



INSTRUCTIONS

GEK-45392B

SUPERSEDES GEK-45392A

STATIC LOGIC UNIT

TYPE SMA51A

GENERAL  ELECTRIC

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STATIC LOGIC UNIT
TYPE SMA51A

DESCRIPTION

The SMA51A relay is an auxiliary logic relay designed to be used in subsynchronous resonance protection of generators. The relay contains the necessary logic to interpret output signals from the associated measuring functions and translate them to an appropriate auxiliary output tripping relay.

The type SMA51A relay is packaged in a four rack unit enclosed metal case. The relay is suitable for mounting in a 19 inch rack. The mounting and outline dimensions are shown in Fig. 2. The internal connections for the SMA51A relay are shown in Fig. 1 and the component and card locations are shown in Fig. 3.

RATINGS

The type SMA51A relay is designed for use in an environment where the air temperature outside the relay case does not exceed -20°C or $+65^{\circ}\text{C}$.

The type SMA51A relay requires ± 15 VDC power source which can be obtained from a TYPE SSA power supply.

BURDENS

The SMA51A relay presents a maximum burden of 300 milliamperes to the +15 VDC supply of the Type SSA power supply.

OPERATING PRINCIPLES

LOGIC CIRCUIT

The functions of the type SMA51A 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 one 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 (Fig. 1) are explained by the legend shown in Fig. 4.

SETTINGS

All the timers in the SMA51A require field adjustment. The timers are to be set in accordance with the data provided by The Electric Utility Systems Engineering Department (EUSED) in Schenectady, New York.

Four types of timers are used in the SMA51A. The T104 and T138 timers are associated with the modal trips paths. The T104 timer has an adjustable pickup delay of 0.1 to 2 seconds in two ranges and a zero drop-out time. The T138 timer has an adjustable pickup delay of 0.2 to 250 seconds in five ranges and a fixed 20 millisecond drop-out time. The T102 and T145 timers are associated with the steady state instability trip paths. The T102 timer has an adjustable pickup and drop-out time of 10 to 80 milliseconds.

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.

The T145 timer has an adjustable pickup delay of 0.2 to 50 seconds in five ranges and a fixed 50 milli-second drop-out time.

CONSTRUCTION

The SMA51A 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 physical location of the components are shown in Figs 2 and 3 respectively.

The SMA51A relay contains printed circuit cards identified by a code number such as T102, L102 where 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 S, T, and AT. TP10 is at the bottom of the AT card and TP1 is at the top of the AT card. 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. TP1 thru TP10 are on card AT, TP11 thru TP20 are on card T and TP21 thru TP30 are on card S.

RECEIVING, HANDLING AND STORAGE

The SMA51A 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 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

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 REDUCED THE EFFECTIVENESS OF THE ISOLATION PROVIDED.

IF THE SMA51A 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 SMAT RELAY FROM THE SYSTEM DURING TEST.

GENERAL

The SMA51A relay is supplied from the factory either as a separate unit, or 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.

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. The procedure for checking and setting the timers is described in a later section.

OPERATIONAL CHECKS

Operation of the SMA51A unit can be checked by observing the signals at the thirty test points (TP1 to TP30), or by observing the output functions in the associated Type SMAT tripping relay. The test points are located on three test cards, 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 (Fig. 1). Test point voltages can be monitored with a portable high impedance voltmeter, the test lamps in the SMAT51B 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 or a digital timer should be used.

In order to test the timer cards it is necessary to remove the card ahead of the timer 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 to test points. The timer test circuit is shown in Fig. 5. Opening the normally closed contact causes the output to step up to +15 VDC after the pickup delay of the timer. To increase the pickup time of all timers except the T138 and T145 turn the upper potentiometer clockwise; to decrease the time turn it counterclockwise. The T138 and T145 timers increase with counterclockwise rotation and decrease with clockwise rotation. Closing the contact causes the timer output to drop out after the reset time delay of the card. If the card is provided with a variable reset delay, it can be adjusted by the lower potentiometer; clockwise rotation increases reset time.

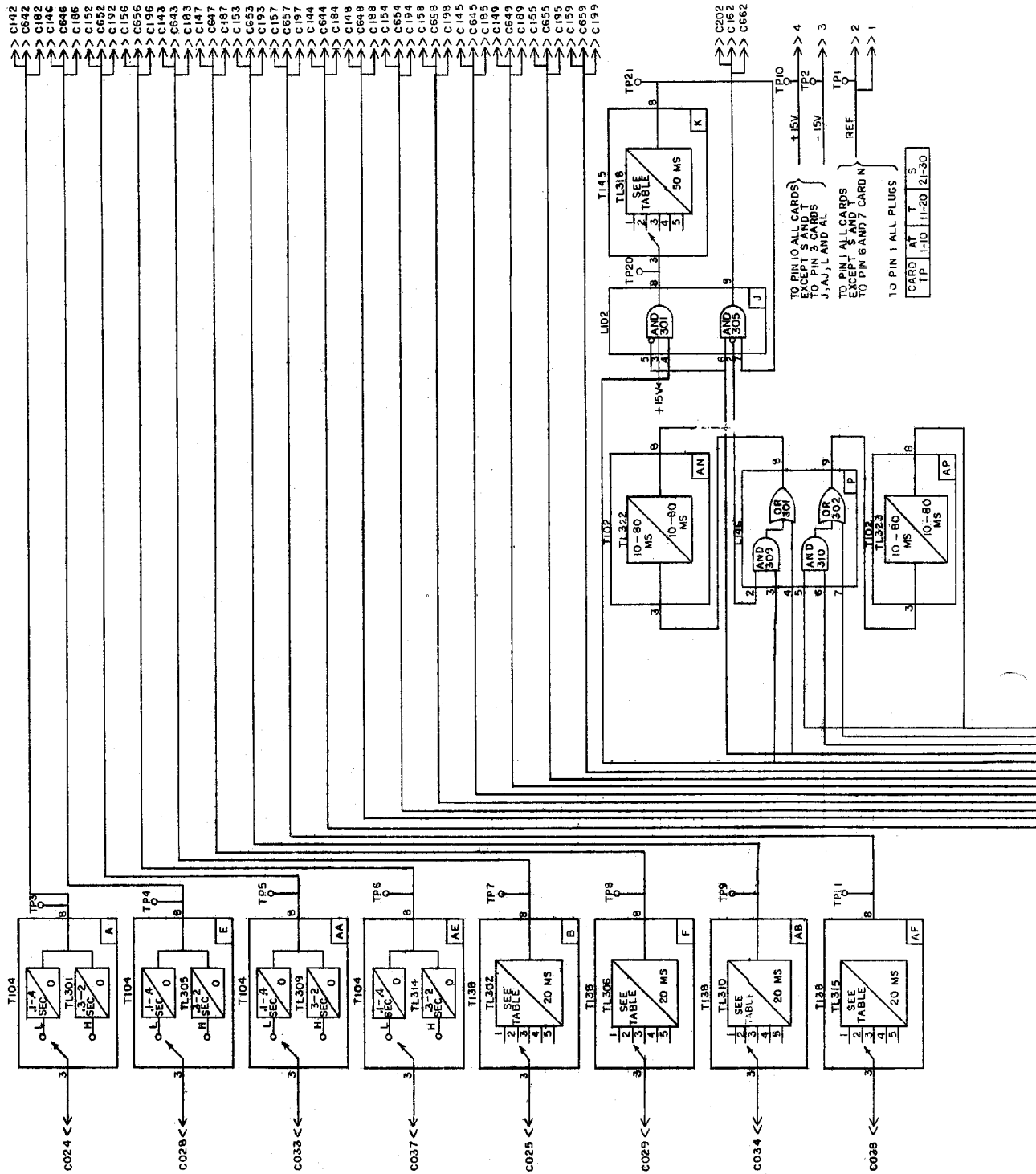
The T138 and T145 cards have ranges which extend to 250 seconds. A method which can be used to reduce the time necessary to set this long time delay is presented below:

- 1) determine the range which will be used i.e., 1 thru 5
- 2) divide the time required by the factors listed below

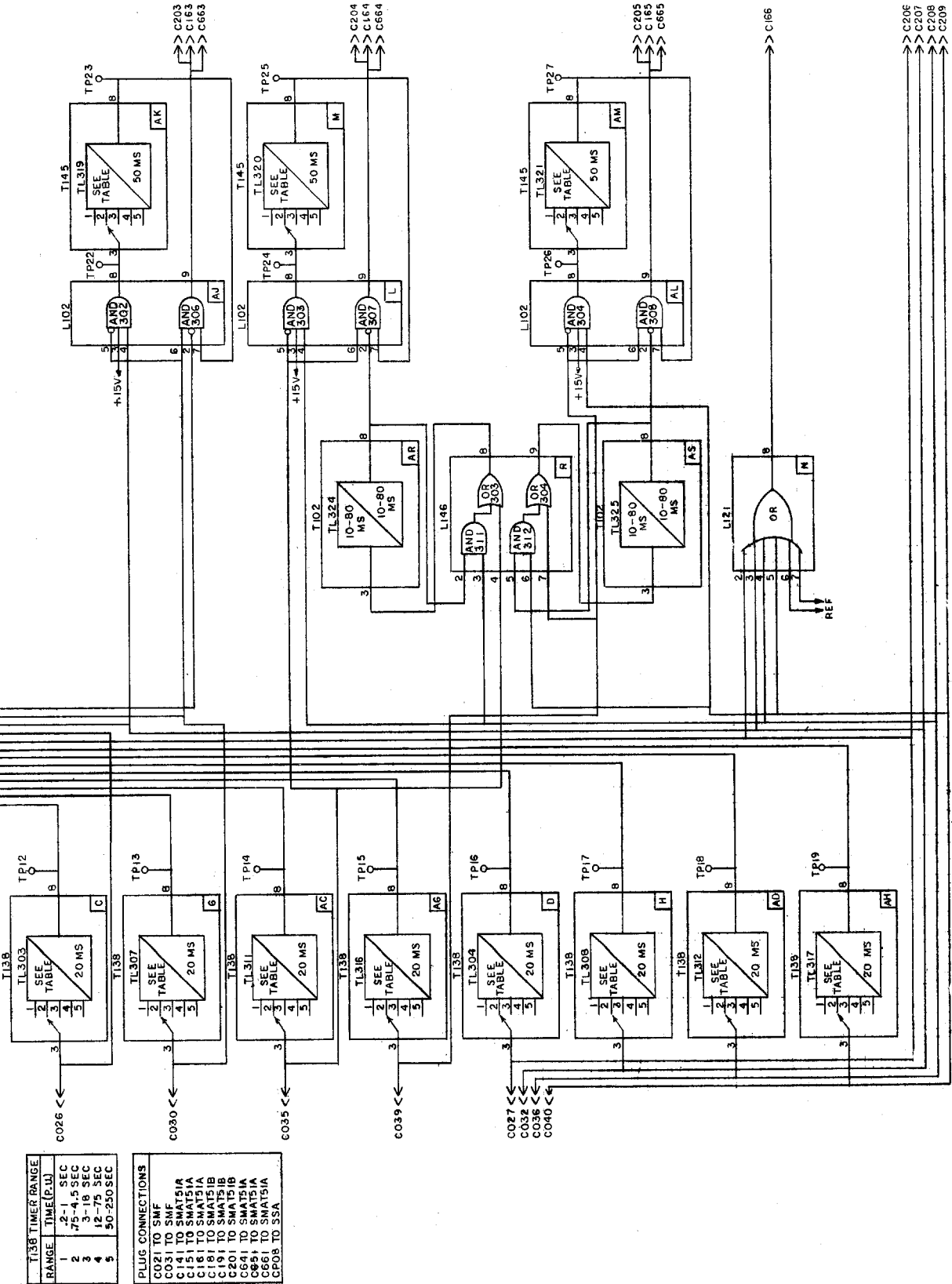
range	}	2	4
to be		3	16
		4	64
used		5	256

divide by

- 3) set the timer, in range 1 using the time found in step 2
- 4) return the range plug to the final range
- 5) make final adjustments



* Fig. 1 (0126D6262-5) Interna



TL308 TIMER RANGE	
RANGE	TIME (P.U.)
1	2-1 SEC
2	75-4.5 SEC
3	3-18 SEC
4	12-75 SEC
5	50-250 SEC

PLUG CONNECTIONS	
C021 TO SMF	
C031 TO SMF	
C141 TO SMAT51A	
C181 TO SMAT51A	
C191 TO SMAT51B	
C201 TO SMAT51B	
C641 TO SMAT51A	
C651 TO SMAT51A	
C661 TO SMAT51A	
C608 TO SSA	

Connections for the Type SMA51A Relay

TABLE I

In some applications, several cards could be omitted in the total scheme. Jumper cards could replace some. Refer to card omission chart of the particular scheme.

TIMER UNDER TEST	POSITION	REMOVE CARD	TP	
			IN	OUT
TL301	A	B		3
TL302	B	C		7
TL303	C	D		12
TL304	D	E		16
TL305	E	AB		4
TL306	F	AC		8
TL307	G	AD		13
TL308	H	AE		17
TL309	AA	H	IN SMF51A	5
TL310	AB	J		9
TL311	AC	K		14
TL312	AD	L		18
TL314	AE	AH		6
TL315	AF	AJ		11
TL316	AG	AK		15
TL317	AH	AL		19
TL318	K	J		21
TL319	AK	AJ	20	21
TL320	M	L	22	23
TL321	AM	AL	24	25
TL322	AN	P	26	27
TL323	AP	P		-
TL324	AR	R		-
TL325	AS	R		-

Example:

To set a T138 card for a pickup time of 165 seconds, range 5 would be used. Following the above procedure divide 165 by 256 giving 0.6445 seconds, note this is in range 1. Now with the range plug in position 1, set the timer for 0.6445 seconds pickup. Return the range plug to range 5 and recheck the time, readjust as required. Note that this procedure allows a coarse adjustment to be made rather quickly, rather than, making multiple time shots at a long time delay to reach the desired setting.

OVERALL EQUIPMENT TESTS

After the SMA51A relay and the associated static relay units have been individually calibrated and tested for the desired setting, 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

When periodic calibration tests are made on the associated measuring units the timers in the SMA51A should also be checked.

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, and a digital timer are 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 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 SMA51A relay are included in the card book GEK-34158.

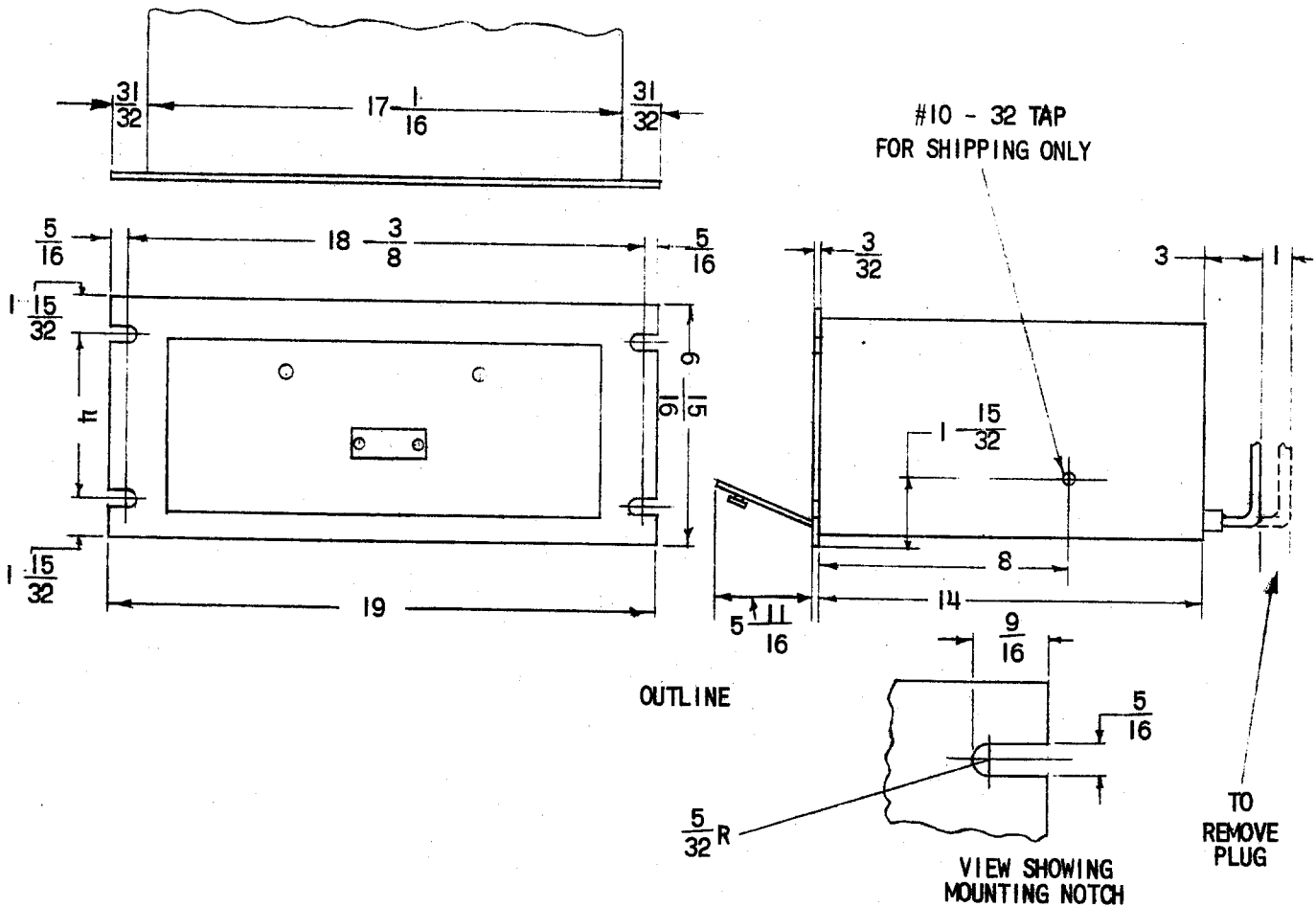
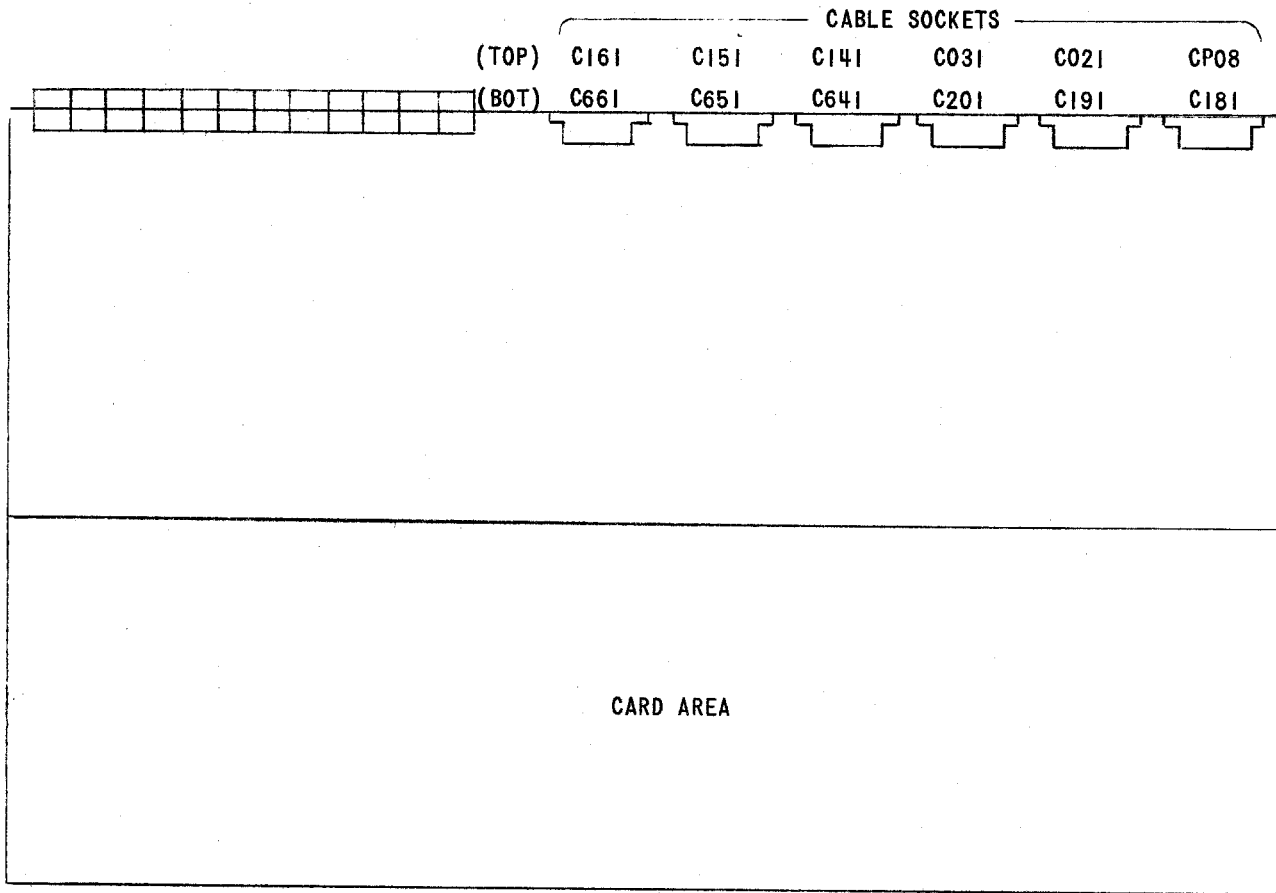
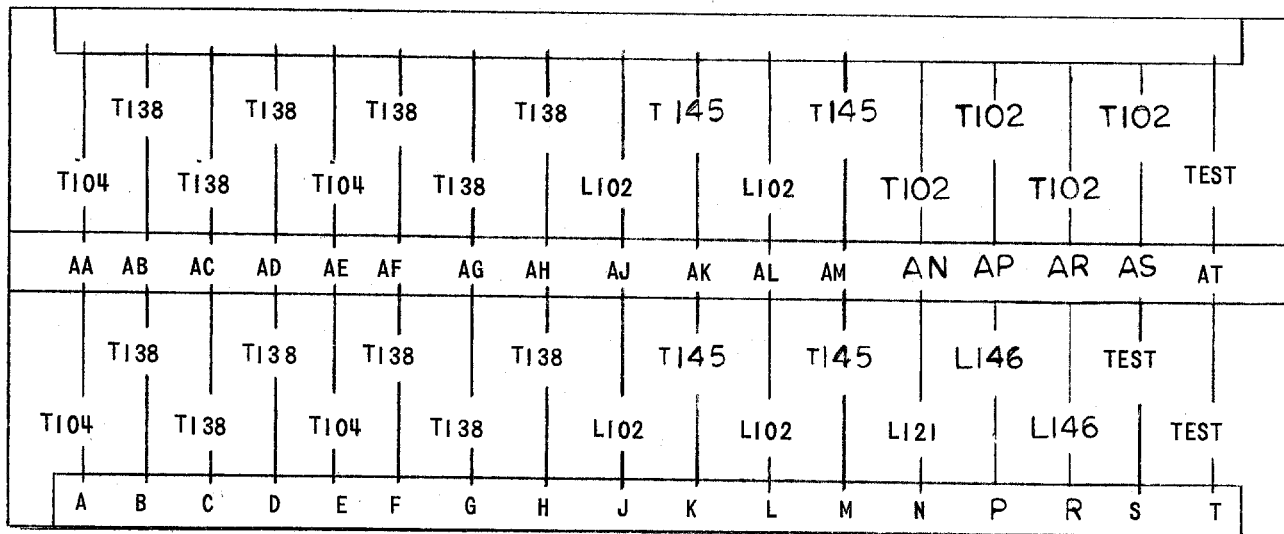


Fig. 2 (0227A2037-0) Outline and Mounting Dimensions



TOP VIEW



FRONT VIEW (COVER REMOVED)

Fig. 3 (0257A8477-1) Component Location Diagram

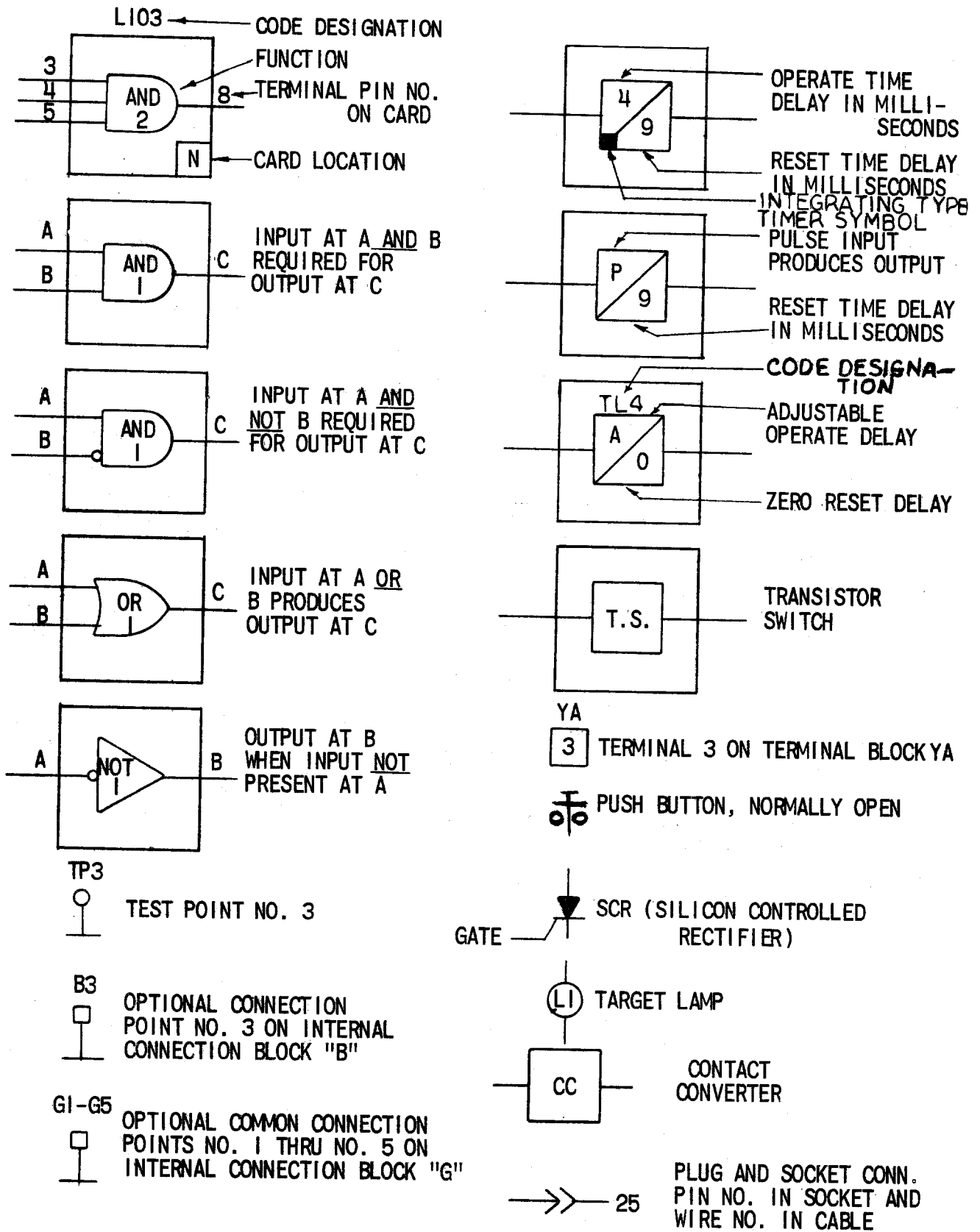
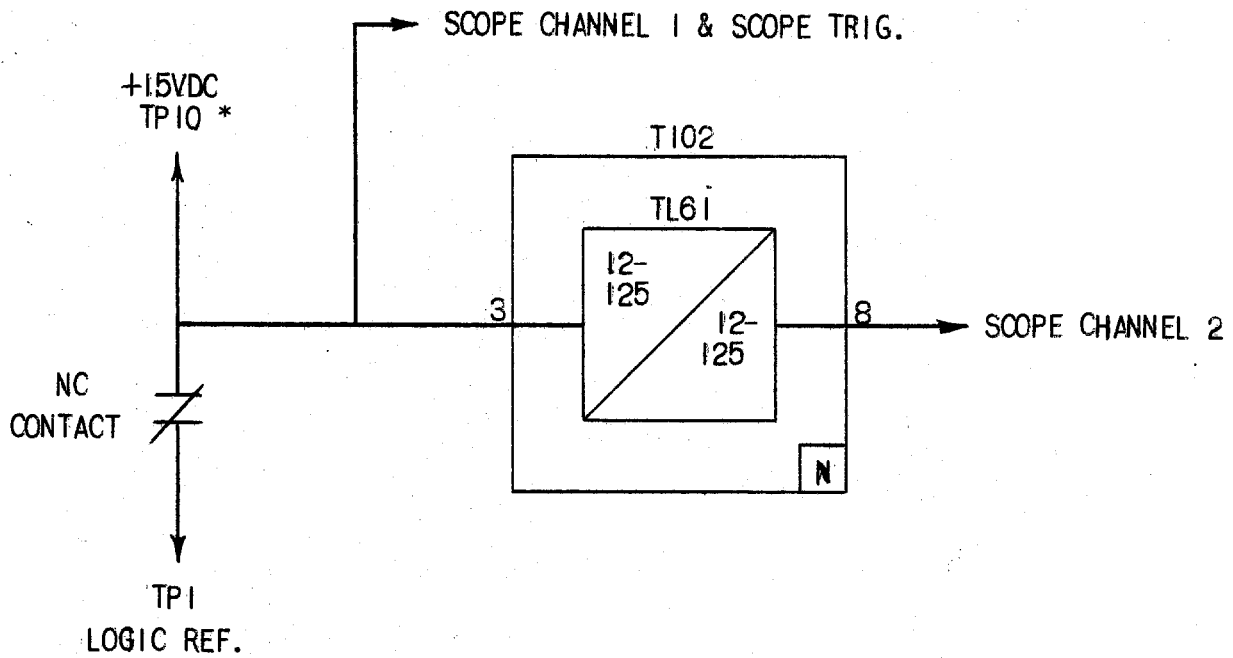


Fig. 4 (0227A2047-0) Logic and Internal Connection Diagram Legend



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

Fig. 5 (0246A7987-0) Logic Timer Test Circuit