



INSTRUCTIONS

GEK-86087

AUXILIARY LOGIC RELAY

TYPE SLA54J

GENERAL  ELECTRIC

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AUXILIARY LOGIC UNIT**TYPE SLA54J****DESCRIPTION**

The SLA54J is an auxiliary logic relay designed for use in permissive overreaching transferred trip schemes. The relay contains the necessary logic to interpret output signals from associated measuring functions and translate them to an appropriate auxiliary output and tripping relay. In addition to the SLA54J relay, proper phase and ground relays, a power supply, and auxiliary tripping relay are required to complete a particular relaying scheme.

The SLA54J relay is packaged in a four-rack unit enclosed metal case. The relay is suitable for mounting in a 19-inch rack; the outline and mounting dimensions are shown in Figure 1. Internal connections for the SLA54J relay are shown in Figure 2, and the component location drawing is shown in Figure 3.

APPLICATION

The SLA54J auxiliary logic relay is designed to operate in conjunction with appropriate phase and ground relays and a suitable communication channel to provide a permissive overreaching transferred tripping scheme for transmission line protection. For a complete description of the particular scheme, refer to the overall logic diagram and the logic description write-up supplied with the scheme.

Protection features required in a relay scheme often vary with the particular application. It is sometimes desirable to initially provide certain features in a relaying scheme and simultaneously to make provisions for adding or changing features should it later become necessary. To this end, this relay design has incorporated circuit flexibility to permit implementation of certain optional features. To implement these features the relay is equipped with matrix connection blocks designated R, Y, OR, V, W, G, BR and B. Appropriate jumper connections are made between the various points to modify the logic. A typical option chart is shown in Figure 5.

Various points in the logic can be monitored by connecting jumpers from the cable plugs 411-420 and 421-430 to the selected matrix points. This option is further described under the heading DATA MONITORING POINTS in the section entitled **OPERATING PRINCIPLES**.

For the specific options and the logic arrangement supplied for a particular relaying scheme, refer to the logic diagram and the logic description supplied with that scheme. If it is desired to make logic changes, the diagrams and instruction books supplied with the equipment should be studied to determine the means for implementing the changes. If further assistance is required, contact the nearest General Electric District Sales Office.

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.

There are no measuring functions to be set in this relay but there are certain timers included that must be set in accordance with the demands of the particular protection scheme being employed and the power system on which it is being used. Refer to the section of this book entitled **SETTINGS** for a description of these timers and for suggestions to be used in making appropriate settings.

RATINGS

The Type SLA54J relay is designed for use in an environment where the air temperature outside the relay case does not exceed minus 20°C or plus 65°C.

The Type SLA54J relay requires a plus or minus 15 volt DC power source which can be obtained from a Type SSA power supply.

Each contact converter in this relay has a link for selecting the proper voltage for the coil circuit on the contact converter. The three possible voltages are 48, 125 and 250 volts DC.

BURDENS

The SLA54J relay presents a burden of 300 milliamperes to the plus 15 volts DC supply of the Type SSA power supply.

Each contact converter, when energized, will draw ten milliamperes from the station battery, regardless of tap setting.

OPERATING PRINCIPLES

LOGIC CIRCUIT

The functions of the Type SLA54J relay involve basic logic (AND, OR, and NOT) where the presence or absence of signals, rather than their magnitude, controls the operation. Signals are measured with respect to a reference bus accessible at TP1. In general, a signal below one volts DC represents an OFF or LOGIC ZERO condition; an ON or LOGIC ONE condition is represented by a signal of approximately plus 15 volts DC.

The symbols used on the internal connection diagram (Figure 2) are explained by the legend shown in Figure 4.

The matrix block options shown in the internal connections of the SLA54J relay are prewired at the factory. The connections are shown on the associated overall logic and are listed on the associated option chart. A sample option chart for the Type SLA54J relay is shown in Figure 5.

Some logic cards contain pushbuttons which allow injection of a logic "Level-1" signal into various logic paths for testing purposes.

CONTACT CONVERTERS

Six contact converters are provided in the SLA54J relay. A contact converter provides an interface between the logic circuits in the SLA54J and the external signals.

CC1 through CC6 are connected to option points (see Figure 2) and can be connected as desired. To determine the connections used on a particular equipment, see the corresponding option chart drawing.

MONITORING POINTS

Various points within the relay logic are brought out to a cable plug mounted on the back of the SLA54J relay. These plugs provide 18 monitoring points plus one point for a voltage reference. Specific points that have been preselected are shown on the logic diagram marked with a number series of 411 to 420. These points may be augmented or readily changed at the matrix boards located inside the SLA relay. To monitor these points, an additional piece of equipment called a DLA (data logging amplifier) is required. The dry contact outputs from the DLA can be fed to an oscillograph to record selected function responses. A typical selection of monitoring points is shown below:

- 413 - Phase overcurrent
- 414 - Ground overcurrent
- 415 - Phase overcurrent
- 416 - Phase distance measurement output
- 417 - Ground distance measurement output
- 418 - Local comparer input
- 419 - Remote comparer input
- 420 - Comparer output

CHANNEL INTERFACE

The logic of the Type SLA54J relay includes an isolation interface (Figure 6) between the relays in the scheme and the associated channel. The circuitry of the isolation interface provides a signal path but maintains metallic isolation. This feature makes it possible to maintain isolation between the DC supply used for the relays and that employed by the channel.

When pins 5 and 6 are both connected to relay reference, a metallicly separate positive logic signal appears at pin 7 with respect to pin 8. When pins 9 and 10 are both connected to relay reference, a metallicly separate positive logic signal appears at pin 11 with respect to pin 12. The output from the isolation interface is a five volt DC, 20 milliampere signal.

OUTPUT CONTACTS

The SLA54J relay has two sets of output contacts. Each set of contacts consists of two normally open, two normally closed or one normally open and one normally closed contact(s). The contacts are wired to terminal strips on the back of the relay per internal connections diagram, Figure 2. Output contacts provide a means of converting logic level signals into external signals.

Output contacts are rated to make and carry three amperes. Interrupting ratings are 100 volt-amperes resistive and 35 volt-amperes reactive. Contacts pick up one to two milliseconds after logic level signal is applied to transistor switch, and drop out one to two milliseconds after logic level signal is removed.

TIMER SETTINGS

In general, when a time range is indicated on the internal connection diagram, the timer has been factory set at a mid-range value. Timers should be set for the operating or reset times indicated on the associated overall logic diagram. When a time range is indicated on the overall logic diagram, the timer should be set at the value recommended for that function in the descriptive write-up accompanying the overall logic diagram. When a setting depends upon conditions encountered on a specific application, this is so stated and the factors influencing the choice of setting are described. The procedure for checking and setting the timers is described below.

When the time-delay cards are to be adjusted or checked, an oscilloscope that can display two traces simultaneously and that has a calibrated sweep should be used.

In order to test the timer cards it is necessary (due to the "sinking logic" technique used in this equipment) to remove the card previous to the timer under test (see Table I) and to place the timer card in a card adapter. The card adapter allows access to the input and output of the timer if they are not brought out on test points. The timer test circuit is shown in Figure 7. Opening the normally closed contact causes the output to step up to plus 15 volts DC after the pickup delay of the timer. To increase the pickup time, turn the upper potentiometer on the timer card clockwise; to decrease the time, turn it counterclockwise. Closing the contact causes the timer output to drop out after the reset time-delay setting of the card. If the timer card is provided with a variable reset relay, it can be adjusted by the lower potentiometer on the timer card (clockwise increases reset time).

A timer tester card (0172C5151G-1) can be obtained to be used instead of the test circuit of Figure 7. This card is equipped with an "ON" and "OFF" push-button switch, an "ON" indicating LED, and two paralleled test jacks. This test card can be plugged into any printed circuit card socket (except the "T" location). One test jack connects, via a test lead, to the input of the timer under test. The second test jack connects to trigger the timing device used. This timer test card provides a bounceless switching action, ease of operation and consistent results.

TABLE I

TIMER UNDER TEST	POSITION	REMOVE CARD IN POSITION
TL1	AG	AF
TL2	G	SEE OPTION CHART
TL3	R	P
TL4	AN	SEE OPTION CHART
TL5	AJ	SEE OPTION CHART
TL6	K	J
TL7	AE	SEE OPTION CHART
TL8	N	SEE OPTION CHART
TL9	AS	SEE OPTION CHART

OPERATIONAL CHECKS

Operation of the SLA54J unit can be checked by observing the signals at the twenty test points (TP1 to TP20) in the SLA54J, by observing the operation of the associated channel equipment, or by observing the output functions in the associated Type SLAT tripping relay. The test points are located on two test cards in positions T and AT and are numbered 1 to 20 from top to bottom. TP1 (on card AT) is at reference bus for the logic circuit; TP10 is at plus 15 volts DC. The remaining points are located at various strategic points throughout the logic as shown on the internal connection diagram (Figure 2). Test point voltages can be monitored with a portable high impedance voltmeter, the voltmeter on the test panel of the associated equipment, or an oscilloscope.

OVERALL EQUIPMENT TESTS

After the SLA54J relay and the associated static relay units have been individually calibrated and tested for the desired settings, a series of overall operating circuit checks is advisable.

The elementary, overall logic, and logic description for the specific job will be useful for determining the overall operation of the scheme.

Overall equipment tests can be performed by applying alternating currents and voltages to the measuring units as specified in the instruction books for the measuring units and checking that proper outputs are obtained from the associated SLAT when the measuring units operate.

CONSTRUCTION

The SLA54J relay is packaged in an enclosed metal case with hinged front covers and removable top cover. The outline and mounting dimensions of the case and the physical location of the components are shown in Figures 1 and 3, respectively.

The SLA54J relay contains printed circuit cards identified by a code number, such as A120, T102, L104 where A designates auxiliary function, T designates time-

delay function, and L designates logic function. The printed circuit cards plug in from the front of the unit. The sockets are marked with letter designations or "addresses" (D, E, F, etc.) which appear on the guide strips in front of each socket, on the component location drawing, on the internal connection diagram, and on the printed circuit card. The test points (TP1, TP2, etc.) shown in the internal connection diagram are connected to instrument jacks on a test card in position T or AT with TP1 at the top of the AT card. TP10 is tied to plus 15 volts DC through a 1.5K resistor. This resistor limits the current when TP10 is used to supply a logic signal to a card.

Other logic options are selected by means of taper tip jumpers and matrix blocks. These matrix blocks are located inside the unit as shown in Figure 3. The red (R), brown (BR), black (B), green (G), orange (OR), white (W) and violet (V) matrix blocks each have 20 individual points. The yellow (YA and YB) matrix blocks each have 20 matrix points which are grouped in ten common points: one to ten are tied to plus 15 volts DC, 11 to 20 are tied to reference.

RECEIVING, HANDLING AND STORAGE

These relays will normally be supplied as 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 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 upper shipping support brackets should be removed from each side of all relay units, to facilitate possible future unit removal for maintenance. These shipping support brackets are approximately eight inches back from the relay front panel. STATIC RELAY EQUIPMENT, WHEN SUPPLIED IN SWING RACK CABINETS, SHOULD BE SECURELY ANCHORED TO THE FLOOR OR TO THE SHIPPING PALLET TO PREVENT THE EQUIPMENT FROM TIPPING OVER WHEN THE SWING RACK IS OPENED.

INSTALLATION TESTS

CAUTION

THE LOGIC SYSTEM SIDE OF THE DC POWER SUPPLY USED WITH MOD III STATIC RELAY EQUIPMENT IS ISOLATED FROM GROUND. IT IS A DESIGN CHARACTERISTIC OF MOST ELECTRONIC INSTRUMENTS THAT ONE OF THE SIGNAL INPUT TERMINALS IS CONNECTED TO THE INSTRUMENT CHASSIS. IF THE INSTRUMENT USED TO TEST THE RELAY EQUIPMENT IS ISOLATED FROM GROUND, ITS CHASSIS MAY HAVE AN ELECTRICAL POTENTIAL WITH RESPECT TO GROUND. THE USE OF A TEST INSTRUMENT WITH A GROUNDED CHASSIS WILL NOT AFFECT THE TESTING OF THE EQUIPMENT. HOWEVER, A SECOND GROUND CONNECTION TO THE EQUIPMENT, SUCH AS A TEST

LEAD INADVERTENTLY DROPPING AGAINST THE RELAY CASE, MAY CAUSE DAMAGE TO THE LOGIC CIRCUITRY. NO EXTERNAL TEST EQUIPMENT SHOULD BE LEFT CONNECTED TO THE STATIC RELAYS WHEN THEY ARE IN PROTECTIVE SERVICE, SINCE TEST EQUIPMENT GROUNDING REDUCES THE EFFECTIVENESS OF THE ISOLATION PROVIDED.

GENERAL

The SLA54J relay is supplied from the factory either mounted in a static relay equipment or as a separate unit associated with measuring relays, a Type SSA power supply, and some form of channel equipment. All relay units for a given terminal of static relaying equipment are tested together at the factory, and each unit will have the same summary number stamped on its nameplate.

MAINTENANCE

PERIODIC TESTS

It should be sufficient to check the outputs produced at test points in the SLA54J when periodic calibration tests are made on the associated measuring units, for example, the phase and ground relays in the line relaying scheme. No separate periodic tests on the SLA54J itself should be required.

TROUBLESHOOTING

In any troubleshooting of equipment, it should first be established which unit is functioning incorrectly. The overall logic diagram supplied with the equipment shows the combined logic of the complete equipment and the various test points in each unit. By signal tracing, using the overall logic diagram and the various test points, it should be possible to quickly isolate the trouble.

A test adapter card is supplied with each static relay equipment to supplement the prewired test points on the test cards. Use of the adapter card is described in the printed circuit card instruction book GEK-34158.

A dual-trace oscilloscope is a valuable aid to detailed troubleshooting, since it can be used to determine phase-shift, operate and reset times, as well as input and output levels. A portable dual-trace oscilloscope with a calibrated sweep and trigger facility is recommended.

SPARE PARTS

To minimize possible outage time, it is recommended that a complete maintenance program should include the stocking of at least one spare card of each type. It is possible to replace damaged or defective components on the printed circuit cards, but great care should be taken in soldering so as not to damage or bridge-over the printed circuit buses, or overheat the semiconductor components. The repaired area should be recovered with a suitable high-dielectric plastic coating to prevent possible breakdowns across the printed buses due to moisture and dust. The wiring diagrams for the cards in the SLA54J relay are included in the printed circuit card instruction book GEK-34158.

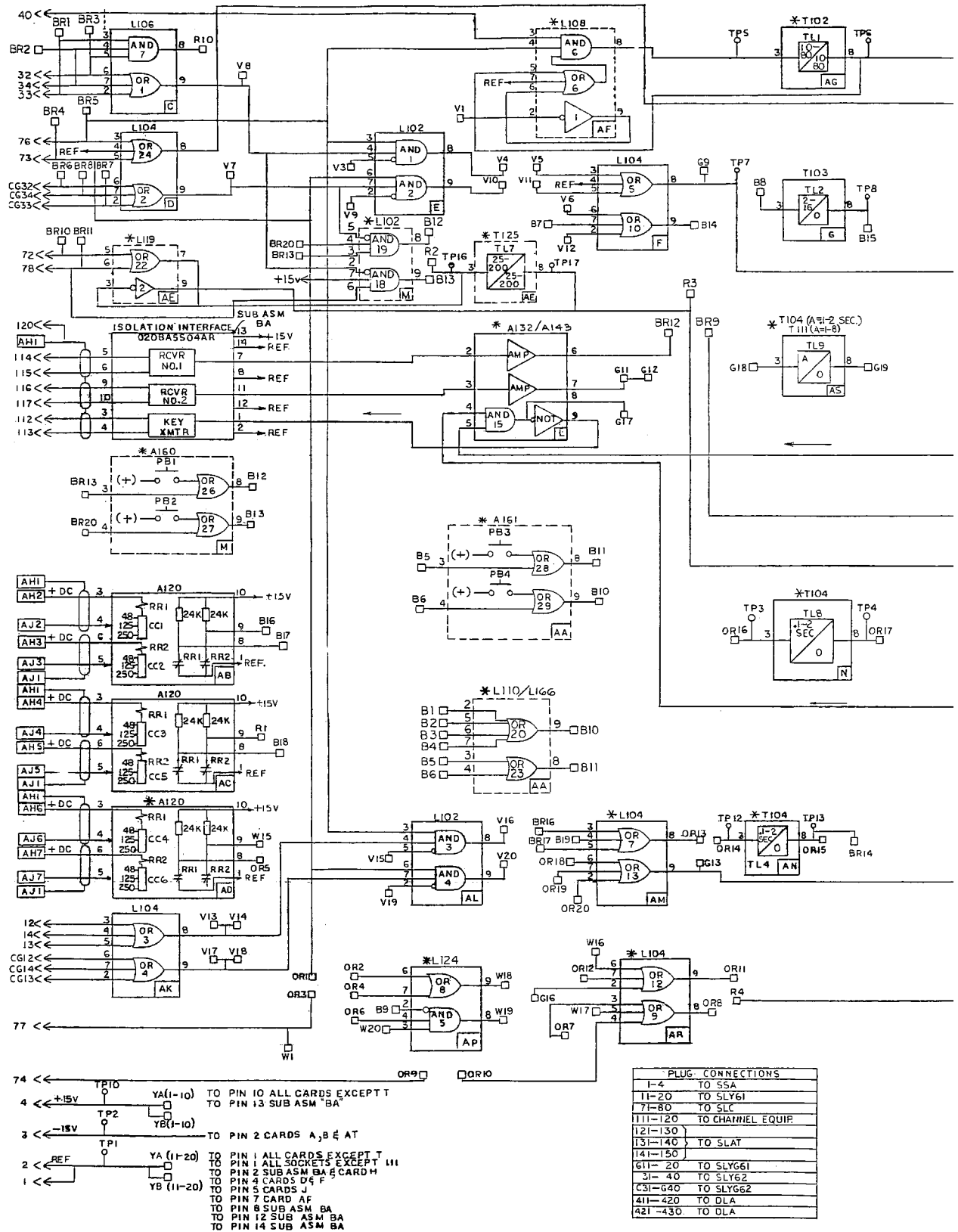


Figure 2A (0153D6135-0) Internal Connections for the Type SLA54J Relay

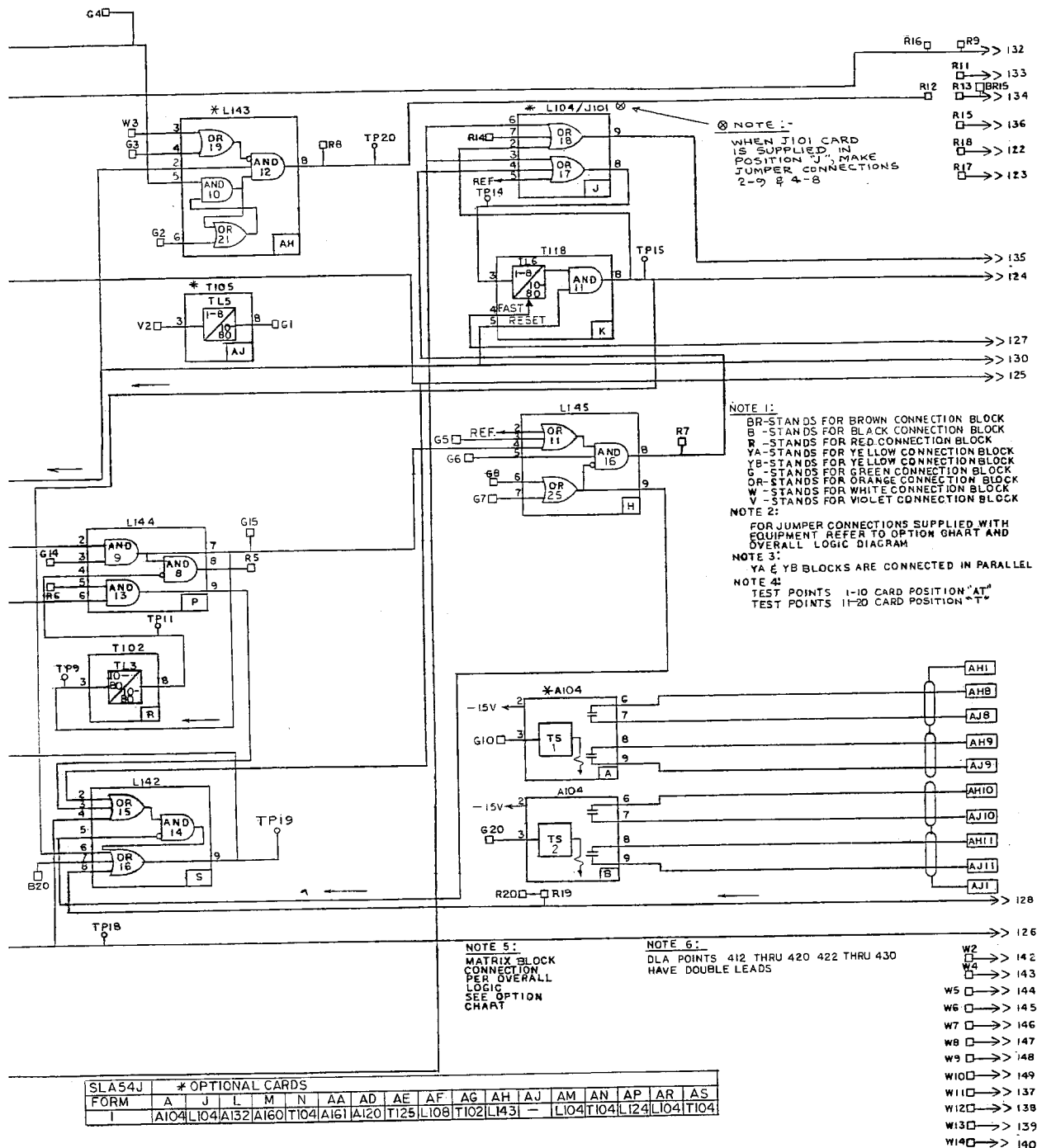


Figure 2B (0153D6135-0) Internal Connections for the Type SLA54J Relay

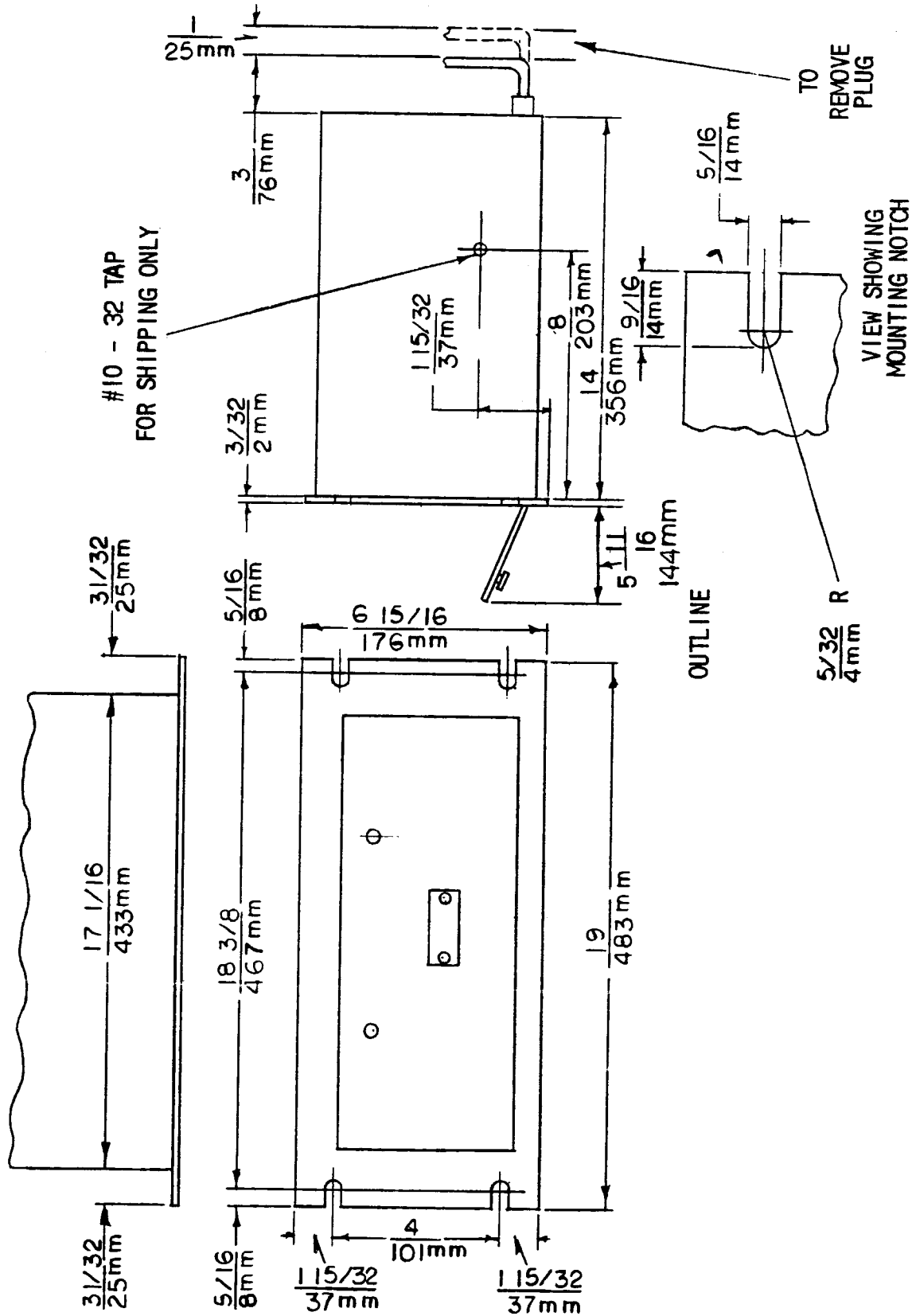
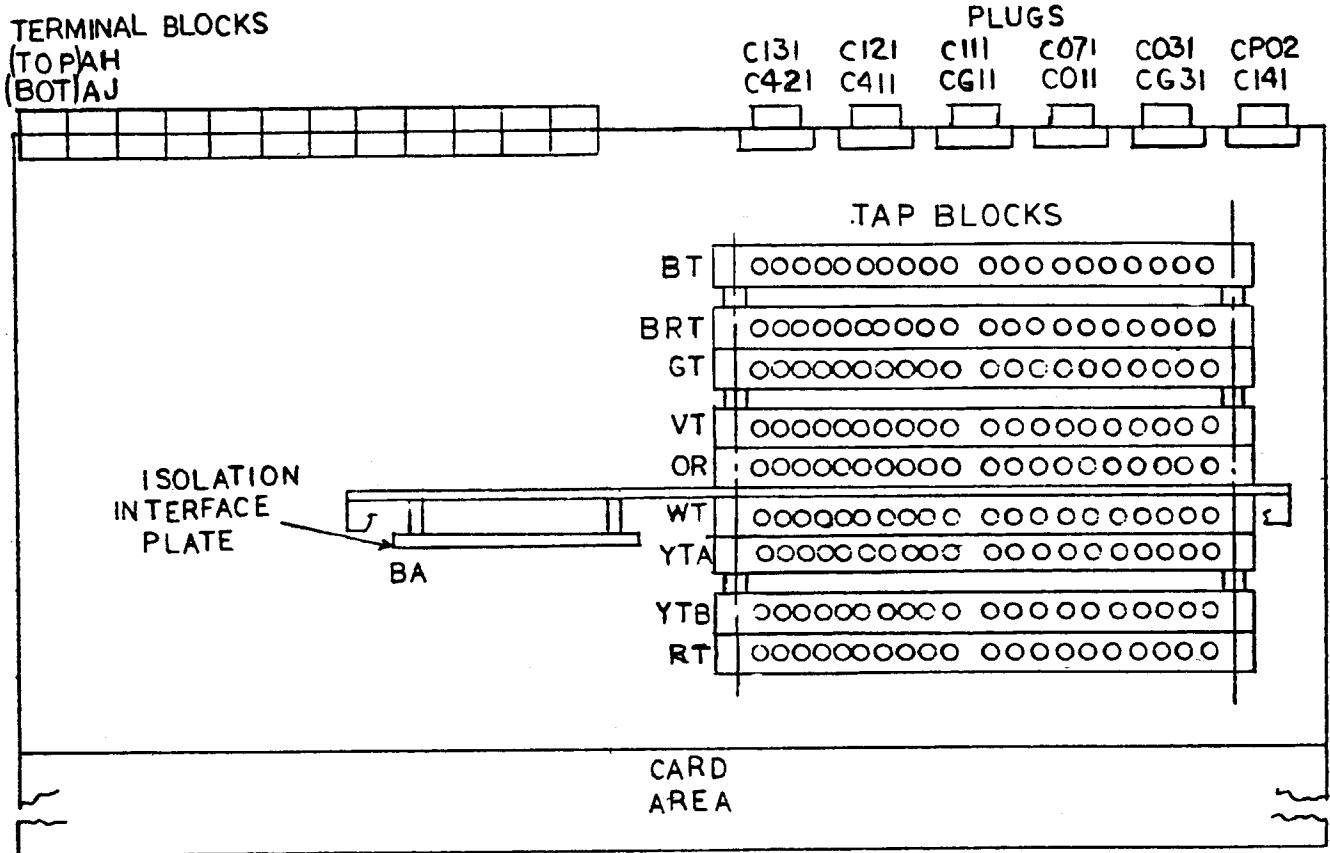


Figure 1 (0227A2037-0) Outline and Mounting Dimensions for the SLA54J Relay



PLAN VIEW

* OPTIONAL P.C. CARDS

* A161	A120	* A120	* L108	* L143	L104	L104	* L124	T104	
	A120	* T125	* T102	*	L102	* T104	* L104	TEST	
AA	AB	AC	AD	AE	AF	AG	AH	AJ	AK
	* A104	L104	L104	L145	T118	* A160	L144	L142	
* A104	L106	L102	T103	* L104	* A132	* T104	T102	TEST	
			J101						
B	C	D	E	F	G	H	J	K	L
							M	N	P
							R	S	T

FRONT VIEW

Figure 3 (0285A8127-0) Component Location Diagram for the Type SLA54J Relay

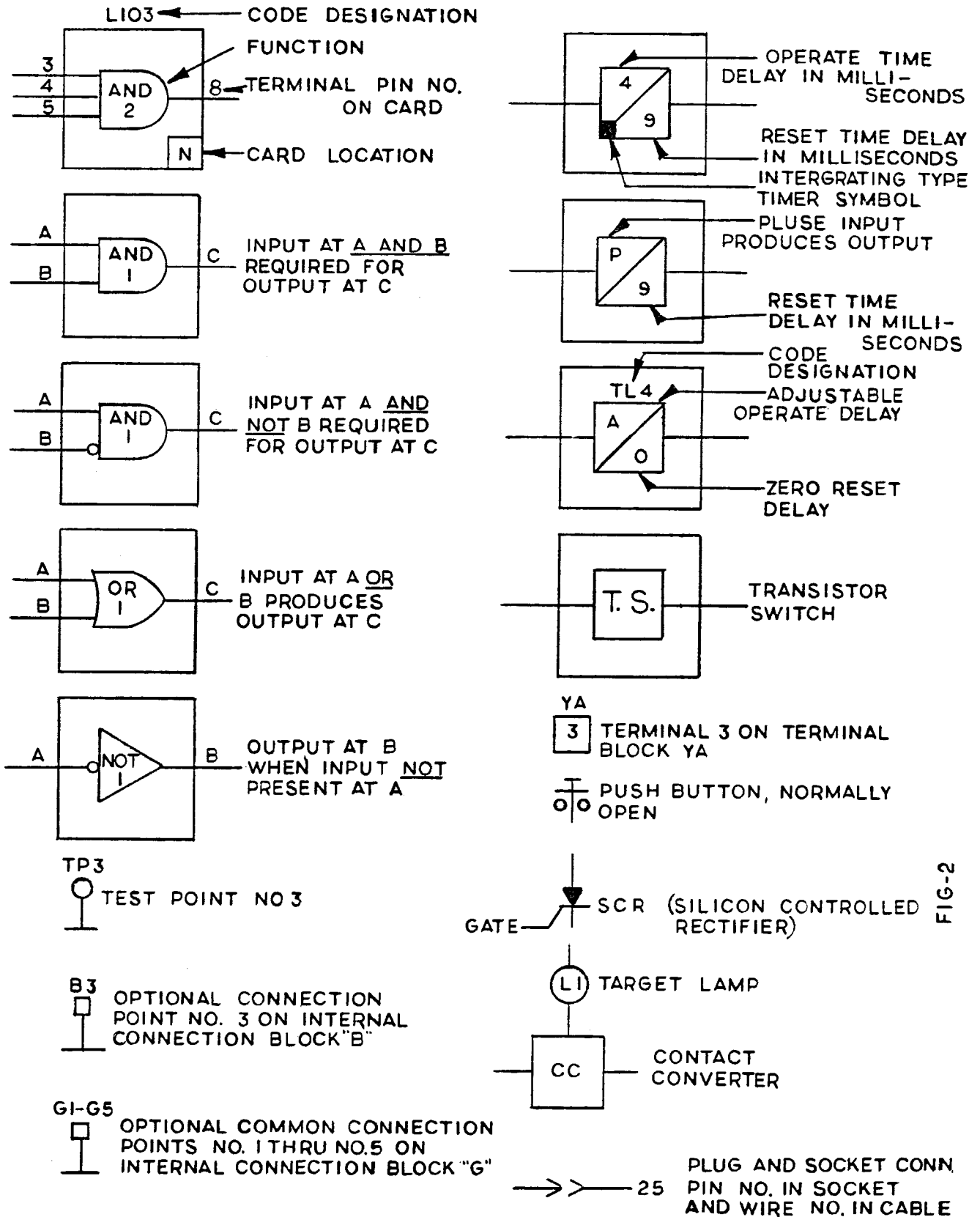


FIG-2

Figure 4 (0227A2047-1) Logic and Internal Connection Diagram Legend

THE FOLLOWING ARE FACTORY CONNECTIONS MADE AT THE MATRIX BLOCKS INSIDE OF THE SLA RELAY ASSOCIATED WITH THIS EQUIPMENT.

SYMBOLS LISTED: PL=RELAY INTERCONNECTING CABLE LEAD

(5)=LOGIC FUNCTION CARD PIN NUMBER

±=3-WAY CONNECTION

*=DLA MONITOR CONNECTION AVAILABLE BUT NOT USED

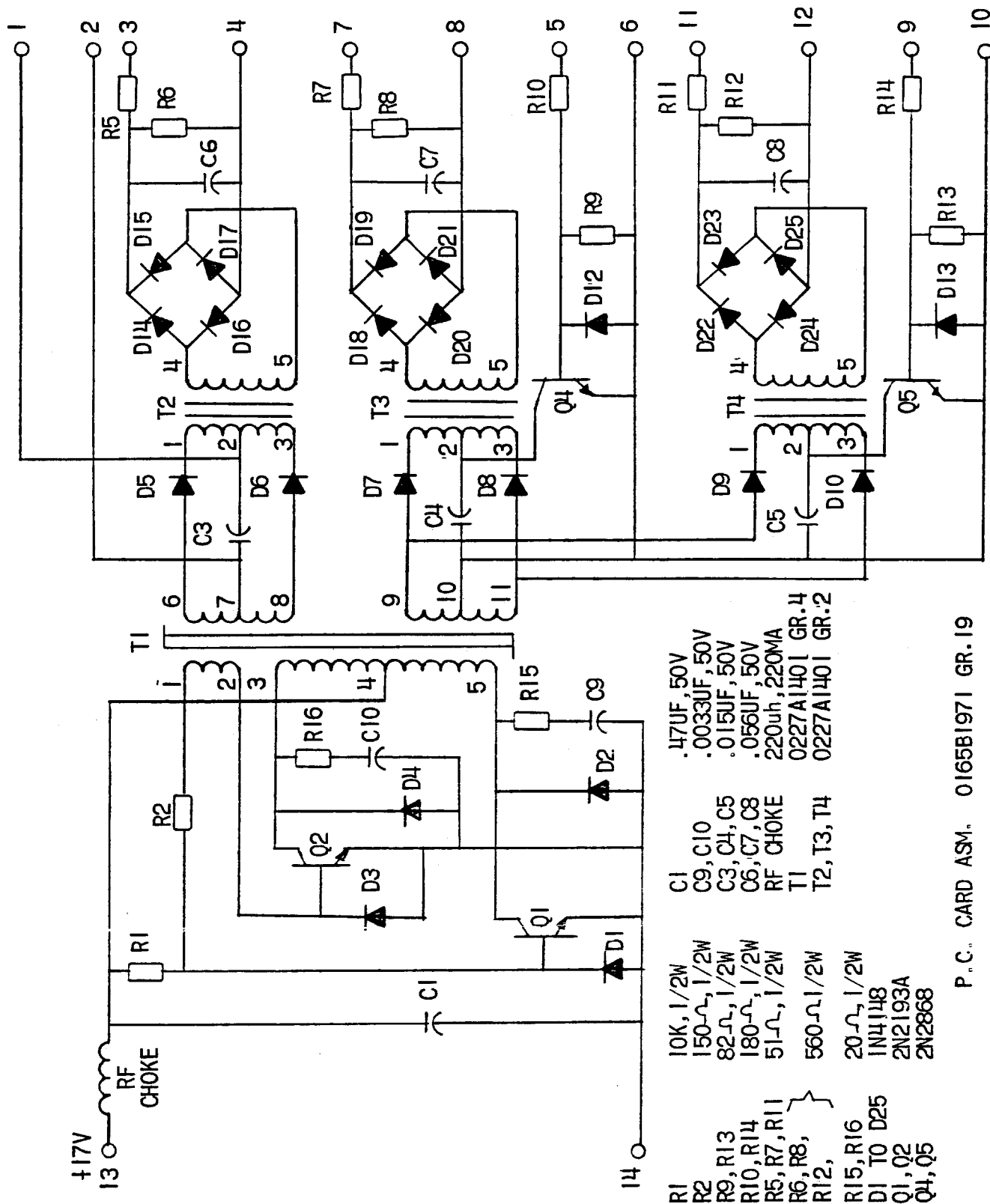
□ = 4 WAY CONNECTION

△ = 5 WAY CONNECTION

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MATRIX BLOCK JUMPERS		LOGIC FUNCTION		MATRIX BLOCK JUMPERS		LOGIC FUNCTION	
FROM	TO	FROM	TO	FROM	TO	FROM	TO
V3	YA11	AND1(5)	REF.	± W19	OR19	AND5(8)	OR13(7)
V9	YA12	AND2(2)	↑	± W19	W6	AND5(8)	PL145
V15	YA13	AND3(5)		± OR9	OR10	PL074	OR9(4)
V19	YA14	AND4(2)		± W1	OR7	PL077	OR9(3)
R14	YA15	OR18(7)		W17	YB13	OR9(5)	REF.
R15	YA16	PL136		± OR9	W4	PL074	PL143
R17	YA17	PL123		± W1	W2	PL077	PL142
R18	YA18	PL122		OR8	B19	OR9(8)	OR7(4)
G7	YA19	OR25(7)	↓	V4	BR20	AND1(8)	OR27(4)
V6	YB11	OR10(6)		△B13	V5	OR27(9)	OR5(3)
V12	YB12	OR10(2)	REF.	△B13	V1	OR27(9)	NOT1(2)
G14	YA10	AND9(3)	+15	G4	R18	TL1(8)	PL122
W12	YA9	PL138	+15	W3	YB14	OR19(3)	REF.
R1	R2	CC5(9)	TL7(3)	G3	YB15	OR19(4)	REF.
R5	R6	AND8(8)	AND13(5)	G2	YA8	OR21(6)	+15V
R19	W5	PL128	PL144	R8	G20	AND12(8)	TS2(3)
G17	G20	AND15(18)	TS2(B3)	± R16	R9	OR24(8)	PL132
± BR9	W15	AND9(P2)	CC6(AD9)	± R16	R11	OR24(8)	PL133
G9	B8	OR5(8)	TL2(3)	± V4	COVER	(BUT NOT CONNECTED)	
B15	B7	TL2(8)	OR10(7)	± V10	COVER	(BUT NOT CONNECTED)	
B14	G6	OR10(9)	AND16(5)	△B13	OR16	OR27(9)	TL8(3)
B16	G8	CC2(9)	OR25(6)	△B13	W9	OR27(9)	PL148
B18	G5	CC3(8)	OR11(3)	V10	B6	AND2(9)	OR29(4)
B17	B20	CC1(8)	OR16(7)	□ B10	V11	OR29(9)	OR5(5)
BR5	W20	PL76	AND5(3)	□ B10	OR14	OR29(9)	TL4(3)
BR9	G10	RCVR	TS1(3)	□ B10	W7	OR29(9)	PL146
OR15	OR2	TL4(8)	OR8(6)	V16	G20	AND3(8)	OR26(3)
G19	B9	TL9(8)	AND5(2)	± B12	BR16	OR26(8)	OR7(3)
BR13	W14	TL4(8)	PL140	± B12	W11	OR26(8)	PL137
W18	OR18	OR8(9)	OR13(6)	V20	B5	AND4(9)	OR28(3)
± OR5	OR6	CC4(8)	AND5(4)	± B11	BR17	OR28(8)	OR7(5)
± OR5	G18	CC4(8)	TL9(3)	± B11	W13	OR28(8)	PL139
± OR17	OR4	TL8(8)	OR8(7)	R13	R20	PL134	PL128
± OR17	W10	TL8(8)	PL149	R7	W8	AND16(8)	PL147
± OR13	OR20	OR7(8)	OR13(2)				
± OR13	R4	OR7(8)	OR17(3)				

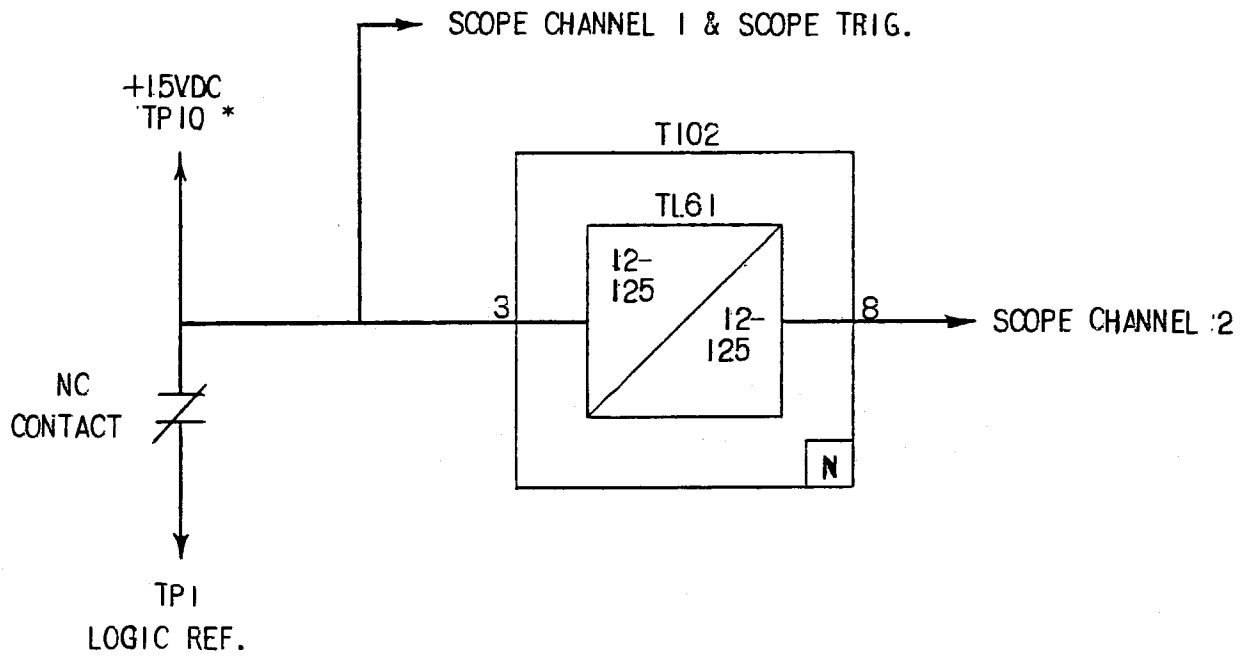
Figure 5 (0227A2050-0, Sh. 316) Typical Option Chart for the Type SLA54J Relay



- R1 10K, 1/2W
- R2 150-Ω, 1/2W
- R9, R13 82-Ω, 1/2W
- R10, R14 180-Ω, 1/2W
- R5, R7, R11 51-Ω, 1/2W
- R6, R8, R12, 560-Ω, 1/2W
- R15, R16 20-Ω, 1/2W
- D1 TO D25 1N4148
- Q1, Q2 2N2193A
- Q4, Q5 2N2868
- C1 .47UF, 50V
- C9, C10 .0033UF, 50V
- C3, C4, C5 .015UF, 50V
- C6, C7, C8 .056UF, 50V
- RF CHOKE 220uh, 220MA
- T1 0227A1401 GR.4
- T2, T3, T4 0227A1401 GR.2

P.C. CARD ASM. 0165B1971 GR.19

Figure 6 (0208A5504AR-0) Internal Connections for the Isolation Interface Used in the Type SLA54J Relay



* THE 1.5VDC SIGNAL AT PIN 10 HAS A CURRENT LIMITING RESISTOR MOUNTED ON THE TEST CARD.

Figure 7 (0246A7987-0) Timer Test Circuit for Setting Timer Cards in the Type SLA54J Relay

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