3.1.9 and 3.1.10. Deleted the description of BUM4. Modified the description. Modified the description. Modified the description. Modified the description. Modified Appendix G, H, I, P and Q.
1.5	Oct. 30, 2007	4.1.2 4.2.3.1 6.7.3 Appendices	Modified Figure 4.1.1. Modified the sample of the fault record screen. Modified the description. Modified Appendix H, I, M and R.
1.6	Jun. 26, 2008	2.2 2.3.3 2.3.6 2.5.1 2.6 3.1.1.1 3.3.2, 3.3.4 4.2.6.7 5.5.2 6.7.2 Appendices	Modified Figure 2.2.1. Modified Figures 2.3.7 and 2.3.8. Modified the description of 'BU address setting'. Modified Figures 2.5.4 and 2.5.6. Changed the title and included the description of the old 2.6 and 2.7 sections. Modified Figure 3.1.1. Modified the description. Modified the description. Modified the description. Modified the description. Modified the description. Modified Appendix M and R.

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