TOSHIBA

Leading Innovation

GRE130

Protection and Control
for MV Systems

FEATURES

- Phase undervoltage protection with IDMTL or DTL(27).
- Phase overvoltage protection with IDMTL or DTL(59).
- Zero phase sequence overvoltage (neutral voltage displacement) protection with IDMTL/DTL(64).
- Negative phase sequence overvoltage protection with IDMTL or DTL(47).
- Under/over frequency protection. (81)
- Frequency rate-of-change protection.
- Local/Remote control
- Two settings groups.
- Configurable binary inputs and outputs.
- Automatic self-supervision.
- Menu-based HMI system.
- Configurable LED indication.
- Metering and recording functions.
- Front mounted USB port for local PC communications.
- Rear mounted RS485 serial port for remote communications.
- Data communication with substation control and automation systems is supported according to the Modbus® RTU, DNP3, IEC 61850 and IEC 60870-5-103 standards.

APPLICATION

GRE130 is a range of fully numeric voltage protection relays designed for applications in medium voltage networks. The devices provide a comprehensive range of protection and control functions within a compact and cost effective package.

GRE130 has two models which differ depending on the application and each model has different types according to the number of binary inputs and outputs fitted, see Table 1.

Table 1 - GRE130 Models

Model	Configuration
GRE130-410	2 x BIs and 4 x BOs
GRE130-411	6 x BIs and 4 x BOs
GRE130-412	6 x BIs and 8 x BOs

Both models include multiple, high accuracy, phase under/overvoltage protection with inverse time and definite time delay functions. Voltage inputs can be configured for phase to phase or phase to neutral operation. Zero sequence overvoltage (neutral voltage displacement) protection is available for detection of earth faults in high impedance earthed or isolated systems. For protection against operation on unbalanced supply voltages, negative phase sequence overvoltage protection is also available. GRE130 can be applied for underfrequency, overfrequency protection and frequency rate-of-change protection for frequency decay rate (-df/dt) and frequency rise rate (+df/dt).

GRE130 provides continuous monitoring of internal circuits and of software. A user-friendly HMI is provided through a backlit LCD, programmable LEDs, keypad and menu-based operating system. PC access is provided for local connection via a front-mounted USB port. The communication system allows the user to read and modify the relay settings, and to access data gathered by the relay's metering and recording functions.Data available either via the relay HMI or communications ports includes the following functions.

- Metering
- Fault recording
- Event recording
- Disturbance recording

  (available via communications ports)

Table 2 - GRE130 Feature

Model Number	**GRD130 – 410, –411, –412**		
Input Phase Setting	**1PP,1PV**	**2PP,2PZ**	**3PP,3PN,3PV**
Configuration	$1V_{ph-ph}$+ V_0 $1V_{ph-n}$ + V_0	$2V_{ph-ph}$ $2V_{ph-ph}$+ V_0	$3V_{ph-n}$ $3V_{ph-n}$ + V_0 $3V_{ph-ph}$ + V_0
Phase U/V (27)	✓	✓	✓
Phase O/V (59)	✓	✓	✓
ZPS O/V (59N)	✓	- (✓)	✓
NPS O/V (47)	-	✓	✓
Under / Over Frequency (81U/O)	✓	✓	✓
Frequency rate of change	✓	✓	✓
Trip circuit supervision (74TC)	✓	✓	✓
Self supervision	✓	✓	✓
CB State Monitoring	✓	✓	✓
Trip Counter Alarm	✓	✓	✓
Two settings groups	✓	✓	✓
Metering	✓	✓	✓
Fault records	✓	✓	✓
Event records	✓	✓	✓
Disturbance records	✓	✓	✓
Modbus Communication	✓* **	✓* **	✓* **
IEC 60870-5-103 Communication	✓	✓	✓
DNP3.0 Communication	✓* **	✓* **	✓* **
IEC 61850 Communication	✓**	✓**	✓**

* Modbus® RTU, IEC 60870-5-103 and DNP3 are supported via built-in RS485 port.

** Modbus® TCP, DNP3 (TCP) and IEC 61850 are supported via an optional communication port for model 412 only.

PROTECTION FUNCTIONS

Phase Overvoltage Protection

GRE130 overvoltage protection provides three independent overvoltage thresholds. The first and second thresholds may be set for inverse time or definite time trip operation. The third threshold can be programmed for definite time alarm operation.

The first and second thresholds has a programmable reset feature, selectable for instantaneous or definite time operation. Each trip output can be inhibited by binary input.

Phase Undervoltage Protection

GRE130 undervoltage protection provides three independent undervoltage thresholds. The first and second thresholds may be set for inverse time or definite time trip operation. The third threshold can be programmed for definite time alarm operation.

The first and second thresholds has a programmable reset feature, selectable for instantaneous or definite time operation. Each trip output can be inhibited by binary input.

An undervoltage blocking function prevents undervoltage tripping in the case of a dead line.

Zero Phase Sequence Overvoltage Protection (ZPS)

GRE130 provides ZPS protection with two independent overvoltage thresholds. The two thresholds may be set for inverse time or definite time operation. The two thresholds have a programmable reset feature, selectable for instantaneous or definite time operation.

In the case of [APPL = 3PN] setting, the zero sequence voltage, V_0 may either be calculated from the three measured phase voltages. At other setting, the V_0 must be measured directly.

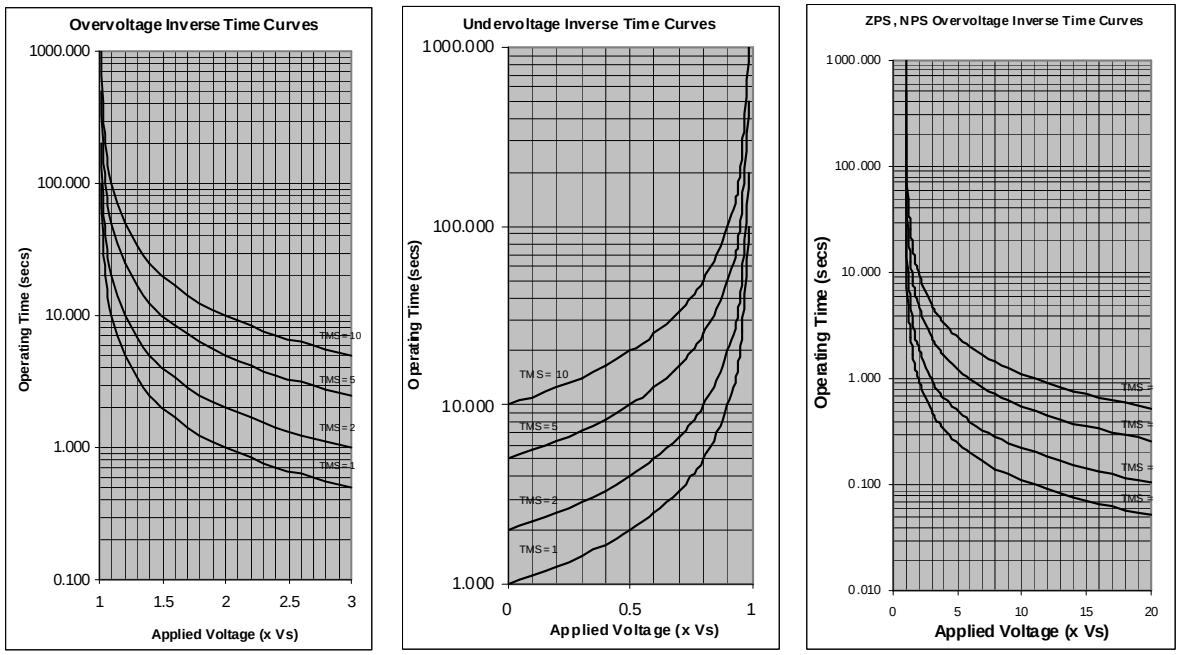
Each trip output can be inhibited by binary input.

Negative Phase Sequence Overvoltage Protection (NPS)

GRE130 provides NPS protection with two independent overvoltage thresholds. The two thresholds may be set for inverse time or definite time operation.

The two thresholds have a programmable reset feature, selectable for instantaneous or definite time operation. Each trip output can be inhibited by binary input.

Inverse Time Operate Curves



$$t = \frac{1}{\left(V/Vs\right) - 1} \times TMS$$

$$t = \frac{1}{1 - \left(V/Vs\right)} \times TMS$$

$$t = \frac{1}{\left(V/Vs\right) - 1} \times TMS$$

Figure 1 - IDMT curves for Overvoltage, Undervoltage and ZPS, NPS Overvoltage

Under / Over frequency Protection

GRE130 underfrequency protection is provided to maintain the balance between the power generation capability and the loads. It is also used to maintain the frequency within the normal range by load shedding.
GRE130 overfrequency protection is provided to protect synchronous machines from possible damage due to overfrequency conditions.

Frequency Rate-of-Change Protection

Rate-of-change of frequency protection is applied to ensure that load shedding occurs very quickly when the frequency change is very rapid.

The frequency rate-of-change protection calculates the gradient of frequency change (df/dt).

GRE130 provides two rate-of-change elements, a frequency decay rate element and a frequency rise rate element. These elements provide a mechanism to measure the change (Δf) in frequency over a time interval (Δt=100ms), as shown Figure 2.

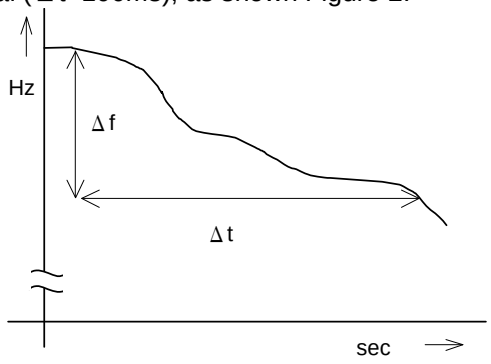


Figure 2. Frequency rate-of-change element

CONTROL FUNCTIONS

Switchgear Control

GRE130 provides the facility for switchgear control on the relay front panel. Two-stepped operation (select-control) is applied for the control procedure of circuit breakers to ensure highly secure operation. An interlock check function is included for safe operation of the switchgear. Password protection is provided for the above functions.

A local/remote selector switch is also provided on the relay front panel so that remote control from station level or load dispatching centre can be chosen.

Equipment status (Open or Closed) is indicated on front LEDs and relay fascia LCD.

MONITORING FUNCTIONS

Trip Circuit Supervision

GRE130 provides a high-integrity trip circuit supervision scheme. Trip circuits can be monitored with the circuit breaker either closed or open using two binary inputs as shown in Figure 3.

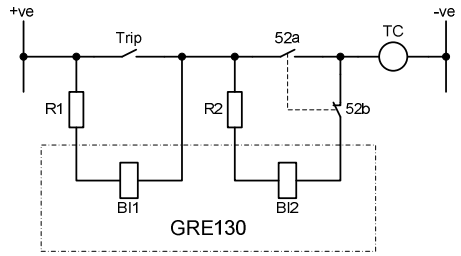


Figure 3 – Trip Circuit Supervision Scheme

CB Closed:
Under healthy conditions, binary input BI1 is energised via external resistor, R1.
If the trip circuit becomes open, BI1 resets and a Trip Circuit Fail alarm is raised.

CB Open:
Under healthy conditions, binary inputs BI1 & BI2 are energised via external resistors, R1 & R2 respectively.
If the trip circuit becomes open, both inputs reset and a Trip Circuit Fail alarm is raised.

The Trip Circuit Fail alarm incorporates a time delay of 400ms to prevent false alarms during normal tripping operations or voltage dips and is given in the form of an output contact operation and LCD/LED indication.

Automatic Self-Supervision

Automatic monitoring of internal circuits and software is provided. In the event of a failure being detected, the ALARM LED or the RELAY FAIL on the relay front panel is illuminated, the 'RELAY FAILURE' binary output operates, and the date and time of the failure is recorded in the event record.

Circuit Breaker State Monitoring

If two binary inputs are programmed to the functions 'CB OPEN' and 'CB CLOSED' then the CB State Monitoring function becomes active. In normal circumstances these inputs are in opposite states. If both show the same state then a 'CB Defective' alarm is raised.

METERING AND RECORDING

Metering

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

- Primary and secondary voltages for each input.
- Positive and negative phase sequence voltages.
- Power frequency.

- CB trip count.
- CB status.
- Relay element output status.
- Binary input and output status.

Event Record

Records are stored for the 200 most recent events, time-tagged to 1ms resolution. The event record is available on the relay front panel LCD and at a local or remote PC. Events are recorded as follows:

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

Fault Record

A relay trip initiates fault recording. Records are stored for the 5 most recent faults, time-tagged to 1ms resolution. The fault record is available on the relay front panel LCD and at a local or remote PC. Fault records include the following data:

- Date and time of trip operation.
- Faulted phase.
- Protection element responsible for trip.
- Measured voltage data.

Disturbance Record

The relay can record 4 analog and 32 binary signals, initiated by relay tripping. The post-trigger recording time can be set, and the maximum number of records which can be stored is dependent on the recording time chosen.

USER INTERFACE

Relay Front Panel

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

- 16 character, 8-line LCD with backlight.
- 14 LEDs (8 fixed display and 6 configurable).
- USB2.0 port for connection of local PC.

Local PC Connection

The user can communicate with the GRE130 from a local PC via the USB2.0 port on the front panel. Using RSM100 software, the user can view and modify settings, monitor real-time metering and analyse recorded data. Figure 4 shows the configuration of typical displays from the RSM100 software.

Modbus and DNP3 Communications

GRE130 supports the Modbus and DNP3 communication protocol. These protocols are used for communication with a substation control and monitoring system or automation system to be linked with SCADA or regional control center, and are used to transfer measurand data, status data and general commands between the relay and the control system.

IEC 60870-5-103 Communications

GRE130 supports the IEC 60870-5-103 communication protocol. This protocol is used for communication with a substation control and monitoring system and is used to transfer measured data, status data and general commands between the relay and the control system via RS485.

IEC 61850 Communication

GRE110-402A and 422A can support data communication according to the IEC 61850 standard via an optional communication port.

Relay Setting

The user can modify relay settings either using the front panel keypad or using the RSM100 software from a local PC. Password protection is available for added security. Two settings groups are provided, allowing the user to set one group for normal conditions, while the other group may be set to cover alternative operating conditions.

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

Binary Outputs

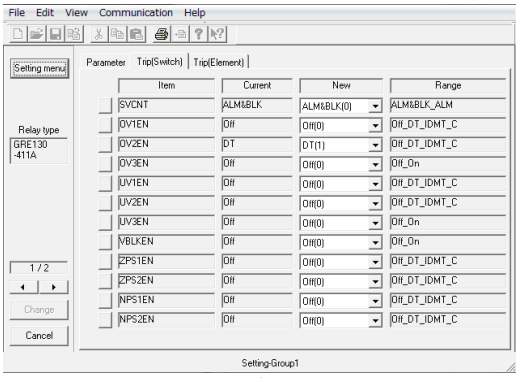
GRE130 provides four or eight user programmable binary output contacts for tripping and alarm. Each of the programmable binary outputs is driven via a logic gate which can be programmed for OR gate or AND gate operation. Further, each output has a programmable reset characteristic, settable for instantaneous drop-off, delayed drop-off, or for latching operation. If latching operation is selected then an operated relay must be reset by the user, either by pressing the RESET button, by energising a binary input which has been programmed for ‘Remote Reset’ operation, or by a communications command.

Binary Inputs

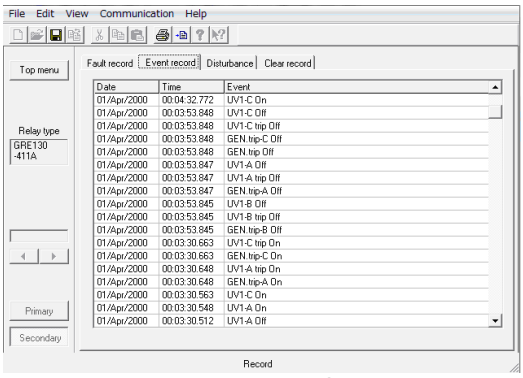
GRE130 provides two programmable binary inputs as standard and a further four available as an option. Each binary input is individually user-programmable for normal or inverted operation and for delayed pick-up and/or drop-off. Each input can also be used to switch relay operation to a different settings group.

General purpose alarm functions are also included. The user can define a text message for each alarm. Then when inputs associated with that alarm are raised, the defined text is displayed on the LCD.

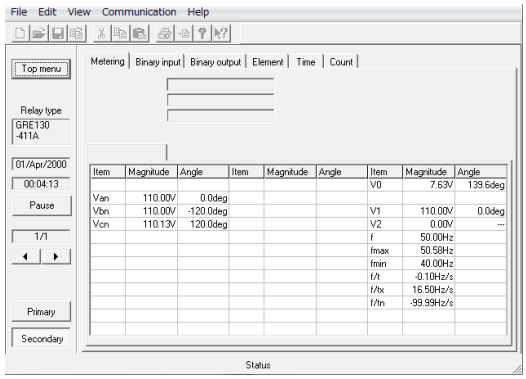
PC DISPLAY



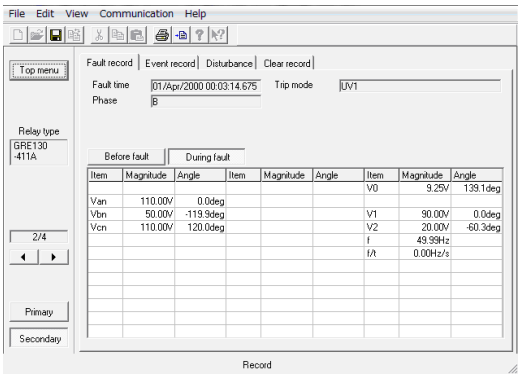
Setting



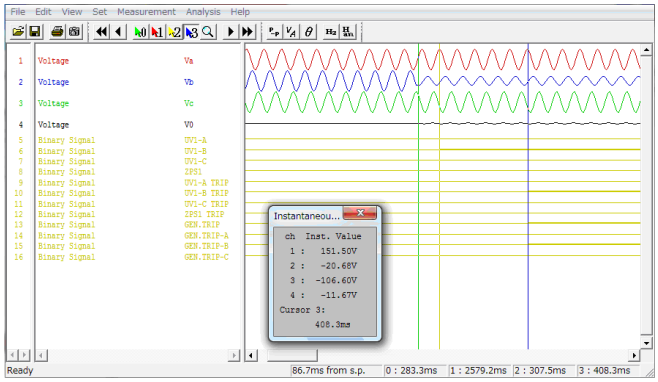
Event record



Metering



Fault record



Data analysis

Figure 4 - Relay Setting and Monitoring System - PC Displays

TECHNICAL DATA

Ratings	
AC voltage V_n:	110V
Frequency:	50/60Hz
Power supply:	110-250Vdc or 100-220Vac (Operative range: 88–300Vdc / 88–264Vac) 48-110Vdc (Operative range: 38.4 – 132Vdc) 24-48Vdc (Operative range: 19.2 – 60.0Vdc)
Superimposed AC ripple on DC supply:	maximum 12%
Power supply interruption:	maximum 50ms at 110V
Binary input circuit DC voltage:	For alarm indication 110-250Vdc (Operative range: 88 - 300Vdc) 48-110Vdc (Operative range: 38.4 - 132Vdc) 24-48Vdc (Operative range: 19.2 – 60.0Vdc) For trip circuit supervision Operative range: ≥38.4V (for 110Vdc rating) ≥88V (for 220/250Vdc rating) ≥19.2V (for 48Vdc rating) ≥9.6V (for 24Vdc rating)
Overload Ratings	
AC voltage inputs:	2 times rated voltage continuous
Burden	
AC phase voltage inputs:	≤ 0.1 VA (at rated voltage)
Power supply:	≤ 10W (quiescent), ≤ 15W (maximum)
Binary input circuit:	≤ 0.5W per input at 220Vdc
Overvoltage Protection (59)	
1st, 2nd, 3rd Overvoltage thresholds:	OFF, 10.0 – 200.0V in 0.1V steps
Delay type:	DTL, IDMTL
IDMTL Time Multiplier Setting TMS:	0.05 - 100.00 in 0.01 steps
DTL delay:	Inst, 0.01 - 300.00s in 0.01s steps
DO/PU ratio	10 - 98% in 1% steps
Reset Delay:	Instantaneous, 0.1 – 300.0s in 0.1s steps
Undervoltage Protection (27)	
1st, 2nd, 3rd Undervoltage thresholds:	OFF, 5.0 – 130.0V in 0.1V steps
Delay type:	DTL, IDMTL
IDMTL Time Multiplier Setting TMS:	0.05 - 100.00 in 0.01 steps
DTL delay:	Inst, 0.01 - 300.00s in 0.01s steps
Reset Delay:	Instantaneous, 0.1 – 300.0s in 0.1s steps
Zero Sequence Overvoltage (ZPS) Protection (59N)	
1st, 2nd ZPS Overvoltage thresholds:	OFF, 1.0 – 130.0V in 0.1V steps
Delay type (1st threshold only):	DTL, IDMTL
IDMTL Time Multiplier Setting TMS:	0.05 - 100.00 in 0.01 steps
DTL delay:	Inst, 0.01 - 300.00s in 0.01s steps
Reset Delay (1st threshold only):	Instantaneous, 0.1 – 300.0s in 0.1s steps
Negative Sequence Overvoltage (NPS) Protection (47)	
1st, 2nd NPS Overvoltage thresholds:	OFF, 1.0 – 130.0V in 0.1V steps
Delay type (1st threshold only):	DTL, IDMTL
IDMTL Time Multiplier Setting TMS:	0.05 - 100.00 in 0.01 steps
DTL delay:	Inst, 0.01 - 300.00s in 0.01s steps
Reset Delay (1st threshold only):	Instantaneous, 0.1 – 300.0s in 0.1s steps

Frequency Protection (81U/O)	
1st – 4th Under frequency	45.00 – 50.00 Hz in 0.01Hz steps (rated frequency: 50Hz) 54.00 – 60.00 Hz in 0.01Hz steps (rated frequency: 60Hz)
1st – 4th Under frequency	50.00 – 55.00 Hz in 0.01Hz steps (rated frequency: 50Hz) 60.00 – 66.00 Hz in 0.01Hz steps (rated frequency: 60Hz)
Frequency rate-of-change	+0.1 to +9.9Hz/s in 0.1Hz/s steps –0.1 to –9.9Hz/s in 0.1Hz/s steps
Timer for stage 1st - 4th	0.00 – 100.00 s in 0.01 s steps
Frequency UV Block	40 – 100V in 1V steps
Accuracy	
IDMTL Overcurrent Pick-up:	105% of setting ± 5%
All Other Overvoltage Pick-ups:	100% of setting ± 5%
Overvoltage PU/DO ratio:	approx, 95% (settable for phase overvoltage)
IDMTL Undervoltage Pick-up:	95% of setting ± 5%
All Other Undervoltage Pick-ups:	100% of setting ± 5%
Undervoltage PU/DO ratio:	approx, 105%
Over Frequency Pick-ups:	100% of setting ± 0.05Hz (setting: ≥ rated frequency - 5.00Hz)
Under Frequency Pick-ups:	100% of setting ± 0.05Hz (setting: ≤ rated frequency + 5.00Hz)
Frequency rate-of-change Pick-ups:	100% of setting ± 0.07Hz (setting: 5.00Hz/s)
Inverse Operate Time:	IEC60255-127, ±5% or 100ms (OV; $1.2 \le G/Gs \le G_D/Gs$, UV; $0 \le G/Gs \le 1$) G_D = 300V
OV Definite Operate Time:	≤ DTL + 45ms (DT, input: ≥ 200% of setting)
UV Definite Operate Time:	≤ DTL + 45ms (DT, input: ≤ 80% of setting)
ZPS Definite Operate Time:	≤ DTL + 45ms (DT, input: ≥ 200% of setting)
NPS Definite Operate Time:	≤ DTL + 50ms (DT, input: ≥ 200% of setting)
Under/Over Frequency Operate Time:	DTL + 80 - 200ms (rated frequency: 50Hz) DTL + 70 - 170ms (rated frequency: 60Hz)
Frequency rate-of-change Operate Time:	190 - 300ms (rated frequency: 50Hz, input: ≥ 200% of setting) 160 - 250ms (rated frequency: 60Hz, input: ≥ 200% of setting) Time delays includs operating time of trip contacts
Front Communication port - local PC (USB2.0)	
Connector type:	USB-Type B
Cable length:	5m (max.)
Rear Communication port - remote PC (RS485)	
Connection:	Multidrop (max. 32 relays)
Cable type:	Twisted pair
Cable length:	1200m (max.)
Connector:	Screw terminals
Isolation:	1kVac for 1 min.
Transmission rate:	19.2 kbps
Rear Communication port (Ethernet)	
100BASE-TX	RJ-45 connector
100BASE-FX	SC connector
Binary Inputs	
Operating voltage	For signal detection Typical 154Vdc (min. 110Vdc) for 220Vdc rating Typical 77Vdc (min. 70Vdc) for 110Vdc rating Typical 33.6Vdc (min. 24Vdc) for 48Vdc rating Typical 16.8Vdc(min. 12Vdc) for 24Vdc rating

	For trip circuit supervision ≥88V for 220/250Vdc rating ≥38.4Vdc for 110Vdc rating ≥19.2V for 48Vdc rating ≥9.6V for 24Vdc rating
Binary Outputs	
Number Ratings model 410 and 411; BO#1 and #2 model 412: BO#1,#2,#5 and #6 other BOs Durability: Pickup time: Reset time:	4 or 8 (excluding Relay Fail contact) Make and carry: 5A continuously Make and carry: 30A, 250Vdc for 0.5s (L/R≥40ms) Break: 0.1A, 250Vdc (L/R=40ms) Make and carry: 4A continuously Make and carry: 8A, 250Vdc for 0.2s (L/R≥40ms) Break: 0.1A, 250Vdc (L/R=40ms) Loaded contact: ≥1,000 operations Unloaded contact: ≥10,000 operations Less than 15ms Less than 10ms
Mechanical design	
Weight Width Height Depth Case color Installation	1.5kg for model 410A and 411A 1.8kg for model 412A 149mm for model 410A and 411A 223mm for model 412A 177mm 168mm Munsell No. 10YR8/0.5 Flush mounting with attachment kits

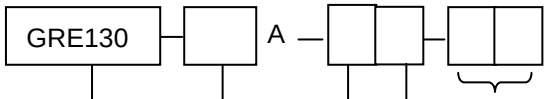
ENVIRONMENTAL PERFORMANCE

Test	Standards	Details
Atmospheric Environment		
Temperature	IEC 60068-2-1/2 IEC 60068-2-30	Operating range: -20°C to +60°C. Storage / Transit: -25°C to +70°C.
Humidity	IEC 60068-2-78	56 days at 40°C and 93% relative humidity.
Enclosure Protection	IEC 60529	IP52 (front), IP20 (rear), IP40 (top)
Mechanical Environment		
Vibration	IEC 60255-21-1	Response - Class 1 Endurance - Class 1
Shock and Bump	IEC 60255-21-2	Shock Response Class 1 Shock Withstand Class 1 Bump Class 1
Seismic	IEC 60255-21-3	Class 1
Electrical Environment		
Dielectric Withstand	IEC 60255-5 IEEE C37.90.0	2kVrms for 1 minute between all terminals and earth. 2kVrms for 1 minute between independent circuits. 1kVrms for 1 minute across normally open contacts.
High Voltage Impulse	IEC 60255-5	Three positive and three negative impulses of 5kV(peak) for CT, Power Supply Unit (PSU), BI and BO circuits; between terminals and earth, and between independent circuits

Test	Standards	Details
		3kV (peak) for RS485 circuit; between terminals and earth 3kV (peak) for BO circuit; across normally open contacts 1.2/50μs, 0.5J between all terminals and between all terminals and earth.
Electromagnetic Environment		
High Frequency Disturbance / Damped Oscillatory Wave	IEC 60255-22-1 Class 3, IEC 61000-4-12 IEEE C37.90.1	1MHz 2.5kV to 3kV (peak) applied to all ports in common mode. 1MHz 1.0kV applied to all ports in differential mode.
Electrostatic Discharge	IEC 60255-22-2 Class 3, IEC 61000-4-2	6kV contact discharge, 8kV air discharge.
Radiated RF Electromagnetic Disturbance	IEC 60255-22-3 Class 3, IEC 61000-4-3	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	IEC 60255-22-4 Class A, IEC 61000-4-4, IEEE C37.90.1	4kV, 2.5kHz, 5/50ns applied to all inputs.
Surge Immunity	IEC 60255-22-5, IEC 61000-4-5	1.2/50μs surge in common/differential modes: HV, PSU and I/O ports: 2kV/1kV (peak) RS485 port: 1kV (peak)
Conducted RF Electromagnetic Disturbance	IEC 60255-22-6 Class 3, IEC 61000-4-6	10Vrms applied over frequency range 150kHz to 100MHz. Additional spot tests at 27 and 68MHz.
Power Frequency Disturbance	IEC 60255-22-7 Class A, IEC 61000-4-16	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	IEC 60255-25, EN 55022 Class A, IEC 61000-6-4	Conducted emissions: 0.15 to 0.50MHz: <79dB (peak) or <66dB (mean) 0.50 to 30MHz: <73dB (peak) or <60dB (mean) Radiated emissions (at 10m): 30 to 230MHz: <40dB 230 to 1000MHz: <47dB
European Commission Directives		
CE	89/336/EEC	Compliance with the European Commission Electromagnetic Compatibility Directive is demonstrated according to generic EMC standards EN 61000-6-2 and EN 61000-6-4.
	73/23/EEC	Compliance with the European Commission Low Voltage Directive is demonstrated according to product safety standard EN 60255-27.

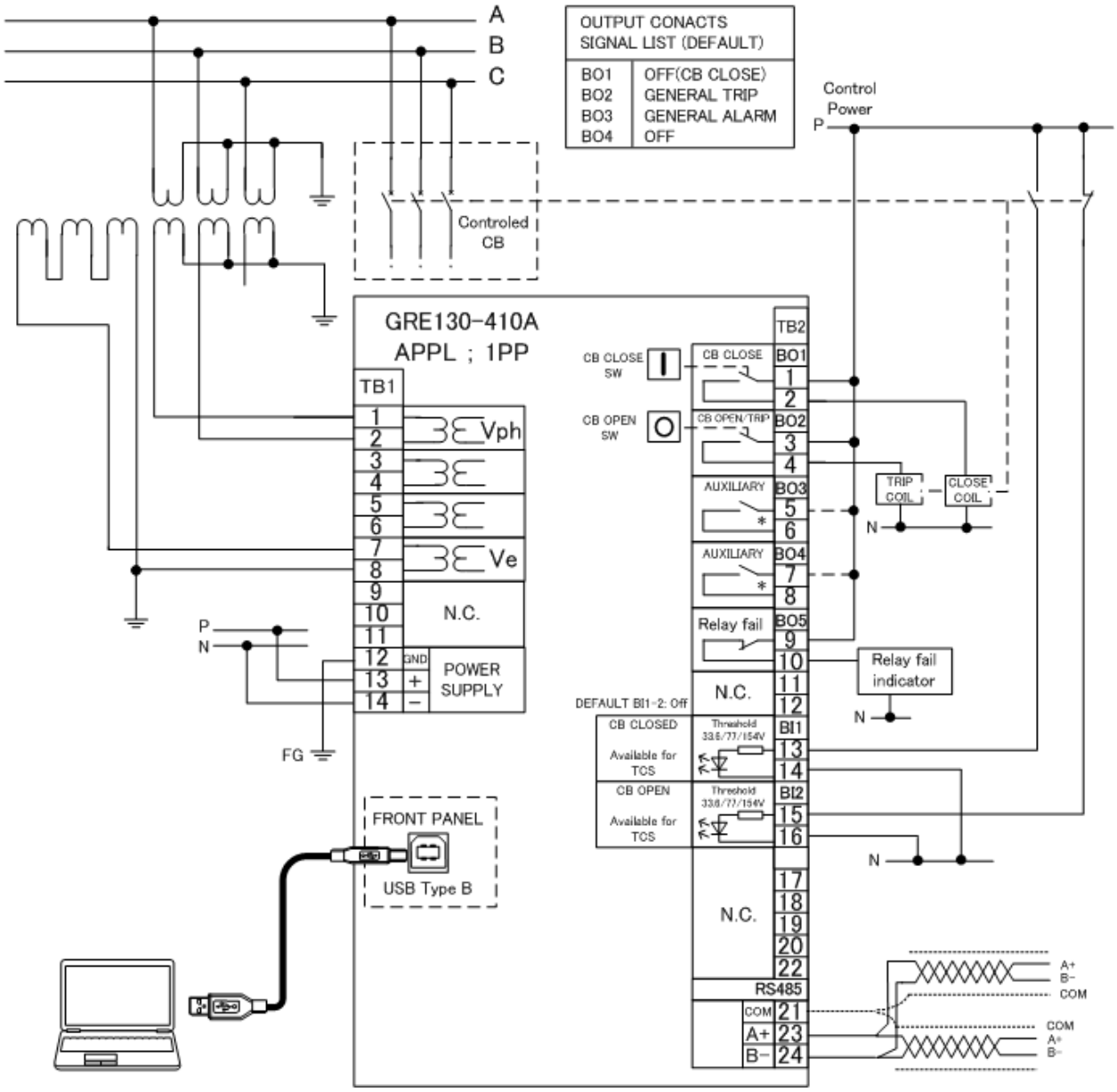
ORDERING

Under/Overvoltage Relay



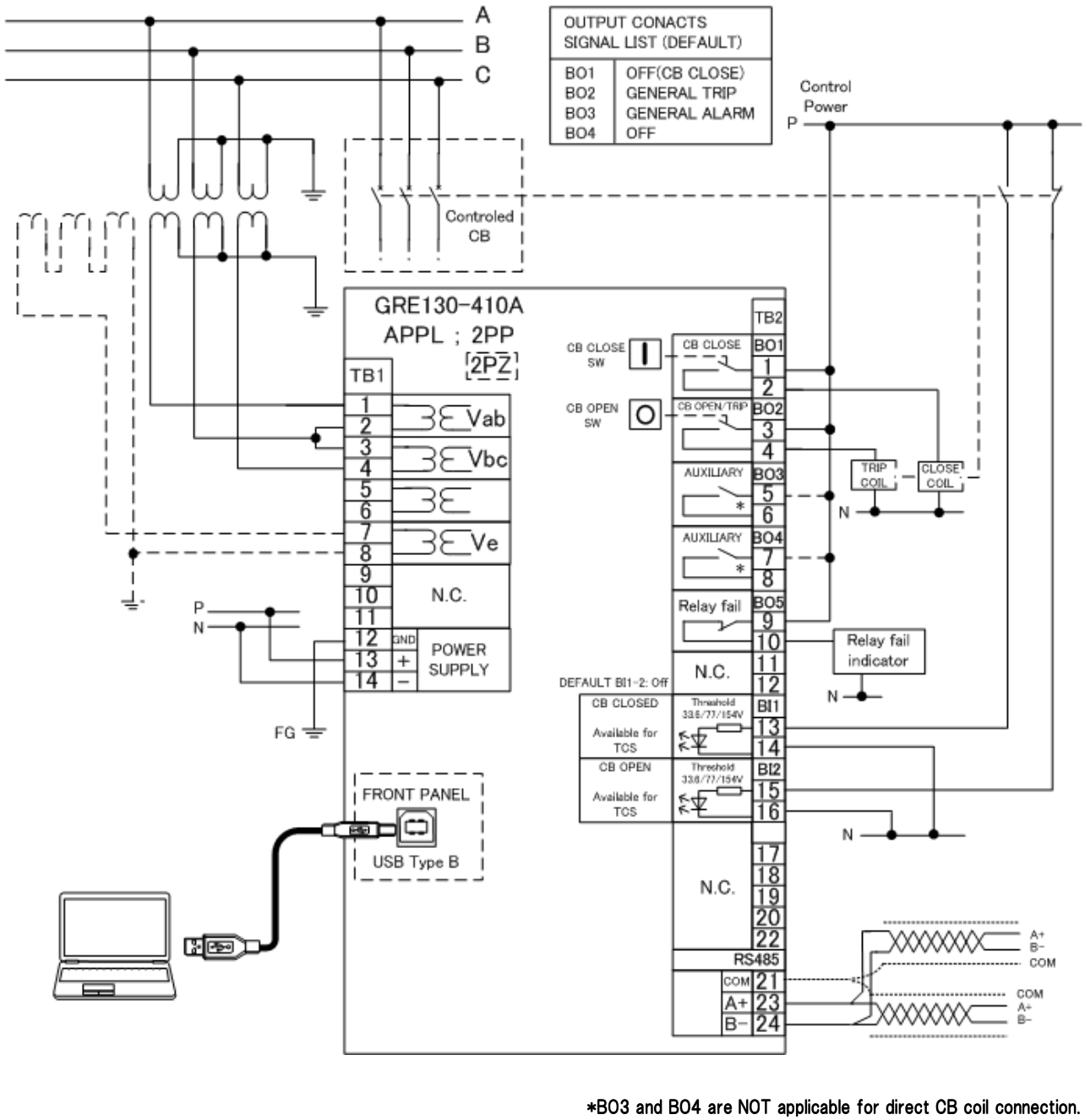
Type:	
Voltage Relay	GRE130
Model:	
- Model 410: Four pole	
2 x BIs, 4 x Bos, 1 x Relay fail	410
6 x BIs, 4 x BOs, 1 x Relay fail	411
6 x BIs, 8 x BOs, 1 x Relay fail	412
Rating:	
VT: 110V, f: 50/60Hz, 110-250Vdc or 100-220Vac	1
VT: 110V, f: 50/60Hz, 48-110Vdc	2
VT: 110V, f: 50/60Hz, 24-48Vdc	A
Standard and language:	
IEC (English)	0
ANSI (English)	1
Communication:	
RS485 1port (Modbus/IEC 60870-5-103)	10
RS485 1port (Modbus/DNP3)	11
Following options can be equipped with Model 412 only	
100BASE-TX 1port (Modbus/IEC 61850) +RS485 1port (Modbus/IEC 60870-5-103)	A0
100BASE-TX 1port (Modbus/IEC 61850/DNP3) +RS485 1port (Modbus/DNP3)	A1
100BASE-FX 1port (Modbus/IEC 61850) +RS485 1port (Modbus/IEC 60870-5-103)	C0
100BASE-FX 1port (Modbus/IEC 61850/DNP3) +RS485 1port (Modbus/DNP3)	C1

TYPICAL APPLICATIONS / CONNECTIONS



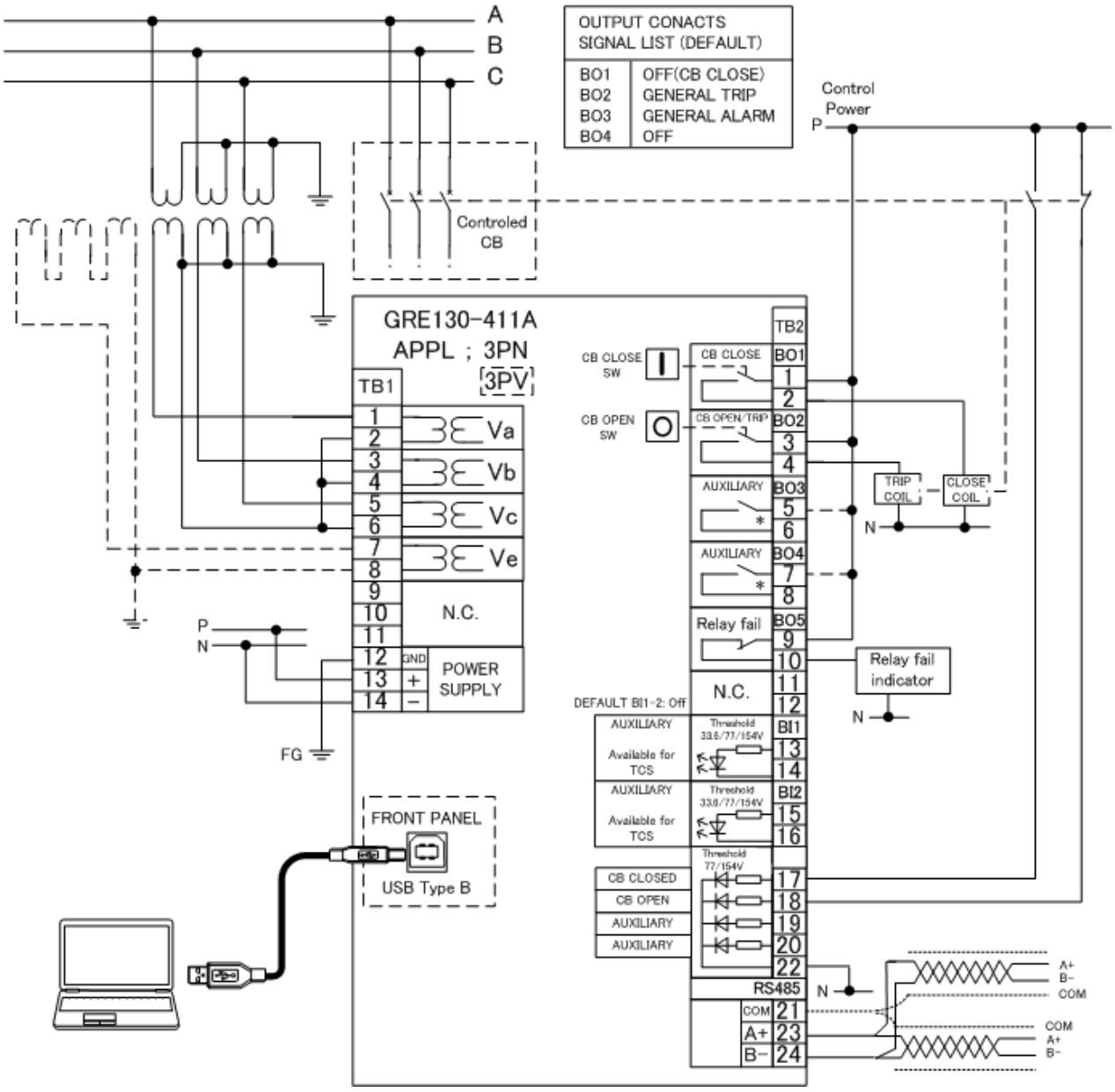
*BO3 and BO4 are NOT applicable for direct CB coil connection.

Figure 5 - Typical External Connections for the GRE130 - 410A 1PP setting



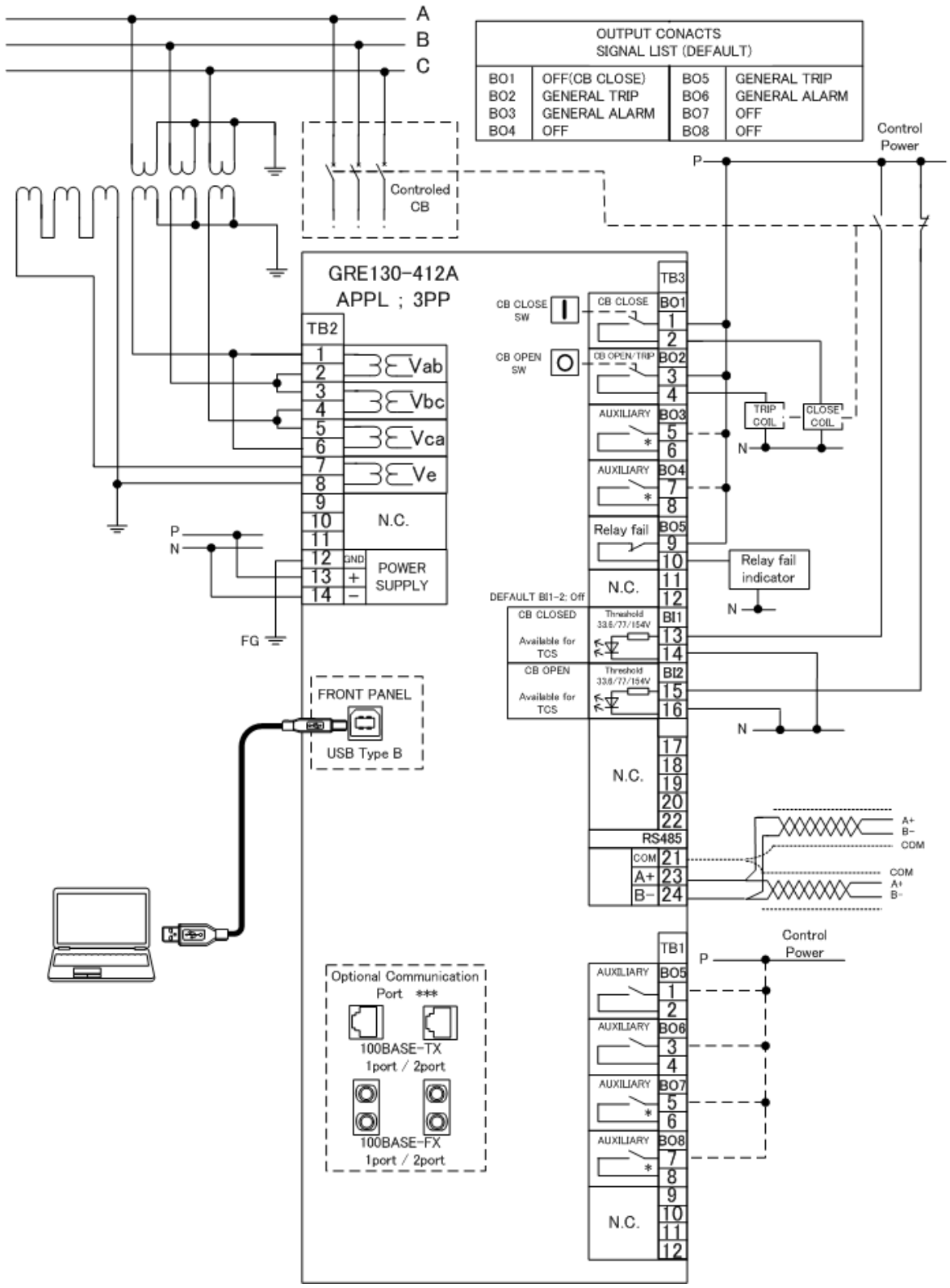
*BO3 and BO4 are NOT applicable for direct CB coil connection.

Figure 6 - Typical External Connections for the GRE130 - 410A 2PP (2PZ) setting



*BO3 and BO4 are NOT applicable for direct CB coil connection.

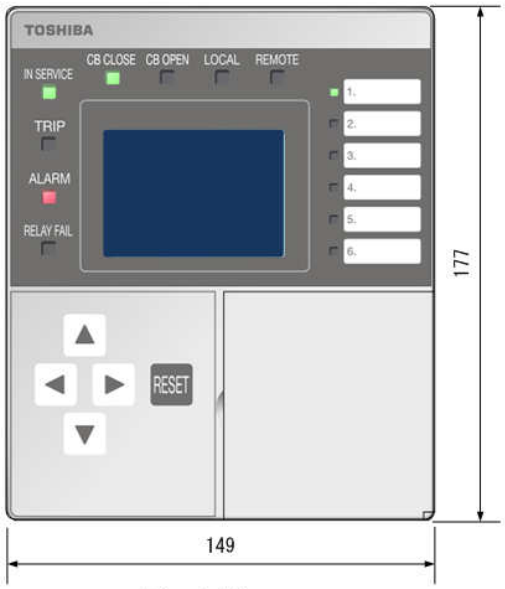
Figure 7 -Typical External Connections for the GRE130 - 411A 3PN (3PV) setting



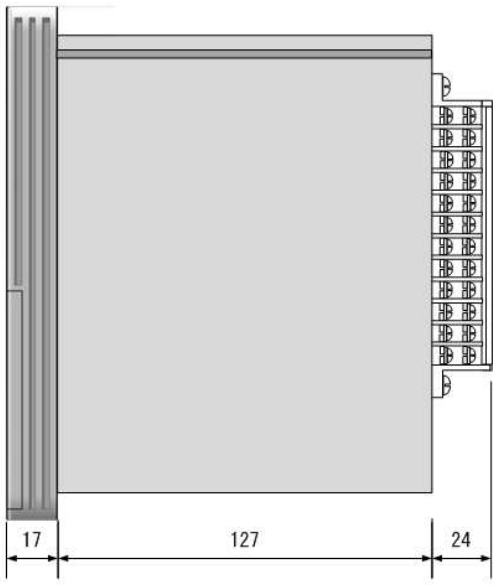
*BO3, BO4, BO7 and BO8 are NOT applicable for direct CB coil connection.
**Analogue current input ports are shorted when the terminal block is removed. (TB2 1-2, 3-4, 5-6, 7-8)

Figure 8 - Typical External Connections for the GRE130 - 412A 3PP setting

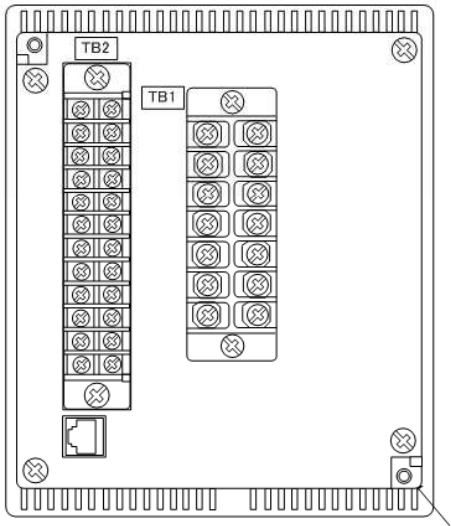
RELAY OUTLINE



Front View



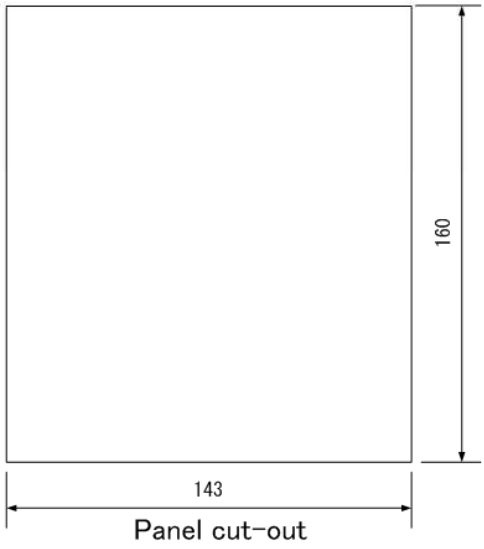
Side View



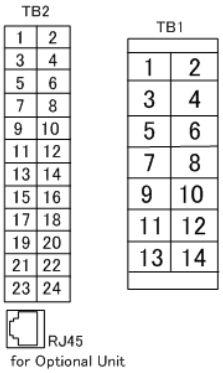
Rear View

2 holes−ϕ4
for Panel mount Jig

2-M4 screw hole
for panel mount jig



Panel cut-out



Terminal block

Figure 9 - GRE130 Outline Diagram – Model 410/411

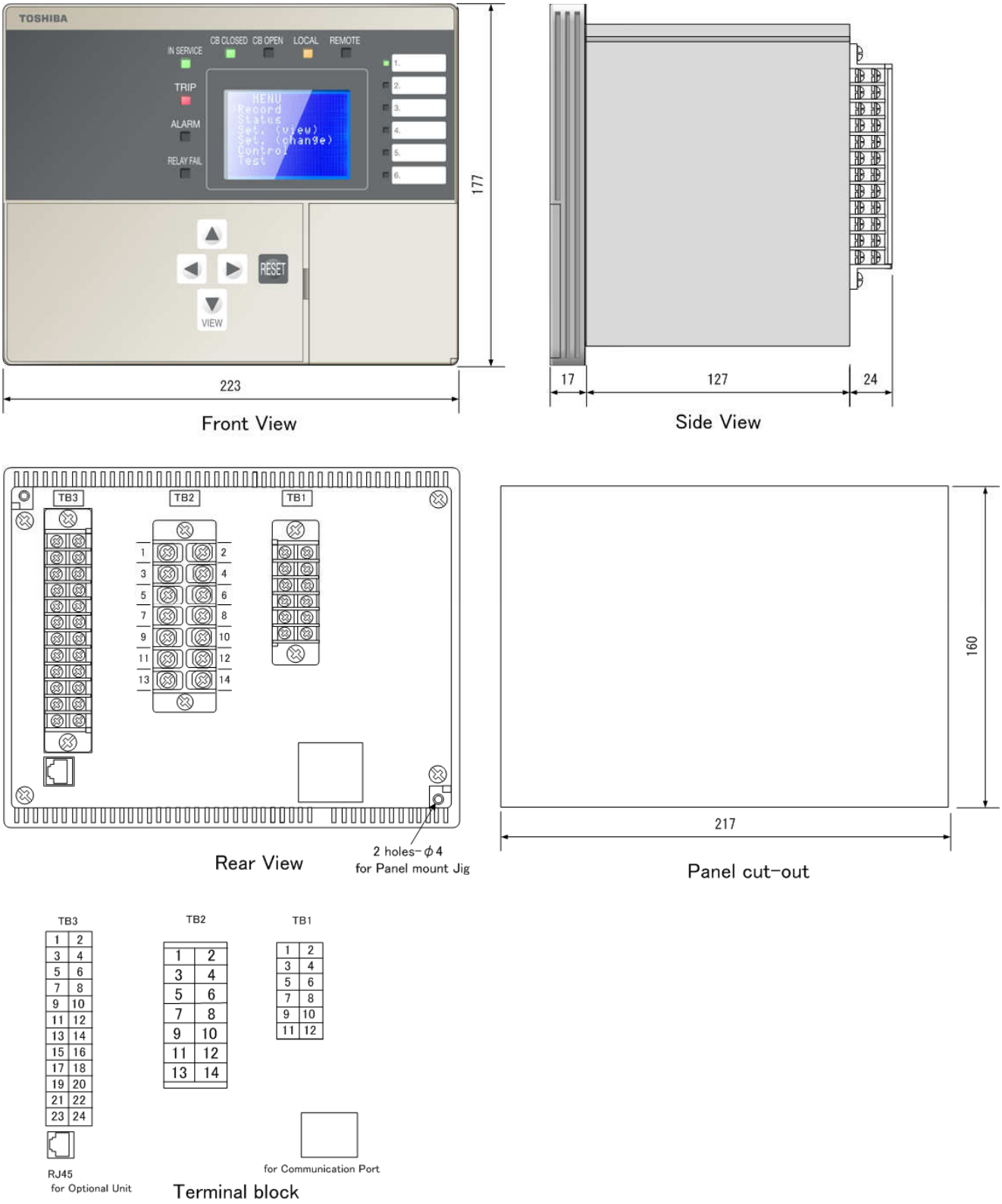


Figure 10 - GRE130 Outline Diagram – Model 412

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