INSTRUCTIONS

GEK-45431

STATIC LOGIC AND TRIPPING UNIT

TYPE SLAT71A

POWER SYSTEMS MANAGEMENT DEPARTMENT

GENERAL ELECTRIC

PHILADELPHIA, PA.

C O N T E N T S

STATIC LOGIC AND TRIPPING UNIT

TYPE SLAT 71A

DESCRIPTION

The SLAT71A is a static auxiliary logic and output tripping relay that was designed for use in a dual channel direct transferred tripping scheme. One GE Type 30 channel and one GE type 71 channel plus an SSA type power supply are required to complete the scheme.

The SLAT71A is packaged in a four rack unit (1 R.U. = $1\frac{3}{4}$") enclosed metal case that is suitable for mounting in a 19 inch rack. The outline and mounting dimensions are given in Figure 2. The internal connections for the relay are given in Figure 1. The component and card locations are shown in Figure 3.

APPLICATION

The SLAT71A is intended for application with dual channel frequency shift communication equipment to accomplish the receiving end tripping function in response to tripping signals initiated at a remote terminal. A typical application would involve tripping a circuit breaker at the remote end of a transmission line in response to the operation of a relay protecting a shunt reactor, or of a relay protecting a transformer to a line with no high side breaker.

The relay is designed for use with GE type 30 and GE type 71 channel equipment. The scheme is normally operated dual channel but link and printed circuit card options are available so that the scheme may be operated as follows:

1. Single channel scheme- either receiver output produces a trip .

2. Single channel scheme- one channel is taken out of service and the remaining channel controls tripping.

3. Dual channel scheme with automatic throwover to single channel on failure of one channel.

4. Dual channel scheme with automatic throwover to delayed trip single channel on the failure of one channel.

In addition to the scheme logic, the following is a list of the various functions included in the relay along with a general description of their intended use.

Trip Outputs - six electrically separate, normally open output contacts for tripping.

RB Outputs - Two normally open and two normally closed contacts for reclose blocking.

RT Outputs - One normally open and one normally closed contact per channel for monitoring or annunciating receipt of a trip signal.

CF Outputs - one normally open and one normally closed contact per channel for monitoring or annunciating a channel failure.

Also included are various target and indicating lamps. For a complete description of the application of the SLAT71A relay in a particular scheme, refer to the overall logic diagram and description supplied with the terminal.

RATINGS

The type SLAT71A relay is designed for use in an environment where the air temperature outside the relay case does not exceed - 20^{o}C or +65^{o}C.

The type SLAT71A relay requires $\pm$15 VDC power source which can be obtained from a type SSA 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 VDC, 125 VDC, and 250 VDC.

The ratings for the telephone relay contacts used for TR and RB are listed in table I.

The contacts of the reed relays that are used for RT and CF are rated for 10 VA resistive. They will carry 0.5 amperes continuously at voltages up to 250 volts.

TABLE I

ABSOLUTE MAXIMUM RATINGS	
180 VA RESISTIVE	INTERRUPTION
60 VA INDUCTIVE*	CAPACITY
3 AMPERES	MAKE & CARRY CONTINUOUS
30 AMPERES	MAKE & CARRY SHORT TIME

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

The coils of the telephone relays used for TR and RB are designed to operate from the station battery. The voltage rating of the coil circuit is listed below.

SLAT71A	1		
BATTERY VOLTAGE	48		

BURDENS

The SLAT71A relay presents a maximum burden to the Type SSA power supply of:

300 ma from the +15 VDC supply
250 ma from the -15 VDC supply

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

Each contact converter, when energized, will draw approximately 10 ma from the station battery, regardless of tap setting.

OUTPUTS

A. TRIP (TR)

Two telephone relays each with 3 normally open contacts are provided. These contacts close within 4 milliseconds of the time the associated coil is energized and open within 16 milliseconds of the time the associated coil is deenergized.

B. RECLOSE BLOCK (RB)

Two normally open and two normally closed electrically separate contacts are provided. These contacts close within 8 milliseconds of the time the associated coil is energized and open within 16 milliseconds of the time the associated coil is deenergized.

C. CHANNEL FAILURE (CF1 & CF2)

CF1 and CF2 each have one normally open contact and one normally closed contact. These contacts are electrically separate and close with 1 millisecond of the time the associated coil is energized and open within 1 millisecond of the time the associated coil is deenergized.

OPERATING PRINCIPLES

A. LOGIC CIRCUIT

The functions of the type SLAT71A 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 1 VDC represents an OFF or LOGIC ZERO condition; an ON or LOGIC ONE condition is represented by a signal of approximately +15 VDC.

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

B. 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 SLAT71A relay. These contact converters, which are labeled CC1 and CC2, have a non-adjustable 2 millisecond pickup delay.

CC1

Contact converter 1 is energized by external contacts (RA and PS) associated with the type 30 equipment.

CC2

Contact converter 2 is energized by an external contact (CFA) associated with the type 71 equipment.

C. DATA MONITORING POINTS

Data monitoring points are accessible through a ten point socket on the rear of the SLAT unit. To monitor these points, an additional piece of equipment, termed a Data Logging Amplifier (DLA), is required. The DLA is connected to the SLAT71A with a 10 conductor shielded cable. This cable is not supplied unless the DLA unit is ordered.

TARGETS

Five target lamps are provided.

C1	Failure Channel 1
C2	Failure Channel 2
R1	Received trip channel 1
R2	Received trip channel 2
T	Trip, lights and seals in wherever a signal is present on the trip bus

PUSH BUTTONS

TRIP REC. #1 TRIP REC. #2	Test buttons simulate received Trip signal
LOS REC. #1 LOS REC. #2	Test buttons simulate loss of receiver
TARGET RESET	Resets trip target lamp.

CHANNEL INTERFACE

The logic of the type SLAT71A relay includes an isolation interface (Figure 7) between the relays in the scheme and the associated channel. The circuitry of the isolation 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 four timers in the SLAT71A relay that require field adjustment.

The 15-100/0 timer, TL1, is part of the channel failure logic. This timer determines the amount of time the healthy channel signal must be present before blocking the channel failure logic.

The 50-400/0 timer, TL2, is also part of the channel failure logic. This timer determines the length of time that a channel failure indication must be present before that channel is removed from service by the channel failure logic. This time should always be set longer than TL1, the 15-100/0 timer.

The A/0 (15-100/0) timers, TL3 and TL4, introduce time delay into the trip path to improve security when a single channel must produce a trip output.

Further details for setting these timers can be found in the logic description provided with each static relaying scheme.

CONSTRUCTION

The SLAT71A 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 Figures 1 and 3 respectively.

The SLAT71A relay contains printed circuit cards identified by a code number such as A117, T128, L102, 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 positions T & AT with TP1 at the top of the AC card. TP10 is tied to +15 VDC through a 1.5K resistor. This resistor limits the current when PT10 is used to supply a logic signal to a card.

The SLAT71A relay 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. 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

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 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 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 REDUCED THE EFFECTIVENESS OF THE ISOLATION PROVIDED.

IF THE SLAT71A RELAY THAT IS TO BE TESTED IS INSTALLED IN AN EQUIPMENT WHICH HAS ALREADY BEEN CONNECTED TO THE POWER SYSTEM, DISCONNECT THE OUTPUTS IN THE ASSOCIATED TYPE SLAT RELAY FROM THE SYSTEM DURING TEST.

A. GENERAL

The SLAT71A relay is supplied from the factory either as a separate unit, or mounted in a static relay equipment associated with 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 writeup accompanying the overall logic diagram. Where a setting depends upon conditions encountered on a specific application, that 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 SLAT71A unit can be checked by observing the signals at the twenty test points (TP1 to TP20), or 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 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.

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.

In order to test the time cards it is necessary to remove the card ahead of the timer (see Table 1) 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 5. Opening the N.C. contact causes the output to step up to +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 counter-clockwise. Closing the contact causes the timer output to drop out after the reset time-delay setting of card. If the timer card is provided with a variable reset delay, it can be adjusted by the lower potentiometer on the timer card (CW increases reset time).

TABLE 1

TIME UNDER TEST	POSITION	REMOVE CARD IN POSITION
T128(15-100/0)	L	K
T128(15-100/0)	P	K
T146(50-400/0)	M	N
T128(15-100/0)	AP	AN

E. 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 DC through a switch to the appropriate pair of terminals of the terminal strip mounted on the rear of the relay. The terminal numbers and polarity of connections for each of the two contact converters are shown in the internal connection diagram, Figure 2. Output of the contact converter card may be monitored between pin 8 and 9 and pin 1 (reference) on the card adapter with either a scope or a meter. Closure of the switch in the test source will provide a +15 volt DC signal at pin 8 or 9 of the card adapter.

F. ISOLATION INTERFACE TESTS

Operation of the isolation interface can be checked without direct connections to the subassembly. External test connections are made to AE2 - AE3 and AE4 - AE5. Logic circuit test connections are made at TP3 and TP17.

Received carrier operation test connections are shown in Figure 6. For this test do not remove

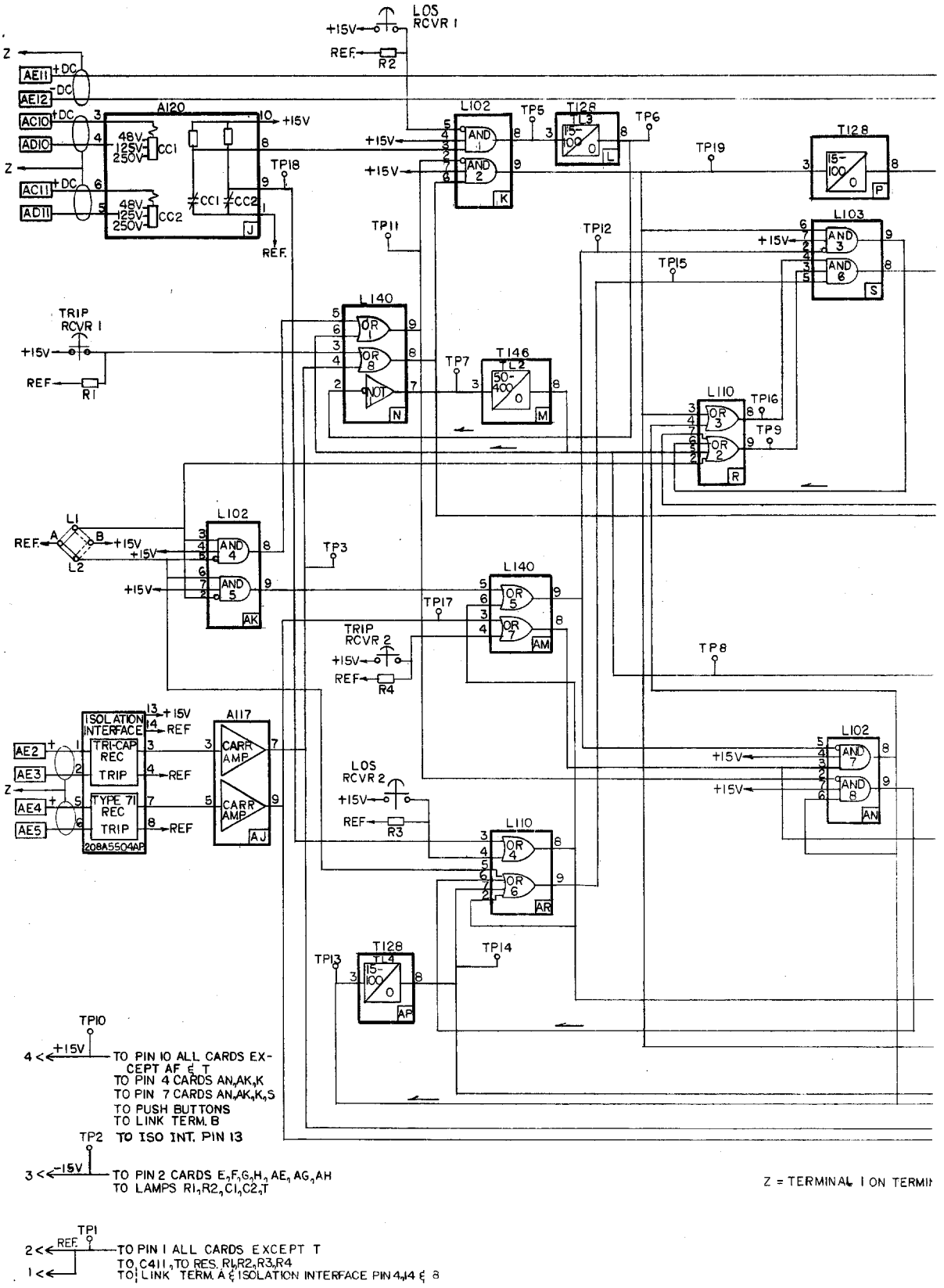
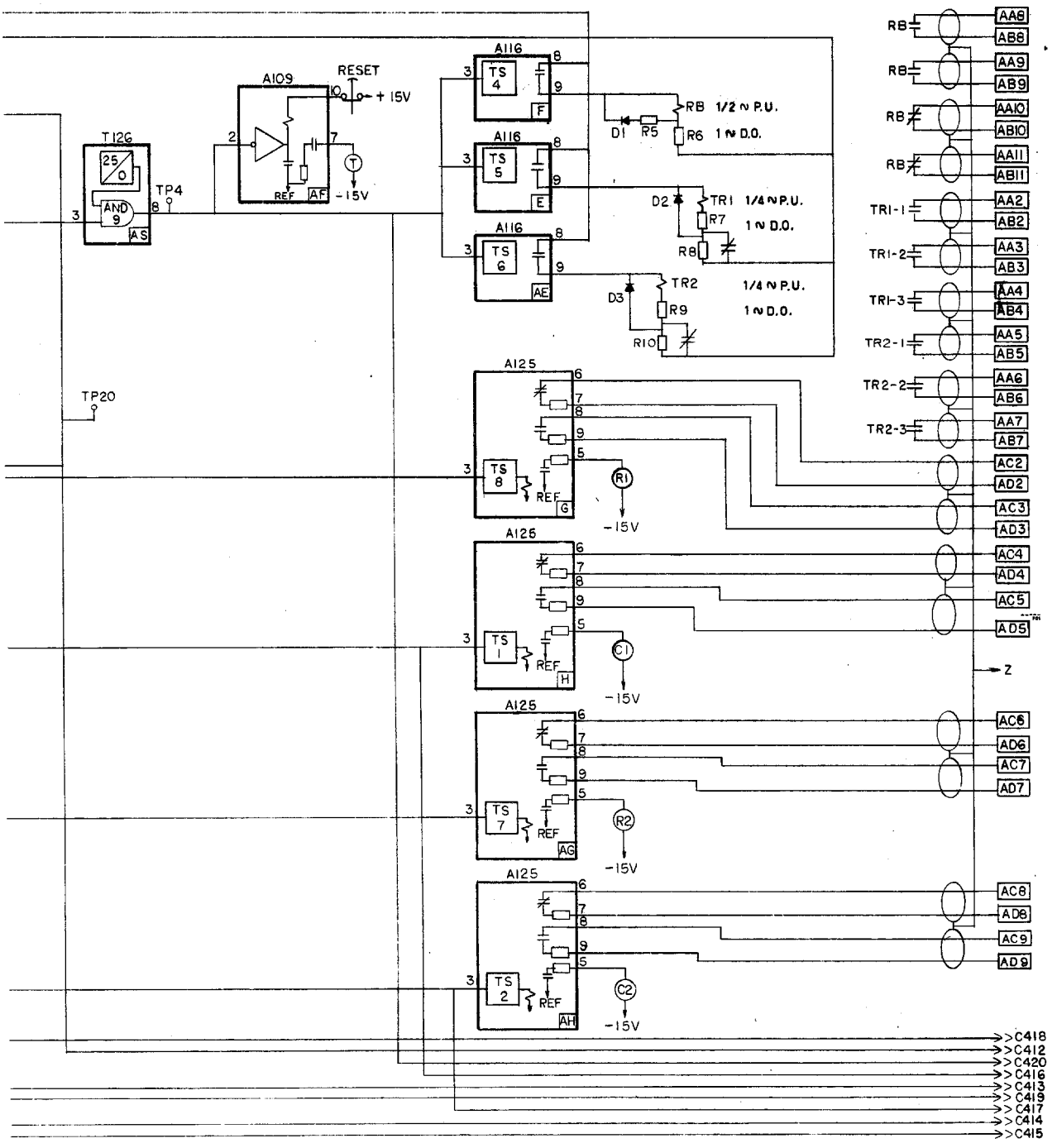


FIG. 1 (0136D1412-1) INTEI



3,AC,AD OR AE

TIONS FOR THE TYPE SLAT71A RELAY

channel control card in position "AJ". Closure of the N.O. contact will simulate a received carrier signal and scope display will go from a logic "0" to a logic "1".

G. TRIP CIRCUIT TESTS

The trip circuits may be checked by connecting an auxiliary lockout relay, such as the type HEA relay, in series with the trip circuit. The lockout relay should have the same D.C. rating as the trip circuit of the relay. 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 or simply a lamp connected in series with the trip contacts.

H. OVERALL EQUIPMENT TESTS

The elementary, overall logic, and logic description for the specific job will be useful for determining the overall operation of the scheme.

Test push buttons are provided which will simulate trip inputs from the channel equipment and channel failure indications from the channel equipment. These switches can be useful in testing the operation of the relay.

MAINTENANCE

A. PERIODIC TESTS

It should be sufficient to check the outputs produced at test points in the SLAT71A when periodic calibration tests are made. No separate periodic tests on the SLAT71A 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-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.

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 SLAT71A relay are included in the card book GEK-34158.

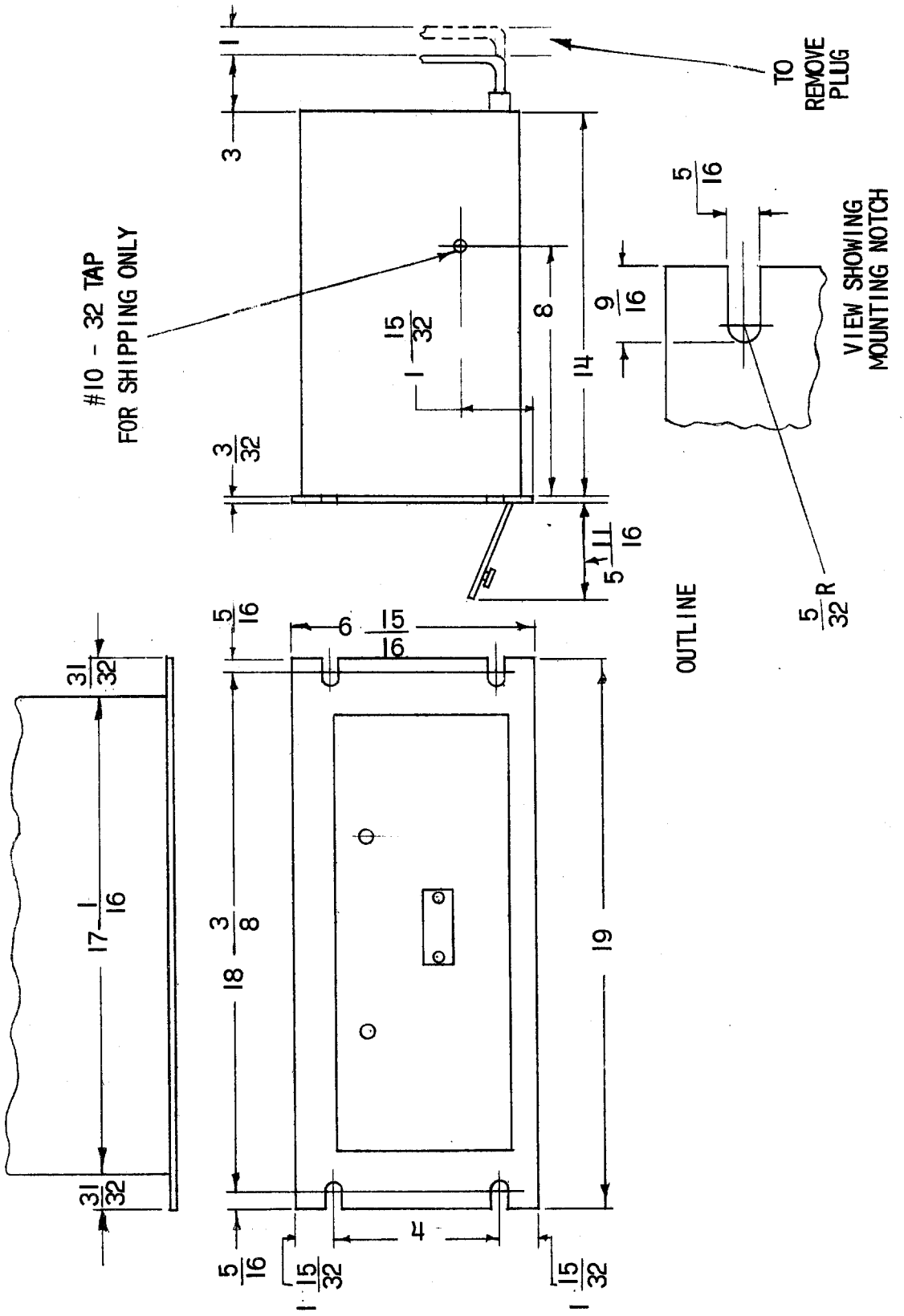


FIG. 2 (0227A2037-0)OUTLINE AND MOUNTING DIMENSIONS

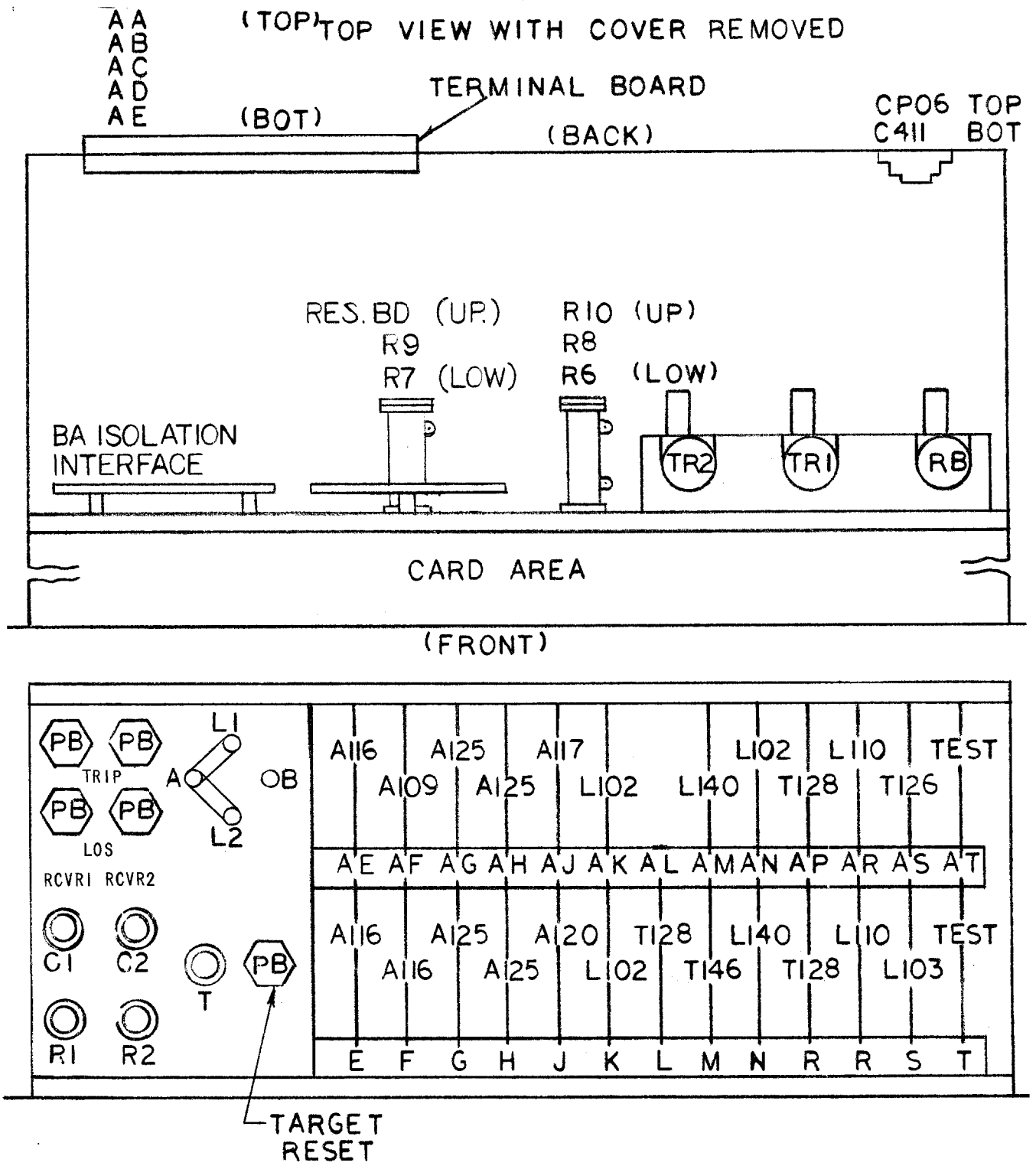


FIG. 3 (257A6299-0) COMPONENT LOCATION DIAGRAM

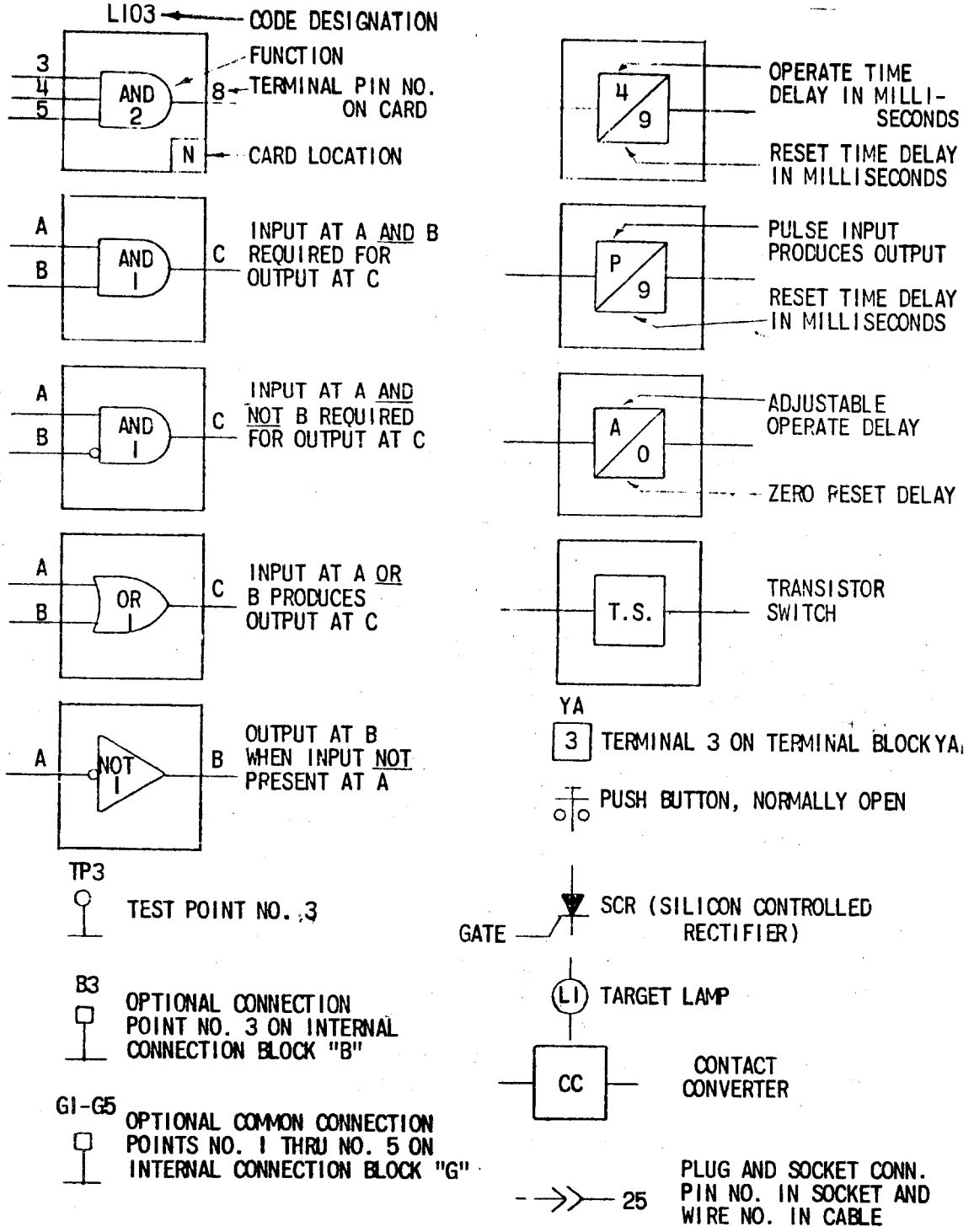
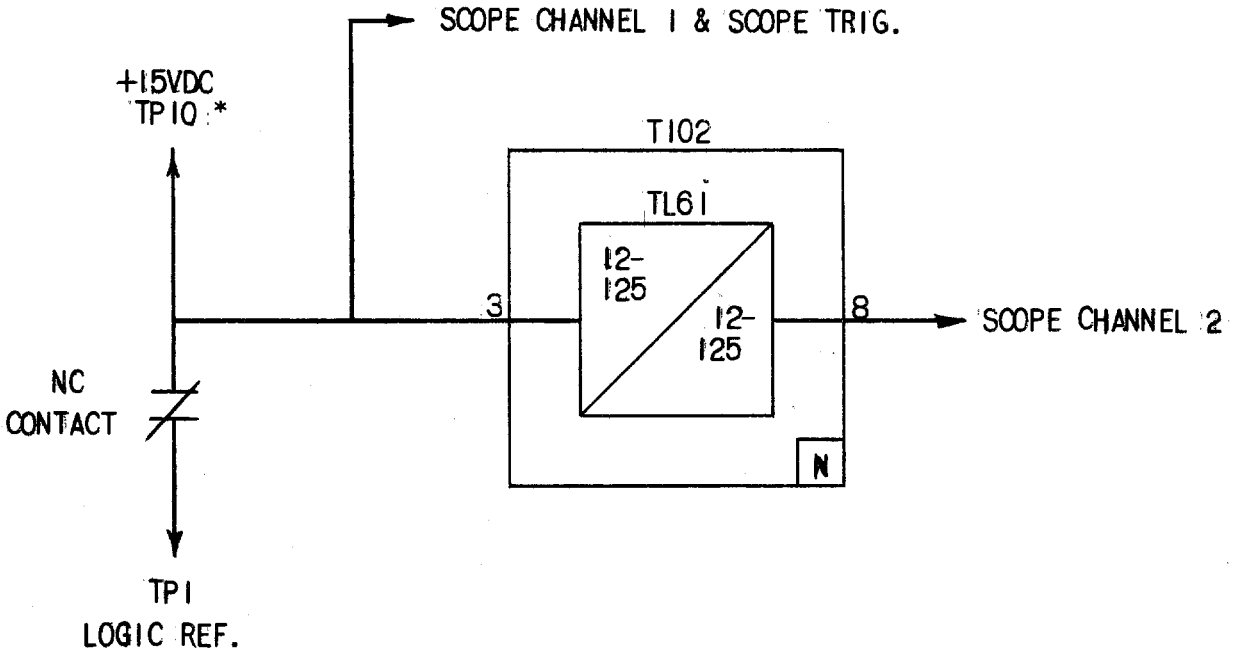
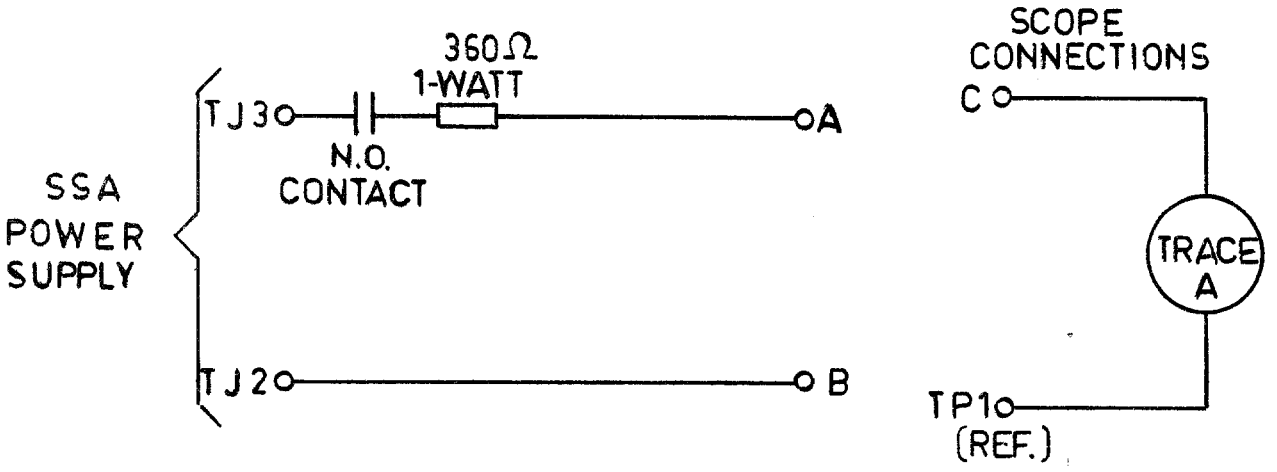


FIG. 4 (227A2047-0) LOGIC AND INTERNAL CONNECTION DIAGRAM LEGEND



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

FIG. 5 (246A7987-0) TIMER TEST CIRCUIT



TEST	CONNECTIONS			RESULTS
	A	B	C	
REC. TRIP TYPE 30	AE2	AE3	TP3	SCOPE DISPLAY WILL GO FROM LOGIC "0" TO LOGIC "1" WHEN CONTACT IS CLOSED
REC. TRIP TYPE 71	AE4	AE5	TP17	

FIG. 6 (257A8706-0) ISOLATION INTERFACE TEST CIRCUIT

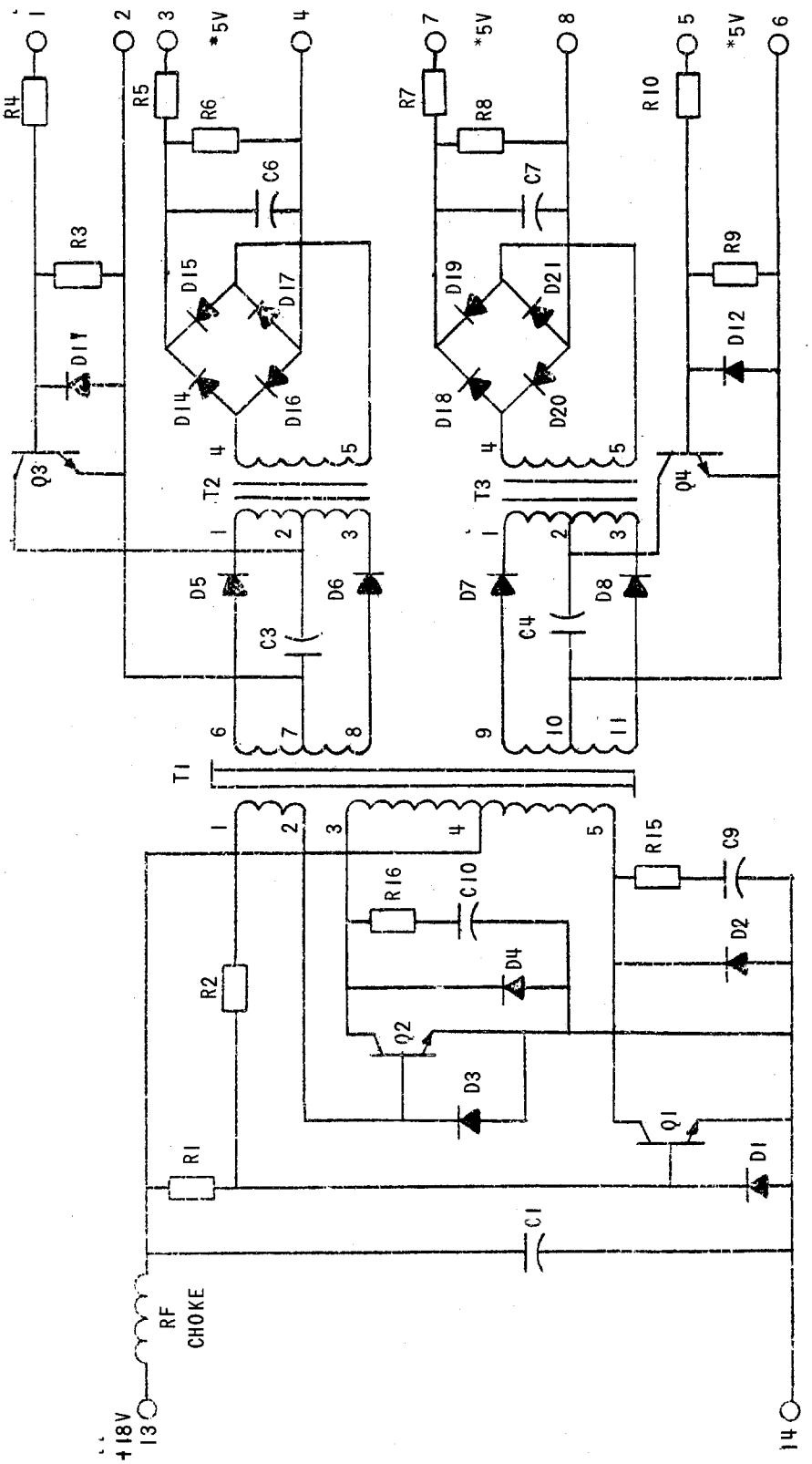


FIG. 7 (208A5504 AP-1) ISOLATION INTERFACE CIRCUIT