

INSTRUCTIONS

GEK-86063

**SOLID STATE AUXILIARY LOGIC RELAY
FOR
TRANSMISSION LINE PROTECTION
TYPE SLA51W**

GENERAL  ELECTRIC

CONTENTS

	<u>PAGE</u>
DESCRIPTION	3
APPLICATION	3
RATINGS	4
BURDENS	4
OPERATING PRINCIPLES	4
LOGIC CIRCUIT	4
CONTACT CONVERTERS	4
DATA MONITORING POINTS	5
CHANNEL INTERFACE	5
SETTINGS	5
CONSTRUCTION	5
RECEIVING, HANDLING AND STORAGE	6
TEST INSTRUCTIONS	6
CAUTION	6
GENERAL	6
OPERATIONAL CHECKS	7
TEST CARD ADAPTER	7
TIMER ADJUSTMENTS AND TESTS	7
TABLE I	8
CONTACT CONVERTER TESTS	8
OVERALL EQUIPMENT TESTS	9
MAINTENANCE	9
PERIODIC TESTS	9
TROUBLESHOOTING	9
SPARE PARTS	9

**SOLID STATE AUXILIARY LOGIC RELAY
FOR TRANSMISSION LINE PROTECTION**

TYPE SLA51W

DESCRIPTION

The SLA51W is an auxiliary logic relay designed for use in a directional comparison 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 SLA51W relay, appropriate ground and phase relays, plus a power supply and auxiliary tripping relay are required to complete a particular relaying scheme.

The Type SLA51W is packaged in a four-rack unit enclosed metal case. The relay is suitable for mounting in a 19-inch rack. The case outline and mounting dimensions are shown in Figure 3. The internal connections for this relay are shown in Figure 1 and the component and printed circuit card locations are shown in Figure 2.

APPLICATION

The SLA51W is designed to operate in conjunction with appropriate phase and ground relays in a directional comparison scheme using a pilot channel. The SLA51W includes circuits to accommodate the use of first and second zone phase and ground distance back-up protection with the blocking directional comparison scheme. A contact interface provides the interconnection between the SLA51W 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 SLA51W 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 the 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 the equipment should be studied to determine the means for implementing the changes. If after study of the diagrams, further assistance is required, 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 SLA51W relay. This option is further described in paragraph, DATA MONITORING POINTS, in the section entitled **OPERATING PRINCIPLES**.

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.

RATINGS

The Type SLA51W relay is designed for use in an environment where the air temperature outside the relay case is between minus 20°C or plus 65°C.

The Type SLA51W relay requires a plus or minus 15 volts DC power source which can be obtained from a Type SSA50/51 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 volts DC, 125 volts DC and 250 volts DC.

BURDENS

The SLA51W relay presents a burden of approximately 400 milliamperes to the plus 15 volts DC supply of the Type SSA50/51 power supply.

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

OPERATING PRINCIPLES

LOGIC CIRCUIT

The functions of the Type SLA51W 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 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 connections shown in the internal connections of the SLA51W 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 SLA51W 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 circuit of the Type SLA51W relay. These contact converters which are labeled CC1 through CC4 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.

DATA MONITORING POINTS

The Type SLA51W relay has provisions to provide data monitoring outputs. The data monitoring (DLA) points are selected on the matrix blocks and are listed on the option chart. Any matrix block points which are not being used for logic connections may be monitored. Key points in the logic have more than one matrix point to allow both logic and monitoring connections. A data logging amplifier (DLA) relay is used to translate these logic signals into usable outputs.

CHANNEL INTERFACE

The logic of the Type SLA51W relay includes contact interface between the relays in the scheme and the associated channel. The circuitry of the contact 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.

SETTINGS

There are certain timers in the SLA51W 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 SLA51W 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 SLA51W 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 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 (O), white (W), brown (BR), blue (BL) and violet (V) matrix blocks each have 20 points. The yellow (Y) matrix block has 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 the taper tip jumpers are supplied with each static terminal.

RECEIVING, HANDLING AND STORAGE

The SLA51W relay 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.

TEST INSTRUCTIONS

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 SLA51W relay that is to be tested is installed in an equipment which has already been connected to the power system, disconnect the trip outputs in the associated Type SLAT relay from the system.

The SLA51W 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 SLA51W unit can be checked by observing the signals at the twenty test points (TP1 to TP20), 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 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 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 6. 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).

TABLE I

TIMER UNDER TEST	POSITION	REMOVE CARD IN POSITION
TL1 T118 (1-10/10-80)	AN	AK
TL2 T104 (100-2000/0)	AL	C
TL3 T104 (100-200/0)	AM	G
TL4 T102 (10-80/10-80)	E	D
TL5 T128 (15-100/0)	AH	AG
TL6 T125 (25-200/25-200)	AE	**
TL7 T157 (50-500/50-500)	AC	**
TL8 T155 (75/0)	AS	--

**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, 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 pin 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 volts DC signal at pin 8 or 9 of the card adapter.

OVERALL EQUIPMENT TESTS

After the SLA51W 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 book for the measuring units and checking that proper outputs are obtained from the associated SLAT when the measuring units operate.

MAINTENANCEPERIODIC TESTS

It should be sufficient to check the outputs produced at test points in the SLA51W 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 relay 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 one spare card of each type be carried in stock. 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 SLA51W relay are included in the card book, GEK-34158.

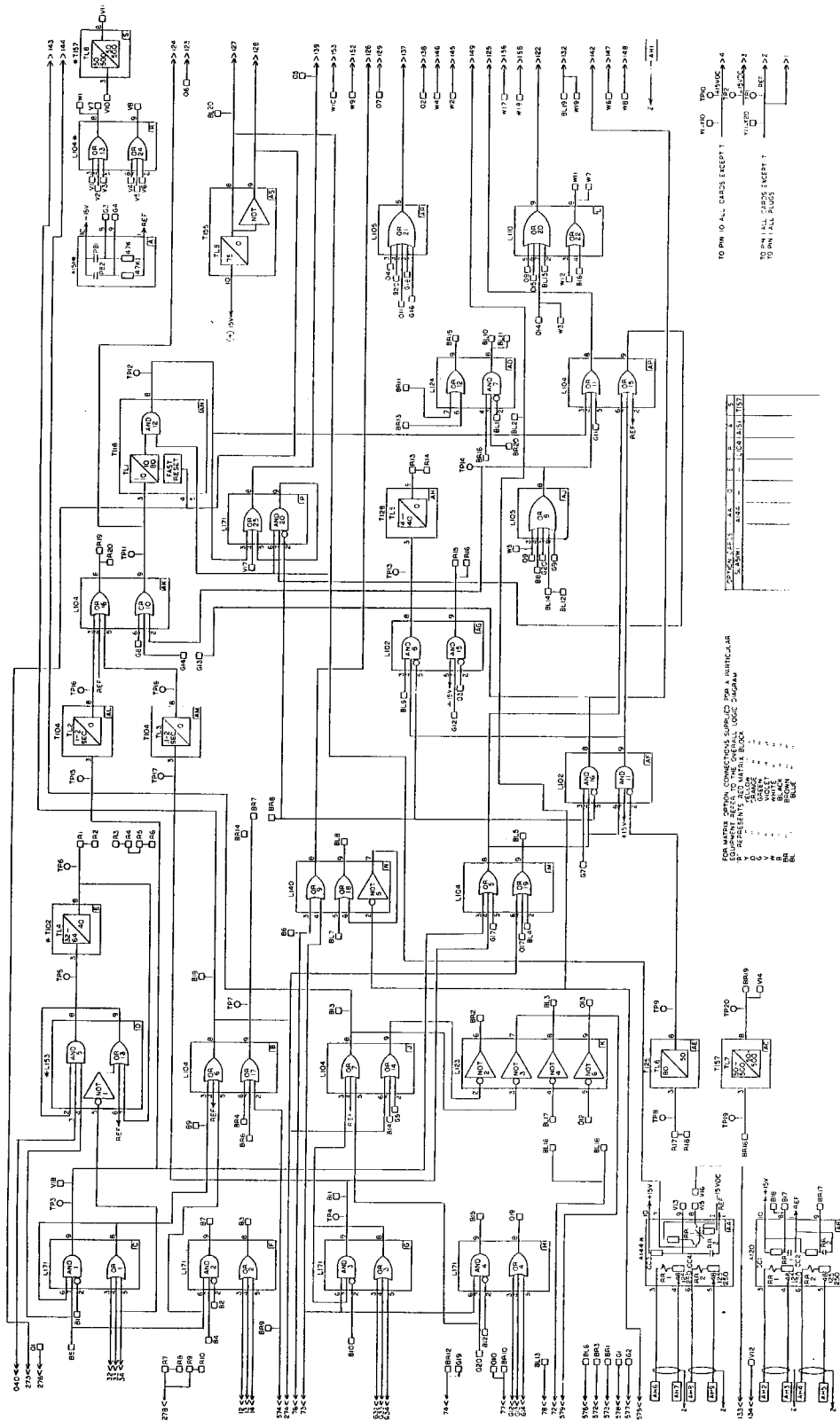


Figure 1 (0145D8996-0) Internal Connections for the Type SLA51W Relay

Figure 2 LATER Component Location Diagram for the Type SLA51W Relay

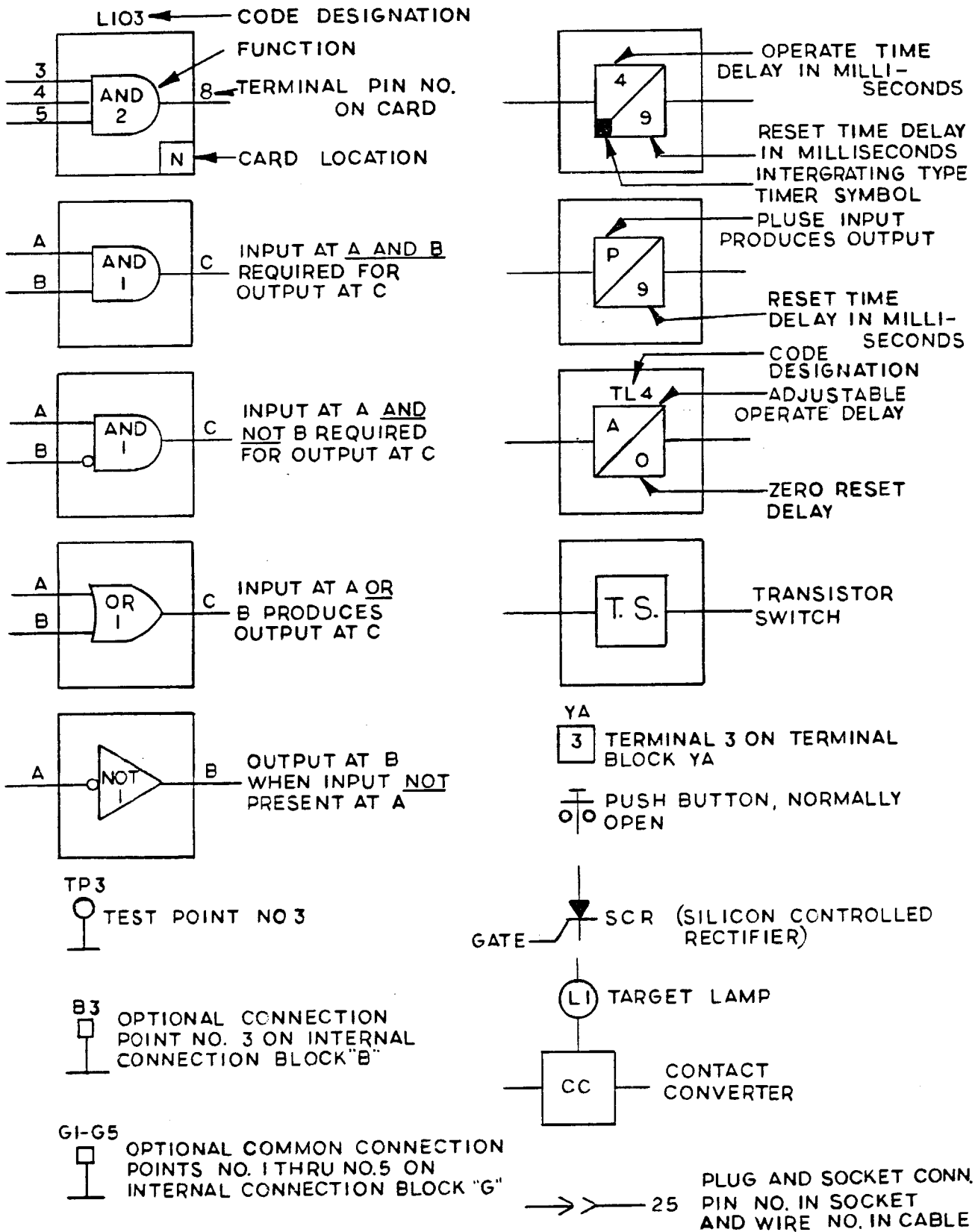
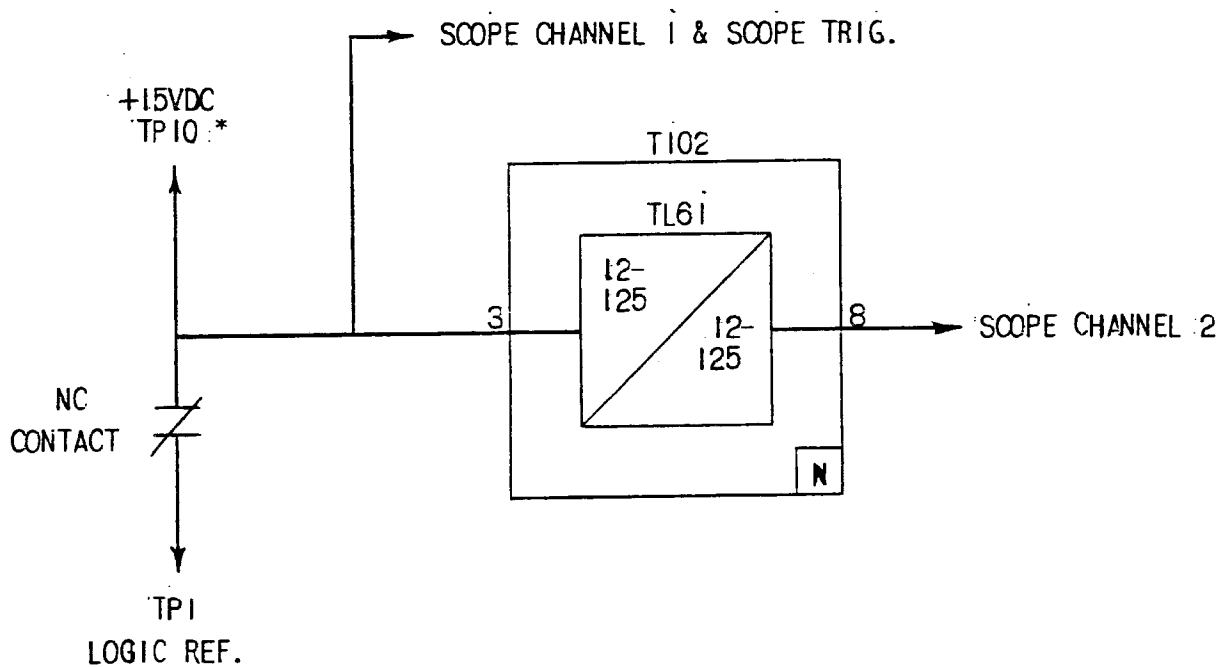


Figure 4 (0227A2047-1) Logic and Internal Connection Diagram Legend

<p>0227A2050 CONT. ON SHEET 299 SH. NO. 298</p>		<p>TITLE MATRIX BLOCK CUSTOM CONNECTION TABLE</p>		<p>JOB NO 3994</p>
<p>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 INSULATE EACH UNUSED DLA OPTION LEAD SEPARATELY AND TIE THE BUNDLE TOGETHER</p>				<p>REVISIONS</p>
MATRIX BLOCK JUMPERS		LOGIC FUNCTION		FUNCTIONAL DESCRIPTION
FROM	TO	FROM	TO	
B6	B5	PL76	AND1(C7)	INPUT TO AND1&AND2 FROM 13Ø
B1	‡Y11	AND1(C2)	REF	UNUSED INPUT TO AND1(INHIBIT MT TRIP)
B10	‡Y11	AND3(G2)	REF	UNUSED INPUT TO AND3(INHIBIT MTG TRIP)
B3	B4	OR2(FB)	AND2(F9)	INPUT TO AND2&OR6 (MI TRIP FUNCTION)
B2	‡Y12	AND2(F2)	REF	UNUSED INPUT TO AND2(INHIBIT MI TRIP)
B12	‡Y12	AND4(H2)	REF	UNUSED INPUT TO AND4(INHIBIT MGI TRIP)
B7	B8	AND2(F9)	OR8(AJ4)	INPUT TO OR8 FROM AND2(MI DIR. TRIP LOGIC)
O19	O20	OR4(HB)	AND4(H7)	INPUT TO AND4 FROM OR4(MGI TRIP LOGIC)
B17	PL412	CC1(AB8)	PL412	DLA INPUT FROM CC1 (RCVR INPUT)
PL412	R17	PL412	TL6(AE3)	INPUT TO TL6 FROM CCI (INPUT TO ECHO LOGIC)
R16	G7	TL6(AE3)	AND11(AF6)	INPUT TO AND11 FROM CCI (ECHO LOGIC)
BL8	BL9	OR18(N9)	AND8(AG3)	INPUT TO AND8 FROM OR18(WEAK INFEED LOGIC)
BL13	O12	PL78	NOT6(K5)	INPUT TO NOT6 FROM G2
O13	‡O17	NOT6(K9)	OR19(M7)	INPUT TO OR19 FROM NOT6(INHIBIT M,B&D ₂ B)
O18	‡O17	PL577	OR19(M7)	RESETTING INPUT TO M,B FOR NOT6
BL16	BL17	PL72	NOT4(K4)	INPUT TO NOT 4 FROM G1
BL3	BL4	NOT4(K8)	OR19(M2)	INPUT TO OR19 FROM NOT 4(INHIBIT D,B LOGIC)
BL5	BL6	OR19(M9)	PL576	RESETTING INPUT TO D ₂ B FOR NOT6
B13	B14	OR7(B13)	OR14(J7)	INPUT TO OR14 FROM OR7 (INHIBIT M ₁ B LOGIC)
G5	‡Y13	OR14(J2)	REF	UNUSED INPUT TO OR14
BR2	BR1	NOT2(K6)	PL573	INPUT TO 9I FROM NOT 2 (INHIBIT M ₁ B)
B15	B16	AND4(H9)	OR22(L4)	INPUT TO OR22 FROM AND4(MGI DIR. TRIP LOGIC)
BR3	BR4	PL572	OR17(B6)	INPUT TO OR17 FROM M ₁ B (M ₁ B BLOCKING LOGIC)
‡Y17	V2	REF	OR23(R4)	UNUSED INPUT TO OR23 (DIR. TRIPPING LOGIC)
D10	O11	PL77	OR21(AR5)	INPUT TO OR21 FROM PH4 (DIR. TRIPPING LOGIC)
BR12	V3	PL74	OR23(R5)	INPUT TO OR23 FROM G4 (DIR. TRIPPING LOGIC)
BL2	BL1	PL575	AND7(AD2)	INHIBITING TO AND7 FROM V ₁
BL18	BL7	PL72	OR18(N5)	INPUT TO OR18 FROM G1 (WEAK INFEED LOGIC)
B19	B20	OR5(B8)	OR21(AR4)	INPUT TO OR21 FROM AND1 (RC LOGIC)
BR10	V1	PL77	OR23(R3)	INPUT TO OR23 FROM PH4 (LINE PICKUP LOGIC)
BR15	B8	OR12(AD9)	OR8(AJ4)	INPUT TO OR8 FROM OR12 (DIRECT TRIP LOGIC)
BL11	PL419	AND7(AD8)	PL419	DLA INPUT FROM AND7 (MONITOR DIR. TRIP LOGIC)
BL12	‡Y17	OR8(AJB)	REF	UNUSED INPUT TO OR8 (DIR. TRIPPING LOGIC)
BR7	BP8	OR17(B9)	AND8(AG5)	INPUT TO AND8 & AND16 FROM M ₁ B & D ₂ B (BLK LOGIC)
R13	PL415	TL5(AHB)	PL415	DLA INPUT FROM TL5
R14	O9	TL5(AHB)	OR8(AJ3)	INPUT TO OR8 FROM TL5

<p>DATE: 6-7-92 BY: [Signature]</p>	<p>APPROVALS</p>	<p>PWR SYS MGT PHILA</p>	<p>0227A2050 CONT. ON SHEET 299 SH. NO. 298</p>
		<p>↑</p>	<p>PSM R CODE 936 SE 1231 (I) REV. 2</p>

Figure 5 (0227A2050-0, Sh. 298) Sample Option Chart



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

Figure 6 (0246A7987-0) Logic Timer Test Circuit

**GENERAL ELECTRIC COMPANY
POWER SYSTEMS MANAGEMENT BUSINESS DEPT.
MALVERN, PA 19355**

GENERAL  ELECTRIC