TOSHIBA

GR Series Relay

Numerical Relay

GRT100

TRANSFORMER PROTECTION

FEATURES

- Fully numerical transformer protection
- Current differential protection for two-winding or three-winding transformers
- High-set differential overcurrent protection
- No interposing CTs required
- CT ratio and vector group compensation
- Restricted earth fault protection
- Time-overcurrent protection
- Thermal overload protection
- Overexcitation protection
- Frequency protection
- Configurable binary outputs
- Automatic monitoring
- Metering and recording functions
- Menu-driven user interface
- Two serial ports for a local PC and a remote PC
- IRIG-B port for external clock

APPLICATION

GRT100 is a numerical transformer protection relay, which can be applied for two-winding or three-winding power transformers, auto-transformers and generator-transformer units.

GRT100 provides the following protection schemes.

- The current differential protection is applied for fast and selective main protection. This protection requires no interposing CTs and provides stability against magnetizing inrush and overexcitation.
- The restricted earth fault protection detects internal earth faults where the transformer star point is directly or low impedance earthed and can be applied on high-voltage and low-voltage side respectively.
- The time-overcurrent protection is mainly used as backup protection and can be applied on high- and low-voltage side respectively.
- The thermal overload protection protects the insulation against thermal stress and provides two independently set levels for alarm and tripping.
- The overexcitation protection provides alarm and tripping.
- The frequency protection operates on over-frequency and underfrequency and provides load shedding.

GRT100 provides the following metering and recording functions.

- Metering (current, voltage, frequency)
- Fault recording
- Event recording
- Disturbance recording

GRT100 provides the following user interfaces for relay setting or viewing of stored data.

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

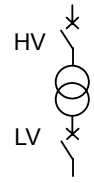
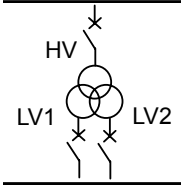
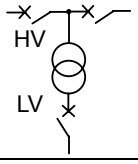
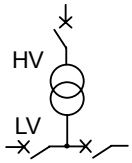
The relay can be accessed from a local PC or a remote PC through communication ports.

A local PC can be connected to the relay via the RS232C port on the front fascia of the relay and a remote PC can be connected to the relay through the RS485 port at the rear of the relay.

GRT100 has two models which differ according to the number of three-phase current inputs for differential protection.

Model 100	- For 2-winding transformers requiring 2 three-phase current inputs
Model 200	- For 3-winding transformers and all power transformers requiring 3 three-phase current inputs

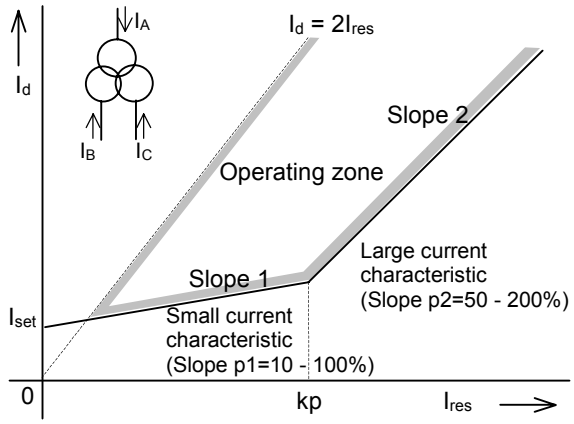
Transformer configuration and applicable model:

Configuration	No. of current inputs	Applicable to:
	2	Model 100
	3	Model 200
	3	Model 200
	3	Model 200

FUNCTIONS

■ Current Differential Protection

GRT100 provides fast, selective protection for two- and three-winding transformers. It has three phase-segregated differential elements, each with a dual-slope, percentage differential characteristic as shown in Figure 1.



I_d: Differential current ($|I_A + I_B + I_C|$)
I_{res}: Restraining current ($(|I_A| + |I_B| + |I_C|)/2$)
I_{set}: Sensitivity setting of small current characteristic
Kp: Sensitivity setting of large current characteristic

Figure 1. Percentage differential element

Slope 1 provides sensitivity to low level faults. For higher level faults, slope 2 with increased bias compensates for the effects of CT saturation.

GRT100 includes internal vector group compensation and CT ratio correction, so that the relay requires no interposing CTs.

During periods of transformer energization, the use of a second harmonic restraint method blocks the relay operation.

When the transformer is overexcited due to a transient power system disturbance, the use of a fifth harmonic restraint method blocks the relay operation.

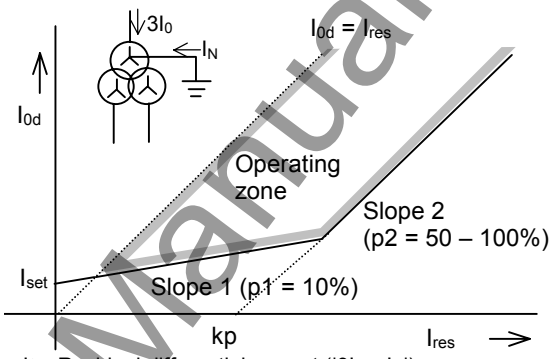
■ High-set Differential Overcurrent Protection

GRT100 also includes high-set unrestrained overcurrent element applied in the differential circuit and ensures rapid clearance of heavy internal faults.

■ Restricted Earth Fault Protection

Employing residual current of each winding and neutral point current, Restricted Earth Fault (REF) protection provides a highly sensitive differential protection for earth faults in a transformer which has a star point directly earthed or low impedance earthed.

The REF element has a dual slope, percentage characteristic as shown in Figure 2 and the independent elements can be applied for each transformer winding.



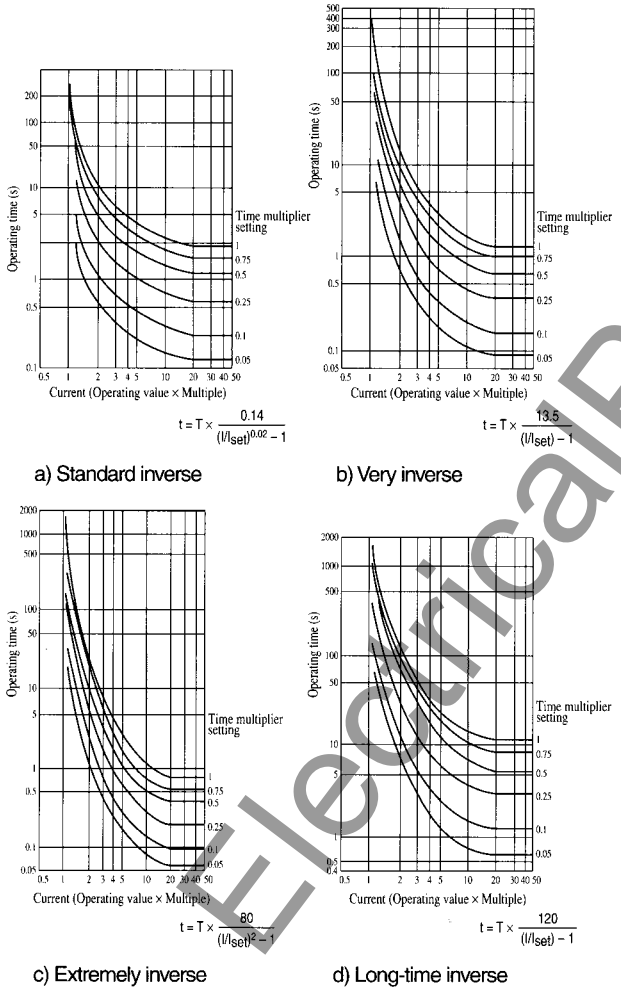
I_{0d}: Residual differential current ($|3I_0 + I_N|$)
I_{res}: Restraining current (Max.(I_A, I_B, I_C, I_N))
I_{set}: Sensitivity setting of small current characteristic
Kp: Sensitivity setting of large current characteristic

Figure 2. Characteristic of REF

■ Time-overcurrent Protection

The overcurrent protection can be applied to two- or three-windings for phase-to-phase faults, and neutral points of the transformer for phase to earth faults on the high- and low-voltage side to provide backup protection. The inverse time overcurrent elements conform to either of three IEC standard characteristics (Standard inverse, Very inverse, and Extremely inverse) or a Long-time inverse characteristic. The characteristics of each element are shown in Figure 3.

The high-set overcurrent element provides an instantaneous or definite time overcurrent protection.



I_{set}: Overcurrent element setting
T: Time multiplier setting
I: Input current
t: Operating time

Figure 3. Characteristics of inverse time delayed overcurrent element

■ Thermal Overload Protection (alarming and/or tripping)

The characteristics are exponential functions according to IEC 60255-8 standard and take into account the I^2R losses due to the particular operational current and the simultaneous cooling due to the coolant. In this way the tripping time during an overload condition takes the pre-overload into consideration. An alarm can be set to operate before reaching the tripping condition.

Thermal image:

$$\text{Trip: } t = \tau \ln \frac{I^2 - Ip^2}{I^2 - (k\, I_B)^2}$$

$$\text{Alarm: } t = \tau \ln \frac{(I^2 - Ip^2)(1 - T_A/\tau)}{I^2 - (k\, I_B)^2}$$

where

t: Operating time
τ: Thermal time constant
k: Constant
I: Relay current
I_B: Basic current
Ip: Specified load current before the overload occurs
T_A: Time for alarm

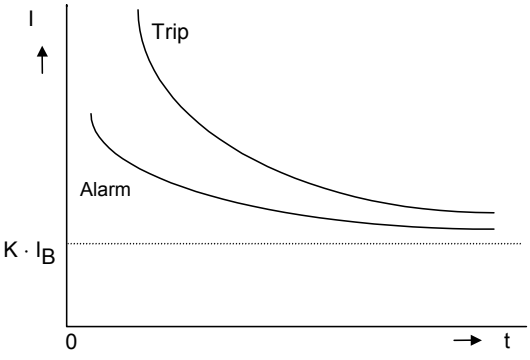


Figure 4. Characteristic of thermal overload element

■ Frequency Protection

GRT100 has two frequency elements, which provide the following schemes:

- Underfrequency protection
- Overfrequency protection

■ Overexcitation Protection

A single phase to phase connected voltage input is provided to detect overexcitation. Alarms and tripping, based on a measurement of the voltage/frequency ratio are provided. The voltage/frequency ratio is calculated using per unit quantities.

The alarm is definite time delayed whilst the characteristic may be selected as either having a definite time or an inverse time delay, as shown in Figure 5.

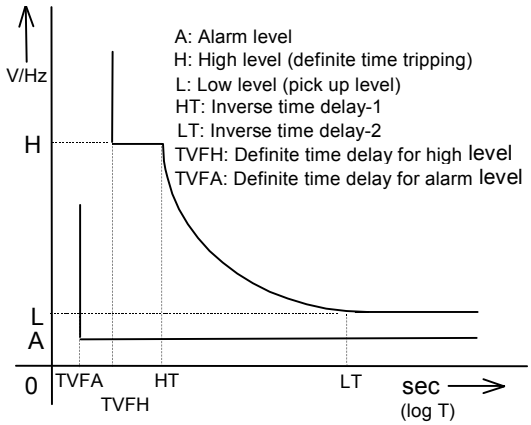
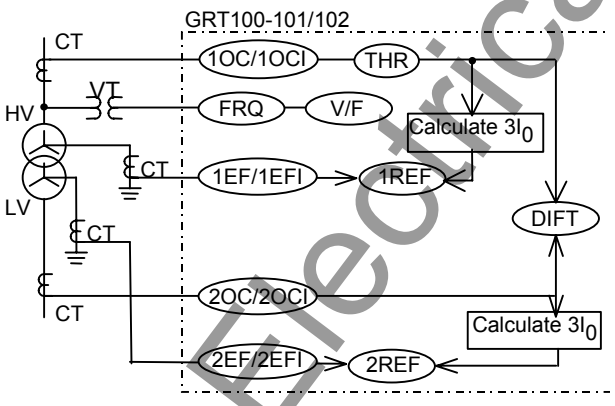


Figure 5. Characteristic of overexcitation element

■ AC Inputs and Protection Elements

Figure 6 shows the typical relationship between the AC inputs and protection elements.



DIFT: Current differential protection
REF: Restricted earth fault protection
OC/OCI, EF/EFI: Overcurrent backup protection
THR: Thermal overload protection
V/F: Overexcitation protection
FRQ: Frequency protection

Figure 6. AC inputs and protection elements

■ Trip and/or Indication of External Protection Devices

External signals such as overpressure devices and Buchholz relay operation, can be applied through 4 binary input circuits. Logic can be arranged for alarms, event recording and tripping. The binary input circuit is provided with a logic level inversion function.

For redundancy it is recommended to route tripping from the Buchholz or overpressure device in parallel to the relay.

HARDWARE

Figure 7 shows the hardware block diagram of the relay.

The relay is a multiple microprocessor design. The microprocessors perform software functions such as signal processing, protection algorithm, scheme logic, output relay control and management of the user interface.

Phase voltage analog inputs are provided, residual current inputs and phase voltage inputs. The number of analog inputs depends on the model of the relay.

The internal auxiliary transformers are used to isolate, step down and condition the inputs from the VT and CTs. Their output signals are then converted into digital data for further processing.

The front panel provides a 4 x 40 character, liquid crystal display (LCD) and 19 pushbutton keys to provide local access to the relay menu. There are also 8 light emitting diodes (LED) for visual indication of the status of the relay.

The relay provides three communication ports, RS232C for connection of a local PC, RS485 for a remote PC and IRIG-B for an external clock.

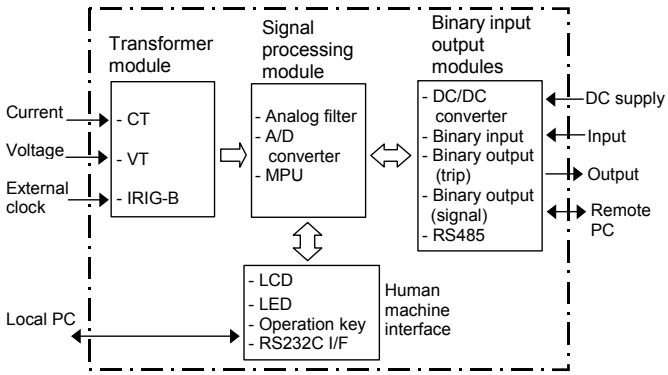


Figure 7. Hardware block diagram

The terminal blocks are located at the rear of the relay providing connections for all input/output circuits.

The relay is housed in a type-A case, suitable for either rack or panel mounting as shown in Figures 10 and 11.

METERING AND RECORDING

■ Metering and Monitoring

The following power system data is measured continuously and displayed on the LCD on the relay fascia, at the local PC, and the remote PC when connected.

- Currents (phase, phase to phase, symmetrical components)
- Differential currents
- Voltage (phase to phase)
- Frequency

Currents, voltages and differential currents can be indicated as primary or secondary values.

The user can monitor the following output and status on the LCD and at local/remote PCs

- Relay element output
- Binary input/output

■ Event Record

The most recent 96 time-tagged events are stored with 1ms resolution. Events recorded are as follows.

- Tripping
- Alarms
- Change of binary input signal
- Change of relay setting
- Relay failure

■ Fault Record

A relay trip initiates fault recording. Time-tagged fault data can be stored for the 8 most recent faults. Fault record items are as follows.

- Date and time
- Operating phase
- Tripping mode
- Pre-fault and post-fault current data (phase, phase to phase, symmetrical components)

■ Disturbance Record

The relay can record 22 analog and 30 binary signals. The disturbance recorder is initiated by operation of the overcurrent element and/or relay tripping. In respect to analog data, phase currents, neutral current and phase to phase voltage are recorded.

Pre-fault recording time is fixed at 300 ms, and post-fault recording time can be set from 100 ms to 3 s. The maximum number of stored records depends on the post-fault recording time. In the case of a post-fault recording time of 500 ms, up to 20 disturbance records can be stored. The number of the recorded data is displayed on the LCD.

■ Calendar and Time

A calendar and time are provided for time- tagging of recorded data. Synchronisation with the GPS (Global Positioning System) is possible using the IRIG-B port.

USER INTERFACE

■ Relay Front Panel

The relay front panel provides the following user interfaces. Setting the relay and viewing stored data are possible using the Liquid Crystal Display (LCD) and operation keys.

- 40 character, 4 line LCD with back light
- 8 Light Emitting Diodes (LED) including 4 that are configurable
- Operation keys
- RS232C port
- Monitoring jacks

Figure 8 shows the relay front panel.

Fig. 8 Relay front panel

The following items are displayed on the LCD.

- Setting
- Metering
- Event records
- Fault records
- The number of disturbance records
- Any failure message detected by the automatic monitoring

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

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

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

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

■ Local PC

The user can communicate with the GRT100 from a local PC via the RS232C port on the relay fascia. The following data can be viewed or analysed on the local PC with RSM100 software.

- Setting
- Metering
- Event records
- Fault records
- Disturbance records

■ Relay Setting and Monitoring (RSM)

GRT100 can be connected to the RSM system via the RS485 interface at the rear of the relay. The user can operate the relay from a remote PC in the same way as from a local PC.

A maximum of 32 x 8 relays can be connected to the remote PC in multi-drop mode, via the protocol converter G1PR2. The G1PR2 can be provided with maximum 8 ports and each port supports maximum 32 relays addressing.

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

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

Figure 9 shows the configuration of the RSM system.

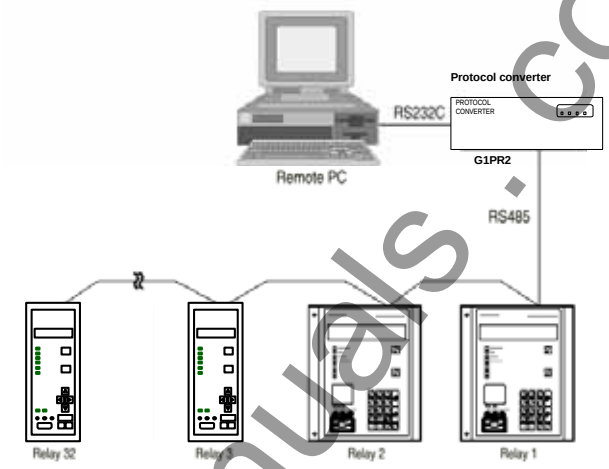


Fig. 9 Relay setting and monitoring system

■ IEC60870-5-103 Communications

GRT100 supports the IEC60870-5-103 communication protocol. This protocol is used for communication with a substation control and monitoring system and is used to transfer measurand data, status data and general commands between the relay and the control system.

■ Relay Setting

The user can input or change settings using the operation keys on the relay fascia or via a local or remote PC with the RSM system.Password protection is provided to change settings.

Eight active setting groups are provided. This allows the user to set one group for normal operating conditions while other groups may be set to cover alternative operating conditions.

■ Configurable Binary Output Contacts

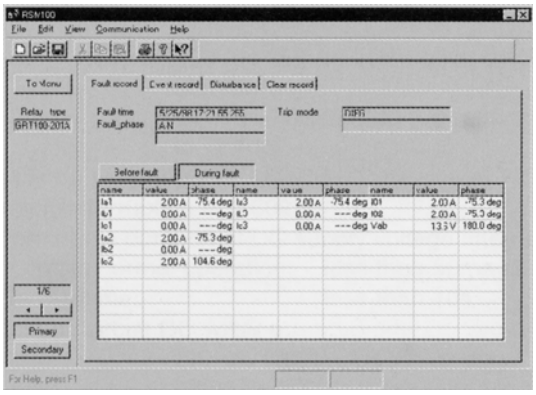
GRT100 provides 13 or 23 user configurable normally open output contacts used for indication and alarm. The number of outputs varies according to the relay model.

■ Binary Inputs

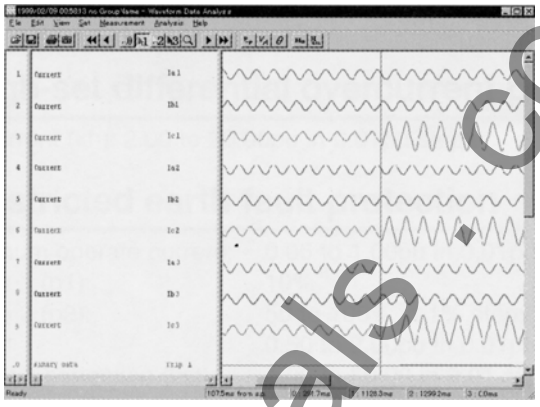
GRT100 is provided with 8 binary inputs for trip and/or indication of external protection devices, etc.

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

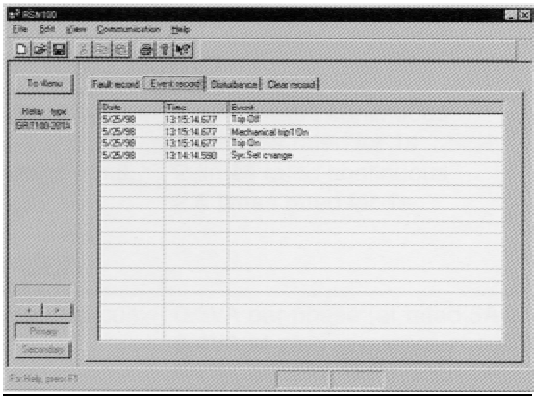
PC DISPLAY



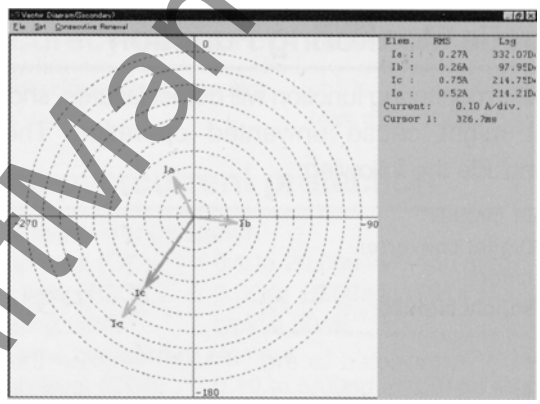
Fault record



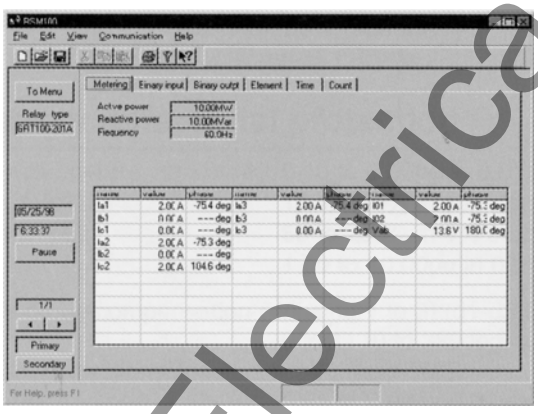
Waveform data analysis



Event record



Vector diagram



Metering

AUTOMATIC MONITORING

■ Automatic Monitoring Function

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

- Analog input circuits
- Analog-to-digital converter
- Watchdog timer
- DC power supply circuits
- CPU

■ Alarms

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

TECHNICAL DATA

Ratings	
AC current	1A or 5A
AC voltage	100V, 110V, 115V, 120V
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)
AC ripple on DC supply IEC 60255-11	maximum 12%
DC supply interruption IEC 60255-11	
Permissive duration of DC supply voltage interruption to maintain normal operation	maximum 50ms at 110Vdc
Restart time	less than 10s
Binary input circuit DC voltage	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 1s
AC voltage input	2 times rated continuous 2.5 times rated for 1s
Burden	
AC current circuit	0.3VA per phase (at rated 5A) 0.4VA at zero sequence circuit (at rated 5A) 0.1VA per phase (at rated 1A) 0.3VA at zero sequence circuit (at rated 1A)
AC voltage circuit	0.1VA (at rated voltage)
DC power supply	less than 14W (quiescent) less than 25W(operation)
Binary input circuit	0.5W/input at 110Vdc
Current differential protection	
Minimum operate current (ik)	0.10 to 1.00pu in 0.01pu steps
Slope 1 (p1)	10 to 100% in 1% steps
Slope 2 (p2)	50 to 200% in 1% steps
kp	1.00 to 10.00pu in 0.01pu steps
Vector group compensation (Winding 1 to 3) (d1 – d3)	0 to 11 (0 to 330deg in 30deg steps)
CT ratio correction (Winding 1 to 3) (kct1 – kct3)	0.05 to 50.00 in 0.01 steps
Inrush setting (2nd harmonic ratio) (k2f)	10 to 50% in 1% steps
Overexcitation setting (5th harmonic ratio) (k5f)	10 to 100% in 1% steps
Operating time	typical 30ms
High-set differential overcurrent protection	
Overcurrent (kh)	2.00 to 20.00pu in 0.01pu steps
Operating time	typical 20ms
Restricted earth fault element	
Minimum operating current	0.05 to 0.50pu in 0.01pu steps
Slope 1 (p1)	10 %
Slope 2 (p2)	50 to 100% in 1% steps
kp	0.50 to 2.00pu in 0.01pu steps
CT ratio correction (kct)	1.00 to 50.00 in 0.01 steps

Time-overcurrent protection	
High-set overcurrent element	
Pick up level (OC, EF)	0.10 to 20.00pu in 0.10pu steps
Delay time (TOC, TEF)	0.00 to 10.00s in 0.01s steps
Operating time	typical 30ms (without delay time)
Inverse time overcurrent element	
Pick up level (OCI, EFI)	0.10 to 5.00pu in 0.01pu steps
Time multiplier (TOCI, TEFI)	0.05 to 1.00 in 0.01 steps
Characteristic	Three IEC standard 60255-3 (Standard inverse, Very inverse, Extremely inverse), or a Long-time inverse *Refer to Figure 3.
Thermal overload protection	
Thermal time constant (τ)	0.5 to 500.0min in 0.1min steps
Constant (k)	0.10 to 4.00 in 0.01 steps
Basic current (IB)	0.50 t0 2.50pu in 0.01pu steps
Special load current before overload (Ip)	0.00 to 1.00pu in 0.01 steps
Time for alarming (TA)	0 to 10min in 1min steps
Frequency protection	
Overfrequency	50.00 to 55.00Hz in 0.01Hz steps (50Hz relay)
	60.00 to 66.00Hz in 0.01Hz steps (60Hz relay)
Underfrequency	45.00 to 50.00Hz in 0.01Hz steps (50Hz relay)
	54.00 to 60.00Hz in 0.01Hz steps (60Hz relay)
Delay time	0.00 to 60.00s in 0.01s steps
Start time	less than 100ms
Undervoltage blocking	40 to 100V in 1V steps
Overexitation protection	
Pickup voltage	100.0 to 120.0V in 0.1V steps
Alarm level (A)	1.03 to 1.30pu in 0.01pu steps
High level (H)	1.10 to 1.40pu in 0.01pu steps
Low level (L)	1.05 to 1.30pu in 0.01pu steps
LT (Definite time)	1 to 600s in 1s steps
HT (Definite time)	1 to 600s in 1s steps
TVFH (Definite time)	1 to 600s in 1s steps
TVFA (Definite time)	1 to 600s in 1s steps
Start time	less than 130ms
RT (Definite time)	60 to 3600s in 1s steps
Accuracy	
Current differential element: pick-up	±5%
reset	±5%
Time-overcurrent protection: pick-up	±5%
Inverse time overcurrent characteristics:	
Standard inverse, Very and long-time inverse	IEC60255-3 class 5
Extremely inverse	IEC60255-3 class 7.5
Thermal overload protection: pick-up	±10%
Frequency protection: pick-up	±0.03Hz
Overexitation protection	±2% of pick-up voltage (frequency range ±2%)
Disturbance record initiation	
Overcurrent element	0.10 to 20.00pu in 0.01pu steps
Earth fault	0.05 to 20.00pu in 0.01pu steps
Pre-fault time	0.3s (fixed)
Post-fault time	0.1 to 3.0s in 0.1s steps

Communication port	
Front communication port (local PC)	
Connection	Point to point
Cable type	Multi-core (straight)
Cable length	15m (max.)
Connector	RS232C 9-pin D-subminiature connector female
Rear communication port (remote PC)	
RS485 I/F:	
Transmission data rate for RSM system	64kbps
Connection	Multidrop mode (max. 32 relays)
Connector	Screw terminals
Cable and length	Twisted pair cable, max. 1200m
Isolation	2kVac for 1min.
Fibre optic I/F:	ST connector, graded-index multi-mode 50/125μm or 62.5/125μm type optical fibres
IRIG-B port	
Connection	BNC connector
Cable type	50 ohm coaxial cable
Binary inputs	
Operating voltage	Typical 74Vdc(min. 70Vdc) for 110V/125Vdc rating Typical 138Vdc(min. 125Vdc) for 220V/250Vdc rating Typical 31Vdc(min. 28Vdc) for 48V/54V/60Vdc rating
Contact ratings	
Trip contacts	
Make and carry	5A continuously, 30A, 290Vdc for 0.5s (L/R=10ms)
Break	0.15A, 290Vdc (L/R=40ms)
Auxiliary contacts	
Make and carry	4A continuously, 10A, 220Vdc for 0.5s (L/R≧5ms)
Break	0.1A, 220Vdc (L/R=40ms)
Durability	
Make and carry	10,000 operations minimum
Break	100,000 operations minimum
Mechanical design	
Weight	12kg
Case color	Munsell No. 10YR8/0.5
Installation	Flush mounting or rack mounting

ENVIRONMENTAL PERFORMANCE

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

Test	Standards	Details
European Commission Directives		
CE	89/336/EEC	Compliance with the European Commission Electromagnetic Compatibility Directive is demonstrated according to EN 61000-6-2 and EN 61000-6-4.
	73/23/EEC	Compliance with the European Commission Low Voltage Directive is demonstrated according to EN 50178 and EN 60255-5.

PROTOCOL CONVERTER G1PR2 (OPTION)

Ratings		
Power supply:	110Vdc/100Vac	Operative range: 88 - 150Vdc of 110Vdc rated voltage 80 - 120Vac of 100Vac rated voltage
	220Vdc/200Vac	Operative range: 170 - 300Vdc of 220Vdc rated voltage 200 - 240Vac of 200Vac rated voltage
	48Vdc	Operative range: 38.4 - 72Vdc
Burden:	less than 20W	
Communication port		
RS232C interface		
Connector type	RS232C 9-pin D-subminiature connector female	
Cable type	Multi-core (straight)	
RS485 interface		
Connector	Screw terminals (Phoenix Contact, FRONT type)	
Cable type	Twisted pair cable	
Optical interface		
Operative Range:	less than 1.2km with 62.5/125μm GI fibre (3dB/km)	
Wavelength:	820nm	
Connector type:	ST	
Fibre type:	62.5/125μm glass fibre	
IRIG-B		
Connector	Screw terminals (Phoenix Contact, FRONT-MSTB type)	
Mechanical design		
Enclosure Protection	IEC60529, IP20	
Weight	5 kg	
Installation	Flush mounting	
Atmospheric Environment		
Temperature	IEC60068-2-1/2	Operating range: -10°C to +55°C. Storage / Transit: -25°C to +70°C.
Humidity	IEC60068-2-78	56 days at 40°C and 93% relative humidity.

ORDERING

1. Transformer Protection

GRT100 – □B – □0 – □□

Type:	
Transformer Protection Relay	GRT100
Model:	
-Model 100: 2 three-phase current inputs for 2-winding transformer	
-13 N/O configurable output contacts	101
-23 N/O configurable output contacts	102
-Model 200 : 3 three-phase current inputs for 3-winding transformer	
- 13 N/O configurable output contacts	201
- 23 N/O configurable output contacts	202
CT Rating:	
1A, 50Hz, 110V/125V	1
1A, 60Hz, 110V/125V	2
5A, 50Hz, 110V/125V	3
5A, 60Hz, 110V/125V	4
1A, 50Hz, 220V/250V	5
1A, 60Hz, 220V/250V	6
5A, 50Hz, 220V/250V	7
5A, 60Hz, 220V/250V	8
1A, 50Hz, 48V/54V/60V	A
1A, 60Hz, 48V/54V/60V	B
5A, 50Hz, 48V/54V/60V	C
5A, 60Hz, 48V/54V/60V	D
Communications:	
RS485	1
Dual RS485	3
Miscellaneous:	
None	0

2. Protocol Converter (Option)

G1PR2 – □A – □ – □

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

RELAY OUTLINE

Panel Surface mount

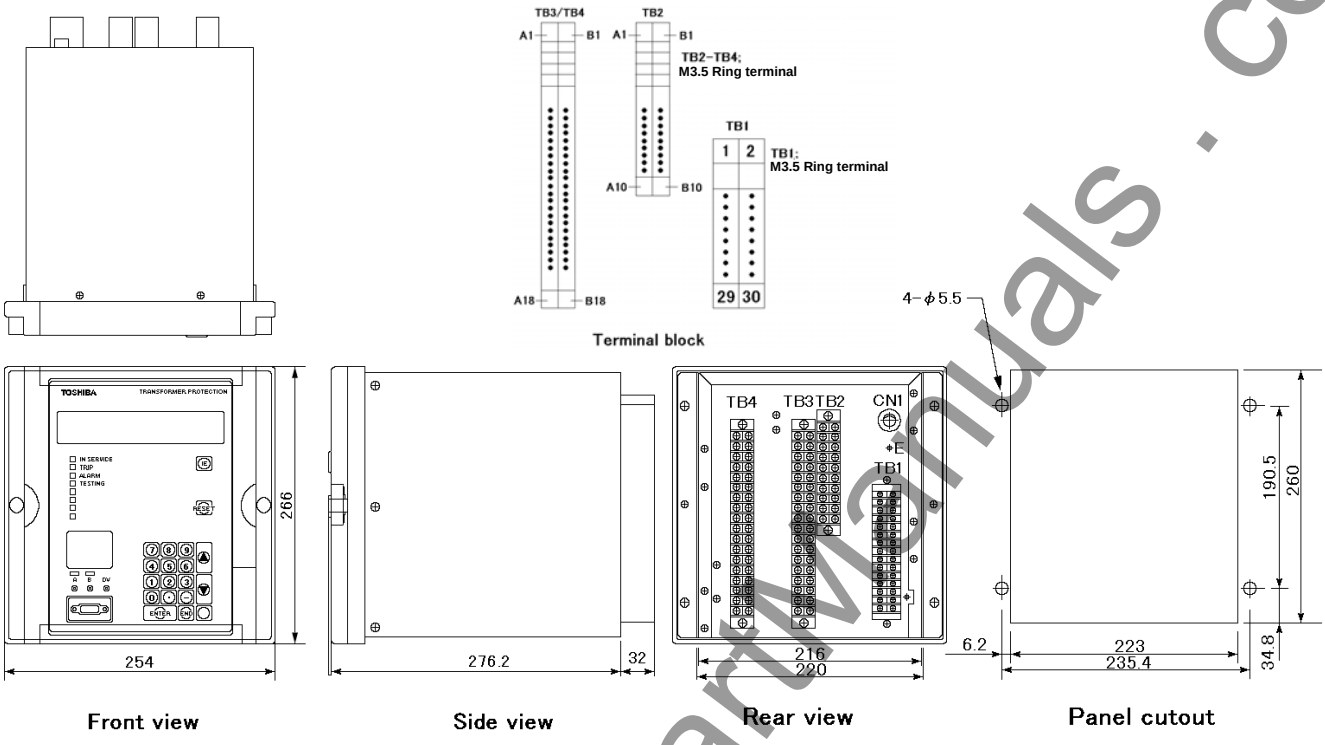


Figure 10. Relay case Type-A outline for surface mount

19-inch rack mount

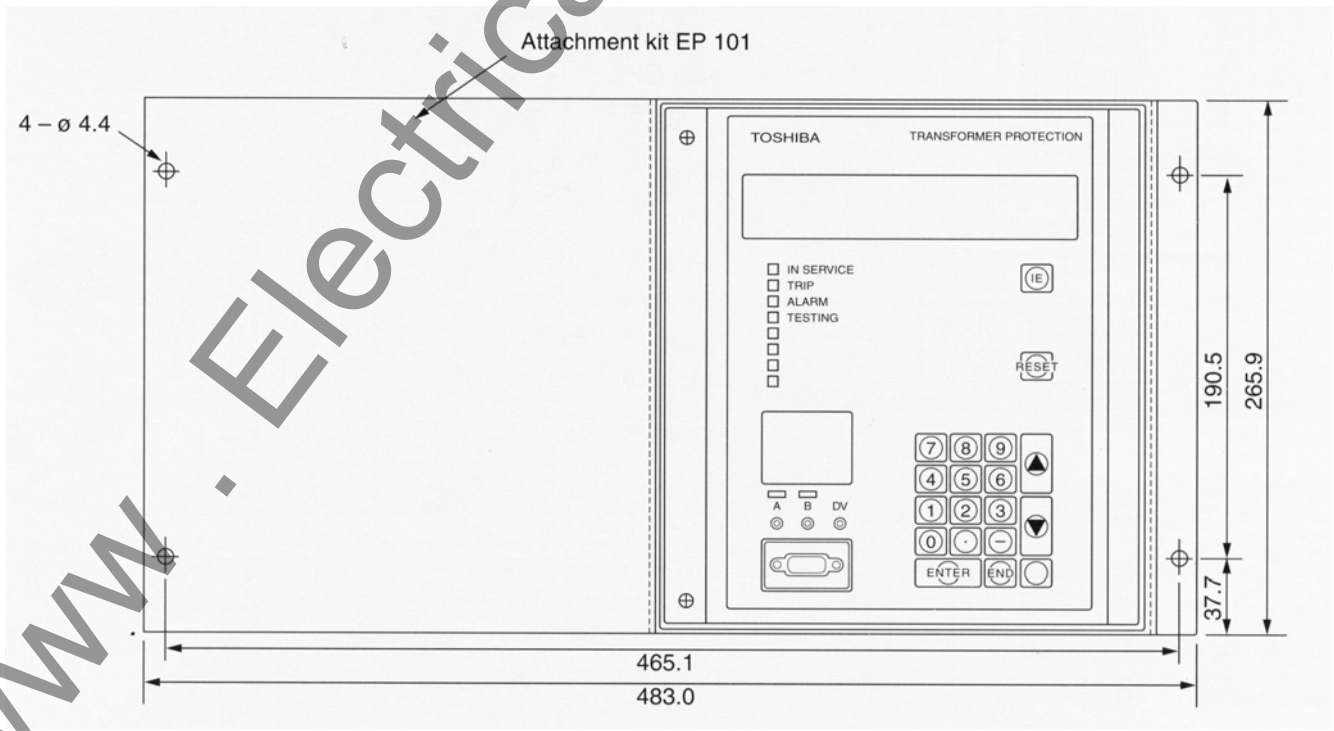


Figure 11. Relay case Type-A outline for rack mount

EXTERNAL CONNECTION DIAGRAM

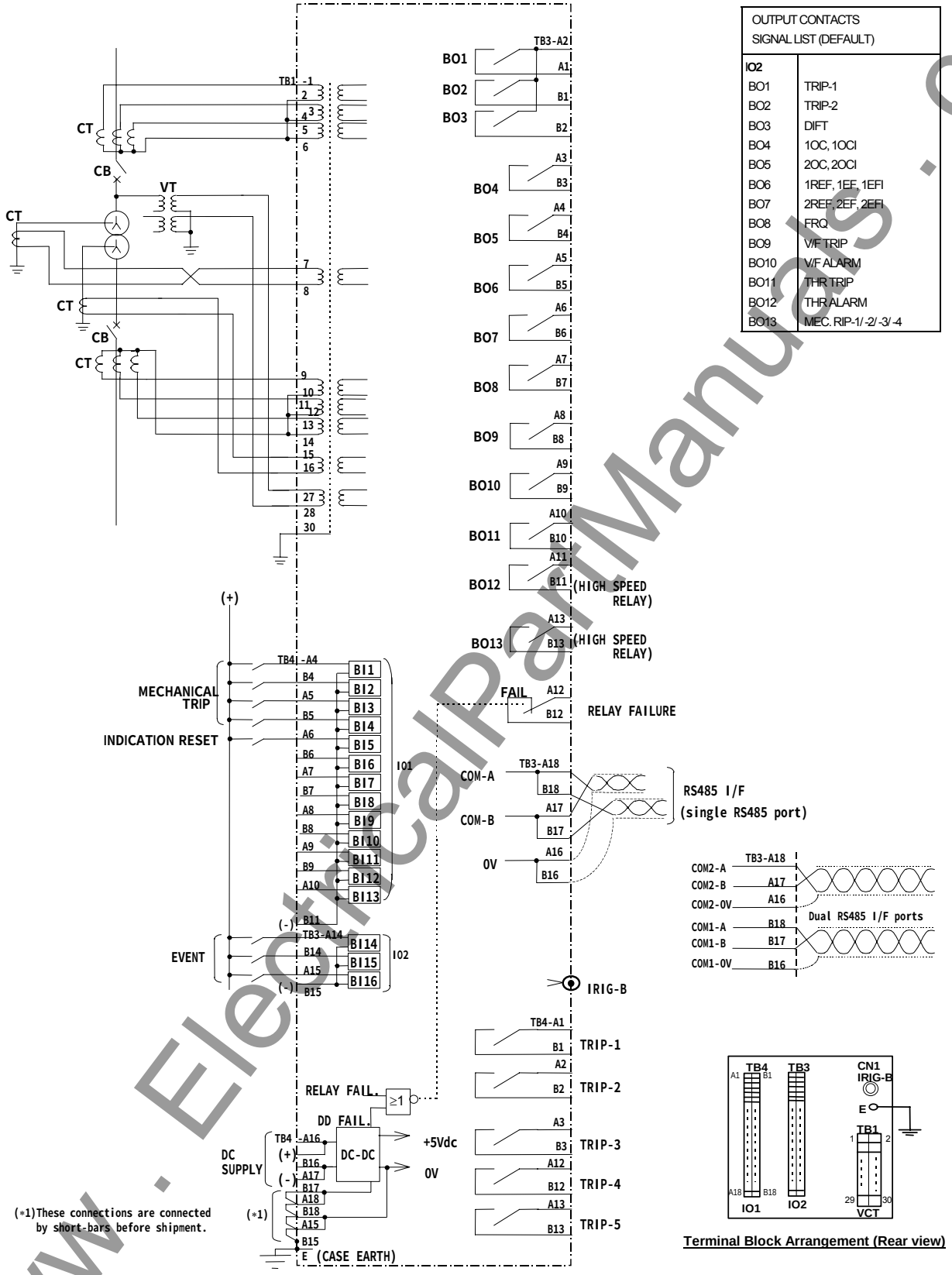
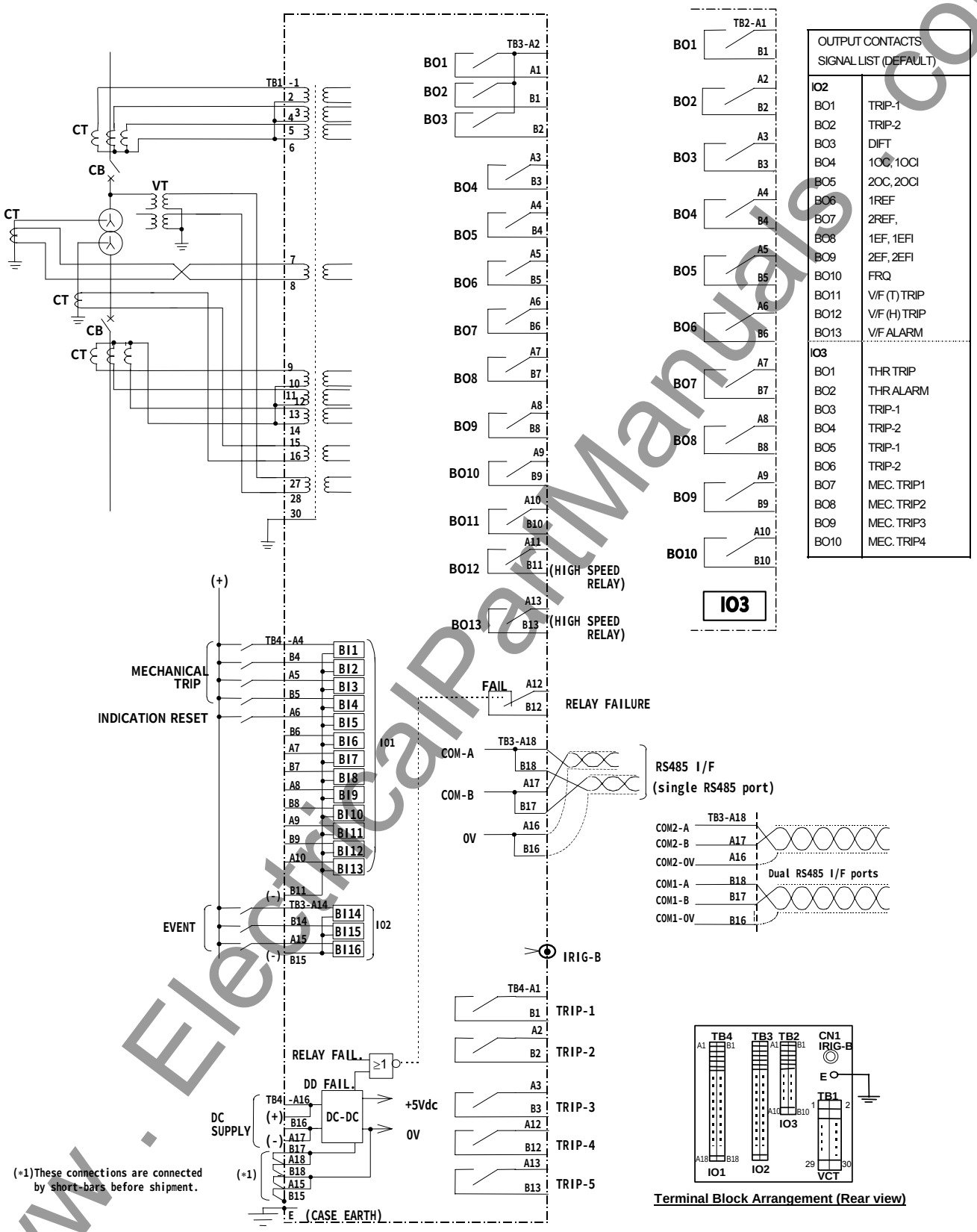
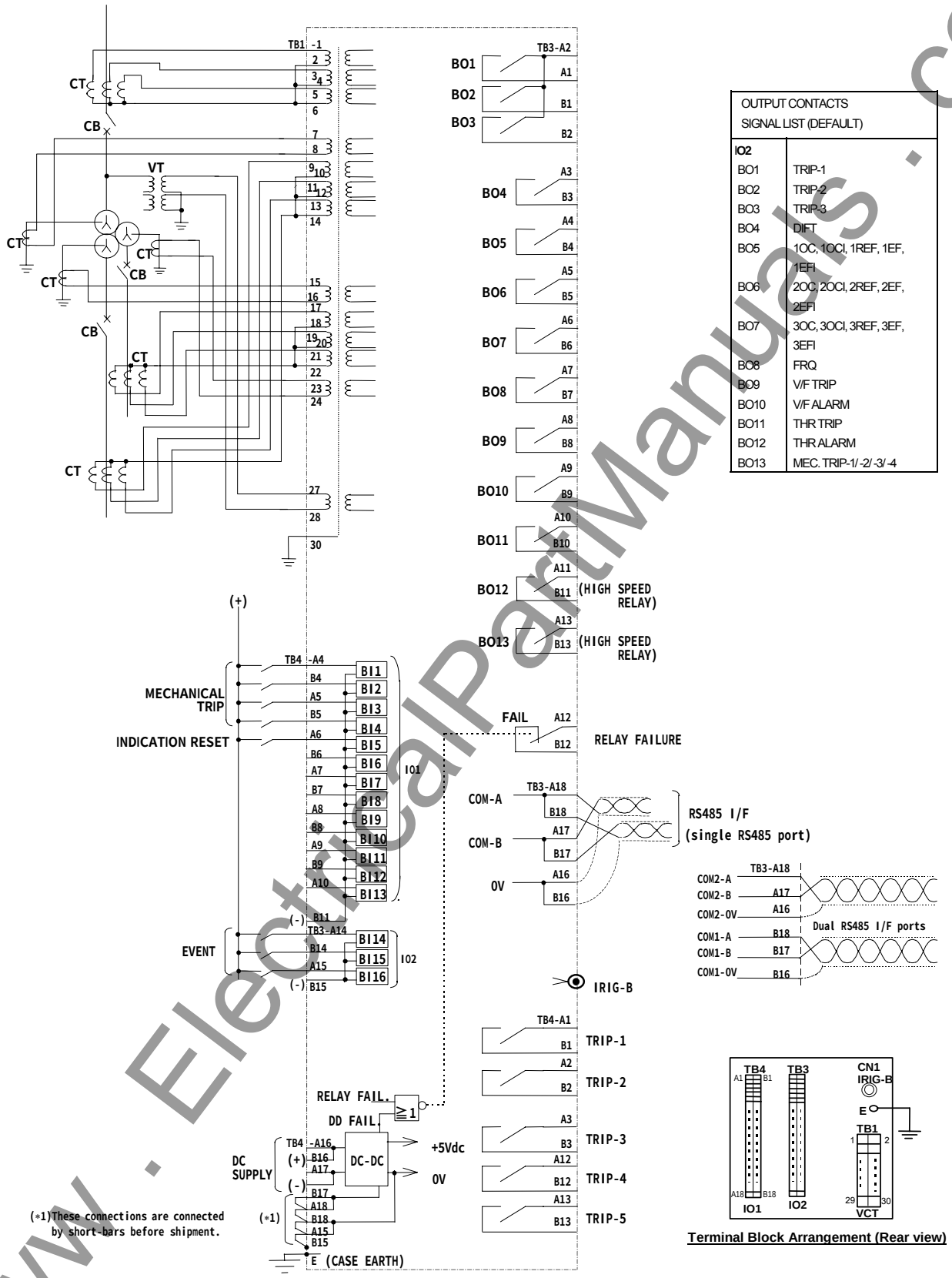


Figure 12. External connection of Model 101



Terminal Block Arrangement (Rear view)

Figure 13. External connection of Model 102



OUTPUT CONTACTS SIGNAL LIST (DEFAULT)	
IO2	
BO1	TRIP-1
BO2	TRIP-2
BO3	TRIP-3
BO4	DIFT
BO5	1OC, 1OCI, 1REF, 1EF, 1EFI
BO6	2OC, 2OCI, 2REF, 2EF, 2EFI
BO7	3OC, 3OCI, 3REF, 3EF, 3EFI
BO8	FRQ
BO9	V/F TRIP
BO10	V/F ALARM
BO11	THR TRIP
BO12	THR ALARM
BO13	MEC. TRIP-1/-2/-3/-4

Figure 14. External connection of Model 201

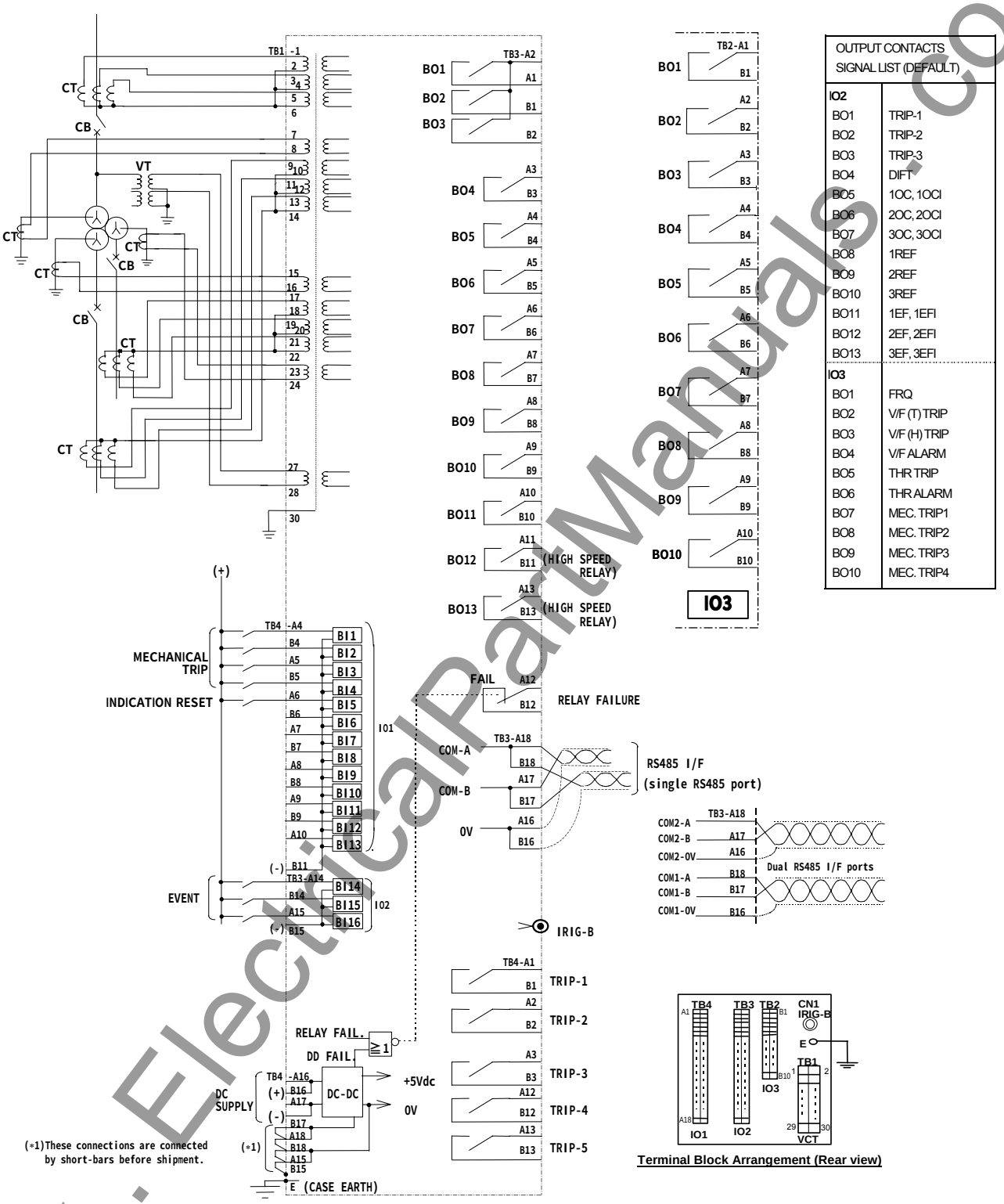


Figure 15. External connection of Model 202

Numerical Relay

GRT100

TRANSFORMER PROTECTION

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