INSTRUCTIONS

GEK-86075

SOLID STATE AUXILIARY LOGIC RELAY

FOR TRANSMISSION LINE PROTECTION

TYPE SLA51Y

GENERAL ELECTRIC

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SOLID STATE AUXILIARY LOGIC RELAY FOR TRANSMISSION LINE PROTECTION TYPE SLA51Y

DESCRIPTION

The Type SLA51Y relay is an auxiliary logic relay designed to be used in a directional comparison ON-OFF carrier scheme. 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 SLA51Y relay, appropriate ground and phase relays, plus a power supply and auxiliary tripping relay, are required to complete a particular relaying scheme.

The Type SLA51Y relay is packaged in a four-rack unit enclosed metal case. The relay is suitable for mounting in a 19-inch rack, and the mounting and outline dimensions are shown in Figure 3. Internal connections for the SLA51Y relay are shown in Figure 1, and the component and card locations are shown in Figure 2.

APPLICATION

The SLA51Y relay is designed to operate in conjunction with appropriate phase and ground relays in a directional comparison ON-OFF blocking scheme, using a Type CS26B/or CS26C power line carrier as the pilot channel. The SLA51Y includes circuits to accomodate the use of first and second zone phase and ground distance back-up protection with the blocking directional comparison scheme. An isolation interface provides the interconnection between the SLA51Y logic and the transmitter and receiver of the pilot channel.

Protection features required in a relaying scheme often vary from scheme to scheme, and it is sometimes desirable to provide certain features initially with the scheme or to provide features so that they may be added at a later date in the field. To this end, the SLA51Y design has incorporated circuit flexibility to permit implementation of certain optional features.

For the specific options and the logic arrangement supplied with a particular scheme, refer to the logic diagram and logic descriptive write-up supplied with that scheme. If it is desired to make logic changes at a later date, the diagrams and instruction books supplied with a particular scheme should be studied to determine the means for implementing the changes. If further assistance is required after study of the diagrams, contact the nearest General Electric District Sales Office.

Various points in the logic can be monitored by providing jumpers from any of the available matrix points to plugs 411 and 421 located on the rear of the SLA51Y

relay. This option is further described in the paragraph, DATA MONITORING POINTS, under the section headed **OPERATING PRINCIPLES.**

RATINGS

The Type SLA51Y 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 SLA51Y relay requires a plus and 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 of the contact converter. The three possible voltages are 48, 125 and 250 volts DC.

BURDENS

The SLA51Y relay presents a maximum burden of 400 milliamperes to the plus 15 volt DC supply of the Type SSA power supply.

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

OPERATING PRINCIPLES

LOGIC CIRCUITS

The functions of the Type SLA51Y 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 VDC 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 1) are explained by the legend shown in Figure 4.

The matrix block options shown on the internal connections diagram of the SLA51Y are provided at the factory. These connections are shown on the associated overall logic diagram, and are listed on the associated option chart. A sample option chart for the Type SLA51Y relay is shown in Figure 5.

CONTACT CONVERTERS

The purpose of this function is to convert a contact operation into a signal that is compatible with the logic circuitry of the relay. These contact converters, labeled CC1 through CC6, have a non-adjustable four millisecond pickup delay. Refer to the logic description for the particular scheme for information concerning the use of each contact converter.

REED RELAY OUTPUTS

The purpose of this function is to convert a signal compatible with the logic circuitry of the relay to an output contact. Refer to Table I for output contact ratings.

TABLE I

ABSOLUTE MAXIMUM RATINGS		
10 VA resistive 3 VA inductive 0.5 amperes make and carry continuous 0.5 amperes make and carry short time		
VOLTS 250 MAX.	INTERRUPTING CAPACITY, AMPS	
	INDUCTIVE	RESISTIVE
48 125 250	0.06 0.02 0.01	0.20 0.08 0.04

PUSHBUTTON CARD

A pushbutton card is available. The function of the pushbutton is to inject a logic level "1" signal at various points in the logic to test the logic circuitry. Refer to overall logic diagram for the logic location of the pushbutton.

DATA MONITORING POINTS

The Type SLA51Y relay has provision for data monitoring outputs. The data monitoring (DLA) points are selected on the matrix blocks and are listed on the option chart. A data logging amplifier (Type DLA) relay is used to translate the logic signals into usable outputs.

CHANNEL INTERFACE

The logic of the Type SLA51Y 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 9 and 10 are both connected to relay reference, a metallically 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.

SETTINGS

There are certain timers in the SLA51Y relay that may require field adjustment. Refer to the logic description supplied with each scheme for the settings to be made on these timers.

CONSTRUCTION

The SLA51Y 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 Figure 3 and 2, respectively.

The SLA51Y relay contains printed circuit cards identified by a code number, such as A102, 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 unit internal connection diagram, and on the printed circuit card. The test points (TP1, TP2, etc.) shown on 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 in the rear of the unit as shown in Figure 2. The green (G), red (R), black (B), orange (OR), white (W), and violet (V) matrix blocks have 20 individual matrix points. The yellow (YA and YB) blocks have 20 points, which are grouped in ten common points; 1 to 10 are tied to plus 15 volts DC, 11 to 20 are tied to reference. Tools for inserting and removing taper tip jumpers are supplied with each relay.

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 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 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

If the SLA51Y relay that is to be tested is installed in an equipment which has already been connected to the power system, disconnect the outputs in the associated Type SLAT relay from the system.

The SLA51Y 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.

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. Where a time range is indicated on the overall logic diagram, the timer should be set for the value recommended for that function in the descriptive write-up accompanying the overall logic diagram. Where 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 in a later section.

OPERATIONAL CHECKS

Operation of the SLA51Y unit can be checked by observing the signals at the twenty test points (TP1 to TP20) in the SLA51Y, 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 is the reference bus for the logic circuit; TP10 is at plus 15 volts DC and TP2 is at minus 15 volts DC. The remaining points are located at various strategic points throughout the logic as shown on the internal connection diagram (Figure 1). 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.

TEST CARD ADAPTER

The test card adapter provides a convenient means of gaining access to any pin of a particular card. Detailed information on the use of the test adapter card is included in the printed circuit card instruction book, GEK-34158.

TIMER ADJUSTMENTS AND TESTS

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

In order to test the timer cards it is necessary to remove the card previous to the timer (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 delay, it can be adjusted by the lower potentiometer on the timer card (clockwise increases reset time).

TABLE II

TIMER UNDER TEST	POSITION	REMOVE CARD IN POSITION
TL1	R	P
TL2	AH	**
TL3	G	H
TL4	L	K
TL5	AF	**
TL6	AG	**
TL7	AD	**
TL8	N	AM

** Refer to scheme logic diagram and Figure 1 to determine card to remove.

CONTACT CONVERTER TESTS

Operation of the contact converters can be checked by placing the contact converter card in a card adapter, after checking that the voltage tap selected agrees with the station battery voltage. Connect the station direct current through a switch to the appropriate pair of terminals of the terminal strip, AH or AJ, mounted on the rear of the relay. The terminal numbers and polarity of connections for each of the contact converters are shown in the internal connection diagram,

Figure 1. Output of the contact converter card may be monitored between pins 8 or 9 and pin 1 (reference) on the card adapter with either a scope or meter. Closure of the switch in the test source will provide a plus 15 volt DC signal at pin 8 or pin 9 of the card adapter.

ISOLATION INTERFACE TESTS

Operation of the three functions (received carrier, transmitter control, and transmitter auxiliary stop) of the isolation interface can be checked without direct connections to the subassembly. External test connections are made to the pins of the C111 socket mounted on the rear of the unit, see Figure 1. Logic circuit test connections are made at the socket pins of the channel control card in position C.

Received carrier operation test connections are shown in Figure 8A. Do not remove the channel control card in position C for this test. Closure of the normally open contact will simulate a received carrier signal and the scope display will go from a LOGIC ZERO to a LOGIC ONE.

For the transmitter control and transmitter auxiliary stop checks, remove the channel control card, C, from its socket and replace it with a test card adapter and test card to gain access to the C socket pins. Transmitter control test connections are shown in Figure 8B. The test contact in the open position simulates a LOGIC ONE condition which holds off the transmitter control output of the isolation interface. Closure of the normally open contact generates a LOGIC ZERO condition, initiating a transmitter control output producing a five to six volt DC signal across the output loading resistor. The transmitter auxiliary stop function can be tested in a similar manner using the test connections of Figure 8C, and the output again will provide a five to six volt DC signal across the output loading resistor.

OUTPUT CONTACT TESTS

Output contacts can be checked using the same input signal as used to initiate timer card pickups and dropouts. Place the output contact card in a card extender, remove the cards feeding the output cantact cards, and apply a LOGIC ONE (15 volts DC to reference) or a LOGIC ZERO signal to the output contact under test. Using an ohmmeter, measure a change in state of output contacts with the application of the test signal. With LOGIC ONE applied, normally open contacts will close and normally closed contacts will open. With a LOGIC ZERO applied, normally open contacts will open and normally closed contacts will close.

OVERALL EQUIPMENT TESTS

After the SLA51Y 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 current and voltages to the measuring units as specified in the instruction book for the measuring units and checking that proper outputs are obtained from the associated SLAT when measuring units operate.

MAINTENANCE

PERIODIC TESTS

It should be sufficient to check the outputs produced at test points in the SLA51Y when periodic calibration tests are made on the associated measuring units, for example, the phase and ground relays in line-relaying scheme. No separate periodic tests on the SLA51Y 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.

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 SLA51Y relay are included in the printed circuit card instruction book, GEK-34158.

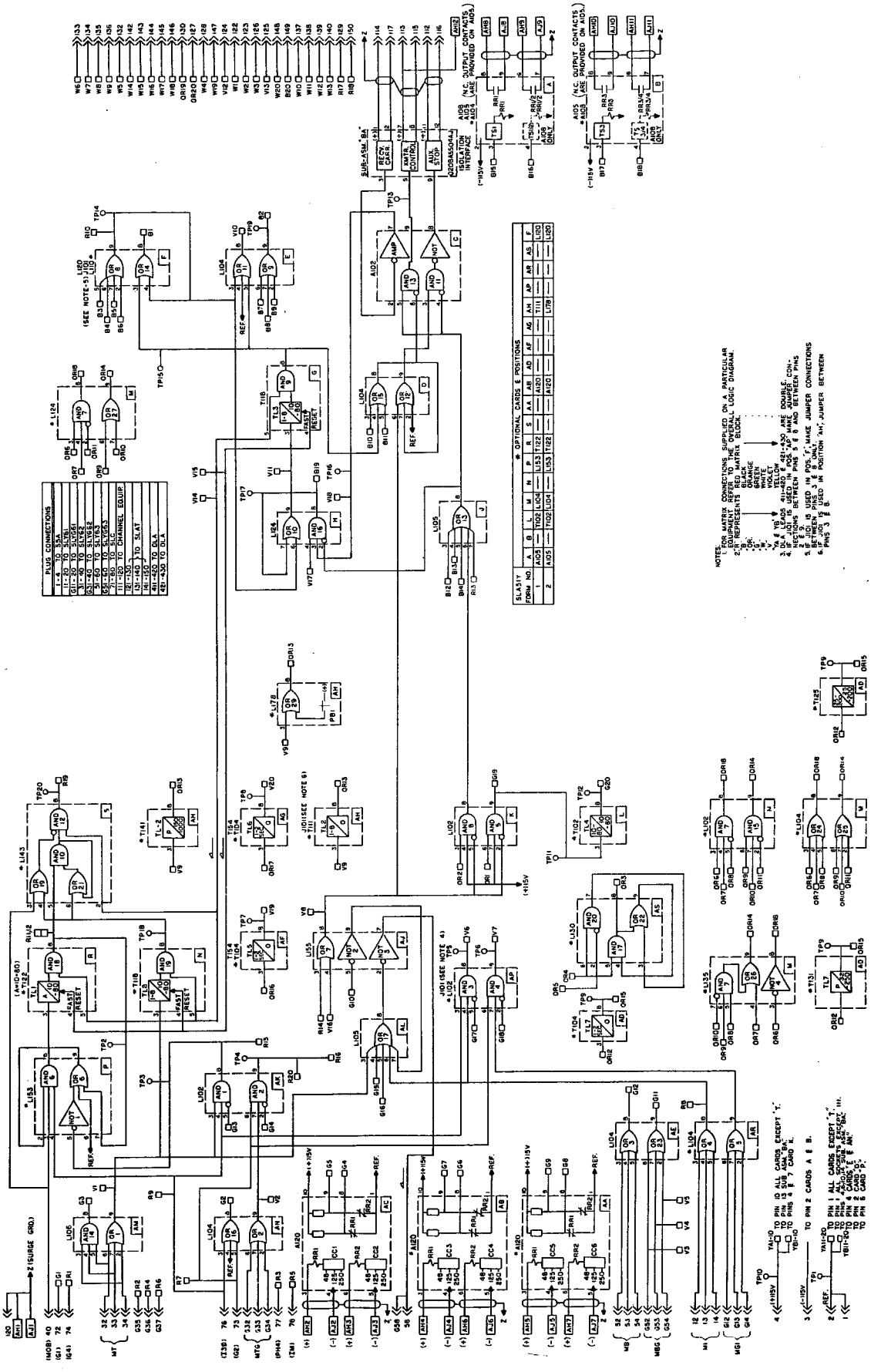

Figure 1 (0145D9091-0) Internal Connection Diagram for the SLA51Y Relay

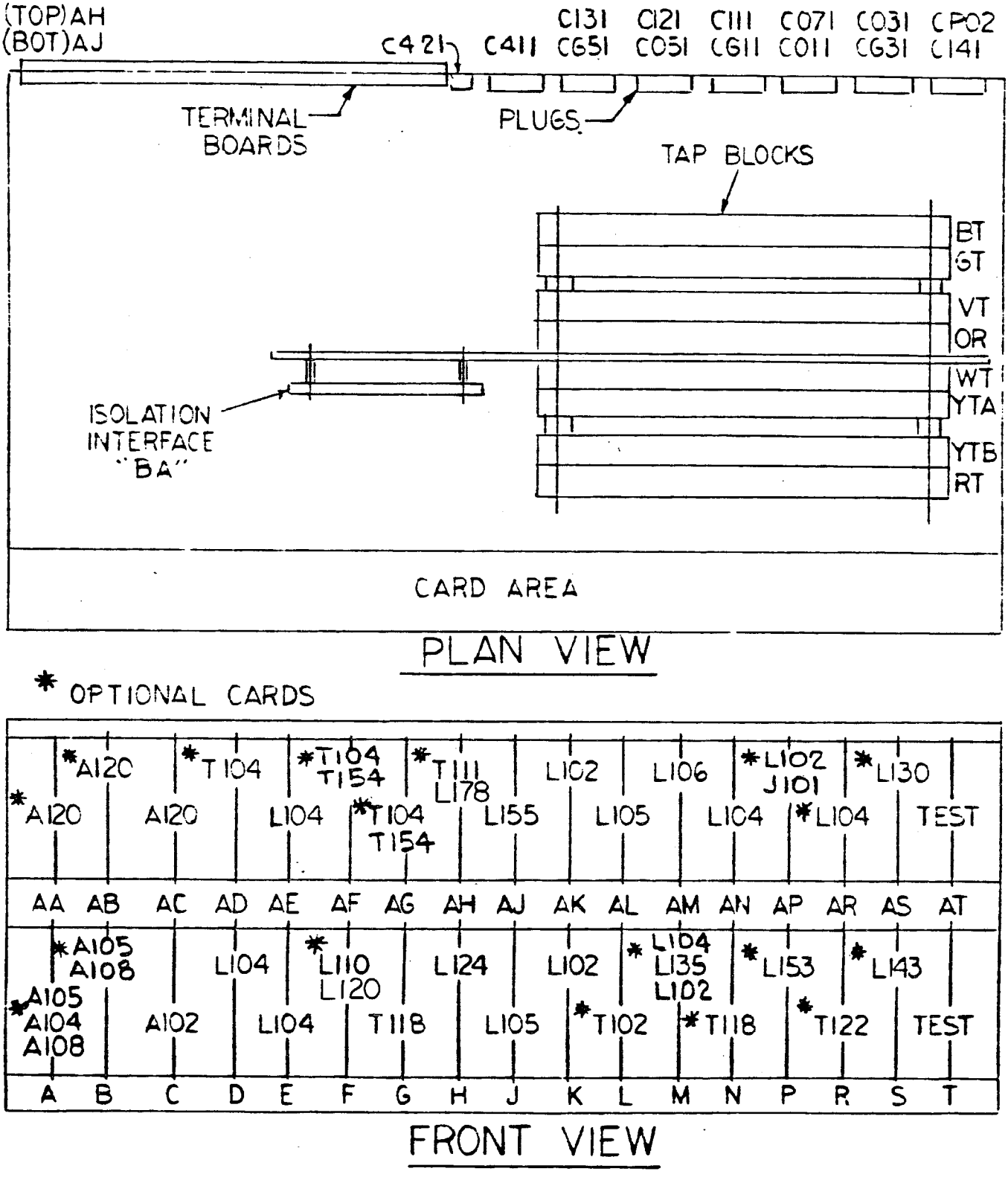

Figure 2 (0285A7197-0) Component Location Diagram for the SLA51Y Relay

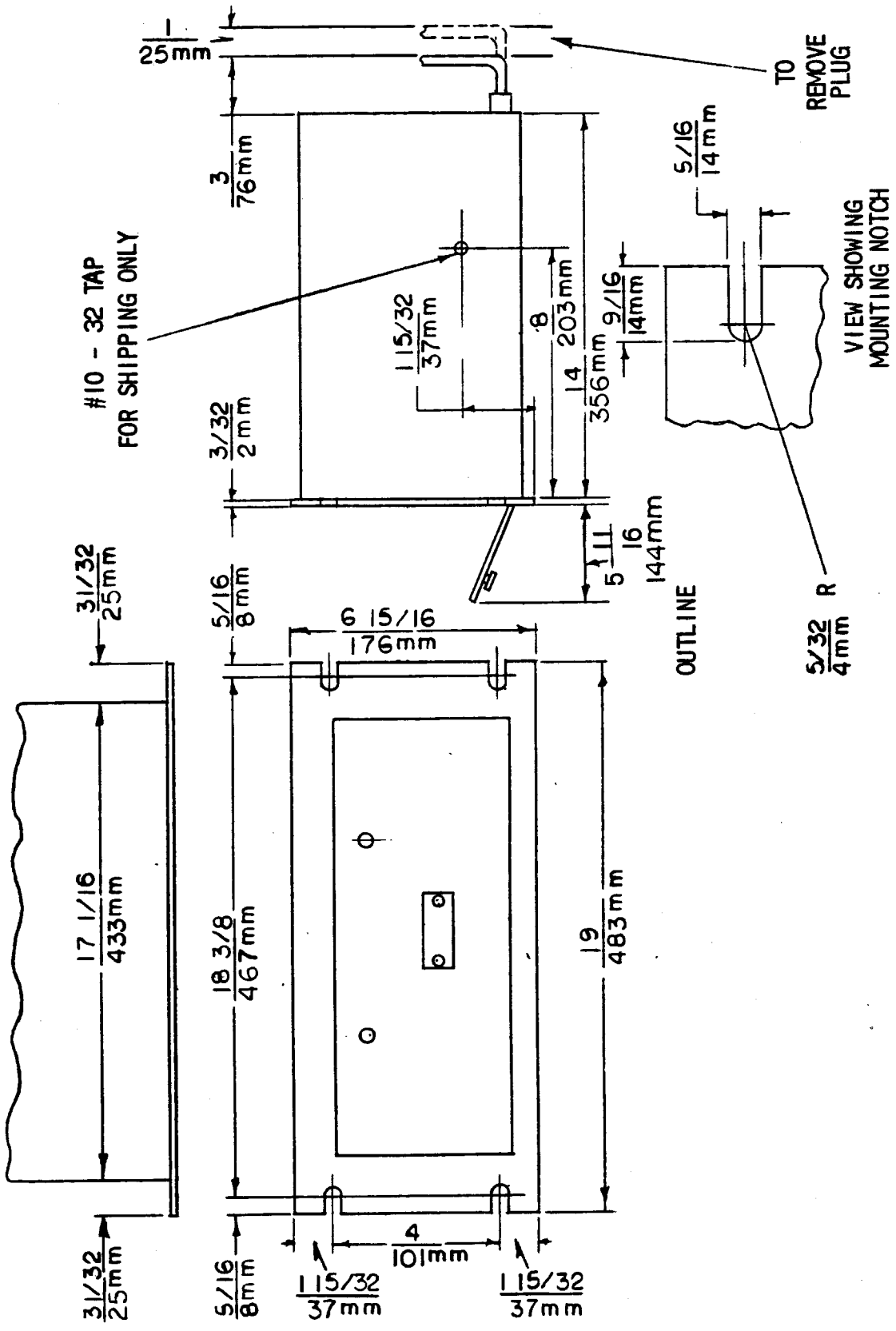

Figure 3 (0227A2037-0) Outline and Mounting Dimensions for the SLA51Y Relay

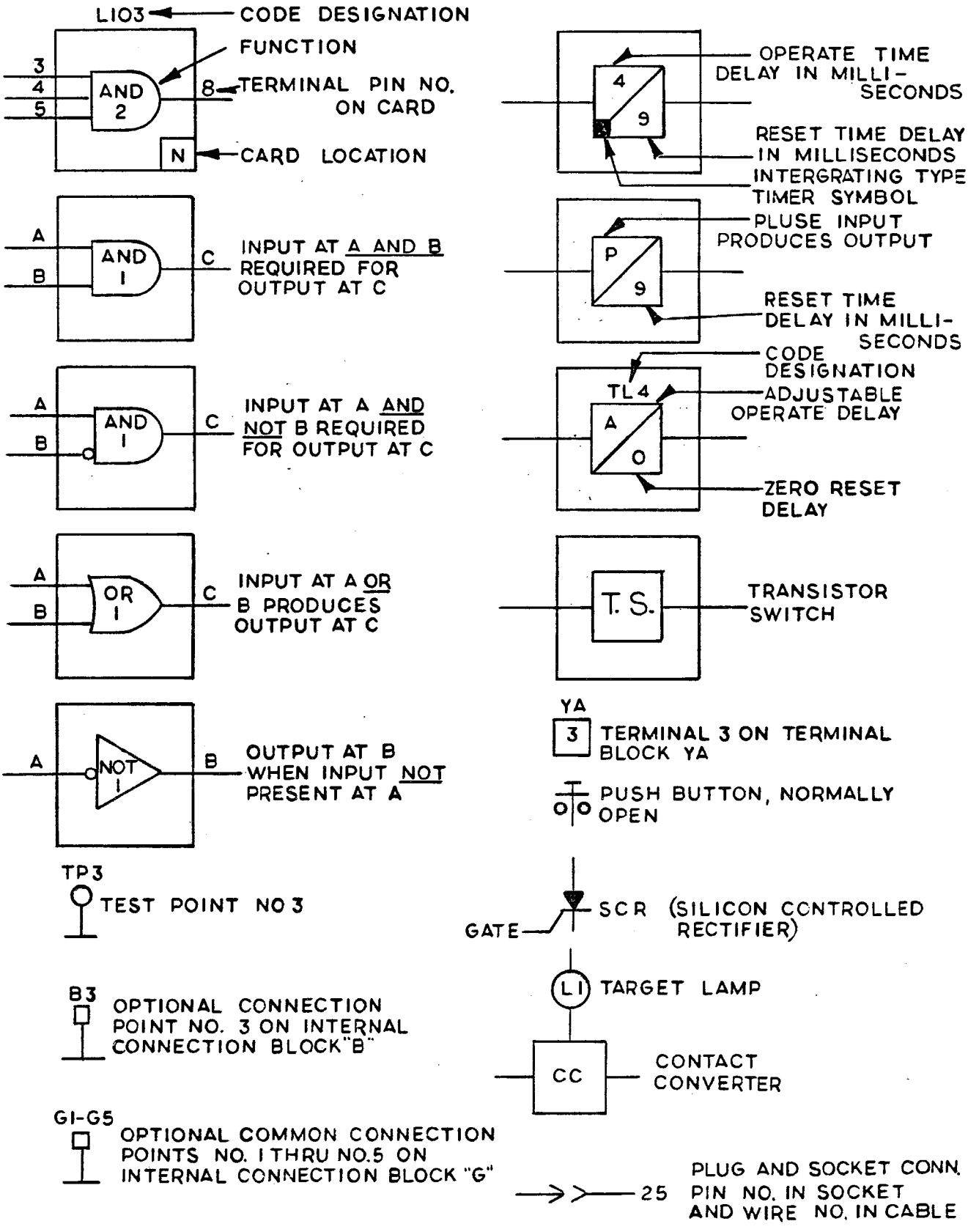

Figure 4 (0227A2047-1) Logic And Internal Connection Diagram Legend

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

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MATRIX BLOCK JUMPERS		LOGIC FUNCTION	
FROM	TO	FROM	TO
G13	YA15 ‡	AND1(5)	REF
G14	YA15 ‡	AND2(2)	REF
W19	YA2	PL147	+15V
W18	YA3	PL146	+15V
W9	YA16	PL136	REF
OR7	YA17	OR24(4)	REF
B3	YA14 ‡	OR8(5)	REF
G15	YA11 ‡	OR17(4)	REF
R8	YA11 ‡	OR17(6)	REF
OR8	YA12 ‡	OR24(5)	REF
B5	YA12 ‡	OR8(7)	REF
B6	YA13	OR8(2)	REF
W1	YA14 ‡	PL122	REF
OR20	V15	PL127	TL3(4)
OR19	V14	PL130	AND18(5)
R11	B15	AND18(8)	TS1(3)
R5	G10	PL78	NOT2(5)
V2	G16	OR2(9)	OR17(5)
G19	B14	AND5(9)	OR13(5)
G4 ‡	B13	CC1(8)	OR13(4)
G4 ‡	B10	CC1(8)	OR15(3)
OR18	B12	OR24(8)	OR13(3)
G20	OR6	TL4(8)	OR24(3)
G5	B11	CC2(9)	OR15(5)
G6	OR2	CC3(8)	AND8(3)
V8	V17	OR7(8)	AND16(4)
R1 ‡	B4	PL74	OR8(6)
R1 ‡	W17	PL74	PL145
B1	W8	OR14(8)	PL135
G2	W5	OR16(8)	PL132
V10	V12	OR11(8)	PL124

MATRIX BLOCK JUMPERS		LOGIC FUNCTION	
FROM	TO	FROM	TO
V11	V13	OR10(9)	PL125
R15‡	W14	AND1(8)	PL142
PL412	G1	DLA	PL72
PL412	OR1	DLA	AND5(6)
PL413	G12	DLA	OR3(8)
PL415	V18	DLA	AND16(3)
PL416	W4	DLA	PL128
PL417	R16	DLA	AND2(9)
PL417	W15	DLA	PL143
PL414	R10	DLA	OR8(9)
PL416	W16	DLA	PL144
R20	V16	AND2(9)	OR7(4)
R15‡	V9	AND1(8)	TL2(3)
OR13	R14	TL2(8)	OR7(3)
G12	R13	OR3(8)	OR13(7)

Figure 5 (0227A2050-0, Sh. 307) Sample Option Chart for the SLA51Y Relay

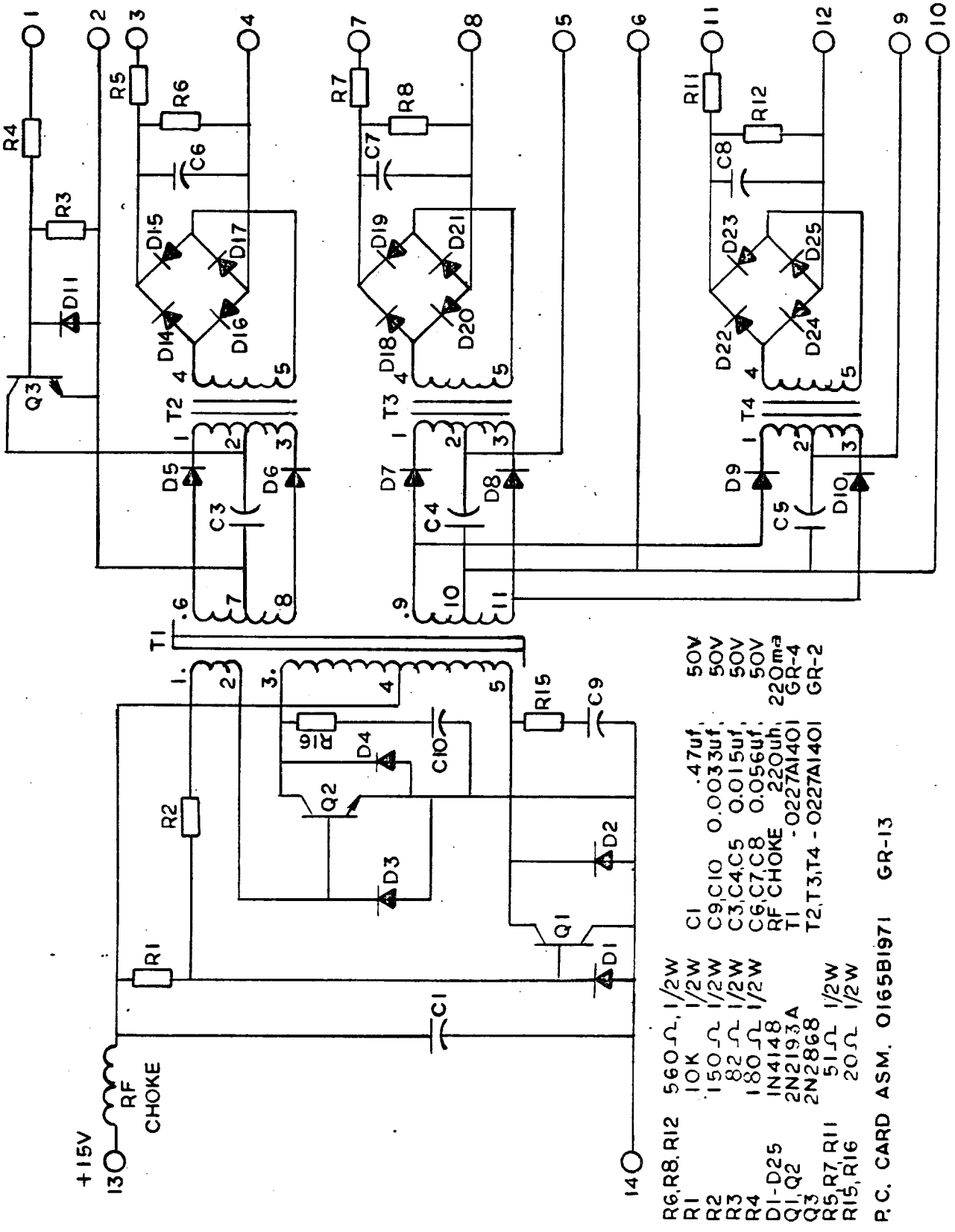
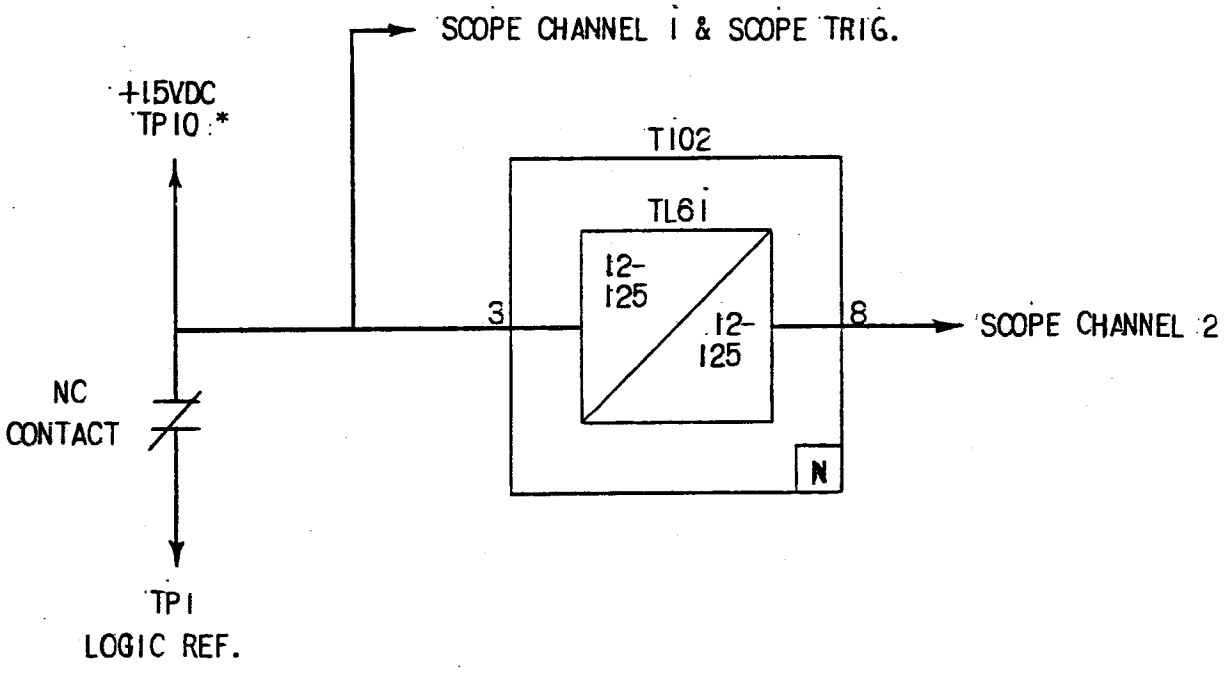


Figure 6 (0208A5504AJ-1) Isolation Interface Circuit



* THE 15VDC SIGNAL AT PIN 10 HAS A CURRENT LIMITING RESISTOR MOUNTED ON THE TEST CARD.

Figure 7 (0246A7987-0) Logic Timer Test Circuits

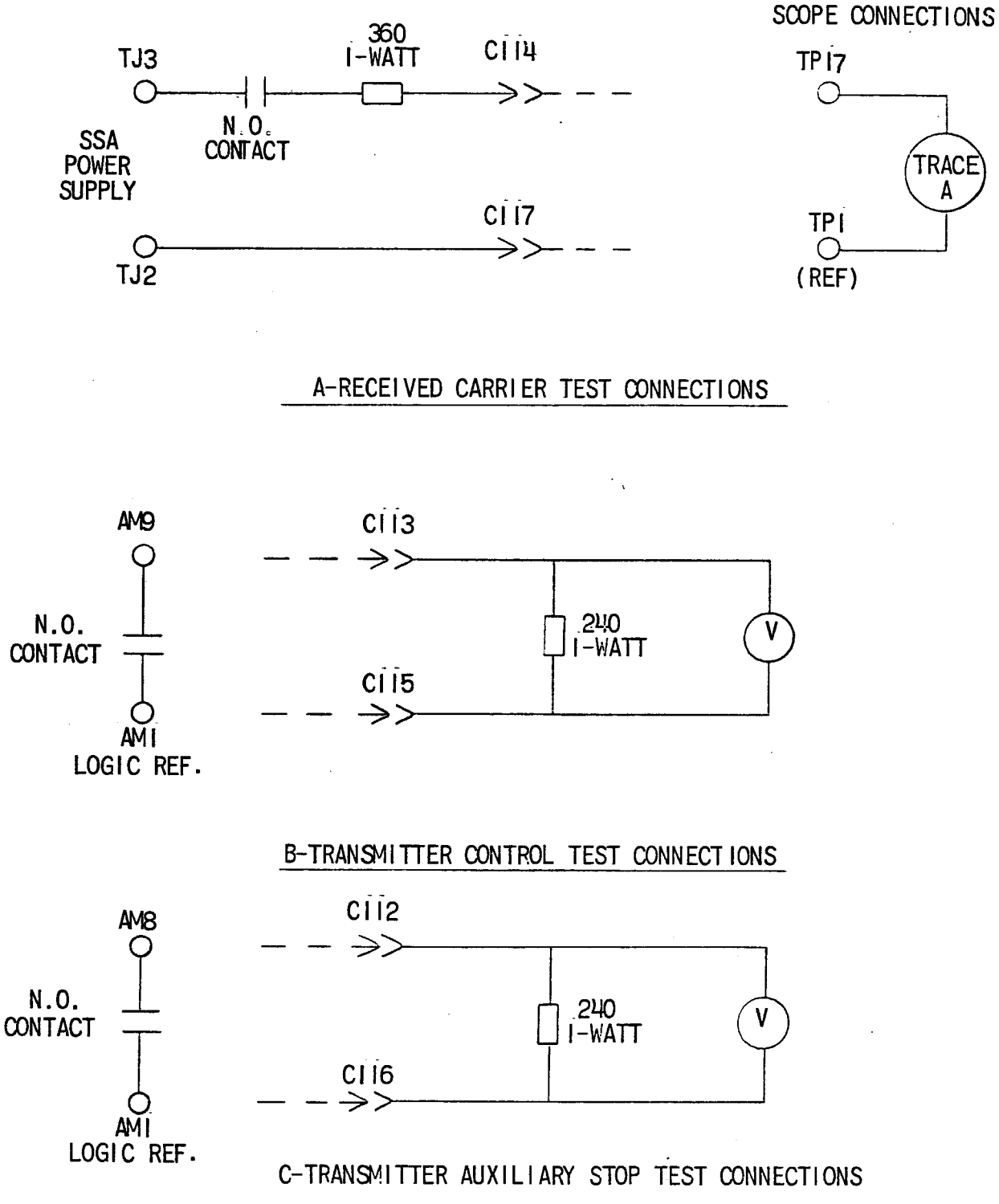


Figure 8 (0257A6244-0) Isolation Interface Test Circuits

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