



INSTRUCTIONS

GEK-26433
INSERT BOOKLET GEK-7386

STATIC GROUND DISTANCE RELAYS

TYPE SLCG1E

POWER SYSTEMS MANAGEMENT DEPARTMENT

GENERAL  ELECTRIC

PHILADELPHIA, PA.

Contents

	<u>Page</u>
Description.....	3
Range Of Adjustment.....	3
D-C Burden.....	4
Application.....	4
MT.....	4
G1.....	4
G2.....	4
G4.....	4
Calculation Of Settings.....	5
Setting Of MT.....	5
Setting Of G1 - G2 - G4.....	5
Timer Settings.....	5
Installation Tests.....	5

STATIC GROUND DISTANCE RELAY
TYPE SLCG11E

DESCRIPTION

The Type SLCG11E relay is a mho type ground distance relay that was specifically designed to provide high speed single-phase-to-ground fault protection in directional comparison carrier blocking pilot relaying schemes. These instructions supplement the basic instruction book GEK-7386 which is included with this book. It is recommended that the basic book be reviewed in conjunction with this book.

This relay is packaged in two separate cases. One case of 3 rack units contains the magnetic circuits and tap adjustments (tap block unit) while the other case of 2 rack units houses the solid state logic circuits (logic unit). These two cases are shown in the basic instruction book. In addition, an auxiliary current transformer is sometimes used to provide the mho function with zero sequence current compensation. This transformer is shown in Figure 1.

The SLCG11E1 and E2 relays are for use with CS26A carrier and the SLCG11E3 relay is for use with CS26B carrier. The internal connections for the tap block and logic units are shown in the Figures as indicated by the following table:

	TAP BLOCK UNIT	LOGIC UNIT
SLCG11E1	Fig. 2	Fig. 4
SLCG11E2	Fig. 3	Fig. 4
SLCG11E3	Fig. 3	Fig. 5

Component locations for the tap block unit are shown in Figure 6. Card and component locations for the logic unit are shown in Fig. 7.

A simplified elementary diagram for this relay is shown in Figure 8. This includes the connections to the auxiliary current transformer to provide the zero sequence current compensation. This transformer is optional and is only supplied when ordered. A complete terminal requires, in addition to the SLCG11E, a suitable phase relay such as the SLY, SLA auxiliary logic and tripping relay, SSA power supply, test panel, and a pilot channel.

The measuring functions included in this relay are as follows:

- MT - Three single phase directional ground mho tripping functions.
- G1 - Non-directional zero sequence instantaneous overcurrent function for carrier starting.
- G2 - Non-directional zero sequence instantaneous overcurrent function for trip level supervision.
- G4 - Non-directional zero sequence direct trip instantaneous overcurrent function.

For a complete description of the overall scheme in which this relay is employed, refer to the overall logic diagram and the associated logic description that covers the specific components used in the scheme.

RANGE OF ADJUSTMENT

The various functions in the SLCG11E that are listed above each has a range of adjustment. These are noted below. Note that subsequent to this writing additional ranges may have been made available. Check nameplate on relay for confirmation of ranges.

	SLCG11E1	SLCG11E2	SLCG11E3
G1	0.4-4	0.4-4	0.4-4
G2	0.5-8	0.5-8	0.5-8
G4	10 - 80	10 - 80	10 - 80
MT REACH IN OHMS AT 60° MAX. REACH ANGLE	2-60	2-60	2-60
MT REACH IN OHMS AT 75° MAX. REACH ANGLE		2.6-78	2.6-78

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the General Electric Company.

To the extent required the products described herein meet applicable ANSI, IEEE and NEMA standards; but no such assurance is given with respect to local codes and ordinances because they vary greatly.

D-C BURDEN

The maximum d-c burden of the Type SLCG11E relay is 130 ma.

APPLICATION

The SLCG11E relay is designed for use in directional comparison blocking pilot relaying schemes. The phase relay usually used is an SLY or SLYL and a suitable SLA pilot control and trip auxiliary relay is also required. Refer to the basic book GEK-7386 for a general description of the SLCG relay and its functions.

MT

In the directional comparison scheme the MT function should be set so as to detect a single-phase-to-ground fault at the remote bus of the protected line section with at least a 25%, preferably a 50%, margin. The required mho function reach will depend upon whether or not zero sequence current compensation is used and whether or not zero sequence mutual impedance is present. Zero sequence current compensation for the impedance of the protected line makes the relays well suited for use on longer transmission lines since it is possible to reduce the mho function ohmic reach setting and still provide adequate line coverage. The smaller ohmic reach setting reduces the likelihood of the relay interfering with the load carrying ability of the line. Refer to Appendix II of the basic book GEK-7386 for a detailed discussion of zero sequence current compensation.

The sensitivity of the MT function is measured by the relation between the relay fault current and the reduction of the ohmic reach of these functions as the current decreases. The sensitivity is defined as the minimum relay current required for the minimum ohm tap selected that will cause the MT reach to pull back to no less than 90% of the nominal or set reach. Relay current is defined as the phase current or the phase current plus the zero sequence compensation current when it is used. For the MT function these current requirements are as follows:

<u>RELAY TAP</u>	<u>RELAY CURRENT</u>
2 ohms	2.5 amperes
6 ohms	0.85 amperes

The MT function has a maximum reach angle which is adjustable from 60 to 75 degrees. It is recommended that the 60 degree setting be used wherever possible because it will accommodate more fault resistance than the 75 degree setting. This is of particular importance with ground faults since they tend to include higher fault resistance than do phase faults. Changing the maximum reach angle from 60 to 75 degrees changes the basic minimum taps from 2/6 to approximately 2.6/7.8 ohms.

G1

The G1 function is used to initiate the carrier blocking signal in the directional comparison scheme. It should therefore be set at the minimum setting of its operating range, 0.4 amp. In any event it should never be set any higher than 75 percent of the setting of G2 at the remote end of the protected line. This will insure the proper coordination so that carrier blocking is started to properly block tripping on external faults. Since the G1 is a blocking function, setting it to operate as sensitively as possible simply adds to the security of the scheme against false tripping.

G2

The G2 function is used to provide tripping level supervision of the MT functions. The G2 setting at one line terminal must never be less than 4/3(1.33) times the G1 setting at the remote line terminal. The G2 pickup also must not exceed 75% of the minimum single phase to ground fault current in the relay for a fault at the remote bus with the remote breaker closed. If zero sequence line charging current is significant refer to Appendix V of the SLCG basic book GEK-7386.

It is desirable to set the G2 pickup as high as possible as long as it will operate for all internal line faults under all system conditions. The higher the G2 setting the less the risk of false tripping and the more secure is the overall scheme.

G4

The G4 overcurrent function must be set to operate at 125% or more of the maximum external single phase to ground fault current. Since this unit is non-directional, the heaviest fault current condition

must be considered whether it be the remote bus location or on the bus immediately behind the relay location.

Refer to Appendix IV of the basic book GEK-7386 for a discussion of the application of this relay to three terminal lines.

CALCULATION OF SETTINGS

SETTING OF MT

The calculation of settings for the MT function are discussed in detail in the basic book GEK-7386.

SETTING OF G1 - G2 - G4

Refer to the APPLICATION section and the basic book GEK-7386 for a discussion of the unit's characteristics and the suggested settings. A short circuit study of the system is necessary to determine the proper pickup settings for these units.

TIMER SETTINGS

It should be noted that the 4/9 measuring unit timers, T13 cards, are factory set and are not intended for field adjustment. The 0-50/0 timer, T28 card, is usually factory set for zero pickup delay unless otherwise specified. This time delay in the trip output is usually only required for coordination of the SLCG11E relay with electromechanical relays at the remote line terminal. Refer to the basic book GEK-7386 for the procedure of how to check and adjust timers.

INSTALLATION TESTS

Installation tests are covered in the basic book GEK-7386. Refer to Appendix II-B for zero sequence compensation.

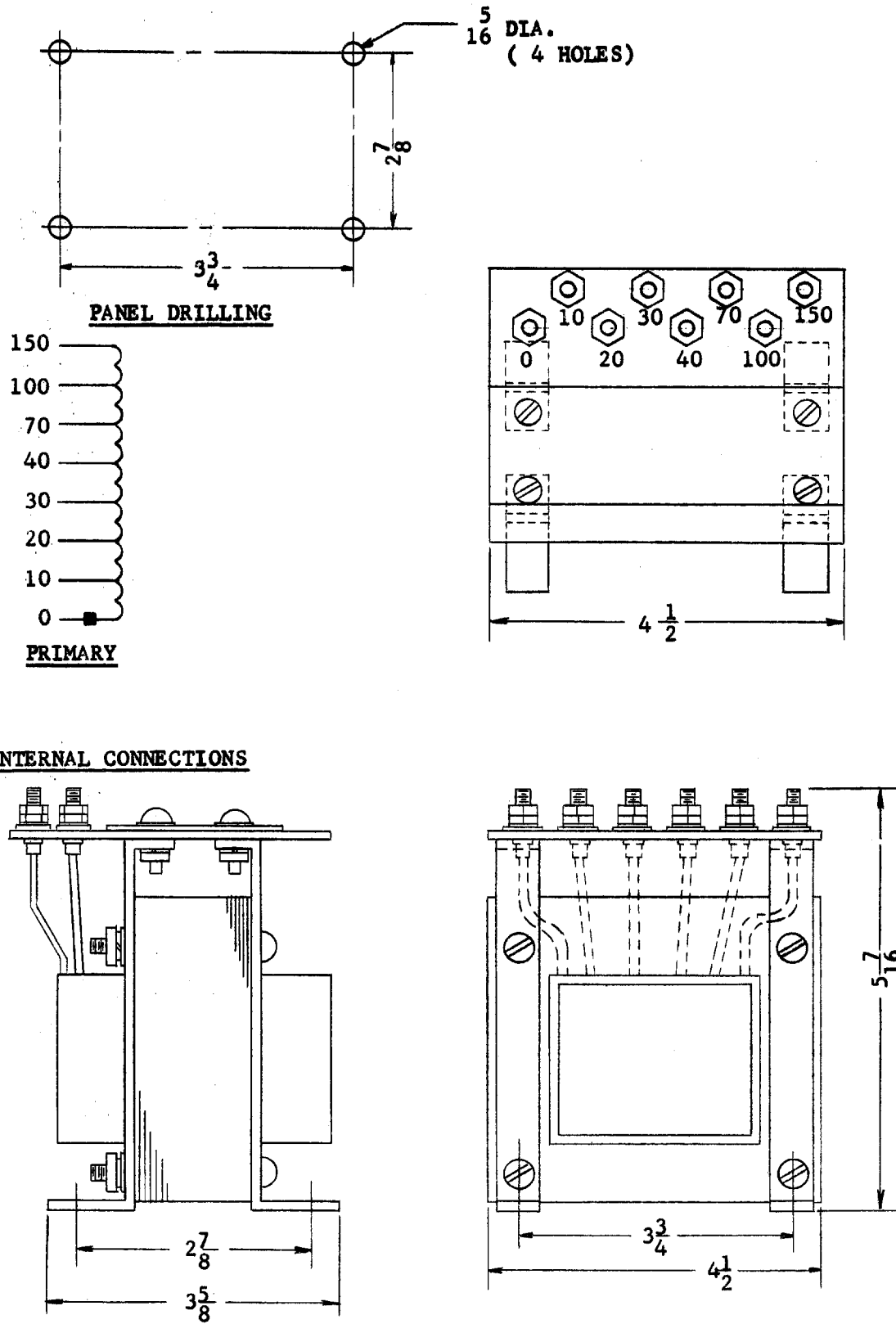
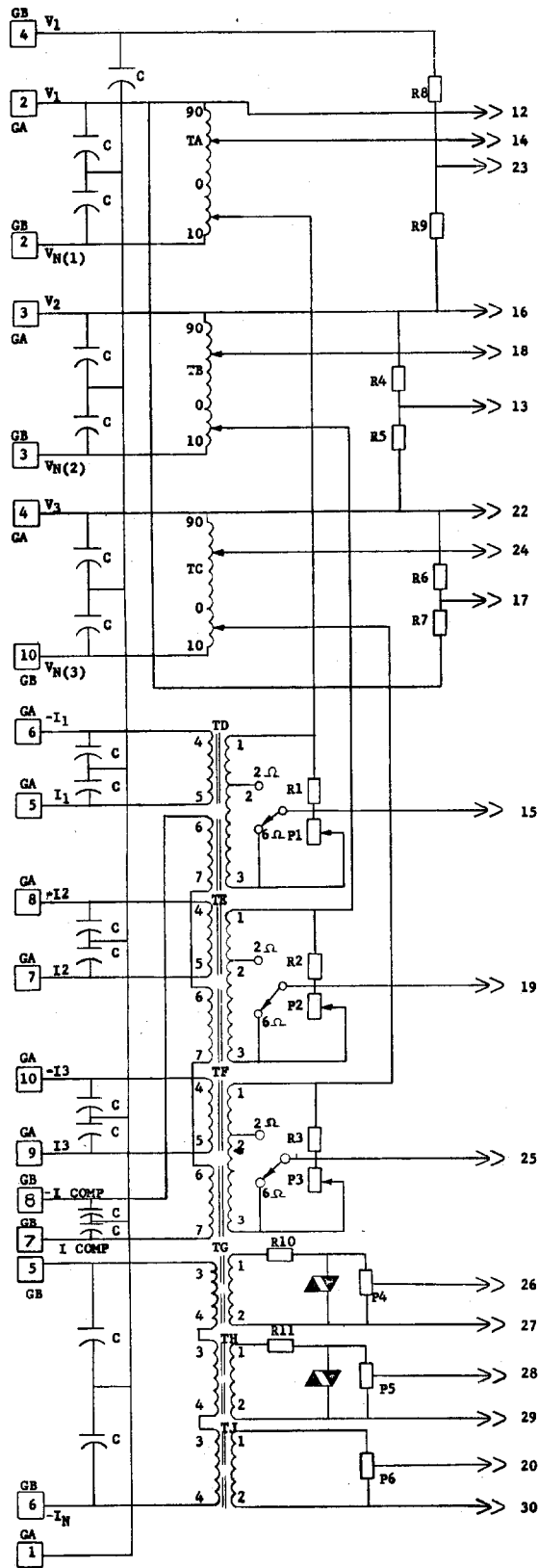


FIG. 1 (0207A5465-0) OUTLINE OF AUXILIARY CURRENT TRANSFORMER

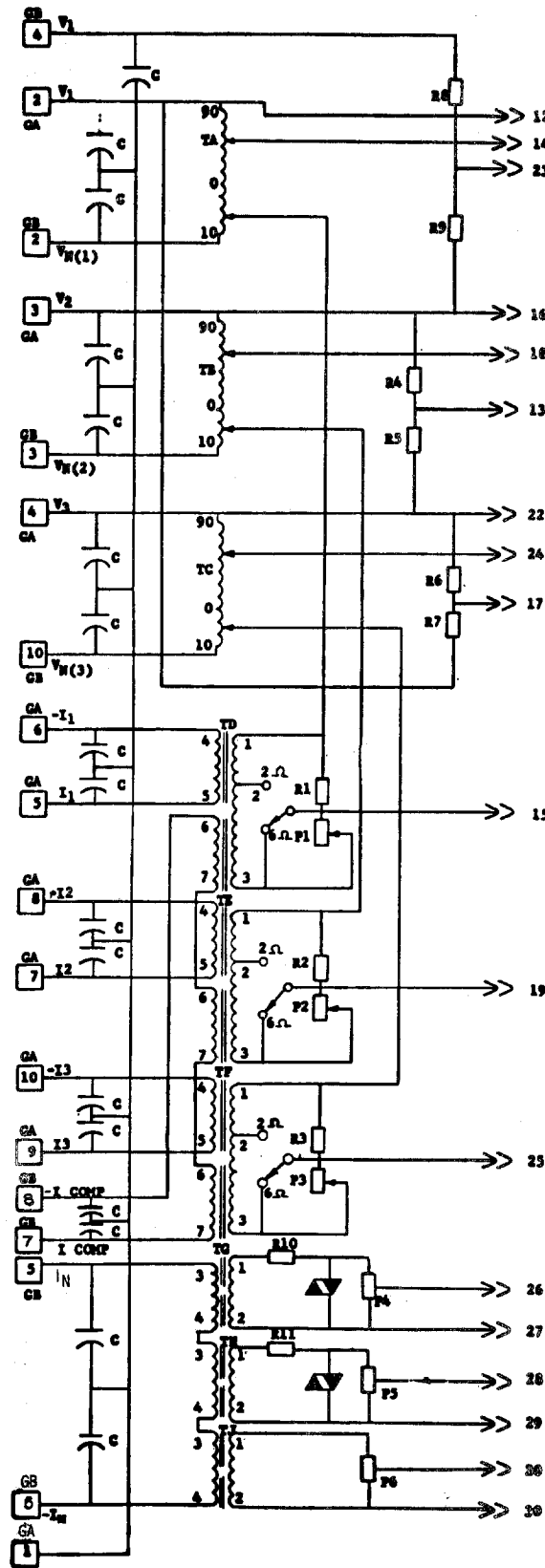


COMPONENT VALUES	
	OHMS WATTS
R1, R2, R3	600 10
R4, R5, R6, R7, R8, R9	2K 5
R10, R11	400 10
P1, P2, P3	250 12.5
P4, P5, P6	5K 12.5
C = 0.5 MUF	

NOTE: TRANSACTOR LEADS MARKED "S" ARE CONNECTED TO PIN NO. 1, ALL PLUG SOCKETS.

TO
SLCG11E
LOGIC UNIT

FIG. 2 (0108B7585-3) INTERNAL CONNECTIONS FOR TYPE SLCG11E-1 RELAY TAP BLOCK UNIT



COMPONENT VALUES		
	OHMS	WATTS
R1, R2, R3	600	10
R4, R5, R6, R7, R8, R9	2K	5
R10, R11	400	10
F1, F2, F3	2500	12.5
F4, F5, F6	5K	12.5
C = 0.5 MUF		

NOTE: TRANSACTOR LEADS MARKED "S" ARE CONNECTED TO PIN NO. 1, ALL PLUG SOCKETS.

TO LOGIC UNIT
TYPE SLCG11-

FIG. 3 (0165B2212-6) INTERNAL CONNECTIONS FOR TYPE SLCG11E2 AND E3 RELAY TAP BLOCK UNIT

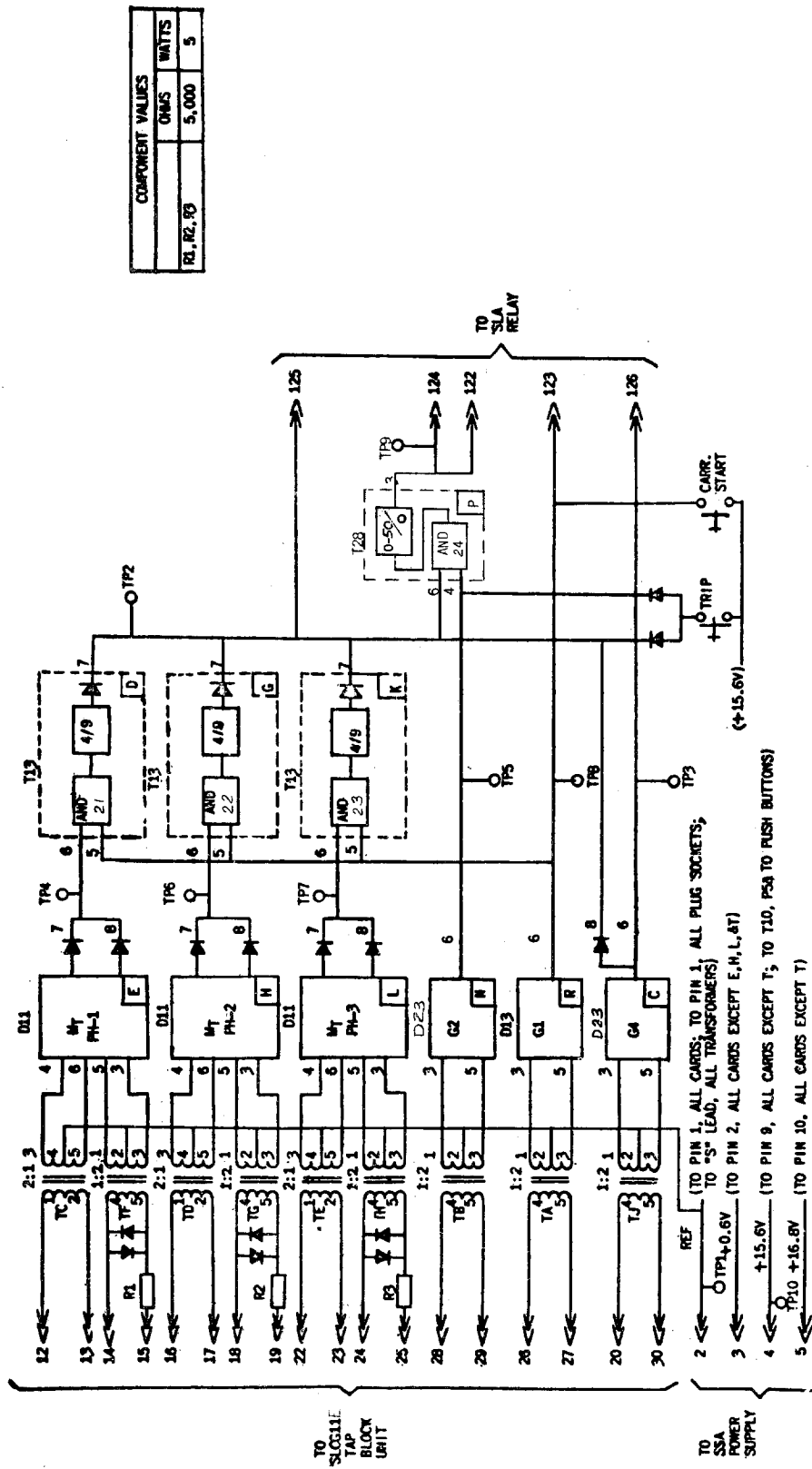


FIG. 4 (0108B7584-2) INTERNAL CONNECTIONS FOR TYPE SLCG11E1 AND E2 RELAY LOGIC UNIT

COMPONENT VALUES		
RES.	OHMS	5
REL. RZ, R3	5,000	5

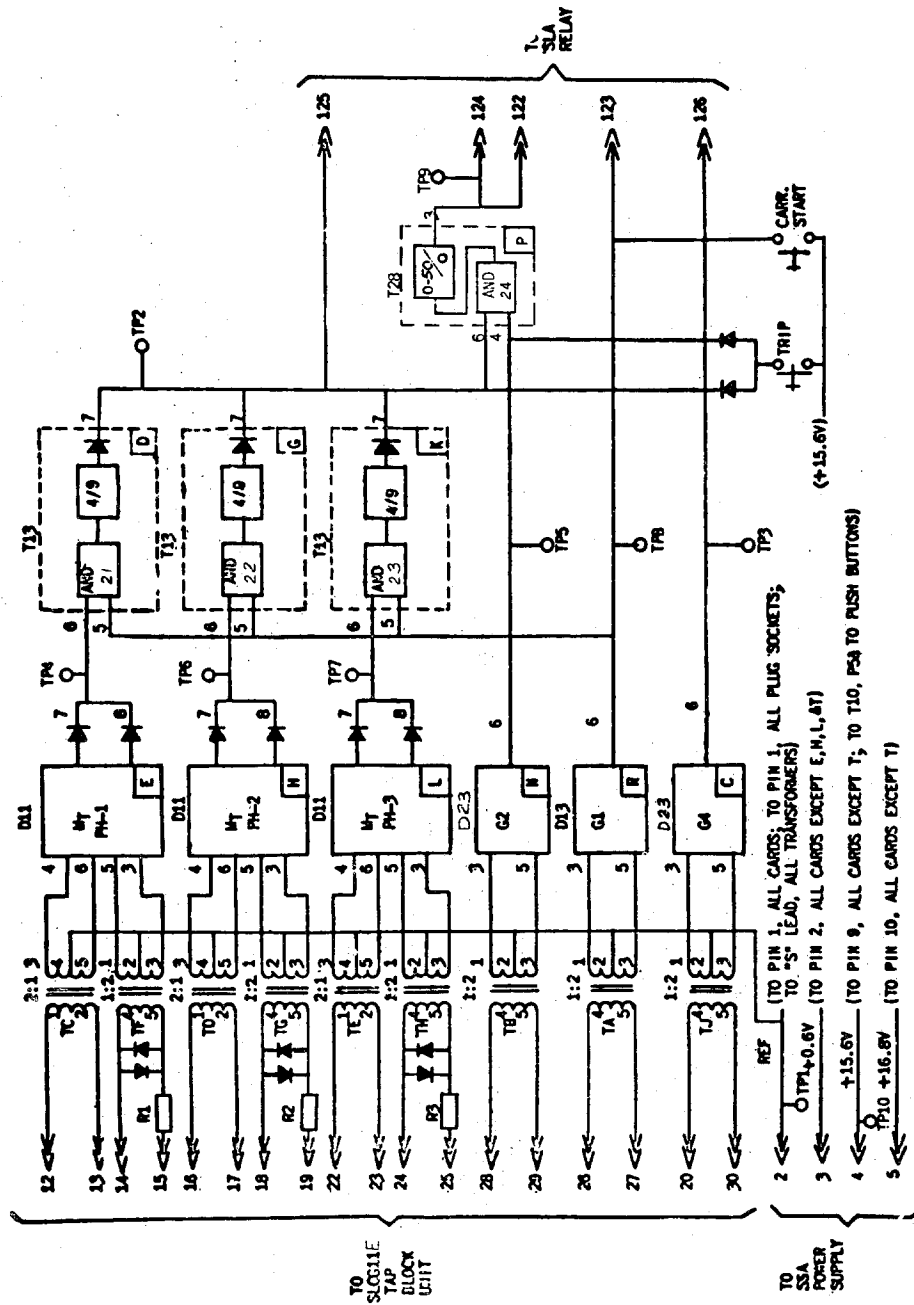


FIG. 5 (0165B2305-0) INTERNAL CONNECTIONS FOR TYPE SLCG11E3 RELAY LOGIC UNIT

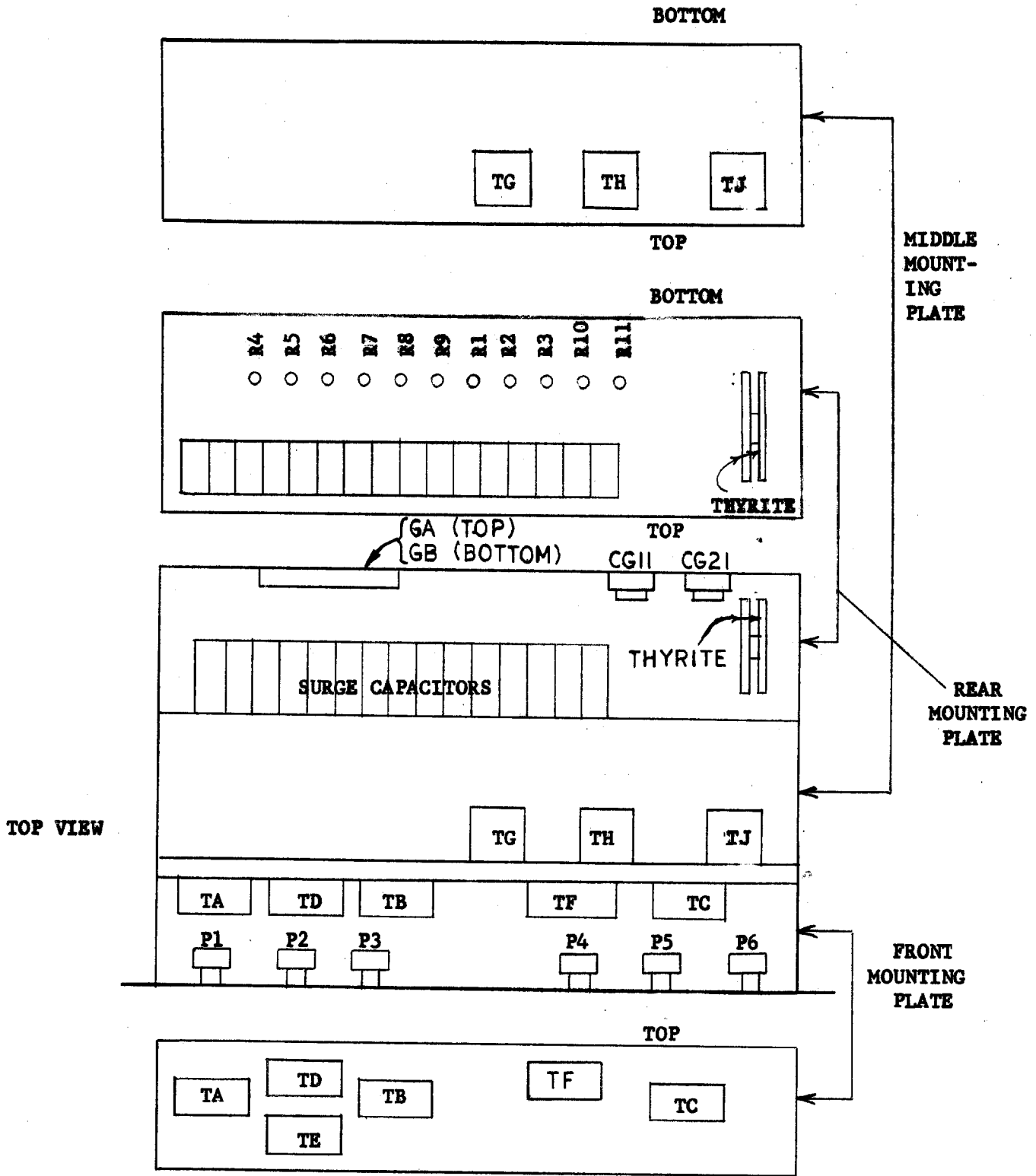
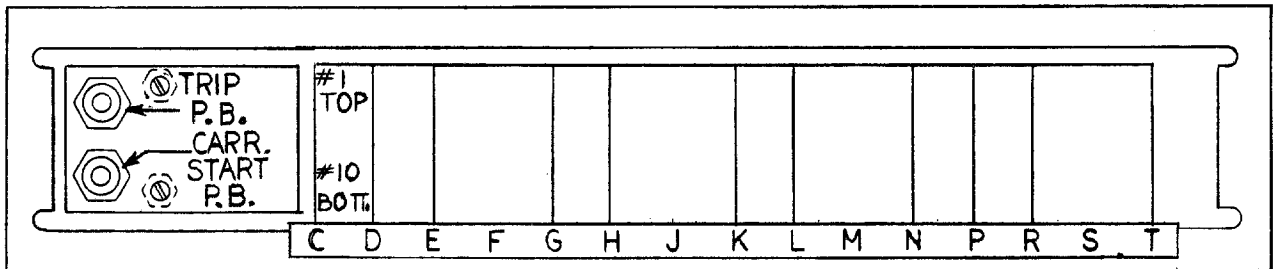
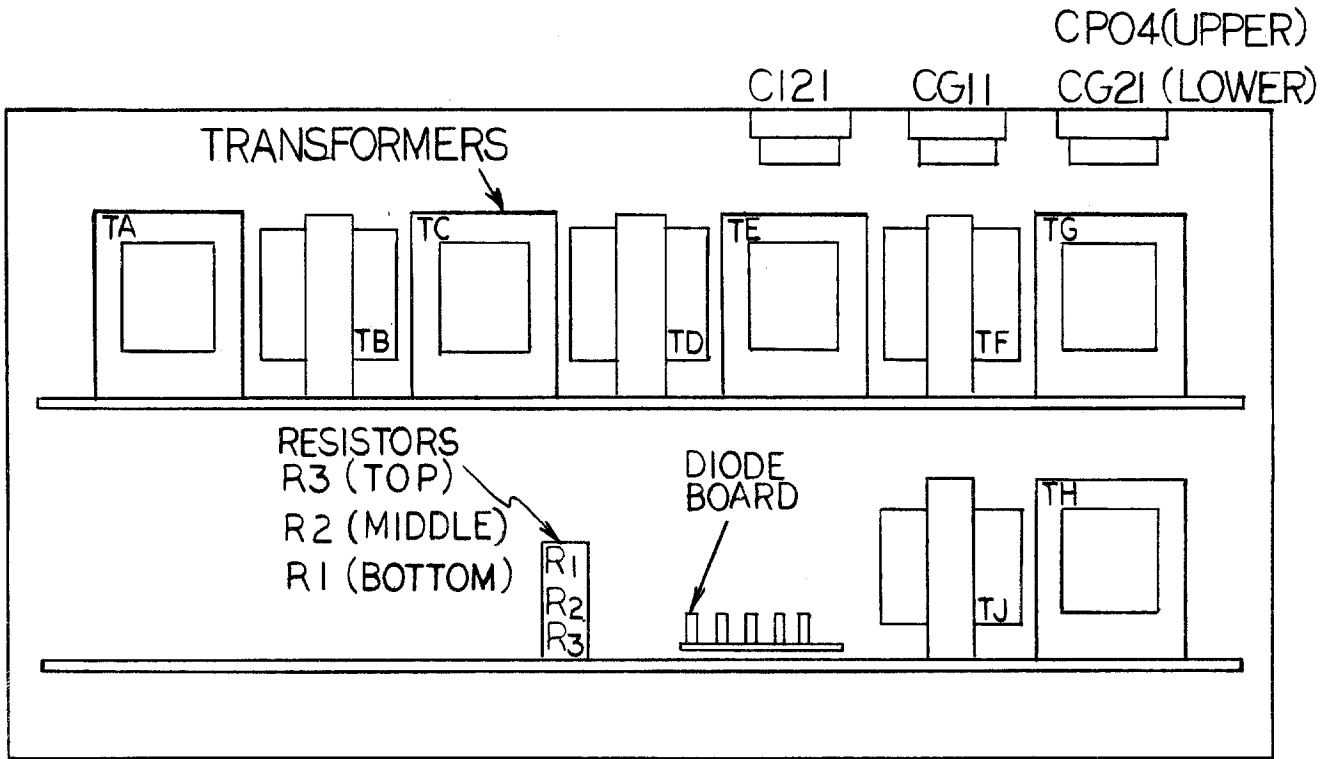


FIG. 6 (0178A7180-2) LOCATION OF COMPONENTS FOR TYPE SLCG11E RELAY TAP BLOCK UNIT



PRINTED CIRCUIT CARD REFERENCE

<u>TYPE</u>	<u>POSITION</u>	<u>CAT NO</u>
D11	E, H, L	0116B6773G1
D13	R	0116B6775G1
D23	C, N	0138B2606G2
T13	D, G, K	0127B8149G1
T28	P	0137B8450G1

FIG. 7 (0208A3789-1) LOCATION OF COMPONENTS FOR TYPE SLCG11E RELAY LOGIC UNIT

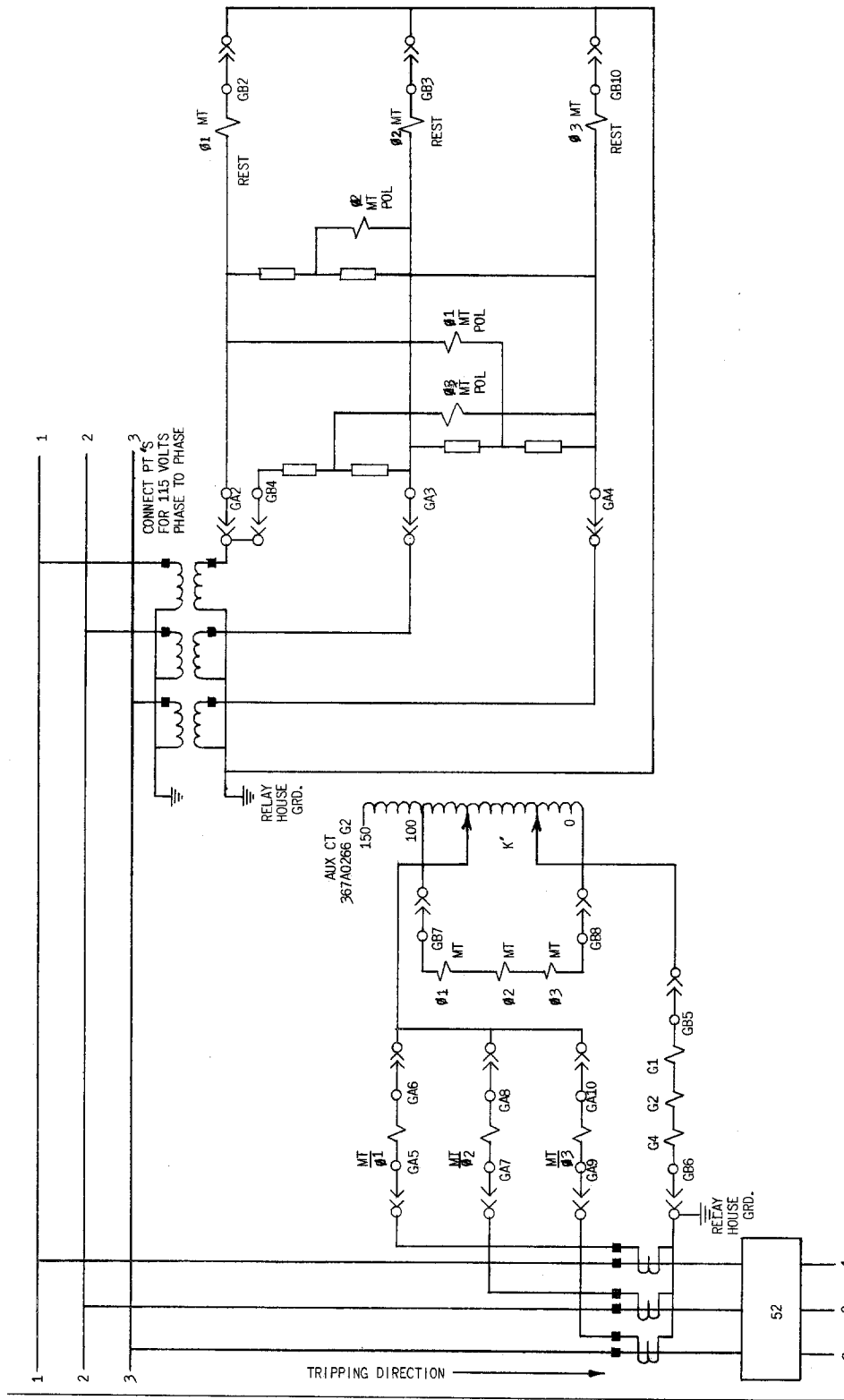


FIG. 8 (0108B8900-0) SIMPLIFIED ELEMENTARY DIAGRAM OF TYPE SLCG11E RELAY WITH ZERO SEQUENCE COMPENSATION



GE Power Management

215 Anderson Avenue
Markham, Ontario
Canada L6E 1B3
Tel: (905) 294-6222
Fax: (905) 201-2098
www.GEindustrial.com/pm