INSTRUCTIONS

GEK-41877

STATIC OUTPUT AND TRIPPING UNIT

TYPE SLAT51D

POWER SYSTEMS MANAGEMENT DEPARTMENT

GENERAL ELECTRIC

PHILADELPHIA, PA.

CONTENTS

DESCRIPTION

The Type SLAT51D 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 SLAT51D relay is packaged in a four rack unit (1 R.U. = 1 3/4") 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 SLAT51D relay are shown in Fig. 2. The component and card locations are shown in Figure 3.

APPLICATION

The Type SLAT51D relay is a static output and tripping relay designed for use in various types of static relaying schemes. For example, the SLAT51D relay can be used in conjunction with types SLY, SLYG, SLC, SSA and SLA relays to make up a directional comparison pilot relaying schemes. Other schemes are also available in which the SLAT51D relay can be used. For a complete description of the particular scheme in which the SLAT51D 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 SLAT51D together with a general description of their intended use.

SCR - Four silicon controlled rectifier trip circuits are provided to permit tripping of associated circuit breakers.

RI/OB - This unit may be used for either of two functions, depending on the position of the selection link. With the link in the RI position the unit may be used to initiate reclosing following a carrier trip or direct trip by G4 or PH4. With link in the OB position the unit is operated by the out-of-step detection circuit in an associated SLA and can be used to block some external function during an out-of-step condition.

BFI - Breaker failure initiation outputs are provided for breaker failure protection.

RC - The optional RC function provides two normally open and two normally closed electrically separate contacts, which can be used to block reclosing following any time delay trip by the associated static protective relay.

In addition to the above output functions, three target lamps are provided with each SLAT51D and three more lamps can be provided as an option.

RATINGS

The Type SLAT51D relay is designed for use in an environment where the air temperature outside the relay case does not exceed $-20^{o}C$ and $+65^{o}C$.

The Type SLAT51D relay requires a ± 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. For the voltage rating of the particular relay in question, refer to the nameplate on the relay case.

The contacts of the telephone type relays that are used for the RI/OB and RC functions, will make and carry 3 amperes continuously and will interrupt up to 0.5 amperes (inductive) at 125 VDC or 0.25 ampere (inductive) at 250 VDC.

The contacts of the reed relay that is used for the B.F.I. function are rated at 100 V.A. They will make and carry 3 amperes continuous current.

BURDENS

The SLAT51D relay presents a maximum burden to the Type SSA power supply of.

335 ma from the +15 VDC supply
70 ma from the -15 VDC supply

In addition, each target lamp draws 80 ma 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 Figure 4. There are two sets of these circuits in the SLAT51D. 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. RI/OB - RECLOSE INITIATE/OUT OF STEP BLOCKING

Four electrically separate contacts, two normally open and two normally closed are provided. These contacts will operate within 17 ms. from the time the associated coil is energized by the logic. The contacts reset within 170 ms from the time the coil is deenergized. The RI/OB function uses a telephone type relay with contact ratings stated under RATINGS.

C. BFI BREAKER FAILURE INITIATE CIRCUIT

Two electrically separate normally open contacts are provided. These contacts close within 2 ms. from the time the associated coil is energized by the logic. These contacts open within 2 ms. from the time the coil is deenergized. The BFI function uses a reed relay with contact ratings stated under RATINGS.

D. RC RECLOSE BLOCKING

The contacts of this optional unit operates within 17 ms. from the time the coil is energized and reset within 170 ms. from the time the coil is deenergized. The RC function employs a telephone-type relay with contact ratings as listed under RATINGS.

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. Four target lamps are included and two additional lamps are available as options in the Type SLAT51D as shown on the internal connections diagram Figure 2. Refer to the overall logic diagram scheme for the target lamps provided.

LOGIC CIRCUITS

The functions of the Type SLAT51D 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 1 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 Figure 5.

CONSTRUCTION

The SLAT51D 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 Figures 1 and 3 respectively.

The SLAT51D relay contains printed circuit cards identified by a code number such as: A104, T106, L109 where A designated an auxiliary function, T designated a time delay function, and L designated a

The SLAT51D relay contains printed circuit cards identified by a code number such as: A104, T106, L109 where A designated an auxiliary function, T designated a time delay function, and L designated 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 SLAT51D 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 SLAT51 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 SLAT51D 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 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 8 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

IF THE SLAT51D RELAY TO BE TESTED IS PART OF A COMPLETE RELAY TERMINAL EQUIPMENT IN SERVICE, THE VARIOUS OUTPUTS FROM THE SLAT51D MUST BE DISCONNECTED PRIOR TO ANY TEST.

A. GENERAL

The SLAT51D 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 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.

B. OPERATIONAL CHECKS

Operation of the SLAT51D unit can be checked by obderving the signals at the ten test points (TP1 to TP10) in the SLAT51D, 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 (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.

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 SLAT51D 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 P.C. card does not get the +15 volt). Connect the logic timer test circuit per Figure 6. When the N.C. contact is opened, +15 volt is applied to the timer, and also to the scope trigger. 25 msec. later, an output should appear on pin 8 of the card. (scope channel 2). Adjust the pot on the P.C. 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 lockout relay, such as the Type HEA relay, in series with the SCR circuit. A typical circuit is shown in Figure 7. The HEA relay should have the same D.C. rating as the SCR trip circuit of the SLAT51D. If an auxiliary lockout relay is not available, it can be replaced by a resistive load which limits the trip circuit current to 3 amperes. 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 SLAT51D 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 test can be performed by applying AC current 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

A. PERIODIC TESTS

It should be sufficient to check the outputs produced at test points in the SLAT51D 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 SLAT51D itself should be required.

B. TROUBLE SHOOTING

In any trouble shooting 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-34258.

A dual trace oscilloscope is a valuable aid to detailed trouble shooting, 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 semi-conductor 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 SLAT51D relay are included in the card book GEK-34158.

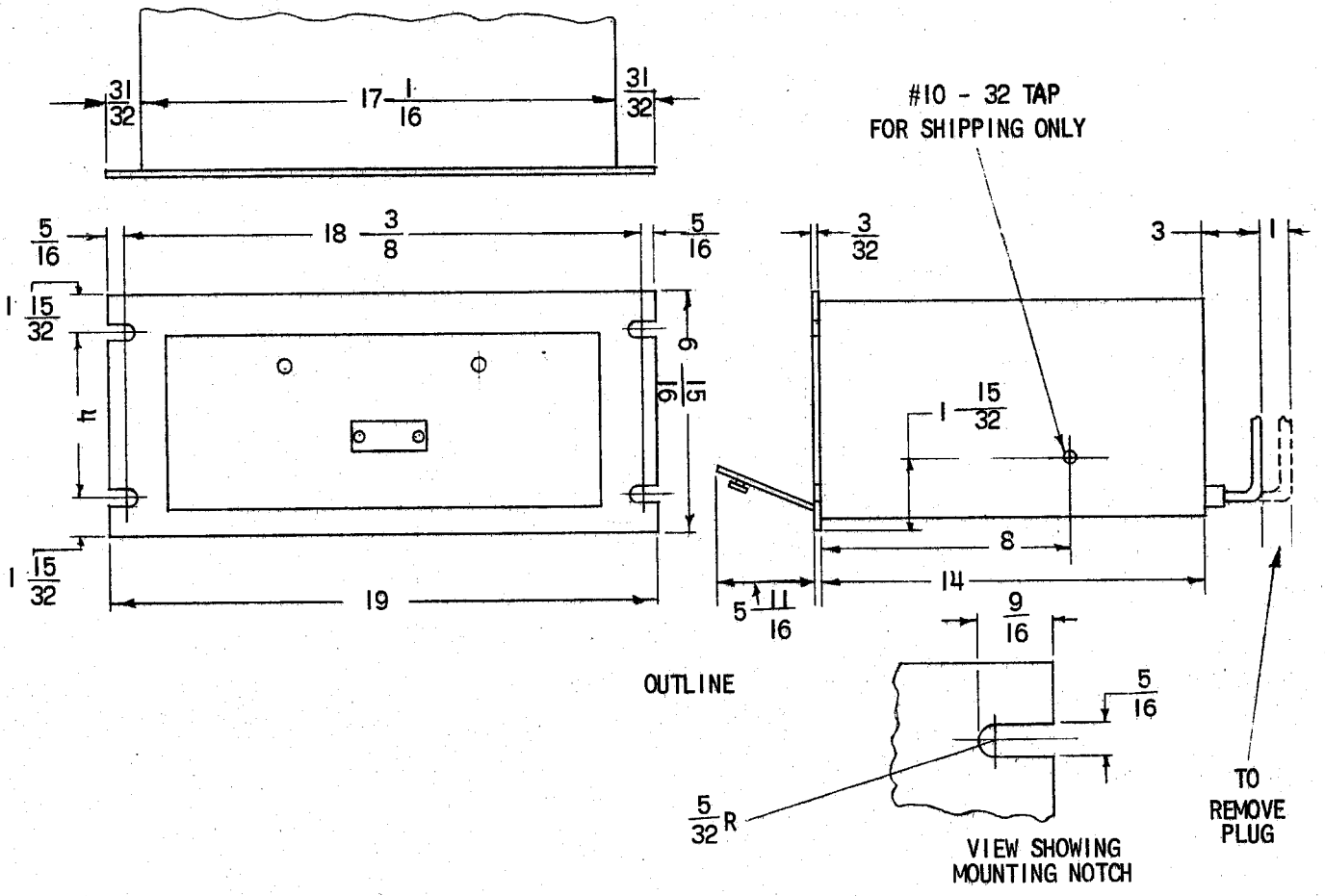


FIG. 1 (0227A2037-0) Outline And Mounting Dimensions For The SLAT51D Relay

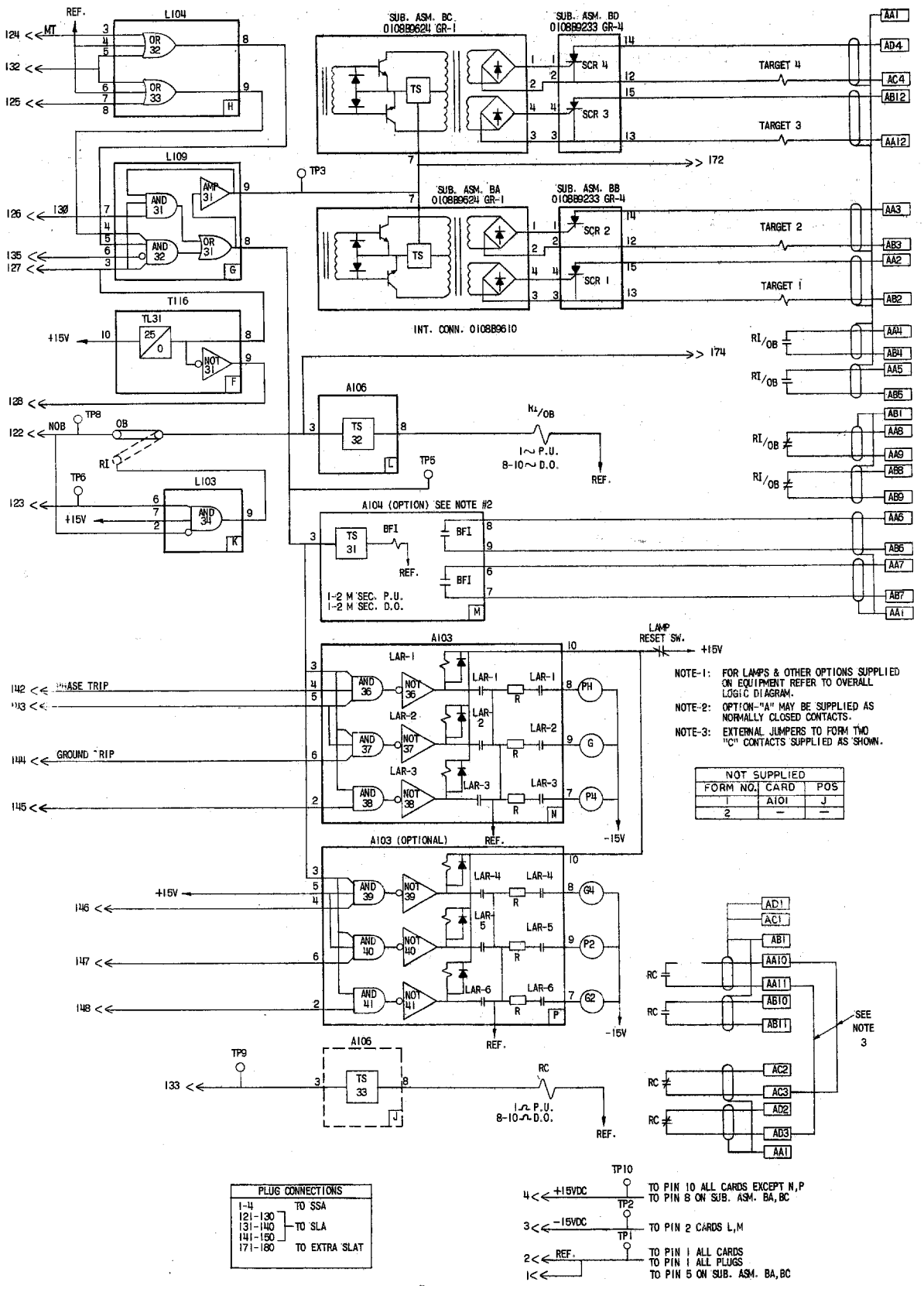
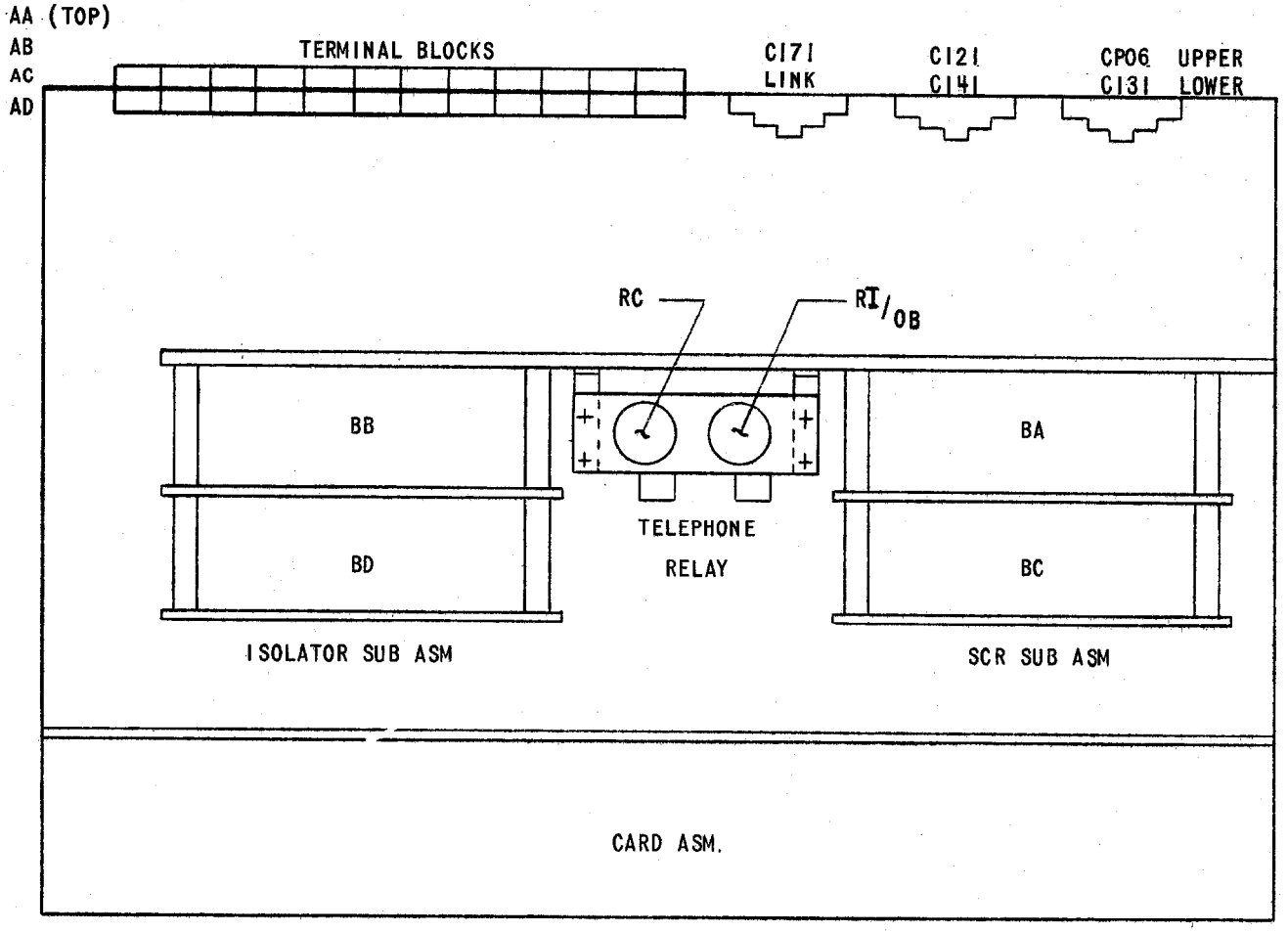


FIG. 2 (0149C7364-1) Internal Connection Diagram For The SLAT51D Relay



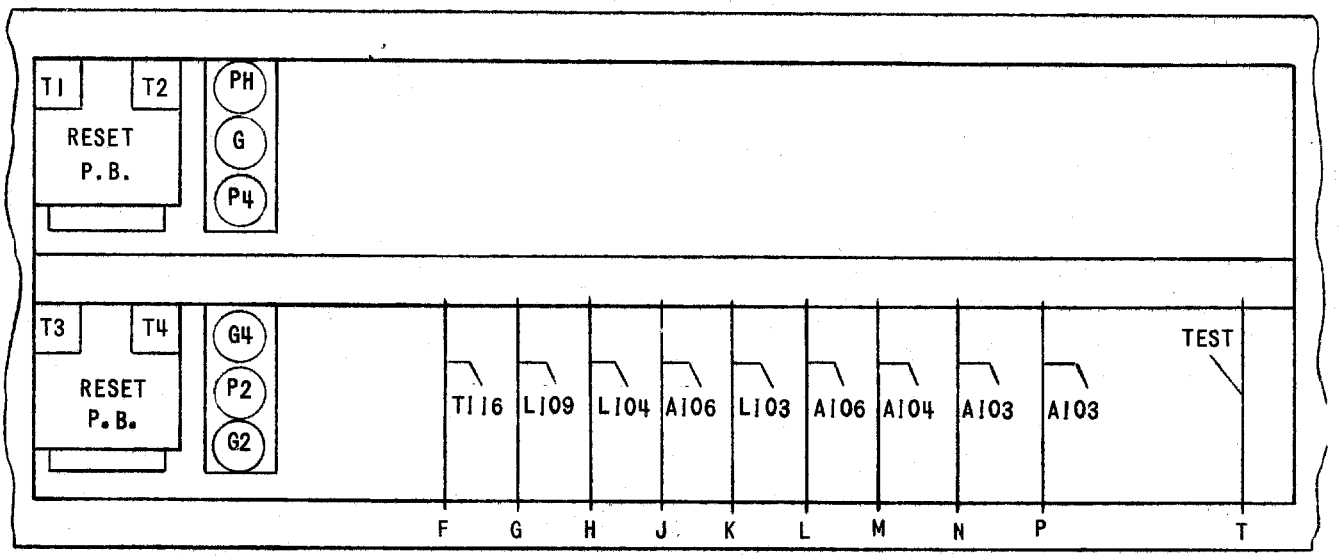


FIG. 3 (0227A2182-0) Component Location Diagram For The SLAT51D Relay

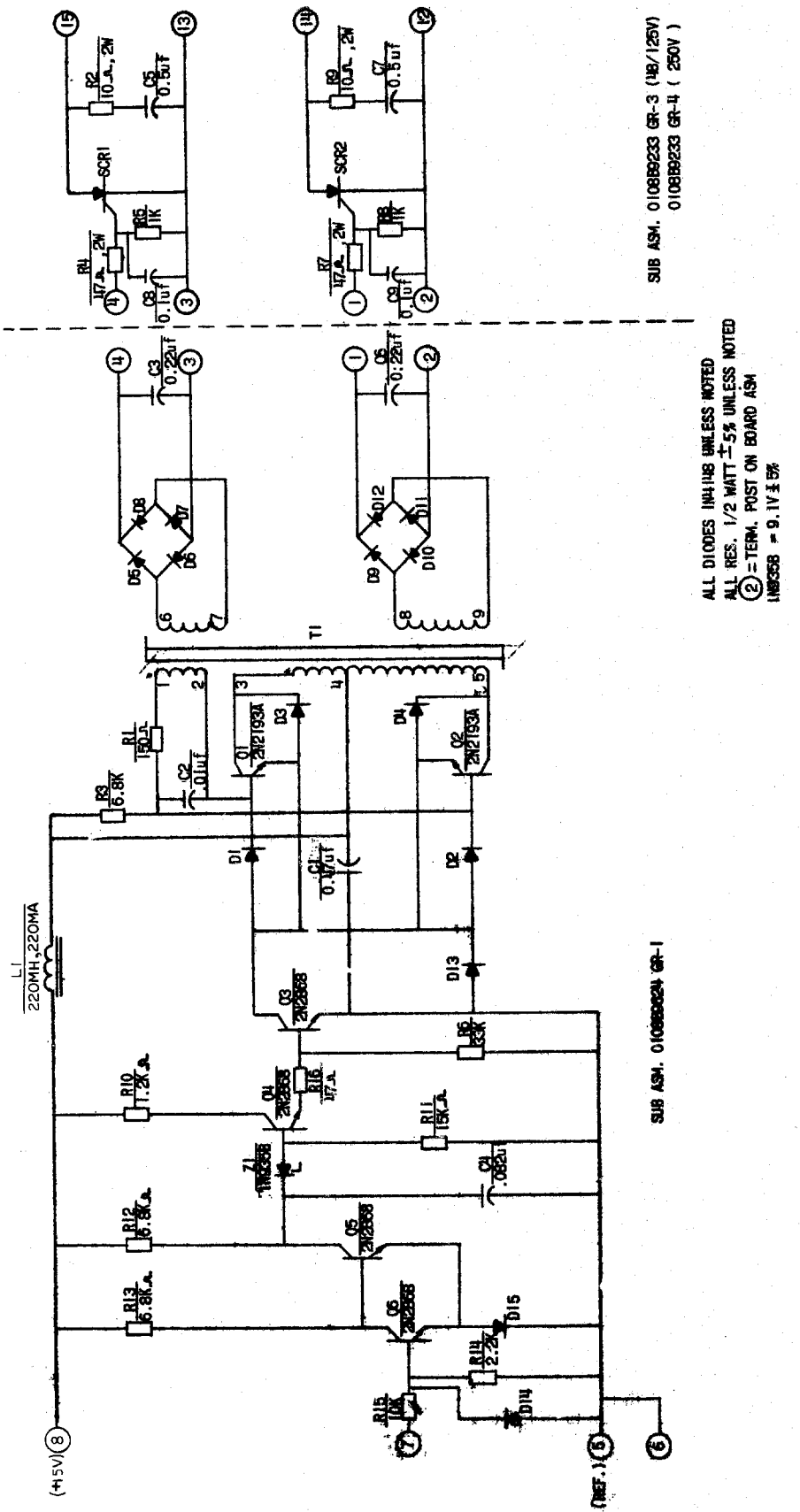


FIG. 4 (108B9610-0) Internal Connections For One Pair Of SCR Trip And Isolator Subassemblies

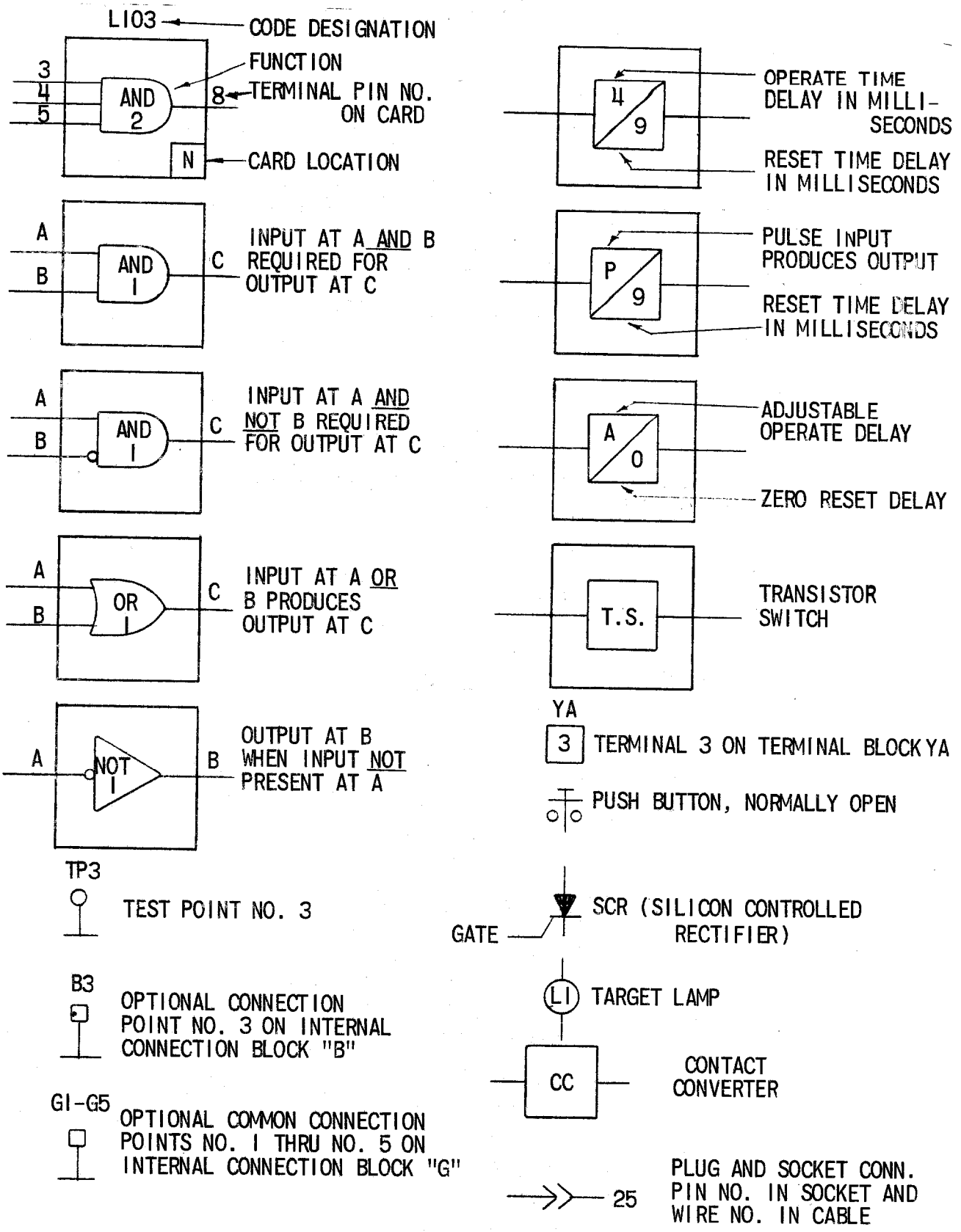
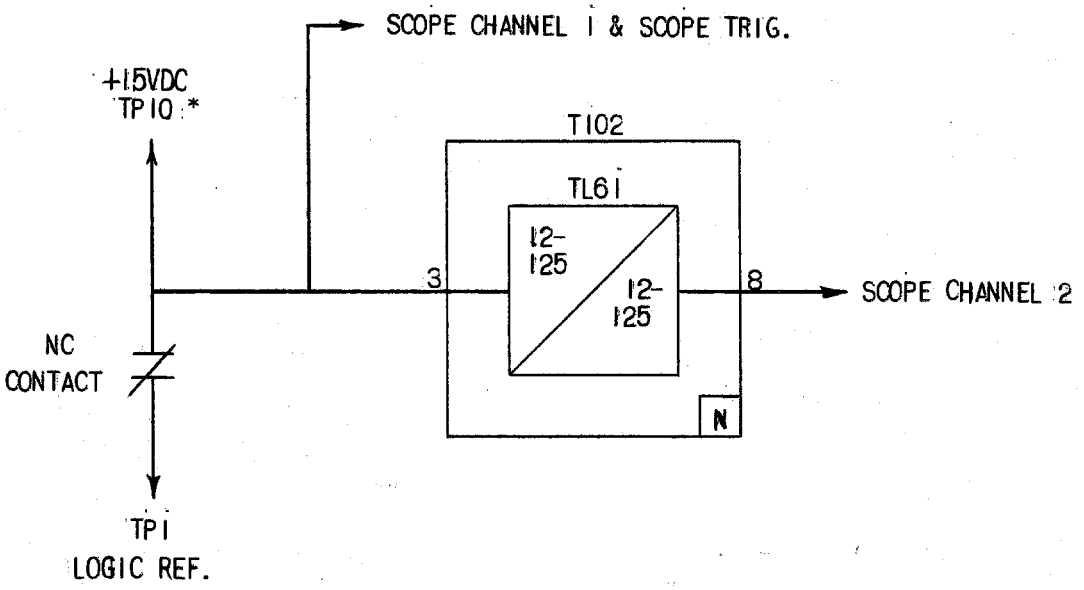


FIG. 5 (0227A2047-0) Logic And Internal Connection Diagram Legend



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

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

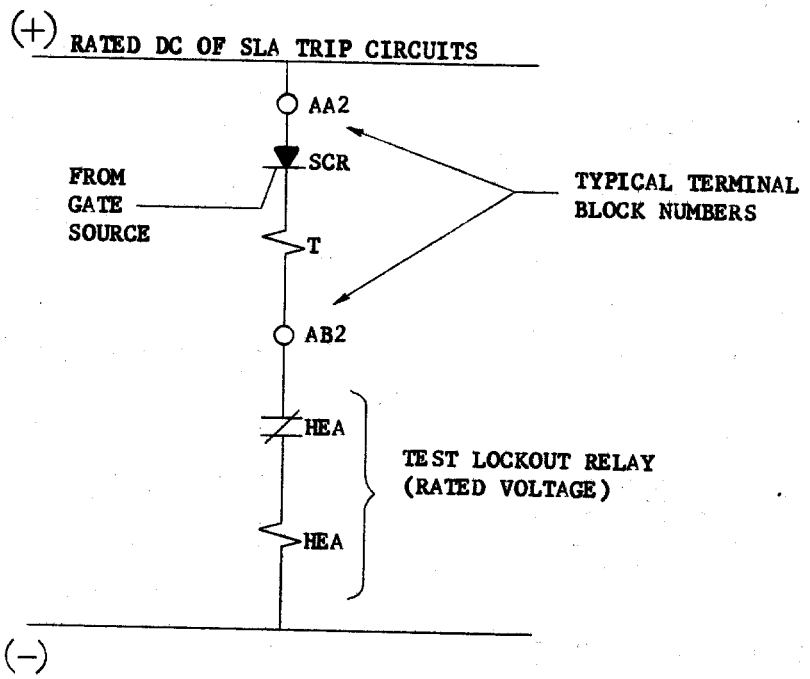


FIG. 7

TYPICAL SCR TEST CIRCUIT FOR TYPE SLA RELAYS

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