INSTRUCTIONS

GEK-86055

STATIC SYNCHRONISM CHECK RELAY

TYPE SLJ99AA

GENERAL ELECTRIC

CONTENTS

STATIC SYNCHRONISM CHECK RELAY

TYPE SLJ99AA

DESCRIPTION

The Type SLJ99AA relay is a static device designed to check synchronism before permitting a breaker to be closed. The closing angle, or angle between which synchronism can be checked and closing will be permitted, is adjustable from 10 to 60 degrees. The relay includes two telephone relays and a voltage differential circuit to check bus and line voltage conditions. The voltage differential circuit has a range of 4 to 20 volts.

Closing will be permitted after a set time delay, adjustable from 0.35 to 6.0 seconds, provided the bus and line voltages are within the selected range and the closing angle is less than or equal to the set closing angle.

The relay comes complete with a target unit and is mounted in an M2 size drawout case. Outline and panel drilling dimensions for the relay are shown in Figure 21. The internal connections for the relay are shown in Figure 6.

APPLICATION

The Type SLJ99AA relay is a static device designed to perform a synchronism check before allowing a breaker to be closed. The relay is not intended to initiate closing of the breaker, but rather to check that the systems, or part of the system, to be connected are within a limited angle of each other before closing of the breaker is permitted. The maximum angle between the systems for which closing will be permitted by the relay is referred to as the closing angle and it is adjustable over the range of 10 to 60 degrees. The relay is basically a single phase device that receives single phase voltages from the same phase(s) on both sides of the breaker, or the equivalent thereof in the case where a delta-wye power transformer is interposed between the two sources of potential. The angle between these two voltages forms the basis on which the synchronism check is made. Typical external connections to the relay are shown in Figure 1 and Figure 2. The synchronism check is initiated by closing a contact which drives the contact converter. If the relay is to be continuously energized, the contact converter should be permanently connected to DC voltage.

The relay is designed to be used primarily in those applications where the parts of the system to be joined are interconnected at other points throughout the system. Even though in synchronism, there may be an angular difference in the voltages existing on either side of the breaker as a result of load flow throughout the interconnected system. It may be desirable to close the breaker even though an angular difference exits, provided of course that the angular difference is not great enough to be detrimental to the system and/or equipment. Each application should be checked on an individual basis to determine the maximum angle for which closing can be tolerated. Once this angle has been determined, the relay should be set accordingly. A time delay range of 0.35 to 6.0 seconds may be chosen to insure that the system is stable and that synchronism really exists.

When the parts of the system to be joined are not interconnected at other points throughout the system, the possibility exists that the systems may not be in synchronism. In that case, there will be some slip between the systems. At slip frequencies below the cut-off slip, the relay will produce an output. For each combination of time delay and closing angle setting, there exists a slip frequency, called the "cut-off slip," above which the relay will not produce an output. At slip frequencies below the cut-off slip, the relay will produce an output. The cut-off slip frequency can be determined from the following equation:

$$S = \frac{2(1000)\ A}{360(T)}$$

where:

S = cut-off slip in hertz
A = closing angle setting in degrees
T = time delay setting in milliseconds

The maximum slip cut-off which this relay will allow for an A setting of 60 degrees and a T time delay of 0.35 seconds is 0.95 hertz (slip cycles per second). This is a high slip rate and care should be exercised in applications requiring these settings.

There will be a small variation in the actual closing angle of the relay from its calibrated setting when the applied voltages vary from the rated value of 120 volts. This variation will not exceed two degrees over a range of 70 to 110 percent of rated voltage. This is true with balanced voltages on the two inputs or with unbalanced voltages on the two inputs.

In order for the SLJ99AA relay to provide an output, there must be a voltage present on both sides of the breaker, and the phase angle between these voltages must be within the closing angle setting of the relay. The voltage on both sides of the breaker must be high enough to pick up the two voltage units (27B and 27L) and hold them in the picked up position. Because the SLJ99A relay also has a voltage differential circuit, these two voltages must also be within the selected voltage difference range. The voltage selection range is 4 to 20 volts. This means that the synchronism check unit alone will not permit picking up a dead line.

For applications where dead line and/or dead bus operation is required, undervoltage detectors are used to bypass the synchronism check device. These undervoltage devices are included as an integral part of the relay. Typical connections illustrating the use of the undervoltage relays for live line-dead bus, dead line-live bus conditions, etc., are shown in Figure 2.

CALCULATION OF SETTINGS

The angular setting, A, of the relay is made by adjusting the pickup time of the TL-1 timer shown in Figure 1. To determine the necessary setting, T, use the following equation:

$$T \text{ (in milliseconds)} = 46.3 \times 10^{-3} (180 - A)$$

For example, for an A setting of 30 degrees:

$$T = 46.3 \times 10^{-3} (180 - 30) = 6.94 \text{ milliseconds}$$

If the T setting of timer TL-1 is known, and the equivalent angular setting is to be determined, use the following equation:

$$A = 180 - \frac{T}{46.3 \times 10^{-3}}$$

For example, for T = 7.25 milliseconds:

$$A = 180 - \frac{7.25}{46.3 \times 10^{-3}} = 180 - 157 = 23 \text{ degrees}$$

Timer settings, T, for common angular settings, A, are given in Table A:

TABLE A

A	T	A	T
10	7.87	40	6.47
20	7.39	50	6.01
30	6.94	60	5.55

SEISMIC LEVEL

The seismic fragility level exceeds a peak axial acceleration of 10 g's (6 g ZPA) when tested using a biaxial multi-frequency input motion to produce a required response spectra (RRS) in accordance with IEEE C37.98, "Seismic Testing of Relays."

RATINGS

The Type SLJ99AA relay is rated for 120 volts and 50 or 60 hertz.

The contacts of the telephone-type relays will make and carry 30 amperes momentarily and will carry three amperes continuously. The telephone relay contacts will interrupt the currents given in Table B.

TABLE B

VOLTS	CURRENT INDUCTIVE	CURRENT NON-INDUCTIVE
48 DC	1.0	3.0
125 DC	0.5	1.5
250 DC	0.25	0.75
115 60 Hz	0.75	2.0
230 60 Hz	0.5	1.0

The target ratings are given in Table C:

TABLE C

DUAL RATED	0.6	2.0
Carry 30 amps for (seconds)	0.5	3.5
Carry 10 amps for (seconds)	5.0	30.0
Carry continuously (amps)	1.2	2.6
Minimum operating (amps)	0.6	2.0
Minimum dropout (amps)	0.15	0.5
DC resistance (ohms)	0.78	0.18
60 hertz impedance (ohms)	6.2	0.65
50 hertz impedance (ohms)	5.1	0.54

The SLJ99A relay will operate over a temperature range of minus 20°C to plus 55°C. The phase angle setting as set at 25°C will vary no more than plus or minus two degrees over a temperature excursion of 0°C to 55°C. An additional minus two degrees variance must be added for temperatures between 0°C and minus 20°C. The time delay timer will vary no more than plus or minus two percent over the full rated temperature range. The 27L and 27B units' pickup and dropout voltages will vary plus or minus five volts over the full temperature range.

BURDENS

TABLE D

AC BURDEN	WATTS	VA
Bus circuit	5	5
Line circuit	5	5

TABLE E

DC BURDEN	48 volts	125 volts	250 volts
Watts	4.5	11.5	22

CHARACTERISTICS

VOLTAGE UNITS

There are two voltage units, one for the AC bus voltage (27B), and the other for the AC line voltage (27L). Each voltage unit is connected through a 2,500 ohm resistor to a diode bridge. The DC side of the bridges is connected to a telephone-type relay. Both telephone relays are set to pick up between 60 and 70 volts and drop out between 50 and 60 volts. Contacts of the voltage units provide the live line-dead bus circuits shown in Figure 2. A 10K ohm loading resistor is also connected across each supply voltage to insure that there is some load on each voltage supply, even if the diode bridge is open. This is to prevent energizing a dead circuit from the other supply. The 27B and 27L units also provide contacts for the synchronism check unit.

SYNCHRONISM CHECK UNIT

The SLJ99AA relay uses a block-block coincidence time scheme to measure the angular separation between the line and bus voltages. The line and bus voltages are applied to transformers with center tapped secondaries. The center tap is grounded and each leg is tied to the input of an AND gate, see Figure 1. The AND gates compare the coincidence of the positive AND1 and negative AND2 half cycles. The outputs of the AND gates are OR'ed together and applied to a timer, TL-1, which measures the coincidence time. The pickup time of TL-1 determines the maximum angle between the line and bus voltage for which the 25 unit will operate. For example, when TL-1 is set for approximately 8.33 milliseconds, the relay would produce an output when the voltages are coincident for 180 degrees on a 60 hertz system; thus the angle between them must be zero degrees. If TL-1 were set for 7.87 milliseconds on a 60 hertz system, the relay would produce an output when the voltages were coincident for 170 degrees or a ten degree angle between the bus and line voltage. As can be seen, any angle can be set by varying the pickup setting of TL-1. The dropout time of TL-1 is set for nine milliseconds for 60 hertz, and 12 milliseconds for 50 hertz, so that once picked up it will provide a continuous input to AND3.

The center tapped transformers also send line and bus voltage information to the voltage differential detector. The detector determines the difference between the bus and line voltage magnitudes. If the difference between the bus and line voltage is within the selected adjustable range (4 to 20 volts), the voltage differential detector will send a signal to AND3 that will permit the 25 unit to operate if the other conditions of closing angle and minimum voltage conditions also permit. However, if the bus and line voltages are not within the selected range of each other, a closure blocking signal will be sent to AND3, preventing the 25 unit operation.

AND3 also receives inputs from CC1 and the 27B and 27L units. The contact converter (CC1) is the supervising input when the external contact is closed, supplying DC to the contact converter. A logic output is produced which is applied to an input of AND3. Normally closed contacts from the 27B unit and 27L units are tied in parallel and connected between the positive logic supply and a NOT input of AND3. If either the line or bus voltage unit drops out, an input will be supplied to the NOT input of AND3, blocking an output of the 25 unit. The output of AND3 drives the delay timer, TL-2. This timer is set to provide whatever fixed time delay is required for the specific application. The output of TL-2 provides one input to AND4. The other input is provided by the TL-3 timer, which insures that the relay will not provide an output until 100 milliseconds after the DC power has been supplied to the relay. The output of AND4 drives a transistor switch, which operates the output relay (the 25 unit). The output relay will pick up within four milliseconds after its coil is energized and drop out within 16 milliseconds after its coil is de-energized.

The voltage differential circuit takes a measurable amount of time to sense a sudden change in the relative magnitudes of the bus and line voltages.

Figure 20 shows the maximum amount of time required for the SLJ99AA relay to sense an instantaneous change in the relative magnitudes of the bus and line voltage, and respond with the correct signal output from the 25 unit telephone relay. Figure 20, Curve A shows the maximum time required for correct relay operation when the voltage differential instantaneously changes from an acceptable voltage differential level to a voltage differential that exceeds the voltage differential selected. Figure 20, Curve B shows the maximum time required for correct relay operation when the voltage differential instantaneously changes from an unacceptable voltage differential level to a voltage differential that is within the selected range.

The minimum overall operating time for the SLJ99AA relay is either the time shown in Figure 20, curve A or B, or the operating time set by the TL-2 time delay, whichever is longer (see **ADJUSTMENTS** section for setting the TL-2 timer).

RECEIVING, HANDLING AND STORAGE

These relays, when not included as part of a control panel will be shipped in cartons designed to protect them against damage. Immediately upon receipt of a relay, examine it 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 Apparatus Sales Office.

Reasonable care should be exercised in unpacking the relay in order that none of the parts are injured or the adjustments disturbed.

If the relays are not to be installed immediately, they should be stored in their original cartons in a place that is free from moisture, dust and metallic chips. Foreign matter collected on the outside of the case may find its way inside when the cover is removed, and cause trouble in the operation of the relay.

CASE

The case is suitable for either surface or semi-flush panel mounting, and an assortment of hardware is provided for either. The cover attaches to the case and also carries the reset mechanism. Each cover screw has provision for a sealing wire.

The case has studs or screw connections for the external connections. The electrical connections between the relay units and the case studs are made through spring-backed contact fingers mounted in a stationary molded inner and outer block, between which nests a removable connecting plug, which completes the circuits. The outer blocks, attached to the case, have the studs for the external connections, and the inner blocks have the terminals for the internal connections.

The relay mechanism is mounted in a steel framework called the cradle and is a complete unit with all leads being terminated at the inner blocks. This cradle is held firmly in the case with a latch at the top and the bottom and by a guide pin at the back of the case. The cases and cradles are so constructed that the relay cannot be inserted in the case upside down. The connecting plug, besides making the electrical connections between the respective blocks of the cradle and case, also locks the latch in place. The cover, which is fastened to the case by thumbscrews, holds the connecting plugs in place.

To remove the relay assembly from the relay case, first take off the cover, then remove the connection plugs. Release the latches at the top and bottom of the cradle. The relay assembly can now be drawn out of the relay case. This procedure is reversed to replace the relay assembly into the relay case.

A separate testing plug can be inserted in place of the connecting plug to test the relay on the panel, either from its normal source of power or from other sources. Or, the relay unit can be withdrawn for testing and replaced by a spare relay unit.

ACCEPTANCE TESTS

Immediately upon receipt of the relay, an inspection and acceptance test should be made to insure that the relay has not been damaged in shipment and that the relay calibrations have not been disturbed. These tests may be performed as part of the receiving acceptance tests or as part of the installation procedure, or both.

MECHANICAL TESTS

Operate the telephone-type relay units manually to check that they all operate smoothly and that the units do not bind.

ELECTRICAL TESTS

Voltage Units:

Connect a variable source of power at rated frequency to the relay as shown in Figure 17 - Test 1. Both voltage units (27B and 27L) will be picked up between 60 and 70 volts and drop out between 50 and 60 volts.

Synchronism Check Units:

Before performing this test, check that the link on the contact converter printed circuit card (card J) is set for the correct DC voltage.

The relay has been adjusted at the factory for a 35-degree closing angle and a pickup delay of 1.0 second. If settings other than this are required, refer to the **ADJUSTMENTS** section.

Connect the relay as shown in Figure 17 - Tests 2 and 3. Adjust the voltage at terminals 15 and 16, and 17 and 18, to rated voltage. The 25 unit telephone relay should pick up at the time delay set in the TL-2 timer (card F) whenever the phase angle between the two voltage inputs measured by the phase angle meter is within the selected closing angle. Check that the 25 unit is not picked up whenever the phase angle between the two voltage inputs exceeds the selected closing angle.

Voltage Differential Unit:

With the relay connected as shown in Figure 17 - Tests 2 and 3, and with the phase angular difference between the two voltage inputs within the selected closing angle, vary the voltage on terminals 17 and 18. The 25 unit telephone relay should pick up at the time delay set in the TL-2 timer (card F) whenever both of the input voltages are above the pickup voltage of the voltage units, and whenever the difference in magnitude between the input voltages are within the voltage differential selected. Check the 25 unit is not picked up whenever the voltage differential is greater than the selected range.

The relay has been adjusted at the factory for a maximum voltage differential of ten volts.

INSTALLATION PROCEDURE

The location should be clean and dry, free from dust and excessive vibration, and well lighted to facilitate inspection and testing.

The relay should be mounted on a vertical surface. The outline and panel diagram is shown in Figure 20.

The internal connection diagram for the relay is shown in Figure 6. The internal connections diagrams for the printed circuit boards are shown in Figure 7 through Figure 16.

Since all drawout relays in service operate in their cases, it is recommended that they be tested in their cases or an equivalent steel case. In this manner, any magnetic effects of the enclosure will be accurately duplicated during testing. A relay may be tested without removing it from the panel by using a 12XLA13A test plug. This plug makes connections with the relay only and does not disturb any shorting bars in the case. The 12XLA12A test plug may also be used. Although this test plug allows greater testing flexibility, it also requires CT shorting jumpers and the exercise of greater care since connections are made to both the relay and the external circuitry.

All alternating current operated devices are affected by frequency. Since periodic waveforms can be analyzed as a fundamental frequency plus harmonics of the fundamental frequency, it follows that alternating current devices (relays) will be affected by the applied waveform. Therefore, in order to properly test alternating current relays it is essential to use a current and/or voltage having a good sine waveform. The purity of the sine wave (i.e., its freedom from harmonics) cannot be expressed as a finite number for any particular relay; however, any relay using tuned circuits, RL or RC networks, or saturating electromagnets, would be essentially affected by non-pure sinusoidal waveforms.

Similarly, relays requiring DC control power should be tested using DC and not full wave rectified power. Unless the rectified supply is well filtered, many relays will not operate properly due to dips in the rectified power. Zener diodes, for example, can turn off during these dips. As a general rule, the DC source should not contain more than five percent ripple.

The section under **ACCEPTANCE TESTS** contains the tests which may be performed as part of the installation procedure.

ADJUSTMENTS

MECHANICAL

The telephone type relays have been carefully adjusted at the factory. If these adjustments have been disturbed, readjust as follows.

With the telephone type auxiliary relay de-energized, each normally open contact should have a gap of 0.010-inch to 0.015-inch. Observe the wipe on each normally closed contact by deflecting the stationary contact member toward the frame. Wipe should be approximately 0.005-inch. The wipe on each normally open contact should also be approximately 0.005-inch. This can be checked by inserting a 0.005-inch shim between the residual screw and the pole piece and operating the armature by hand. The normally open contacts should make before the residual screw touches the shim.

The dropout of the telelphone type relays can be adjusted by changing the residual screw setting. This screw must be locked by means of its lock nut after resetting. The pickup of the telelphone type relays can be decreased by bending the contact arm to decrease the spacing between the armature and the pole face.

After a pickup or dropout adjustment, the relay contact gap and wipe must be rechecked as described above. The contact pressure should never be less than ten grams when measured at the contact tips.

ELECTRICAL

WARNING: THE RELAY CONNECTION PLUGS SHOULD BE REMOVED BEFORE A PRINTED CIRCUIT CARD IS PULLED.

WARNING: IT IS A DESIGN CHARACTERISTIC OF MOST ELECTRONIC INSTRUMENTS THAT ONE OF THE SIGNAL INPUT TERMINALS IS CONNECTED TO THE INSTRUMENT CHASSIS. SINCE THE PRINTED CIRCUIT CARD REFERENCE VOLTAGE, WHICH NORMALLY WILL BE CONNECTED TO THE GROUND INPUT OF THE INSTRUMENT, IS NEAR THE POSITIVE OR NEGATIVE STATION BATTERY VOLTAGE LEVEL, THE INSTRUMENT CHASSIS MUST BE INSULATED FROM STATION GROUND. IF THE INSTRUMENT POWER CORD CONTAINS A THIRD LEAD, THAT LEAD MUST NOT BE CONNECTED TO STATION GROUND.

Phase Angle Adjustment:

The phase angle setting is made by adjusting the pickup time of the TL-1 timer (card C). The internal connections diagram for this card is shown in Figure 9. Adjusting potentiometer P1 will select a phase angle within a range of 10 degrees to 60 degrees.

To make this adjustment, connect the relay per Figure 17, Tests 2 and 3. Use rated voltage at terminals 15 and 16, and 17 and 18. Adjust the phase shifter to the maximum phase angle desired to permit a reclosure signal. Turn P1 clockwise to the the maximum setting. Allow time for the 25 unit telephone relay contacts to close (the pickup time is determined by the TL-2 timer and may exceed six seconds, depending on the TL-2 timer setting).

Slowly, turn the P1 potentiometer counterclockwise until the 25 unit contacts open. This potentiometer setting now defines the maximum allowable phase angle difference between the bus and line voltages.

Check this potentiometer setting by decreasing the phase angle to zero with the phase shifter. Allow sufficient time for the 25 unit to pick up (the pickup time is determined by the TL-2 timer and may exceed six seconds, depending on the TL-2 timer setting). After the 25 unit is picked up, slowly increase the phase angle with the phase shifter. The 25 unit contacts will open when the phase angle exceeds the P1 setting.

Voltage Differential Adjustment:

The maximum allowable differential between line and bus voltages is selected on the voltage differential detector printed circuit board (card A). The internal connections diagram is shown in Figure 7. Adjusting potentiometer P1 (the top potentiometer, that is, the potentiometer furthest from the printed circuit board) selects the maximum allowable differential. The range of adjustment is from a minimum of four volts to a maximum of 20 volts. The lower potentiometer, P2, (one closest to the printed circuit board) is pre-set and sealed at the factory and should not be adjusted.

To make the differential voltage adjustment, connect the relay per Figure 17, Tests 2 and 3. Apply rated voltage to terminals 15 and 16, and 17 and 18. Set the phase shifter so the phase angle difference between terminals 15 and 16, and terminals 17 and 18 is zero. Adjust the voltage on terminals 17 and 18 to the maximum differential desired. Maintain the phase angle at zero.

Turn potentiometer P1 fully clockwise. Observe that the 25 unit telephone relay contacts close. Allow a sufficient amount of time for the 25 unit telephone relay to pick up (the pickup time is determined by the TL-2 timer and may exceed six seconds, depending on the TL-2 timer setting). Slowly, turn P1 counterclockwise until the 25 unit contacts open. This P1 potentiometer setting corresponds to the maximum voltage differential desired.

Check this potentiometer setting by resetting the voltage at terminals 17 and 18 to be the same as the rated voltage on terminals 15 and 16. Observe that the 25 unit telephone relay picks up. Allow a sufficient amount of time for the 25 unit telephone relay to pick up (the pickup tme is determined by the TL-2 timer and may exceed six seconds, depending on the TL-2 timer setting). Slowly, change the voltage on terminals 17 and 18. The 25 unit contacts will open when the voltage differential exceeds the P1 setting.

TL-2 Timer Adjustment:

The TL-2 timer is on printed circuit board card F and will furnish a time delay ranging from 0.35 seconds to 6.0 seconds on the high (H) position, or 0.35 seconds to 0.9 seconds on the low (L) position. The low (L) position should be used for delay times less than 0.9 seconds because it allows a finer time adjustment. The internal connections diagram is shown in Figure 12.

Connect the relay per Figure 18, Test 4. Use rated voltage at all terminals and set the phase angle between the bus and the line voltage to zero with the phase shifter. Relay and timer operation is initiated when the double pole single throw switch is closed. Timer operation is stopped when the 25 unit telephone relay picks up. Clockwise rotation of the P1 potentiometer will increase the length of time delay. Counterclockwise rotation shortens the length of time delay.

The measured time delay includes the telephone relay pickup time.

TROUBLESHOOTING

In the event that improper operation is indicated during the installation checkout or during routine testing, a troubleshooting program should be followed to determine the specific function or card which is causing the trouble. When checking signals, it should be noted that a typical card in the OFF condition will have an output of less than one volt, and in the ON condition, will have an output in the range of from 10 to 15 volts.

The logic diagram, Figure 1, is the starting point for isolating trouble. This diagram represents the overall scheme in functional block diagram form. Input and output signals can be measured either by means of a high-impedance voltmeter, or by means of an oscilloscope. Signals should be measured between the test points and the relay reference voltage, pin 1, on all cards.

Remove the questionable card from its socket and plug the adapter card (0128B2221G2) into that position. Then insert the card to be checked into the socket of the adapter card. It is now possible to check voltages at all ten pins of the questionable card. The internal connection diagram for the relay, Figure 6, should be referred to at this time to determine which pins of the card are actively involved. First, check that the plus and minus supply voltages, as indicated on the internal connection logic diagram, are actually getting to the card pins. Next, check that the required input signals are getting to the card. If supply voltages and all required input signals are present, and the output signal is not present, the trouble is on the card and not in the interconnecting circuit.

Once the trouble has been traced to a particular card, it is recommended that this card be removed and replaced with a spare. In most instances, the insertion of a spare card represents the most expeditious means of returning the equipment to service. The faulty card can then be returned to the factory for repair or replacement.

Although it is not generally recommended, it is possible with the proper equipment and trained personnel to repair cards in the field. This, however, may be time consuming and may extend the outage time of the equipment.

CAUTION: GREAT CARE MUST BE TAKEN IN REPLACING COMPONENTS ON THE CARDS. SPECIAL SOLDERING EQUIPMENT SUITABLE FOR USE ON THE SOLID-STATE COMPONENTS MUST BE USED AND, EVEN THEN, CARE MUST BE TAKEN NOT TO CAUSE THERMAL DAMAGE TO THE COMPONENTS, AND NOT TO DAMAGE OR BRIDGE OVER THE PRINTED CIRCUIT BUSES. THE REPAIRED AREA MUST BE RECOVERED WITH A SUITABLE HIGH DI-ELECTRIC PLASTIC COATING TO PREVENT POSSIBLE BREAKDOWNS ACROSS THE PRINTED CIRCUIT BUSES DUE TO MOISTURE OR DUST.

PERIODIC CHECKS AND ROUTINE MAINTENANCE

In view of the vital role of protective relays in the operation of a power system, it is important that a periodic test program be followed. It is recognized that the interval between periodic checks will vary depending upon environment, type of relay and the user's experience with periodic testing. Until the user has accumulated enough experience to select the test interval best suited to his individual requirements, it is suggested that the points listed below be checked at an interval of from one to two years.

CONTACT CLEANING

A burnishing tool with a flexible working surface should be used for cleaning relay contacts. The polishing action of this tool is such that no scratches are left, yet it will clean off any corrosion thoroughly and quickly. The flexibility of the tool insures the cleaning of the actual points of contact. Do not use knives, files, abrasive paper or cloth of any kind to clean relay contacts.

RENEWAL PARTS

Sufficient quantities of renewal parts should be carried in stock to enable the prompt replacement of any that are worn, broken or damaged.

When ordering renewal parts, address the nearest Sales Office of the General Electric Company, specify quantity required, name of the part wanted, and the complete model number for which the part is required.

SPARE CARDS

The number of spare cards which should be carried in stock will depend on the total number of static relays using similar cards at a particular location, or serviced by the same test group. For each type of card, that is for each code designation, a suggested minimum number of spare cards would be:

One spare for one to 25 cards
Two spares for 26 to 76 cards
Three spares for 76 to 150 cards.

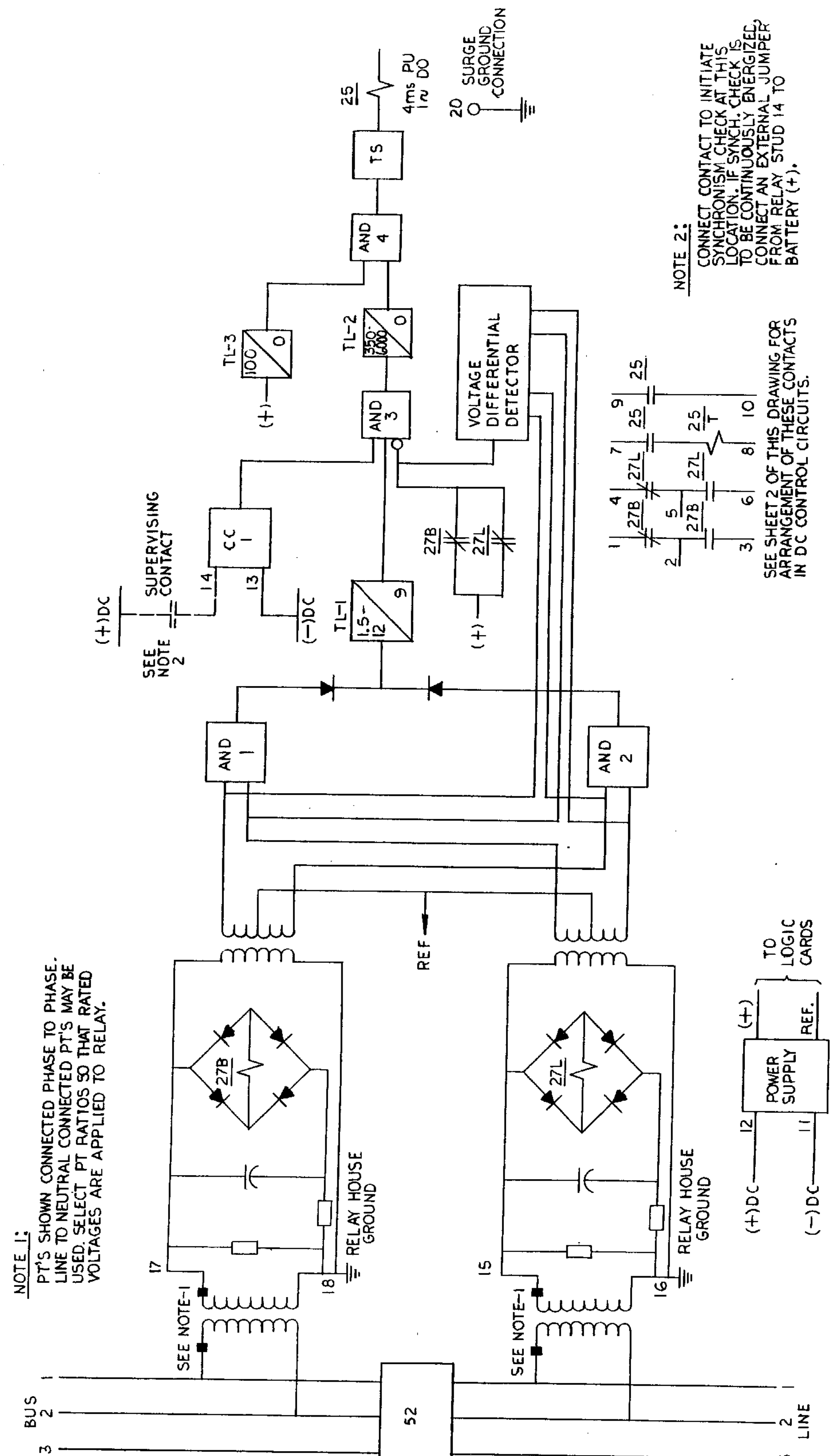


Figure 1 (0138B7626-0, Sh. 1) Logic and External Connections for the Type SLJ99AA Relay

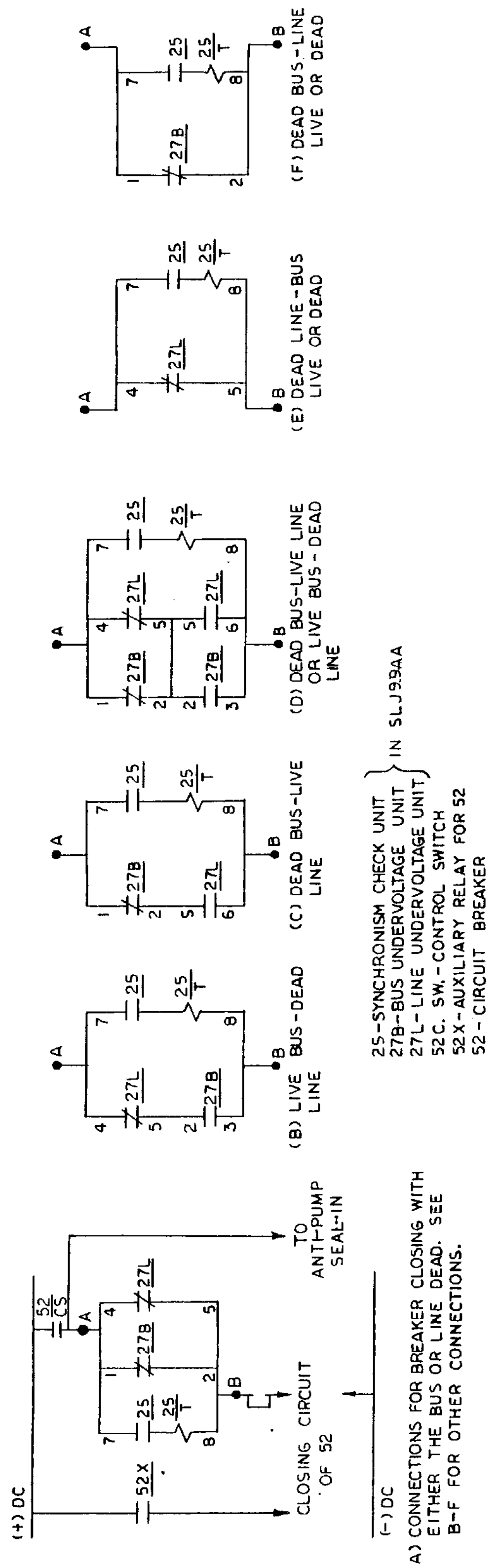
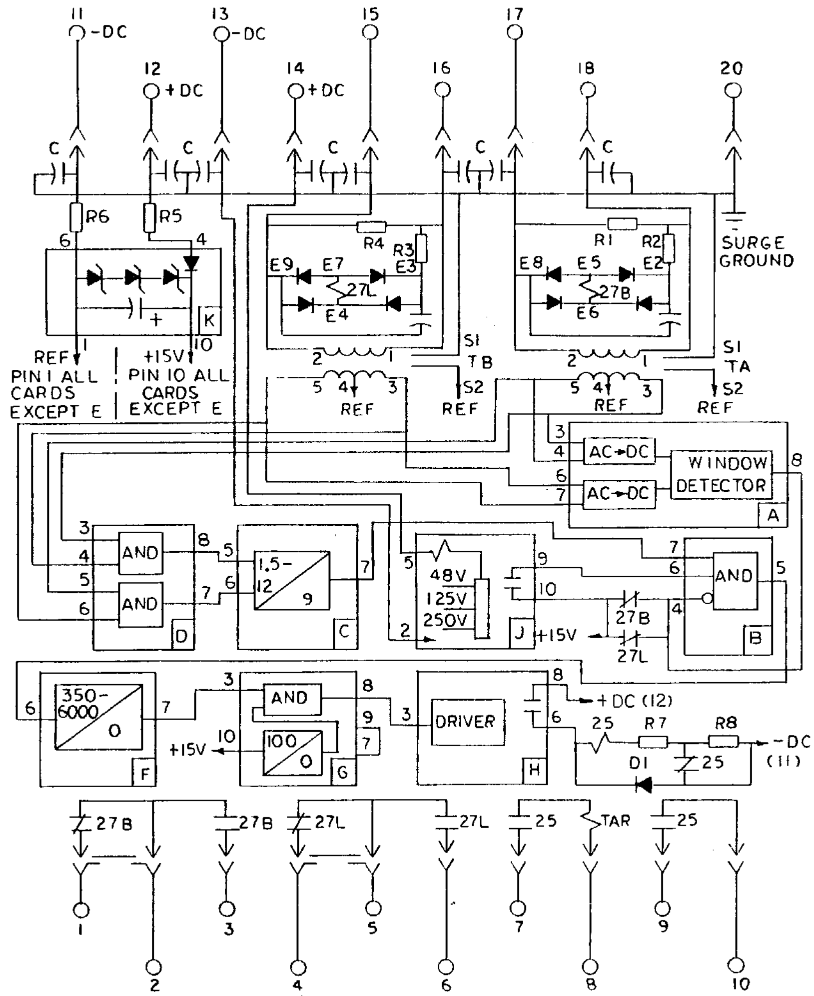


Figure 2 (0138B7626-0, Sh. 2) Output Circuit Connections for the Type SLJ99AA Relay

Figure 3 (later) Three-quarter Front View of Type SLJ99AA Relay
Out-of-Case, Showing Nameplate

Figure 4 (later) Three-quarter Front View of
Type SLJ99AA Relay Out-of-Case

Figure 5 (later) Three-quarter Rear View of
Type SLJ99AA Relay Out-of-Case



MODEL	FORM	
12SLJ99AA(-)A	1	
VOLTS DC	125	
RESISTANCE IN OHMS/WATTS		
R1	10K/12	
R2	2.5K/12	
R3	10K/12	
R4	2.5K/12	
R6	400/12	
R7	850/17	
R8	1.7K/17	
R5	500/12	

ALL C = 0.5uf

E9 ◄ E7
SHOWS PIN NO 9 & PIN NO 7 ON "E" POSITION CARD

D1 = IN5061

Figure 6 (0285A6641-0, Sh. 1, 2) Internal Connections Diagram for the Type SLJ99AA Relay

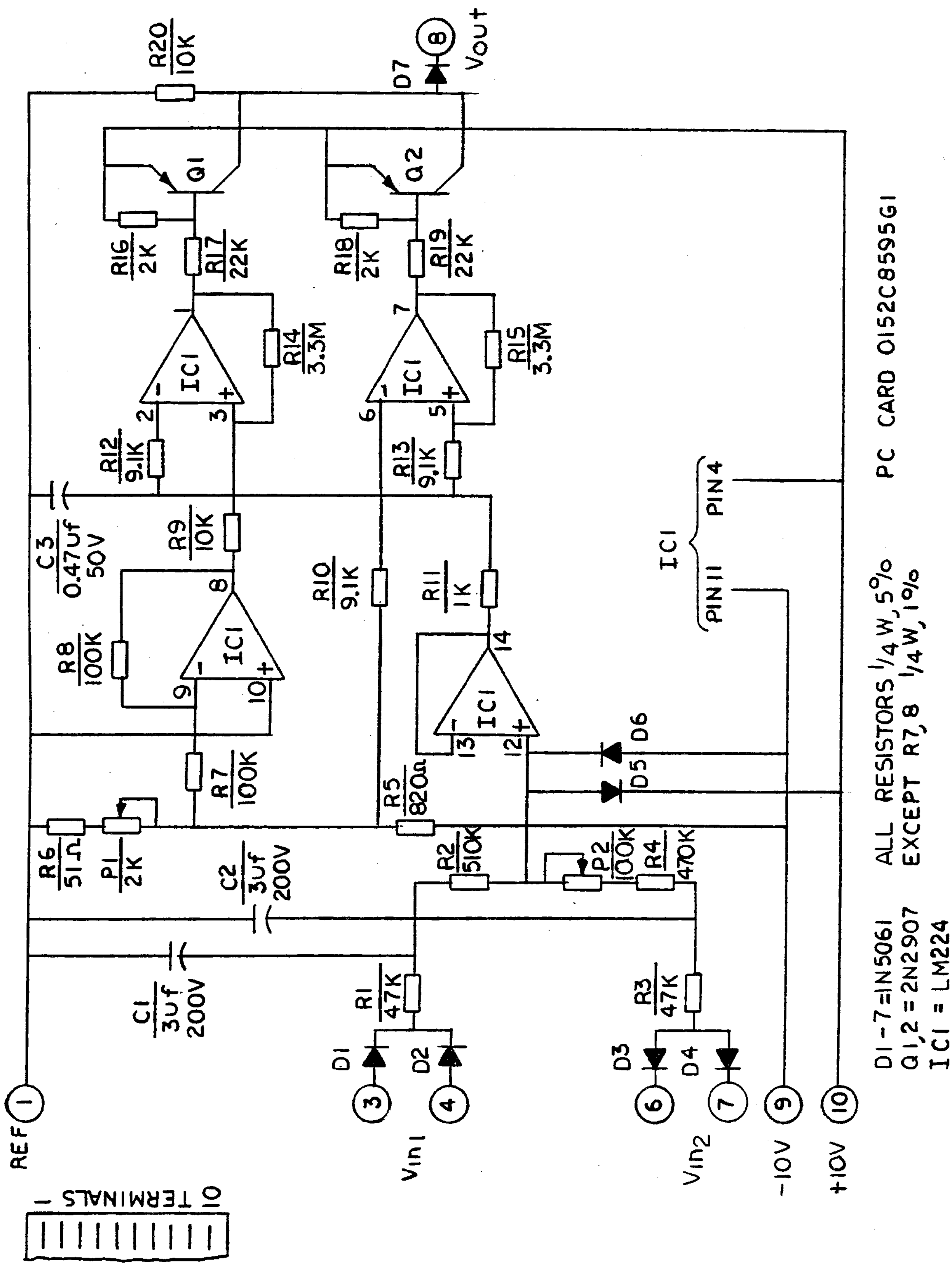


Figure 7 (0148A3917AX-0) Internal Connections of the Voltage Differential Detector Printed Circuit Board (Card A)

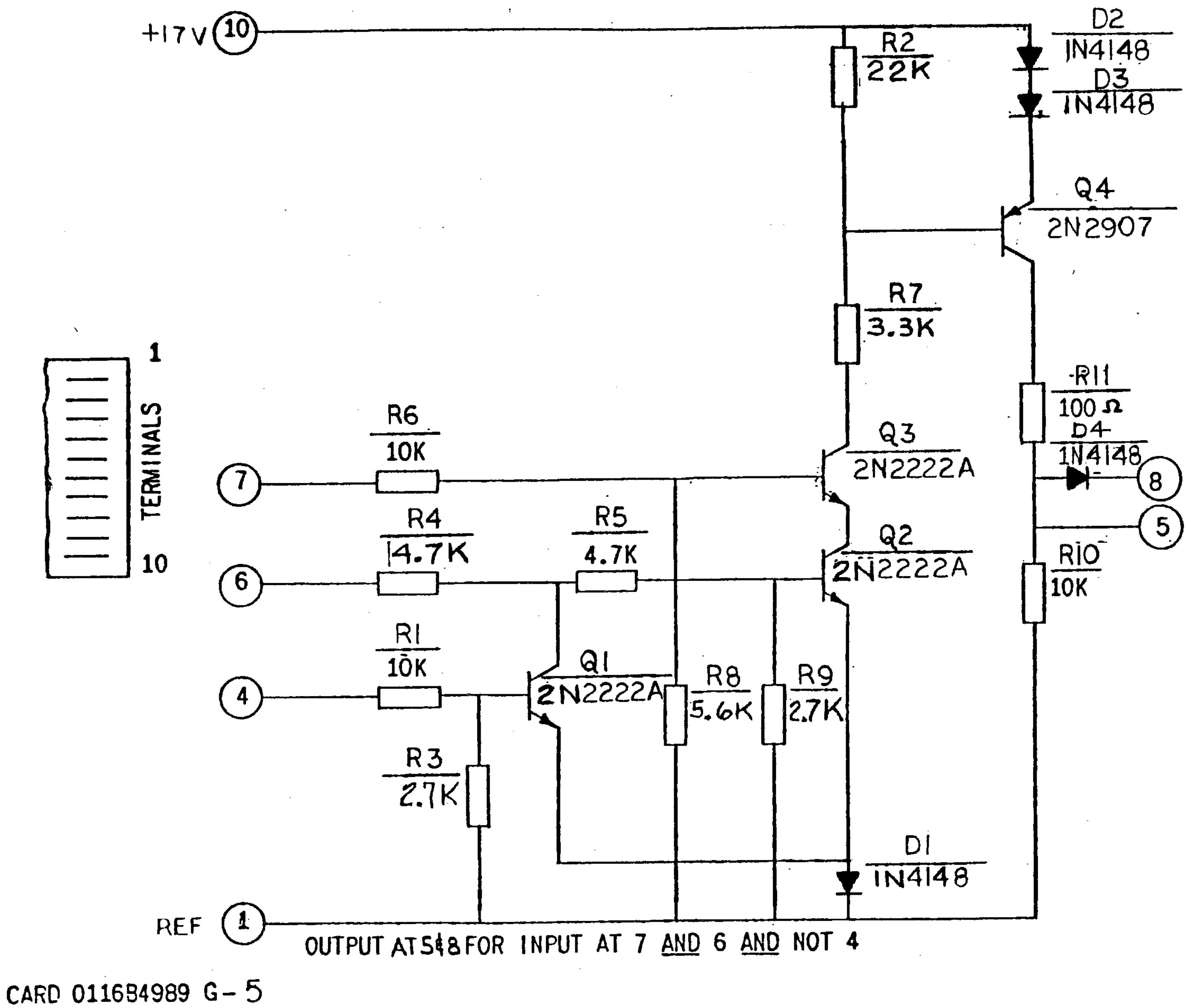


Figure 8 (0148A3901DE-0) Internal Connections of the Comparer Printed Circuit Board (Card B)

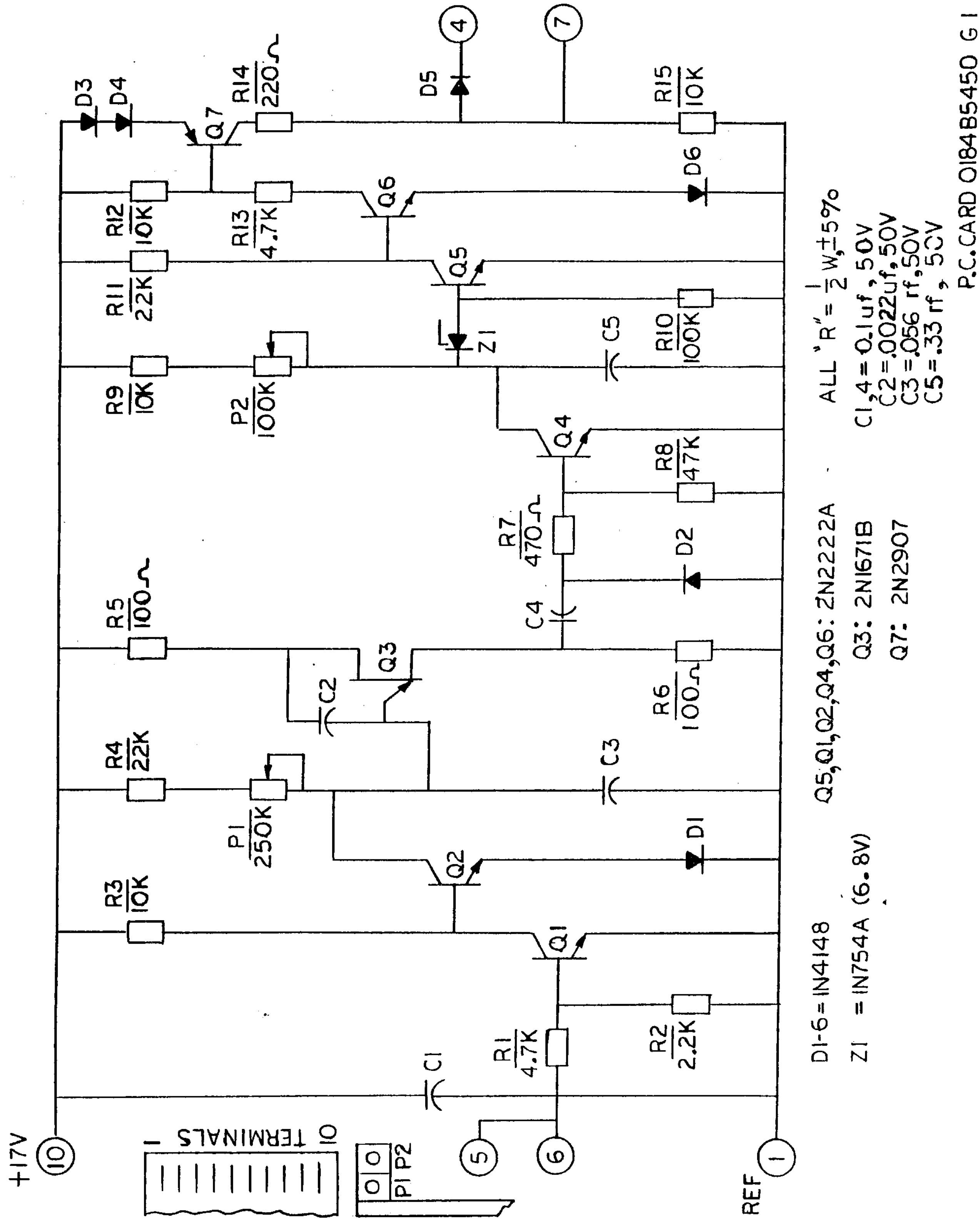


Figure 9 (0148A3906FG-0) Internal Connections of the TL-1 Timer Printed Circuit Board (Card C)

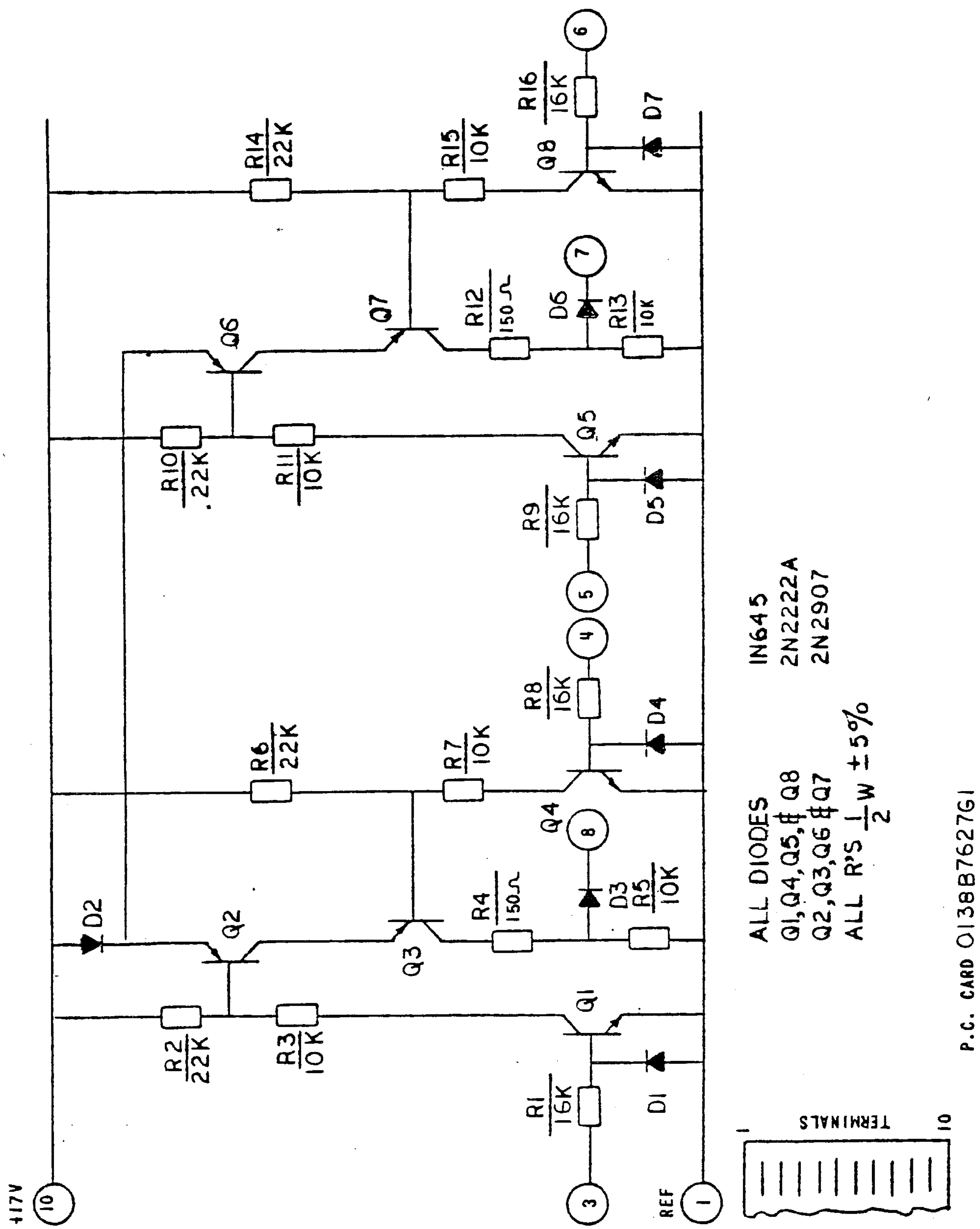
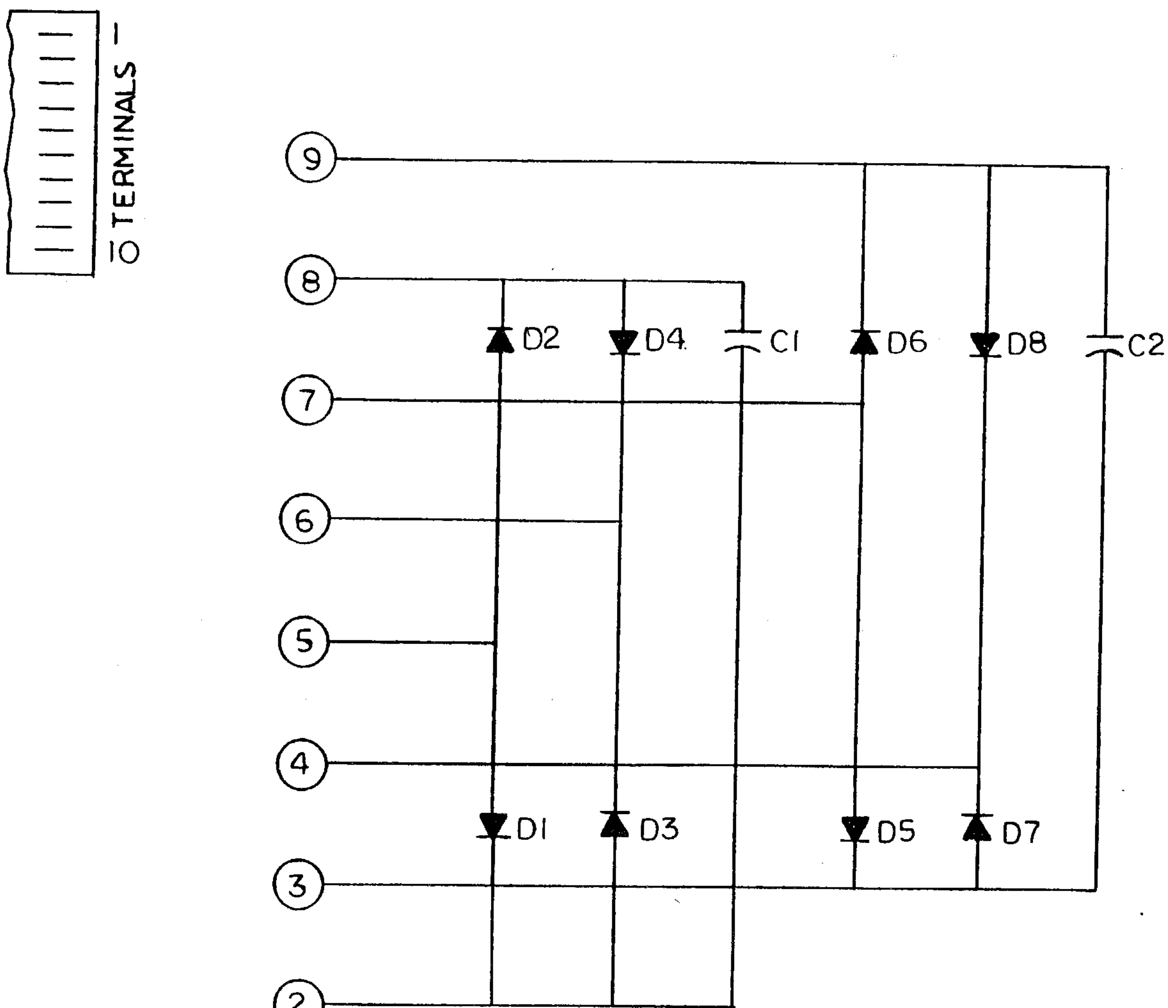


Figure 10 (0148A3917AZ-0) Internal Connections of the AND-1 and AND-2 Printed Circuit Board (Card D)



ALL "D" = IN5061

ALL "C" = .05uf, 600V

PC CARD 0184B5495G1

Figure 11 (0148A3915AE-0) Internal Connections of the Full Wave Bridge Assembly Printed Circuit Board (Card E)

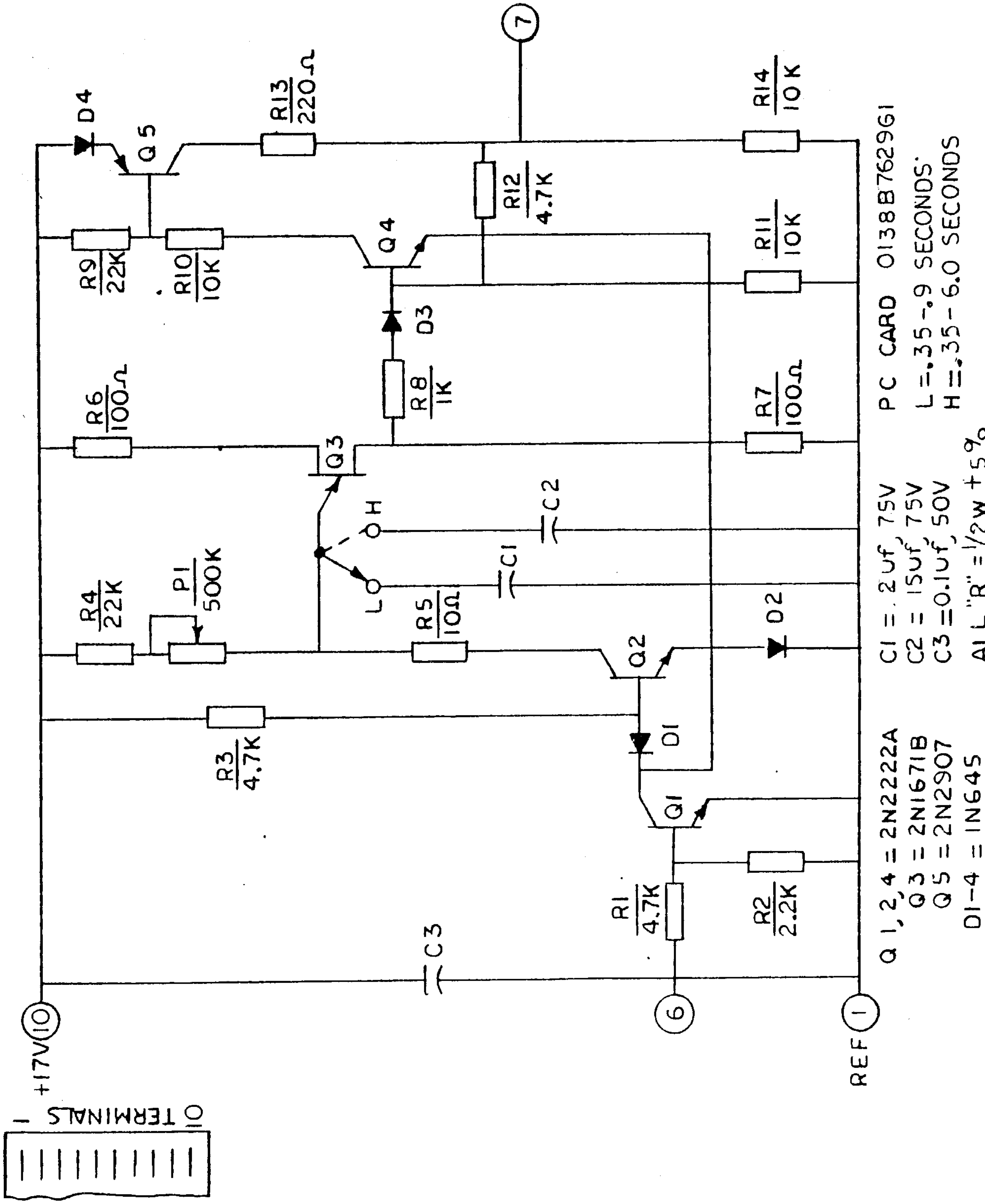


Figure 12 (0148A3906GF-0) Internal Connections of the TL-2 Timer
Printed Circuit Board (Card F)

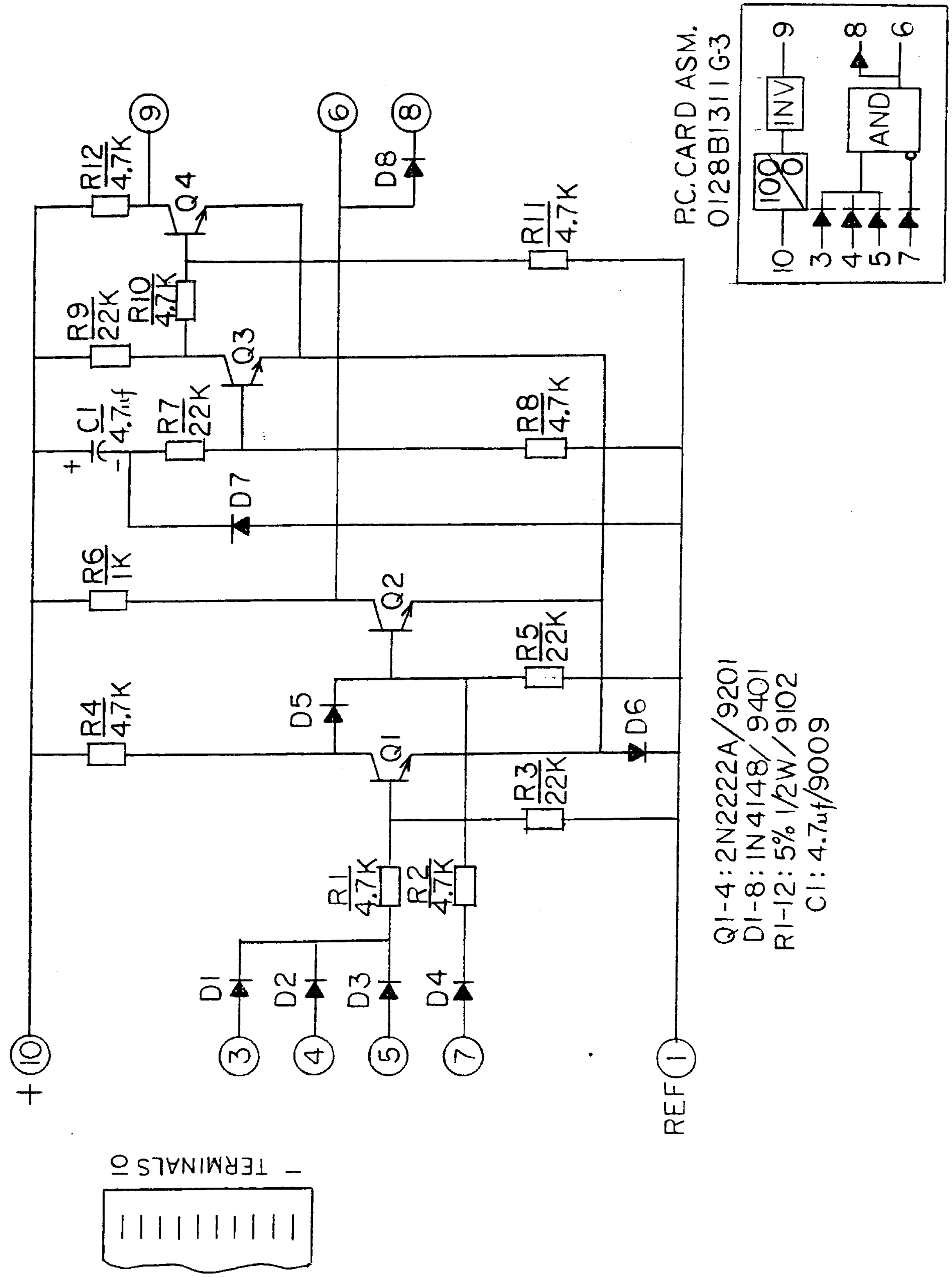


Figure 13 (0148A3901EW-0) Internal Connections of the TL-3 Trip Logic with 100 Millisecond Delay Printed Circuit Board (Card G)

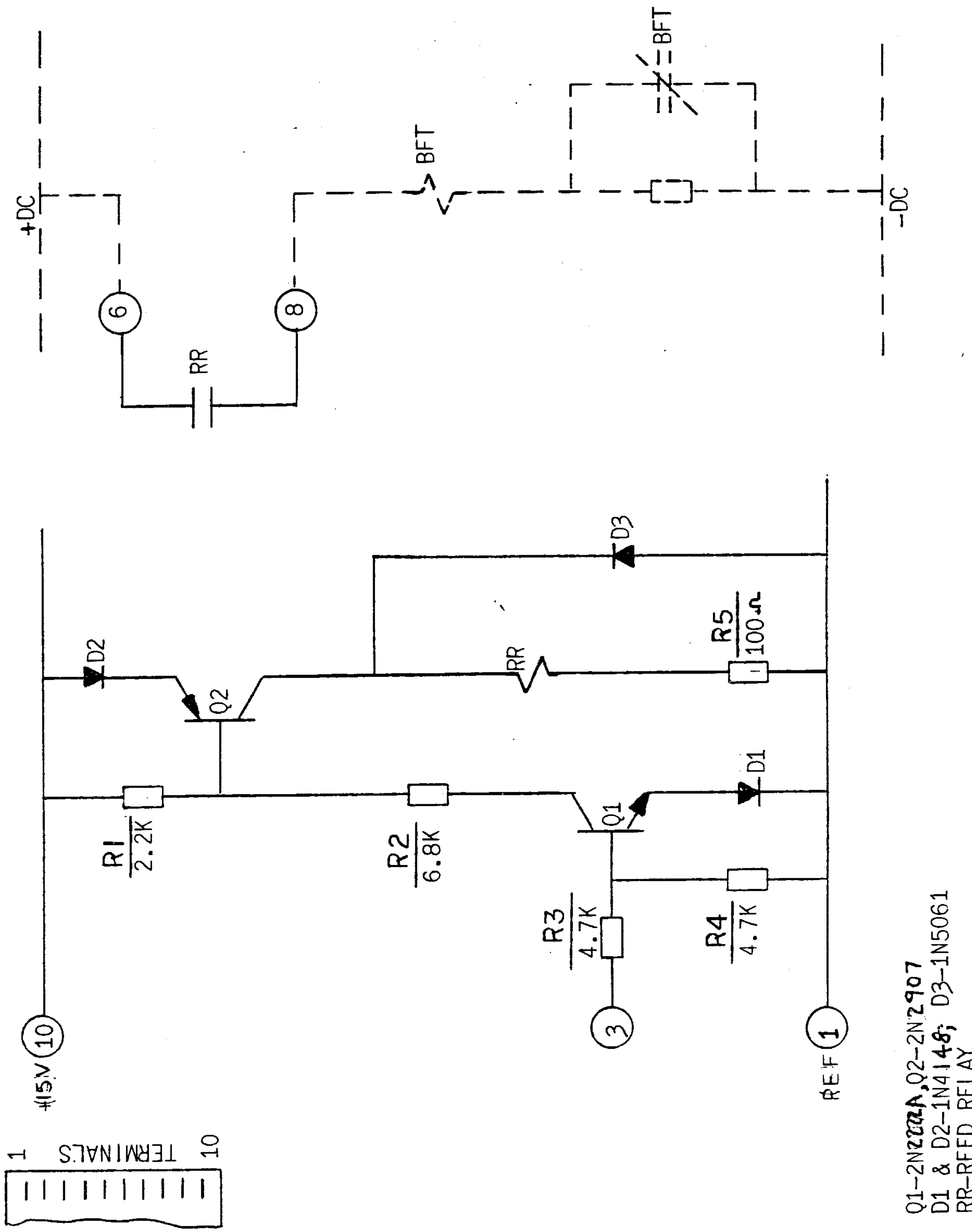


Figure 14 (0148A3918AF-0) Internal Connections of Telephone Relay Driver Printed Circuit Board (Card H)

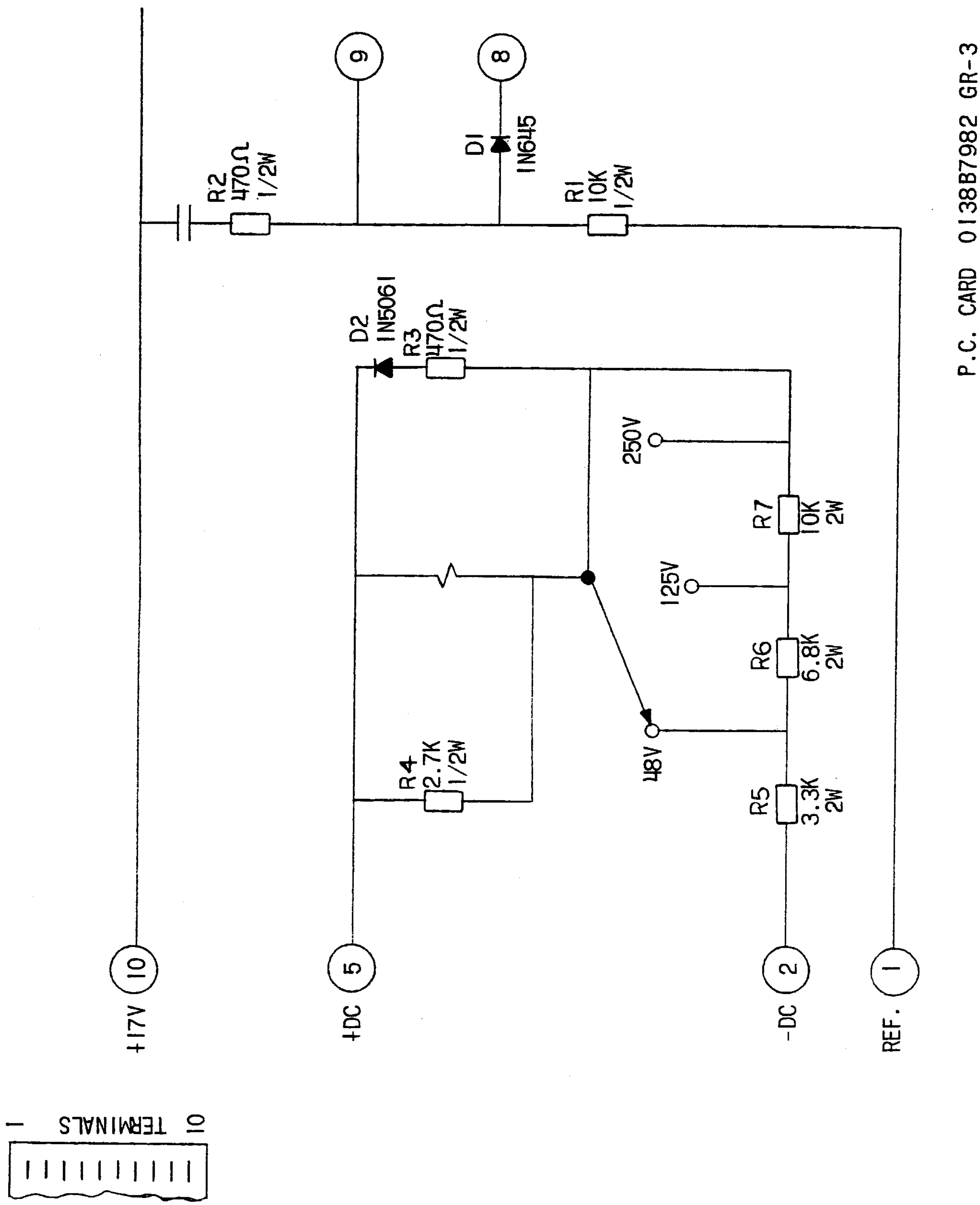


Figure 15 (0148A3910AX-0) Internal Connections of Contact Converter Printed Circuit Board (Card J)

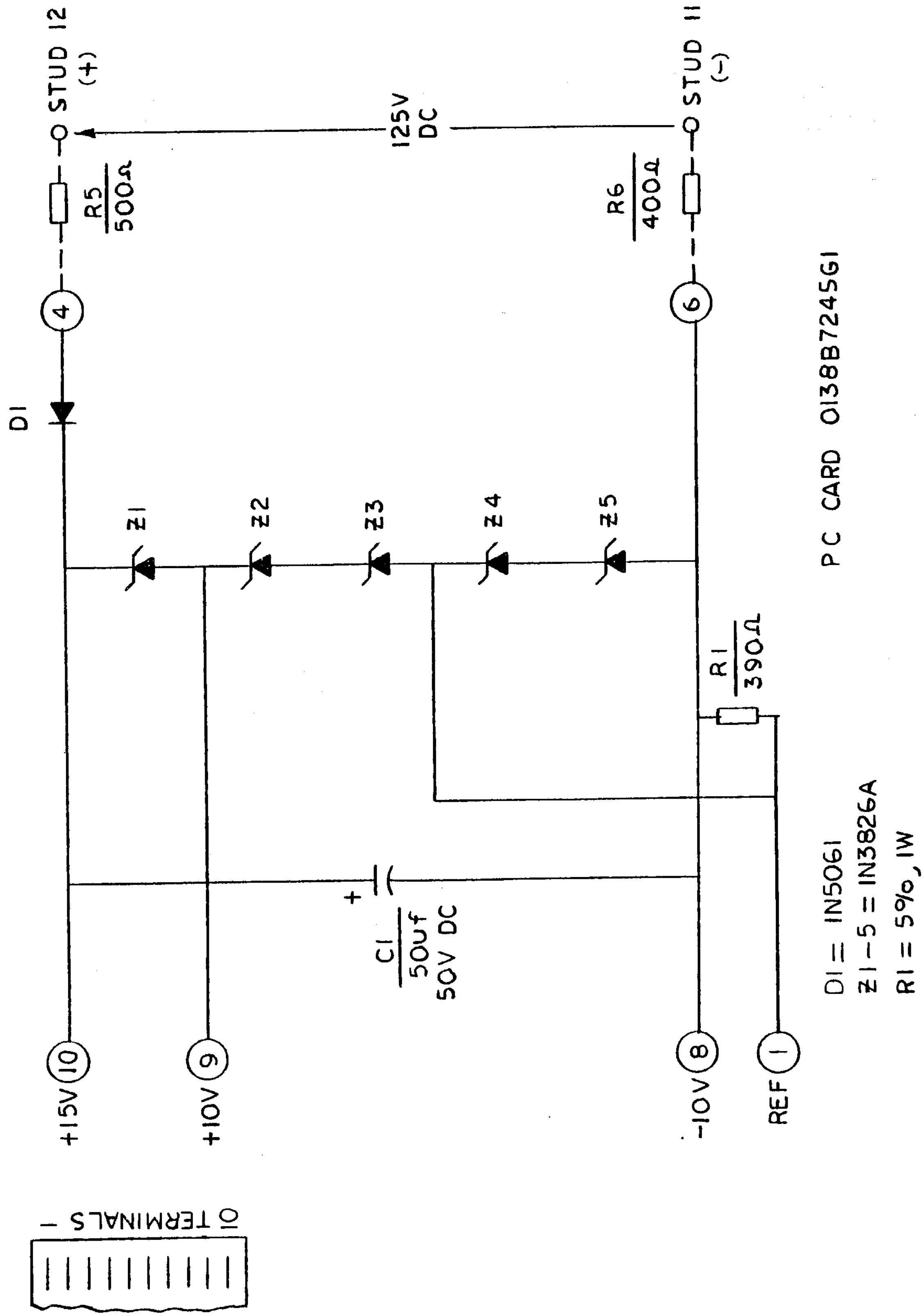
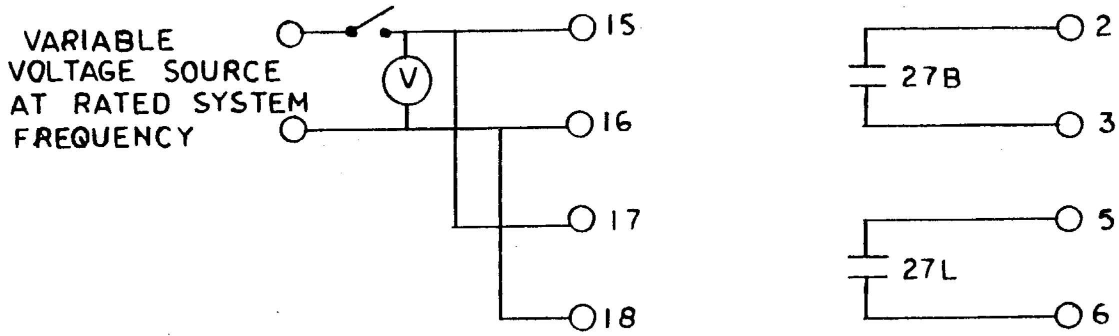
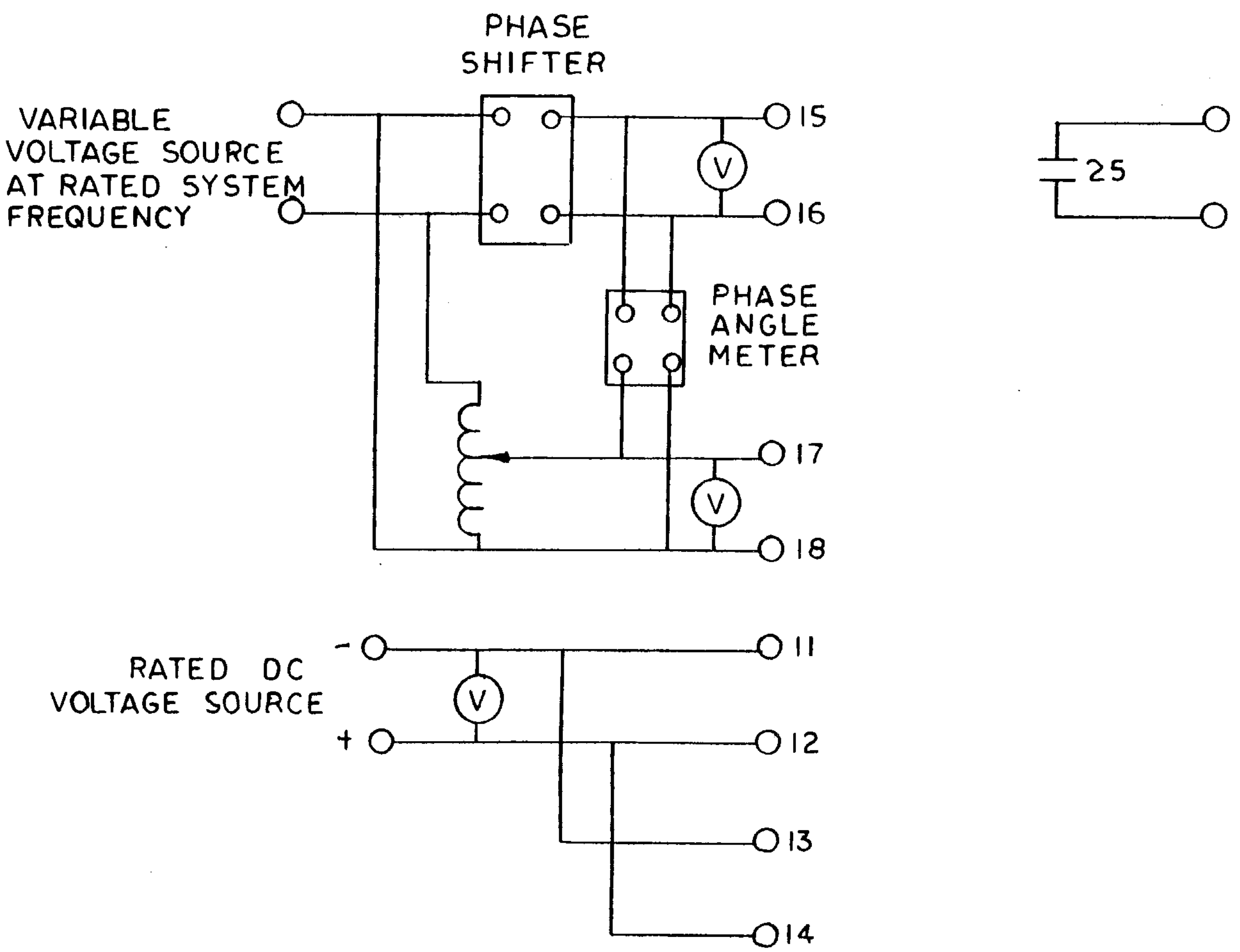


Figure 16 (0148A3915AG-0) Internal Connections of Power Supply Printed Circuit Board (Card K)

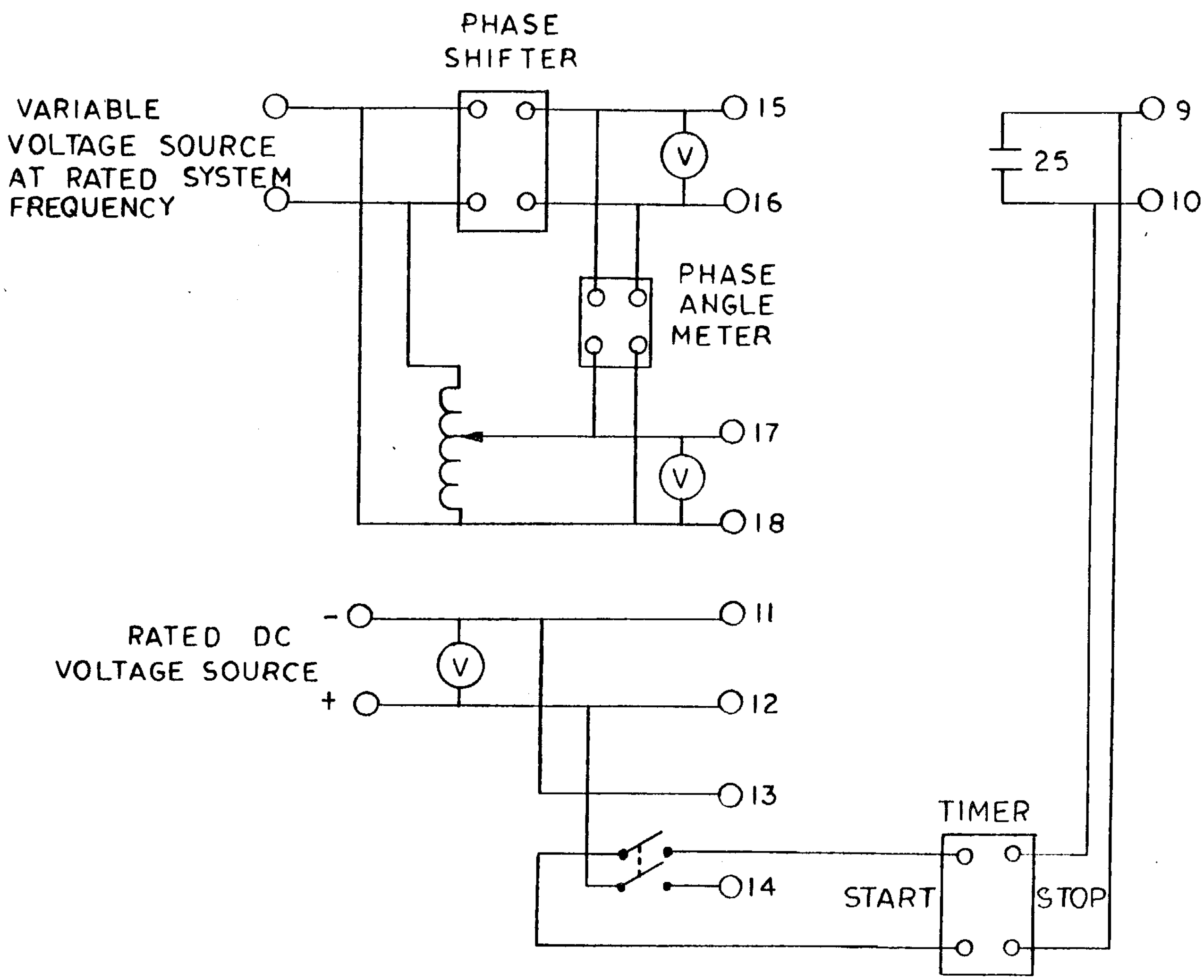


TEST 1



TESTS 2 AND 3

Figure 17 (0285A6656-0, Sh. 1) Test Connections



TEST 4

Figure 18 (0285A6656-0, Sh. 2) Test Connections

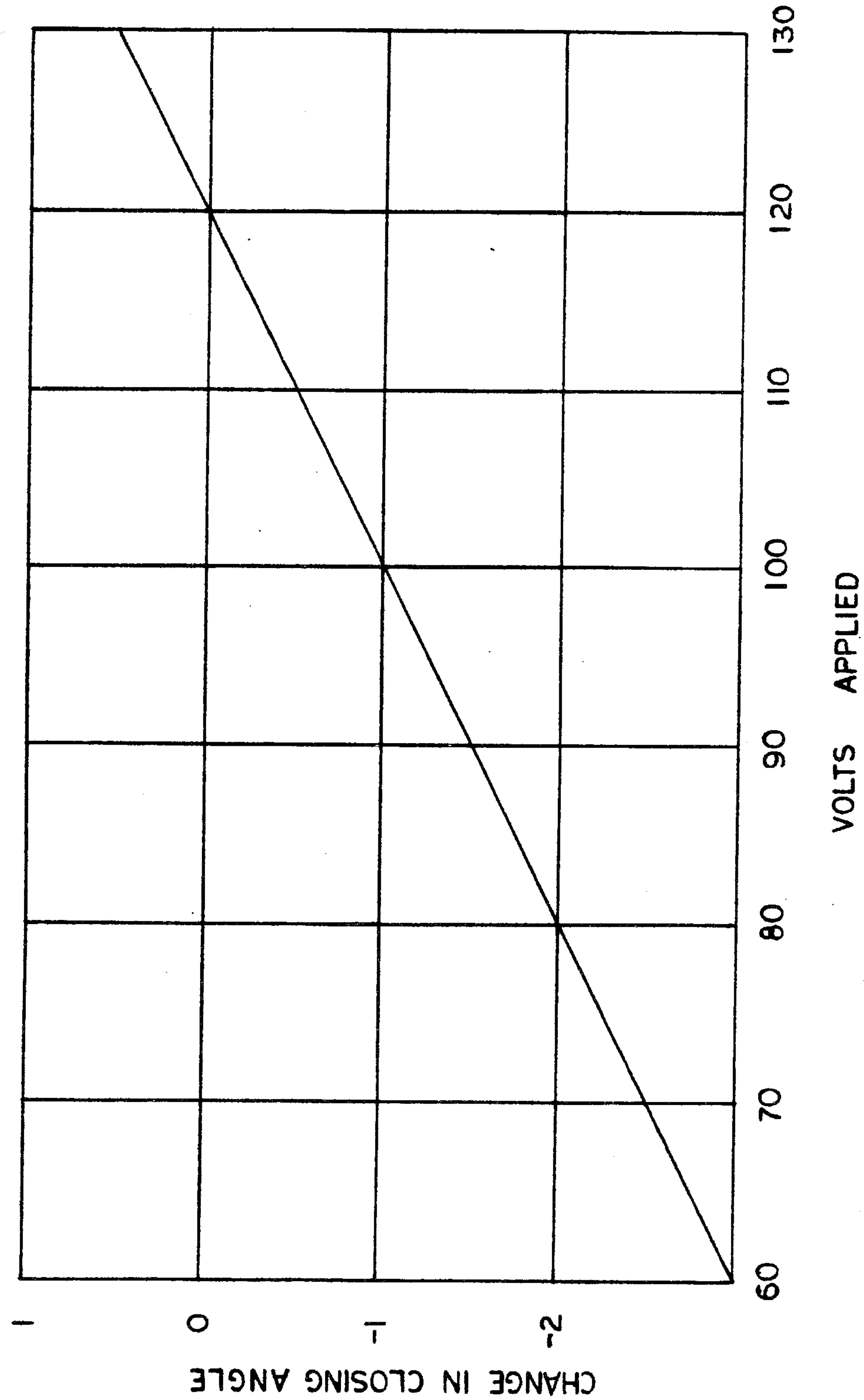


Figure 19 (0275A2073-0) Typical Voltage-Phase Angle Characteristics

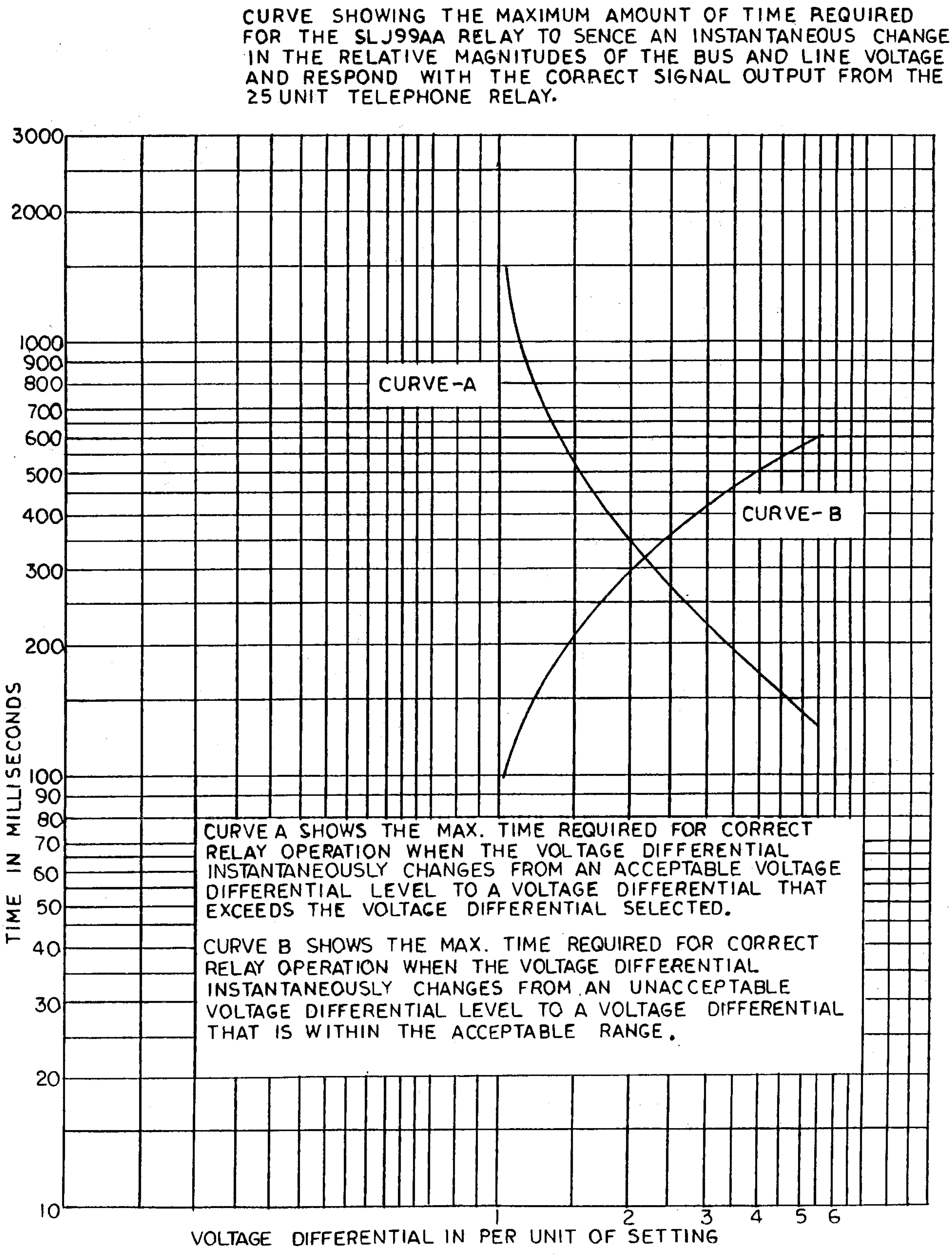


Figure 20 (0285A6657-0) Detection and Restore Times Versus Differential Voltage

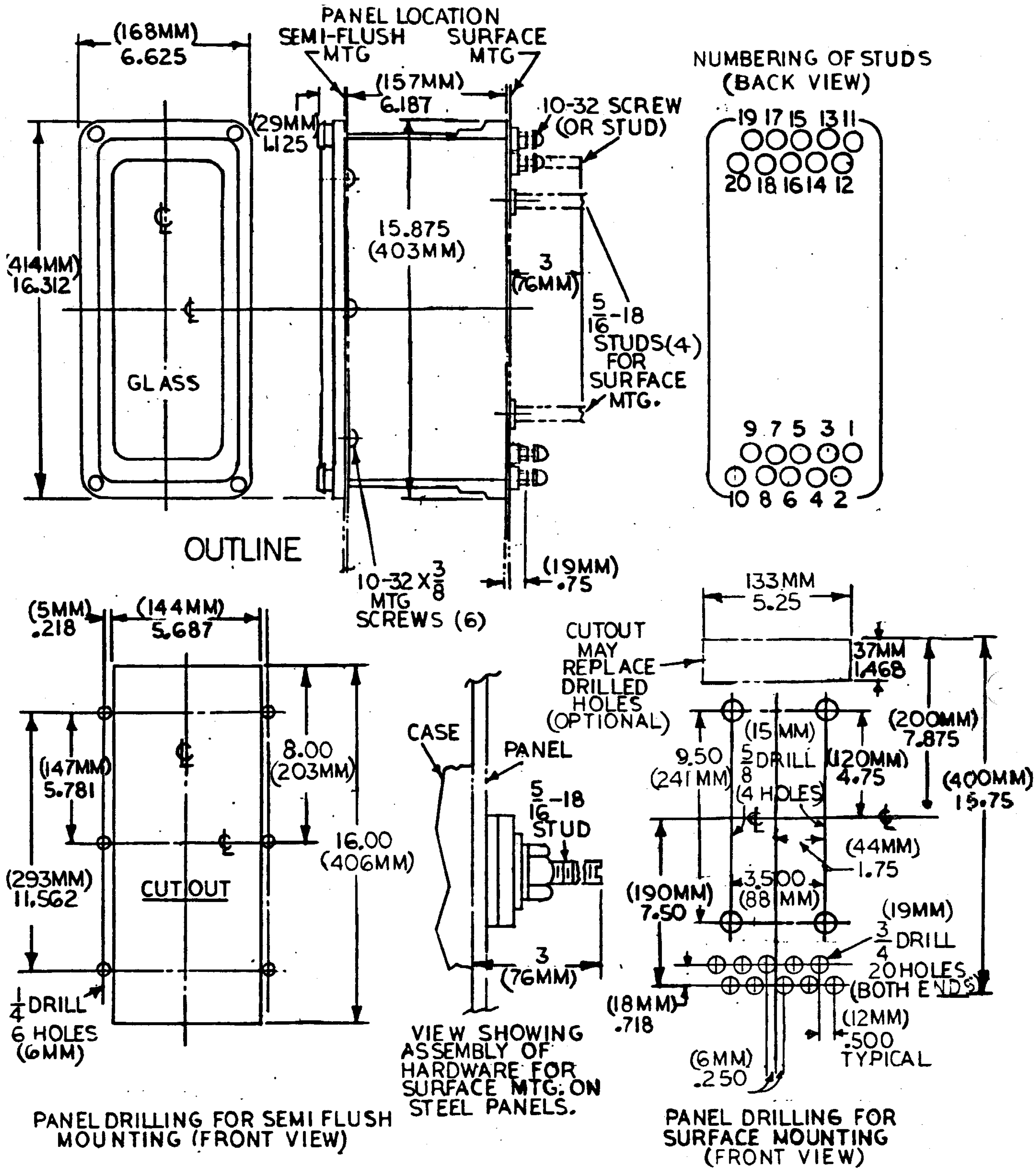


Figure 21 (K-6209274-3) Outline and Panel Drilling for Type SLJ99AA Relay, Size M2 Case