



INSTRUCTIONS

GEK-49784A

SUPERSEDES GEK-49784

STATIC OUTPUT AND TRIPPING UNIT

TYPE SLAT51K

POWER SYSTEMS MANAGEMENT DEPARTMENT

GENERAL  ELECTRIC

PHILADELPHIA, PA.

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STATIC OUTPUT AND TRIPPING UNIT

TYPE SLAT51K

DESCRIPTION

The Type SLAT51K relay is a static output and tripping unit. It is not intended to be used by itself, but rather as part of a complement of equipment that forms a protective relaying scheme. For a 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 terminal of equipment.

The Type SLAT51K relay is packaged in a four rack unit (1 R.U. = 1 3/4 inches) enclosed metal case suitable for mounting on a 19 inch rack. The outline and mounting dimensions are shown in Fig. 1. The internal connections for the SLAT51K relay are shown in Fig. 2. The component and card locations are shown in Fig. 3.

APPLICATION

The Type SLAT51K relay is a static output and tripping relay designed for use in various types of static relaying schemes. For example, the SLAT51K relay can be used in conjunction with types SLY, SLYG, SLC, SSA and SLA relays to make up a directional comparison pilot relaying scheme. Other schemes are also available in which the SLAT51K relay can be used. For a complete description of the particular scheme in which the SLAT51K relay is employed, refer to the overall logic diagram and description supplied with the scheme. The following is a listing of the various output functions included in the SLAT51K together with a general description of their intended uses.

- SCR - Four silicon controlled rectifier trip circuits are provided to permit tripping of associated circuit breakers.
- BFI - Breaker failure back-up initiation function provides two contact outputs for breaker failure protection. Included diodes provide the option of supervising the BFI contacts by the SCR trip circuits.
- RC - The RC function provides two electrically-separate, normally open contacts which can be used to cancel reclosing following operation of the out-of-step detection scheme.

In addition to the above output functions, four target lamps are provided with each SLAT51K and three more lamps can be provided as an option.

RATINGS AND SPECIFICATIONS

The Type SLAT51K relay is designed for use in an environment where the air temperature outside the relay case does not exceed -20°C and $+65^{\circ}\text{C}$.

The Type SLAT51K relay requires a ± 15 VDC power source which can be obtained from a Type SSA power supply.

The four electrically isolated SCR tripping circuits are rated for 48/125 or 250 VDC. Each has a 1.0 ampere series target. The tripping circuits are designed to carry 30 amperes for one second. For the voltage rating of the particular relay in question, refer to the equipment summary and to the nameplate on the relay case.

The contacts of the telephone-type relay that is used for the BFI function will make and carry three amperes continuously and will interrupt up to 0.5 ampere inductive at 125 VDC or 0.25 ampere inductive at 250 VDC.

The contacts of the reed relay that is used for the RC function are rated at 100 voltamperes. They will make and carry three amperes continuous current.

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.

BFI Pickup Time.....	4 milliseconds
BFI Drop-out Time	16 milliseconds
RC Pickup Time	1-2 milliseconds
RC Drop-out Time	1-2 milliseconds
D2 To D5	600 VDC peak reverse voltage, 35 amperes for one second
Number of Target Lamps.....	Refer to overall logic diagram of the particular equipment

BURDENS

The SLAT51K relay presents a maximum burden to the Type SSA power supply of
 300 ma from the +15 VDC supply
 70 ma from the -15 VDC supply

In addition, each target lamp draws 80 milliamperes from the -15 VDC supply.

A. SCR TRIP CIRCUIT

Four electrically separate, isolated SCR trip circuits are provided to trip four breakers. Each circuit is capable of carrying 30 amperes for one second.

The internal connections for two SCR trip, and isolator subassemblies are shown in Fig. 4. There are two sets of these circuits in the SLAT51K. The isolator card, by means of a DC-to-DC converter, provides a signal path but maintains metallic isolation. This feature makes it possible to isolate the relay power supply from the trip circuit power supply.

B. RC - RECLOSE CANCELLATION

Two electrically separate, normally open contact are provided. These contacts will operate 1-2 milliseconds after the coil is energized, and drop out 1-2 milliseconds after the coil is de-energized. Welding of the contacts may occur if subjected to an overload.

C. BFI - BREAKER FAILURE INITIATION

Two electrically separate normally open contacts are provided. These contacts close within four milliseconds from the time the coil is energized and drop out 16 milliseconds from the time the coil is de-energized. The BFI function uses a telephone-type relay. Contact ratings of this relay should not be exceeded since the contacts of this relay are open to the air. It is not recommended to apply less than 50 volts across them.

D. DIODES

Four tripping duty diodes are provided in the SLAT51K relay. They are connected internally in pairs, with their cathodes shorted together. (See Fig. 2)

TARGETS

Four electromechanical target coils are included, one in series with each SCR. These targets operate on a minimum of one ampere of trip current when the associated SCR passes current. The trip circuit resistance in the relay is 0.40 ohm. Target lamps are included in the Type SLAT51K as shown on the internal connections diagram Fig. 2. Refer to the overall logic diagram scheme for the number of target lamps provided.

LOGIC CIRCUITS

The functions of the Type SLAT51K 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 is represented by a signal of approximately +15 VDC.

The symbols used on the internal connection diagram (Fig. 2) are explained by the legend shown in Fig. 5.

CONSTRUCTION

The SLAT51K relay is packaged in an enclosed metal case with hinged front cover and removable top cover. The outline and mounting dimensions of the case and the physical location of the components are shown in Figs. 1 and 3 respectively.

The SLAT51K relay contains printed circuit cards identified by a code number such as: A104, T116, L109 where A designates an auxiliary function, T designates a time-delay function, and L designates a logical 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 with TP1 at the top of the T card. TP1 is tied to reference; TP10 is tied to +15 VDC through a 1.5K resistor. This resistor limits the current when TP10 is used to supply a logic signal to a card.

The SLAT51K relay receives its inputs from the associated Type SLA relay. These units are interconnected by ten-conductor-shielded cables. The sockets for these cables are located on the rear panel of the unit. The SLAT51K output functions are connected to 12-point terminal strips, which are also located on the rear of the unit.

A window is provided in the hinged cover of the relay to allow target lamps and the mechanical targets to be seen. Push buttons are also provided to reset the targets and lamps without opening the cover.

RECEIVING, HANDLING AND STORAGE

The SLAT51K 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 the static relay equipment 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.

CAUTION:

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:

IF THE SLAT51K RELAY TO BE TESTED IS PART OF A COMPLETE RELAY TERMINAL EQUIPMENT IN SERVICE, THE VARIOUS OUTPUTS FROM THE SLAT51K MUST BE DISCONNECTED PRIOR TO ANY TEST.

A. GENERAL

The SLAT51K 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 connections 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.

B. OPERATIONAL CHECKS

Operation of the SLAT51K unit can be checked by observing the signals at the ten test points (TP1 to TP10) in the SLAT51K, or by observing the output functions. The test points are located on a test card in position T, and are numbered 1 to 10 from top to bottom. TP1 is the reference bus for the logic circuit, TP10 is at +15 VDC. The remaining points are located at various strategic points throughout the logic as shown in the internal connection diagram (Fig. 2). Test point d-c voltages can be monitored with a portable high-impedance voltmeter, the voltmeter on the test panel of the associated equipment, or an oscilloscope. Where a wave form other than direct current (step function) is expected, an oscilloscope should be used exclusively.

CAUTION

THE SLAT51K RELAY UTILIZES SINKING LOGIC (SEE PRINTED CIRCUIT CARDS INSTRUCTION BOOK, GEK-34158). EXTREME CAUTION MUST BE EXERCISED WHEN CONNECTING ANY POINT IN THE LOGIC TO REFERENCE OR +15 VDC. FOR EXAMPLE, IF TP5 IS ACCIDENTALLY CONNECTED TO TP2 (-15 VDC) INSTEAD OF TP1, THE OUTPUT STAGE OF CARD POSITION "G", AND THE INPUT STAGE OF CARDS' POSITIONS "L", "N", AND "P" WILL BURN OUT INSTANTLY. SIMILARLY, IF +15 VDC IS APPLIED TO TP5 WITHOUT A SERIES LIMITING RESISTOR (AS IS SUPPLIED WITH TP10), THE OUTPUT STAGE OF CARD POSITION "G" WILL BURN OUT INSTANTLY.

C. 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.

D. 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.

There is only one timer card in the SLAT51K relay. This timer is factory set, and normally will not require field adjustments. In the event that adjustment becomes necessary, or a check of this timer is desired, the following procedure should be followed: Pull the lead connecting pin #10 of the socket on top of the extender card, and insulate the free end of the wire. Remove card T116, position "F" and plug it into the extender. Plug the extender into position "F". (The printed circuit card does not get the +15 volts.) Connect the logic timer test circuit per Fig. 6. When the normally closed contact is opened, +15 volts are applied to the timer, and also to the scope trigger. Twenty-five milliseconds later, an output should appear on pin 8 of the card (scope channel 2). Adjust the pot on the printed circuit card if the time delay is off.

E. TRIP CIRCUIT TESTS

The SCR trip circuits and series mechanical targets may be checked by connecting an auxiliary lock-out relay, such as the Type HEA relay, in series with the SCR circuit. A typical circuit is shown in Fig. 7. The HEA relay should have the same d-c rating as the SCR trip circuit of the SLAT51K. If an auxiliary lock-out relay is not available, it can be replaced by a resistive load which limits the trip circuit current to three amperes. This current should be interrupted after a few seconds. In most equipments, the SCR can be gated by operating a test push button in the associated units.

Prior to final installation, a check of the overall trip circuit should be made with the SCR outputs connected to trip the circuit breakers.

F. OVERALL EQUIPMENT TESTS

After the SLAT51K 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 and checking that proper outputs are obtained when the measuring units operate.

MAINTENANCEA. PERIODIC TESTS

It should be sufficient to check the outputs produced at test points in the SLAT51K when periodic calibration tests are made on the associated measuring units, for example, the phase and ground relays in a line-relaying scheme. No separate periodic tests on the SLAT51K itself should be required.

B. 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 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.

C. 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 busses, 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 busses due to moisture and dust. The wiring diagrams for the cards in the SLAT51K relay are included in the card book GEK-34158.

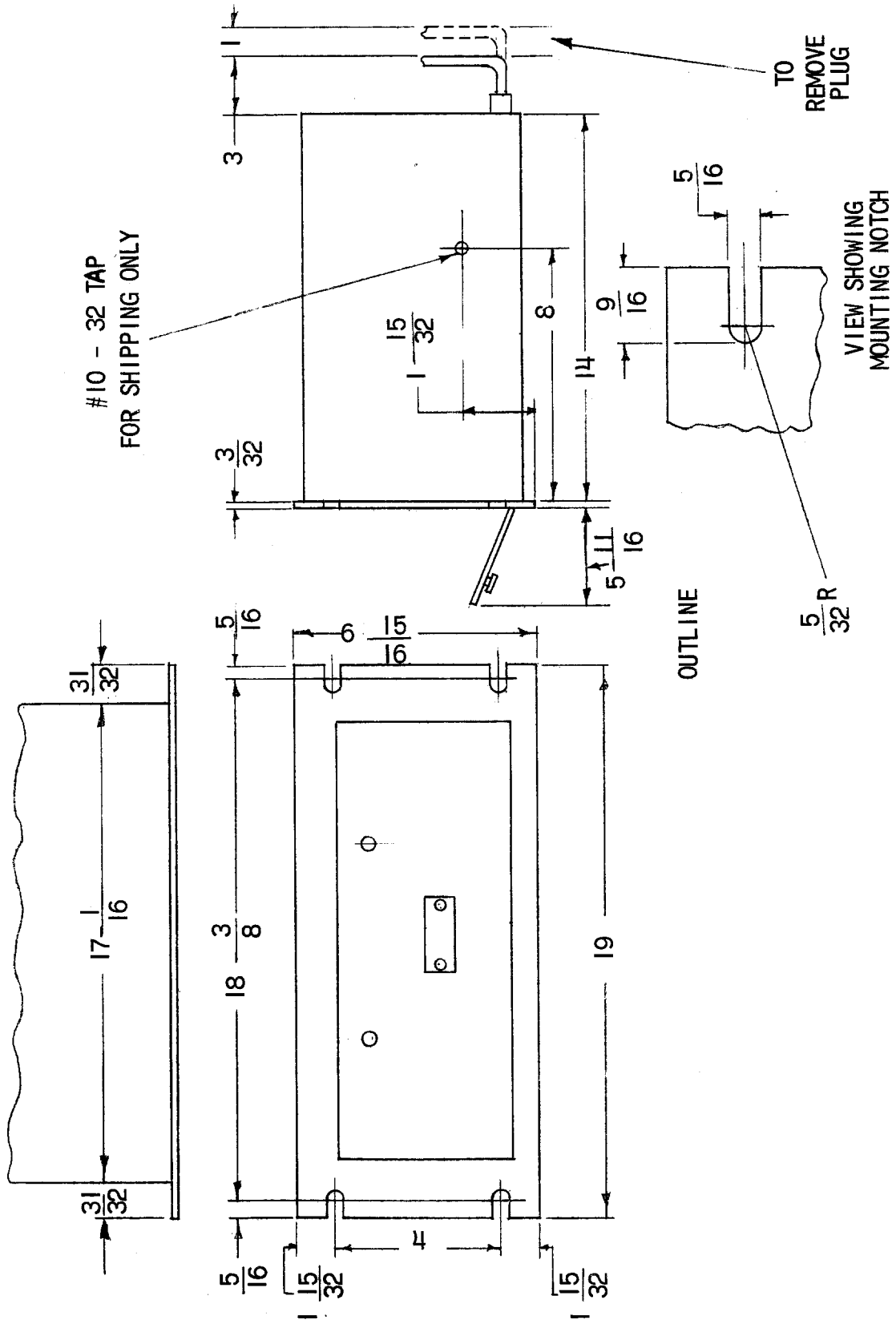


Fig. 1 (0227A2037-0) OUTLINE AND MOUNTING DIMENSIONS FOR THE SLAT51K RELAY

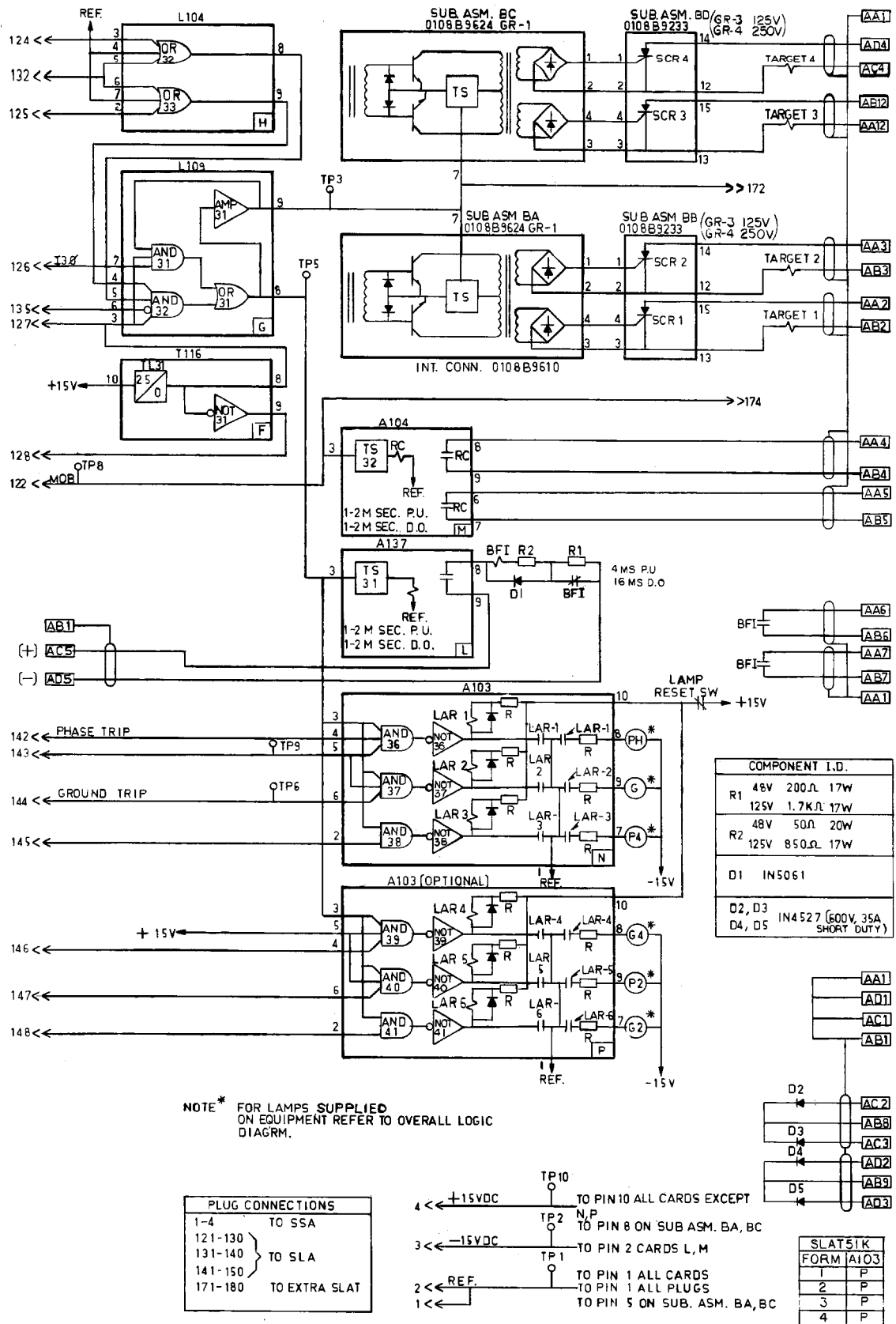


Fig. 2 (0171C7893-3) INTERNAL CONNECTIONS FOR THE SLAT51K RELAY

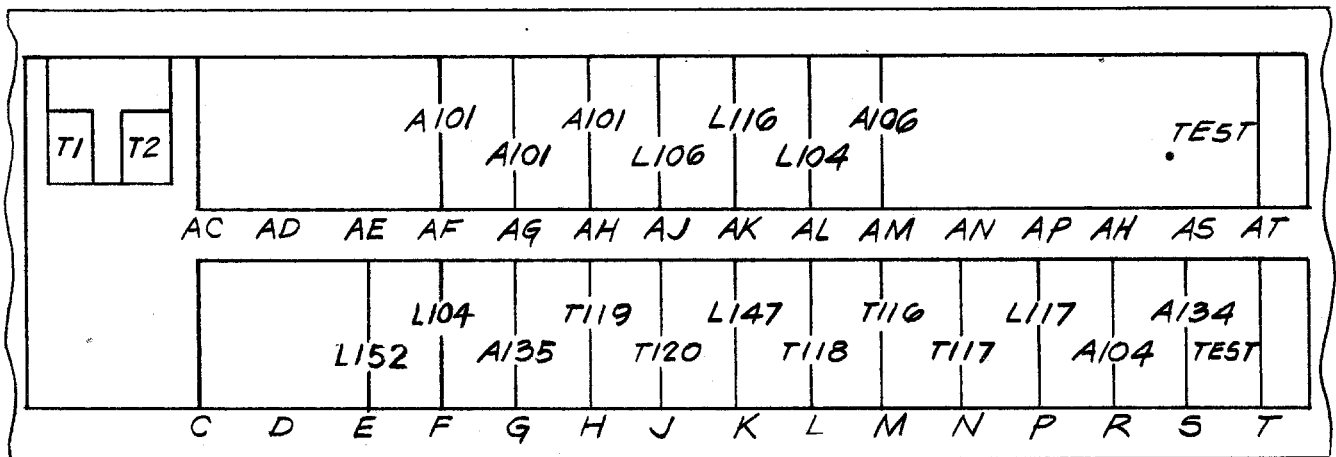
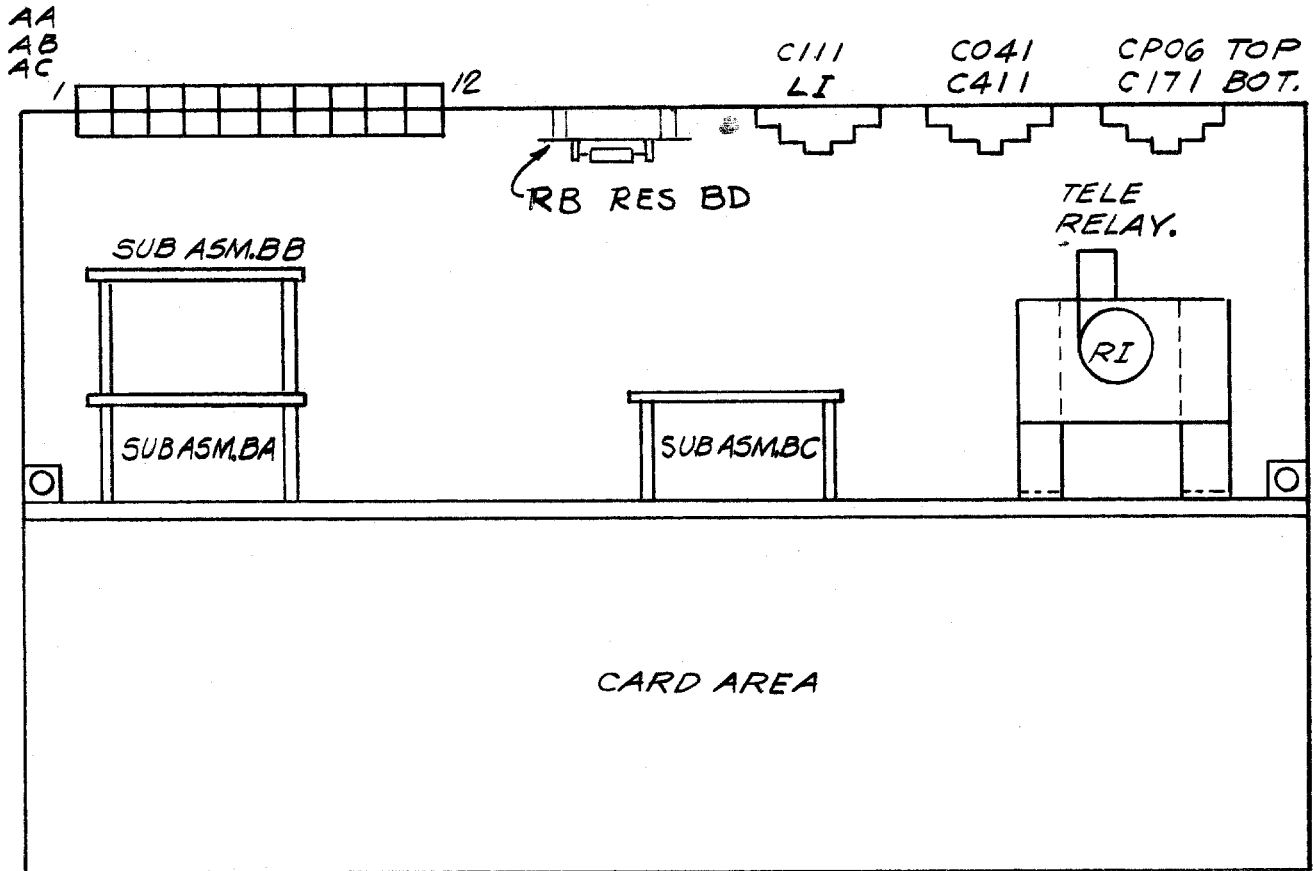
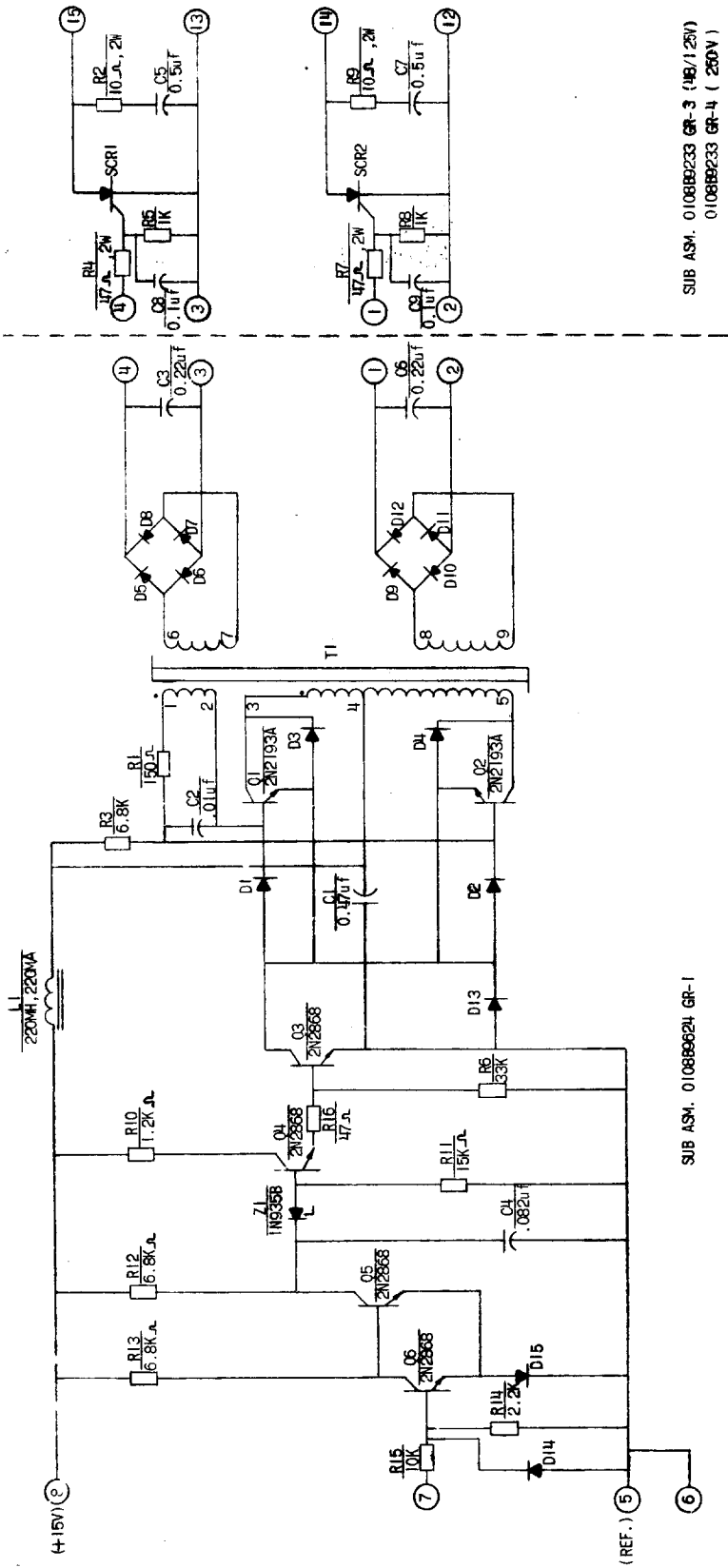


Fig. 3 (0257A8791-2) COMPONENT LOCATION DIAGRAM FOR THE SLAT51K RELAY.



SUB ASM. 0108B9233 GR-3 (146/125V)
0108B9233 GR-4 (280V)

SUB ASM. 0108B9624 GR-1

ALL DIODES INH148 UNLESS NOTED
ALL RES. 1/2 WATT \pm 5% UNLESS NOTED
② = TERM. POST ON BOARD ASM
IN935B = 9.1V \pm 5%

Fig. 4 (0108B9610-0) INTERNAL CONNECTIONS FOR ONE PAIR OF SCR TRIP AND ISOLATOR SUBASSEMBLIES

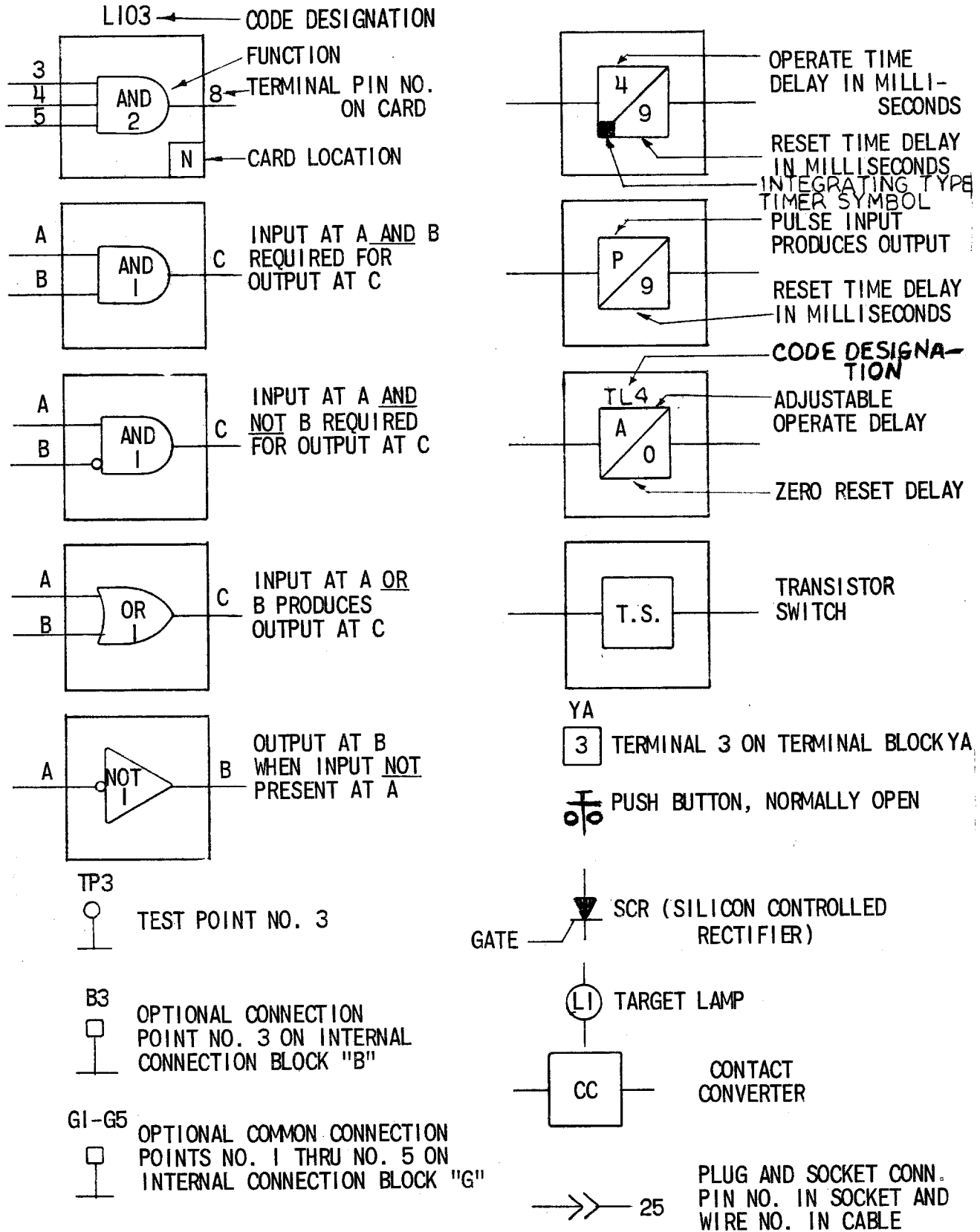
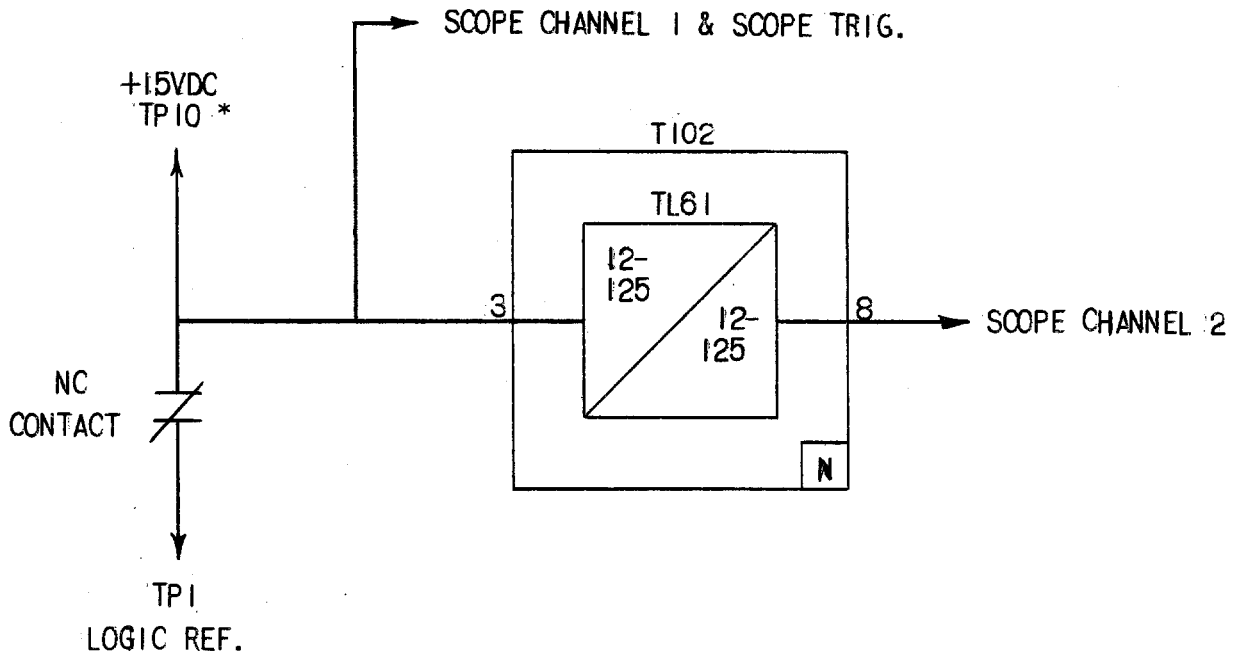


Fig. 5 (0227A2047-1) LOGIC AND INTERNAL CONNECTION DIAGRAM LEGEND



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

Fig. 6 (0246A7987-0) LOGIC TIMER TEST CIRCUIT

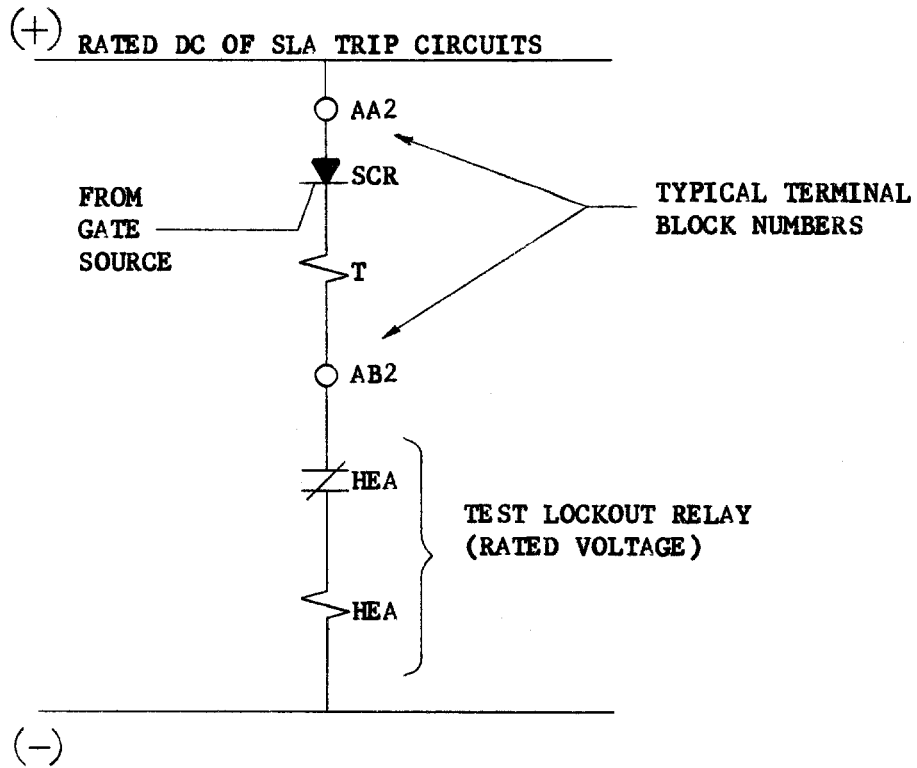


FIG. 7

TYPICAL SCR TEST CIRCUIT FOR TYPE SLA RELAYS

Fig. 7 (0208A2365-0) TYPICAL SCR TRIP CIRCUIT TEST CONNECTIONS

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