INSTRUCTIONS

GEK-86632A
Supersedes GEK-86632

TROUBLESHOOTING GUIDE FOR SLS MODULAR RELAYS

GENERAL ELECTRIC

Contents

TROUBLESHOOTING GUIDE FOR SLS MODULAR RELAYS

INTRODUCTION

For any complicated piece of equipment, it is virtually impossible to state in detail every conceivable mode of failure. The SLS is no exception. There are, however, basic functions and signal paths which can and should be checked in the event of a failure. The aim of this guide is to offer a structured approach to troubleshooting these functions and signals in the SLS. The intent is to isolate the problem in a given module (or modules), that can then be replaced. No attempt should be made to repair the circuitry within a faulty module.

This guide is to be used in conjunction with the tests prescribed in instruction book GEK-86044. The format is such that if the equipment does not pass a given test in the instruction book, the corresponding section in this guide can provide suggestions for isolating the problem to a particular module.

A comprehensive wiring list is included as an Appendix, followed by schematic diagrams of all the modules.

PROCEDURAL NOTES

A. This guide repeatedly suggests the removal and reinsertion of various modules. Both AC and DC power should be shut off prior to the removal and reinsertion of any module. Failure to follow this practice may result in permanent damage to the circuitry. The ON/OFF switch on the front of the PSM module provides a convenient shut-off point for the DC power.

B. When using a card extender (GE No. 0138B7406G-1), pins 1, 30, 31 or 60 provide reference points.

WARNING

EXERCISE CAUTION WHEN INSERTING A CARD EXTENDER INTO EITHER AN ROM101 OR DOM201 POSITION OF AN INSTALLED UNIT, SINCE STATION BATTERY POTENTIAL MAY BE PRESENT ON CERTAIN POINTS.

A1. Phase Selector Tests

1. Symptom: (1) Yellow Ø-sel LED on DMM101 doesn't light, (2) Ø-sel alarm contacts don't close, and (3) OSCILLOGRAPH START contacts don't close.

   Probable Problem: The simultaneous failure to operate all three of these indicators points to the lack of an output from the phase selector under test.

   Suggested Approach: Use the specified test circuit and settings. Apply V_T = 60 volts and I_T = 7 amperes (five amp relay) or 1.4 amperes (one amp

relay) at 75 degrees lagging to the phase under test. Use a scope and/or voltmeter (preferably both) for monitoring the points indicated in the following sequence:

a) Output Signal: Place DSM101 on a card extender. Monitor the output of the Ø-sel under test - pin 21 (A), 22 (B), or 52 (C). This signal will likely be low, though it would be high (+12 volts) if the unit were functioning properly.

Remove DLM101 - signal switches high, REPLACE DLM101
- signal remains low, reinsert DLM101 and proceed

Remove DMM101 - signal switches high, REPLACE DMM101
- signal remains low, reinsert DMM101 and proceed

b) Current Supervision Signal: Leave DSM101 on a card extender. Monitor the signal for the Ø-sel under test - pin 6 (UCSA), pin 38 (UCSB), or pin 45 (UCSC). This signal should be high (+10 volts). If it is, proceed to step c; if it is low, proceed as follows:

Remove DSM101 from extender - signal switches high, REPLACE DSM101
signal switches low - reinsert DSM101 and proceed.

Remove DLM101 - signal switches high, REPLACE DLM101
- signal remains low, reinsert DLM101 and proceed

Remove DBM101*- signal switches high, REPLACE DBM101
- signal remains low, reinsert DBM101 and proceed

Place DIM101 on a card extender. The same extender may be used if desired, by reinserting DSM101 directly into the relay. Monitor the input current signal on DIM101 for the Ø-sel under test, pin 4 (IAS), 6 (IBS), or 36 (ICS). It should measure approximately 0.14 volts RMS (0.4 volts peak-to-peak). If it does, the current supervision detector is defective, REPLACE DIM101.

If it does not measure 0.14 volts RMS, proceed as follows:

Remove DIM101 from extender - signal measures 0.14 volts RMS, REPLACE DSM101
- signal still incorrect, remove extender reinsert DIM101 directly into relay, and proceed.

Place DFM101, 102 on an extender, and monitor the input current signal for the Ø-sel under test - pin 58 (IAP), 57 (IBP) or 27 (ICP). It should also measure approximately 0.14 volts RMS. If it does, REPLACE DFM101, 102. If it does not, proceed as follows:

*If included and connected (interconnection cables in place), located in case B.

Remove DFM101, 102 from extender - signal measures 0.14 volts RMS, REPLACE DIM101
- signal still incorrect, remove extender, reinsert DIM101 directly into relay, and proceed.

If there is no signal at all, the internal wiring and/or connection points may be open at some point.

c) Clock Input: Again place DSM101 on a card extender. Monitor the clock signal - pin 40 (CKCT) - with a scope or frequency counter (a scope is preferable). The clock signal should be a square wave which switches between 1 volt and 11 volts (approximately) at a frequency of 21.6 kHz (period of 46 microseconds) for a 60 hertz relay setting, or 18.0 kHz (period of 56 microseconds) for a 50 hertz relay setting. If it is correct, proceed to step d. If it is incorrect, proceed as follows.

Remove DSM101 from extender - proper waveform appears, REPLACE DSM101.
- waveform still incorrect, reinsert DSM101 and proceed.

Remove DLM101 from extender - proper waveforms appears, REPLACE DLM101
- waveform still incorrect, reinsert DLM101.

This tends to indicate that the oscillator in DMM101 is not functioning. Replace DMM101.

d) AC Signal Inputs: Using a card extender(s), measure the signals indicated below with a voltmeter and/or scope (preferably both). The values stated are the correct levels for the given operating conditions for the A Ø-sel. For the B and C Ø-sel's, simply rotate the numbers to correspond to the phase under test.

For each module, one of the signals is assigned to be the reference for the angle measurements. This is arbitrary. The angle measurements have been made using a scope, and are therefore approximate.

DVM101 pin	5	(VAND)	6.0 VRMS (17V p-p)	0°	(reference for angle)
	6	(VBNP)	6.9 VRMS (19.5V p-p)	120°	lagging
	36	(VCNP)	6.9	240°	lagging
	26	(VAN)	6.0	0°	
	56	(VBN)	6.9	120°	lagging
	25	(VCN)	6.9	240°	lagging
	16	(-VOP)	0.32 (0.9V p-p)	approx. 10°	leading
	27	(-VO)	0.32 "	" "	"
DFM101 DFM102 pin	58	(IAP)	0.14 VRMS (0.4V p-p)	0°	(reference for angle)
	57	(IBP)	0		
	27	(ICP)	0		

	28 (3IOP)	0.14		0°
	25 (IAS)	0.14		approx. 7° lagging
	26 (IBS)	0		
	56 (ICS)	0		
	55 (3IOS)	0.14		approx. 7° lagging
	16 (-VAIM)	6.49	(18.4V p-p)	approx. 187° lagging
	47 (-VBIM)	6.58	(18.6V p-p)	approx. 53° leading
	46 (-VCIM)	6.53	(18.5V p-p)	approx. 67° lagging
DIM101 pin	35 (IZA)	0.29	(0.8V p-p)	0° (reference for angle)
	39 (IZB)	0.14		0°
	38 (IZC)	0.14		0°
DSM101 pin	5 (-VAIM)	6.49	(18.4V p-p)	0° (reference for angle)
	36 (OPA)	1.74	(4.9V p-p)	180° out-of-phase

If these values are all correct and the Ø-sel is still not producing an output (step a), REPLACE DSM101. If the unit still doesn't work, the problem is beyond the scope of this guide.

If a signal that should be present is not, check the wiring.

If VANP, VBNP, VCNP or -VOP is incorrect, remove DVM101, and continue to monitor the signal(s) in question with a card extender in the DVM position. If the signal(s) is corrected, REPLACE DVM101. If there is no change, REPLACE MGM110, 111 or 112.

If VANP, VBNP, VCNP and -VOP are correct, but VAN, VBN, VCN or -VO is incorrect, reinsert DVM101 into the card extender. Monitor the signal(s) in question at that point. Sequentially remove the following modules, checking the signals after each is removed. If the signal(s) is corrected, REPLACE the module just removed. If there is no change, proceed to the next module.

DSM101
DBM101*
DFM101, 102

If the signal(s) is still incorrect, REPLACE DVM101.

If IAP, IBP, ICP or 3IOP are incorrect, remove DFM101, 102, and continue to monitor the signal(s) in question with a card extender in the DFM101, 102 position. If the signal(s) is corrected, REPLACE DFM101, 102. If there is no change, REPLACE MGM110, 111 or 112.

If IAP, IBP, ICP or 3IOP are correct, but IAS, IBS, ICS or 3IOS are incorrect, reinsert DFM101, 102 into the card extender. Monitor the signal(s) in question at that point. Remove DIM101. If the signal(s) is corrected, REPLACE DIM101. If the signal(s) is still incorrect, REPLACE DFM101, 102.

*If included and connected (interconnection cable in place), located in case B.

If VAN, VBN, VCN and -VO are correct, but -VAIM, -VBIM or -VCIM are incorrect, monitor the signal in question with DFM101, 102 on a card extender. Sequentially remove the following modules, checking the signal(s) after each removal. If the signal is corrected, replace the module just removed. If there is no change, proceed to the next module.

DSM101
DIM101
DBM101*

If the signal(s) is still incorrect, REPLACE DFM101, 102. This may not clear up the problem because the circuit is divided onto two modules. If replacing DFM101, 102 fails, REPLACE DVM101.

If IAS, IBS, ICS and 3IOS are correct, but IZA, IZB or IZC is incorrect, place DIM101 on a card extender and monitor the signal(s) in question at that point. Remove DSM101. If the signal(s) is corrected, REPLACE DSM101. If the signal is still incorrect, REPLACE DIM101.

e) Undervoltage/Overcurrent Signal: Place DIM101 on a card extender and monitor pin 24 (UVOC). This signal should be low (zero volts). If it is not, proceed as follows:

Remove DLM101 - signal switches low, REPLACE DLM101
- signal remains at other than zero volts, reinsert DLM101 and proceed.

Remove DVM101 - signal switches low, REPLACE DVM101
- signal remains at other than zero volts, REPLACE DIM101.

2. Symptom: (1) Yellow Ø-sel LED doesn't light, (2) Ø-sel alarm contacts don't close, but (3) OSCILLOGRAPH START contacts do close.

Probable Problem: The proper closure of the OSCILLOGRAPH START contacts indicates that the Ø-sel is operating properly. The problem is most likely in the output circuitry or the directional unit.

Suggested Approach: Use the specified test circuit and settings with V_T = 60 volts and I_T = 7 amperes (five amp relay) or 1.4 amperes (one amp relay).

a) Output Circuitry: Place DLM101 on a card extender and monitor pin 44 (MUSP). If it is high (+12 volts) and the yellow LED still is not lit, REPLACE DMM101. If it is low, check pin 53 (DU). If DU is high and MUSP is low, REPLACE DLM101. If DU is low, proceed to the next step.

b) Directional Unit: Remove DLM101 from the card extender but leave the extender in place and continue to monitor pin 53 (DU). If the signal

*If included and connected (interconnection cable in place), located in case B.

switches high when DLM101 is removed, REPLACE DLM101. If the signal remains low, reinsert DLM101 and proceed.

Place DSM101 on a card extender and monitor the AC signal inputs to the directional unit. They should be as follows:

pin 16 (-IA2) 0.57VRMS (1.6V p-p) 0^{o} (reference for angle)
pin 46 (VA2-IA2) 0.86VRMS (2.4V p-p) approx. 5^{o} leading

If these values are correct but the unit is still not functioning, REPLACE DSM101. If that doesn't work, the problem is beyond the scope of this guide.

If VA2-IA2 is incorrect, remove DSM101 from the card extender. If the signal is then correct, REPLACE DSM101. If there is no change, REPLACE DFM101, 102.

If -IA2 is incorrect, remove DSM101 from the card extender. If the signal is then correct, REPLACE DSM101. If there is no change, reinsert DSM101 into the relay and place DFM101, 102 on a card extender. Monitor -IA2 at pin 15 of DFM101, 102, and proceed as follows:

Remove DVM101 - signal becomes correct, REPLACE DVM101
- no change, REPLACE DFM101, 102

Note: The removal of DVM101 may result in spurious operation of some of the relay functions. These may be disregarded, as the intent is to concentrate only on the -IA2 signal.

3. Symptom: (1) Yellow Ø-sel LED lights, (2) Ø-sel alarm contacts close, but (3) OSCILLOGRAPH START contacts don't close.

Probable Problem: The Ø-sel is obviously functioning. Either the logic to the OSCILLOGRAPH START relay is faulty, or the output relay itself is faulty.

Suggested Procedure: Remove DOM201, place card extender in its left-hand position, and insert the left-hand board of DOM201 into the extender (the right-hand board may remain disconnected). Monitor pin 5 (ZTR). It should be low (approximately 0.7 volts). If it is, and the OSCILLOGRAPH START contacts are still not closed, REPLACE the left-hand board of DOM201 (0138B7410G-3) or the entire moduel. If ZTR is not low, REPLACE DLM101.

4. Symptom: (1) Yellow Ø-sel LED lights, (2) but Ø-sel alarm contacts don't close.

Probable Problem: The output relay for the alarm contacts may be faulty.

Suggested Approach: Replace right-hand board of DOM201 (0138B7436G-1) or the entire module.

5. Symptom: (1) Yellow Ø-sel LED doesn't light, but (2) Ø-sel alarm contacts do close.

   Probable Problem: The LED itself may be faulty.

   Suggested Approach: REPLACE DMM101 module.

6. Symptom: The pickup angle for the phase selector under test is significantly out-of-limits.

   Probable Problem: The clock frequency may be wrong, the coincidence timer may be faulty, or one or more of the AC signals may be incorrectly phase shifted.

   Suggested Approach: First check the clock signal using the procedure outlined in A1.1c. Next check the AC signals listed in A1.1d. Note that it is necessary to have I_T lagging by 75 degrees (relay angle) and the Ø-sel characteristic set to a circle (link in DSM101) to obtain the values given in A1.1d. If the AC signals are correct and the angle at pickup is still incorrect, REPLACE DSM101. Otherwise follow the procedure outlined in A1.1d.

   Note: If the pickup angle is only slightly outside the specified limits, troubleshooting will be difficult, and is not recommended. Rather, replacement of the following modules is recommended on a one-by-one basis (in the order given) until results are satisfactory:

   DFM101, 102
   DIM101
   DVM101

7. Symptom: The reach of the Ø-sel under test is incorrect; it requires significantly more or less current than calculated to obtain pickup.

   Probable Problem: One or more of the AC signals may be incorrectly attenuated or amplified. The clock and coincidence timer are also suspect.

   Suggested Approach: Same as for symptom 6 above.

   Note: If the pickup current (reach) is only slightly out-of-limits, refer to the note following symptom 6 above.

A2. Phase-to-Ground Measuring Unit Tests - Mho Type Characteristic

1. Symptom: Phase selector picks up but, (1) red phase trip target (A, B or C) on DLM101 doesn't light, (2) red zone 1 trip target (I) on DLM101 doesn't light, and (3) series-connected output contacts for phase under test do not close.

Probable Problem: The simultaneous failure to operate of all three indicators points to the lack of an output from the tripping logic for the phase under test.

Suggested Approach: Use the specified test circuit and settings. Apply V_T = 20 volts and I_T = 6.7 amperes (five amp relay) or 1.34 amperes (one amp relay) at 75 degrees lagging to the phase under test. Use a scope and/or a voltmeter (preferably both) for monitoring the points indicated, in the following sequence.

a) Measuring Unit Output: Place DLM101 on a card extender and monitor pin 13 (MU). If this signal is high (+12 volts), and the unit is still not operating properly, REPLACE DLM101. If this signal is not high, proceed to the next step.

b) Fault Type Signal:

1) Monitor the fault type switching signal for the phase under test - pin 19 ($\overline{AG}$), 50 ($\overline{BG}$) or 20 ($\overline{CG}$). If the signal is low (zero volts), proceed to the next step. If it is not low, and the Ø-sel is working properly, there may be a problem in DVM101, but it is far more likely that the problem is in DLM101. Therefore, REPLACE DLM101.

2) Remove DLM101 from the extender and insert a jumper between pin 1 and 19 ($\overline{AG}$), 1 and 50 ($\overline{BG}$) or 1 and 20 ($\overline{CG}$), depending on the phase under test. If the MU signal (pin 13) switches high, REPLACE DLM101. Otherwise, proceed to the next step.

c) AC Signal Inputs: Use a card extender(s) to measure the signals indicated below with a voltmeter and/or scope (preferably both). The values stated are the correct levels for the given operating conditions. For each module specified, one of the signals is assigned to be the reference for the angle measurements. This is arbitrary. The angle measurements have been made using a scope, and therefore are approximate.

DVM101	pin 51	(POL)	5.09VRMS	(14.4V p-p)	0° (reference for angle)
	54	(-VX/T)	1.97VRMS	(5.6V p-p)	approx. 173° lagging
DFM101 DFM102	11	(IZ-V)	2.17VRMS	(6.1V p-p)	0° (reference for angle)
	42	(VOP)	3.38VRMS	(9.6V p-p)	in-phase
DMM101	53	(POL)	5.09VRMS	(14.4V p-p)	0° (reference for angle)
	22	(VOP)	3.38VRMS	(9.6V p-p)	180° out-of-phase

Many of the AC signals in the modules noted are not included in the above checklist, because if the phase selector is operating properly, those other signals must be correct.

If all the values listed above are correct, and the measuring unit is still not producing an output, REPLACE DMM101. If the unit still doesn't work, the problem is beyond the scope of this guide.

If a signal that should be present is not, check the wiring.

If POL is incorrect, place DVM101 on a card extender and monitor that signal (pin 52). Remove DMM101 and connect the fault type control signal for the phase under test to reference by inserting a jumper between pin 1 and 42 ($\overline{AG}$), 1 and 20 ($\overline{BG}$) or 1 and 22 ($\overline{CG}$) on the DVM extender. If the POL signal is corrected, REPLACE DMM101. Otherwise, REPLACE DVM101.

If -VX/T is incorrect, place DMV101 on a card extender and monitor that signal (pin 54). Remove DLM101 and DIM101 and connect the fault type control signal for the phase under test to reference as described in the preceeding paragraph/ If the -VX/T signal is corrected, REPLACE DIM101. Otherwise, proceed to the next step.

Note: The removal of DLM101 and DIM101, and the nsertion of the jumper on the DVM extender may result in spurious operation of some of the relay functions. These may be disregarded, since the intent is to concentrate only on the -VX/T signal.

If -VX/T is correct and the phase selector is operating properly, but IZ-V is incorrect, the problem is either in DIM101 or DFM101, 102. However, it cannot be readily isolated to one of the two. First, REPLACE DIM101, since in this case that is the more likely of the two modules to be faulty. If that doesn't correct the signal, REPLACE DFM101, 102.

If IZ-V is correct, but VOP Is incorrect, the problem is either in DFM01, 102 or in DMM101, but it cannot be readily isolated down t one of the two. First, REPLACE DFM101, 102 since in this case that is the more likely of the two modules to be faulty. If that doesn't correct the signal, REPLACE DMM101.

2. Symptom: Phase selector picks up, red phase and zone 1 targets light, but series-connected output contacts do not close.

Probable Problem: The output circuitry, either in the magnetics module or in the DOM201 module, may be faulty.

Suggested Approach: The test circuit in GEK-86044 has the trip and the BFI relay contacts conected in series for monitoring. To determine which is not operating, either: (1) break the connections and monitor the outputs separately; or (2) remove the front panel from the MGM110, 111 or 112 magnetics module and visually verify the operation (or lack thereof) of the telephone relay corresponding to the phase under test. If the telephone relay is not picking up, REPLACE MGM110, 111 or 112. If it is, the BFI relay in DOM201 isn't operating. REPLACE the left-hand board of DOM201 (0138B7410G-3) or the entire module.

3. Symptom: The output relays operate properly, but one or both of the red target LEDs on DLM101 that should light, don't.

   Probable Problem: There is almost certainly a problem in DLM101.

   Suggested Approach: REPLACE DLM101.

4. Symptom: The angle at the trip point is significantly out-of-limits.

   Probable Problem: The main measuring unit coincidence timer may be faulty, or one or more of the AC signals may be incorrectly phase shifted.

   Suggested Approach: Check the AC signals listed in A2.1c. Note that it is necessary to have I_T lagging by 75 degrees (relay angle) to obtain the values given in A2.1c. If the AC signals are correct and the angle at the trip point is still incorrect, REPLACE DMM101. Otherwise, follow the procedure outlined in A2.1c.

   Note: If the pickup angle is only slightly out-of-limits, refer to the note following A1.6.

5. Symptom: The reach of the zone one unit is incorrect; it requires significantly more or less current than calculated to obtain a trip output.

   Probable Problem: The main measuring unit coincidence timer may be faulty, or one or more of the AC signals may be incorrectly amplified or attenuated. If the pickup current is less than it should be, the relay may be in the wrong zone.

   Suggested Approach: Same as for symptom 4 above.

   Note: If the pickup current (reach) is only slightly out-of-limits, refer to the note following A1.6.

6. Symptom: The relay trips in the wrong zone. The pickup current is one of the following percentages of the calculated zone one current:

Zone Ix	67%
II	50%
III	25%
IV	Trips when Ø-sel picks up

   These numbers correspond to the test settings given in GEK-86044. If the trip is in zone II, III or IV, the corresponding LED on DLM101 will probably light. If it is in the extended zone one (Ix), the I target will light, as it normally would.

   Probable Problem: The logic output from the zone timer module may be incorrect.

Suggested Approach: Place DTM101 on a card extender and monitor the following points. They should be as indicated:

pin 50	(Z1)	low (0 volt)
26	(Z1X)	high (+12 volts)
20	(Z2)	high
49	(Z3)	high
55	(Z4)	low

If one of the first four signals is incorrect, remove DVM101 and connect the signal as indicated, using jumpers and loose resistors on the DVM card extender:

pin 50 to ref. (pin 1) through 100K
26 to +12V (pin 2) through 100K
40 to +12V (pin 2) through 100K
49 to +12V (pin 2) through 100K

If this corrects the signal(s) REPLACE DVM101. Otherwise, REPLACE DTM101.

If the Z4 signal is incorrect, remove DLM101. If it now becomes correct, REPLACE DLM101. Otherwise REPLACE DTM101.

7. Symptom: Relay trips three pole for the single phase fault test.

Probable Problem: The relay will normally trip three pole under the following conditions:

Fault in zone II, III or IV
Phase-to-phase or three-phase fault
Supervise three pole trip signal from recloser
Direct trip signal from recloser
Trip during line pickup
Relay set for three pole operation only.

One or more of these conditions is being erroneously replicated if the relay is tripping three pole during these single phase tests.

Suggested Approach: For a trip in the wrong zone, refer to symptom 6; otherwise, check the following logic signals:

a) Supervise 3 Pole Trip: Place DLM101 on a card extender and monitor pin 21 (SPV3PT). With the interconnection cable(s) removed as specified in the test instructions, this signal should be high (+10 volts). If it is low, check the 1P/3P switch to be sure it is in the 1P position. If the switch is right, and the signal is still low, REPLACE DLM101.

b) Direct Trip: With DLM101 still on a card extender, monitor pin 25 (TRIP). This should also be high (+10 volts). If it isn't, REPLACE DLM101.

c) Undervoltage/Overcurrent: This condition produces a three pole trip during line pickup. Monitor pin 24 (UVOC) on the DLM card extender. It should be low (zero volts). If it is not, follow the procedure described in A1.13.

If the above signals are all correct, and the phase selector is operating properly (only one phase selector picked up), REPLACE DLM101.

A3. Phase-to-Ground Measuring Unit Tests - Reactance Characteristic

The phase to ground measuring circuitry for the reactance charcteristic is one and the same as that for the mho type characteristic. The only difference is in the signals used for the polarizing quantities; i.e., the mho type characteristic uses positive sequence voltage with memory, the reactance uses negative sequence current.

The same procedures used in section A2 should be used to troubleshoot improper operation of the reactance charcteristic, with the exception of the AC signals listed in A2.1c. The following procedure and signal levels should be used for checking the AC inputs for the reactance characteristic.

1. Use the specified test circuit and settings Apply V_T = 20 volts and I_T = 6.0 amperes (five amp relay) or 1.2 amperes (one amp relay) at 90 degrees lagging, to the phase under test. Use a card extender, and measure the signals indicated below with a voltmeter and/or scope (preferably both). The values stated are the correct levels for the given operating conditions for an A-G fault. For B-G and C-G faults, simply rotate the values to correspond to the phase under test. For each module, one of the signals is assigned to be the reference for the angle measurements. This is arbitrary; the angle measurements have been made using a scope, and are therefore approximate.

DVM101 pin	51	(POL)	0.473VRMS	(1.34V p-p)	0^o (reference for angle)
	54	(-VX/T)	1.97VRMS	(5.57V p-p)	approx. 175^o lagging
	43	(-IA2)	0.486VRMS	(1.37V p-p)	approx. 170^o lagging
	53	(-IB2)	0.479VRMS	(1.35V p-p)	approx. 54^o lagging
	23	(-IC2)	0.479VRMS	(1.35V p-p)	approx. 66^o lagging
DFM101 DFM102	11	(IZ-V)	2.21VRMS	(6.25V p-p)	0^o (reference for angle)
	42	(VOP)	3.41VRMS	(9.64V p-p)	in phase
DMM101 pin	53	(POL)	0.474VRMS	(1.33V p-p)	0^o (reference for angle)
	22	(VOP)	3.41VRMS	(9.64V p-p)	approx. 110^o leading

If all the values listed above are correct and the measuring unit is still not producing an output, REPLACE DMM101.

If -IA2, -IB2 or -IC2 is incorrect, place a card extender in the DVM position. Monitor the point in question. If the signal is corrected when DVM101 is removed from the extender, REPLACE DVM101. Otherwise, replace DFM101, 102.

If -IA2, -IB2 or -IC2 is correct, but one of the remaining AC signals (repeated below) is incorrect, follow the procedures described in A2.1c.

POL
-VX/T
IZ-V
VOP

B. Fuse Failure Detector Test

1. Symptom: (1) Fuse failure target LED on DLM101 will not light, and (2) fuse failure alarm contacts will not close.

Probable Problem: The fact that both of the indicators are not functioning points to the lack of an output from the fuse failure detector.

Suggested Approach: Use the specified test circuit and settings. Apply balanced three phase voltage (69 volts) and then switch off one phase to simulate a failed fuse condition. It is not necessary to apply current at this time.

a) Detector Output: Place DVM101 on a card extender and monitor pin 3 (FF). If this is high (+11 volts), and the unit is still not operating properly, REPLACE DLM101. If it is not high, proceed as follows:

Remove DLM101 - signal switches high, REPLACE DLM101
- no change, proceed to next step.

b) AC Signal Inputs: Measure the signal(s) indicated below with a voltmeter and/or scope (preferably both). The values stated are the current levels for the given operating conditions (phase A voltage switched off).

DVM101 pin 46 (-VA2) 2.28VRMS (6.45V p-p)
34 (-IA2) 0

If these values are correct and the FF signal on pin 3 is still low, REPLACE DVM101.

If -VA2 is incorrect, but the phase selectors have successfully passed their tests, the problem is either in DVM101 or DFM101, 102. However, it cannot be readily isolated to one of the two. First, REPLACE DFM101, 102, since in this case, that is the most likely of the two modules to be faulty. If that doesn't solve the problem, REPLACE DVM101.

2. Symptom: Fuse failure detector picks up and operates indicators, but does not block tripping.

Probable Problem: The blocking circuitry in DLM101 is not functioning.

Suggested Approach: Double check that the OFF/BLK link in DLM101 is in the BLK position and is making good contact. If it is, and the detector is still unable to block tripping, REPLACE DLM101.

3. Symptom: FF target light on DLM101 lights, but alarm contact does not close.

   Probable Problem: There likely is a problem with the output relay in DOM201.

   Suggested Approach: Replace the left-hand board of DOM201 (0138B7410G-3) or the entire module.

4. Symptom: FF alarm contact closes but target LED on DLM101 does not light.

   Probable Problem: There is almost certainly a problem in DLM101.

   Suggested Approach: REPLACE DLM101.

5. Symptom: Fuse failure indicators operate when they shouldn't.

   Probable Problem: The logic may be faulty, the negative sequence voltage network may be producing an erroneous output, or the negative sequence current network may not be producing a signal to inhibit the detector under fault conditions.

   Note: The fuse failure detector is a relatively sensitive circuit which operates on a percentage of negative sequence voltage in the absence of negative sequence current. If the test circuit and/or connected power system do not supply continuously well-balanced voltages having pure waveforms, operation of the fuse failure detector may be unavoidable.

   Suggested Approach: Apply balanced three phase voltage (69 volts) to the relay without applying any current. The FF indicator would not operate uhder these conditions if the detector were functioning properly.

   a) Detector Output: Place DMV101 on a card extender and monitor pin 3 (FF). If this is low (zero volts) and the FF indicators are operating, REPLACE DLM101. If it is not low, proceed as follows:

      Remove DLM101 - signal becomes low, REPLACE DLM101
                    - no change, proceed to next step.

   b) AC Signal Inputs: Measure the signals indicated below with a voltmeter and/or scope (preferably both). The values stated are the correct levels for the given operating conditions.

      DVM101 pin 46 (-VA2) 0.1VRMS or less
                 34 (-IA2) 0

      If these values are correct and the FF signal on pin 3 is still not low, REPLACE DVM101.

If -VA2 or -IA2 are of appreciable magnitude, REPLACE DFM101, 102.

Now remove the three phase voltage and apply single phase current of I_T = 5 amperes (five amp relay), or one ampere (one amp relay) at 75 degrees lagging, to phase A. After current is applied, switch on the phase B and C voltages only (69 volts). The relay should give a zone one trip output (OFF/BLK link in DLM101 in OFF position). The FF indicators would not operate under these conditions if the detector were functioning properly.

c) Detector Output: Repeat step a).

d) AC Signal Inputs: Measure the following

DVM101 pin 46	(-VA2)	2.28VRMS	(6.45V p-p)	0^o (reference for angle)
34	(-IA2)	0.40VRMS	(1.13V p-p)	approx. 170^o lagging

If these values are correct and the FF signal on pin 3 is still low, REPLACE DVM101.

If -VA2 is incorrect, but the phase selectors have successfully passed their tests, the problem is either in DMV101 or DFM101, 102. It cannot be readily isolated to one of the two, however. First, REPLACE DFM101, 102, since in this case that is the most likely of the two modules to be faulty. If that doesn't solve the problem, REPLACE DVM101.

If -IA2 is incorrect, proceed as follows:

Remove DSM101 - signal becomes correct, REPLACE DSM101
- no change, proceed to next step.

Remove DVM101 from extender - signal becomes correct, replace DVM101.
- no change, REPLACE DFM101, 102

C. Phase-to-Phase Reach Tests

1. Symptom: Phase selectors pick up, but (1) red phase trip targets (A and B, B and C, or C and A) on DLM101 don't light, and (2) red zone 1 trip target (I) on DLM101 doesn't light. The output trip contacts are not monitored in these tests since they were checked in the phase-to-ground measuring unit tests.

Probable Problem: The simultaneous failure to operate of both the phase and the zone targets tends to indicate the lack of an output from the tripping logic for the phase pair under test.

Suggested Approach: Use the specified test circuit and settings (note that the zone one reach should now be four ohms (five amp relay), and 20 ohms (one amp relay). Apply V_T = 40 volts and I_T = 5.5 amperes (five amp relay), or 1.1 amperes (one amp relay) at 75 degrees lagging to the phase pair under test. Use a scope and/or a voltmeter (preferably both) for monitoring the points indicated in the following sequence:

a) Measuring Unit Output: Place DLM101 on a card extender and monitor pin 13 (MU). If this signal is high (+12 volts), and the unit is still not operating properly, REPLACE DLM101. If the signal is not high, proceed to the next step.

b) Fault Type Signal: Monitor the fault type switching signal for the phase pair under test - pin 27 ($\overline{AB}$), 58 ($\overline{BC}$) or 57 ($\overline{CA}$) on the DLM extender. If the signal is low (zero volts), proceed to the next step. If it is not low, and the phase selectors are working properly, there may be a problem in DVM101. More likely, the problem is in DLM101 - REPLACE DLM101.

b1) Remove DLM101 from the extender and insert a jumper between pins 1 and 27 ($\overline{AB}$), 1 and 58 ($\overline{BC}$) or 1 and 57 ($\overline{CA}$), depending upon the phase pair under test. If the MU signal (pin 13) switches high, REPLACE DLM101. Otherwise, proceed to the next step.

c) AC Signal Inputs: Using a card extender(s) measure the signals indicated below with a voltmeter and/or scope (preferably both). The values stated are the correct levels for the given operating conditions for an A-B fault. For B-C and C-A faults, rotate the values to correspond to the phase pair under test. For each module specified, one of the signals is assigned to be reference for the angle measurements. This is arbitrary. The angle measurements have been made using a scope, and therefore are approximate.

DVM101 pin	37	(VABP)	2.29VRMS	(6.5V p-p)	0^o (reference for angle)
	17	(VBCP)	1.19VRMS	(3.4V p-p)	180^o out-of-phase
	47	(VCAP)	1.09VRMS	(3.1V p-p)	180^o out-of-phase
	55	(VAB)	2.29VRMS	(6.5V p-p)	in-phase
	58	(VBC)	1.19VRMS	(3.4V p-p)	180^o out-of-phase
	28	(VCA)	1.09VRMS	(3.1V p-p)	180^o out-of-phase
	51	(POL)	2.00VRMS	(5.7V p-p)	approx. 10^o lagging
	54	(-VX/T)	2.27VRMS	(6.4V p-p)	180^o out-of-phase
DFM101 DFM102 pin	10	(VPA)	2.04VRMS	(5.8V p-p)	0^o (reference for angle)
	19	(VPBM)	1.10VRMS	(3.1V p-p)	approx. 163^o lagging
	5	(VPC)	1.03VRMS	(2.9V p-p)	approx. 168^o leading
	11	(IZ-V)	0.70VRMS	(2.0V p-p)	approx. 15^o lagging*
	42	(VOP)	0.96VRMS	(2.7V p-p)	approx. 15^o lagging
DMM101 pin	53	(POL)	2.00VRMS	(5.7V p-p)	0^o (reference for angle)
	22	(VOP)	0.96VRMS	(2.7V p-p)	approx. 172^o leading

Many of the AC signals in the modules noted are not included in the above checklist, because if the phase selectors are operating properly, those other signals must be correct.

If all the values listed above are correct, and the measuring unit is still not producing an output, REPLACE DMM101. If the unit still does not work, it is beyond the scope of this guide.

*Waveform may not be smooth and may contain DC offset

If a signal that should be present is not, check the wiring.

If VABP, VBCP or VCAP is incorrect, remove DVM101 and continue to monitor the signal(s) in question with a card extender in the DVM position. If the signal(s) is corrected, REPLACE DVM101. If there is no change, REPLACE MGM110, 111 or 112.

If VABP, VBCP and VCAP are correct, but VAB, VBC or VCA is incorrect, reinsert DVM101 into the card extender.

Remove DVM101, 102 - signal corrected, REPLACE DFM101, 102
- no change, REPLACE DVM101

If VAB, VBC and VCA are correct, but VPA, VPBM or VPC is incorrect, the problem is either in DVM101 or DFM101, 102. However, it cannot be readily isolated to one of the two. First REPLACE DFM101, 102, since in this case that is the most likely of the two to be faulty. If that doesn't correct the signal, REPLACE DVM101.

If POL is incorrect, place DMV101 on a card extender and monitor that signal (pin 51). Remove DMM101 and connect the fault type control signal for the phase pair under test to reference by inserting a jumper between pin 1 and 41 ($\overline{AB}$), 1 and 39 ($\overline{BC}$) or 1 and 38 ($\overline{CA}$) on the DVM extender. If the POL signal is corrected, REPLACE DMM101. Otherwise, REPLACE DVM101.

If -VX/T is incorrect, place DVM101 on a card extender and monitor that signal (pin 54). Remove DLM101 and DIM101 and connect the fault type control signal for the phase pair under test to reference as described in the preceeding paragraph. If the -VX/T signal is corrected, REPLACE DIM101. Otherwise, proceed to the next step.

Note: The removal of DLM101 and DIM101, and the insertion of a jumper on the DVM extender may result in spurious operation of some of the relay functions. These may be disregarded, since the intent is to concentrate only on the -VX/T signal.

While monitoring -VX/T, also monitor Z1 (pin 24). This should be low (zero volts). If it is not, it will cause -VX/T to be incorrect. In that case, remove DTM101. If Z1 goes low and -VX/T becomes correct, REPLACE DTM101. If Z1 still does not go low, REPLACE DVM101.

If -VX/T is correct and the phase selectors are operating properly, but IZ-V is incorrect, the problem is either in DIM101 or DFM101, 102. However, it cannot be readily isolated to one of the two. First, REPLACE DIM101, since in this case, that is the more likely of the two to be faulty. If that doesn't correct the signal, REPLACE DFM101, 102.

If IZ-V is correct, but VOP is incorrect, the problem is either in DFM01, 102 or in DMM101, but it cannot be readily isolated to one of

the two. First, REPLACE DFM101, 102 since in this case it is the more likely of the two to be faulty. If that doesn't correct the signal, REPLACE DMM101.

2. Symptom: The reach and/or angle is incorrect.

   Probable Problem: The main measuring unit coincidence timer may be faulty or one or more of the AC signals may be incorrectly amplified, or attenuated, or phase shifted. If the pickup current is less than it should be, the relay may be in the wrong zone (see symptom 3).

   Suggested Approach: Check the AC signals listed in C.1c. Note that it is necessary to have I_T lagging by 75 degrees (relay) to obtain the values given in C.1c. If the AC signals are correct and the reach and/or angle is still incorrect, REPLACE DMM101. Otherwise, follow the procedure outlined in C.1c.

   Note: If the reach and/or angle are only slightly outside the specified limits, troubleshooting will be difficult, and is not recommended. Rather, replacement of the following modules is recommended on a one-by-one basis (in the order given) until results are satisfactory:

   DFM101, 102
   DIM101
   DVM101

3. Symptom: The relay trips in the wrong zone. The pickup current is one of the following percentages of the calculated zone one current:

Zone Ix	67%
II	50%
III	25%
IV	Trips when Ø-sel picks up

   These numbers correspond to the test settings given in GEK-86044. If the trip is in zone II, III or IV, the corresponding LED on DLM101 will probably light. If it is in the extended zone one (Ix), the I target will light, as it normally would.

   Probable Problem: Refer to A2.6.

4. Symptom: Only one phase selector picks up.

   Probable Problem: The test angle is outside the recommended limits.

   Suggested Approach: Check that the angle between I_T and V_T is between 30 and 120 degrees for all tests. This restriction is a particular shortcoming of using a single phase test circuit for phase-to-phase reach tests.

   Also, check that the phase selector reach (Zp) is set to its maximum value.

D. Zone Switching Time Tests

1. Symptom: Relay will not successfully advance to all zones.

Probable Problem: (1) The zone timer may not be advancing, or (2) the AC signals into the main measuring unit for a given zone (or zones) may be incorrect.

Suggested Approach: Use the specified test circuit and settings, except adjust the zone timer settings on the front of the DTM101 as follows:

II	.30
III	.60
IV	9.0
X1/X10, II/III, X10	

Set V_T = 40 volts and I_T = 1.0 amperes (five amp relay), or 0.2 amperes (one amp relay) at 75 degrees lagging. Note that the test circuit arbitrarily uses the C-A phase pair.

a) Zone Timer Input: Place DTM101 on a card extender, apply the test voltage (V_T), and monitor pin 57 (Z_T). It should be low (zero volts) and switch high (+12 volts) when the test current (I_T) is applied. If it does not, remove DTM101 from the card extender. If the Z_T signal switches high, REPLACE DTM101. If it remains low after the phase selectors have operated, REPLACE DLM101.

b) Clock Signal: With DTM101 on a card extender, monitor pin 14 (CK2K). It should be a pulse train with a low-going pulse every 0.5 milliseconds. If it is not, remove DTM101 from the extender. If that corrects the clock signal, REPLACE DTM101. Otherwise, REPLACE DMM101.

c) Zone Timer Outputs: With DTM101 on a card extender, monitor the following four points. They should switch successively in the intervals stated.

Apply Current (Time Zero)		3 sec.	6 sec.	9 sec.
Pin 50 (Z1)	low	sw high	high	high
Pin 20 (Z2)	high	sw low	sw high	high
Pin 49 (Z3)	high	high	sw low	sw high
Pin 55 (z4)	low	low	low	sw high

If the Z1, Z2 or Z3 signals fail to switch as specified, remove DVM101 and DLM101. With the AC voltage and current removed, connect one end of a jumper lead to pin 57 (Z_T) on the DTM extender, and connect the other end to pin 2 (+12 volts) to commence the timing cycle. The lead should remain connected for the duration of the cycle. If the signal(s) now switches as required, REPLACE DVM101. If it is still incorrect, REPLACE DTM101.

Note: To repeat this time test, shut off the DC control power for at least ten seconds to allow the circuitry to reset. The switch on PSM201 may be used for this purpose.

If the Z4 signal fails to switch, repeat the above test with DVM inserted and DLM101 removed. If the signal switches correctly, REPLACE DLM101. Otherwise REPLACE DTM101.

Note: For repeat tests, refer to the above note.

d) AC Signals: Place DMV101 on a card extender, and with AC voltage (V_T) applied, monitor pin 47 (VCAP). It should be approximately 2.3 volts RMS. If it is not, remove DVM101 from the extender. If the signal is corrected, REPLACE DVM101. Otherwise, REPLACE MGM110, 111 or 112. Next monitor pin 54 (-VX/T). DVM101 should be inserted in the extender. With voltage applied, switch on current (I_T) and verify the following changes in signal level as the timer advances.

	Before I_T is applied	0 VRMS
Zone I	0 to 3 seconds	2.27 VRMS
Zone II	3 to 6 seconds	1.13 VRMS
Zone III	6 to 9 seconds	0.56 VRMS
	After 9 secondds	0 VRMS

If one of these signals is incorrect, but not the others, REPLACE DVM101. If they are all incorrect, there may be a problem in DIM101, but if the zone one tests were successful, the problem is more likely to be in DVM101. Therefore, REPLACE DVM101.

2. Symptom: Red zone target LEDs on DLM101 light, but zone trip indication contacts do not close.

Probable Problem: There likely is a problem with the output relay in DOM201.

Suggested Approach: Replace left-hand board of DOM201 (0138B7410G-3), or the entire module.

3. Symptom: The relay trips in the proper zone at the proper time, but the red zone target LED on DLM101 doesn't light.

Probable Problem: There is almost certainly a problem in DLM101.

Suggested Approach: REPLACE DLM101.

E. Out-of-Step Blocking Test (Three Phase Condition)

1. Symptom: One or more of the phase selectors do not pick up.

Probable Problem: If the phase selectors successfully passed their portion of the testing (section A.1), the problem is more than likely in the test circuit.

Suggested Approach: Two phase voltage is applied to an open delta arrangement in the test circuit in order to simulate a three phase source. Check all three voltages around the open delta to make sure they are balanced in magnitude and each separated by 120° from the other two (terminals BC2-BC3, BC3-BC4 and BC4-CB2).

The currents are applied to the relay in an ungrounded wye arrangement, and therefore are phase-to-neutral currents. The reactors are intended to shift the currents approximately 90 degrees lagging.

If a multi-channel electronic test source is used in lieu of the circuit given in GEK-86044, great care must be taken to set the proper phase angles between the various inputs in order to simulate the conventional test set-up. The angles should be as follows:

V_T, BC2-BC3: 0° (reference for angle)
$-V_T$, BC4-BC3: 60° leading*
I_A, 120° lagging (includes 90° shift for reactors)
I_B, 120° leading (includes 90° shift for reactors)
I_C, 0°

On many electronic test sources, it is necessary to reconnect the neutral for the current even though a balanced three phase input is applied. In this case, the current neutral lead should be connected to terminals BD5, 6 and 7.

2. Symptom: All three phase selectors pick up, but the out-of-step blocking unit does not operate when V_T = 75 volts (OSB LED on DMM101 doesn't light, and OSB output contacts don't close).

   Probable Problem: The out-of-step detector may be faulty, or the permissive zone may be overreaching.

   Suggested Approach: Use the specified test circuit and settings. With V_T = 75 volts and I_T applied, monitor the points indicated in the following sequence:

   a) OSB Detector Input: Place DMM101 on a card extender and monitor pin 44 (3PD). It should be high (+12 volts). If it is not, remove DLM101 and connect a jumper between pin 44 and pin 2 (+12 volts) on the DMM extender. If the OSB indicator now operates, REPLACE DLM101. Otherwise, proceed to the next step.

   b) Permissive Zone Output: With DMM101 on an extender, monitor pin 14 (23FLT). It should be low (zero volts). If it is not, remove DTM101. If that corrects the signal, REPLACE DTM101. If not, proceed to the next step.

*With the common voltage neutral connected to terminal BC3, the second channel of the electronic test source will actually be applying V_{CB}, not V_{BC}. This makes it necessary to rotate the required V_{BC} by 180 degrees to compensate for the reversal.

c) AC Signals for Permissive Zone: Using a card extender(s) measure the signals indicated below with a voltmeter and/or scope (preferably both). The values stated are the correct levels for the given operating conditions. For each module specified, one of the signals is assigned to be reference for the angle measurements. This is arbitrary. The angle measurements have been made using a scope, and therefore are approximate.

DVM101 pin 51	(POL)	4.19VRMS	(1.9V p-p)	0^o (reference for angle)
40	(VZ3)	1.73VRMS	(4.9Vp-p)	approx. 170^o lagging
DIM101 pin 34	(VZ3)	1.73VRMS	(4.9Vp-p)	0^o (reference for angle)
37	(Z3OP)	2.24VRMS	(6.3V p-p)	approx. 164^o lagging
DMM101 pin 23	(POL)	4.19VRMS	(1.9V p-p)	0^o (reference for angle)
52	(Z3OP)	2.24VRMS	(6.3V p-p)	approx. 23^o leading

If all of the values listed above are correct and the permissive zone measuring unit is still producing a false output, REPLACE DMM101.

If VZ3 is incorrect, place DVM101 on a card extender and monitor that signal (pin 40). Remove DLM101 and DIM101 and connect the fault type control signal for three phase faults ($\overline{BC}$) to reference by inserting a jumper between pins 1 and 9 on the DVM extender. If the VZ3 signal is corrected, REPLACE DIM101. Otherwise, REPLACE DVM101.

Note: The removal of DLM101 and DIM101 and the insertion of the jumper on the DVM extender may result in spurious operation of some of the relay functions. These may be disregarded, since the intent is to concentrate only on the VZ3 signal.

If VZ3 is correct and Z3OP is incorrect, place DMM101 on a card extender and monitor Z3OP (pin 52). Remove DLM101 and place DVM101 on a second card extender. Connect the fault type control signal for three phase faults ($\overline{BC}$) to reference by inserting a jumper between pins 1 and 9 on the DVM extender, as above. Now remove DMM101 from the extender. If that corrects the Z3OP signal, REPLACE DMM101. Otherwise, REPLACE DIM101.

3. Symptom: The out-of-step detector operates when V_T = 30 or 15 volts.

Probable Problem: The permissive zone measuring unit may be underreaching or it may be continuously picked up.

Suggested Approach: Use the specified test circuit and settings. With V_T = 30 volts, monitor the points indicated in the following sequence.

a) Permissive Zone Output: With DMM101 on a card extender, monitor pin 14 (Z3FLT). It should be high (+12 volts). If it is not, remove DTM101. If that corrects the signal, REPLACE DTM101. If not, monitor the AC signals according to E.2c (note that it will be necessary to apply V_T = 75 volts to obtain the values stated therein).

4. Symptom: Yellow OSB LED on DMM101 lights, but OSB output contacts do not close.

   Probable Problem: There likely is a problem with the output relay in DOM201.

   Suggested Approach: Replace the left-hand board of DOM201 (0138B7410G-3) or the entire module.

5. Symptom: The OSB output contact closes but the yellow LED on DMM101 doesn't light.

   Probable Problem: There is almost certainly a problem in DMM101.

   Suggested Approach: REPLACE DMM101.

F. Out-of-Step Blocking Test (Phase-to-Phase Condition with One Pole Open)

1. Symptom: The A and B phase selectors pick up, but the out-of-step blocking unit does not operate when V_T = 60 volts (OSB LED on DMM101 doesn't light, and OSB output contacts don't close).

   Probable Problem: The out-of-step detector may be faulty or the permissive zone may be overreaching.

   Suggested Approach: Use the specified test circuit and settings. With V_T = 60 volts and I_T applied, monitor the points indicated in the following sequence:

   a) OSB Detector Inputs: Place DMM101 on a card extender and monitor pin 18 (1POD) . With DC power connected to terminals AA7 and AA8, this point should be low (zero volts) due to the action of the contact converter (CC6). If it is not, replace the right-hand board of DOM201 (0138B7436G-1) or replace the entire module.

      Next monitor pin 11 (P). It should be high (+12 volts). If it is not, remove DLM101 and connect a jumper between pin 11 and pin 2 (+12 volts) on the DMM extender. If the OSB indicator now operates, REPLACE DLM101. Otherwise, proceed to the next step.

   b) Permissive Zone Output: With DMM101 on an extender, monitor pin 14 (Z3FLT). It should be low (zero volts). If it is not, remove DTM101. If that corrects the signal, REPLACE DTM101. If not, proceed to the next step.

   c) AC Signals for Permissive Zone: Using a card extender(s) measure the signals indicated below with a voltmeter and/or scope (preferably both). The values stated are the correct levels for the given operating conditions. For each module specified, one of the signals is assigned to be reference for the angle measurements. This is arbitrary. The angle measurements have been made using a scope, and therefore are approximate.

DVM101 pin 51	(POL)	3.00VRMS	(8.5V p-p)	0^{o} (reference for angle)
40	(VZ3)	2.29VRMS	(6.5V p-p)	approx. 170^{o} lagging
DIM101 pin 34	(VZ3)	2.29VRMS	(6.5V p-p)	0^{o} (reference for angle)
37	(Z3OP)	2.18VRMS	(6.2V p-p)	approx. 170^{o} leading
DMM101 pin 23	(POL)	3.00VRMS	(8.5V p-p)	0^{o} (reference for angle)
52	(Z3OP)	2.18VRMS	(6.2V p-p)	in phase

If all of the values listed above are correct and the permissive zone measuring unit is still producing a false output, REPLACE DMM101.

If VZ3 is incorrect, place DVM101 on a card extender and monitor that signal (pin 40). Remove DLM101 and DIM101 and connect the fault type control signal for A-B faults ($\overline{AB}$) to reference by connecting a jumper between pins 1 and 11 on the DVM extender. If the VZ3 signal is corrected, REPLACE DIM101. Otherwise, REPLACE DVM101.

Note: The removal of DLM101 and DIM101 and the insertion of the jumper on the DVM extender may result in spurious operation of some of the relay functions. These may be disregarded, since the intent is to concentrate only on the VZ3 signal.

If VZ3 is correct and Z3OP is incorrect, place DMM101 on a card extender and monitor Z3OP (pin 52). Remove DLM101 and place DVM101 on a second card extender. Connect the fault type control signal for A-B faults ($\overline{AB}$) to reference by inserting a jumper between pins 1 and 11 on the DVM extender, as above. If that corrects the Z3OP signal, REPLACE DMM101. Otherwise, REPLACE DIM101.

3. Symptom: The out-of-step detector operates when V_T = 30 or 20 volts.

Probable Problem: The permissive zone measuring unit may be underreaching or it may be continuously picked up.

Suggested Approach: Follow the procedure described in E.3, except, when checking the AC signals, use the values given in F.1c (note that it will be necessary to apply V_T = 60 volts to obtain the values stated therein).

G. Line Pickup Tests

1. Symptom: Relay trips when SW2 in the test circuit is open.

Probable Problem: Contact converter CC3 is giving an erroneous output, or there is faulty logic in DLM101.

Suggested Approach: It is only necessary to apply DC control voltage to check CC3 and the logic. Place DLM101 on a card extender and monitor pin 55 (MACD). With SW2 open (no input to terminals AA1 and AA2; CC3), this signal should be high (+10 volts). If it is not, remove DOM201. If it switches high, REPLACE the right-hand board of DOM201 (0138B7436G-1) or

the entire module. If it remains not high when DOM201 is removed, REPLACE DLM101.

If MACD is high as it should be, and the relay still produces a trip output, monitor pin 56 (MAC). This should be low (approximately 0.6 volt). If it is not, remove DTM101. If the signal is corrected, REPLACE DTM101. If not, REPLACE DLM101.

If MACD is high and MAC is low, but the relay still produces a trip output, monitor pin 14 (MACT). This signal should normally be low (zero volts).

2. Symptom: Relay does not trip.

Probable Problem: Contact converter CC3 may not be operating, the logic in DLM101 may be faulty, or the undervoltage/overcurrent detector may not be functioning.

Suggested Approach: Connect the relay according to the specified test circuit (AC and DC).

a) Contact Converter Output Signal: Place DLM101 on a card extender and monitor pin 55 (MACD). With SW2 in the test circuit closed, this signal should be low (zero volts). If it is not, replace the right-hand board of DOM201 (0138B7436G-1) or the entire module. If MACD is low, as it should be, and the relay still fails to trip, monitor pin 56 (MAC). This should be high (+10 volts). If it is not, remove DTM101. If the signal switches high (+12 volts with DTM101 removed), REPLACE DTM101. If not, REPLACE DLM101.

If MACD is low and MAC is high, but the relay still produces a trip output, monitor pin 14 (MACT). This signal should be normally low (zero volts) but should pulse high for approximately 220 milliseconds when SW2 is closed. If it does not, remove DLM101 from the extender and momentarily connect MAC (pin 56) to +12 volts (pin 2) using a jumper while monitoring MACT. If the signal pulses high, as it should, REPLACE DLM101. Otherwise, REPLACE DLM101.

b) DLM101 Logic: With DLM101 on a card extender, monitor pin 24 (UVOC). It should be low (approximately 0.6 volt) when there is no AC current applied (SW1 open) and should switch high (approximately 8 volts) when SW1 is closed. If it does not switch high, remove DLM101 from the extender. If the signal now switches high (+12 volts with DLM101 removed), REPLACE DLM101. Otherwise, proceed to step c).

c) Undervoltage Detector: With a card extender in the DLM position (module not inserted in extender), monitor pin 24 (UVOC). Remove DIM101. UVOC should be high (+12 volts). If it is not, REPLACE DVM101.

d) Overcurrent Detector: With all of the modules inserted, place DIM101 on a card extender and monitor pin 4 (IAS - AC signal) and pin 24 (UVOC). With SW1 closed, IAS should measure 0.41 volt RMS. If it does, and UVOC is still low, REPLACE DIM101. If IAS does not measure 0.41 volt RMS, proceed to the next step.

e) AC Current Signal: Place DFM101, 102 on a card extender and monitor pin 24 (IAS). With SW1 closed, it should measure 0.41 volt RMS as noted above. If it does not, remove DIM101. If that corrects the signal, REPLACE DIM101. If not, monitor pin 58 (IAP). It should also measure 0.41 volt RMS. If it does not, remove DFM101, 102 from the extender. If that corrects the IAP signal, REPLACE DFM101, 102. If not, REPLACE MGM110, 111, 112, or 113.

H1. Zone 2 Acceleration Test

1. Symptom: Relay does not trip in zone two; it trips only in zone one.

Probable Problem: The CHANNEL SIGNAL RECEIVED contact converter (CC1) may not be functioning, the logic in DTM101 may be faulty, the permissive zone may not be producing an output, or the zone two reach may be incorrect.

Suggested Approach: Use the specified test circuit and settings. Apply V_T = 40 volts and I_T = 4 amperes (five amp relay), or 0.8 ampere (one amp relay). Monitor the signals indicated in the following sequence:

a) CC1 Output Signal: Place DTM101 on a card extender and monitor pin 53 (RCVR). With DC connected to terminals AC9 and AC10, this signal should be low. If it is not, replace the left-hand board of DOM201 (0138B7410G-3) or the entire module.

b) Zone 2 Reach Control Signal: With DTM101 on a card extender, monitor pin 20 (Z2). This should be low (zero volts). If it is, proceed to the next step. If it is not, monitor pin 12 (Z3FLT). This signal should be high (+12 volts). If it is not, proceed to the next step. If it is high, and Z2 is not low, remove DVM101 and DMM101 and insert a jumper between pin 2 (+12 volts) and pin 12 on the DTM extender. If Z2 (pin 20) now becomes low, REPLACE DVM101. Otherwise, REPLACE DTM101.

c) Permissive Zone Output: Place DMM101 on a card extender and monitor pin 14 (Z3FLT). It should be high (+12 volts). If it is not, remove DTM101. If it switches high, REPLACE DTM101. Otherwise, proceed to the next step.

d) AC Signals for Permissive Zone: Using a card extender(s), measure the signals indicated below with a voltmeter and/or scope (preferably both). The values stated are the correct levels for the given operating conditions. For each module specified, one of the signals is assigned to be reference for the angle measurements. This is arbitrary. The angle measurements have been made using a scope and therefore are approximate.

DVM101 pin 51	(POL)	5.74VRMS	(16.2V p-p)	0^{o} (reference for angle)
40	(VZ3)	1.97VRMS	(5.6V p-p)	approx. 170^{o} lagging
DIM101 pin 34	(VZ3)	1.97VRMS	(5.6V p-p)	0^{o} (reference for angle)
37	(Z3OP)	3.72VRMS	(10.5V p-p)	approx. 10^{o} lagging
DMM101 pin 23	(POL)	5.74VRMS	(16.2V p-p)	0^{o} (reference for angle)
52	(Z3OP)	3.72VRMS	(10.5V p-p)	180^{o} out-of-phase

If all of the values listed above are correct and the permissive zone measuring unit is still not producing an output, REPLACE DMM101.

If VZ3 is incorrect, place DVM101 on a card extender and monitor that signal (pin 40). Remove DLM101 and DIM101 and connect the fault type control signal for A-G faults ($\overline{AG}$) to reference by connecting a jumper between pins 1 and 12 on the DVM extender. If the VZ3 signal is corrected, REPLACE DIM101. Otherwise, REPLACE DVM101.

Note: The removal of DLM101 and DIM101, and the insertion of the jumper on the DVM extender, may result in spurious operation of some of the relay functions. These may be disregarded, since the intent is to concentrate only on the VZ3 signal.

If VZ3 is correct and Z3OP is incorrect, place DMM101 on a card extender and monitor Z3OP (pin 52). Remove DLM101 and place DVM101 on a second card extender. Connect the fault type control signal for A-G faults ($\overline{AG}$) to reference by inserting a jumper between pins 1 and 12 on the DVM extender, as above. If that corrects the Z3OP signal, REPLACE DMM101. Otherwise, REPLACE DIM101.

2. Symptom: The relay trips when the NO CH TRIP switch is closed (right position) or when the BLOCK CHANNEL TRIP contact converter (CC2) is energized.

Probable Problem: The switch may be bad, the logic may be faulty, or the contact converter may not be producing an output.

Suggested Approach: Use the specified test circuit and settings. Apply V_T = 40 volts and I_T = 4 amperes (five amp relay), or 0.8 amperes (one amp relay). Monitor the signals indicated in the following sequence:

a) CC2 Output Signal: Place DTM101 on a card extender and monitor pin 27 (BKCHTR). With SW1 in the test circuit closed, this signal should be low (zero volts). If it is not, replace the left-hand board of DOM201 (0138B7410G-3) or the entire module.

b) NO CH TRIP Switch: With DTM101 still on a card extender, monitor pin 27 (BKCHTR) with SW1 in the test circuit open. The signal should be high (+12 volts) when the NO CH TRIP switch on the front of DTM101 is to the left, and low (zero volts) when it is to the right. If it is not, REPLACE DTM101.

If the relay continues to trip when the BKCHTR signal is low, REPLACE DTM101.

3. Symptom: The KEY TRANSMITTER contact does not close.

   Probable Problem: The logic in DTM101 is faulty, or the output relay in DOM201 is not functioning.

   Suggested Approach: Using the specified test circuit and settings, apply V_T = 40 volts and I_T = 4 amperes (five amp relay), or 0.8 amperes (one amp relay). Place DTM101 on a card extender and monitor pin 22. It should be low (approximately 0.6 volt). If it is not, REPLACE DTM101. If it is low, and the contacts still are not closing, the output relay is most likely faulty, and it is recommended that the the left-hand board of DOM201 (0138B7410G-3) or the entire module be replaced.

H2. Permissive Underreaching Transfer Tripping Tests

1. Symptom: The relay does not produce a channel trip in the permissive zone; it only trips in zone one.

   Probable Problem: CC1 may not be functioning, the logic may be faulty, or the permissive zone may not be producing an output.

   Suggested Approach: Using the specified test circuit and settings, apply V_T = 40 volts and I_T = 4 amperes (five amp relay), or 0.8 amperes (one amp relay). Monitor the signals indicated in the following sequence:

   a) CC1 Output: Check according to H1.1a.

   b) Permissive Zone Output: Check according to H1.1c.

   c) AC Signals for Permissive Zone: Check according to H1.1d.

2. Symptom: The relay trips when the NO CH TRIP switch is closed (right position) or when the BLOCK CHANNEL TRIP contact converter (CC2) is energized.

   Probable Problem: The switch may be bad, the logic may be faulty, or the contact converter may not be producing an output.

   Suggested Approach: Check according to H1.2.

3. Symptom: The KEY TRANSMITTER contact does not close.

   Probable Problem: The logic in DTM101 is faulty, or the output relay in DOM201 is not functioning.

   Suggested Approach: Check according to H1.3.

H3. Permissive Overreaching Transfer Tripping Tests

Much of the circuitry involved in the permissive overreaching scheme is the same as that used in the permissive underreaching scheme (CC1, CC2, permissive zone measuring unit, NO CH TRIP switch, KEY TRANSMITTER relay, target LEDs, etc.). The difference in the two schemes consists of small differences in the logic (DTM101 module) and in the factors that determine the reach settings (application considerations). For this reason, use the same troubleshooting procedures for the permissive overreaching scheme that were used for the permissive underreaching scheme.

I. Tests for Auxiliary Functions

1. Symptom: Relay will not trip three pole with SW3 in the test circuit closed.

   Probable Problem: The 3 POLE TRIP ENABLE contact converter (CC4) may not be functioning, or the logic in DLM101 may be faulty.

   Suggested Approach: Use the specified test circuit and settings. Place DLM101 on a card extender and monitor pin 21 (SPV3PT). It should be high (+10 volts) when SW3 in the test circuit is open, and low (zero volts) when SW3 is closed. If it is not low when SW3 is closed, replace the right-hand board of DOM201 (0138B7436G-1) or the entire module. If it is low, and the relay still does not trip three pole, REPLACE DLM101.

2. Symptom: Targets on DLM101 cannot be reset externally by SW5 in the test circuit.

   Probable Problem: The REMOTE TARGET RESET contact converter (CC8) may not be functioning, or the logic in DLM101 may be faulty.

   Suggested Approach: Use the specified test circuit and settings. Place DLM101 on a card extender and monitor pin 49 (TRR). It should be high (+10 volts) when SW5 in the test circuit is open, and low (zero volts) when SW5 is closed. If it is not low when SW5 is closed, replace the right-hand board of DOM201 (0138B7436G-1) or the entire module. If it is low, and the targets still do not reset, REPLACE DLM101.

   Note: When the RESET button on DLM101 is depressed, all of the target LEDs (except fuse failure) will light temporarily. When a remote reset such as SW5 is used, the targets should all blink on when the switch is first closed, and again when it is opened.

3. Symptom: Tripping cannot be blocked externally by SW4 in the test circuit.

   Probable Problem: The BLOCK TRIPPING contact converter may not be functioning, or the logic in DLM101 may be faulty.

Suggested Approach: Use the specified test circuit and settings. Place DLM101 on a card extender and monitor pin 22 (BLK). It should be high (+12 volts) when SW4 in the test circuit is open, and low (zero volts) when SW4 is closed. If it is not low when SW4 is closed, replace the right-hand board of DOM201 (0138B7436G-1) or the entire module. If it is low, and tripping still cannot be blocked, REPLACE DLM101.

J1. Automatic Reclosing: Two Attempts

1. Symptom: Reclosing cycle never gets underway. OPN LED on RLM101 does not light, RECLOSE IN PROGRESS contacts do not close, and the output reclosing contacts do not close.

   Probable Problem: The reclose initiate signal may not be getting through, the "b" switch contact converter (CC9) may not be functioning, there may be an erroneous inhibit signal, or the logic in RLM101 or RTM101 may be faulty.

   Suggested Approach: Use the specified test circuit and settings. For fault simulation, apply V_T = 20 volts, and I_T = 1.7 amperes (five amp relay), or 0.34 amperes (one amp relay). Monitor the signals indicated in the following sequence:

   a) Reclosing Supervision Signal: Place RTM101 on a card extender and monitor pin 36 (OKD). This should be low (approximately 0.6 volt). If it is not, proceed as follows:

      Remove RTM101 from extender - signal switches low, REPLACE RTM101
      - no change, check PL-1 cable continuity
      - cable OK, REPLACE DTM101.

   b) Reclose Initiate Signal: With RTM101 on a card extender, monitor pin 37 (AFD). It should be normally high (approximately +24 volts) and switch low (approximately 0.6 volt) when the distance relay gives a phase A trip output. It should remain low as long as fault current is applied. If it does not, remove RTM101 from the extender. If the signal switches low, REPLACE RTM101. If it does not, check cable PL-1 for continuity. The signal output from DTM101 in case A should be correct if the SLS successfully passed the distance relay tests.

   c) Reclose Blocking Signal: Place RLM101 on a card extender. An unintentionally low signal on any of the following three points will result in reclosing being blocked:

      pin 26 (INHIBIT)
      pin 57 (SYNC CK)
      pin 27 (RESET)

      If INHIBIT or RESET is low, remove ROM101. If the signal in question switches high (approximately 13 volts), REPLACE ROM101. If not, REPLACE RLM101.

If SYNC CK is low and the recloser includes an SVM module (set to DLDB for this test circuit), remove the SVM module. If the signal switches high, REPLACE SVM. If it remains low, REPLACE RLM101.

If SYNC CK is low and the recloser does not include an SVM101 module, REPLACE RLM101.

d) "b" Switch Input: It takes a closed "b" switch (breaker pole tripped open), and a reclose initiate signal, to begin the reclosing cycle. To check this for pole A (used in this test), place RLM101 on a card extender and monitor pin 24 (52^1/b). It should be high (approximately 13 volts) when SW2 and SW3 in the test circuit are open, and low (approximately 0.6 volt), when either is closed. If the signal fails to switch low, REPLACE ROM101.

The following checks (e through h) should be made with the recloser reset and the AC inputs removed from the distance relay to insure that tripping is not initiated.

e) Clock Signal: The oscillator in RTM101 must be functioning for proper operation of the recloser. To check the clock, leave RLM101 on an extender and monitor pin 51 (CKD) with a scope or frequency counter. It should be a square wave with a frequency of 1 KHZ (period of one millisecond) that switches between zero and +12 volts. If the clock signal is incorrect, remove RLM101 from the extender. If that corrects it, REPLACE RLM101. Otherwise, REPLACE RTM101.

f) Logic Level "b" Switch Signal: With RLM101 on an extender, monitor pin 21 (52OR). This should be low (zero volts) when SW2 and SW3 in the test circut are open, and high (+12 volts) when either is closed. If it does not switch high, remove RTM101. If that corrects the signal, REPLACE RTM101. If not, REPLACE RLM101.

g) DC Supervision Signals: With RLM101 on an extender, monitor pins 15 and 6 (PWRS and PWCLT, respectively). They should both be low (zero volts). If PWRS is not low, remove RTM101. If that corrects the signal, REPLACE RTM101. If not, REPLACE RLM101. If PWCLT is not low, REPLACE RLM101.

h) Internal Reset Signal: With RLM101 on an extender, monitor pin 46 (RSLD). It should be low (zero volts). If it is not, remove RLM101 from the extender. If that corrects the signal, REPLACE RLM101. if not, REPLACE RTM101.

If all of the above are correct, and the reclosing cycle stil fails to get underway, the problem is most likely within RLM101 or RTM101, but cannot be readily isolated to one of the two.

2. Symptom: The recloser cycles properly (OPN LED lights and goes out in specified sequence), but the output reclosing contacts do not close.

Probable Problem: The driver circuitry for the telephone relays in MGM310, 311 or 312 may be faulty.

Suggested Approach: Use the specified test circuit and settings. Apply V_T = 20 volts, and I_T = 1.7 amperes (five amp relay), or 0.34 amperes (one amp relay) for fault simulation. Monitor the signals indicated in the following sequence:

Reclosing Output Signal: Place RLM101 on a card extender and monitor pin 40 (RCA1). It should be normally high (approximately +24 volts) and switch low at the end of the reclosing time (five seconds in this case) for a duration of two seconds (dwell timer setting). If the signal follows this pattern and the output contacts still do not close, REPLACE MGM310, 311 or 312. If the signal is incorrect, but the OPN LED is lighting and going out as specified, REPLACE RLM101.

Note: The output reclosing contacts may be checked using contact monitors, as shown in the test circuit or, perhaps more easily by removing the front panel from the magnetics modules and visually monitoring them.

For the second shot three-pole reclose, monitor signals at pin 40 (RCA1), pin 10 (RCB1) and pin 37 (RCC1).

3. Symptom: The reclosing times are incorrect.

Probable Problem: The clock frequency may be wrong. If the times are off by a factor of ten, the multiplier switch signals may not be correct.

Suggested Approach: With DC only applied, monitor the signal indicated below:

a) Clock Signal: Check as described in J1.1e.

b) Single Pole Reclose Time Multiplier: Place RLM101 on a card extender and monitor pin 54 (X10-1). This should be low (zero volts) when the X1/X10, 1Ø switch on RLM101 is to the left, and high (+12 volts) when it is to the right. If it is incorrect REPLACE RLM101. If the times are still off by a factor of ten, REPLACE RTM101.

c) Three Pole Reclose Time Multiplier: Repeat step b above, except monitor pin 23 (X10-3).

4. Symptom: The distance relay always trips three pole when the recloser is connected, but trips single pole when the interconnection cable is disconnected.

Probable Problem: An erroneous "supervise three pole trip" signal is being produced by RLM101 or RTM101.

Suggested Approach: Use the specified test circuit and settings. For fault simulation, apply V_T = 20 volts, and I_T = 1.7 amperes (five amp relay), or 0.34 amperes (one amp relay). Place RLM101 on a card extender

and monitor pin 34 (SPV3PT). This signal should be normally high (+10 volts) and should switch low (approximately 0.6 volt) when the fault current is removed immediately following the first trip. If the distance relay is always tripping three pole, this signal will likely always be low. Remove AC, remove RTM101 and reset the recloser via the pushbutton on RLM101 after DC is applied. If SPV3PT switches high, REPLACE RTM101. If not, reinsert RTM101 and remove RLM101 from the extender. If the signal now switches high, REPLACE RLM101. If it still remains low, check the signal within the distance relay according to I.1.

5. Symptom: The recloser goes to lockout erroneously.

Probable Problem: (a) If this occurs immediately upon tripping, the problem is most likely in the RTM101 logic; (b) if it occurs at the end of the reclose time, the simulated "b" switch in the test circuit (SW2 or SW3) may not be opening during the dwell time, or the logic in RLM101 may be faulty; (c) if it occurs at the end of the reset time, the hold latch (#1) in RLM101 is not getting reset, and may be receiving an erroneous blocking signal.

Suggested Approach: For (a), REPLACE RTM101. For (b) check the test switch and make sure the dwell time is set to the maximum (two seconds). For (c), REPLACE RLM101.

LIST OF SCHEMATIC DIAGRAMS

FIG. NO.		
1	CDM101 and CTM101	0138D4714
2, 2A	DBM101	" 12G-3
3	DFM101, 102	" 08
4	DIM101	" 11
5	DLM101	" 09
6	DMM101	" 13
7, 7A	DOM201 (left)	" 10
8	DOM201 (right)	" 36
9, 9A	DSM101	" 12G-2
10,10A,10B	DTM101	" 03
11	DVM101	" 07
12	MGM110, 111, 112	0138B7754
13	310	" 57
14	311	" 58
15	312	" 59
16	401	" 60
17	402	" 61
18	PSM201	0138D4735
19	RLM101	" 01
20, 20A	ROM101	" 04
21,21A,21B	RTM101	" 00
22, 22A	SVM101	" 17

Printed Circuit Board for:

23	MGM110, 111, 112	0138D4738G-3
	310, 311, 321	" G-5

A_A-PSM201 (35)	R_A-DIM101 (11)	A_B-DBM101 (12G3)	PM_B-MGM310, 311, 312, 401, 402
B_A-DOM201 (right) (36)	T_A-DFM101,102 (08)	E_B-LOM101 or 102 (16)	
D_A-DOM201 (left) (10)	V_A-DVM101 (07)	G_B-CTM101 or CDM101 (14)	CM_B-MGM310, 311, 312, 401, 402
	PM_A-MGM110,111,112	K_B-SVM101 (17)	TP_{BS}-Case B Test Plug (system side)
F_A-DLM101 (09)	CM_A-MGM110,111,112	M_B-not used	
J_A-DTM101 (03)	TP_{AS}-Case A Test Plug (system side)	P_B-RLM101 (01)	TP_{BR}-Case B Test Plug (relay side)
L_A-DSM101 (12G2)	TP_{AR}-Case A Test Plug (relay side)	T_B-RTM101 (00)	TP_A-Case A Test Plug (both sides)
N_A-DMM101 (13)		V_B-ROM101 (04)	TP_B-Case B Test Plug (both sides)

Alphabetical Index of Wiring to Rear Terminal Board

Wire	Signal
AA1 - $B17_A$	LINE PICKUP CC3 (+)
2 - $B18_A$	LINE PICKUP CC3 (-)
3 - $B14_A$	3 POLE TRIP ENABLE CC4 (+)
4 - $B15_A$	3 POLE TRIP ENABLE CC4 (-)
5 - $B11_A$	PULL BACK EXTENDED ZONE ONE CC5 (+)
6 - $B12_A$	PULL BACK EXTENDED ZONE ONE CC5 (-)
7 - $B45_A$	ONE POLE OPEN CC6 (+)
8 - $B44_A$	ONE POLE OPEN CC6 (-)
9 - $B48_A$	BLOCK TRIPPING CC7 (+)
10 - $B47_A$	BLOCK TRIPPING CC7 (-)
11 - $B51_A$	REMOTE TARGET RESET CC8 (+)
12 - $B50_A$	REMOTE TARGET RESET CC8 (-)
AB1 - $D21_A$	KEY TRANSMITTER CONTACT LEAD
2 - $D51_A$	KEY TRANSMITTER CONTACT LEAD
3 - $D22_A$	CHANNEL SIGNAL RECEIVED CONTACT LEAD
4 - $D52_A$	CHANNEL SIGNAL RECEIVED CONTACT LEAD
5 - $B26_A$	CHANNEL TRIP ALARM CONTACT LEAD
6 - $B27_A$	CHANNEL TRIP ALARM CONTACT LEAD
7 - $B23_A$	ENABLE RECLOSING CONTACT LEAD
8 - $B24_A$	ENABLE RECLOSING CONTACT LEAD
9 - $B20_A$	A PHASE SELECTOR CONTACT LEAD
10 - $B21_A$	A PHASE SELECTOR CONTACT LEAD
11 - $B56_A$	B PHASE SELECTOR CONTACT LEAD
12 - $B57_A$	B PHASE SELECTOR CONTACT LEAD
13 - $B54_A$	C PHASE SELECTOR CONTACT LEAD
14 - $B53_A$	C PHASE SELECTOR CONTACT LEAD
AC1 - $D26_A$	OSCILLOGRAPH START CONTACT LEAD
2 - $D56_A$	OSCILLOGRAPH START CONTACT LEAD
5 - $D20_A$	OUT-OF-STEP BLOCK CONTACT LEAD
6 - $D50_A$	OUT-OF-STEP BLOCK CONTACT LEAD
7 - $D25_A$	FUSE FAILURE ALARM CONTACT LEAD
8 - $D55_A$	FUSE FAILURE ALARM CONTACT LEAD
9 - $D24_A$	CHANNEL SIGNAL RECEIVED CC1 (+)
10 - $D23_A$	CHANNEL SIGNAL RECEIVED CC1 (-)
11 - $D54_A$	BLOCK CHANNEL TRIP CC2 (+)
12 - $D53_A$	BLOCK CHANNEL TRIP CC2 (-)
13 - $D27_A$	BFI - ANY PHASE CONTACT LEAD
14 - $D57_A$	BFI - ANY PHASE CONTACT LEAD

A_A-PSM201 (35)	R_A-DIM101 (11)	A_B-DBM101 (12G3)	PM_B-MGM310, 311, 312, 401, 402
B_A-DOM201 (right) (36)	T_A-DFM101,102 (08)	E_B-LOM101 or 102 (16)	
D_A-DOM201 (left) (10)	V_A-DVM101 (07)	G_B-CTM101 or CDM101 (14)	CM_B-MGM310, 311, 312, 401, 402
	PM_A-MGM110,111,112	K_B-SVM101 (17)	TP_{BS}-Case B Test Plug (system side)
F_A-DLM101 (09)	CM_A-MGM110,111,112	M_B-not used	
J_A-DTM101 (03)	TP_{AS}-Case A Test Plug (system side)	P_B-RLM101 (01)	TP_{BR}-Case B Test Plug (relay side)
L_A-DSM101 (12G2)	TP_{AR}-Case A Test Plug (relay side)	T_B-RTM101 (00)	TP_A-Case A Test Plug (both sides)
N_A-DMM101 (13)		V_B-ROM101 (04)	TP_B-Case B Test Plug (both sides)

Alphabetical Index of Wiring to Rear Terminal Board

Wire	Signal
AD1 - $D17_A$	ZONE 1 TRIP ALARM CONTACT LEAD
2 - $D47_A$	ZONE 1 TRIP ALARM CONTACT LEAD
3 - $D16_A$	ZONE 2 TRIP ALARM CONTACT LEAD
4 - $D46_A$	ZONE 2 TRIP ALARM CONTACT LEAD
5 - $D15_A$	ZONE 3 TRIP ALARM CONTACT LEAD
6 - $D45_A$	ZONE 3 TRIP ALARM CONTACT LEAD
7 - $D14_A$	ZONE 4 TRIP ALARM CONTACT LEAD
8 - $D44_A$	ZONE 4 TRIP ALARM CONTACT LEAD
9 - $D19_A$	BFI - ØA CONTACT LEAD
10 - $D49_A$	BFI - ØA CONTACT LEAD
11 - $D18_A$	BFI - ØB CONTACT LEAD
12 - $D48_A$	BFI - ØB CONTACT LEAD
13 - $D28_A$	BFI - ØC CONTACT LEAD
14 - $D58_A$	BFI - ØC CONTACT LEAD
BA1 - $PM31_A$	PHASE A TRIP INDICATION CONTACT LEAD
2 - $PM44_A$	PHASE A TRIP INDICATION CONTACT LEAD
3 - $PM37_A$	PHASE B TRIP INDICATION CONTACT LEAD
4 - $PM50_A$	PHASE B TRIP INDICATION CONTACT LEAD
5 - $PM57_A$	PHASE C TRIP INDICATION CONTACT LEAD
6 - $PM70_A$	PHASE C TRIP INDICATION CONTACT LEAD
12 - $A10_A$	POWER SUPPLY ALARM CONTACT LEAD (OPEN WHEN OUT-OF-REGULATION)
13 - $A8_A$	POWER SUPPLY ALARM CONTACT LEAD (COMMON)
14 - $A12_A$	POWER SUPPLY ALARM CONTACT LEAD (CLOSED WHEN OUT-OF-REGULATION)
BB1 - $TP2_{AS}$	TRIP PHASE A CONTACT (1) LEAD
2 - $TP24_{AS}$	TRIP PHASE A CONTACT (1) LEAD
3 - $TP3_{AS}$	TRIP PHASE A CONTACT (2) LEAD
4 - $TP25_{AS}$	TRIP PHASE A CONTACT (2) LEAD
5 - $TP4_{AS}$	TRIP PHASE B CONTACT (1) LEAD
6 - $TP26_{AS}$	TRIP PHASE B CONTACT (1) LEAD
7 - $TP5_{AS}$	TRIP PHASE B CONTACT (2) LEAD
8 - $TP27_{AS}$	TRIP PHASE B CONTACT (2) LEAD
9 - $TP6_{AS}$	TRIP PHASE C CONTACT (1) LEAD
10 - $TP28_{AS}$	TRIP PHASE C CONTACT (1) LEAD
11 - $TP22_{AS}$	TRIP PHASE C CONTACT (2) LEAD
12 - $TP23_{AS}$	TRIP PHASE C CONTACT (2) LEAD
BC1 - BC5	INTERNAL JUMPER FOR AC VOLTAGE NEUTRAL
2 - $TP16_{AS}$	PHASE A PT INPUT
3 - $TP18_{AS}$	PHASE B PT INPUT

A_A-PSM201 (35)	R_A-DIM101 (11)	A_B-DBM101 (12G3)	PM_B-MGM310, 311, 312, 401, 402
B_A-DOM201 (right) (36)	T_A-DFM101,102 (08)	E_B-LOM101 or 102 (16)	
D_A-DOM201 (left) (10)	V_A-DVM101 (07)	G_B-CTM101 or CDM101 (14)	CM_B-MGM310, 311, 312, 401, 402
	PM_A-MGM110,111,112	K_B-SVM101 (17)	TP_{BS}-Case B Test Plug (system side)
F_A-DLM101 (09)	C_{MA}-MGM110,111,112	M_B-not used	
J_A-DTM101 (03)	TP_{AS}-Case A Test Plug (system side)	P_B-RLM101 (01)	TP_{BR}-Case B Test Plug (relay side)
L_A-DSM101 (12G2)	TP_{AR}-Case A Test Plug (relay side)	T_B-RTM101 (00)	TP_A-Case A Test Plug (both sides)
N_A-DMM101 (13)		V_B-ROM101 (04)	TP_B-Case B Test Plug (both sides)

Alphabetical Index of Wiring to Rear Terminal Board

Wire	Signal
BC4 - $TP20_{AS}$	PHASE C PT INPUT
5 - BC1	INTERNAL JUMPER FOR AC VOLTAGE NEUTRAL
6 - $TP17_{AS}$	PHASE A PT NEUTRAL
7 - $TP19_{AS}$	PHASE B PT NEUTRAL
8 - $TP21_{AS}$	PHASE C PT NEUTRAL
10 - $TP1_{AS}$	STATION BATTERY (+) INPUT
11 - $TP15_{AS}$	STATION BATTERY (-) INPUT
13 - $TP1_{AR}$-$PM9_A$-$PM10_A$-$PM22_A$	(+) DC CONTROL VOLTAGE
14 - $TP15_{AR}$-$PM12_A$-$PM13_A$-$PM25_A$	(-) DC CONTROL VOLTAGE
BD1 - $TP7_{AS}$	PHASE A CT INPUT
2 - $TP9_{AS}$	PHASE B CT INPUT
3 - $TP11_{AS}$	PHASE C CT INPUT
4 - $TP13_{AS}$	NEUTRAL CURRENT RETURN
5 - $TP8_{AS}$	PHASE A CT RETURN
6 - $TP10_{AS}$	PHASE B CT RETURN
7 - $TP12_{AS}$	PHASE C CT RETURN
8 - $TP14_{AS}$	NEUTRAL CURRENT INPUT
13 - $A6_A$	SURGE GROUND FOR POWER SUPPLY
CA1 - $G9_B$	GROUND TOC ALARM CONTACT LEAD (NORMALLY OPEN)
2 - $G5_B$	GROUND TOC ALARM CONTACT LEAD (COMMON)
3 - $G7_B$	GROUND TOC ALARM CONTACT LEAD (NORMALLY CLOSED)
4 - $E21_B$	LINE OVERLOAD ALARM CONTACT LEAD (NORMALLY OPEN)
5 - $E19_B$	LINE OVERLOAD ALARM CONTACT LEAD (COMMON)
6 - $E1_B$	LINE OVERLOAD ALARM CONTACT LEAD (NORMALLY CLOSED)
7 - $E27_B$	LINE OVERLOAD ALARM CONTACT LEAD (NORMALLY OPEN)
8 - $E25_B$	LINE OVERLOAD ALARM CONTACT LEAD (COMMON)
9 - $E23_B$	LINE OVERLOAD ALARM CONTACT LEAD (NORMALLY CLOSED)
CC1 - $V45_B$	NOT USED
2 - $V45_B$	NOT USED
3 - $V47_B$	NOT USED
4 - $V48_B$	NOT USED
5 - $V56_B$	NOT USED
6 - $V57_B$	NOT USED
7 - $V53_B$	NOT USED
8 - $V54_B$	NOT USED
13 - $V12_B$	RECLOSE OPERATION IN PROGRESS INDICATION CONTACT LEAD
14 - $V13_B$	RECLOSE OPERATION IN PROGRESS INDICATION CONTACT LEAD
CD1 - $V18_B$	52A/b CC9 (+)

A_A-PSM201 (35)	R_A-DIM101 (11)	A_B-DBM101 (12G3)	PM_B-MGM310, 311, 312, 401, 402
B_A-DOM201 (right) (36)	T_A-DFM101,102 (08)	E_B-LOM101 or 102 (16)	
D_A-DOM201 (left) (10)	V_A-DVM101 (07)	G_B-CTM101 or CDM101 (14)	CM_B-MGM310, 311, 312, 401, 402
	PM_A-MGM110,111,112	K_B-SVM101 (17)	TP_{BS}-Case B Test Plug (system side)
F_A-DLM101 (09)	CM_A-MGM110,111,112	M_B-not used	
J_A-DTM101 (03)	TP_{AS}-Case A Test Plug (system side)	P_B-RLM101 (01)	TP_{BR}-Case B Test Plug (relay side)
L_A-DSM101 (12G2)	TP_{AR}-Case A Test Plug (relay side)	T_B-RTM101 (00)	TP_A-Case A Test Plug (both sides)
N_A-DMM101 (13)		V_B-ROM101 (04)	TP_B-Case B Test Plug (both sides)

Alphabetical Index of Wiring to Rear Terminal Board

Wire	Signal
2 - $V19_B$	52B/b CC9 (+)
3 - $V20_B$	52C/b CC11 (+)
4 - $V21_B$	(-) FOR CC9, 10, 11
5 - $V23_B$	BLOCK RECLOSE CC15 (+)
6 - $V24_B$	BLOCK RECLOSE CC15 (-)
7 - $V50_B$	MANUAL CLOSE CC17 (+)
8 - $V51_B$	MANUAL CLOSE CC17 (-)
9 - $V26_B$	REMOTE RECLOSER RESET CC16 (+)
10 - $V27_B$	REMOTE RECLOSER RESET CC16 (-)
12 - $V41_B$	RECLOSER IN SERVICE INDICATION CONTACT LEAD (NORMALLY OPEN)
13 - $V42_B$	RECLOSER IN SERVICE INDICATION CONTACT LEAD (COMMOM)
14 - $V43_B$	RECLOSER IN SERVICE INDICATION CONTACT LEAD (NORMALLY CLOSED)
DA1 - $PM1_B$	RECLOSE POLE A CONTACT LEAD
2 - $PM14_B$	RECLOSE POLE A CONTACT LEAD
3 - $PM3_B$	RECLOSE POLE B CONTACT LEAD
4 - $PM16_B$	RECLOSE POLE B CONTACT LEAD
5 - $PM5_B$	RECLOSE POLE C CONTACT LEAD
6 - $PM18_B$	RECLOSE POLE C CONTACT LEAD
DB1 - $PM27_B$	NOT USED
2 - $PM40_B$	NOT USED
3 - $PM29_B$	NOT USED
4 - $PM42_B$	NOT USED
5 - $PM31_B$	NOT USED
6 - $PM44_B$	NOT USED
DC1 - $TP3_{BS}$	SYNC CK LINE VOLTAGE INPUT
2 - $TP4_{BS}$	SYNC CK LINE VOLTAGE NEUTRAL
3 - $TP5_{BS}$	SYNC CK BUS VOLTAGE INPUT
4 - $TP6_{BS}$	SYNC CK BUS VOLTAGE NEUTRAL
5 - $TP1_{BS}$	GROUND TOC POLARIZING VOLTAGE (NON-POLARITY MARK ON OPEN DELTA)
6 - $TP2_{BS}$	GROUND TOC POLARIZING VOLTAGE (POLARITY MARK ON OPEN DELTA)
13 - $PM9_B$-$PM10_B$-$PM22_B$	- NOT USED
14 - $PM12_B$-$PM13_B$-$PM25_B$	- NOT USED
DD1 - $TP9_{BS}$	3Io GROUND TOC OPERATING CURRENT RETURN
2 - $TP10_{BS}$	3Io GROUND TOC OPERATING CURRENT INPUT
3 - $TP11_{BS}$	LINE OVERLOAD CURRENT INPUT
4 - $TP12_{BS}$	LINE OVERLOAD CURRENT RETURN
5 - $TP13_{BS}$	GROUND TOC POLARIZING INPUT
6 - $TP14_{BS}$	GROUND TOC POLARIZING CURRENT RETURN

A_A-PSM201 (35)	R_A-DIM101 (11)	A_B-DBM101 (12G3)	PM_B-MGM310, 311, 312, 401, 402
B_A-DOM201 (right) (36)	T_A-DFM101,102 (08)	E_B-LOM101 or 102 (16)	
D_A-DOM201 (left) (10)	V_A-DVM101 (07)	G_B-CTM101 or CDM101 (14)	CM_B-MGM310, 311, 312, 401, 402
	PM_A-MGM110,111,112	K_B-SVM101 (17)	TP_{BS}-Case B Test Plug (system side)
F_A-DLM101 (09)	C_{MA}-MGM110,111,112	M_B-not used	
J_A-DTM101 (03)	TP_{AS}-Case A Test Plug (system side)	P_B-RLM101 (01)	TP_{BR}-Case B Test Plug (relay side)
L_A-DSM101 (12G2)	TP_{AR}-Case A Test Plug (relay side)	T_B-RTM101 (00)	TP_A-Case A Test Plug (both sides)
N_A-DMM101 (13)		V_B-ROM101 (04)	TP_B-Case B Test Plug (both sides)

Alphabetical Index of Wiring to Module Connectors - Case A

Wire	Signal
A1A-PINS 1, 30, 31, 60, ALL MODULES; BOTH CASES - PL1-1 - PL2-1 - PL3-1 - $PM89_A$-$PM98_A$-PM104A-E15B-$M48_B$-$P50_B$-$PM80_B$-$PM82_B$-$PM84_B$-$PM104_B$	(REF; OV)
A2A-PIN2 2 AND 32, ALL MODULES; BOTH CASES - PL1-2	(+12 VOLTS DC)
A4A-A34A-B3A-D3A-F3A-J54A-$N3_A$-$PM93_A$-PL1-15 - $E4_B$-$E14_B$-$G33_B$-$M28_B$-$M43_B$-$P28_B$-$T13_B$-$T43_B$-$V3_B$ - $PM100_B$-$PM101_B$	(+24 VOLTS DC, 1 AMP)
$A6_A$ - BD13	(SURGE GROUND FOR POWER SUPPLY)
$A8_A$ - BA13	(POWER SUPPLY ALARM CONTACT - COMMON)
$A10_A$ - BA12	(POWER SUPPLY ALARM CONTACT - OPEN)
$A12_A$ - BA14	(POWER SUPPLY ALARM CONTACT - CLOSED)
$A21_A$ - $PM103_A$	(+25 VOLTS DC, 0.2 AMP)
A23A-A53A-$PM23_A$	(+ STATION BATTERY DC)
$A25_A$ - $PM102_A$	(REFERENCE FOR +25 VOLTS DC, 0.2 AMP)
$A27_A$-$A57_A$-$PM26_A$	(- STATION BATTERY DC)
$A29_A$-PINS 29 AND 59, ALL MODULES; BOTH CASES - PL1-3	(-12 VOLTS DC)
$A30_A$ - SEE $A1_A$	(REF)
$A31_A$ - SEE $A1_A$	(REF)
$A34_A$ - SEE $A4_A$	(+24 VOLTS DC, 1 AMP)
$A53_A$ - SEE $A23_A$	(+ STATION BATTERY DC)
$A57_A$ - SEE $A27_A$	(- STATION BATTERY DC)
$A60_A$ - SEE $A1_A$	(REF)
$B3_A$ - SEE $A4_A$	(+24 VOLTS DC, 1 AMP)
$B4_A$-$N18_A$-PL-12-$P9_B$-M22B	(1PO: ONE POLE OPEN, LOW LOGIC)
$B5_A$ - $F22_A$	(BLK: BLOCK TRIPPING, LOW LOGIC)
$B6_A$ - $F49_A$	(TRR: REMOTE TARGET RESET, LOW LOGIC)
$B7_A$-$F55_A$-PL1-13-$P12_B$	(COF: LINE PICKUP CC/MANUAL CLOSE, LOW LOGIC)
$B8_A$-$F21_A$-PL1-9-$T33_B$-$P34_B$	(SPV3PT: SUPERVISE 3 POLE TRIP, LOW LOGIC)
$B9_A$-$J24_A$-PL1-4-$T3_B$-$P4_B$	(ZIED: PULL BACK EXTENDED ZONE 1, LOW LOGIC)
$B11_A$ - AA5	(PULL BACK EXTENDED ZONE 1 CC5 (+))
$B12_A$ - AA6	(PULL BACK EXTENDED ZONE 1 CC5 (-))
$B14_A$ - AA3	(3 POLE TRIP ENABLE CC4 (+))
$B15_A$ - AA4	(3 POLE TRIP ENABLE CC4 (-))
$B17_A$ - AA1	(LINE PICKUP CC3 (+))
$B18_A$ - AA2	(LINE PICKUP CC3 (-))
$B20_A$ - AB9	(A PHASE SELECTOR CONTACT LEAD)
$B21_A$ - AB10	(A PHASE SELECTOR CONTACT LEAD)

A_A-PSM201 (35)	R_A-DIM101 (11)	A_B-DBM101 (12G3)	PM_B-MGM310, 311, 312, 401, 402
B_A-DOM201 (right) (36)	T_A-DFM101,102 (08)	E_B-LOM101 or 102 (16)	
D_A-DOM201 (left) (10)	V_A-DVM101 (07)	G_B-CTM101 or CDM101 (14)	CM_B-MGM310, 311, 312, 401, 402
	PM_A-MGM110,111,112	K_B-SVM101 (17)	TP_{BS}-Case B Test Plug (system side)
F_A-DLM101 (09)	CM_A-MGM110,111,112	M_B-not used	
J_A-DTM101 (03)	TP_{AS}-Case A Test Plug (system side)	P_B-RLM101 (01)	TP_{BR}-Case B Test Plug (relay side)
L_A-DSM101 (12G2)	TP_{AR}-Case A Test Plug (relay side)	T_B-RTM101 (00)	TP_A-Case A Test Plug (both sides)
N_A-DMM101 (13)		V_B-ROM101 (04)	TP_B-Case B Test Plug (both sides)

Alphabetical Index of Wiring to Module Connectors - Case A

Wire	Signal
$B23_A$ - AB7	(ENABLE RECLOSING CONTACT LEAD)
$B24_A$ - AB8	(ENABLE RECLOSING CONTACT LEAD)
$B26_A$ - AB5	(CHANNEL TRIP ALARM CONTACT LEAD)
$B27_A$ - AB6	(CHANNEL TRIP ALARM CONTACT LEAD)
$B33_A$-$F28_A$-$J51_A$	(CHTR: CHANNEL TRIP RELAY AND TARGET DRIVER, LOW LOGIC)
$B34_A$ - $N54_A$	(CPD: C Ø-SEL RELAY DRIVER, LOW LOGIC)
$B35_A$-$J52_A$-PL1-5-$T36_B$	(OKD: ENABLE RECLOSING, RELAY DRIVER, LOW LOGIC)
$B36_A$ - $N7_A$	(APD: A Ø-SEL RELAY DRIVER, LOW LOGIC)
$B37_A$ - $N20_A$	(BPD: B Ø-SEL RELAY DRIVER, LOW LOGIC)
$B44_A$ - AA8	(ONE POLE OPEN CC6 (-))
$B45_A$ - AA7	(ONE POLE OPEN CC6 (+))
$B47_A$ - AA10	(BLOCK TRIPPING CC7 (-))
$B48_A$ - AA9	(BLOCK TRIPPING CC7 (+))
$B50_A$ - AA12	(REMOTE TARGET RESET CC8 (-))
$B51_A$ - AA11	(REMOTE TARGET RESET CC8 (+))
$B53_A$ - AB14	(C PHASE SELECTOR CONTACT LEAD)
$B54_A$ - AB13	(C PHASE SELECTOR CONTACT LEAD)
$B56_A$ - AB11	(B PHASE SELECTOR CONTACT LEAD)
$B57_A$ - AB12	(B PHASE SELECTOR CONTACT LEAD)
$CM1_A$ - $TP7_{AR}$	(PHASE A CT INPUT)
$CM2_A$ - $TP9_{AR}$	(PHASE B CT INPUT
$CM3_A$ - $TP8_{AR}$	(PHASE A CT RETURN)
$CM4_A$ - $TP10_{AR}$	(PHASE B CT RETURN)
$CM5_A$ - $TP11_{AR}$	(PHASE C CT RETURN)
$CM6_A$ - $TP13_{AR}$	(NEUTRAL CURRENT RETURN)
$CM7_A$ - $TP12_{AR}$	(PHASE C CT REUTRN)
$CM8_A$ - $TP14_{AR}$	(NEUTRAL CURRENT INPUT)
$D3_A$ - SEE $A4_A$	(+24 VOLTS DC, 1 AMP)
$D4_A$ - $F40_A$	(BFIR: BFI - ANY PHASE RELAY DRIVER, LOW LOGIC)
$D5_A$ - $F33_A$	(ZTR: OSCILLOGRAPH START RELAY DRIVER, LOW LOGIC)
$D6_A$ -$J53_A$	(RCVR: CHANNEL SIGNAL RECEIVED, LOW LOGIC)
$D7_A$ - $J22_A$	(SEND: KEY TRANSMITTER RELAY DRIVER, LOW LOGIC)
$D8_A$-$F9_A$-PL1-8-$T37_B$	(AFD: BFI - ØA RELAY DRIVER, LOW LOGIC)
$D9_A$ - $F7_A$	(Z2TR: ZONE 2 TRIP RELAY AND TARGET DRIVER, LOW LOGIC)
$D10_A$ - $F34_A$	(Z4TR: ZONE 4 TRIP RELAY AND TARGET DRIVER, LOW LOGIC)
$D14_A$ - AD7	(ZONE 4 TRIP ALARM CONTACT LEAD)
$D15_A$ - AD5	(ZONE 3 TRIP ALARM CCONTACT LEAD)

A_A-PSM201 (35)	R_A-DIM101 (11)	A_B-DBM101 (12G3)	PM_B-MGM310, 311, 312, 401, 402
B_A-DOM201 (right) (36)	T_A-DFM101,102 (08)	E_B-LOM101 or 102 (16)	
D_A-DOM201 (left) (10)	V_A-DVM101 (07)	G_B-CTM101 or CDM101 (14)	CM_B-MGM310, 311, 312, 401, 402
	PM_A-MGM110,111,112	K_B-SVM101 (17)	TP_{BS}-Case B Test Plug (system side)
F_A-DLM101 (09)	CM_A-MGM110,111,112	M_B-not used	
J_A-DTM101 (03)	TP_{AS}-Case A Test Plug (system side)	P_B-RLM101 (01)	TP_{BR}-Case B Test Plug (relay side)
L_A-DSM101 (12G2)	TP_{AR}-Case A Test Plug (relay side)	T_B-RTM101 (00)	TP_A-Case A Test Plug (both sides)
N_A-DMM101 (13)		V_B-ROM101 (04)	TP_B-Case B Test Plug (both sides)

Alphabetical Index of Wiring to Module Connectors - Case A

Wire	Signal
$D16_A$ - AD3	(ZONE 2 TRIP ALARM CONTACT LEAD)
$D17_A$ - AD1	(ZONE 1 TRIP ALARM CONTACT LEAD)
$D18_A$ - AD11	(BFI - ØB CONTACT LEAD)
$D19_A$ - AD9	(BFI - ØA CONTACT LEAD)
$D20_A$ - AC5	(OUT-OF-STEP BLOCK CONTACT LEAD)
$D21_A$ - AB1	(KEY TRANSMITTER CONTACT LEAD)
$D22_A$ - AB3	(CHANNEL SIGNAL RECEIVED CONTACT LEAD)
$D23_A$ - AC10	(CHANNEL SIGNAL RECEIVED CC1 (-))
$D24_A$ - AC9	(CHANNEL SIGNAL RECEIVED CC1 (+))
$D25_A$ - AC7	(FUSE FAILURE ALARM CONTACT LEAD)
$D26_A$ - AC1	(OSCILLOGRAPH START CONTACT LEAD)
$D27_A$ - AC13	(BFI - ANY PHASE CONTACT LEAD
$D28_A$ - AD13	(BFI ØC CONTACT LEAD)
$D33_A$-$F10_A$-PL1-6-$T38_B$	(CFD: BFI ØC RELAY DRIVER, LOW LOGIC)
$D34_A$ - $F11_A$	(FFR: FUSE FAILURE RELAY AND TARGET DRIVER, LOW LOGIC)
$D35_A$ - $J23_A$	(CHSP: STOP TRANSMITTER RELAY DRIVER, LOW LOGIC)
$D36_A$ - $J27_A$	(CKCHTR: BLOCK CHANNEL TRIP CC, LOW LOGIC)
$D37_A$ - $N49_A$	(SOBR: OUT-OF-STEP BLOCK RELAY AND TARGET DRIVER, LOW LOGIC)
$D38_A$-$F39_A$-PL1-7-$T7_B$	(BFD: BFI ØB RELAY DRIVER, LOW LOGIC)
$D39_A$ - $F36_A$	(A1TR: ZONE 1 TRIP RELAY AND TARGET DRIVER, LOW LOGIC)
$D40_A$ - $F4_A$	(Z3TR: ZONE 3 TRIP RELAY AND TARGET DRIVER, LOW LOGIC)
$D44_A$ - AD8	(ZONE 4 TRIP ALARM CONTACT LEAD)
$D45_A$ - AD6	(ZONE 3 TRIP ALARM CONTACT LEAD)
$D46_A$ - AD4	(ZONE 2 TRIP ALARM CONTACT LEAD)
$D47_A$ - AD2	(ZONE 4 TRIP ALARM CONTACT LEAD)
$D48_A$ - AD12	(BFI - ØB CONTACT LEAD)
$D49_A$ - AD10	(BFI - ØA CONTACT LEAD)
$D50_A$ - AC6	(OUT-OF-STEP BLOCK CONTACT LEAD)
$D51_A$ - AB2	(KEY TRANSMITTER CONTACT LEAD)
$D52_A$ - AB4	(CHANNEL SIGNAL RECEIVED CONTACT LEAD)
$D53_A$ - AC12	(BLOCK CHANNEL TRIP CC2 (-))
$D54_A$ - AC11	(BLOCK CHANNEL TRIP CCW (+))
$D55_A$ - AC8	(FUSE FAILURE ALARM CONTACT LEAD)
$D56_A$ - AC2	(OSCILLOGRAPH START CONTACT LEAD)
$D57_A$ - AC14	(BFI - ANY PHASE CONTACT LEAD)
$D58_A$ - AD14	(BFI - ØC CONTACT LEAD)

A_A-PSM201 (35)	R_A-DIM101 (11)	A_B-DBM101 (12G3)	PM_B-MGM310, 311, 312, 401, 402
B_A-DOM201 (right) (36)	T_A-DFM101,102 (08)	E_B-LOM101 or 102 (16)	
D_A-DOM201 (left) (10)	V_A-DVM101 (07)	G_B-CTM101 or CDM101 (14)	CM_B-MGM310, 311, 312, 401, 402
	PM_A-MGM110,111,112	K_B-SVM101 (17)	TP_{BS}-Case B Test Plug (system side)
F_A-DLM101 (09)	CM_A-MGM110,111,112	M_B-not used	
J_A-DTM101 (03)	TP_{AS}-Case A Test Plug (system side)	P_B-RLM101 (01)	TP_{BR}-Case B Test Plug (relay side)
L_A-DSM101 (12G2)	TP_{AR}-Case A Test Plug (relay side)	T_B-RTM101 (00)	TP_A-Case A Test Plug (both sides)
N_A-DMM101 (13)		V_B-ROM101 (04)	TP_B-Case B Test Plug (both sides)

Alphabetical Index of Wiring to Module Connectors - Case A

Wire	Signal
$F4_A$ - $D40_A$	(Z3TR: ZONE 3 TRIP RELAY AND TARGET DRIVER, LOW LOGIC)
$F5_A$ - $PM79_A$	(AFR: PHASE A TRIP OUTPUT RELAY DRIVER, LOW LOGIC)
$F6_A$ - $PM80_A$	(CFR: PHASE C TRIP OUTPUT RELAY DRIVER, LOW LOGIC)
$F7_A$ - $D9_A$	(Z2TR: ZONE 2 TRIP RELAY AND TARGET DRIVER, LOW LOGIC)
$F8_A$-$R19_A$-$L5_A$-PL3-6-$A6_B$	(UCSA: ØA UNDERCURRENT SUPERVISION, HIGH LOGIC)
$F9_A$ - SEE $D8_A$	(AFD: BFI - ØA RELAY DRIVER, LOW LOGIC)
$F10_A$ - SEE $D33_A$	(CFD: BFI - ØC RELAY DRIVER, 'OW LOGIC)
$F11_A$ - $D34_A$	(FFRD: FUSE FAILURE RELAY AND TARGET DRIVER, LOW LOGIC)
$F12_A$ - $J58_A$	(Z3TAR: ZONE 3 TARGET READY, HIGH LOGIC)
$F13_A$ - $N8_A$	(MU: MAIN MEASURING UNIT OUTPUT, HIGH LOGIC)
$F14_A$ - $J3_A$	(MACT: MANUAL CLOSE/LINE PICKUP TIMER OUTPUT, "IGH LOGIC)
$F15_A$ - $J55_A$	(Z4: TIMER ADVANCED TO FOURTH ZONE, HIGH LOGIC)
$F16_A$-$L21_A$-$N19_A$	(A: A Ø-SEL OUTPUT, HIGH LOGIC)
$F17_A$-$L52_A$-$N21_A$	(C: C Ø-SEL OUTPUT, HIGH LOGIC)
$F18_A$-PL1-11-M19B-$P7_B$	(COFD: CLOSE ONTO A FAULT, LOW LOGIC)
$F19_A$-$R25_A$-$V12_A$-$V42_A$	(AG: A Ø-SEL ONLY, INVERSE LOGIC)
$F20_A$-$R28_A$-$V22_A$-$V52_A$	(CG: C Ø-SEL ONLY, INVERSE LOGIC)
$F21_A$ - SEE $B8_A$	(SPV3PT: SUPERVISE 3 ~OLE TRIP , LOW LOGIC)
$F22_A$ - $B5_A$	(BLK: BLOCK TRIPPING, LOW LOGIC)
$F23_A$ - $J42_A$	(Z1FLT: FAULT IN ZONE 1, HIGH LOGIC)
$F24_A$-$R24_A$-$V21_A$	(UVOC: UNDERVOLTAGE AND OVERCURRENT, HIGH LOGIC)
$F25_A$-PL1-10-A4B-G3B-P11B-$M20_B$	(TRIP: DIRECT 3 POLE TRIP, LOW LOGIC)
$F26_A$ - $N10_A$	(PPL: CHANGE IN NUMBER OF Ø-SEL'S PICKED UP, HIGH PULSE)
$F27_A$-$R21_A$-$V11_A$-$V41_A$	(AB: A AND B Ø-SEL'S, INVERSE LOGIC)
$F28_A$ - SEE $B33_A$	(CHTAR: CHANNEL TRIP RELAY AND TARGET DRIVER, 'OW LOGIC)
$F33_A$ - $D5_A$	(ZTR: OSCILLOGRAPH START RELAY DRIVER, 'OW LOGIC)
$F34_A$ - $D10_A$	(Z4TR: ZONE 4 TRIP RELAY AND TARGET DRIVER, LOW LOGIC)
$F35_A$ - $PM92_A$	(BFR: PHASE B TRIP OUTPUT RELAY DRIVER, LOW LOGIC)
$F36_A$ - $D39_A$	(Z1TR: ZONE 1 TRIP RELAY AND TARGET DIRVER, LOW LOGIC)
$F37_A$-$L38_A$-$R44_A$-PL3-7-$A38_B$	(UCSB: ØB UNDERCURRENT SUPERVISION, HIGH LOGIC)
$F38_A$-$R18_A$-$L45_A$-PL3-8-$A45_B$	(UCSC: ØC UNDERCURRENT SUPERVISION, GH LOGIC)
$F39_A$ - SEE $D38_A$	(BFD: BFI - ØB RELAY DRIVER, LOW LOGIC)
$F40_A$ - $D4_A$	(BFIR: BFI - ANY PHASE RELAY DRIVER, LOW LOGIC)
$F41_A$ - $J19_A$	(Z2TAR: ZONE 2 TARGET READY, HIGH LOGIC)
$F42_A$-$L40_A$-$N12_A$	(CKCT: 18.0/21.6KHZ CLOCK, SQUARE WAVE)
$F43_A$ - $J11_A$	(CHTR: CHANNEL TRIP, HIGH LOGIC)
$F44_A$ - $N38_A$	(MUSP: MEASRUING UNIT SUPERVISION, HIGH LOGIC)

A_A-PSM201 (35)	R_A-DIM101 (11)	A_B-DBM101 (12G3)	PM_B-MGM310, 311, 312, 401, 402
B_A-DOM201 (right) (36)	T_A-DFM101,102 (08)	E_B-LOM101 or 102 (16)	
D_A-DOM201 (left) (10)	V_A-DVM101 (07)	G_B-CTM101 or CDM101 (14)	CM_B-MGM310, 311, 312, 401, 402
	PM_A-MGM110,111,112	K_B-SVM101 (17)	TP_{BS}-Case B Test Plug (system side)
F_A-DLM101 (09)	CM_A-MGM110,111,112	M_B-not used	
J_A-DTM101 (03)	TP_{AS}-Case A Test Plug (system side)	P_B-RLM101 (01)	TP_{BR}-Case B Test Plug (relay side)
L_A-DSM101 (12G2)	TP_{AR}-Case A Test Plug (relay side)	T_B-RTM101 (00)	TP_A-Case A Test Plug (both sides)
N_A-DMM101 (13)		V_B-ROM101 (04)	TP_B-Case B Test Plug (both sides)

Alphabetical Index of Wiring to Module Connectors - Case A

Wire	Signal
$F45_A$ - $N44_A$	(3PD: START OUT-OF-STEP TIMER, HIGH LOGIC)
$F46_A$-$L22_A$-$N51_A$	(B: B Ø-SEL OUTPUT, HIGH LOGIC)
$F47_A$ - $N11_A$	(P: TWO Ø-SEL'S PICKED-UP, HIGH LOGIC)
$F48_A$ - $V3_A$	(FF: FUSE FAILURE, HIGH LOGIC)
$F49_A$ - $B6_A$	(TRR: REMOTE TARGET RESET, LOW LOGIC)
$F50_A$-$R57_A$-$V20_A$-$V50_A$	(BG: B Ø-SEL ONLY, INVERSE LOGIC)
$F51_A$ - $J17_A$	(BFI: BFI - ANY PHASE (TRIP BUS), HIGH LOGIC)
$F52_A$ - $J48_A$	(OK: TIMER IN FIRST ZONE - OK TO RECLOSE, HIGH LOGIC)
$F53_A$ - $L51_A$	(DU: DIRECTIONAL UNIT OUTPUT, HIGH LOGIC)
$F54_A$ - $J57_A$	(ZT: START ZONE TIMER, HIGH LOGIC)
$F55_A$ - SEE $B7_A$	(MACD: LINE PICKUP CC/MANUAL CLOSE, LOW LOGIC)
$F56_A$ - $J38_A$	(MAC: INVERSE OF MACD (B7A), HIGH LOGIC)
$F57_A$-$R27_A$-$V8_A$-$V38_A$	(CA: C AND A Ø-SEL'S, INVERSE LOGIC)
$F58_A$-$R56_A$-$V9_A$-$V39_A$	(BC: B AND C Ø-SEL'S, INVERSE LOGIC)
$J3_A$ - $F14_A$	(MACT: MANUAL CLOSE/LINE PICKUP TIMER OUTPUT, HIGH LOGIC)
$J5_A$ - $N36_A$	(80: 80 MSEC SEQUENTIAL TRIP TIME, HIGH LOGIC)
$J6_A$ - $N34_A$	(20: 20 MSEC SEQUENTIAL TRIP TIME, HIGH LOGIC)
$J7_A$ - $N35_A$	(40: 40 MSEC SEQUENTIAL TRIP TIME, HIGH LOGIC)
$J11_A$ - $F43_A$	(CHTR: CHANNEL TRIP, HIGH LOGIC)
$J12_A$ - $N14_A$	(Z3FLT: PERMISSIVE ZONE MEASURING UNIT OUTPUT, HIGH LOGIC)
$J13_A$-PL3-2-$A22_B$	(BVB: ØB MB UNIT OUTPUT, HIGH LOGIC)
$J14_A$-$N17_A$	(CK2K: 2 KHZ CLOCK, LOW-GOING PULSES)
$J15_A$-$L33_A$-PL3-9-$A33_B$	(TRPW; DC POWER CLEAR, LOW PULSE)
$J16_A$ - $N46_A$	(ZTP: ZONE TIMER ADVANCING A ZONE, HIGH PULSE)
$J17_A$ - $F51_A$	(BFI: BFI - ANY PHASE (TRIP BUS), HIGH LOGIC)
$J19_A$ - $F41_A$	(Z2TAR: ZONE 2 TARGET READY, HIGH LOGIC)
$J20_A$ - $V48_A$	(Z2: RELAY MEASURING IN ZONE 2, INVERSE LOGIC)
$J22_A$ - $D7_A$	(SEND: KEY TRANSMITTER RELAY DRIVER, LOW LOGIC)
$J23_A$ - $D35_A$	(CHSP: STOP TRANSMITTER RELAY DRIVER, LOW LOGIC)
$J24_A$ - SEE $B9_A$	(ZEID: PULL BACK EXTENDED ZONE 1, LOW LOGIC)
$J25_A$ - $N9_A$	(Z1B: STANDBY OR SEQUENTIAL TRIP TIME IN PROGRESS, HIGH LOGIC)
$J26_A$ - $V57_A$	(Z1X: RELAY MEASURING IN EXTENDED ZONE 1, INVERSE LOGIC)
$J27_A$ - $D36_A$	(BKCHTR: BLOCK CHANNEL TRIP, LOW LOGIC)
$J33_A$-PL3-10-$A34_B$	(CK1K: 1 KHZ CLOCK, HIGH PULSES)
$J34_A$ - $N5_A$	(200: 200 MILLISECOND SEQUENTIAL TRIP TIME, HIGH LOGIC)
$J35_A$ - $N6_A$	(100: 100 MILLISECOND SEQUENTIAL TRIP TIME, HIGH LOGIC)
$J36_A$ - $N4_A$	(10: 10 MILLISECOND SEQUENTIAL TRIP TIME, HIGH LOGIC)

A_A-PSM201 (35)	R_A-DIM101 (11)	A_B-DBM101 (12G3)	PM_B-MGM310, 311, 312, 401, 402
B_A-DOM201 (right) (36)	T_A-DFM101,102 (08)	E_B-LOM101 or 102 (16)	
D_A-DOM201 (left) (10)	V_A-DVM101 (07)	G_B-CTM101 or CDM101 (14)	CM_B-MGM310, 311, 312, 401, 402
	PM_A-MGM110,111,112	K_B-SVM101 (17)	TP_{BS}-Case B Test Plug (system side)
F_A-DLM101 (09)	C_{MA}-MGM110,111,112	M_B-not used	
J_A-DTM101 (03)	TP_{AS}-Case A Test Plug (system side)	P_B-RLM101 (01)	TP_{BR}-Case B Test Plug (relay side)
L_A-DSM101 (12G2)	TP_{AR}-Case A Test Plug (relay side)	T_B-RTM101 (00)	TP_A-Case A Test Plug (both sides)
N_A-DMM101 (13)		V_B-ROM101 (04)	TP_B-Case B Test Plug (both sides)

Alphabetical Index of Wiring to Module Connectors - Case A

Wire	Signal
$J38_A$ - $F56_A$	(MAC: INVERSE OF MACD ($B7_A$), HIGH LOGIC)
$J42_A$ - $F23_A$	(Z1FLT: FAULT IN ZONE 1, HIGH LOGIC)
$J44_A$-PL3-3-$A52_B$	(BVC: ØC MB UNIT OUTPUT, HIGH LOGIC)
$J46_A$-PL3-5-$A21_B$	(BVA: ØA MB UNIT OUTPUT, HIGH LOGIC)
$J48_A$ - $F52_A$	(OK: TIMER IN FIRST ZONE - OK TO RECLOSE, HIGH LOGIC)
$J49_A$ - $V18_A$	(Z3: RELAY MEASURING IN ZONE 3, INVERSE LOGIC)
$J50_A$ - $J24_A$	(Z1: RELAY MEASURING IN ZONE 1, INVERSE LOGIC)
$J51_A$ - SEE $B33_A$	(CHTAR: CHANNEL TRIP RELAY AND TARGET DRIVER, LOW LOGIC)
$J52_A$ - $B35_A$	(OKD: OK TO RECLOSE RELAY DRIVER, LOW LOGIC)
$J53_A$ - $D6_A$	(RCVR: CHANNEL SIGNAL RECEIVED, LOW LOGIC)
$J54_A$ - SEE $A4_A$	(_24 VOLTS DC, 1 AMP)
$J55_A$ - $F15_A$	(Z4: TIMER ADVANCED TO FOURTH ZONE, HIGH LOGIC)
$J57_A$ - $F54_A$	(ZT: START ZONE TIMER, HIGH LOGIC)
$J58_A$ - $F12_A$	(Z3TAR; ZONE 3 TARGET READY, HIGH LOGIC)
$L5_A$-$L41_A$-$R22_A$-$T15_A$-$V13_A$-$V35_A$-PL2-4-A5B-$A41_B$	(-VAIM: *)
$L6_A$ - SEE $F8_A$	(UCSA; ØA UNDERCURRENT SUPERVISION, HIGH LOGIC)
$L7_A$-$L48_A$-$R15_A$-$T47_A$-$V49_A$-PL2-5-A7B-A48B	(-VBIM: **)
$L8_A$ - $L39_A$	(BIN: BLOCKS INTO B Ø-SEL COINCIDENCE TIMER)
$L9_A$ - $L34_A$	(AIN: BLOCKS INTO A Ø-SEL COINCIDENCE TIMER)
$L10_A$ - $L47_A$	(DUIN: BLOCKS INTO DIRECTIONAL UNIT COINCIDENCE TIMER)
$L11_A$-$T22_A$-$TR3_A$-$V26_A$-PL2-7-$A11_B$	(VAN: ØA - NEUTRAL VOLTAGE, AC SIGNAL)
$L12_A$ - $L17_A$	(TVA: RESTRAINT VOLTAGE FOR A Ø-SEL, AC SIGNAL)
$L13_A$ - $L36_A$	(OPA: NOT OPERATING QUANTITY FOR A Ø-SEL, AC SIGNAL)
$L14_A$-$L25_A$-$R14_A$-$T46_A$-$V19_A$-PL2-6-A14B-$A26_B$	(-VCIM: ***)
$L16_A$-$V34_A$-$V43_A$-$T15_A$-$T48_A$	(-IA2: NON-SEQUENTIAL CURRENT SIGNAL REFERENCED TO ØA, AC SIGNAL)
$L17_A$ - $L12_A$	(TVA: RESTRAINT VOLTAGE FOR A Ø-SEL, AC SIGNAL)
$L18_A$ - $L23_A$	(TVB: RESTRAINT VOLTAGE FOR B Ø-SEL, AC SIGNAL)
$L19_A$-$T41_A$-$T52_A$-$V56_A$-PL2-8-$A19_B$	(VBN: ØB-NEUTRAL VOLTAGE, AC SIGNAL)
$L20_A$ - $L43_A$	(CIN: BLOCKS INTO C Ø-SEL COINCIDENCE TIMER)
$L21_A$ - SEE $F16_A$	(A: A Ø-SEL OUTPUT, HIGH LOGIC)
$L22_A$ - SEE $F46_A$	(B: B Ø-SEL OUTPUT, HIGH LOGIC)
$L23_A$ - $L18_A$	(TVB: RESTRAINT VOLTAGE FOR B Ø-SEL, AC SIGNAL)
$L24_A$ - $L55_A$	(TVC: RESTRAINT VOLTAGE FOR C Ø-SEL, AC SIGNAL)
$L25_A$ - $R38_A$	(IZC: OPERATING QUANTITY FOR C Ø-SEL COINCIDENCE TIMER)

*Positive sequence voltage with memory reference to ØA, AC signal.
**Positive sequence voltage with memory reference to ØB, AC signal.
***Positive sequence voltage with memory reference to ØC, AC signal.

A_A-PSM201 (35)	R_A-DIM101 (11)	A_B-DBM101 (12G3)	PM_B-MGM310, 311, 312, 401, 402
B_A-DOM201 (right) (36)	T_A-DFM101,102 (08)	E_B-LOM101 or 102 (16)	
D_A-DOM201 (left) (10)	V_A-DVM101 (07)	G_B-CTM101 or CDM101 (14)	CM_B-MGM310, 311, 312, 401, 402
	PM_A-MGM110,111,112	K_B-SVM101 (17)	TP_{BS}-Case B Test Plug (system side)
F_A-DLM101 (09)	CM_A-MGM110,111,112	M_B-not used	
J_A-DTM101 (03)	TP_{AS}-Case A Test Plug (system side)	P_B-RLM101 (01)	TP_{BR}-Case B Test Plug (relay side)
L_A-DSM101 (12G2)	TP_{AR}-Case A Test Plug (relay side)	T_B-RTM101 (00)	TP_A-Case A Test Plug (both sides)
N_A-DMM101 (13)		V_B-ROM101 (04)	TP_B-Case B Test Plug (both sides)

Alphabetical Index of Wiring to Module Connectors - Case A

Wire	Signal
$L26_A$ - SEE $L14_A$	(-VCIM: POSITIVE SEQUENCE VOLTAGE WITH MEMORY, REFERENCED TO ØC, AC SIGNAL)
$L33_A$ - SEE $J15_A$	(TRPW: DC POWER CLEAR, LOW PULSE)
$L35_A$ - $L9_A$	(AIN: BLOCKS INTO A Ø-SEL COINCIDENCE TIMER)
$L36_A$ - $L13_A$	(OPA: NET OPERATING QUANTITY FOR A Ø-SEL, AC SIGNAL)
$L37_A$ - $L50_A$	(OPB: NET OPERATING QUANTITY FOR B Ø-SEL, AC SIGNAL)
$L38_A$ - SEE $F37_A$	(UCSB: ØB UNDERCURRENT SUPERVISION, HIGH LOGIC)
$L39_A$ - $L8_A$	(BIN: BLOCKS INTO B Ø-SEL COINCIDENCE TIMER)
$L40_A$ - SEE $F42_A$	(CKCT: 18.0/21.6 KHZ CLOCK, SQUARE WAVE)
$L41_A$ - SEE $L5_A$	(-VAIM: POSITIVE SEQUENCE VOLTAGE WITH MEMORY, REFERENCED TO ØA, AC SIGNAL)
$L42_A$ - $R35_A$	(IZA: OPERATING QUANTITY FOR A Ø-SEL, AC SIGNAL)
$L45_A$ - SEE $F38_A$	(UCSC: ØC UNDERCURRENT SUPERVISION, HIGH LOGIC)
$L46_A$ - $T35_A$	(VA2-IA2: POLARIZING QUANTITY FOR DIRECTIONAL UNIT, AC SIGNAL)
$L47_A$ - $L10_A$	(DUIN: BLOCKS INTO DIRECTIONAL UNIT CONCIDENCE TIMER)
$L48_A$ - SEE $L7_A$	(-VBIM: POSITIVE SEQUENCE VOLTAGE WITH MEMORY, REFERENCED TO ØB, AC SIGNAL)
$L50_A$ - $L37_A$	(OPB: NET OPERATING QUANTITY FOR B Ø-SEL, AC SIGNAL)
$L51_A$ - $F53_A$	(DU: DIRECTIONAL UNIT OUTPUT, HIGH LOGIC)
$L52_A$ - SEE $F17_A$	(C: C Ø-SEL OUTPUT, HIGH LOGIC)
$L53_A$ -$R39_A$	(IZB: OPERATING QUANTITY FOR B Ø-SEL, AC SIGNAL)
$L54_A$-$T4_A$-$T21_A$-$V25_A$-$\overline{PL2-9}$-$A54_B$	(VCN: ØC-NEUTRAL VOLTAGE, AC SIGNAL)
$L55_A$ - $L24_A$	($\overline{TVC}$: RESTRAINT VOLTAGE FOR C Ø-SEL, AC SIGNAL)
$L57_A$ - $L44_A$	(OPC: NET OPERATING QUANTITY FOR C Ø-SEL, AC SIGNAL)
$N3_A$ - SEE $A4_A$	(+24 VOLTS DC, 1 AMP)
$N4_A$ - $J36_A$	(10: 10 MILLISECONDS SEQUENTIAL TRIP TIME, HIGH LOGIC)
$N5_A$ - $J34_A$	(200: 200 MILLISECONDS SEQUENTIAL TRIP TIME, HIGH LOGIC)
$N6_A$ - $J35_A$	(100: 100 MILLISECONDS SEQUENTIAL TRIP TIME, HIGH LOGIC)
$N7_A$ - $B36_A$	(APD: A Ø-SEL RELAY DRIVER, LOW LOGIC)
$N8_A$ - $F13_A$	(MU: MAIN MEASURING UNIT OUTPUT, HIGH LOGIC)
$N9_A$ - $J25_A$	(Z1B: STANDBY OR SEQUENTIAL TRIP TIME IN PROGRESS, HIGH LOGIC)
$N10_A$ - $F26_A$	(PPL: CHANGE IN NUMBER OF Ø-SEL'S PICKED UP, HIGH PULSE)
$N11_A$ - $F47_A$	(P: TWO Ø-SEL'S PICKED UP, HIGH LOGIC)
$N12_A$ - SEE $F42_A$	(CKCT: 18.0/21.6 KHZ CLOCK, SQUARE WAVE)
$N13_A$ - $N25_A$	(Z3T: BLOCKS INTO PERMISSIVE ZONE CHARACTERISTIC TIMER)
$N14_A$ - $J12_A$	(Z3FLT: PERMISSIVE ZONE MEASURING UNIT OUTPUT, "IGH LOGIC)
$N17_A$ - $J14_A$	(CK2K: 2KHZ CLOCK, SQUARE WAVE)

A_A-PSM201 (35)	R_A-DIM101 (11)	A_B-DBM101 (12G3)	PM_B-MGM310, 311, 312, 401, 402
B_A-DOM201 (right) (36)	T_A-DFM101,102 (08)	E_B-LOM101 or 102 (16)	
D_A-DOM201 (left) (10)	V_A-DVM101 (07)	G_B-CTM101 or CDM101 (14)	CM_B-MGM310, 311, 312, 401, 402
	PM_A-MGM110,111,112	K_B-SVM101 (17)	TP_{BS}-Case B Test Plug (system side)
F_A-DLM101 (09)	CM_A-MGM110,111,112	M_B-not used	
J_A-DTM101 (03)	TP_{AS}-Case A Test Plug (system side)	P_B-RLM101 (01)	TP_{BR}-Case B Test Plug (relay side)
L_A-DSM101 (12G2)	TP_{AR}-Case A Test Plug (relay side)	T_B-RTM101 (00)	TP_A-Case A Test Plug (both sides)
N_A-DMM101 (13)		V_B-ROM101 (04)	TP_B-Case B Test Plug (both sides)

Alphabetical Index of Wiring to Module Connectors - Case A

Wire	Signal
$N18_A$ - SEE $B4_A$	(1PO: ONE POLE OPEN, LOW LOGIC)
$N19_A$ - SEE $F16_A$	(A: A Ø-SEL OUTPUT, HIGH LOGIC)
$N20_A$ - $B37_A$	(BPD: B Ø-SEL RELAY DRIVER, LOW LOGIC)
$N21_A$ - SEE $F17_A$	(C: C Ø-SEL OUTPUT, HIGH LOGIC)
$N22_A$ - $T42_A$	(VOP: NET OPERATING QUANTITY FOR MAIN MEASURING UNIT, AC SIGNAL)
$N23_A$-$N53_A$-$V51_A$	(POL: POLARIZING QUANTITY FOR MAIN AND PERMISSIVE ZONE MEASURING UNITS, AC SIGNAL)
$N24_A$ - $N43_A$	(MUT: BLOCKS INTO MAIN MEASURING UNIT CHARACTERISTIC TIMER)
$N25_A$ - $N13_A$	(Z3T: BLOCKS INTO PERMISSIVE ZONE MEASURING UNIT CHARACTERISTIC TIMER)
$N34_A$ - $J6_A$	(2O: 20 MILLISECOND SEQUENTIAL TRIP TIME, HIGH LOGIC)
$N35_A$ - $J7_A$	(4O: 40 MILLISECOND SEQUENTIAL TRIP TIME, HIGH LOGIC)
$N36_A$ - $J5_A$	(8O: 80 MILLISECOND SEQUENTIAL TRIP TIME, HIGH LOGIC)
$N38_A$ - $F44_A$	(MSUP: MEASURING UNIT SUPERVISION, HIGH LOGIC)
$N42_A$-PL3-4-$A40_B$	(CKCT: 18.0/21.6 KHZ CLOCK, SQUARE WAVE)
$N43_A$ - $N24_A$	(MUT: BLOCKS INTO MAIN MEASURING UNIT CHARACTERISTIC TIMER)
$N44_A$ - $F45_A$	(3PD: START OUT-OF-STEP TIMER, HIGH LOGIC)
$N46_A$ -$J16_A$	(ZTP: ZONE TIMER ADVANCING A ZONE, HIGH PULSE)
$N49_A$ - $D37_A$	(OSBR: OUT-OF-STEP BLOCK RELAY AND TARGET DRIVER, LOW LOGIC)
$N51_A$ - SEE $F46_A$	(B: B Ø-SEL OUTPUT, HIGH LOGIC)
$N52_A$ - $R37_A$	(Z3OP: NET OPERATING QUANTITY FOR PERMISSIVE ZONE MEASURING UNIT, AC SIGNAL)
$N53_A$ - SEE $N23_A$	(POL: POLARIZING QUANTITY FOR MAIN AND PERMISSIVE ZONE MEASURING UNITS, AC SIGNAL)
$N57_A$ - $B34_A$	(CPD: C Ø-SEL RELAY AND TARGET DRIVER, LOW LOGIC)
$PM1_A$ - $TP16_{AR}$	(PHASE A PT INPUT)
$PM3_A$ - $TP18_{AR}$	(PHASE B PT INPUT)
$PM5_A$ - $TP20_{AR}$	(PHASE C PT INPUT)
$PM9_A$-$PM10_A$-$PM22_A$-TP1AR-BC13	(+ STATION BATTERY DC)
$PM10_A$- SEE $PM9_A$	(+ STATION BATTERY DC)
$PM12_A$-$PM13_A$-$PM25_A$-TP15AR-BC14	(- STATION BATTERY DC)
$PM13_A$- SEE $PM12_A$	(- STATION BATTERY DC)
$PM14_A$- $TP17_{AR}$	(PHASE A PT RETURN)
$PM16_A$- $TP19_{AR}$	(PHASE B PT RETURN)
$PM18_A$- $TP21_{AR}$	(PHASE C PT RETURN)
$PM22_A$- SEE $PM9_A$	(+ STATION BATTERY DC)
$PM23_A$- SEE $A23_A$	(+ STATION BATTERY DC)

A_A-PSM201 (35)	R_A-DIM101 (11)	A_B-DBM101 (12G3)	PM_B-MGM310, 311, 312, 401, 402
B_A-DOM201 (right) (36)	T_A-DFM101,102 (08)	E_B-LOM101 or 102 (16)	
D_A-DOM201 (left) (10)	V_A-DVM101 (07)	G_B-CTM101 or CDM101 (14)	CM_B-MGM310, 311, 312, 401, 402
	PM_A-MGM110,111,112	K_B-SVM101 (17)	TP_{BS}-Case B Test Plug (system side)
F_A-DLM101 (09)	CM_A-MGM110,111,112	M_B-not used	
J_A-DTM101 (03)	TP_{AS}-Case A Test Plug (system side)	P_B-RLM101 (01)	TP_{BR}-Case B Test Plug (relay side)
L_A-DSM101 (12G2)	TP_{AR}-Case A Test Plug (relay side)	T_B-RTM101 (00)	TP_A-Case A Test Plug (both sides)
N_A-DMM101 (13)		V_B-ROM101 (04)	TP_B-Case B Test Plug (both sides)

Alphabetical Index of Wiring to Module Connectors - Case A

Wire	Signal
$PM25_A$ - SEE $PM12_A$	(- STATION BATTERY DC)
$PM26_A$ - SEE $A27_A$	(- STATION BATTERY DC)
$PM29_A$ - $TP2_{AR}$	(TRIP PHASE A CONTACT (1) LEAD)
$PM29_A$ - $TP3_{AR}$	(TRIP PHASE A CONTACT (2) LEAD)
$PM31_A$ - BA1	(PHASE A TRIP INDICATION CONTACT LEAD)
$PM33_A$ - $TP4_{AR}$	(TRIP PHASE B CONTACT (1) LEAD)
$PM35_A$ - $TP5_{AR}$	(TRIP PHASE B CONTACT (2) LEAD)
$PM37_A$ - BA3	(PHASE B TRIP INDICATION CONTACT LEAD)
$PM40_A$ - $TP24_{AR}$	(TRIP PHASE A CONTACT (1) LEAD)
$PM42_A$ - $TP25_{AR}$	(TRIP PHASE A CONTACT (2) LEAD)
$PM44_A$ - BA2	(PHASE A TRIP INDICATION CONTACT LEAD)
$PM46_A$ - $TP26_{AR}$	(TRIP PHASE B CONTACT (1) LEAD)
$PM48_A$ - $TP27_{AR}$	(TRIP PHASE B CONTACT (2) LEAD)
$PM50_A$ - BA4	(PHASE B TRIP INDICATION CONTACT LEAD)
$PM53_A$ - $TP6_{AR}$	(TRIP PHASE C CONTACT (1) LEAD)
$PM55_A$ - $TP22_{AR}$	(TRIP PHASE C CONTACT (2) LEAD)
$PM57_A$ - BA5	(PHASE C TRIP INDICATION CONTACT LEAD)
$PM66_A$ - $TP28_{AR}$	(TRIP PHASE C CONTACT (1) LEAD)
$PM68_A$ - $TP23_{AR}$	(TRIP PHASE C CONTACT (2) LEAD)
$PM70_A$ - BA6	(PHASE C TRIP INDICATION CONTACT LEAD)
$PM79_A$ - $F5_A$	(AFR; PHASE A TRIP OUTPUT RELAY DRIVER, LOW LOGIC)
$PM80_A$ - $F6_A$	(CFR: PHASE C TRIP OUTPUT RELAY DRIVER, LOW LOGIC)
$PM82_A$ - $V37_A$	(VABP: PHASE A-B VOLTAGE FROM MGM PT'S, AC SIGNAL)
$PM83_A$ - $V16_A$	(-VOP: ZERO SEQUENCE VOLTAGE FROM MGM PT'S, AC SIGNAL)
$PM84_A$ - $V6_A$	(VBNP: PHASE A-N VOLTAGE FROM MGM PT'S, AC SIGNAL)
$PM85_A$ - $V36_A$	(VCNP: PHASE C-N VOLTAGE FROM MGM PT'S, AC SIGNAL)
$PM87_A$ - $T58_A$	(IAP: PHASE A CURRENT SIGNAL FROM MGM TRANSACTOR, AC SIGNAL)
$PM88_A$ - $T27_A$	(ICP: PHASE C CURRENT SIGNAL FROM MGM TRANSACTOR, AC SIGNAL)
$PM38_A$ - SEE $A1_A$	(REFERENCE)
$PM92_A$ - $F35_A$	(BFR: PHASE B TRIP OUTPUT RELAY DRIVER, LOW LOGIC)
$PM93_A$ - SEE $A4_A$	(+24 VOLTS DC, 1 AMP)
$PM95_A$ - $V5_A$	(VANP: PHASE A-N VOLTAGE FROM MGM PT'S, AC SIGNAL)
$PM96_A$ - $V17_A$	(VBCP: PHASE B-C VOLTAGE FROM MGM PT'S, AC SIGNAL)
$PM97_A$ - $V47_A$	(VCAP: PHASE C-A VOLTAGE FROM MGM PT'S, AC SIGNAL)
$PM98_A$ - SEE $A1_A$	(REFERENCE)
$PM100_A$ - $T57_A$	(IBP: PHASE B CURRENT SIGNAL FROM MGM TRANSACTOR, AC SIGNAL)
$PM101_A$ - $T28_A$	(3IOP: NEUTRAL CURRENT SIGNAL FROM MGM TRANSACTOR, AC SIGNAL)
$PM102_A$ - $A25_A$	(REFERENCE FOR +25 VOLTS DC, 0.2 AMP)

A_A-PSM201 (35)	R_A-DIM101 (11)	A_B-DBM101 (12G3)	PM_B-MGM310, 311, 312, 401, 402
B_A-DOM201 (right) (36)	T_A-DFM101,102 (08)	E_B-LOM101 or 102 (16)	
D_A-DOM201 (left) (10)	V_A-DVM101 (07)	G_B-CTM101 or CDM101 (14)	CM_B-MGM310, 311, 312, 401, 402
	PM_A-MGM110,111,112	K_B-SVM101 (17)	TP_{BS}-Case B Test Plug (system side)
F_A-DLM101 (09)	CM_A-MGM110,111,112	M_B-not used	
J_A-DTM101 (03)	TP_{AS}-Case A Test Plug (system side)	P_B-RLM101 (01)	TP_{BR}-Case B Test Plug (relay side)
L_A-DSM101 (12G2)	TP_{AR}-Case A Test Plug (relay side)	T_B-RTM101 (00)	TP_A-Case A Test Plug (both sides)
N_A-DMM101 (13)		V_B-ROM101 (04)	TP_B-Case B Test Plug (both sides)

Alphabetical Index of Wiring to Module Connectors - Case A

Wire	Signal
$PM103_A$ - $A21_A$	(+25 VOLT DC, 0.2 AMP)
$PM104_A$ - SEE $A1_A$	(REFERENCE)
$R4_A$ - $T25_A$	(IAS: SHIFTED PHASE CURRENT SIGNAL, AC SIGNAL)
$R5_A$-$R17_A$-PL2-2-$A42_B$	(-IZA: OPERATING QUANTITY FOR ØA MB UNIT, AC SIGNAL)
$R6_A$ - $\overline{T26}_A$	(IBS: SHIFTED PHASE B CURRENT SIGNAL, AC SIGNAL)
$R7_A$-$T11_A$-$T17_A$	(IZ-V: NET OPERATING QUANTITY FOR MAIN MEASURING UNIT, AC SIGNAL)
$R8_A$-$R45_A$-PL2-2-$A53_B$	(-IZB: OPERATING QUANTITY FOR ØB MB UNIT, AC SIGNAL)
$R9_A$ - $\overline{V54}_A$	(-VX/T: RESTRAINING QUANTITY FOR MAIN MEASURING UNIT, AC SIGNAL)
$R10_A$-$R11_A$-PL2-3-$A25_B$	(-IZC: OPERATING QUANTITY FOR ØC MB UNIT, AC SIGNAL)
$R11_A$ - SEE $\overline{R10}_A$	(-IZC: OPERATING QUANTITY FOR ØC MB UNIT, AC SIGNAL)
$R14_A$ - SEE $L14_A$	(-VCIM: POSITIVE SEQUENCE VOLTAGE WITH MEMORY, REFERENCED TO ØC, AC SIGNAL)
$R15_A$ - SEE $L7_A$	(-VBIM: POSITIVE SEQUENCE VOLTAGE WITH MEMORY, REFERENCED TO ØB, AC SIGNAL)
$R17_A$ - SEE $R5_A$	(-IZA: OPERATING QUANTITY FOR ØA MB UNIT, AC SIGNAL)
$R18_A$ - SEE $F38_A$	(UCSC: ØC UNDERCURRENT SUPERVISION, HIGH LOGIC)
$R19_A$ - SEE $F8_A$	(UCSA: ØA UNDERCURRENT SUPERVISION, HIGH LOGIC)
$R21_A$ - SEE $F27_A$	(AB: A AND B Ø-SEL'S, INVERSE LOGIC)
$R27_A$ - SEE $F57_A$	(CA: C AND A Ø-SEL'S, INVERSE LOGIC)
$R28_A$ - SEE $F20_A$	(CG: C Ø-SEL ONLY, INVERSE LOGIC)
$R34_A$ - $V40_A$	(VZ3: RESTRAINING QUANTITY FOR PERMISSIVE ZONE MEASURING UNIT, AC SIGNAL)
$R35_A$ - $L42_A$	(IZA: OPERATING QUANTITY FOR A Ø-SEL, AC SIGNAL)
$R36_A$ - $T56_A$	(ICS: SHIFTED PHASE C CURRENT SIGNAL, AC SIGNAL)
$R37_A$ - $N52_A$	(Z3OP: NET OPERATING QUANTITY FOR PERMISSIVE ZONE MEASURING UNIT, AC SIGNAL)
$R38_A$ - $L25_A$	(IZC: OPERATING QUANTITY FOR C Ø-SEL, AC SIGNAL)
$R39_A$ - $L53_A$	(IZB: OPERATING QUANTITY FOR B Ø-SEL, AC SIGNAL)
$R44_A$ - $F37_A$	(UCSB: ØB UNDERCURRENT SUPERVISION, HIGH LOGIC)
$R45_A$ - SEE $R8_A$	(-IZB: OPERATING QUANTITY FOR ØB MB UNIT, AC SIGNAL)
$R56_A$ - SEE $F58_A$	(BC: B AND C Ø-SEL'S, INVERSE LOGIC)
$T4_A$ - SEE $L54_A$	(VCN: ØC-NEUTRAL VOLTAGE, AC SIGNAL)
$T5_A$ - $V33_A$	(VPC: POLARIZING QUANTITY FOR C-A FAULT, AC SIGNAL)
$T6_A$ - $V55_A$	(VAB: ØA - ØB VOLTAGE, AC SIGNAL)
$T7_A$ - $T38_A$	(+IA2: NEGATIVE SEQUENCE CURRENT SIGNAL REFERENCED TO ØA, AC SIGNAL)
$T8_A$ - $V28_A$	(VCA: ØC - ØA VOLTAGE, AC SIGNAL)

A_A-PSM201 (35)	R_A-DIM101 (11)	A_B-DBM101 (12G3)	PM_B-MGM310, 311, 312, 401, 402
B_A-DOM201 (right) (36)	T_A-DFM101,102 (08)	E_B-LOM101 or 102 (16)	
D_A-DOM201 (left) (10)	V_A-DVM101 (07)	G_B-CTM101 or CDM101 (14)	CM_B-MGM310, 311, 312, 401, 402
	PM_A-MGM110,111,112	K_B-SVM101 (17)	TP_{BS}-Case B Test Plug (system side)
F_A-DLM101 (09)	C_{MA}-MGM110,111,112	M_B-not used	
J_A-DTM101 (03)	TP_{AS}-Case A Test Plug (system side)	P_B-RLM101 (01)	TP_{BR}-Case B Test Plug (relay side)
L_A-DSM101 (12G2)	TP_{AR}-Case A Test Plug (relay side)	T_B-RTM101 (00)	TP_A-Case A Test Plug (both sides)
N_A-DMM101 (13)		V_B-ROM101 (04)	TP_B-Case B Test Plug (both sides)

Alphabetical Index of Wiring to Module Connectors - Case A

Wire	Signal
$T10_A$ - $V7_A$	(VPA: POLARIZING QUANTITY FOR A-B FAULT, AC SIGNAL)
$T11_A$ - SEE $R7_A$	(IZ-V: NET OPERATING QUANTITY FOR MAIN MEASURING UNIT, AC SIGNAL)
$T13_A$-$T51_A$-$V27_A$	(-VO: ZERO SEQUENCE VOLTAGE, AC SIGNAL)
$T15_A$ - SEE $L16_A$	(-IA2: NEGATIVE SEQUENCE CURRENT SIGNAL REFERENCED TO ØA, AC SIGNAL
$T16_A$ - SEE $L5_A$	(-VAIM: POSITIVE SEQUENCE VOLTAGE W/MEMORY REFERENCED TO ØA, AC SIGNAL)
$T17_A$ - SEE $R7_A$	(IZ-V: NET OPERATING QUANTITY FOR MAIN MEASURING UNIT, AC SIGNAL)
$T19_A$ - $V4_A$	(VPBM: POLARIZING QUANTITY FOR B-C AND 3Ø FAULTS (MEMORY), AC SIGNAL)
$T20_A$ - $V53_A$	(-IB2: NEGATIVE SEQUENCE CURRENT SIGNAL REFERENCED TO ØB, AC SIGNAL)
$T21_A$ - SEE $L54_A$	(VCN: ØC-NEUTRAL VOLTAGE, AC SIGNAL)
$T22_A$ - SEE $L11_A$	(VAN: ØA-NEUTRAL VOLTAGE, AC SIGNAL)
$T25_A$ - $R4_A$	(IAS: SHIFTED ØA CURRENT SIGNAL, AC SIGNAL)
$T26_A$ - $R6_A$	(IBS: SHIFTED ØB CURRENT SIGNAL, AC SIGNAL)
$T27_A$ - $PM88_A$	(ICP: ØC CURRENT SIGNAL FROM MGM TRANSACTOR, AC SIGNAL)
$T28_A$ - $PM101_A$	(3IOP: NEUTRAL CURRENT SIGNAL FROM MGM TRANSACTOR, AC SIGNAL)
$T35_A$ - $L46_A$	(VA2-IA2: POLARIZING QUANTITY FOR DIRECTIONAL UNIT, AC SIGNAL)
$T36_A$ - $V58_A$	(VBC: ØB-ØC VOLTAGE, AC SIGNAL)
$T37_A$-$T50_A$-$V46_A$	(-VA2: NEGATIVE SEQUENCE VOLTAGE REFERENCED TO ØA, AC SIGNAL)
$T38_A$ - $T7_A$	(+IAS: NEGATIVE SEQUENCE CURRENT SIGNAL REFERENCED TO ØA, AC SIGNAL)
$T41_A$ - SEE $L19_A$	(VBN: ØB-NEUTRAL VOLTAGE, AC SIGNAL)
$T42_A$ - $N22_A$	(VOP: NET OPERATING QUANTITY FOR MAIN MEASURING UNIT, AC SIGNAL)
$T43_A$ - SEE $L11_A$	(VAN: ØA-NEUTRAL VOLTAGE, AC SIGNAL)
$T45_A$ - $V23_A$	(-IC2: NEGATIVE SEQUENCE CURRENT SIGNAL REFERENCED TO ØC, AC SIGNAL)
$T46_A$ - SEE $L14_A$	(-VCIM: POSITIVE SEQUENCE VOLTAGE W/MEMORY REFERENCED TO ØC, AC SIGNAL)
$T47_A$ - SEE $L7_A$	(-VBIM: POSITIVE SEQUENCE VOLTAGE W/MEMORY REFERENCED TO ØB, AC SIGNAL)
$T48_A$ - SEE $L16_A$	(-IAS: NEGATIVE SEQUENCE CURRENT SIGNAL REFERENCED TO ØA, AC SIGNAL)
$T50_A$ - SEE $T37_A$	(-VAS: NEGATIVE SEQUENCE VOLTAGE REFERENCED TO ØA, AC SIGNAL)
$T51_A$ - SEE $T13_A$	(-VO: ZERO SEQUENCE VOLTAGE, AC SIGNAL)
$T52_A$ - SEE $L19_A$	(VBN: ØB-NEUTRAL VOLTAGE, AC SIGNAL)

A_A-PSM201 (35)	R_A-DIM101 (11)	A_B-DBM101 (12G3)	PM_B-MGM310, 311, 312, 401, 402
B_A-DOM201 (right) (36)	T_A-DFM101,102 (08)	E_B-LOM101 or 102 (16)	
D_A-DOM201 (left) (10)	V_A-DVM101 (07)	G_B-CTM101 or CDM101 (14)	CM_B-MGM310, 311, 312, 401, 402
	PM_A-MGM110,111,112	K_B-SVM101 (17)	TP_{BS}-Case B Test Plug (system side)
F_A-DLM101 (09)	C_{MA}-MGM110,111,112	M_B-not used	
J_A-DTM101 (03)	TP_{AS}-Case A Test Plug (system side)	P_B-RLM101 (01)	TP_{BR}-Case B Test Plug (relay side)
L_A-DSM101 (12G2)	TP_{AR}-Case A Test Plug (relay side)	T_B-RTM101 (00)	TP_A-Case A Test Plug (both sides)
N_A-DMM101 (13)		V_B-ROM101 (04)	TP_B-Case B Test Plug (both sides)

Alphabetical Index of Wiring to Module Connectors - Case A

Wire	Signal
$T55_A$ - $R58_A$	(3IOS: SHIFTED NEUTRAL CURRENT SIGNAL, AC SIGNAL)
$T56_A$ - $R36_A$	(ICS: SHIFTED ØC CURRENT SIGNAL, AC SIGNAL)
$T57_A$ - $PM100_A$	(IBP: ØB CURRENT SIGNAL FROM MGM TRANSACTOR, AC SIGNAL)
$T58_A$ - $PM86_A$	(IAP: ØA CURRENT SIGNAL FROM MGM TRANSACTOR, AC SIGNAL)
$TP1_{AS}$ - BC10	(+ STATION BATTERY DC)
$TP1_{AR}$ - SEE $PM9_A$	(+ STATION BATTERY DC)
$TP2_{AS}$ - BB1	(TRIP PHASE A CONTACT (1) LEAD)
$TP2_{AR}$ - $PM27_A$	(TRIP PHASE A CONTACT (1) LEAD)
$TP3_{AS}$ - BB3	(TRIP PHASE A CONTACT (2) LEAD)
$TP3_{AR}$ - $PM29_A$	(TRIP PHASE A CONTACT (2) LEAD)
$TP4_{AS}$ - BB5	(TRIP PHASE B CONTACT (1) LEAD)
$TP4_{AR}$ - $PM3_A$	(TRIP PHASE B CONTACT (1) LEAD)
$TP5_{AS}$ - BB9	(TRIP PHASE B CONTACT (2) LEAD)
$TP5_{AR}$ - $PM53_A$	(TRIP PHASE B CONTACT (2) LEAD)
$TP6_{AS}$ - BB9	(TRIP PHASE C CONTACT (1) LEAD)
$TP6_{AR}$ - $PM53_A$	(TRIP PHASE C CONTACT (1) LEAD)
$TP7_{AS}$ - BD1	(PHASE A CT INPUT)
$TP7_{AR}$ - $CM1_A$	(PHASE A CT INPUT)
$TP8_{AS}$ - BD5	(PHASE A CT RETURN)
$TP8_{AR}$ - $CM3_A$	(PHASE A CT RETURN)
$TP9_{AS}$ - BD2	(PHASE B CT INPUT)
$TP9_{AR}$ - $CM2_A$	(PHASE B CT INPUT)
$TP10_{AS}$ - BD6	(PHASE B CT RETURN)
$TP10_{AR}$ - $CM4_A$	(PHASE B CT RETURN)
$TP11_{AS}$ - BD3	(PHASE C CT INPUT)
$TP11_{AR}$ - $CM5_A$	(PHASE C CT INPUT)
$TP12_{AS}$ - BD7	(PHASE C CT RETURN)
$TP12_{AR}$ - $CM7_A$	(PHASE C CT RETURN)
$TP13_{AS}$ - BD4	(NEUTRAL CURRENT RETURN)
$TP13_{AR}$ - $CM6_A$	(NEUTRAL CURRENT RETURN)
$TP14_{AS}$ - BD8	(NEUTRAL CURRENT INPUT)
$TP14_{AR}$ - $CM8_A$	(NEUTRAL CURRENT INPUT)
$TP11_{AS}$ - BC11	(- STATION BATTERY DC)
$TP15_{AR}$ - SEE $PM12_A$	(- STATION BATTERY DC)
$TP16_{AS}$ - BC2	(PHASE A PT INPUT)
$TP16_{AR}$ - $PM1_A$	(PHASE A PT INPUT)

A_A-PSM201 (35)	R_A-DIM101 (11)	A_B-DBM101 (12G3)	PM_B-MGM310, 311, 312, 401, 402
B_A-DOM201 (right) (36)	T_A-DFM101,102 (08)	E_B-LOM101 or 102 (16)	
D_A-DOM201 (left) (10)	V_A-DVM101 (07)	G_B-CTM101 or CDM101 (14)	CM_B-MGM310, 311, 312, 401, 402
	PM_A-MGM110,111,112	K_B-SVM101 (17)	TP_{BS}-Case B Test Plug (system side)
F_A-DLM101 (09)	CM_A-MGM110,111,112	M_B-not used	
J_A-DTM101 (03)	TP_{AS}-Case A Test Plug (system side)	P_B-RLM101 (01)	TP_{BR}-Case B Test Plug (relay side)
L_A-DSM101 (12G2)	TP_{AR}-Case A Test Plug (relay side)	T_B-RTM101 (00)	TP_A-Case A Test Plug (both sides)
N_A-DMM101 (13)		V_B-ROM101 (04)	TP_B-Case B Test Plug (both sides)

Alphabetical Index of Wiring to Module Connectors - Case A

Wire	Signal
$TP17_{AS}$ - BC6	(PHASE A PT NEUTRAL)
$TP17_{AR}$ - $PM14_A$	(PHASE A PT NEUTRAL)
$TP18_{AS}$ - BC3	(PHASE B PT INPUT)
$TP18_{AR}$ - $PM3_A$	(PHASE B PT INPUT)
$TP19_{AS}$ - BC7	(PHASE B PT NEUTRAL)
$TP19_{AR}$ - $PM16_A$	(PHASE B PT NEUTRAL)
$TP20_{AS}$ - BC4	(PHASE C PT INPUT)
$TP20_{AR}$ - $PM5_A$	(PHASE C PT INPUT)
$TP21_{AS}$ - BC8	(PHASE C PT NEUTRAL)
$TP21_{AR}$ - $PM18_A$	(PHASE C PT NEUTRAL)
$TP22_{AS}$ - BB11	(TRIP PHASE C CONTACT (2) LEAD)
$TP22_{AR}$ - $PM55_A$	(TRIP PHASE C CONTACT (2) LEAD)
$TP23_{AS}$ - BB12	(TRIP PHASE C CONTACT (2) LEAD)
$TP23_{AR}$ - $PM68_A$	(TRIP PHASE C CONTACT (2) LEAD)
$TP24_{AS}$ - BB2	(TRIP PHASE A CONTACT (1) LEAD)
$TP24_{AR}$ - $PM40_A$	(TRIP PHASE A CONTACT (1) LEAD)
$TP25_{AS}$ - BB4	(TRIP PHASE A CONTACT (2) LEAD)
$TP25_{AR}$ - $PM42_A$	(TRIP PHASE A CONTACT (2) LEAD)
$TP26_{AS}$ - BB6	(TRIP PHASE B CONTACT (1) LEAD)
$TP26_{AR}$ - $PM46_A$	(TRIP PHASE B CONTACT (1) LEAD)
$TP27_{AS}$ - BB8	(TRIP PHASE B CONTACT (2) LEAD)
$TP27_{AR}$ - $PM48_A$	(TRIP PHASE B CONTACT (2) LEAD)
$TP28_{AS}$ - BB10	(TRIP PHASE C CONTACT (1) LEAD)
$TP28_{AR}$ - $PM66_A$	(TRIP PHASE C CONTACT (1) LEAD)
$V3_A$ - $F48_A$	(FF: FUSE FAILURE, HIGH LOGIC)
$V4_A$ - $T19_A$	(VPBM: POLARIZING QUANTITY FOR B-C AND 3Ø FAULTS (MEMORY), AC SIGNAL)
$V5_A$ - $PM95_A$	(VANP: ØA-N VOLTAGE FROM MGM PT, AC SIGNAL)
$V6_A$ - $PM84_A$	(VBNP: ØB-N VOLTAGE FROM MGM PT, AC SIGNAL)
$V7_A$ - $T10_A$	(VPA: POLARIZING QUANTITY FOR A-B FAULT, AC SIGNAL)
$V8_A$ - SEE $F57_A$	(CA: C AND A Ø-SELS, INVERSE LOGIC)
$V9_A$ - SEE $F58_A$	(BC: B AND C Ø-SELS, INVERSE LOGIC)
$V11_A$ - SEE $F27_A$	(AB: A AND B Ø-SELS, INVERSE LOGIC)
$V12_A$ - SEE F19A:	(AG: A Ø-SEL ONLY, INVERSE LOGIC)
$V13_A$ - SEE $L5_A$	(-VAIM: POSITIVE SEQUENCE VOLTAGE W/MEMORY REFERENCED TO ØA, AC SIGNAL)
$V16_A$ - $PM83_A$	(-VOP: ZERO SEQUENCE VOLTAGE FROM MGM PT, AC SIGNAL)

A_A-PSM201 (35)	R_A-DIM101 (11)	A_B-DBM101 (12G3)	PM_B-MGM310, 311, 312, 401, 402
B_A-DOM201 (right) (36)	T_A-DFM101,102 (08)	E_B-LOM101 or 102 (16)	
D_A-DOM201 (left) (10)	V_A-DVM101 (07)	G_B-CTM101 or CDM101 (14)	CM_B-MGM310, 311, 312, 401, 402
	PM_A-MGM110,111,112	K_B-SVM101 (17)	TP_{BS}-Case B Test Plug (system side)
F_A-DLM101 (09)	C_{MA}-MGM110,111,112	M_B-not used	
J_A-DTM101 (03)	TP_{AS}-Case A Test Plug (system side)	P_B-RLM101 (01)	TP_{BR}-Case B Test Plug (relay side)
L_A-DSM101 (12G2)	TP_{AR}-Case A Test Plug (relay side)	T_B-RTM101 (00)	TP_A-Case A Test Plug (both sides)
N_A-DMM101 (13)		V_B-ROM101 (04)	TP_B-Case B Test Plug (both sides)

Alphabetical Index of Wiring to Module Connectors - Case A

Wire		Signal
$V17_A$	- $PM96_A$	(VBCP: ØB-C VOLTAGE FROM MGM PT, AC SIGNAL)
$V18_A$	- $J49_A$	(Z3: RELAY MEASURING IN ZONE 3, INVERSE LOGIC)
$V19_A$	- SEE $L14_A$	(-VCIM: POSITIVE SEQUENCE VOLTAGE W/MEMORY REFERENCED TO ØC, AC SIGNAL)
$V20_A$	- SEE $F50_A$	(BG: B Ø-SEL ONLY, INVERSE LOGIC)
$V23_A$	- $T45_A$	(-IC2: NEGATIVE SEQUENCE CURRENT SIGNAL REFERENCED TO ØC, AC SIGNAL)
$V24_A$	- $J50_A$	(Z1: RELAY MEASURING IN ZONE 1, INVERSE LOGIC)
$V25_A$	- SEE $L54_A$	(VCN: ØC-NEUTRAL VOLTAGE, AC SIGNAL)
$V26_A$	- SEE $L11_A$	(VAN: ØA-NEUTRAL VOLTAGE, AC SIGNAL)
$V27_A$	- SEE $T13_A$	(-VO: ZERO SEQUENCE VOLTAGE, AC SIGNAL)
$V28_A$	- $T8_A$	(VCA: ØC-ØA VOLTAGE, AC SIGNAL)
$V33_A$	- $T5_A$	(VPC: POLARIZING QUANTITY FOR C-A FAULT, AC SIGNAL)
$V34_A$	- SEE $L16_A$	(IA2: NEGATIVE SEQUENCE CURRENT SIGNAL REFERENCED TO ØC, AC SIGNAL)
$V35_A$	- SEE $L5_A$	(-VAIM: POSITIVE SEQUENCE VOLTAGE W/MEMORY REFERENCED TO ØA, AC SIGNAL)
$V36_A$	- $PM85_A$	(VCNP: ØC-N VOLTAGE SIGNAL FROM MGM PT, AC SIGNAL)
$V37_A$	- $PM82_A$	(VABP: ØA-B VOLTAGE SIGNAL FROM MGM PT, AC SIGNAL)
$V38_A$	- SEE $F57_A$	(CA: C AND A Ø-SELS, INVERSE LOGIC)
$V39_A$	- SEE $F58_A$	(BC: B AND C Ø-SELS, INVERSE LOGIC)
$V40_A$	- $R34_A$	(VZ3: RESTRAINING QUANTITY FOR PERMISSIVE ZONE MEASURING UNIT, AC SIGNAL)
$V41_A$	- SEE $F27_A$	(AB: A AND B Ø-SELS, INVERSE LOGIC)
$V42_A$	- SEE $F19_A$	(AG: A Ø-SEL ONLY, INVERSE LOGIC)
$V43_A$	- SEE $L16_A$	(-IA2: NEGATIVE SEQUENCE CURRENT SIGNAL REFERENCED TO ØA, AC SIGNAL)
$V46_A$	- SEE $T37_A$	(-VA2: NEGATIVE SEQUENCE VOLTAGE REFERENCED TO ØA, AC SIGNAL)
$V47_A$	- $PM97_A$	(VCAP: ØC-A VOLTAGE FROM MGM PT, AC SIGNAL)
$V48_A$	$J20_A$	(Z2: RELAY MEASURING IN ZONE 2, INVERSE LOGIC)
$V49_A$	- SEE $L7_A$	(-VBIM: POSITIVE SEQUENCE VOLTAGE W/MEMORY REFERENCED TO ØB, AC SIGNAL)
$V50_A$	- SEE $F50_A$	(BG: B Ø-SEL ONLY, INVERSE LOGIC)
$V51_A$	- SEE $N23_A$	(POL: POLARIZING QUANTITY FOR MAIN AND PERMISSIVE ZONE MEASURING UNITS, AC SIGNAL)
$V42_A$	- SEE $F20_A$	(CG: C Ø-SEL ONLY, INVERSE LOGIC)
$V53_A$	- $T20_A$	(-IB2: NEGATIVE SEQUENCE CURRENT SIGNAL REFERENCED TO ØB, AC SIGNAL)

A_A-PSM201 (35)	R_A-DIM101 (11)	A_B-DBM101 (12G3)	PM_B-MGM310, 311, 312, 401, 402
B_A-DOM201 (right) (36)	T_A-DFM101,102 (08)	E_B-LOM101 or 102 (16)	
D_A-DOM201 (left) (10)	V_A-DVM101 (07)	G_B-CTM101 or CDM101 (14)	CM_B-MGM310, 311, 312, 401, 402
	PM_A-MGM110,111,112	K_B-SVM101 (17)	TP_{BS}-Case B Test Plug (system side)
F_A-DLM101 (09)	C_{MA}-MGM110,111,112	M_B-not used	
J_A-DTM101 (03)	TP_{AS}-Case A Test Plug (system side)	P_B-RLM101 (01)	TP_{BR}-Case B Test Plug (relay side)
L_A-DSM101 (12G2)	TP_{AR}-Case A Test Plug (relay side)	T_B-RTM101 (00)	TP_A-Case A Test Plug (both sides)
N_A-DMM101 (13)		V_B-ROM101 (04)	TP_B-Case B Test Plug (both sides)

Alphabetical Index of Wiring to Module Connectors - Case A

Wire		Signal
$V54_A$	- $R9_A$	(-VX/T: RESTRAINING QUANTITY FOR MAIN MEASURING UNIT, AC SIGNAL)
$V55_A$	- $T6_A$	(VAB: ØA-ØB VOLTAGE, AC SIGNAL)
$V56_A$	- SEE $L19_A$	(VBN: ØB-NEUTRAL VOLTAGE, AC SIGNAL)
$V57_A$	- $J26_A$	(Z1X: RELAY MEASURING IN EXTENDED ZONE 1, INVERSE LOGIC)
$V58_A$	- $T36_A$	(VBC: ØB-ØC VOLTAGE, AC SIGNAL)

A_A-PSM201 (35)	R_A-DIM101 (11)	A_B-DBM101 (12G3)	PM_B-MGM310, 311, 312, 401, 402
B_A-DOM201 (right) (36)	T_A-DFM101,102 (08)	E_B-LOM101 or 102 (16)	
D_A-DOM201 (left) (10)	V_A-DVM101 (07)	G_B-CTM101 or CDM101 (14)	CM_B-MGM310, 311, 312, 401, 402
	PM_A-MGM110,111,112	K_B-SVM101 (17)	TP_{BS}-Case B Test Plug (system side)
F_A-DLM101 (09)	CM_A-MGM110,111,112	M_B-not used	
J_A-DTM101 (03)	TP_{AS}-Case A Test Plug (system side)	P_B-RLM101 (01)	TP_{BR}-Case B Test Plug (relay side)
L_A-DSM101 (12G2)	TP_{AR}-Case A Test Plug (relay side)	T_B-RTM101 (00)	TP_A-Case A Test Plug (both sides)
N_A-DMM101 (13)		V_B-ROM101 (04)	TP_B-Case B Test Plug (both sides)

Alphabetical Index of Wiring to Module Connectors - Case B

Wire	Signal
$A4_B$ - SEE $F25_A$	(TRIP: DIRECT 3 POLE TRIP, LOW LOGIC)
$A5_B$ - SEE $L5_A$	(-VAIM: POSITIVE SEQUENCE VOLTAGE W/MEMORY REFERENCED TO ØA, AC SIGNAL)
$A6_B$ - SEE $F8_A$	(UCSA: ØA UNDERCURRENT SUPERVISION, HIGH LOGIC)
$A7_B$ - SEE $L7_A$	(-VBIM: POSITIVE SEQUENCE VOLTAGE W/MEMORY REFERENCED TO ØB, AC SIGNAL)
$A8_B$ - $A39_B$	(BIN: BLOCKS INTO ØB MB UNIT COINCIDENCE TIMER
$A9_B$ - $A35_B$	(AIN: BLOCKS INTO ØA MB UNIT COINCIDENCE TIMER
$A11_B$ - SEE $L11_A$	(VAN: ØA-NEUTRAL VOLTAGE, AC SIGNAL)
$A12_B$ - $A17_B$	(TVA: RESTRAINT VOLTAGE FOR ØA MB UNIT, AC SIGNAL)
$A13_B$ - $A36_B$	(OPA: NET OPERATING QUANTITY FOR ØA MB UNIT, AC SIGNAL)
$A14_B$ - SEE $L14_A$	(-VCIM: POSITIVE SEQUENCE VOLTAGE W/MEMORY REFERENCED TO ØC, AC SIGNAL)
$A17_B$ - $A12_B$	(TVA: RESTRAINT VOLTAGE FOR ØA MB UNIT, AC SIGNAL)
$A18_B$ - $A23_B$	(TVB: RESTRAINT VOLTAGE FOR ØB MB UNIT, AC SIGNAL)
$A19_B$ - SEE $L19_A$	(VBN: ØB-NEUTRAL VOLTAGE, AC SIGNAL)
$A20_B$ - $A43_B$	(CIN: BLOCKS INTO ØC MB UNIT COINCIDENCE TIMER)
$A21_B$ - SEE $J46_A$	(BVA: ØA MB UNIT OUTPUT, HIGH LOGIC)
$A22_B$ - SEE $J13_A$	(VBV: ØB MB UNIT OUTPUT, HIGH LOGIC)
$A23_B$ - $A18_B$	(TVB: RESTRAINT VOLTAGE FOR ØB MB UNIT, AC SIGNAL)
$A24_B$ - $A55_B$	(TVC: RESTRAINT VOLTAGE FOR ØC MB UNIT, AC SIGNAL)
$A25_B$ - SEE $R10_A$	(-IZC: OPERATING QUANTITY OF ØC MB UNIT, AC SIGNAL)
$A26_B$ - SEE $LA4_A$	(-VCIM: POSITIVE SEQUENCE VOLTAGE W/MEMORY REFERENCED TO ØC, AC SIGNAL)
$A33_B$ - SEE $J15_A$	(TRPW: DC POWER CLEAR, LOW PULSE)
$A34_B$ - SEE $J33_A$	(CK1K: 1 KHZ CLOCK, HIGH PULSES)
$A35_B$ - $A9_B$	(AIN: BLOCKS INTO ØA MB UNIT COINCIDENCE TIMER
$A36_B$ - $A13_B$	(OPA: NET OPERATING QUANTITY FOR ØA MB UNIT, AC SIGNAL)
$A37_B$ - $A50_B$	(OPB: NET OPERATING QUANTITY FOR ØB MB UNIT, AC SIGNAL)
$A38_B$ - SEE $F37_A$	(UCSB: ØB UNDERCURRENT SUPERVISION, HIGH LOGIC)
$A39_B$ - $A8_B$	(BIN: BLOCKS INTO ØB MB UNIT COINCIDENCE TIMER)
$A40_B$ - SEE $N42_A$	(CKCT: 18.0/21.6 KHZ CLOCK, SQUARE WAVE)
$A41_B$ - SEE $L5_A$	(-VAIM: POSITIVE SEQUENCE VOLTAGE W/MEMORY REFERENCED TO ØA, AC SIGNAL)
$A42_B$ - SEE $R5_A$	(-IZA: OPERATING QUANTITY FOR ØA MB UNIT, AC SIGNAL)
$A43_B$ - $A20_B$	(CIN: BLOCKS IN ØC MB UNIT COINCIDENCE TIMER)
$A44_B$ - $A57_B$	(OPC: NET OPERATING QUANTITY OF ØC MB UNIT, AC SIGNAL)

A_A-PSM201 (35)	R_A-DIM101 (11)	A_B-DBM101 (12G3)	PM_B-MGM310, 311, 312, 401, 402
B_A-DOM201 (right) (36)	T_A-DFM101,102 (08)	E_B-LOM101 or 102 (16)	
D_A-DOM201 (left) (10)	V_A-DVM101 (07)	G_B-CTM101 or CDM101 (14)	CM_B-MGM310, 311, 312, 401, 402
	PM_A-MGM110,111,112	K_B-SVM101 (17)	TP_{BS}-Case B Test Plug (system side)
F_A-DLM101 (09)	CM_A-MGM110,111,112	M_B-not used	
J_A-DTM101 (03)	TP_{AS}-Case A Test Plug (system side)	P_B-RLM101 (01)	TP_{BR}-Case B Test Plug (relay side)
L_A-DSM101 (12G2)	TP_{AR}-Case A Test Plug (relay side)	T_B-RTM101 (00)	TP_A-Case A Test Plug (both sides)
N_A-DMM101 (13)		V_B-ROM101 (04)	TP_B-Case B Test Plug (both sides)

Alphabetical Index of Wiring to Module Connectors - Case B

Wire		Signal
$A45_B$	- SEE $F38_A$	(UCSC: ØC UNDERCURRENT SUPERVISION, HIGH LOGIC)
$A48_B$	- SEE $L7_A$	(-VBIM: POSITIVE SEQUENCE VOLTAGE W/MEMORY REFERENCED TO ØB, AC SIGNAL)
$A50_B$	- $A37_B$	(OPB: NET OPERATING QUANTITY FOR ØB MB UNIT, AC SIGNAL)
$A52_B$	- SEE $J44_A$	(BVCC: ØC MB UNIT OUTPUT, HIGH LOGIC)
$A53_B$	- SEE $R8_A$	(-IZB: OPERATING QUANTITY FOR ØB MB UNIT, AC SIGNAL)
$A54_B$	- SEE $L54_A$	(VCN: ØC-NEUTRAL VOLTAGE, AC SIGNAL)
$A55_B$	- $A24_B$	(TVC: RESTRAINT VOLTAGE FOR ØC MB UNIT, AC SIGNAL)
$A57_B$	- $A44_B$	(OPC: NET OPERATING QUANTITY FOR ØC MB UNIT, AC SIGNAL)
$CM1_B$	- $TP9_{BR}$	(3IO GROUND TOC OPERATING CURRENT RETURN)
$CM3_B$	- $TP10_{BR}$	(3IO GROUND TOC OPERATING CURRENT INPUT)
$CM5_B$	- $TP13_{BR}$	(GROUND TOC POLARIZING CURRENT INPUT
$CM6_B$	- $TP11_{BR}$	(LINE OVERLOAD CURRENT RETURN)
$E4_B$	- SEE $A4_A$	(+ 24 VOLTS DC, 1 AMP)
$E6_B$	- $PM91_B$	(LINE OVERLOAD CURRENT SIGNAL FROM MGM CT, POLARITY MARK)
$E8_B$	- $PM92_B$	(LINE OVERLOAD CURRENT SIGNAL FROM MGM CT, NON-POLARITY MARK)
$E14_B$	- SEE $A4_A$	(+ 24 VOLTS DC, 1 AMP)
$E17_B$	- CA6	(LINE OVERLOAD ALARM CONTACT LEAD - CLOSED)
$E19_B$	- CA5	(LINE OVERLOAD ALARM CONTACT LEAD - COMMON)
$E21_B$	- CA4	(LINE OVERLOAD ALARM CONTACT LEAD - OPEN)
$E23_B$	- CA9	(LINE OVERLOAD ALARM CONTACT LEAD - CLOSED)
$E25_B$	- CA8	(LINE OVERLOAD ALARM CONTACT LEAD - COMMON)
$E27_B$	- CA7	(LINE OVERLOAD ALARM CONTACT LEAD - OPEN)
$G3_B$	- SEE $F25_A$	(TRIP: DIRECT 3 POLE TRIP, LOW LOGIC)
$G5_B$	- CA2	(GROUND TOC ALARM CONTACT LEAD - COMMON)
$G7_B$	- CA3	(GROUND TOC ALARM CONTACT LEAD - CLOSED)
$G9_B$	- CA1	(GROUND TOC ALARM CONTACT LEAD - OPEN)
$G11_B$	- $PM87_B$	(IDC: RECTIFIED GROUND TOC OPERATING SIGNAL, FULL WAVE RECTIFIED)
$G12_B$	- $PM86_B$	(IAC LO: OPERATING CURRENT SIGNAL FOR GROUND TOC DIRECTIONAL UNIT - POLARITY MARK)
$G13_B$	- $G14_B$	(DIRC: DIRECTIONAL UNIT OUTPUT FOR DIRECTIONAL GROUND TOC, HIGH LOGIC)
$G14_B$	- $G13_B$	(DIRC: DIRECTIONAL UNIT OUTPUT FOR DIRECTIONAL GROUND TOC, HIGH LOGIC)
$G16_B$	- $PM90_B$	(VPOL: POLARIZING VOLTAGE FOR GROUND TOC DIRECTIONAL UNIT, AC SIGNAL - NON-POLARITY MARK)
$G21_B$	- $PM88_B$	(IAC HI: OPERATING CURRENT SIGNAL FOR GROUND TOC DIRECTIONAL UNIT - NON-POLARITY MARK)

A_A-PSM201 (35)	R_A-DIM101 (11)	A_B-DBM101 (12G3)	PM_B-MGM310, 311, 312, 401, 402
B_A-DOM201 (right) (36)	T_A-DFM101,102 (08)	E_B-LOM101 or 102 (16)	
D_A-DOM201 (left) (10)	V_A-DVM101 (07)	G_B-CTM101 or CDM101 (14)	CM_B-MGM310, 311, 312, 401, 402
	PM_A-MGM110,111,112	K_B-SVM101 (17)	TP_{BS}-Case B Test Plug (system side)
F_A-DLM101 (09)	CM_A-MGM110,111,112	M_B-not used	
J_A-DTM101 (03)	TP_{AS}-Case A Test Plug (system side)	P_B-RLM101 (01)	TP_{BR}-Case B Test Plug (relay side)
L_A-DSM101 (12G2)	TP_{AR}-Case A Test Plug (relay side)	T_B-RTM101 (00)	TP_A-Case A Test Plug (both sides)
N_A-DMM101 (13)		V_B-ROM101 (04)	TP_B-Case B Test Plug (both sides)

Alphabetical Index of Wiring to Module Connectors - Case B

Wire	Signal
$G33_B$ - SEE $A4_A$	(+ 24 VOLTS DC, 1 AMP)
$G42_B$ - $PM85_B$	(IPOL: POLARIZING CURRENT SIGNAL FOR GROUND TOC DIRECTIONAL UNIT, AC SIGNAL)
$K3_B$ - $K26_B$	(NOT USED)
$K6_B$ - $PM79_B$	(BUS 1 VOLTAGE: SYNC CK VOLTAGE INPUT, AC SIGNAL)
$K7_B$ - $PM83_B$	(NOT USED)
$K15_B$ - $PM81_B$	(LINE VOLTAGE: SYNC CK VOLTAGE INPUT, AC SIGNAL)
$K16_B$ - $K25_B$	(NOT USED)
$K26_B$ - $K3_B$	(NOT USED)
$K27_B$ - $M34_B$	(NOT USED)
$K28_B$ - $P57_B$	(OUT 1: SYNC CK UNIT OUTPUT, HIGH LOGIC)
$K57_B$ - $M35_B$	(NOT USED)
$K58_B$ - $M25_B$	(NOT USED)
$M3_B$ - $P3_B$	(NOT USED)
$M4_B$ - $P22_B$	(NOT USED)
$M7_B$ - $P19_B$	(NOT USED)
$M8_B$ - $P43_B$	(NOT USED)
$M11_B$ - $P44_B$	(NOT USED)
$M14_B$-$P51_B$-$T27_B$-$T57_B$	(CKD: 1 KHZ CLOCK, SQUARE WAVE)
$M15_B$ - $P33_B$	(NOT USED)
$M16_B$ - $P52_B$	(AUTO: MANUAL CLOSE THROUGH RECLOSER, HIGH LOGIC)
$M17_B$-$P18_A$-$T41_B$	(INHI: RECLOSE INITIATE: 1, 2 OR 3 POLES, HIGH LOGIC)
$M18_B$ - $P38_B$	(NOT USED)
$M19_B$ - SEE $F18_A$	(COFD: CLOSE ONTO A FAULT, LOW LOGIC)
$M20_B$ - SEE $F25_A$	(TRIP: DIRECT 3 POLE TRIP, LOW LOGIC)
$M21_B$-$P17_B$-$V37_B$	(OPN: RECLOSE OPERATION IN PROGRESS, LOW LOGIC)
$M22_B$ - SEE $B4_A$	(1PO: ONE POLE OPEN, LOW LOGIC)
$M23_B$ - $P20_B$	(NOT USED)
$M24_B$-$P47_B$-$T19_B$	(INHB: BLOCK RECLOSER OPERATION THROUGH RESETTING, HIGH LOGIC)
$M25_B$ - $K58_B$	(NOT USED)
$M26_B$ - $V9_B$	(NOT USED)
$M27_B$ - $V34_B$	(NOT USED)
$M28_B$ - SEE $A4_A$	(+ 24 VOLTS DC, 1 AMP)
$M34_B$ - $K27_B$	(NOT USED)
$M35_B$ - $K57_B$	(NOT USED)
$M38_B$ - $P45_B$	(NOT USED)
$M39_B$ - $P41_B$	(NOT USED)

A_A-PSM201 (35)	R_A-DIM101 (11)	A_B-DBM101 (12G3)	PM_B-MGM310, 311, 312, 401, 402
B_A-DOM201 (right) (36)	T_A-DFM101,102 (08)	E_B-LOM101 or 102 (16)	
D_A-DOM201 (left) (10)	V_A-DVM101 (07)	G_B-CTM101 or CDM101 (14)	CM_B-MGM310, 311, 312, 401, 402
	PM_A-MGM110,111,112	K_B-SVM101 (17)	TP_{BS}-Case B Test Plug (system side)
F_A-DLM101 (09)	C_{MA}-MGM110,111,112	M_B-not used	
J_A-DTM101 (03)	TP_{AS}-Case A Test Plug (system side)	P_B-RLM101 (01)	TP_{BR}-Case B Test Plug (relay side)
L_A-DSM101 (12G2)	TP_{AR}-Case A Test Plug (relay side)	T_B-RTM101 (00)	TP_A-Case A Test Plug (both sides)
N_A-DMM101 (13)		V_B-ROM101 (04)	TP_B-Case B Test Plug (both sides)

Alphabetical Index of Wiring to Module Connectors - Case B

Wire	Signal
$M41_B$-$P15_B$-$T6_B$	(PWRS: DC POWER RESET, HIGH LOGIC OR PULSE)
$M43_B$ - SEE $A4_A$	(+ 24 VOLTS DC, 1 AMP)
$M44_B$-$P13_B$-$T15_B$	(CLSAL: RECLOSE ALL 3 POLES, HIGH LOGIC)
$M45_B$-$P42_B$-$T11_B$	(RCRS: RECLOSE COMMAND, HIGH PULSE)
$M48_B$ - SEE $A1_A$	(REF)
$M49_B$ - $PM96_B$	(NOT USED)
$M50_B$ - $PM97_B$	(NOT USED)
$M51_B$ - $PM98_B$	(NOT USED)
$M53_B$-$P49_B$-$T14_B$	(DLY: SECOND SHOT RECLOSURE ENABLED, HIGH LOGIC)
$M54_B$ - $V36_B$	(NOT USED)
$M56_B$ - $V33_B$	(NOT USED)
$M57_B$ - $T12_B$	(2ØP: 2 OR 3 PHASE RECLOSE INITIATE, HIGH PULSE)
$P3_B$ - $M3_B$	(NOT USED)
$P4_B$ - SEE $B9_A$	(ZIED: PULL BACK EXTENDED ZONE 1, LOW LOGIC)
$P5_B$ - $T28_B$	(LCOP: LOCKOUT PULSE, HIGH PULSE)
$P7_B$ - SEE $F18_A$	(COFD: CLOSE ONTO A FAULT, LOW LOGIC)
$P9_B$ - SEE $B4_A$	(1PO: ONE POLE OPEN, LOW LOGIC)
$P10_B$ - $PM94_B$	(RCB1: RECLOSE POLE B, LOW LOGIC)
$P11_B$ - SEE $F25_A$	(TRIP: DIRECT 3 POLE TRIP, LOW LOGIC OR PULSE)
$P12_B$ - SEE $B7_A$	(MACD: LINE PICKUP CC/MANUAL CLOSE, LOW LOGIC)
$P13_B$ - SEE $M44_B$	(CLSAL: RECLOSE ALL 3 POLES, HIGH LOGIC)
$P14_B$ - $T5_B$	(MAC: MANUAL CLOSE, HIGH LOGIC)
$P15_B$ - SEE $M41_B$	(PWRS: DC POWER RESET, HIGH LOGIC OR PULSE)
$P16_B$ - $T35_B$	(MCB: BLOCK AUTO RECLOSE AFTER MANUAL CLOSE, HIGH LOGIC)
$P17_B$ - SEE $M21_B$	(OPN: RECLOSE OPERATION IN PROGRESS, LOW LOGIC)
$P18_B$ - SEE $M17_B$	(INHI: RECLOSE INITIATE, 1, 2 OR 3 POLES, HIGH LOGIC)
$P19_B$ - $M7_B$	(NOT USED)
$P20_B$ - $M23_B$	(NOT USED)
$P21_B$ - $T26_B$	(52OR: ANY "b" SWITCH CLOSED (POLE OPEN), HIGH LOGIC)
$P22_B$ - $M4_B$	(NOT USED)
$P23_B$ - $T56_B$	(X10-3: MULTIPLY FIRST SHOT 3 POLE RECLOE TIME BY 10, HIGH LOGIC)
$P24_B$ - $V4_B$	(52A1/b: POLE A "b" SWITCH, LOW LOGIC)
$P25_B$ - $V6_B$	(52C1/b: POLE C "b" SWITCH, LOW LOGIC)
$P26_B$ - $V7_B$	(INHIBIT: BLOCK RECLOSER OPERATION, LOW LOGIC)
$P27_B$ - $V8_B$	(RESET: REMOTE RECLOSER RESET, LOW LOGIC)
$P28_B$ - SEE $A4_A$	(+ 24 VOLTS DC, 1 AMP)

A_A-PSM201 (35)	R_A-DIM101 (11)	A_B-DBM101 (12G3)	PM_B-MGM310, 311, 312, 401, 402
B_A-DOM201 (right) (36)	T_A-DFM101,102 (08)	E_B-LOM101 or 102 (16)	
D_A-DOM201 (left) (10)	V_A-DVM101 (07)	G_B-CTM101 or CDM101 (14)	CM_B-MGM310, 311, 312, 401, 402
	PM_A-MGM110,111,112	K_B-SVM101 (17)	TP_{BS}-Case B Test Plug (system side)
F_A-DLM101 (09)	CM_A-MGM110,111,112	M_B-not used	
J_A-DTM101 (03)	TP_{AS}-Case A Test Plug (system side)	P_B-RLM101 (01)	TP_{BR}-Case B Test Plug (relay side)
L_A-DSM101 (12G2)	TP_{AR}-Case A Test Plug (relay side)	T_B-RTM101 (00)	TP_A-Case A Test Plug (both sides)
N_A-DMM101 (13)		V_B-ROM101 (04)	TP_B-Case B Test Plug (both sides)

Alphabetical Index of Wiring to Module Connectors - Case B

Wire	Signal
$P27_B$ - $V8_B$	(RESET: REMOTE RECLOSER RESET, LOW LOGIC)
$P28_B$ - SEE $A4_A$	(+ 24 VOLTS DC, 1 AMP)
$P33_B$ - $M15_B$	(NOT USED)
$P34_B$ - SEE $B8_A$	(SPV3PT; SUPERVISE 3 POLE TRIP, LOW LOGIC)
$P35_B$ - $V39_B$	(OFFA: RECLOSER OUT-OF-SERVICE, LOW LOGIC)
$P36_B$ - $T20_B$	(RST: RESET TIMER BLOCKED (RECLOSE IN PROGRESS), HIGH LOGIC)
$P37_B$ - $PM95_B$	(RCC1: RECLOSE POLE C, LOW LOGIC)
P38 $M18_B$	(NOT USED)
$P39_B$ - $T4_B$	(LCO: LOCKOUT, HIGH LOGIC)
$P40_B$ - $PM93_B$	(RCA1: RECLOSE POLE A, LOW LOGIC)
$P41_B$ - $M39_B$	(NOT USED)
$P42_B$ - SEE M45	(RCRS: RECLOSE COMMAND, HIGH PULSE)
$P43_B$ - $M8_B$	(NOT USED)
$P44_B$ - $M11_B$	(NOT USED)
$P45_B$ - $M38_B$	(NOT USED)
$P46_B$ - $T34_B$	(RSLD: RESET RECLOSER VIA RESET TIMER, LOCKOUT, OR POWER RESET, HIGH LOGIC)
$P47_B$ - SEE $M24_B$	(INHB: BLOCK RECLOSER OPERATION THROUGH RESETTING, HIGH LOGIC)
$P48_B$ - $T8_B$	(2Ø: 2 OR 3 PHASE RECLOSE INITIATE, HIGH LOGIC)
$P49_B$ - SEE $M53_B$	(DLY: SECOND SHOT RECLOSURE ENABLED, HIGH LOGIC)
$P50_B$ - SEE $A1_A$	(REF)
$P51_B$ - SEE $M14_B$	(CKD: 1 KHZ CLOCK, SQUARE WAVE)
$P52_B$ - $M16_B$	(AUTO: MANUAL CLOSE THROUGH RECLOSER, HIGH LOGIC)
$P53_B$ - $T16_B$	(3PS: 3 POLE RECLOSING ONLY, HIGH LOGIC)
$P54_B$ - $T25_B$	(X10-1: MULTIPLY FIRST SHOT SINGLE POLE RECLOSE TIME BY 10, HIGH LOGIC)
$P55_B$ - $V5_B$	(52B1/B: POLE B "b" SWITCH, LOW LOGIC)
$P56_B$ - $V35_B$	(MANUAL CLOSE: EXTERNAL CONTACT, LOW LOGIC)
$P57_B$ - $K28_B$	(SYNC CK: RECLOSING PERMITTED BY SYNC CK CIRCUIT, HIGH LOGIC)
$PM1_B$ - DA1	(RECLOSE POLE A CONTACT LEAD)
$PM3_B$ - DA3	(RECLOSE POLE B CONTACT LEAD)
$PM5_B$ - DA5	(RECLOSE POLE C CONTACT LEAD)
PM9B-PM10B-PM22B-DC13	(NOT USED)
$PM10_B$ - SEE $PM9_B$	(NOT USED)
PM12B-PM13B-PM25B-DC14	(NOT USED)
$PM13_B$ - SEE $PM12_B$	(NOT USED)
$PM14_B$ - DA2	(RECLOSE POLE A CONTACT LEAD)

A_A-PSM201 (35)	R_A-DIM101 (11)	A_B-DBM101 (12G3)	PM_B-MGM310, 311, 312, 401, 402
B_A-DOM201 (right) (36)	T_A-DFM101,102 (08)	E_B-LOM101 or 102 (16)	
D_A-DOM201 (left) (10)	V_A-DVM101 (07)	G_B-CTM101 or CDM101 (14)	CM_B-MGM310, 311, 312, 401, 402
F_A-DLM101 (09)	PM_A-MGM110,111,112	K_B-SVM101 (17)	TP_{BS}-Case B Test Plug (system side)
J_A-DTM101 (03)	CM_A-MGM110,111,112	M_B-not used	TP_{BR}-Case B Test Plug (relay side)
L_A-DSM101 (12G2)	TP_{AS}-Case A Test Plug (system side)	P_B-RLM101 (01)	TP_A-Case A Test Plug (both sides)
N_A-DMM101 (13)	TP_{AR}-Case A Test Plug (relay side)	T_B-RTM101 (00)	TP_B-Case B Test Plug (both sides)
		V_B-ROM101 (04)	

Alphabetical Index of Wiring to Module Connectors - Case B

Wire	Signal
$PM16_B$ - DA4	(RECLOSE POLE B CONTACT LEAD)
$PM18_B$ - DA6	(RECLOSE POLE C CONTACT LEAD)
$PM22_B$ - SEE $PM9_B$	(NOT USED)
$PM25_B$ - SEE $PM12_B$	(NOT USED)
$PM27_B$ - DB1	(NOT USED)
$PM29_B$ - DB3	(NOT USED)
$PM31_B$ - DB5	(NOT USED)
$PM35_B$ - $TP1_{BR}$	(GROUND TOC POLARIZING VOLTAGE, NON-POLARITY MARK ON OPEN DELTA)
$PM37_B$ - $TP3_{BR}$	(SYNC CHECK LINE VOLTAGE INPUT)
$PM39_B$ - $TP5_{BR}$	(SYNC CHECK BUS VOLTAGE INPUT)
$PM40_B$ - DB2	(NOT USED)
$PM42_B$ - DB4	(NOT USED)
$PM44_B$ - DB6	(NOT USED)
$PM48_B$ - $TP2_{BR}$	(GROUND TOC POLARIZING VOLTAGE, POLARITY MARK ON OPEN DELTA)
$PM50_B$ - $TP4_{BR}$	(SYNC CK LINE VOLTAGE NEUTRAL)
$PM52_B$ - $TP12_{BR}$	(LINE OVERLOAD CURRENT RETURN)
$PM79_B$ - $K6_B$	(BUS 1 VOLTAGE: SYNC CK VOLTAGE INPUT, AC SIGNAL)
$PM80_B$ - SEE $A1_A$	(REF)
$PM81_B$ - $K15_B$	(LINE VOLTAGE: SYNC CK VOLTAGE INPUT, AC SIGNAL)
$PM82_B$ - SEE $A1_A$	(REF)
$PM83_B$ - $K7_B$	(NOT USED)
$PM84_B$ - SEE $A1_A$	(REF)
$PM85_B$ - $G42_A$	(IPOL: POLARIZING CURRENT SIGNAL FOR GROUND TOC DIRECTIONAL UNIT, AC SIGNAL)
PM86 $G12_R$	(IAC LO: OPERATING CURRENT SIGNAL FOR GROUND TOC DIRECTIONAL UNIT - POLARITY MARK)
$PM87_B$ - $G11_B$	(IDC: RECTIFIED GROUND TOC OPERATING SIGNAL, FULL WAVE RECTIFIED)
$PM88_B$ - $G21_B$	(IAC HI: OPERATING CURRENT SIGNAL FOR GROUND TOC DIRECTIONAL UNIT - NON-POLARITY MARK)
$PM89_B$ - SEE $A1_A$	(REF)
$PM90_B$ - $G16_B$	(VPOL: POLARIZING VOLTAGE FOR GROUND TOC DIRECTIONAL UNIT, AC SIGNAL)
$PM91_B$ - $E6_B$	(LINE OVERLOAD CURRENT SIGNAL FROM MGM CT, POLARITY MARK)
$PM92_B$ - $E8_B$	(LINE OVERLOAD CURRENT SIGNAL FROM MGM CT, NON-POLARITY MARK)
$PM93_B$ - $P40_B$	(RCA1: RECLOSE POLE A, LOW LOGIC)
$PM94_B$ - $P10_B$	(RCB1: RECLOSE POLE B, LOW LOGIC)
$PM95_B$ - $P37_B$	(RCC1: RECLOSE POLE C, LOW LOGIC)
$PM96_B$ - $M49_B$	(NOT USED)

A_A-PSM201 (35)	R_A-DIM101 (11)	A_B-DBM101 (12G3)	PM_B-MGM310, 311, 312, 401, 402
B_A-DOM201 (right) (36)	T_A-DFM101,102 (08)	E_B-LOM101 or 102 (16)	
D_A-DOM201 (left) (10)	V_A-DVM101 (07)	G_B-CTM101 or CDM101 (14)	CM_B-MGM310, 311, 312, 401, 402
	PM_A-MGM110,111,112	K_B-SVM101 (17)	TP_{BS}-Case B Test Plug (system side)
F_A-DLM101 (09)	CM_A-MGM110,111,112	M_B-not used	
J_A-DTM101 (03)	TP_{AS}-Case A Test Plug (system side)	P_B-RLM101 (01)	TP_{BR}-Case B Test Plug (relay side)
L_A-DSM101 (12G2)	TP_{AR}-Case A Test Plug (relay side)	T_B-RTM101 (00)	TP_A-Case A Test Plug (both sides)
N_A-DMM101 (13)		V_B-ROM101 (04)	TP_B-Case B Test Plug (both sides)

Alphabetical Index of Wiring to Module Connectors - Case B

Wire	Signal
PM97B - M50B	(NOT USED)
PM98B - M51B	(NOT USED)
PM100B - SEE A4A	(+ 24 VOLTS DC, 1 AMP)
PM101B - SEE A4A	(+ 24 VOLTS DC, 1 AMP)
PM104B - SEE A1A	(REF)
T3B - SEE B9A	(Z1ED: PULL BACK EXTENDED ZONE 1, LOW LOGIC)
T4B - P39B	(LCO: LOCKOUT, HIGH LOGIC)
T5B - P14B	(MAC: MANUAL CLOSE, HIGH LOGIC)
T6B - SEE M41B	(PWRS: DC POWER RESET, HIGH LOGIC OR PULSE)
T7B - SEE D38A	(BFD: ØB RECLOSE INITIATE, INVERSE LOGIC)
T8B - P48B	(2Ø: 2 OR 3 PHASE RECLOSE INITIATE, HIGH LOGIC)
T11B - SEE M45B	(RCRS: RECLOSE COMMAND, HIGH PULSE)
T13B - SEE A4A	(+24 VOLTS DC, ONE AMP)
T14B - SEE M53B	(DLY: SECOND SHOT RECLOSURE ENABLED, HIGH LOGIC)
T15B - SEE M44B	(CLSAL: RECLOSE ALL 3 POLES, HIGH LOGIC)
T16B - P53B	(3PS: 3 POLE RECLOSING ONLY, HIGH LOGIC)
T19B - DEE M24B	(INHB: BLOCK RECLOSER OPERATION THROUGH RESETTING, HIGH LOGIC)
T20B - P36B	(RST: RESET TIMER BLOCKED (RECLOSE IN PROGRESS), HIGH LOGIC
T25B - P54B	(X10-1: MULTIPLY FIRST SHOT SINGLE POLE RECLOSER TIME BY 10, HIGH LOGIC)
T26B - P21B	(52OR: ANY "B" SWITCH CLOSED (POLE OPEN) HIGH LOGIC)
T27B - SEE M14B	(CKD: 1 KHZ CLOCK, SQUARE WAVE)
T28B - P5B	(LCOP: LOCKOUT PULSE, HIGH PULSE)
T33B - SEE B8A	(SPV3PT: SUPERVISE 3 POLE TRIP, LOW LOGIC)
T34B - P46B	(RSLD: RESET RECEIVER VIA RESET TIMER LOCKOUT OR POWER CLEAR, HIGH LOGIC)
T35B - P16B	(MCB: BLOCK AUTO RECLOSER AFTER MANUAL CLOSE, HIGH LOGIC)
T36B - SEE B35A	(OKD: ENABLE RECLOSING, LOW LOGIC)
T37B - SEE D8A	(AFD: PHASE A RECLOSE INITIATE, INVERSE LOGIC)
T38B - SEE D33A	(CFD: PHASE C RECLOSE INITIATE, INVERSE LOGIC)
T41B - SEE M17B	(INHI: RECLOSE INITIATE, 1, 2 OR 3 POLES, HIGH LOGIC)
T43B - SEE A4A	(+ 24 VOLTS DC, 1 AMP)
T56B - P23B	(X10-3: MULTIPLY FIRST SHOT 3 POLE RECLOSE TIME BY 10, HIGH LOGIC)
T57B - M14B	(CKD: 1 KHZ CLOCK SQUARE WAVE)
TP1BS - DC5	(GROUND TOC POLARIZING VOLTAGE: NON-POLARITY MARK)
TP1BR - PM35B	(GROUND TOC POLARIZING VOLTAGE: NON-POLARITY MARK)

A_A-PSM201 (35)	R_A-DIM101 (11)	A_B-DBM101 (12G3)	PM_B-MGM310, 311, 312, 401, 402
B_A-DOM201 (right) (36)	T_A-DFM101,102 (08)	E_B-LOM101 or 102 (16)	
D_A-DOM201 (left) (10)	V_A-DVM101 (07)	G_B-CTM101 or CDM101 (14)	CM_B-MGM310, 311, 312, 401, 402
	PM_A-MGM110,111,112	K_B-SVM101 (17)	TP_{BS}-Case B Test Plug (system side)
F_A-DLM101 (09)	C_{MA}-MGM110,111,112	M_B-not used	
J_A-DTM101 (03)	TP_{AS}-Case A Test Plug (system side)	P_B-RLM101 (01)	TP_{BR}-Case B Test Plug (relay side)
L_A-DSM101 (12G2)	TP_{AR}-Case A Test Plug (relay side)	T_B-RTM101 (00)	TP_A-Case A Test Plug (both sides)
N_A-DMM101 (13)		V_B-ROM101 (04)	TP_B-Case B Test Plug (both sides)

Alphabetical Index of Wiring to Module Connectors - Case B

Wire		Signal
$TP2_{BS}$	- DC6	(GROUND TOC POLARIZING VOLTAGE: POLARITY MARK)
$TP2_{BR}$	- PM48B	(GROUND TOC POLARIZING VOLTAGE: POLARITY MARK)
$TP3_{BS}$	- DC1	(SYNC CK LINE VOLTAGE INPUT)
$TP3_{BR}$	- PM37B	(SYNC CK LINE VOLTAGE INPUT)
$TP4_{BS}$	- DC2	(SYNC CK LINE VOLTAGE NEUTRAL)
$TP4_{BR}$	- PM50B	(SYNC CK LINE VOLTAGE NEUTRAL)
$TP5_{BS}$	- DC3	(SYNC CK BUS VOLTAGE INPUT)
$TP5_{BR}$	- PM39B	(SYNC CK BUS VOLTAGE INPUT)
$TP6_{BS}$	- DC4	(SYNC CK BUS VOLTAGE NEUTRAL)
$TP6_{BR}$	- PM52B	(SYNC CK BUS VOLTAGE NEUTRAL)
$TP9_{BS}$	- DD1	(3IO GROUND TOC OPERATING CURRENT RETURN)
$TP9_{BR}$	- CM1B	(3IO GROUND TOC OPERATING CURRENT RETURN)
$TP10_{BS}$	- DD2	(3IO GROUND TOC OPERATING CURRENT INPUT)
$TP10_{BR}$	- CM3B	(3IO GROUND TOC OPERATING CURRENT INPUT)
$TP11_{BS}$	- DD3	(LINE OVERLOAD CURRENT INPUT)
$TP11_{BR}$	- CM6B	(LINE OVERLOAD CURRENT INPUT)
$TP12_{BS}$	- DD4	(LINE OVERLOAD CURRENT RETURN)
$TP12_{BR}$	- CM8B	(LINE OVERLOAD CURRENT RETURN)
$TP13_{BS}$	- DD5	(GROUND TOC POLARIZING CURRENT INPUT)
$TP13_{BR}$	- CM5B	(GROUND TOC POLARIZING CURRENT INPUT)
$TP14_{BS}$	- DD6	(GROUND TOC POLARIZING CURRENT RETURN)
$TP14_{BR}$	- CM7B	(GROUND TOC POLARIZING CURRENT RETURN)
V3B	- SEE $A4_A$	(+24 VOLTS DC, 1 AMP)
V4B	- P24B	(52A1/b: POLE A "b" SWITCH, LOW LOGIC)
V5B	- P55B	(52B1/b: POLE B "b" SWITCH, LOW LOGIC)
V6B	- P25B	(52B1/b: POLE C "b" SWITCH, LOW LOGIC)
V7B	- P26B	(INHIBIT: BLOCK RECLOSER OPERATION, LOW LOGIC)
V8B	- P27B	(RESET: REMOTE RECLOSER RESET, LOW LOGIC)
V9B	- M26B	(NOT USED)
V10B	- M55B	(NOT USED)
V12B	- CC13	(RECLOSE OPERATION IN PROGRESS INDICATION CONTACT LEAD)
V13B	- CC14	(RECLOSE OPERATION IN PROGRESS INDICATION CONTACT LEAD)
V18B	- CD1	(52A/b CC9 (+))
V19B	- CD2	(52B/b CC10 (+))
V20B	- CD3	(52C/b CC11 (+))
V21B	- CD4	((-) FOR CC9, CC10, CC11)

A_A-PSM201 (35)	R_A-DIM101 (11)	A_B-DBM101 (12G3)	PM_B-MGM310, 311, 312, 401, 402
B_A-DOM201 (right) (36)	T_A-DFM101,102 (08)	E_B-LOM101 or 102 (16)	
D_A-DOM201 (left) (10)	V_A-DVM101 (07)	G_B-CTM101 or CDM101 (14)	CM_B-MGM310, 311, 312, 401, 402
	PM_A-MGM110,111,112	K_B-SVM101 (17)	TP_{BS}-Case B Test Plug (system side)
F_A-DLM101 (09)	CM_A-MGM110,111,112	M_B-not used	
J_A-DTM101 (03)	TP_{AS}-Case A Test Plug (system side)	P_B-RLM101 (01)	TP_{BR}-Case B Test Plug (relay side)
L_A-DSM101 (12G2)	TP_{AR}-Case A Test Plug (relay side)	T_B-RTM101 (00)	TP_A-Case A Test Plug (both sides)
N_A-DMM101 (13)		V_B-ROM101 (04)	TP_B-Case B Test Plug (both sides)

Alphabetical Index of Wiring to Module Connectors - Case B

Wire		Signal
$V23_B$	- CD5	(BLOCK RECLOSE CC15 (+))
$V24_B$	- CD6	(BLOCK RECLOSE CC15 (-))
$V26_B$	- CD9	(REMOTE RECLOSER RESET CC16 (+))
$V27_B$	- CD10	(REMOTE RECLOSER RESET CC16 (-))
$V33_B$	- $M56_B$	(NOT USED)
$V34_B$	- $M27_B$	(NOT USED)
$V35_B$	- $P56_B$	(MANUAL CLOSE: EXTERNAL CONTACT, LOW LOGIC)
$V36_B$	- $M54_B$	(NOT USED)
$V37_B$	- SEE $M21_B$	(OPN: RECLOSE OPERATION IN PROGRESS, LOW LOGIC)
$V39_B$	- $P35_B$	(OFFA: RECLOSER OUT OF SERVICE, LOW LOGIC)
$V41_B$	- CD12	(RECLOSER IN SERVICE INDICATION CONTACT LEAD (NORMALLY OPEN))
$V42_B$	- CD13	(RECLOSER IN SERVICE INDICATION CONTACT LEAD (COMMON))
$V43_B$	- CD14	(RECLOSER IN SERVICE INDICATION CONTACT LEAD (NORMALLY CLOSED))
$V45_B$	- CC1	(NOT USED)
$V46_B$	- CC2	(NOT USED)
$V47_B$	- CC3	(NOT USED)
$V48_B$	- CC4	(NOT USED)
$V50_B$	- CD7	(MANUAL CLOSE CC17 (+))
$V51_B$	- CD8	(MANUAL CLOSE CC17 (-))
$V53_B$	- CC7	(NOT USED)
$V54_B$	- CC8	(NOT USED)
$V56_B$	- CC5	(NOT USED)
$V57_B$	- CC6	(NOT USED)

LIST OF ILLUSTRATIONS

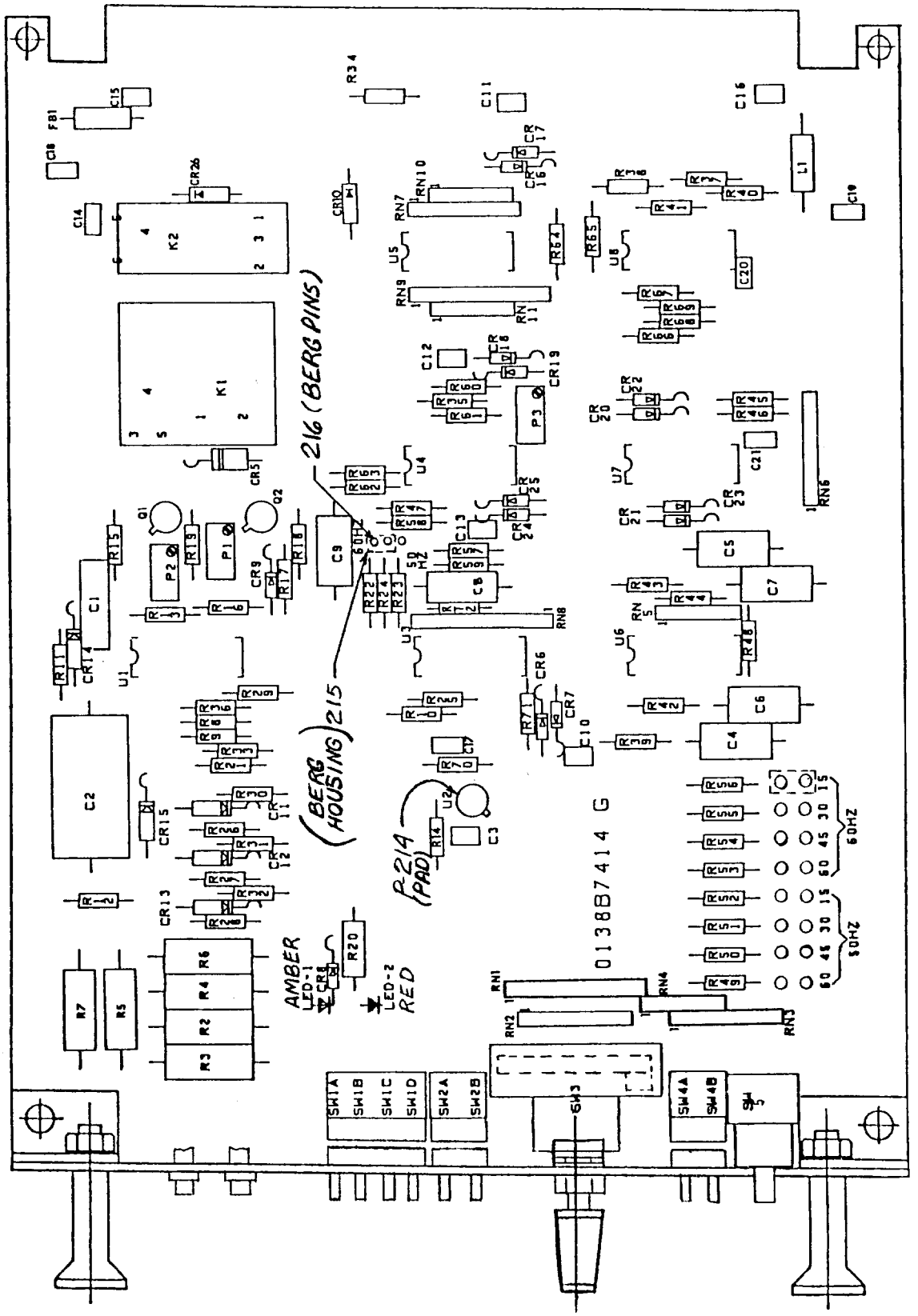


Figure 1 (0138B7414-7, Sh. A1) Silk Screen for CDM and CTM Modules

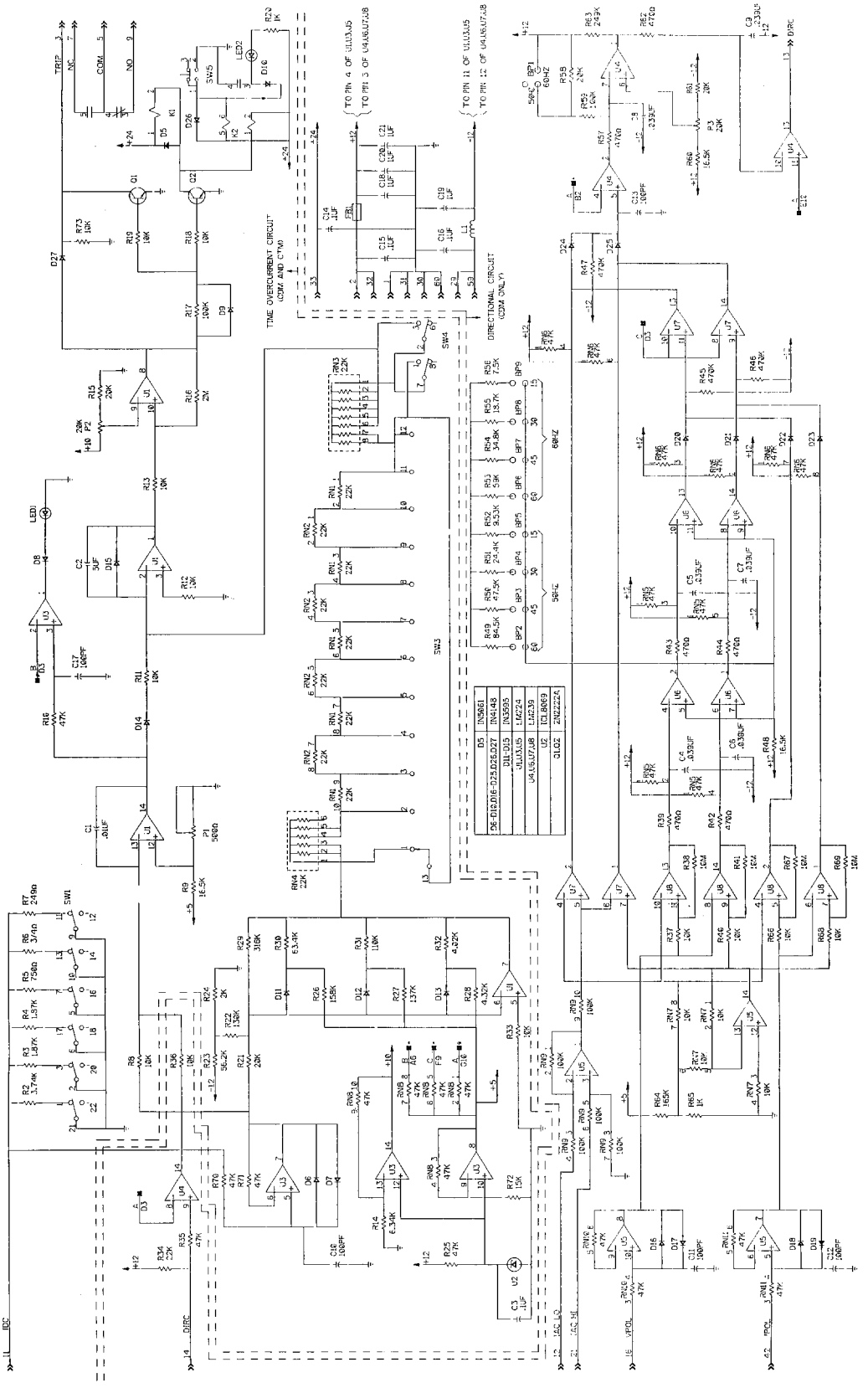


Figure 2 (0138D4714-8) Schematic Diagram for CDM and CTM Modules

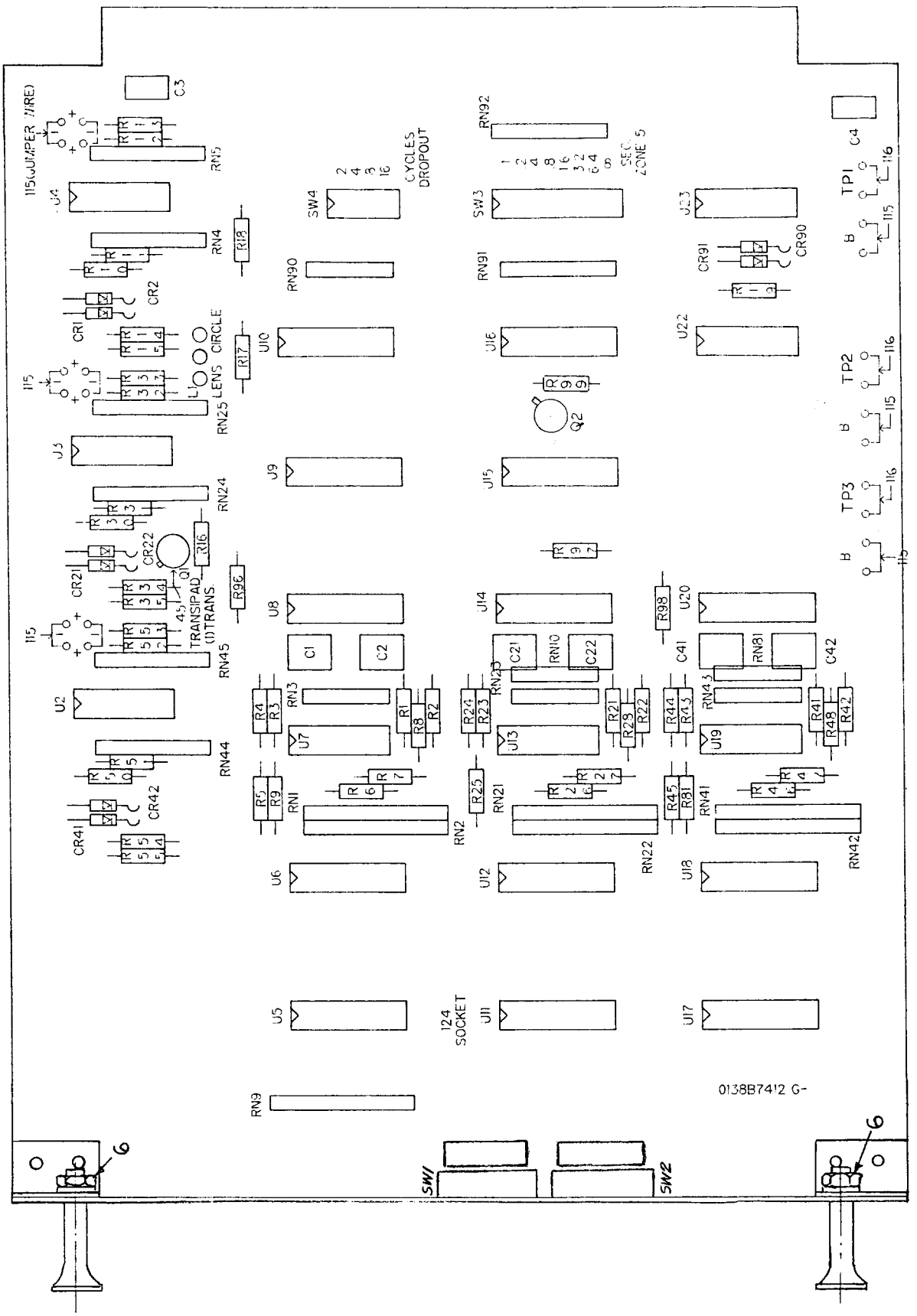


Figure 3 (0138B7412-3, Sh. A3) Silk Screen for DBM Module

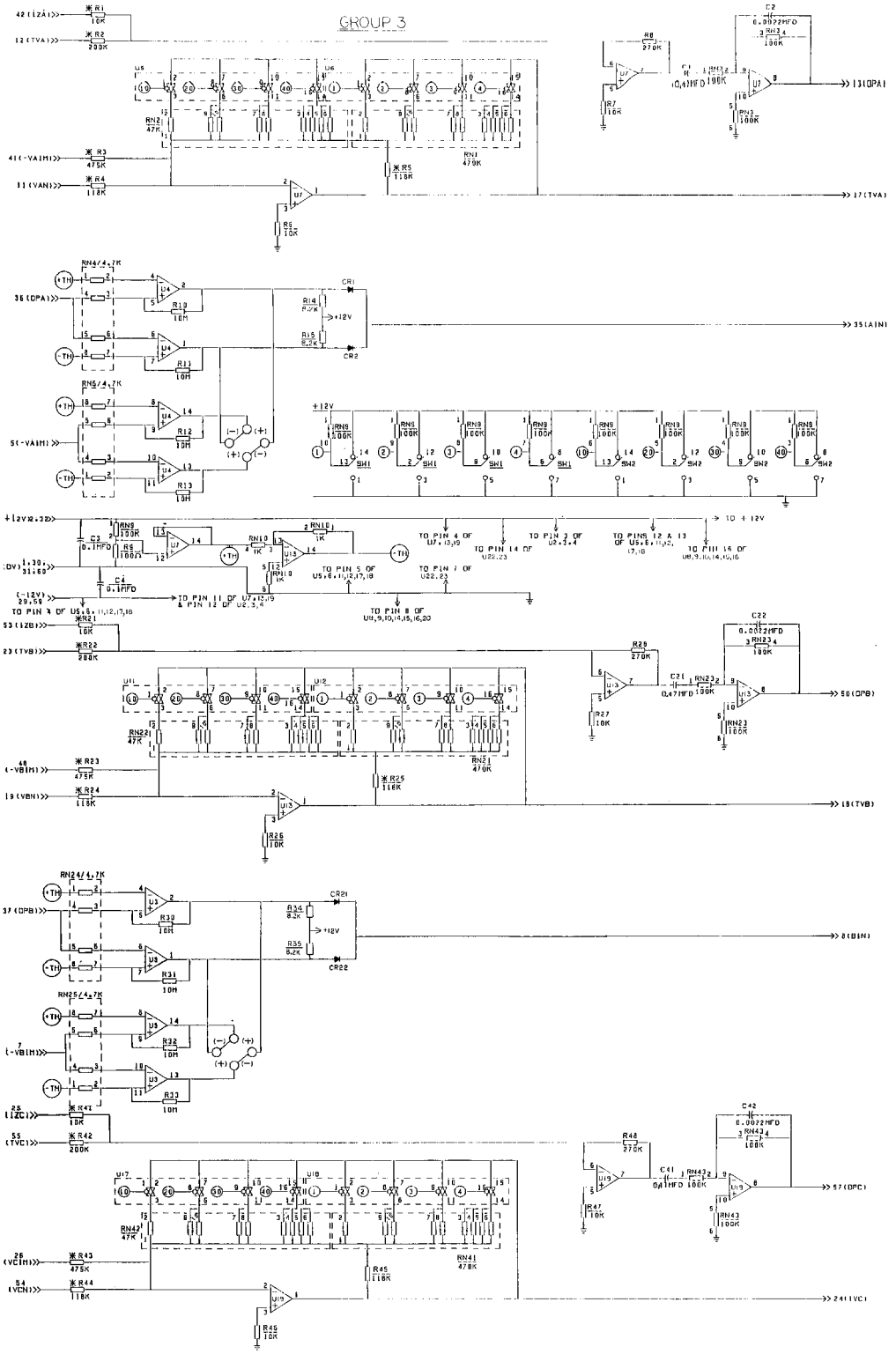


Figure 4 (0138D4712-1, Sh. 5) Schematic Diagram for DBM Module

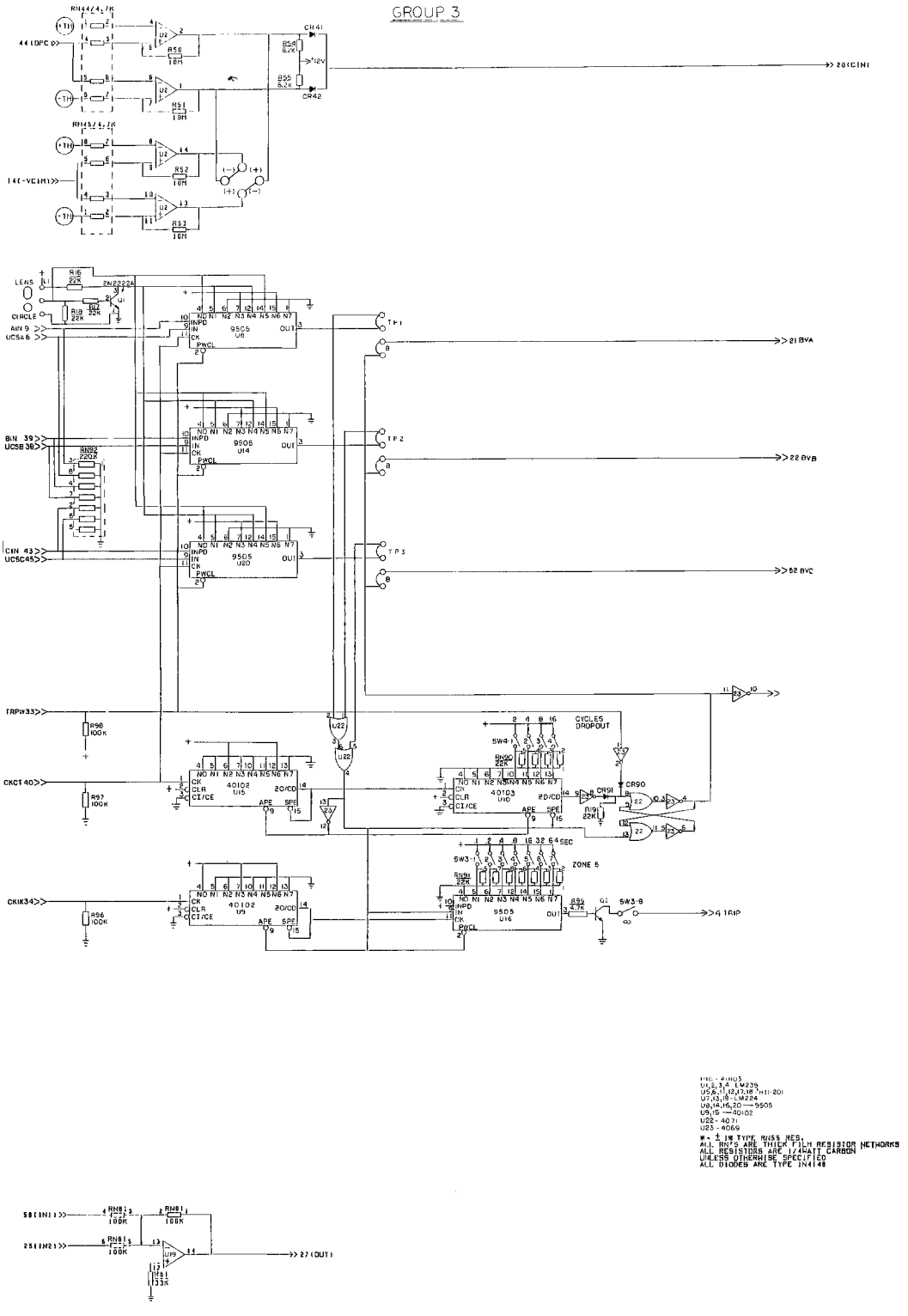


Figure 4A (0138D4712-2, Sh. 6) Schematic Diagram for DBM Module

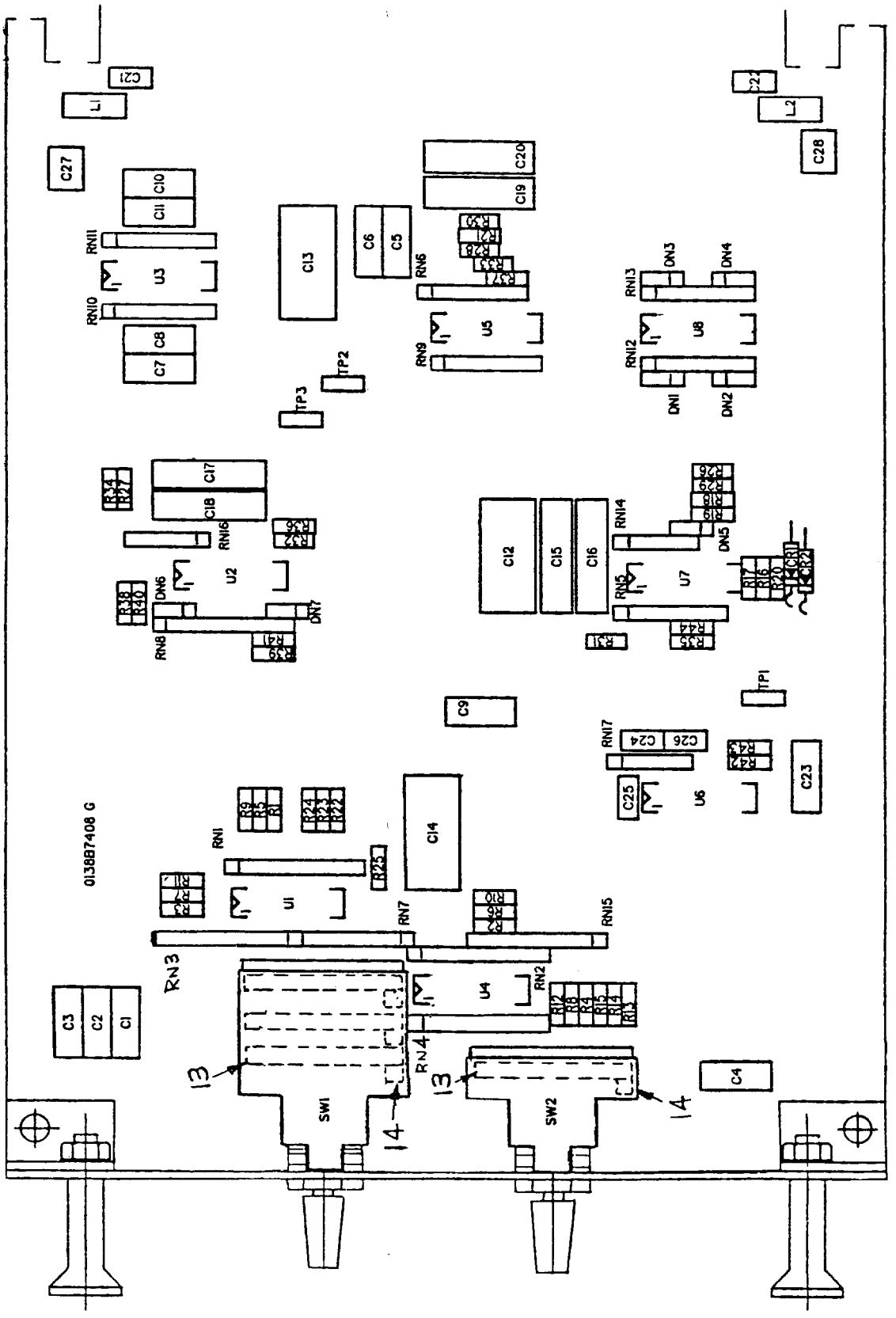


Figure 5 (0138B7408-2, Sh. A2) Silk Screen for DFM Module

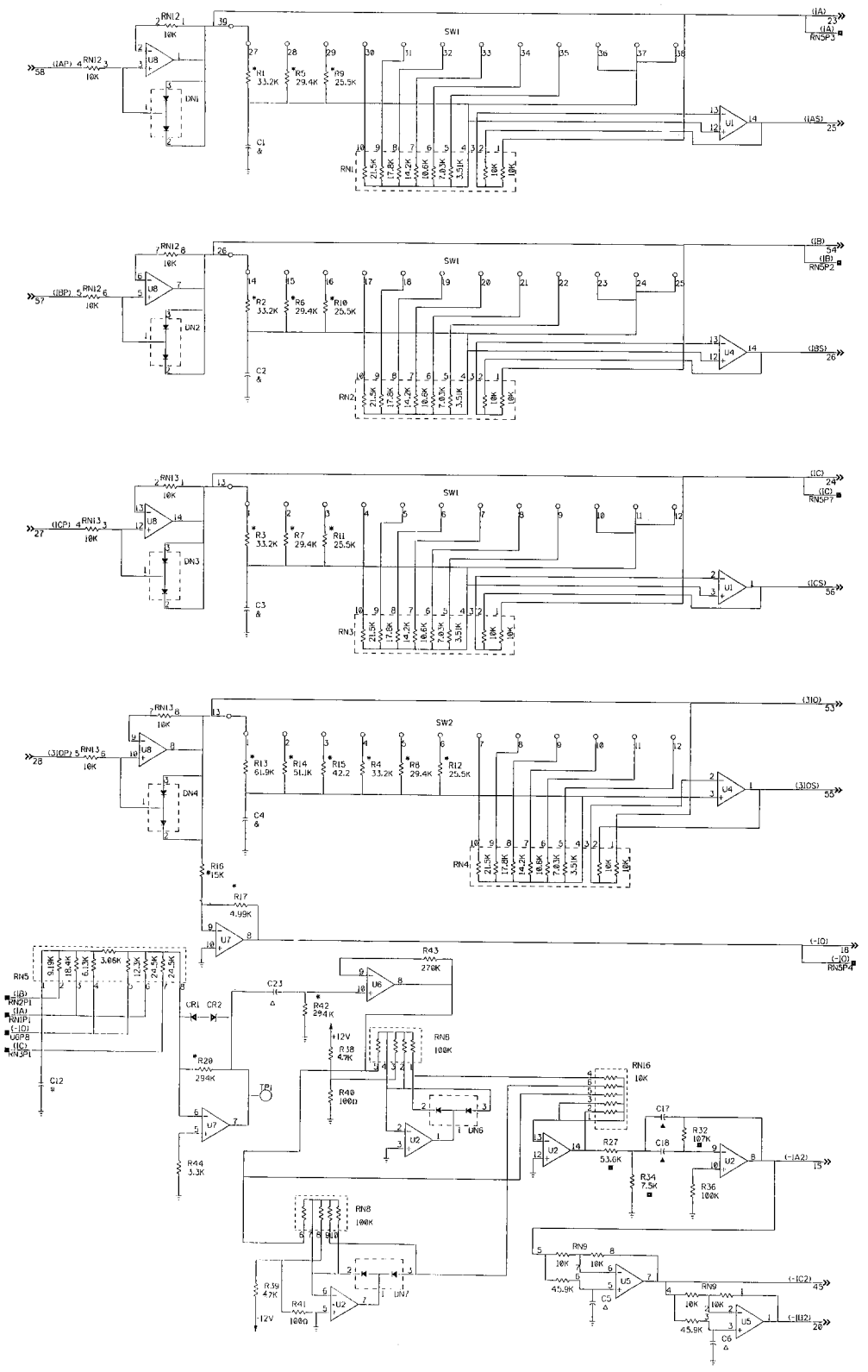


Figure 6 (0138D4708-4, Sh. 1) Schematic Diagram of DFM Module

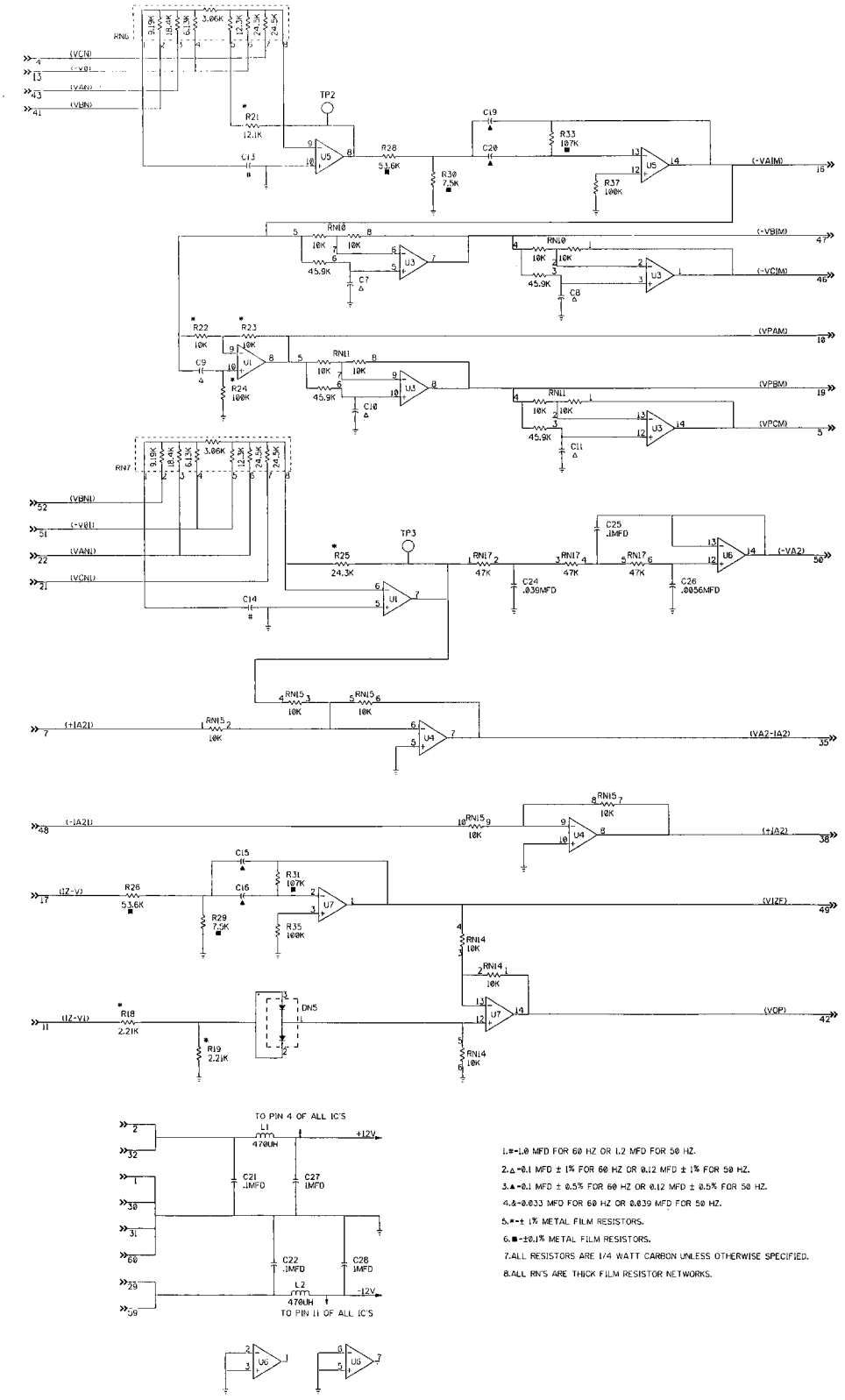


Figure 6A (0138D4708-0, Sh. 2) Schematic Diagram of DFM Module

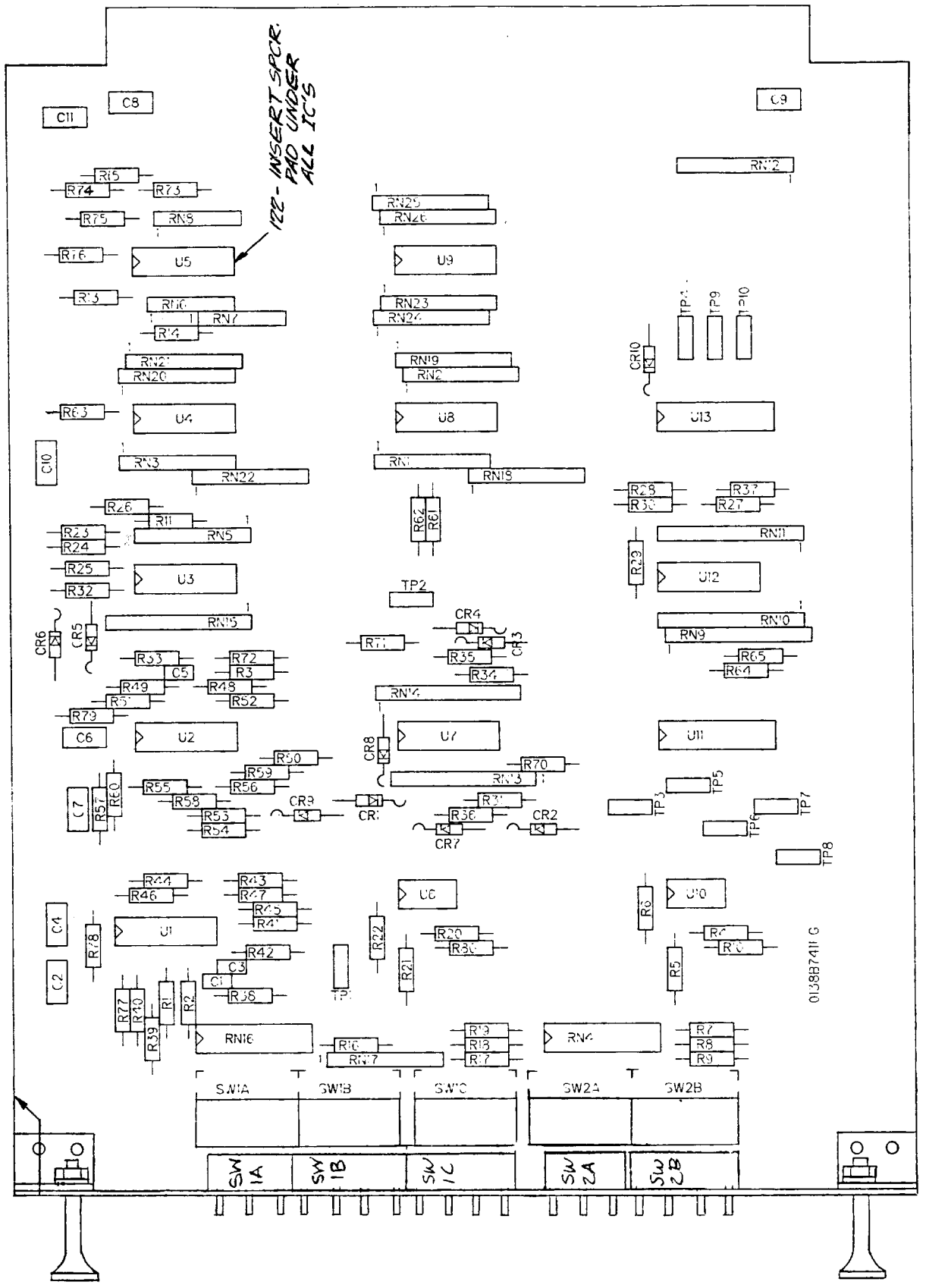


Figure 7 (0138B7411-5, Sh. A1) Silk Screen for DIM Module

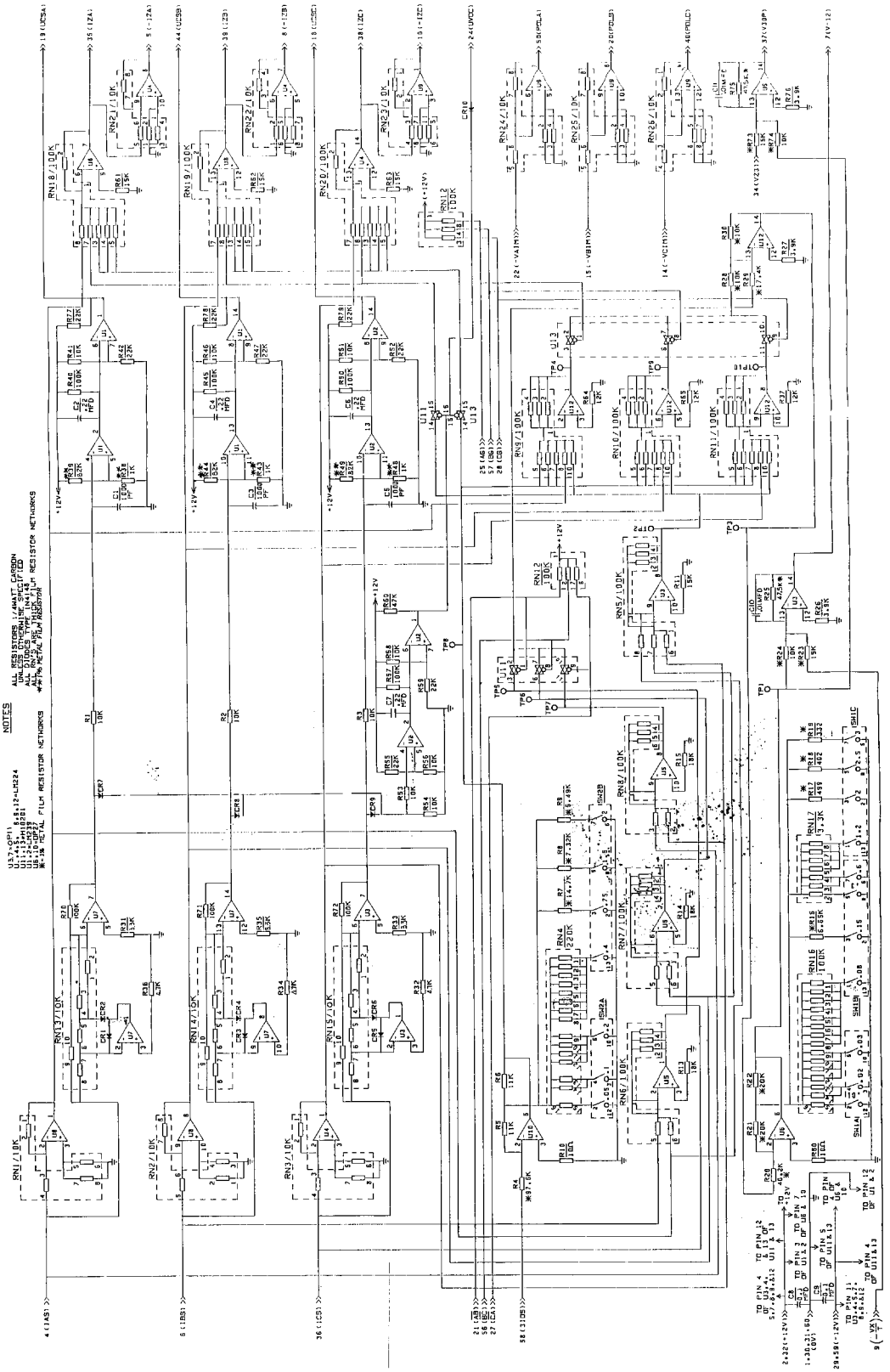


Figure 8 (0138D4711-3) Schematic Diagram of DIM Module

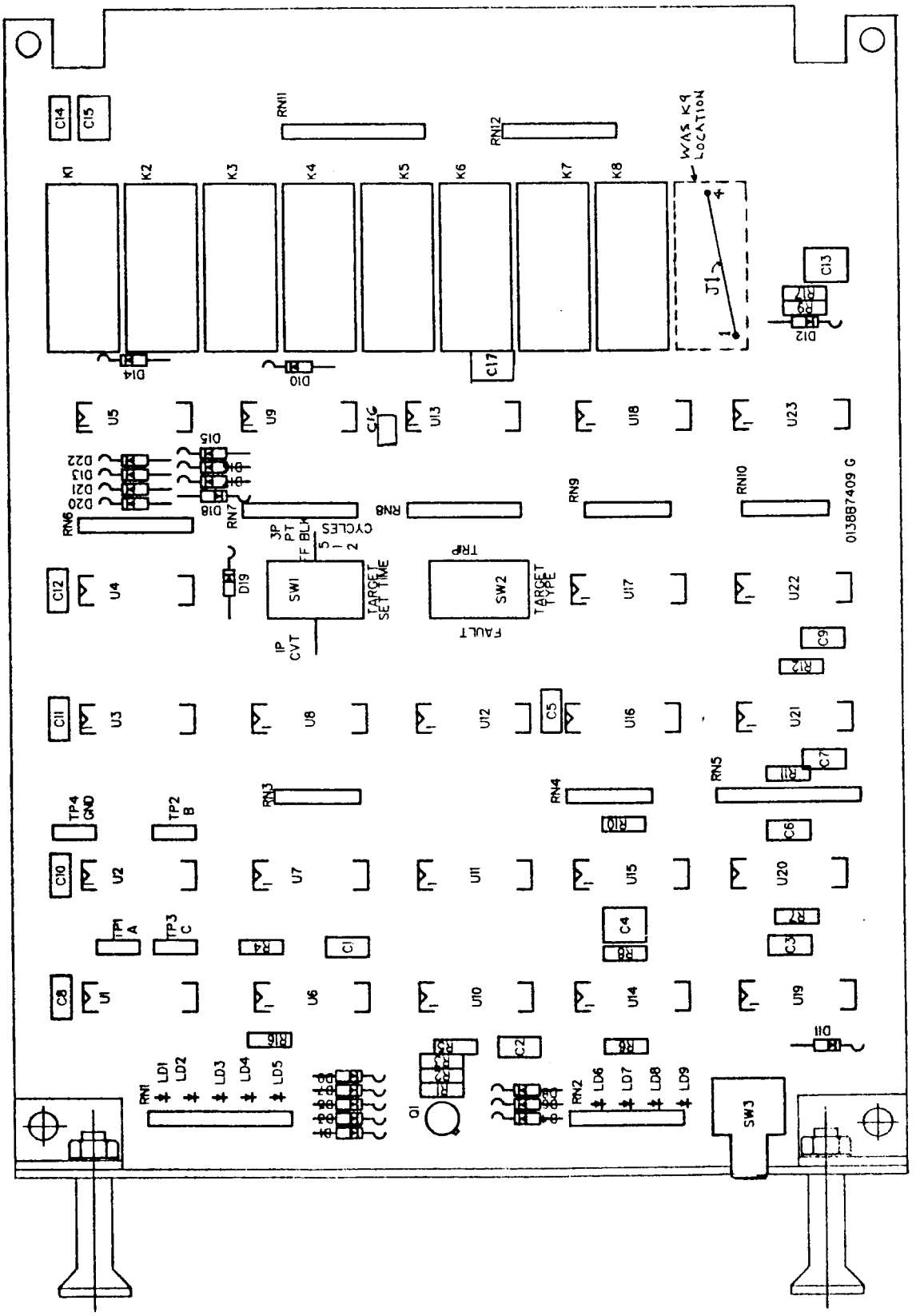


Figure 9 (0138B7409-3, Sh. A2) Silk Screen for DLM Module

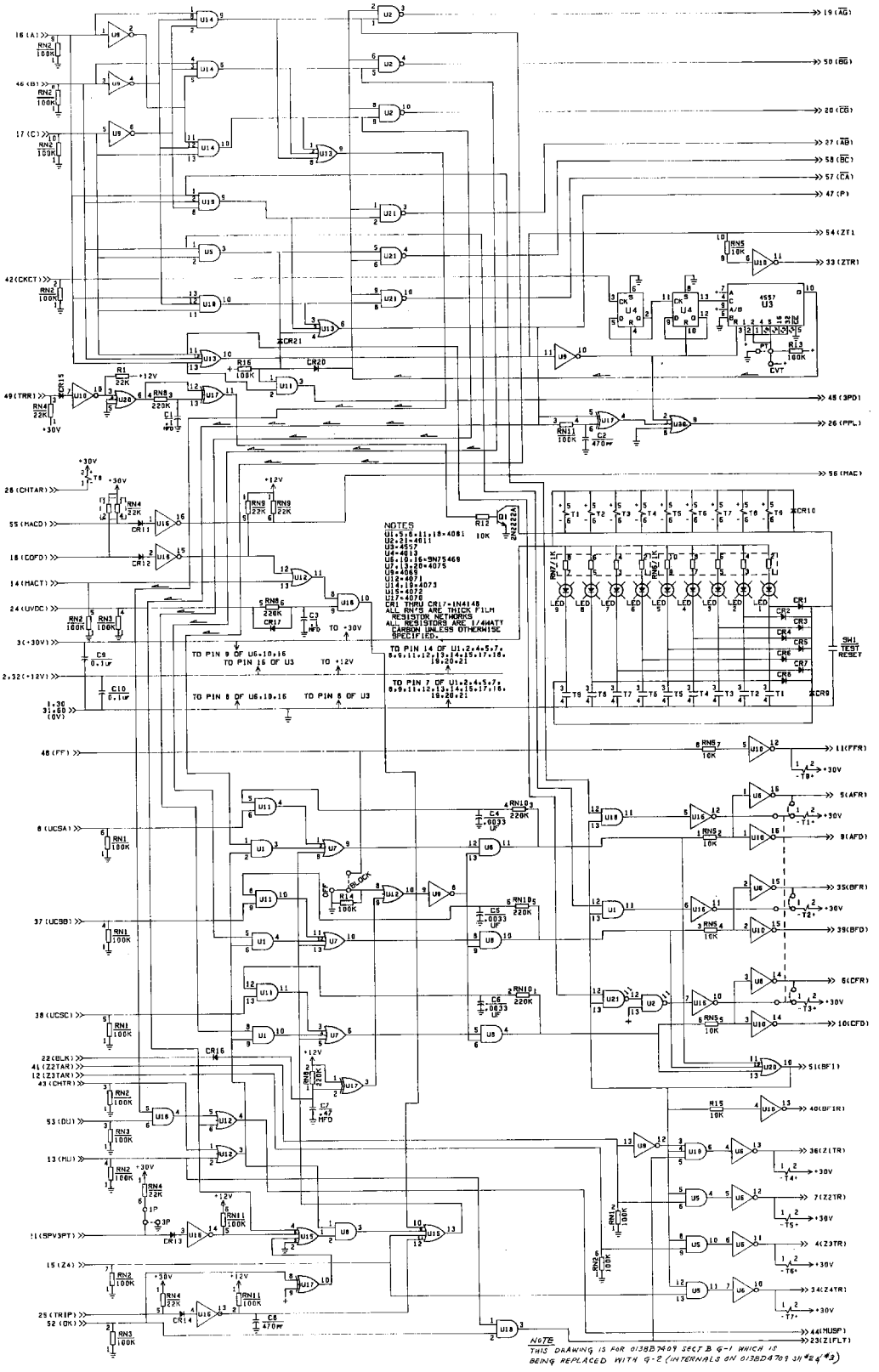


Figure 10 (0138D4709-4, Sh. 1) Schematic Diagram of DLM Module

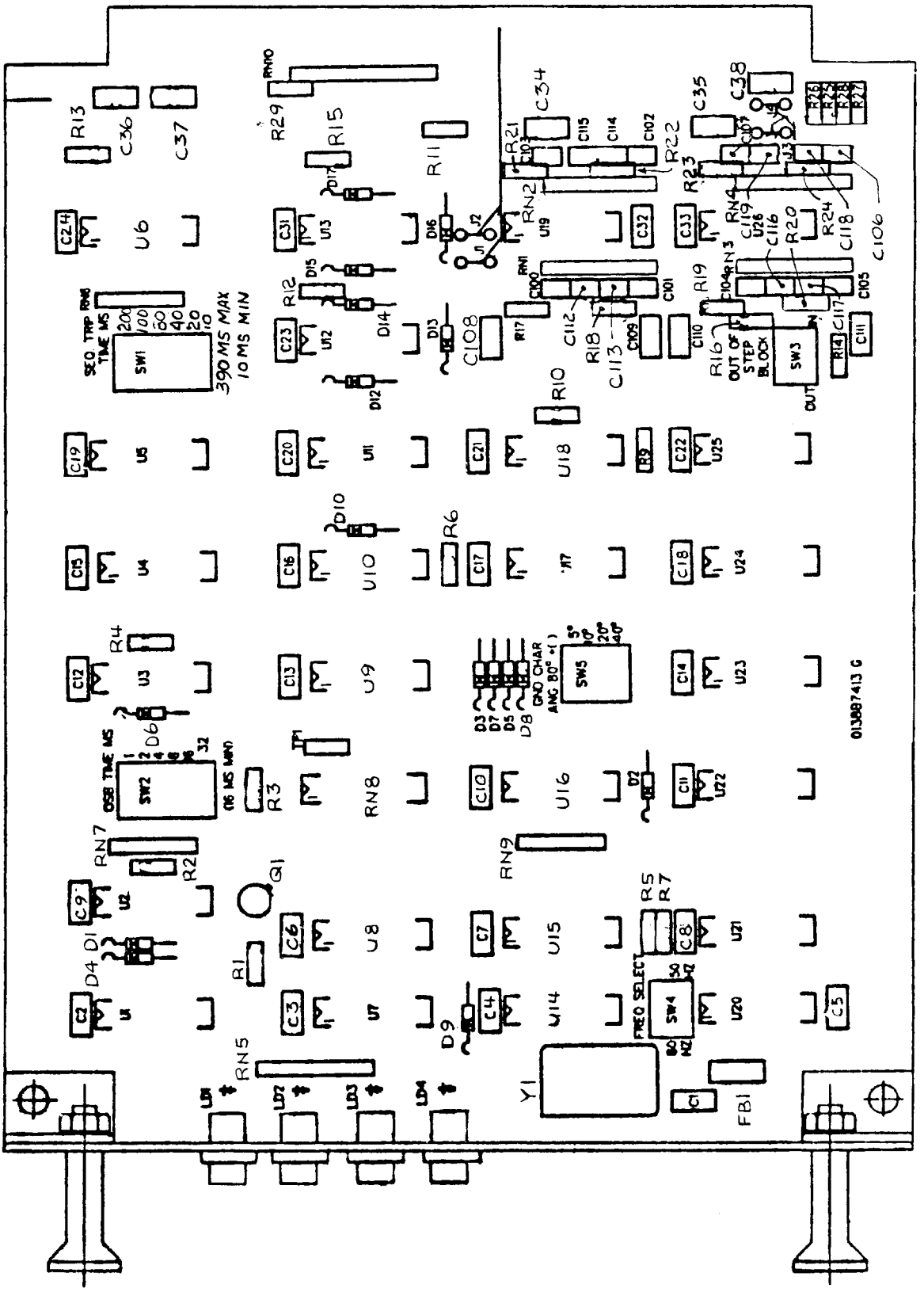


Figure 11 (0138B7413-4, Sh. A2) Silk Screen for DMM Module

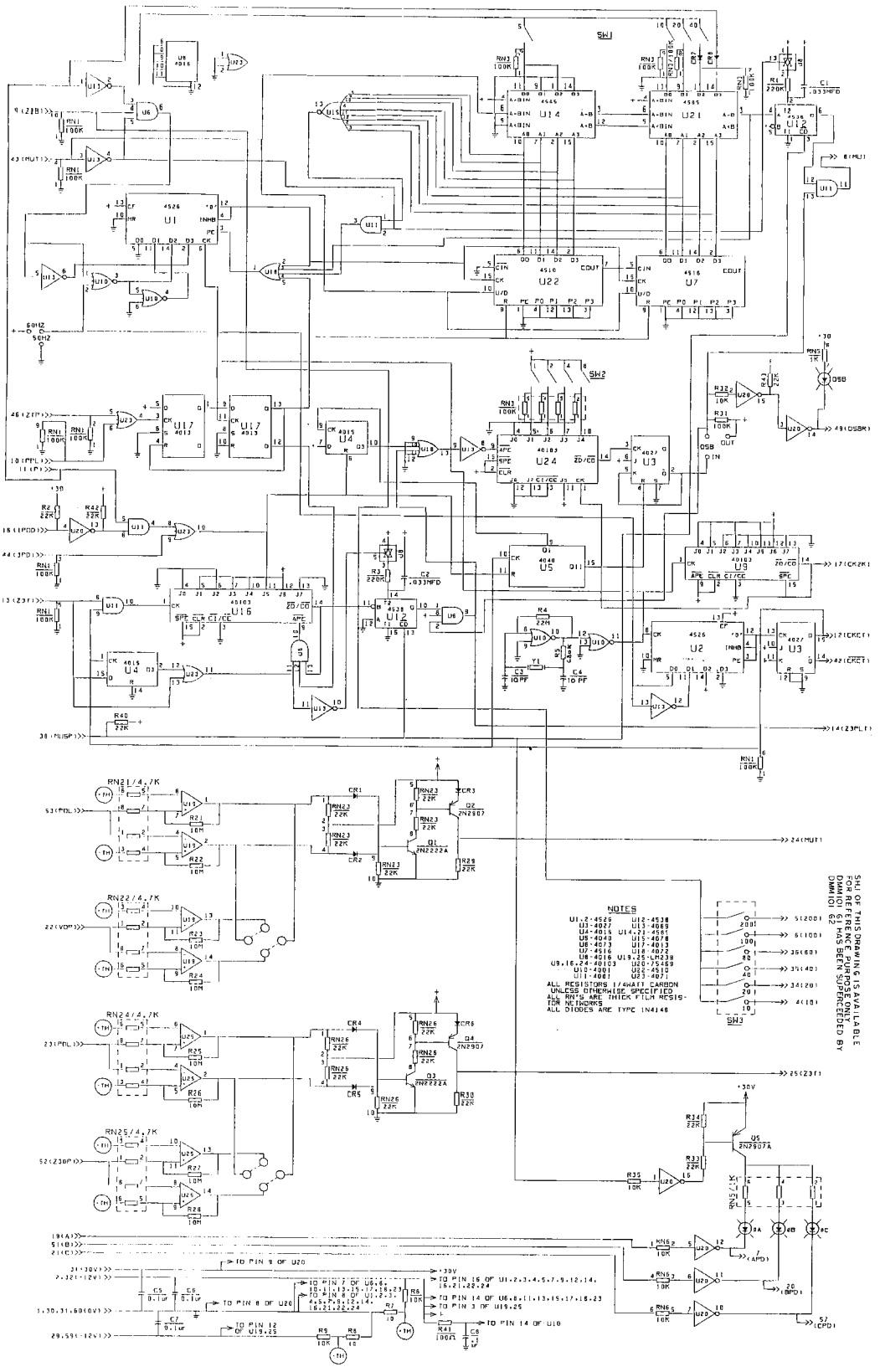


Figure 12 (0138D4713-4, Sh. 1) Schematic Diagram of DMM Module

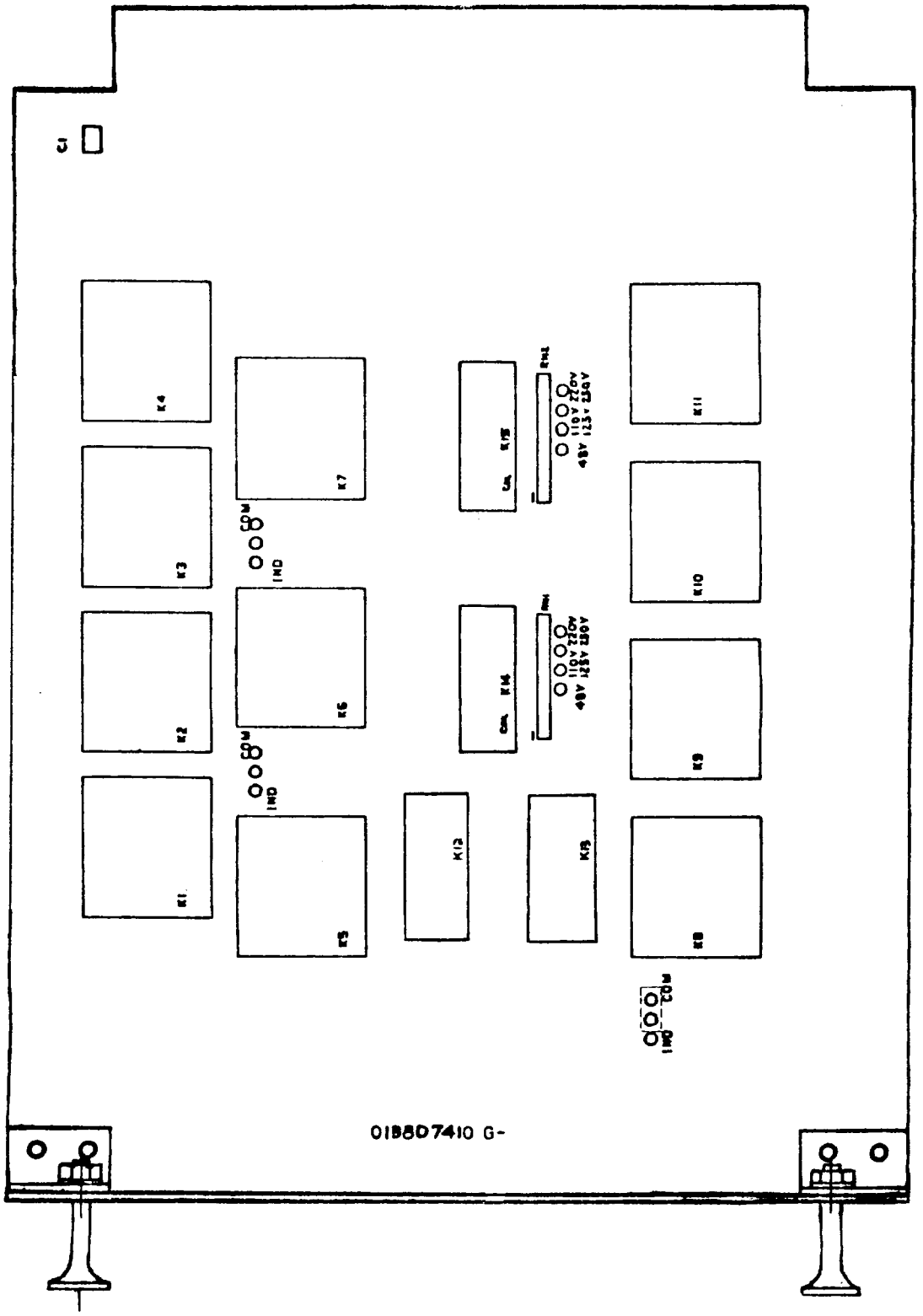


Figure 13 (0138B7410-2, Sh. A3) Silk Screen for DOM Module (left)

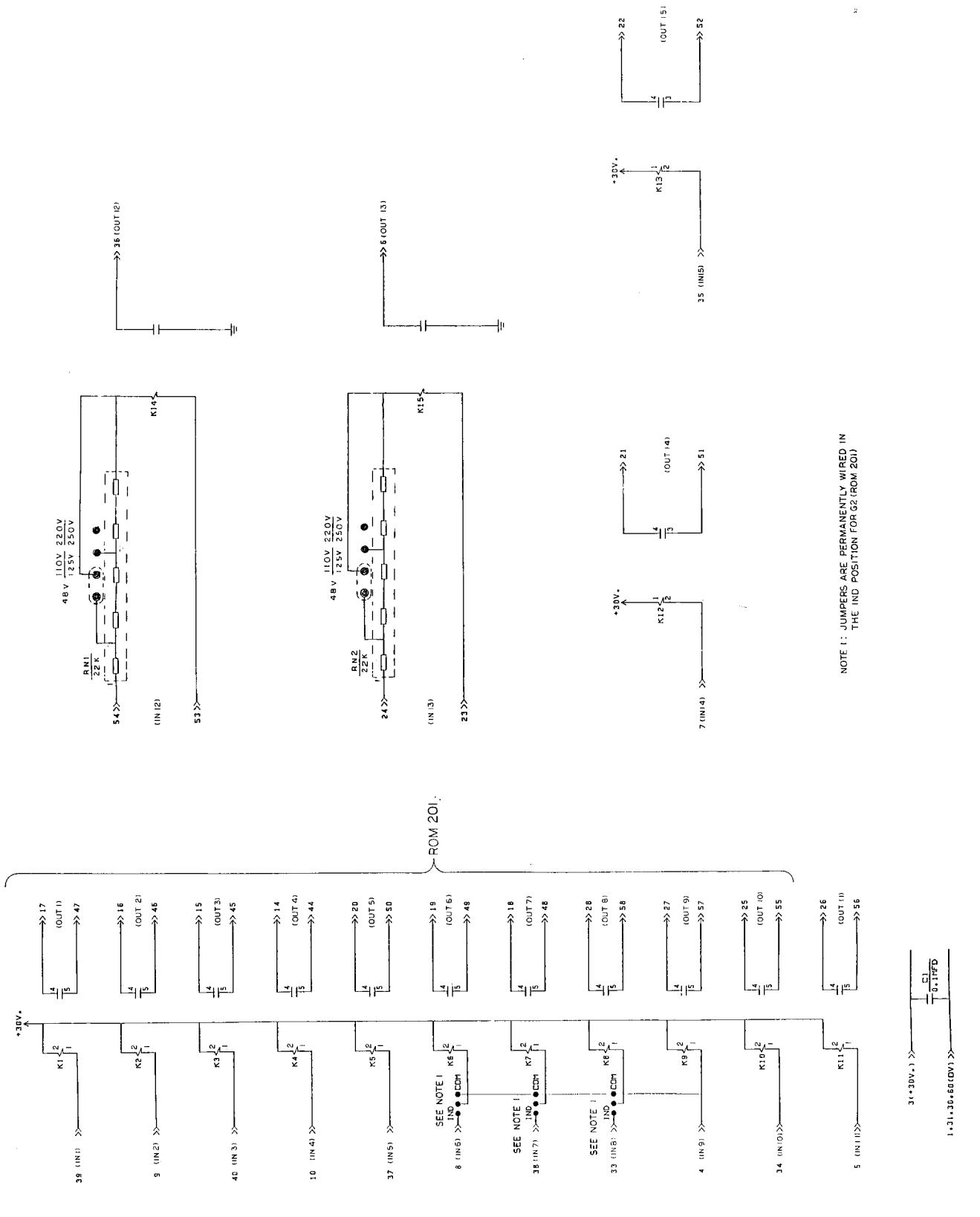


Figure 14 (0138D4710-2, Sh. 2) Schematic Diagram of DOM Module (left)

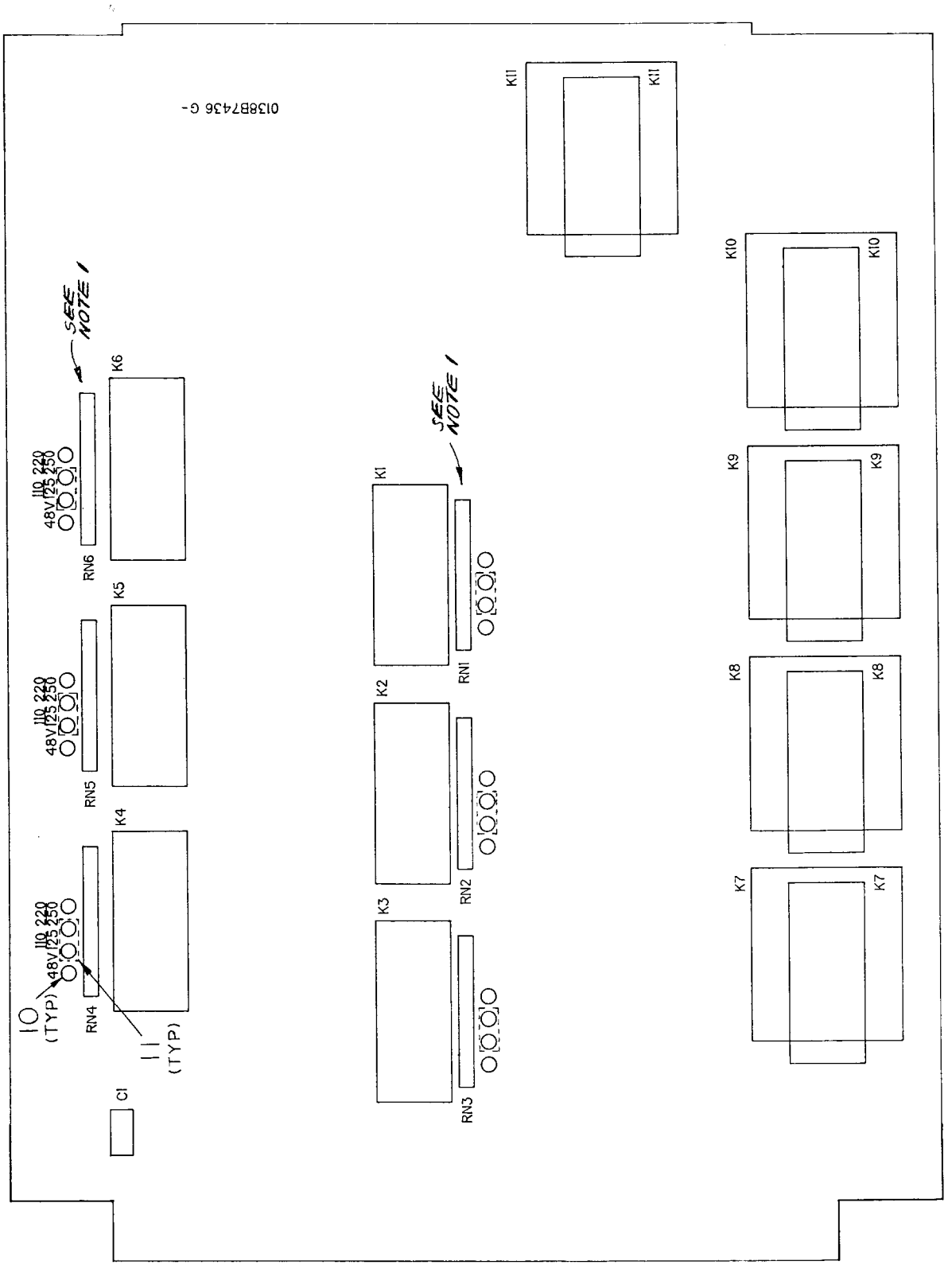


Figure 15 (0138B7436-2, Sh. A1) Silk Screen for DOM Module (right)

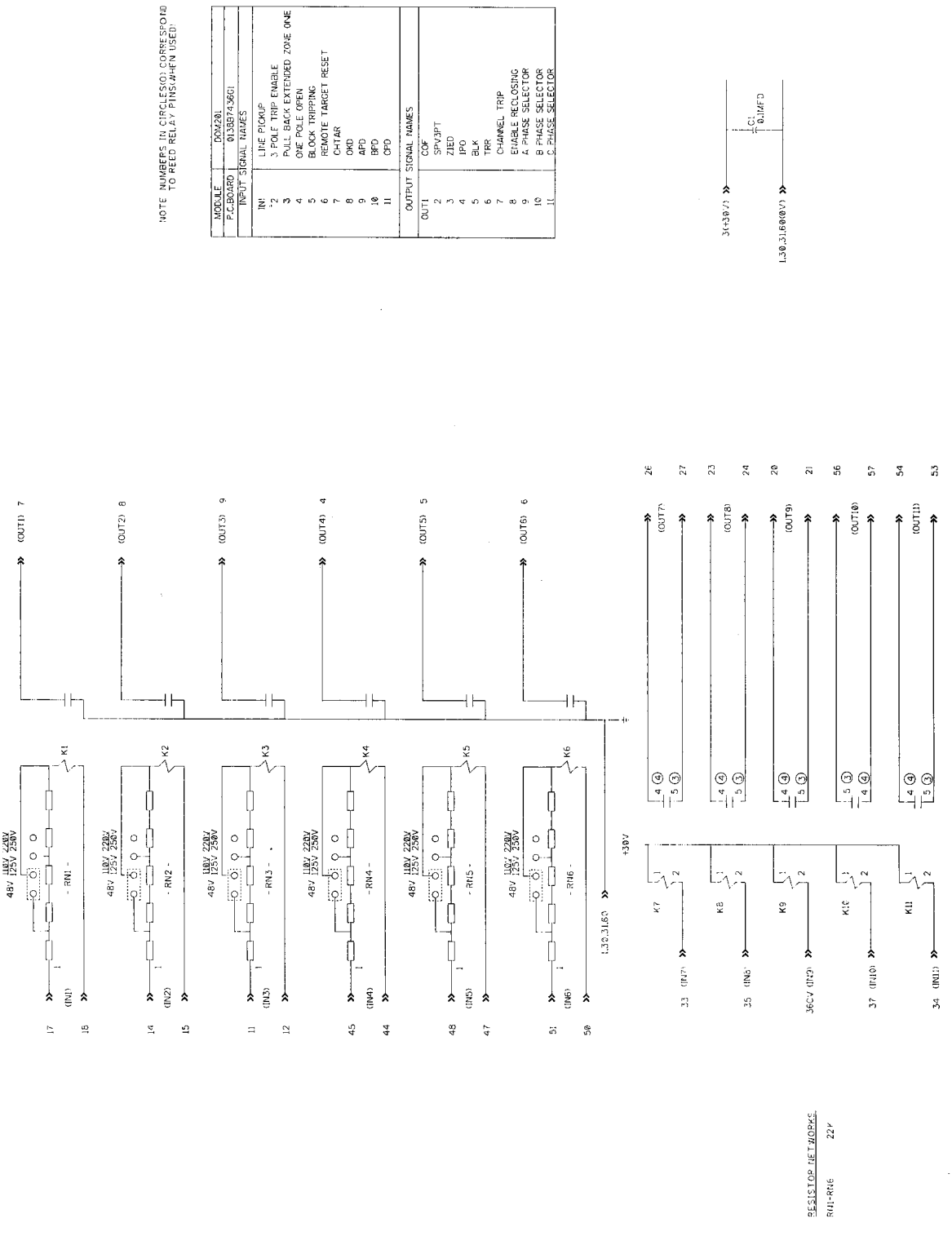


Figure 16 (0138D4736-1) Schematic Diagram of DOM Module (right)

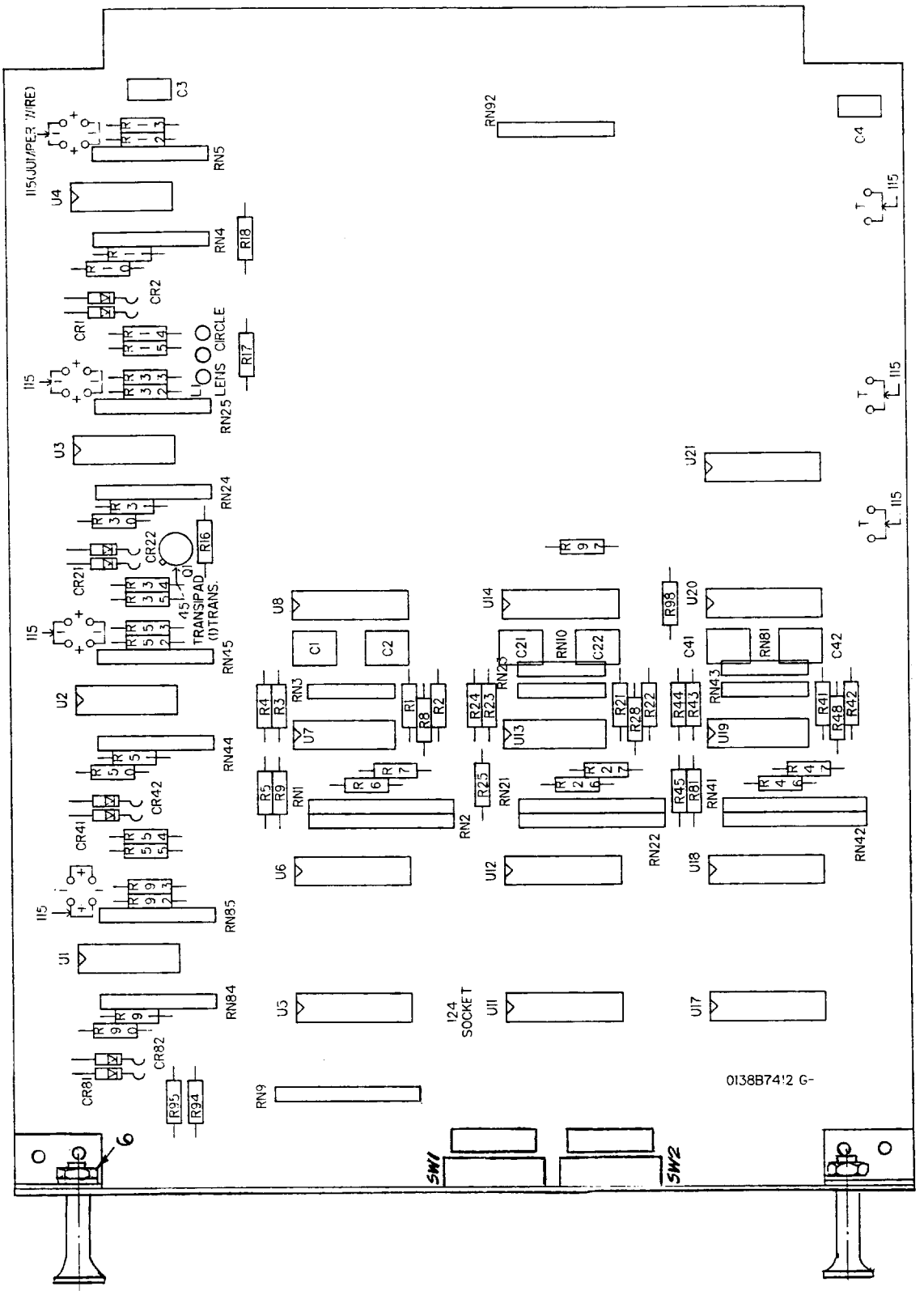


Figure 17 (0138B7412-2, Sh. A2) Silk Screen for DSM Module

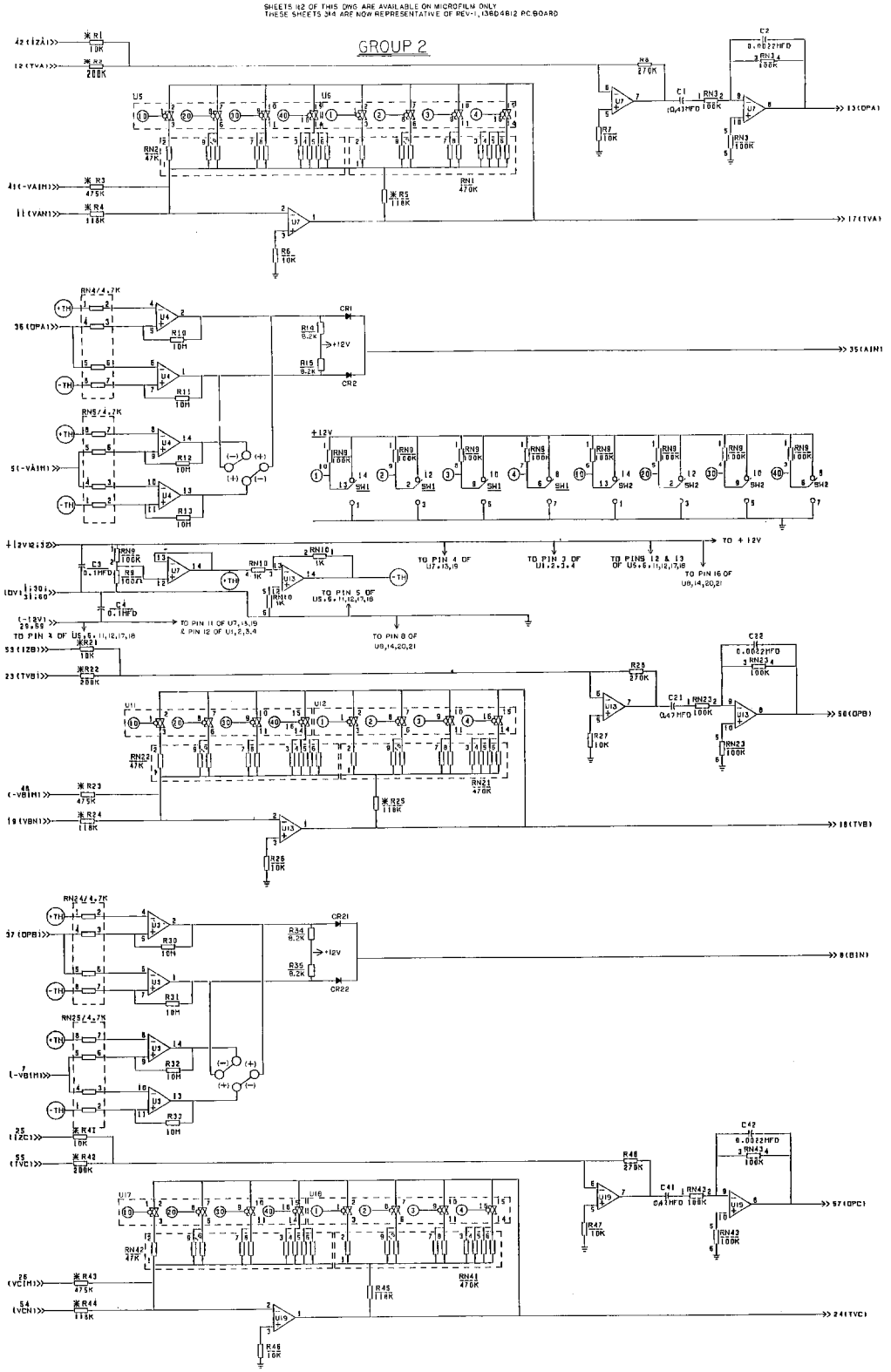


Figure 18 (0138D4712-1, Sh. 3) Schematic Diagram of DSM Module

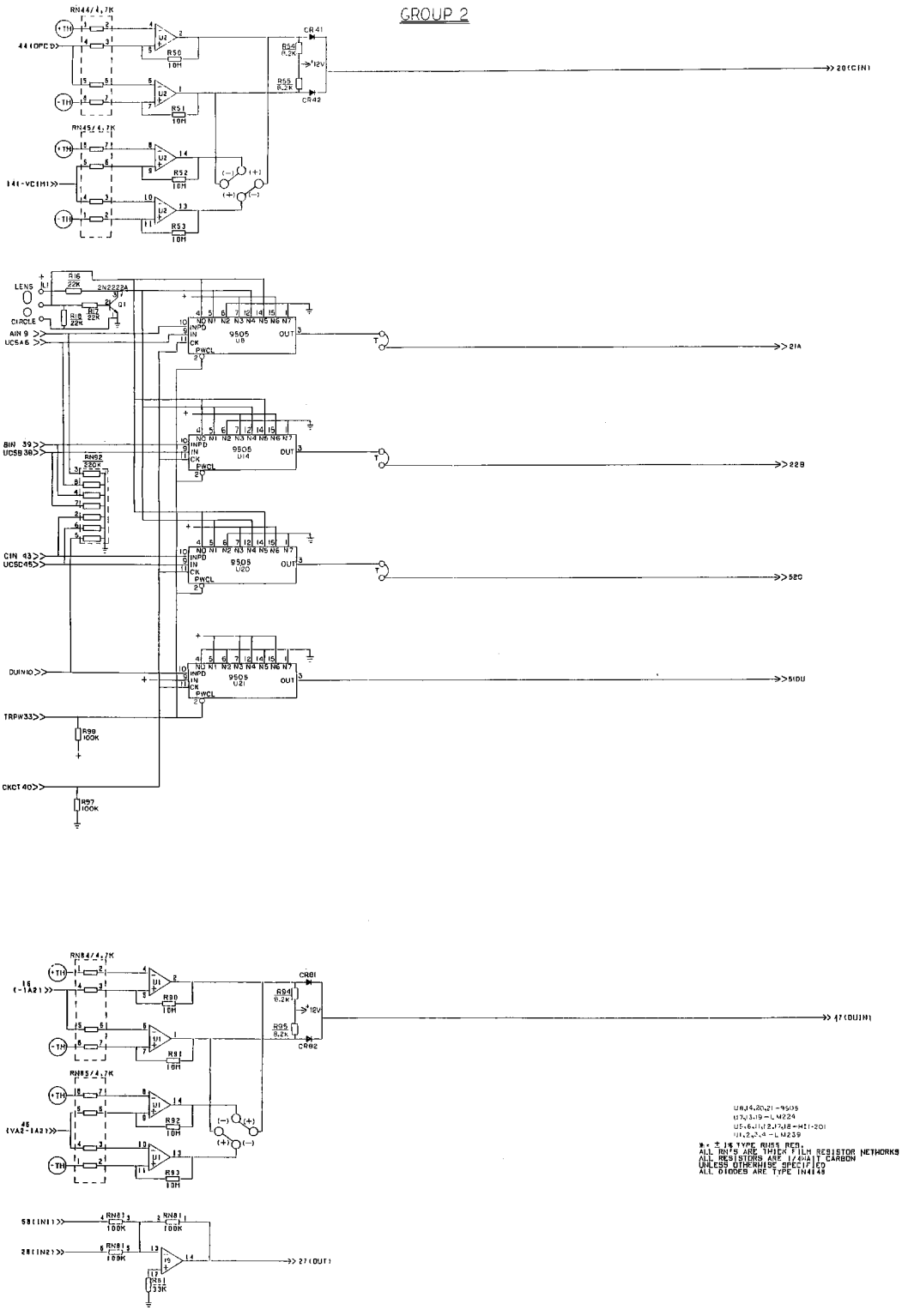


Figure 18A (0138D4712-1, Sh. 4) Schematic Diagram of DSM Module

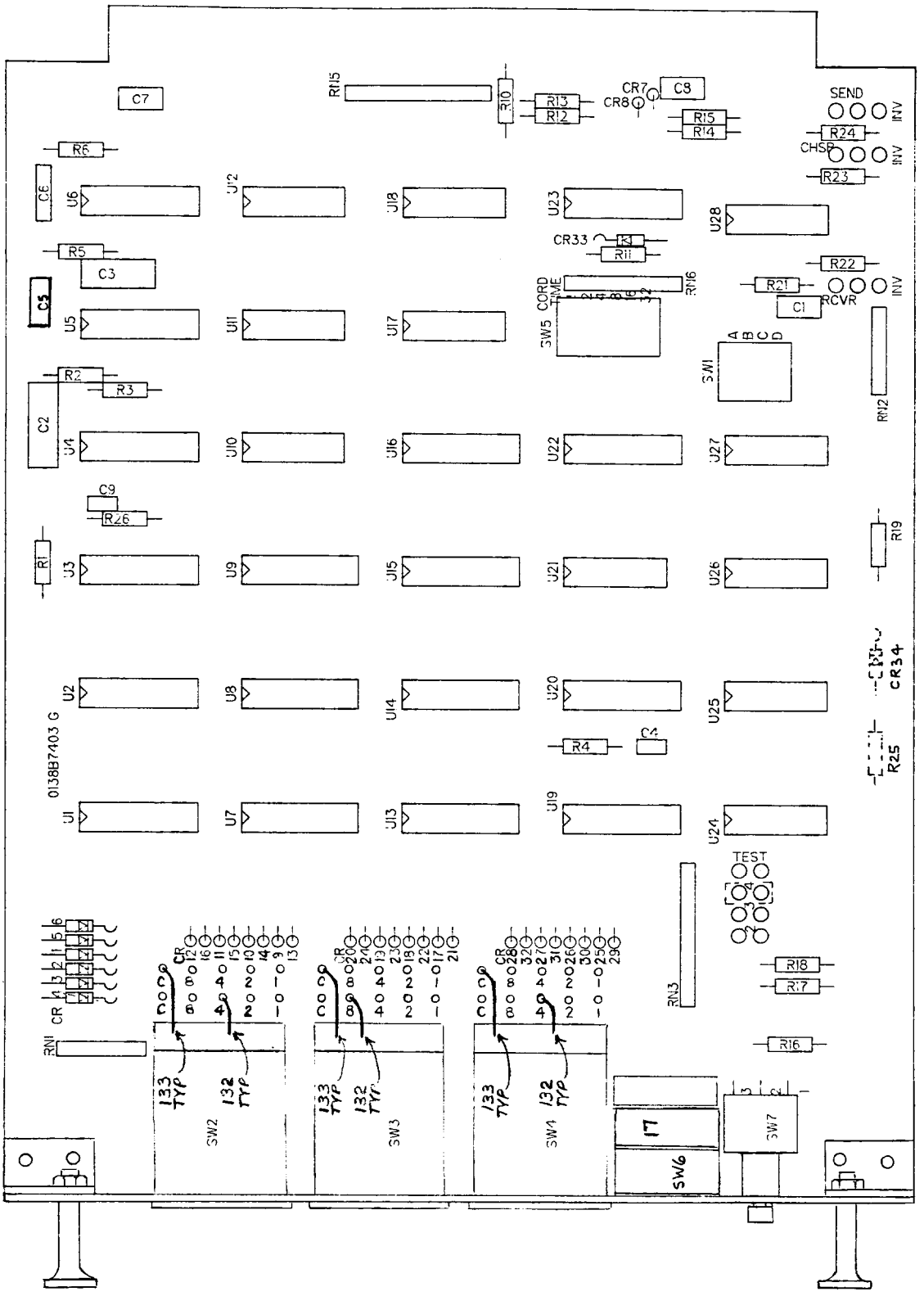


Figure 19 (0138B7403-4, Sh. A2) Silk Screen for DTM Module

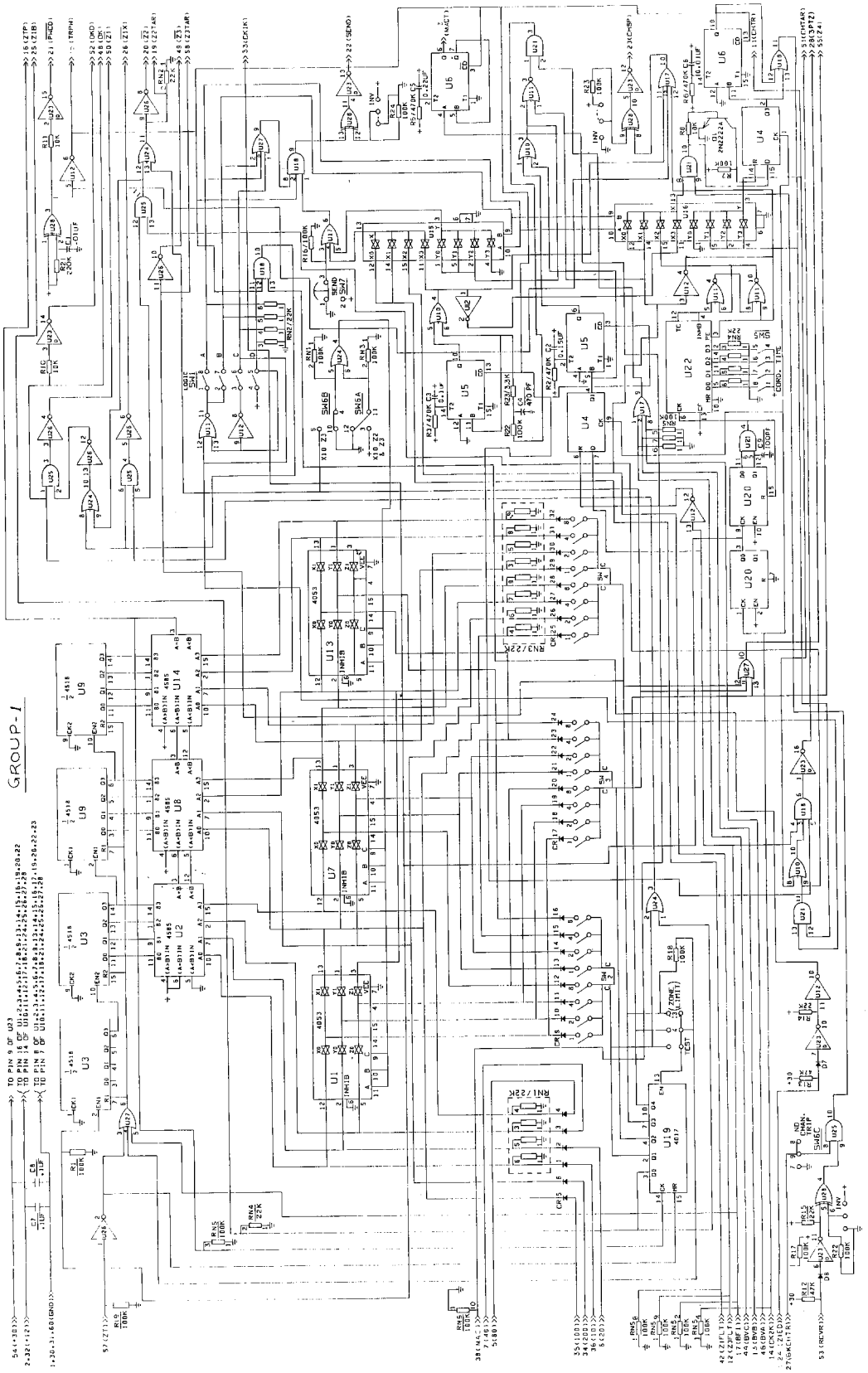


Figure 20 (0138D4703-2, Sh. 1) Schematic Diagram of DTM Module

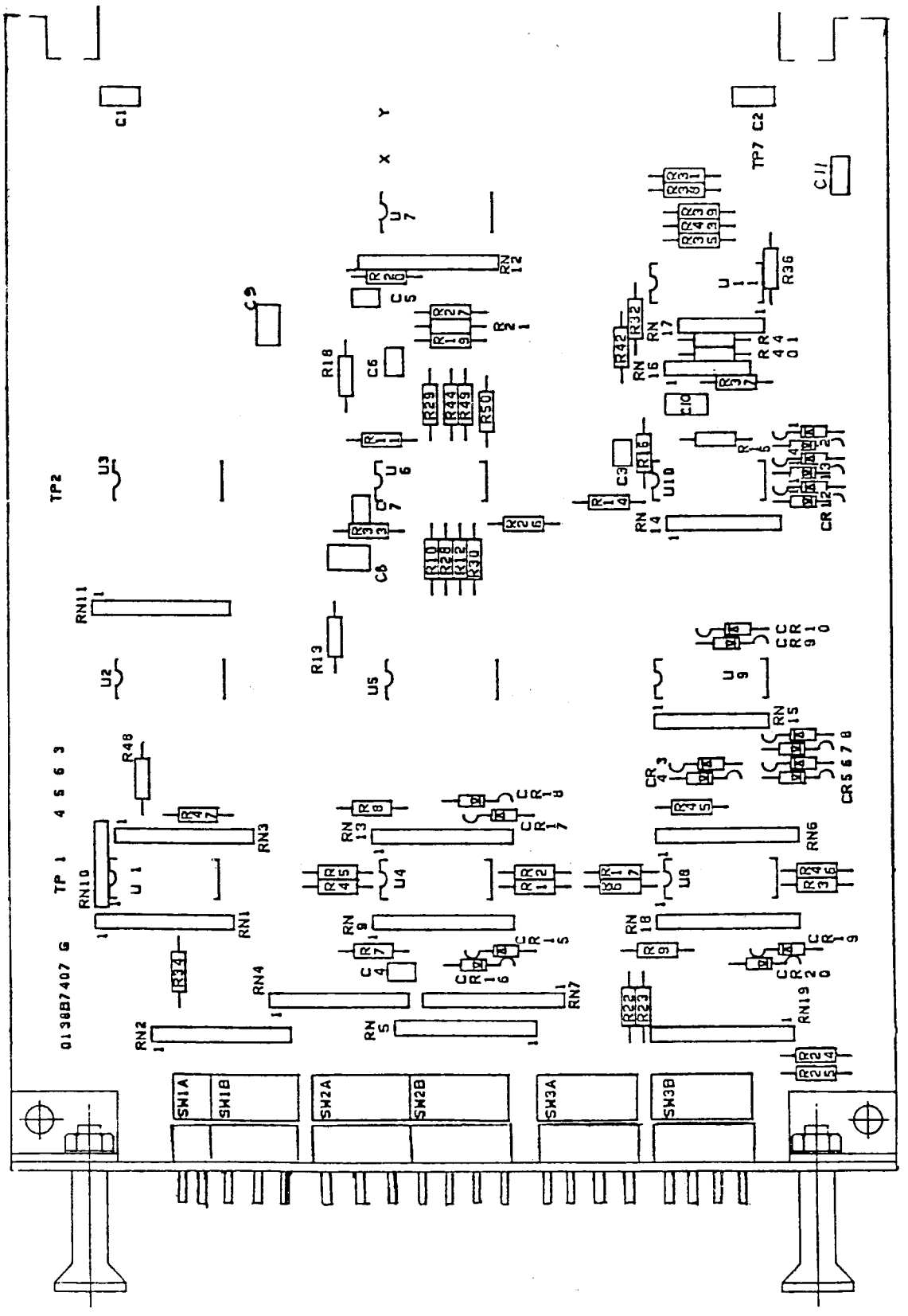


Figure 21 (0138B7407-2, Sh. A1) Silk Screen for DVM Module

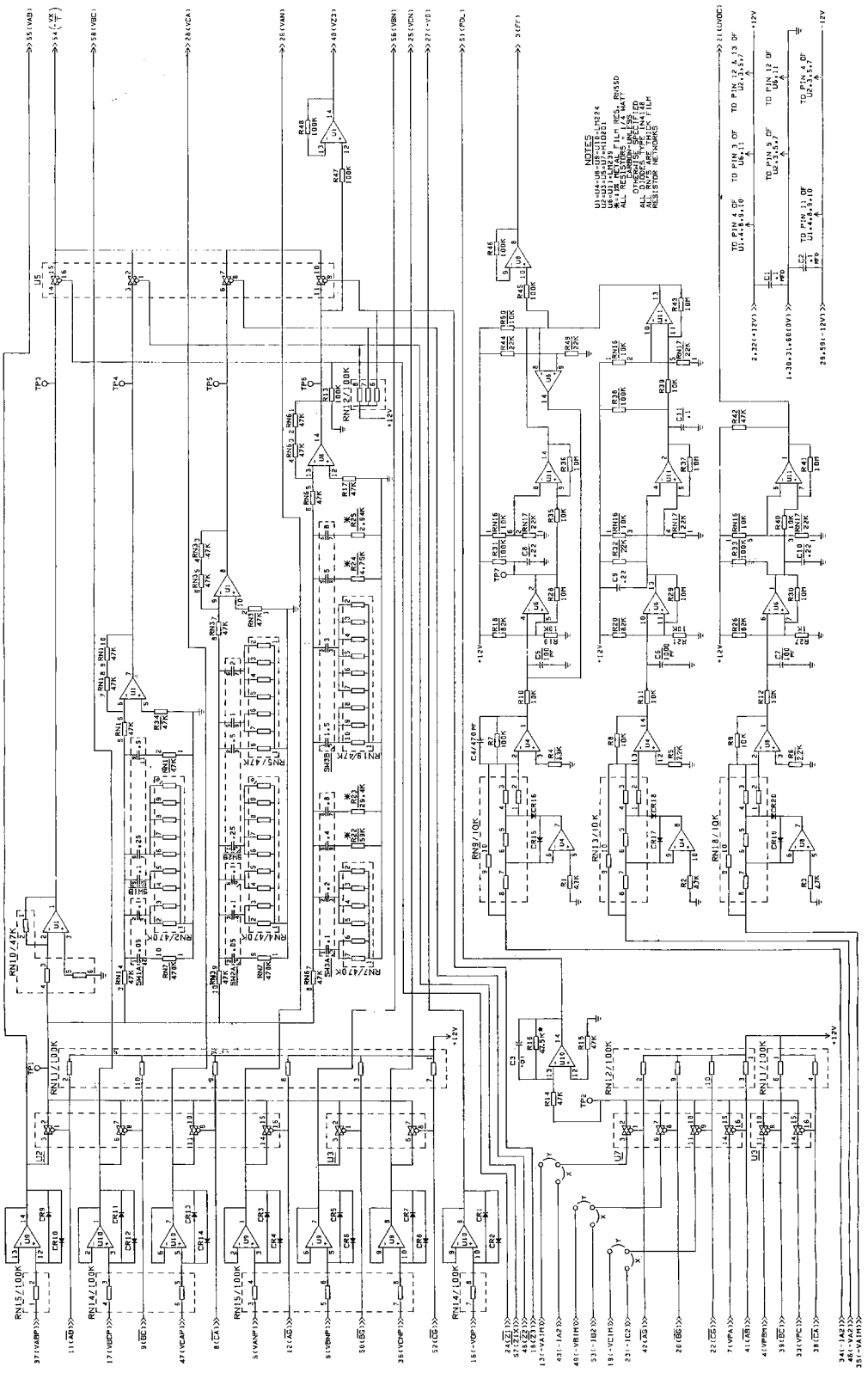
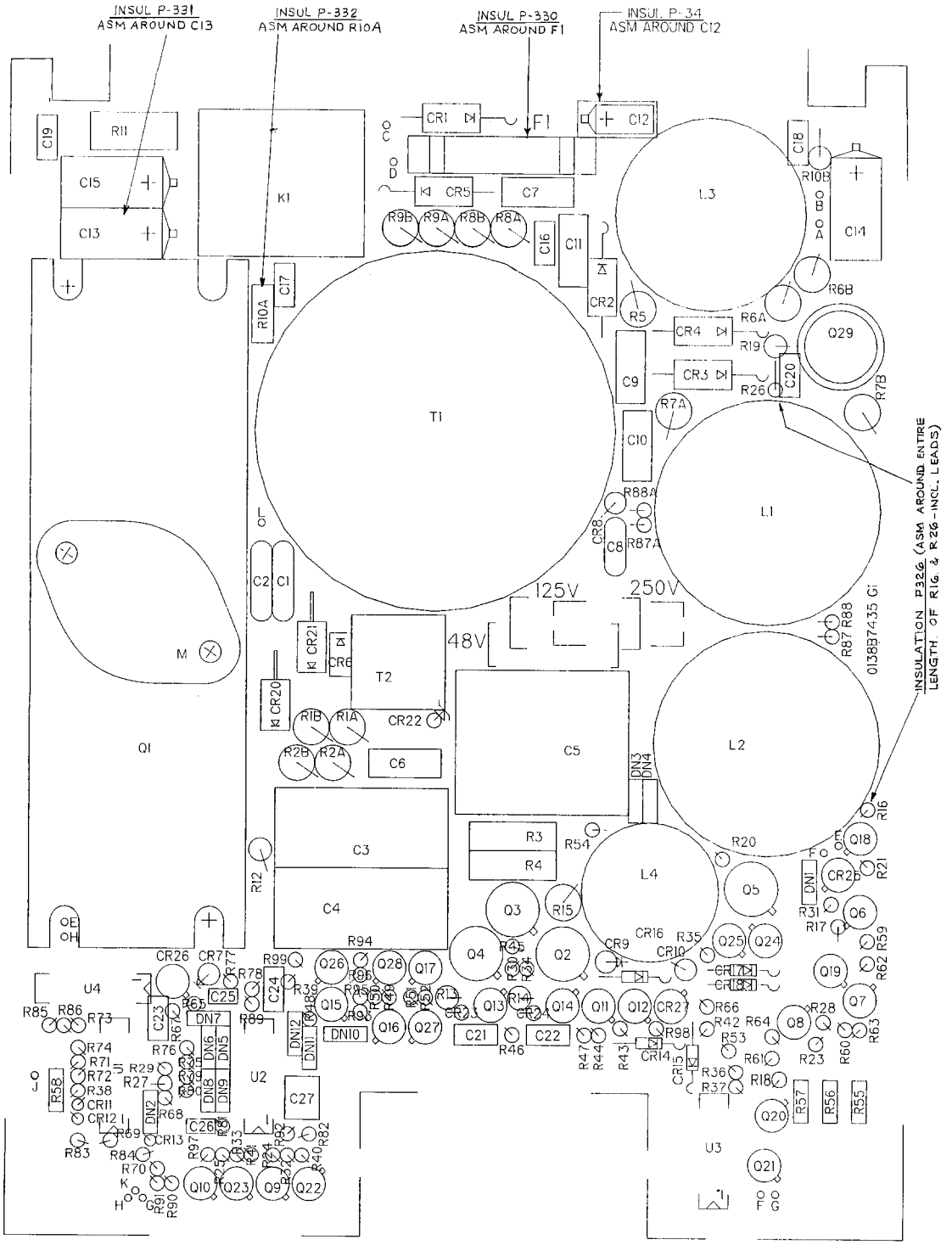


Figure 22 (0138D4707-3) Schematic Diagram of DVM Module



NOTE - SLEEVING (P-324) IS TO BE ASSEMBLED ON
ALL VERTICALLY MOUNTED RESISTORS & DIODES.
R58, CR14, CR15 ARE HORIZONTALLY MOUNTED COMPONENTS
& ARE TO HAVE SLEEVING ON BOTH ENDS.

Figure 23 (0153D6146-3) Silk Screen for PSM Module

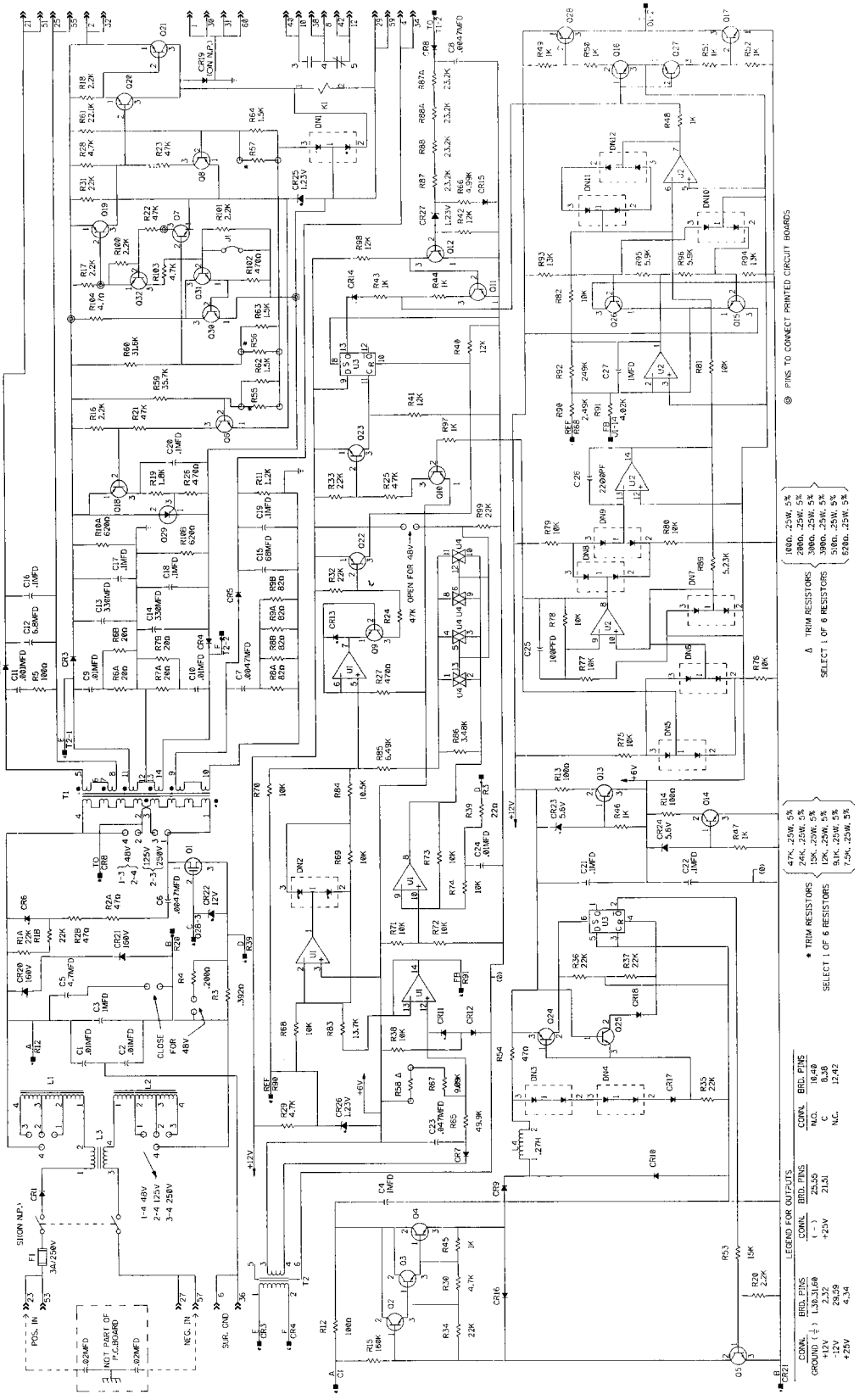


Figure 24 (0138D4735-2) Schematic Diagram of PSM Module

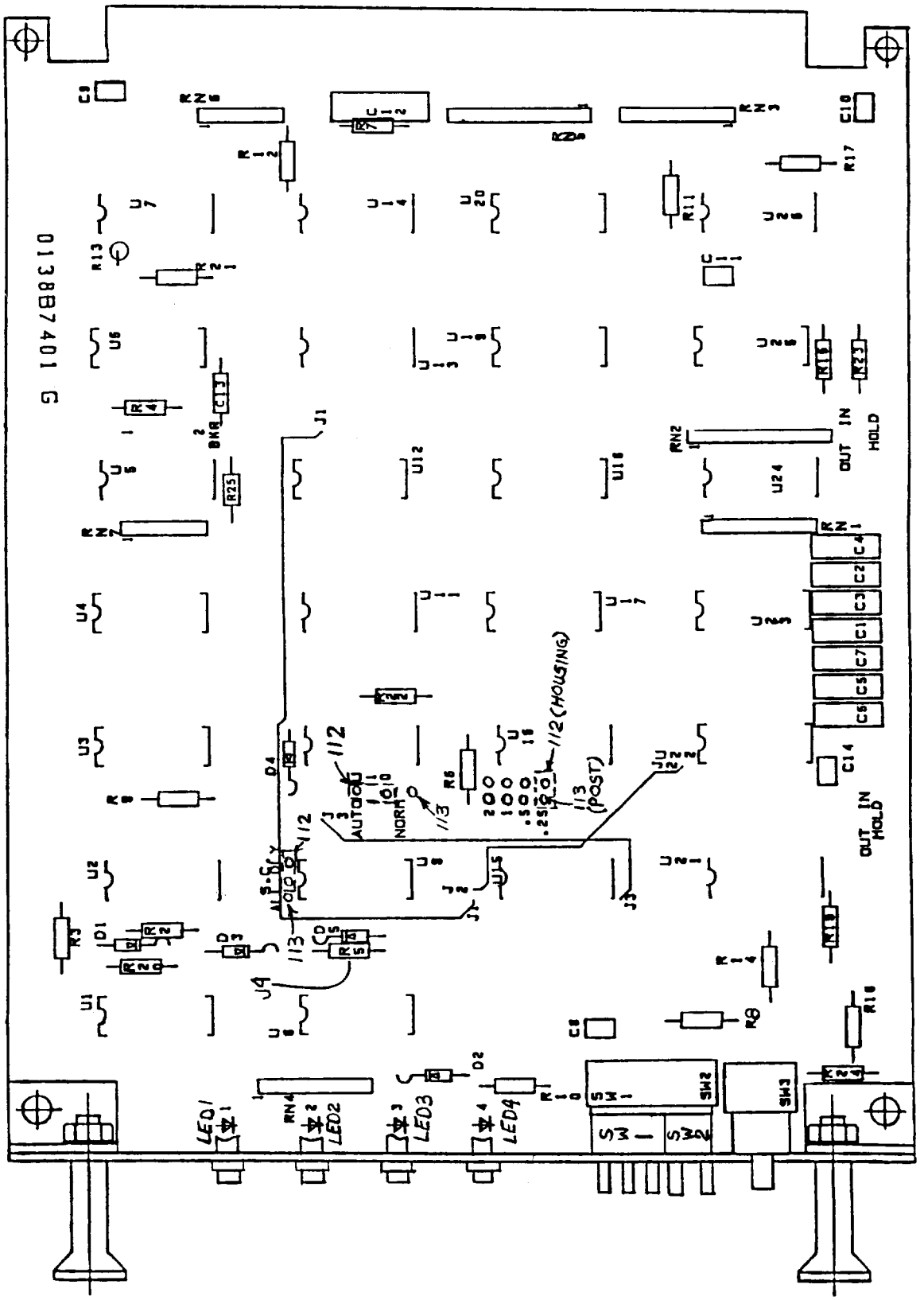


Figure 25 (0138B7401-2, Sh. A2) Silk Screen for RLM Module

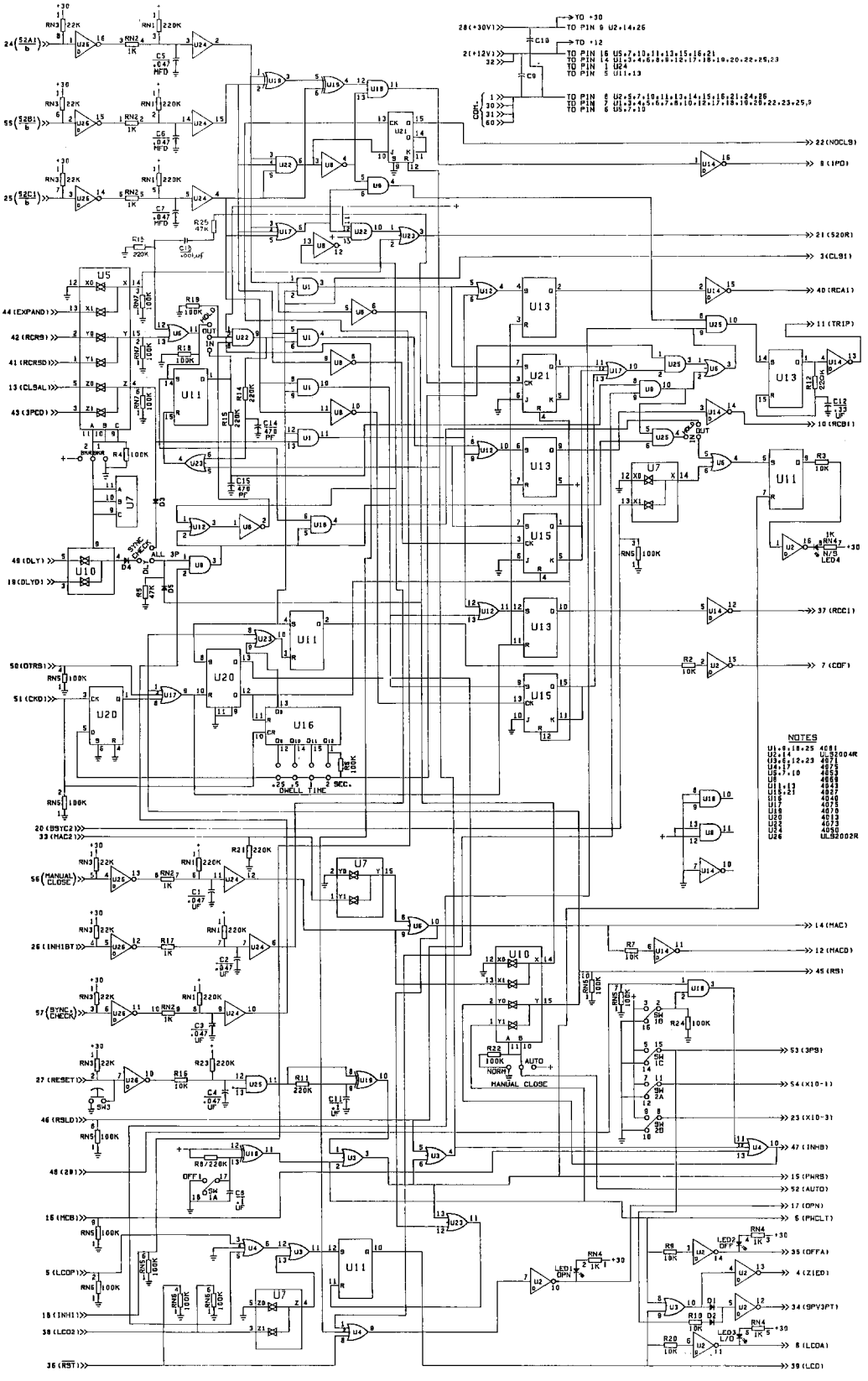


Figure 26 (0138D4701-2, Sh. 3) Schematic Diagram of RLM Module

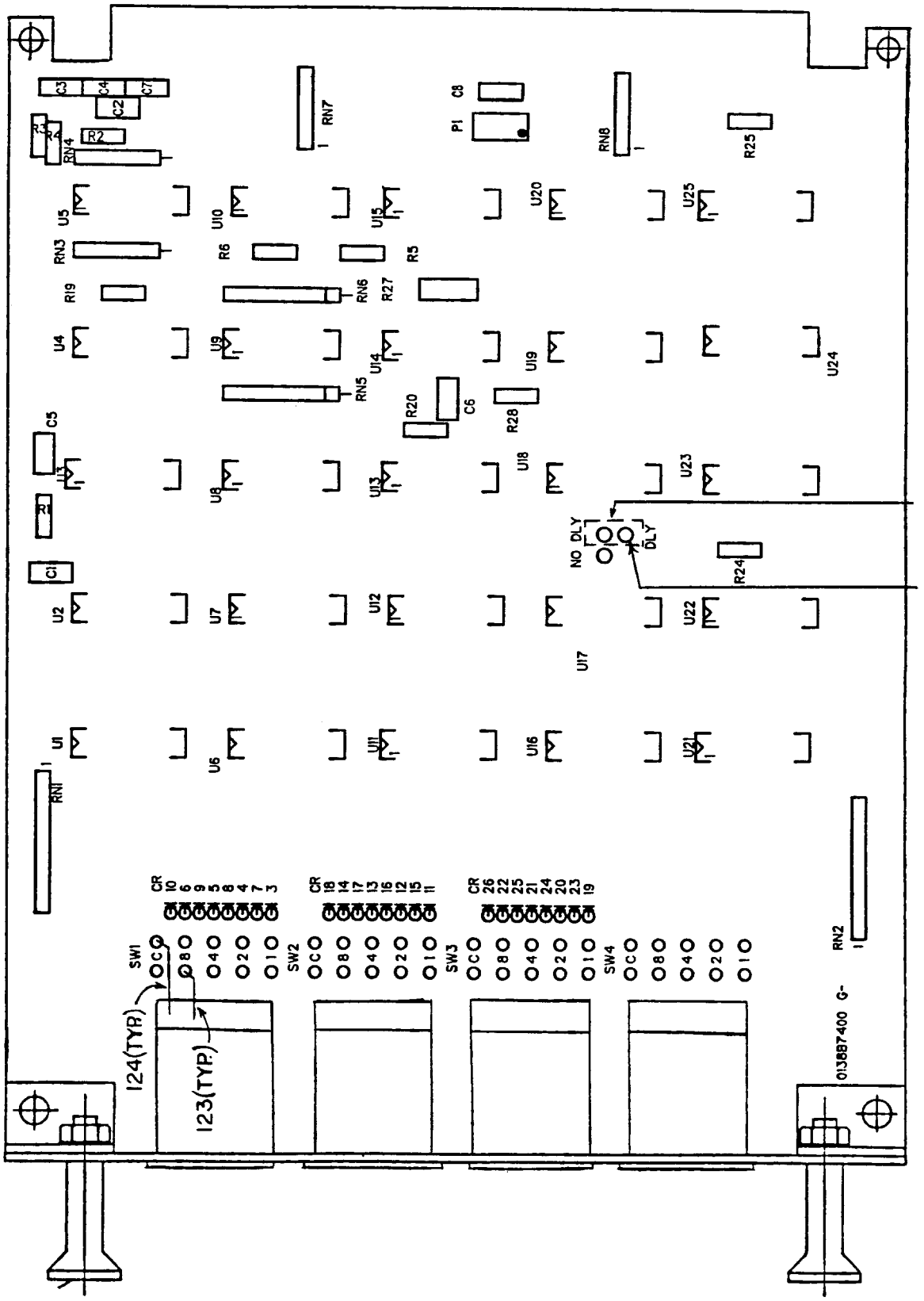


Figure 27 (0138B7400-2, Sh. A3) Silk Screen for RTM Module

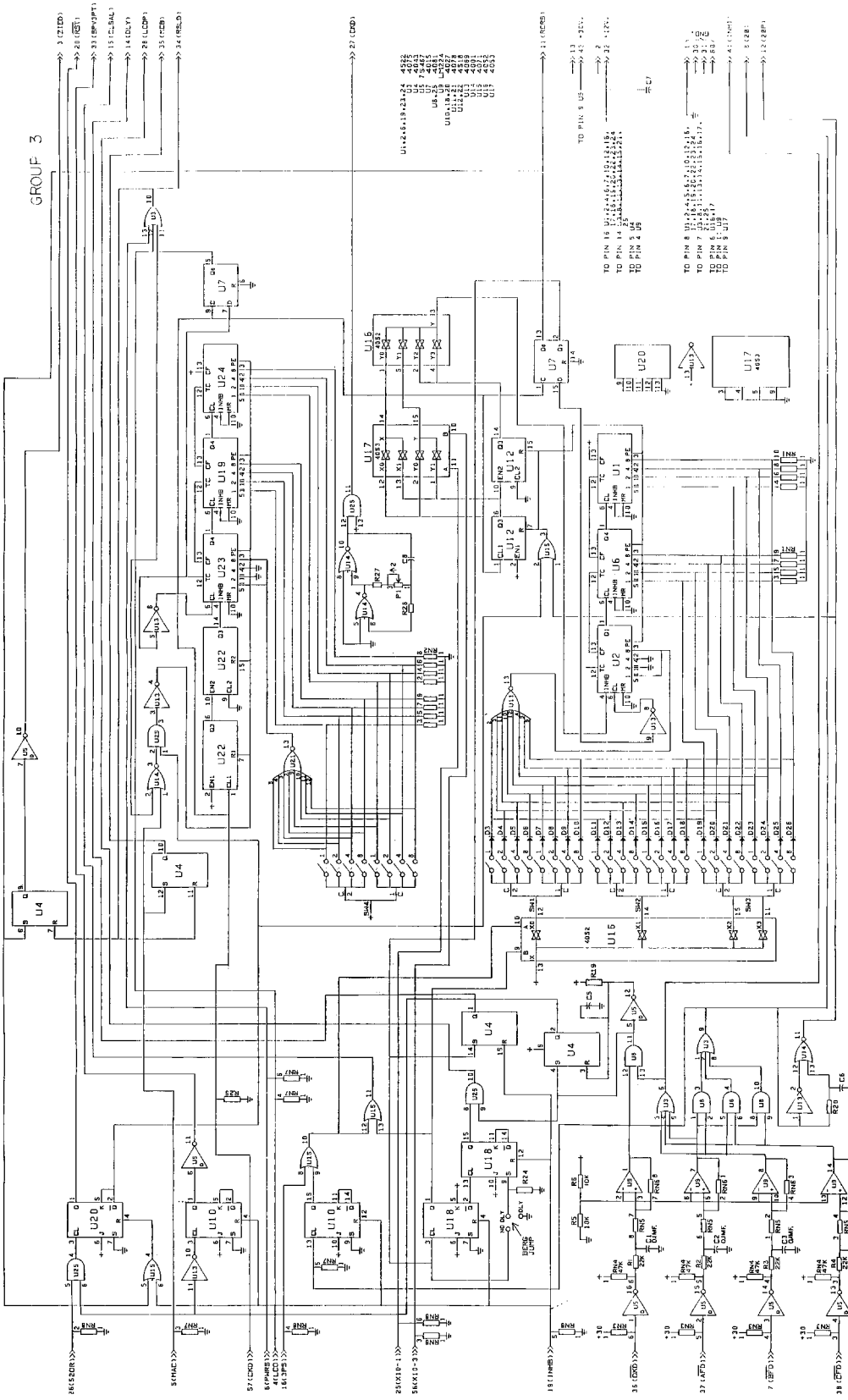


Figure 28 (0138D4700-1, Sh. 3) Schematic Diagram of RTM Module

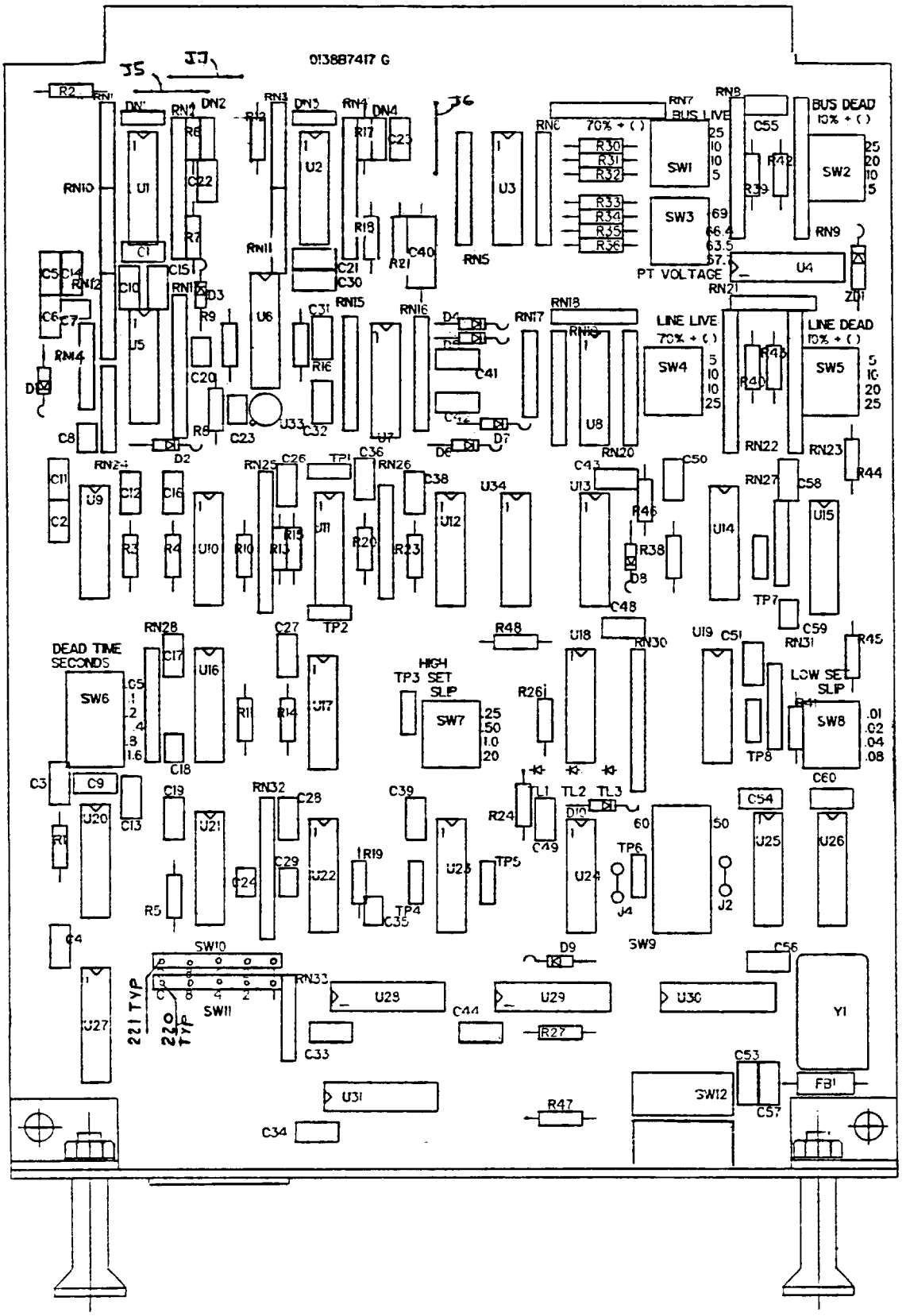


Figure 29 (0138B7417-0, Sh. A2) Silk Screen for SVM Module

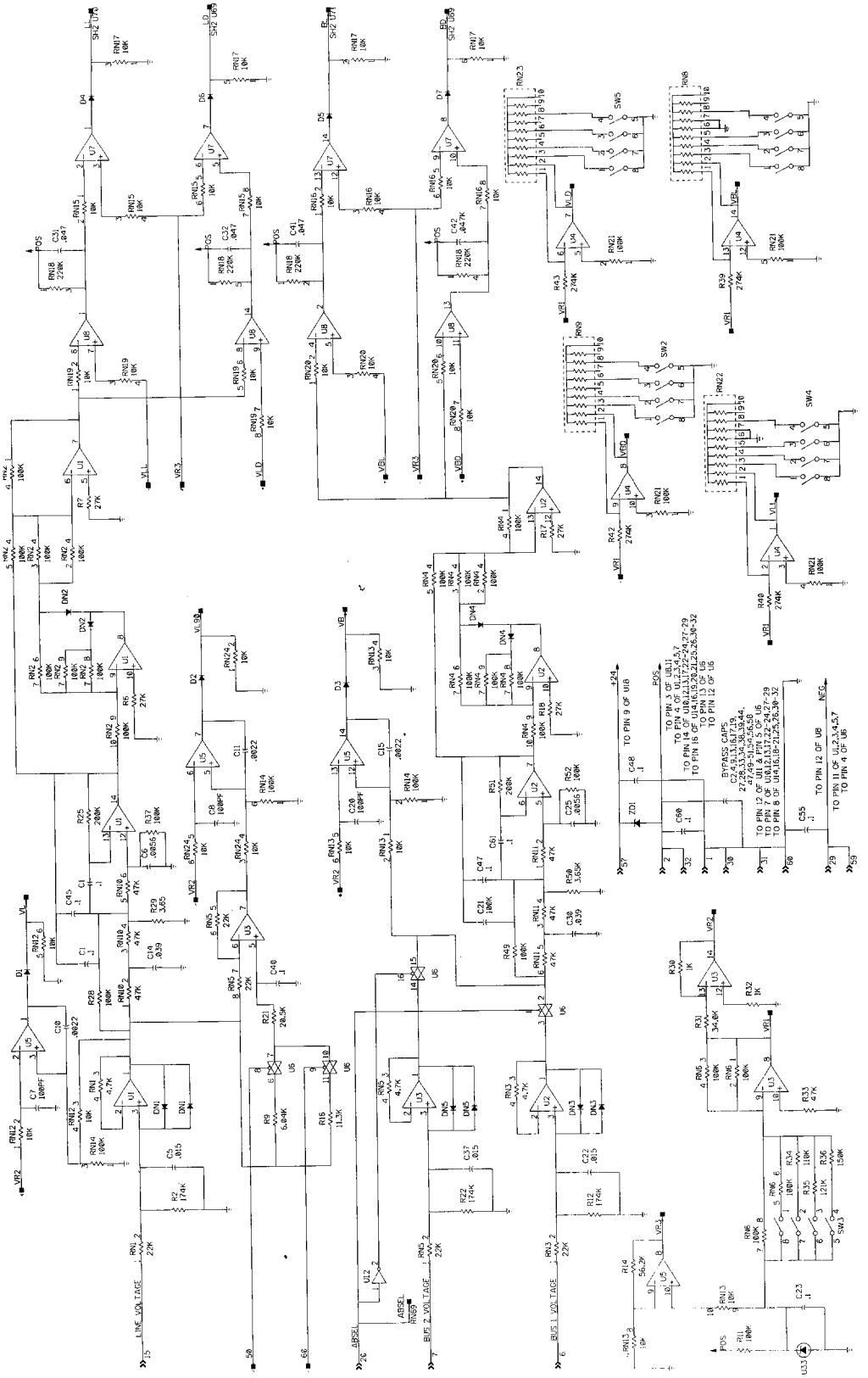


Figure 30 (0138D4717-2, Sh. 2) Schematic Diagram of SVM Module

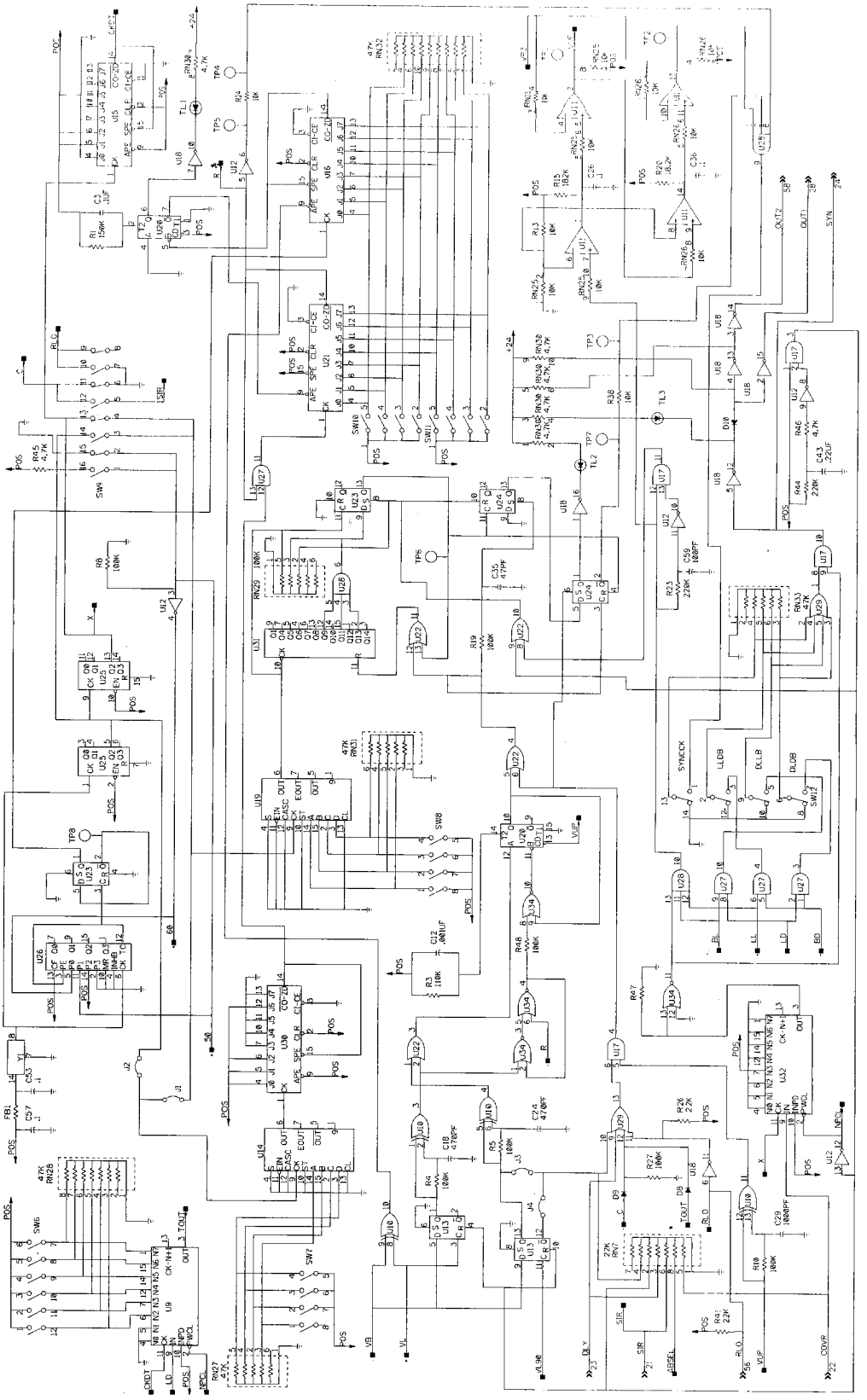


Figure 30A (0138D4717-1, Sh. 3) Schematic Diagram of SVM Module

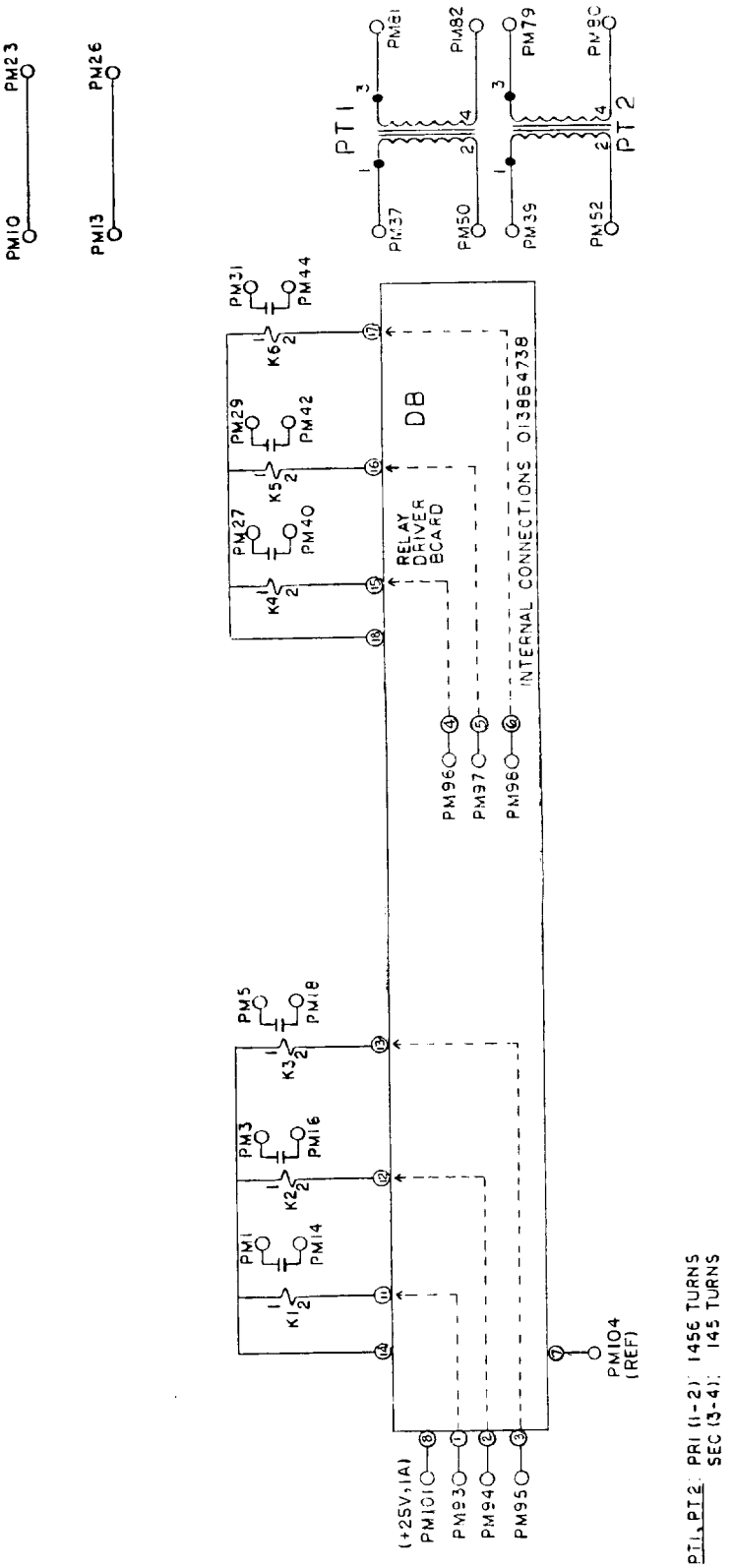


Figure 31 (0138B7755-0) Schematic Diagram of MGM210 Module

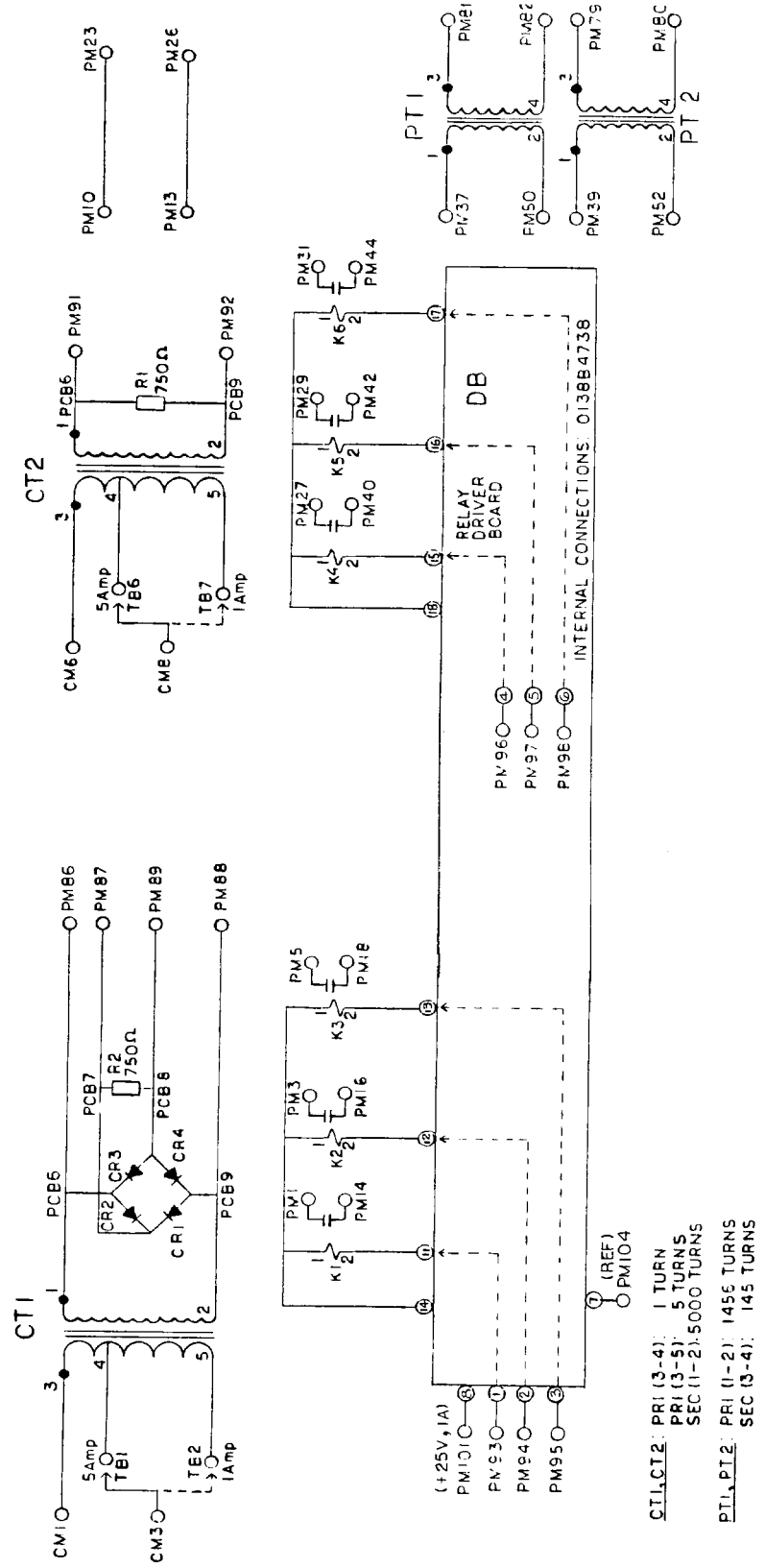


Figure 32 (0138B7756-0) Schematic Diagram of MGM211 Module

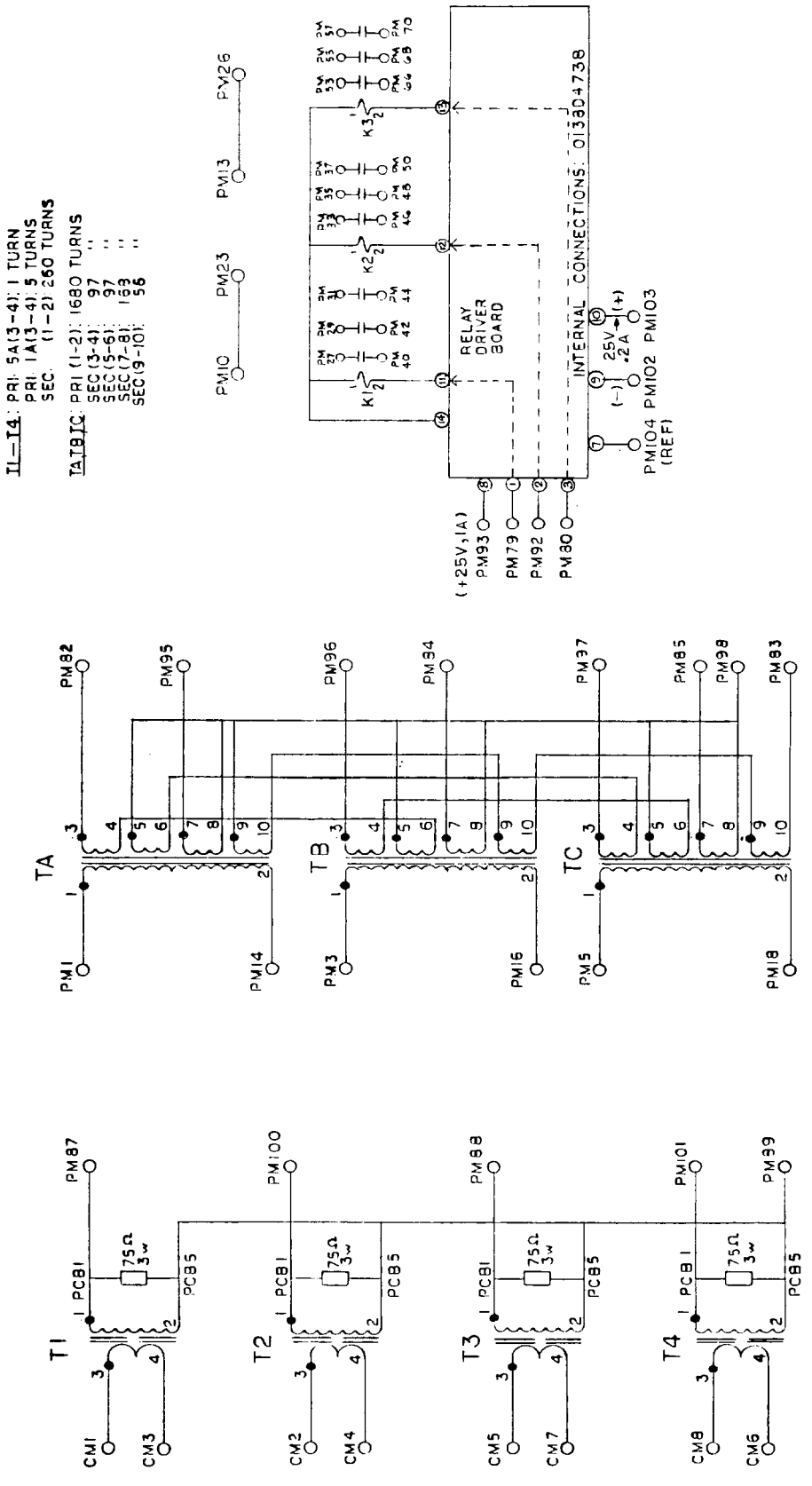


Figure 33 (0138B7754-0) Schematic Diagram of MGM110, 111, 112 Module

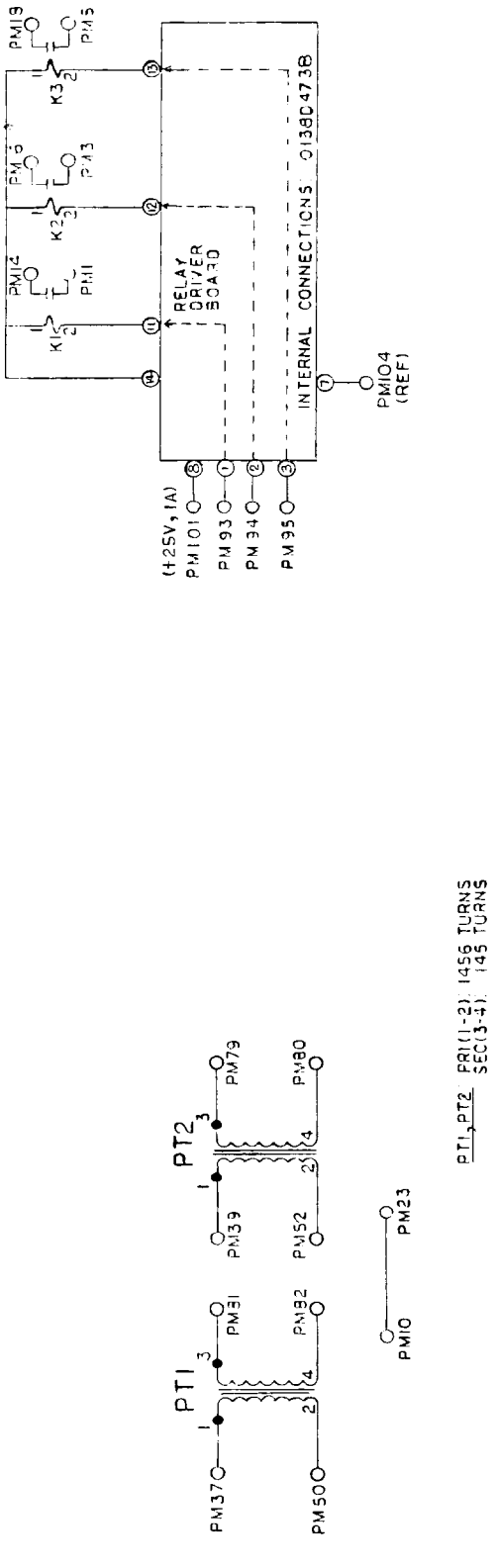


Figure 34 (0138B7757-0) Schematic Diagram of MGM310 Module

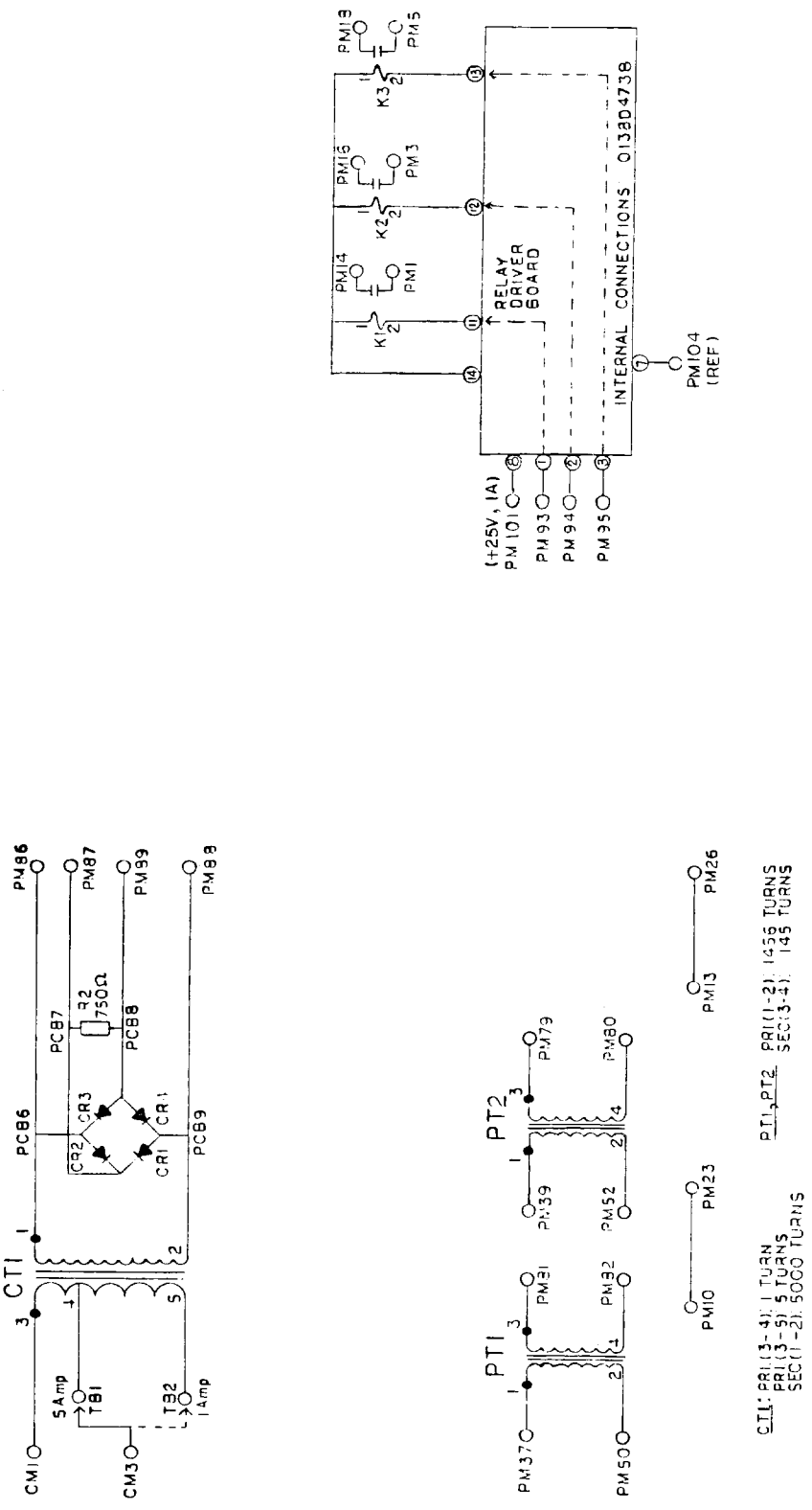


Figure 35 (0138B7758-0) Schematic Diagram of MGM311 Module

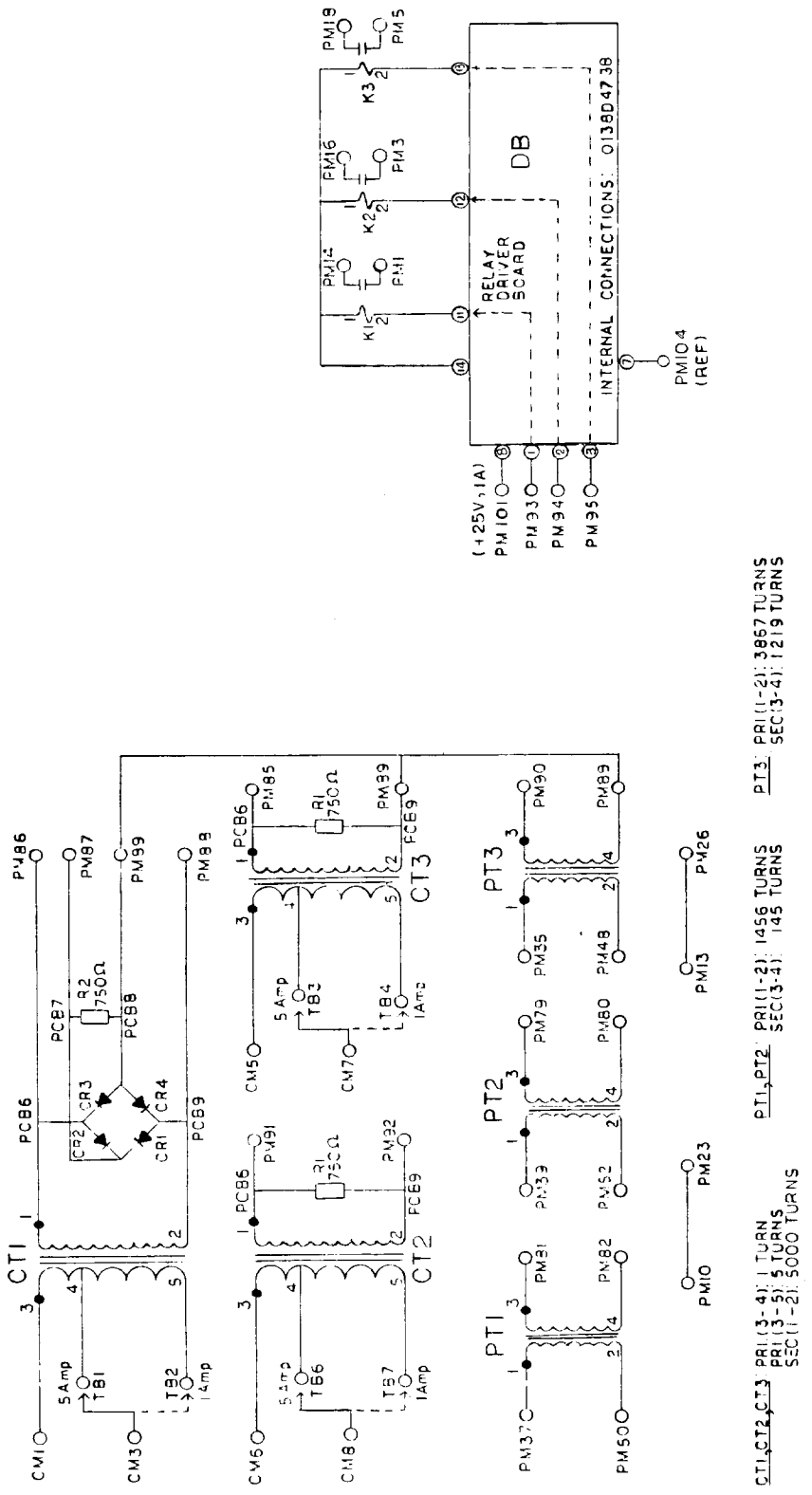
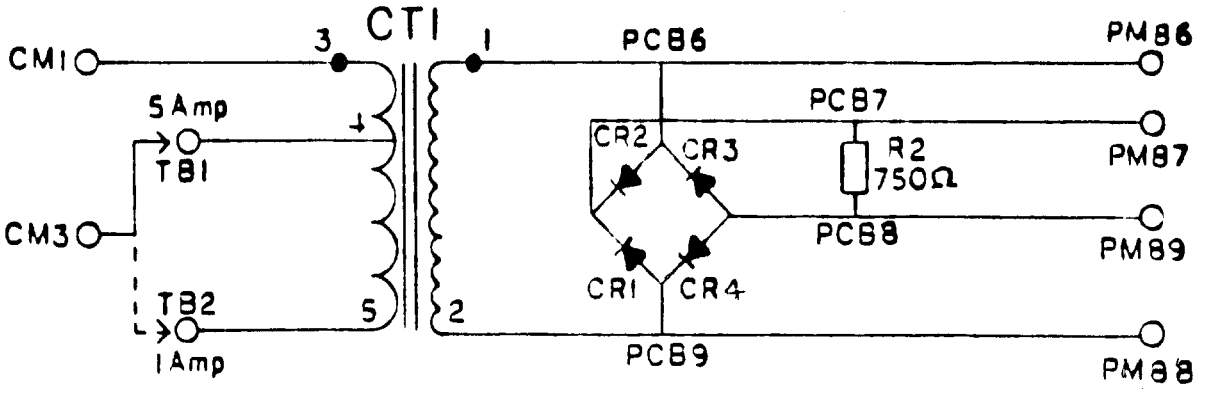
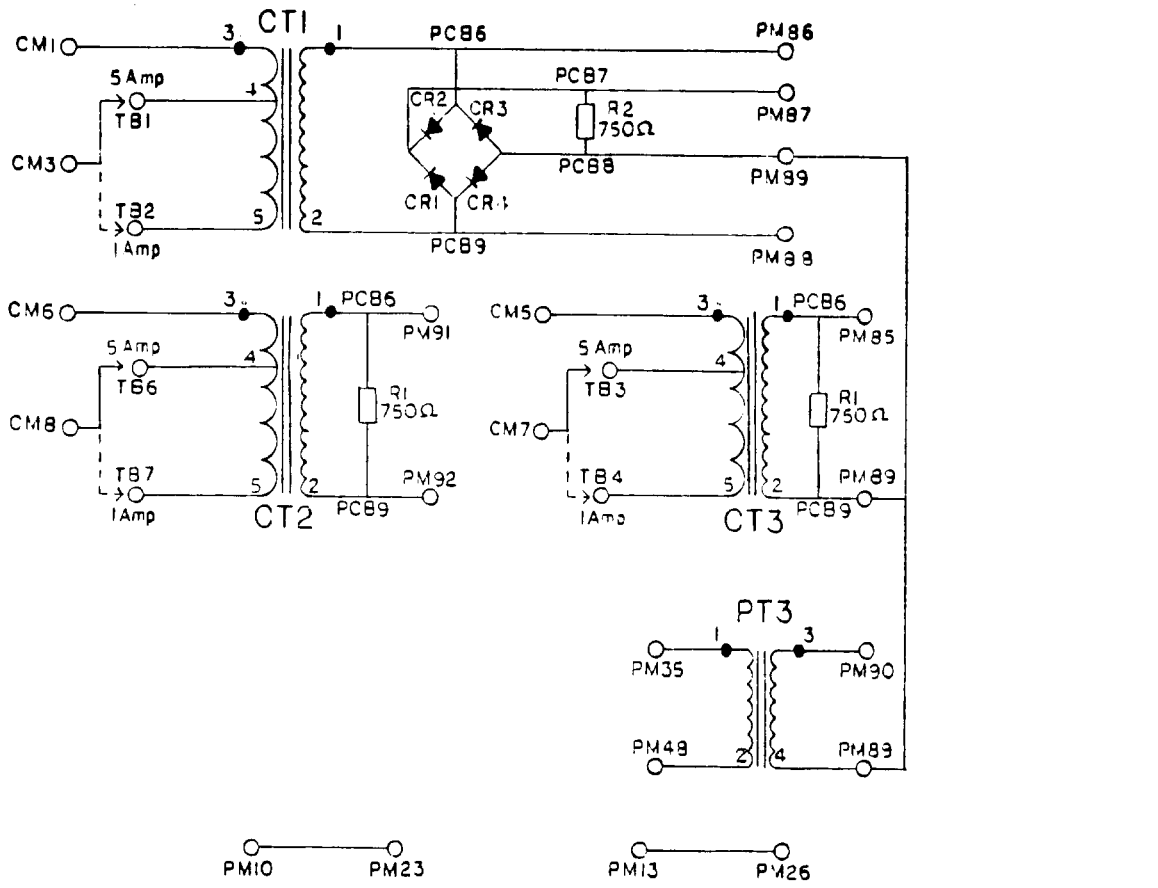


Figure 36 (0138B7759-0) Schematic Diagram of MGM312 Module



CT1: PRI.(3-4): 1 TURN
PRI.(3-5): 5 TURNS
SEC.(1-2): 5000 TURNS

Figure 37 (0138B7760-0) Schematic Diagram of MGM401 Module



CT1,CT2,CT3: PRI.(3-4): 1 TURN
PRI.(3-5): 5 TURNS
SEC.(1-2): 5000 TURNS

PT3: PRI.(1-2): 3867 TURNS
SEC.(3-4): 1219 TURNS

Figure 38 (0138B7761-0) Schematic Diagram of MGM402 Module

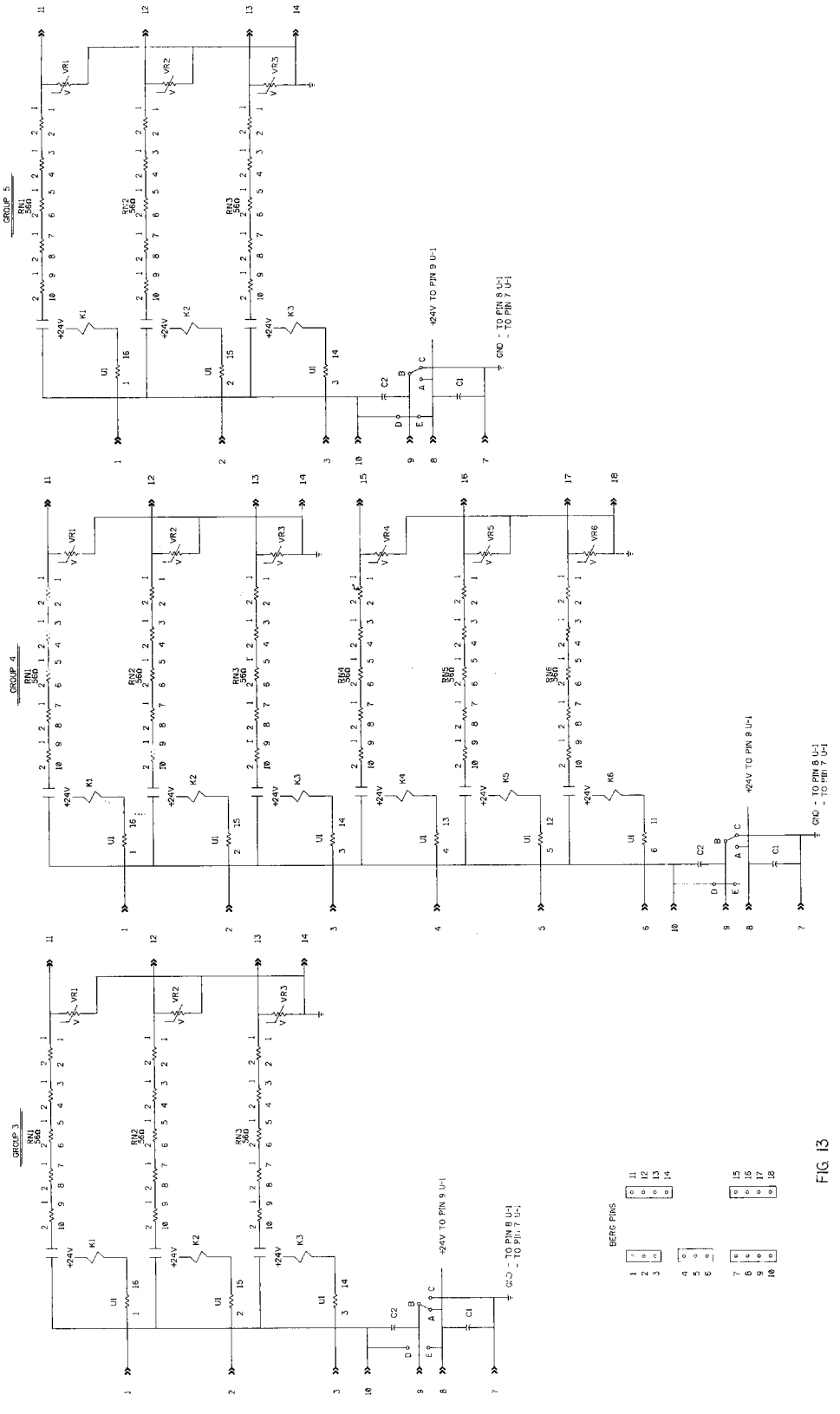


Figure 39 (0138D4738-1, Sh. 2) Printed Circuit Board Diagram for MGM Modules

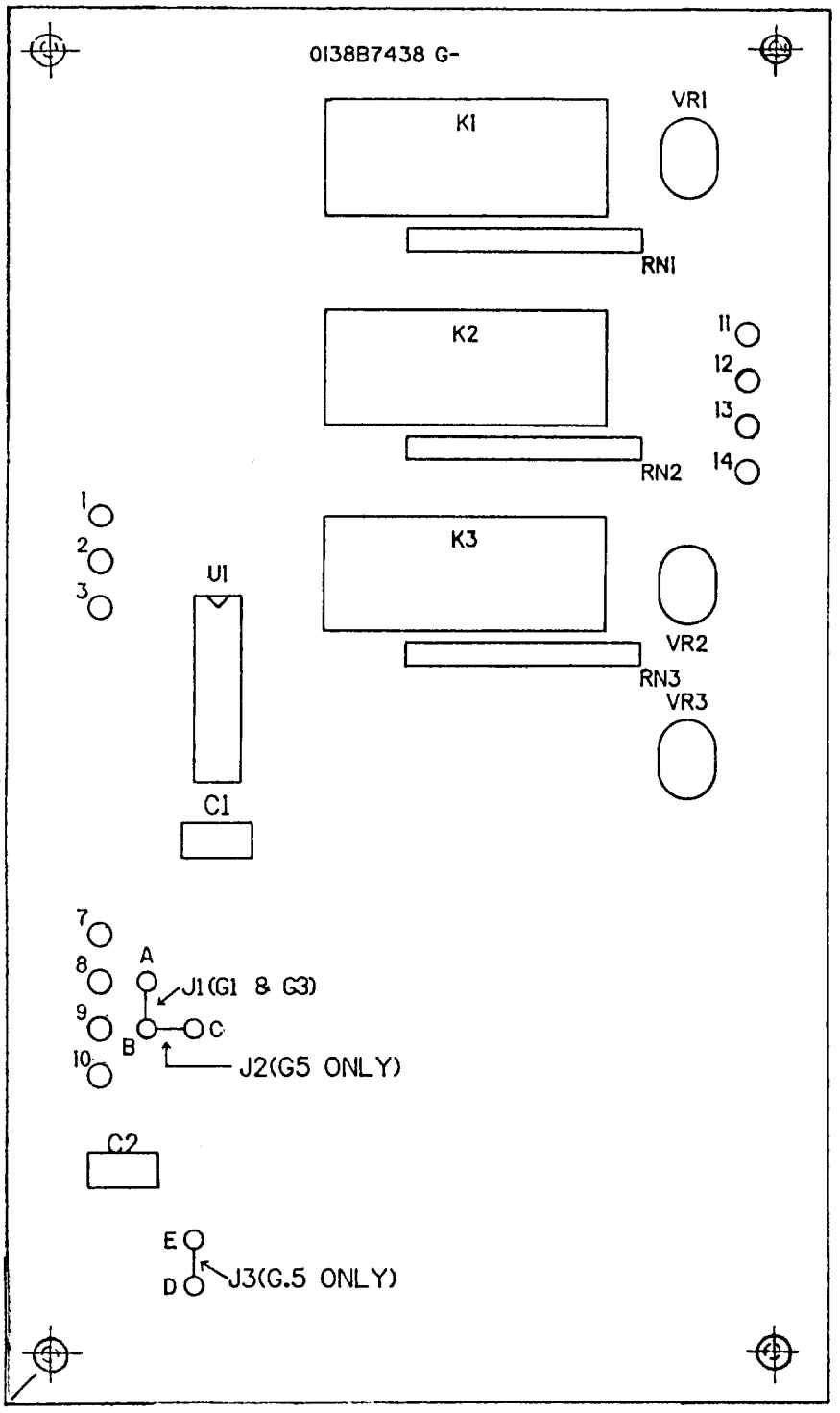


FIG.- 1 P18H-HP4 (FLOW SOLDER G.E. SPEC.)

Figure 40 (0138B7438-2, Sh. A1) Relay Driver Board Silk Screen for MGM110, 111, 112, 310, 311, 312

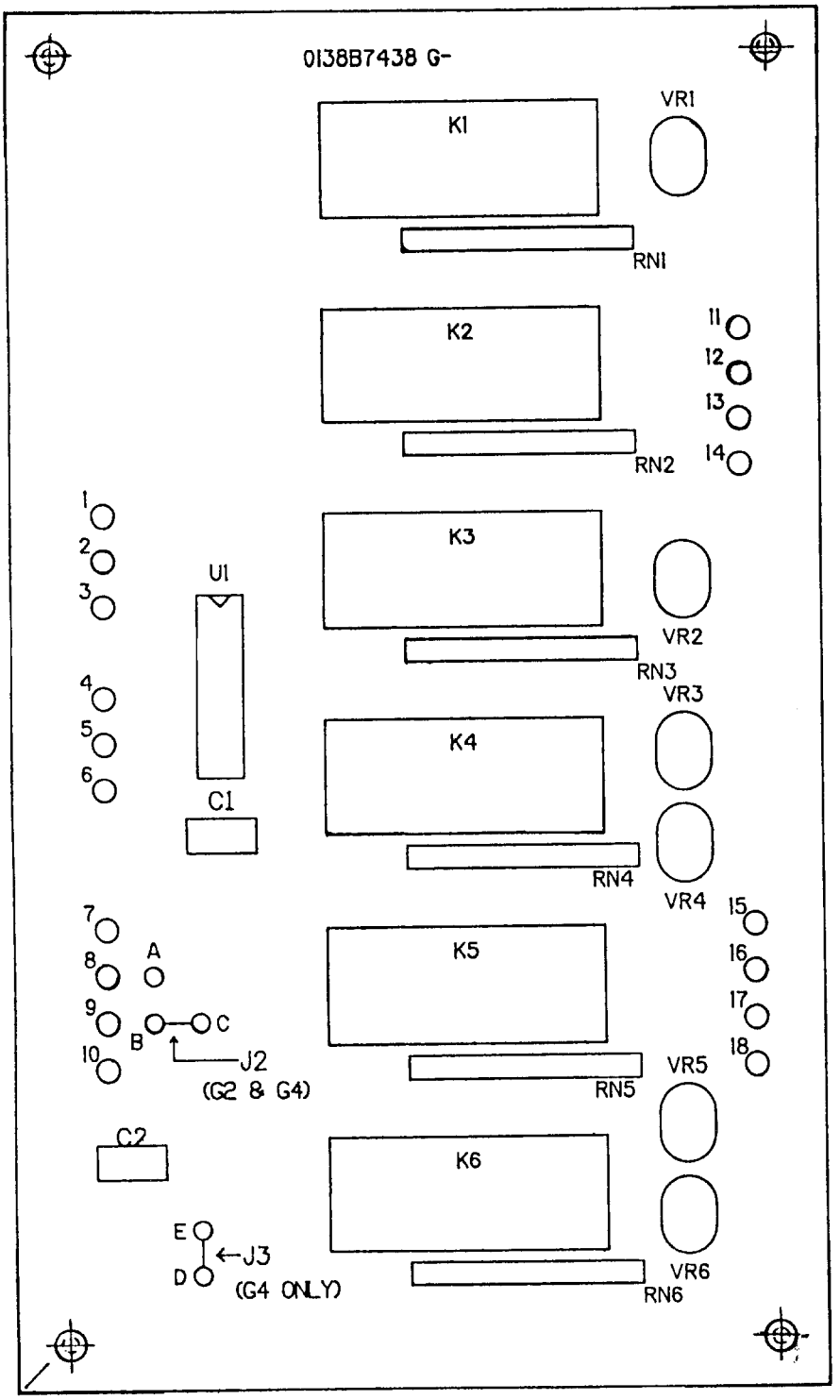


FIG.- 2 P18H-HP4 (FLOW SOLDER G.E. SPEC.)

Figure 41 (0138B7438-2, Sh. A2) Relay Driver Board Silk Screen for MGM210, 211

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