**INSTRUCTIONS**

GEK-45394A
Supersedes GEK-45394

# STATIC OUTPUT AND TRIPPING UNIT

## TYPE SMAT51A

GENERAL ELECTRIC

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# STATIC OUTPUT AND TRIPPING UNIT
# TYPE SMAT51A

## DESCRIPTION

The Type SMAT51A relay is a static output and tripping unit. The Type SMAT51A 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 complete 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 SMAT51A relay is packaged in a four rack unit (one rack unit equals 1 3/4 inches) enclosed metal case suitable for mounting on a 19 inch rack. The outline and mounting dimensions are shown in * Fig. 2. The internal connections for the SMAT51A relay are shown in Fig. 1. The component and card locations are shown in Fig. 3.

## RATINGS

The Type SMAT51A relay is designed for use in an environment where the air temperature outside the relay case does not exceed $-20^{0}$C and $+65^{0}$C.

The Type SMAT51A relay requires a $\pm$ 15 VDC power source which can be obtained from a Type SSA power supply.

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

## BURDENS

The SMAT51A relay presents a maximum burden to the Type SSA power supply of:

100 ma from the +15 VDC supply
50 ma from the -15 VDC supply

## OUTPUTS

### TRIP OUTPUTS

There are two output tripping telephone relays. Each of these telephone relays has two tripping output contacts. Thus there are four electrically separate tripping circuits. Each of these four circuits has its own mechanically latched target to indicate the flow of current in its circuit. The contact ratings for the trip circuit can be found in Table I.

The seal-in unit operates within 60-70 milliseconds of the time the associated coil is energized by the trip relay. The coil has two taps, two amps and 0.6 amp pick up. It is factory set for 0.6 amp pick-up. The tap can be changed to two amps if necessary. See Table II for the ratings of the SI unit.

The electromechanical target coils in series with the SI and TR contacts operate on one ampere of current when the associated trip circuit is activated. The target coil resistance is 0.35 ohm.

*Indicates revision

## ALARM OUTPUTS

### Trip Alarm Outputs

Each of the two output tripping telephone relays has two electrically separate normally open contacts which are intended for alarm or data logging. These contacts do not seal in and will open when the telephone relay drops out. See Table I for contact ratings.

### Level Detector Alarm

Two electrically separate normally open contacts close whenever any one or more of the most sensitive level detectors associated with the narrow band filters picks up. See Table III for contact ratings.

## LOGIC CIRCUITS

The functions of the Type SMAT51A 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.

* The symbols used on the internal connection diagram (Fig. 1) are explained by the legend shown in Fig. 4.

TABLE I

TRIP CIRCUIT CONTACT RATINGS

| ABSOLUTE MAXIMUM RATINGS | | |
|---|---|---|
| 180 VA Resistive<br>60 VA Inductive**<br>3 Amperes Make & Carry Continuous<br>30 Amperes Make & Carry Short Time | | |
| Volts | Interruption Capacity Amperes | |
| | Inductive** | Resistive |
| 48 DC | 1.25 | 3.5 |
| 125 DC | 0.48 | 1.4 |
| 250 DC | 0.24 | 0.72 |
| 115 AC | 0.75 | 2.25 |
| 230 AC | 0.50 | 1.5 |

TABLE II

CHARACTERISTICS OF SEAL-IN UNIT

| Tap | 0.6 | 2 |
|---|---|---|
| DC Resistance ± 10% | 0.6 | 0.13 |
| Min. Operating (Amperes) | 0.6 | 2.0 |
| Carry Cont. (Amperes) | 0.9 | 3 |
| Carry 30 Amps for (SEC.) | 0.5 | 4 |
| Carry 10 Amps for (SEC.) | 4 | 30 |
| Minimum Dropout (Amperes) | 0.15 | 0.5 |
| | | |

*Indicates revision
**The inductive rating is based on the inductance of a coil having a $X_L/R$ ratio of 3 to 1.

TABLE III

TLD CONTACT RATINGS

| ABSOLUTE MAXIMUM RATINGS | | |
|---|---|---|
| 100 VA Resistive<br>35 VA Inductive**<br>3 Amperes Make & Carry Continuous<br>3 Amperes Make & Carry Short Time | | |
| Volts | Interruption Capacity Amperes | |
| 1000 Max. | Inductive** | Resistive |
| 48 | 0.72 | 2 |
| 125 | 0.28 | 0.8 |
| 250 | 0.14 | 0.4 |

## CONSTRUCTION

The SMAT51A 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 2 and 3 respectively.

The SMAT51A relay contains printed circuit cards identified by a code number such as: A104, T143 L110, where A designates an auxiliary function, T designates a time-delay function, and L designates a * logical function. In some applications, several cards may be omitted. See card omission chart for the particular scheme. 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 test cards in positions T and AT with TP1 at the top of the AT card. TP1 is tied to reference; TP10 is tied to +15 VDC through a 2.2K resistor. This resistor limits the current when TP10 is used to supply a logic signal to a card.

The SMAT51A relay receives its inputs from the associated Type SMA 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 SMAT51A output functions are connected to 12 point terminal strips, which are also located on the rear of the unit.

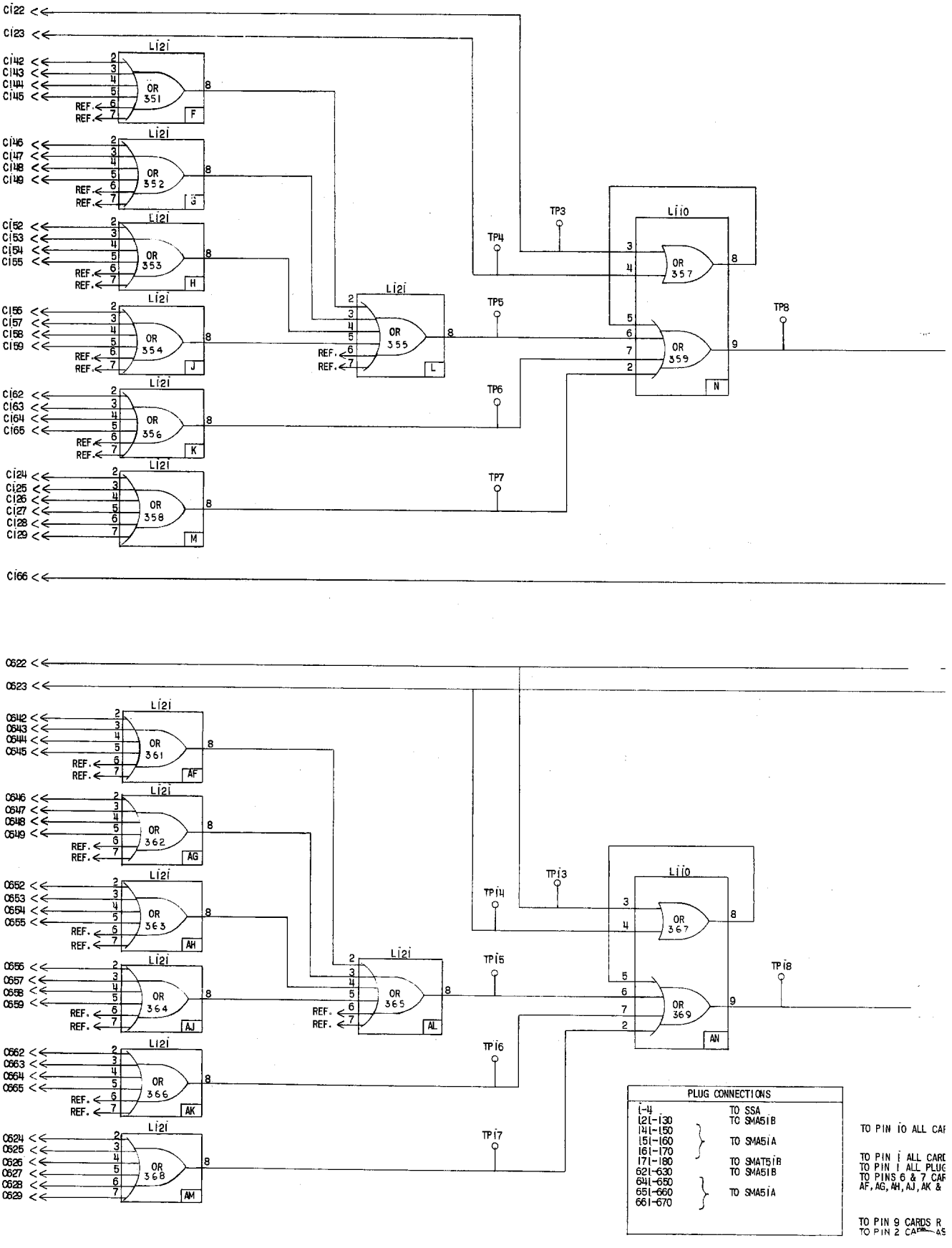
A window is provided in the hinged cover of the relay to allow the mechanical targets to be seen. Push buttons are also provided to reset the targets and lamps which are located in the SMAT51B, without opening the cover.

## RECEIVING, HANDLING AND STORAGE

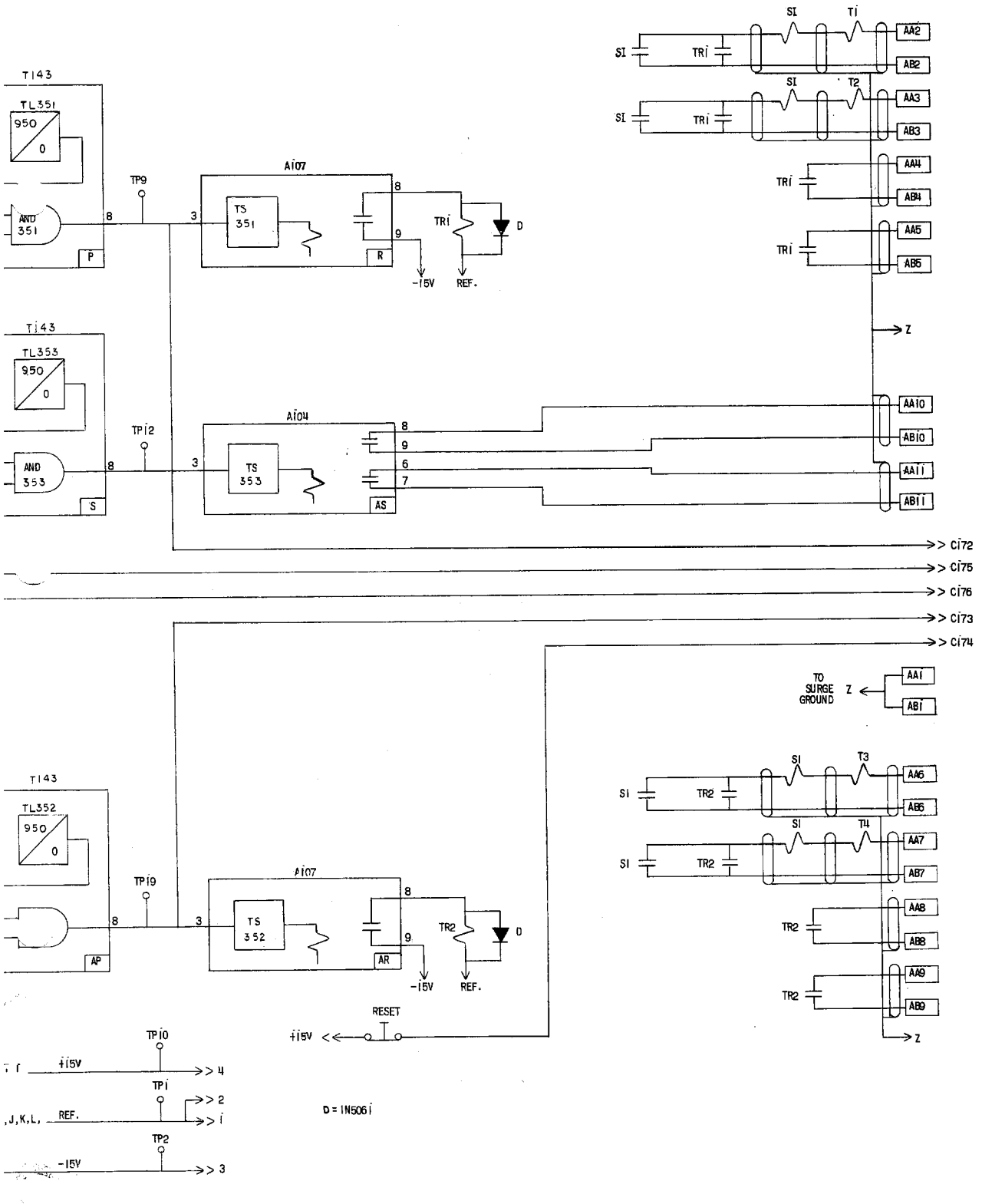
These relays will normally be supplied as a part of a static relay equipment, mounted in a rack or cabinet with other static relays and test equipment. Immediately upon receipt of a static relay equipment, it should be unpacked and examined for any damage sustained in transit. If injury or damage resulting 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.

*Indicates revision
**The inductive rating is based on the inductance of a coil having a $X_L/R$ ratio of 3 to 1.




* Fig. 1 (0126D6252-1) I




nal Connections SMAT51A Relay

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. 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.

## 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.

If the SMAT51A 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.

### GENERAL

The SMAT41A relay is supplied from the factory mounted in a static relay 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.

### OPERATIONAL CHECKS

Operation of the SMAT51A unit can be checked by observing the signals at the twenty test points (TP1 to TP20) in the SMAT51A by observing the output functions. 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 +15 VDC and TP2 is at -15 VDC. The remaining points are located at various strategic points throughout the logic as shown in the internal connection diagram (Fig. 1). Test point voltages can be monitored with a portable high impedance voltmeter, 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 TESTS

The trip and alarm relays are supervised by a delay timer which prevents an output from occurring for a fixed time delay, after the DC power is turned on. No adjustment is provided for this delay. To verify the operation of this timer remove the card immediately preceding it and turn the DC power-supply on and off. The time measured should be within $\pm$ 10 percent of the nominal value shown on the internal connection diagram (Fig. 1).

### TRIP CIRCUIT TESTS

The 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 circuit. The HEA relay should have the same DC rating as the trip circuit of the SMAT51A. If an auxiliary lockout relay is not available, it can be replaced by a resistive load which limits the trip circuit current to three amperes.

*Indicates revision

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

### OVERALL EQUIPMENT TESTS

After the SMAT51A 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.

## MAINTENANCE

### PERIODIC TESTS

It should be sufficient to check the outputs produced at test points in the SMAT51A when periodic calibration tests are made. No separate tests on the SMAT51A itself should be required.

### TROUBLE SHOOTING

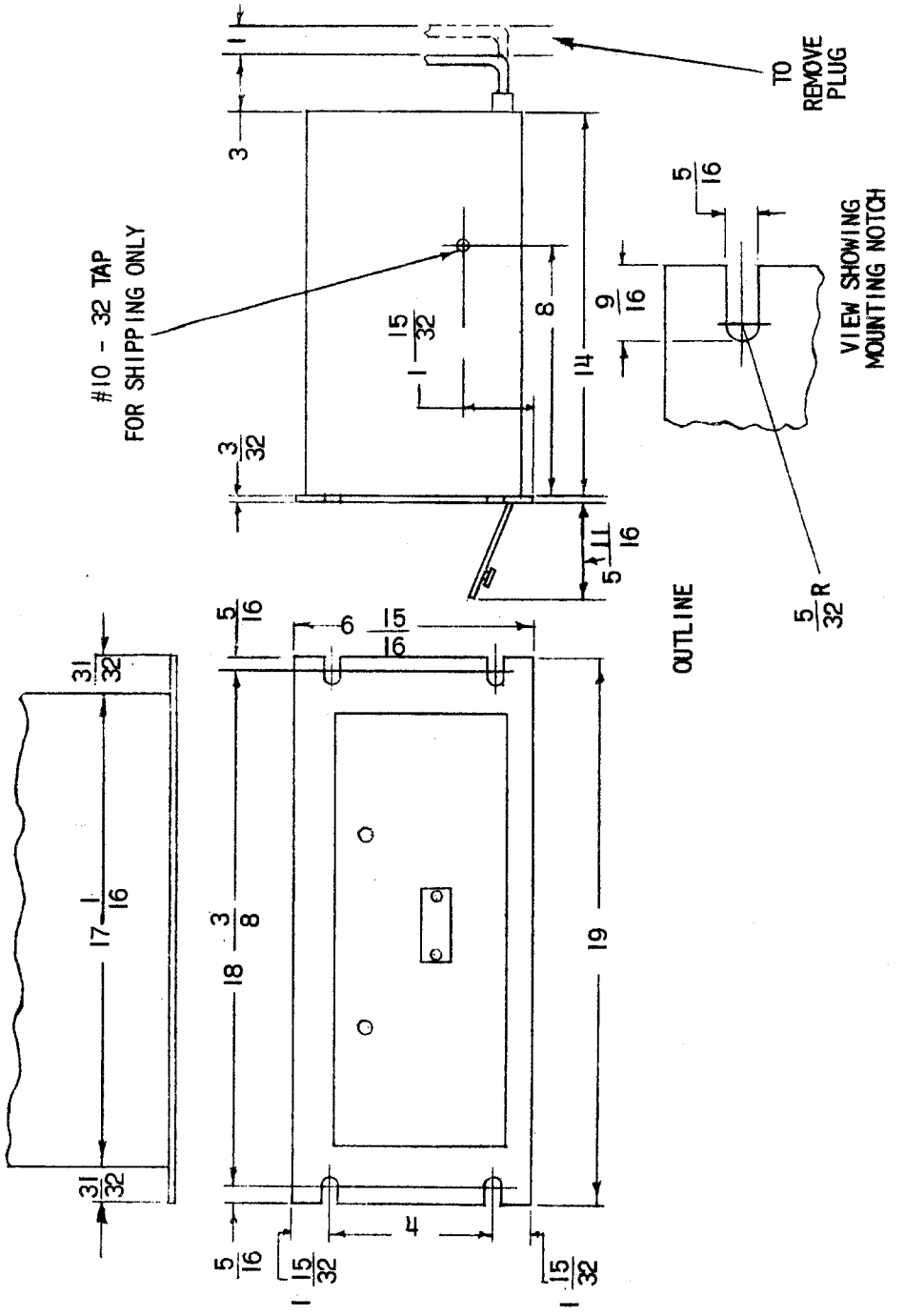
If any trouble shooting of equipment, it should first be established which unit is functioning incorrectly. The overall logic diagram supplied with the equipment shows the combined logic of the complete equipment and the various test points in each unit. By signal tracing, using the overall logic diagram 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-34158.

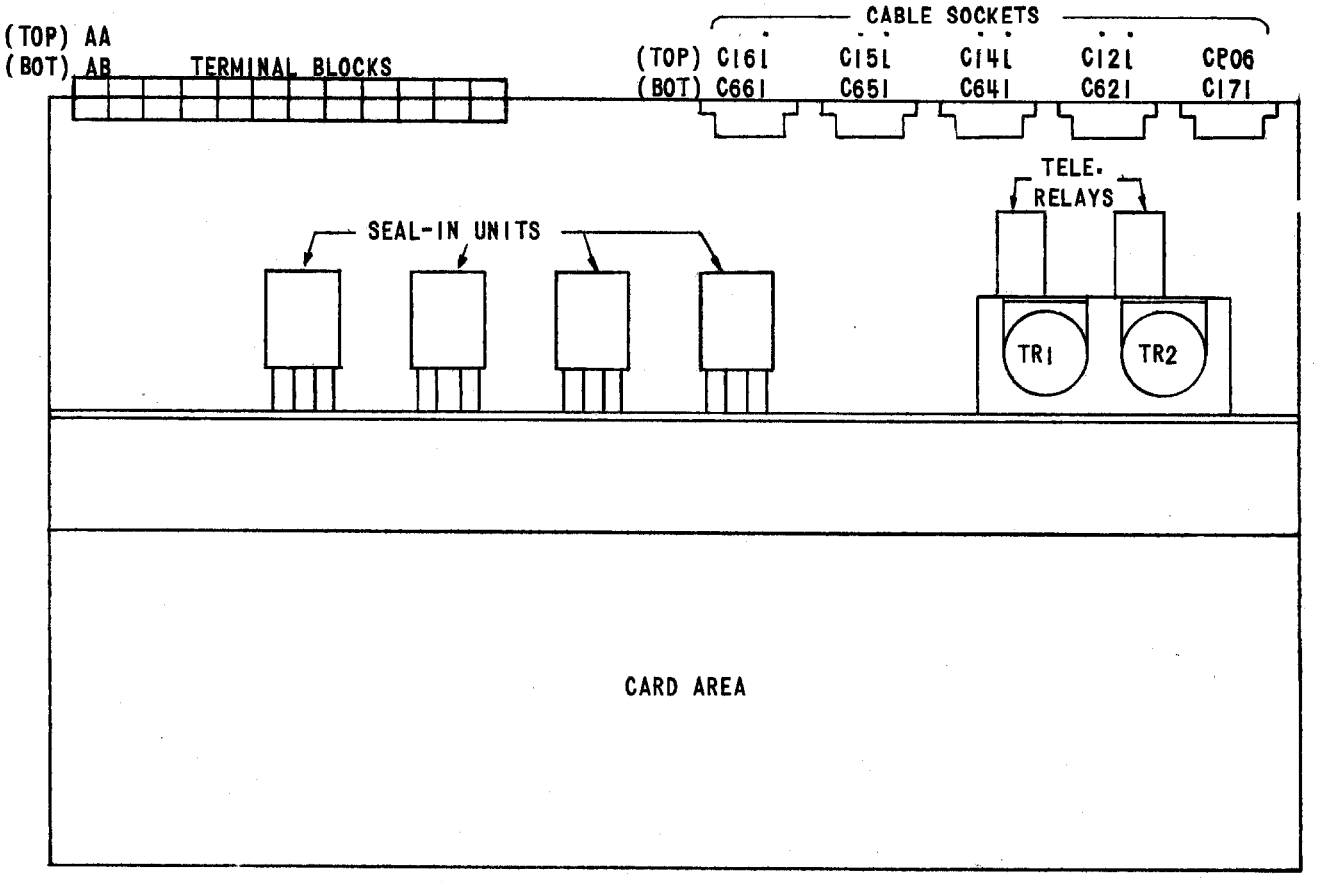
A dual trace oscilloscope is a valuable aid to detailed trouble shooting, since it can be used to determine phase shift, operate and reset times as well as input and output levels. A portable dual-trace oscilloscope with a calibrated sweep and trigger facility is recommended.

## SPARE PARTS

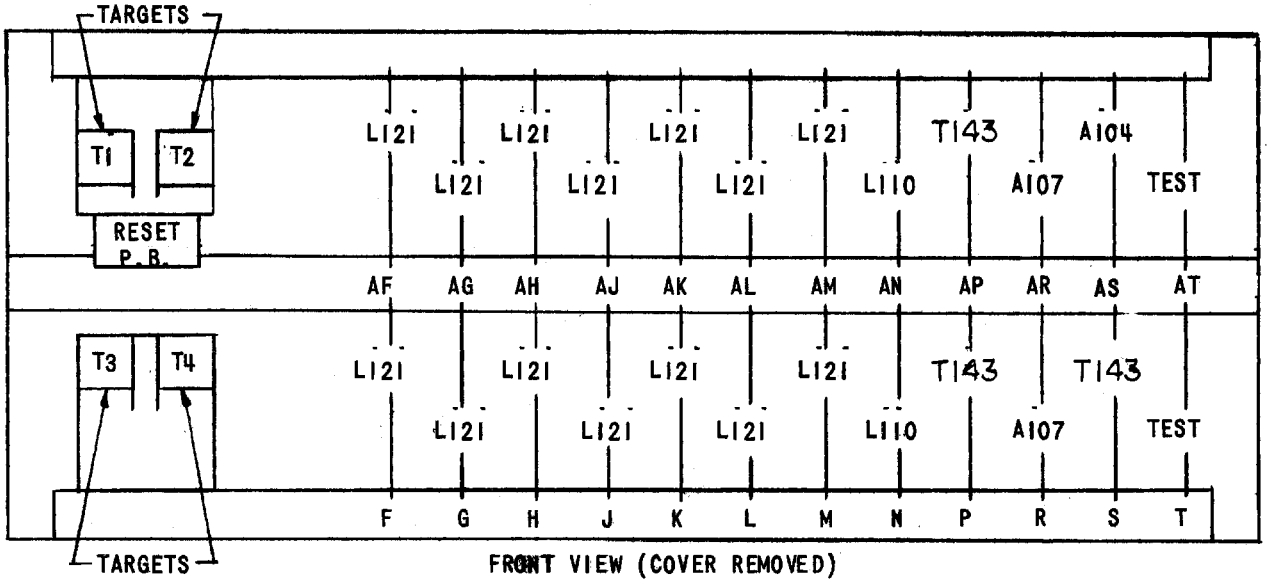
To minimize possible outage time, it is recommended that a complete maintenance program should include the stocking of at least one spare card of each type. It is possible to replace damaged or defective components on the printed circuit cards, but great care should be taken in soldering so as not to 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 busses due to moisture and dust. The wiring diagrams for the cards in the SMAT51A relay are included in the card book GEK-34158.




* Fig. 2 (0227A2037-0) Outline and Mounting Dimensions




TOP VIEW




FRONT VIEW (COVER REMOVED)

Fig. 3 (0257A8476-0) Component Location Diagram SMAT51A

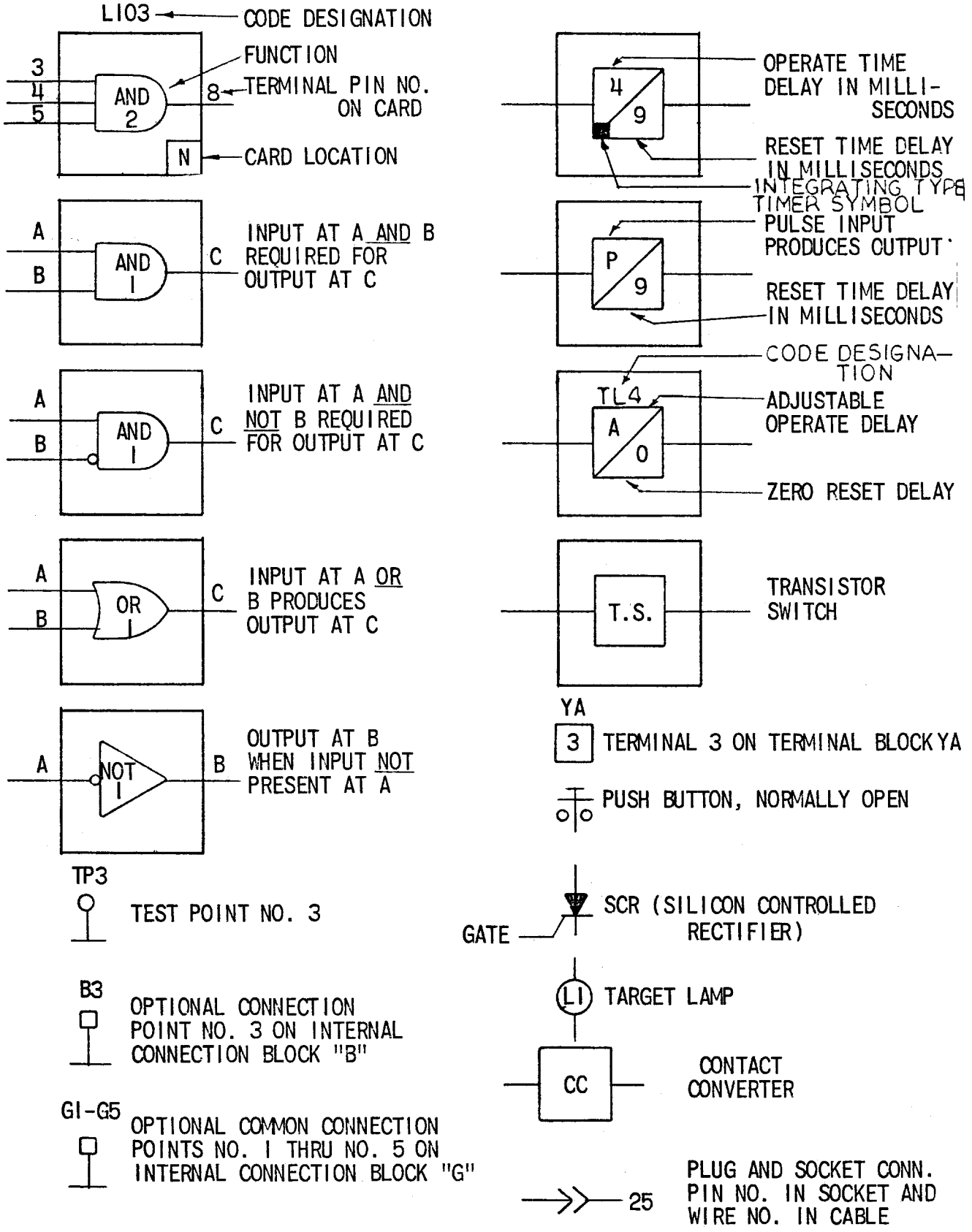



Fig. 4 (0227A2047-0) Logic Internal Connection Diagram Legend