INSTRUCTIONS

GEK- 34024A

SUPERSEDES GEK-34024

STATIC THREE PHASE

OFFSET MHO DISTANCE RELAY

TYPE SLY53A

GENERAL ELECTRIC

CONTENTS

DESCRIPTION

The type SLY53A is a static, three phase mho distance relay with provisions for offsetting the characteristic. The relay is used primarily to provide the carrier starting function in directional comparison pilot relaying schemes. One type SLY53A relay will detect all multi-phase faults that fall within its reach setting. The SLY53A relay is packaged in one 2 - rack unit case as shown in Figure 1. Component locations for the SLY53A are shown in Figure 2.

The SLY53A relay is not intended to be used by itself, but rather as part of a complement of equipment that forms a protective relaying scheme. For example, in addition to the SLY53A, a typical directional comparison pilot relaying scheme may be composed of a type SLC overcurrent relay, a type SLY phase tripping relay, a type SLYG ground relay, a type SLA logic relay, a type SLAT output relay and a type SSA power supply. Figure 3 illustrates typical external connections to the SLY53A relay when it is used in a directional comparison blocking scheme.

The type SLY53A relay outputs are d-c logic signals that are fed into a type SLA logic relay, the circuitry of which depends on the overall protection scheme. The static circuits of the SLY53A require ±15V d-c which is obtained from a type SSA power supply. The internal connections for the SLY53A relay are shown in Figure 7.

The type SLY53A relay includes two tap blocks for setting the reach in the blocking and offset directions. These reach settings are commonly referred to as MB* (blocking) and MB (offset).

For a complete description of the overall scheme in which this relay is employed, refer to the overall logic diagram and its associated logic description that is supplied with each complete terminal of equipment.

APPLICATION

The SLY53A is an offset mho distance type relay and it is used primarily to provide the carrier starting (blocking) function in directional comparison relaying schemes. However, it may also be applied in conjunction with a suitable timing function for non-directional time delay backup protection. The relay will provide protection against all multi-phase faults.

The SLY53A relay is not intended for use by itself, but rather is meant to be used as part of a complement of equipment to complete a protective relaying scheme. The additional relays and other equipment required to complete a specific scheme are dependent on the nature of the scheme and are described in the logic description that accompanies the overall logic diagram for that particular scheme. Figure 3 illustrates typical external connections to the SLY53A relay when it is used in a directional comparison blocking scheme.

In a directional comparison blocking scheme, the blocking (carrier starting) functions must be able to detect all faults outside the protected line section that the MT functions at the remote end of the line are also to detect including any effects of arc resistance that may be present. If this were not so, carrier would never be started for certain faults. A blocking signal would not be sent and the remote MT functions would produce a false trip. Figure 4, where the blocking function (MB) at station B and the tripping function (MT) at station A have been plotted on an R-X diagram, illustrates this point.

Referring to Figure 4 it will be noted that for any external fault along or near the angle of the protected line for which the MT function will operate at A, the MB function at B will also operate. However, for a fault just beyond terminal B with sufficient arc resistance to plot in the shaded area, the MT function at A is apt to operate while the MB function at B will not. For this condition a false trip could result. An increase in either the MB offset reach setting or its reach setting in the blocking direction, or both, would eliminate this source of trouble.

With regards to the above, it should be recognized that fault resistances that are relatively large as compared to the relay settings will generally occur on short lines where increased reach settings of both the tripping and blocking functions introduce no load limiting problems. On long lines, the arc resistance tends to be smaller relative to the relay settings so that any reasonable setting of MB will suffice.

The reach settings for the SLY53A will depend to some degree on the specific application. Thus, for any given equipment, the description of the scheme that accompanies the logic diagram should be consulted for specific recommendations concerning the settings. However, as a general rule the following guide lines should be followed.

1. Set the offset which is the reach in the tripping direction (MB) for at least 25 percent of the ohmic length of the line.
2. The reach setting in the blocking direction (MB*) should be based on whichever of the following two criteria results in the larger setting.

   a) The ohmic reach setting in the blocking direction should be at least as great as the ohmic reach setting of the MT function at the remote end of the line.
   b) The ohmic reach setting in the blocking direction should be at least twice as great as the remote MT function reach beyond the end of the line. That is, referring to Figure 4, the distance $\overline{BC}$ should be at least twice the distance $\overline{BD}$.

3. Where required, the settings should be such that the shaded area on Figure 4 would be eliminated.

In order to actually make the settings discussed above, it is necessary to select basic tap settings and percent restraint settings. In general, the sensitivity of the MB function increases as the basic tap settings is raised. Therefore, it is recommended that the highest basic tap setting that will accommodate the desired reach setting should be used. In selecting the basic tap setting for the reach in the blocking direction, it is necessary that the tap selected be at least equal to and preferably greater than the basic tap setting used in the MT function at the remote end of the line. This must be done even if it means setting a larger circle diameter than initially contemplated. If this procedure is followed, the MB function in this relay will automatically coordinate with the MT function in the SLY51A at the remote end of the line.

On three terminal lines, the same general considerations apply. The blocking function must detect all faults outside the protected area that can be detected by the MT tripping functions at the remote terminals. The application is more complex and the effects of infeed must be considered in setting the MT functions. Consequently, the settings of the blocking functions will be affected accordingly. Infeed affects the apparent impedance seen by the MT functions and the fault can appear to be further away impedance wise than it actually is. Increase in the infeed leads to an increase in the apparent impedance and consequently to an increase in the required reach settings of the MT functions. With infeed removed, the MT functions will reach considerably farther beyond the remote terminals. This must be considered in setting the blocking functions if they are not to be outreached by the tripping functions during zero infeed conditions.

There is a certain amount of flexibility in the recommended settings. In general, the larger the setting of the MB function relative to the remote MT function, the more secure will be the application. However, the gain diminishes rapidly beyond the recommendations given above. In any case, the MB function should not be set so big that maximum load and/or minor system swings will cause it to produce an output.

RATINGS

The Type SLY53A relays are designed for use in an environment where the air temperature outside the relay case does not exceed 65°C.

The current circuits of the Type SLY53A relay are rated at 5 amperes, 60 cycles, for continuous duty, and have a one second rating of 300 amperes. The potential circuits are rated 120 volts, 60 cycles.

The range of adjustment of the functions in the Type SLY53A relay are listed below:

MB BLOCKING

Reach in tripping direction - 0.2 to 30 ohms at 75°
Reach in blocking direction - 1.0 to 40 ohms at 75°

BASIC TAPS:	MB	MB*
	0.2	1.0
	.75	2.0
	3.0	4.0

* BURDENS

The maximum Potential Burden per phase measured at 120 VRMS line voltage is as follows:

0.30 Volt Amp
0.24 Watts
0.18 Vars

The maximum Current Burden per phase measured at 5 amps line current is as follows:

$Z = 0.017 \angle 40^o$
$R = 0.013$
$X = 0.011$

OPERATING PRINCIPLES AND CHARACTERISTICS

The offset mho characteristic for the SLY53A relay is shown in Figure 5. This MB characteristic is a circle that does not pass through the origin. All measurements are made on a phase-to-phase basis. V_{a-b} is compared with I_a-I_b in order to obtain the same relay reach for a phase-to-phase, a three phase and a double phase-to-ground fault.

Four quantities are used to derive the relay characteristic. These quantities are $\overline{IZ_a}$, $\overline{IZ_b}$, $\overline{V_a}$, and $\overline{V_b}$. The $\overline{IZ}$ quantities are a voltage proportional to the line current obtained by passing the line current through a network consisting of a current transformer and a reactor. The setting of $\overline{IZ}_b$ establishes the "Base Reach" of the relay in the reverse (away from the protected line) direction. The quantities $\overline{V}_a$ and $\overline{V}_b$ are proportional to the polarizing voltage $\overline{V}$, which is the line voltage at the relay location, equal to $\overline{IZ}_F$, where $\overline{Z}_F$ is the line impedance out to the fault. The setting for $\overline{V}_a$ establishes the "Base Reach" of the relay in the forward (along the protected line) direction $\overline{V}_a$ is combined with $\overline{IZ}_a$ and $\overline{V}_b$ is combined with $\overline{IZ}_b$. The combined quantities $(\overline{V}_a-\overline{IZ}_a)$ and $(\overline{V}_b+\overline{IZ}_b)$ are the input quantities to the F103 printed circuit card. These quantities are converted into blocks of voltage. The output blocks of the F103 cards are then fed to the C103 card. The leading edge of the $(\overline{V}_b+\overline{IZ}_b)$ block generates a spike of voltage. This spike is compared with the block obtained from the $(\overline{V}_a-\overline{IZ}_a)$ quantity. Coincidence of the block and spike (having the same polarity) will produce an output from the C103 card. It should be noted that the $(\overline{V}_a-\overline{IZ}_a)$ quantity undergoes a 90^o lagging shift in the F103 card. Figure 6 shows the relationship of the $(\overline{V}_a-\overline{IZ}_a)$ and $(\overline{V}_b+\overline{IZ}_b)$ quantities.

MB BLOCKING FUNCTION

The MB function is an offset mho characteristic whose circle does not pass through the origin. See Figure 5.

If the 100% voltage tap is used, the phase to neutral reach of the relay at the angle of maximum reach, ϕ, is equal to the "Base Reach" taps chosen. This is true for both the forward and reverse reach of the relay. If a voltage tap other than 100% is chosen, relay reach is increased in inverse proportion to the voltage tap. For example, if the 50% voltage tap is used, relay operation still occurs for the same voltage applied to the measuring circuit, but since the actual line voltage is twice this amount, the relay reach is twice as great. The resulting circle has twice the reach, at any fault angle.

Relay reach for the MB unit at any fault angle may be calculated from the expression:

$$Z_{max} = \frac{IZ\ (TAP)}{V\ (Tap)} \quad X\ 100\ \text{(at angle } \phi) \qquad (1)$$

where V (Tap) is the restraint tap setting expressed in percent and $Zo = Z_{max} \cos(\theta-\phi)$. Zo is the impedance the relay will see at any angle θ. ϕ is the angle of maximum reach.

The angle of maximum reach, ϕ, of the Type SLY53A relay is fixed at 75^o.

CIRCUIT DESCRIPTION

The internal connections of the SLY53A relay are shown in Figure 7. The points on the left of the diagram designated YG2, YG3 and YG4 are the voltage inputs. The points at the lower left designated YG6 through YG10 are the current inputs.

The relay input voltage is passed through transformers which produce the V_a and V_b voltage. These voltages are fed to the F103 cards where they are combined with the IZ quantities. The IZ quantites come from the input current passing through a current transformer and a secondary current being passed through a reactor. The section above, "Operating Principles and Characteristics" describes how these inputs are combined and then pass through the F103 and C103 cards. The spike outputs of the three C103 cards are paralleled and fed to a P/100 "pulse-stretcher". This P/100 (T110 Card) "pulse-stretcher" converts the spike inputs to a continuous output logic signal. This signal is then fed by way of the C051 cable to an SLA logic unit.

* Indicates Revision

CHOICE AND CALCULATION OF SETTINGS

The following settings must be made in the SLY53A relay:

1. Offset (MB)
   a) Minimum basic reach tap (0.2, 0.75, or 3.0 ohms)
   b) Percent restraint tap setting (10 - 100)
2. Reach in blocking direction (MB*)
   a) Minimum basic reach tap (1.0, 2.0 or 4.0 ohms)
   b) Percent restraint tap setting (10 - 100)

Both MB and MB* have a fixed angle of maximum reach of 75°. To illustrate the determination of the required settings, assume a two terminal line having the following characteristic to be the protected line.

Z_L = 21 /85° primary ohms

CT Ratio = 2000/5

PT Ratio = 3000/1

In terms of secondary ohms,

$$Z_L \text{ (sec)} = Z_L \text{ (pri)} \times \frac{\text{CT Ratio}}{\text{PT Ratio}}$$

$$= 21 \angle 85^\circ \times \frac{400}{3000}$$

$$= 2.8 \angle 85^\circ$$

Assume that the MT function at the remote end of the line is set for 4.5 secondary ohms at an angle of 75 degrees. Assume further that based on the considerations given in the section under APPLICATION that it is desired to set the MB reach in the tripping direction for 0.75/75° ohms and the MB reach in the blocking direction for 5.2/75° ohms.

Select the highest possible base reach tap for each setting and calculate the restraint tap setting as follows:

$$T = \frac{100 \times T_B \times \cos(\theta - \phi)}{\text{(Desired reach in secondary ohms)}}$$

where, T = Restraint tap setting in percent

T_B = Basic minimum reach tap setting

θ = Angle of protected line

ϕ = Angle of maximum reach

1. Reach in blocking direction (MB*)

   MB* = 5.2/75° secondary ohms

   Select basic minimum reach tap, T_B = 4.0 ohms.

$$T = \frac{100 \times 4 \times \cos(75-75)}{5.2}$$

$$= 77\%$$

Set taps at 77%.

Set top MB* lead in 70% tap

Set bottom MB* lead in 7% tap

2. Offset reach (MB)

MB = $0.75\underline{/75^{o}}$ secondary ohms

$$T = \frac{100 \times 0.75 \text{ Cos } (75-75)}{0.75}$$

$= 100\%$

Set taps at 100 percent

Set top MB lead in 100% tap

Set bottom MB lead in 0% tap

Figure 5 illustrates these settings on an R-X diagram.

CONSTRUCTION

The Type SLY53A relay is packaged in a metal enclosure designed for mounting on a 19 inch rack. The relay is two rack units high (one rack unit is 1 3/4 inches). The relay contains the magnetics and tap blocks for setting the base reach and the percent restraint. It also contains the printed circuit cards for protecting all three phases of a power system. The relay has a 90^{o} hinged front cover and a removable top cover.

The tap block portion of the Type SLY53A relay is located at the left of the unit. Figure 8 shows the setting of one phase pair. The tap block is divided into two sections, percent restraint and base reach. These sections are identified at the top. The base reach portion of the tap block is at the right. In this portion every two pins are common inside the molded block. It makes no difference which of the two holes under any heading (0.2, .75, etc.) are used. The right portion of the upper block of each phase pair, is used to set the base reach (3.0, .75, 0.2) in the forward direction (MB). The right portion of the lower block of each phase pair, is used to set the base reach (4.0, 2.0, 1.0) in the reverse direction (MB*). Figure 8 shows an MB base reach of 3.0 and an MB* base reach of 2.0.

To set the percent restraint tap for either MB or MB* simply put the top MB or MB* lead in the desired 10% hole and the bottom MB or MB* lead in the desired 1% hole. The setting for MB of 82% restraint and MB* of 52% restraint is shown in Figure 8.

The base reach and percent restraint settings are made by jumpers with taper tip pins on the end. Two special tools have been supplied for these pins. One is an insertion tool and the other is an extraction tool. In order to get a proper connection and not cause any damage to the pins it is important that these tools be used.

The printed circuit cards are located to the right of the tap block portion. Printed circuit cards are identified by a code number such as F103, C103, etc. A test card is located in the "T" position. Test points are numbered 1 to 10 from top to bottom on the test card. The upper test point, TP1, is connected to relay reference. The bottom test point, TP10, is connected to the +15 VDC bus. TP2 is connected to the -15 VDC bus. The other test points are located, as shown on the internal connection diagram, at selected points within the logic circuitry to permit test measurement of the outputs of the various functions and facilitate signal tracing when trouble shooting.

RECEIVING, HANDLING AND STORAGE

This relay will normally be supplied as a part of a static relay equipment, mounted in a rack or cabinet with other static relays and test equipment. Immediately upon receipt of a static relay equipment it should be unpacked and examined for any damage sustained in transit. If injury or damage resulting from rough handling is evident, file a damage claim at once with the transportation company and promptly notify the nearest General Electric Sales Office.

Reasonable care should be exercised in unpacking the equipment. If the equipment is not to be installed immediately, it should be stored indoors in a location that is free from moisture, dust, metallic chips, and severe atmospheric contaminants.

Just prior to final installation the shipping support bolt should be removed from each side of all relay units, to facilitate possible future unit removal for maintenance. These shipping support bolts are approximately 8 inches back from the relay unit front panel. Static relay equipment, when supplied in swing rack cabinets, should be securely anchored to the floor or to the shipping pallet tr prevent the equipment from tipping over when the swing rack is opened.

The Type SLY53A relay contains printed circuit cards with trimmer potentiometers mounted on them. Some of these potentiometers are calibrated at the factory and sealed. These potentiometers should not be adjusted by the user.

INSTALLATION TESTS

The Type SLY53 relay is usually supplied from the factory mounted and wired in a static relay equipment.

All units of a given terminal have been calibrated together at the factory and will have the same summary number on the unit nameplates.

These units must be tested and used together.

NECESSARY ADJUSTMENTS

The following checks and adjustments should be made by the user in accordance with the procedures given below under DETAILED TESTING INSTRUCTIONS, before the relays are put in service. Some of the following items are checks of factory calibrations and settings, or installation connections and hence do not normally require readjustment in the field. Other items cover settings or adjustments which depend on installation conditions and hence must be made on the installed equipment.

1. MB base reach taps
2. MB* base reach taps
3. MB percent restraint tap setting
4. MB* percent restraint tap setting

GENERAL TESTING INSTRUCTIONS

INPUT CIRCUITS

The top terminal block on the rear of the Type SLY53A relay case is identified as YG. This terminal block is wired through the test panel in a static relay equipment where input currents and voltages can be supplied through the standard Type XLA test plug. Where other test facilities are used, input currents and voltages should be applied to test points which connect to the same YG terminal points as those shown on the test circuit diagram.

Where the Type SLY53A relay is furnished in a static relay equipment, reference to the job elementary will provide information concerning customer relay inputs.

OUTPUT SIGNALS

Output signals are measured with respect to the reference bus or TP1. Outputs are continuous signals of approximately +12 to +15 volts for the "ON" condition and 0 volts for the "OFF" condition. This output can be monitored with an oscilloscope, a portable high impedance d-c voltmeter, or with the test panel voltmeter if available. To connect the test panel voltmeter, place the test lead in the proper test point pin jack and the other end in the pin jack on the test panel.

DETAILED TESTING INSTRUCTIONS

REQUIRED ADJUSTMENTS

REACH TAP SETTINGS

The arrangement of the reach setting portion of the tap block is described under the section on CONSTRUCTION and the choice of tap settings is described under the section on CHOICE AND CALCULATIONS OF SETTINGS.

TESTING MB CHARACTERISTIC

The MB characteristic may be checked over its entire range by using the test circuit employing the phase shifter and phase angle meter shown in Figure 9. Input connections for testing any of the phase-pair characteristics should be made with Figure 9 and Table 1.

TABLE 1

	CONNECT YG TERMINALS TO POINTS IDENTIFIED BY LETTERS						
	A	B	C	D	E	F	OUTPUT
PHASE 1-2	YG2	YG3	YG5	YG6	YG8	YG7	TP6
PHASE 2-3	YG3	YG4	YG7	YG8	YG10	YG9	TP6
PHASE 3-1	YG4	YG2	YG9	YG10	YG6	YG5	TP6

By setting the current to 5 amperes (constant) the reach at any angle becomes a function of the settings of both the base reach and restraint taps. Rotating the phase shifter provides a means of checking the reach on any point of the characteristic. Notice that as the percent value of the restraint taps decreases the phase to phase impedance increases.

To obtain any points on the relay characteristic for any one of the three phases, observe the following procedure.

(a) Set up the test circuit of Figure 9 for the particular phase being tested. Make the AC connections according to Table 1.

(b) Set the test current to 5 amps RMS.

(c) Be sure that the current limiting reactor is as high as possible in ohmic value (perhaps 24 ohms). This assures the most harmonic-free current possible.

(d) Remove the coincidence cards (C103) of the phases not being tested. Jumper the test point outputs of these cards down to reference.
Example: When testing Ø 1-2, remove the C103 cards in positions "N" and "S" and jumper TP4 and TP5 to reference.

(e) Connect the instrumentation (preferably an oscilloscope) between the MB output of the phase under test and reference at TP1.

(f) Set the phase angle meter at the angle of maximum reach, 75^{o}, by rotating the phase shifter.

(g) Adjust the variac until the MB function in the forward direction picks up. Note that the point just at the verge of pick-up, as read on Figure 9 voltmeter (V), defines the relay MB characteristic.

The voltage at the angle of maximum reach, at which the relay picks up can be expressed by:

$$V = \frac{2\ IZ}{\%\ \text{Restraint Tap}} \times 100 \qquad (2)$$

where Z = base reach tap chosen
I = 5 amp test current

Should the voltage at which the MB function in the forward direction picks-up be different from the calculated value it will be necessary to adjust the P10 potentiometer located on the F103 card of the phase under test.

(h) Set the phase angle meter at 255^{o} ($75^{o} + 180^{o}$) by rotating the phase shifter.

(i) Adjust the variac until the MB* function in the reverse direction picks up.

The value of voltage at which the MB* function picks-up at 255^{o} can be expressed by equation (2) above. The value for Z must now be the base reach in the reverse direction (MB* base reach).

Should the voltage at which the MB* function in the reverse direction picks-up be different from the calculated value it will be necessary to adjust the P52 potentiometer located on the F103 card of the phase under test.

(j) As many points as necessary to define the characteristic can now be obtained by rotating the phase shifter and adjusting the variac.

TIMER ADJUSTMENTS AND TESTS

The following information concerns items which have been covered in factory tests. This information is supplied for use in trouble-shooting or in checking the overall performance of the Type SLY53A relay.

F103 FILTER CARDS

The F103 filter cards have three potentiometers located on them. By number these potentiometers are P61, P10 and P52. Potentiometer P61 is for filter purposes. It has been set in factory test and sealed. This potentiometer should not be moved. Potentiometers P10 and P52 are for adjusting the relay reach at the angle of maximum reach. The procedure used to set these potentiometers is described under the "Testing MB Characteristic" section.

T110 TIMER CARD

The P/100 timer has two potentiometers on it. The upper potentiometer, P1, is used to set the acceptable pulse level. It has been set in factory test and sealed. This potentiometer should not be moved. The lower potentiometer adjust the dropout time delay. It has also been set in factory test for a 100 millisecond dropout delay and sealed. This potentiometer should not be moved.

MAINTENANCE

PERIODIC CHECKS

For any periodic testing of the Type SLY53 relay the trip coil circuit of the circuit breaker should be opened by opening the disconnect switches or other test switches provided for this purpose.

TROUBLE SHOOTING

Test points are provided at selected points in the Type SLY53A relay to observe outputs if trouble-shooting is necessary. The use of a card adapter will make the pins on any one card available for testing.

For the physical location of components and cards refer to Figure 2, the component location diagram.

SPARE CARDS

The number of spare cards to carry in stock would depend on the total number of static relays, using similar cards, at the same location or serviced by the same test group. For each type of card (difference code designation) a suggested minimum number of spare cards would be:

1 spare for 1 to 25 cards
2 spares for 26 to 75 cards
3 spares for 76 to 150 cards

CARD DRAWINGS

Details of the circuits of the printed circuit cards can be obtained in the printed circuit card book GEK-34158.

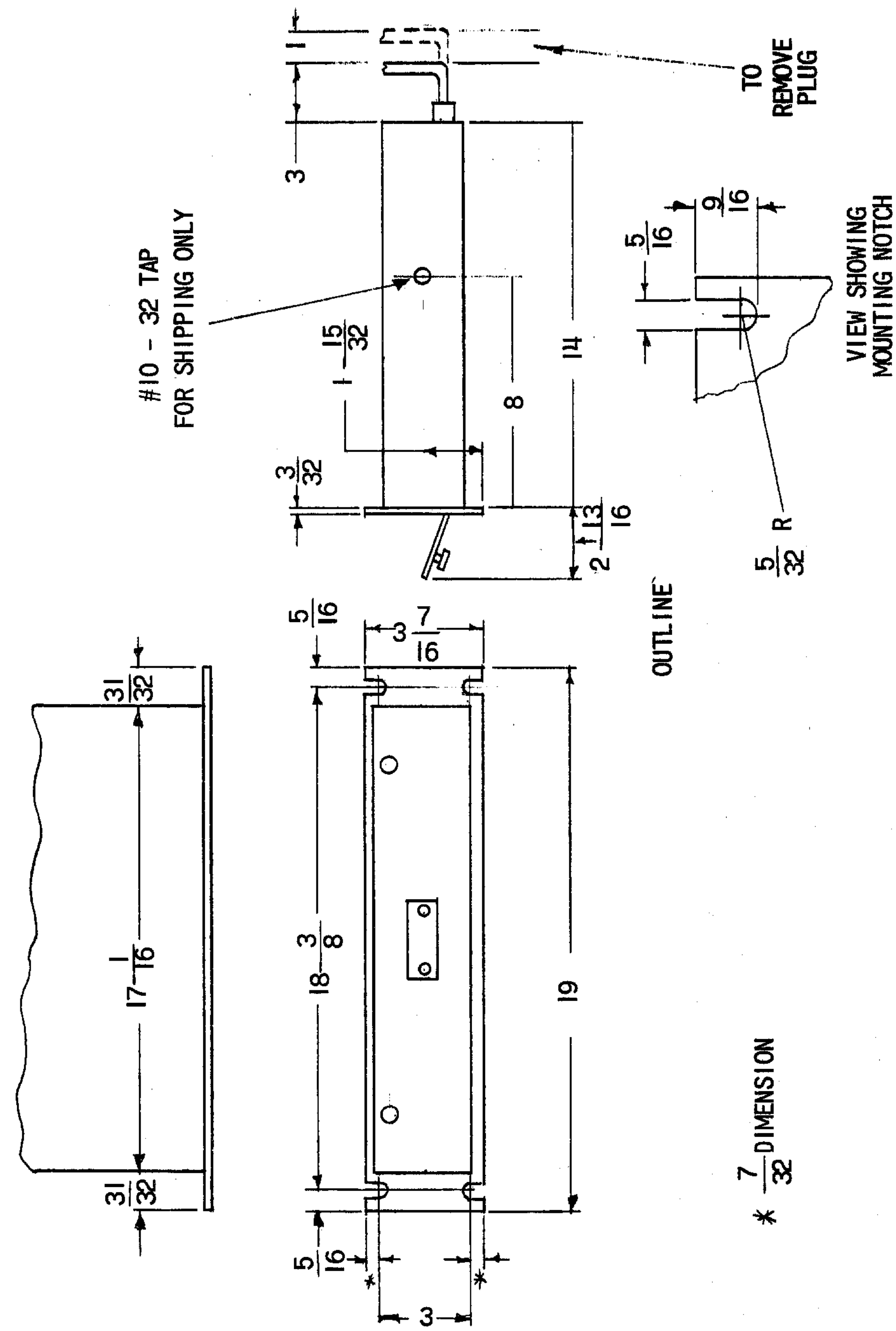


FIG. 1 (0227A2036-0) SLY53A Outline And Mounting Dimensions

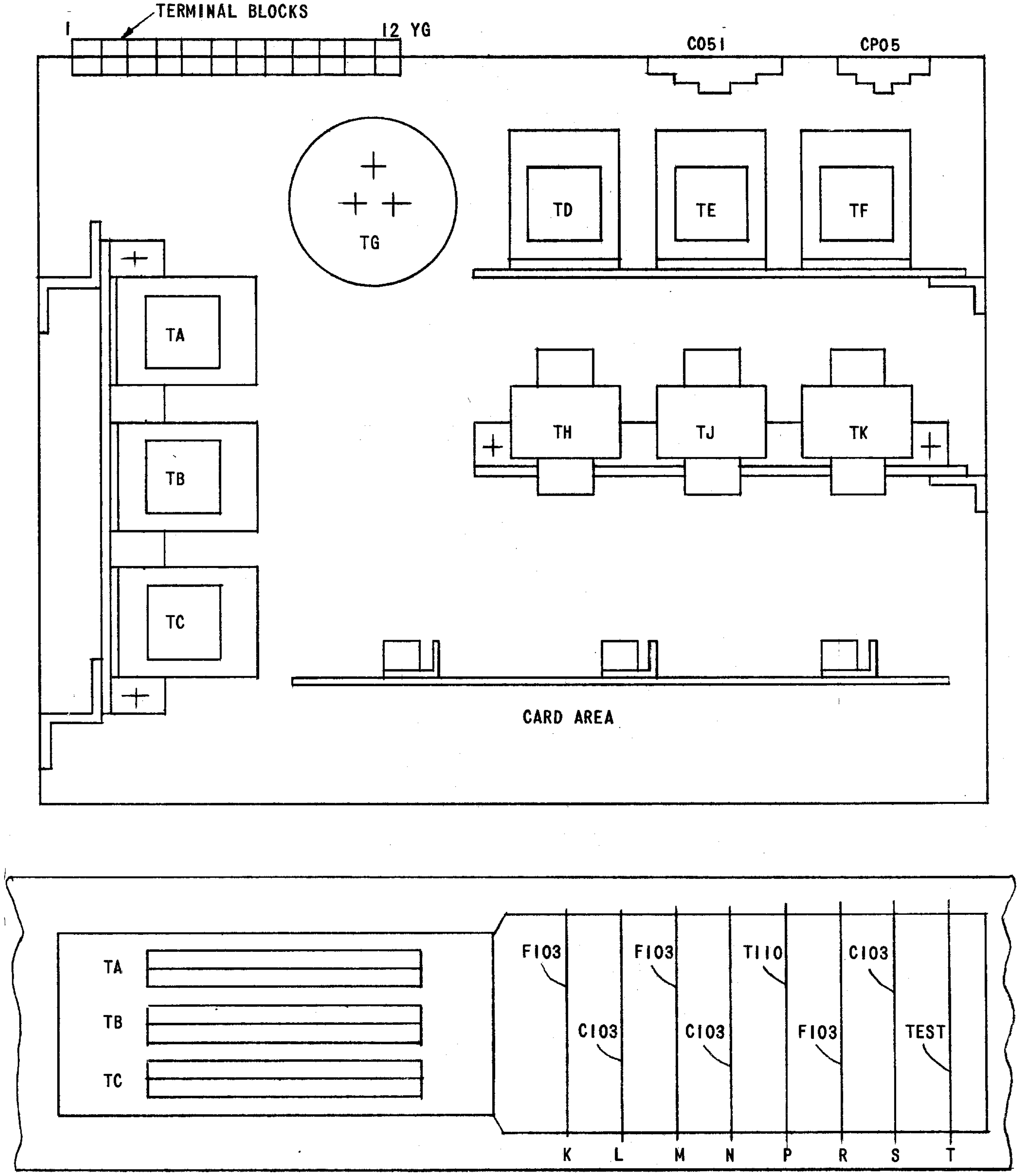
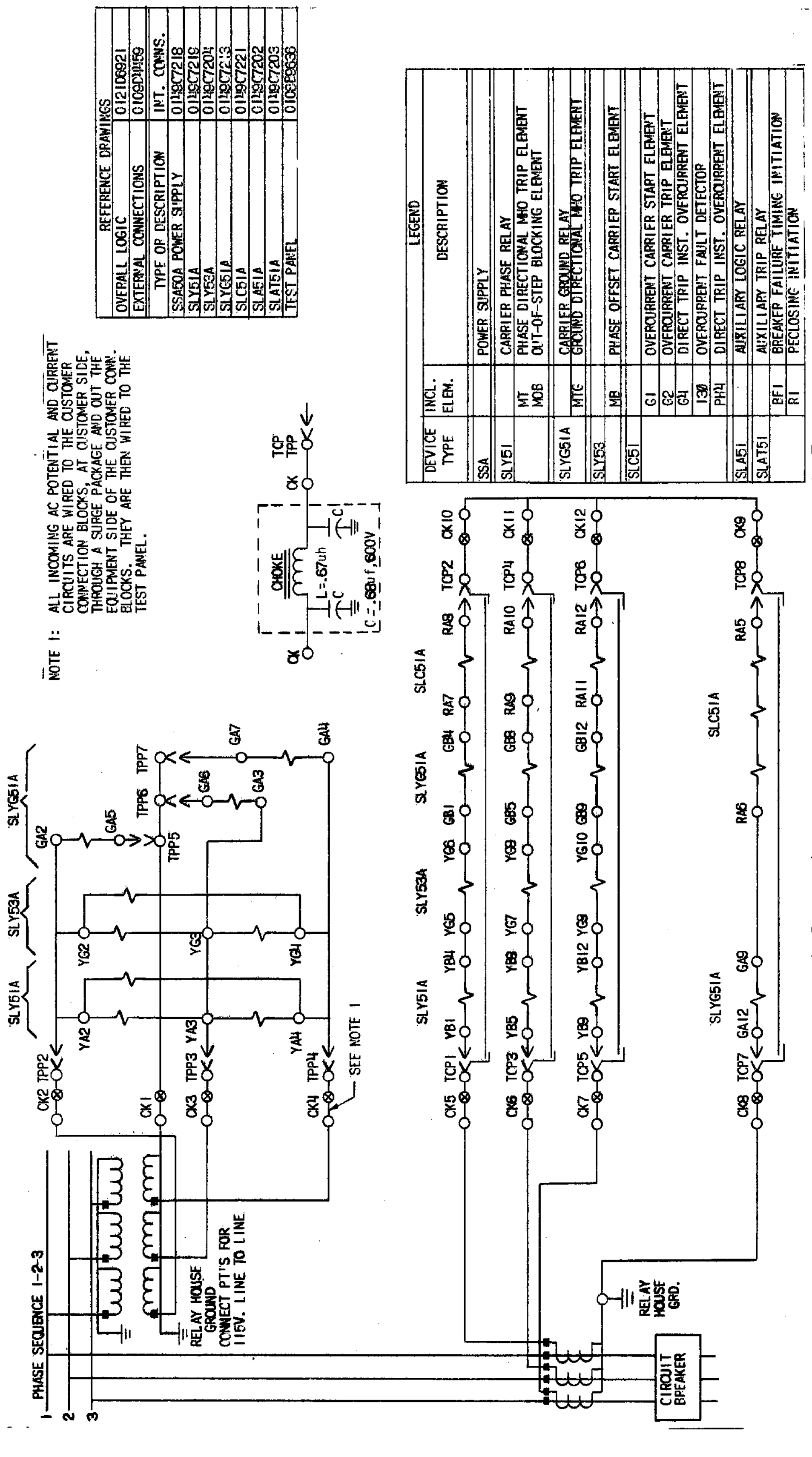


FIG. 2 (0227A2108-0) SLY53A Component Location Diagram

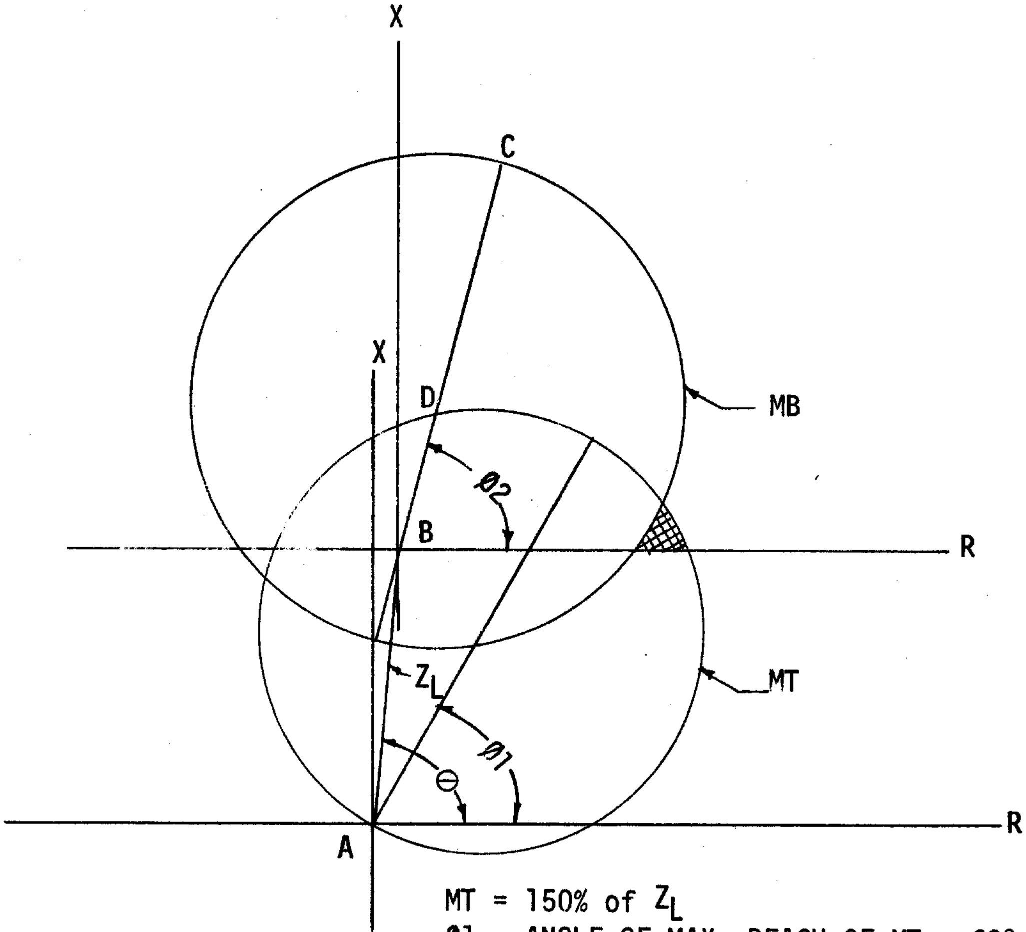


REFERENCE DRAWINGS	
OVERALL LOGIC	0121D6921
EXTERNAL CONNECTIONS	0109D1459
TYPE OR DESCRIPTION	INT. CONNS.
SSA50A POWER SUPPLY	0149C7218
SLY51A	0149C7219
SLY53A	0149C7204
SLYG51A	0149C7213
SLC51A	0149C7221
SLA51A	0149C7202
SLAT51A	0149C7203
TEST PANEL	0108B8636

LEGEND

DEVICE TYPE	INCL. ELEM.	DESCRIPTION
SSA		POWER SUPPLY
SLY51		CARRIER PHASE RELAY
	MT	PHASE DIRECTIONAL MHO TRIP ELEMENT
	MOB	OUT-OF-STEP BLOCKING ELEMENT
SLYG51A		CARRIER GROUND RELAY
	MTG	GROUND DIRECTIONAL MHO TRIP ELEMENT
SLY53		
	MB	PHASE OFFSET CARRIER START ELEMENT
SLC51		
	G1	OVERCURRENT CARRIER START ELEMENT
	G2	OVERCURRENT CARRIER TRIP ELEMENT
	G4	DIRECT TRIP INST. OVERCURRENT ELEMENT
	I30	OVERCURRENT FAULT DETECTOR
	PH4	DIRECT TRIP INST. OVERCURRENT ELEMENT
SLA51		AUXILIARY LOGIC RELAY
SLAT51		AUXILIARY TRIP RELAY
	BFI	BREAKER FAILURE TIMING INITIATION
	RI	RECLOSING INITIATION

FIG. 3 (0165B2601-0) Typical AC External Connections



MT = 150% of Z_L
Ø1 = ANGLE OF MAX. REACH OF MT = 60°

MB = 30% OF Z_L
MB* = 150% of Z_L
Ø2 = ANGLE OF MAX. REACH OF MB = 75°

θ = ANGLE OF Z_L = 85°

FIG 4 (0246A6818-0) R-X Diagram Of MB In SLY53A Relay In Relation To MT Function In SLY51A At Remote End Of Line

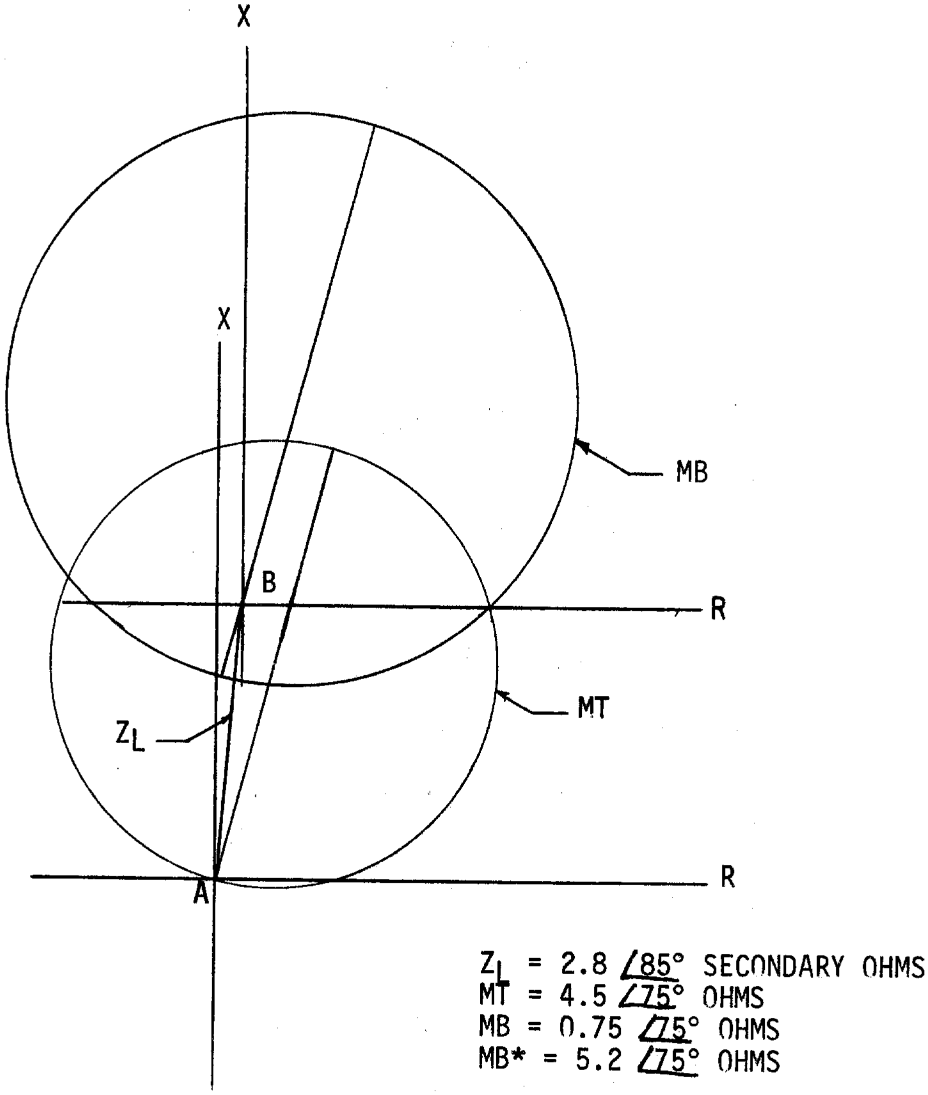


FIG. 5 (0246A6819-0) R-X Diagram Of MB In SLY53A

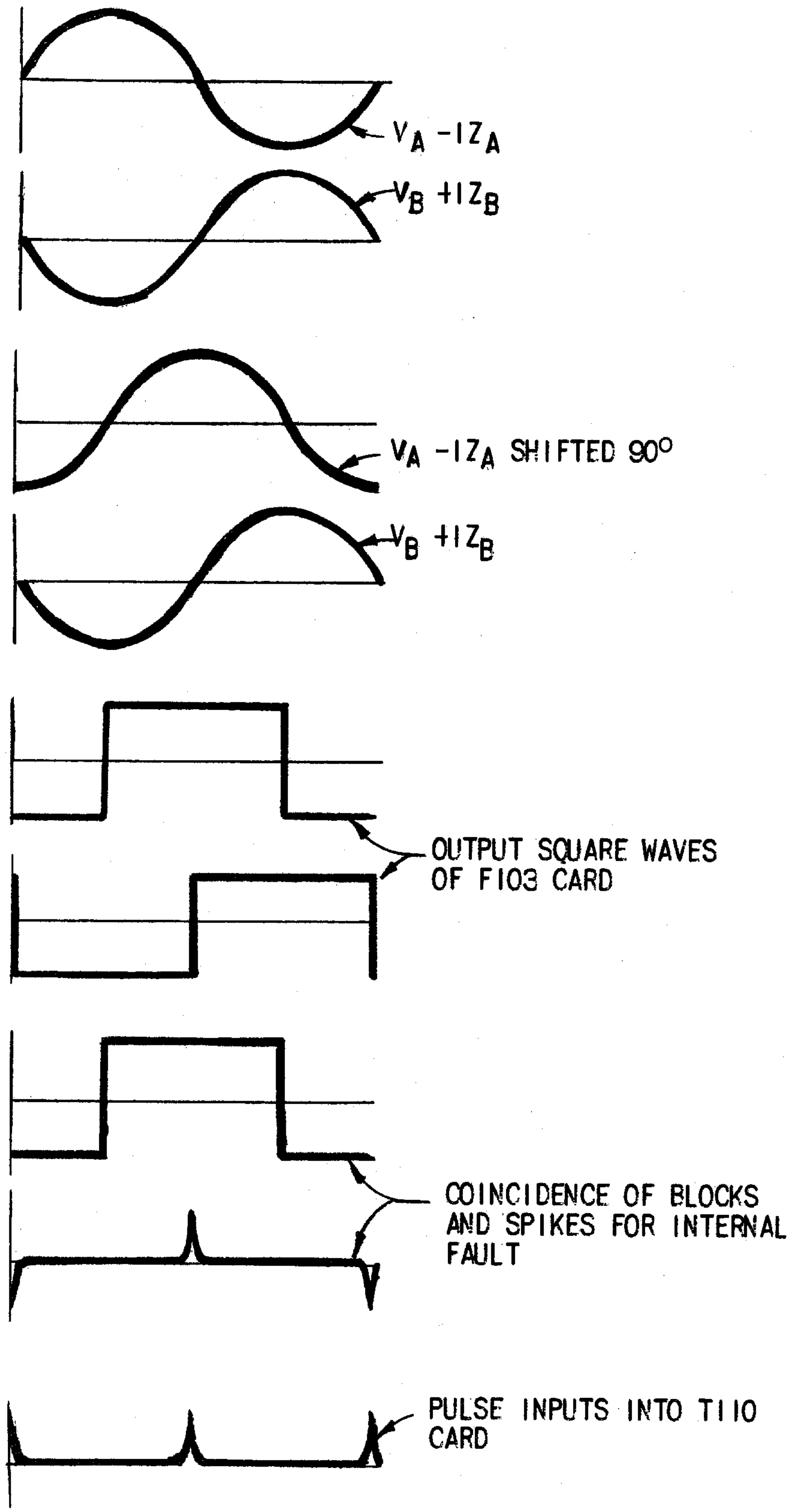


FIG. 6 (0246A3641) MB Measurement Principles

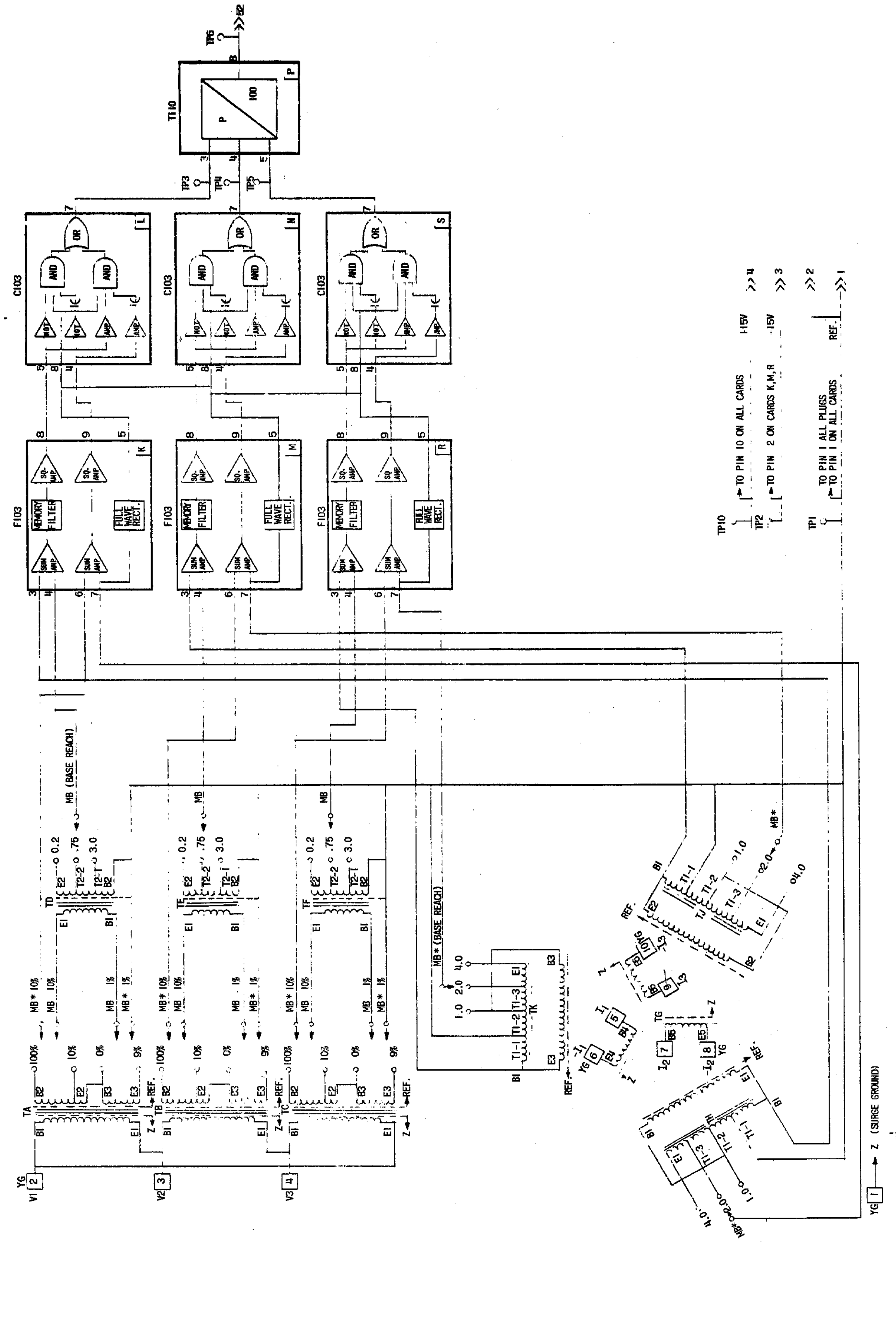


FIG. 7 (0149C7204) Internal Connections Diagram Of Type SLY53A Relay

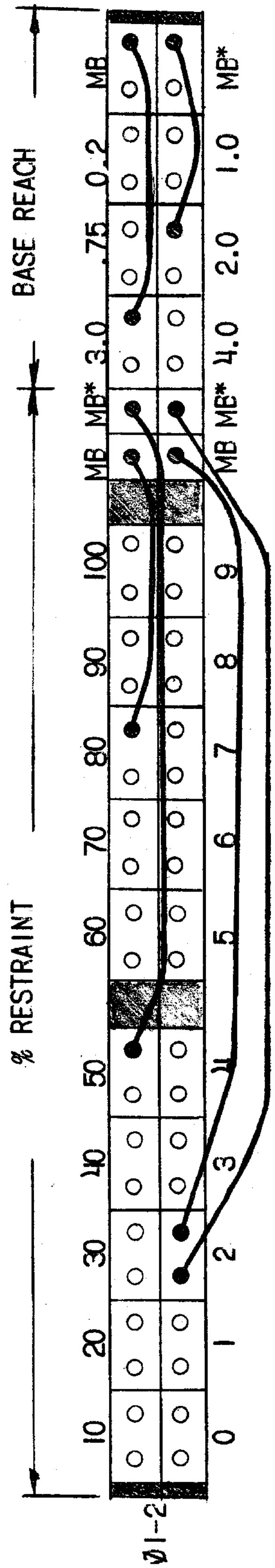


FIG. 8 (0246A3642) Typical SLY53A Tap Block Connections

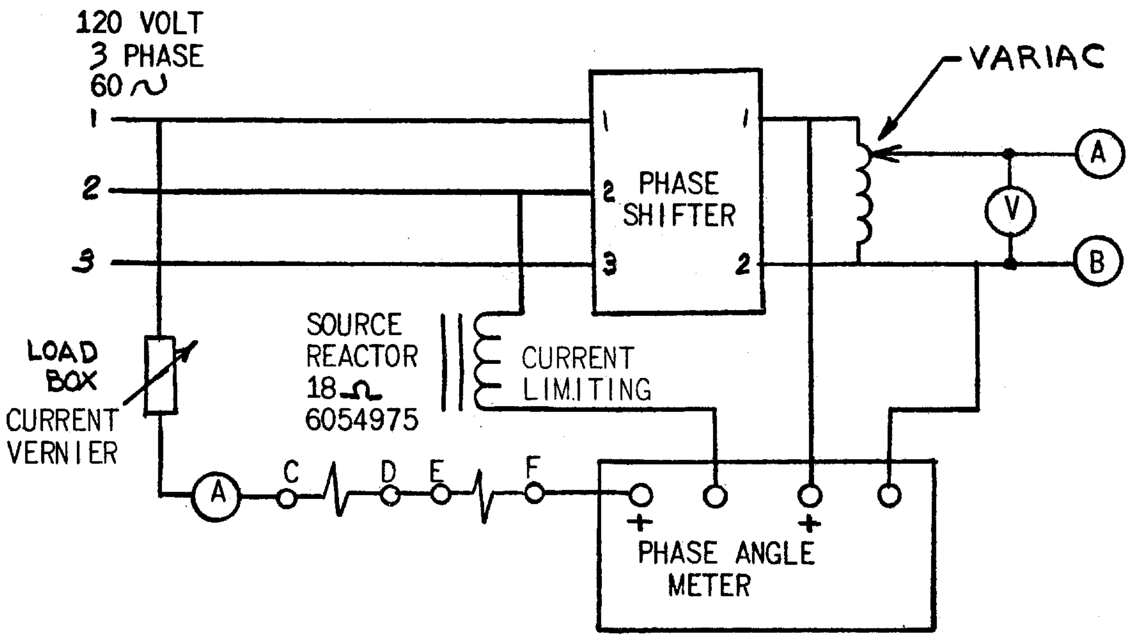


FIG. 9 (0178A7029-3) Phase Shifter Test Circuit

GE Power Management

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