INSTRUCTIONS

GEK-65608

STATIC OUTPUT AND TRIPPING UNIT

TYPE SLAT53F

GENERAL ELECTRIC

CONTENTS

STATIC OUTPUT AND TRIPPING UNIT

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DESCRIPTION

The SLAT53F relay is a static auxiliary output and tripping unit for transmission line protection schemes utilizing single pole tripping and reclosing. The relay is packaged in a two rack unit (one rack unit equals 1-3/4 inches) enclosed metal case suitable for 19-inch wide rack mounting. The case outline and mounting dimensions are shown in Fig. 1. The internal connections for the SLAT53F are shown in Fig. 2. The component and printed circuit card locations are shown in Fig. 3.

APPLICATION

The SLAT53F relay is designed to operate in conjunction with an SLAT output and tripping unit and with SLY, SLYG and SLC measuring relays in a single pole tripping directional comparison scheme. For a complete description of the overall scheme in which the relay is employed, refer to the logic diagram and its associated logic description supplied with a specific equipment.

The following is a listing of the various output functions and their intended uses:

SCR

Two silicon controlled rectifier trip circuits are provided to operate all three poles of the associated breakers directly for multiphase faults.

RI-3Ø

Two transfer contacts are provided to initiate automatic reclosing after a three pole trip.

BFI-3Ø

Two high speed normally open contacts are provided to initiate breaker failure protection after a three pole trip.

TARGETS

A current-operated hand reset electromechanical target is included in each of the nine SCR trip circuits. Hand reset lamp targets are also included to indicate operation of the following functions in connection with a relay trip output: Ø (phase fault), G (ground fault), G4 (ground direct trip overcurrent), P4 (phase direct trip over-current), G1 (zone 1 ground), M1 (zone 1 phase), Z2 (zone 2 trip).

The only user setting required in the SLAT53F is the pickup time on timer TL31. This timer should be set for a pickup time-delay equal to the maximum breaker clearing time plus a 20 millisecond margin for relay reset. Refer to the logic description for detailed information on this circuit.

RATINGS

The Type SLAT53F relay is designed for use in an environment where the air temperature outside the relay case is between minus 20°C and plus 65°C.

The Type SLAT53F relay requires a plus or minus 15 VDC power source which can be obtained from a Type SSA power supply.

The 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.

The contacts of the telephone-type relay that is used for RI-3Ø will make and carry three amperes continuously. They will make and carry 30 amperes for tripping duty. The contacts will interrupt 180 volt-amperes resistive (60 volt-amperes inductive).

The contacts of the reed relays that are used for BFI-3Ø and AUX will make and carry three amperes continuously or short time. The contacts will interrupt 100 volt-amperes resistive (35 volt-amperes inductive). These contacts will carry 15 amperes for one-half second if this loading is applied after closing the contacts on less than the rated closing current.

Refer to the unit nameplate for the ratings of a particular relay.

BURDENS

The SLAT53F relay presents a maximum burden to the Type SSA power supply of:

200 milliamperes from the plus 15 VDC supply
130 milliamperes from the minus 15 VDC supply

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

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

FUNCTIONS

SCR TRIP CIRCUIT (T31,T32)

Electrically separate, isolated SCR trip circuits are provided. Each circuit is capable of carrying 30 amperes for one second.

The internal connections for the SCR trip and isolator subassemblies are shown in Fig. 4. 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.

RI-3Ø - THREE POLE RECLOSE INITIATE CIRCUIT

Two electrically separate Form C contacts are provided. These contacts close within eight milliseconds from the time the associated coil is energized by the logic. The contacts open within 16-32 milliseconds from the time the coil is de-energized. The RI-3Ø function uses a telephone-type relay with contact ratings stated under **RATINGS.**

BFI-3Ø - BREAKER FAILURE INITIATE CIRCUITS

Two electrically separate normally open contacts are provided per phase. These These contacts close within two milliseconds from the time that the associated coil is energized by the logic. The contacts open within two milliseconds from the time the coil is de-energized. The BFI function uses reed relays with contact ratings stated under **RATINGS.**

AUX (OPTIONAL)

Two electrically separate normally open contacts are provided. These contacts close within two milliseconds from the time that the associated coil is energized by the logic. The contacts open within two milliseconds from the time the coil is de-energized. The AUX function uses reed relays with contact ratings stated under **RATINGS.**

TARGETS

Two electromechanical target coils are included, one in series with each SCR. These targets operate on one ampere of trip current when the associated SCR passes current. The trip circuit resistance of the target coil is 0.40 ohm.

Nine target lamps are included in the SLAT53F. These are designated as indicated on the internal connection diagram (Fig. 2).

LOGIC CIRCUITS

The functions of the Type SLAT53F 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 state is represented by a signal of approximately plus or minus 15 VDC.

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

CONSTRUCTION

The SLAT53F 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 Fig. 1 and 3, respectively.

The SLAT53F relay contains printed circuit cards identified by a code number, such as: A104, T132, L105; where A designates an auxiliary function, T designates a time-delay function, and L designates a 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. TP1 is tied to reference; TP10 is tied to plus 15 VDC through a 22K resistor. This resistor limits the current when TP10 is used to supply a logic signal to a card.

The SLAT53F relay receives its inputs from the associated Type SLA and SLAT relays. These units are interconnected by ten-conductor shielded cables. The sockets for these cables are located on the rear panel of the unit. The SLAT53F 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

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 bolts 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.

WARNING: 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

If the SLAT53F relay that is to be tested is installed in an equipment which has already been connected to the power system, disconnect the outputs to the system.

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 A 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 SLAT53F 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.

Timers should be set for 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 writeup 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 SLAT53F unit can be checked by observing the signals at the twenty test points (TP1 to TP20) in the SLAT53F, by observing the operation of the associated channel equipment, or by observing the output functions. The test points are located on the test card 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 VDC. The remaining points are located at various strategic points throughout the logic as shown on the internal connection diagram (Fig. 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.

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 horizontal sweep, should be used.

In order to test the timer cards it is necessary to remove the card which supplied the input 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 Fig. 6. Opening the normally closed contact causes the output to step up to plus 15 VDC 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 I

TIMER UNDER TEST	POSITION	REMOVE CARD IN POSITION IN SLA
TL31 TL32	N K	Refer to the logic diagram to determine the preceding function

TRIP CIRCUIT TESTS

The SCR trip circuits and the 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 DC rating as the SCR trip circuit of the SLAT53F. 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.

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

OVERALL EQUIPMENT TESTS

After the SLAT53F 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 when the measuring units operate.

MAINTENANCE

PERIODIC TESTS

It should be sufficient to check the outputs produced at test points in the SLAT53F where 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 SLAT53F 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 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 a 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 SLAT53F relay are included in the card book, GEK-34158.

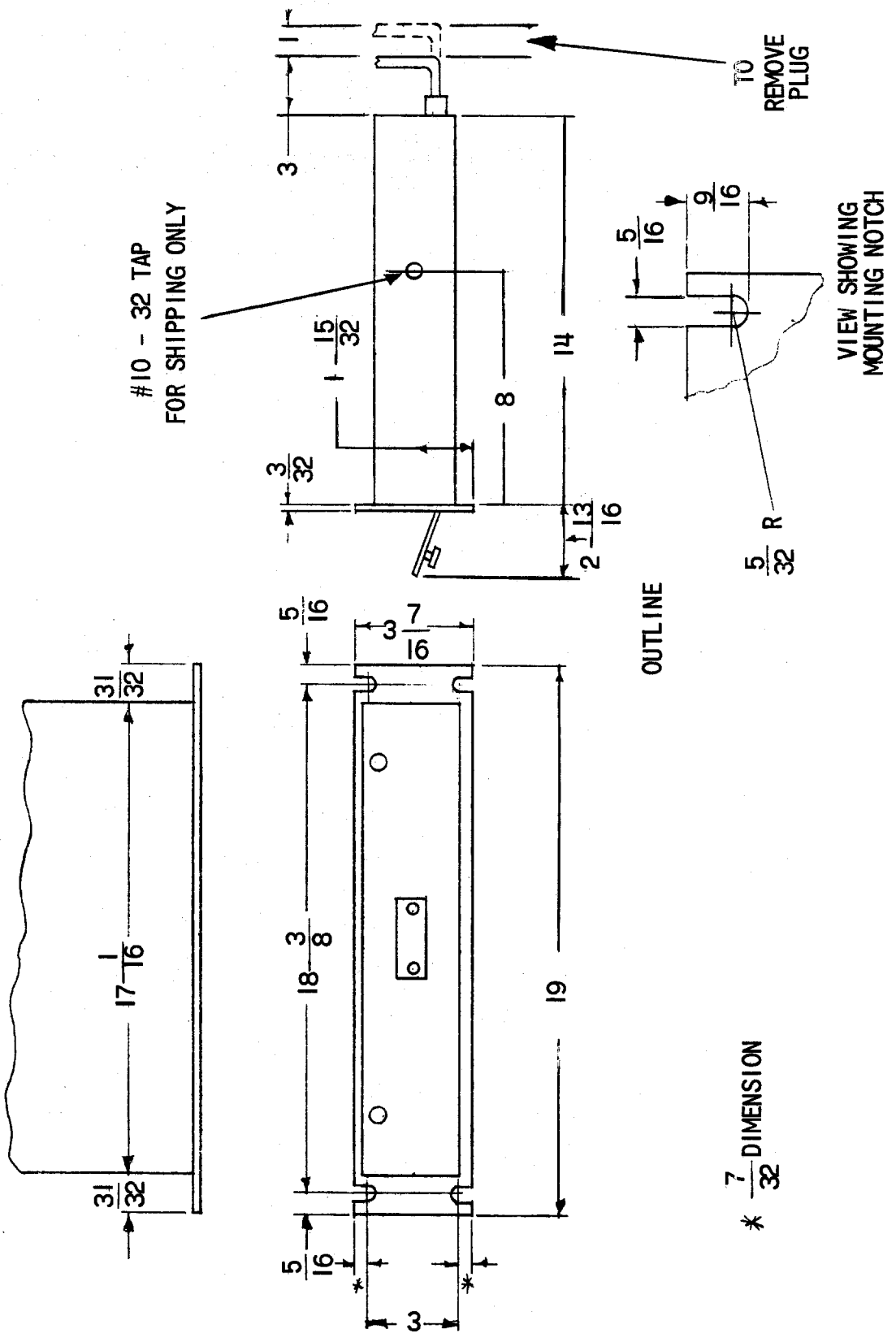


Fig. 1 (0227A2036-0) Outline and Mounting Dimensions

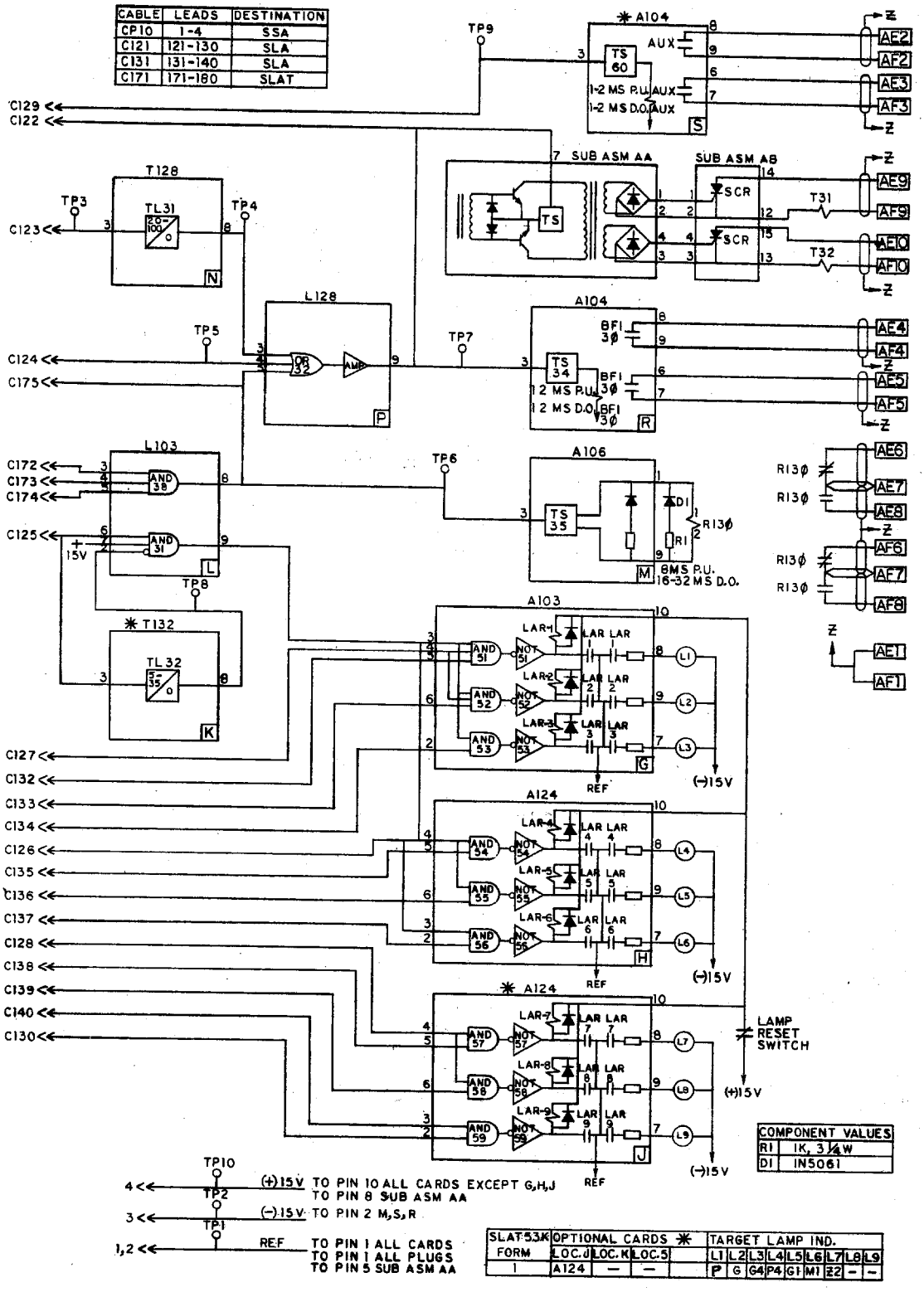
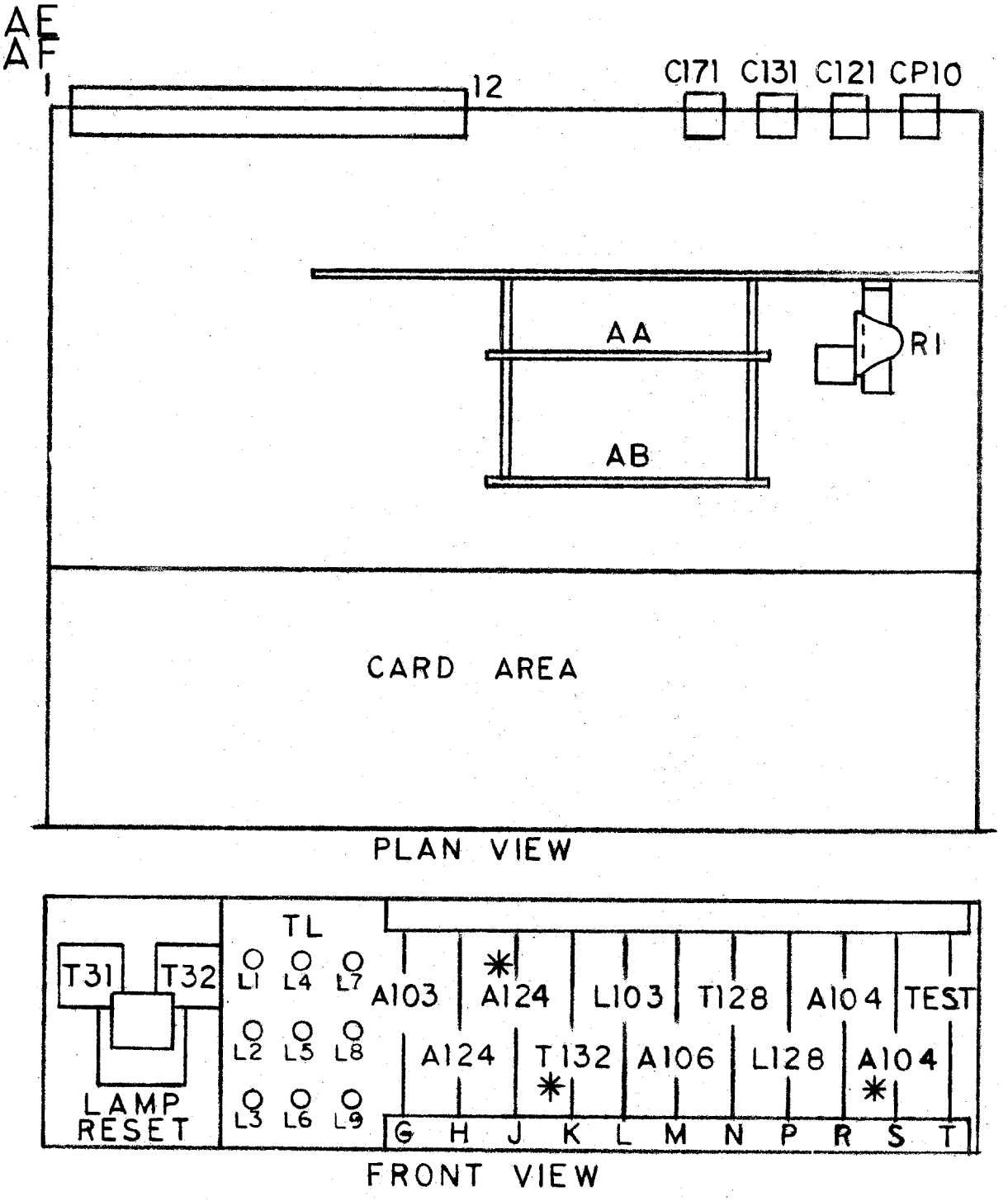


Fig. 2 (0179C6178-0) Internal Connections for the Type SLAT53F Relay



* OPTIONAL REFER TO UNIT INTERNAL CONNECTIONS

Fig. 3 (0285A5720-0) Component Location Diagram for the Type SLAT53F Relay

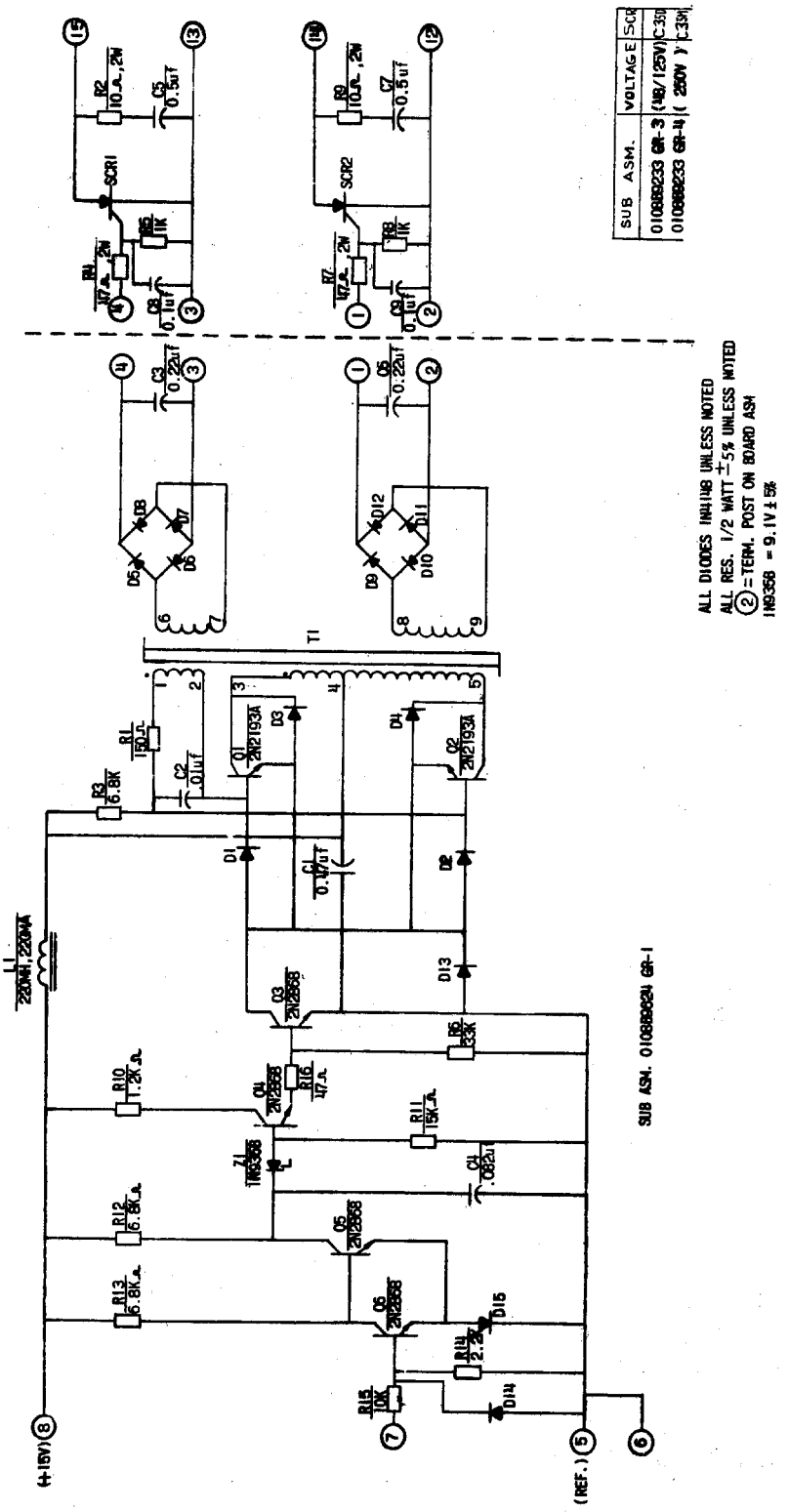


Fig. 4 (0108B9610-0) Internal Connections for the SCR Trip and Isolation Subassemblies

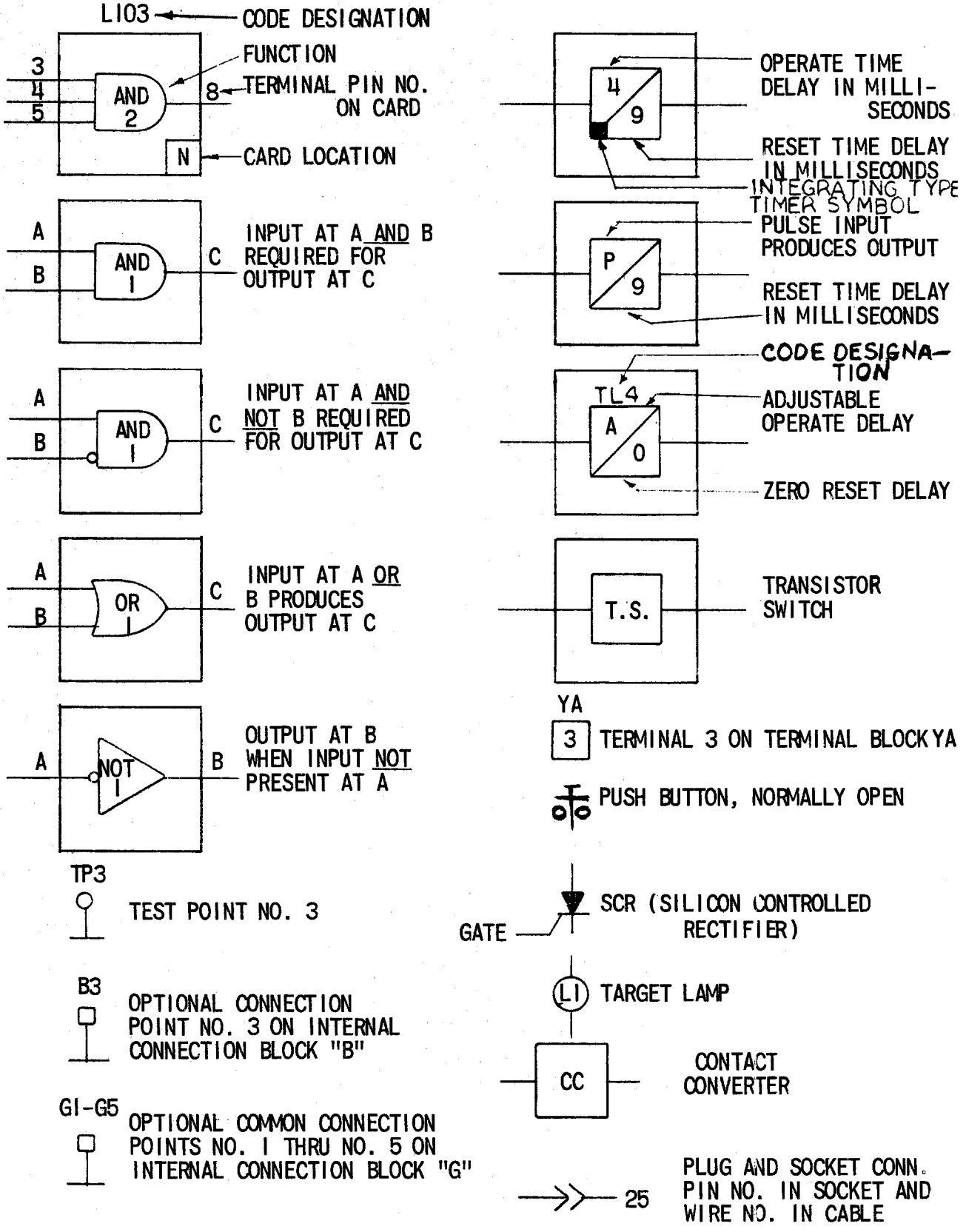
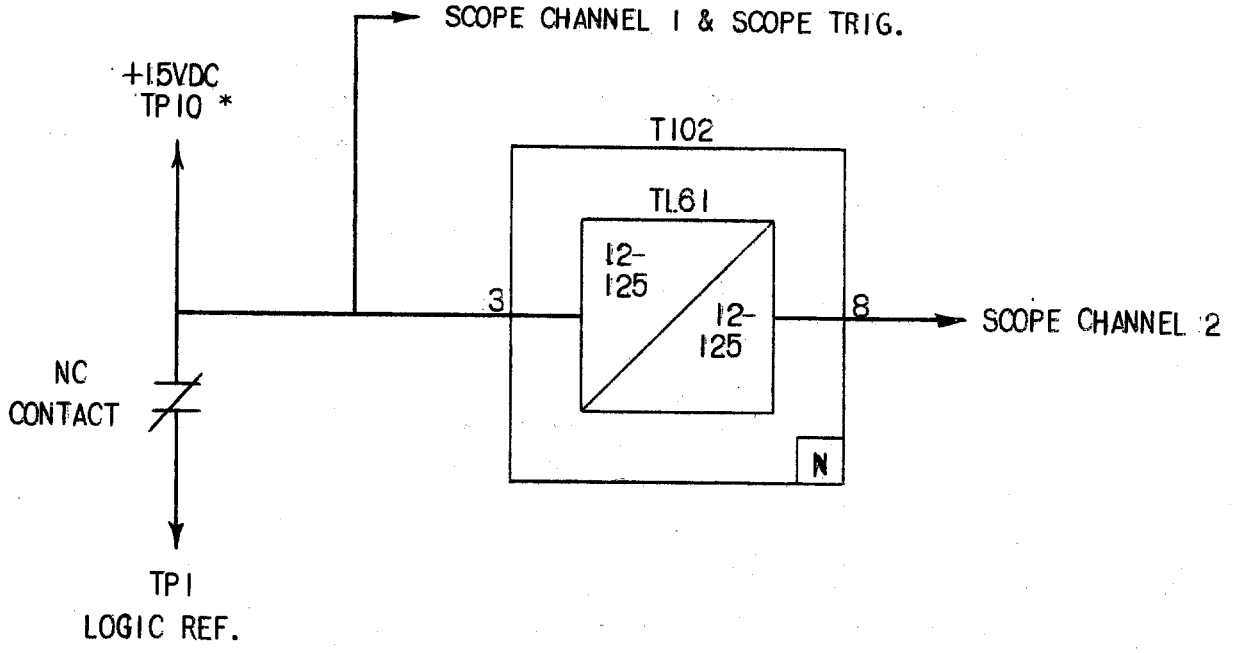


Fig. 5 (0227A2047-1) Internal Connection Diagram Legend



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

Fig. 6 (0246A7987-0) Logic Timer Test Circuit

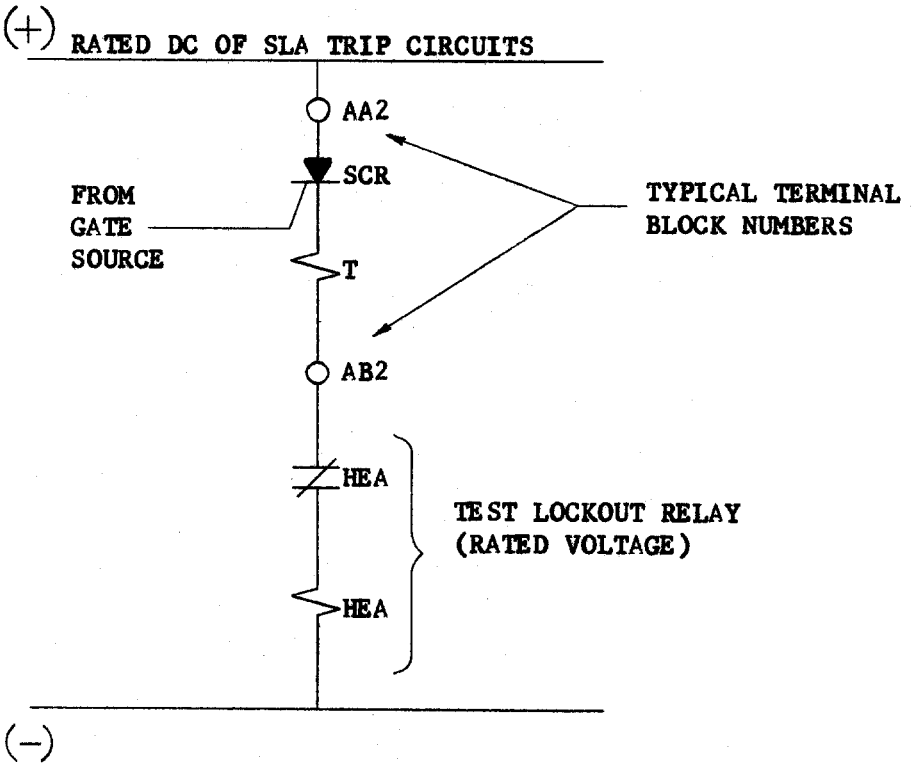


FIG. 7

TYPICAL SCR TEST CIRCUIT FOR TYPE SLA RELAYS

Fig. 7 (0208A2365-0) Typical SCR Trip Circuit Test Connections