RC820 (2E RELAY)

INSTRUCTION MANUAL

RELAY MODELS
RC820-HP__Y__
RC820-AP__Y

AUXILIARY MODULES
RC-81A (GROUND FAULT)
RC-81 B (PHASE REVERSAL)
RC-81C (GROUND FAULT/PHASE REVERSAL)

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OUTLINE

The 2E Relay (static relay for three-phase induction motors) is widely used in various industrial fields to protect induction motors against overloads and other abnormal conditions (i.e., single phase, unbalanced phases). Optional plug-in type modules can be installed which include the RC81A ground fault module, RC81B phase reversal module, and RC81C ground fault/phase reversal module.

INITIAL INSPECTION

(1) Check that the 2E Relay and/or additional module is per ordering specifications.

(2) Check the 21: Relay and/or additional module for damage incurred during shipment (breakage, loose parts).

APPLICATIONS

The 2F Relay and/or additional module is used to protect three phase induction motors and other three-phase loads, not only from overloads and single phase conditions but also from phase reversal and ground fault.

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RATINGS AND PERFORMANCES

Table 1 lists the ratings and performance of the 2E Relay.

Table 1 Ratings and Performances of the 2E Relay

Items \ Type -Form		RC 820 –
		HP1 / HP1 12 / AP1 — HP2Y / HP2Y12 / AP2Y — HP3Y / HP3Y12 / AP3Y
Applicable circuit		Wee-phase circuits rated up to 600V AC, 50/60 HZ - Direct (Also, applicable to high-voltage circuit: by combining with high-voltage CTs)
Protective functions		Dual functions (2E relay) ---- Over load and Single phase protection.
Rated Current	Rated ampere-turns	7AT / 55AT / 110AT
	Setting range	75∿150% of rated at [75+(5+10+20+40)%]
Overload operating characte-ristics	Ultimate operating current	105∿125% of current setting
	Operating time setting range	3∿40 Sec. for starting characteristics at 600% of current setting [3+(2+5+10+20)sec.1
	Operating time accuracy	±20% of tine setting
Single-phase protection operating character-istics	Minimum operating current	85% of current setting under one-phase completely loss state (When measured on either remaining phase.) -- See Fig. 1
	operating time	Less than **4 sec.**
Control voltage	Rating	100∿120V/200∿240 V AC, 1ø , 50/60 HZ
	Tolerance	85% ∿ 110%

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Items \ Type -Form		RC820- HP1Y / HP1Y12 / AP1Y	RC820- HP2Y / HP2Y12 / AP2Y	RC820- HP3Y / HP3Y12 / AP3Y
Power consumption	Control power circuit	2 VA		
	Detecting circuit	0.3 VA/phase at rated current		
Output contact specifications	Contact arrangement	1NO - NC (SPDT/Form C)		
	Contact capacity NEMA B300	120V AC-5.0A (Resistive load) 120V AC-3.0A (Inductive load, pf=0.40) 125V DC-0.2A (L/R=7ms) 250V DC-0.1A (L/R=7ms)		
Fault indication		LED		
Reset mode		RC820-HP1Y ... Manual Reset Type RC820-HP1Y12 Manual & Remote Reset RC820-AP1Y ... Auto Reset Type		
Application conditions	Ambient temperature	-10 ~ +60°C		
	Relative humidity	45 ~ 85% at 20°C		

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The additional modules are connected to the 2E relay with gold plated pins and their principal ratings are the same as that of 2E Relay. In Table 2 is listed its ratings range and parformances.

Table 2 Ratings and Performances of optional modules

Items \ Type-Form		RC81A	RC81B	RC81C
Phase reversal characteristics	Operating current		90% of 2E relay current setting	90% of 2E relay current setting
	Operating time		Less than 0.5s	Less than 0.5s
	Ground fault current setting	4A ∿ 12A ZCT Primary		4A ∿ 12A ZCT Primary
	Maximum ground fault current	60A		60A
	Ground fault time setting	0.1s∿1.0s		0.1s∿1.0s
Output signal		output contacts of basic relay		
Trip indication		LED (manual reset)		
ZCT		12A:40mA Connected Impedance : 300Ω		12A:40mA connected Impedance : 300Ω

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Overload operating characteristics
Ultimate operating current --- 105~125 of current setting
Single phase protection operating characteristics
min. operating current --- 85% of current setting

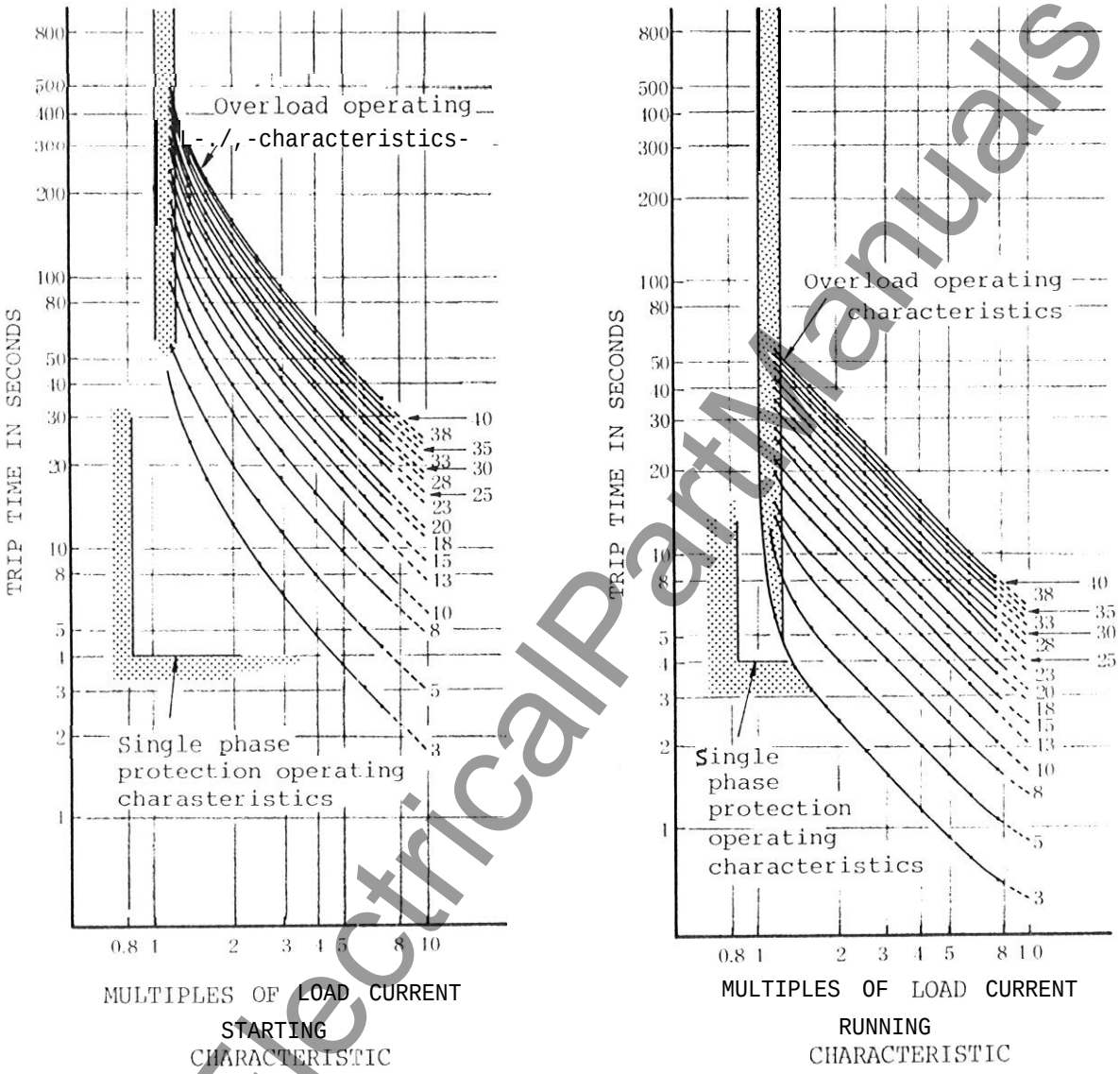

Fig. 3. Operating characteristic curve

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PRECAUTIONS IN APPLICATIONS

When planning to use Toshiba Static 2E Relays, be sure to give full consideration to the following precautions:

(1) (Control power source supply

The power circuit must be arranged so that control power is always supplied to the 2E Relay before the main circuit is switched ON.

(2) Limit the secondary burden when combining with external CT's. When the relay is used in a medium or high voltage circuit, an excessive CT secondary burden may cause secondary current waveform distortion.

Since large waveform distortion may be detected as unbalanced current, limit the external CT secondary burden according to the overcurrent constant while referring to Table 3.

Table 3 Limit of external CT secondary burden

CT Overcurrent Constant	Recommended Secondary Burden
3	Not greater than 50% of rating
5	Not greater than 85% of rating
10 or above	Up to rated burden

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(3) Application on DC systems

See Fig. 2.

In DC control systems main current does not flow sinusoidaly even though the power system (voltage) may be AC, so the 2E Relay, and/or additional modules, are not applicable.

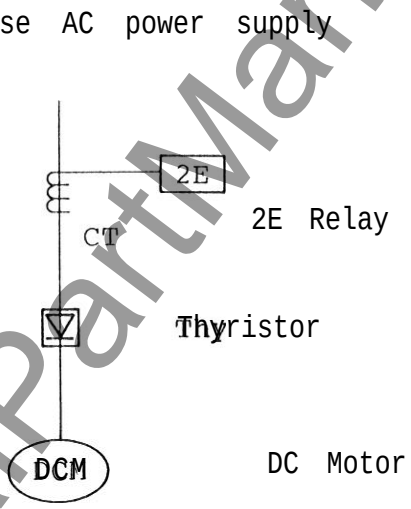

Fig. 2 Example of misapplication of the 2E Relay

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(4) The 2E Relay has phase unbalance detecting characteristics. Figure 4 shows how the current's unbalanced trip point depends upon the relay's current setting and the unbalanced current rate.

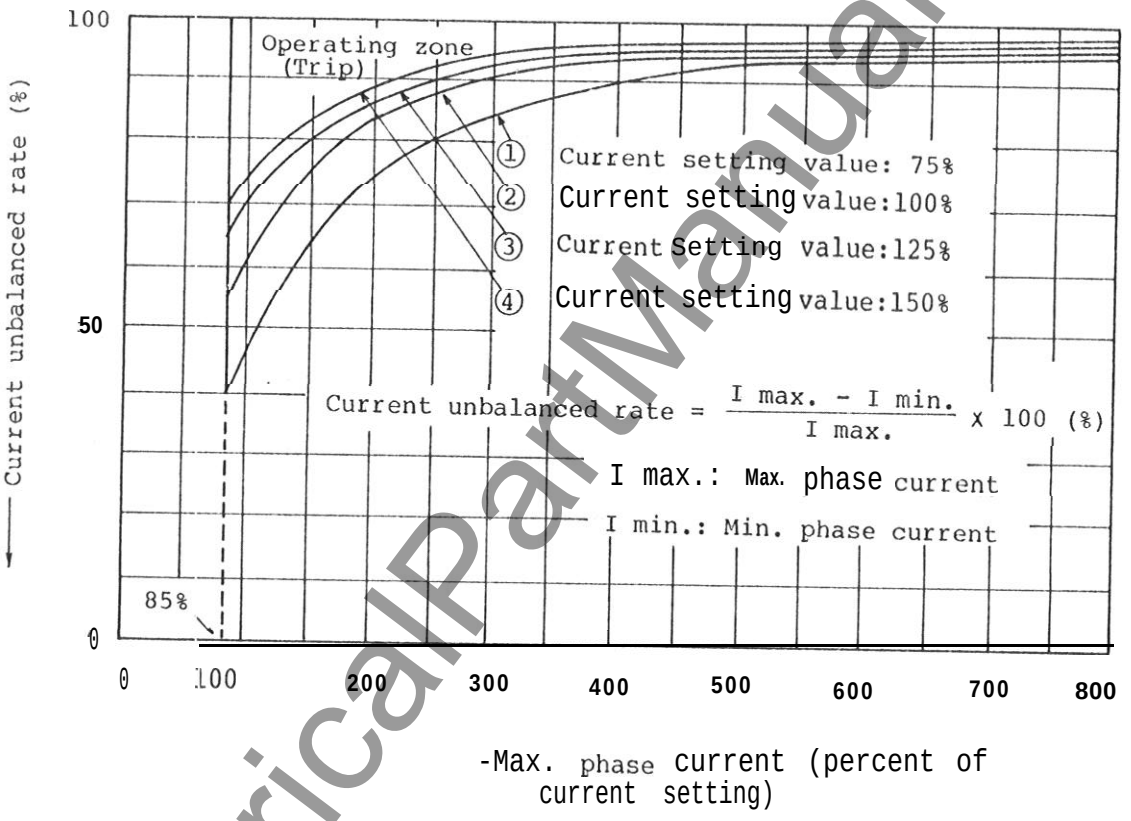

Fig. 3 Phase unbalance detecting characteristics

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INSTALLATION

1. Surface Mounting

The 2E relay will be shipped with mounting feet loose. Before installation, attach the mounting feet to the relay as shown Fig. 4. The below shown mounting feet and hardware will be shipped together with the relay as standard accessory.

Do not use a screw-locking agent when tightening.

Mounting **Feet** Accessory

Parts	Quantity
Mounting Feet	2
M4 Screws	4
M4 Spring Washers	4

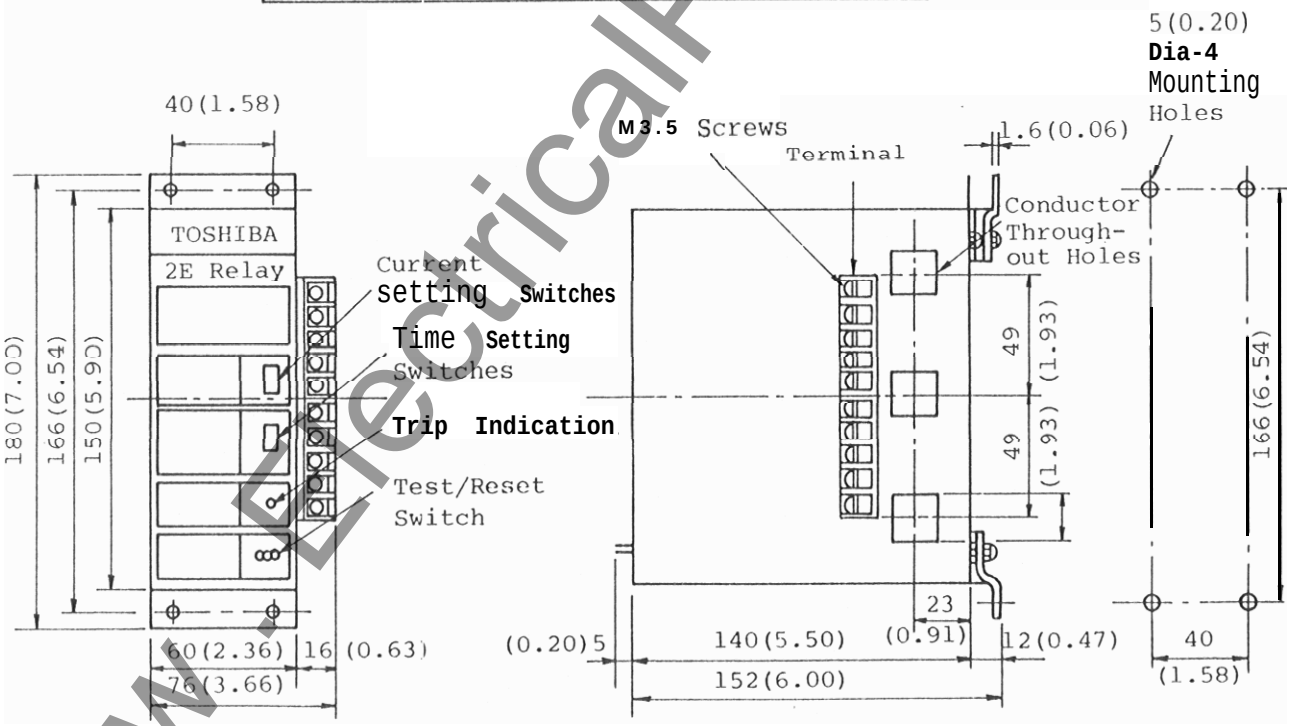

Fig. 4 Surface mount type 2E Relay

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2. Flush Mounting

For flush mounting, flush mounting kit (order separately) is required.

Before installation, attach the flush mounting fee to the relay instead of surface mounting feet as shown Fig.5.

Flush Mounting Kit

Parts	Quantity
Flush Mounting Feet	2
Flush Cover with Nylatch	1
M4 Screws	4
M4 Spring Washers	4

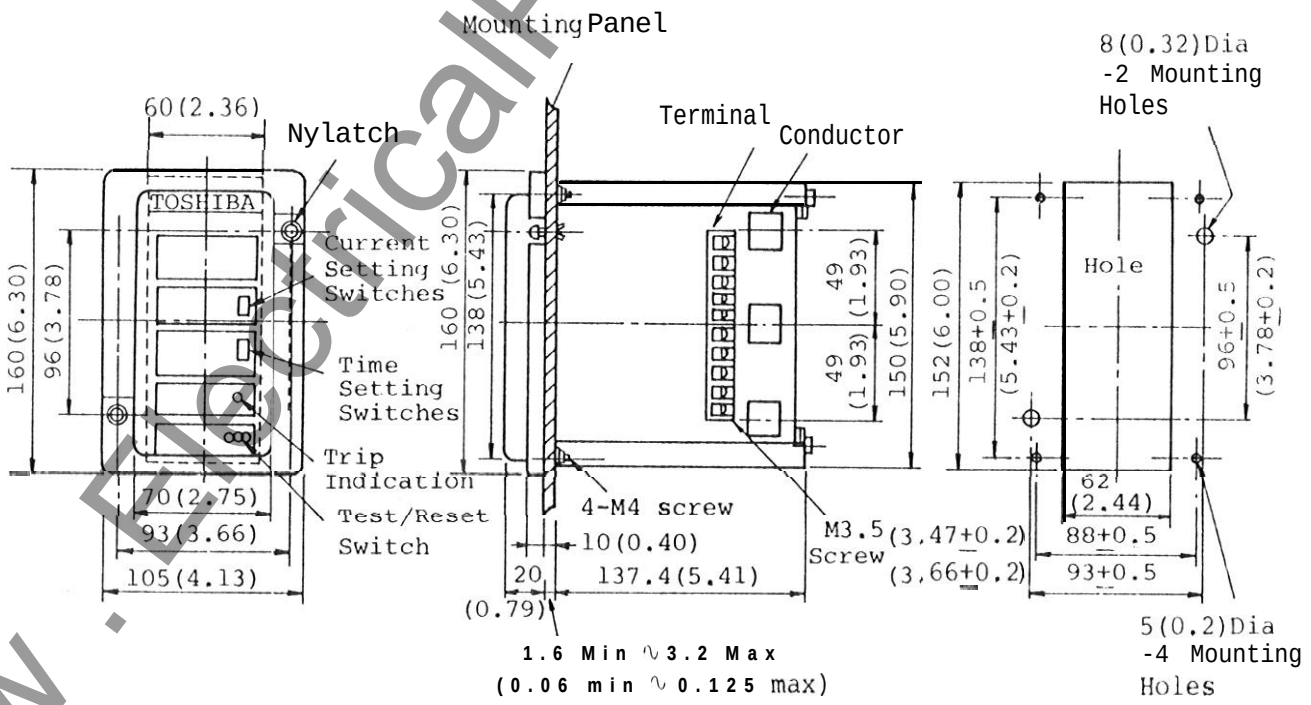

Fig. 5 Flush mount type 2E Relay

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3. Optional Module Installation

Install module with two knurl screws (accessory of module) as shown Fig. 6 after the relay installation and wiring to the relay are completed.

For: module installation, peel off the side label on the relay to open the holes for connection pins.

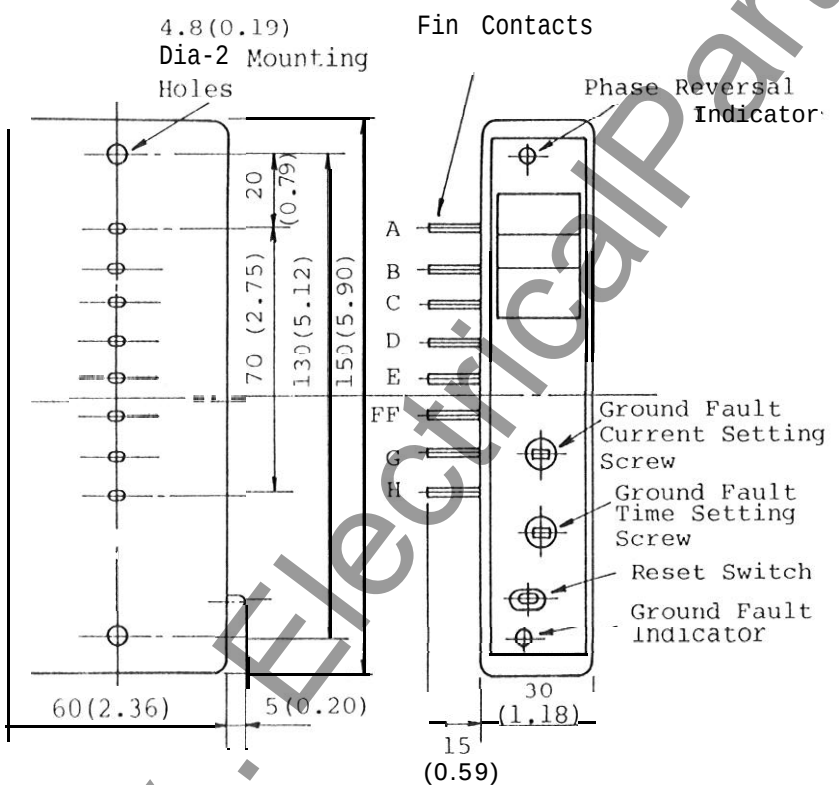

Fig. 6A Additional module

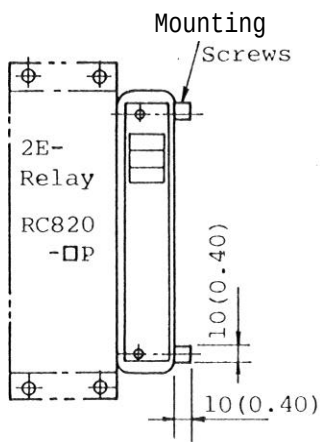

Fig. 6B Combination of 2E relay and additional module

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CIRCUIT CONSTRUCTIONS

When wiring primary wires through the CT windows, see Fig. 9, take care of the following:

1) Primary wires must go through the correct CT windows.
2) Primary wires must go through in the same direction.
3) Primary wires must have the same number of turns through the CT windows.

Before applying the 2E Relay and/or additional module for low voltage induction motor protection, see Fig. 8, which illustrates the typical wiring connections.

Applying the 2E Relay for high voltage, or low voltage large capacity systems, see Fig. 9. It is necessary to balance the CT secondary load, that is, CT secondary wire length.

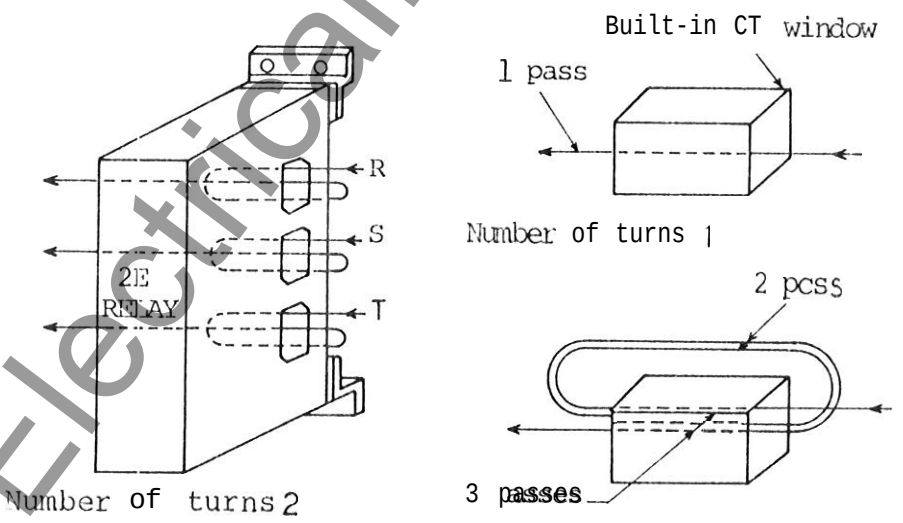

Fig. 7 Installation of wires passing through the built-in CT's

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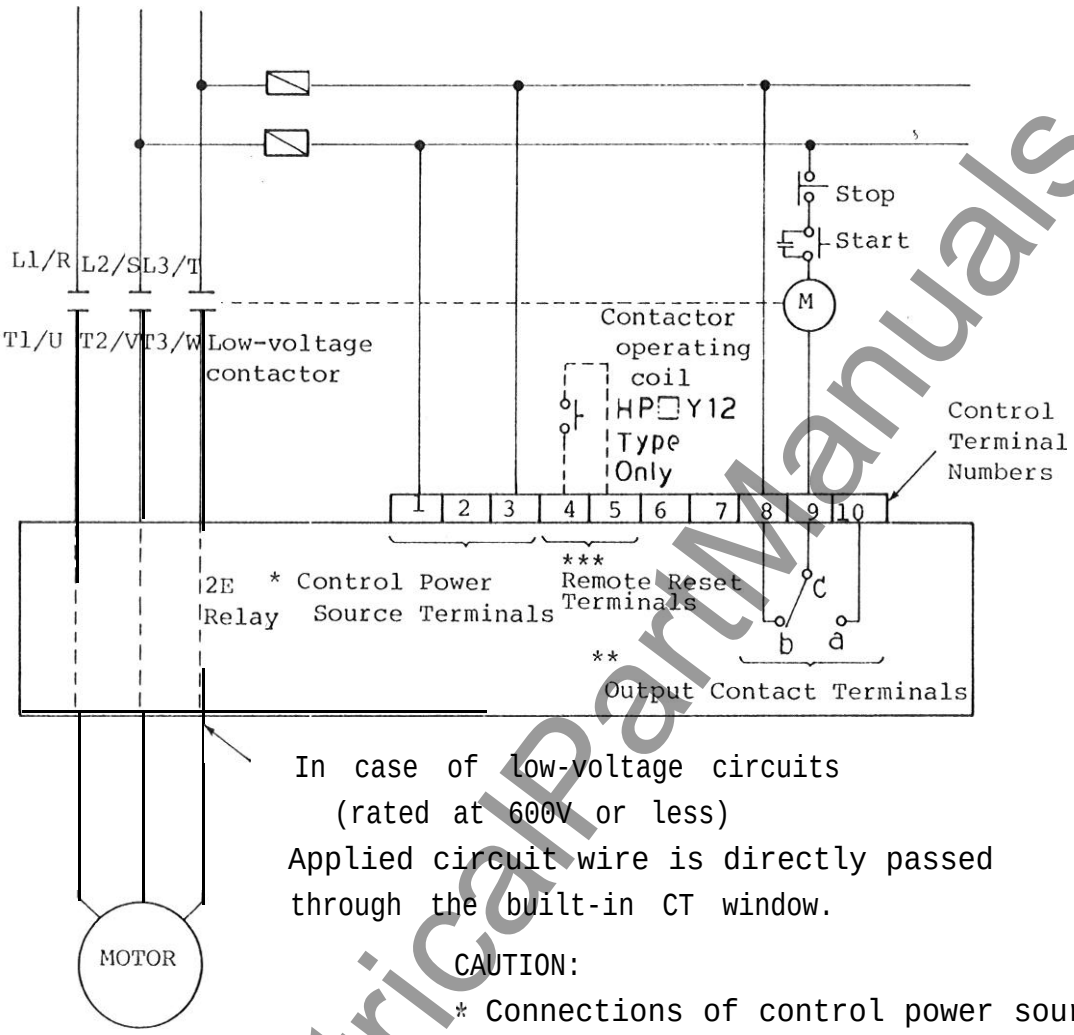
Low-voltage power supply
200V ∿ 240V AC



In case of low-voltage circuits
(rated at 600V or less)
Applied circuit wire is directly passed
through the built-in CT window.

Tow-voltage induction motor

CAUTION:

* Connections of control power source
AC 100-120V --- Terminals l-2
AC 200-240V --- Terminals l-3

** Connections of output contacts
NC-contact (opened when the 2E Relay operated) --- Terminals 8-9
NO-contact (closed when the 2E Relay operated) --- Terminals 9-10

*** Connections of Remote reset switch
Remote reset --- Terminals 4-5
(Special spec.: RC820-HP □Y I 2
Wiring length, from 2E to reset switch must he less than 5m.

Fig. 8 Typical application to low-voltage induction motor circuit

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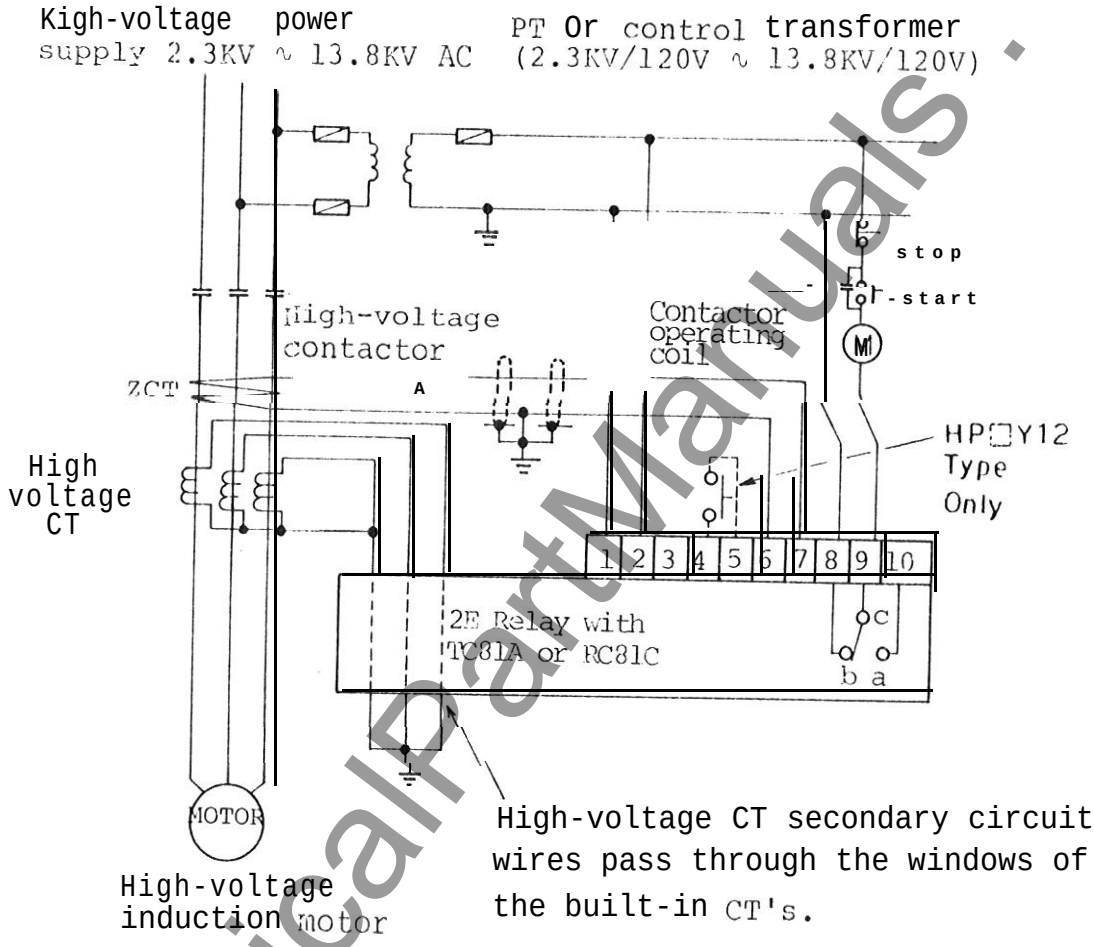

Fig. 9 Typical application to high-voltage induction motor circuit with ground fault protection

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HOW TO SET

The 2E relay is offered in three models,

Model	Ampere-Turn Rating
RC820-□P1Y	7AT
RC820-□P2Y	55AT
RC820-□P3Y	110AT

with each having an adjustable (Ampere-Turn) range of 75~150%. Each model has direct wiring capability through the three current transformer's windows. This is limited to 165 amperes (RC820-□P3Y). For larger currents, or voltages above 600V, the use of external current transformers is required.

Selection of the suitable model may require some preliminary calculations. See "Current Setting Adjustments" to determine if the calculated "% Dial Setting" can be obtained with the selected model given the motor's full load current (FLA). Model Selection can also be influenced by wire size limiting the number of turns that can be passed through the CT windows (0.75 in. by 0.75 in.).

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SELECTION AND ADJUSTMENTS

(1) Current Setting Adjustment

$$N(T) = \frac{2E \text{ Amp-Turn Rating} \times \text{External CT Ratio*}}{\text{Motor FLA}}$$

N(T) : Number of turns through the 2E's built-in CT's, rounded off to nearest integer (CT wraps are additive).

$$\text{Current Setting \%} = \frac{\text{Motor FLA} \times N(T) \times 100\%}{\text{2E Amp-Turn RAting} \times \text{External CT Ratio*}}$$

* External CT Ratio: Ex. 500A/5A CT's = 100:1

If no external CT's are used, substitute with "1.0".

** For 1.15 Service Factor Motors. If the motor has a 1.0 S. F., multiply the calculated Current Setting %" by 0.93.

NOTE : Select the external CT's ratio so that the current setting % is as close to 100% as possible.

Example #1: 50HP, 4GOV 65A Full Load, 1.15 S.F.
Across-the-line start.
Since the full load falls within the range of the 55 AT (75 - 150%) 2E Relay's CT's, and no external CT's are required,

The 8 Dial Setting $= \frac{65 \times 1 \times 100\%}{55} = 118\% = 115\%$ or 120%

Example X2: 200HP, 460V, 240A Full Load, 1.15 S.F.
Across-the-line start.
240 Amps exceeds the highest rated 2E Relay, therefore, external CT's must be used, and the HPlY , 7 AT rated 2E, will be chosen as the standard model when the current exceeds the HP3Y 's rating. If 300/5 CT's are used,

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the Current Setting 8 $= \frac{240 \times N(T) \times 100\%}{7 \times (300)/5}$

$= N(T) \times 57.14\%$.

And if 2 turns through the 2E Relay's CT windows (from the external CT's) are used, the % Dial Setting = 2 x 57.14 = 114% = 110% or 115%

(2) Time setting

Determine the protection curve from 2E Relay operating curves shown in Fig. 1, and read the operating time at 600% of setting current. 'Adjust the time setting dip switch to the nearest setting above the operating time. When using the RC81A or RC81C with the 2E Relay, determine the settings with the same manner mentioned above.

(3) Fault Indication and Reset

The LED on the 2E relay is illuminated by any trip condition.

The optional module's have individual indicators (LED's). When the 2E Relay detects an overload, single phase or phase unbalance condition, and the LED indicator lights, throw the reset toggle switch to reset the relay. When the 2E relay equiped with an optional module detects a phase reversal or ground fault reset the toggle switch of the 2E relay and optional module to turn off both LED'S.

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INSPECTION AND MAINTENANCE

Before inspection and maintenance, read the following items to determine the maintenance period.

Intervals of inspection

(1) When the 2E Relay and/or additional module in an ordinary electric control room is operated under relatively good environmental conditions . . . . . Approx. annually

(2) When the 2E Relay and/or additional module is operated under adverse environmental conditions . . . . . Approx. semi-annually

Items to be inspected

(1) Dust accumulation . . . . . When dust accumulation or contamination is observed near the current-conducting components, wipe them clean with a soft, dry cloth. Do NOT use gasoline, bengine, or other organic solvents.

(2) Loose scress

(3) Preset points of the current-setting and time-setting switches

(4) Operation of the test switch, if necessary

(5) Operating characteristics, if necessary

(6) Damage or other defects

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TROUBLE-SHOOTING

In case of trouble, determine the cause of the trouble in accordance with the sequence shown in Fig. 10 or Fig. 11. After clarifying the cause, take the actions shown in the chart to correct the problem.

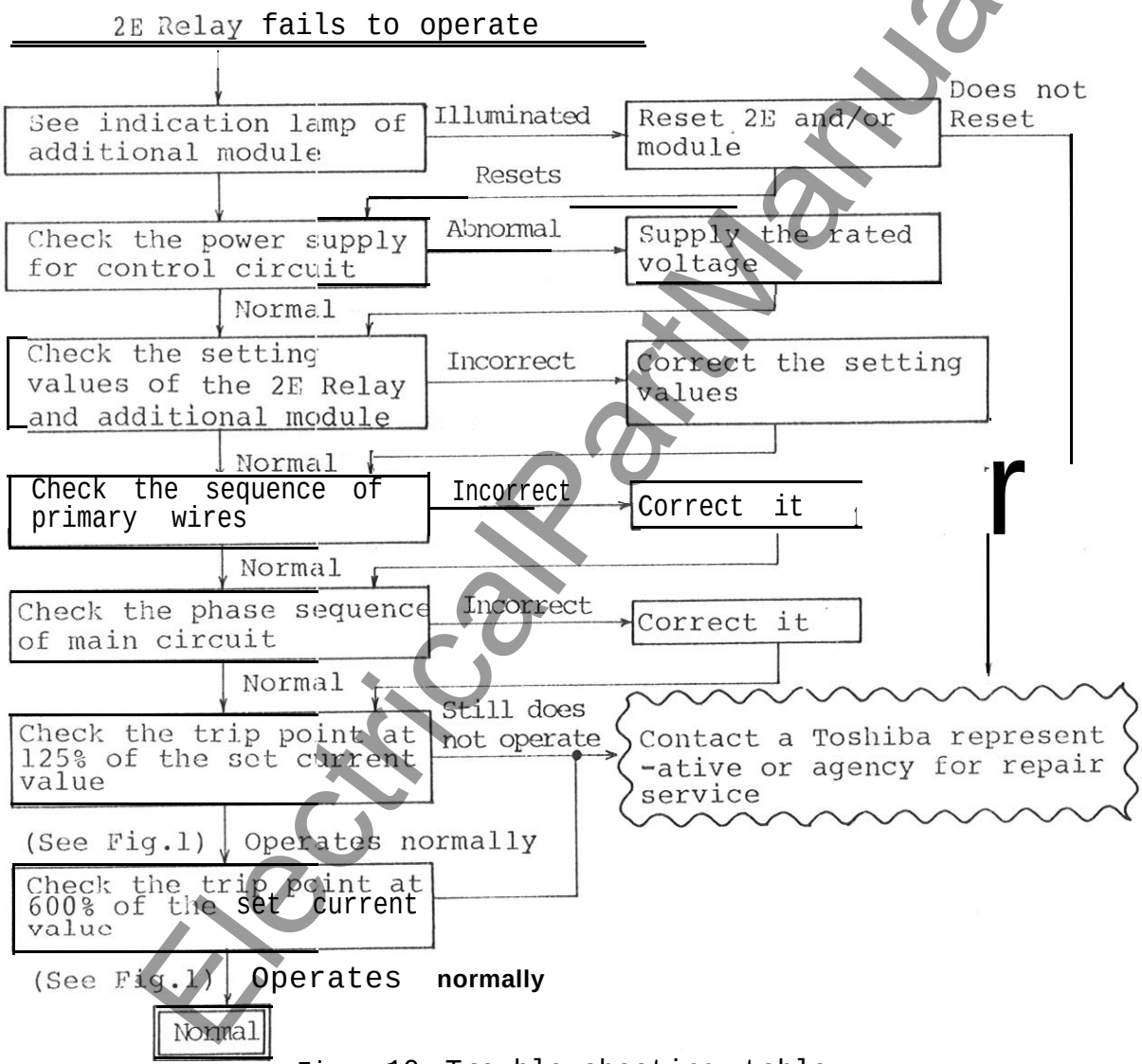

Fig. 10 Trouble-shooting table
(When 2E Relay fails to operate)

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2E Relay trips during motor start-up and operation

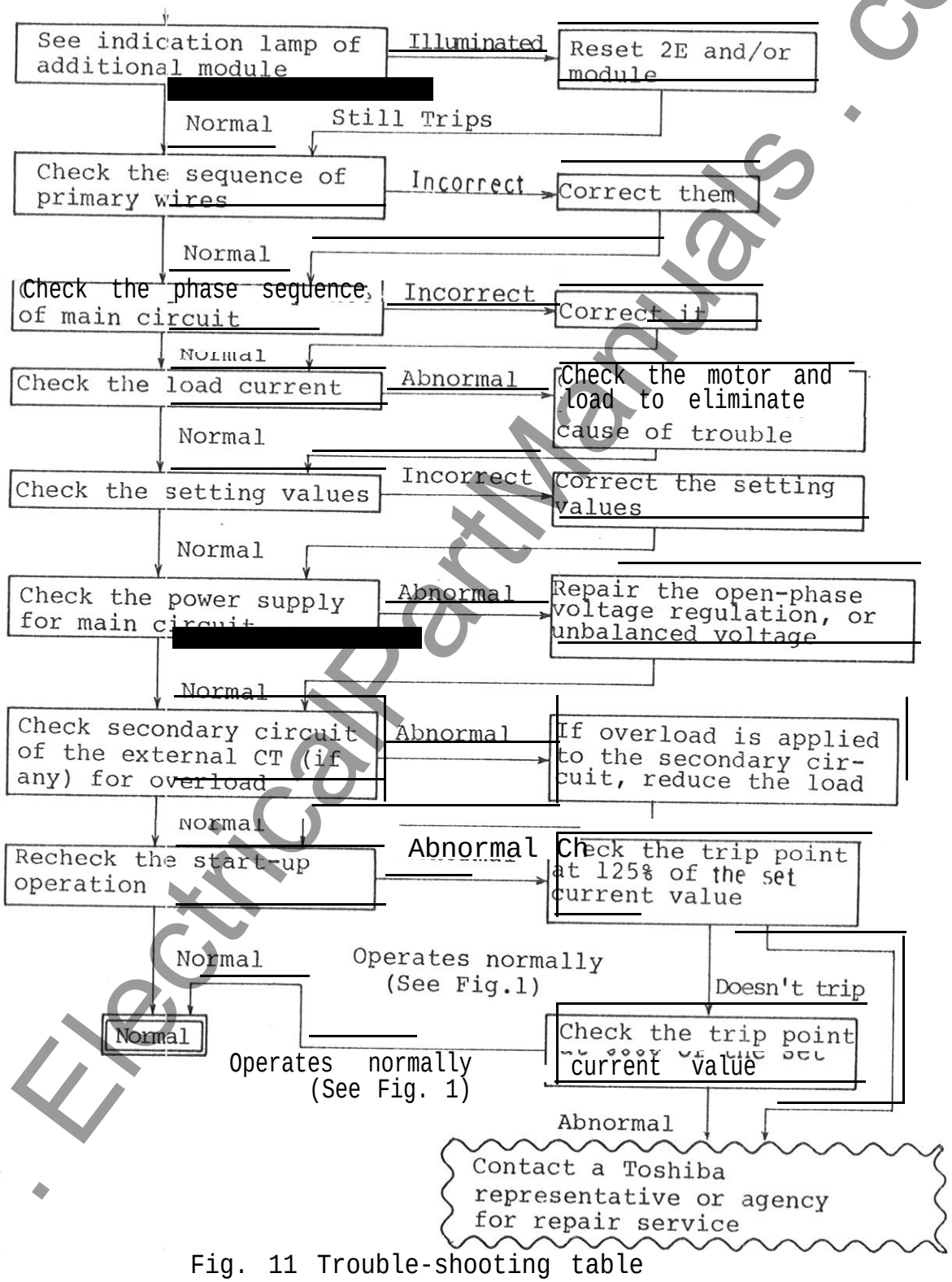

Fig. 11 Trouble-shooting table

(When 2E Relay operates during motor start-up and operating)

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INSTALLATION TEST PROCEDURE

It is not necessary to schedule periodic maintenance and testing of the ground fault protection. However, if tests are desired to confirm the proper operation of the system, one of the following procedures can be used.

1. Mounted in control panel

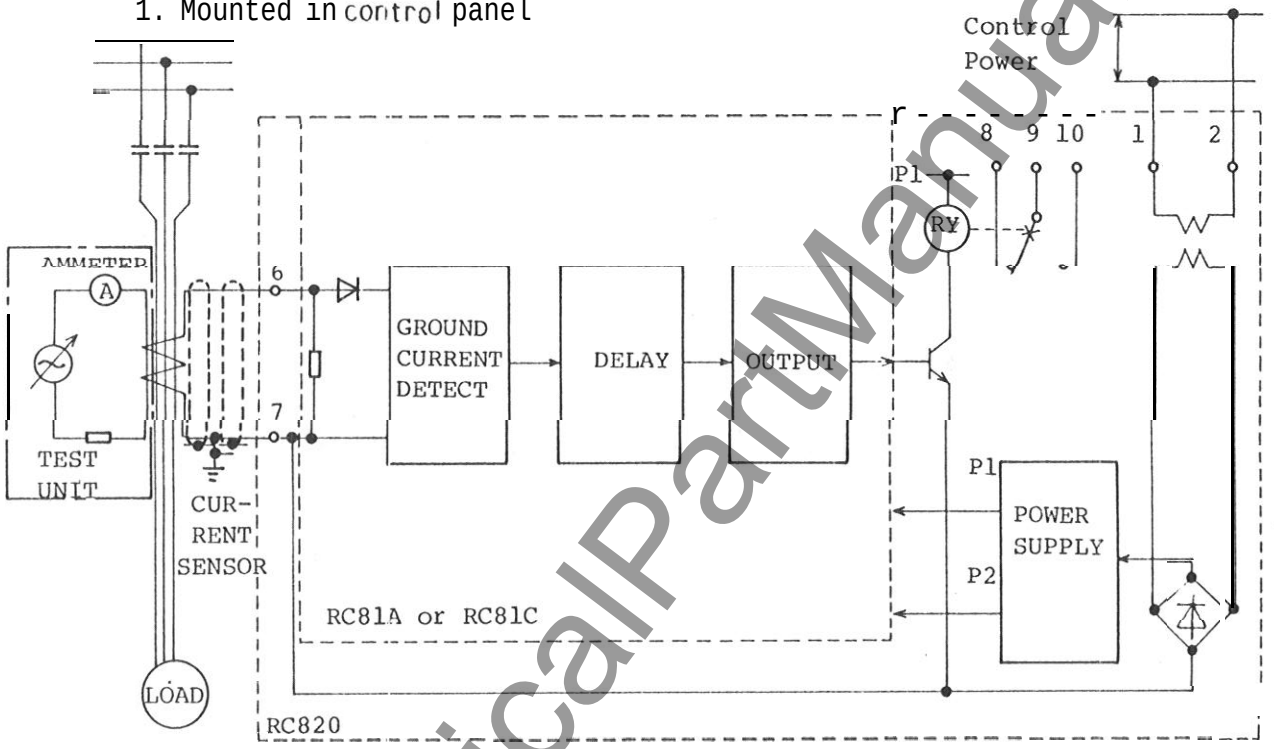

Fig. 12 Test circuit

Note.

The above figure shows the relay reset. (not tripped).
The resistor in the test unit is for current limiting.

1. When testing the ground fault module, keep the main circuit de-energized.
2. Set the ground current knob at a proper value of IGS. (ground fault trip point)
3. Connect the test wire through the ZCT window as show in Fig. 12.
4. Apply control power to the 2E and interrupting device.
5. Apply 1.25xIGS with the test circuit and interrupt the current when the relay operates.
6. Check the operation of the relay with test switch on the 2E and check that the LED indicator lights.
7. If the relay does not operate at the set time, interrupt the test current., cheek the current setting and the repeat test.

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2. Bench Test

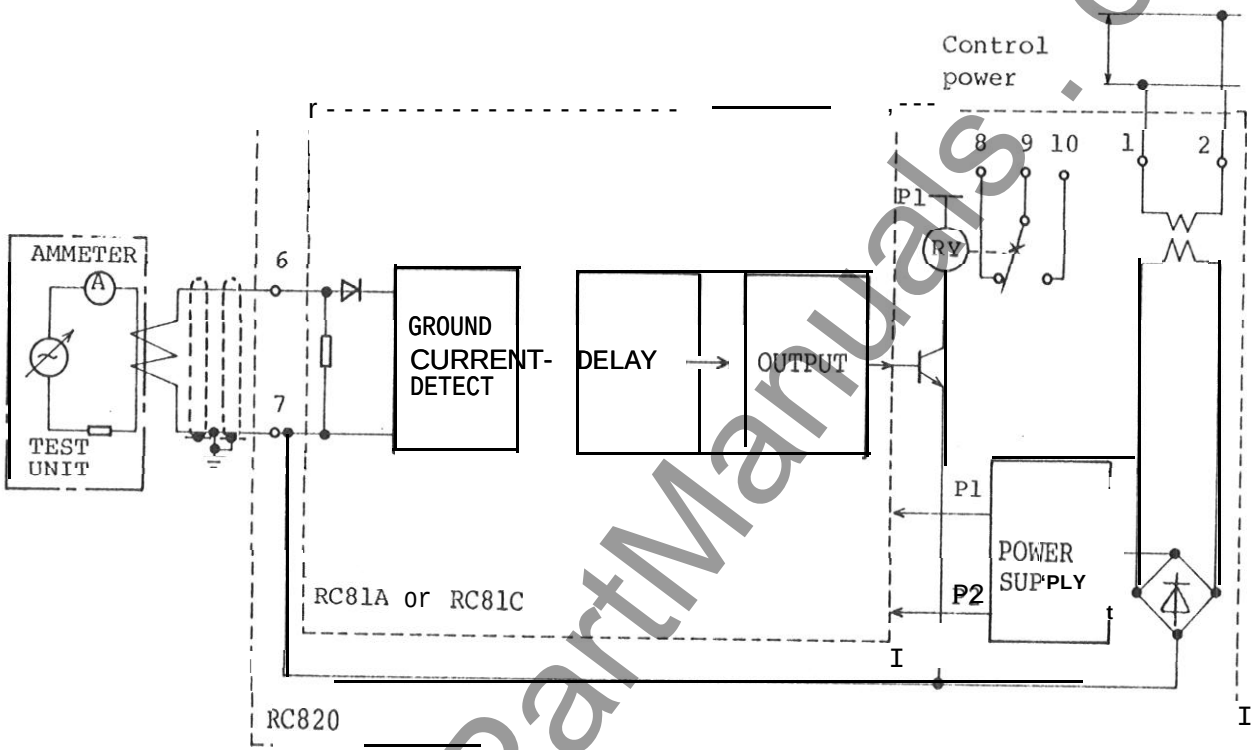

Fig. 13 Test circuit

Note.
The above figure shows the relay reset.(not tripped).
The resistor in the test unit is for current limiting.

1. Connect the sensor and relay as shown in FIG. 13.
2. Set the ground current knob at a proper value of IGS (ground fault trip point).
3. Apply 1.25xIGS with the test circuit and interrupt the current when the relay operates.
4. Check the operation of the relay with the test switch on the 2E and check that the LED indicator lights.
5. If relay does not operate at the set time, interrupt the test current, check the current setting and repeat the test.

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GROUND FAULT TEST FOR

No.	Date	Setting	Test current	Result	Note
1					
2					
3					
4					
5					

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