3048 MS

HP 8663A
SYNTHESIZED SIGNAL GENERATOR
(Including Options 001, 002, & 003)

Service Manual

Volume 4

SERIAL NUMBERS

This manual applies directly to instruments with serial numbers prefixed:

2234A to 2927A and all *MAJOR* changes that apply to your instrument.

rev.01JUL91

For additional important information about serial numbers, refer to "INSTRUMENTS COVERED BY THIS MANUAL" in Section 1.

Third Edition

Service Manual (Volume 1, 2, 3, 4) HP Part 08663-90071

Other Documents Available:
Operation and Calibration Manual HP Part 08663-90069
Microfiche Service Manual HP Part 08663-90072
Microfiche Operation and Calibration Manual HP Part 08663-90070

Printed in U.S.A. : November 1990

HEWLETT PACKARD

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VOLUME 4 CONTENTS

SERVICE SHEET 38
A11A4 FM PHASE DETECTOR

REFERENCE BLOCK DIAGRAM 7
Table 4-1. Recommended Performance Tests After Adjustments or Repairs
Table 5-2. Post-Repair Adjustment Procedures

PRINCIPLES OF OPERATION

General

The purpose of the FM Phase Detector (A11A4) is to develop the FM Loop Error Voltage. This is accomplished by comparing the VCO output with a 10 MHz reference signal.

Phase Detector Circuitry

The Phase Detector Circuitry compares the phase difference between the reference signal (FM 10 MHz Reference Signal) and the output of the VCO (FM Loop N-Divider Drive), then generates a voltage proportional to the phase error. Both input signals are first divided down to 100 kHz before they are compared by the FM Loop Phase Detector, U4. The 10 MHz signal from the Reference Section is divided by a total of 100. This signal becomes the reference input to the phase detector. The 140 MHz VCO output is divided by a total of 1400. This signal becomes the variable input to the phase detector.

The Phase Detector, U4, is a digital phase detector that generates output pulse widths proportional to the phase difference between the two input signals. If the variable 100 kHz signal is lower in frequency or lags the reference input in phase, the output on pin 13 generates a pulse (See Figure 8-601). When the variable input is higher in frequency or leads the input in phase the output on pin 2 generates a pulse (see Figure 8-602).

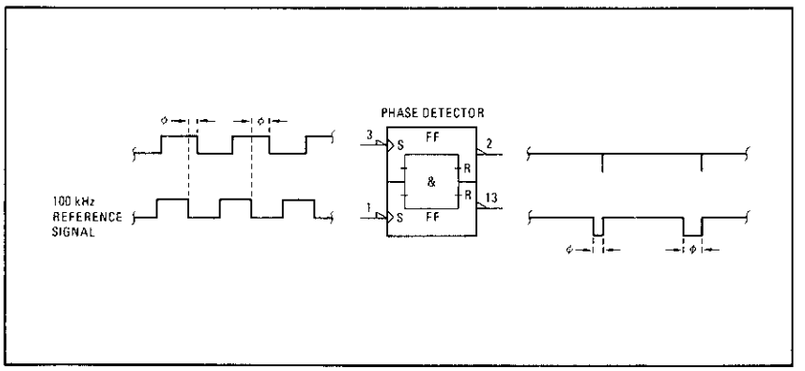


Figure 8-601. Phase Detector Operation
(Variable Input is Lower in Frequency than Reference Signal)

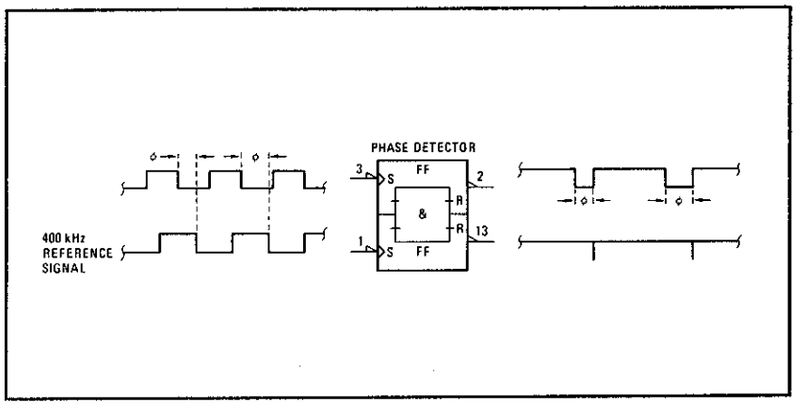


Figure 8-602. Phase Detector Operation
(Variable Input is Higher in Frequency than Reference Signal)

Following the FM Loop Phase Detector are the Switch, Low-Pass Filter, and Integrator circuits. In a phase-locked condition the switch circuit (gates U3A and U3D) is enabled, allowing the output pulses from the phase detector to pass through. The Low-Pass Filter and the Integrator convert the pulses into a voltage. This becomes the FM Loop Error Voltage. Each pulse causes a given amount of charge to be stored in the integrating capacitors, C11 and C12.

When the FM Loop is disabled the switch circuit prevents the phase detector output pulses from reaching the Integrator. To prevent the Integrator's output from slewing against the power supply rails when the FM Loop is disabled, R20 is shunted across the integrating capacitors.

When no modulation signal is applied, the error voltage developed by the Phase Detector Circuit is dependent on the frequency and phase of the 140 MHz VCO. In the phase-locked FM mode the error voltage is also dependent on the instantaneous frequency deviation. The FM Loop's bandwidth is about 6 Hz, however, phase-locked FM is only possible down to modulation rates of 20 Hz. Modulation rates below 20 Hz result in the gradual cancellation of the modulating signal because the phase-locked loop can now start responding to the modulation signal.

An overmodulation condition exists when the peak deviation of the 140 MHz VCO exceeds the limit or range of the phase detector, U4. This overmodulation condition is detected by monitoring the output of the phase detector. The output is first filtered by a Low Pass Filter consisting of R11 and C7. The output waveform from the low pass filter is similar to a half wave rectified sine wave. This signal is monitored by the Overmodulation Detector (located on the Modulation Drive) which is a peak detector circuit. If the output waveform from the low pass filter exceeds 1 volt peak, the Overmodulation Detector is triggered.

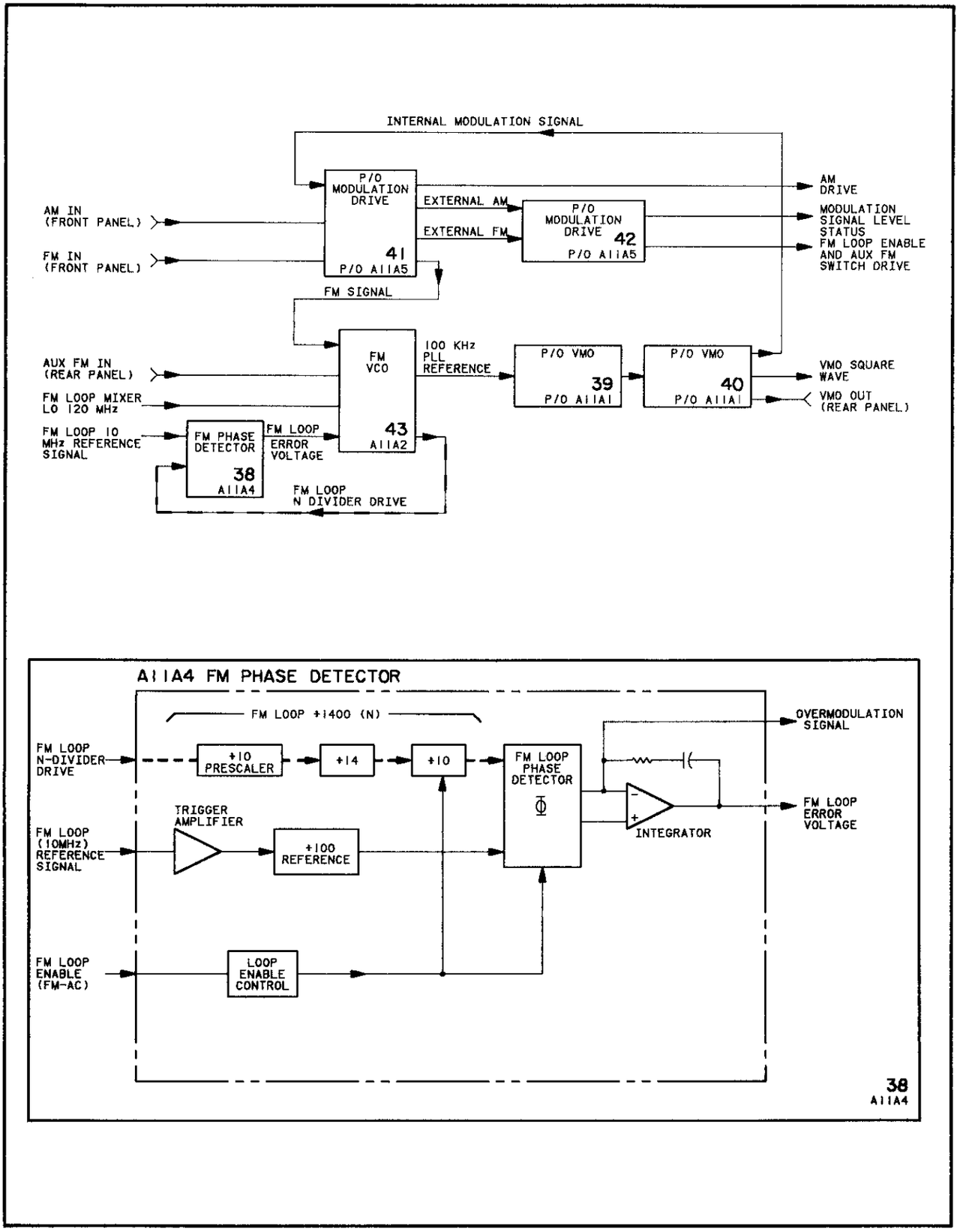


Figure 8-603. A11A4 FM Phase Detector Block Diagrams

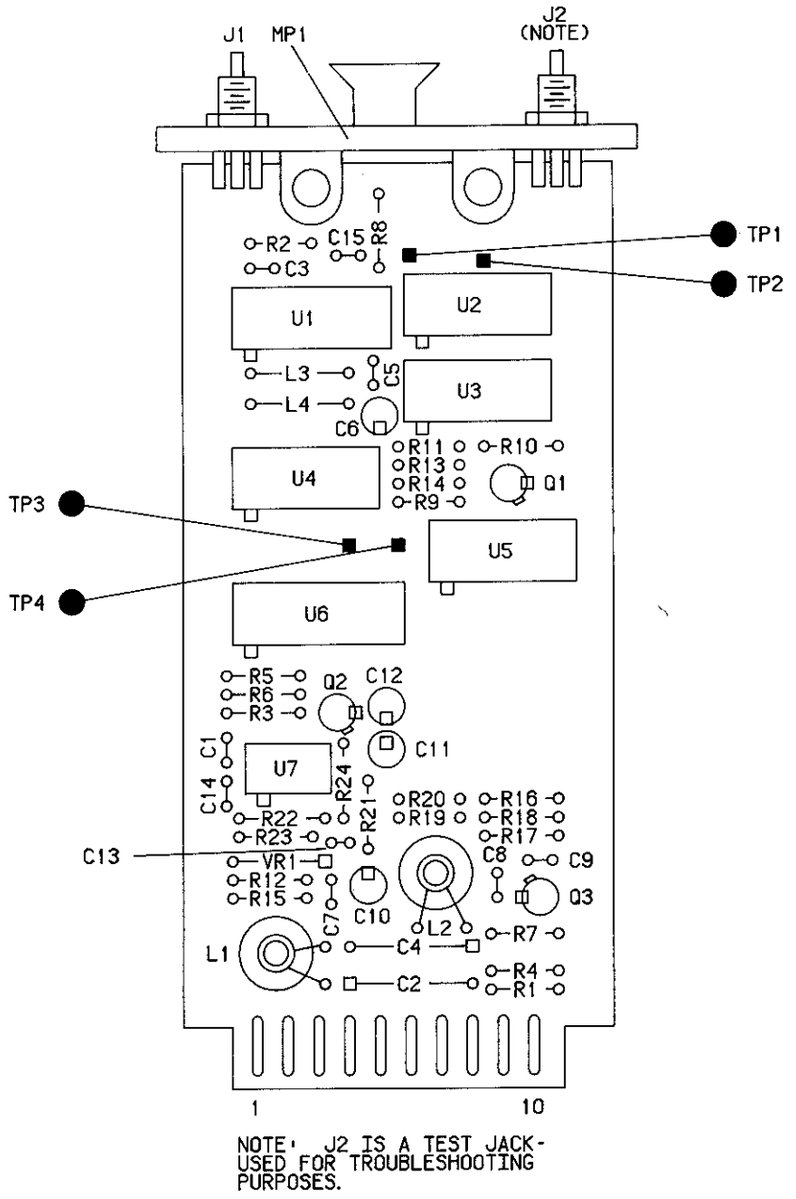


Figure 8-604. A11A4 FM Phase Detector Component Locator

CHANGES

All serial prefixes

On the schematic:

- Bullet "T" FM LOOP ENABLE (FM-AC) FROM MODULATION DRIVE - In the lower left portion of the schematic, change the line label of bullet "T" from "TTL HIGH=ENABLE" to "Special Levels, +9V=Enable, -19V=Disable".

Fig 8-603
Sht 1 of 4

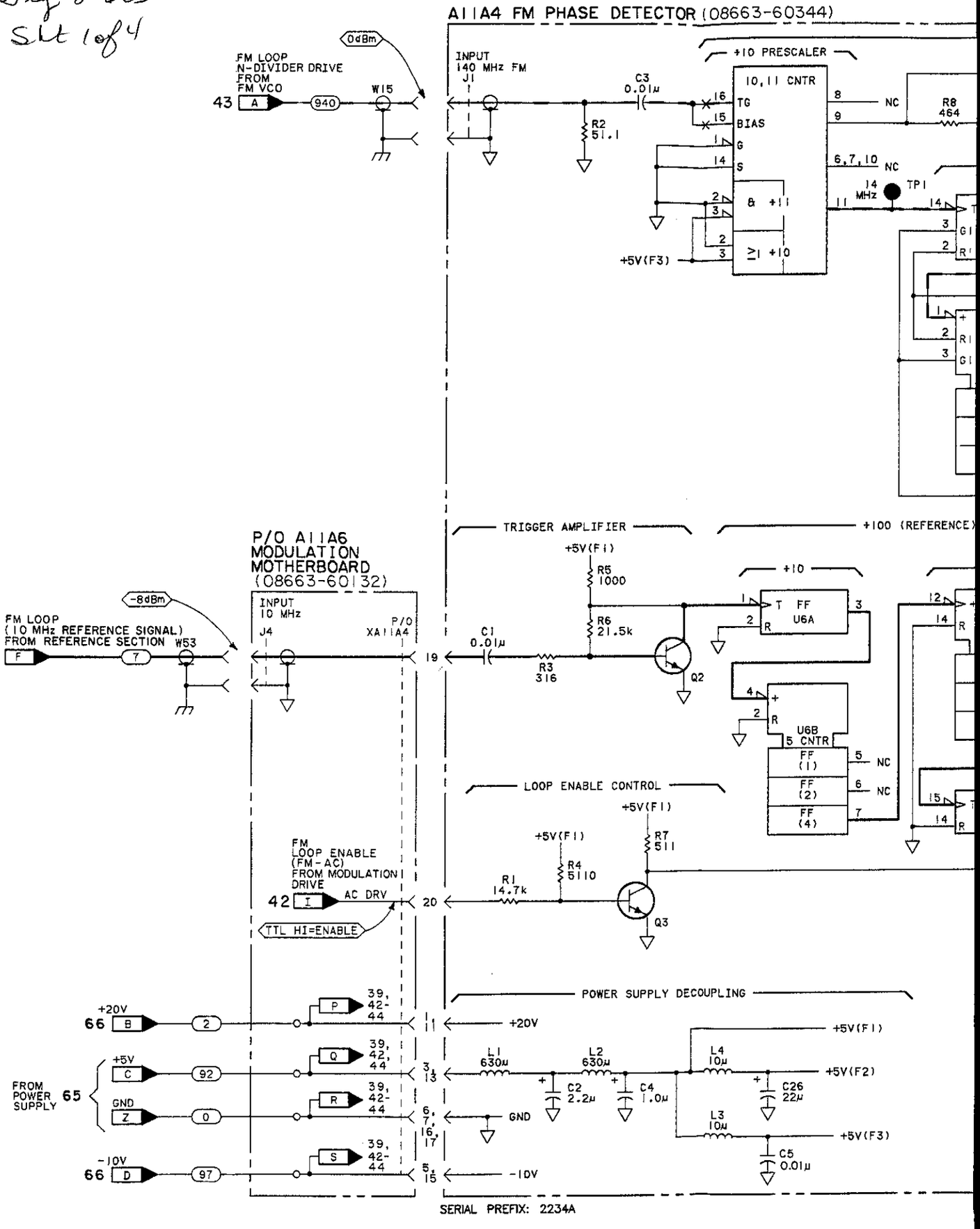


Fig 8-603 Sht 2 of 4

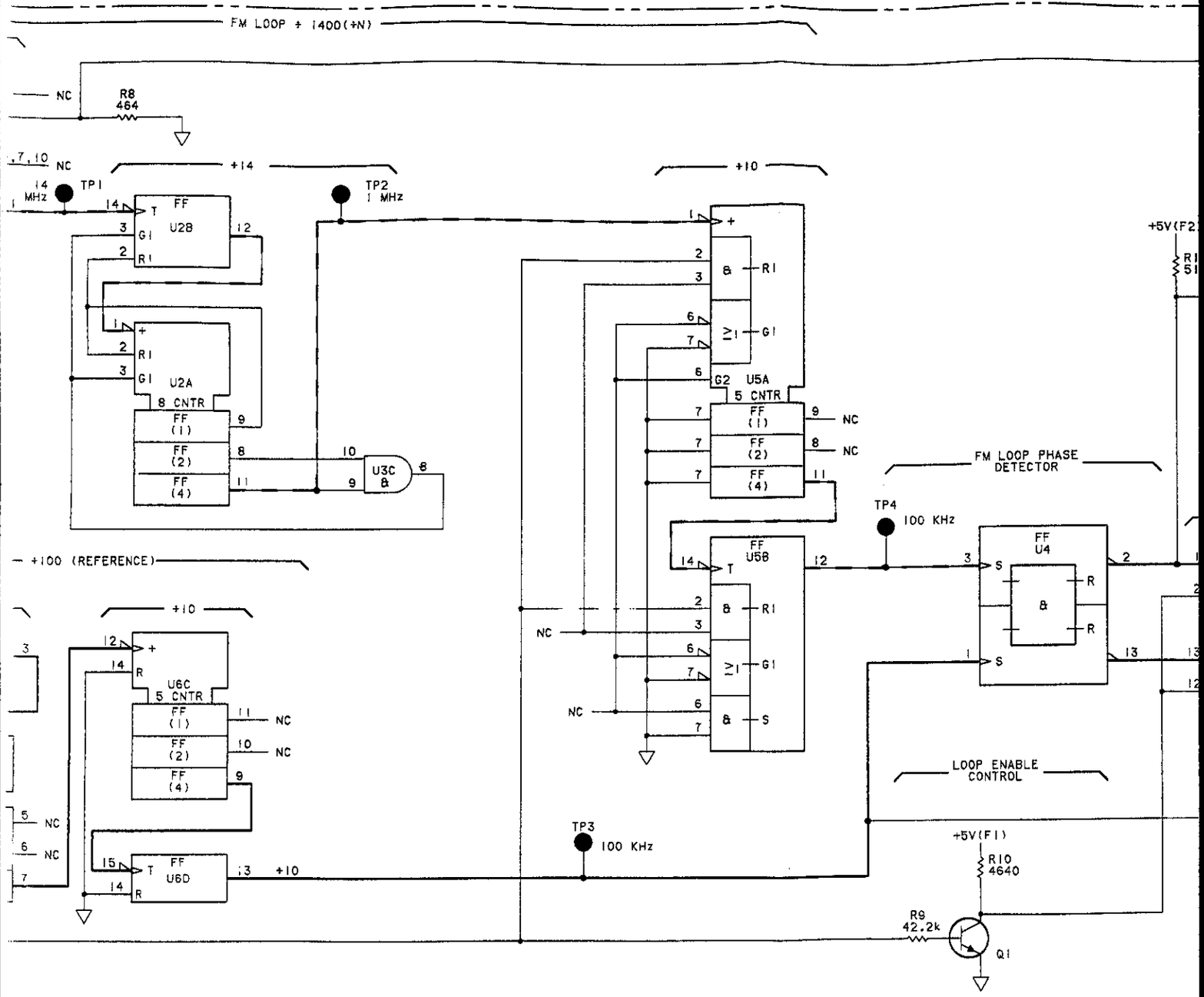


Fig 8-603 Sht 3 of 4

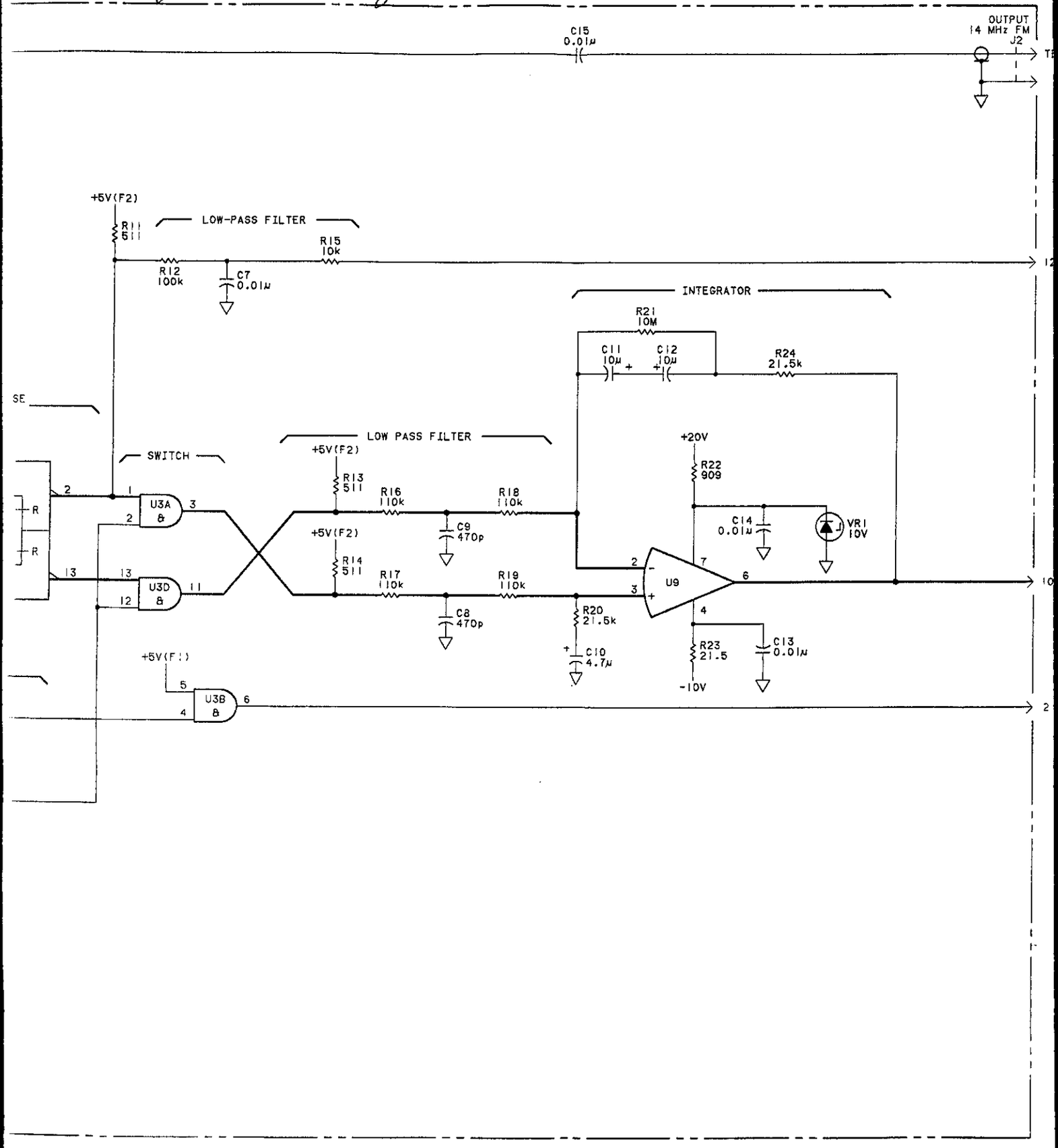
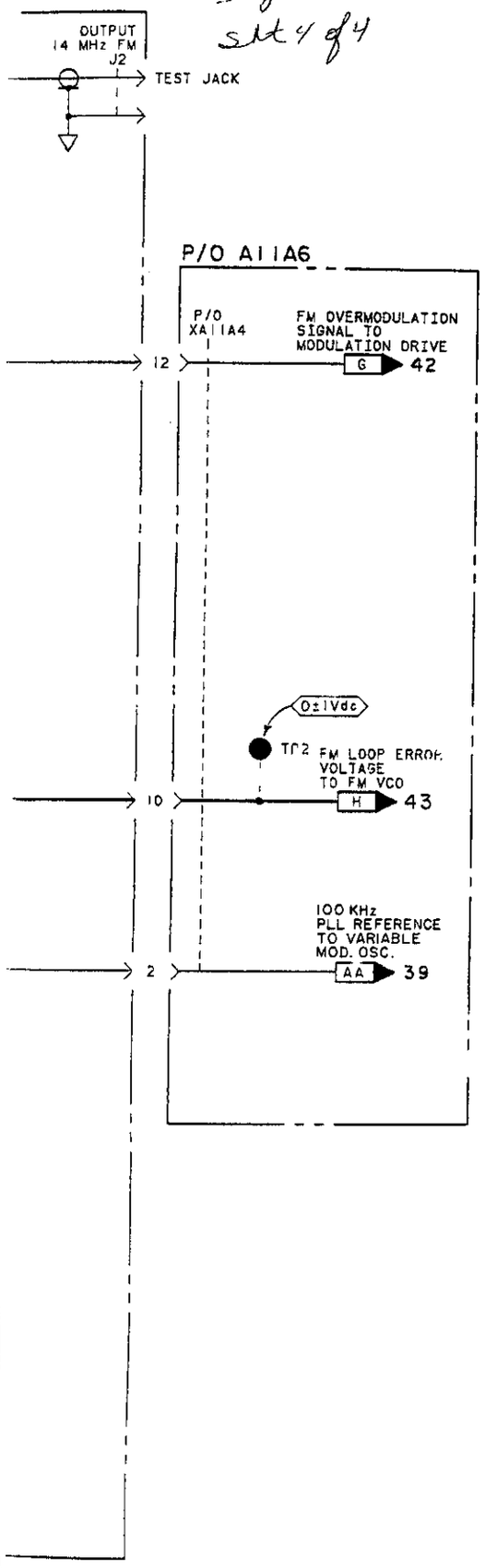


Fig 8-603
sht 4 of 4



NOTES

1. REFER TO TABLE 8-102 FOR SCHEMATIC DIAGRAM NOTES.
2. TROUBLESHOOTING VALUES ARE TYPICAL. THEY ARE ACTUAL MEASURED VALUES. YOUR MEASUREMENTS MAY BE SLIGHTLY DIFFERENT THAN WHAT IS SHOWN.

† BACKDATING INFORMATION IN SECTION VII.

REFERENCE DESIGNATIONS

NO PREFIX	A4A10
W15,37	J4 TP2 XA11A4
A4A6	
C1-15 J1,2 L1-4 Q1-3 R1-24 TP1-4 U1-6,9 VR1	

LOGIC LEVELS

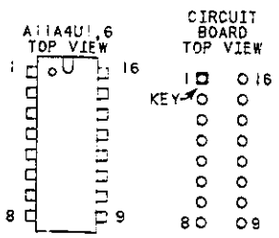
	TTL
HIGH	>+2V
LOW	<+0.8V
< IS MORE NEG. THAN > IS MORE POS. THAN	
OPEN	HIGH
GROUND	LOW

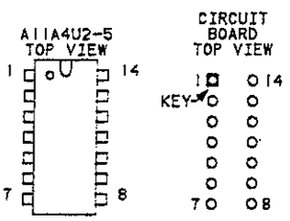
TRANSISTOR AND INTEGRATED CIRCUIT PART NUMBERS

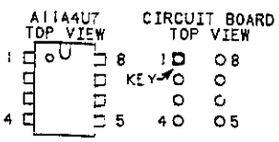
REFERENCE DESIGNATIONS	PART NUMBERS
Q1,3	1854-0404
Q2	1854-0019
U1	1820-1780
U2	1820-1478
U3	1820-1201
U4	1820-0630
U5	1820-1490
U6	1820-1463
U9	1826-0013

INTEGRATED CIRCUIT VOLTAGE AND GROUND CONNECTIONS

REFERENCE DESIGNATIONS	PIN NUMBERS
U1	+5V(F3)- 4,5 ▽ - 12,13
U2	+5V(F1)- 5 ▽ - 10
U3	+5V(F1)- 14 ▽ - 7
U4	+5V(F2)- 14 ▽ - 7
U5	+5V(F2)- 5 ▽ - 10
U6	+5V(F1)- 16 ▽ - 8







SERVICE SHEET 38
A11A4

Figure 8-603. A11A4 FM Phase Detector Schematic

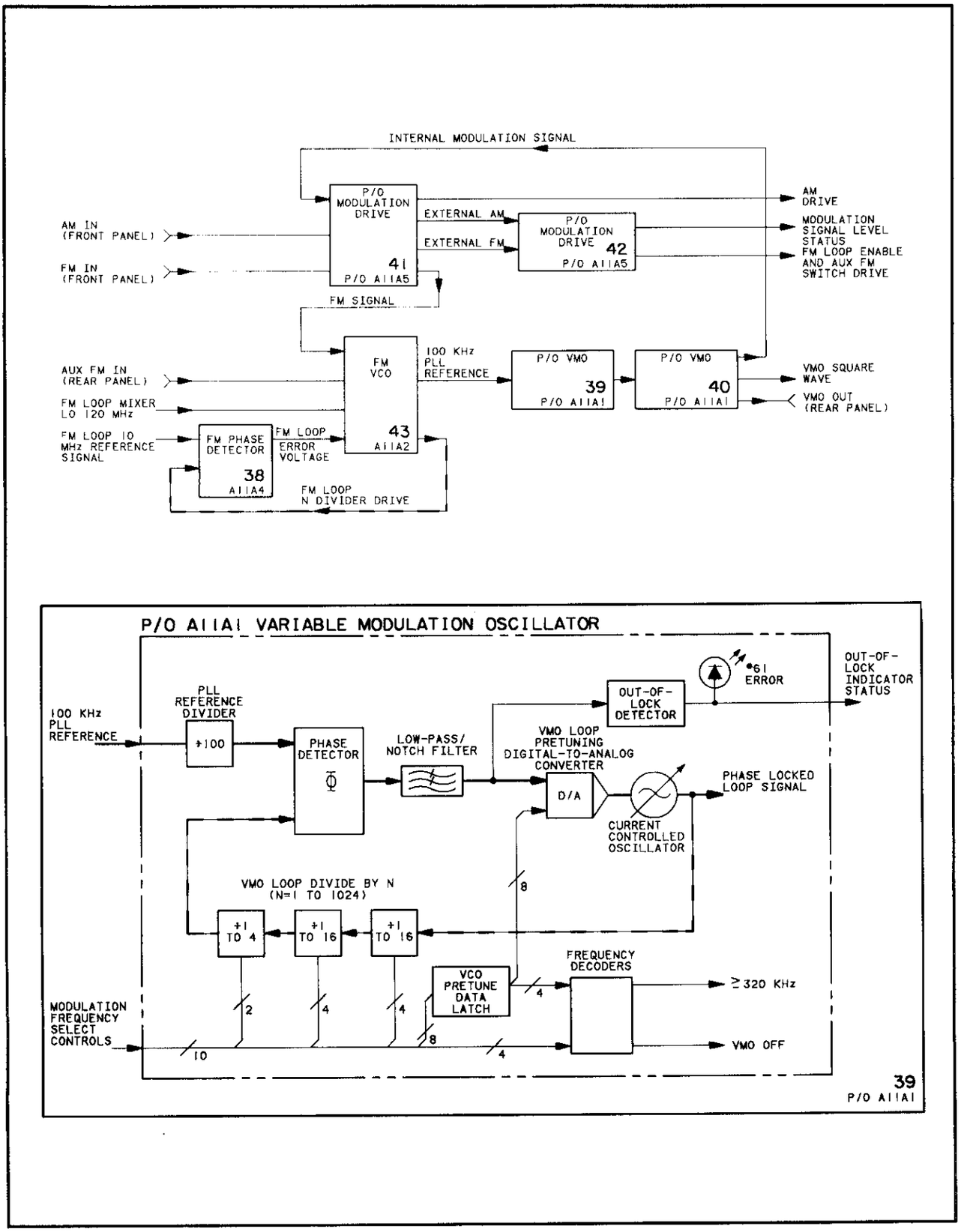


Figure 8-606. P/O A11A1 Variable Modulation Oscillator Block Diagrams

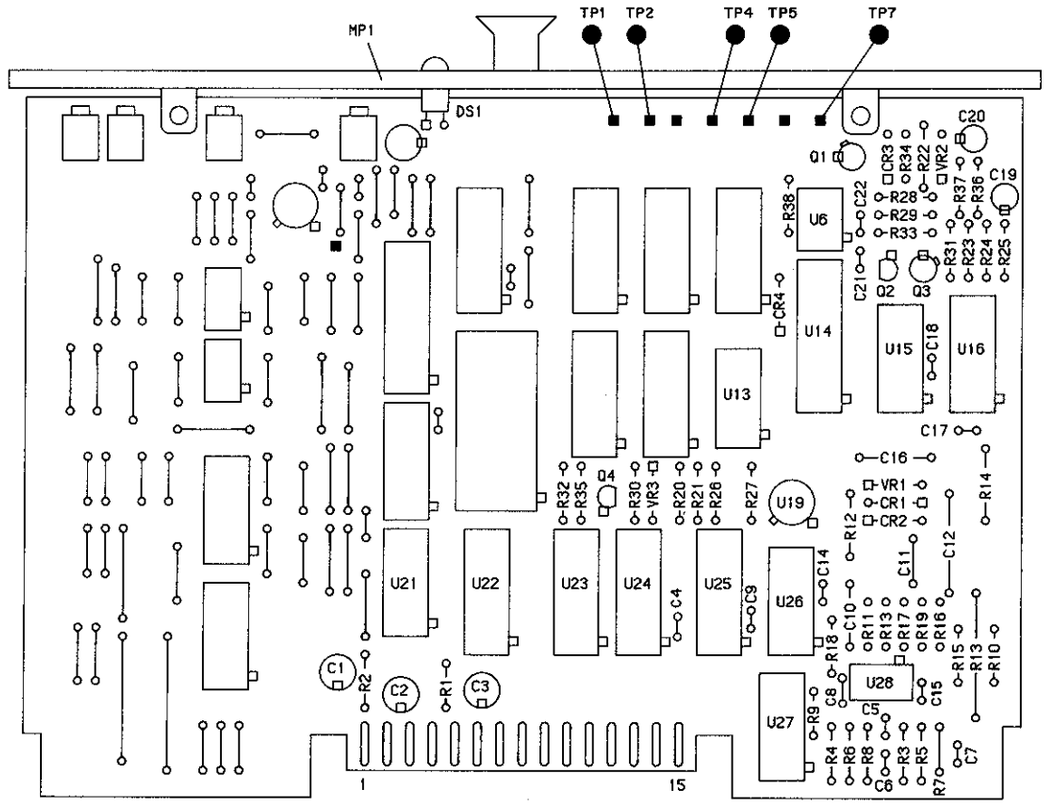


Figure 8-607. P/O A11A1 Variable Modulation Oscillator Component Locator

CHANGES

All serial prefixes

On the schematic:

- A11A1U28 - In the Table of Transistor and Integrated Circuit Part Numbers, change the part number of U28 to 1826-0785.
- A11A1Q1 - Add Q1, 1854-0477 to the Table of Transistor and Integrated Circuit Part Numbers.

On the A11A1 schematic:

- A11A1U26 - Move the low-level-active polarity indicator (triangle) from U26 pin 8 to U26 pin 6.

On the Component Locator:

- A11A1C13 - On the component locator, change R13 to C13, between R15 and R10

Fig 8-608
Sht 1 of 5

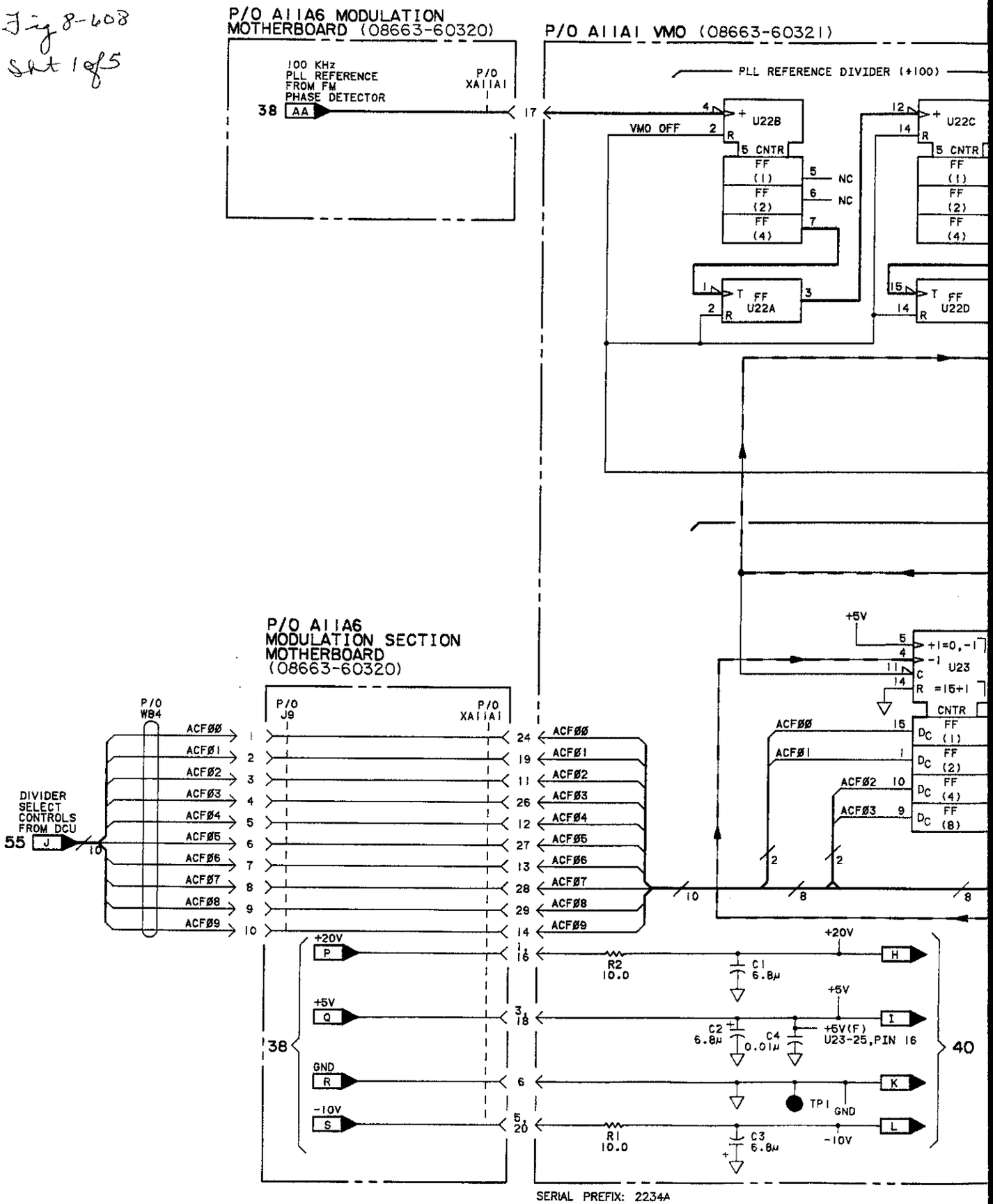


Fig 8-608 Sht 2 of 5

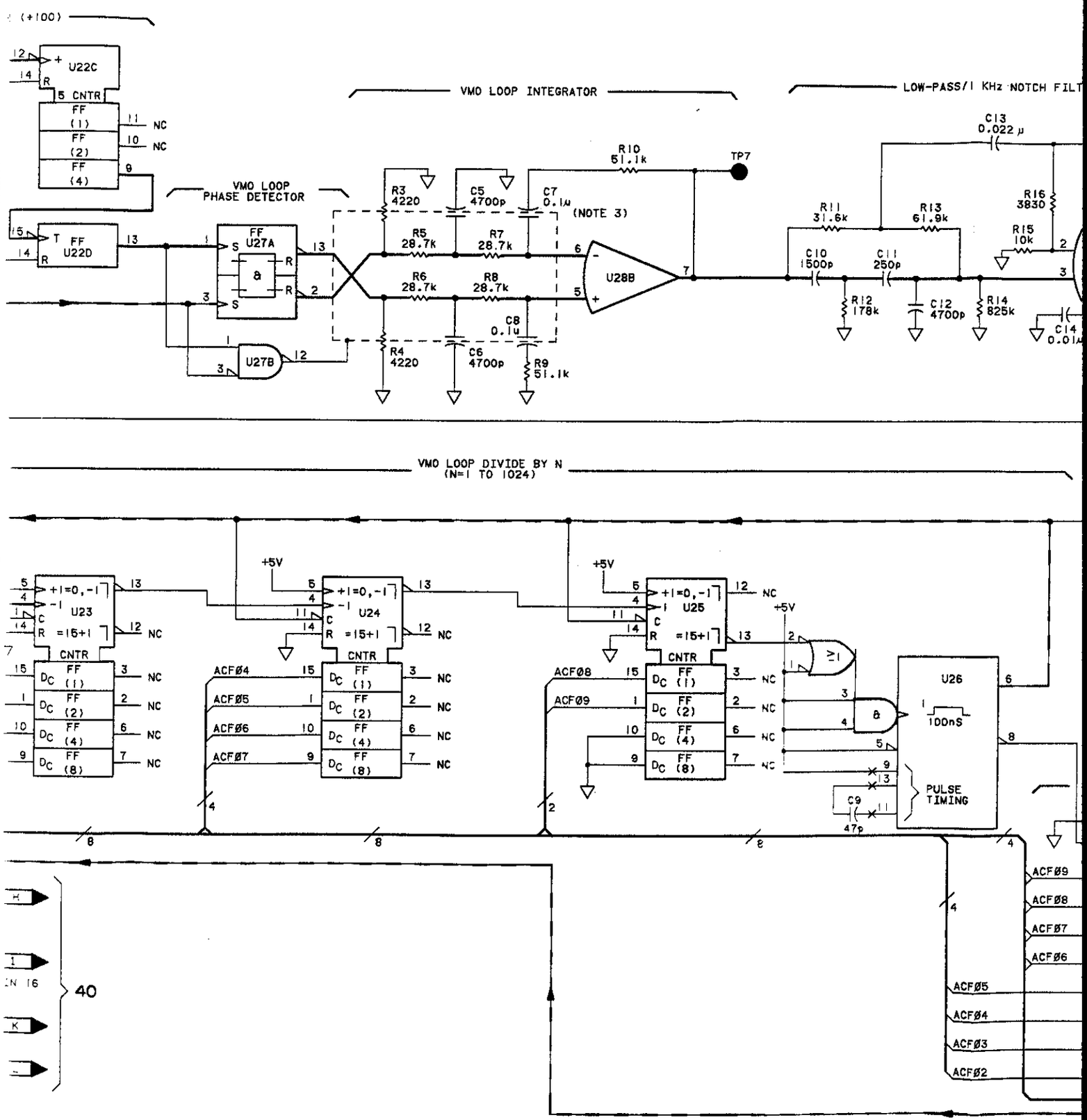


Fig 8-608 Sht 3 of 5

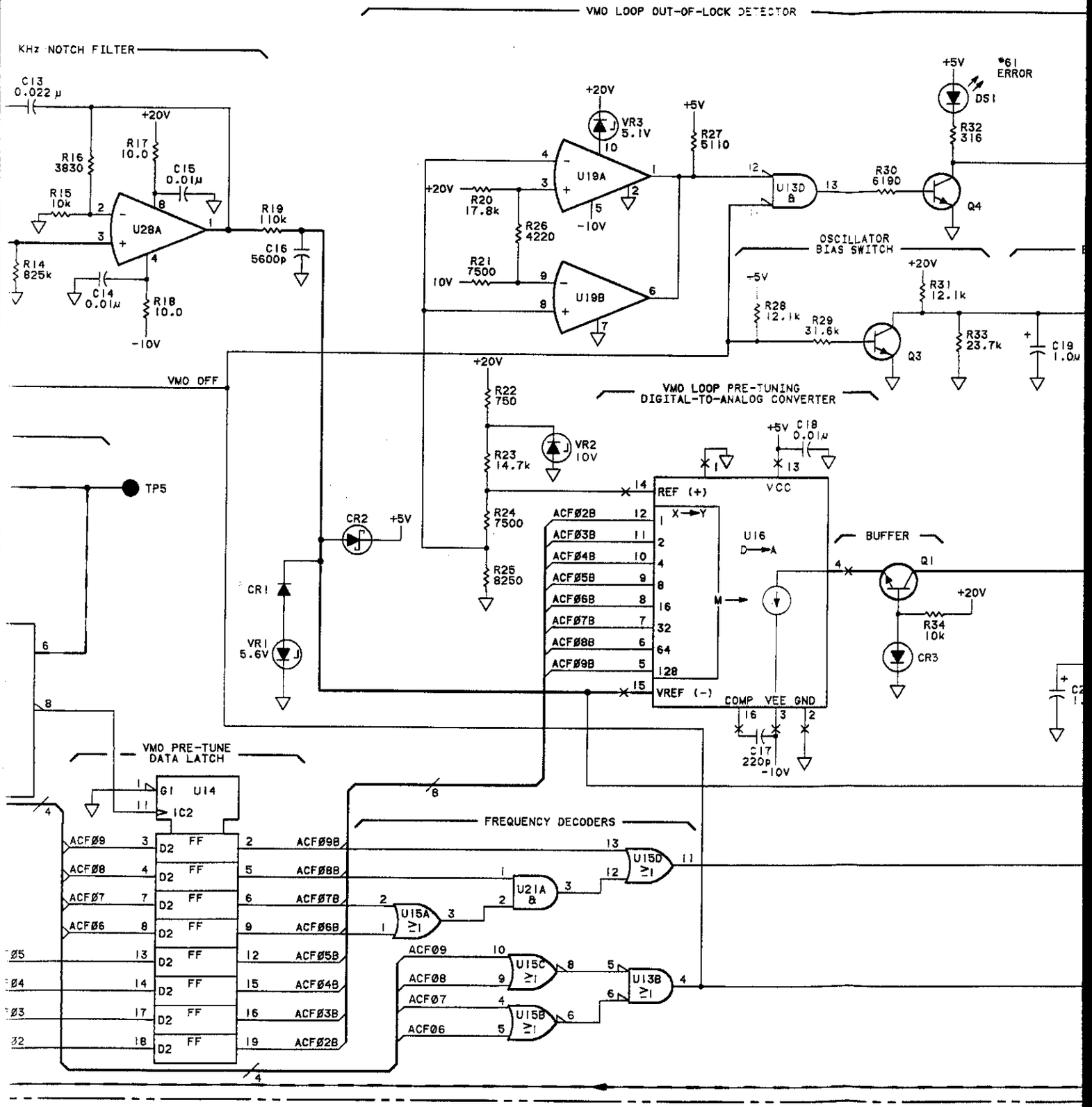


Fig 8-608 Sht 4 of 5

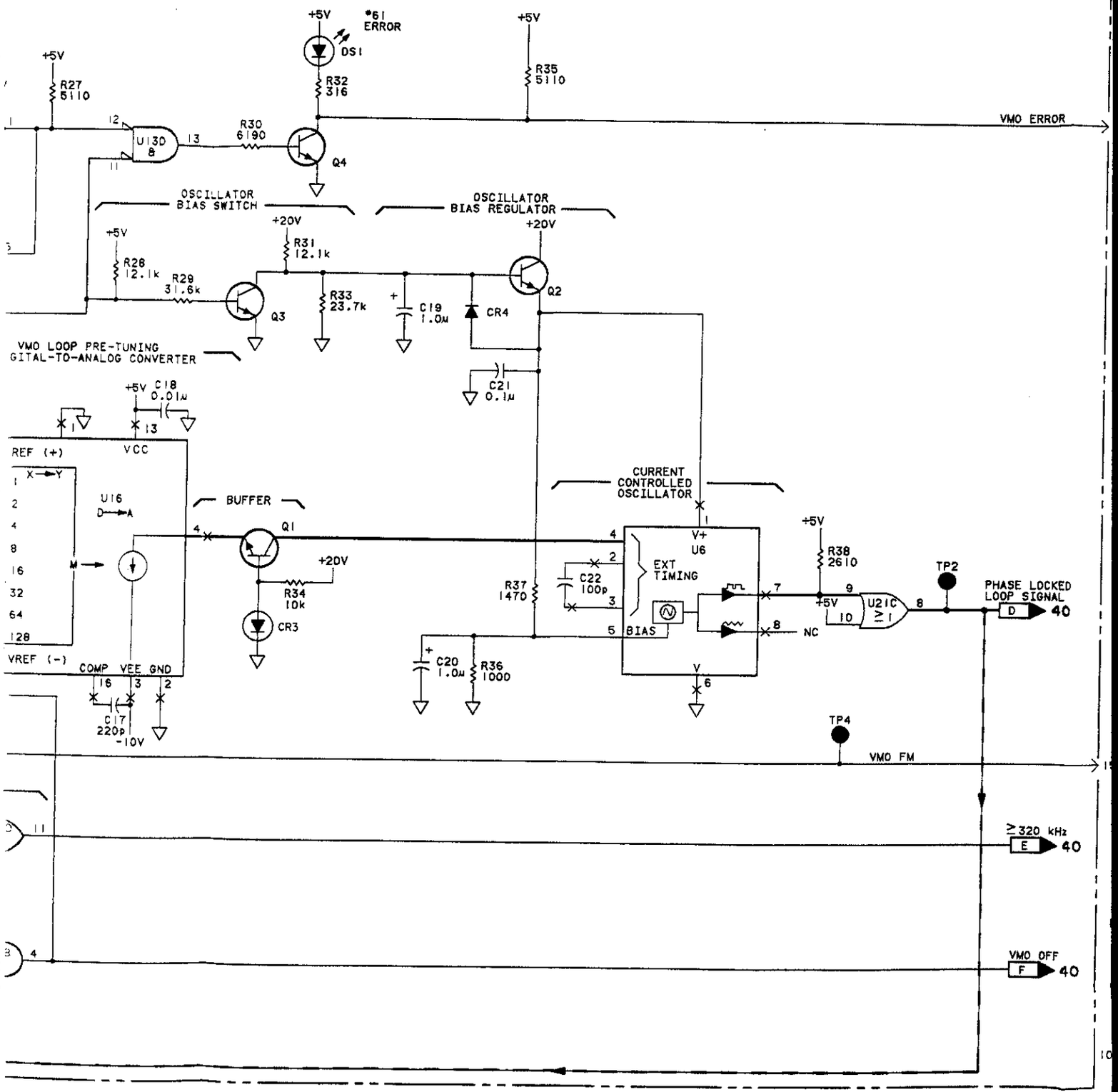
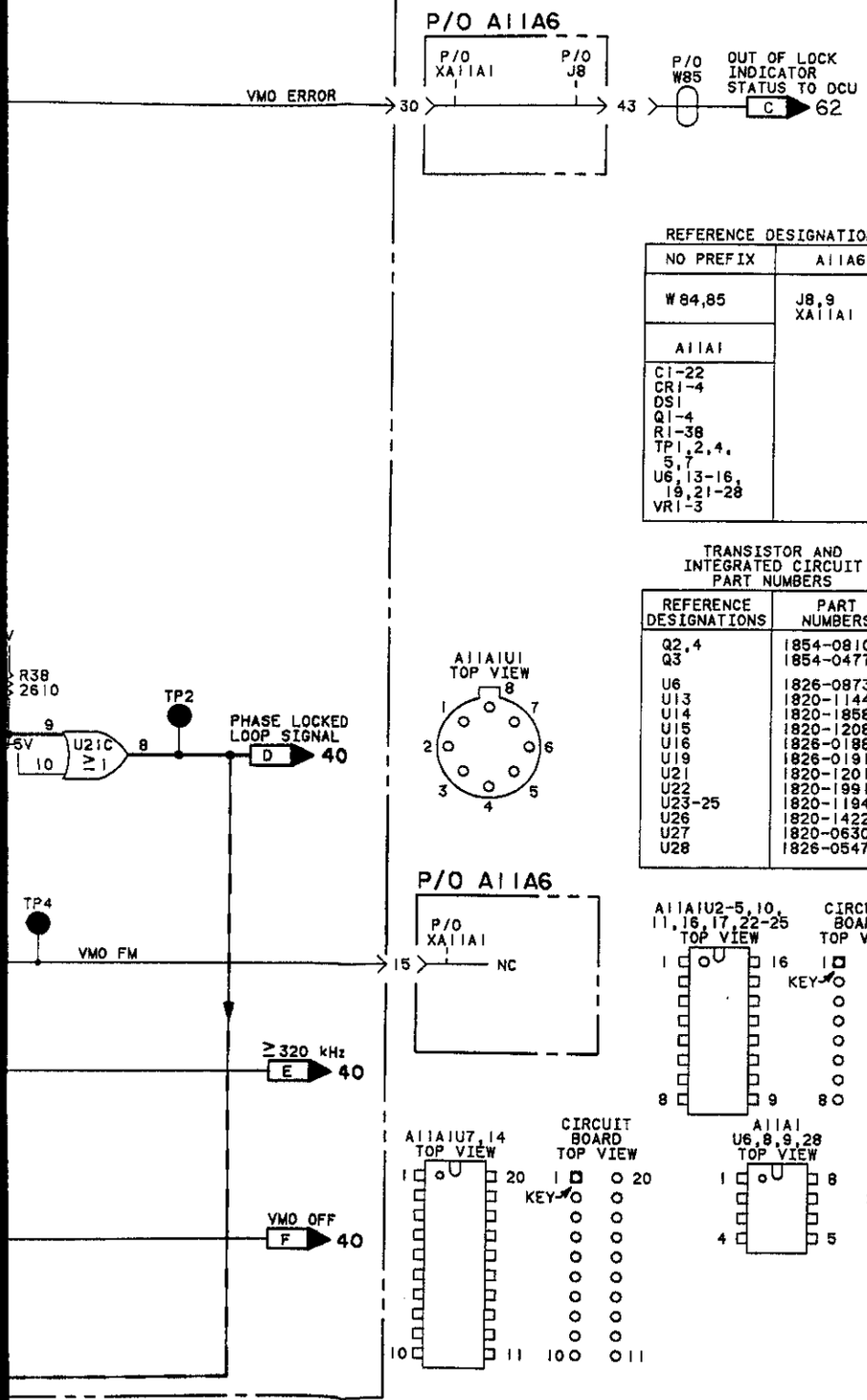


Fig 8-608
Sht 5 of 5

1. REFER TO TABLE 8-102 FOR SCHEMATIC DIAGRAM NOTES.
2. TROUBLESHOOTING VALUES ARE TYPICAL. THEY ARE ACTUAL MEASURED VALUES. YOUR MEASUREMENTS MAY BE SLIGHTLY DIFFERENT THAN WHAT IS SHOWN.
3. INDICATED SHIELD IS A PRINTED CIRCUIT TRACE.



REFERENCE DESIGNATIONS

NO PREFIX	A11A6
W84,85	J8,9 XA11A1
A11A1	
C1-22 CR1-4 DS1 Q1-4 R1-38 TP1,2,4,5,7 U6,13-16,19,21-28 VR1-3	

LOGIC LEVELS

	TTL
HIGH	>+2V
LOW	<+0.8V
< IS MORE NEG. THAN > IS MORE POS. THAN	
OPEN	HIGH
GROUND	LOW

TRANSISTOR AND INTEGRATED CIRCUIT PART NUMBERS

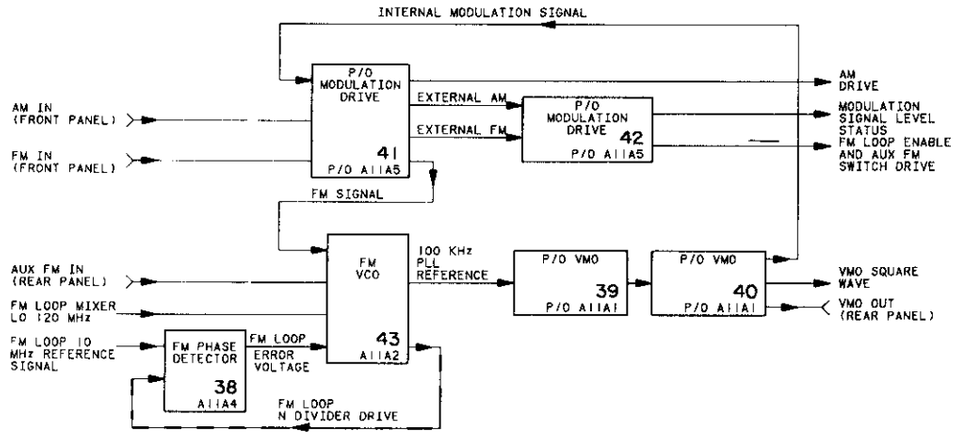
REFERENCE DESIGNATIONS	PART NUMBERS
Q2,4	1854-0810
Q3	1854-0477
U6	1826-0873
U13	1820-1144
U14	1820-1858
U15	1820-1208
U16	1826-0188
U19	1826-0191
U21	1820-1201
U22	1820-1991
U23-25	1820-1194
U26	1820-1422
U27	1820-0630
U28	1826-0547

INTEGRATED CIRCUIT VOLTAGE AND GROUND CONNECTIONS

REFERENCE DESIGNATIONS	PIN NUMBERS
U13,15,21 26,27	+5V - 14 ▽ - 7
U14	+5V - 20 ▽ - 10
U22	+5V - 16 ▽ - 8

SERVICE SHEET 39
P/O A11A1

Figure 8-608. P/O A11A1 Variable Modulation Oscillator Schematic



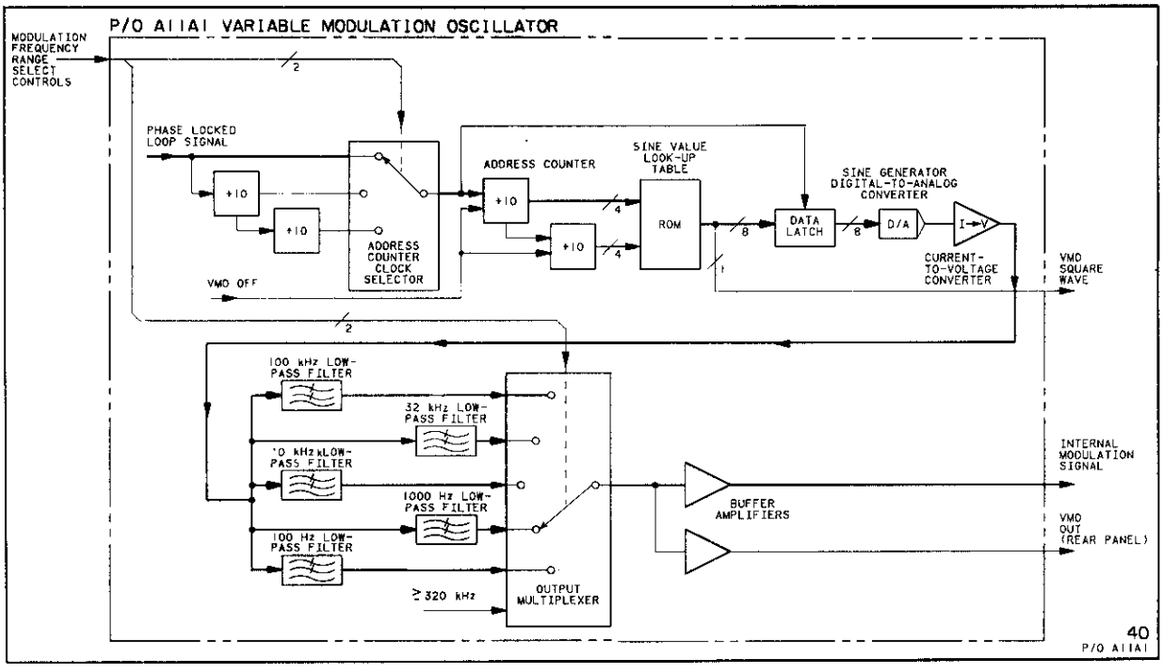


Figure 8-609. P/O A11A1 Variable Modulation Oscillator Block Diagrams

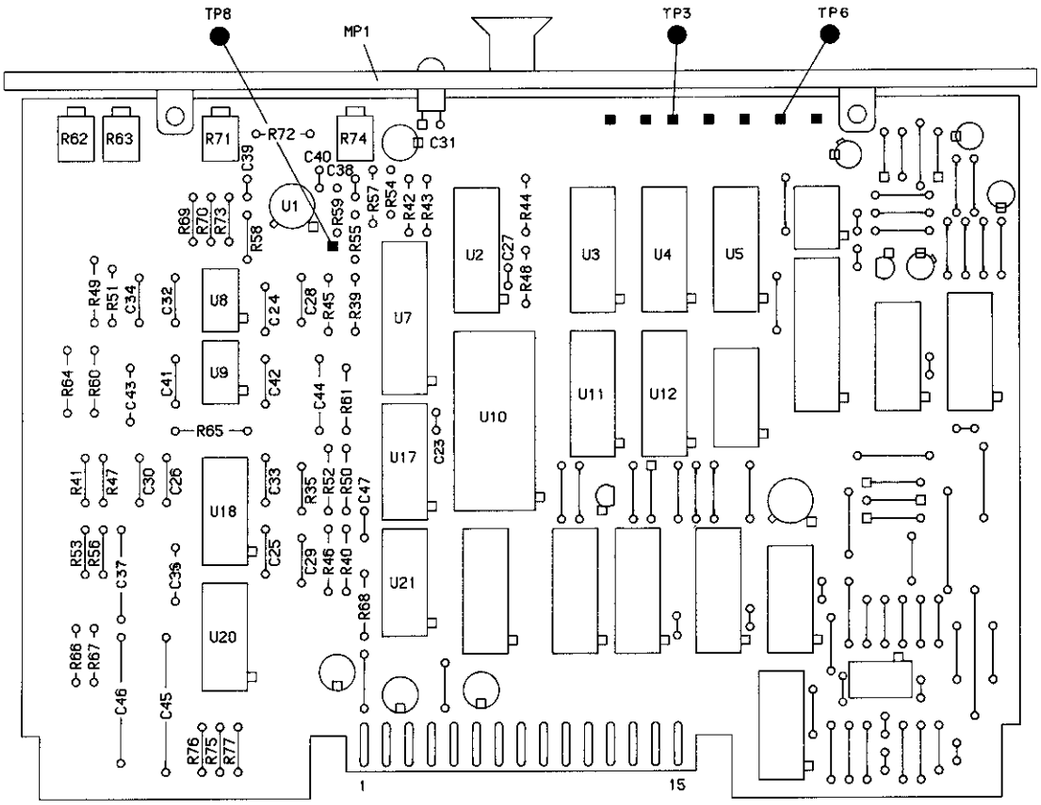


Figure 8-610. P/O A11A1 Variable Modulation Oscillator Component Locator

Fig 8-611 Sht 1 of 5

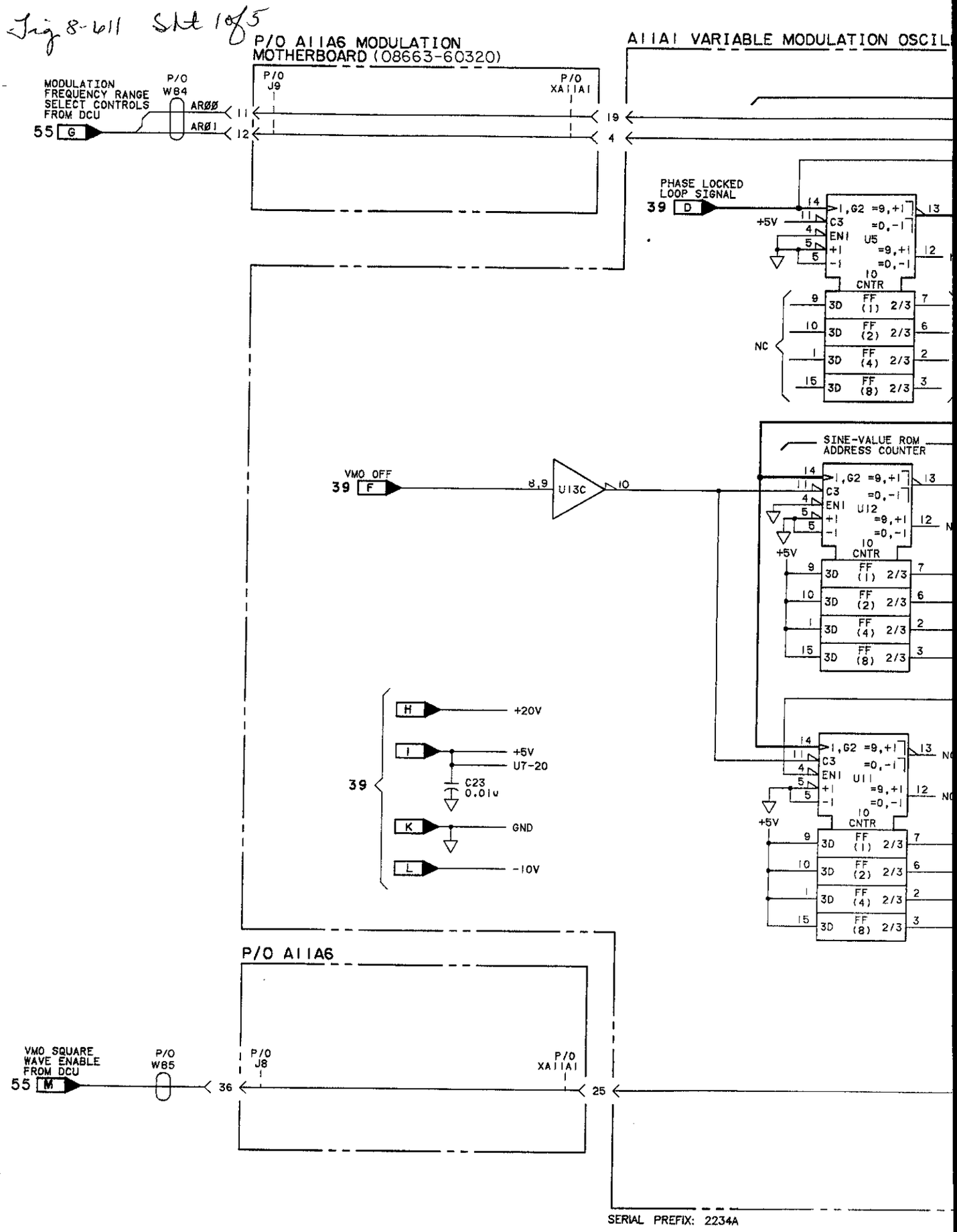


Fig 8-611 sht 2 of 5

ATION OSCILLATOR (08663-60321)

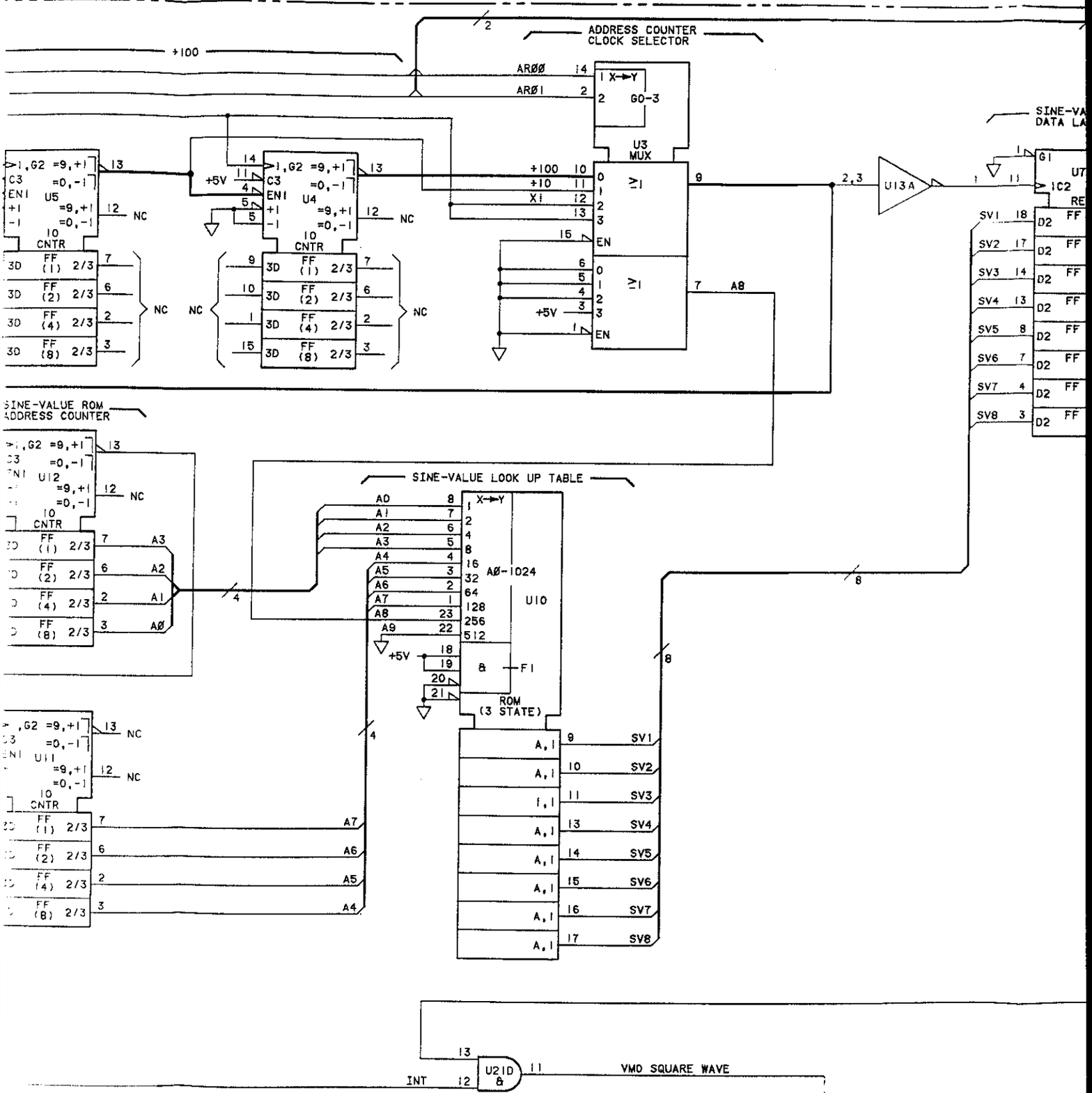


Fig 8-611 Sht 3 of 5

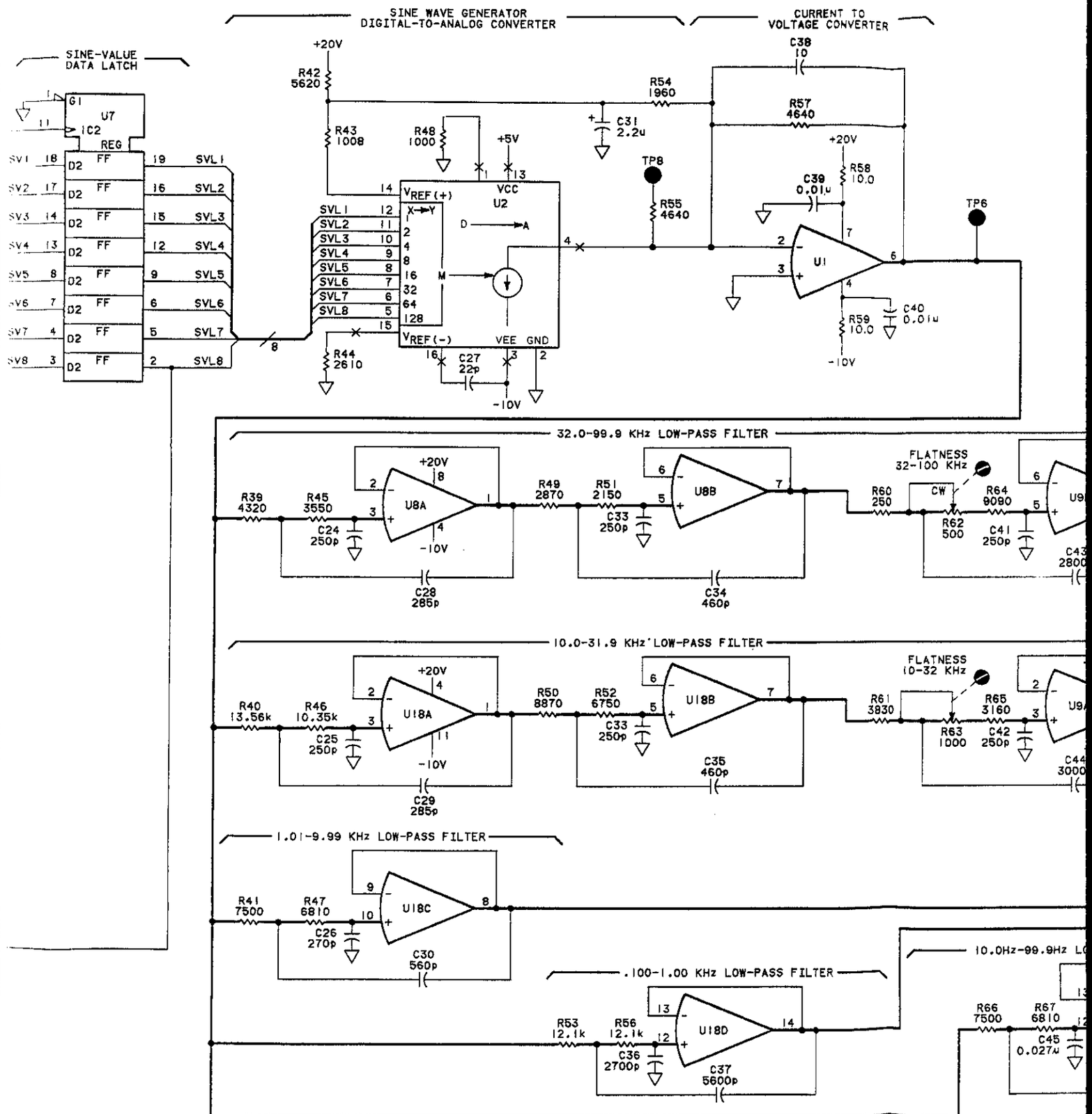


Fig 8-611 Sht 4 of 5

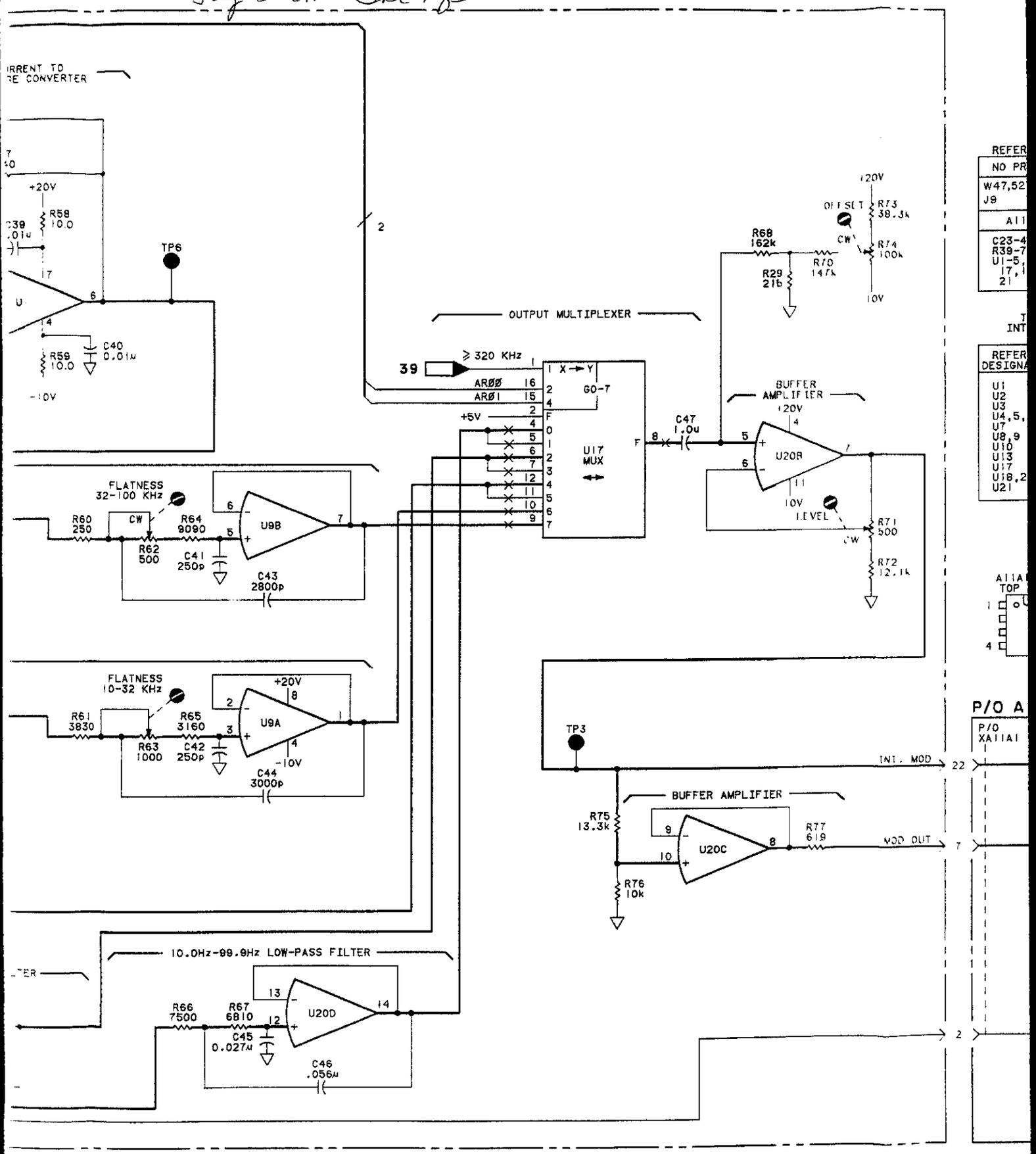


Fig 8-611
Sht 5 of 5

NOTES

1. REFER TO TABLE 8-102 FOR SCHEMATIC DIAGRAM NOTES.
2. TROUBLESHOOTING VALUES ARE TYPICAL. THEY ARE ACTUAL MEASURED VALUES. YOUR MEASUREMENTS MAY BE SLIGHTLY DIFFERENT THAN WHAT IS SHOWN.

REFERENCE DESIGNATIONS

NO PREFIX	A11A6
W47,52,84,85 J9	J2,7,8,9
A11A1	XA11A1
C23-47 R39-77 U1-5,7-12, 17,18,20, 21	

LOGIC LEVELS

	TTL
HIGH	>+2.0V
LOW	<+0.8V
< IS MORE NEG. THAN > IS MORE POS. THAN	
OPEN	HIGH
GROUND	LOW

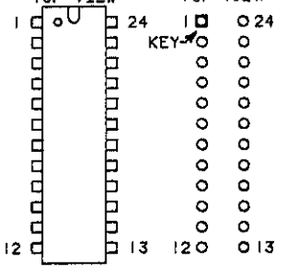
TRANSISTOR AND INTEGRATED CIRCUIT PART NUMBERS

REFERENCE DESIGNATIONS	PART NUMBERS
U1	1826-0488
U2	1826-0188
U3	1820-1244
U4,5,11,12	1820-1279
U7	1820-1858
U8,9	1826-0716
U10	08663-80004
U13	1820-1144
U17	1826-0609
U18,20	1826-0753
U21	1820-1201

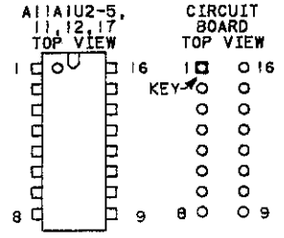
INTEGRATED CIRCUIT VOLTAGE AND GROUND CONNECTIONS

REFERENCE DESIGNATIONS	PIN NUMBERS
U3-5,11,12	+5V - 16 ▽ - 8
U7	+5V - 20 ▽ - 10
U10	+5V - 24 ▽ - 12
U13,21	+5V - 14 ▽ - 7

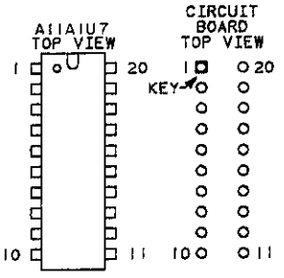
A11A1U10 TOP VIEW — CIRCUIT BOARD TOP VIEW



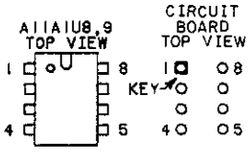
A11A1U2-5, 11, 12, 17 TOP VIEW — CIRCUIT BOARD TOP VIEW



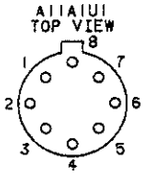
A11A1U7 TOP VIEW — CIRCUIT BOARD TOP VIEW



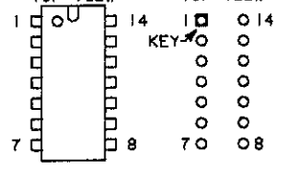
A11A1U8,9 TOP VIEW — CIRCUIT BOARD TOP VIEW

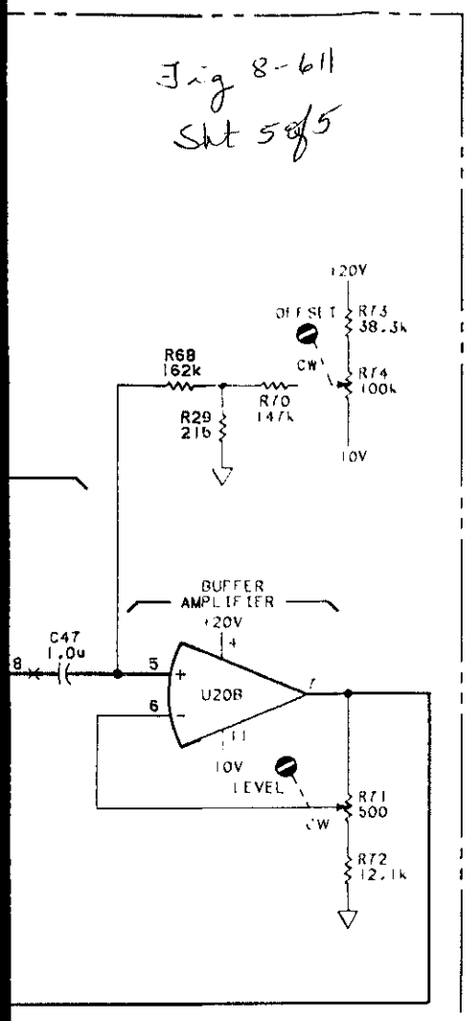


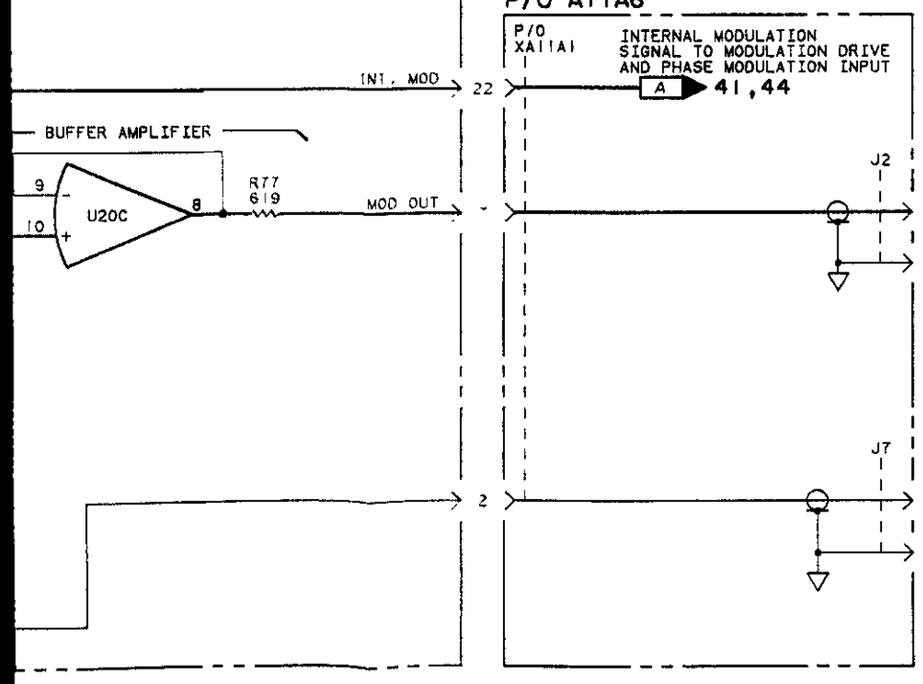
A11A1U1 TOP VIEW



A11A1U13, 18, 20, 21 TOP VIEW — CIRCUIT BOARD TOP VIEW







SERVICE SHEET 40

P/O A11A1

Figure 8-611. P/O A11A1 Variable Modulation Oscillator Schematic

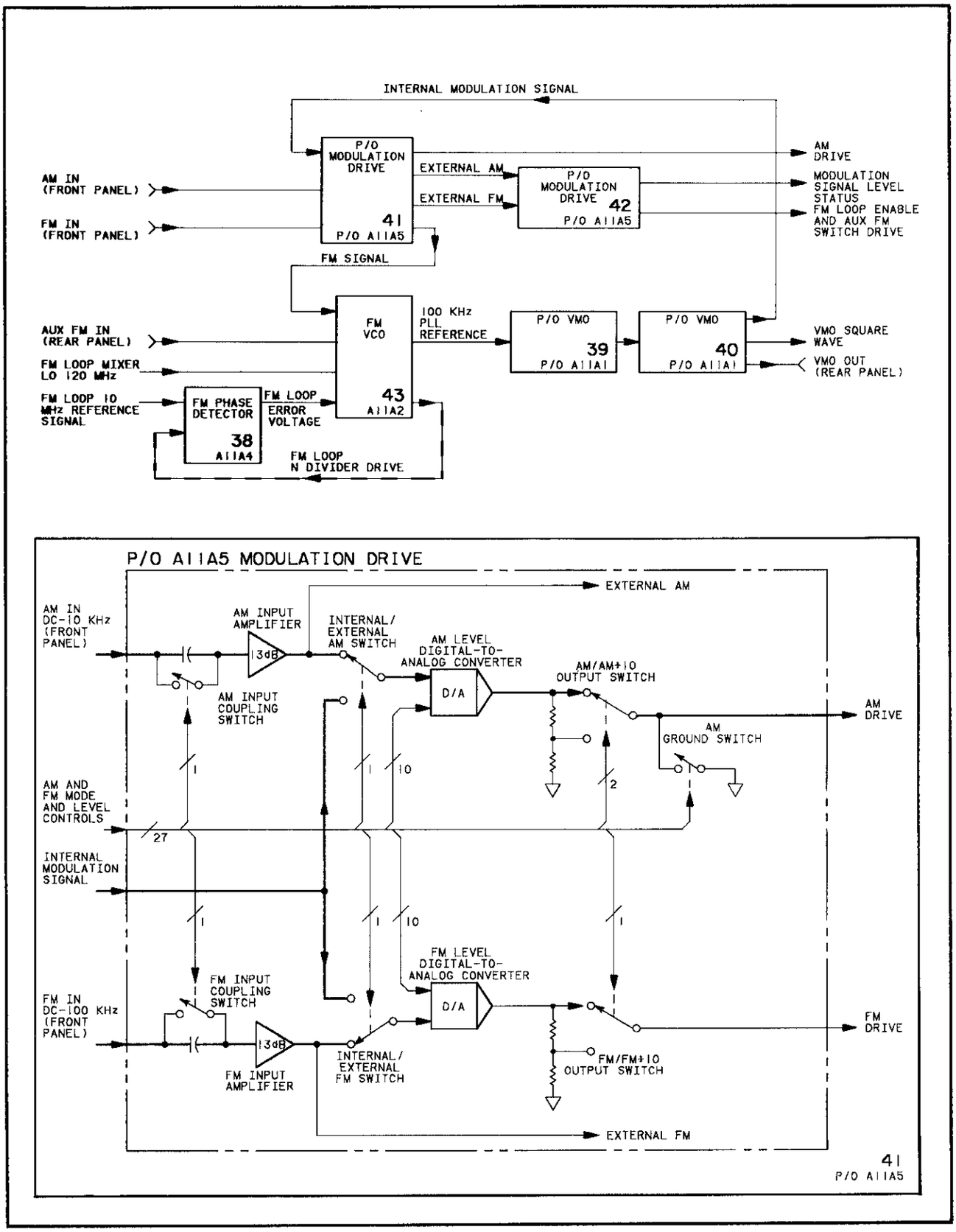


Figure 8-612. P/O A11A5 Modulation Drive Block Diagrams

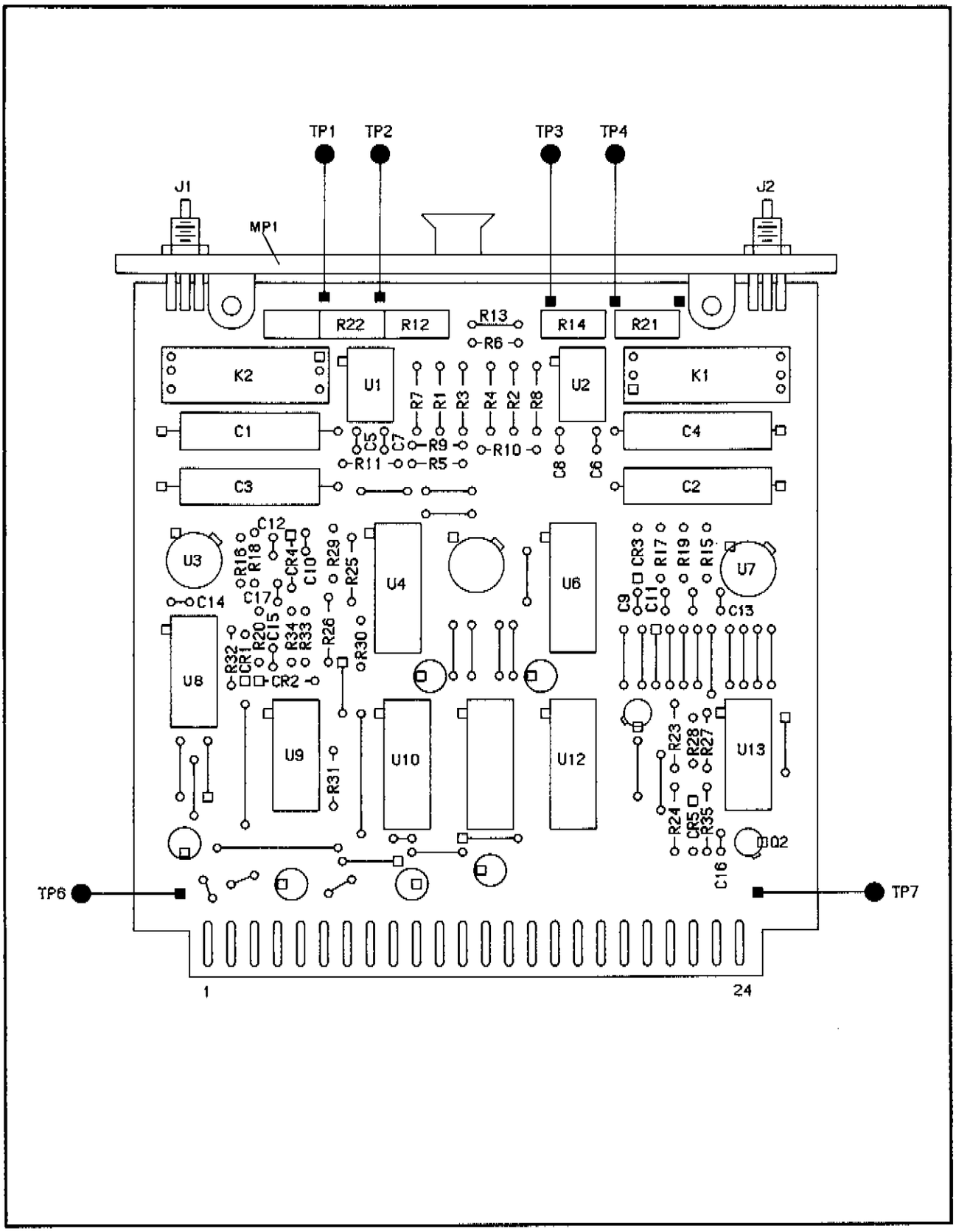


Figure 8-613. P/O A11A5 Modulation Drive Component Locator

CHANGES

All serial prefixes

On the A11A5 schematic:

- A11A1R1 - R1 is incorrectly shown connected between output pin 6 of U1 and ground. R1 should be connected between inverting input, U1 pin 2, and ground.
- A11A1R2 - R2 is incorrectly shown connected between output pin 6 of U2 and ground. R2 should be connected between inverting input, U2 pin 2, and ground.
- A11A1R29, R30 - Change the value of R29 to 90.9 ohms. Change the value of R30 to 10 ohms.

2333A and Above

On the A11A5 component locator:

- A11A5CR8 - Delete CR8.

On the A11A5 schematic:

- A11A5CR8 - Delete CR8.

On the A2A2 component locator:

- A2A2CR5 - Delete CR5.

On the A2A2 schematic:

- A2A2CR5 - Delete CR5.

Fig 8-614
Sht 1 of 4

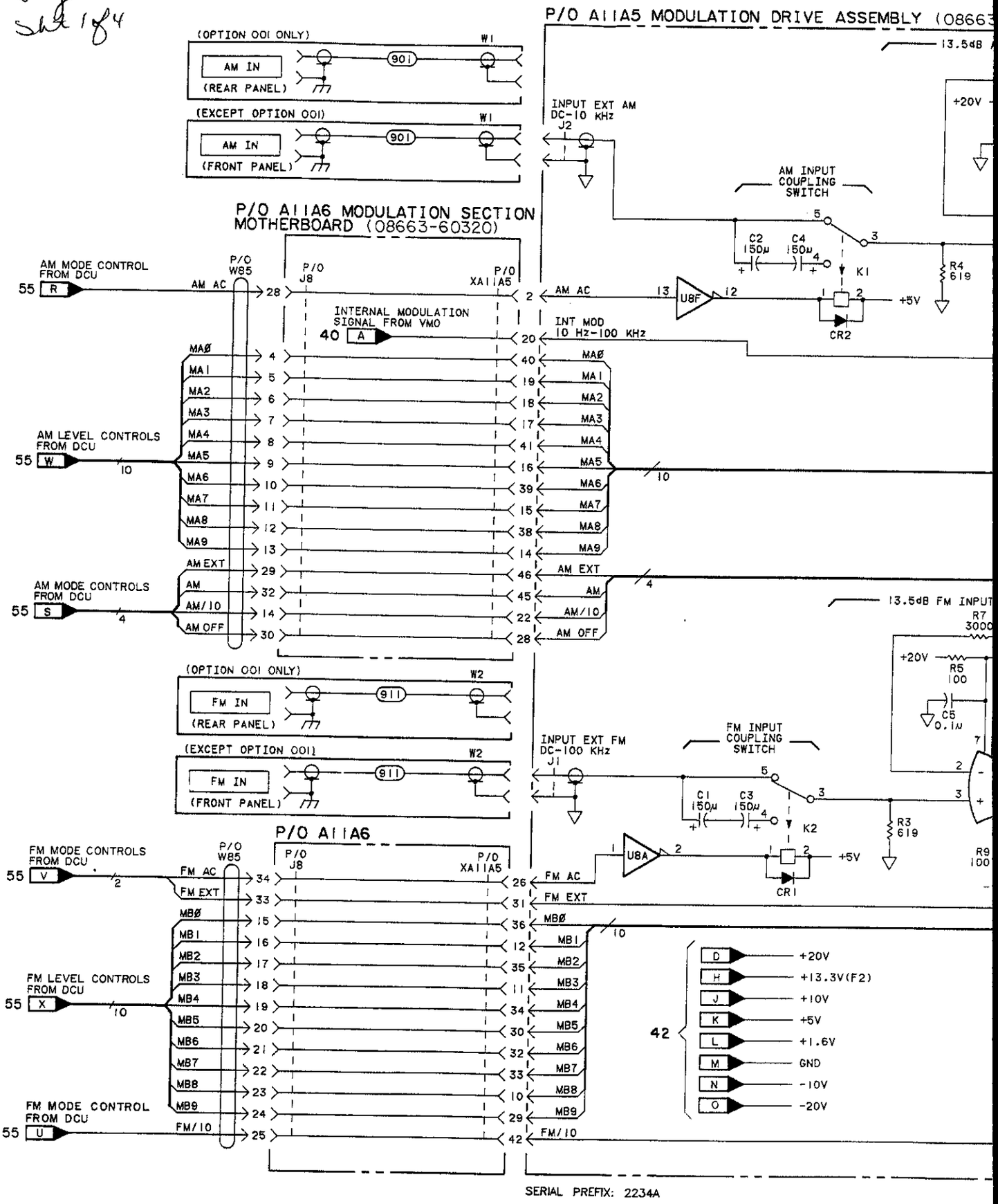


Fig 8-614 Sht 2 of 4

DRIVE ASSEMBLY (08663-60323)

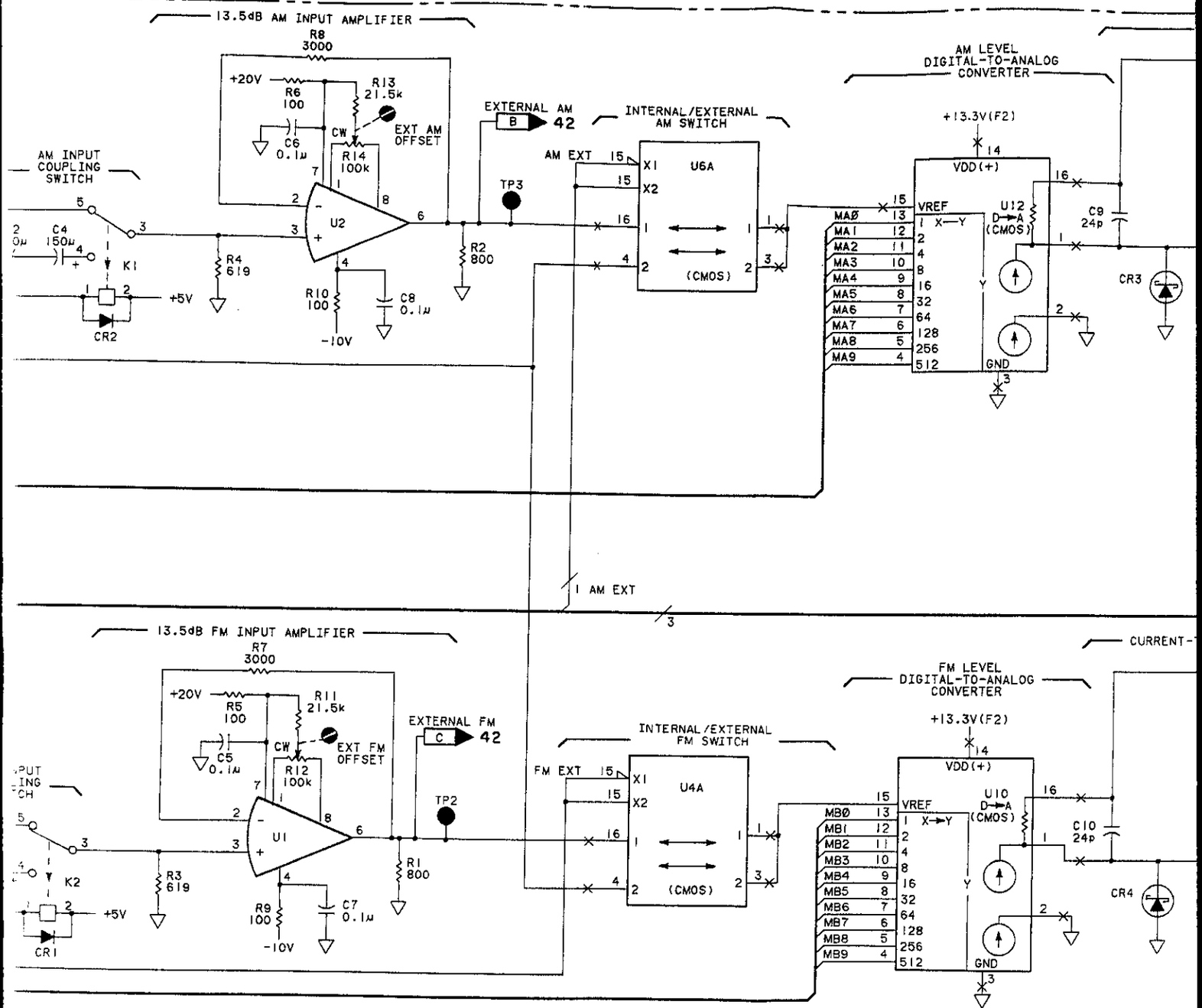


Fig 8-614 Sht 3 of 4

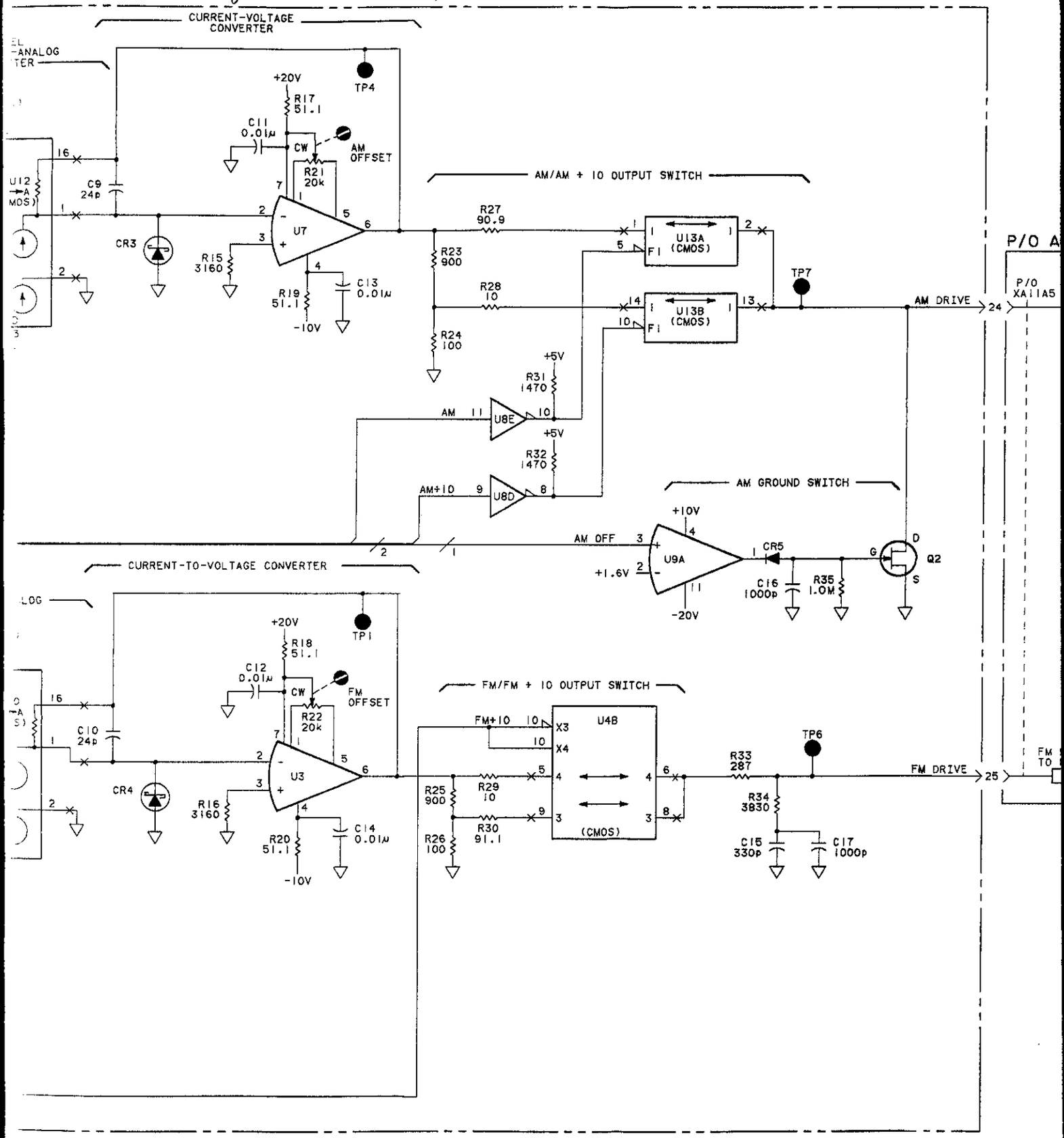


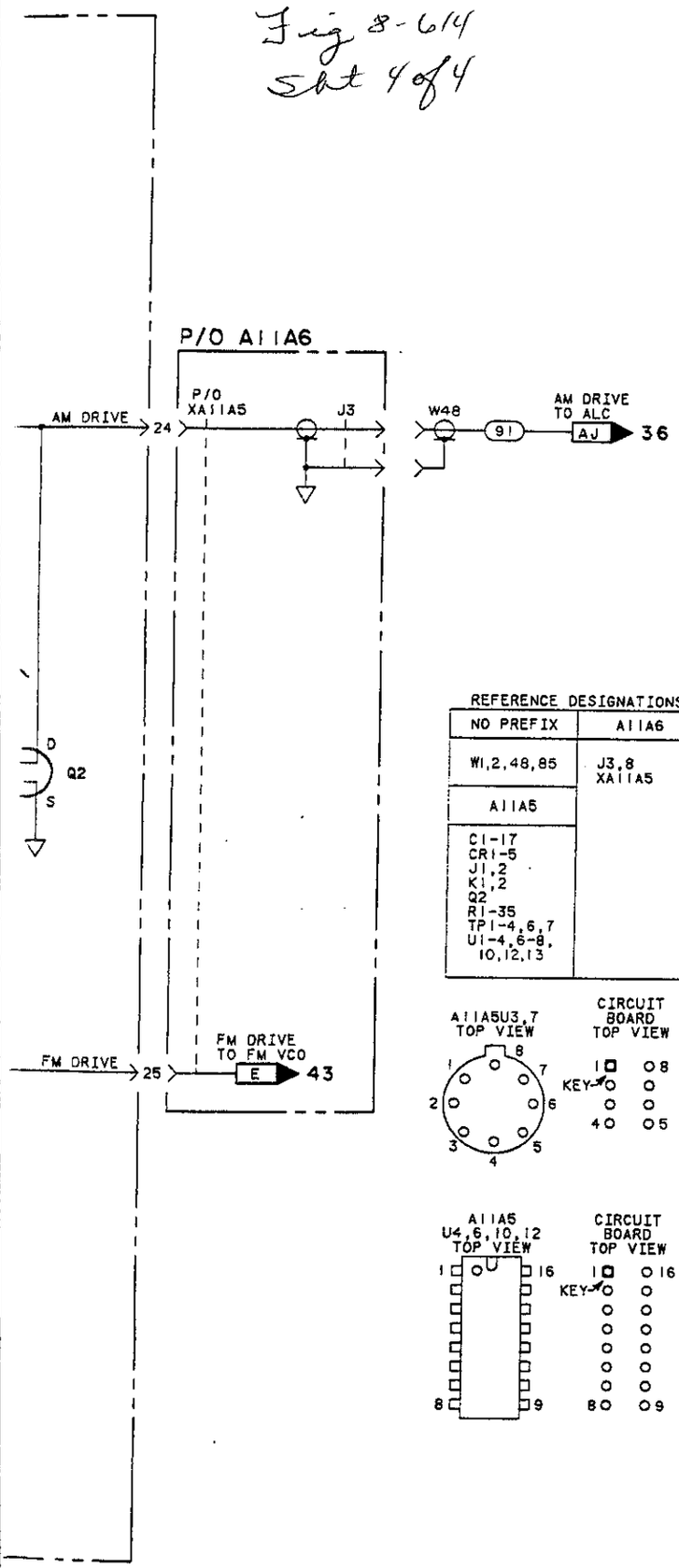
Fig 8-614
Sht 4 of 4

NOTES

1. REFER TO TABLE 8-102 FOR SCHEMATIC DIAGRAM NOTES.
2. TROUBLESHOOTING VALUES ARE TYPICAL. THEY ARE ACTUAL MEASURED VALUES. YOUR MEASUREMENTS MAY BE SLIGHTLY DIFFERENT THAN WHAT IS SHOWN.

LOGIC LEVELS

	TTL
HIGH	>+2.0V
LOW	<+0.8V
< IS MORE NEG.THAN > IS MORE POS.THAN	
OPEN	HIGH
GROUND	LOW



TRANSISTOR AND INTEGRATED CIRCUIT PART NUMBERS

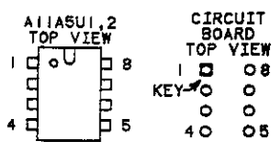
REFERENCE DESIGNATIONS	PART NUMBERS
Q2	1885-0020
U1,2	1826-0783
U3,7	1826-0358
U4,6	1826-0950
U8	1820-1199
U9	1826-0161
U10,12	1826-0254
U13	1826-0951

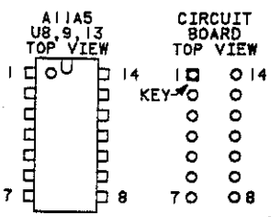
REFERENCE DESIGNATIONS

NO PREFIX	A11A6
W1,2,48,85	J3,8 XA11A5
A11A5	
C1-17 CR1-5 J1,2 K1,2 Q2 R1-35 TP1-4,6,7 U1-4,6-8, 10,12,13	

INTEGRATED CIRCUIT VOLTAGE AND GROUND CONNECTIONS

REFERENCE DESIGNATIONS	PIN NUMBERS
U4,6	+10V - 11 +5V - 12 -20V - 14 ▽ - 13
U8	+5V - 14 ▽ - 7
U13	+10V - 6 +5V - 7 -20V - 9 ▽ - 8

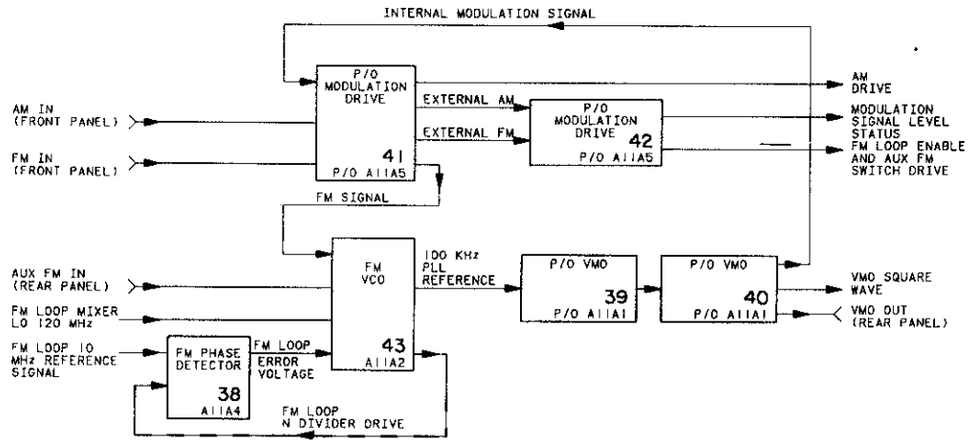




SERVICE SHEET 41

P/O A11A5

Figure 8-614. P/O A11A5 Modulation Drive Schematic



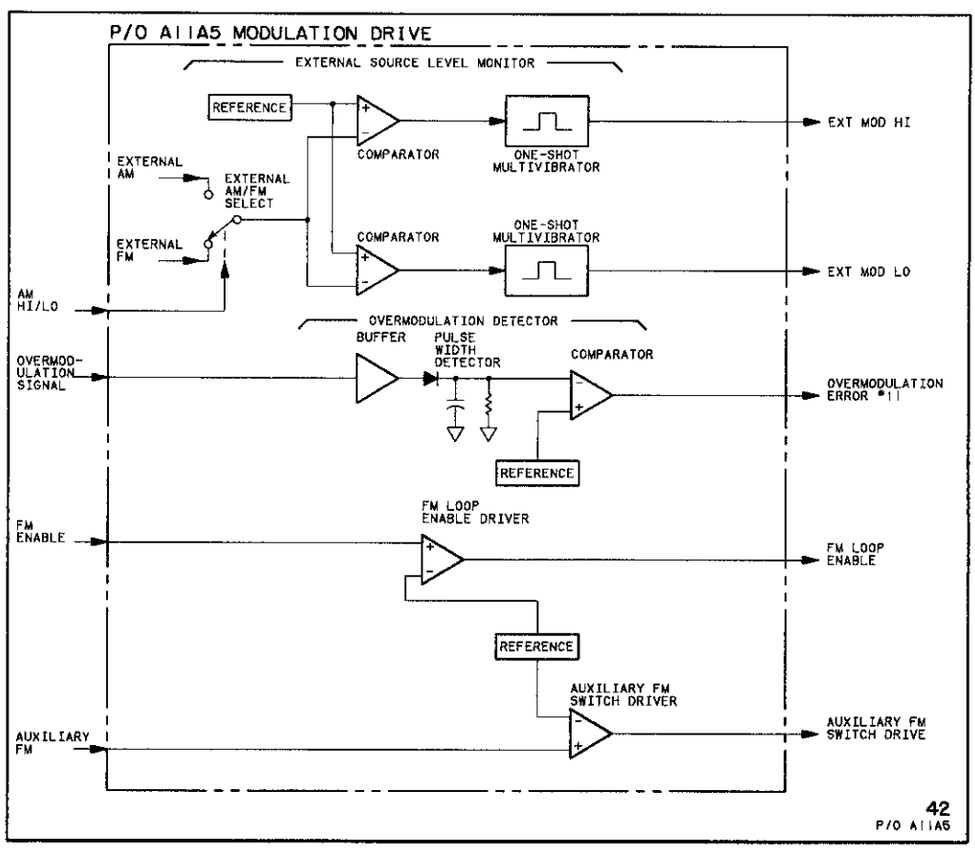


Figure 8-615. P/O A11A5 Modulation Drive Block Diagrams

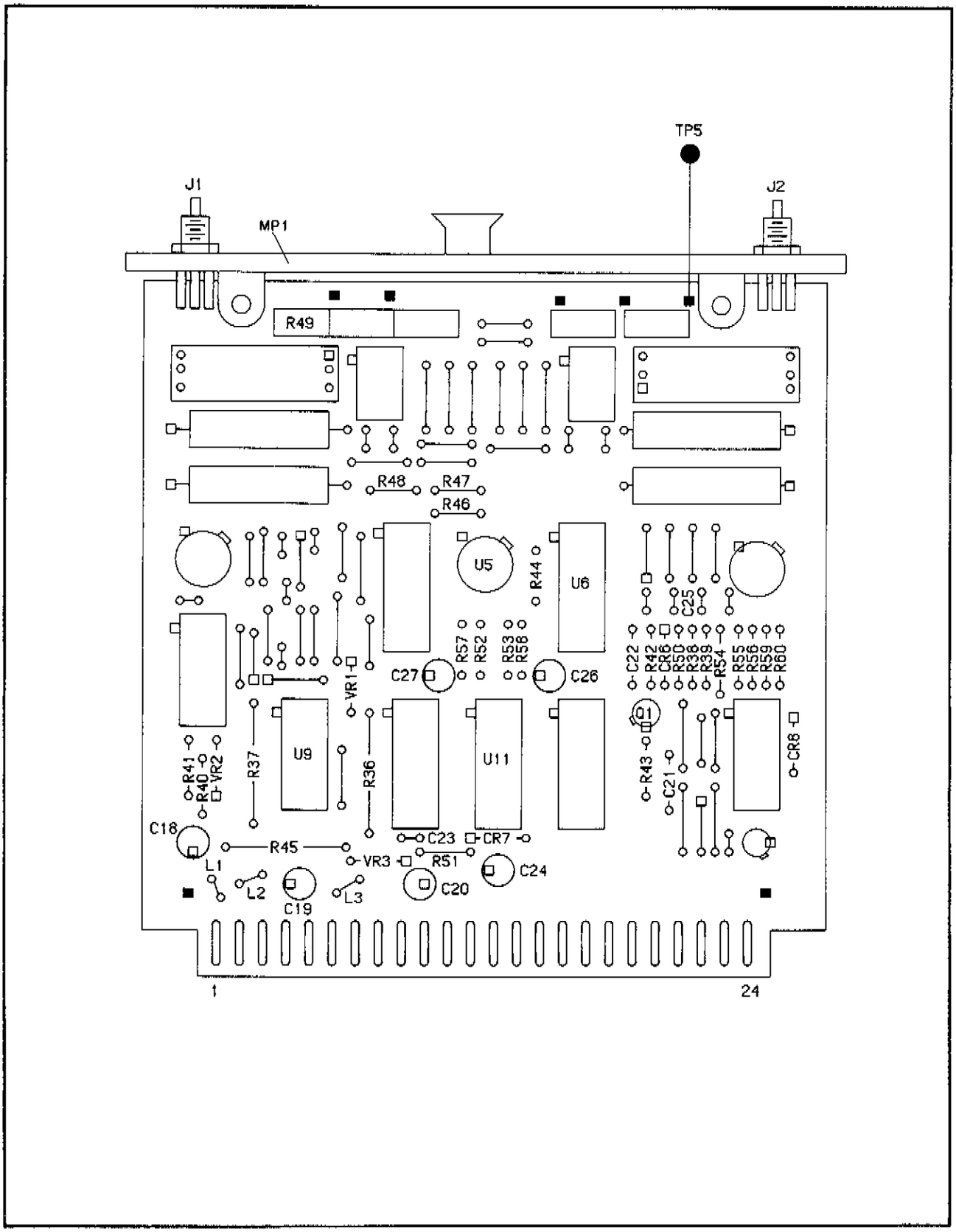


Figure 8-616. P/O A11A5 Modulation Drive Component Locator

CHANGES

All serial prefixes

On the A11A5 schematic:

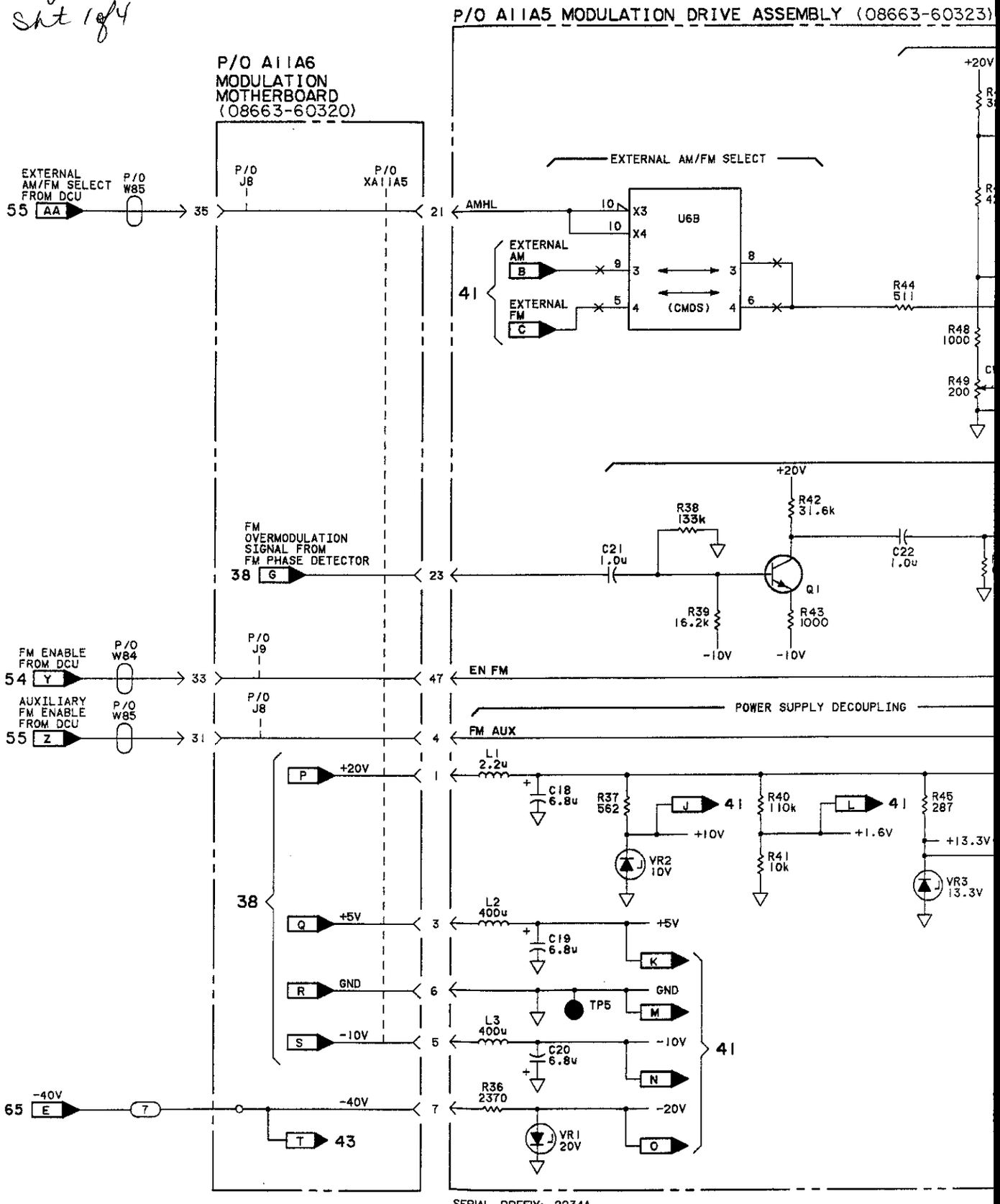
- The output line U9B pin 7 is incorrectly labeled FM LOOP ENABLE. Change the label to AUXILIARY FM SWITCH DRIVE.

2601A and Above

On the A11A5 schematic:

- A11A5R36 - Change the value of R36 to 1.33k.
- A11A5U9 - In the Table of Transistor and Integrated Circuit Part Numbers, change the part number of U9 to 1826-0753.

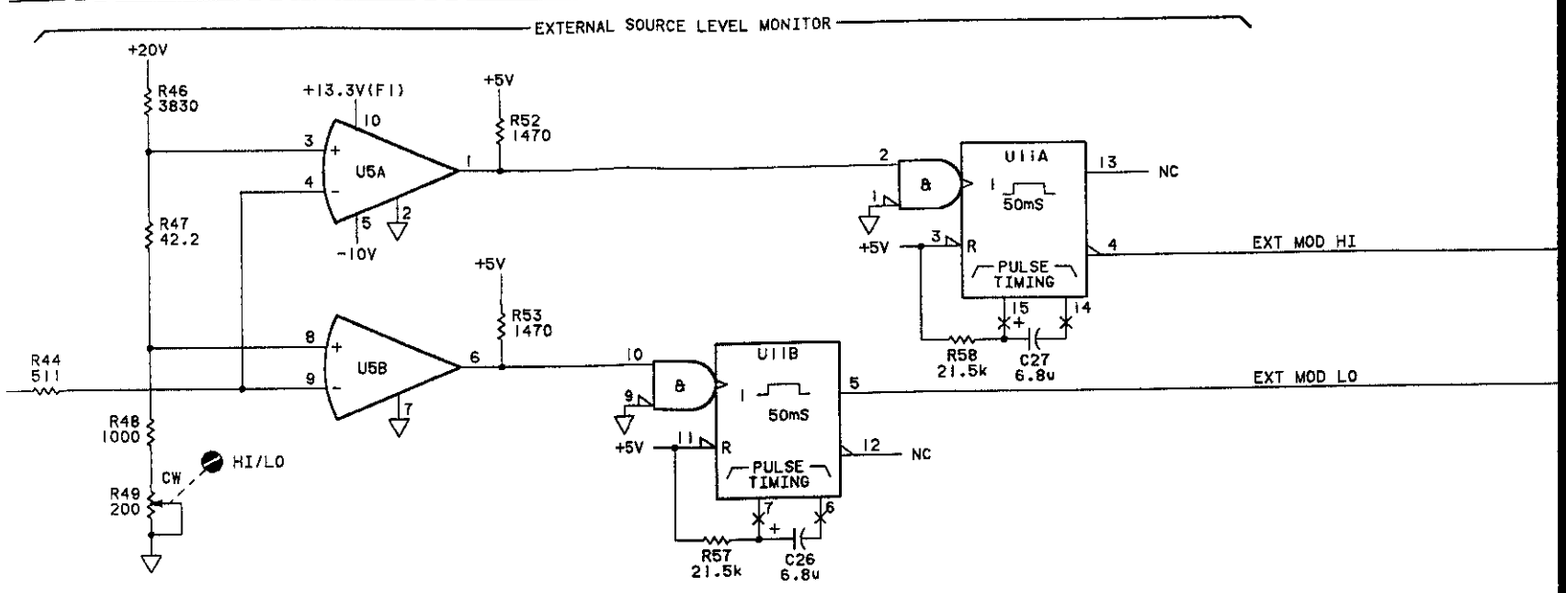
Fig 8-617
Sht 1 of 4

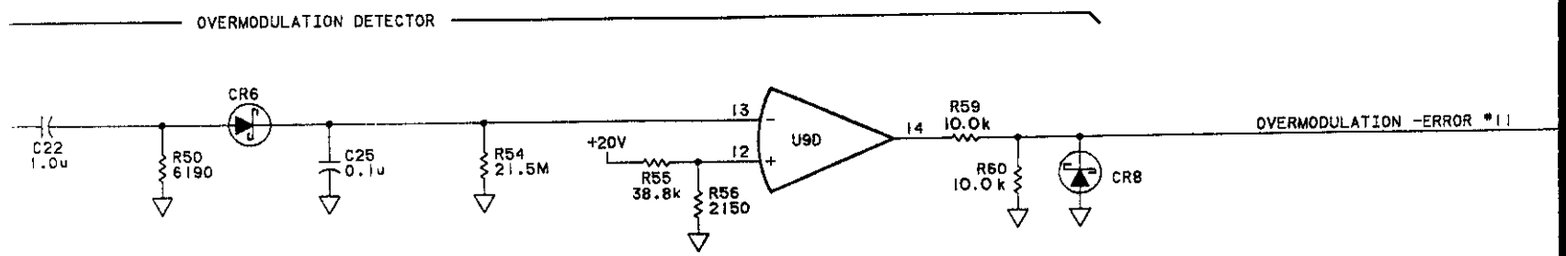


SERIAL PREFIX: 2234A

Fig 8-617 Sht 2 of 4

3663-60323)





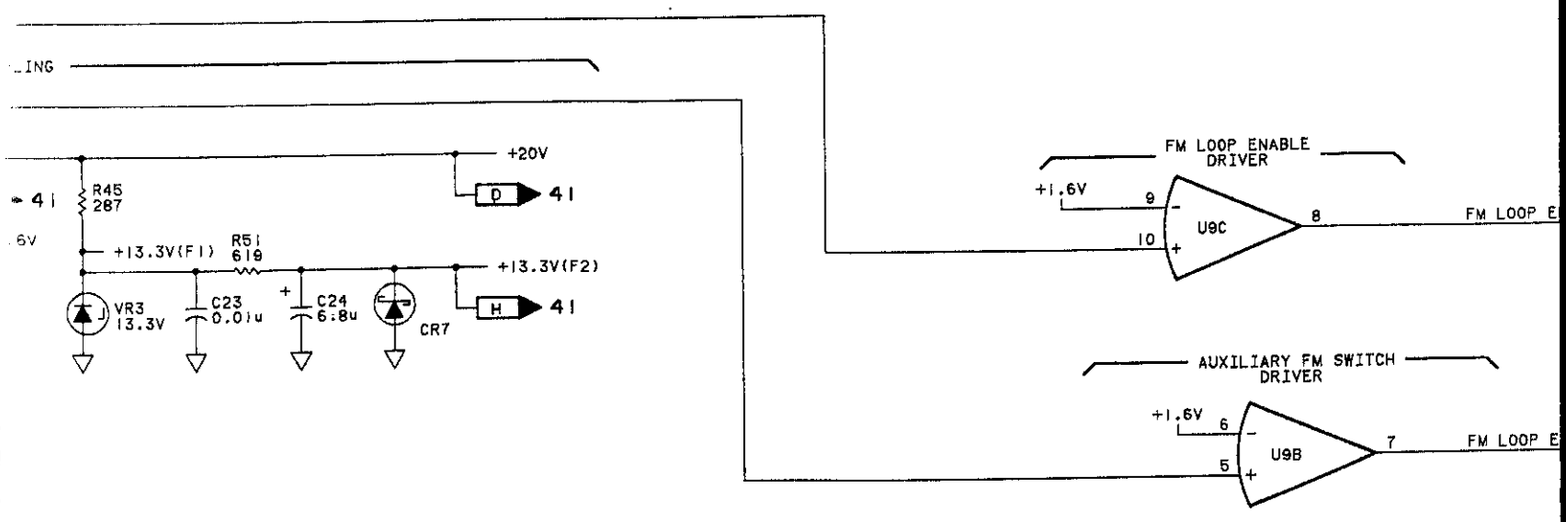


Fig 8-617 Sht 3 of 4

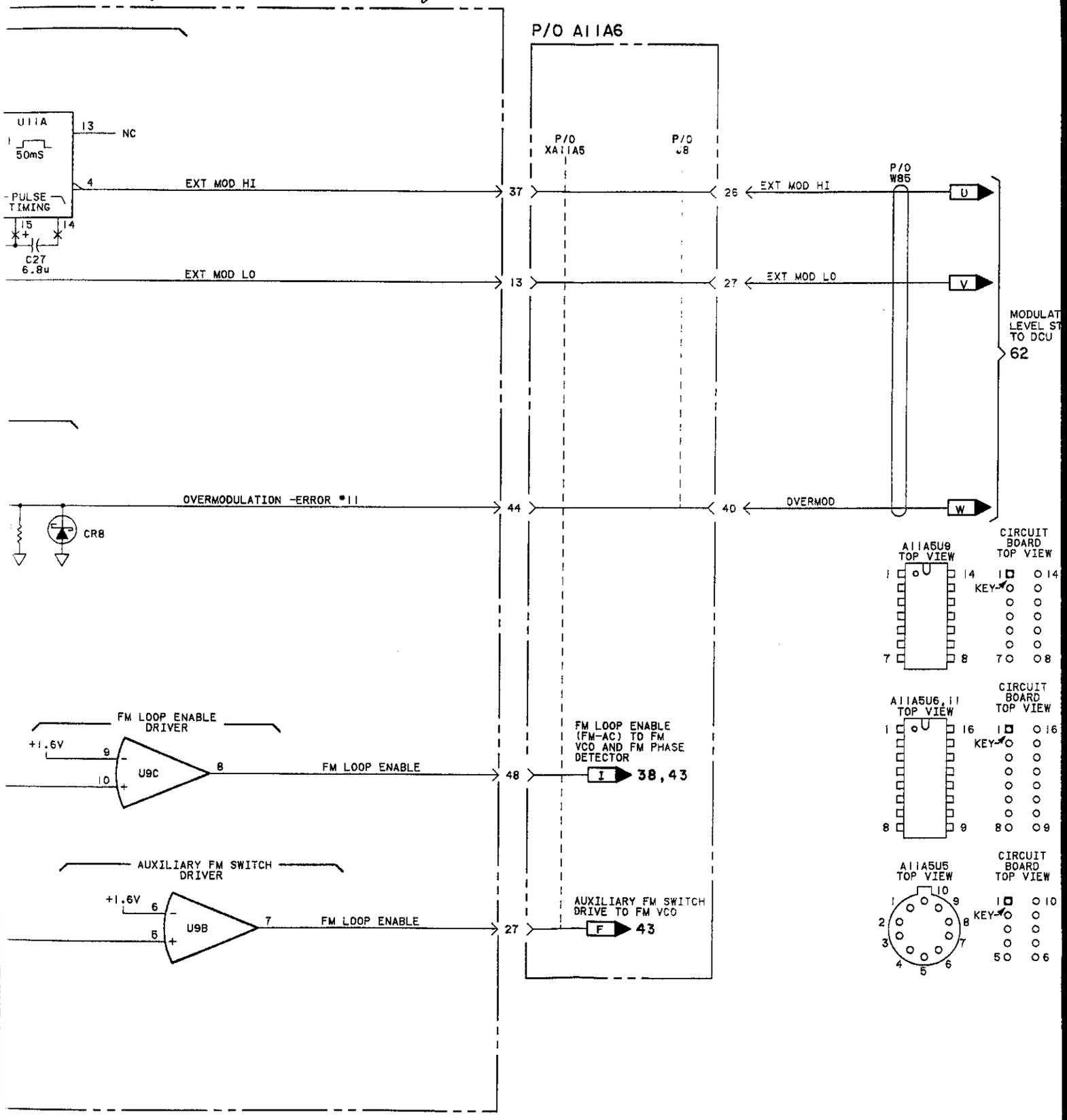
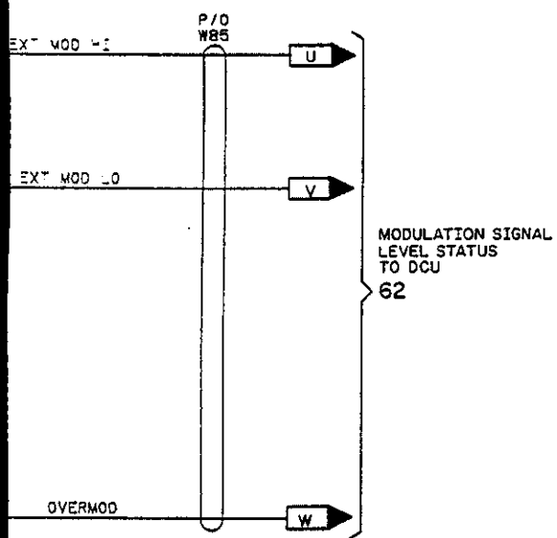


Fig 8-617
Sht 4 of 4

NOTES

1. REFER TO TABLE 8-102 FOR SCHEMATIC DIAGRAM NOTES.
2. TROUBLESHOOTING VALUES ARE TYPICAL. THEY ARE ACTUAL MEASURED VALUES. YOUR MEASUREMENTS MAY BE SLIGHTLY DIFFERENT THAN WHAT IS SHOWN.



REFERENCE DESIGNATIONS

NO PREFIX	A11A6
W84,85	J8,9 XA11A5
A11A5	
C18-27 CR6-8 L1-3 Q1 R36-60 TP5 U5,6,9,11 VR1-3	

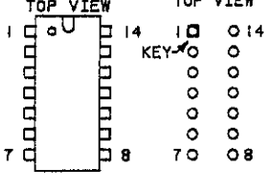
TRANSISTOR
INTEGRATED CIRCUIT
PART NUMBERS

REFERENCE DESIGNATIONS	PART NUMBERS
Q1	1854-0810
U5	1826-0191
U6	1826-0950
U9	1826-0161
U11	1820-1423

LOGIC LEVELS

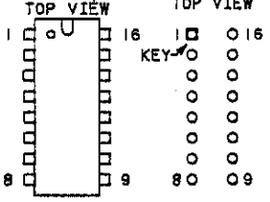
	TTL
HIGH	>+2V
LOW	<+0.8V
< IS MORE NEG.THAN > IS MORE POS.THAN	
OPEN	HIGH
GROUND	LOW

A11A5U9
TOP VIEW



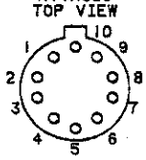
CIRCUIT
BOARD
TOP VIEW

A11A5U6,11
TOP VIEW

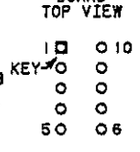


CIRCUIT
BOARD
TOP VIEW

A11A5U5
TOP VIEW



CIRCUIT
BOARD
TOP VIEW



INTEGRATED CIRCUIT
VOLTAGE AND
GROUND CONNECTIONS

REFERENCE DESIGNATIONS	PIN NUMBERS
U68	+10V - 11 +5V - 12 -20V - 14 ⏚ - 13
U11	+5V - 16 ⏚ - 8

SERVICE SHEET 42

P/O A11A5

Figure 8-617. P/O A11A5 Modulation Drive Schematic

SERVICE SHEET 43
A11A2 FM VCO

REFERENCE BLOCK DIAGRAM 7
Table 4-1. Recommended Performance Tests After Adjustments or Repairs
Table 5-2. Post-Repair Adjustment Procedures

PRINCIPLES OF OPERATION

General

The FM VCO (A11A2) generates the frequency modulated 20 MHz signal. The FM signal is generated by applying the modulation signal to the varactor diode that forms part of the oscillator's tank circuit. The FM VCO has two primary outputs. One is the 140 MHz VCO output which is used to lock the loop and the other output is the frequency modulated 20 MHz signal. The 20 MHz FM signal is developed by heterodyning the 140 MHz VCO output with the 120 MHz signal from the Reference Section. The primary inputs are the modulation signals and the FM Loop Error Voltage which is used to lock the loop.

140 MHz Voltage Controlled Butler Oscillator (VCO)

Q1, Q2 and associated components form the 140 MHz Voltage Controlled Oscillator. Q1 is a common-gate FET amplifier with the tank circuit located in its drain circuit. The signal developed in the tank circuit is coupled to the gate of Q2 by C13. Q2 acts as a source follower in the feedback circuit, providing a high impedance at its gate and a low output impedance at its drain. Q2 amplifies the feedback signal and feeds the signal back to Q1 to sustain oscillation.

The 140 MHz VCO is both frequency modulated and phase locked by varying the reverse-bias voltage across the varactor diode. An increase in the reverse-bias voltage reduces the junction capacitance, which increases the resonant frequency of the tank circuit. This causes the VCO to oscillate at a higher frequency. When the FM Loop is phase locked the center frequency is always 140 MHz.

Gain Limiting and Mixer Circuit

The 140 MHz signal developed across the tank is coupled to Limiter, U1. The Limiter acts as a buffer amplifier for the VCO and provides a constant level output. One output from the Limiter is used to phase lock the loop. The other output is applied to the RF port of the double balanced mixer, U2. The Mixer heterodynes the 140 MHz VCO output with the 120 MHz signal to produce the 20 MHz FM signal.

Shaping Network and Shaping Network Bias

Due to the nonlinear tuning characteristic of the varactor diode and the large amount of shunt capacity used in the resonant circuit, a Shaping Network is required. The Shaping Network conditions the modulation signal applied to the varactor to ensure that the frequency change is linear with the applied voltage.

The Shaping Network consist of a ladder of diodes that are reverse biased, in sequence, at a voltage higher than the reverse bias on the diode previous to it. As the input signal level increases (negative direction) the diodes successively become forward biased, in sequence, and present a lower impedance to the input signal.

The Shaping Network Bias circuit acts as a voltage supply for the resistor-diode network and for Q3. The bias voltage is about +14.1 Vdc.

Voltage to Current Converter

The various input signals (the FM Loop Error Voltage, DC Offset and the modulating signals) are summed at the emitter of Q5. Q5 operates in a common-base mode with the inputs applied at its emitter. The base is biased one diode drop above ground, therefore the voltage at the emitter is approximately zero volts.

Loop and Aux FM Switch

Q6 and Q7 are JFETs used as analog switches. The FM Loop Enable and the Aux FM Switch Drive lines are the control lines that drive the JFET switches either ON or OFF. To maintain the JFET switches in the ON state, the control lines are biased to approximately +9 Vdc. This reverse biases both diodes, CR1 and CR2, and the gates are essentially left floating. To turn the JFET switches OFF, the control lines are biased to approximately -19 Vdc. This voltage forward biases both diodes, and clamps the gates at a negative voltage. This negative voltage at the gates effectively pinches off the JFETs (OFF state).

Loop switch, Q6, is used to disable the FM Loop Error Voltage. The Aux FM switch, Q7, isolates the modulation signal from the Aux FM Input.

Phase Lock Detector

The Phase Lock Detector consists of two comparators that form a window comparator circuit. This circuit determines if the FM Loop Error Voltage lies between two preset voltage limits (the window). R41, R42, and R43 form a voltage divider that establishes the upper and lower voltage limits. The upper and lower voltage limits, +1.39 Vdc and -1.34 Vdc respectively, are applied to the inverting input of comparator U3A and U3B. When the error voltage is within the voltage window, indicating the FM Loop is phase locked, the output from the

comparators will remain high. If the error voltage lies outside the voltage window, one of the comparators will go low, turning the Out of Lock Indicator on.

TROUBLESHOOTING

If any components in the 140 MHz Voltage Controlled Butler Oscillators fail, the A11A2 assembly may have to be replaced. Resistors R21-R24 are selected to match the characteristics of the oscillator. Changing a component in the oscillator could change the characteristics enough to require new selected resistors. The selection process requires a special test fixture and is very time consuming; therefore, it cannot be done in the field.

To determine whether or not a new assembly is needed, replace the defective conponent and measure FM distortion with 100 kHz deviation. If FM distortion is within the specifications listed in Table 1-1, the repair is successful. However, if FM is not within the specifications, the assembly will have to be replaced. The varactor diode, CR9, is the most critical component.

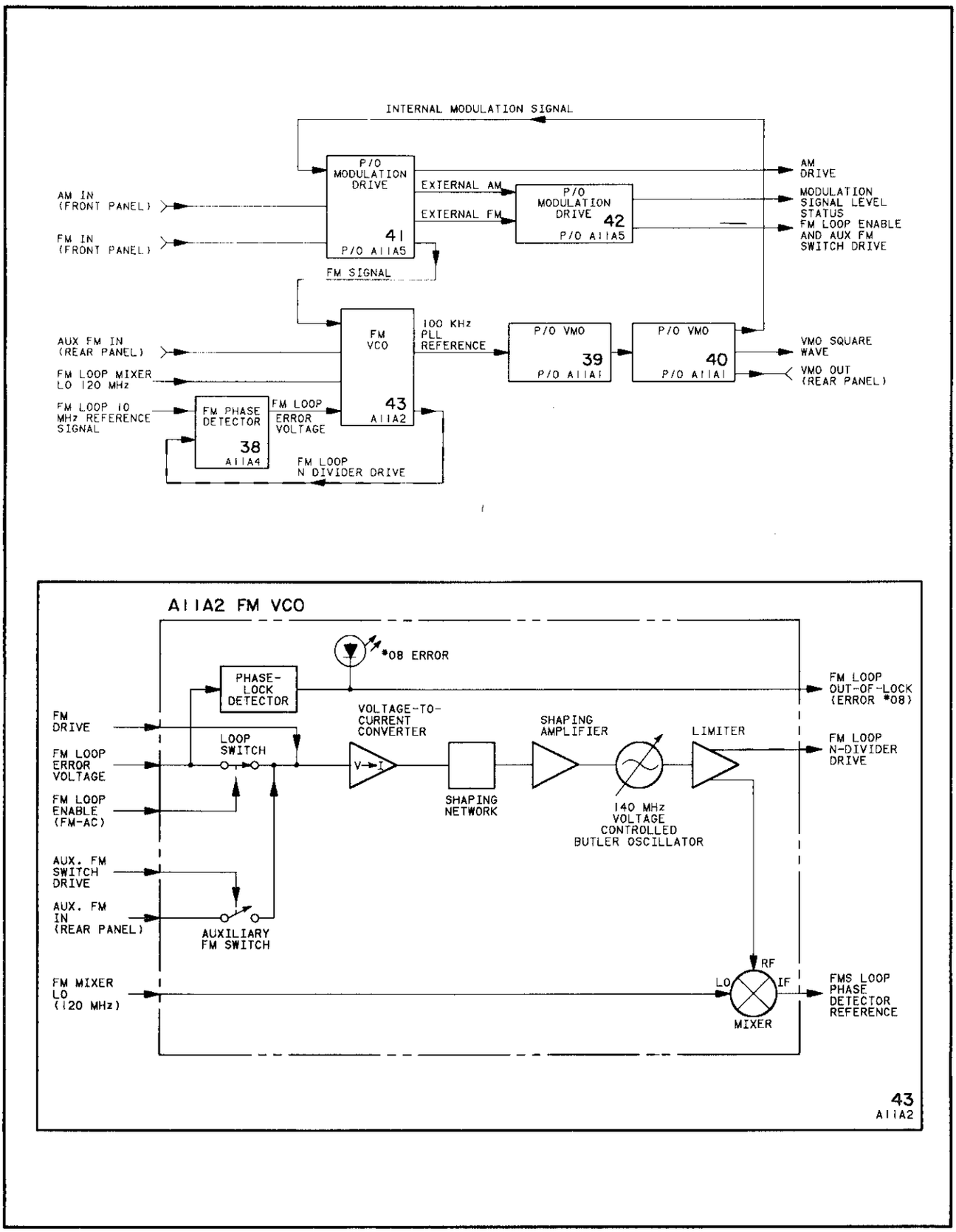


Figure 8-618. A11A2 FM Loop Voltage Controlled Oscillator Block Diagrams

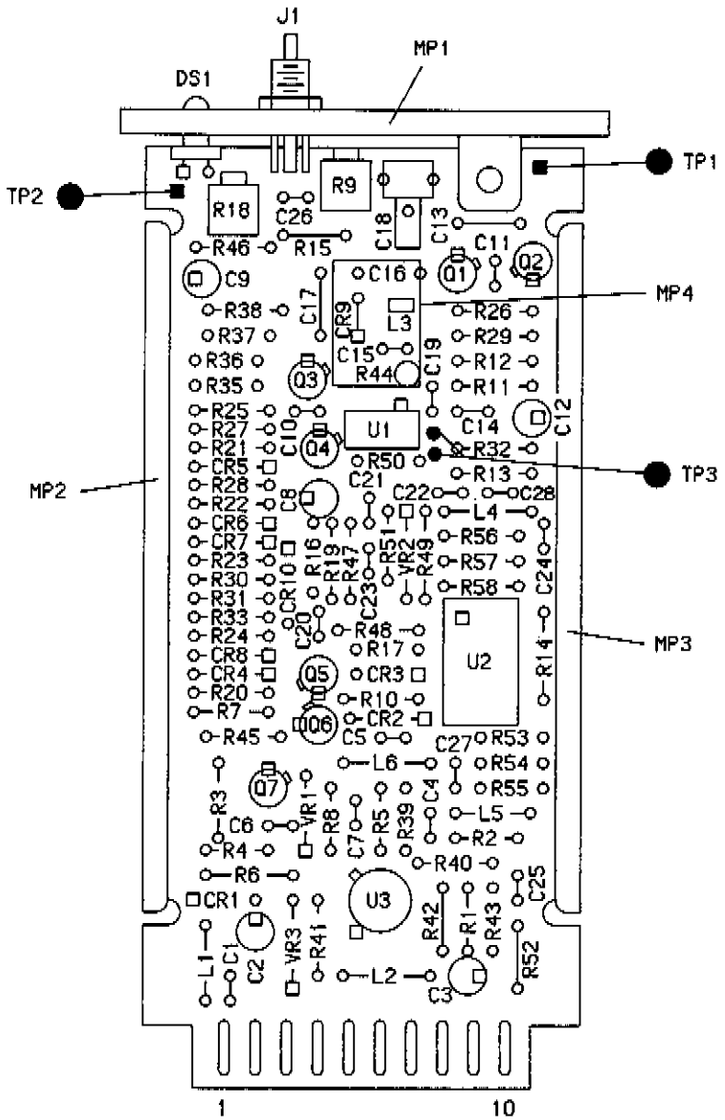
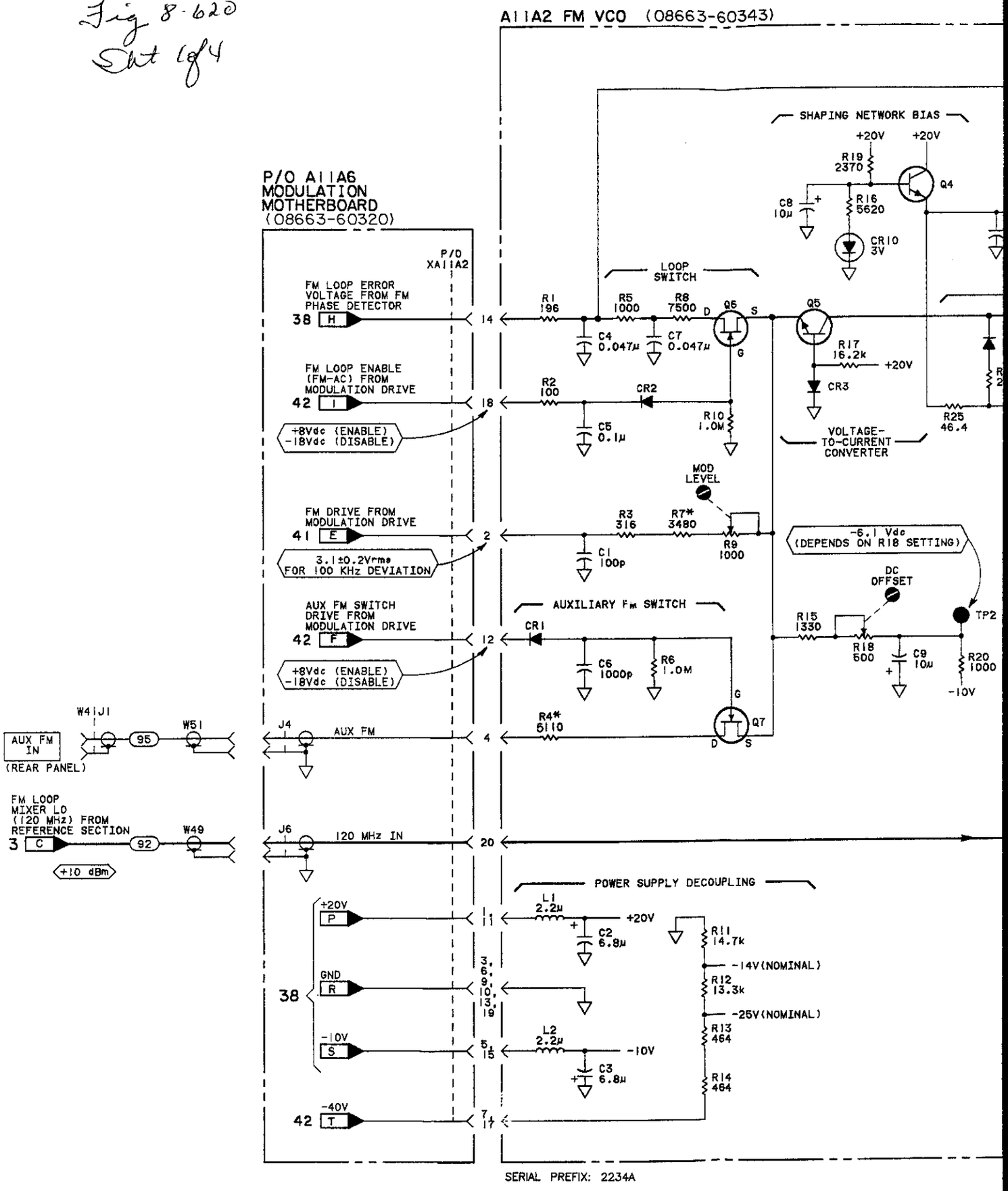


Figure 8-619. A11A2 FM Loop Voltage Controlled Oscillator Component Locator

CHANGES

All Serial Prefixes	**On the A11A2 schematic:** • A11A2R4*, R7* - Change the value of R4* to 5.62k. Change the value of R7* to 5.11k.
All Serial Prefixes	**On the A11A2 Schematic:** • R7* - Change the value of R7* to 4.22k.

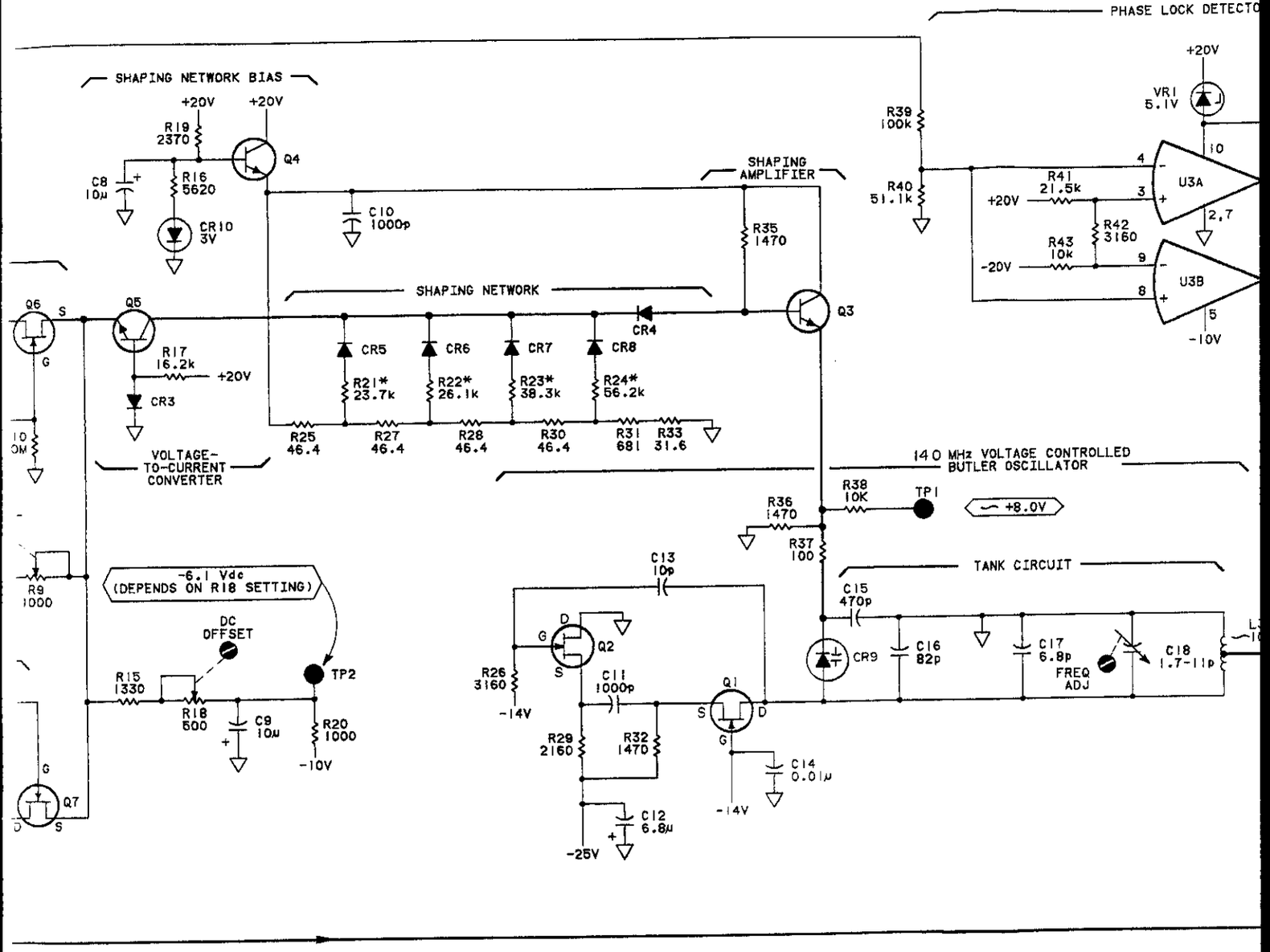
Fig 8-620
Sht 1 of 4



SERIAL PREFIX: 2234A

60343)

Fig 8-620 Sht 2/4



DUPLING

R11
14.7k

— -14V(NOMINAL)

R12
13.3k

— -25V(NOMINAL)

R13
464

R14
464

Fig 8-620 Sht 3 of 4

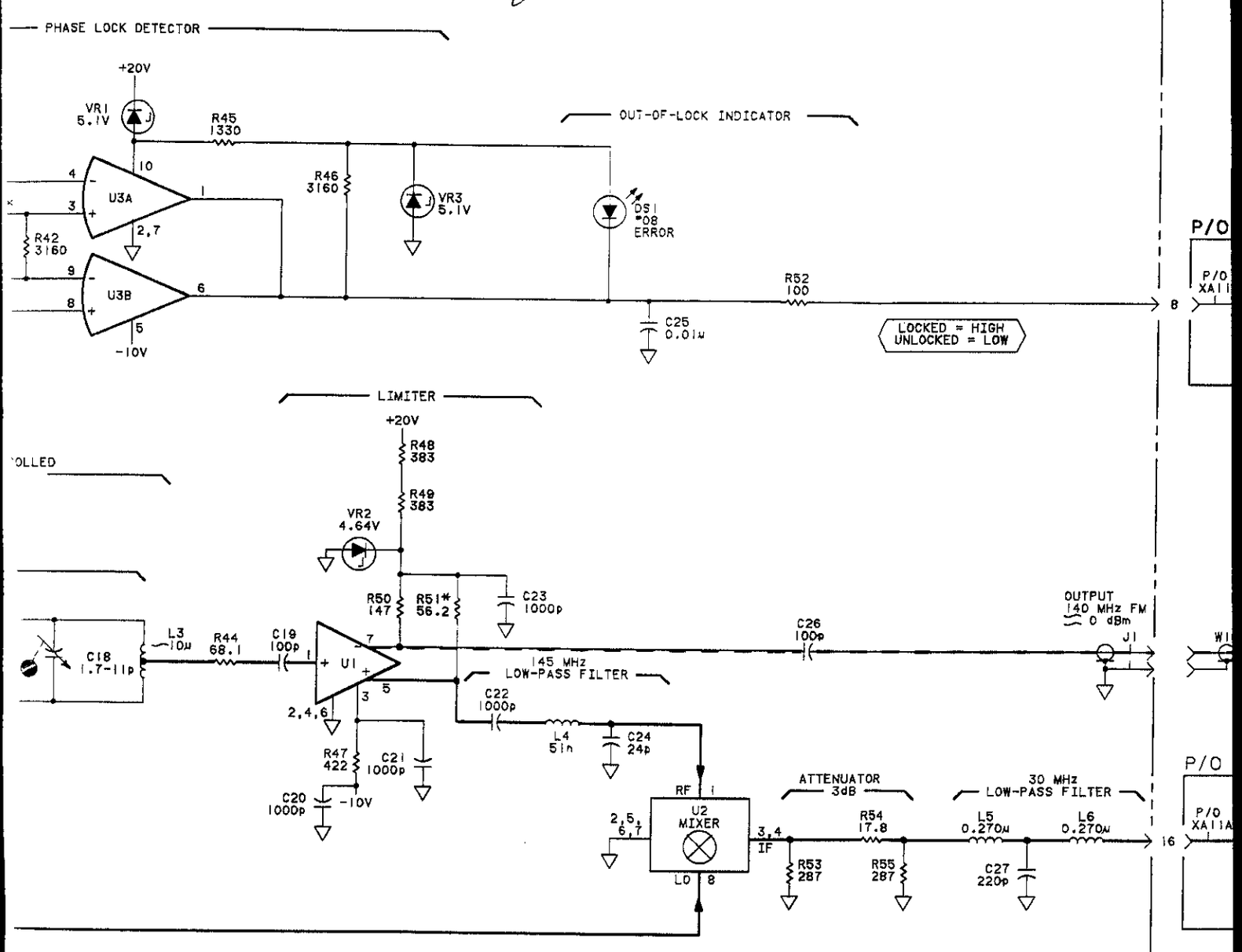
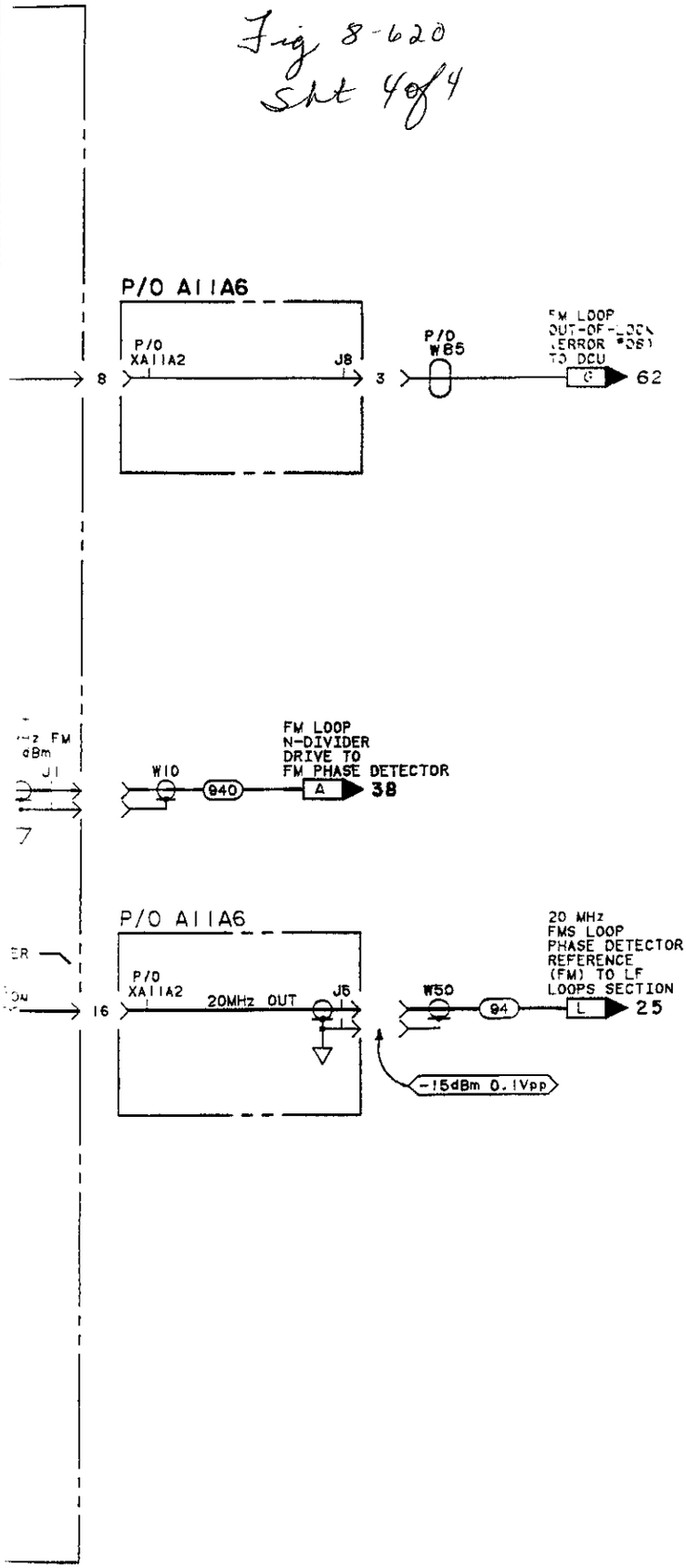


Fig 8-620
Sht 4 of 4

NOTES

1. REFER TO TABLE 8-102 FOR SCHEMATIC DIAGRAM NOTES.
2. TROUBLESHOOTING VALUES ARE TYPICAL. THEY ARE ACTUAL MEASURED VALUES. YOUR MEASUREMENTS MAY BE SLIGHTLY DIFFERENT THAN WHAT IS SHOWN.
3. ASTERISK (*) INDICATES THAT THESE PARTS ARE SELECTED IN TEST. THE VALUES SHOWN ARE TYPICAL ONLY. SEE SECTION V FOR PROCEDURE.



LOGIC LEVELS

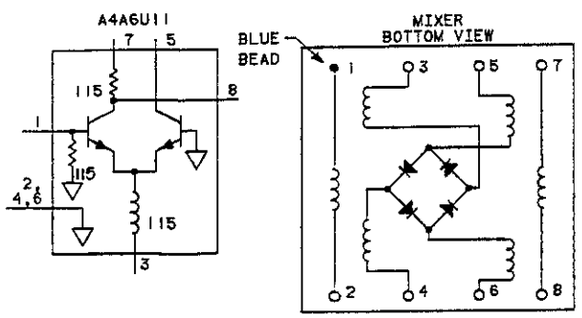
	TTL
HIGH	>+2V
LOW	<+0.8V
< IS MORE NEG.THAN > IS MORE POS.THAN	
OPEN	HIGH
GROUND	LOW

TRANSISTOR AND INTEGRATED CIRCUIT PART NUMBERS

REFERENCE DESIGNATIONS	PART NUMBERS
Q1,2	1855-0235
Q3-5	1854-0404
Q6,7	1855-0020
U1	1826-0372
U3	1826-0191

REFERENCE DESIGNATIONS

NO PREFIX	A11A2
W W41J1	C1-27 CR1-10 DS1 J1 L1-6 Q1-7 R1-33,35-55 TP1,2 U1-3 VR1-3
	A11A6
	J4-6,8 XA11A2 XA11A4



SERVICE SHEET A11A2 43

Figure 8-620. A11A2 FM Loop Voltage Controlled Oscillator Schematic

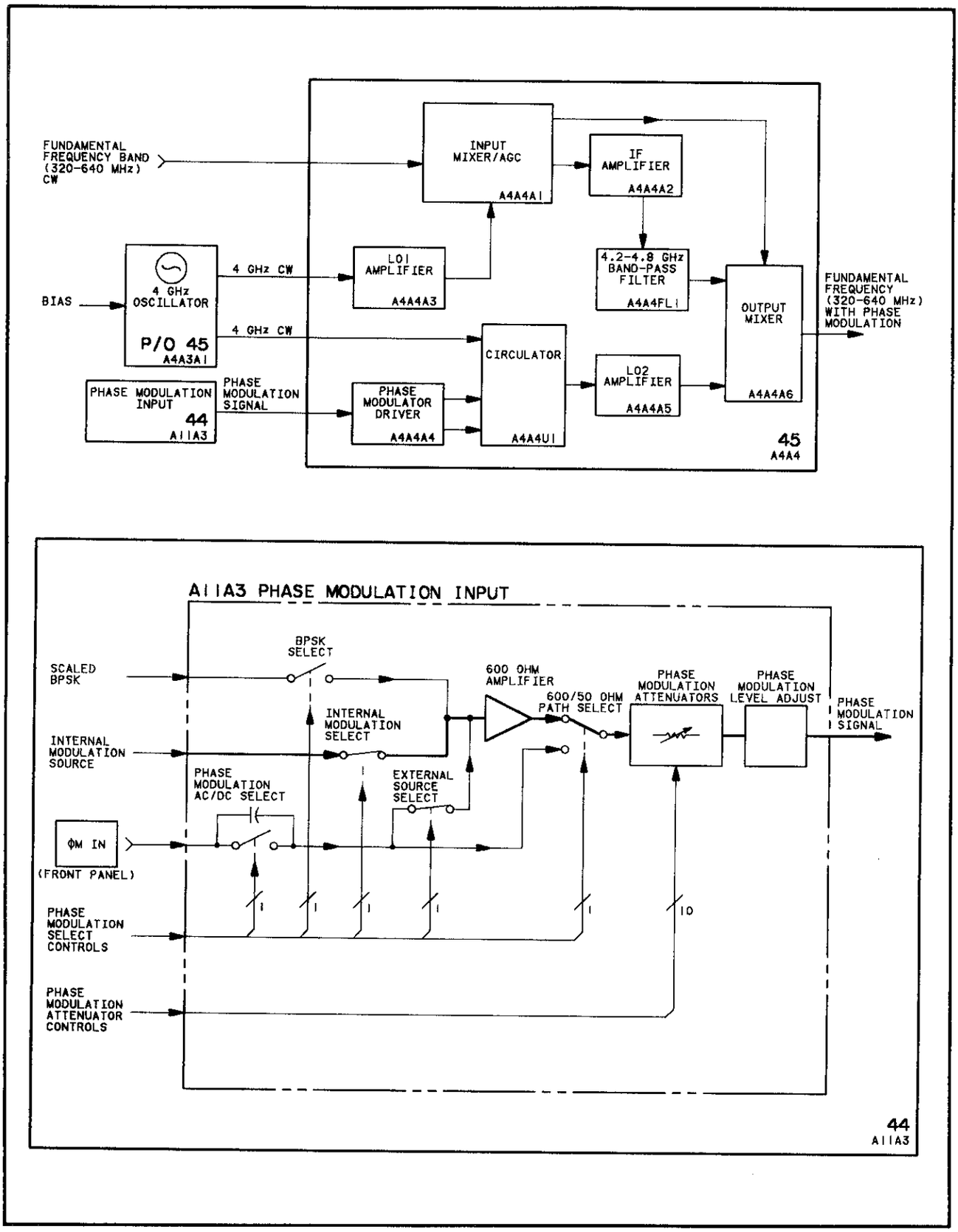


Figure 8-621. A11A3 Phase Modulation Input Block Diagrams

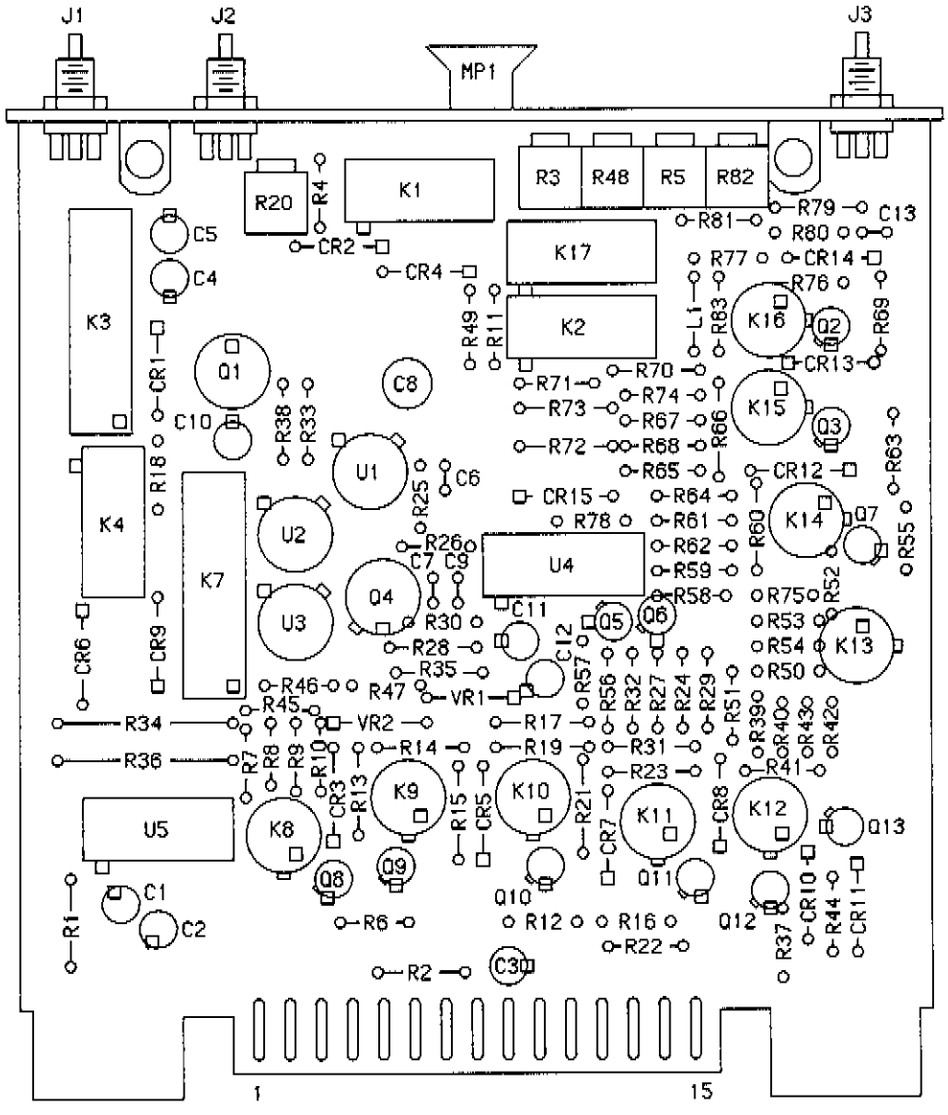


Figure 8-622. A11A3 Phase Modulation Input Component Locator

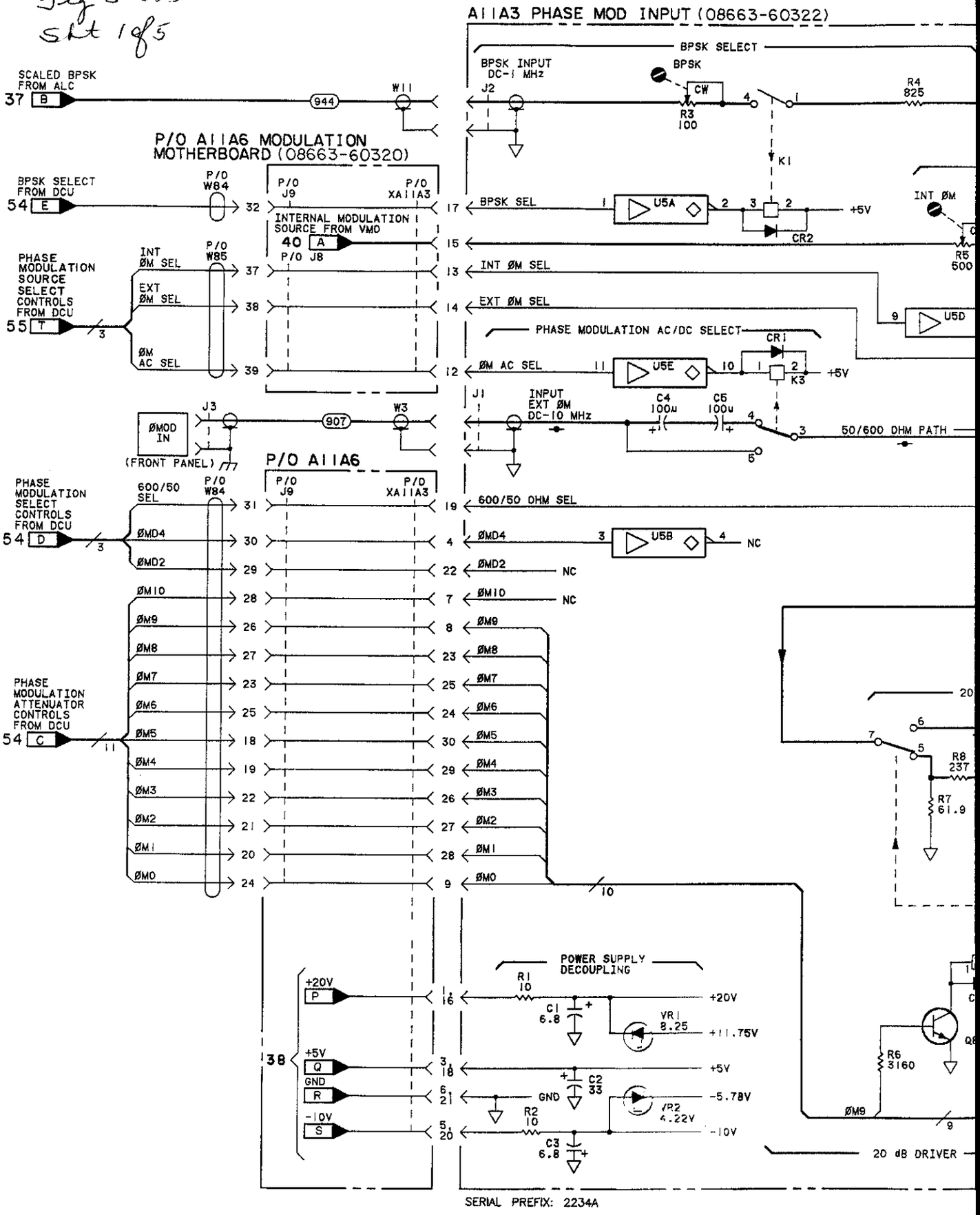
CHANGES

All serial prefixes

On the A11A3 schematic:

- A11A3U3 - On the U3 symbol, reverse the "+" and "-" symbols at the inputs. Pin 3 should be inverting (-) and pin 2 should be non-inverting (+).

Fig 8-623
Sht 1 of 5



SERIAL PREFIX: 2234A

Fig 8-623 Sht 2 of 5

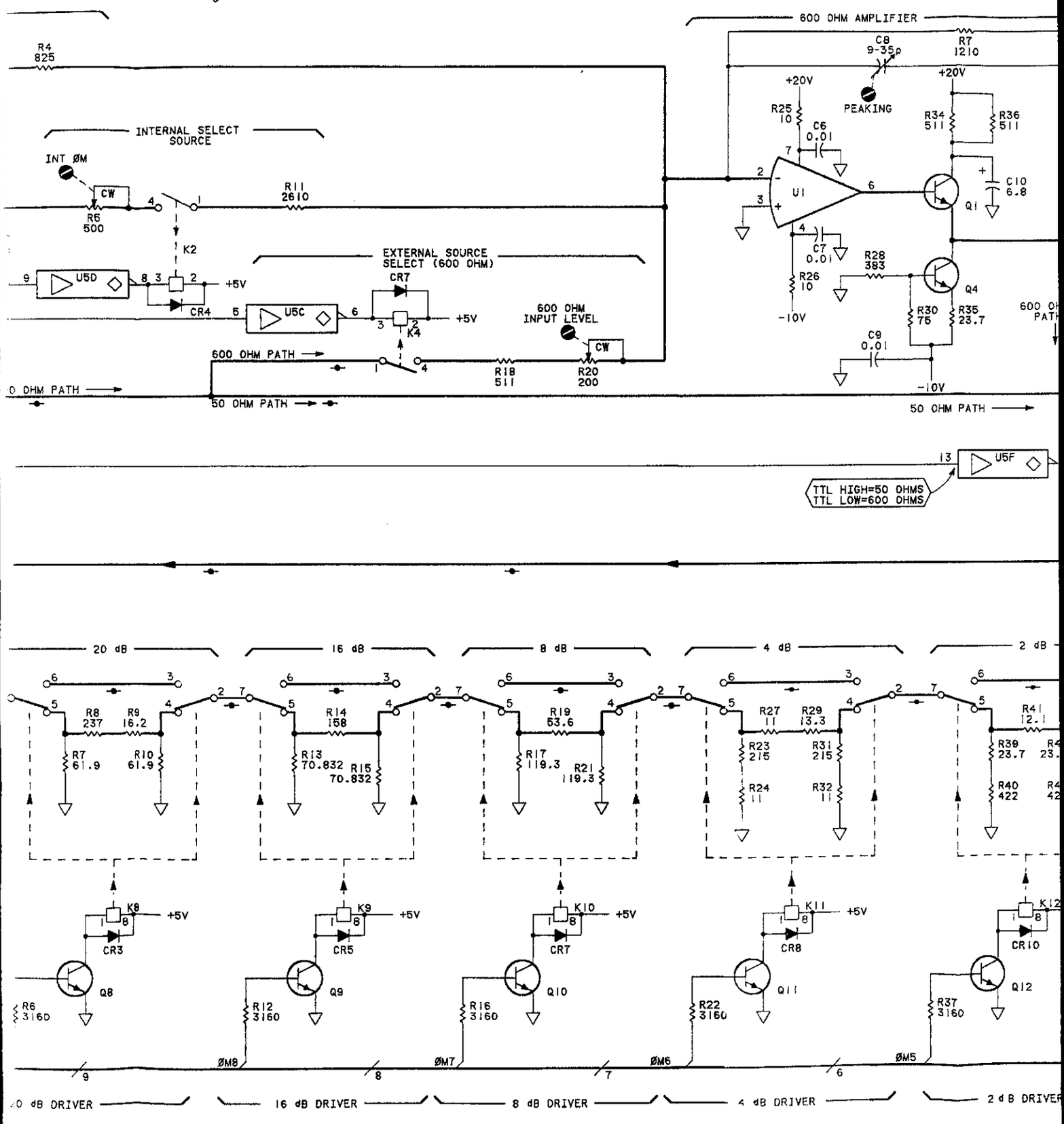
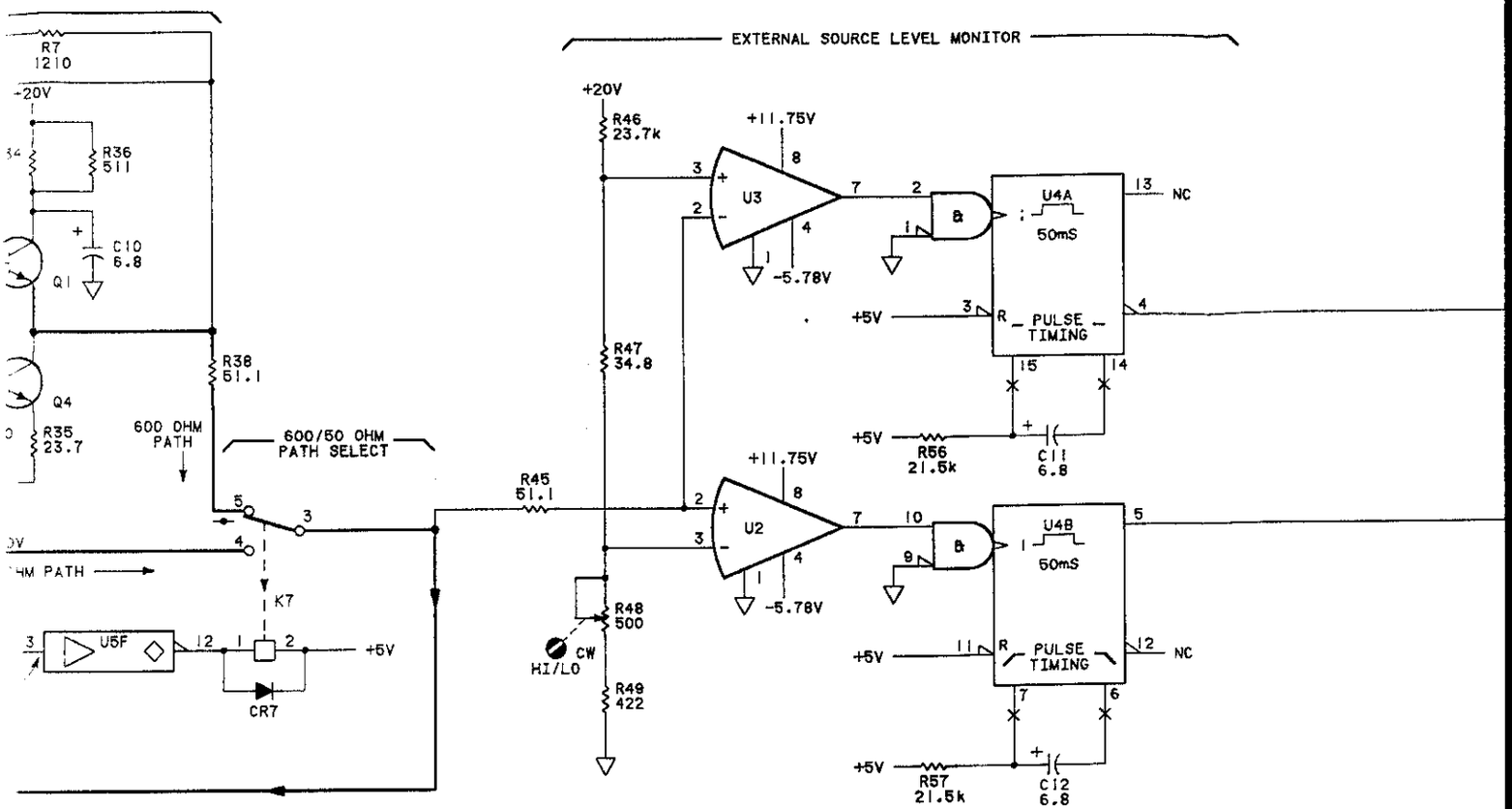
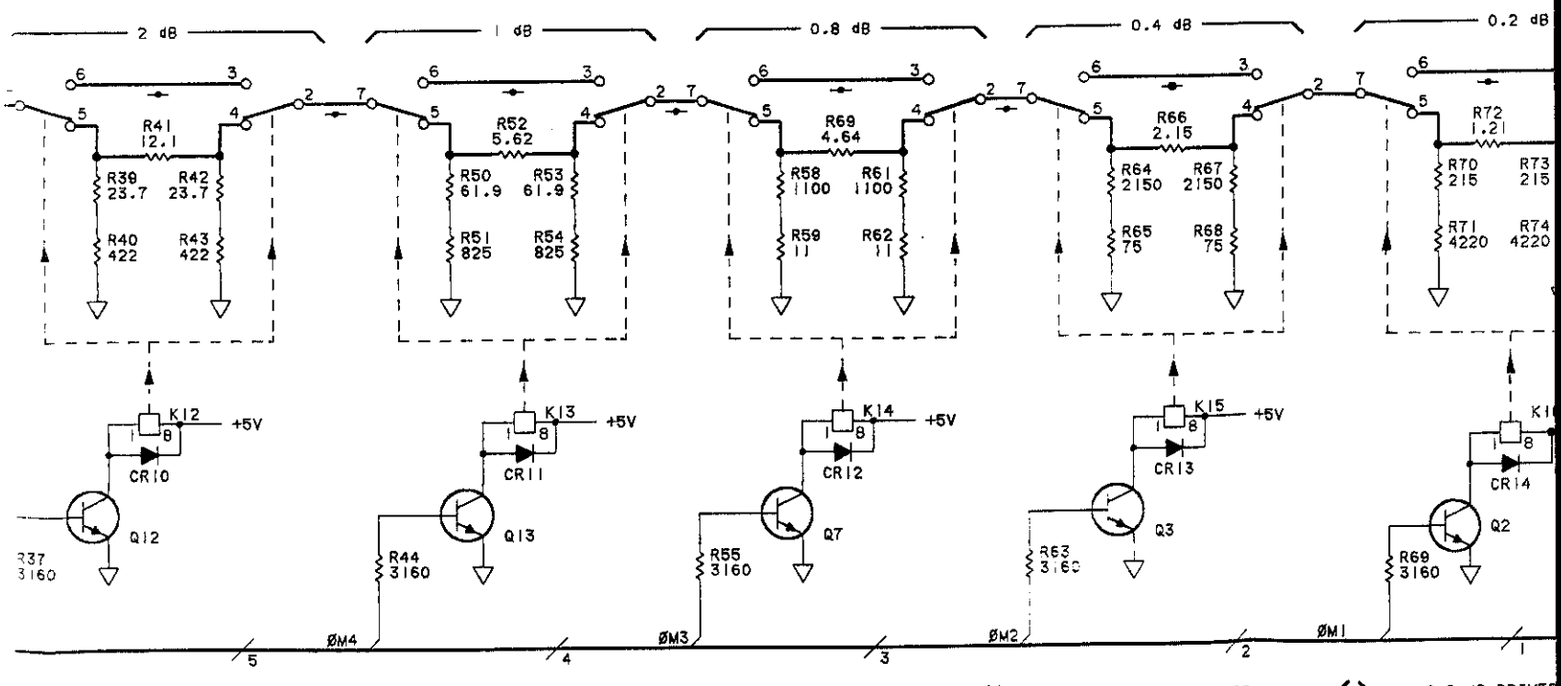


Fig 8-623 Sht 3 of 5

/21880C





/21880C

Fig 8-623
Sht 4 of 5

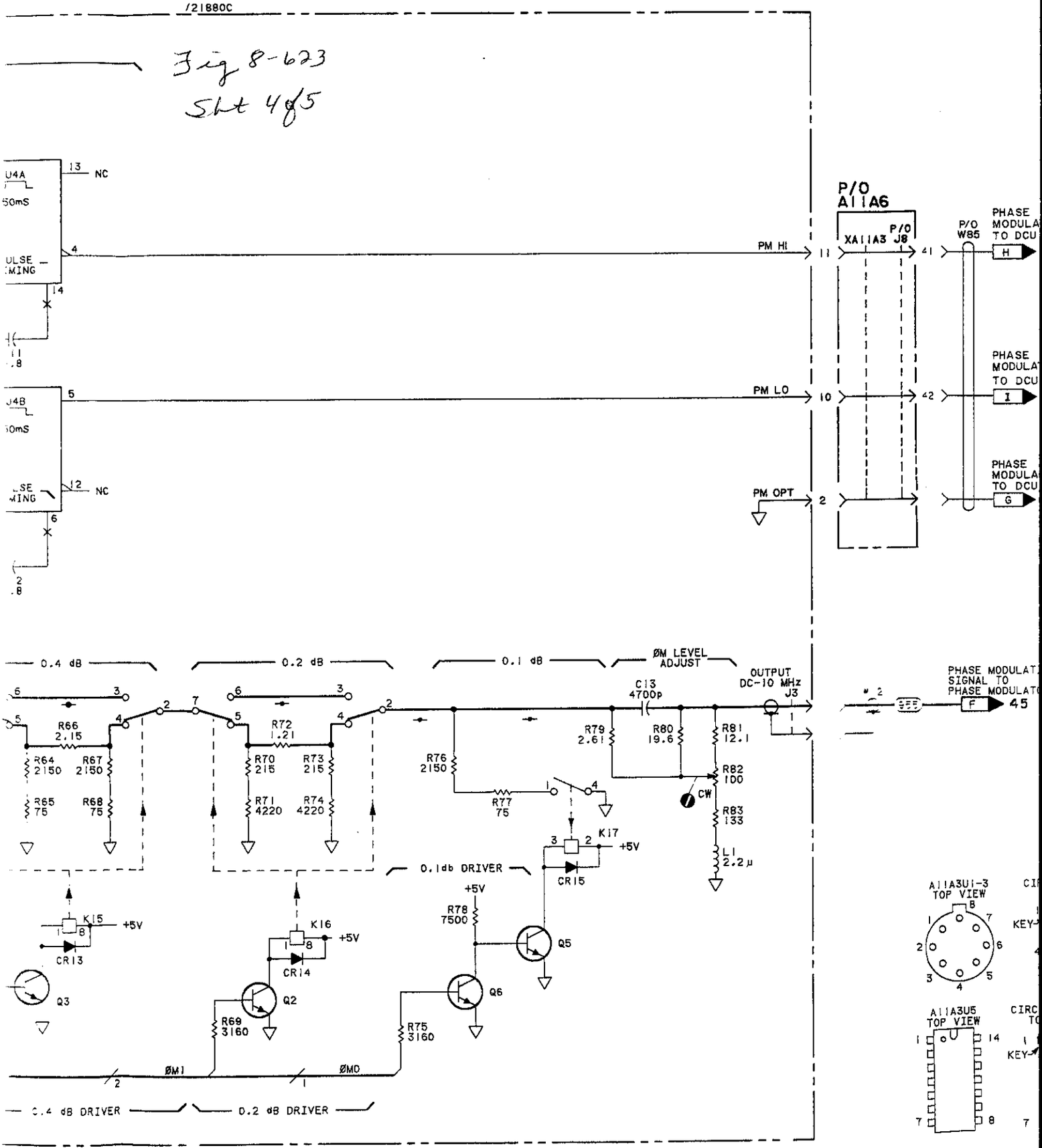


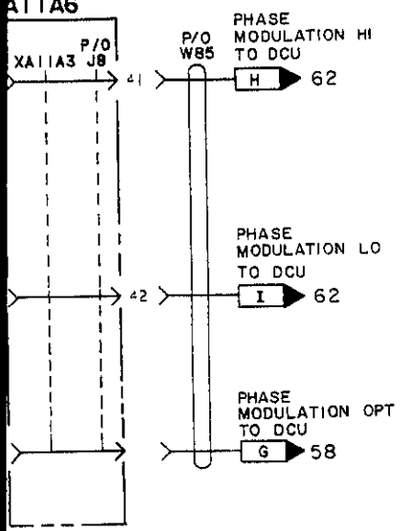
Fig 8-623
sht 5 of 5

NOTES

1. REFER TO TABLE 8-102 FOR SCHEMATIC DIAGRAM NOTES.
2. TROUBLESHOOTING VALUES ARE TYPICAL. THEY ARE ACTUAL MEASURED VALUES. YOUR MEASUREMENTS MAY BE SLIGHTLY DIFFERENT THAN WHAT IS SHOWN.

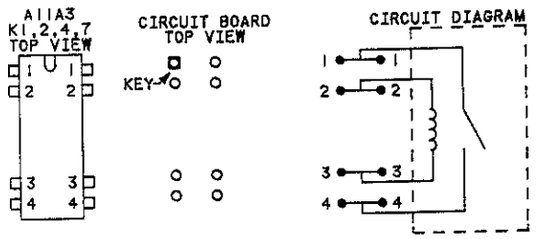
LOGIC LEVELS

	TTL
HIGH	>+2V
LOW	<+0.8V
< IS MORE NEG. THAN > IS MORE POS. THAN	
OPEN	HIGH
GROUND	LOW



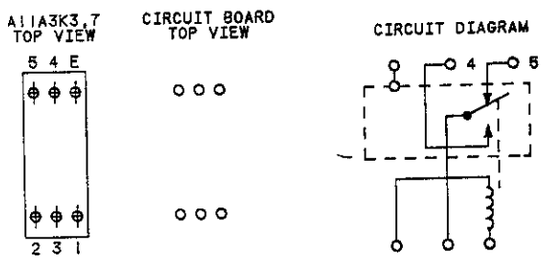
REFERENCE DESIGNATIONS

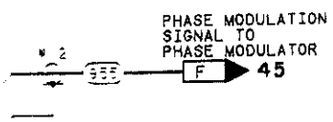
NO PREFIX	A11A6
W3,11,12, 84,85	J8,9 XA11A6
A11A3	
C1-13 CR1-15 J1-3 K1-4,7-17 L1 Q1-13 R1-83 U1-5 VR1,2	



TRANSISTOR AND INTEGRATED CIRCUIT PART NUMBERS

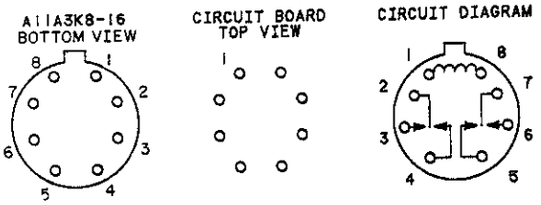
REFERENCE DESIGNATIONS	PART NUMBERS
Q1,4	1854-0721
Q2,3,5-13	1854-0477
U1	1826-0488
U2,3	1820-0321
U4	1820-1423
U5	1820-1200

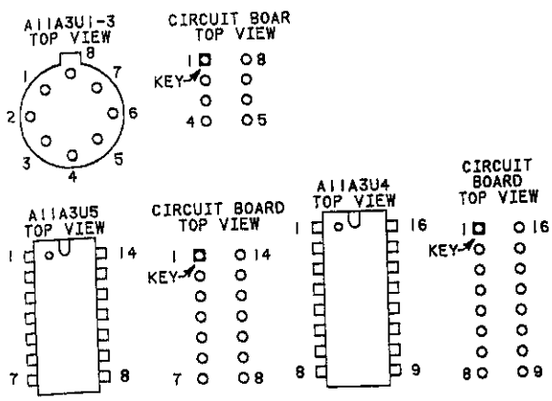




INTEGRATED CIRCUIT VOLTAGE AND GROUND CONNECTIONS

REFERENCE DESIGNATIONS	PIN NUMBERS
U4	+5V - 16 ▽ - 8
U5	+5V - 14 ▽ - 8





SERVICE SHEET A11A3 44

Figure 8-623. A11A3 Phase Modulation Input Schematic

Fig 8-624 Sht 1 of 1

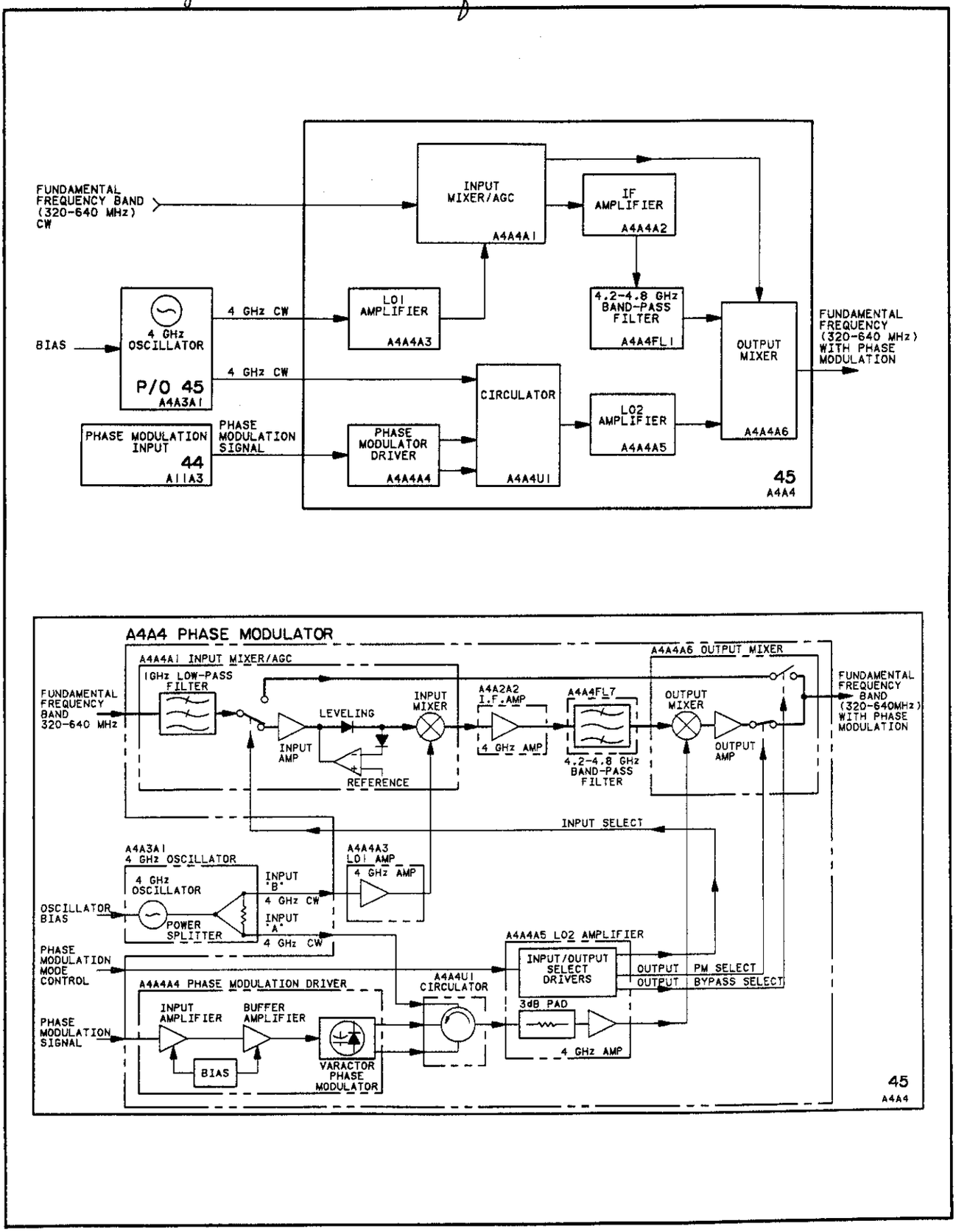
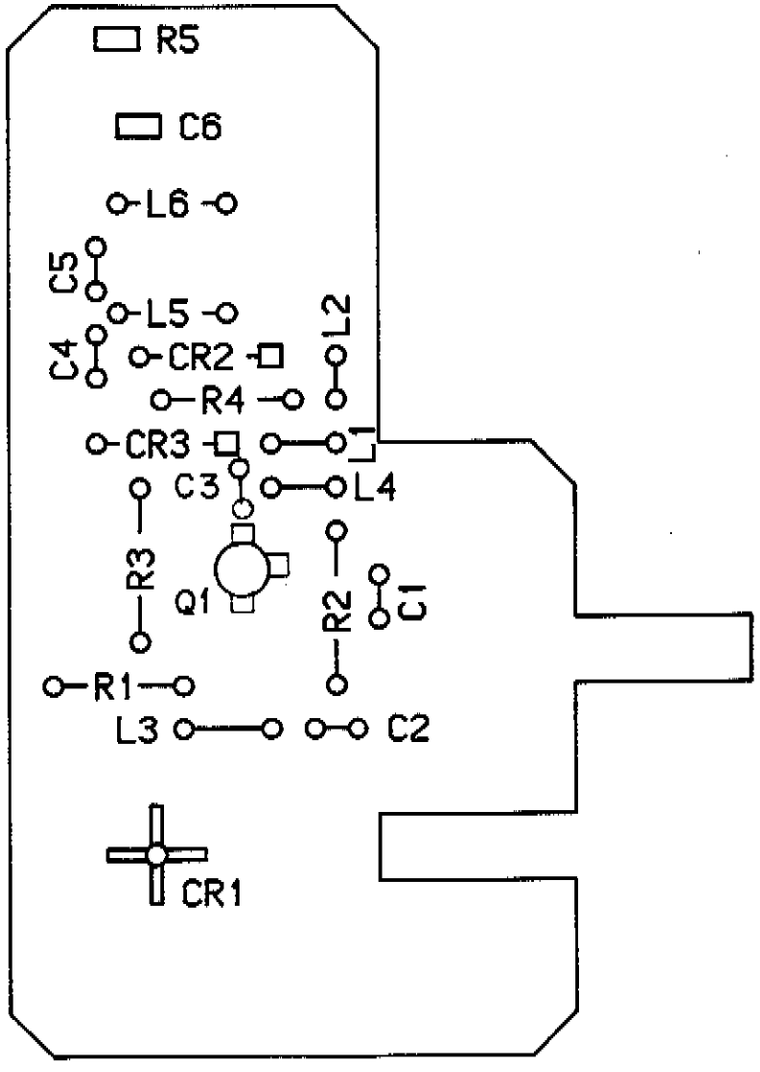


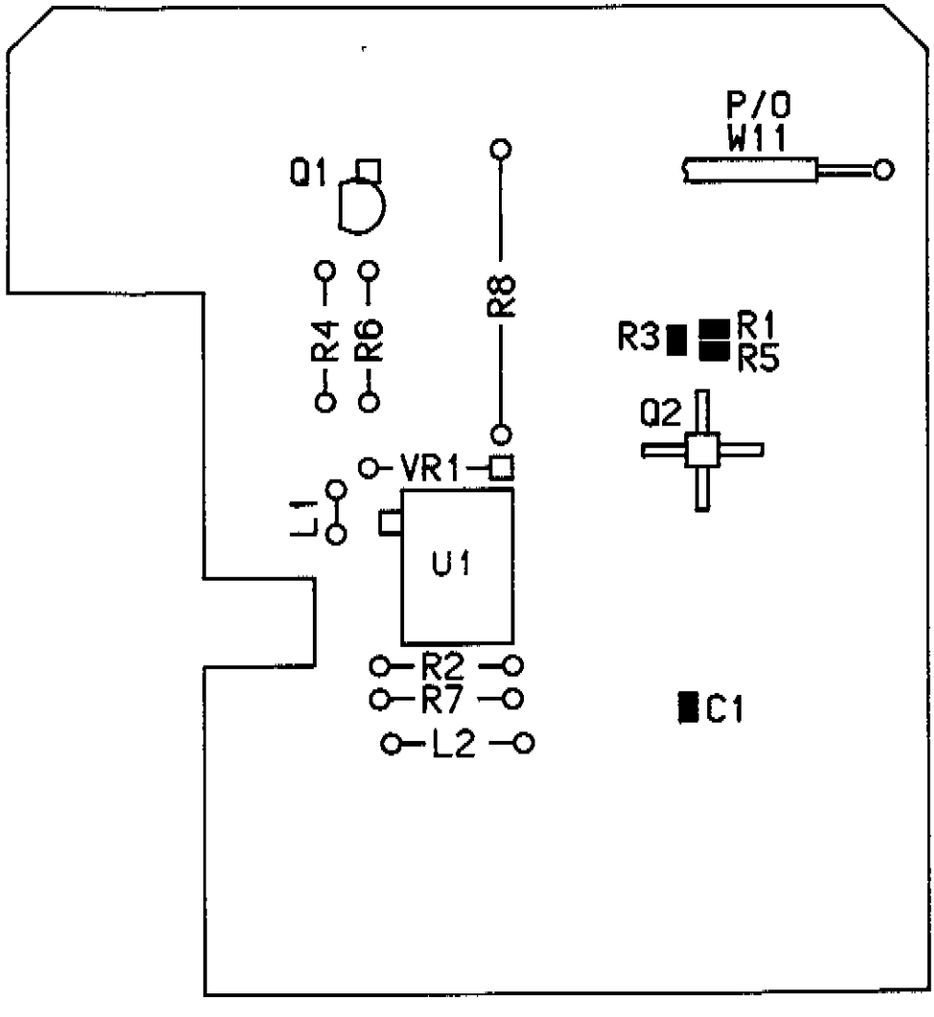
Figure 8-624. A4A4 Phase Modulator Block Diagrams

Fig 8-625 Sht 1 of 3



A4A4A6

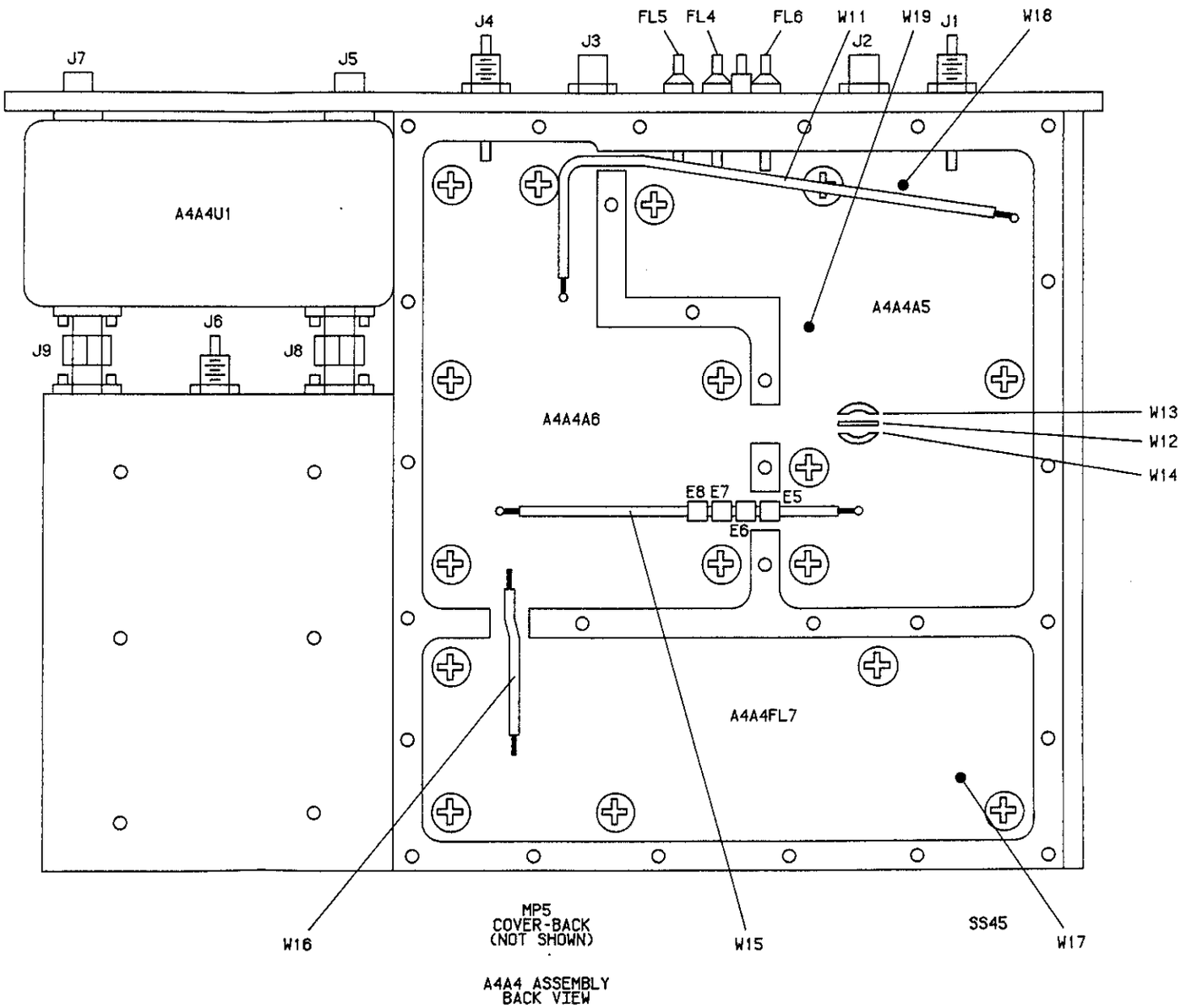
Fig 8-625 Sht 2 of 3



A4A4A5

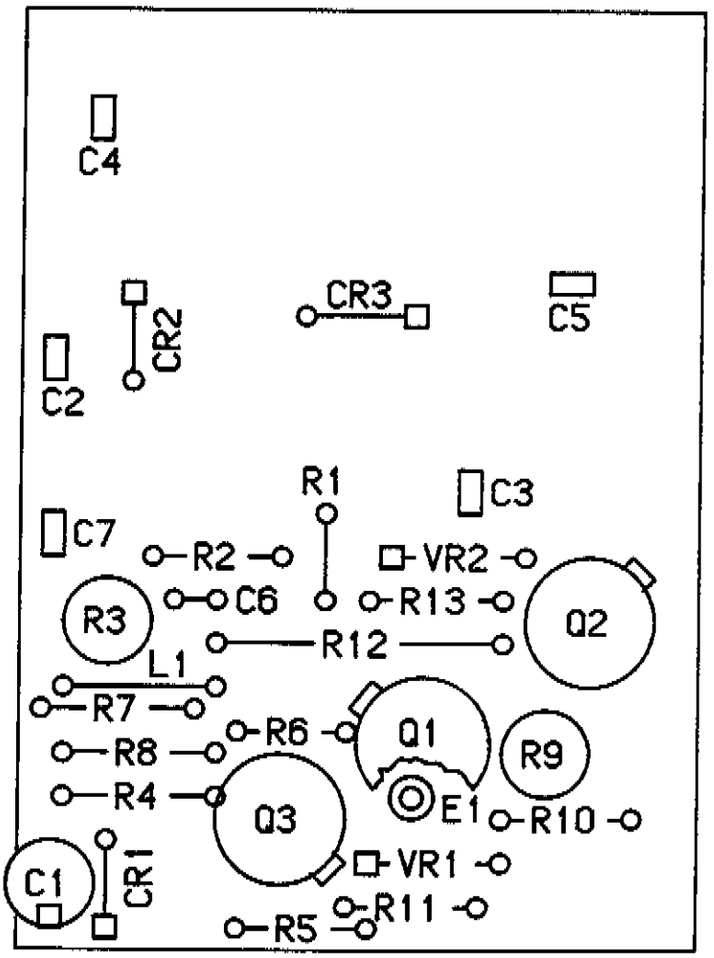
Figure 8-625. A4A4 Phase Modulator Component Locator (1 of 2)

Fig 8-625 Sht 3 of 3



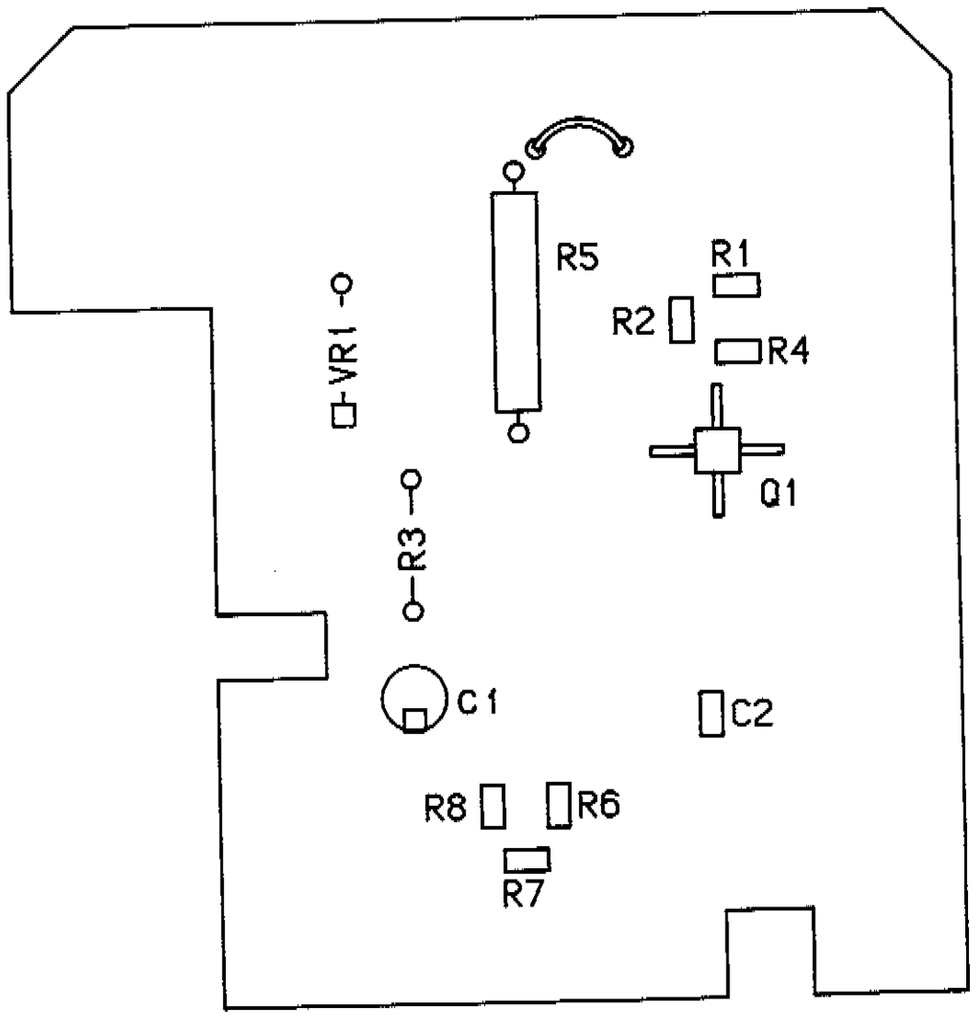
A4A4 ASSEMBLY
BACK VIEW

Fig 8-625a
Sht 1 of 5



A4A4A4

Fig 8-625a
Sht 2 of 5



A4A4A3

Fig 8-625a
Sht 3 of 5

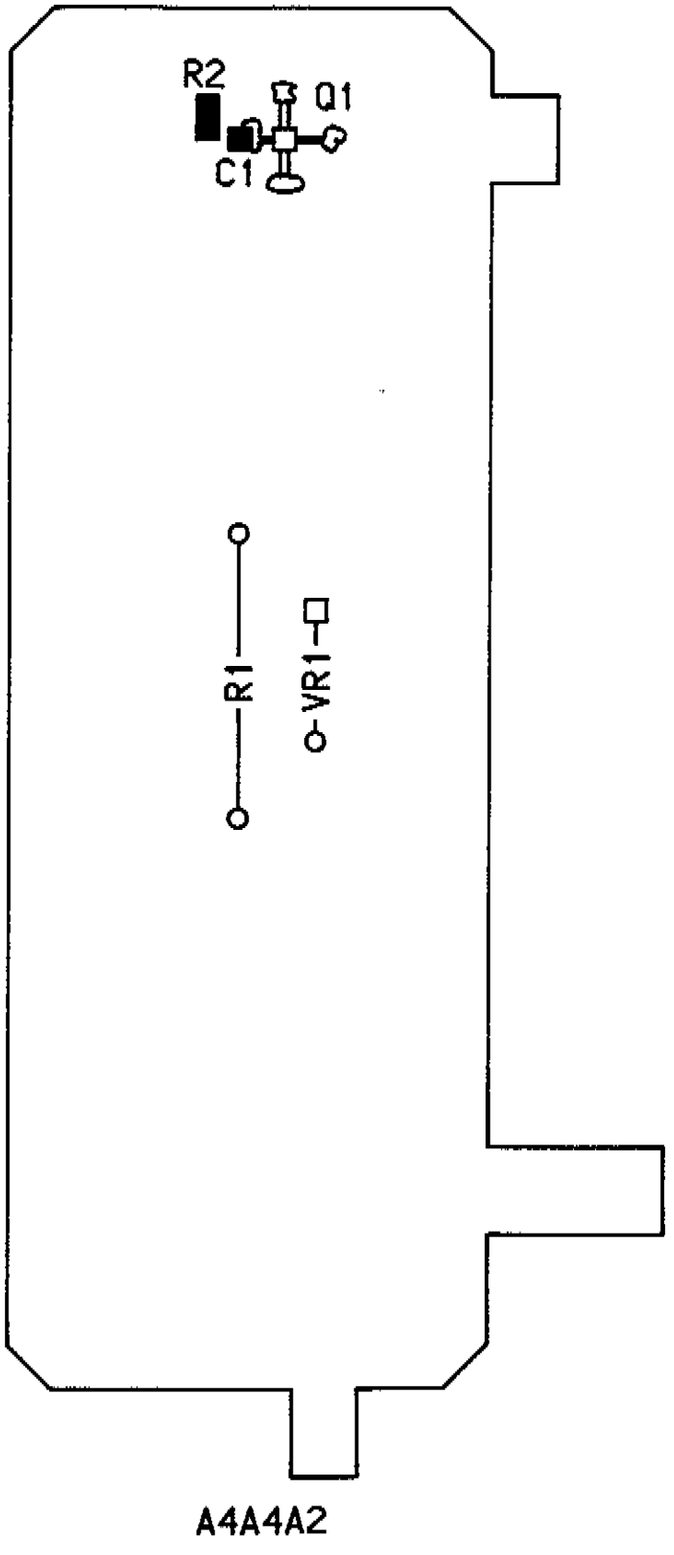
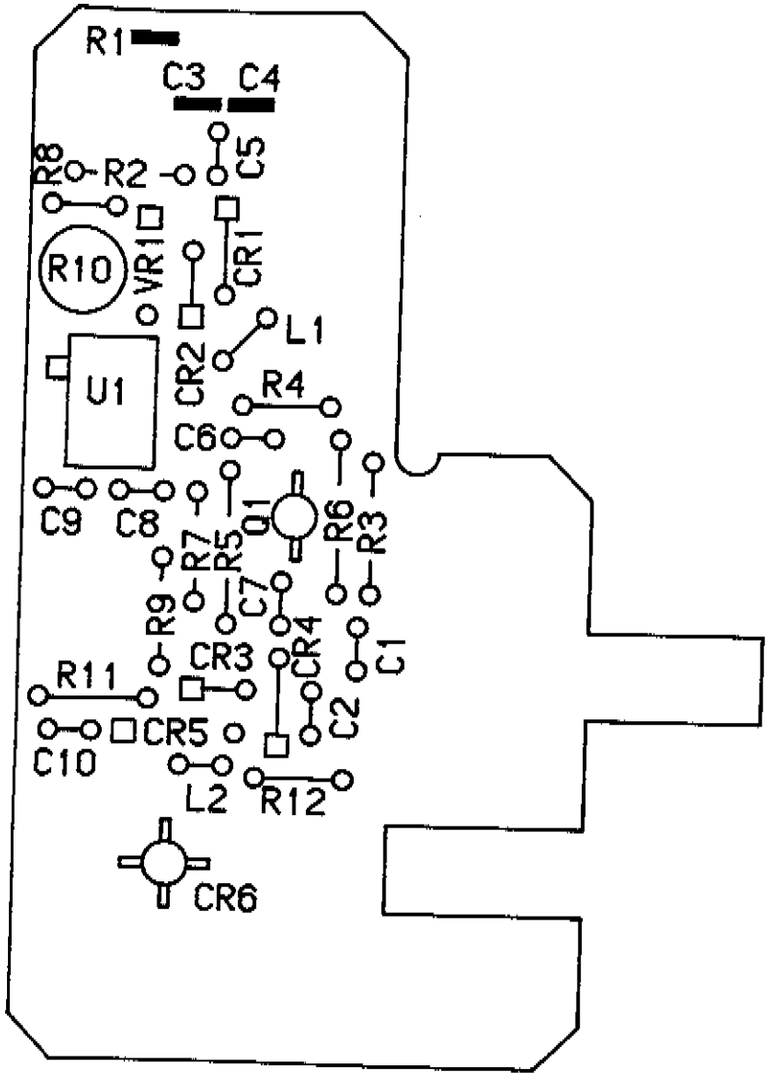


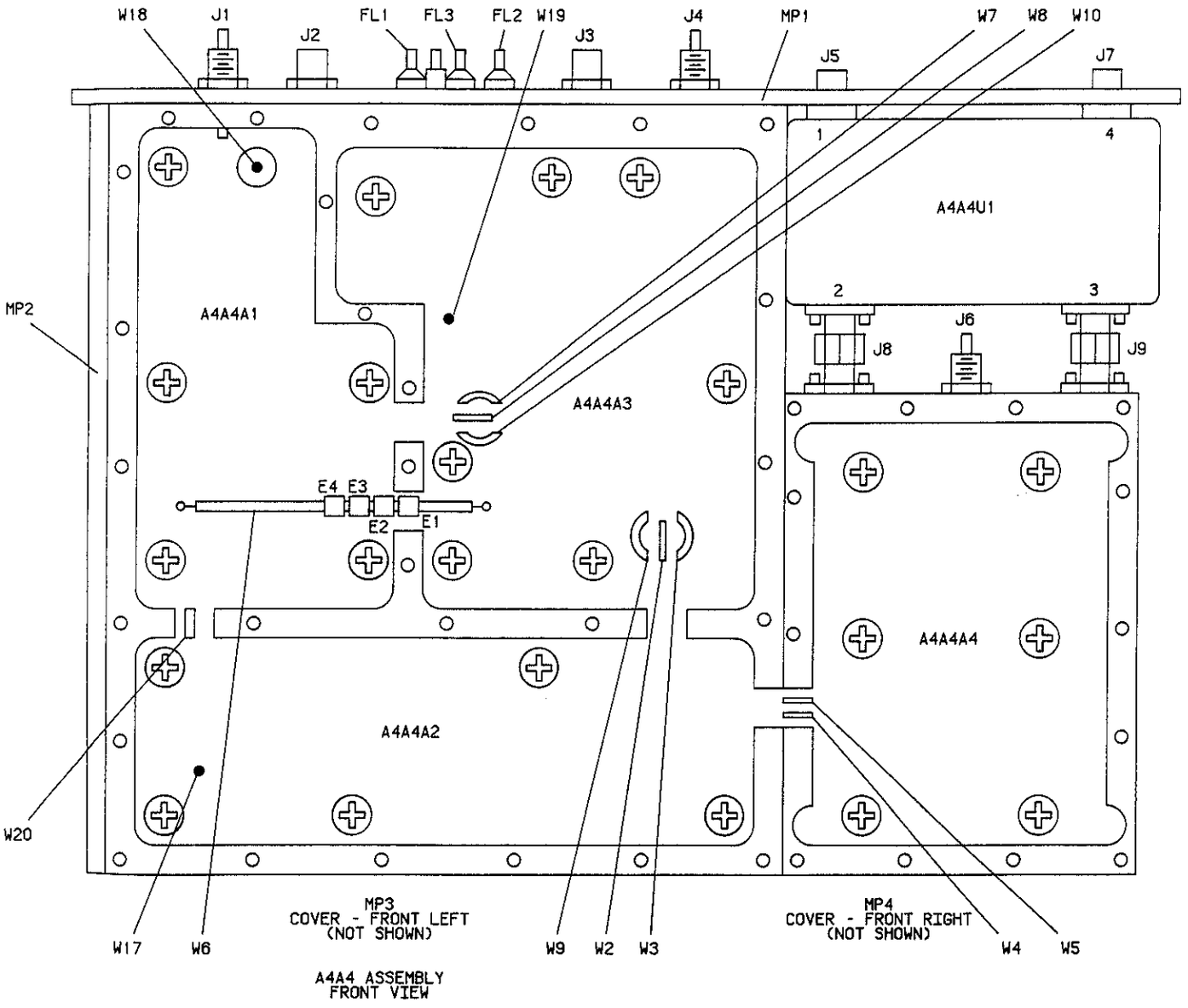
Figure 8-625. A4A4 Phase Modulator Component Locator (2

Fig 8-625a
Sht 4 of 5



A4A4A1

Fig 8-625a
Sht 5 of 5



CHANGES

All serial prefixes

On the schematic:

- W1 (W19), - In the upper left portion of the schematic, change the **W1** to **W19**.

  W2 - Label the -10V line connecting A4A4A3 and P/O A4A4A2 **W2**.

  W3 - Label the +20V line connecting A4A4A3 and P/O A4A4A2 **W3**.

  W4 - Label the -10V line connecting P/O A4A4A2 and A4A4A4 **W4**.

  W5 - Label the +20V line connecting P/O A4A4A2 and A4A4A4 **W5**.

  W6 - Label the coaxial cable connecting A4A4A3 and A4A4A1 (associated with E1-4) **W6**.

  W7 - Label the **INPUT BYPASS SEL** line connecting A4A4A3 and A4A4A1 **W7**.

  W8 - Label the +20V line connecting A4A4A3 and A4A4A1 **W8**.

  W9 - Label the +5V line connecting A4A4A3 and P/O A4A4A2 **W9**.

  W10 - Label the -10V line connecting A4A4A3 and A4A4A1 **W10**.

  W12 - Label the **OUTPUT BYPASS SEL 1** line connecting A4A4A5 and A4A4A6 **W12**.

  W13 - Label the **OUTPUT BYPASS SEL 2** line connecting A4A4A5 and A4A4A6 **W13**.

  W14 - Label +20V line connecting A4A4A5 and A4A4A6 **W14**.

  W15 - Label the coaxial cable connecting A4A4A5 and A5A5A6 (associated with E5-8) **W15**.

  W16 - Label the coaxial cable connecting A4A4FL7 and A4A4A6 **W16**.

  W17 - Label the line connecting A4A4A2 and A4A4FL7 **W17**.

  W20 - Label the line connecting A4A4A1Z2 to A4A4A2Z1 **W20**.

CHANGES

2323A and Above

A4A4A4 component locator:

- A4A4A4 - Use the new component locator "P/O Figure 8-625. A4A4 Phase Modulator Component Locator (2 of 2) (2323A)" on page 8-638.3.

On the A4A4A4 schematic:

- A4A4A4R10, R11 - Add an asterisk (*) to R10 and R11 to indicate a factory selected component.

2535A and Above

A4A4A2, A4A4A3, and A4A4A5 component locators:

- A4A4A2, A4A4A3, A4A4A5 - Use the component locators "A4A4A2, A4A4A3, and A4A4A5 Component Location Diagrams (2535A)" on page 8-638.4.

A4A4A2 schematic:

- A4A4A2 - Use the A4A4A2 schematic "P/O Figure 8-626. A4A4A2 Schematic (2535A)" on page 8-638.5.

A4A4A3 schematic:

- A4A4A3 - Use the A4A4A3 schematic "P/O Figure 8-626. A4A4A3 Schematic (2535A)" on page 8-638.5.

A4A4A5 schematic:

- A4A4A5 - Use the A4A4A5 schematic "P/O Figure 8-626. A4A4A5 Schematic (2535A)" on page 8-638.6.

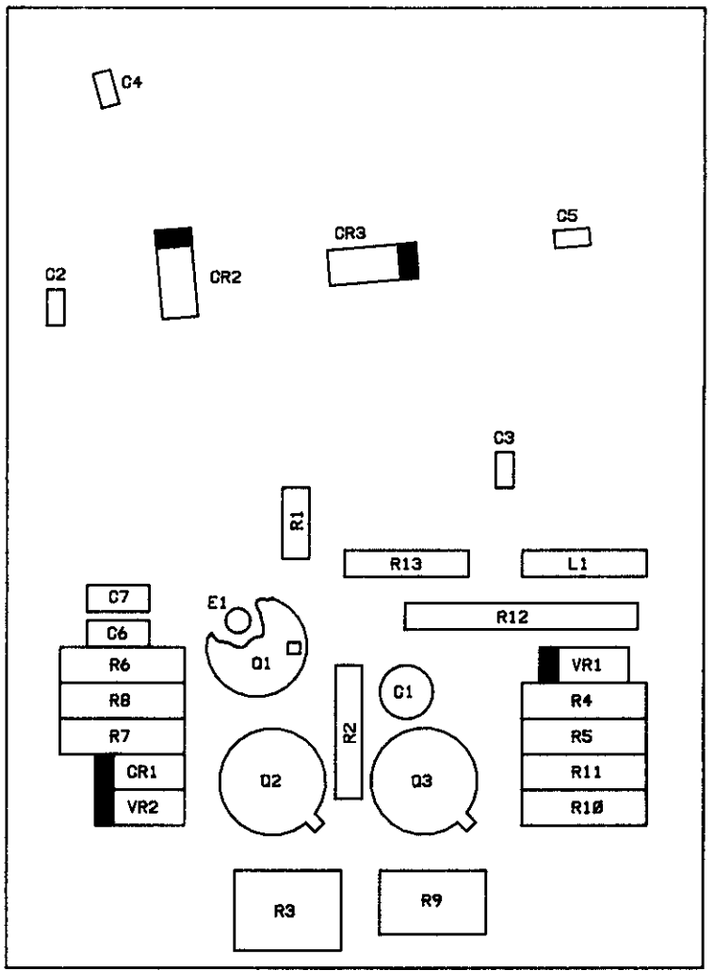
2545A and Above

On the A4A4A6 component locator:

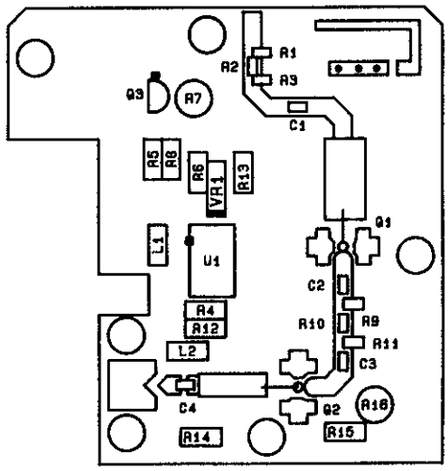
- A4A4A6C7 (R5) - Change R5 to C7.

On the A4A4A6 schematic:

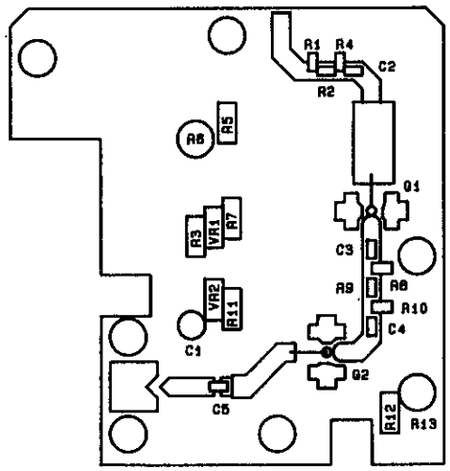
- A4A4A6C6 - Change the value of C6 to 4.7p.
- A4A4C7 (R5) - Replace R5 with a capacitor, C7 (4.7p)



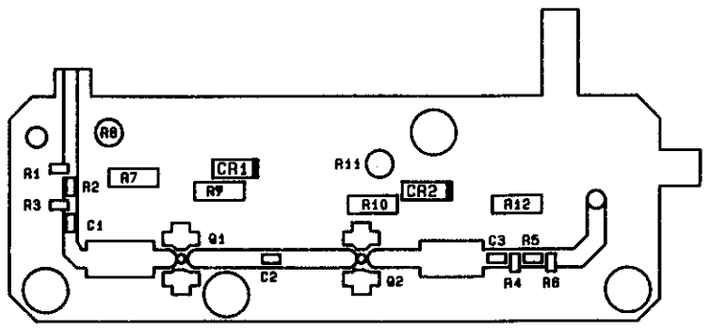
P/O Figure 8-625. *A4A4 Phase Modulator Component Locator (2 of 2) (2323A)*



60366

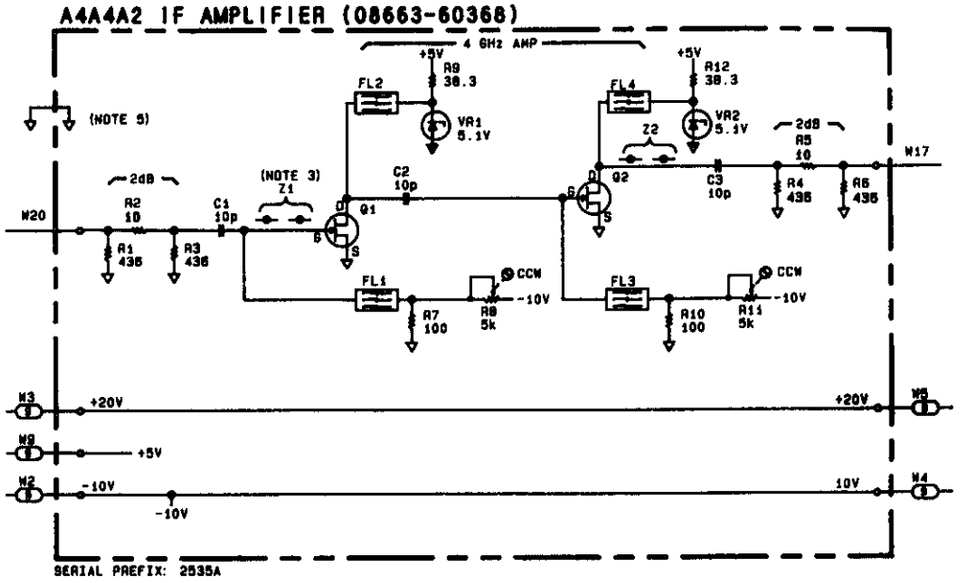


60367

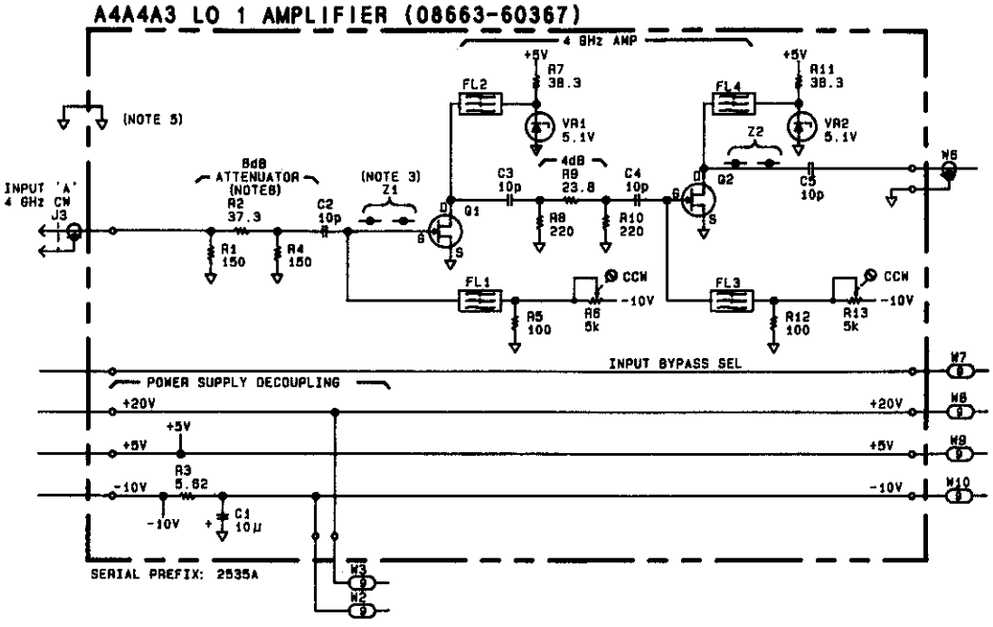


60368

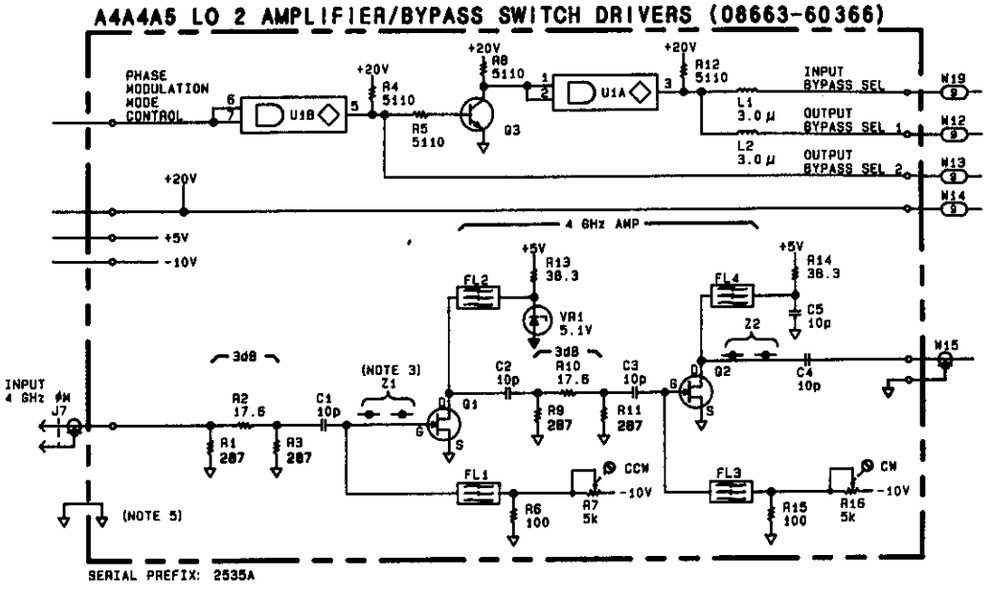
A4A4A2, A4A4A3, and A4A4A5 Component Location Diagrams (2535A)



P/O Figure 8-626. A4A4A2 Schematic (2535A)



P/O Figure 8-626. A4A4A3 Schematic (2535A)



P/O Figure 8–626. *A4A4A5 Schematic (2535A)*

Fig 8-626
Sht 1 of 5

CAUTION

IELD EFFECT TRANSISTORS A4A4A2Q1, A4A4A3Q1 AND A4A4A5Q2 ARE HIGHLY SUSCEPTIBLE TO DAMAGE OR DESTRUCTION FROM STATIC DISCHARGES. OBSERVE APPROPRIATE PRECAUTIONS BEFORE CONTACTING THESE PARTS.

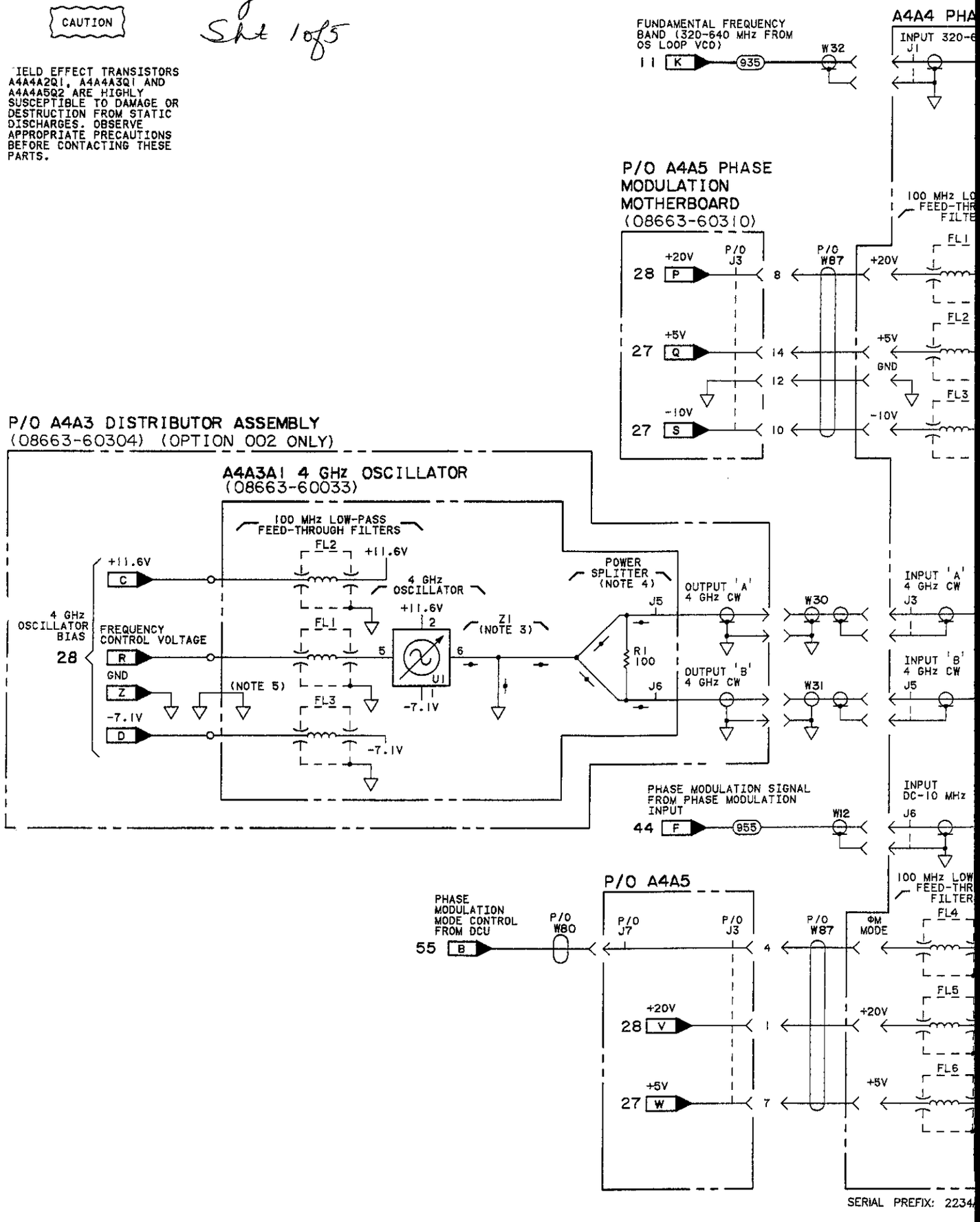


Fig 8-62b Sht 2 of 5

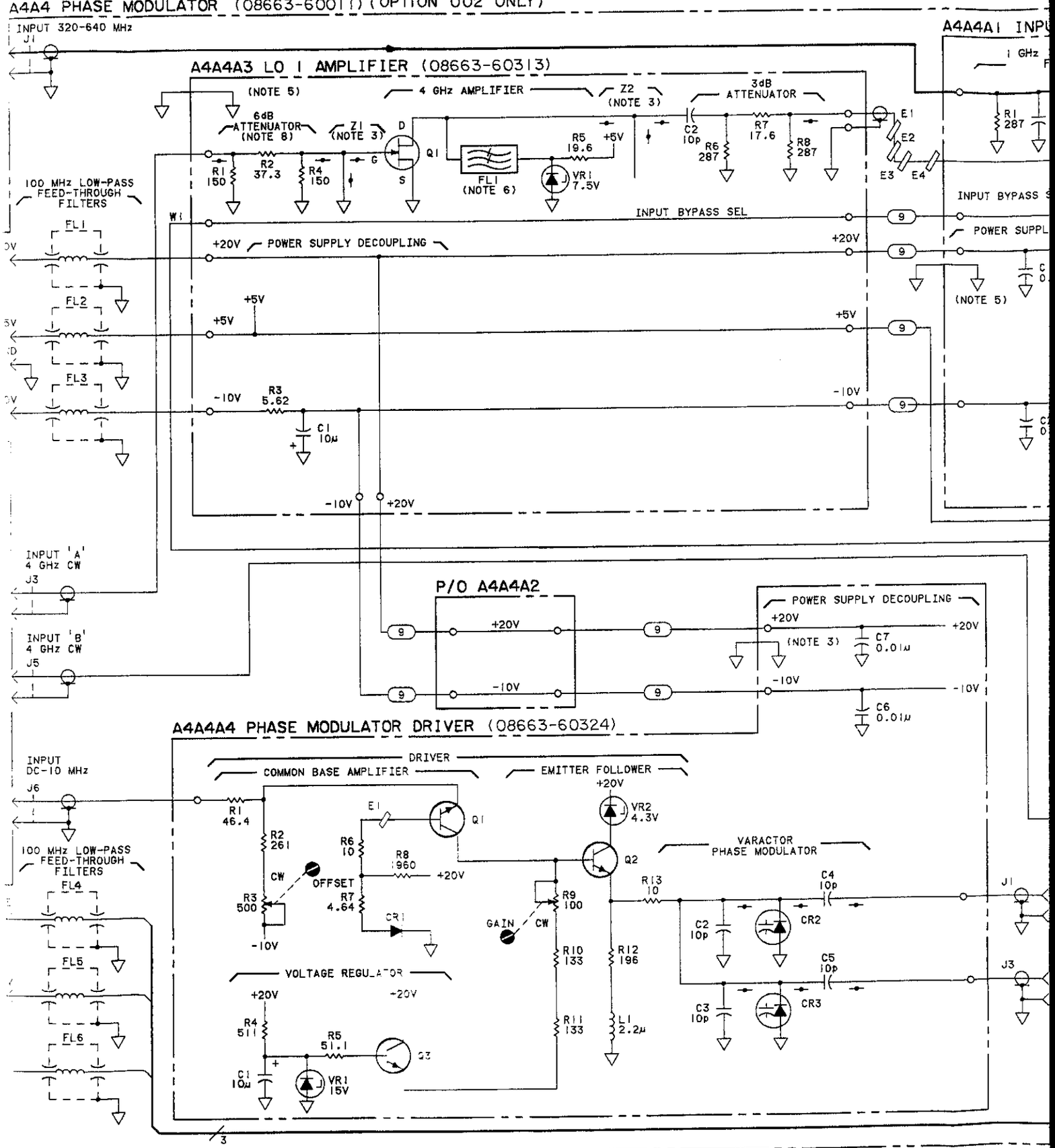


Fig 8-626 Sht 3 of 3

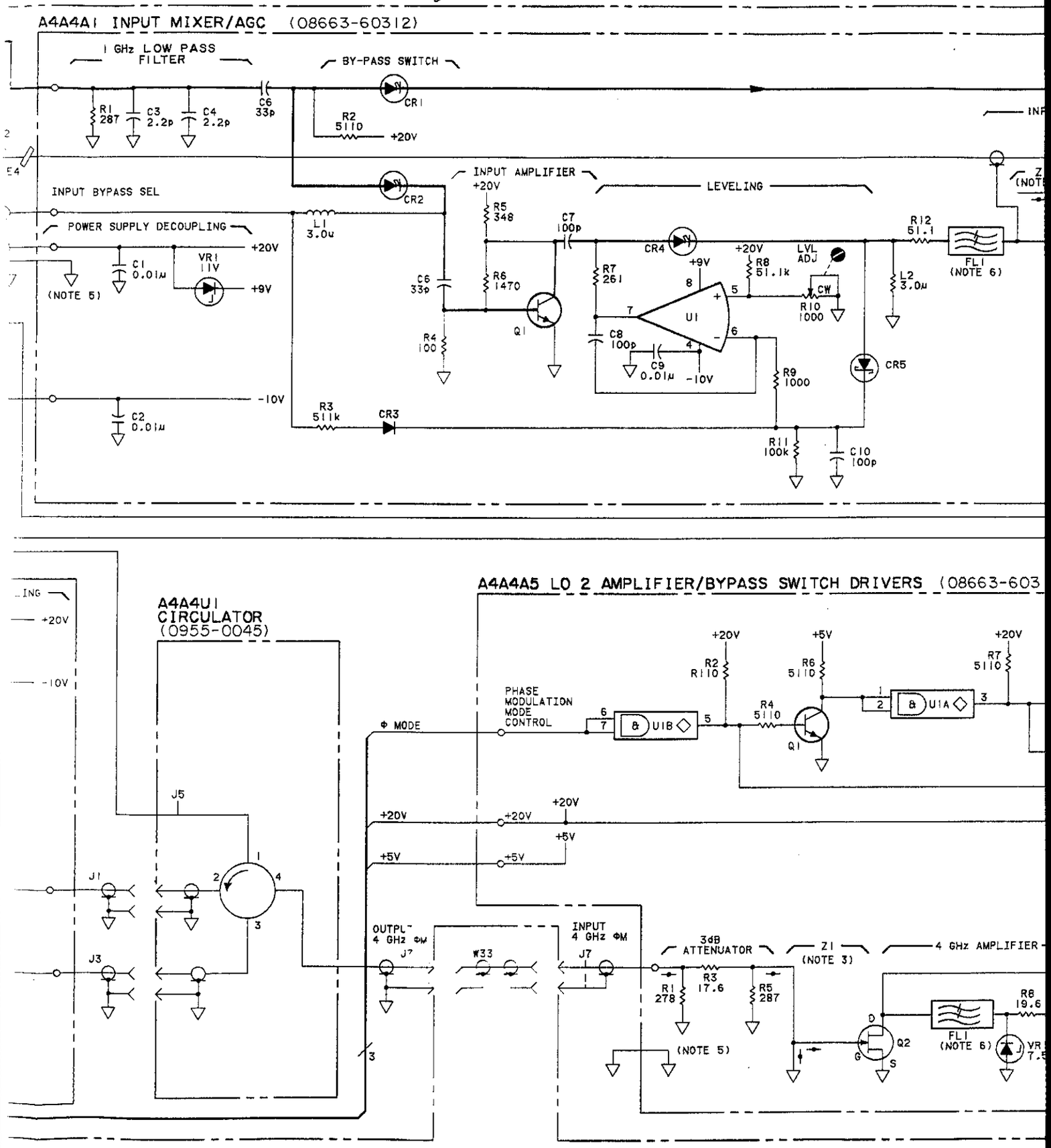


Fig 8-626 Sht 4 of 5

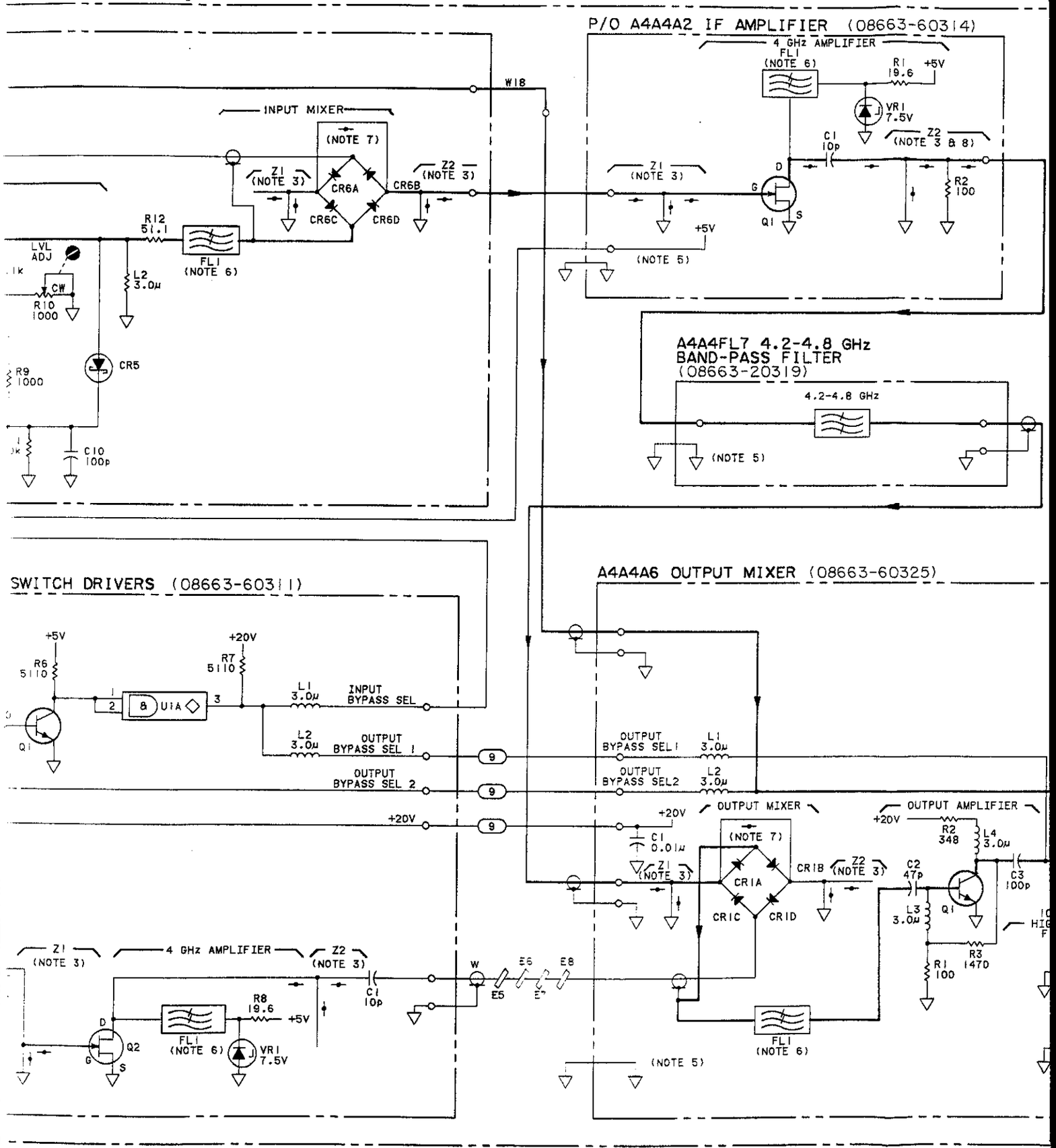
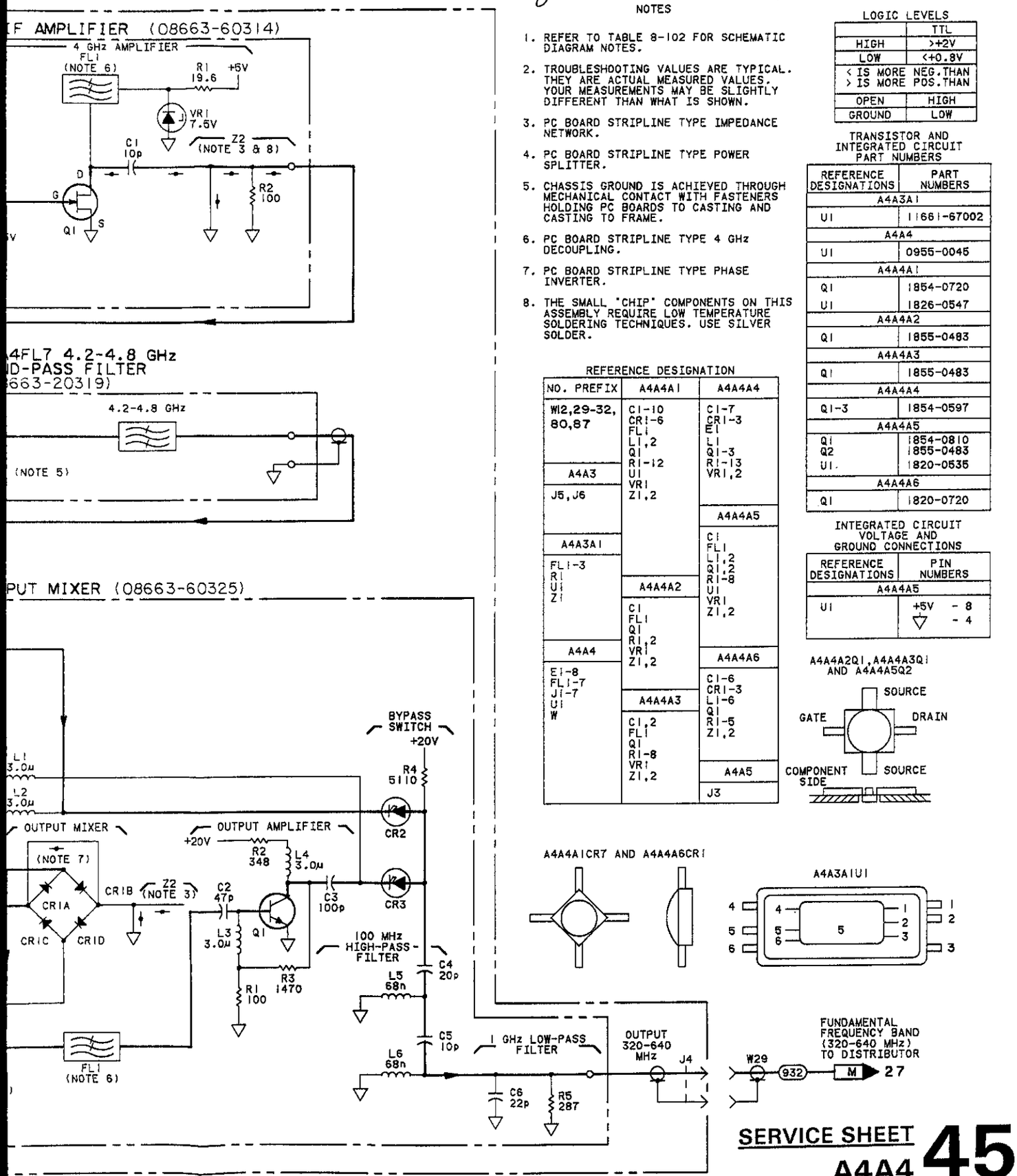


Fig 8-626 Sht 5 of 5



NOTES

1. REFER TO TABLE 8-102 FOR SCHEMATIC DIAGRAM NOTES.
2. TROUBLESHOOTING VALUES ARE TYPICAL. THEY ARE ACTUAL MEASURED VALUES. YOUR MEASUREMENTS MAY BE SLIGHTLY DIFFERENT THAN WHAT IS SHOWN.
3. PC BOARD STRIPLINE TYPE IMPEDANCE NETWORK.
4. PC BOARD STRIPLINE TYPE POWER SPLITTER.
5. CHASSIS GROUND IS ACHIEVED THROUGH MECHANICAL CONTACT WITH FASTENERS HOLDING PC BOARDS TO CASTING AND CASTING TO FRAME.
6. PC BOARD STRIPLINE TYPE 4 GHz DECOUPLING.
7. PC BOARD STRIPLINE TYPE PHASE INVERTER.
8. THE SMALL "CHIP" COMPONENTS ON THIS ASSEMBLY REQUIRE LOW TEMPERATURE SOLDERING TECHNIQUES. USE SILVER SOLDER.

LOGIC LEVELS

	TTL
HIGH	>+2V
LOW	<+0.8V
< IS MORE NEG.THAN > IS MORE POS.THAN	
OPEN	HIGH
GROUND	LOW

TRANSISTOR AND INTEGRATED CIRCUIT PART NUMBERS

REFERENCE DESIGNATIONS	PART NUMBERS
A4A3A1	
U1	11661-67002
A4A4	
U1	0955-0045
A4A4A1	
Q1	1854-0720
U1	1826-0547
A4A4A2	
Q1	1855-0483
A4A4A3	
Q1	1855-0483
A4A4A4	
Q1-3	1854-0597
A4A4A5	
Q1	1854-0810
Q2	1855-0483
U1	1820-0535
A4A4A6	
Q1	1820-0720

REFERENCE DESIGNATION

NO. PREFIX	A4A4A1	A4A4A4
W12,29-32, 80,87	C1-10 CR1-6 FL1 L1,2 Q1 R1-12 U1 VR1 Z1,2	C1-7 CR1-3 E1 L1 Q1-3 R1-13 VR1,2
A4A3		A4A4A5
J5,J6		C1 FL1 L1,2 Q1,2 R1-8 U1 VR1 Z1,2
A4A3A1		
FL1-3 R1 U1 Z1	A4A4A2	
	C1 FL1 Q1 R1,2 VR1 Z1,2	A4A4A6
A4A4		C1-6 CR1-3 L1-6 Q1 R1-5 Z1,2
E1-8 FL1-7 J1-7 U1 W	A4A4A3	
	C1,2 FL1 Q1 R1-8 VR1 Z1,2	A4A5
		J3

INTEGRATED CIRCUIT VOLTAGE AND GROUND CONNECTIONS

REFERENCE DESIGNATIONS	PIN NUMBERS
A4A4A5	
U1	+5V - 8 ▽ - 4

A4A4A2Q1, A4A4A3Q1 AND A4A4A5Q2

A4A4A1CR7 AND A4A4A6CR1

A4A3A1U1

FUNDAMENTAL FREQUENCY BAND (320-640 MHz) TO DISTRIBUTOR

SERVICE SHEET A4A4 45

Figure 8-626. A4A4 Phase Modulator Schematic

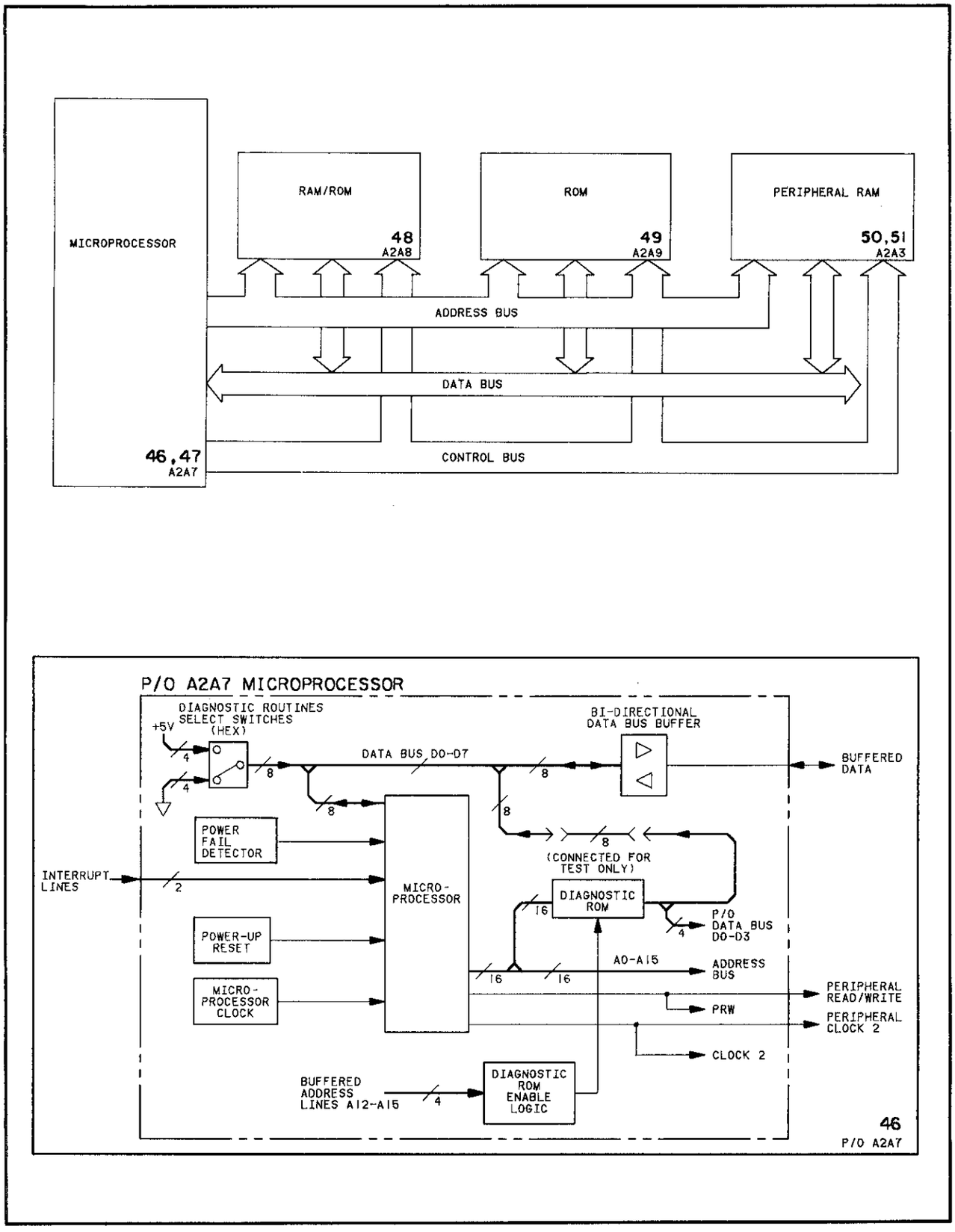


Figure 8-701. P/O A2A7 Microprocessor Block Diagrams

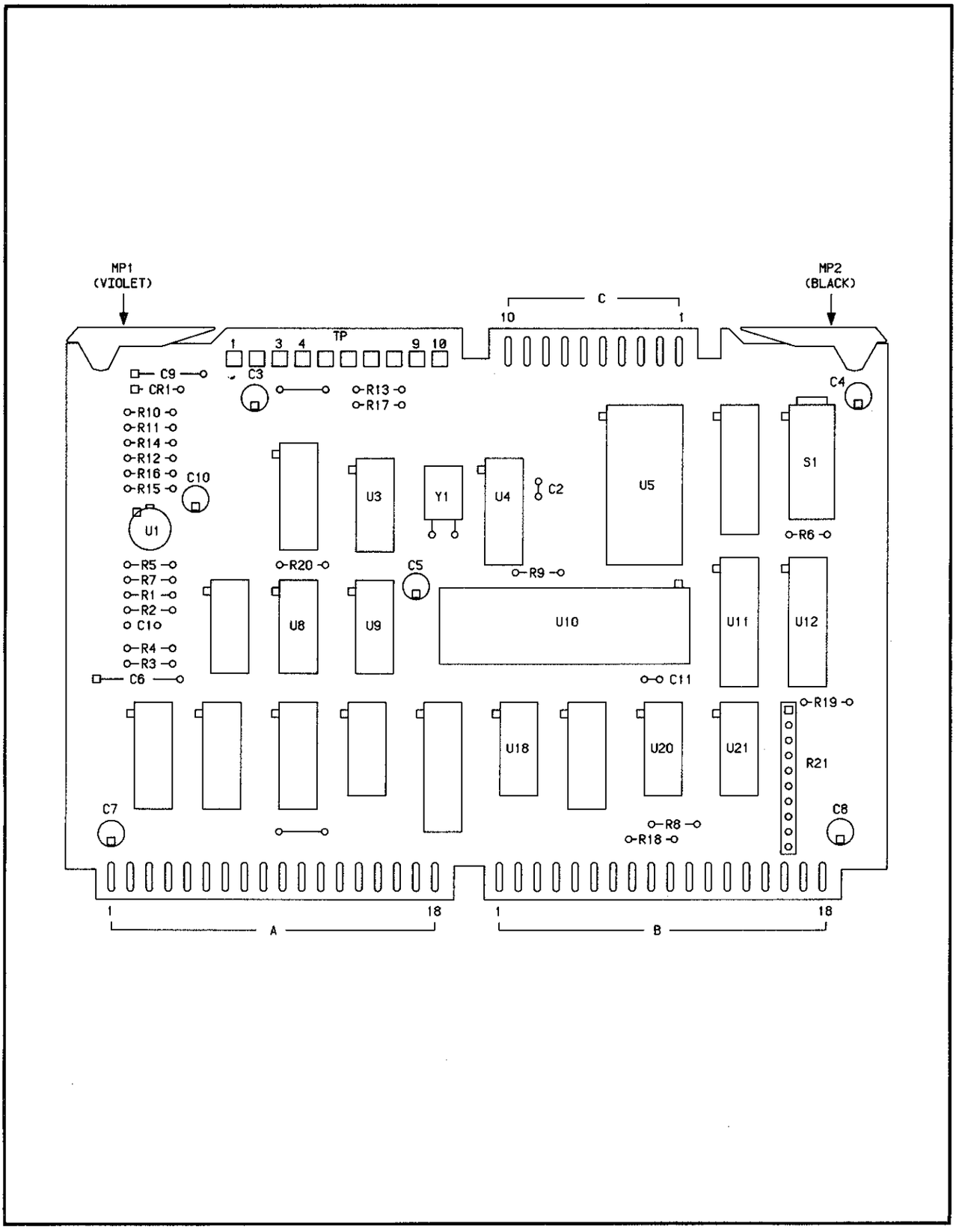


Figure 8-702. P/O A2A7 Microprocessor Component Locator

CHANGES

All serial prefixes

On the A2A7 schematic:

- A2A7C9 - Change the value of C9 to 2.2u.
- A2A7R15 - Change the value of R15 to 121k.

2346A and Above

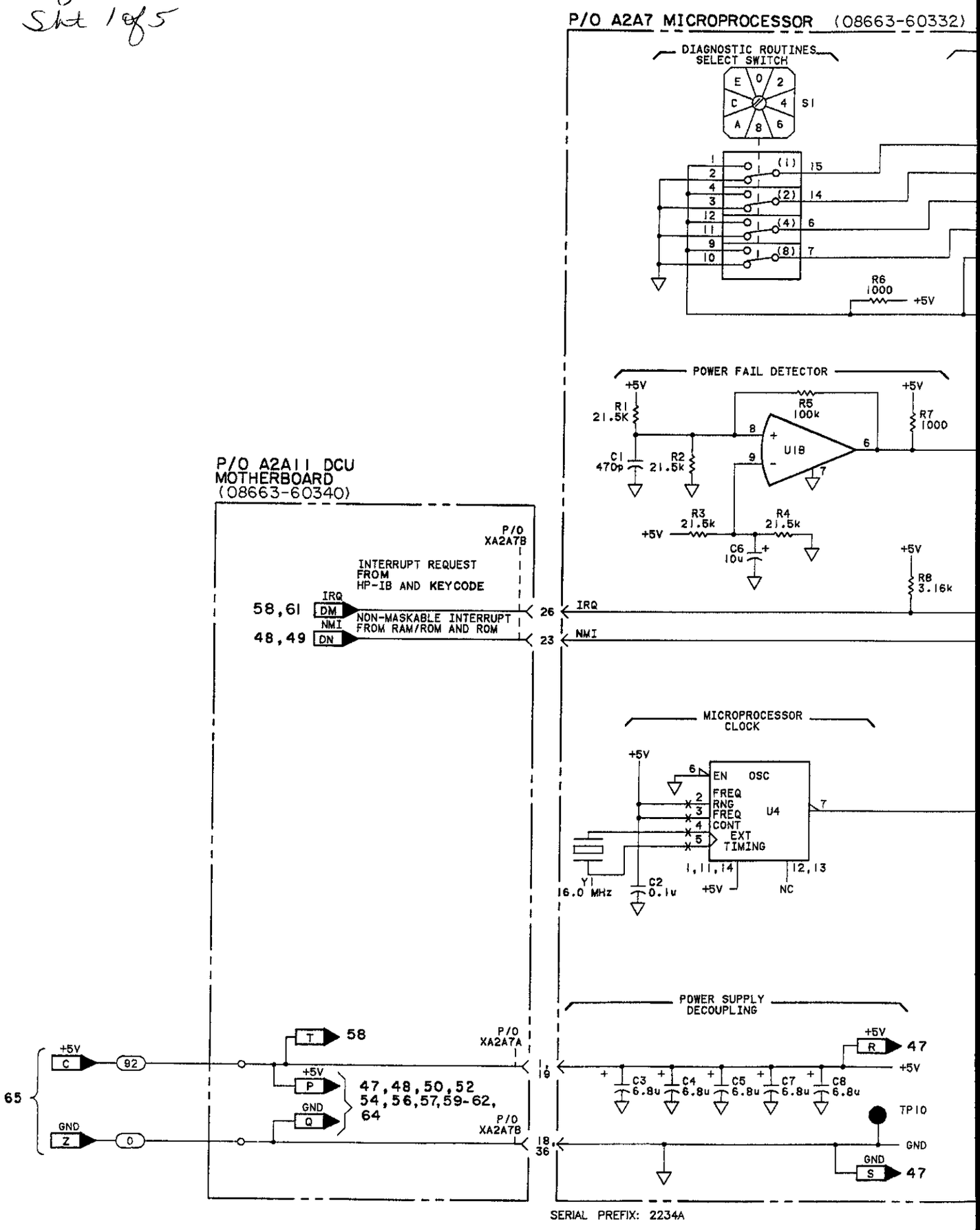
On the A2A7 component locator:

- A2A7C12 - Add chip capacitor C12. C12 is added to the circuit side of the board, soldered in parallel with pins 4 and 5 of U4. (Use a dotted outline to indicate that this component is on the circuit side of the board.)

On the A2A7 schematic:

- A2A7C12 - Add capacitor C12 (22p) in parallel with Y1 and pins 4 and 5 of U4.

Fig 8-703
Sht 1 of 5



OR (08663-60332)

Fig 8-703 Sht 2 of 5

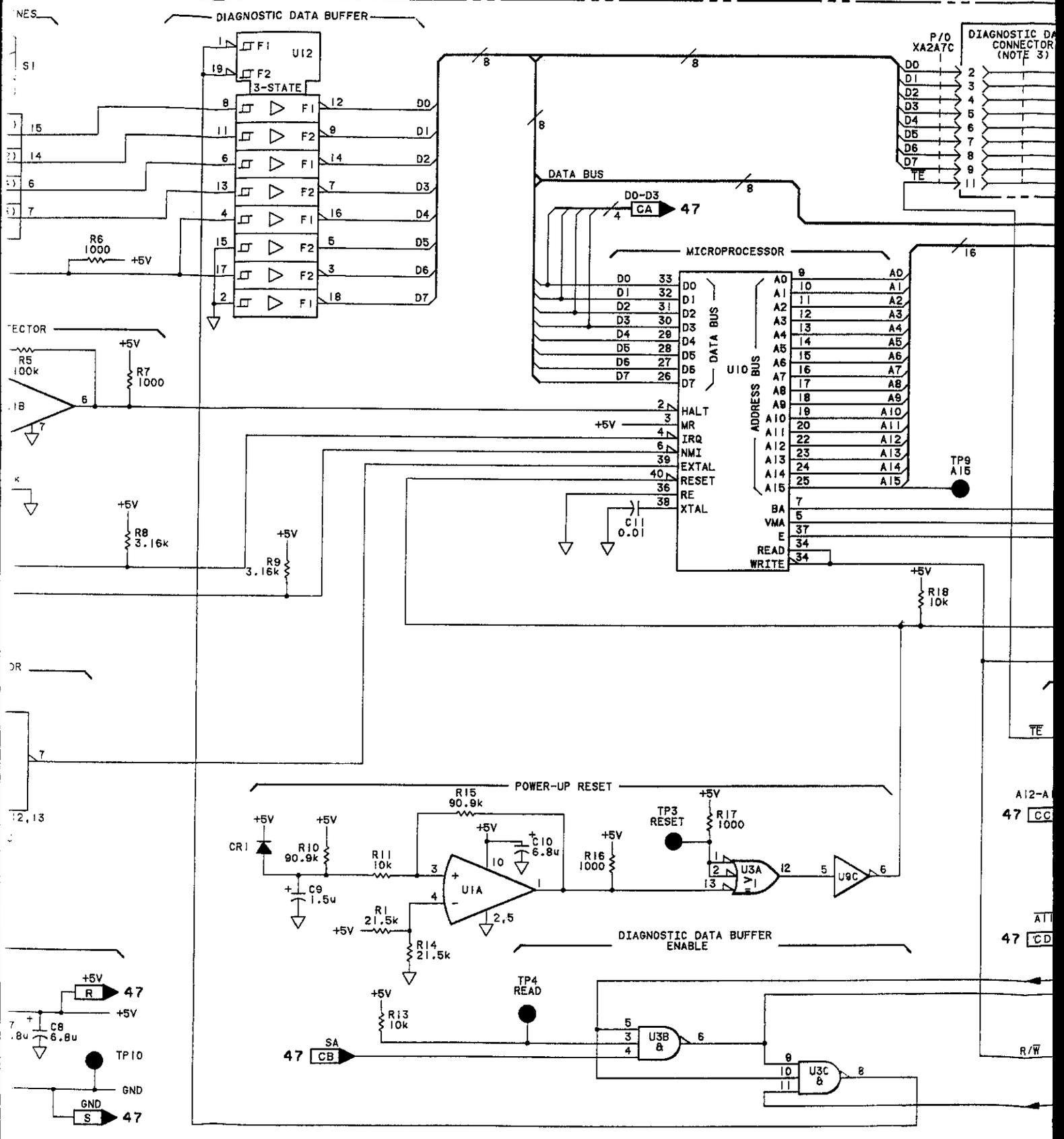


Fig 8-703 Sht 3 of 5

/218718

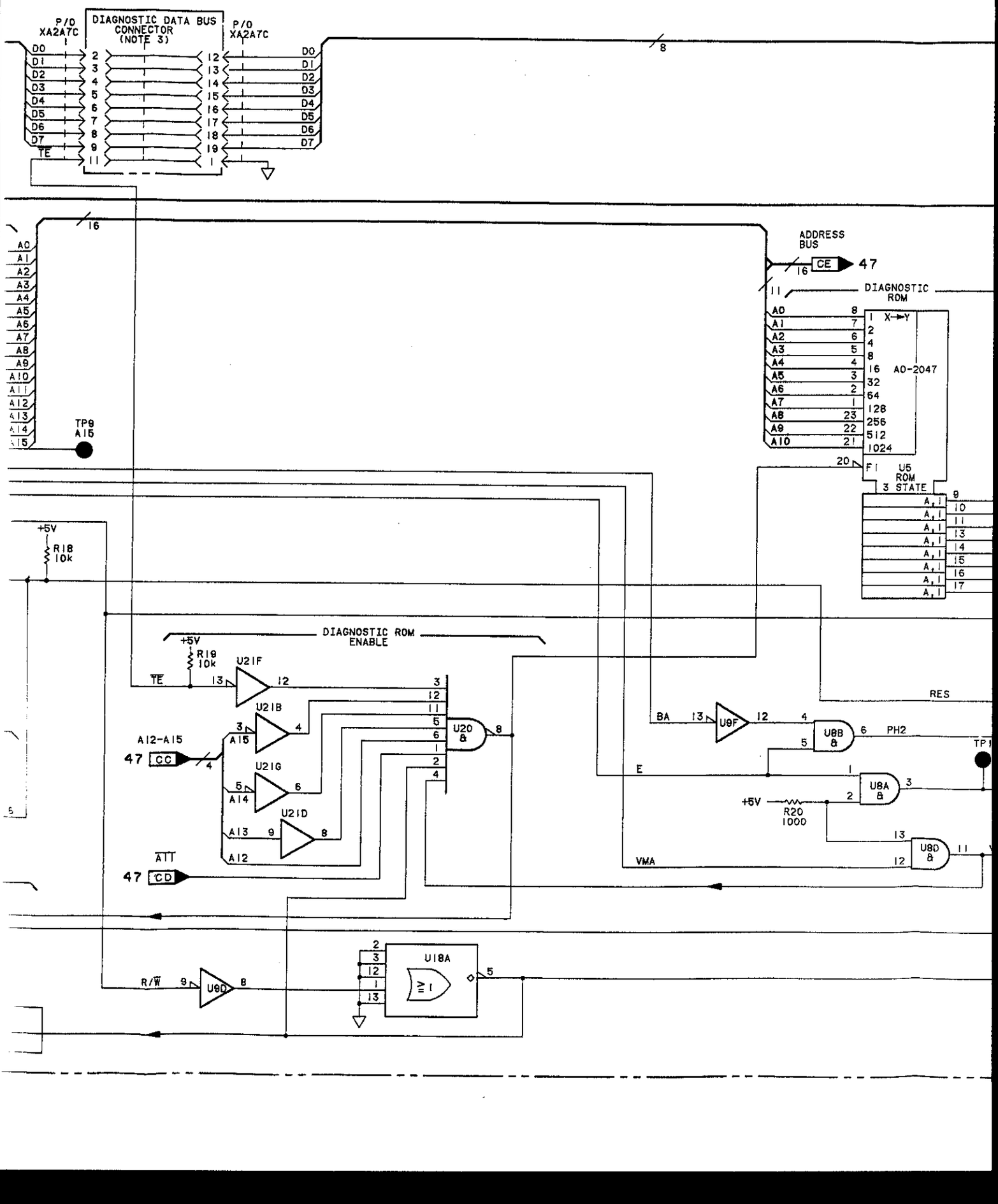


Fig 8-703 Sht 4 of 5

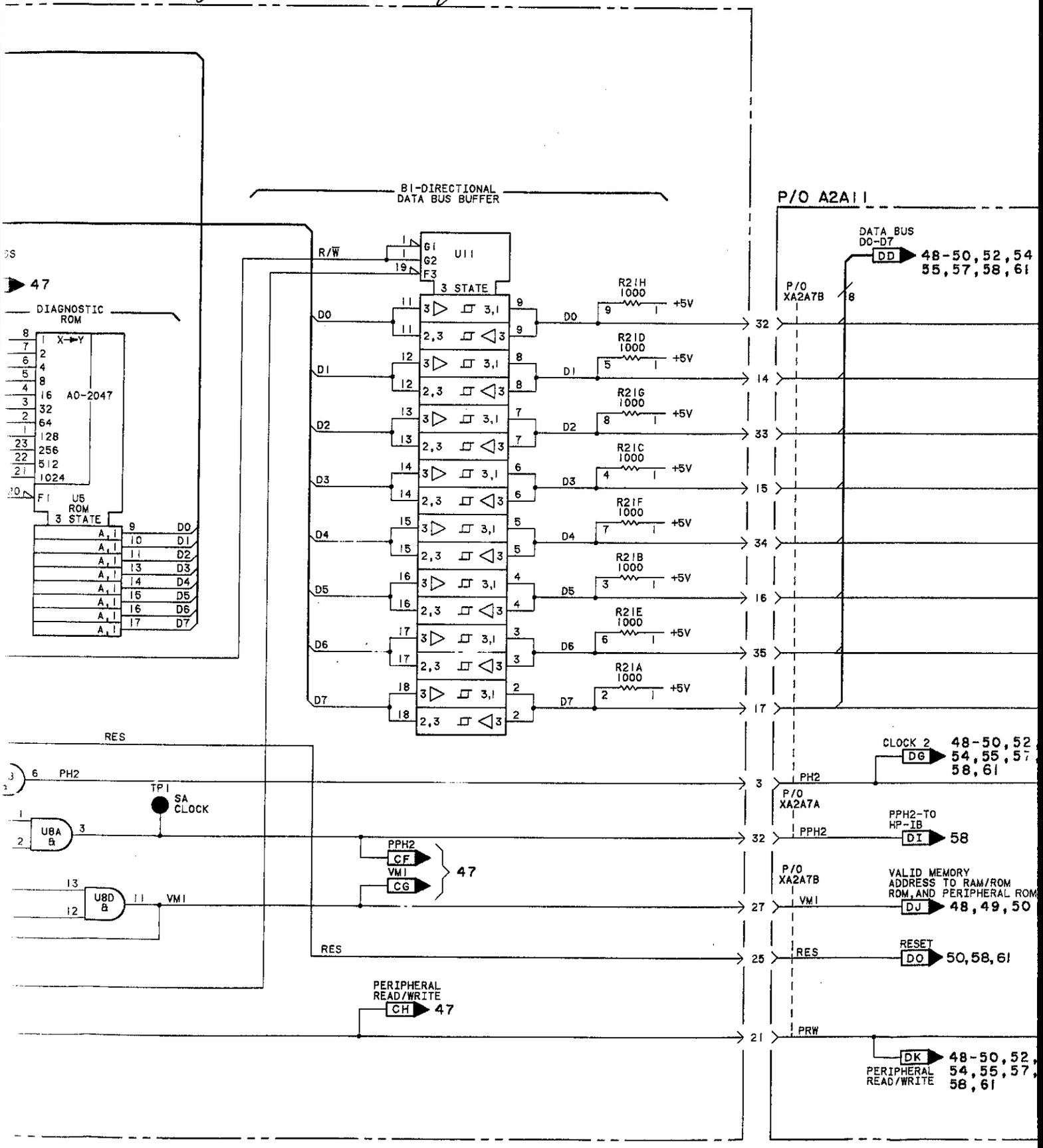
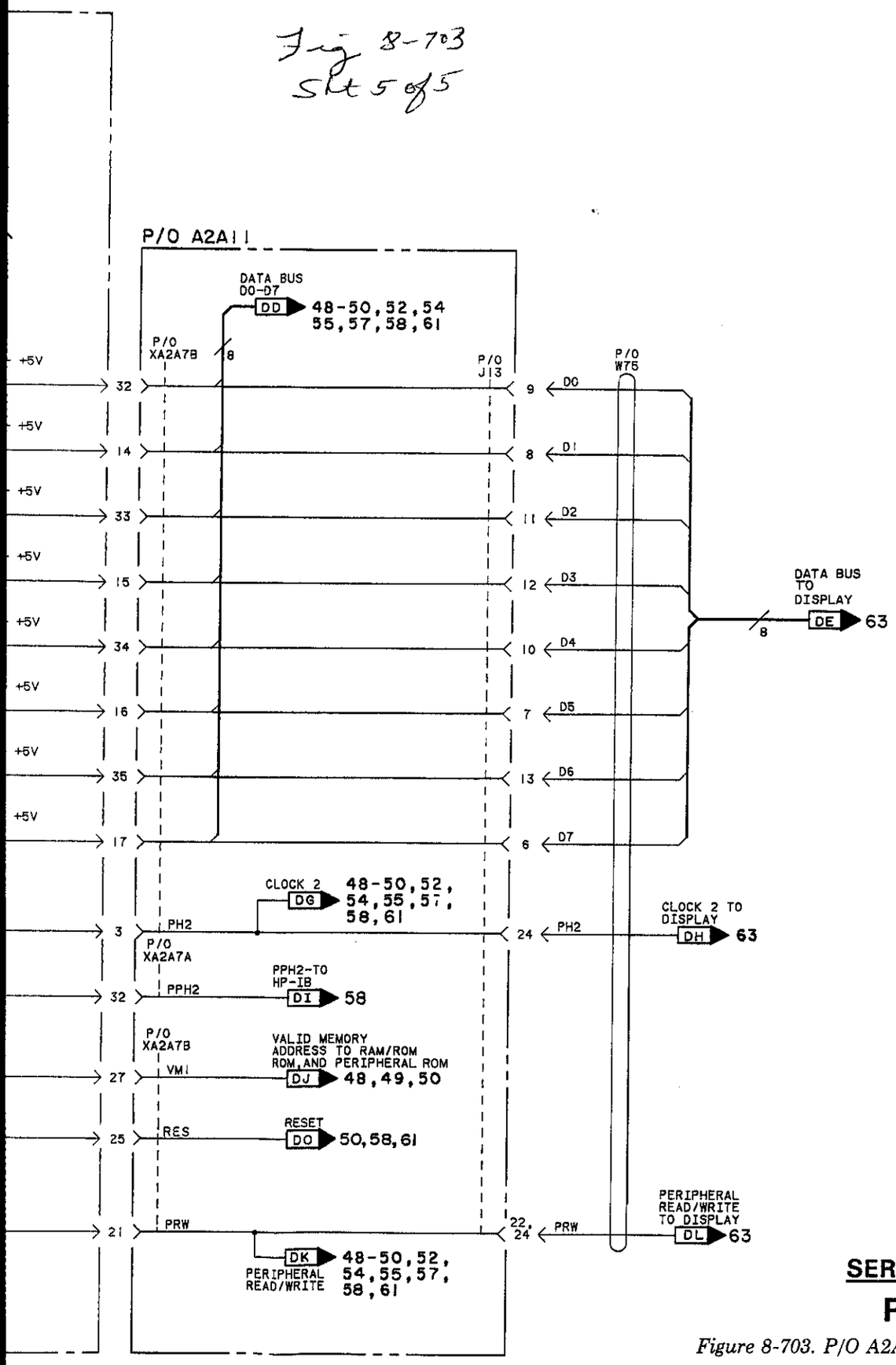


Fig 8-703
Sht 5 of 5



SERVICE SHEET 46
P/O A2A7

Figure 8-703. P/O A2A7 Microprocessor Schematic

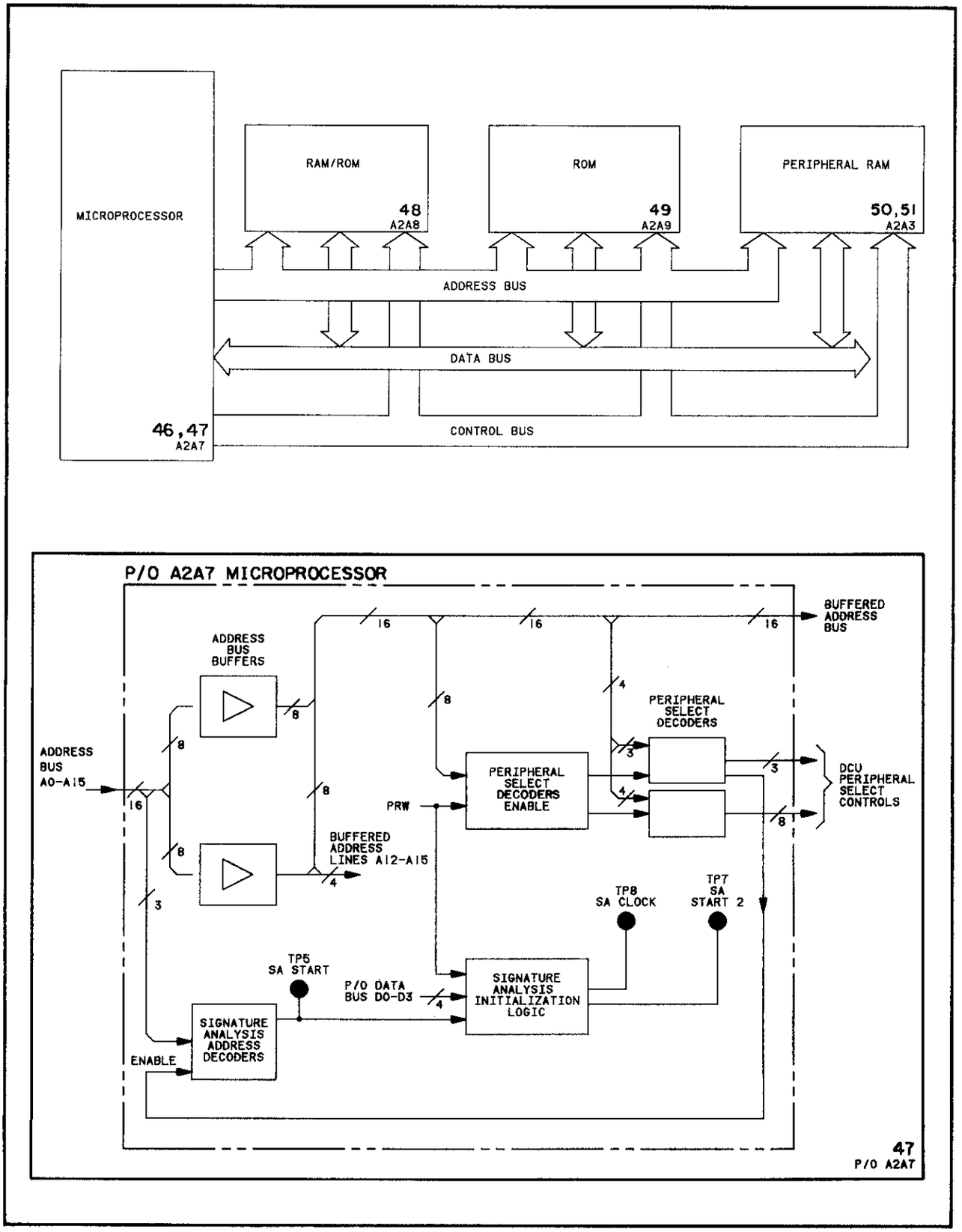


Figure 8-704. P/O A2A7 Microprocessor Block Diagrams

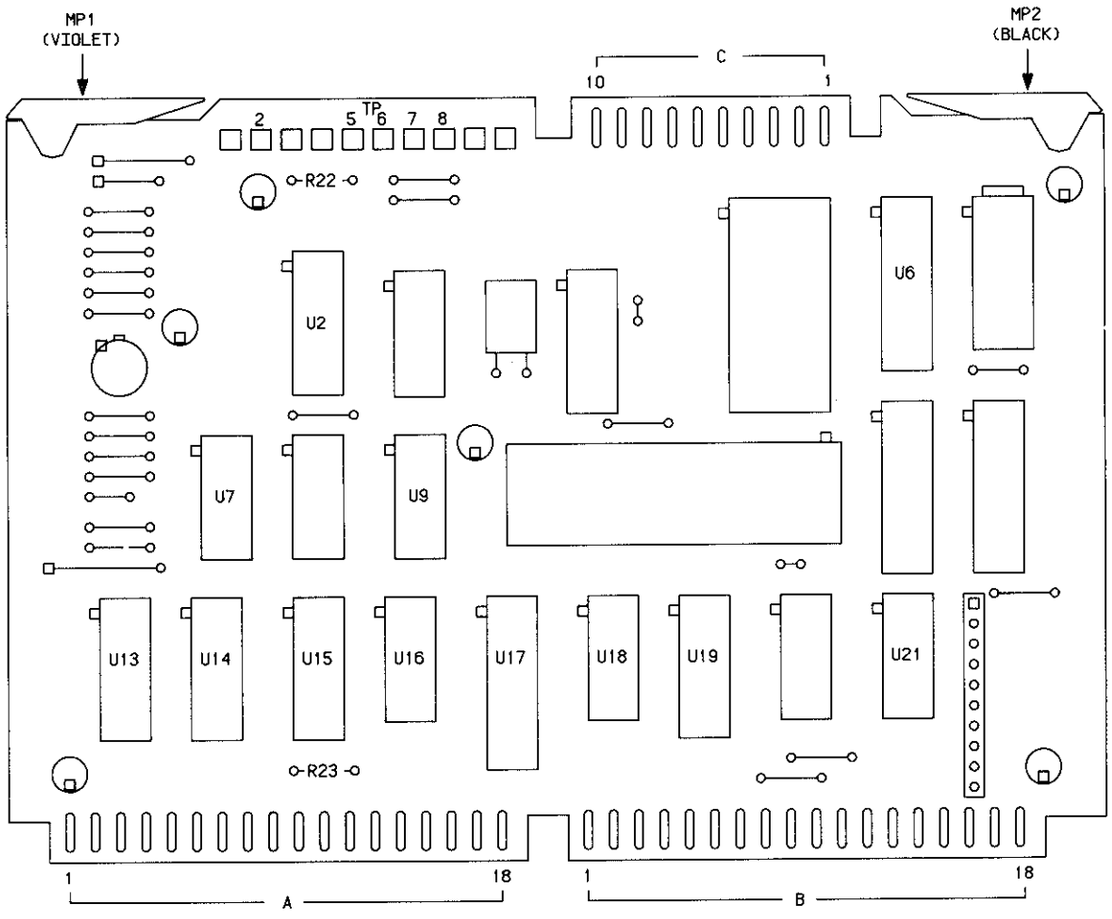
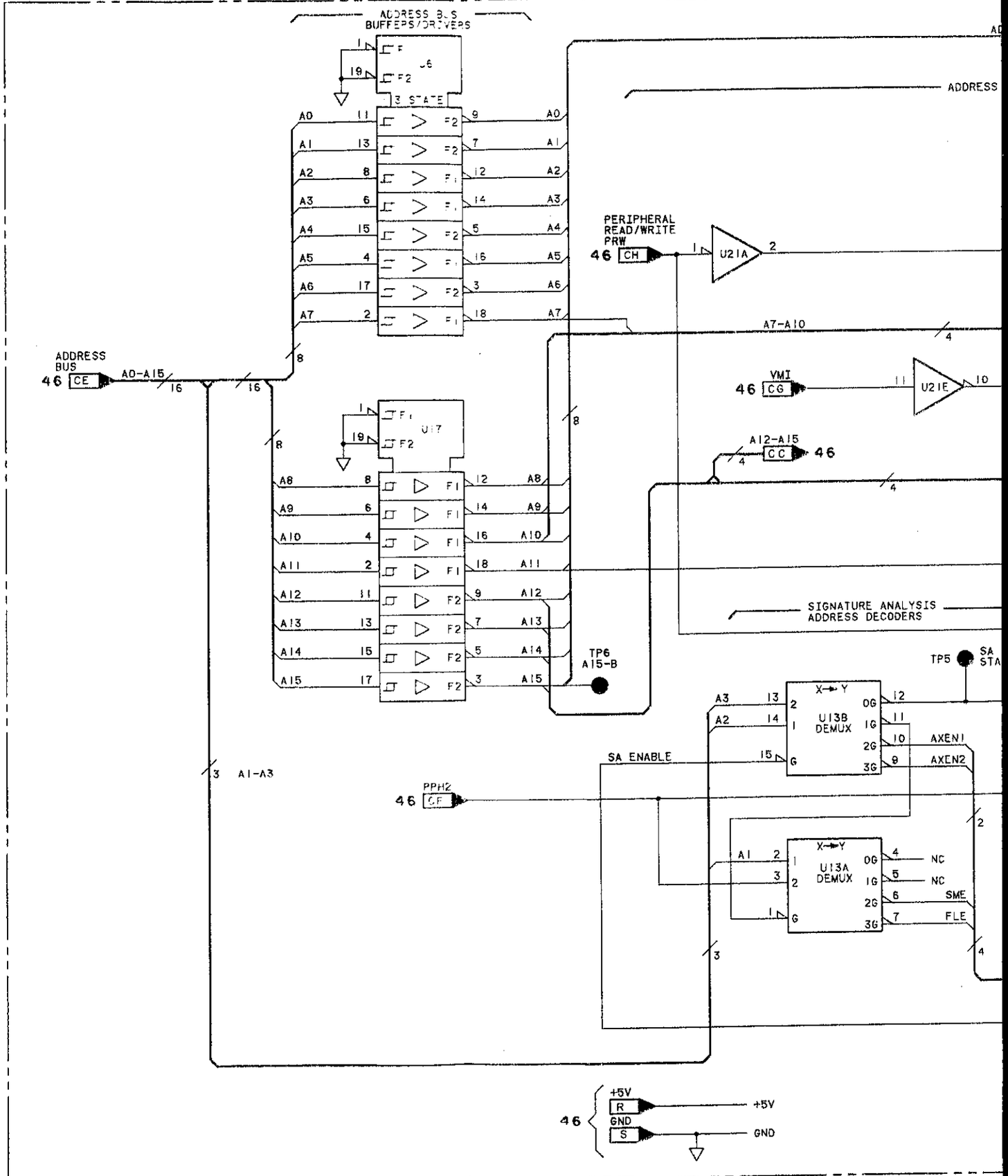


Figure 8-705. P/O A27 Microprocessor Component Locator

Fig 8-706 Sht 1 of 4

A2A7 MICROPROCESSOR (08663-60332)



SERIAL PREFIX: 2234A

Fig 8-706 Sht 2 of 4

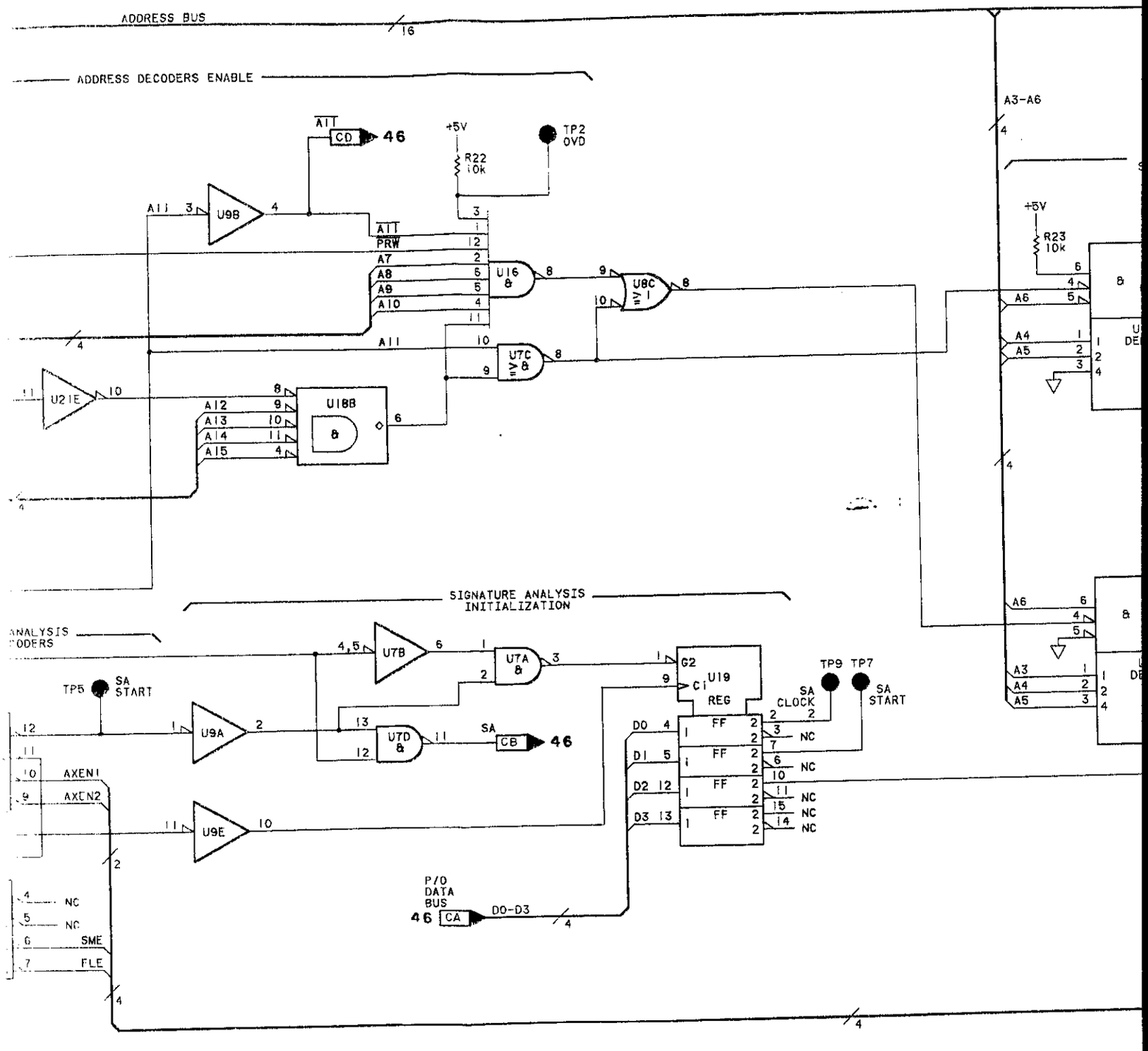
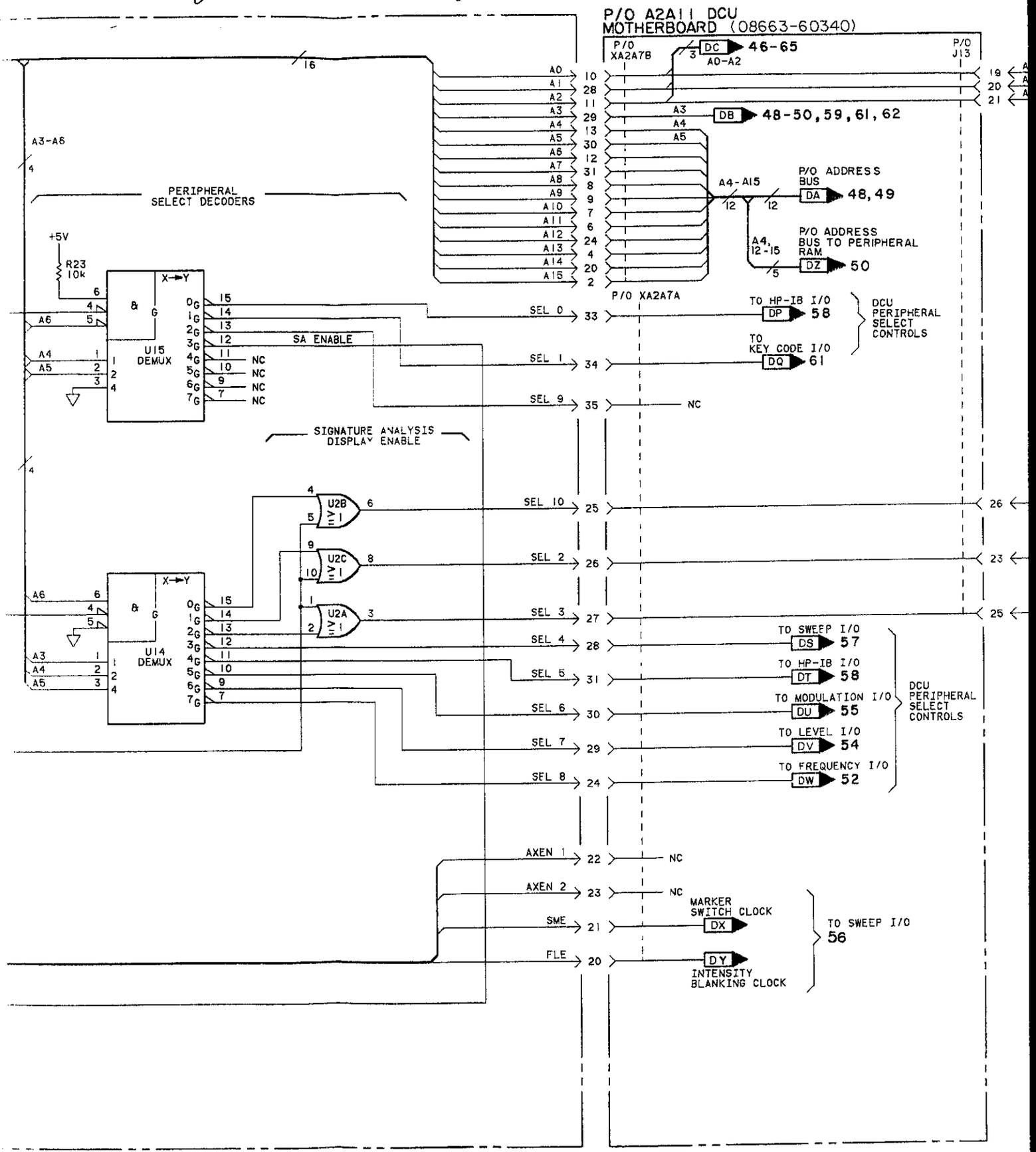


Fig 8-706 Sht 3 of 4



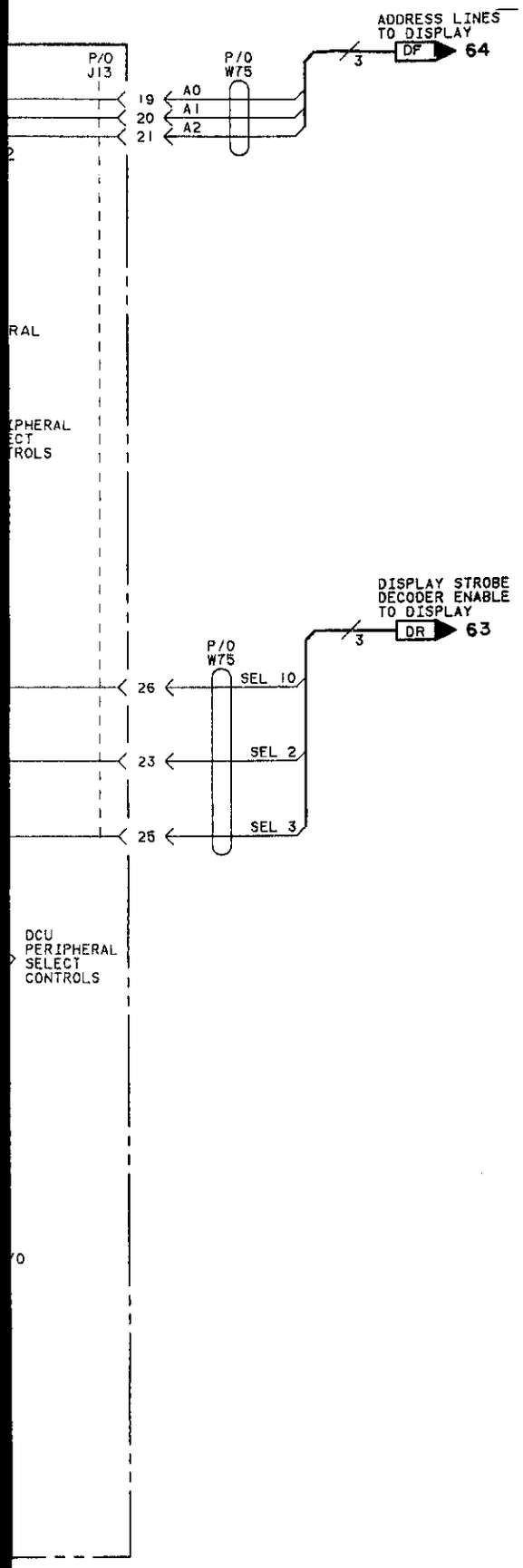


Fig 8-706
Sht 4 of 4

SERVICE SHEET 47

P/O A2A7

Figure 8-706. P/O A2A7 Microprocessor Schematic

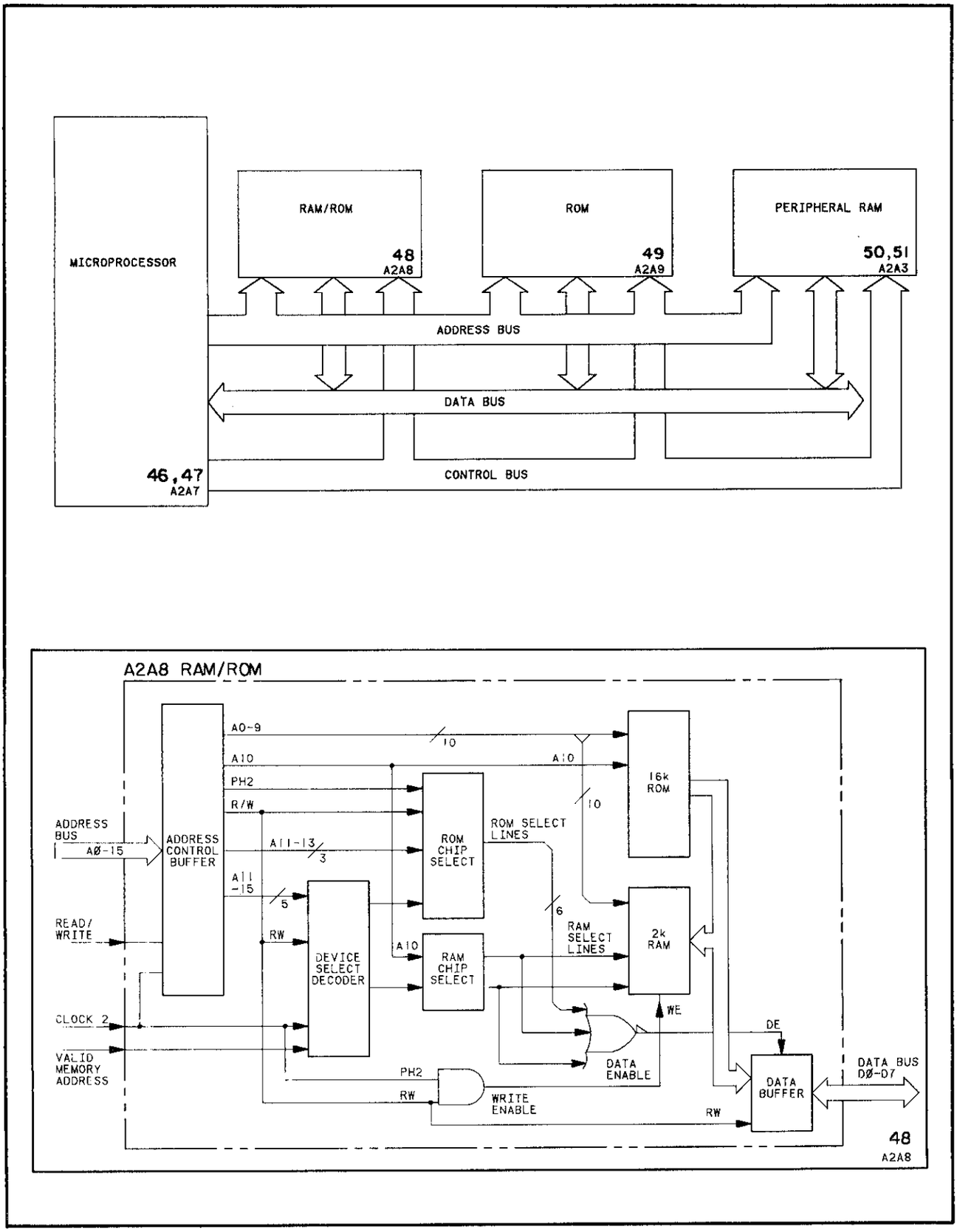


Figure 8-707. A2A8 RAM/ROM Block Diagrams

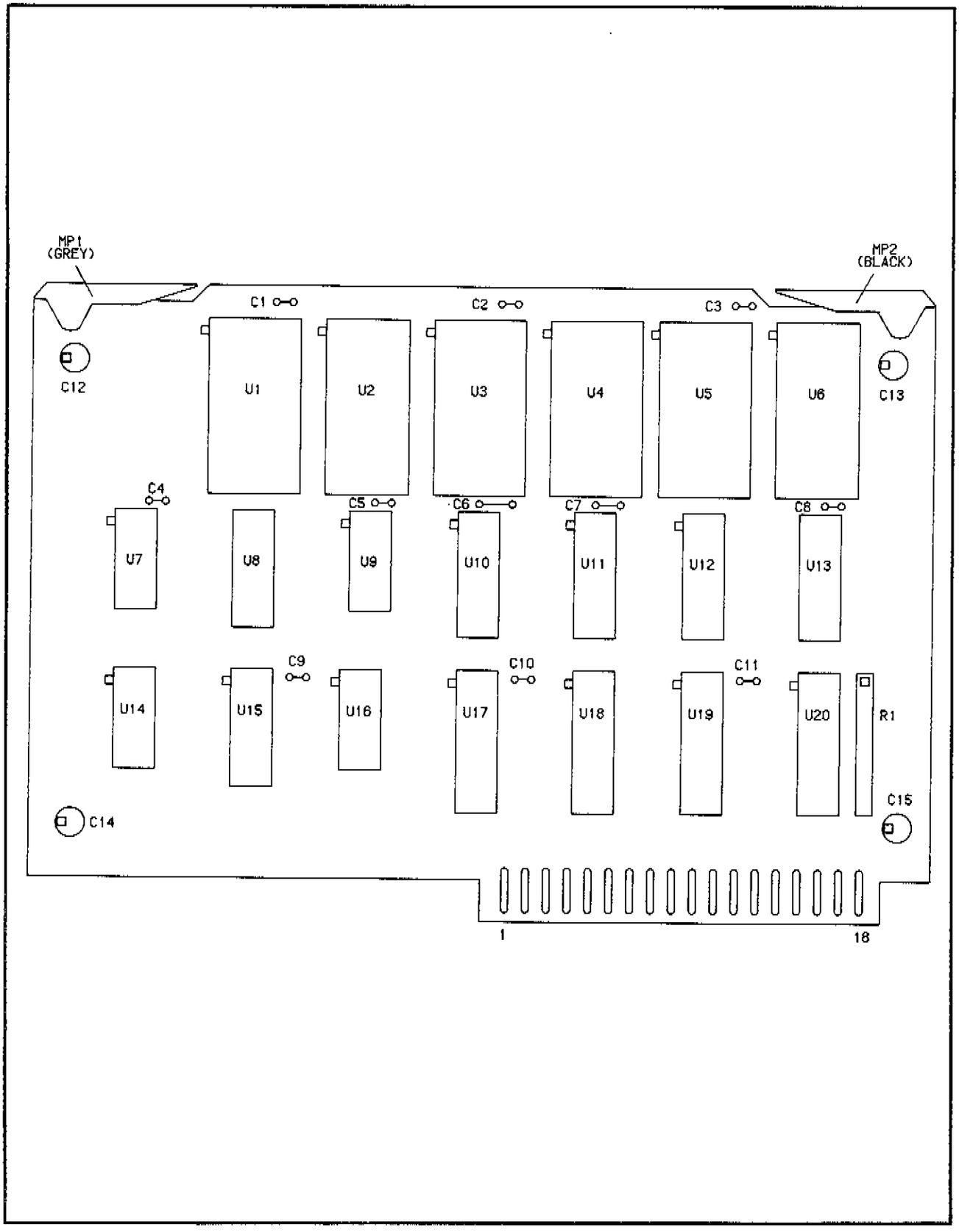


Figure 8-708. A2A8 RAM/ROM Component Locator

CHANGES

2537A and Above

A2A8 component locator:

- A2A8 - Use the component locator "Figure 8-708. A2A8 RAM/ROM Component Locator (2537A)" on page 8-710.3.

A2A8 schematic:

- A2A8 - Use the schematic "Figure 8-709. A2A8 RAM/ROM Schematic (2537A)" on page 8-710.5

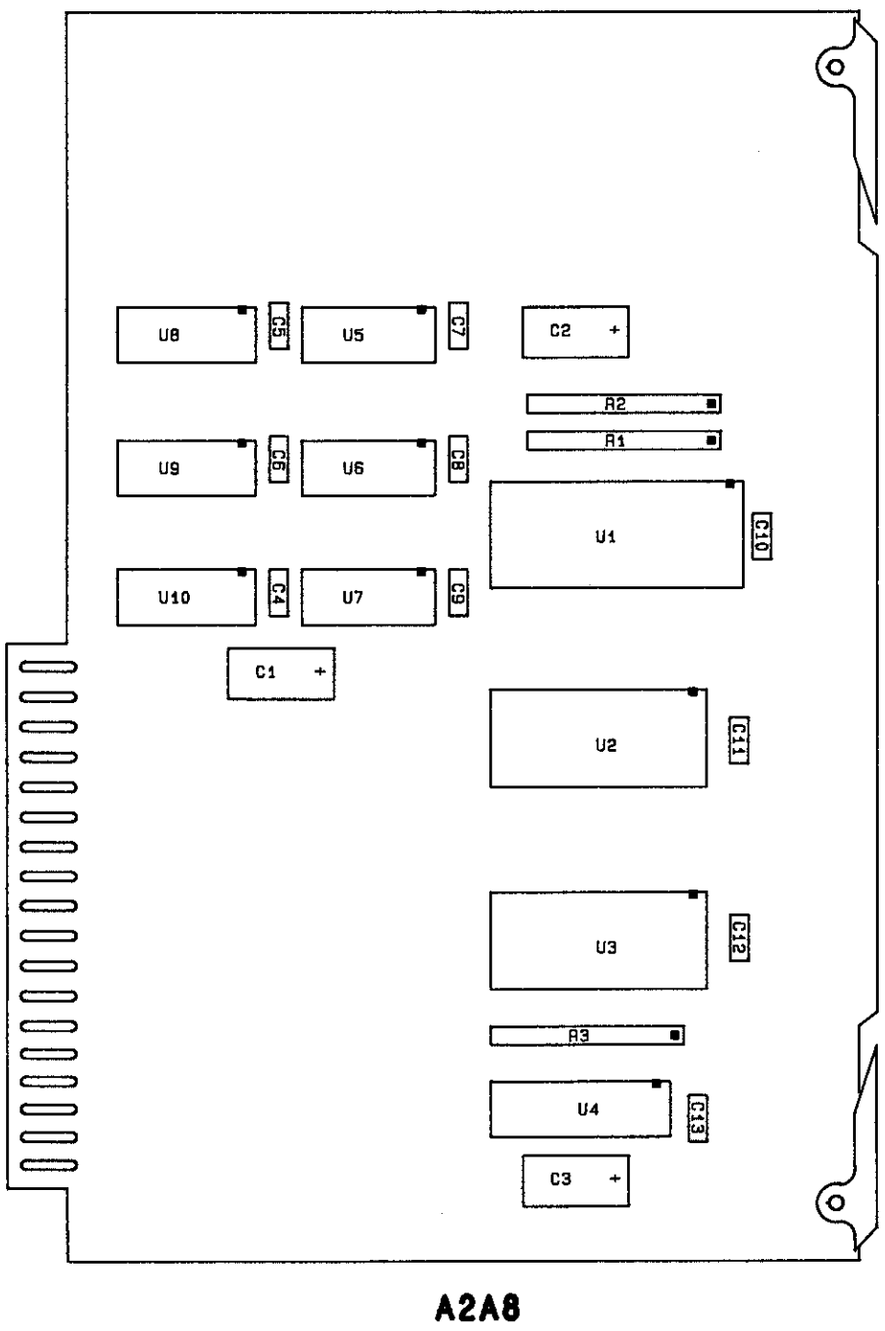
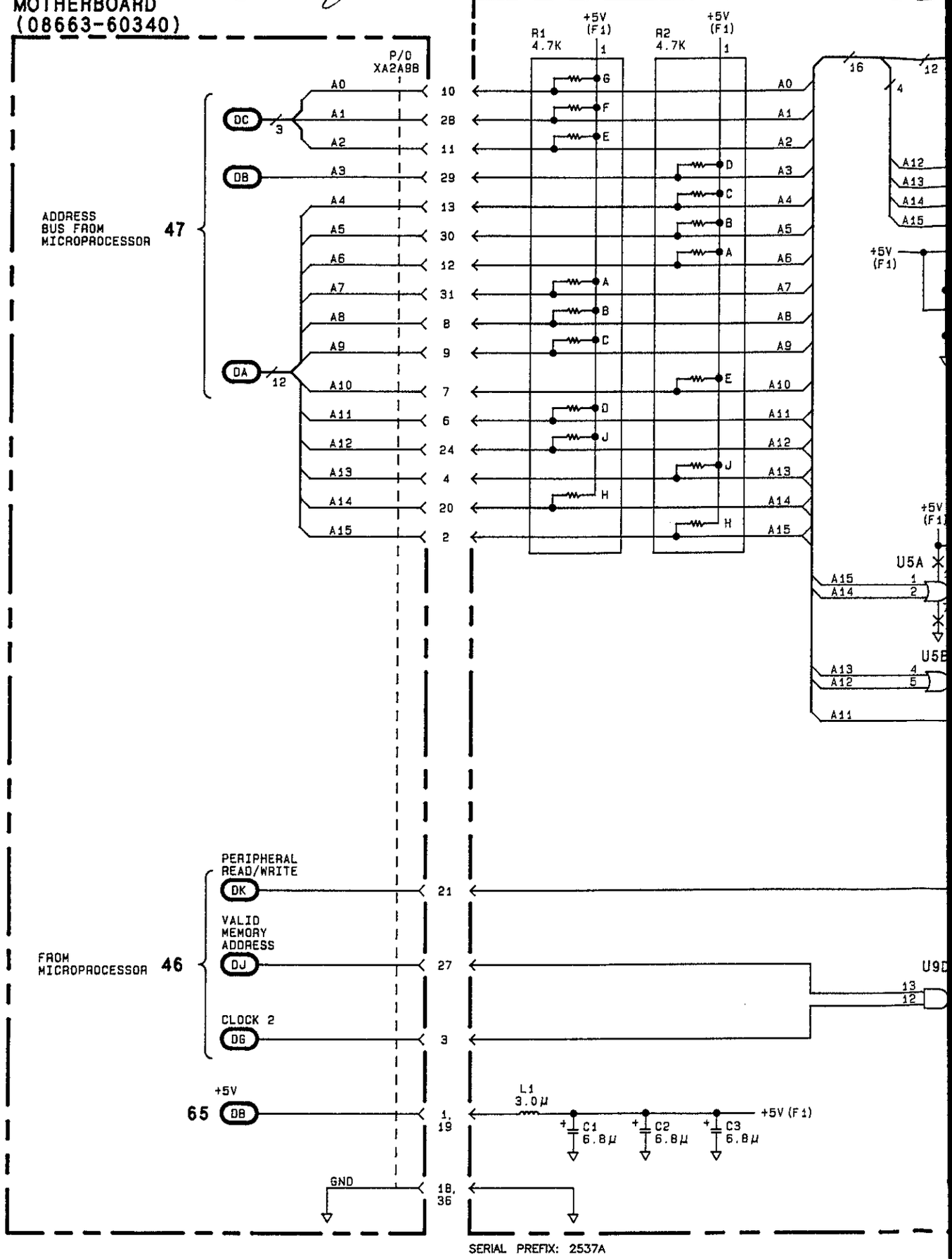


Figure 8–708. *A2A8 RAM/ROM Component Locator (2537A)*

Fig 8-709
Sht 1 of 5

P/O A2A11 DCU MOTHERBOARD (08663-60340)

A2A8 RAM/ROM MEMORY (08663-60365)



SERIAL PREFIX: 2537A

60365)

Fig 8-709 Sht 2 of 5

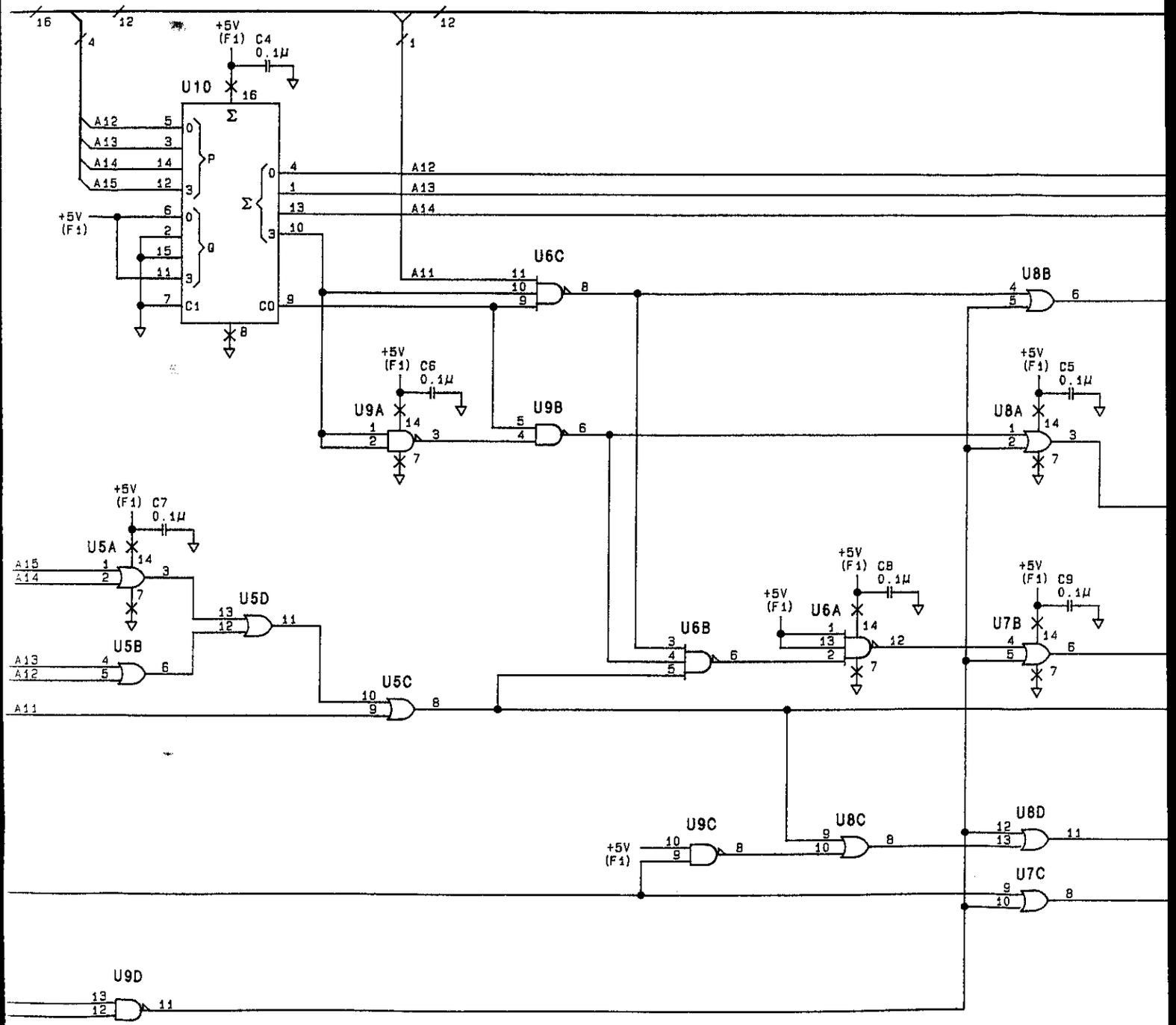


Fig 8-709 Sht 3 of 5

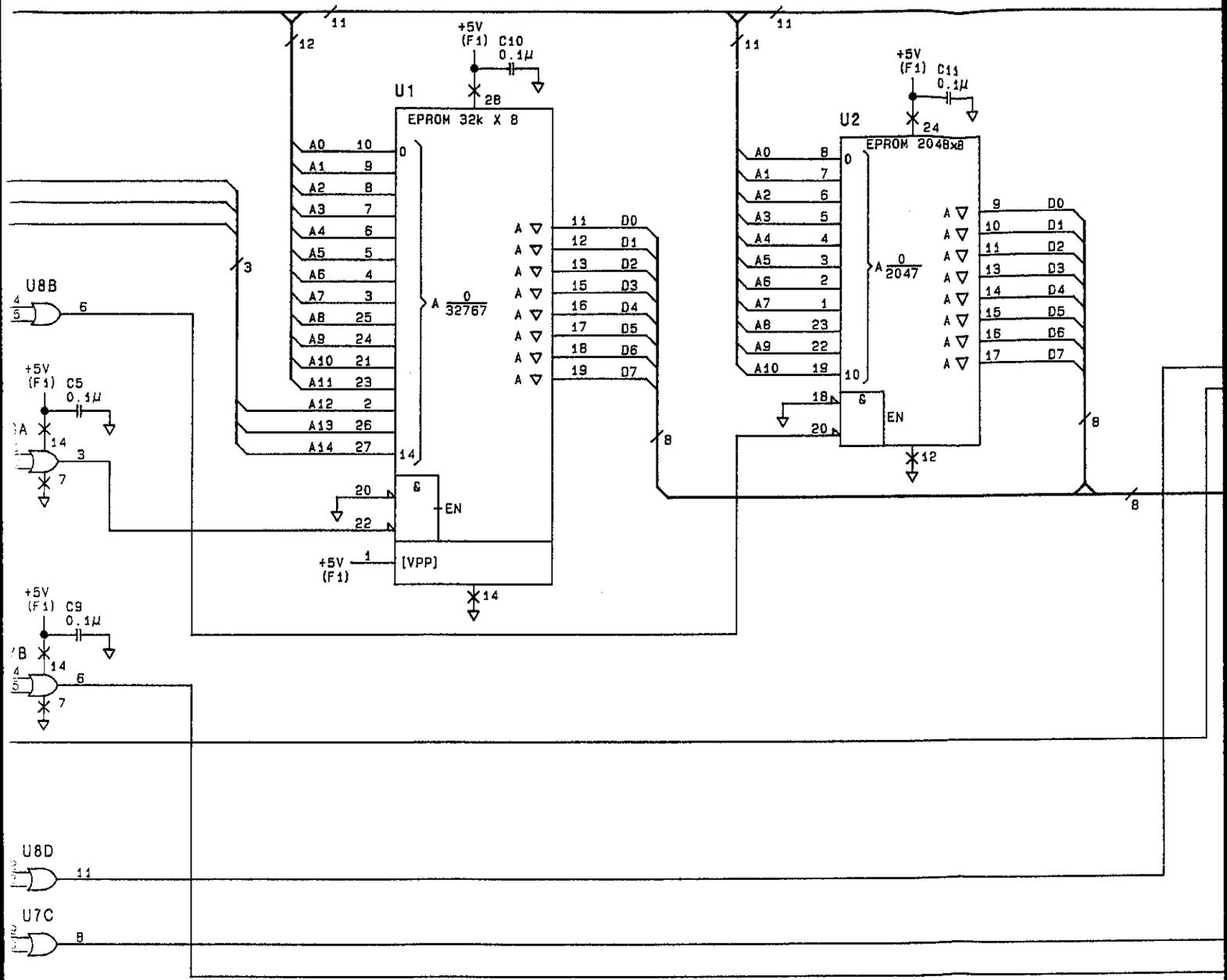


Fig 8-709 Sht 4 of 5

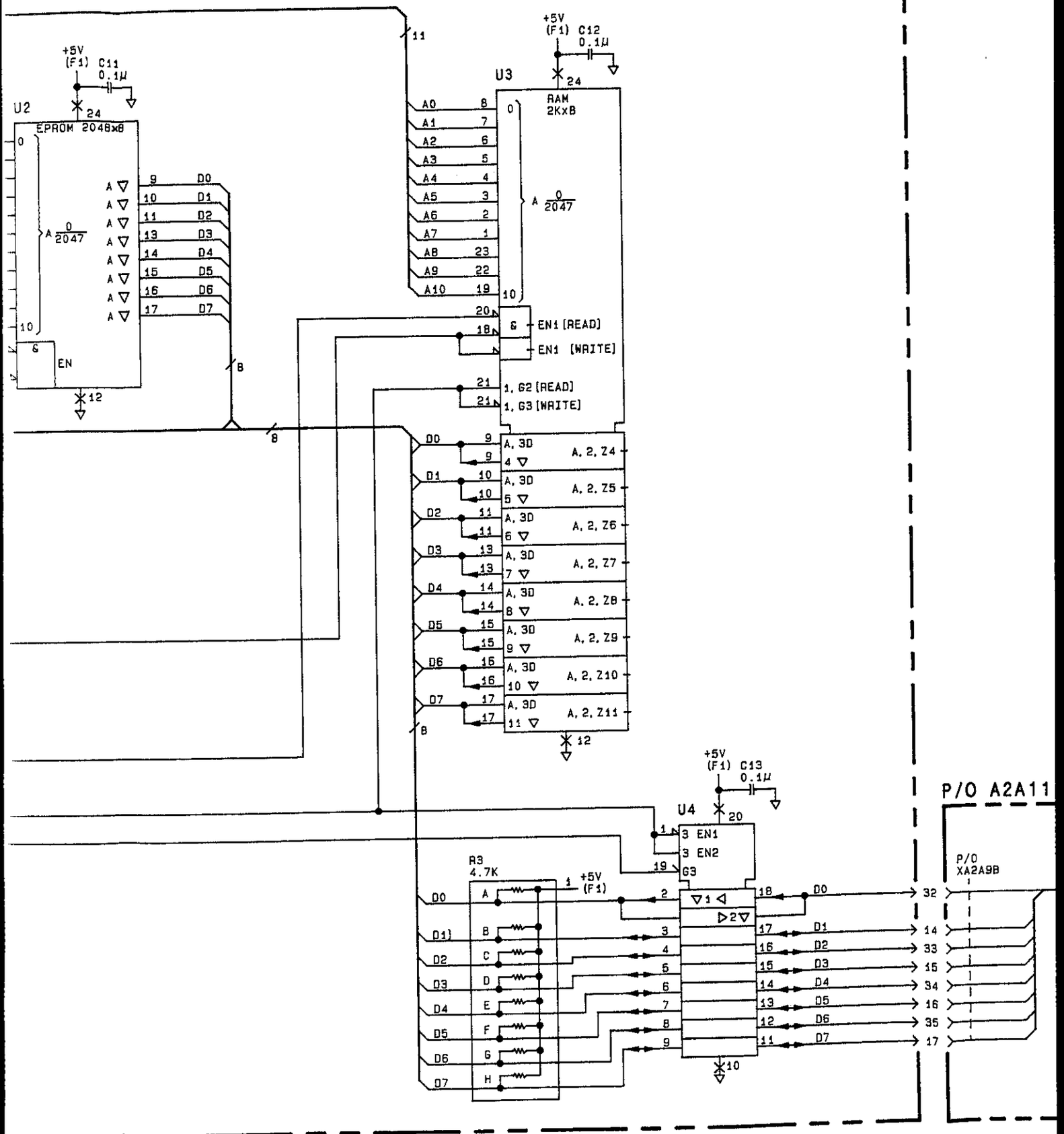
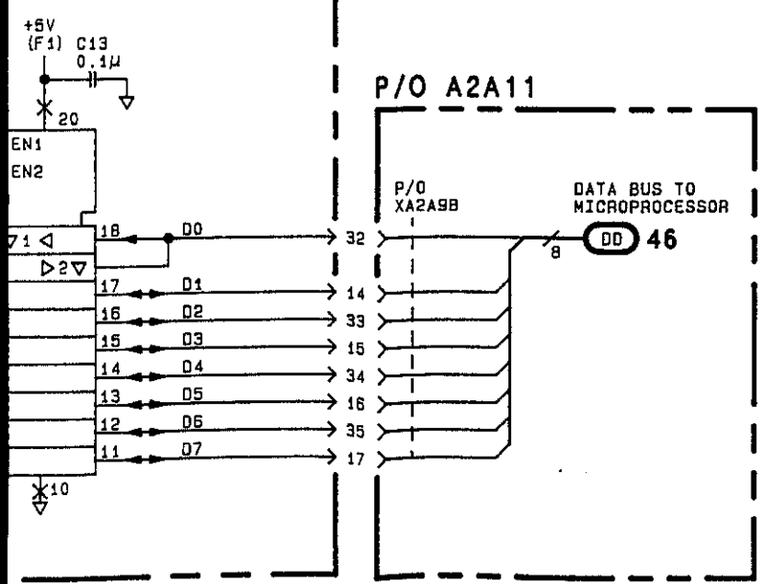


Fig 8-709
Sht 5 of 5



SERVICE SHEET A2A8 48

Figure 8-709. A2A8 RAM/ROM Schematic.

Fig 8-709a Sht 1 of 5

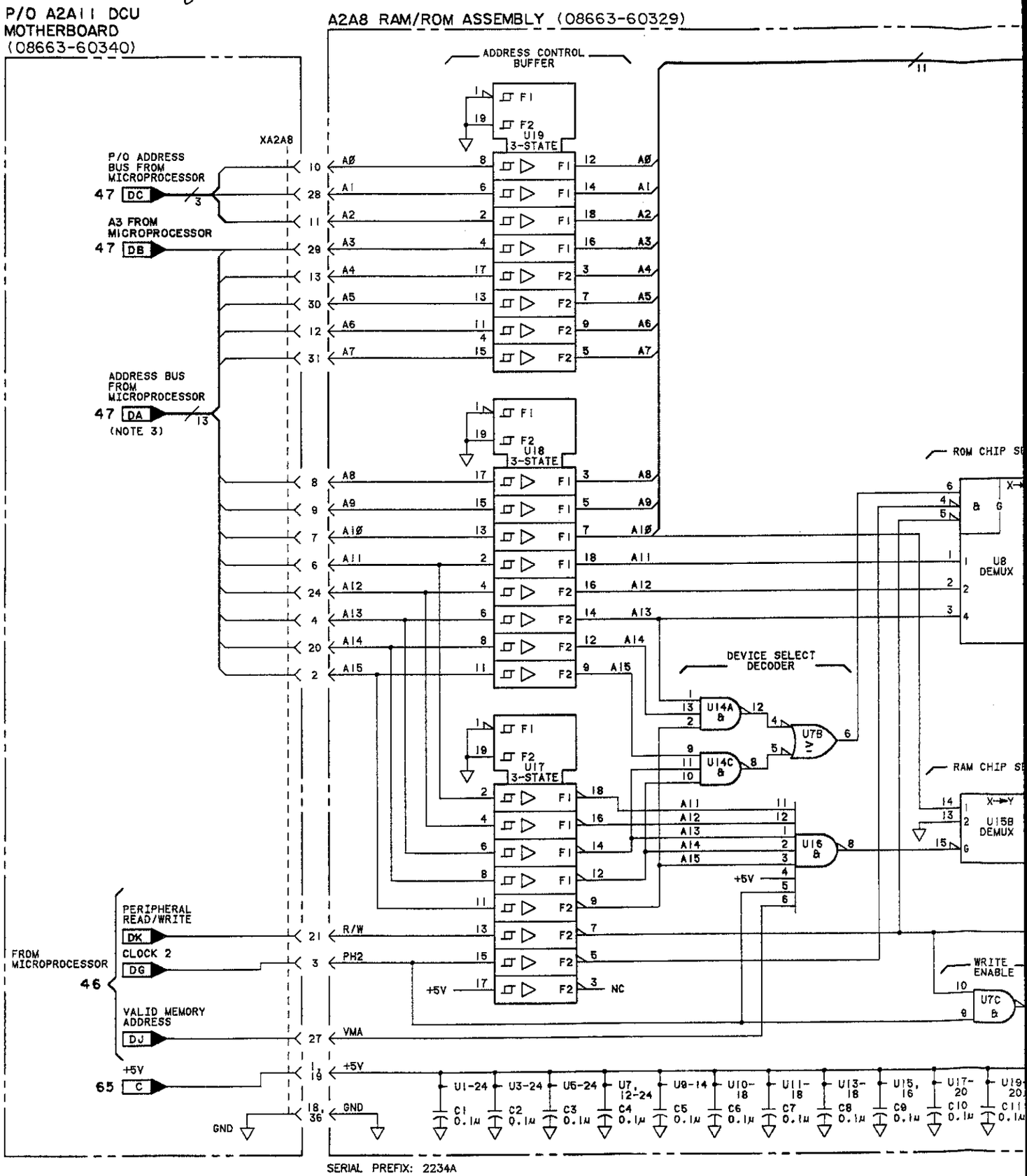


Fig 8-709a Sht 2 of 5

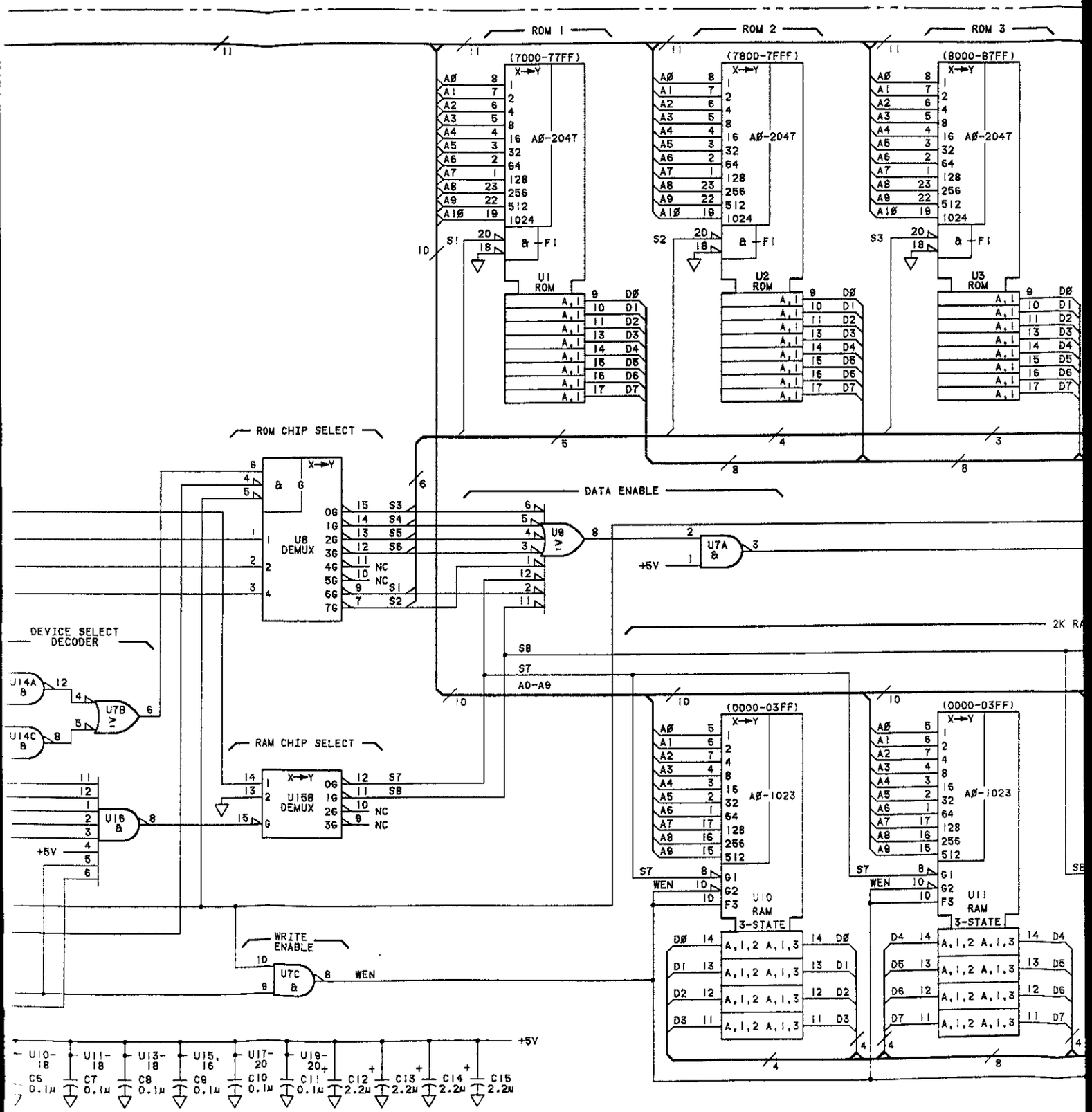


Fig 8-709a Sht 3 of 5

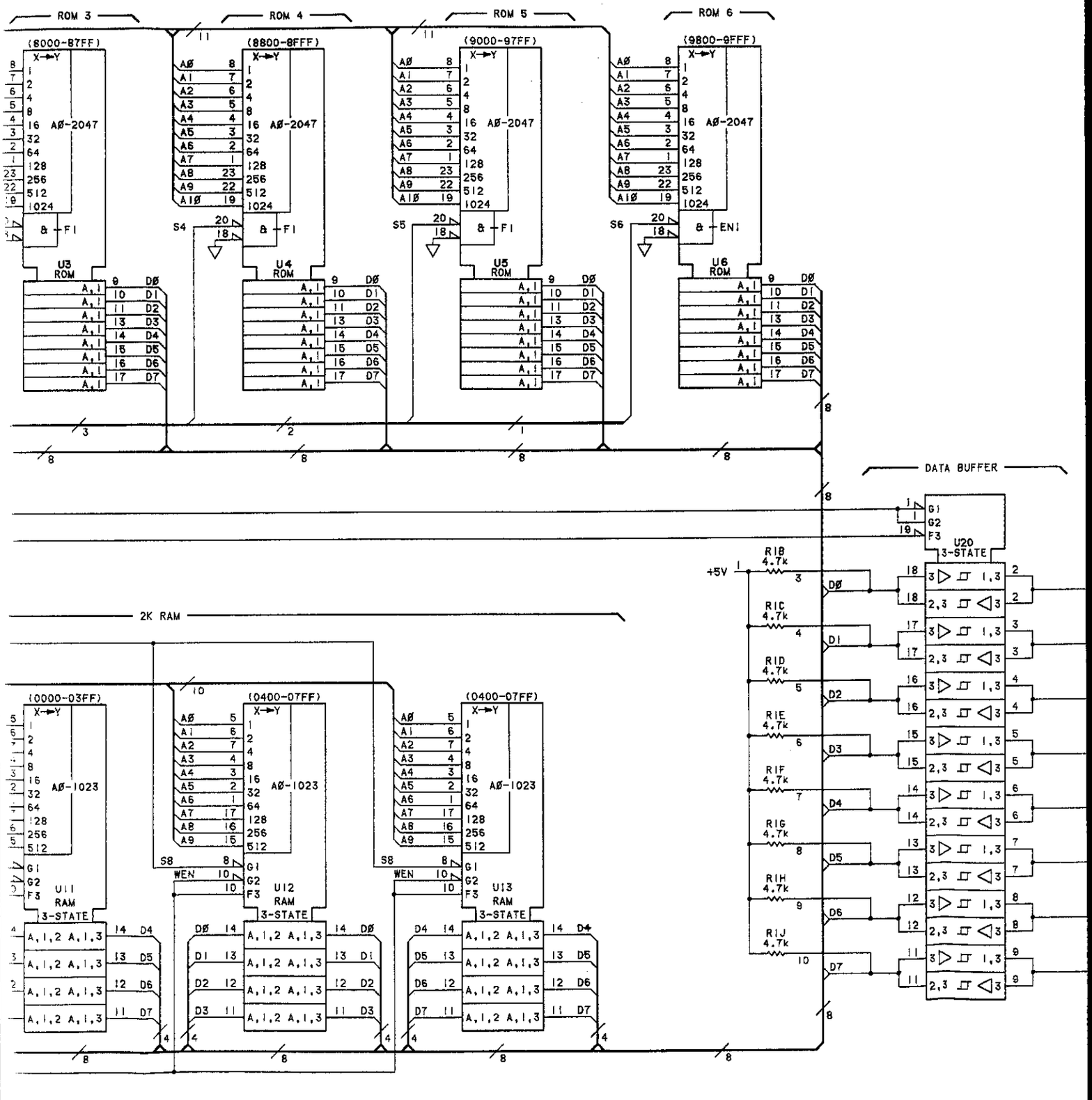
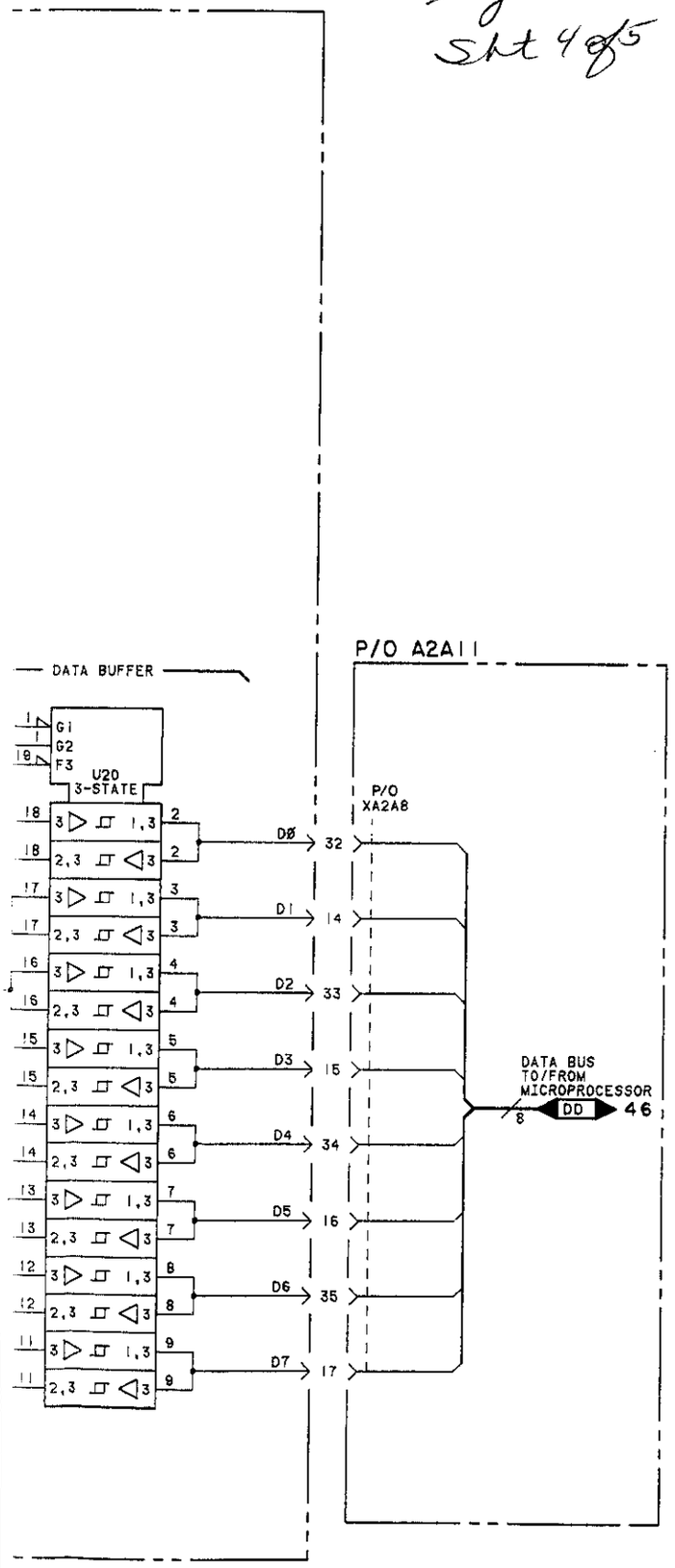


Fig 8-709a
Sht 4 of 5



INTEGRATED CIRCUIT
PART NUMBERS

REFERENCE DESIGNATIONS	PART NUMBERS
U1	08663-80005
U2	08663-80006
U3	08663-80007
U4	08663-80008
U5	08663-80009
U6	08663-80010
U7	1820-1197
U8	1820-1216
U9,16	1820-1207
U10-13	1818-0443
U14	1820-1202
U15	1820-1281
U17	1820-1917
U18,19	1820-2024
U20	1820-2076

NOTES

1. REFER TO TABLE 8-102 FOR S
DIAGRAM NOTES.
2. TROUBLESHOOTING VALUES ARE
THEY ARE ACTUAL MEASURED V
YOUR MEASUREMENTS MAY BE S
DIFFERENT THAN WHAT IS SHO
3. ADDRESS DATA IS TRANFERRED
TRUE FROM THE MICROPROCESS
ADDRESS BUS (A0-A15).
4. DATA IS TRANSFERRED POSITI
FROM ROM OR RAM MEMORY TO
MICROPROCESSOR ON THE DATA

INTEGRATED CIRCUIT
VOLTAGE AND
GROUND CONNECTIONS

REFERENCE DESIGNATIONS	PIN NUMBERS
U1-6	+5V - 21,24 ⏚ - 12
U8,15	+5V - 16 ⏚ - 8
U7,9,14,16	+5V - 14 ⏚ - 7
U10-13	+5V - 18 ⏚ - 9
U17-20	+5V - 20 ⏚ - 10

LOGIC	TTL	ECL	EECL
HIGH(1)	≥2V	≥+4.0V	≥+4.[illegible]
LOW(0)	≤0.8V	≤+3.5V	≤+4.[illegible]
≤= EQUAL TO OR MORE NEGATIV			
≥= EQUAL TO OR MORE POSITIV			
INPUT	TTL	ECL	EECL
GROUND	LOW(0)	HIGH(1)	HIGH(
OPEN	HIGH(1)	LOW(0)	LOW(0
GROUND = 0V; X= UNDEFINED			

REFERENCE DESIGNATIONS

A2A8	A2A11
C1-15 R1 U1-20	XA2A8

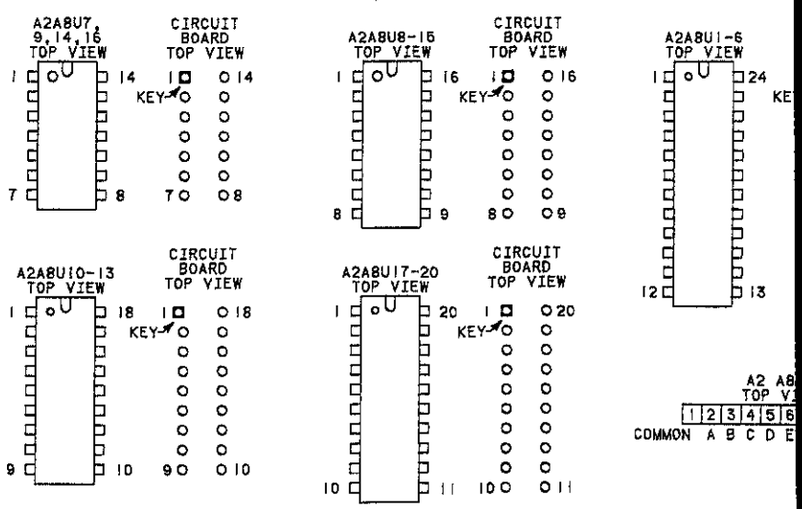


Fig 8-709a Sht 5 of 5

INTEGRATED CIRCUIT PART NUMBERS

REFERENCE DESIGNATIONS	PART NUMBERS
U1	08663-80005
U2	08663-80006
U3	08663-80007
U4	08663-80008
U5	08663-80009
U6	08663-80010
U7	1820-1197
U8	1820-1216
U9,16	1820-1207
U10-13	1818-0443
U14	1820-1202
U15	1820-1281
U17	1820-1917
U18,19	1820-2024
U20	1820-2075

NOTES

1. REFER TO TABLE 8-102 FOR SCHEMATIC DIAGRAM NOTES.
2. TROUBLESHOOTING VALUES ARE TYPICAL. THEY ARE ACTUAL MEASURED VALUES. YOUR MEASUREMENTS MAY BE SLIGHTLY DIFFERENT THAN WHAT IS SHOWN.
3. ADDRESS DATA IS TRANFERRED POSITIVE TRUE FROM THE MICROPROCESSOR ON THE ADDRESS BUS (AØ-A15).
4. DATA IS TRANSFERRED POSITIVE TRUE FROM ROM OR RAM MEMORY TO THE MICROPROCESSOR ON THE DATA BUS (DØ-D7).

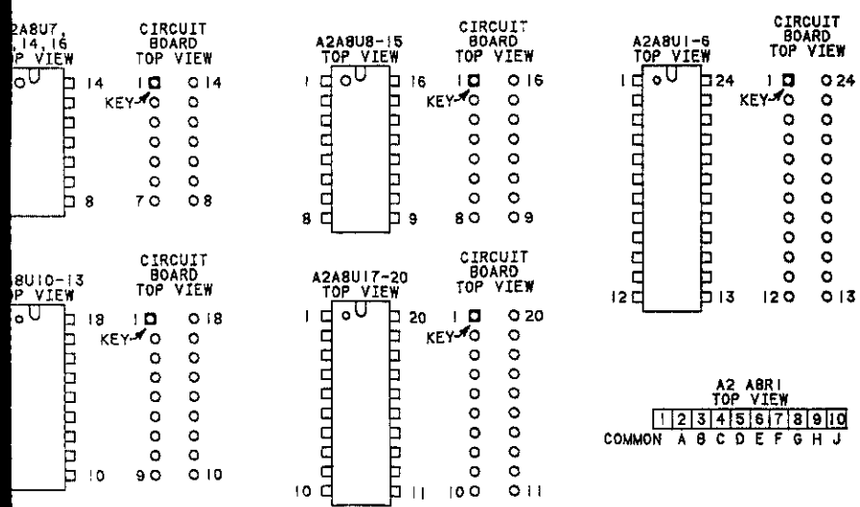
INTEGRATED CIRCUIT VOLTAGE AND GROUND CONNECTIONS

REFERENCE DESIGNATIONS	PIN NUMBERS
U1-6	+5V - 21,24 ▽ - 12
U8,16	+5V - 16 ▽ - 8
U7,9,14, 16	+5V - 14 ▽ - 7
U10-13	+5V - 18 ▽ - 9
U17-20	+5V - 20 ▽ - 10

LOGIC	TTL	ECL	EECL	CMOS
HIGH(1)	≥2V	≥+4.0V	≥+4.9V	≂VDD
LOW(0)	≤0.8V	≤+3.5V	≤+4.4V	≤0.1V
≤= EQUAL TO OR MORE NEGATIVE THAN				
≥= EQUAL TO OR MORE POSITIVE THAN				
INPUT	TTL	ECL	EECL	CMOS
GROUND	LOW(0)	HIGH(1)	HIGH(1)	LOW(0)
OPEN	HIGH(1)	LOW(0)	LOW(0)	X
GROUND = 0V; X= UNDEFINED				

REFERENCE DESIGNATIONS

A2A8	A2A11
C1-15 R1 U1-20	XA2A8



SERVICE SHEET A2A8 48

Figure 8-709. A2A8 RAM/ROM Schematic

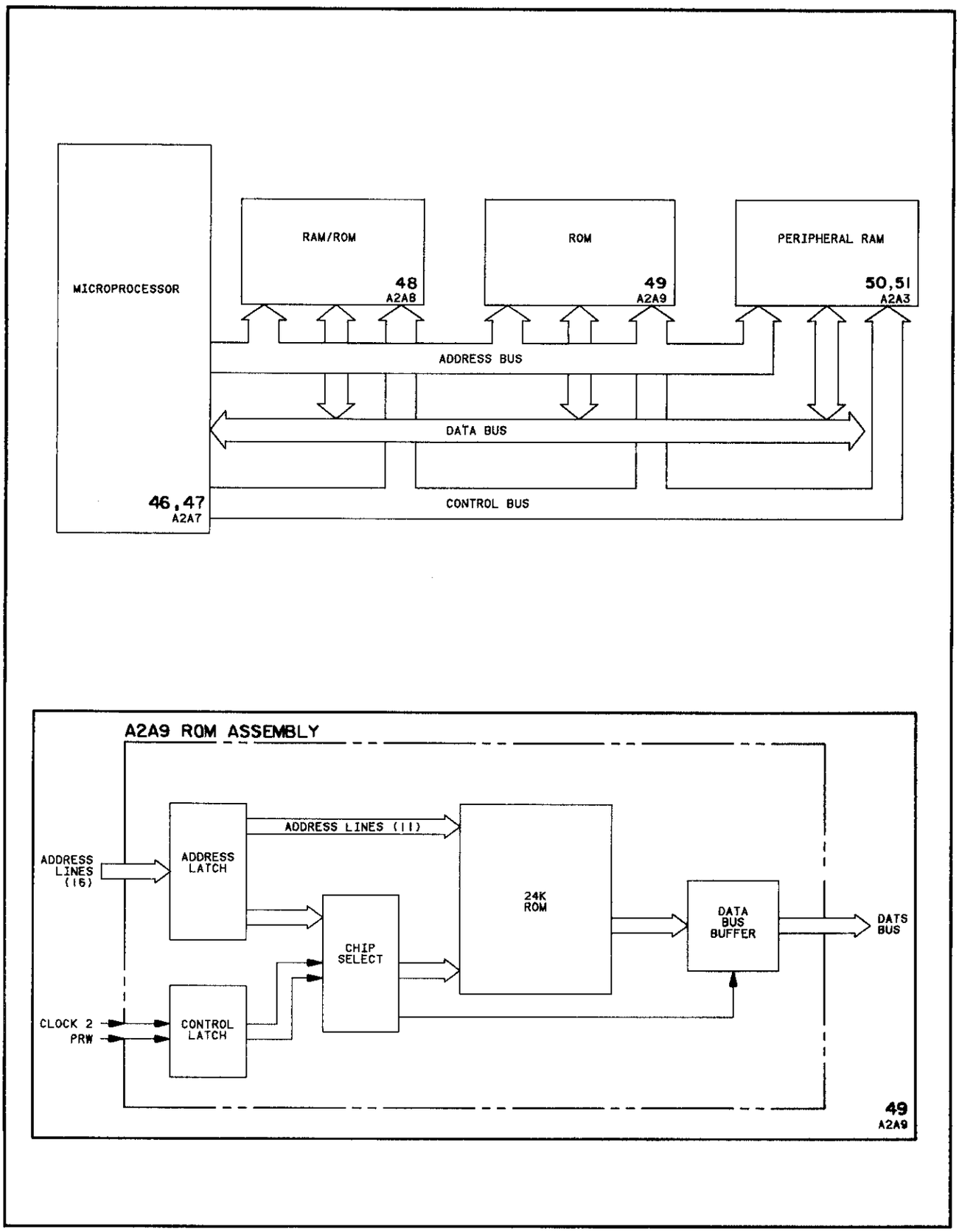


Figure 8-710. A2A9 ROM Block Diagrams

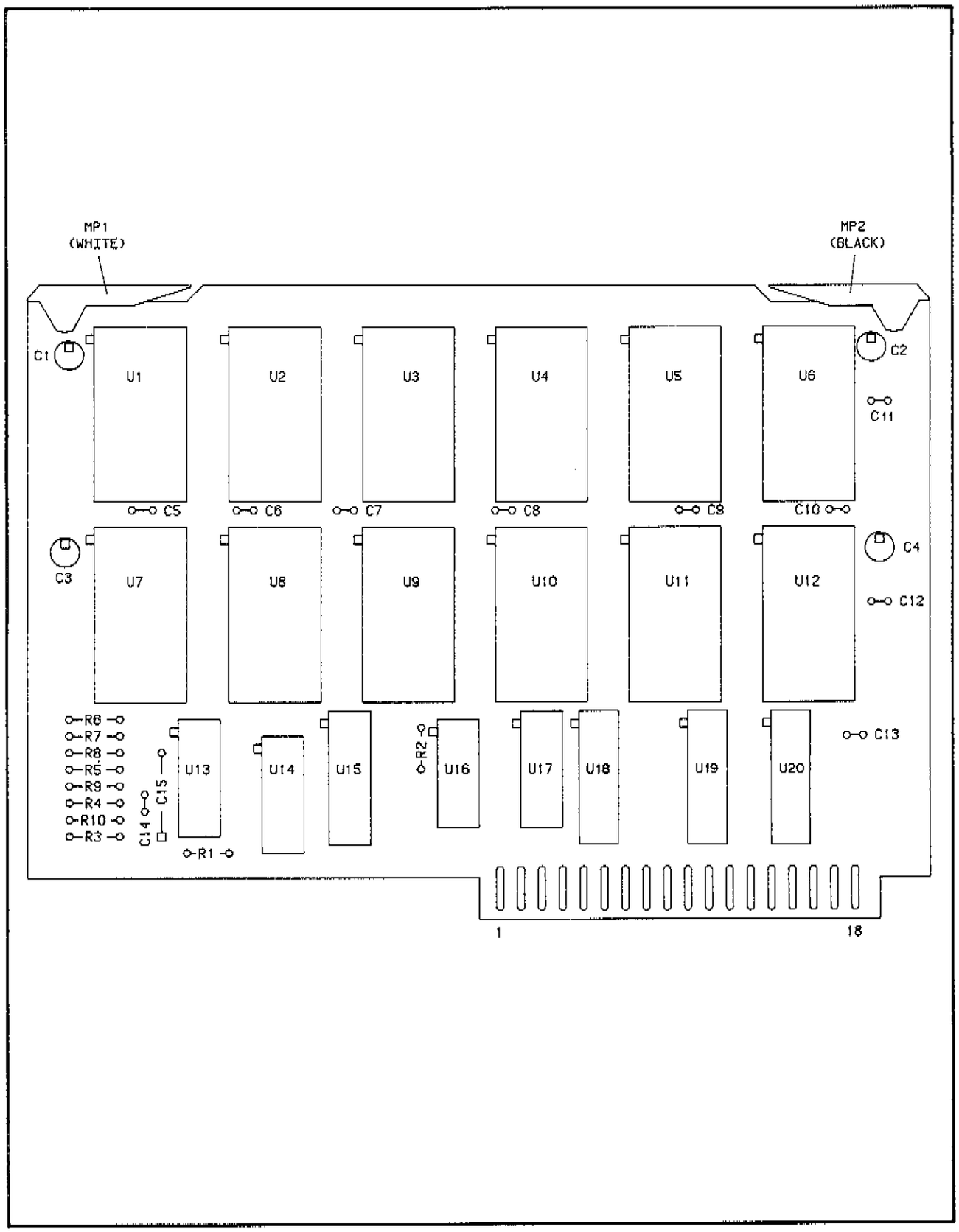
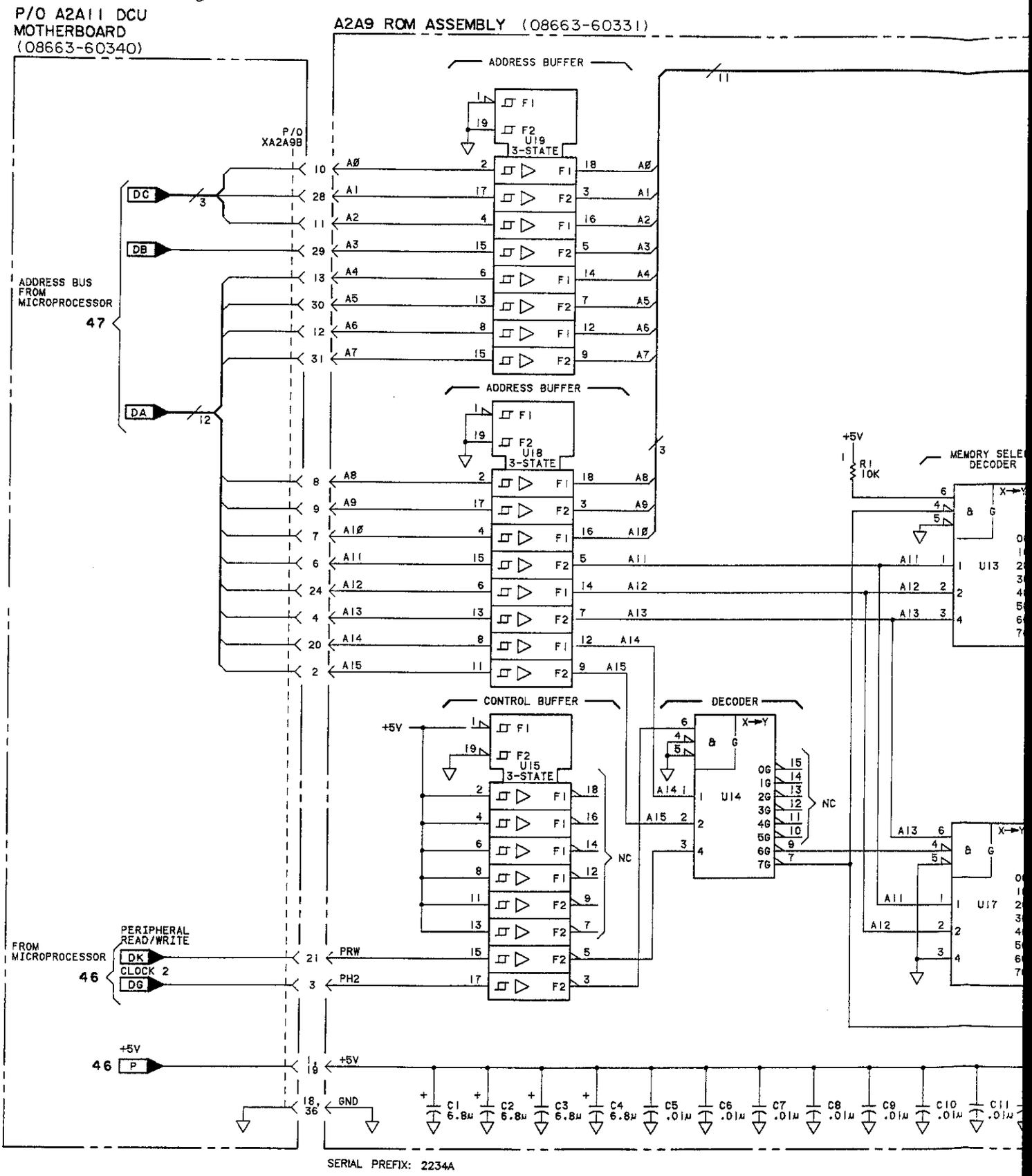


Figure 8-711. A2A9 ROM Component Locator

Fig 8-712 Sht 1 of 5



SERIAL PREFIX: 2234A

Fig 8-712
Sht 2 of 5

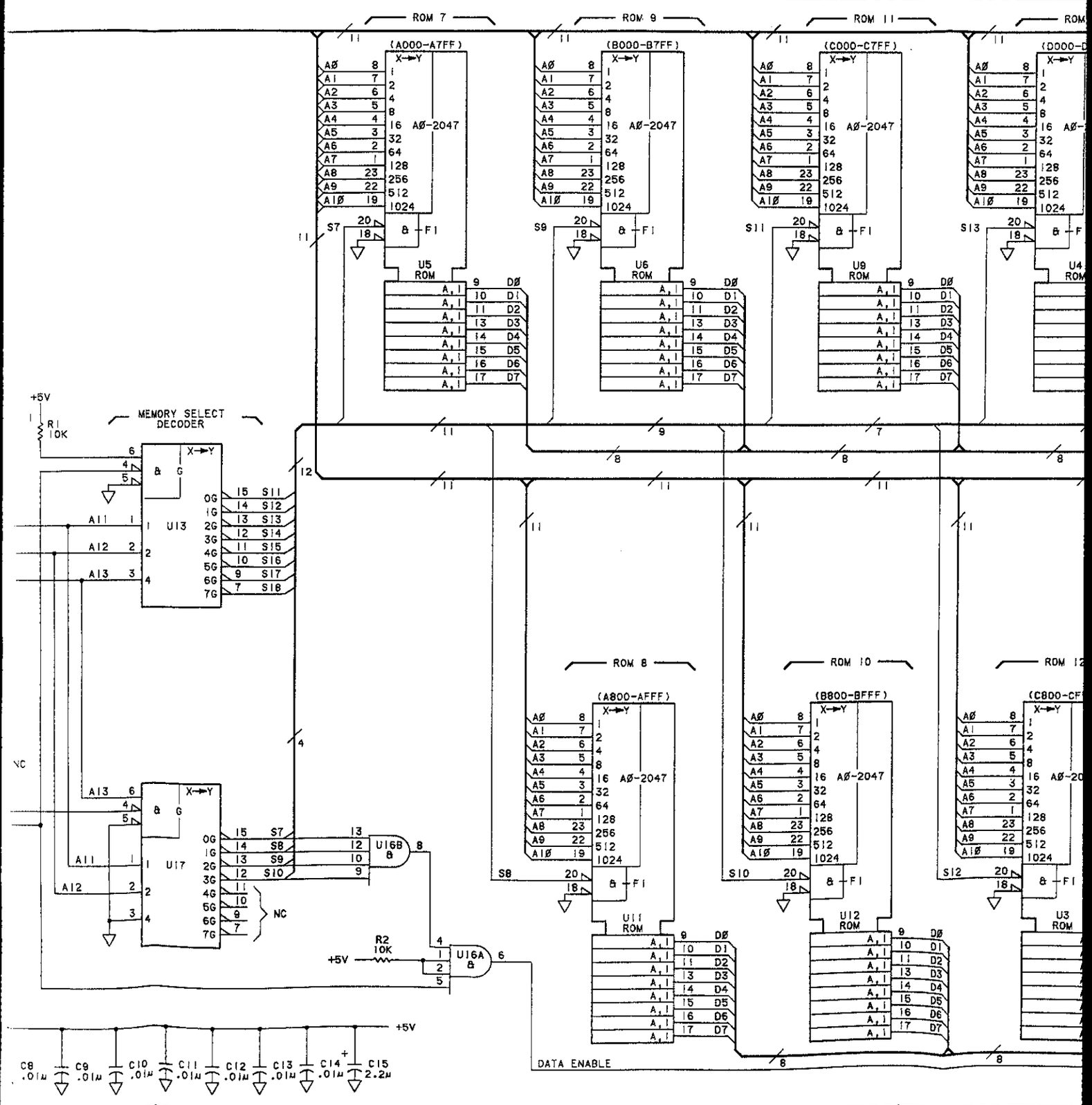


Fig 8-712
Sht 3 of 5

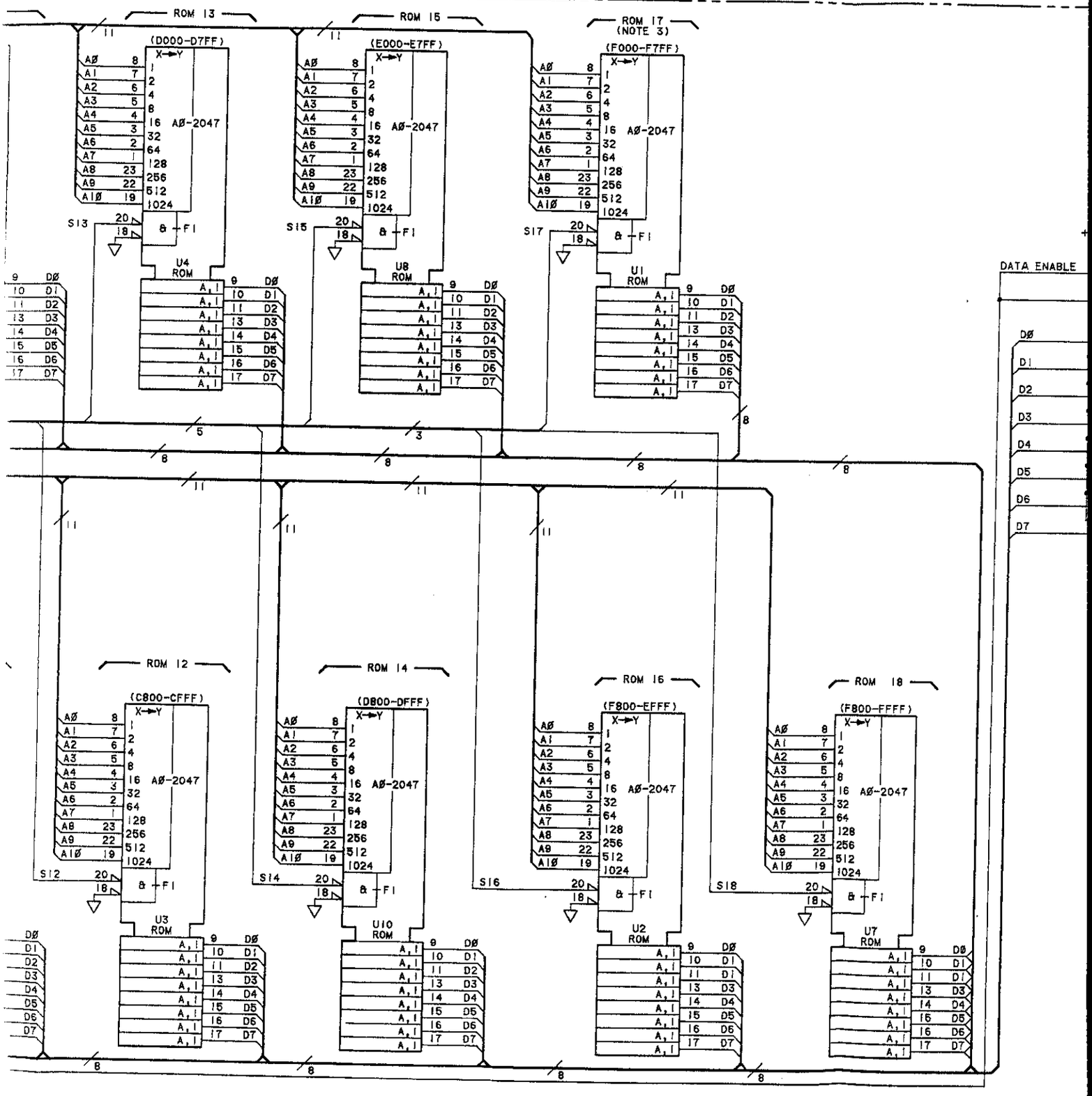
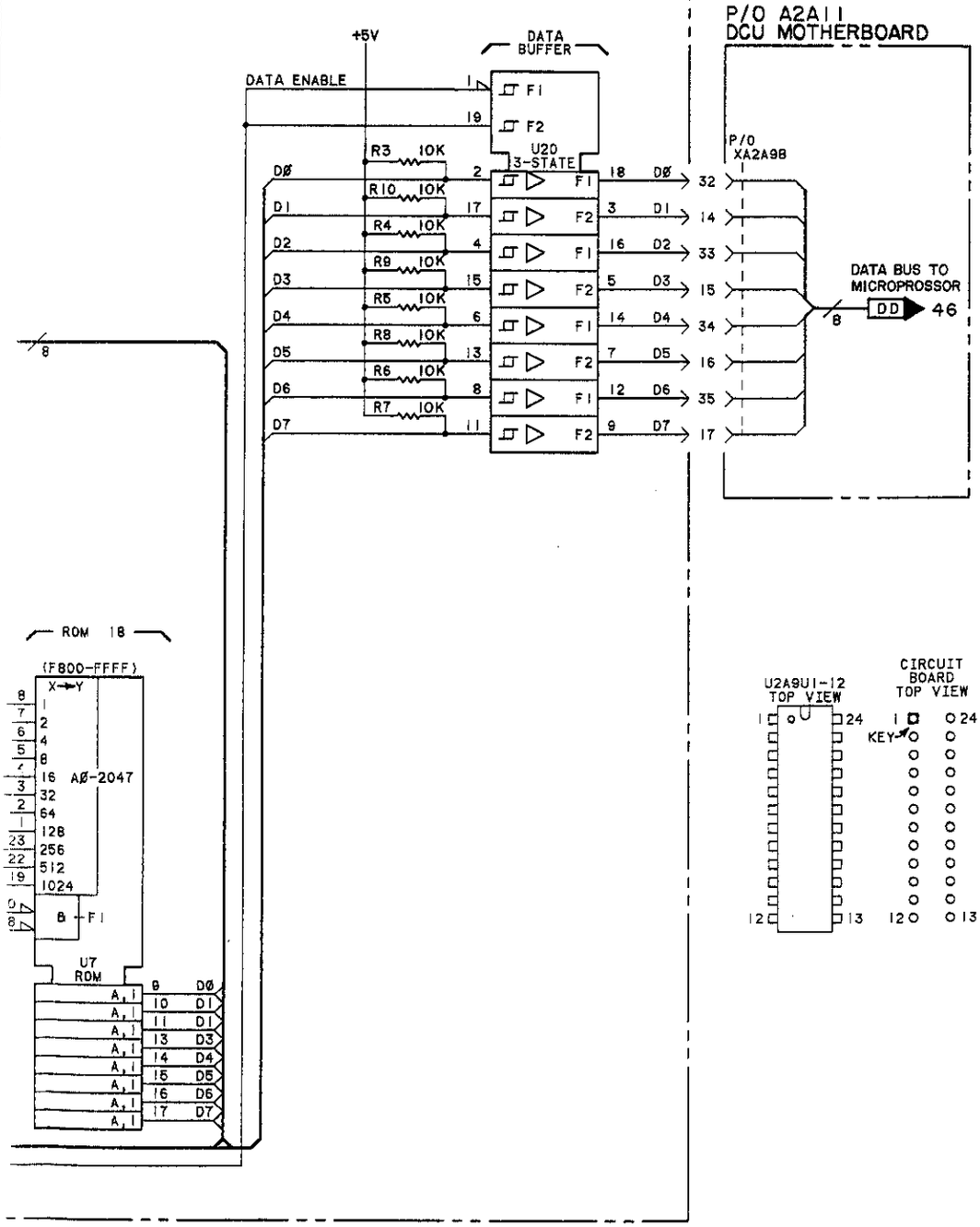


Fig 8-712
Sht 4 of 5

NOTES

1. REFER TO TABLE 8-102 FOR SCHEMATIC DIAGRAM NOTES.
2. TROUBLESHOOTING VALUES ARE TYPICAL. THEY ARE ACTUAL MEASURED VALUES. YOUR MEASUREMENTS MAY BE SLIGHTLY DIFFERENT THAN WHAT IS SHOWN.
3. U1 (ROM 7) IS NOT CURRENTLY SUPPLIED. THE CORRESPONDING SOCKET IS RESERVED FOR FUTURE USE.



REFERENCE DESIGNATIONS

A2A9	A2A11
C1-15 R1-10 U1-20	XA2A9

LOGIC LEVELS

	TTL
HIGH	>+2V
LOW	<+0.8V
< IS MORE NEG.THAN > IS MORE POS.THAN	
OPEN	HIGH
GROUND	LOW

INTEGRATED CIRCUIT PART NUMBERS

REFERENCE DESIGNATIONS	PART NUMBERS
U1-12	1818-0851
U13,14,17	5081-2483
U15,18,19,20	1820-2024
U16	1820-1205

INTEGRA
VOL
GROUND

REFERENCE DESIGNATIO
U1-12
U13,14,17
U15,18,19,20
U16

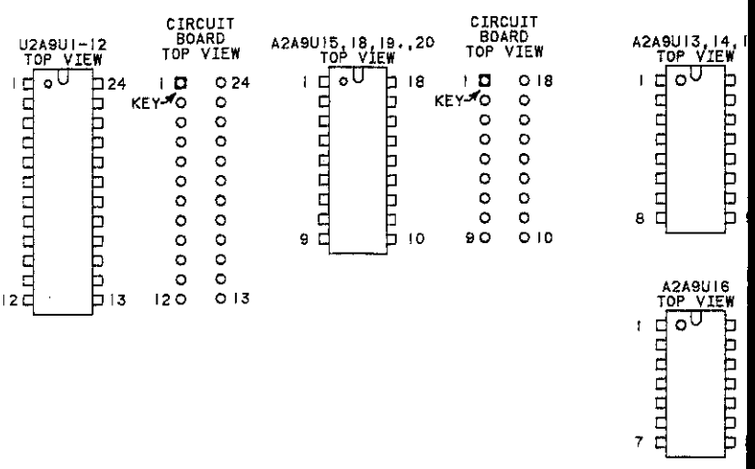
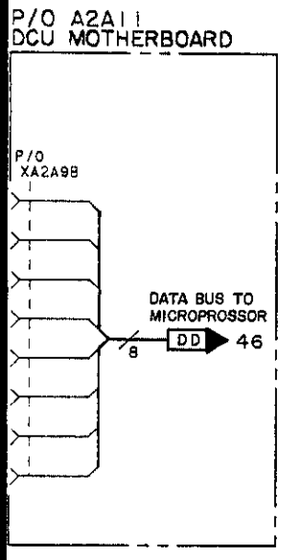


Fig 8-712
Sht 5 of 5

NOTES

1. REFER TO TABLE 8-102 FOR SCHEMATIC DIAGRAM NOTES.
2. TROUBLESHOOTING VALUES ARE TYPICAL. THEY ARE ACTUAL MEASURED VALUES. YOUR MEASUREMENTS MAY BE SLIGHTLY DIFFERENT THAN WHAT IS SHOWN.
3. U1 (ROM 7) IS NOT CURRENTLY SUPPLIED. THE CORRESPONDING SOCKET IS RESERVED FOR FUTURE USE.



REFERENCE DESIGNATIONS

A2A9	A2A11
C1-15 R1-10 U1-20	XA2A9

LOGIC LEVELS

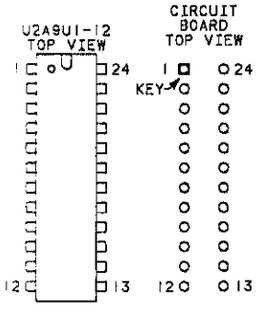
	TTL
HIGH	>+2V
LOW	<+0.8V
< IS MORE NEG. THAN > IS MORE POS. THAN	
OPEN	HIGH
GROUND	LOW

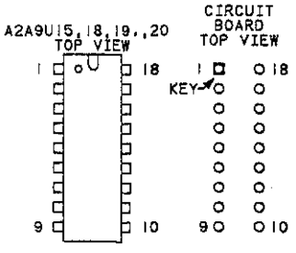
INTEGRATED CIRCUIT PART NUMBERS

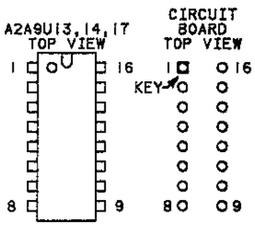
REFERENCE DESIGNATIONS	PART NUMBERS
U1-12	1818-0851
U13,14,17	5081-2483
U15,18,19,20	1820-2024
U16	1820-1205

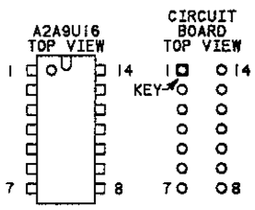
INTEGRATED CIRCUIT VOLTAGE AND GROUND CONNECTIONS

REFERENCE DESIGNATIONS	PIN NUMBERS
U1-12	+5V - 24 ⏚ - 12
U13,14,17	+5V - 16 ⏚ - 8
U15,18,19,20	+5V - 20 ⏚ - 10
U16	+5V - 14 ⏚ - 7









SERVICE SHEET A2A9 49

Figure 8-712. A2A9 ROM Schematic

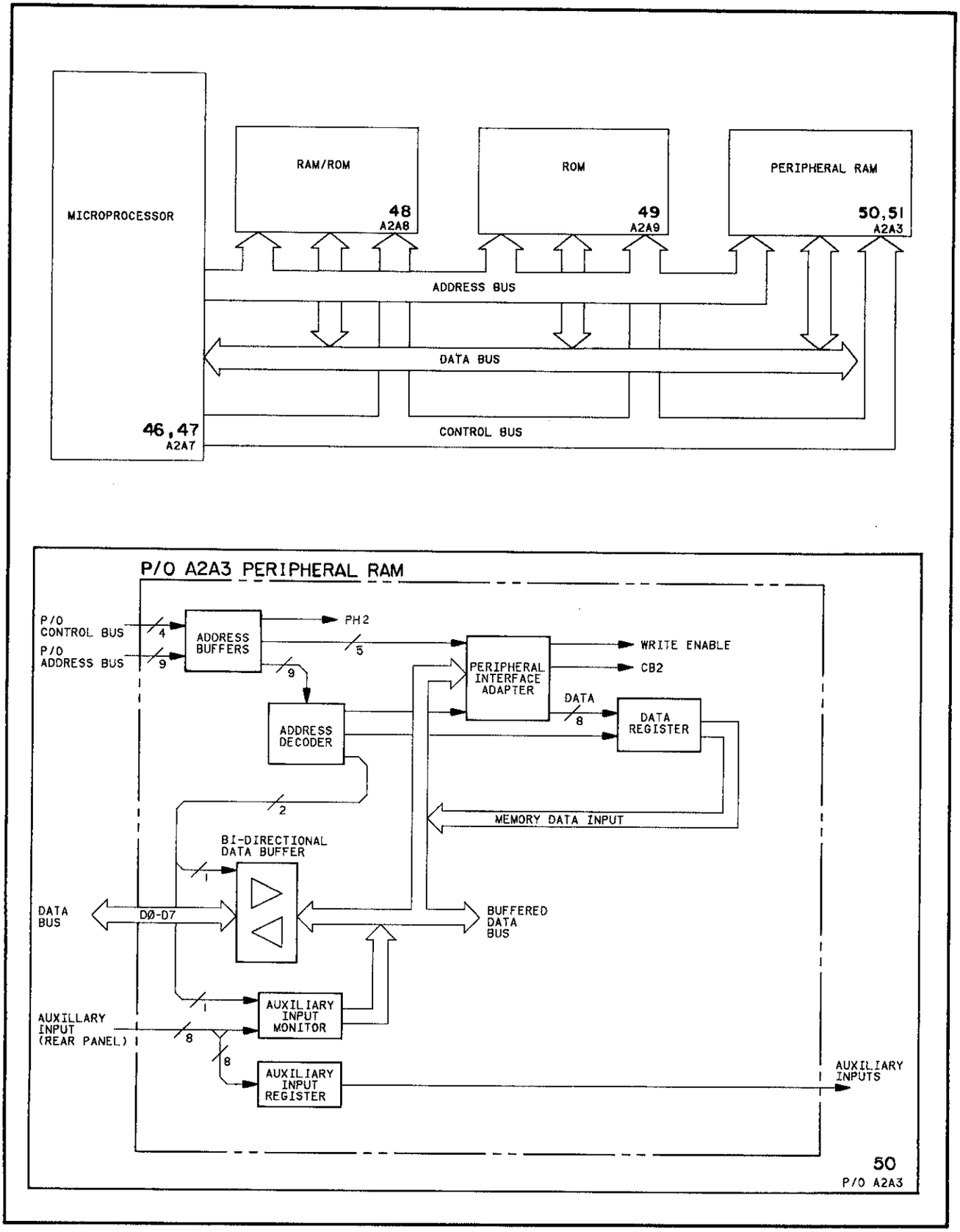


Figure 8-713. P/O A2A3 Peripheral RAM Block Diagrams

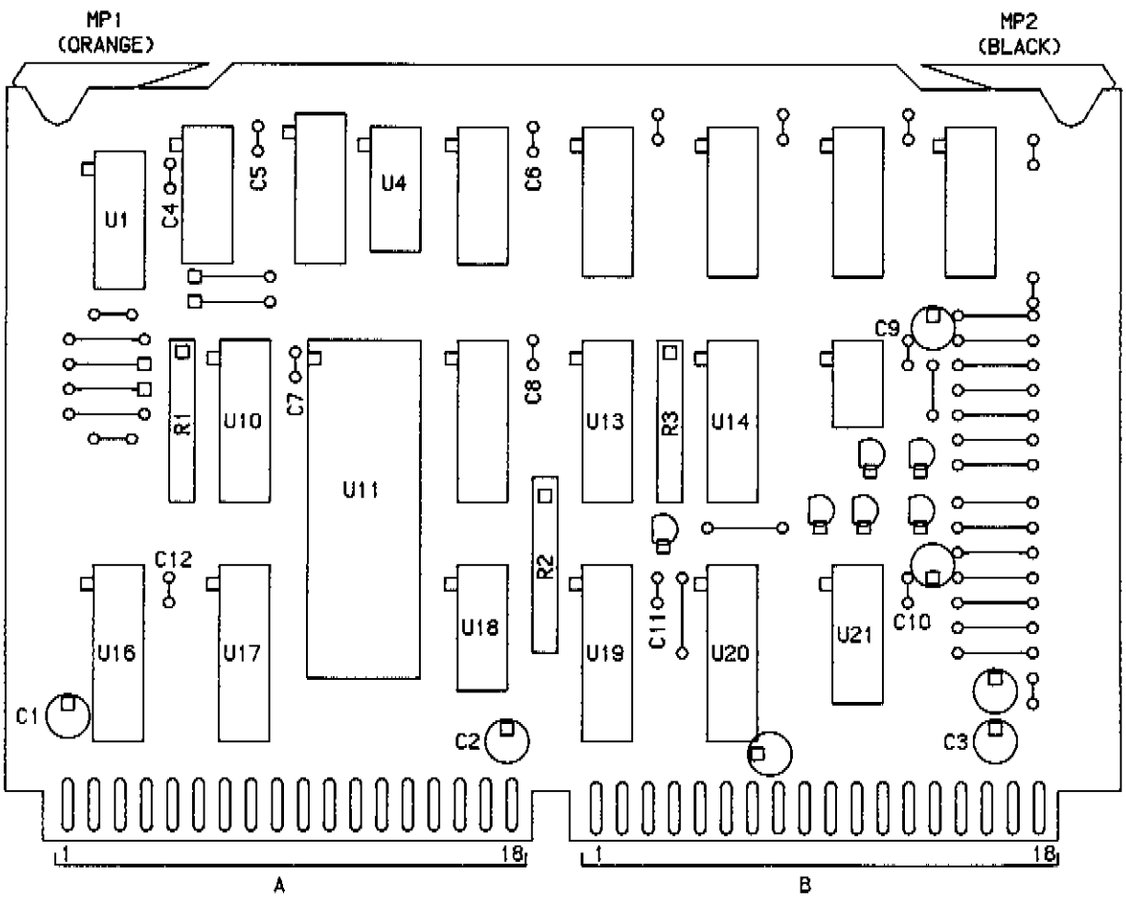
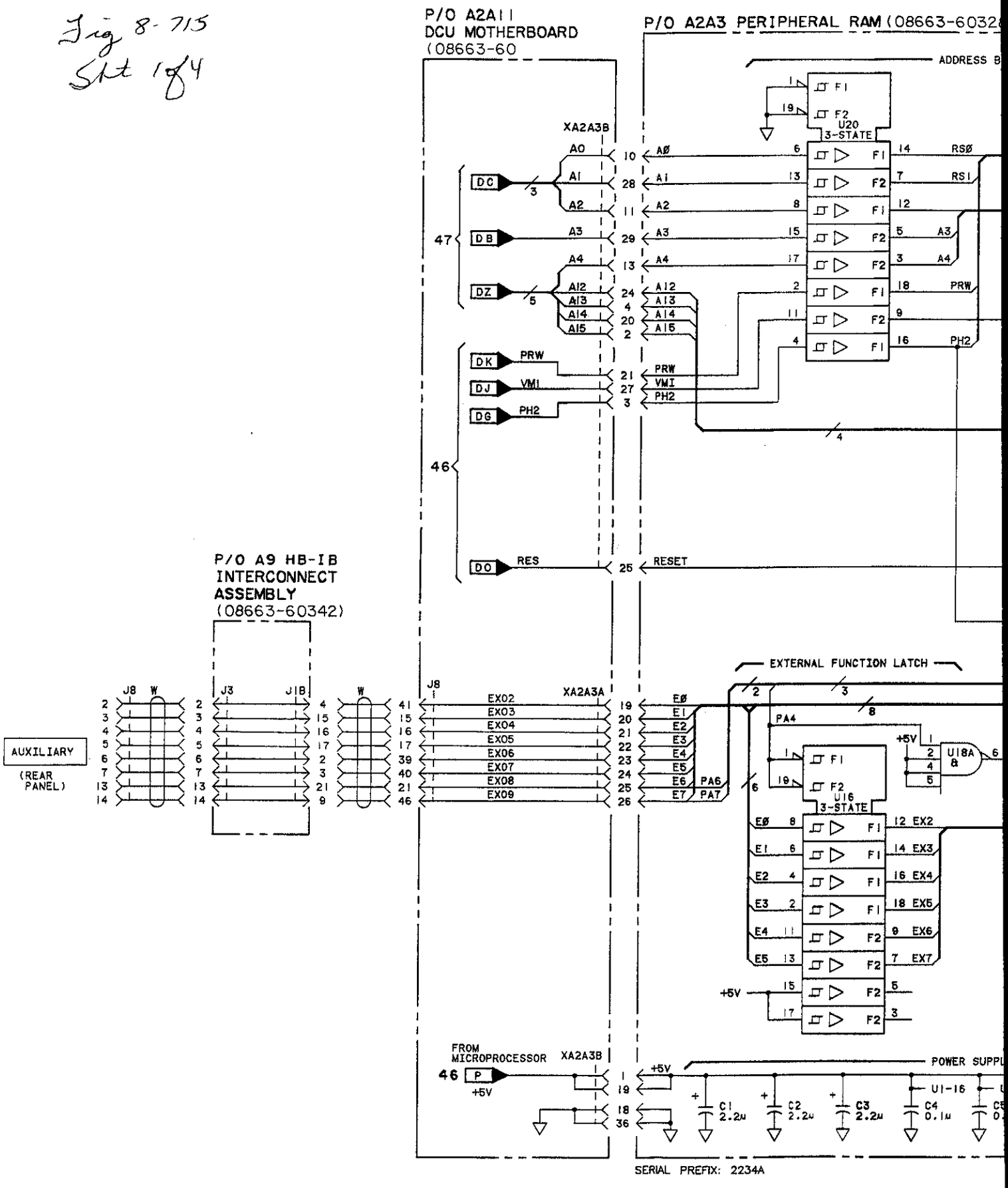


Figure 8-714. P/O A2A3 Peripheral RAM Component Locator

Fig 8-715
Sht 1 of 4



(08663-60328) Fig 8-715 Sht 2 of 4

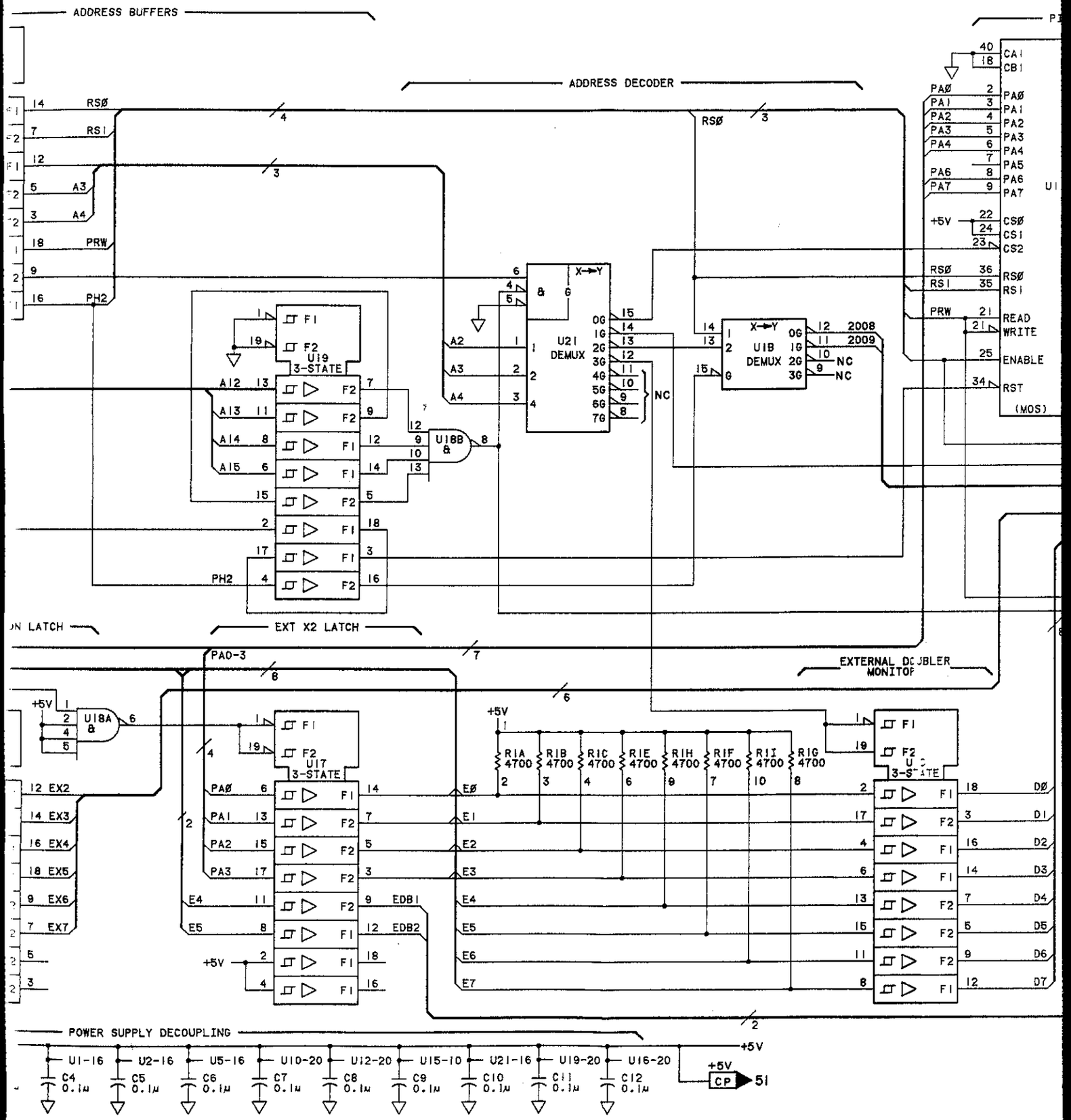


Fig 8-715 Sht 3 of 4

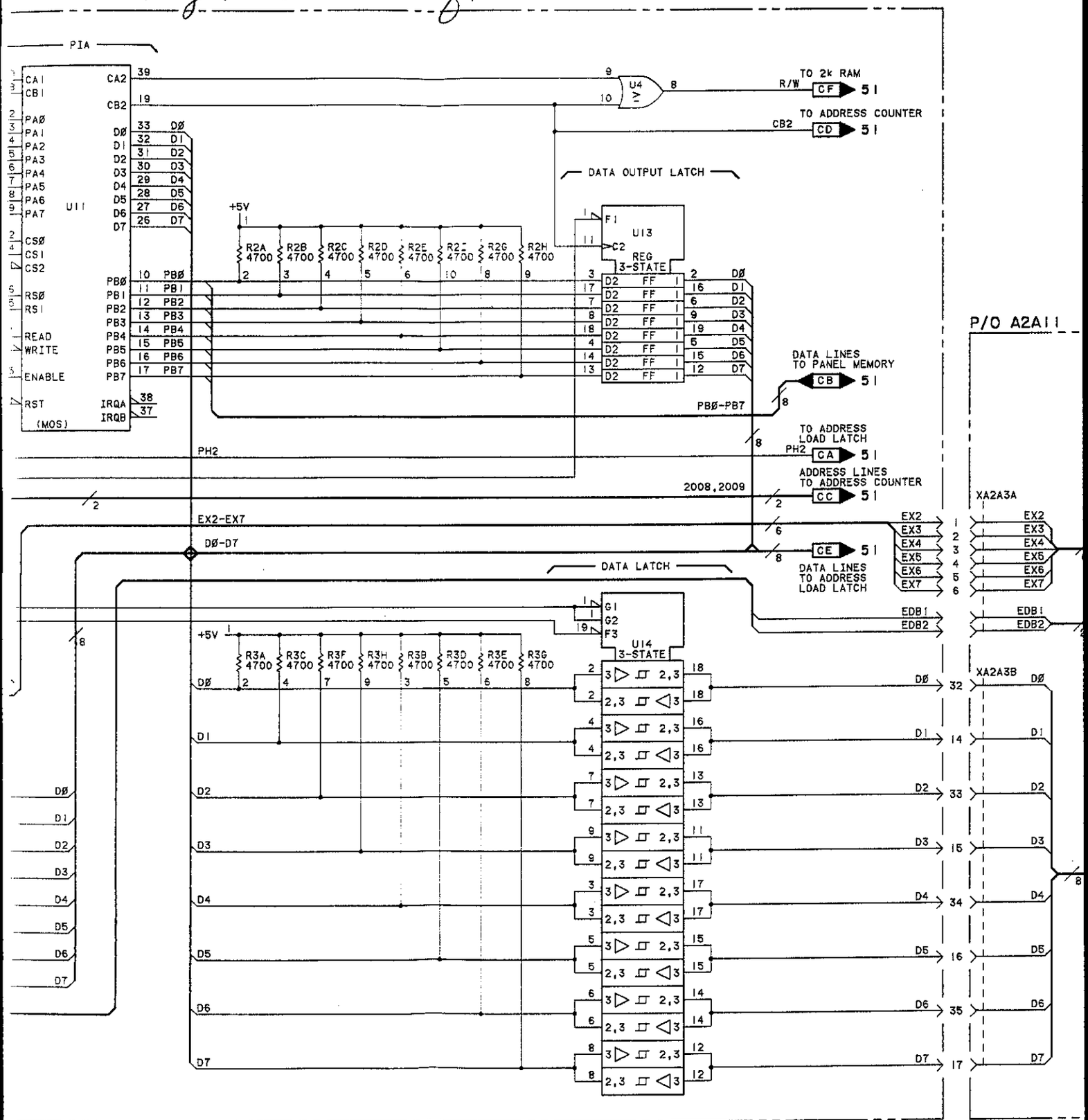
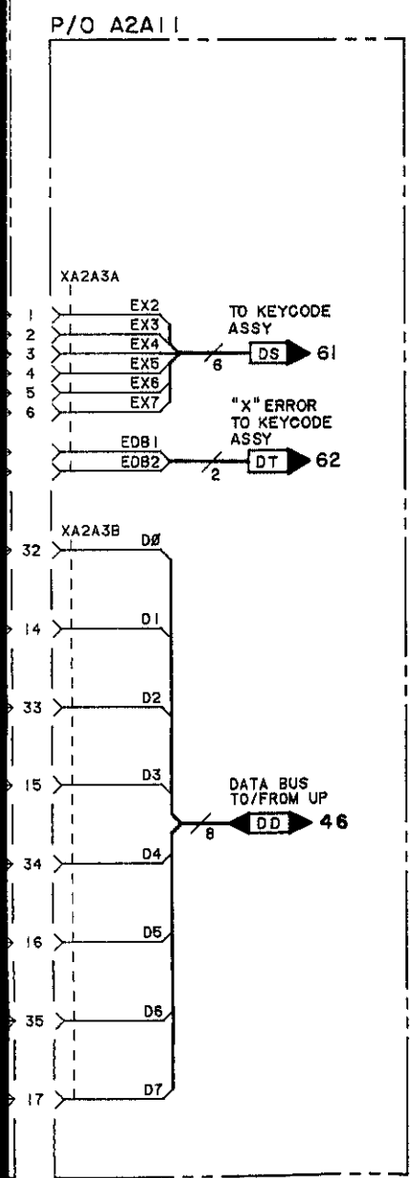


Fig 8-715
sht 4084



SERVICE SHEET 50

P/O A2A3

Figure 8-715. P/O A2A3 Peripheral RAM Schematic

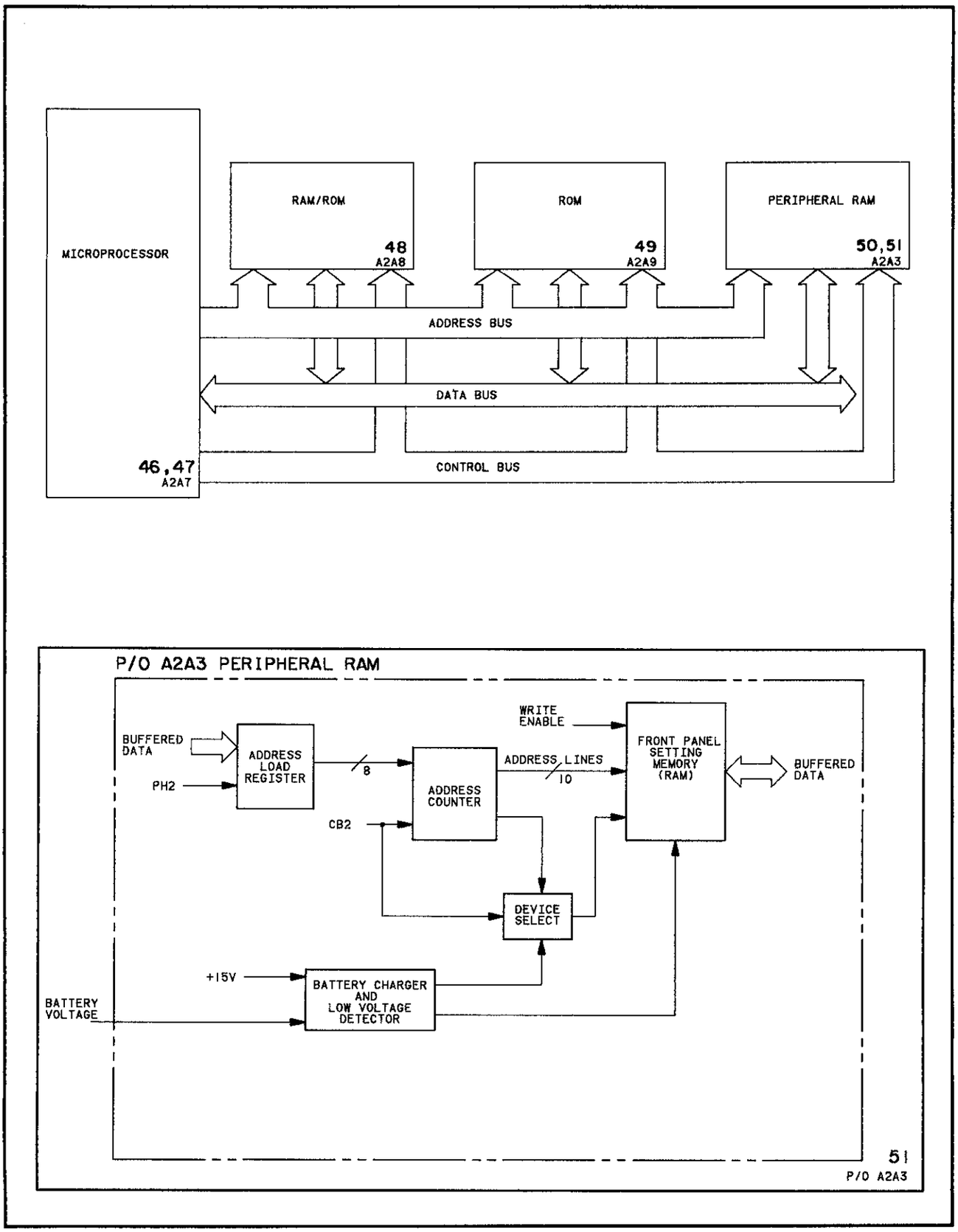


Figure 8-716. P/O A2A3 Peripheral RAM Block Diagrams

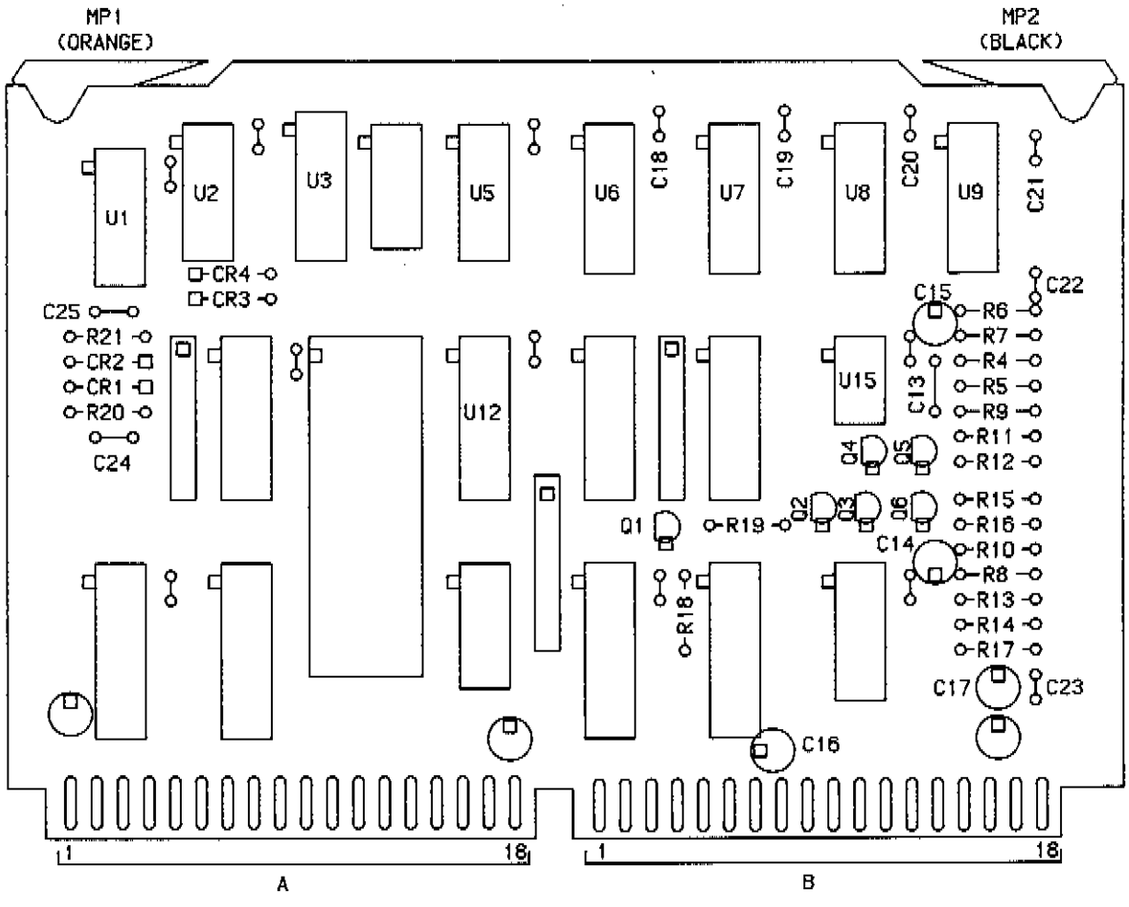


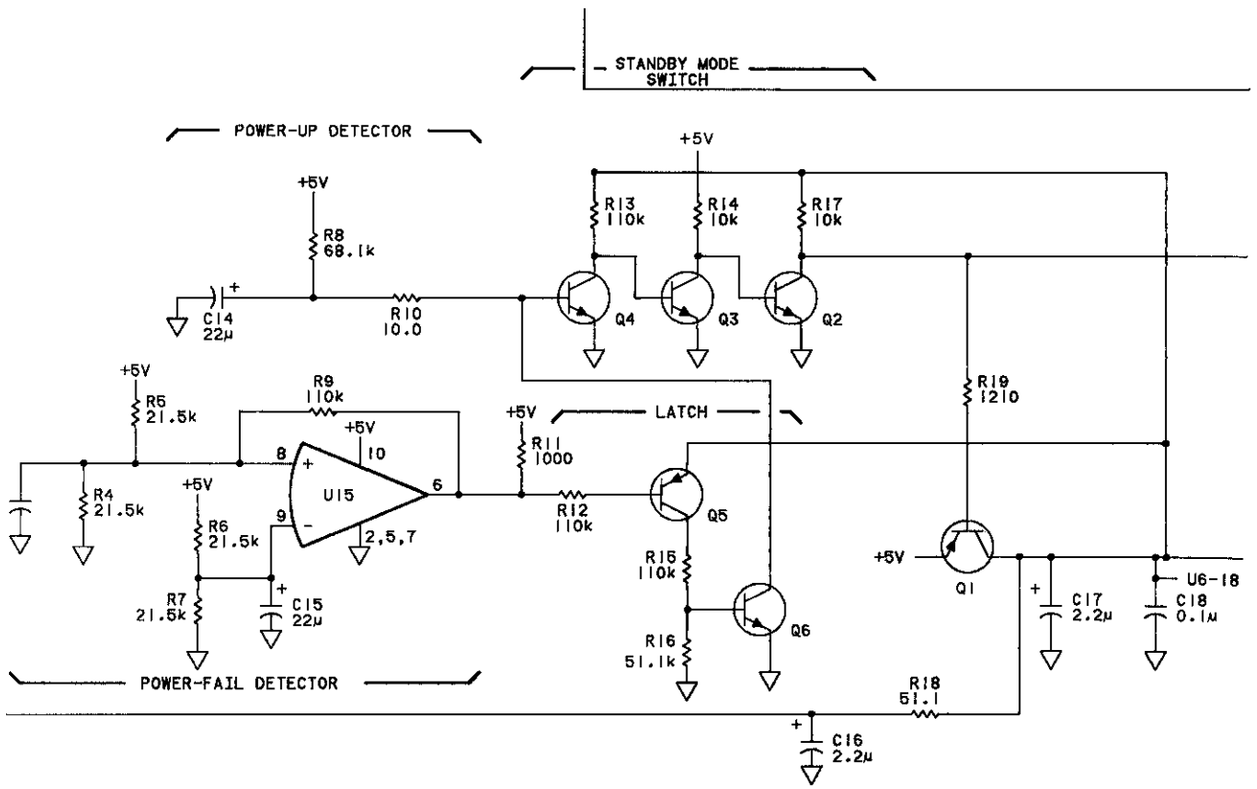
Figure 8-717. P/O A2A3 Peripheral RAM Component Locator

CHANGES

All serial prefixes

On the A2A3 schematic:

- A2A3 - Modify the schematic as shown in the partial schematic "P/O Figure 8-718. Peripheral RAM Schematic" on page 8-722.3.



P/O Figure 8–718. *Peripheral RAM Schematic*

Fig 8-718
Sht 1 of 3

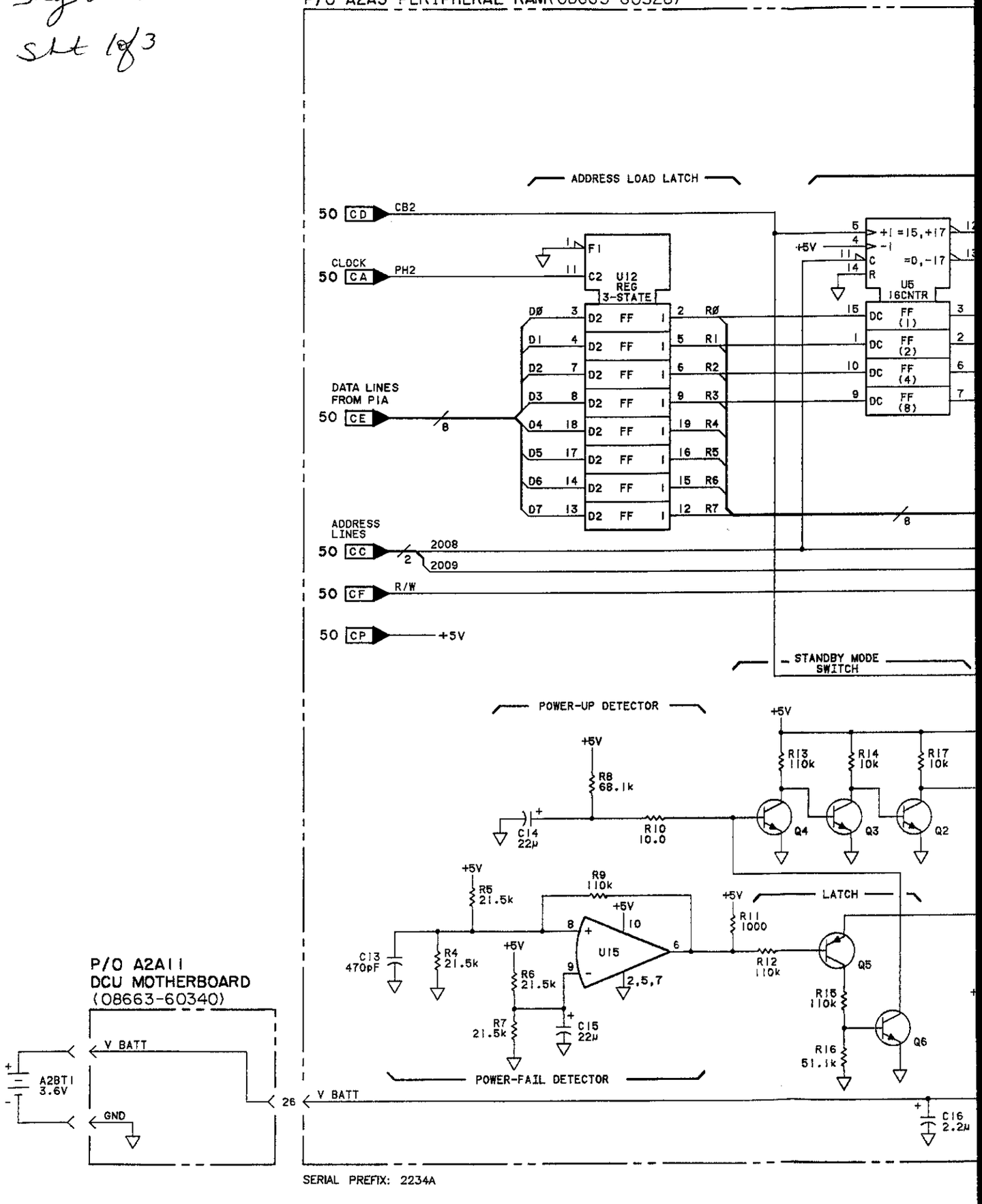


Fig 8-718 Sht 2 of 3

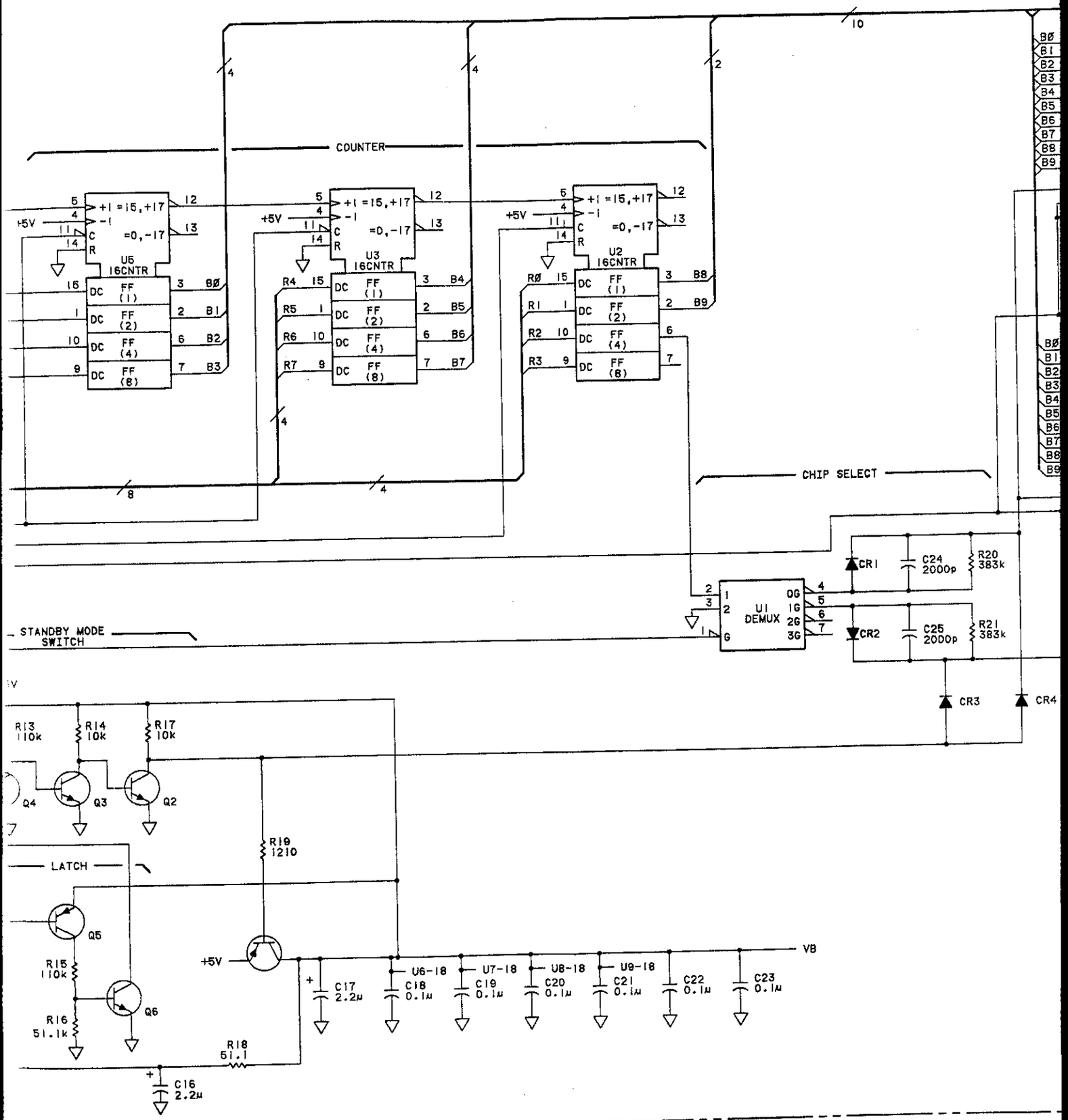
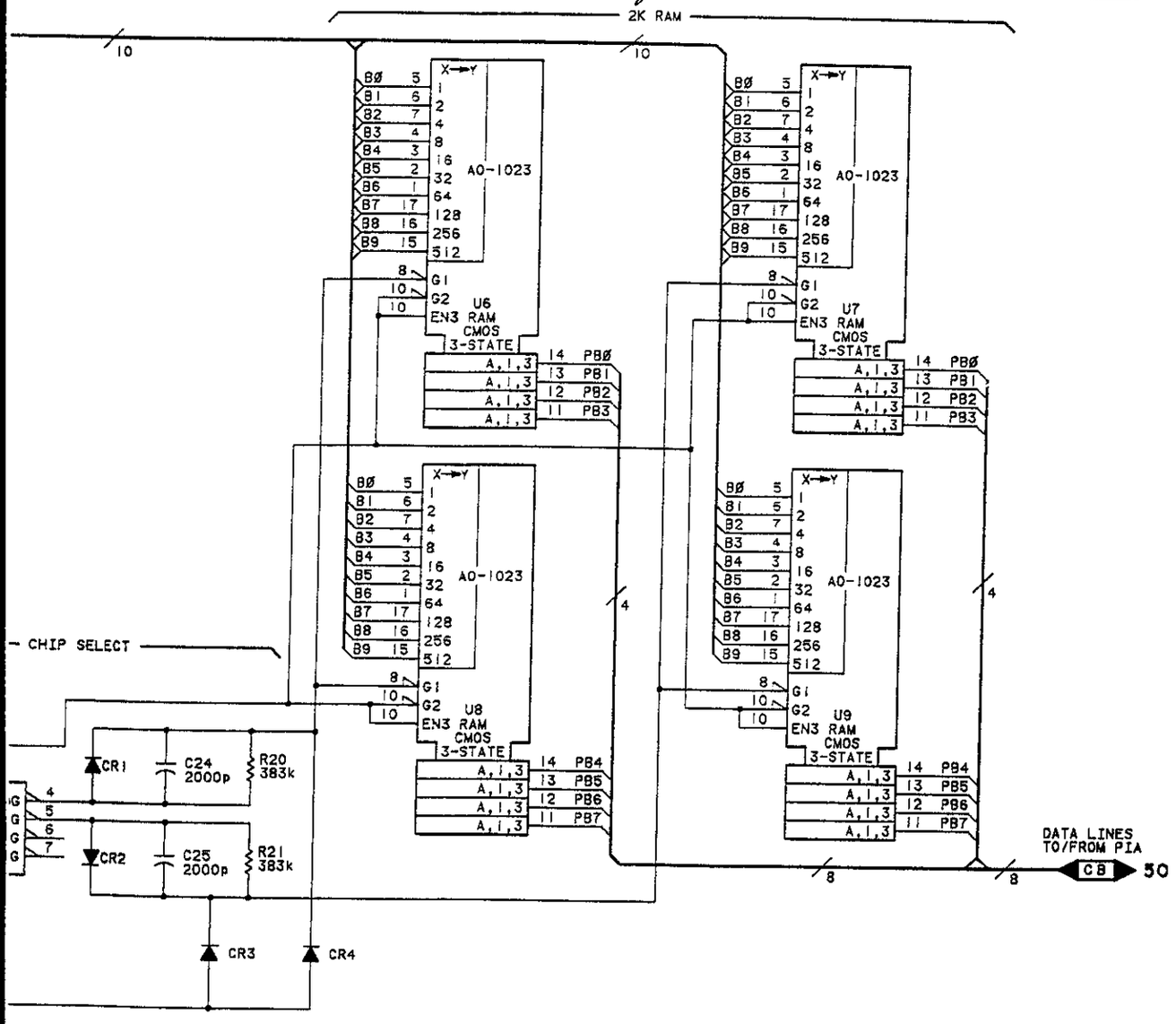


Fig 8-718 Sht 3 of 3



SERVICE SHEET 51

P/O A2A3

Figure 8-718. P/O A2A3 Peripheral RAM Schematic

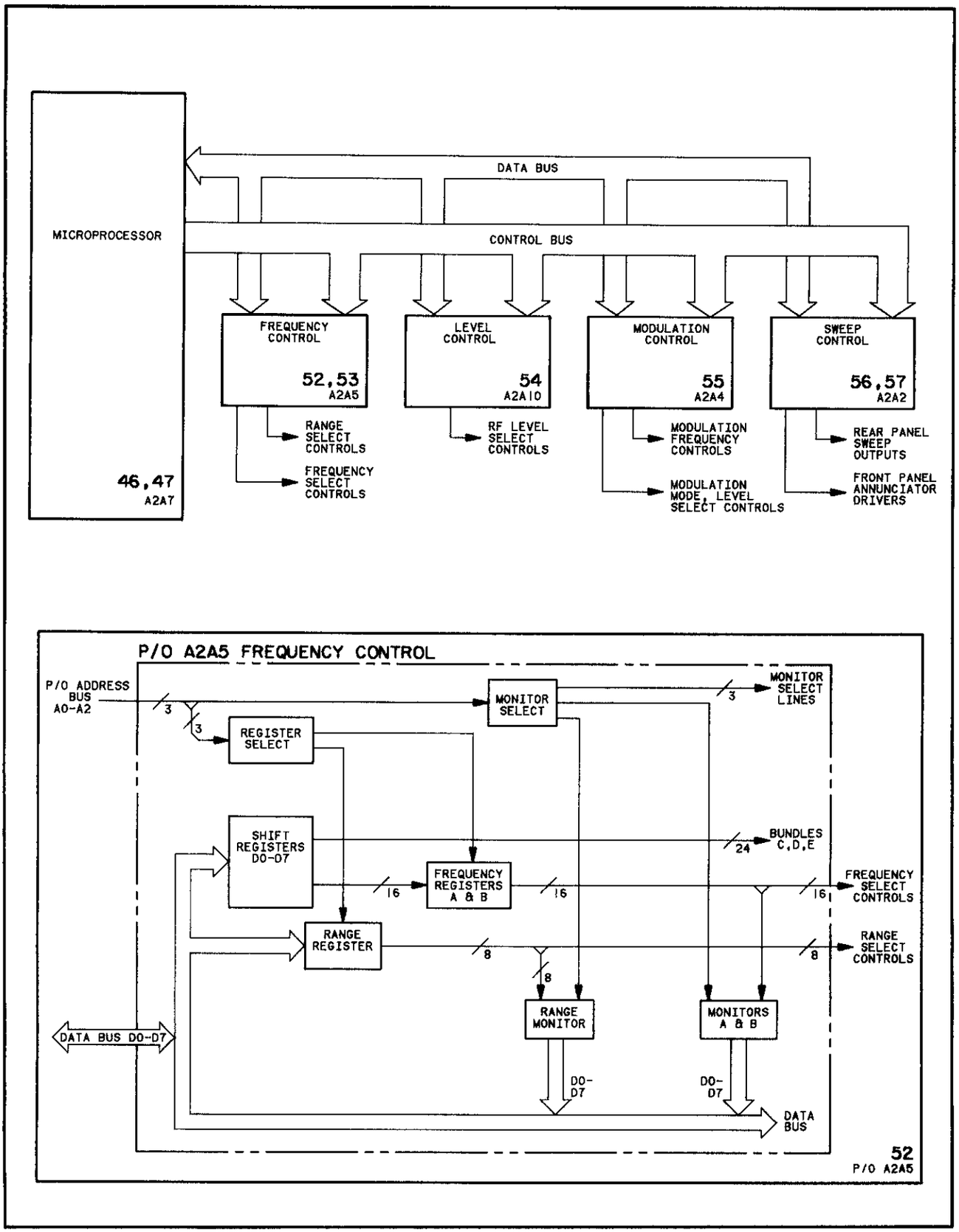


Figure 8-719. P/O A2A5 Frequency Control Assembly Block Diagrams

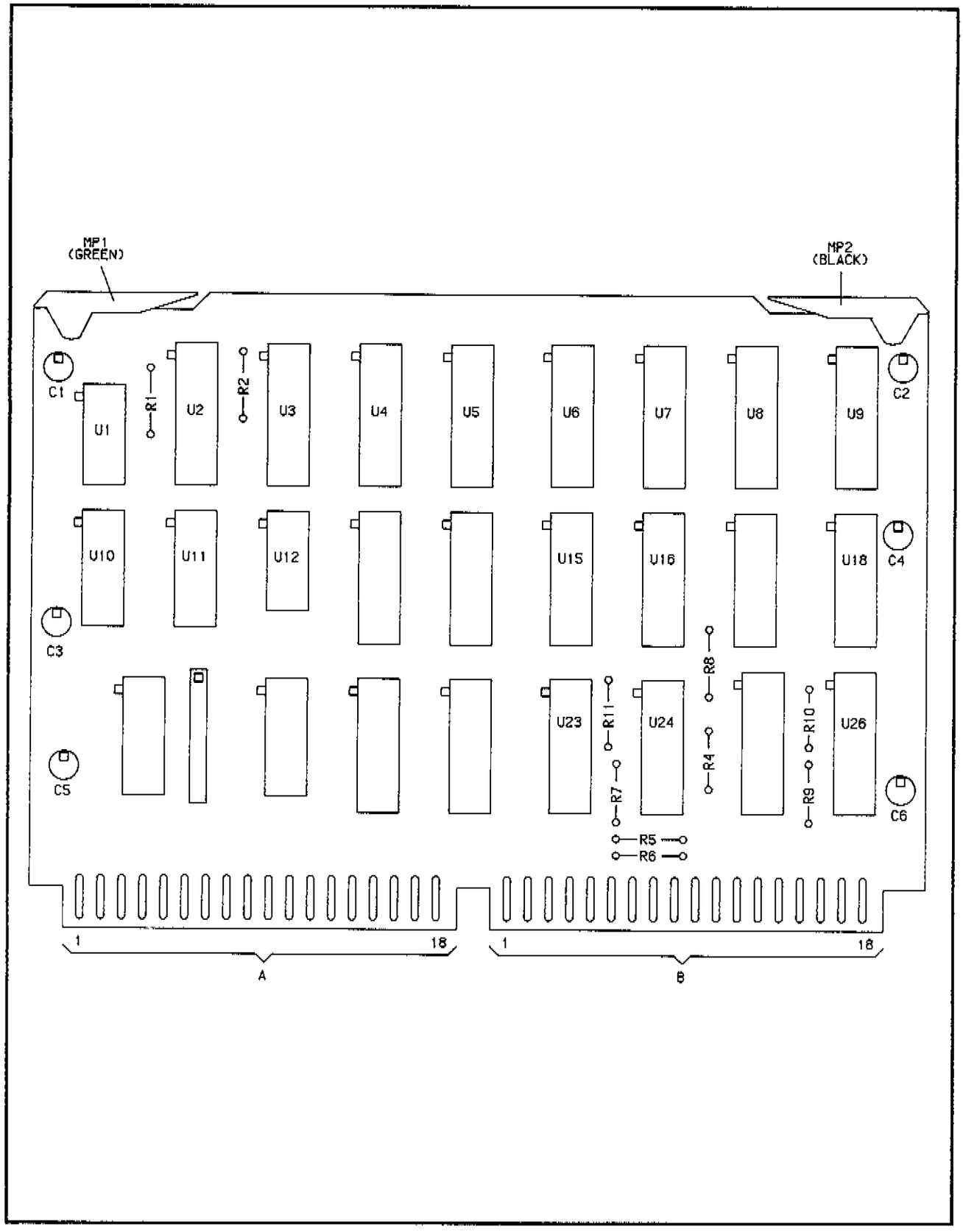
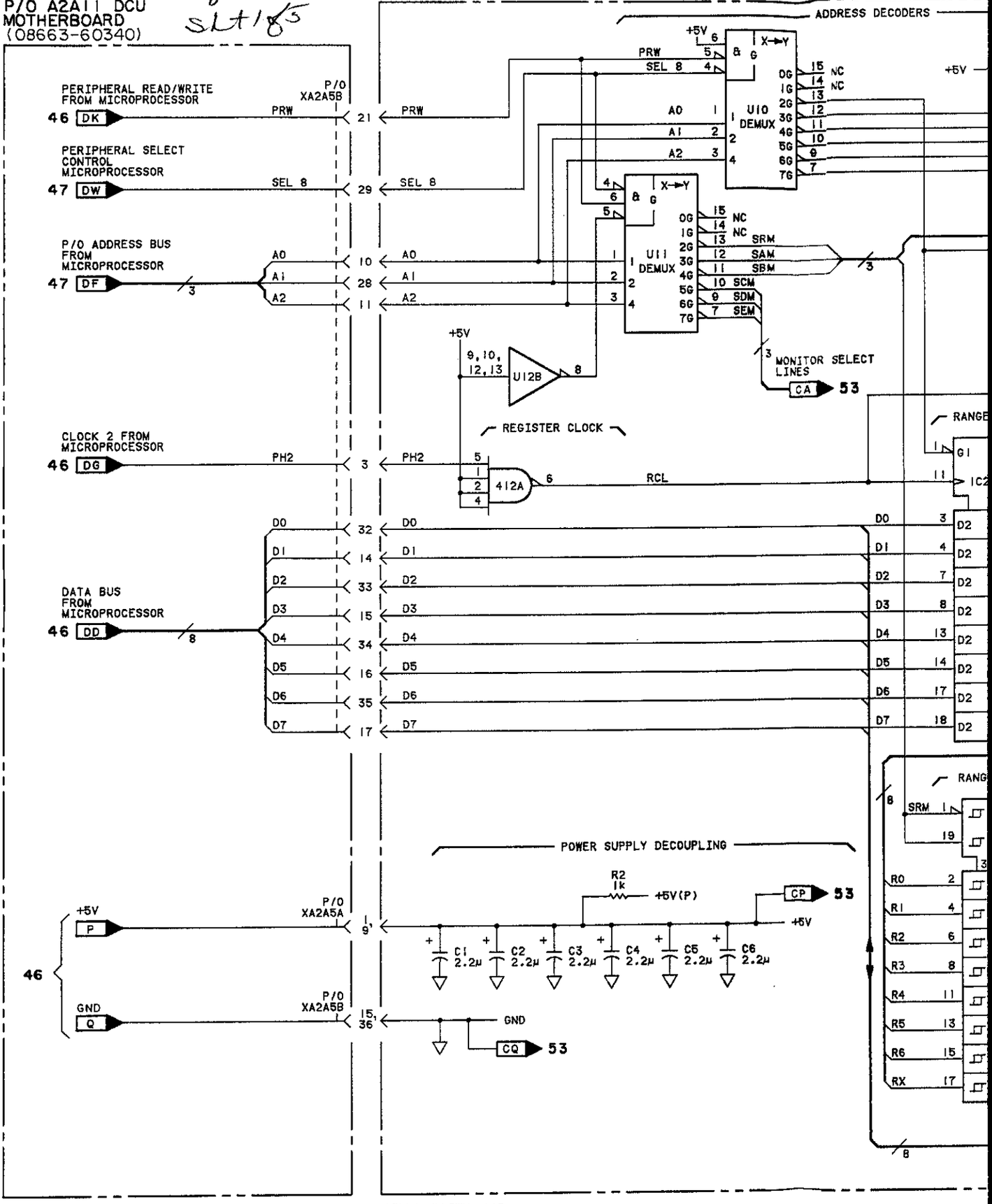


Figure 8-720. P/O A2A5 Frequency Control Assembly Component Locator

Fig 8-721
SLT 185

P/O A2A11 DCU MOTHERBOARD (08663-60340)

P/O A2A5 FREQUENCY CONTROL (08663-60341)



SERIAL PREFIX: 2234A

Fig 8-721 Sht 2 of 5

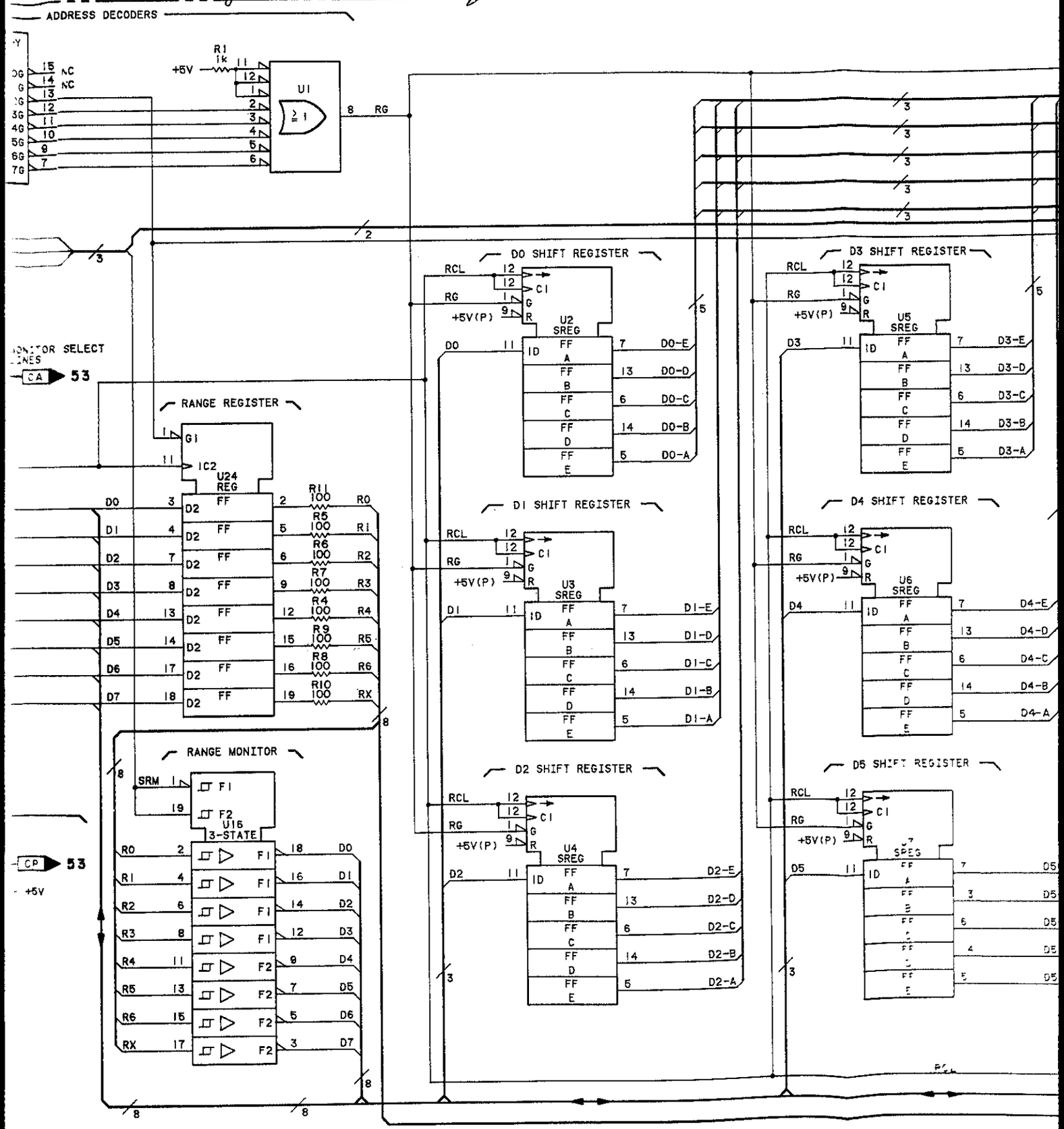


Fig 8-721 Sht 3 of 5

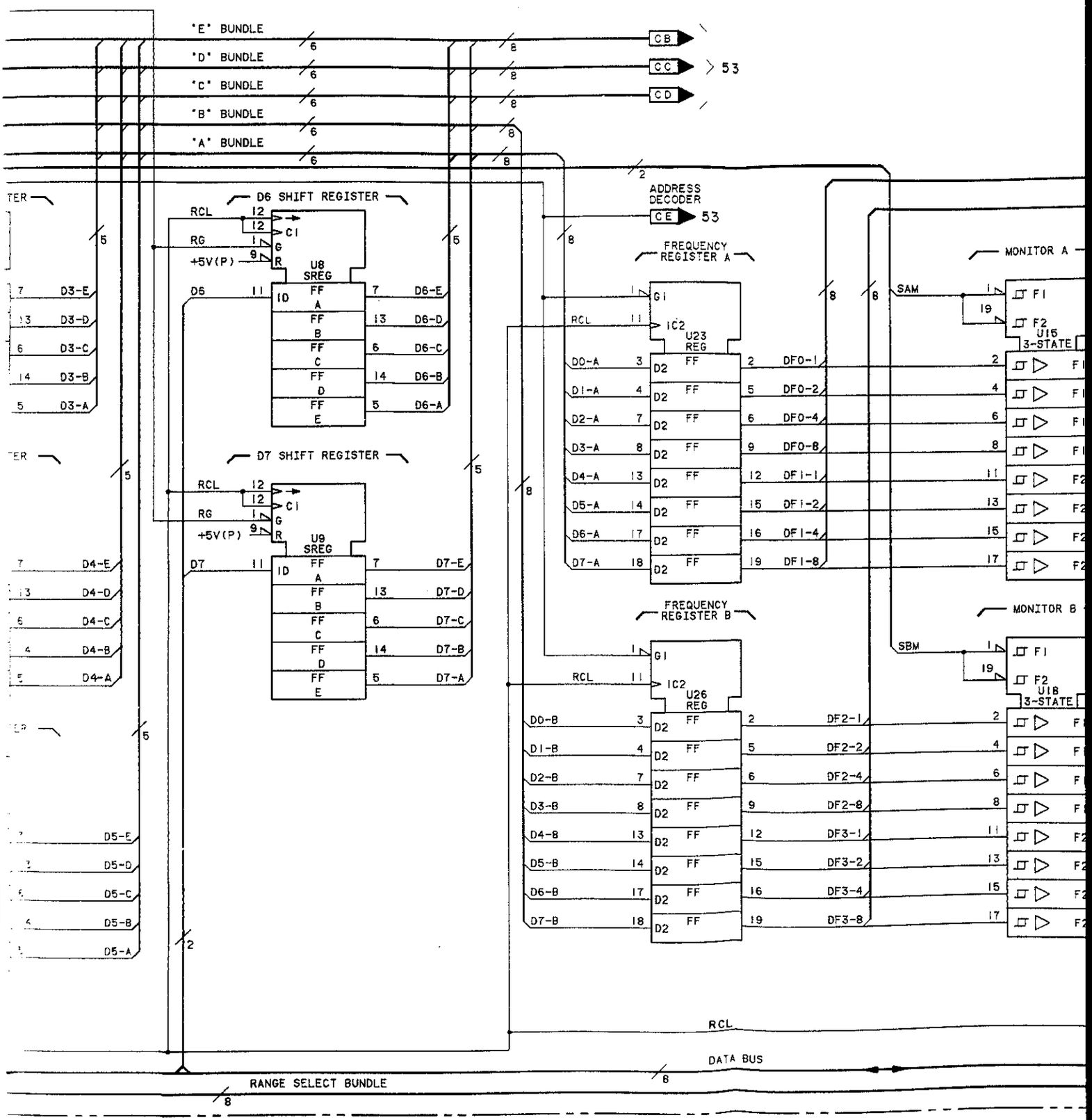


Fig 8-721 Sht 4 of 5

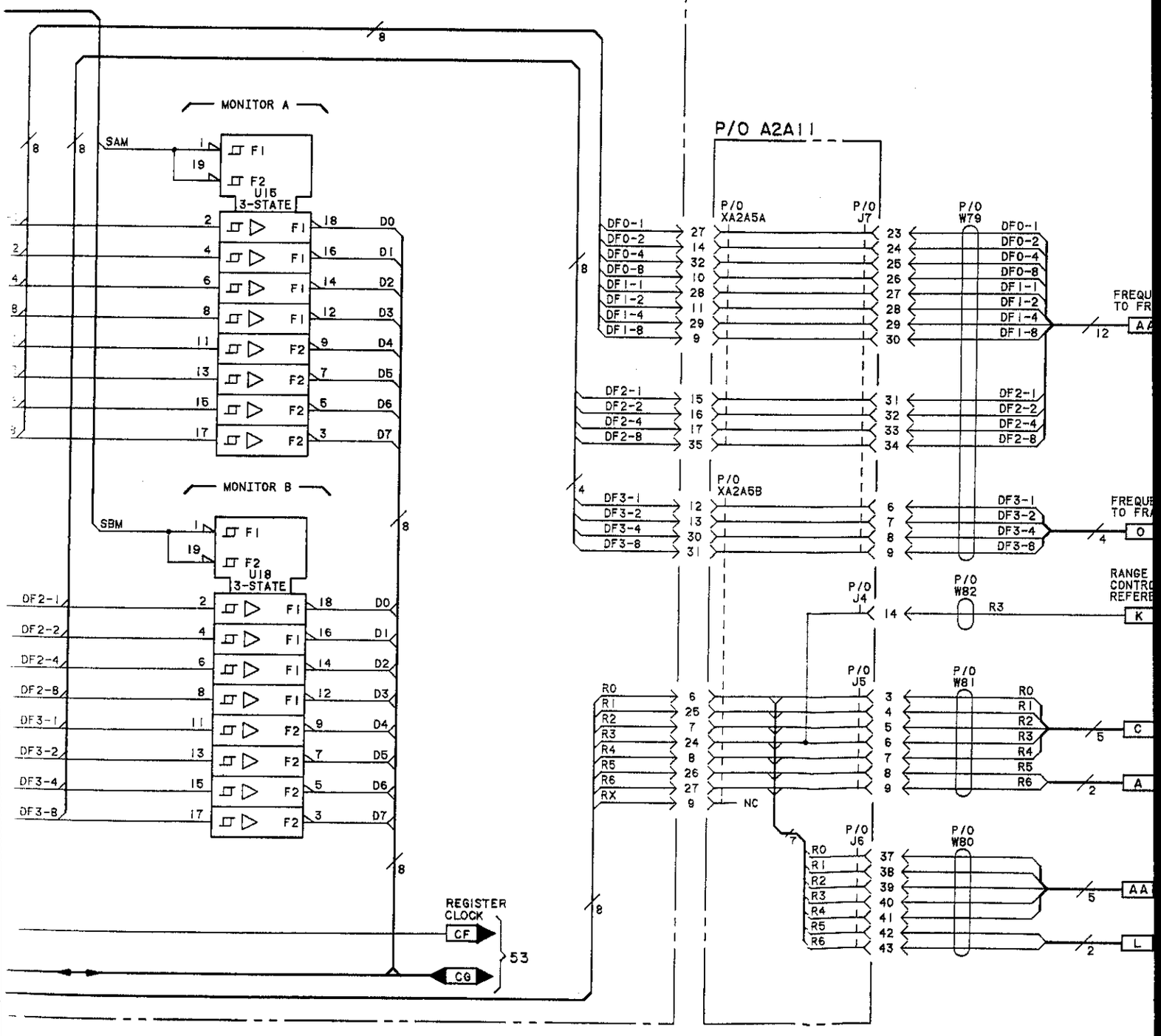
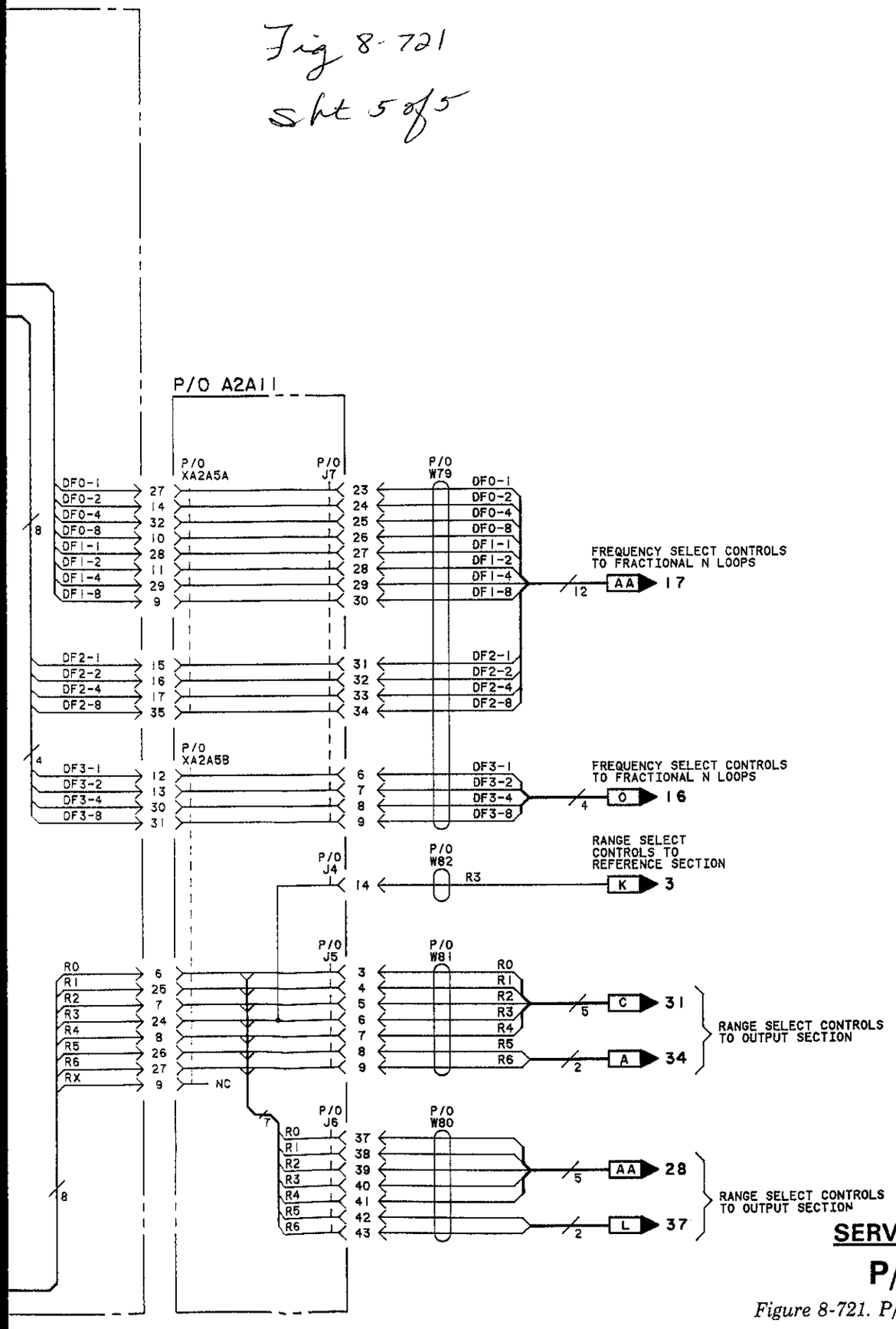


Fig 8-721
sht 5 of 5



SERVICE SHEET 52

P/O A2A5

Figure 8-721. P/O A2A5 Frequency Control Assembly Schematic

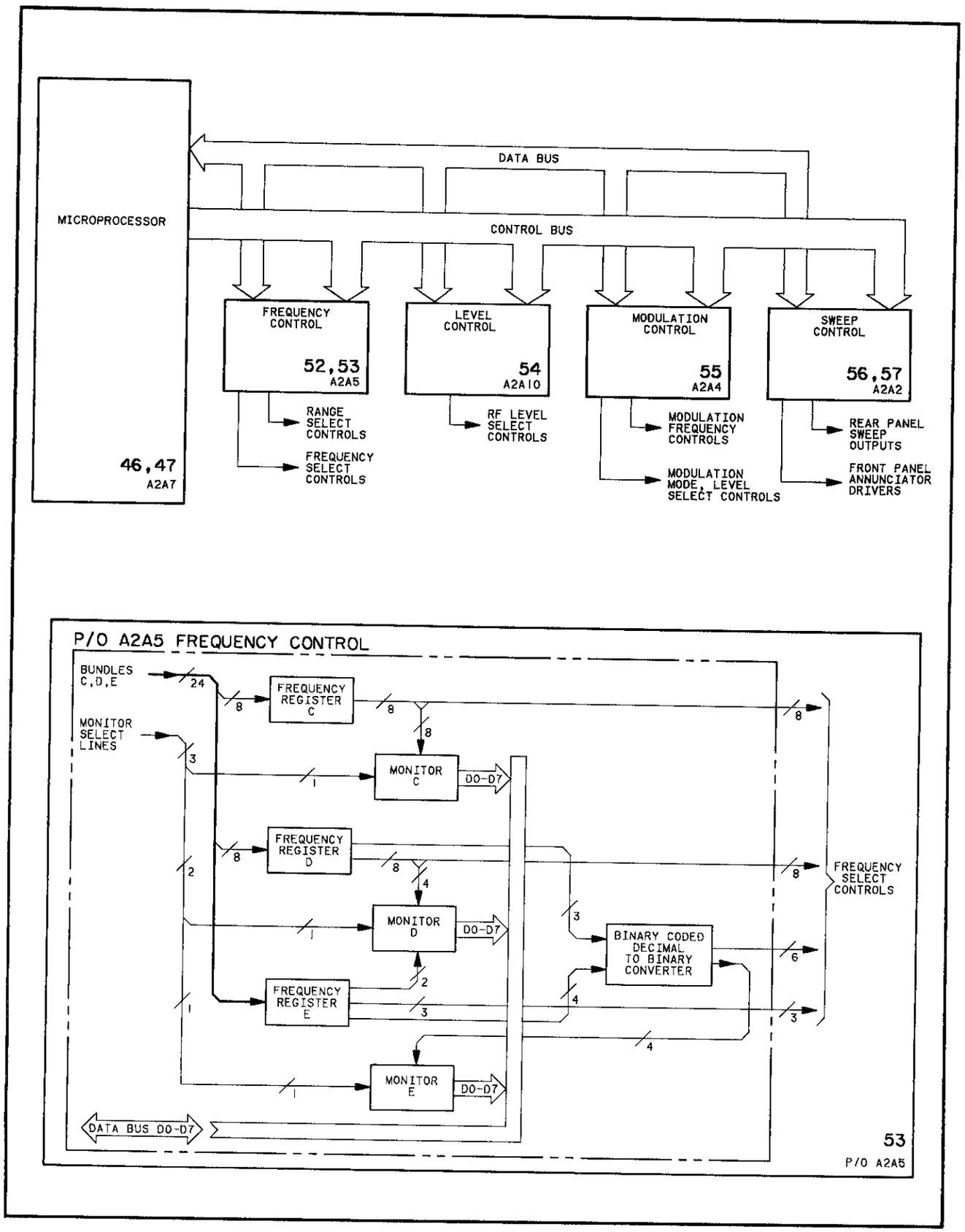


Figure 8-722. P/O A2A5 Frequency Control Assembly Block Diagrams

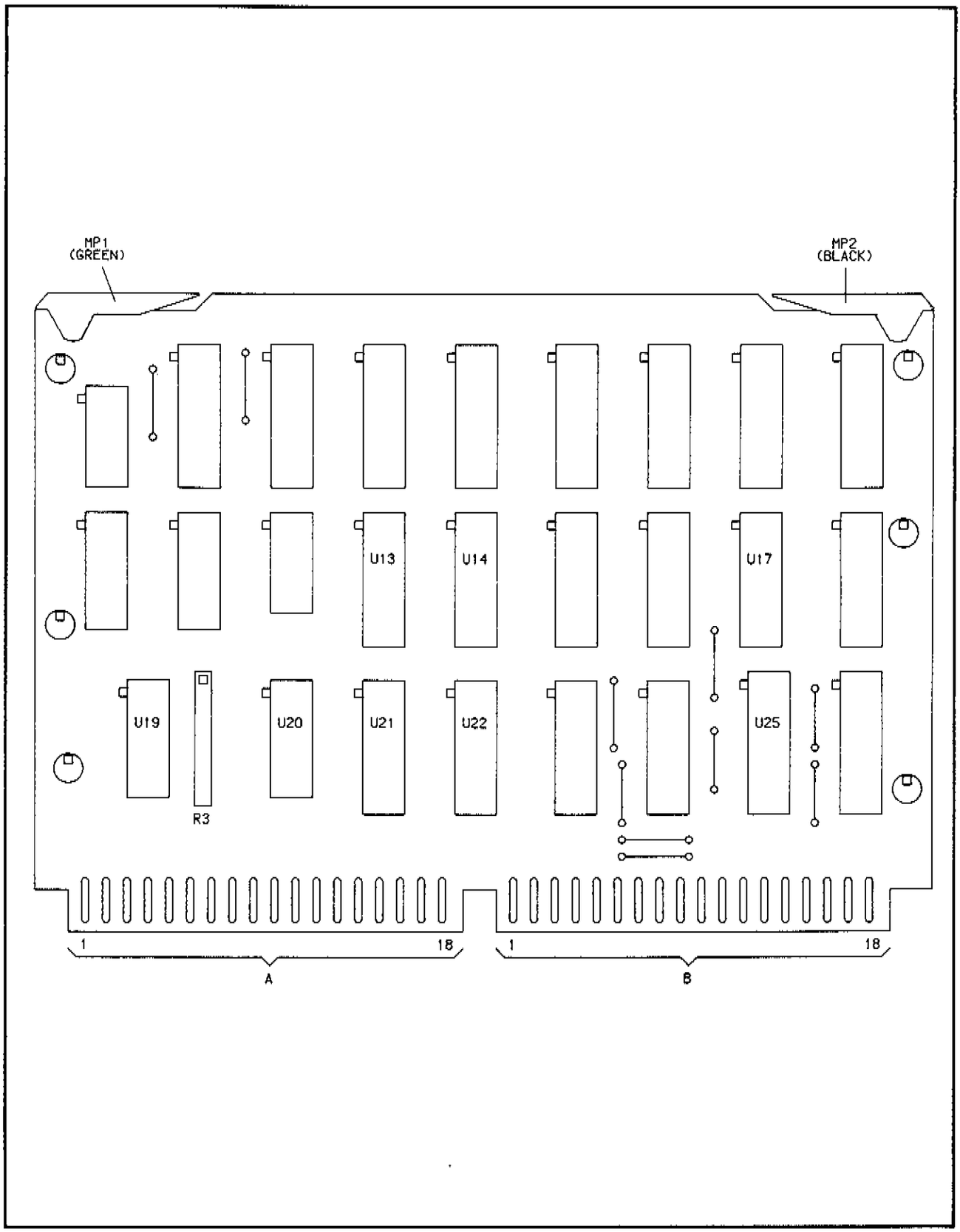
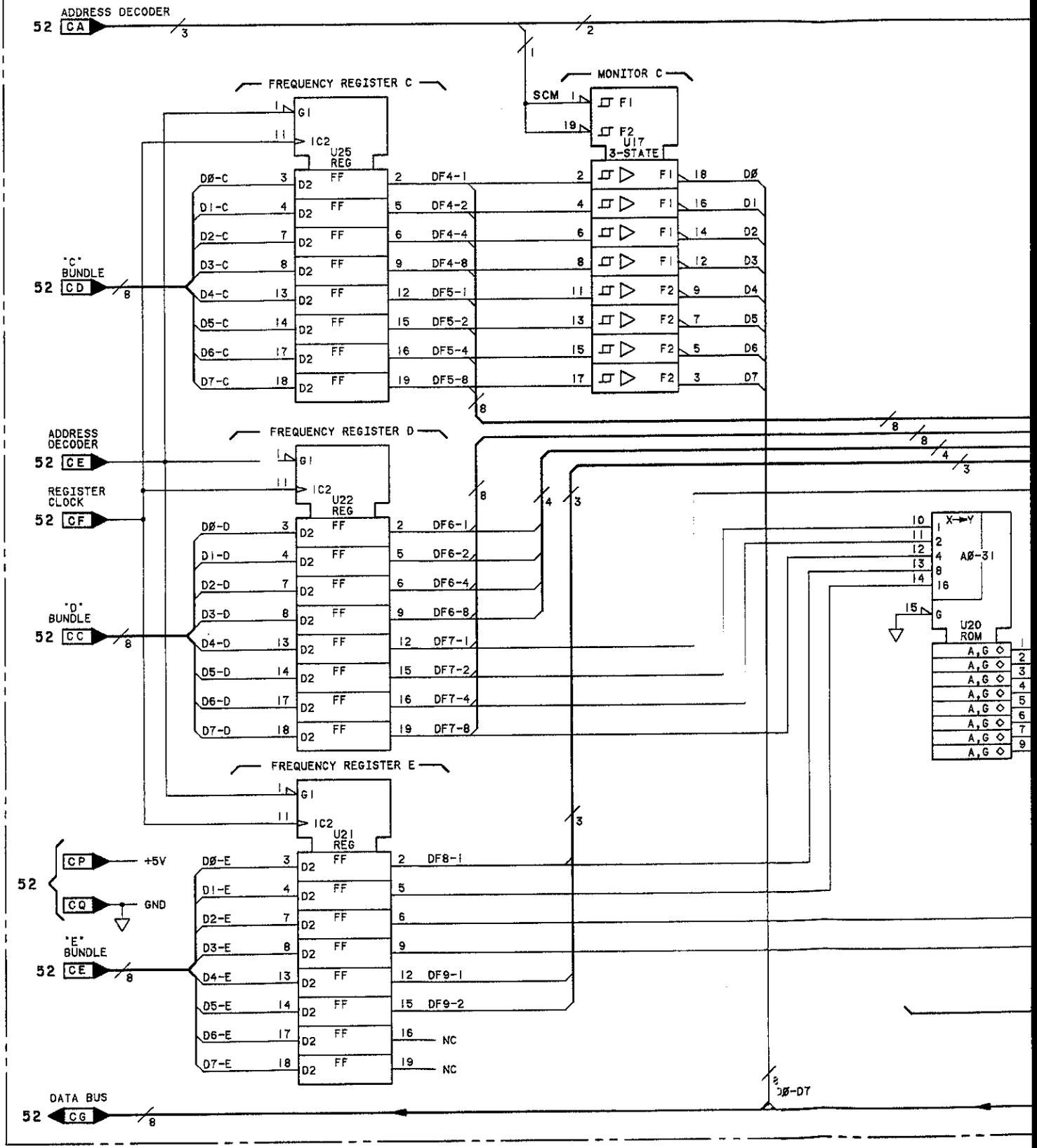


Figure 8-723. P/O A2A5 Frequency Control Assembly Component Locator

P/O A2A5 FREQUENCY CONTROL (08663-60341) Fig 8-724 Sht 1 of 3



SERIAL PREFIX: 2234A

Fig 8-724 Sht 2 of 3

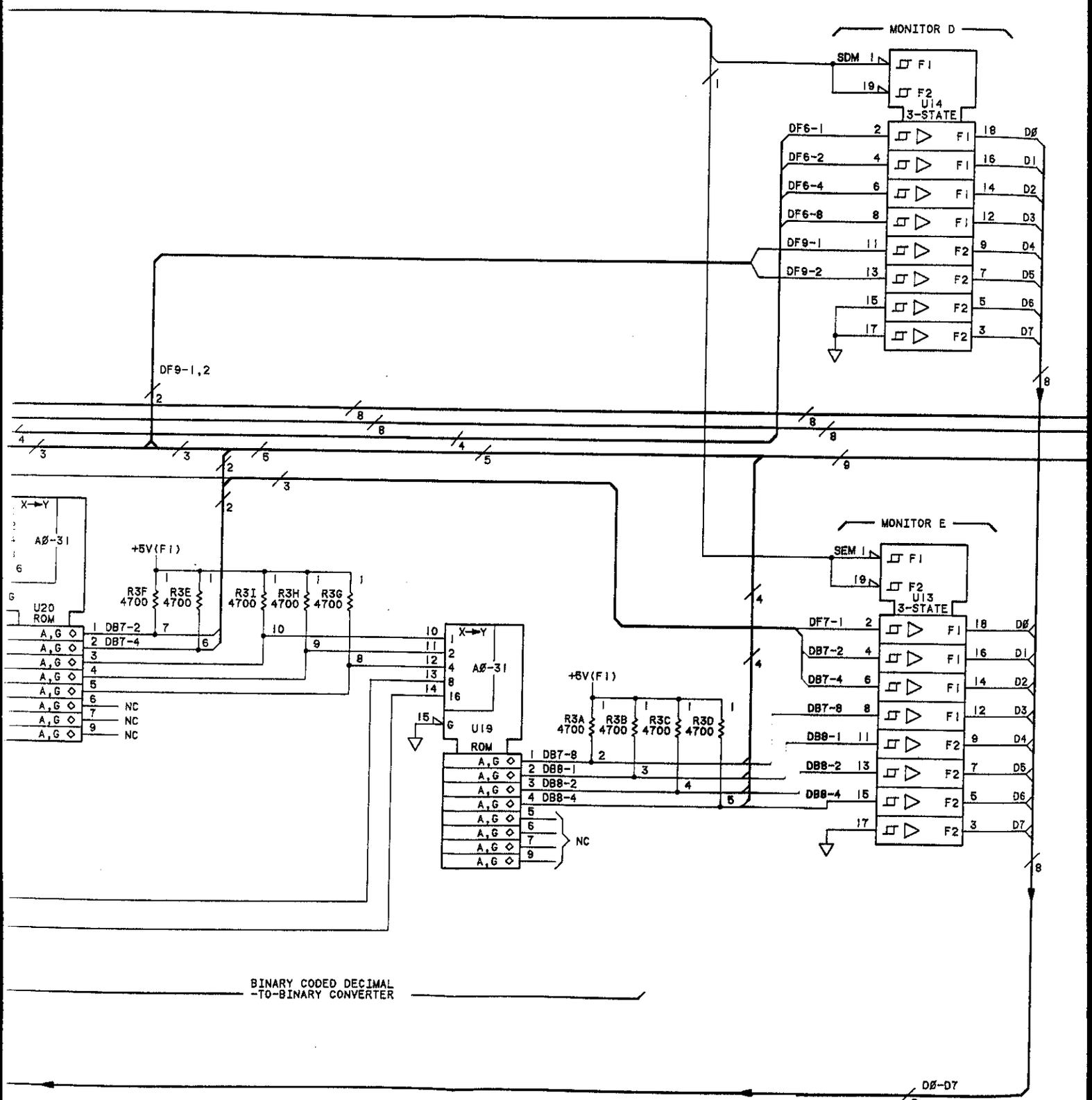
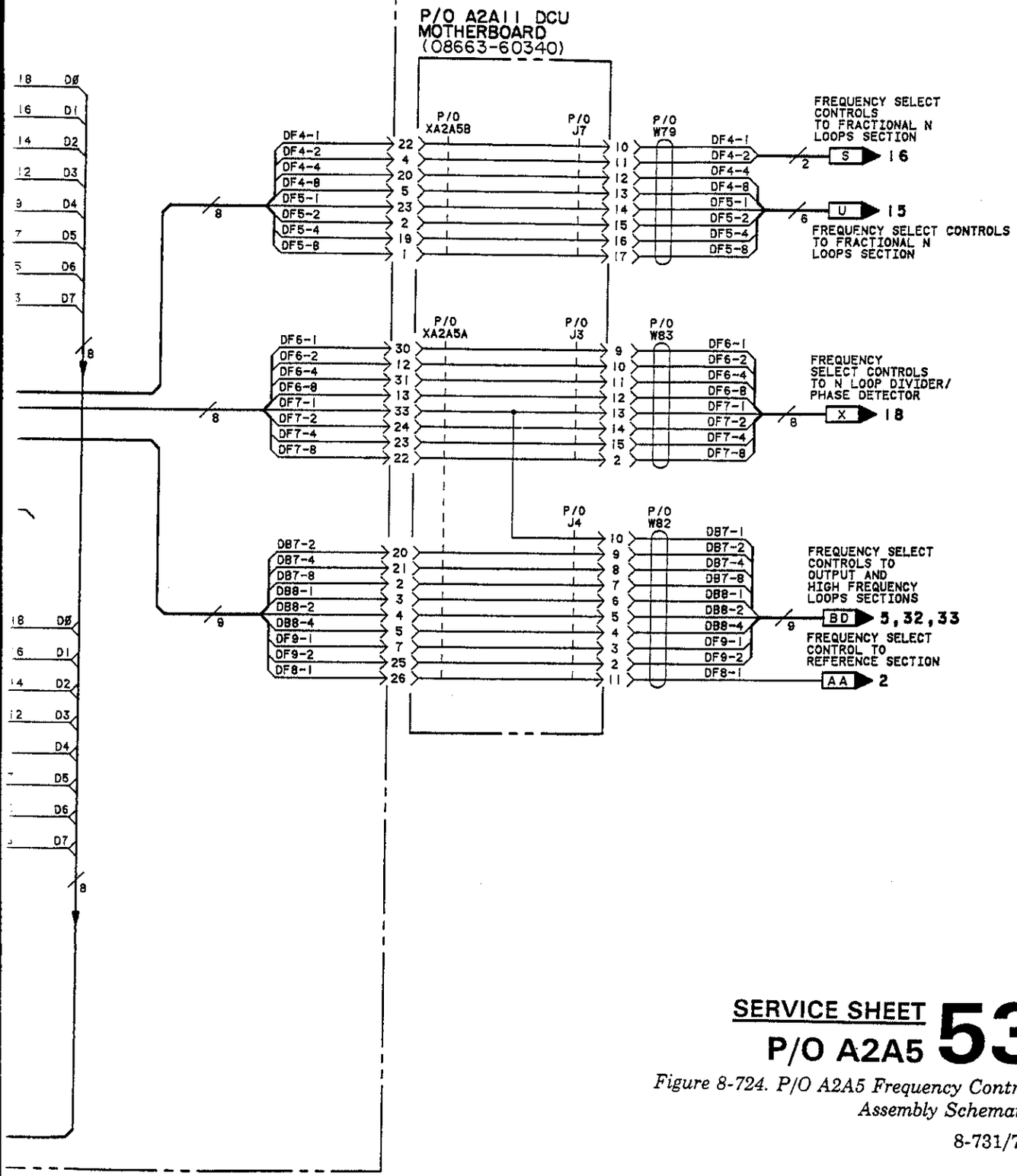


Fig 8-724
Sht 3 of 3



SERVICE SHEET 53

P/O A2A5

Figure 8-724. P/O A2A5 Frequency Control Assembly Schematic

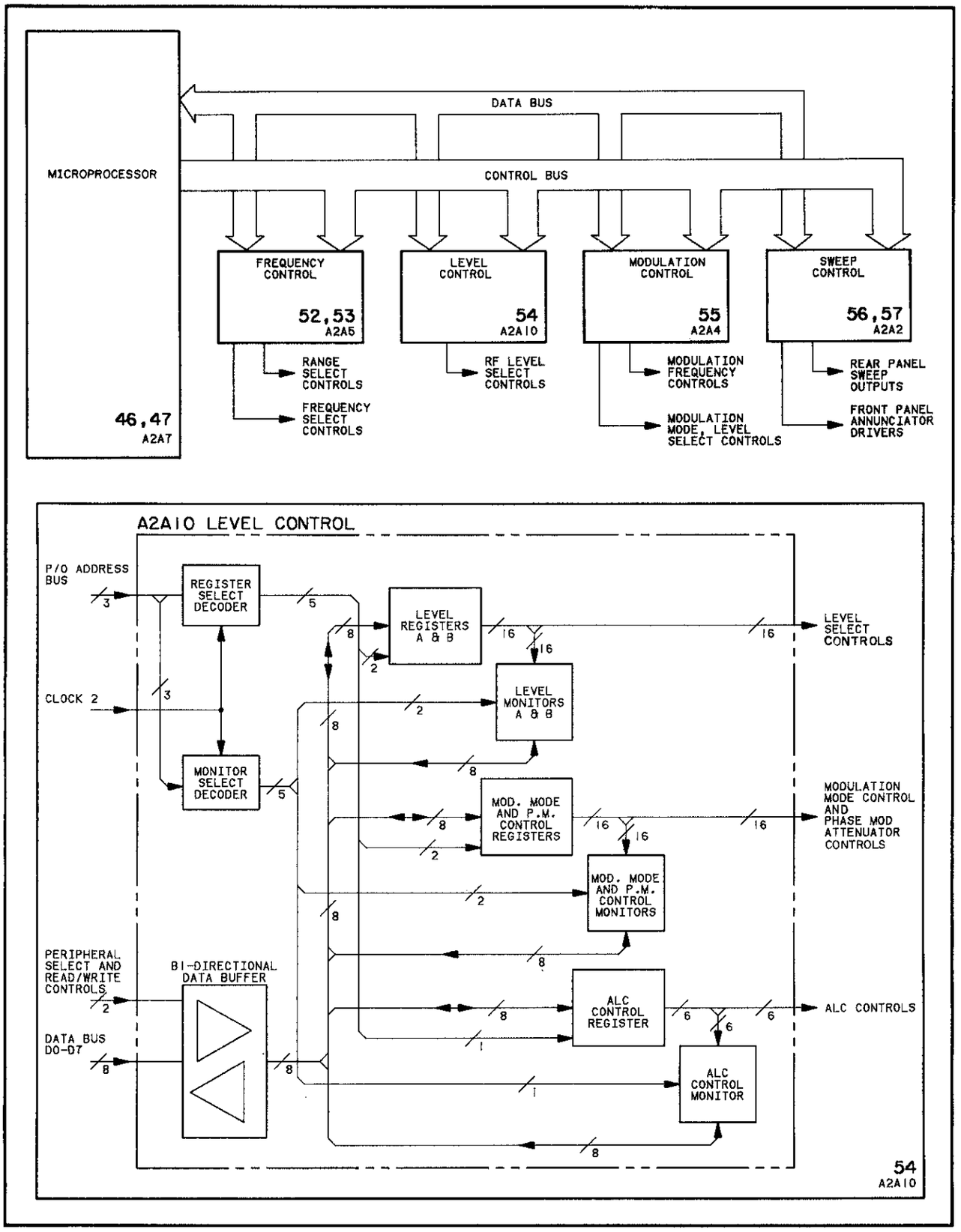


Figure 8-725. A2A10 Level Control Assembly Block Diagrams

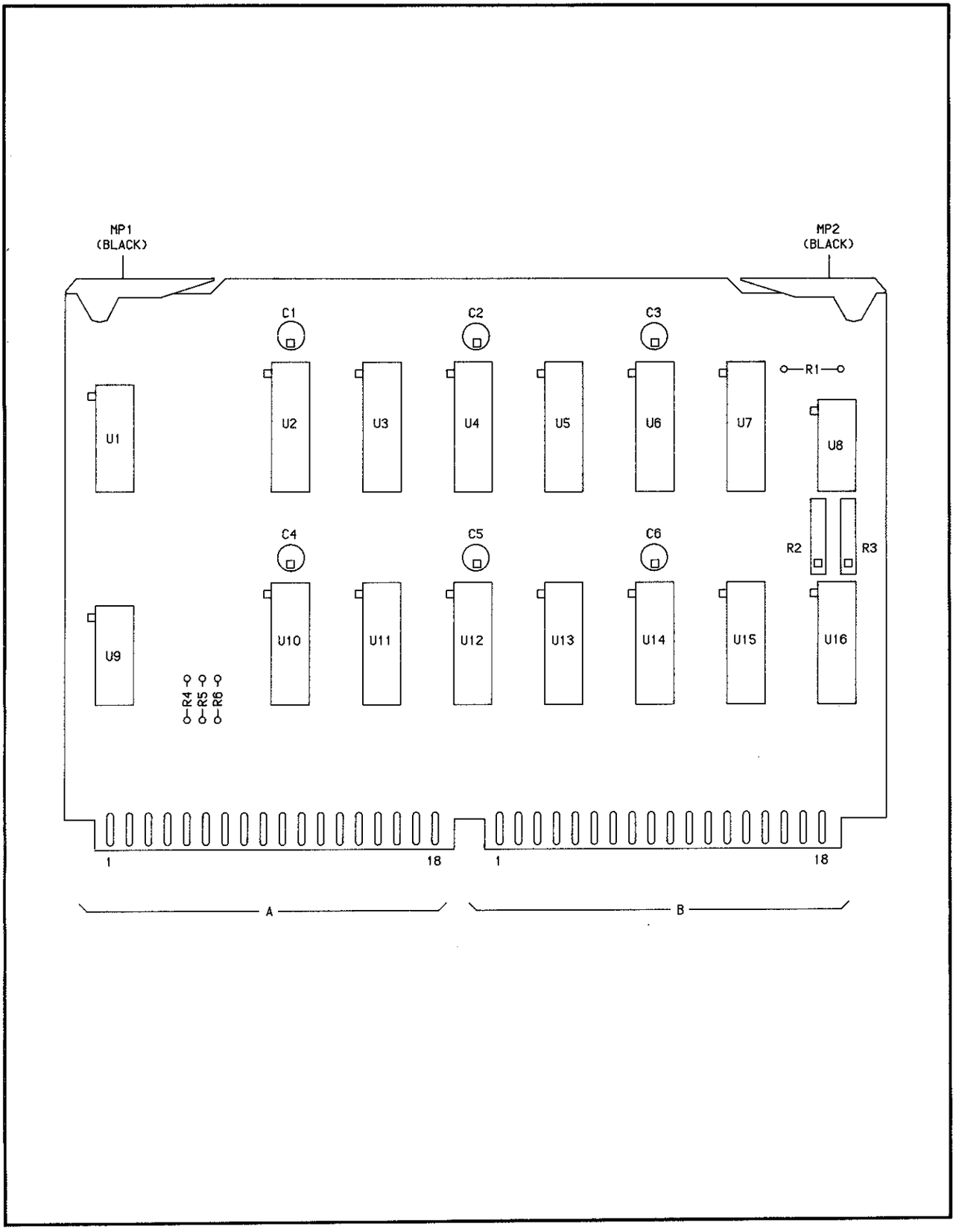
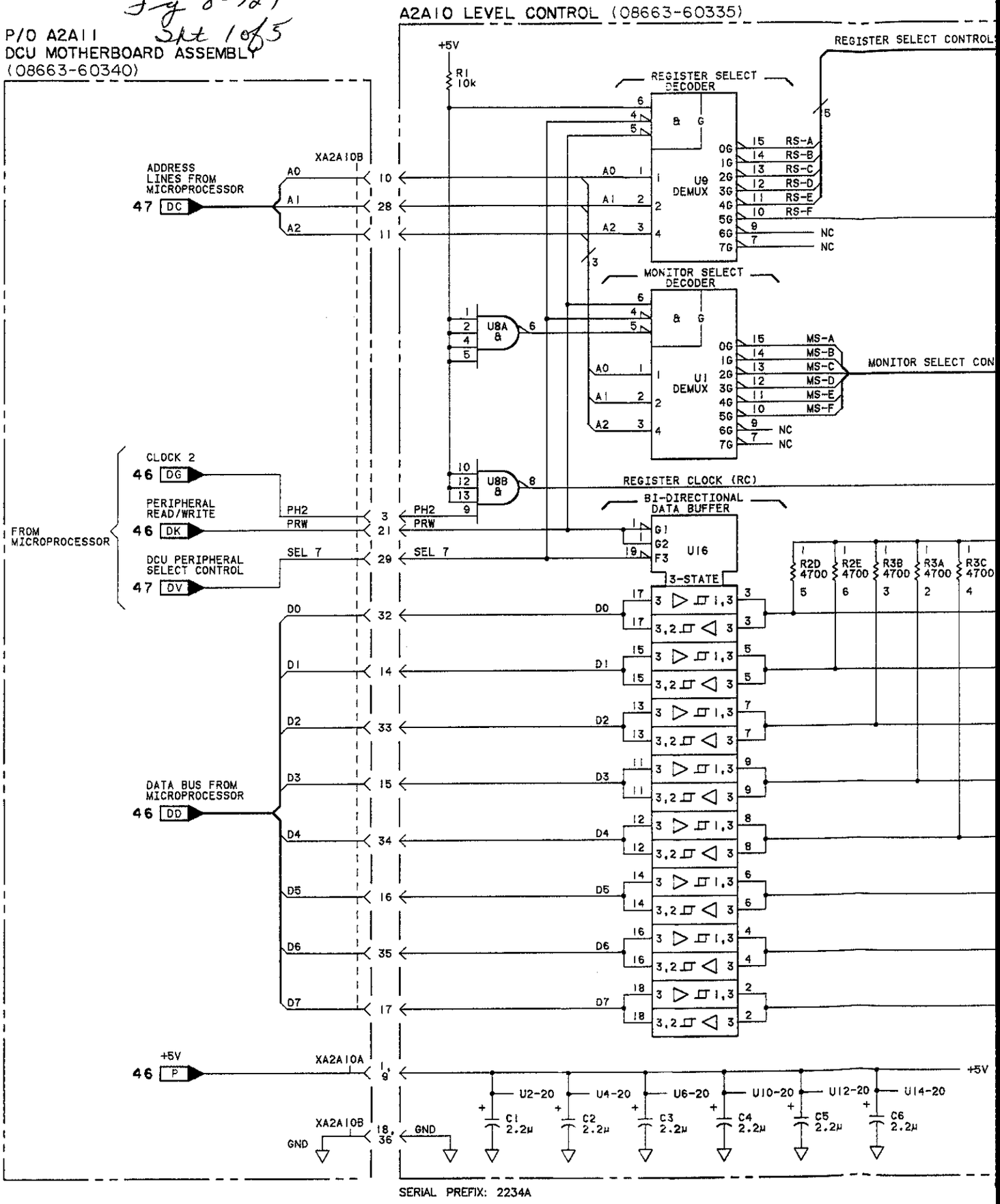


Figure 8-726. A2A10 Level Control Assembly Component Locator

Fig 8-727
Sht 1 of 5

P/O A2A11
DCU MOTHERBOARD ASSEMBLY
(08663-60340)



SERIAL PREFIX: 2234A

Fig 8-727 Sht 2 of 5

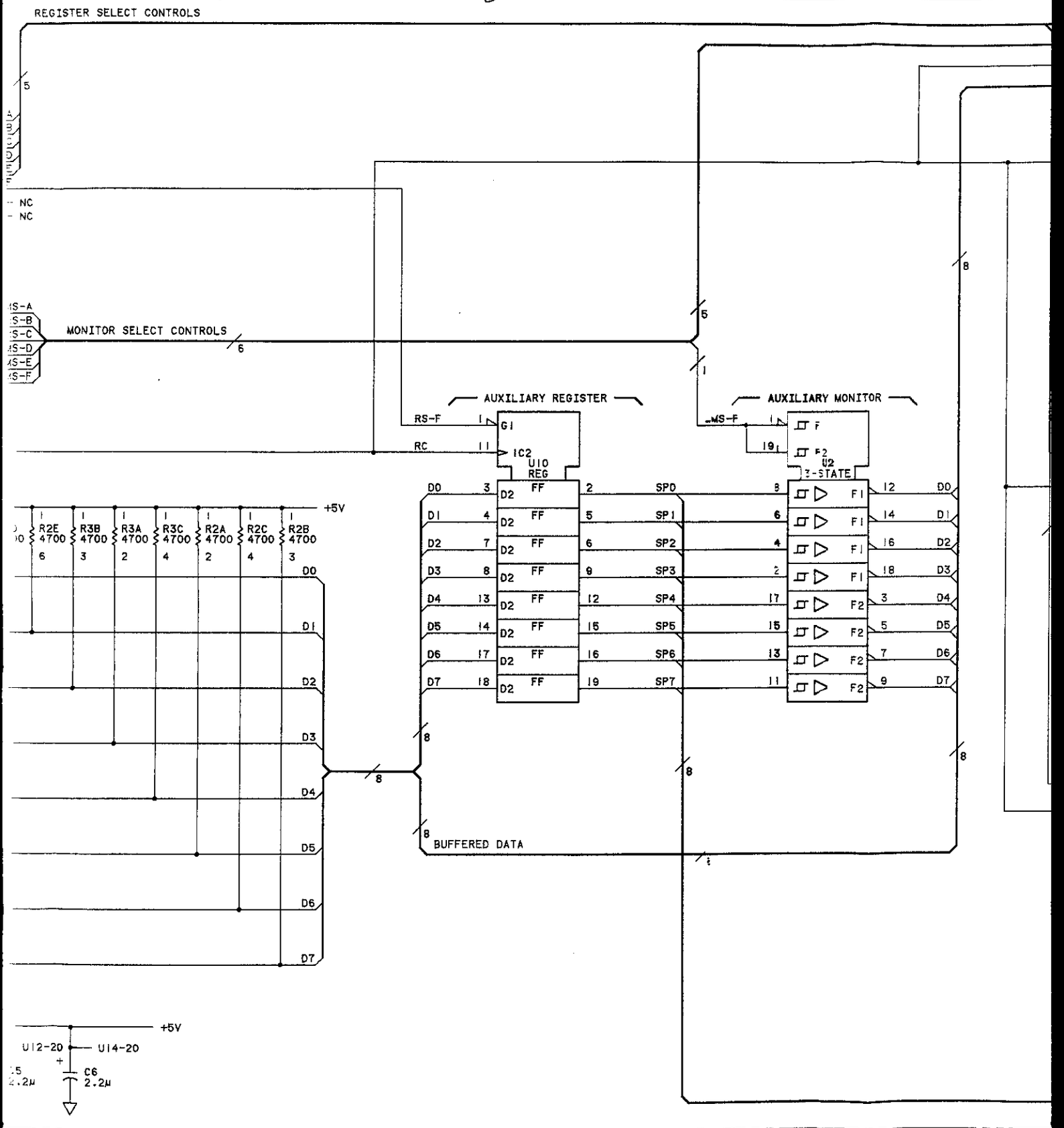


Fig 8-727 Sht 3 of 5

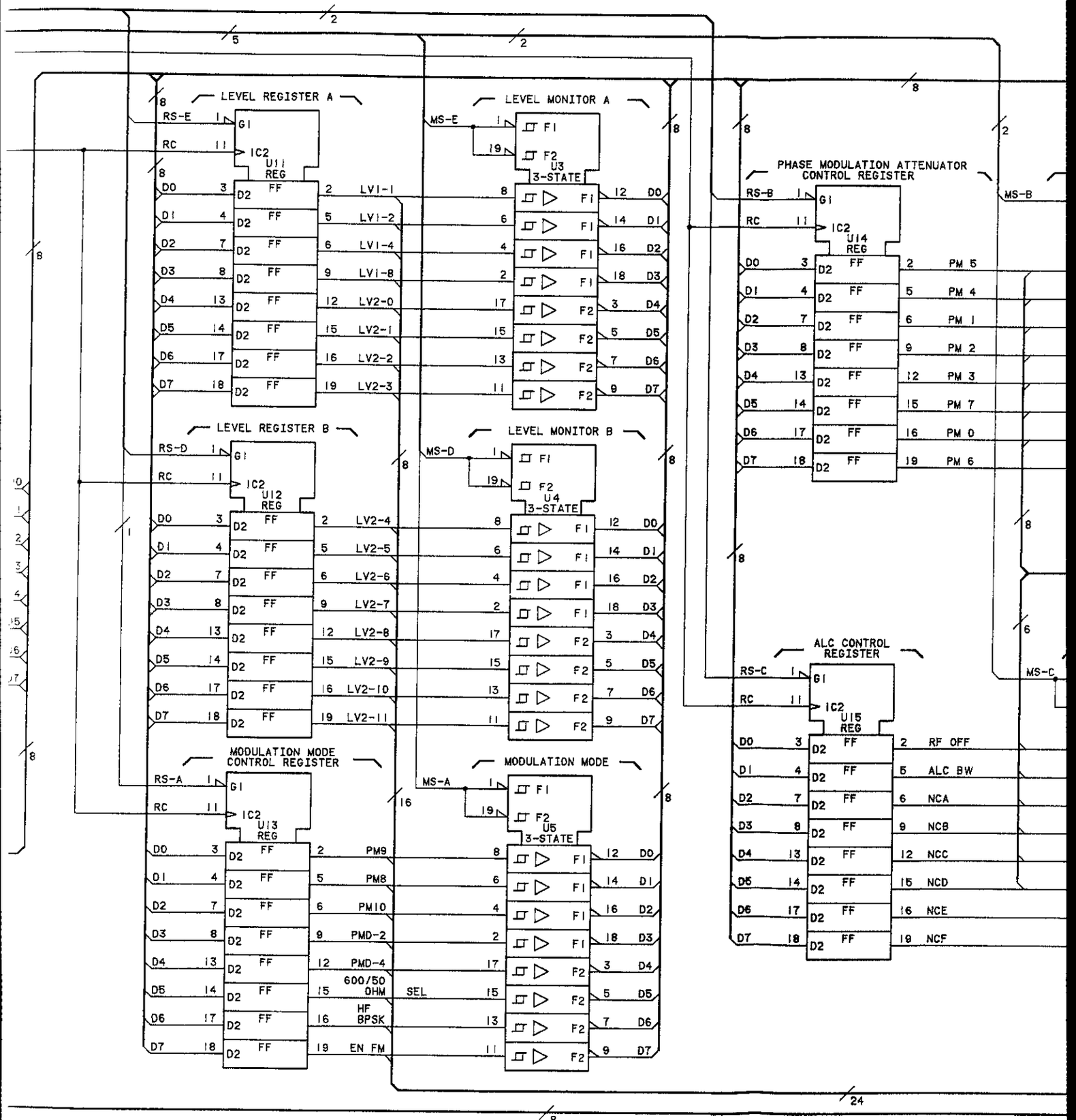
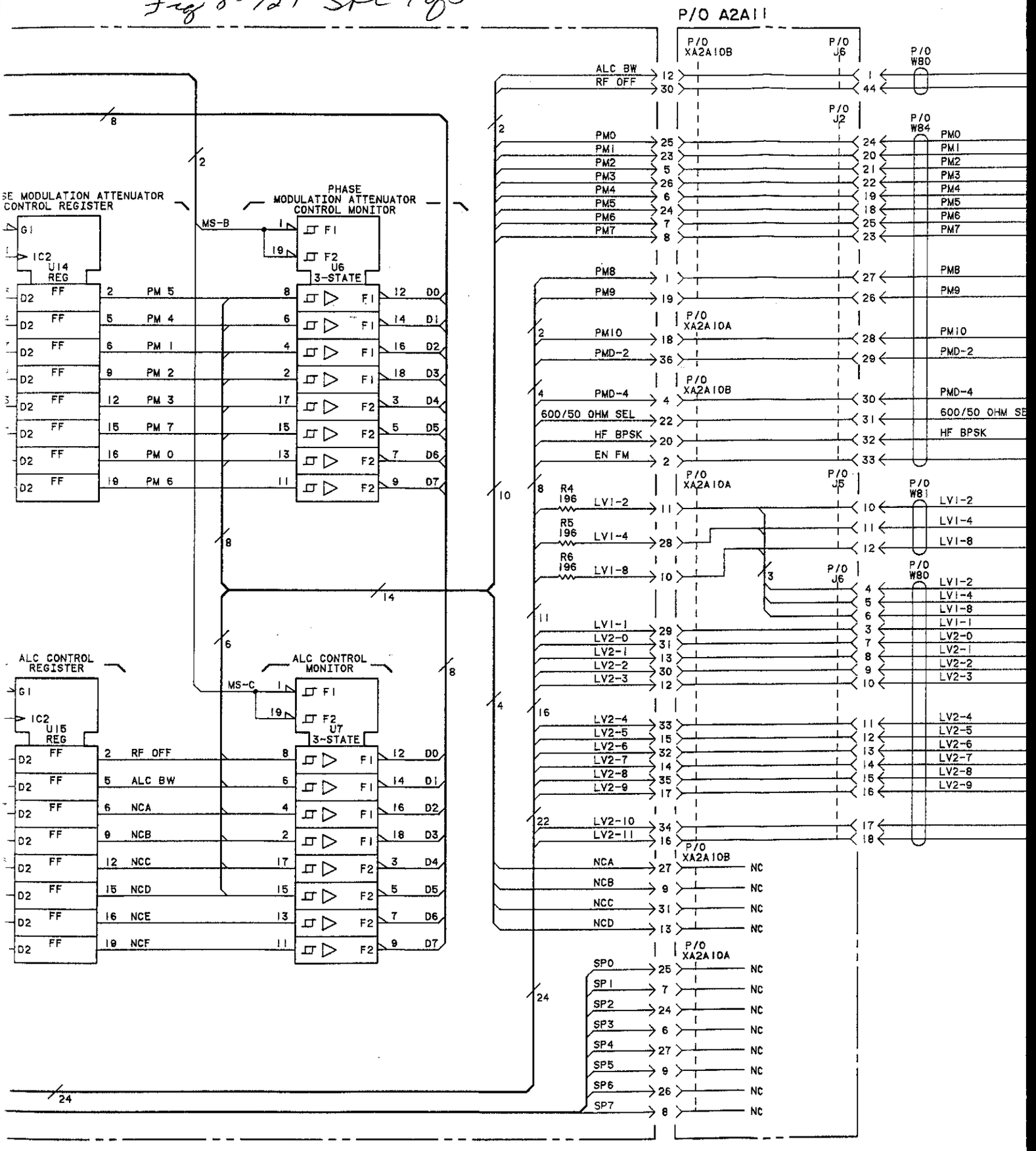
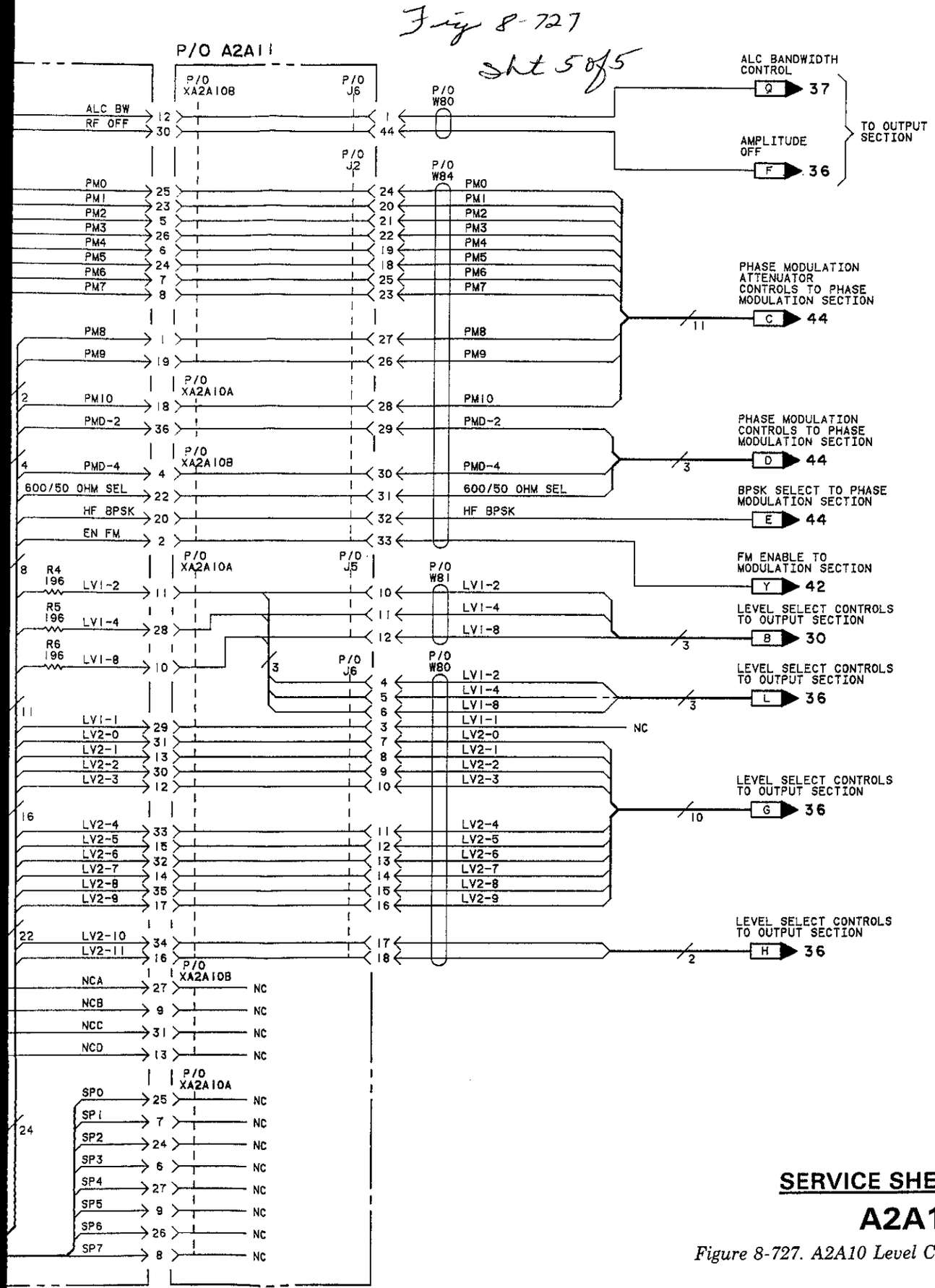


Fig 8-727 Sht 4 of 5





SERVICE SHEET A2A10 54

Figure 8-727. A2A10 Level Control Assembly Schematic

8-735/736

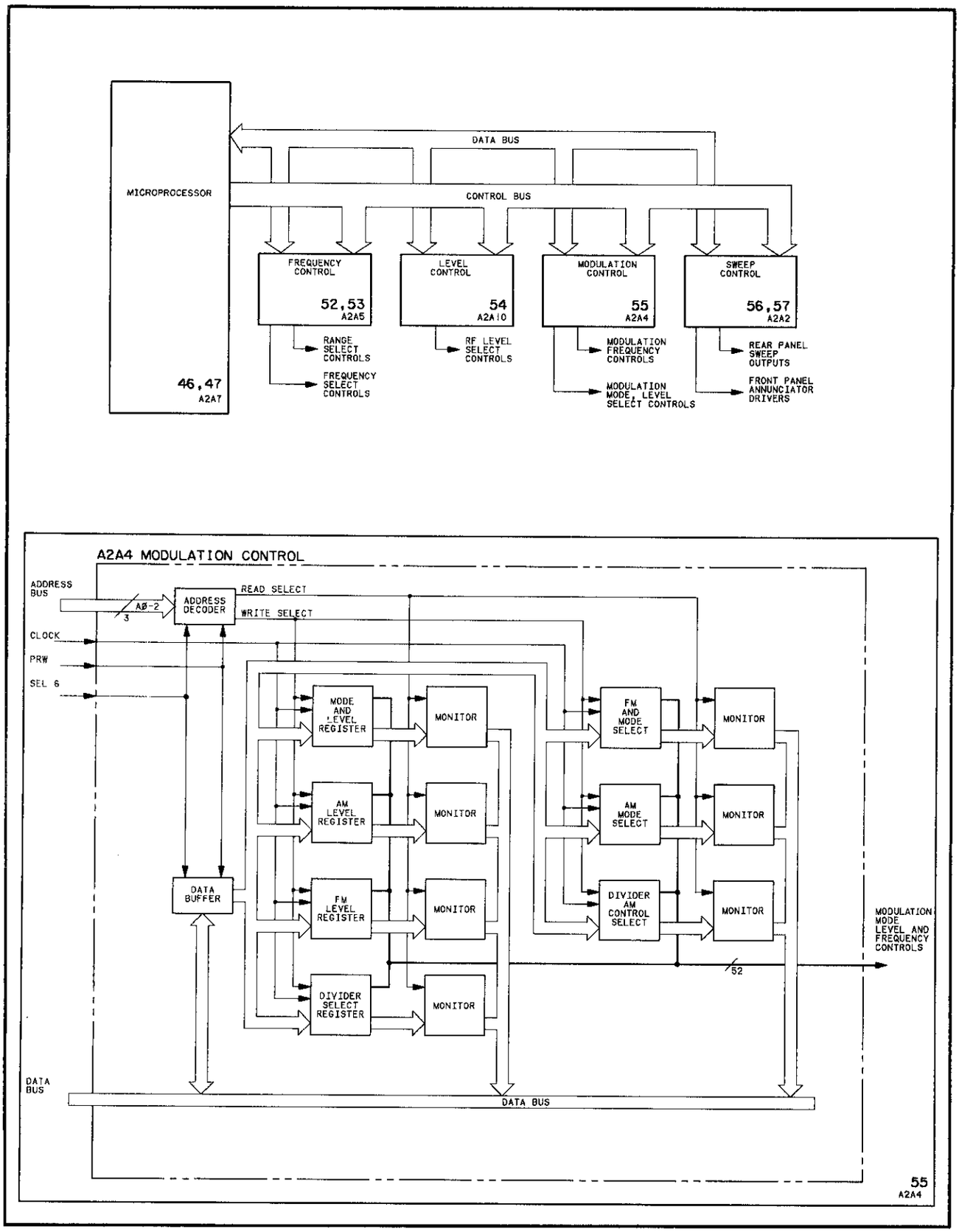


Figure 8-728. A2A4 Modulation Assembly Block Diagrams

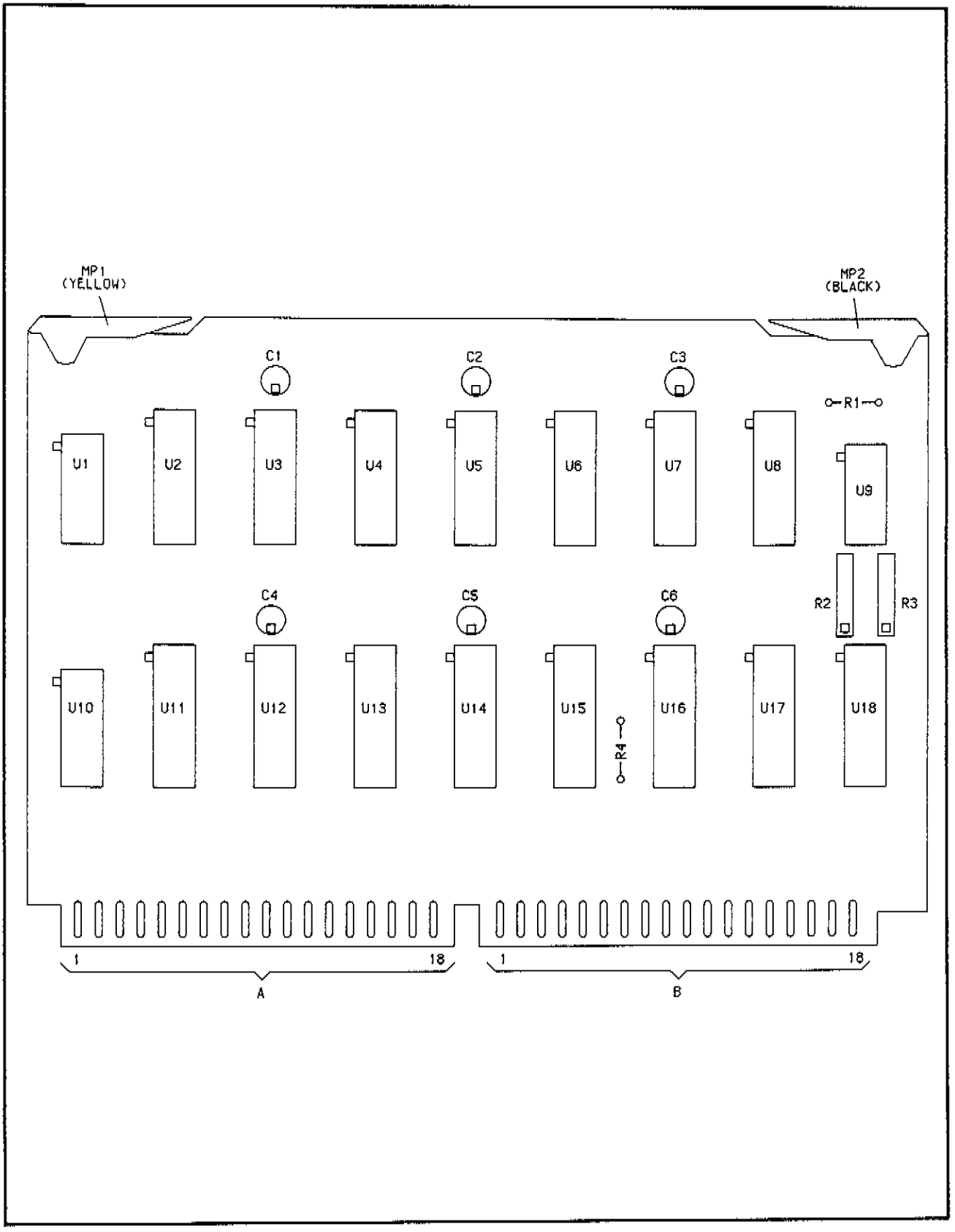
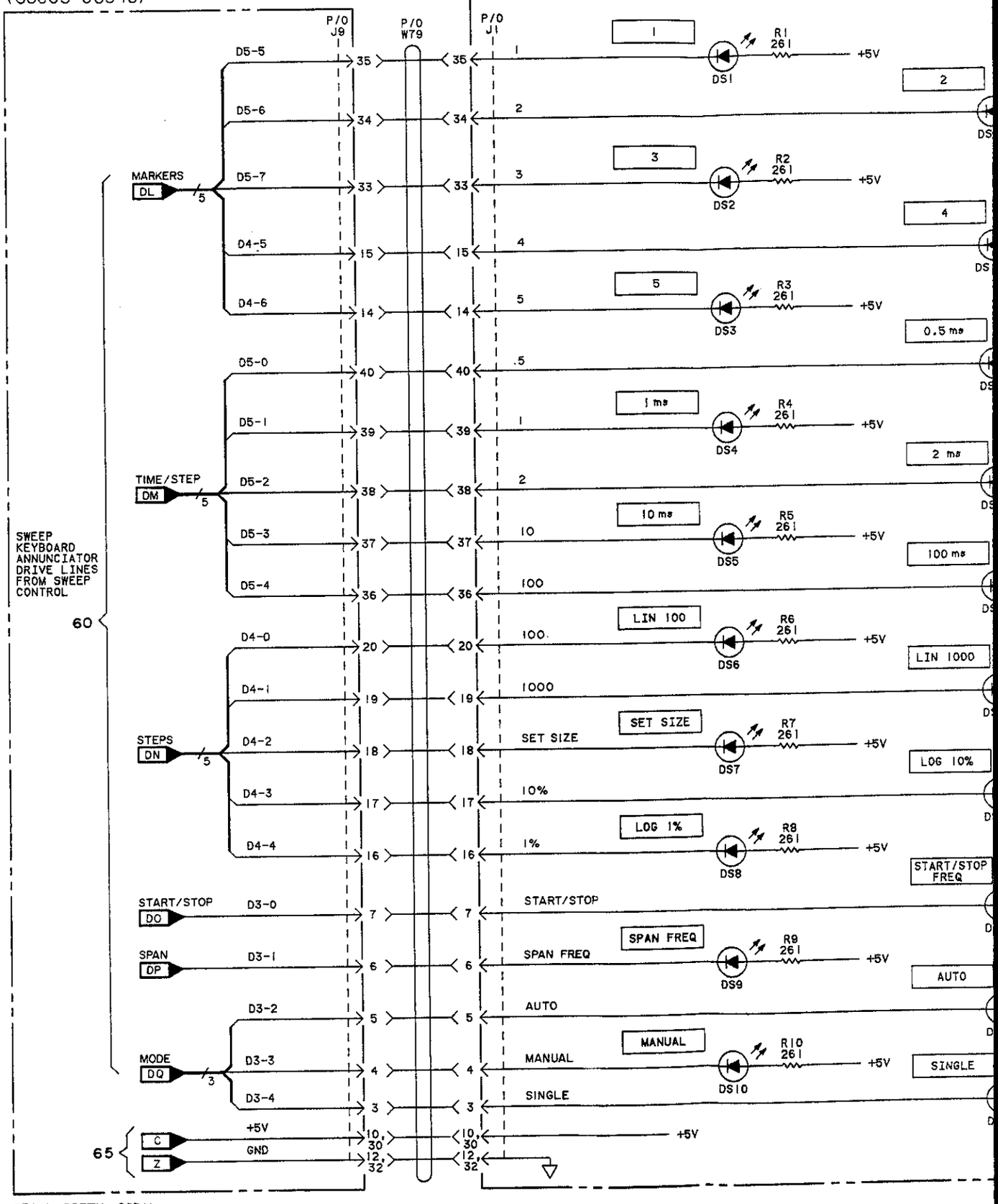


Figure 8-729. A2A4 Modulation Assembly Component Locator

Fig 8-74
Sht 2 of 3

P/O A2A11 DCU MOTHERBOARD (08663-60340)

A1A2 SWEEP KEYBOARD (08663-60168)



SERIAL PREFIX: 2234A

Fig 8-730 Sht 2 of 5

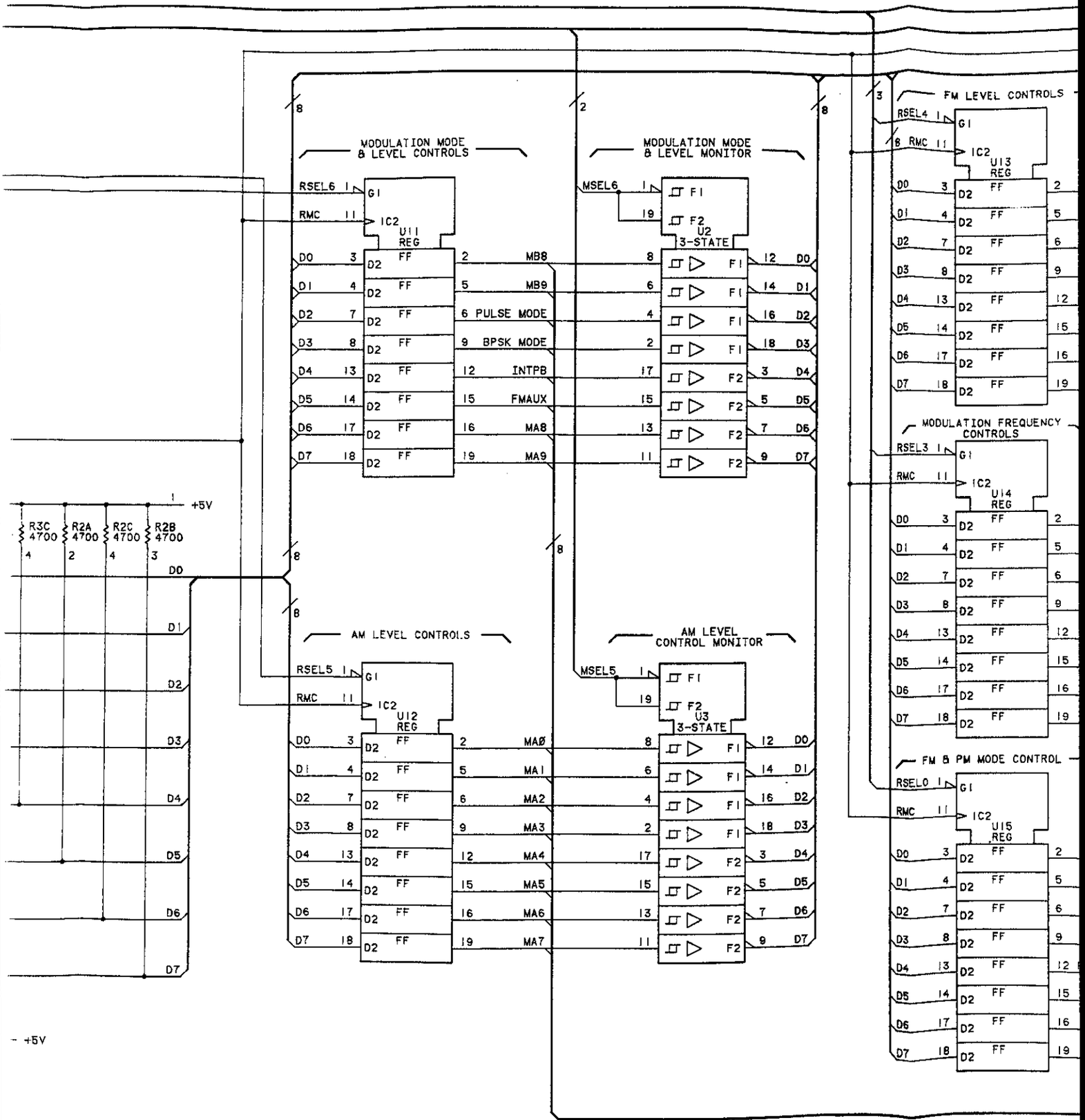


Fig 8-730 Sht 3 of 5

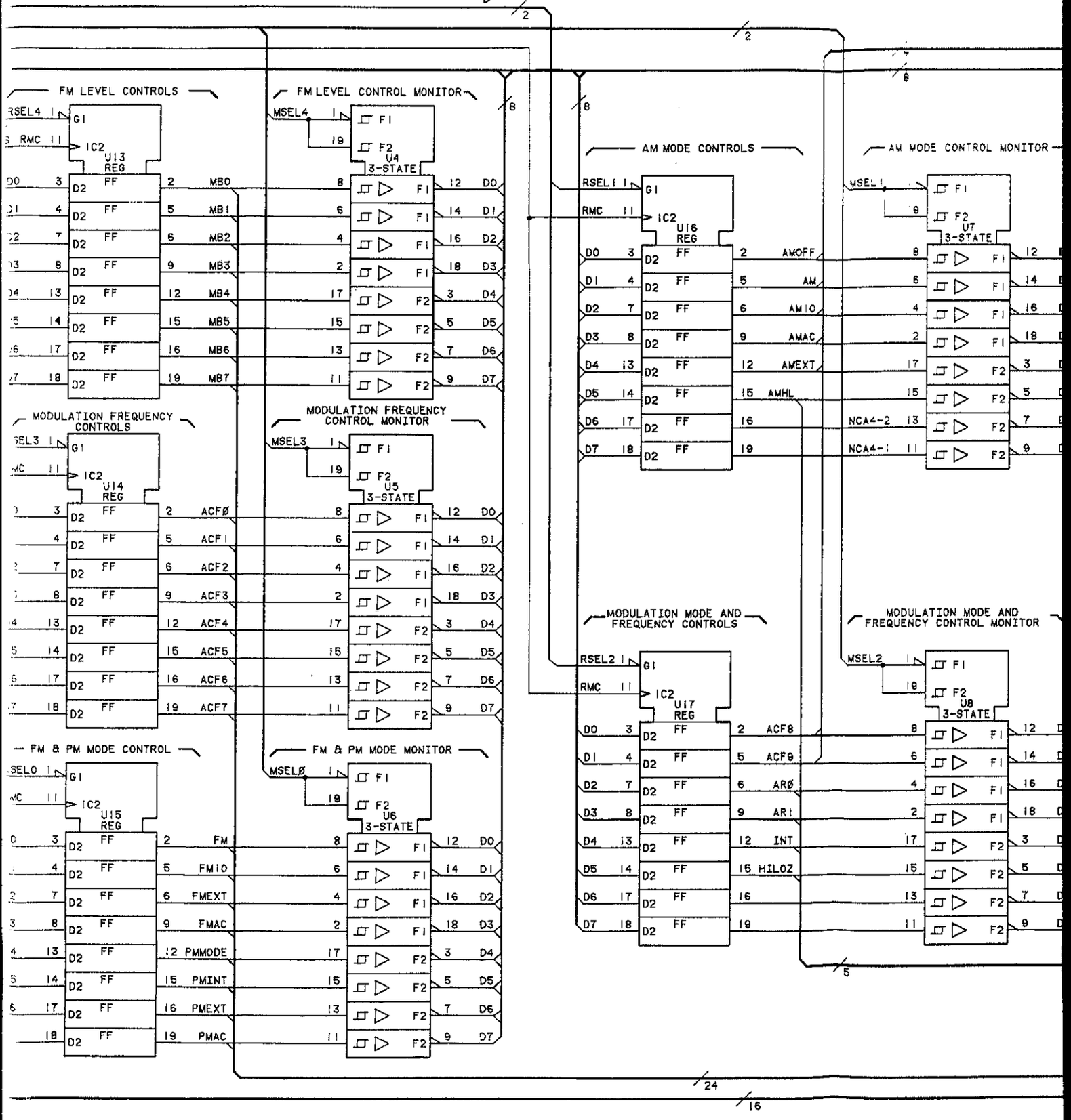
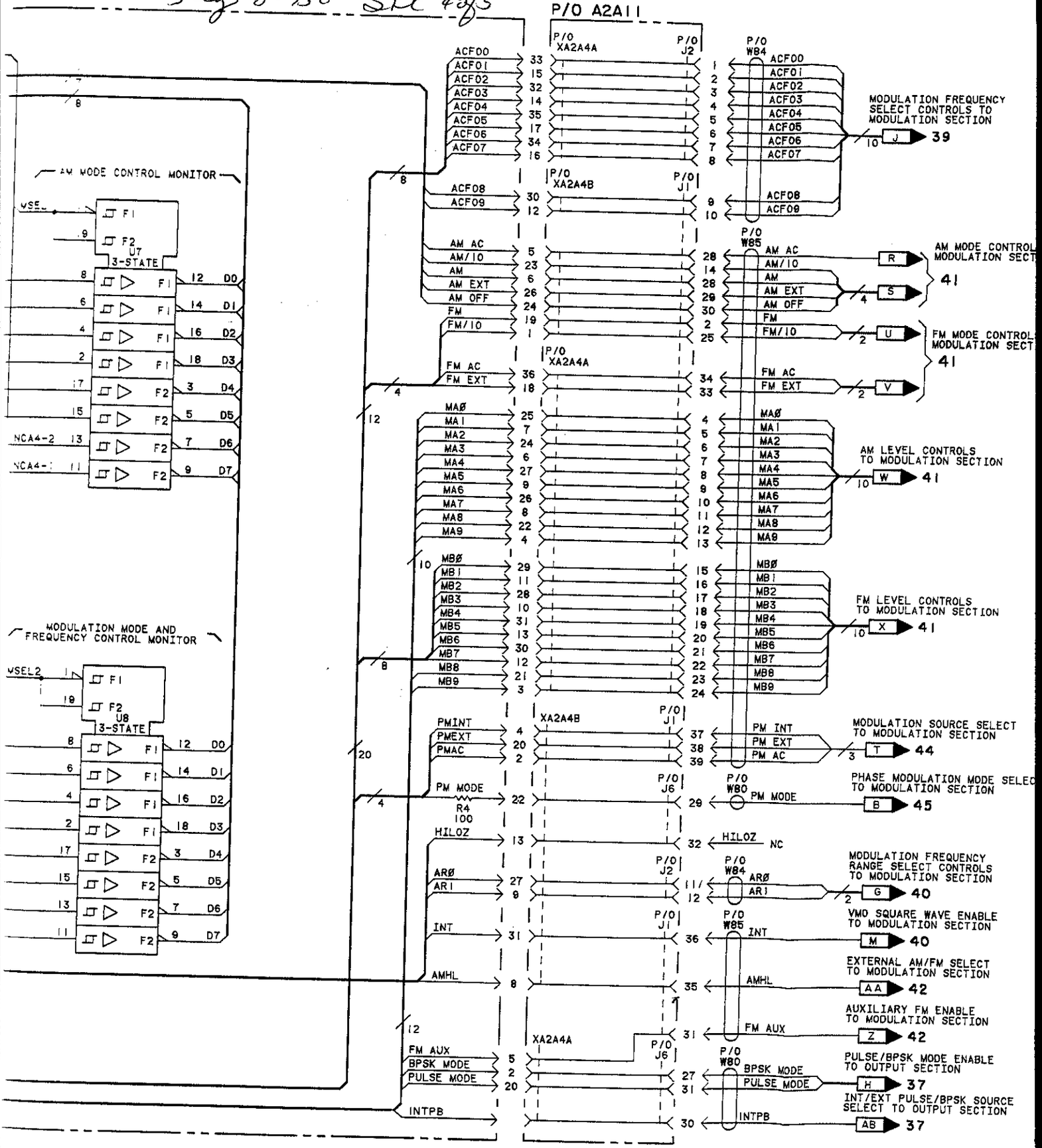
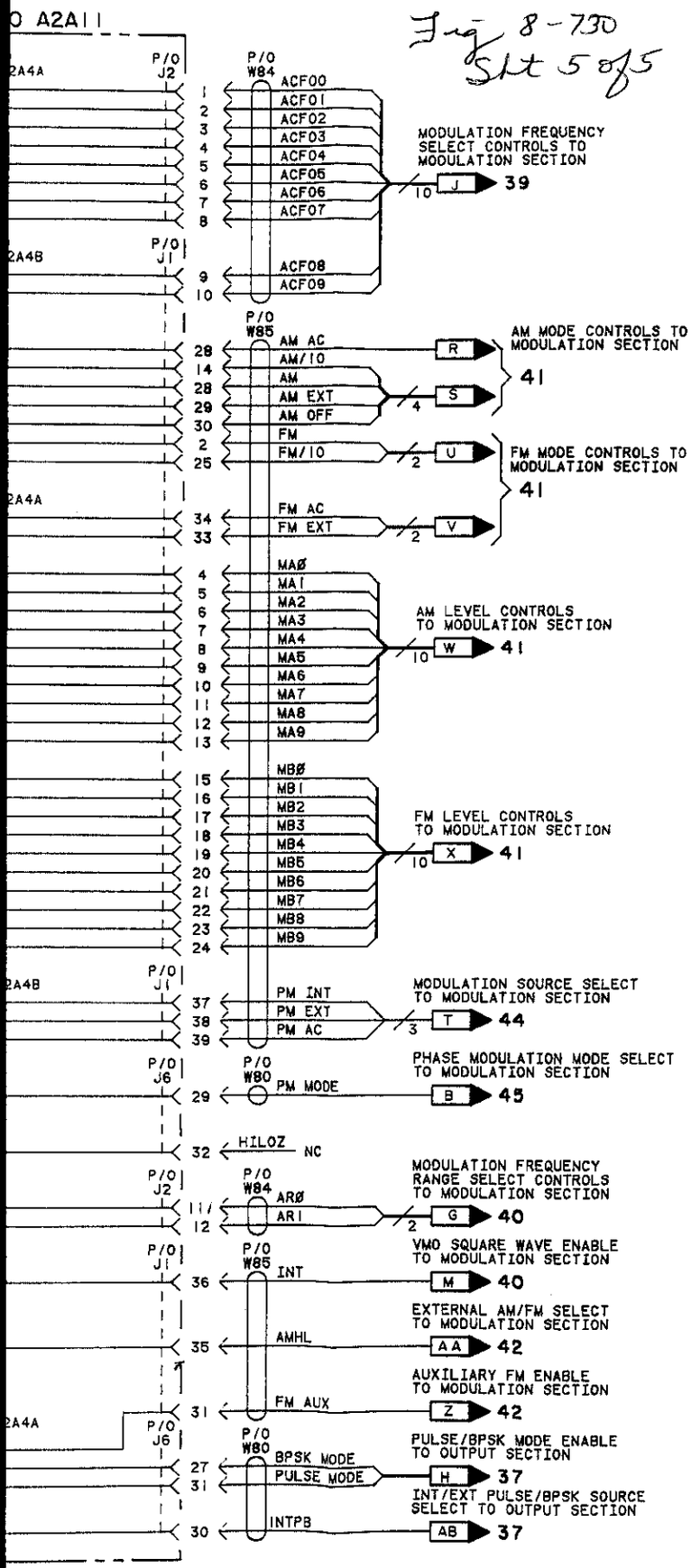


Fig 8-730 Sht 4 of 5





NOTES

1. REFER TO TABLE 8-102 FOR SCHEMATIC DIAGRAM NOTES.
2. TROUBLESHOOTING VALUES ARE TYPICAL. THEY ARE ACTUAL MEASURED VALUES. YOUR MEASUREMENTS MAY BE SLIGHTLY DIFFERENT THAN WHAT IS SHOWN.

REFERENCE DESIGNATIONS

NO PREFIX	
W80,84,85	
A2A4	A2A11
C1-6 R1-3 U1-18	XA2A4A XA2A4B J1,2,6,8

INTEGRATED CIRCUIT PART NUMBERS

REFERENCE DESIGNATIONS	PART NUMBERS
U1,10	1820-1216
U2,8	1820-2024
U9	1820-1204
U11-17	1820-1858
U18	1820-2075

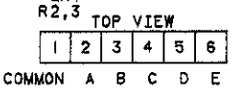
LOGIC LEVELS

	TTL
HIGH	>+2.0V
LOW	<+0.8V
< IS MORE NEG.THAN > IS MORE POS.THAN	
OPEN	HIGH
GROUND	LOW

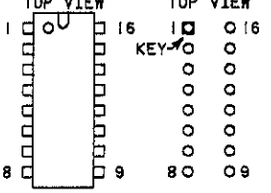
INTEGRATED CIRCUIT VOLTAGE AND GROUND CONNECTIONS

REFERENCE DESIGNATIONS	PIN NUMBERS
U18	+5V - 20 ▽ - 10
U2-8	+5V - 20 ▽ - 10
U11-17	+5V - 20 ▽ - 10
U1,10	+5V - 16 ▽ - 8
U9	+5V - 14 ▽ - 7

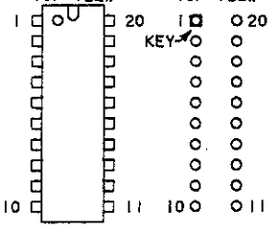
A2A4 R2,3 TOP VIEW



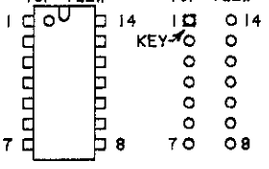
A2A4 U1,10 TOP VIEW — CIRCUIT BOARD TOP VIEW



A2A4 U2-8,11-18 TOP VIEW — CIRCUIT BOARD TOP VIEW



A2A4 U9 TOP VIEW — CIRCUIT BOARD TOP VIEW



SERVICE SHEET A2A4 55

Figure 8-730. A2A4 Modulation Assembly Schematic

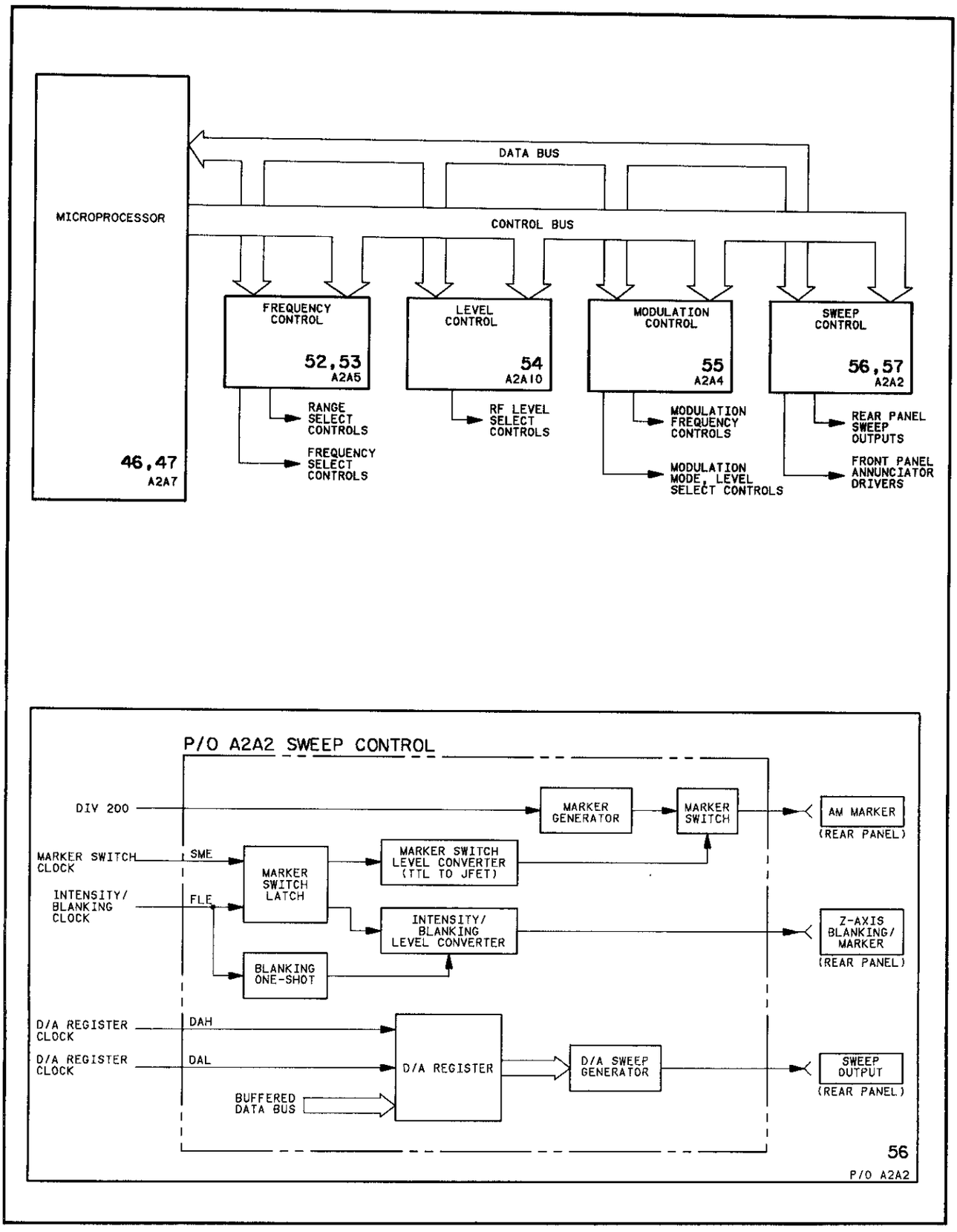


Figure 8-731. P/O A2A2 Sweep Control Assembly Block Diagrams

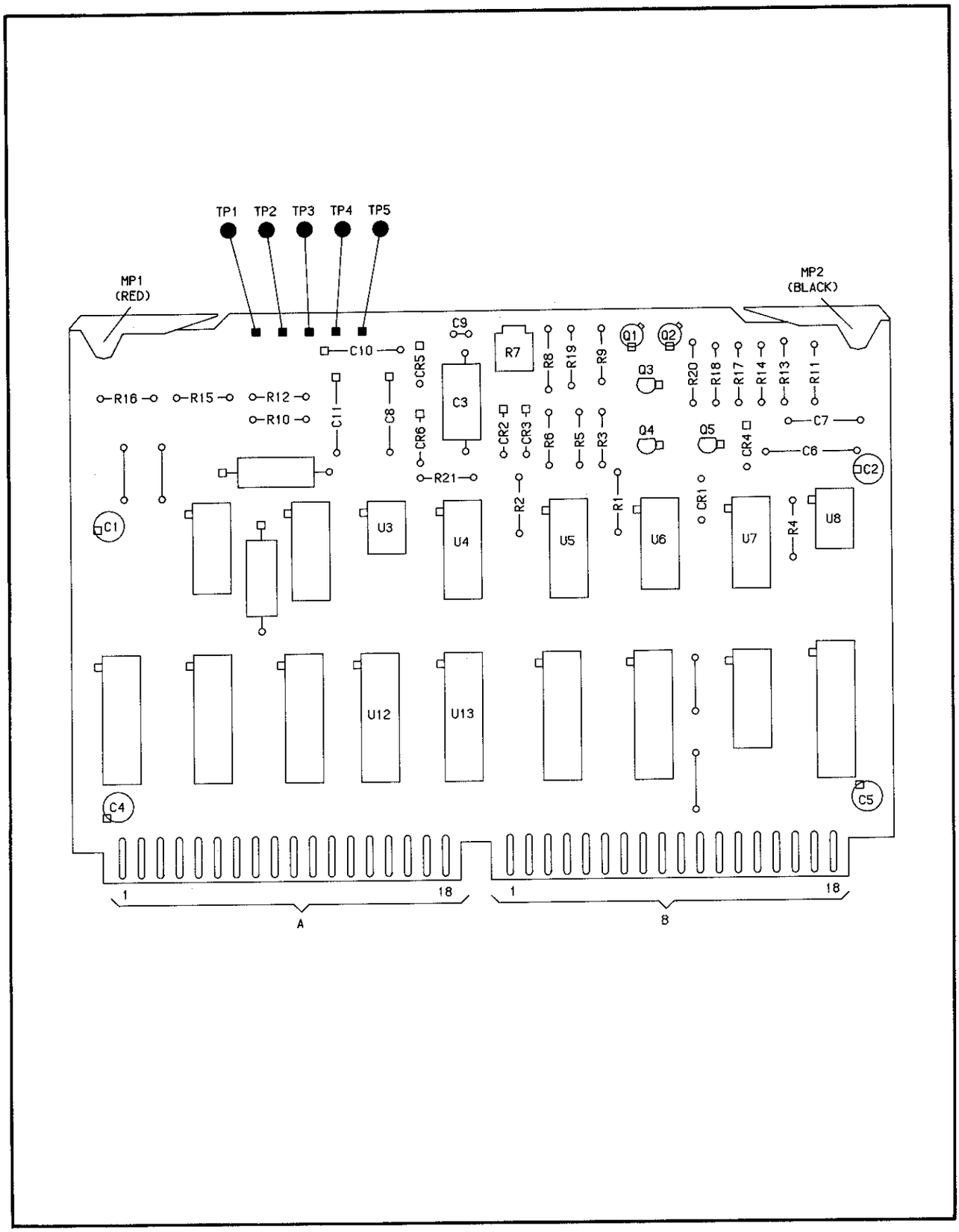
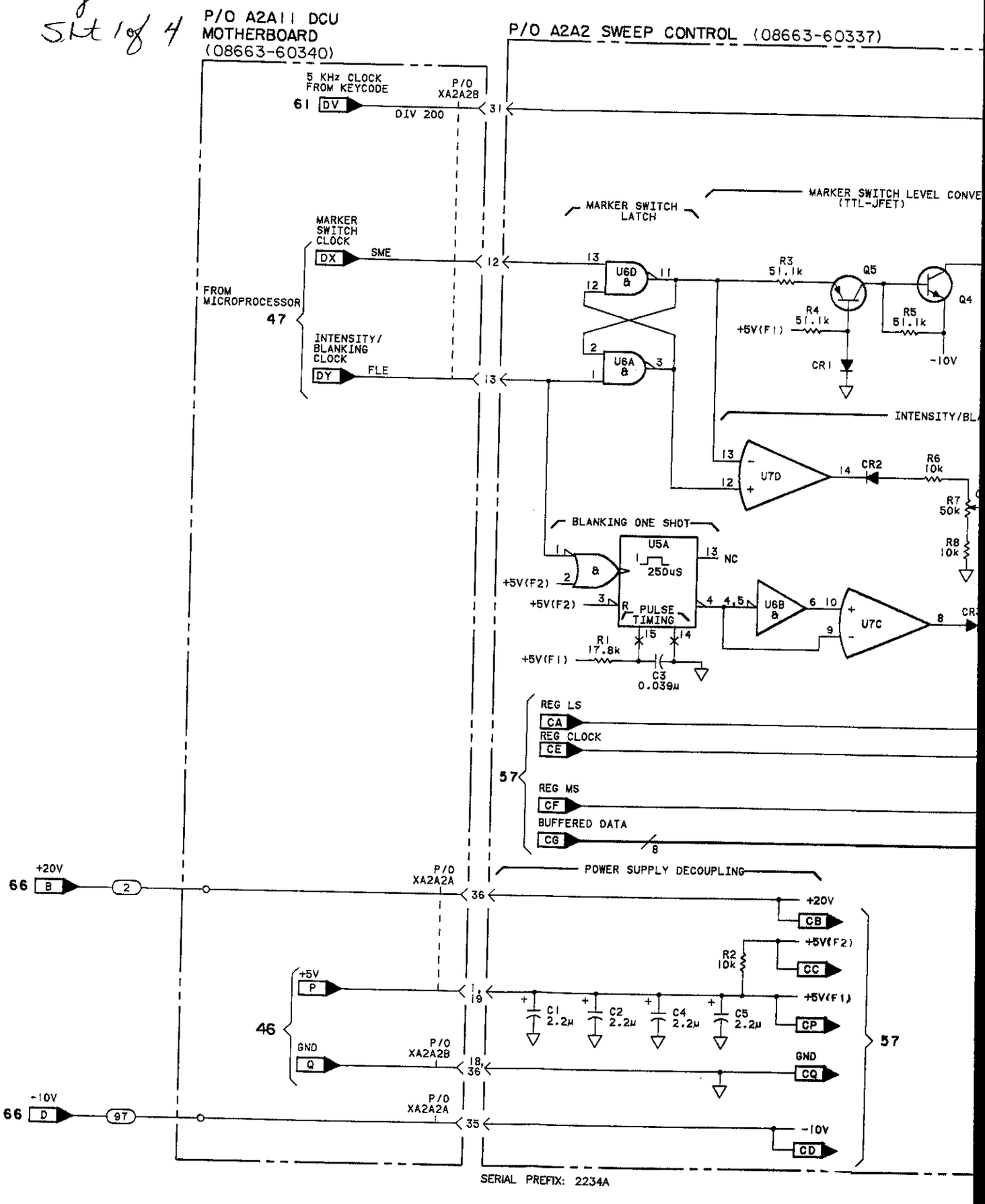


Figure 8-732. P/O A2A2 Sweep Control Assembly Component Locator

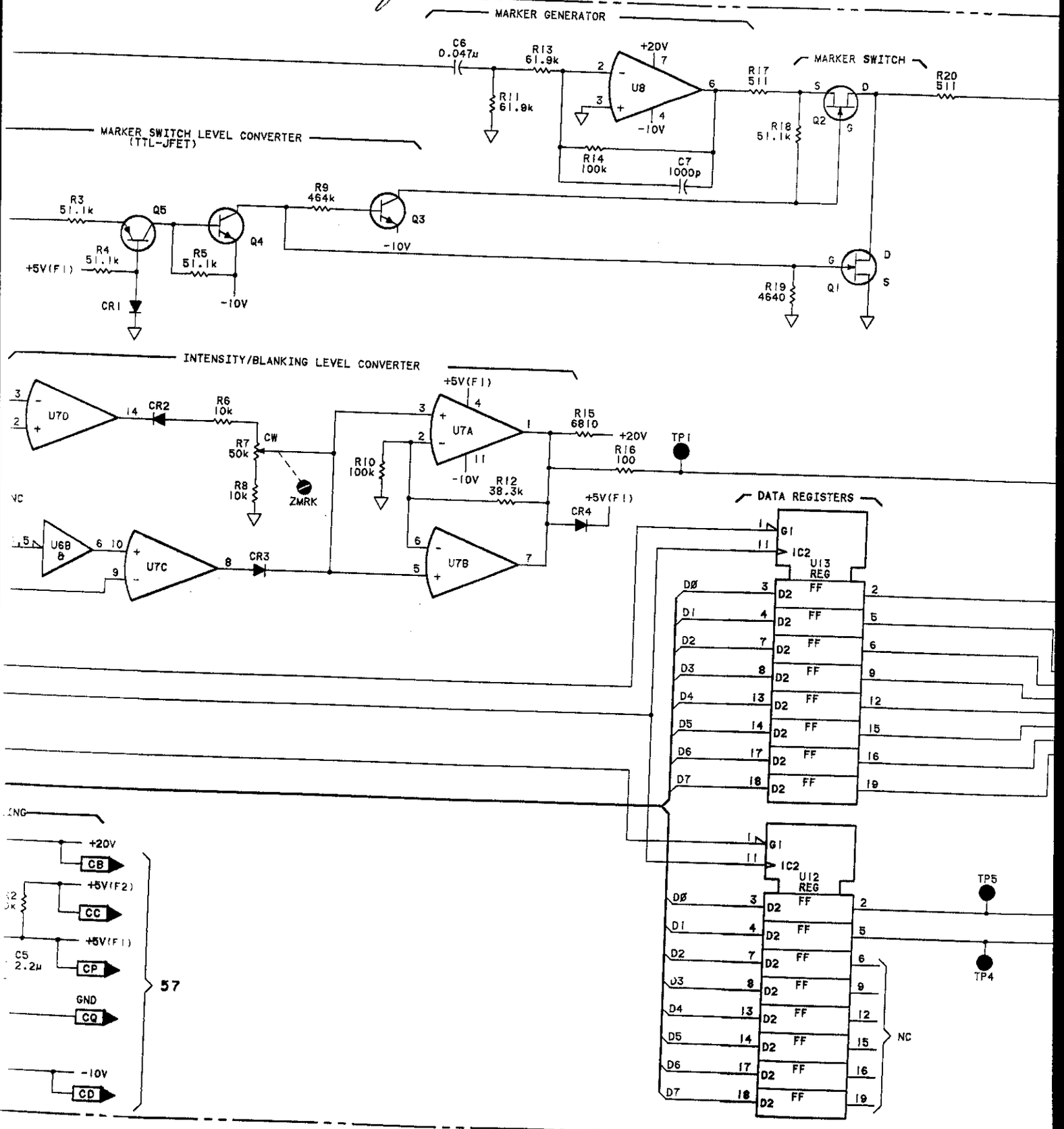
Fig 8-733
Sht 1 of 4



OL (08663-60337)

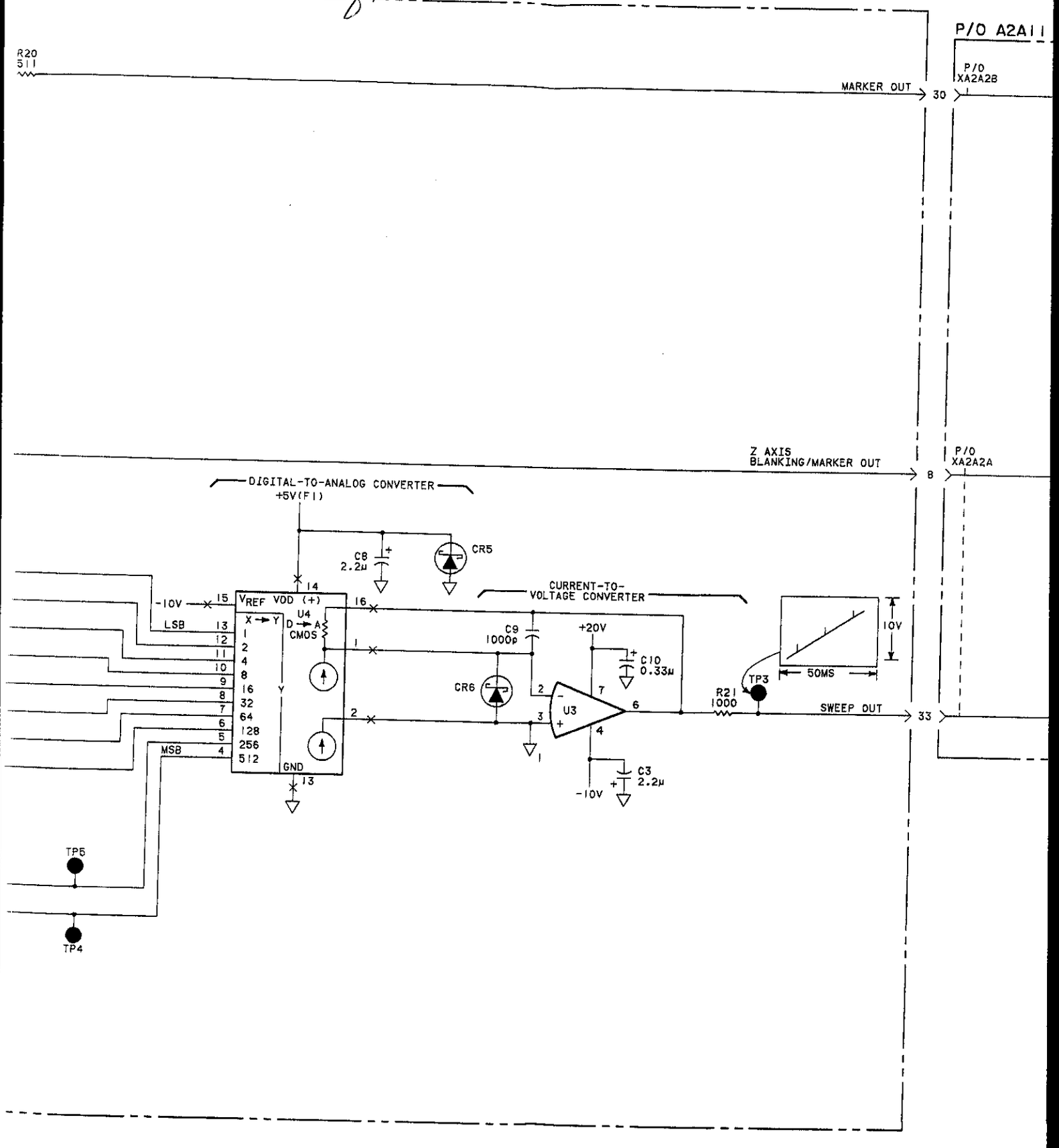
Fig 8-733
Sht 2 of 4

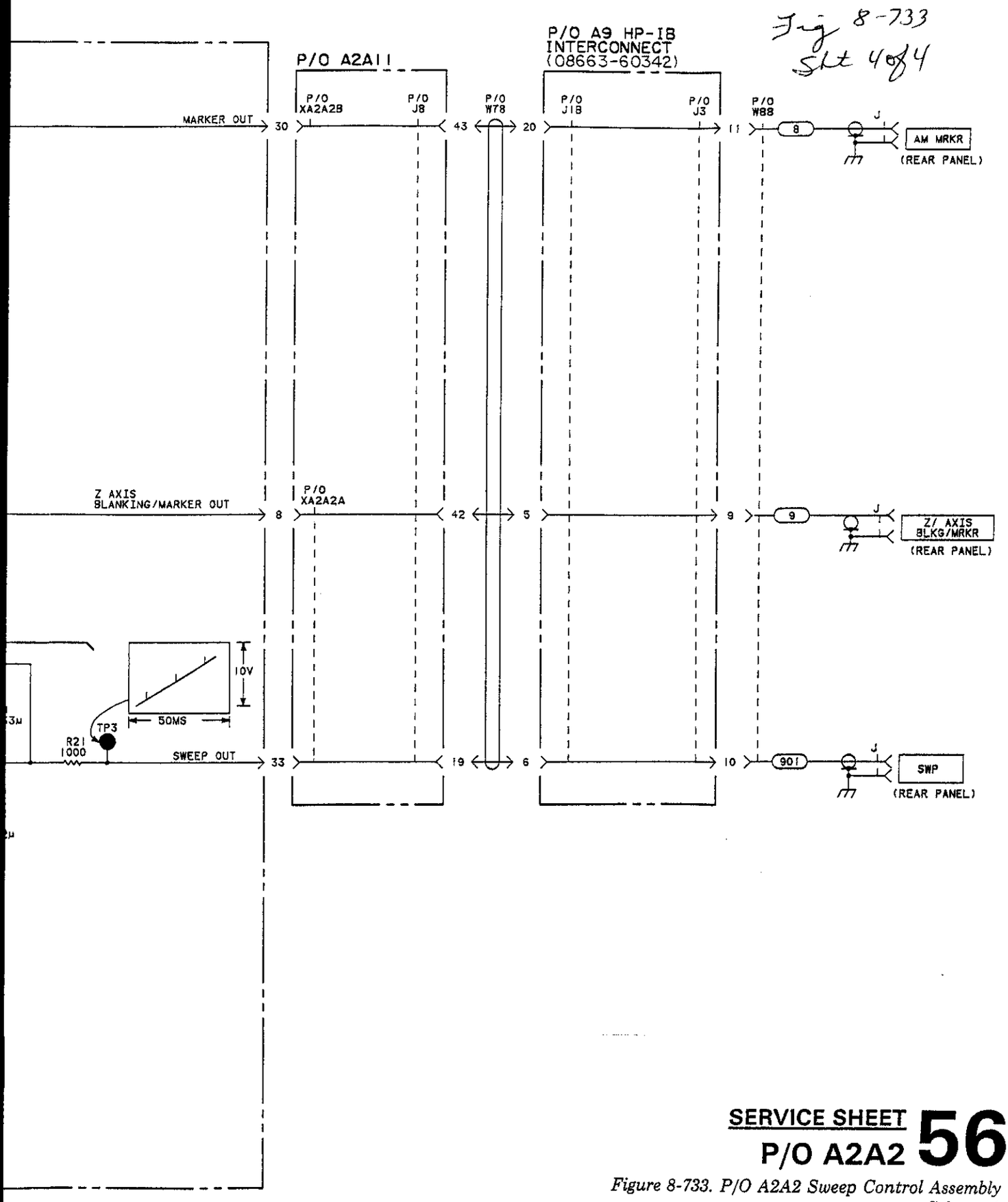
/2200



/22009B

Fig 8-733
Sht 3 of 4





SERVICE SHEET 56

P/O A2A2

Figure 8-733. P/O A2A2 Sweep Control Assembly Schematic

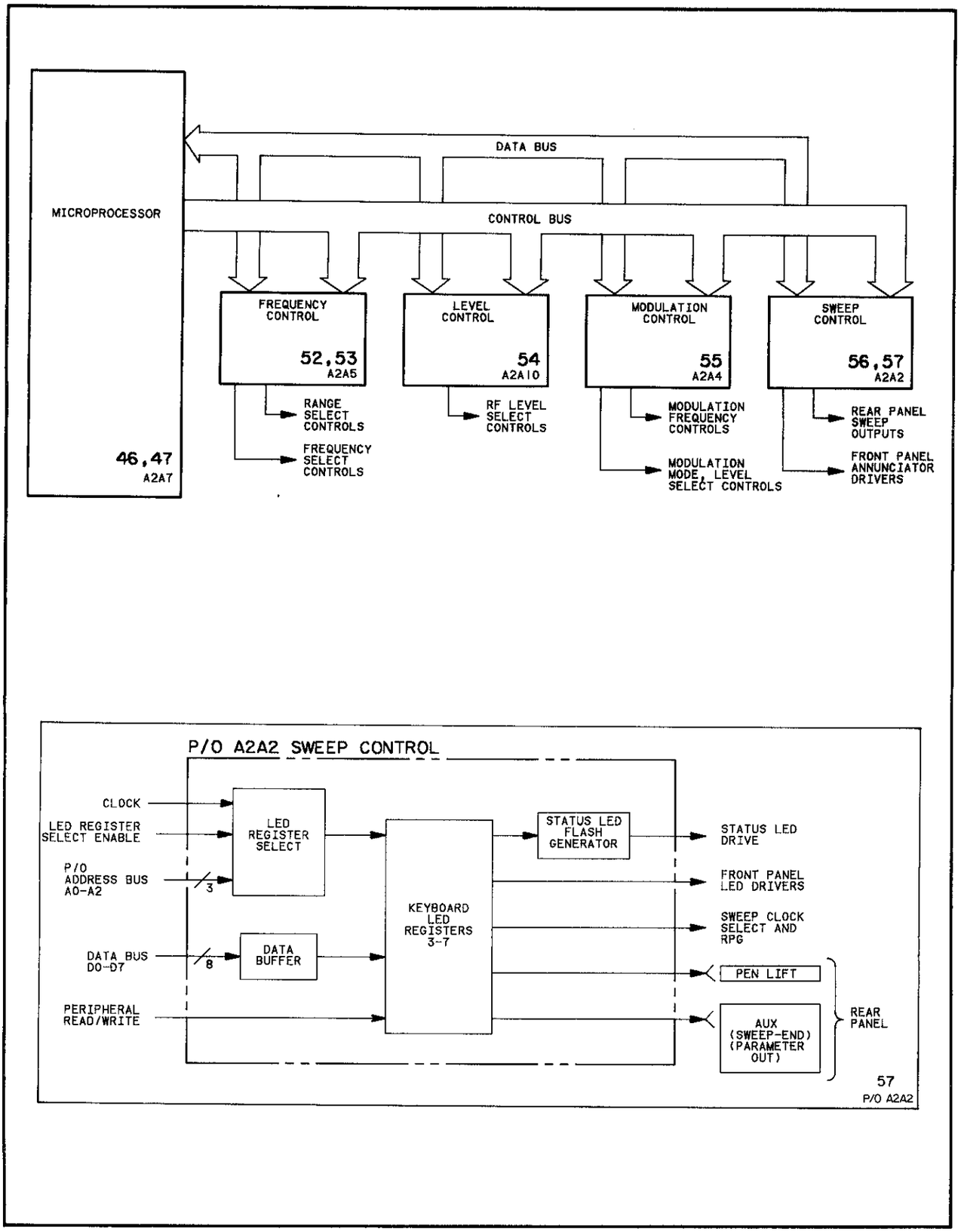


Figure 8-734. P/O A2A2 Sweep Control Assembly Block Diagrams

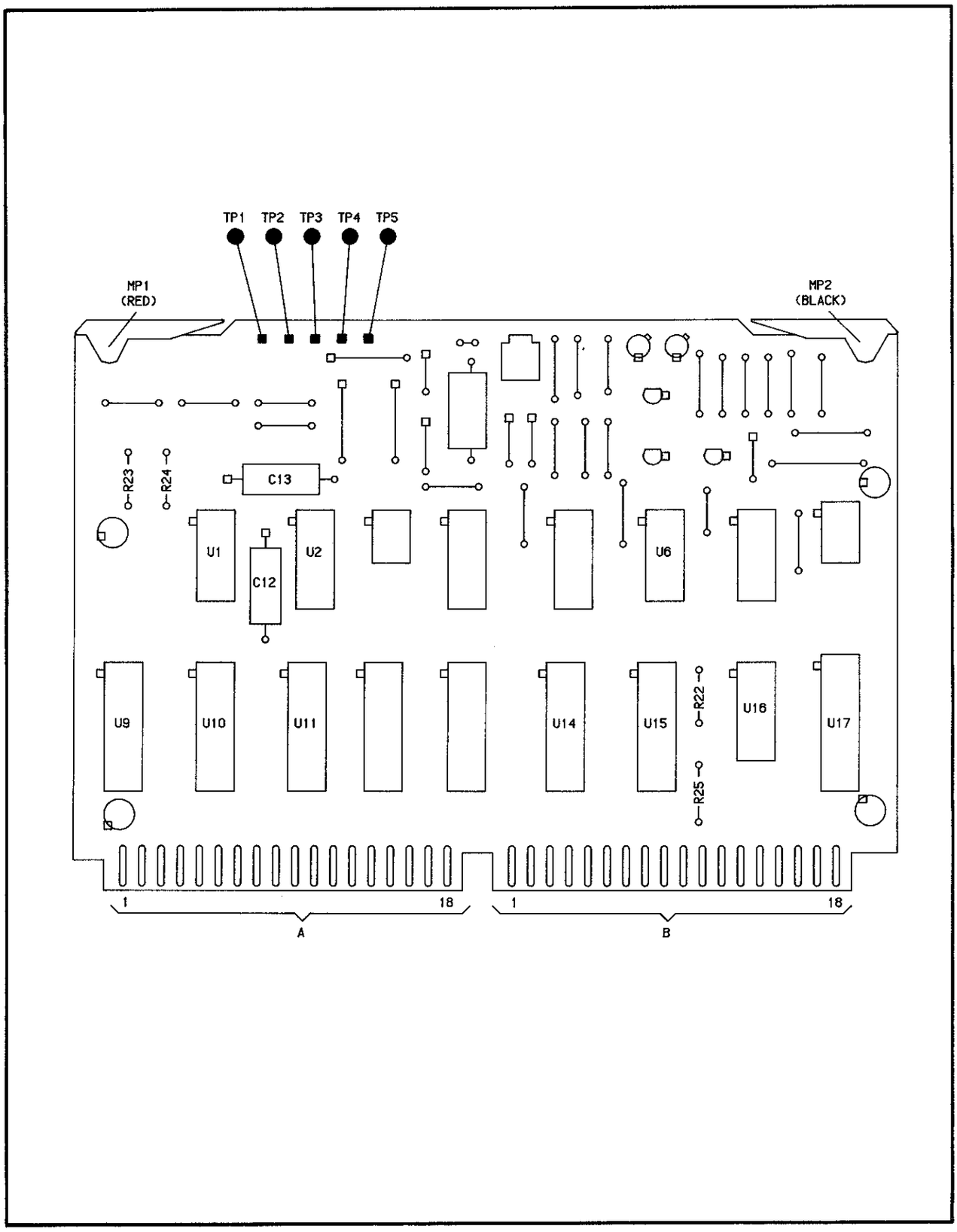
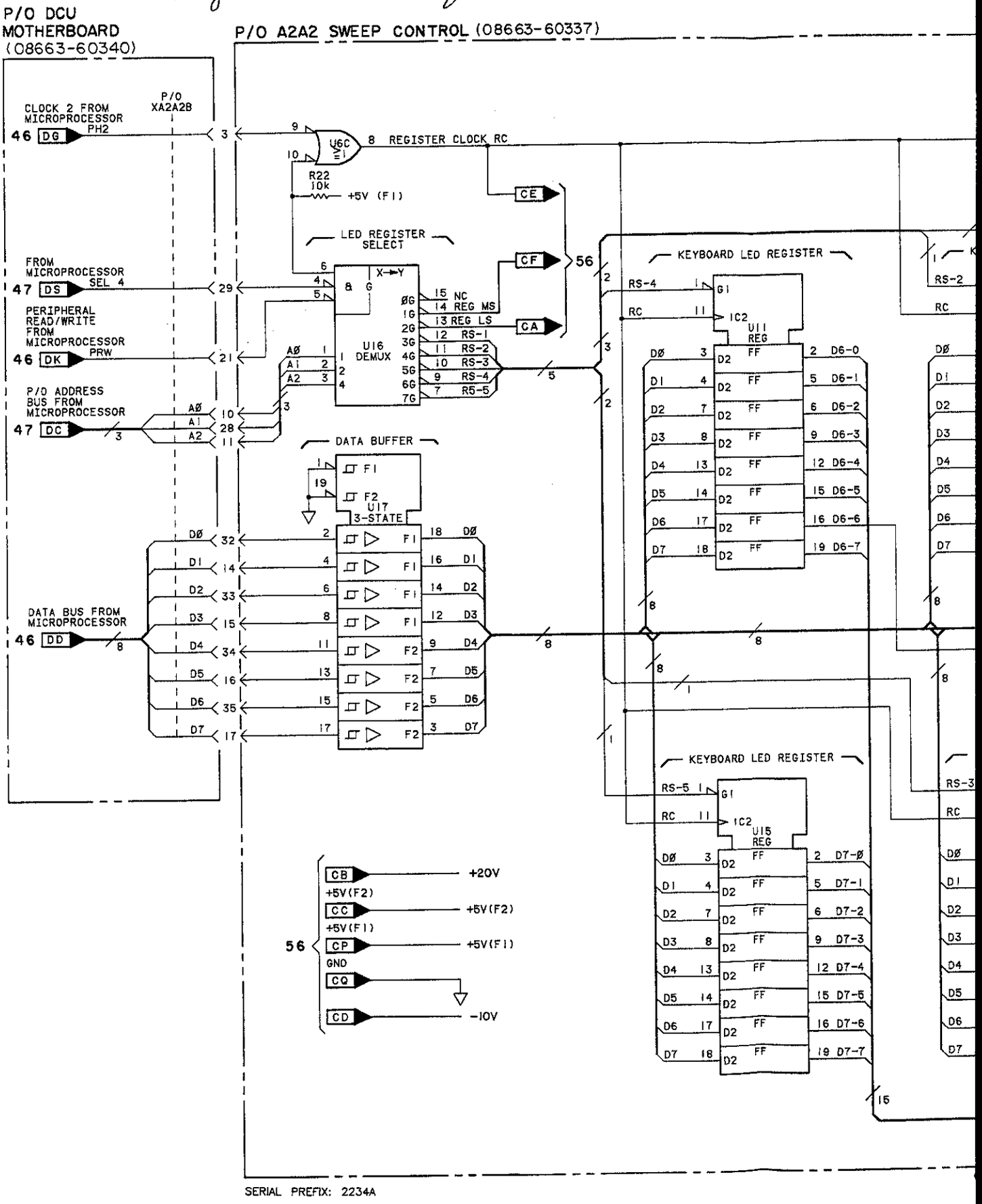


Figure 8-735. P/O A2A2 Sweep Assembly Component Locator

Fig 8-736 Sht 1 of 3



SERIAL PREFIX: 2234A

Fig 8-73L
Sht 2 of 3

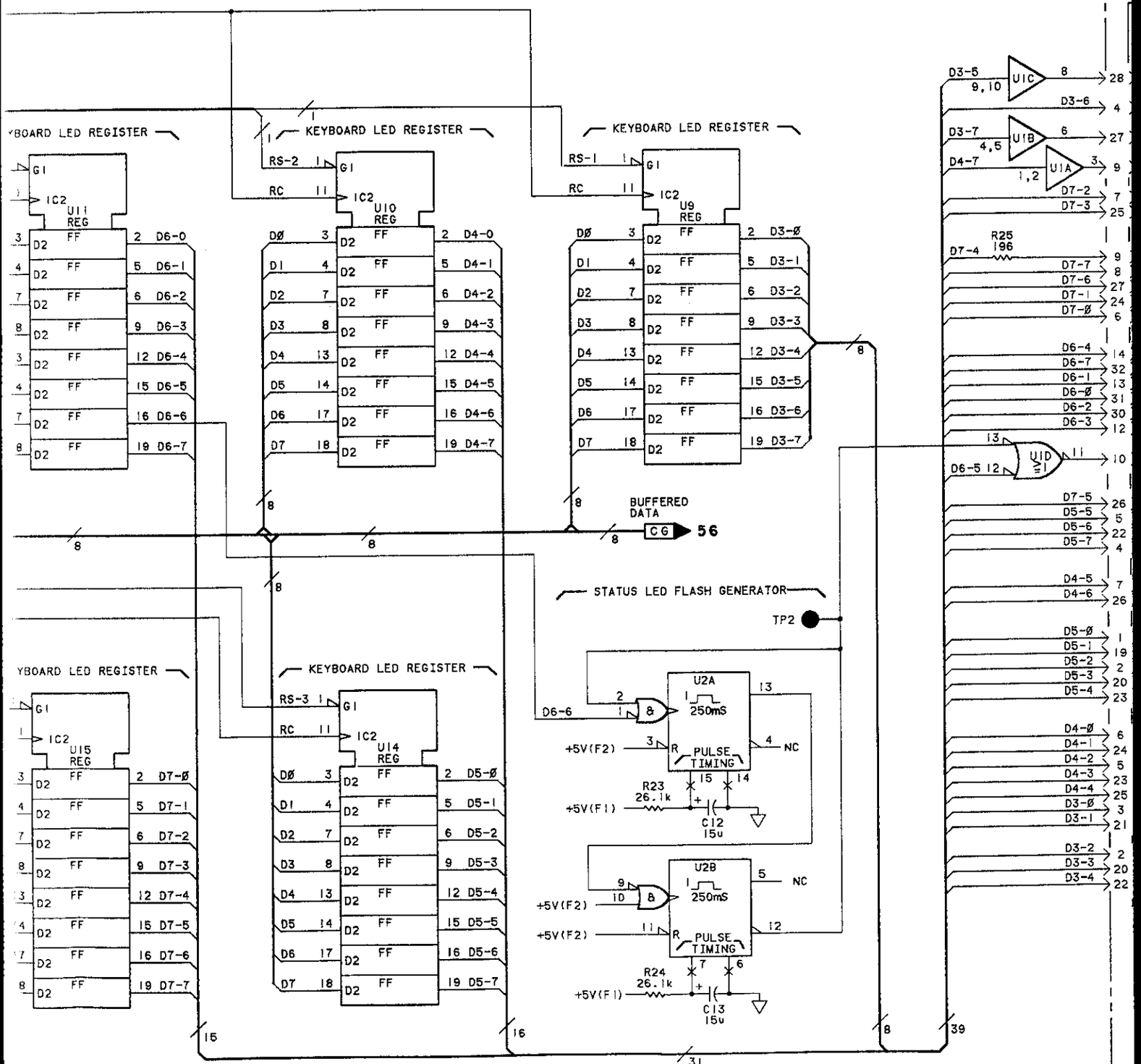
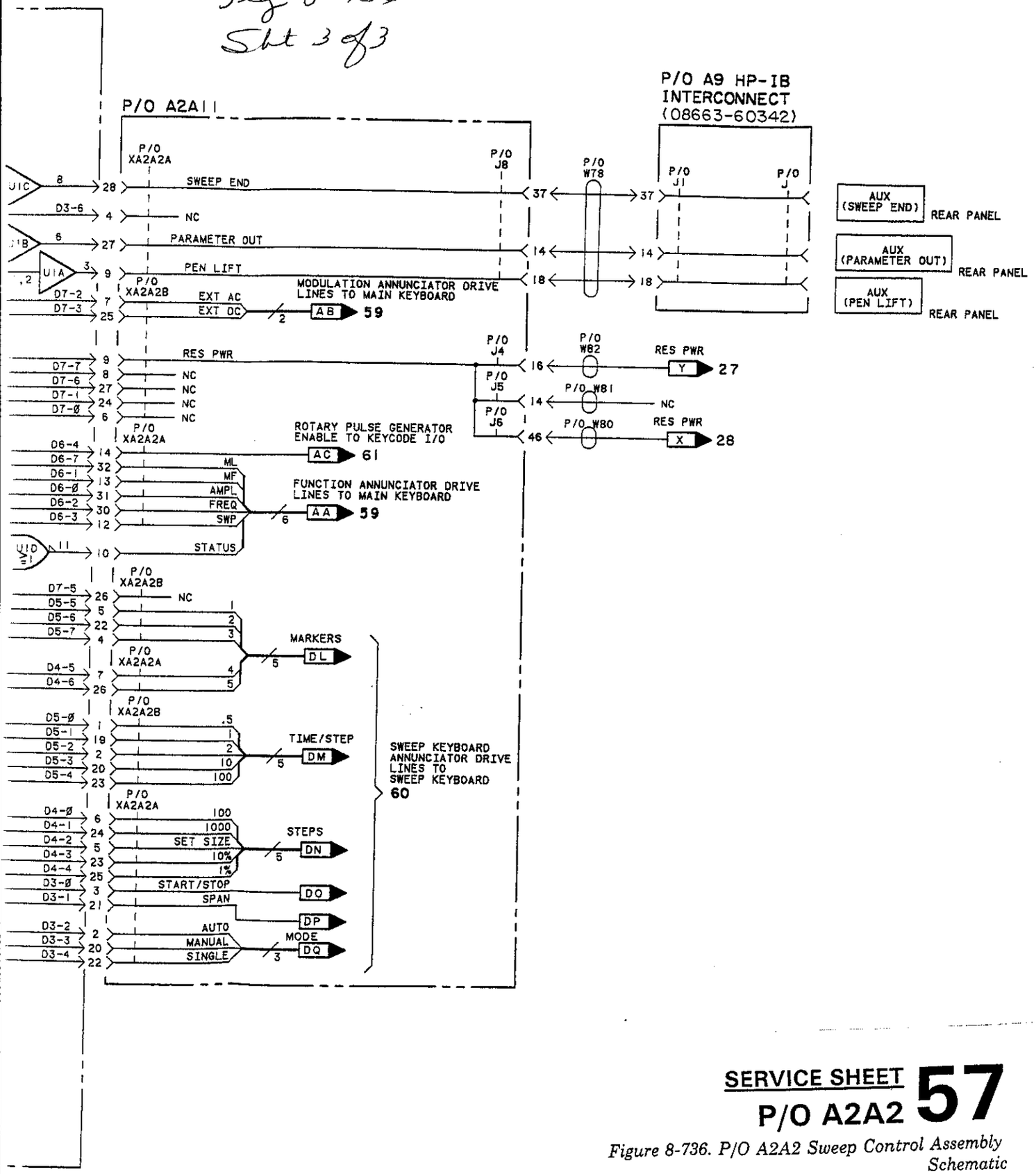


Fig 8-736
Sht 3 of 3



SERVICE SHEET 57

P/O A2A2

Figure 8-736. P/O A2A2 Sweep Control Assembly Schematic

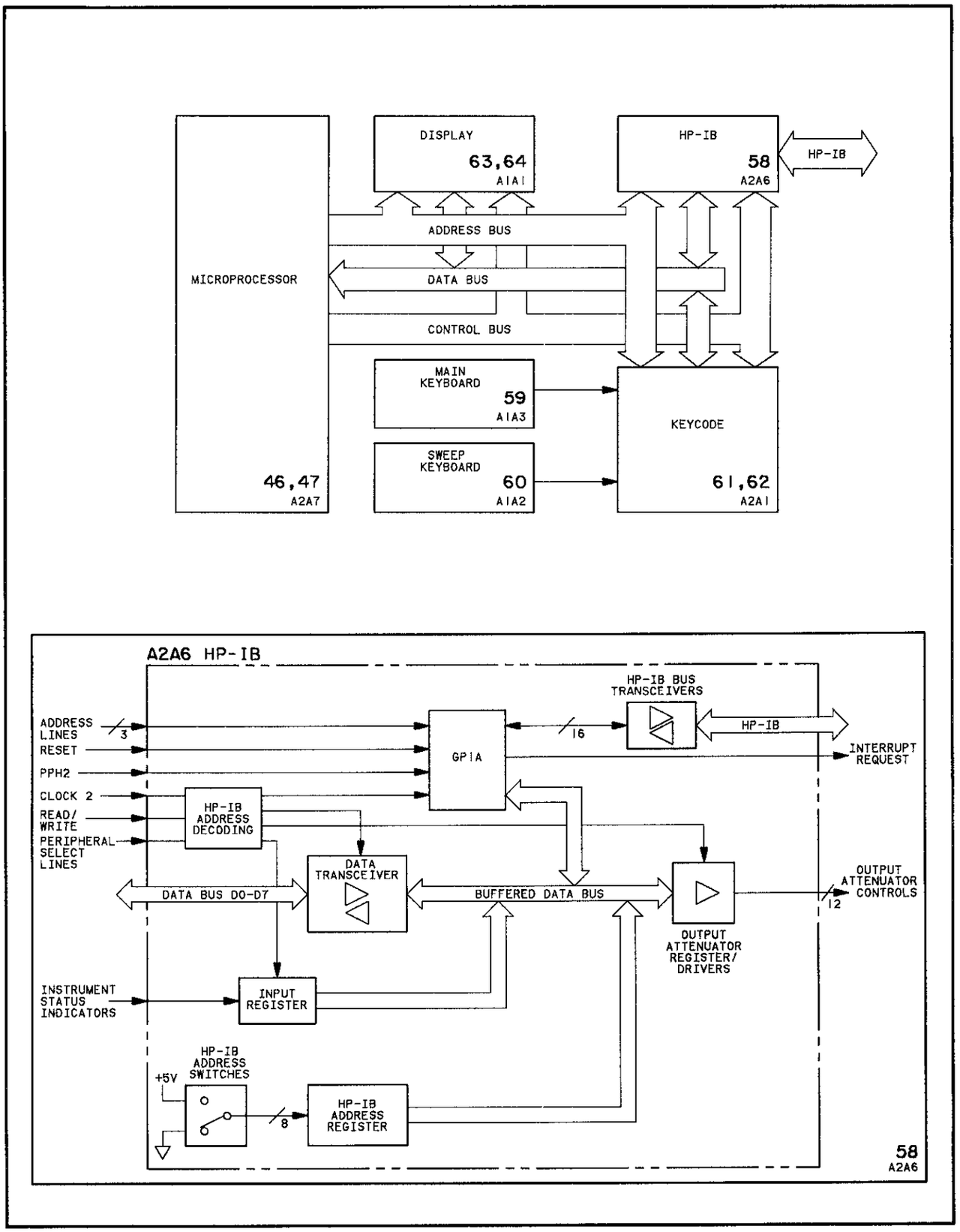


Figure 8-737. A2A6 HP-IB Assembly Block Diagrams

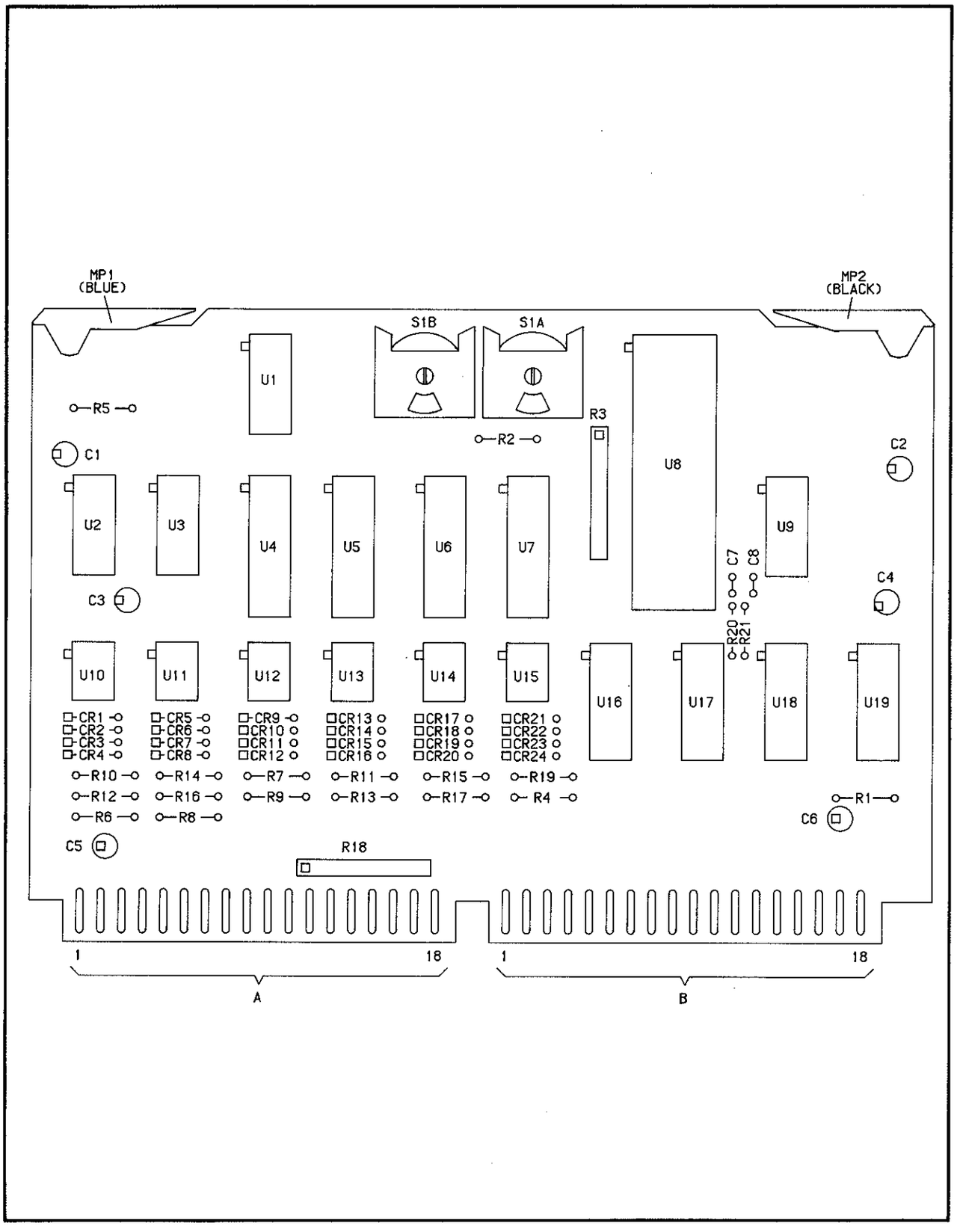
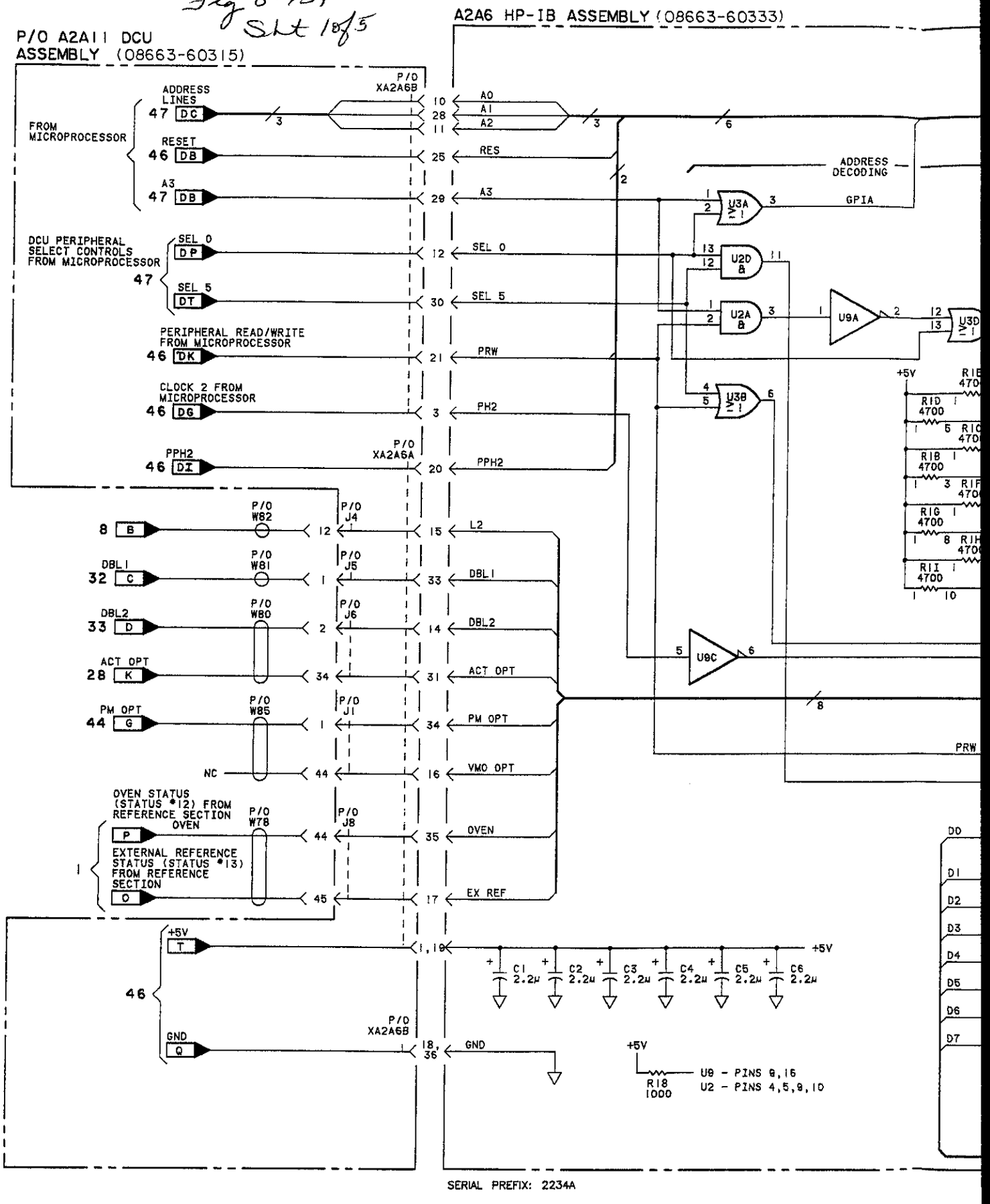


Figure 8-738. A2A6 HP-IB Assembly Component Locator

Fig 8-739 Sht 10 of 5



SERIAL PREFIX: 2234A

Fig 8-739 Sht 2 of 5

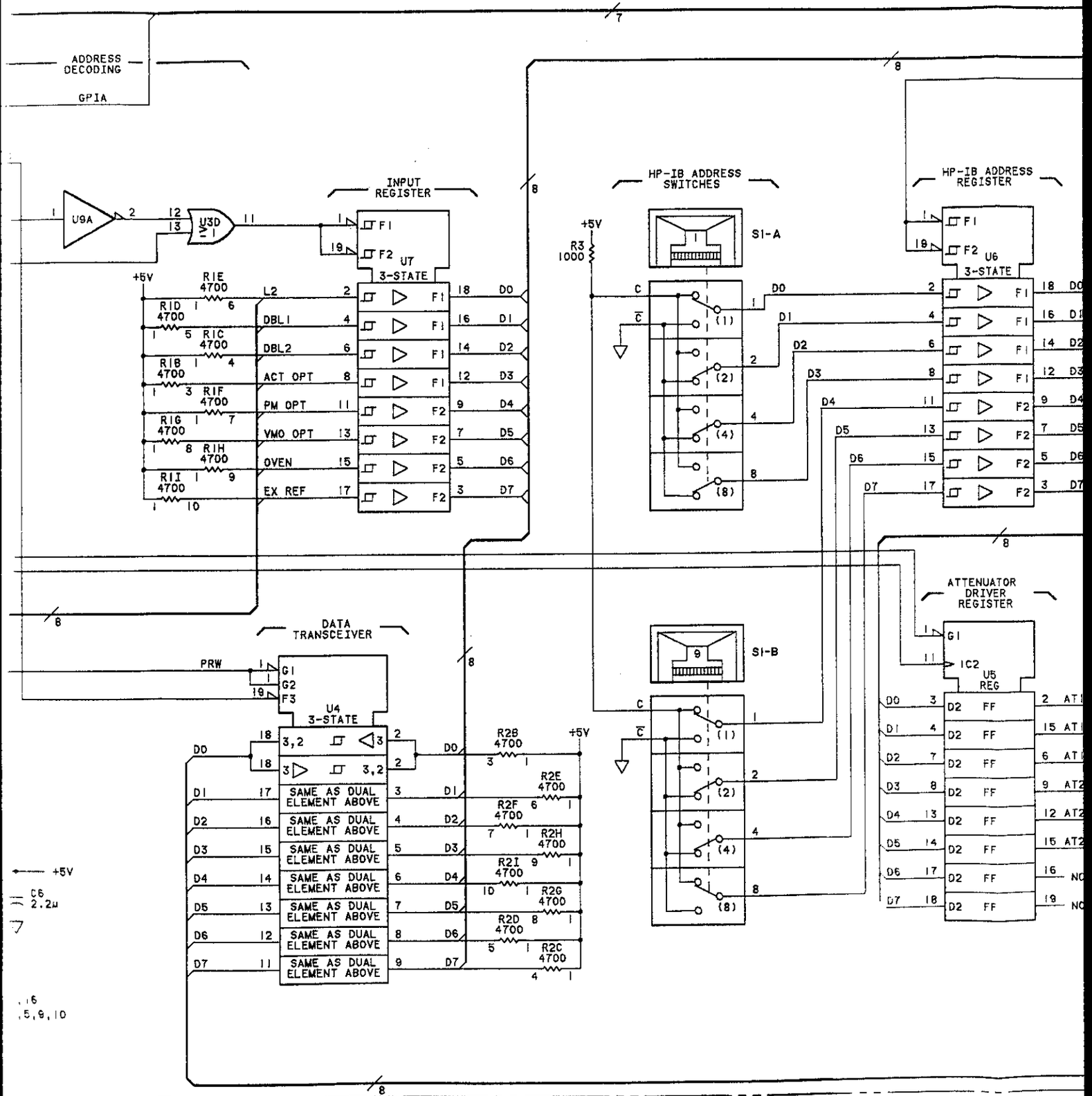


Fig 8-739 Sht 3 of 5

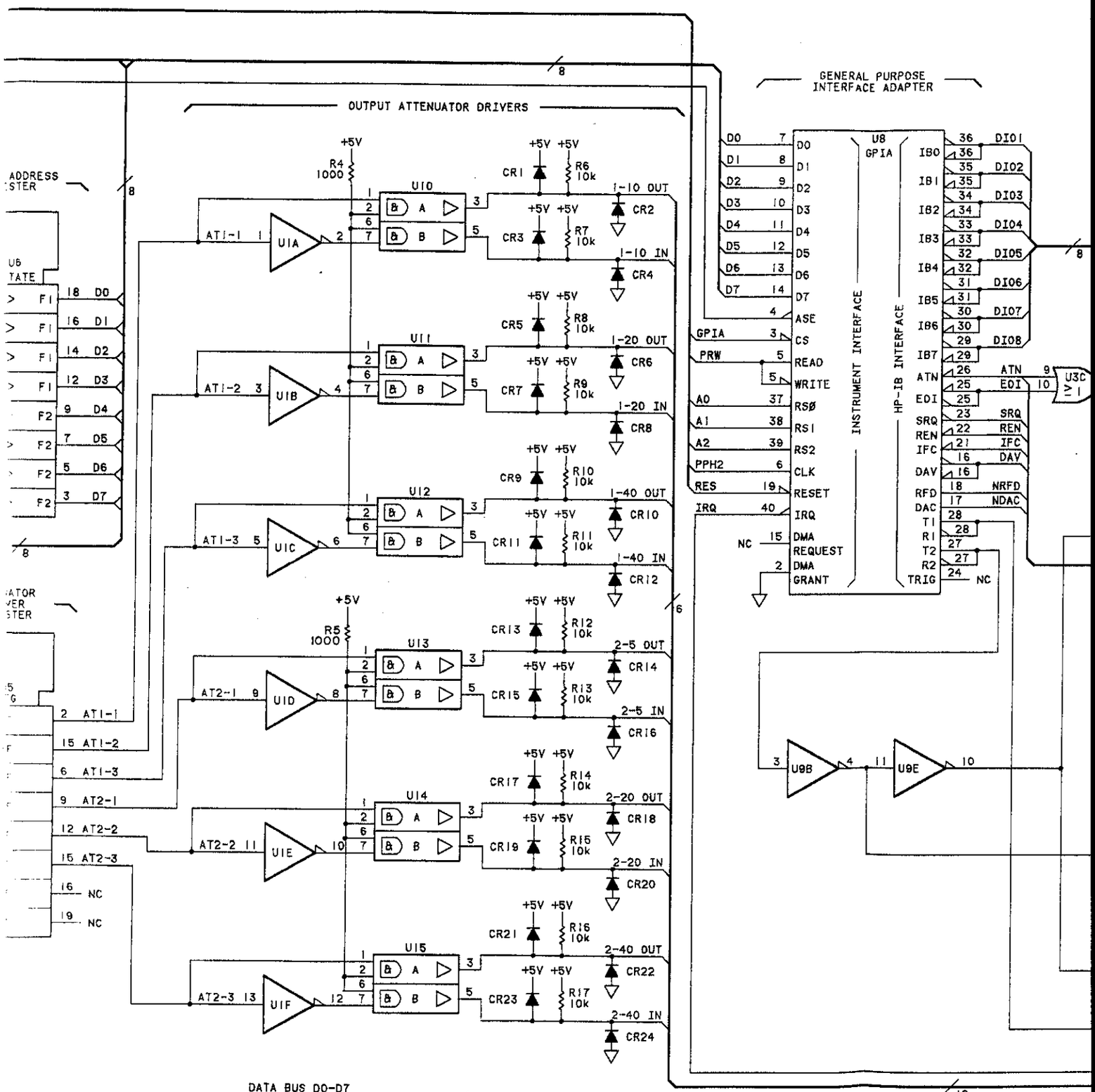
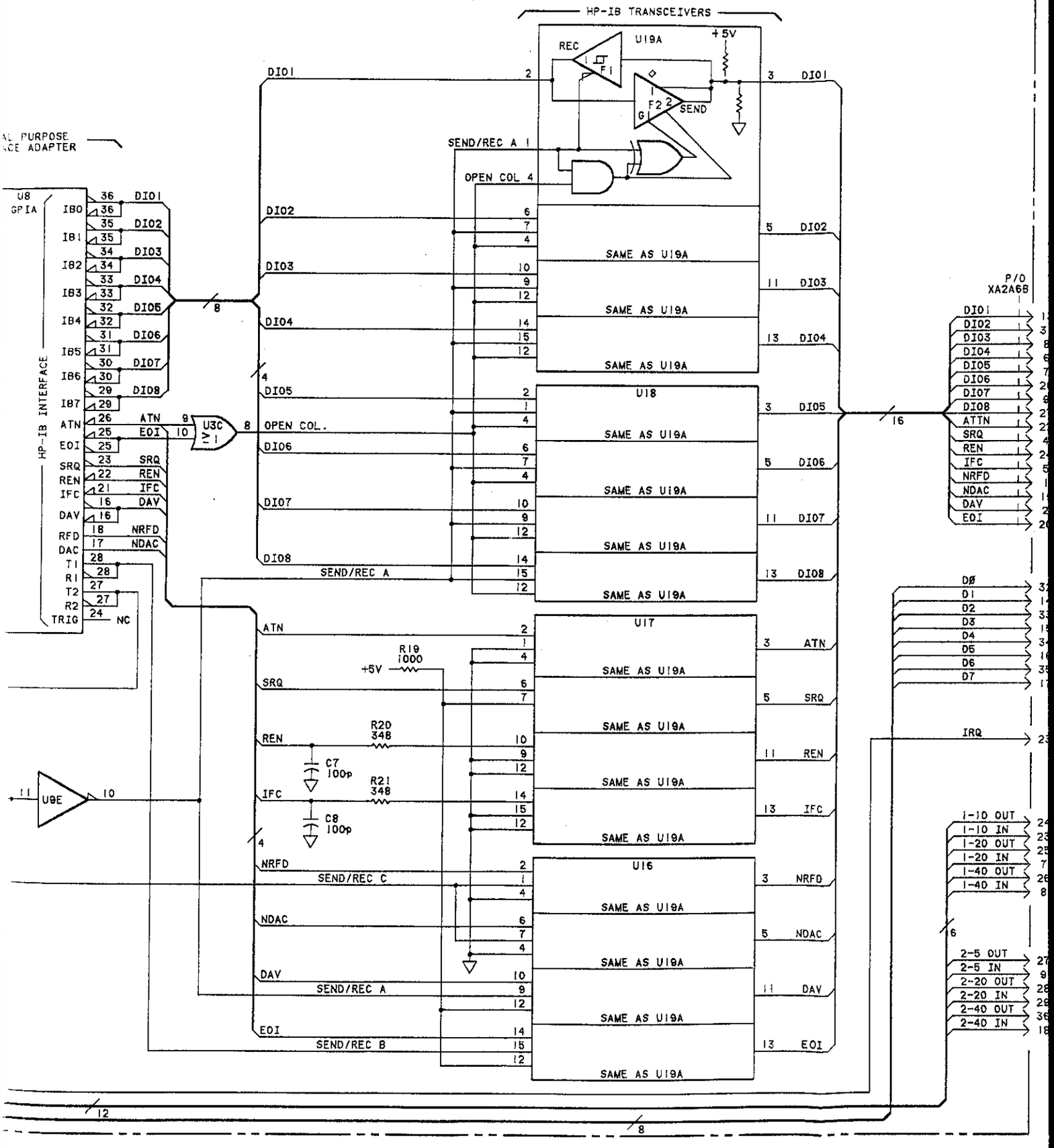
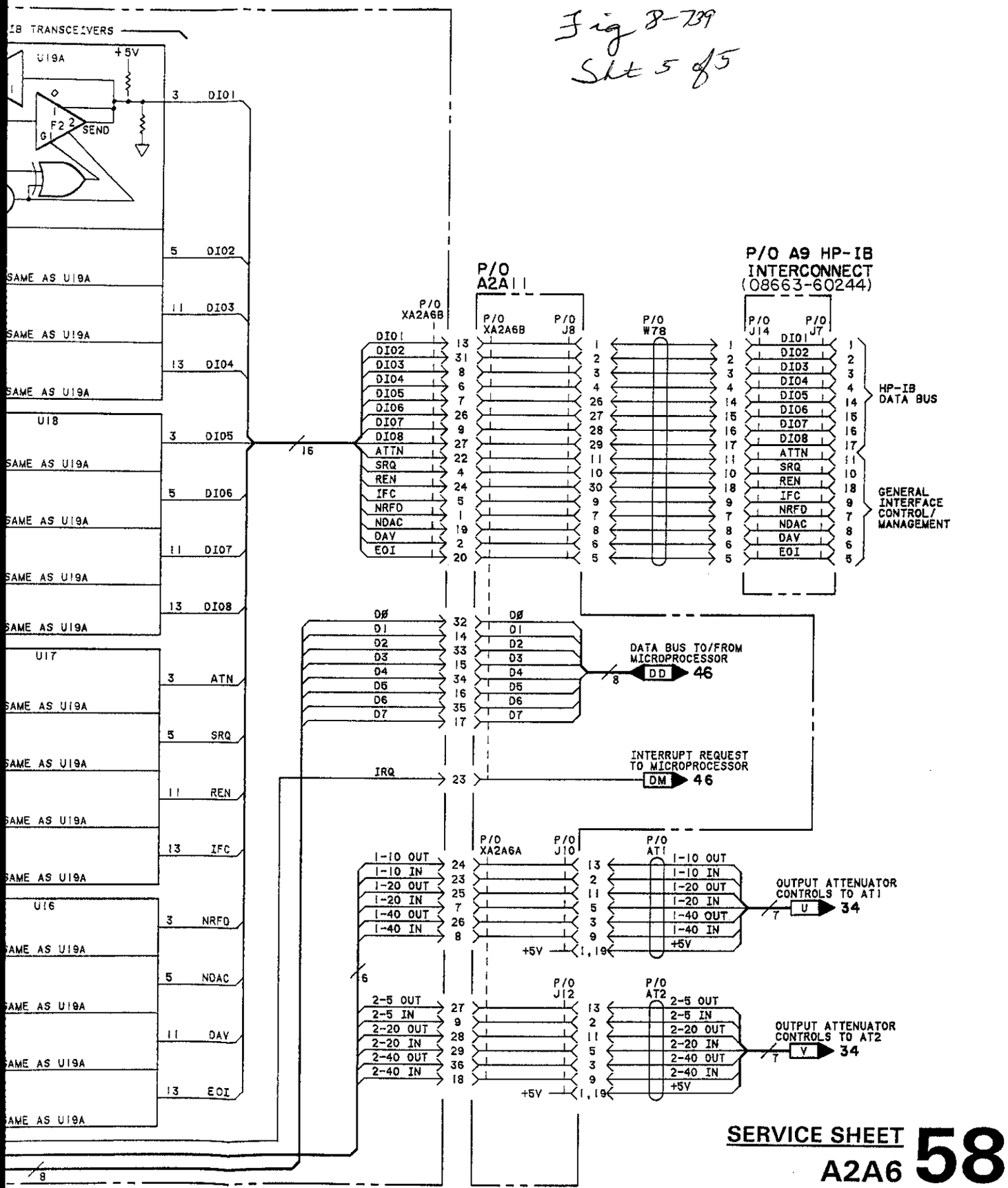


Fig 8-239 Sht 4 of 5





SERVICE SHEET A2A6 58

Figure 8-739. A2A6 HP-IB Assembly Schematic

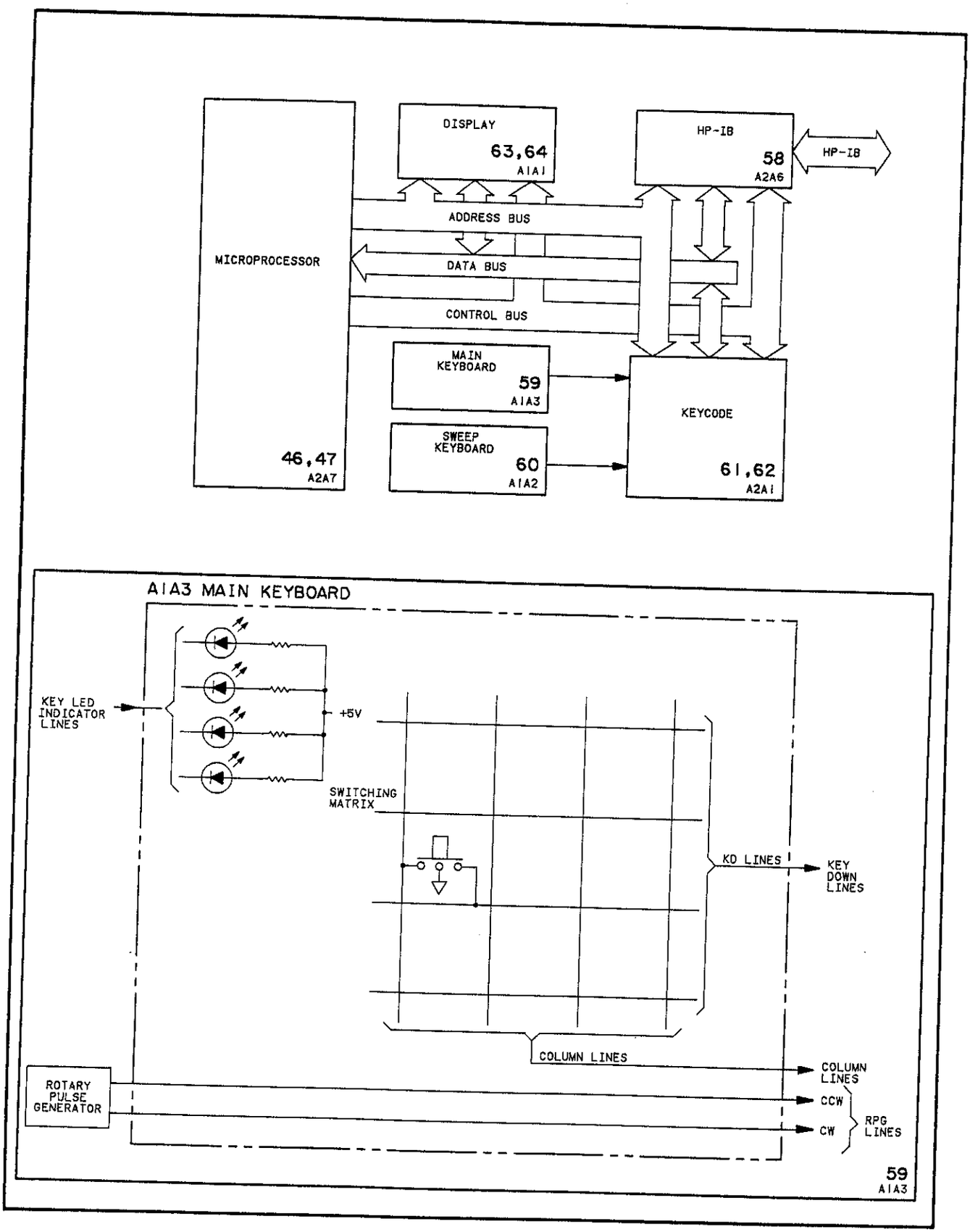


Figure 8-740. A1A3 Main Keyboard Block Diagrams

Fig 8-741
Sht 1 of 2

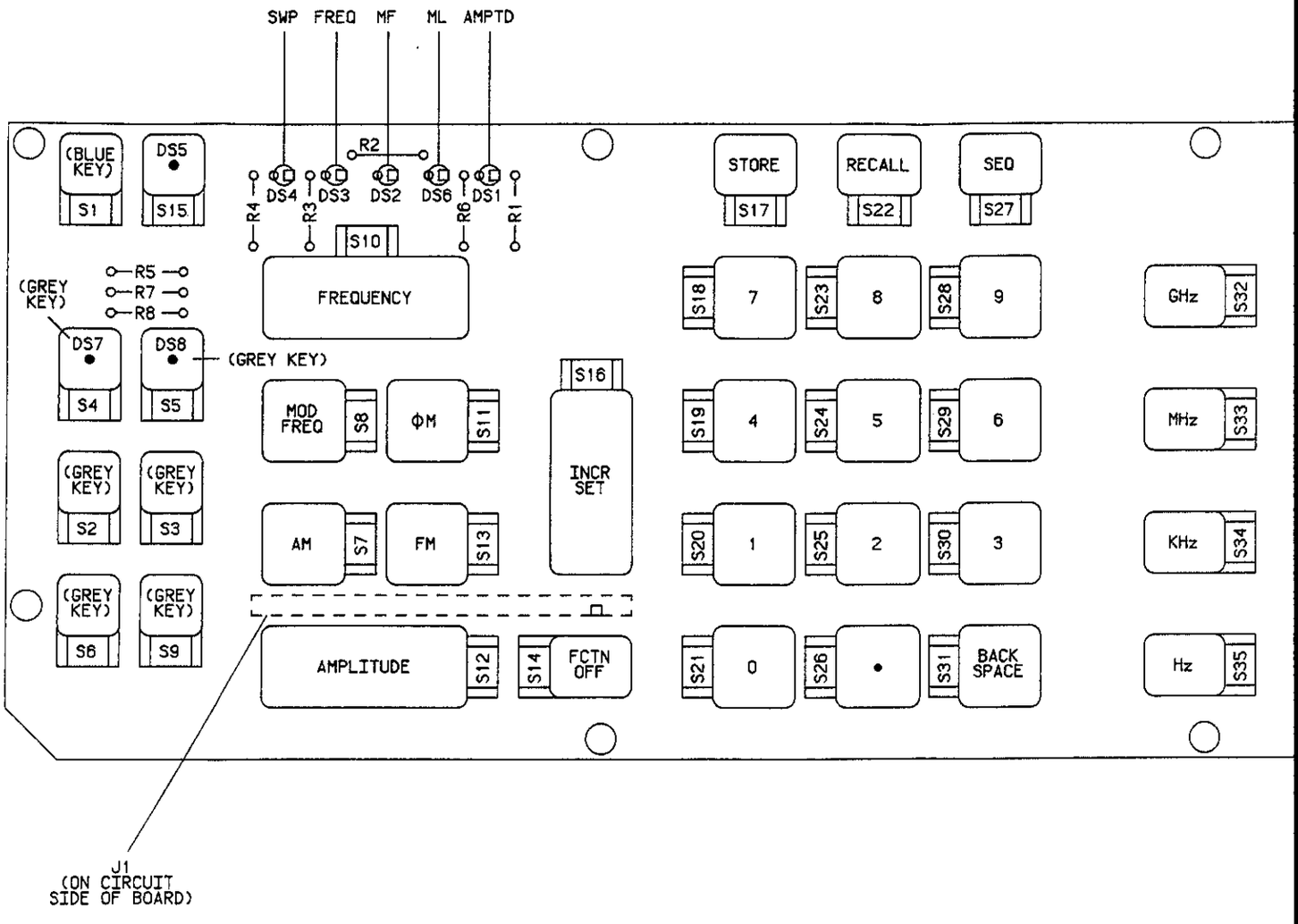


Figure 8-741. A1A3 Main Keyboard Component Locator

Fig 8-741
Sht 2 of 2

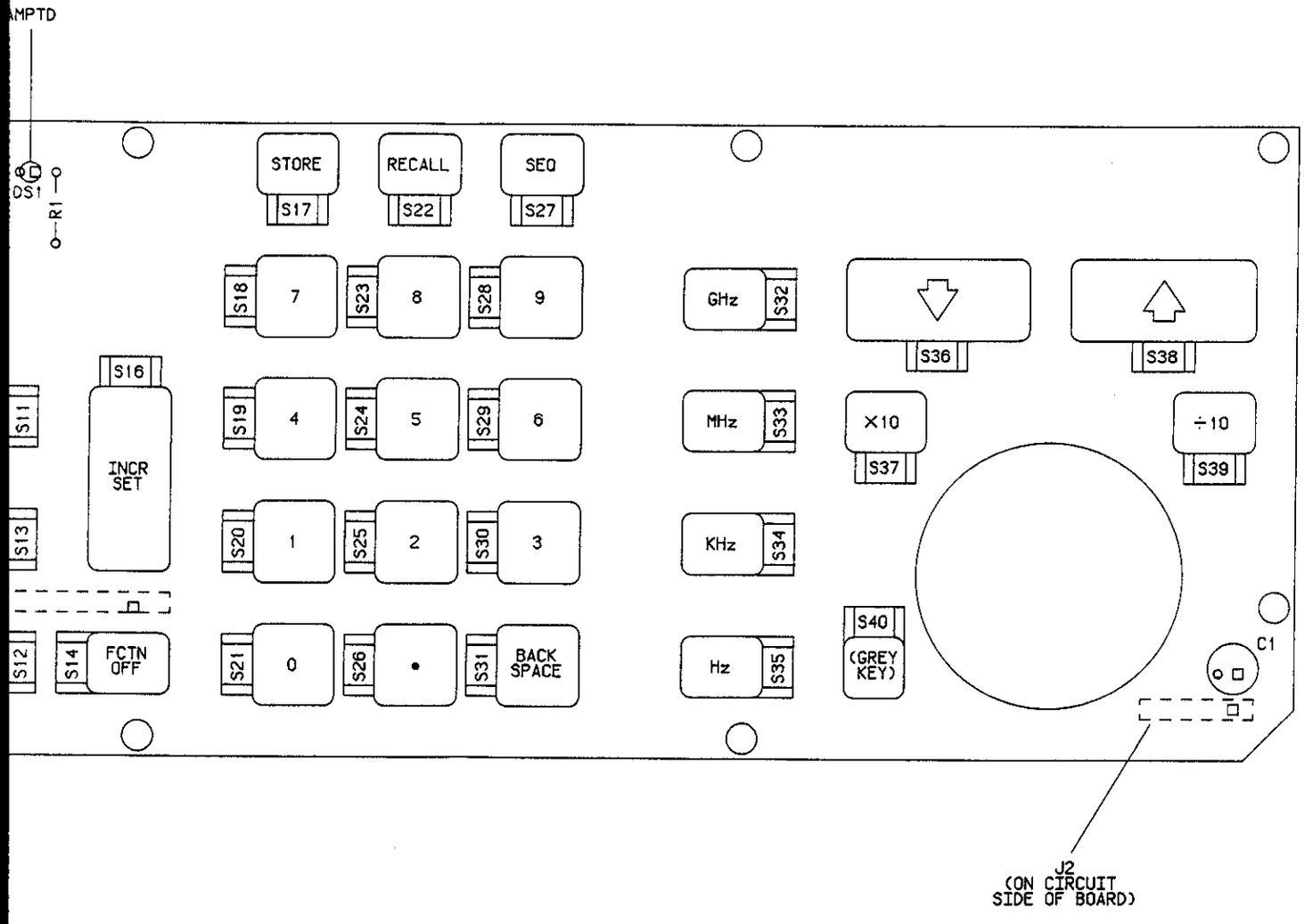
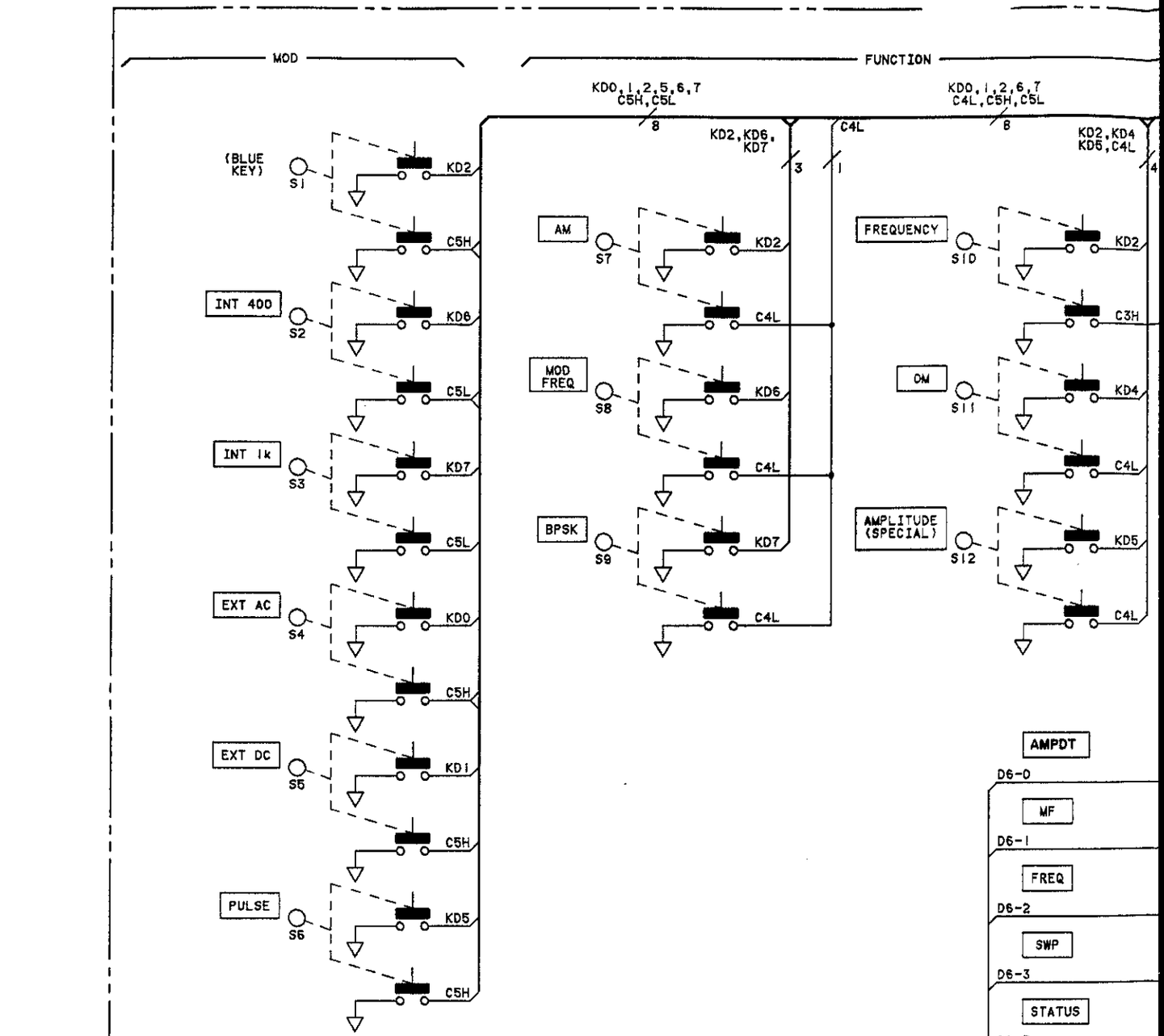


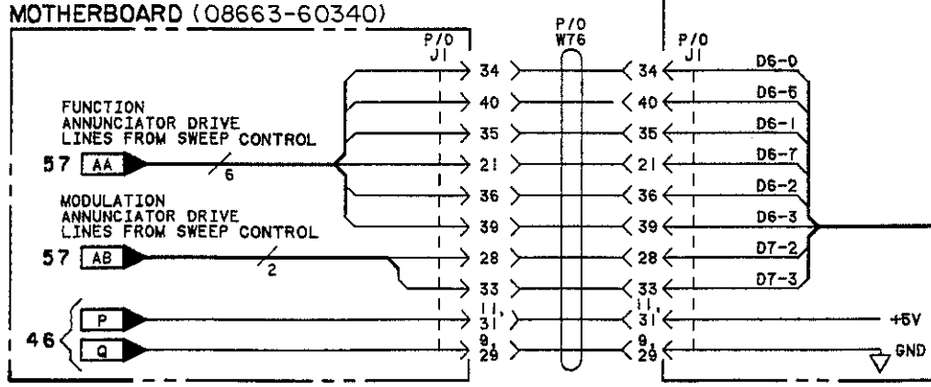
Figure 8-741. A1A3 Main Keyboard Component Locator

Fig 8-742 Sht 1 of 3

P/O A1A3 MAIN KEYBOARD ASSEMBLY (08663-60339)



P/O A2A11 DCU MOTHERBOARD (08663-60340)



SERIAL PREFIX: 2234A

Fig 8-142 Sht 2 of 5

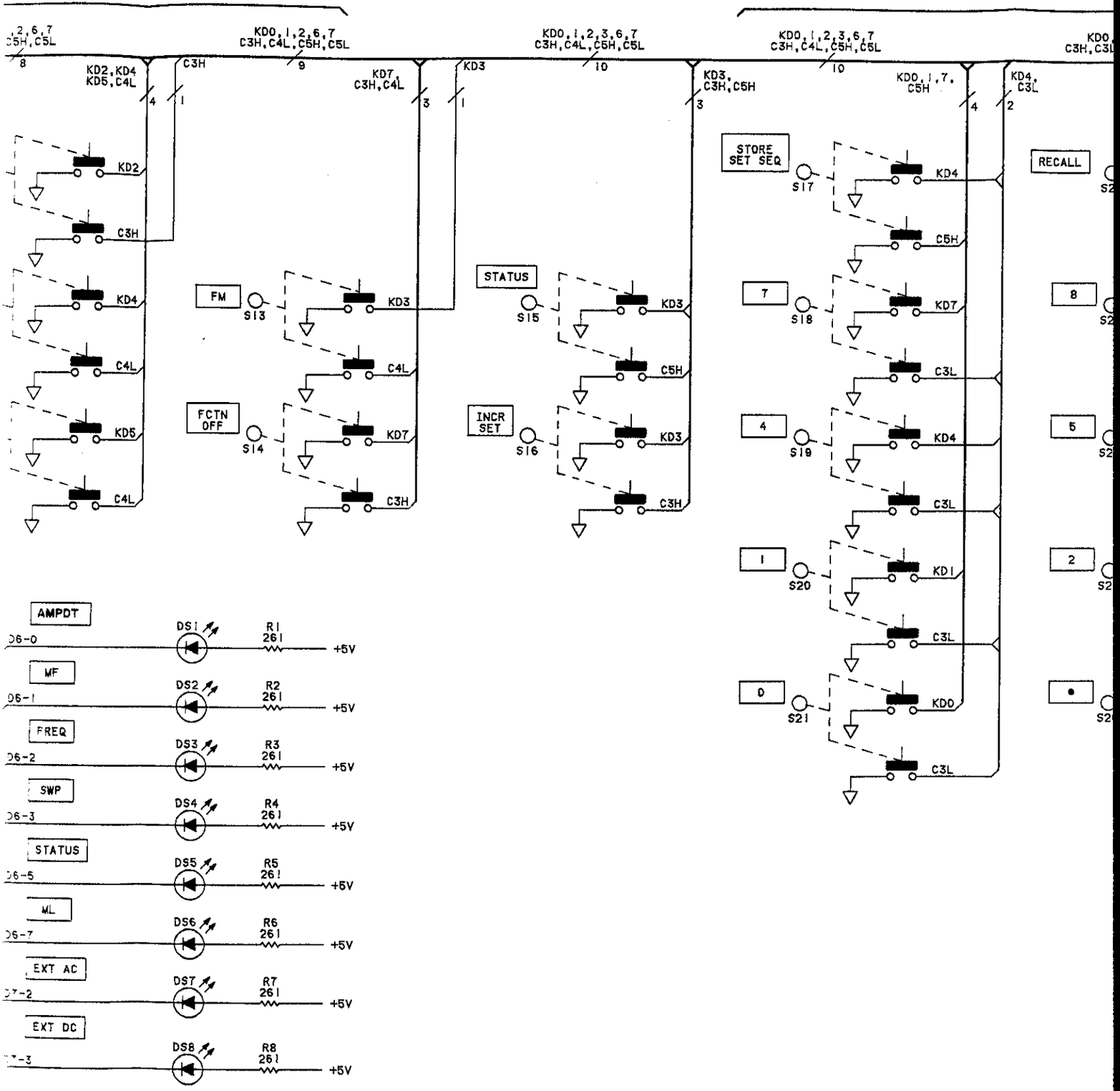


Fig 8-7/2 Sht 3 of 5

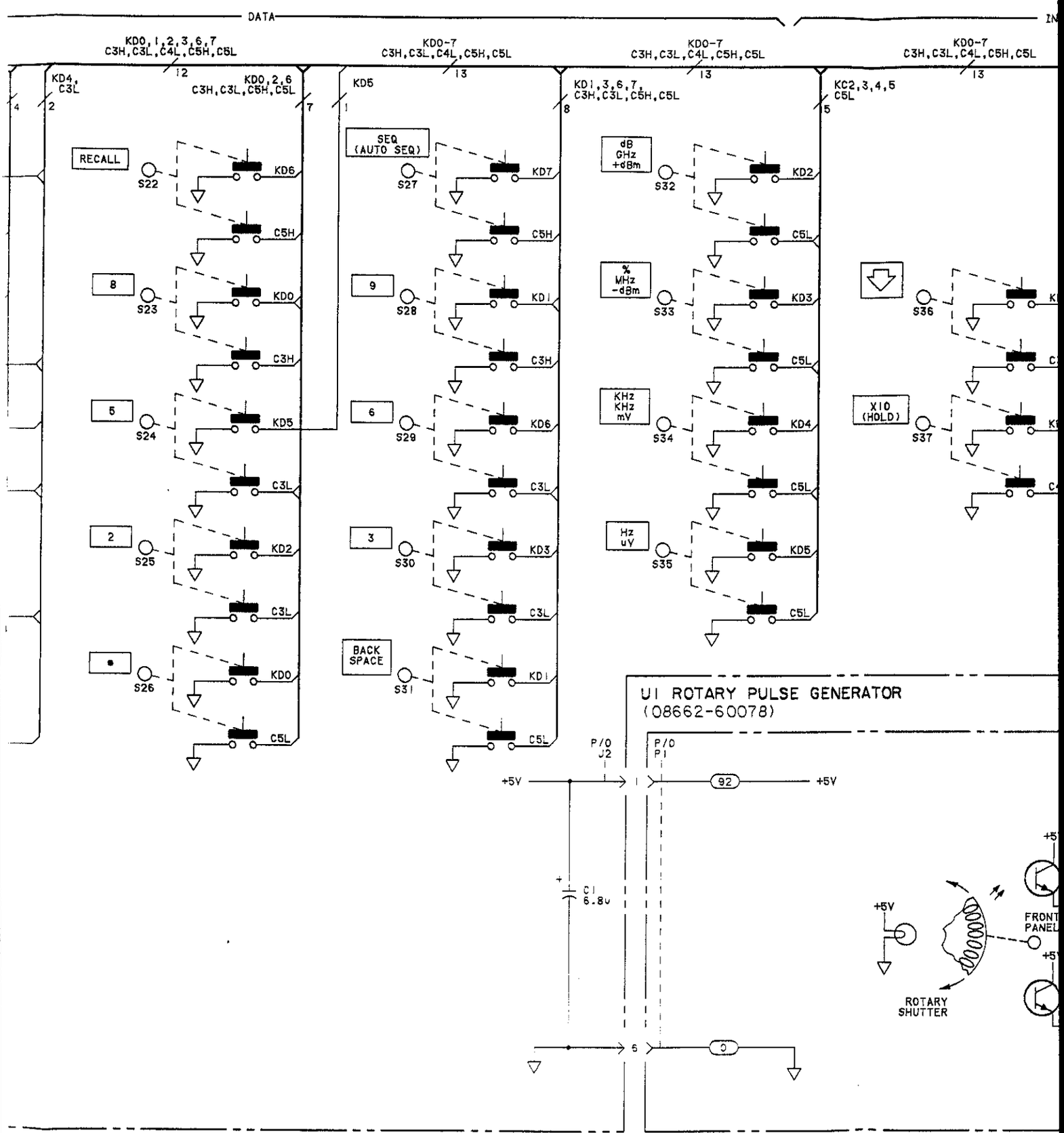
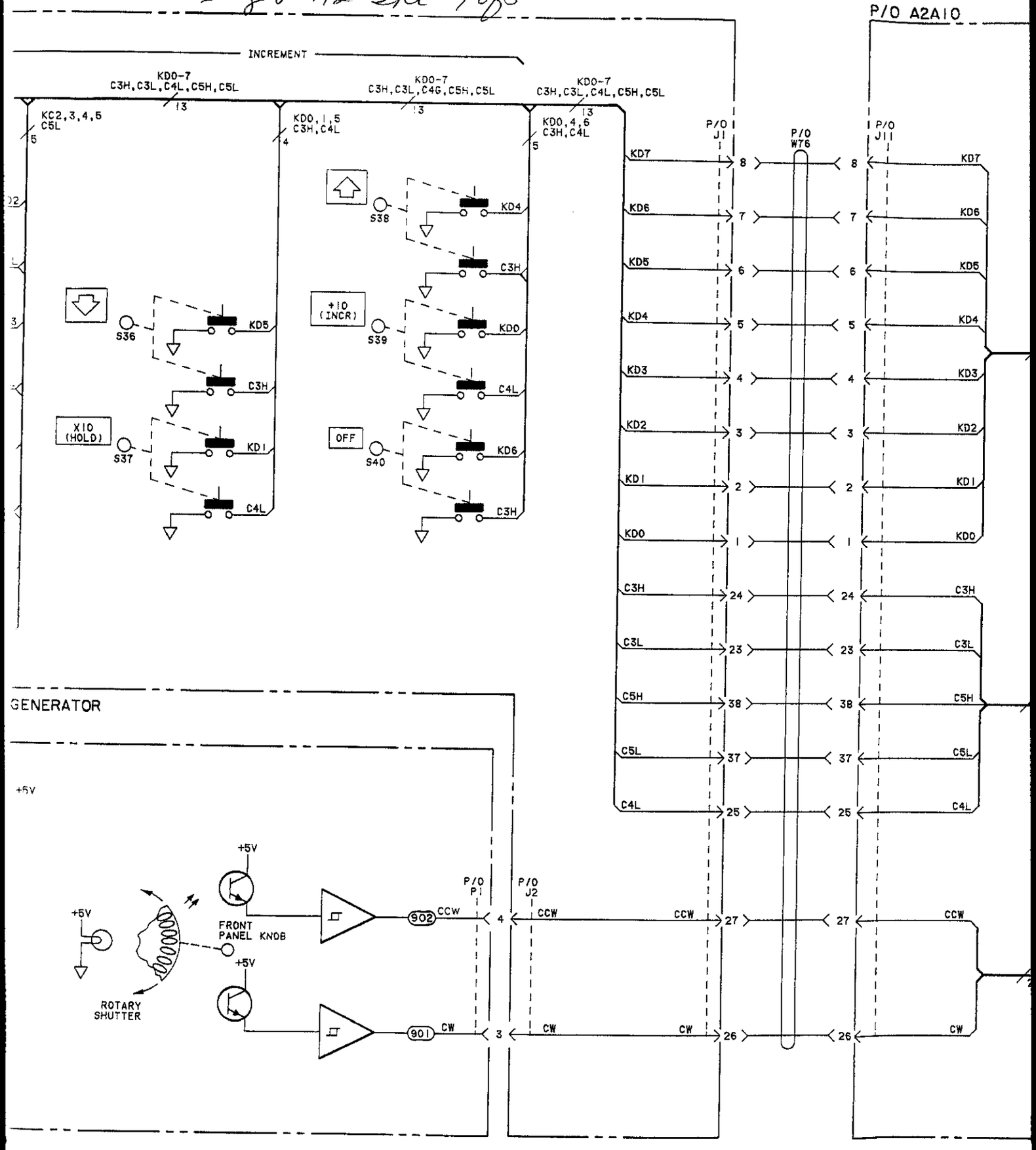


Fig 8-742 Sht 4 of 5



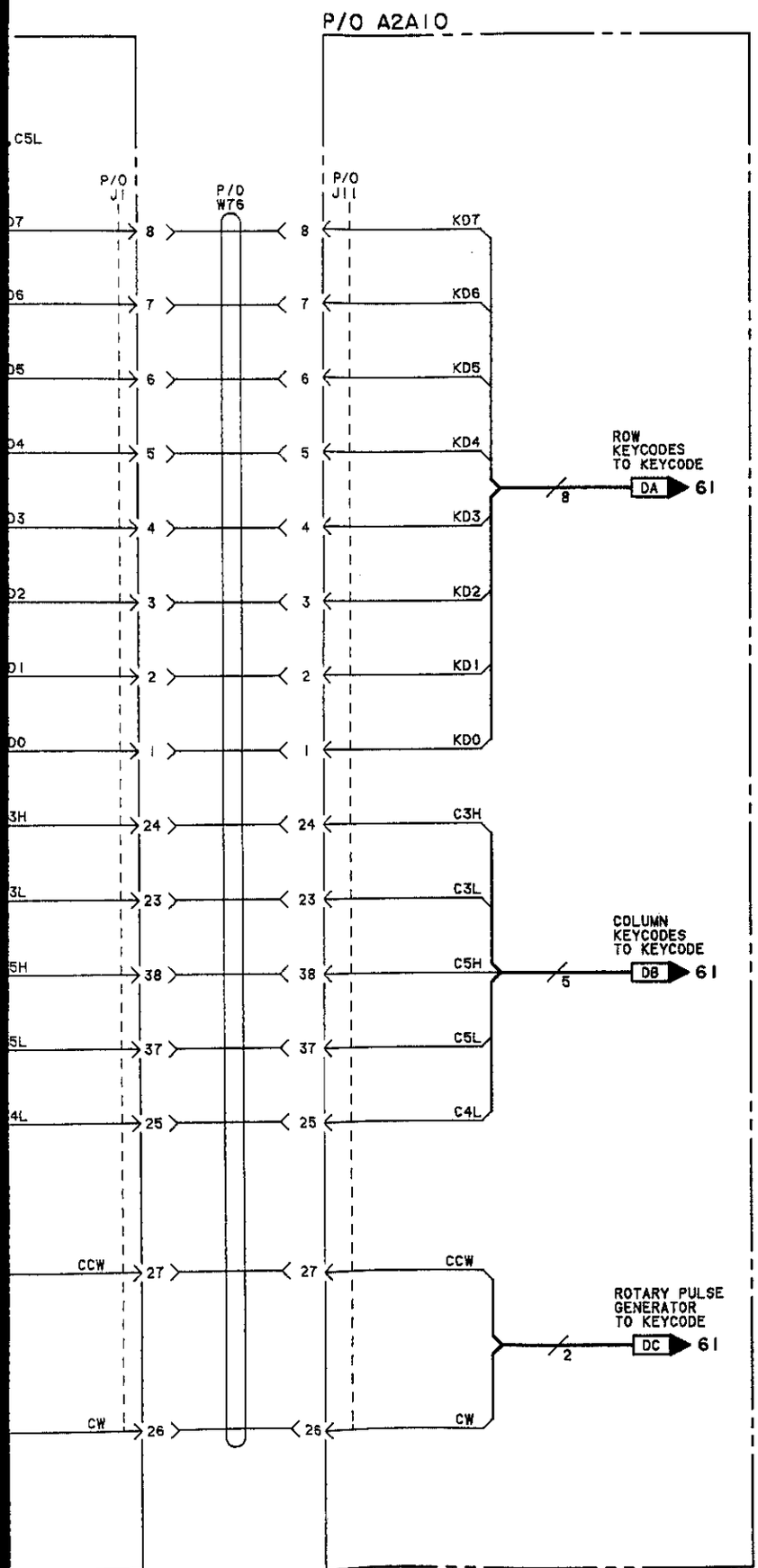


Fig 8-742
Sht 5 of 5

SERVICE SHEET 59
A1A3

Figure 8-742. A1A3 Main Keyboard Schematic

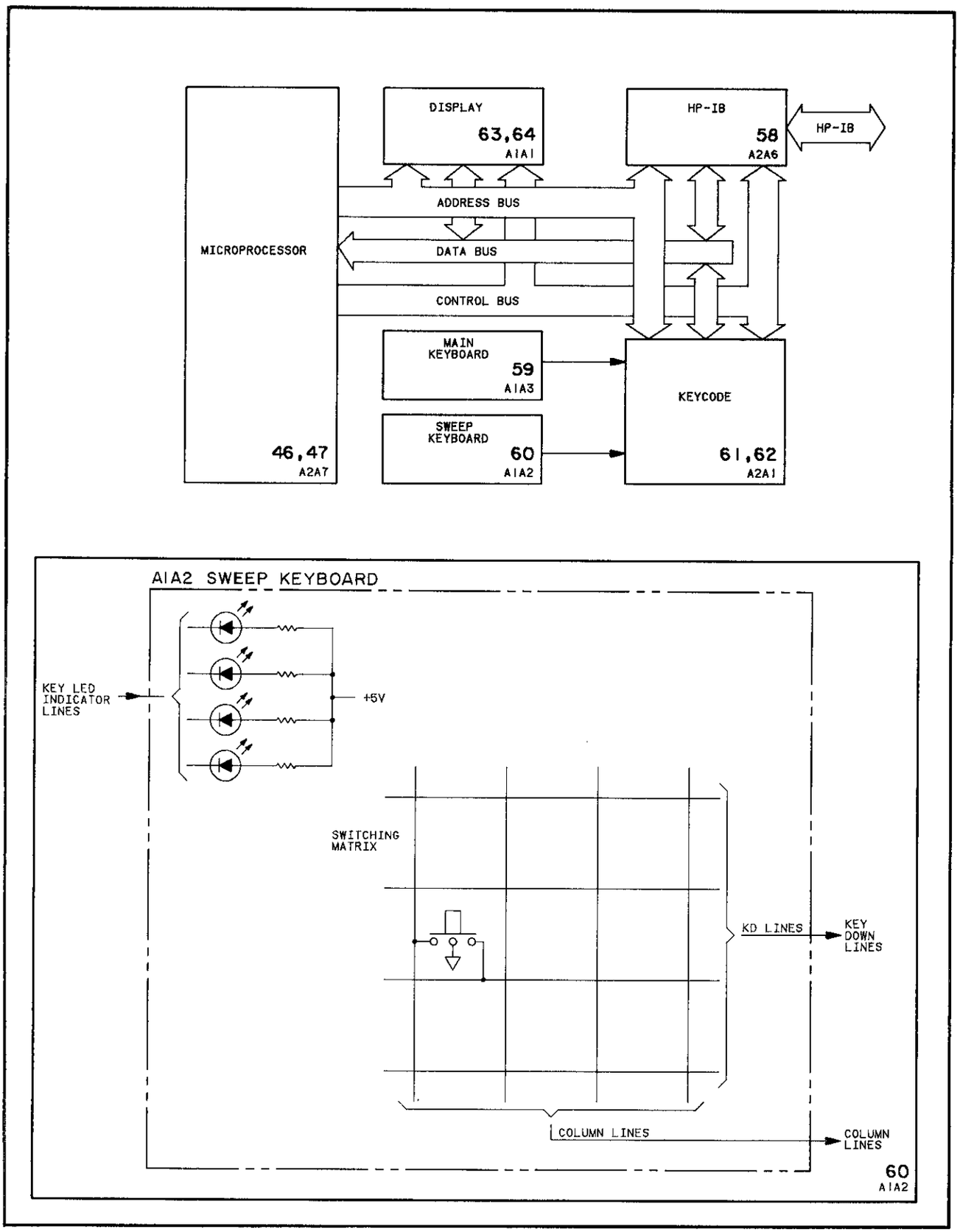


Figure 8-743. A1A2 Sweep Keyboard Block Diagrams

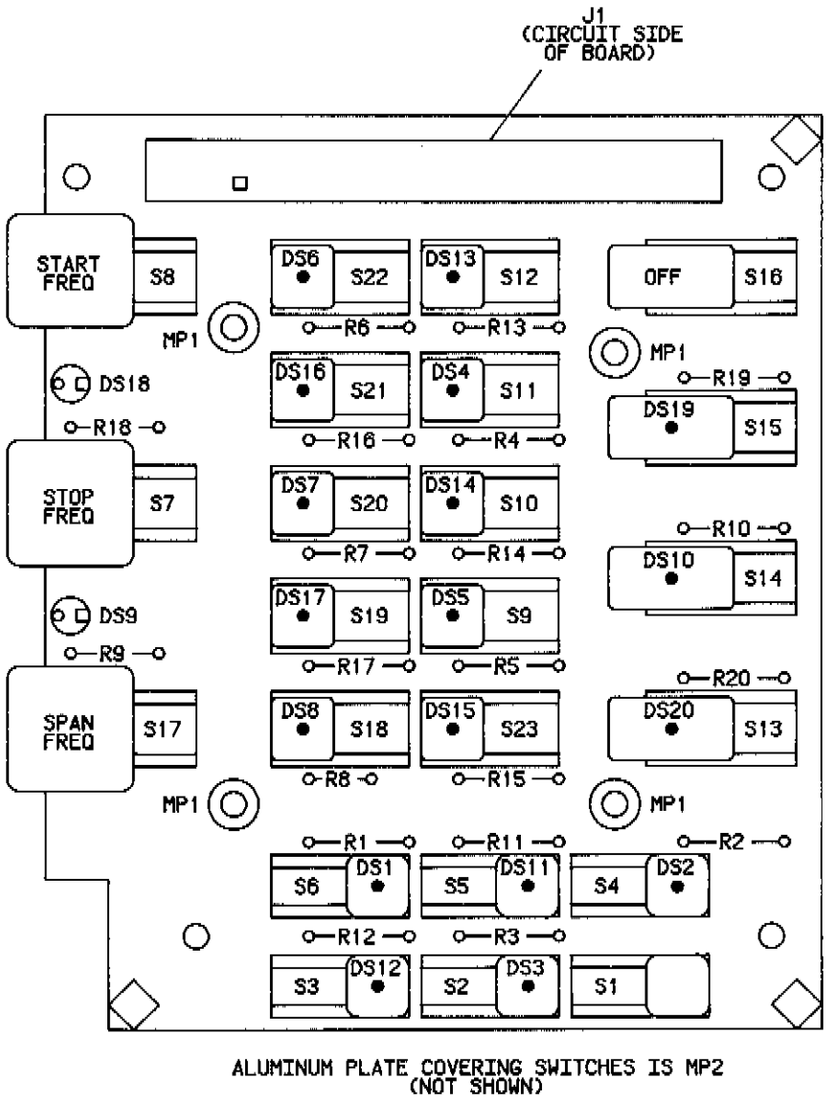
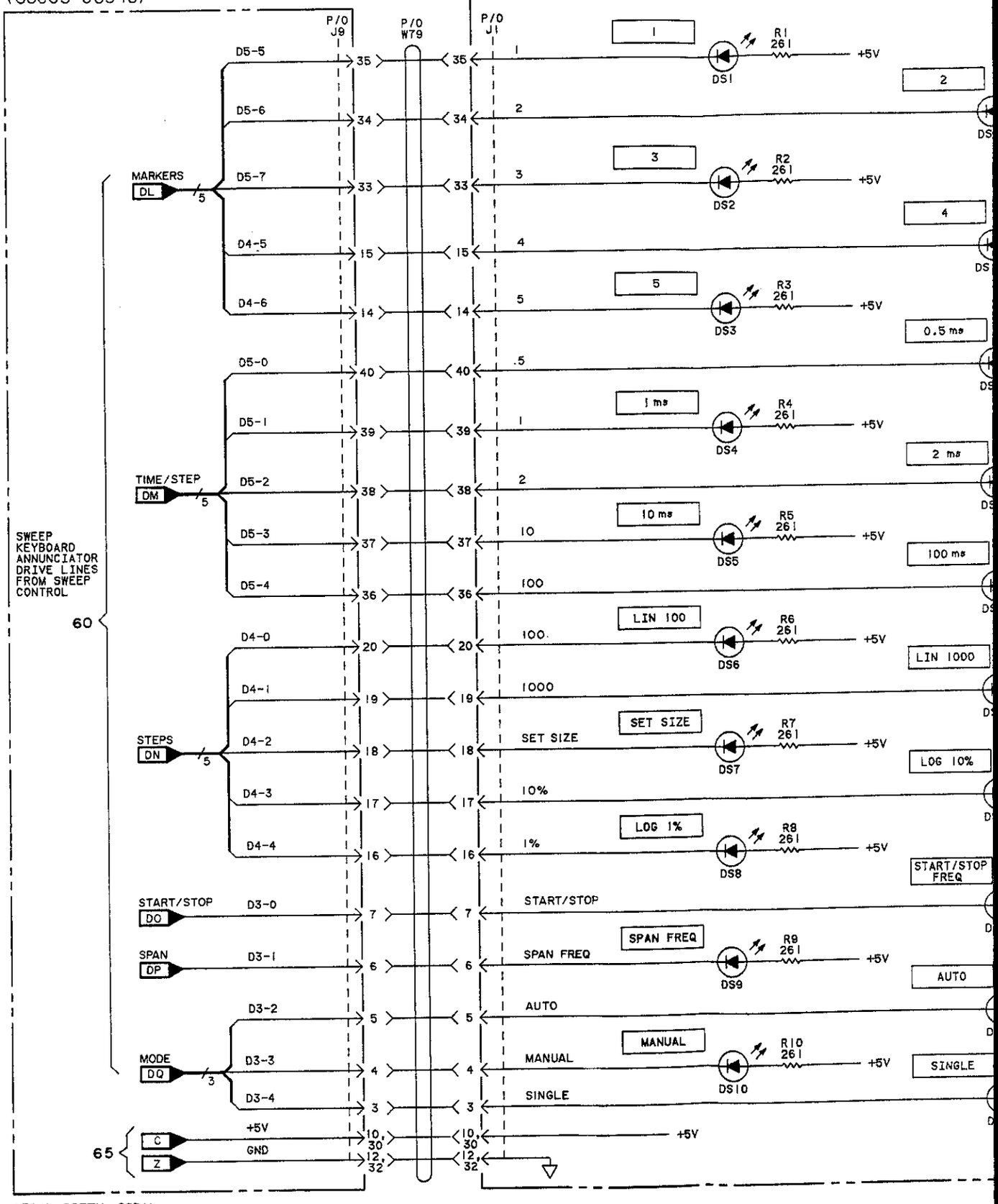


Figure 8-744. A1A2 Sweep Keyboard Component Locator

Fig 8-74
Sht 2 of 3

P/O A2A11 DCU MOTHERBOARD (08663-60340)

A1A2 SWEEP KEYBOARD (08663-60168)



SERIAL PREFIX: 2234A

)168) Fig 8-745 Sht 2 of 3

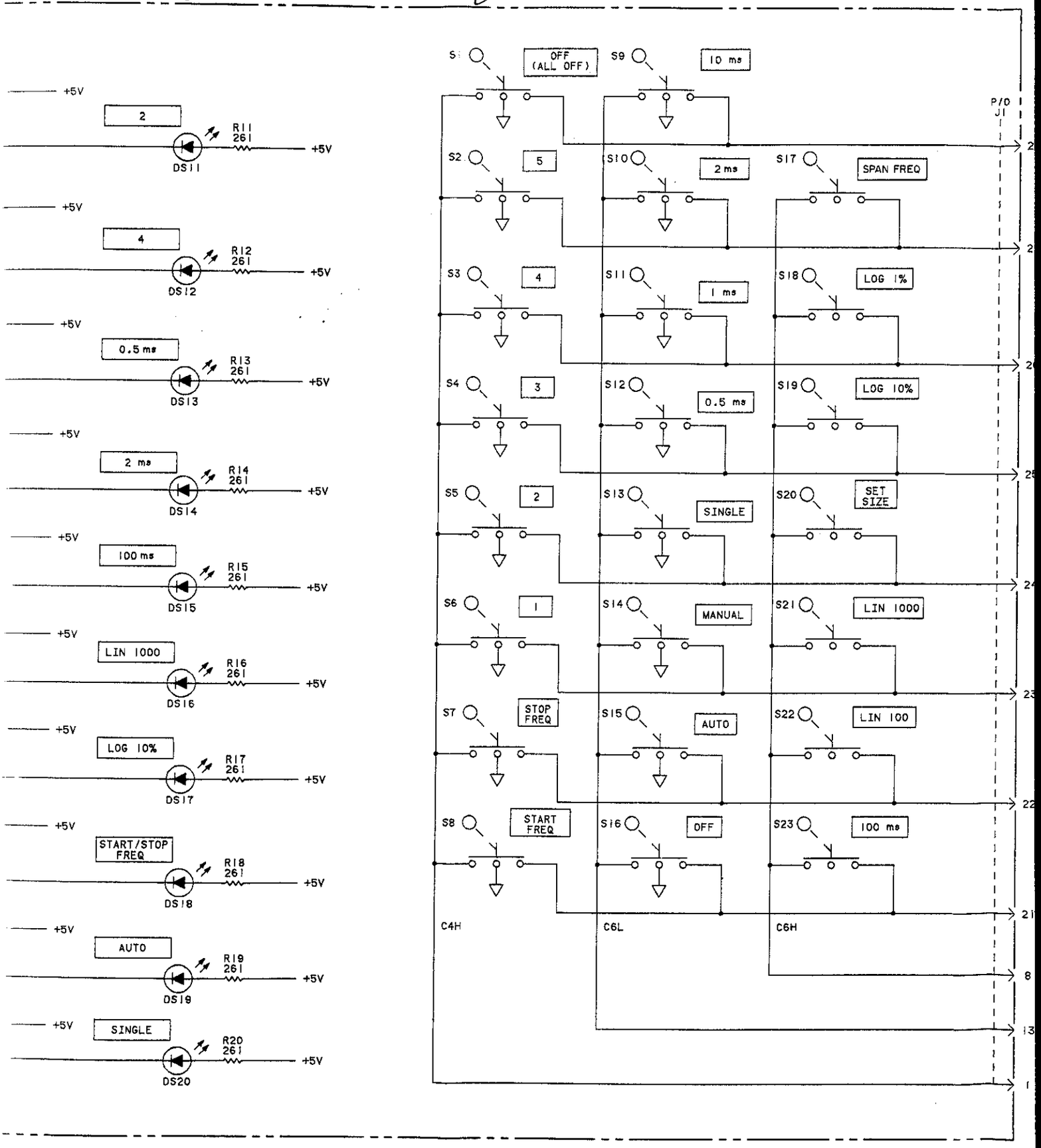
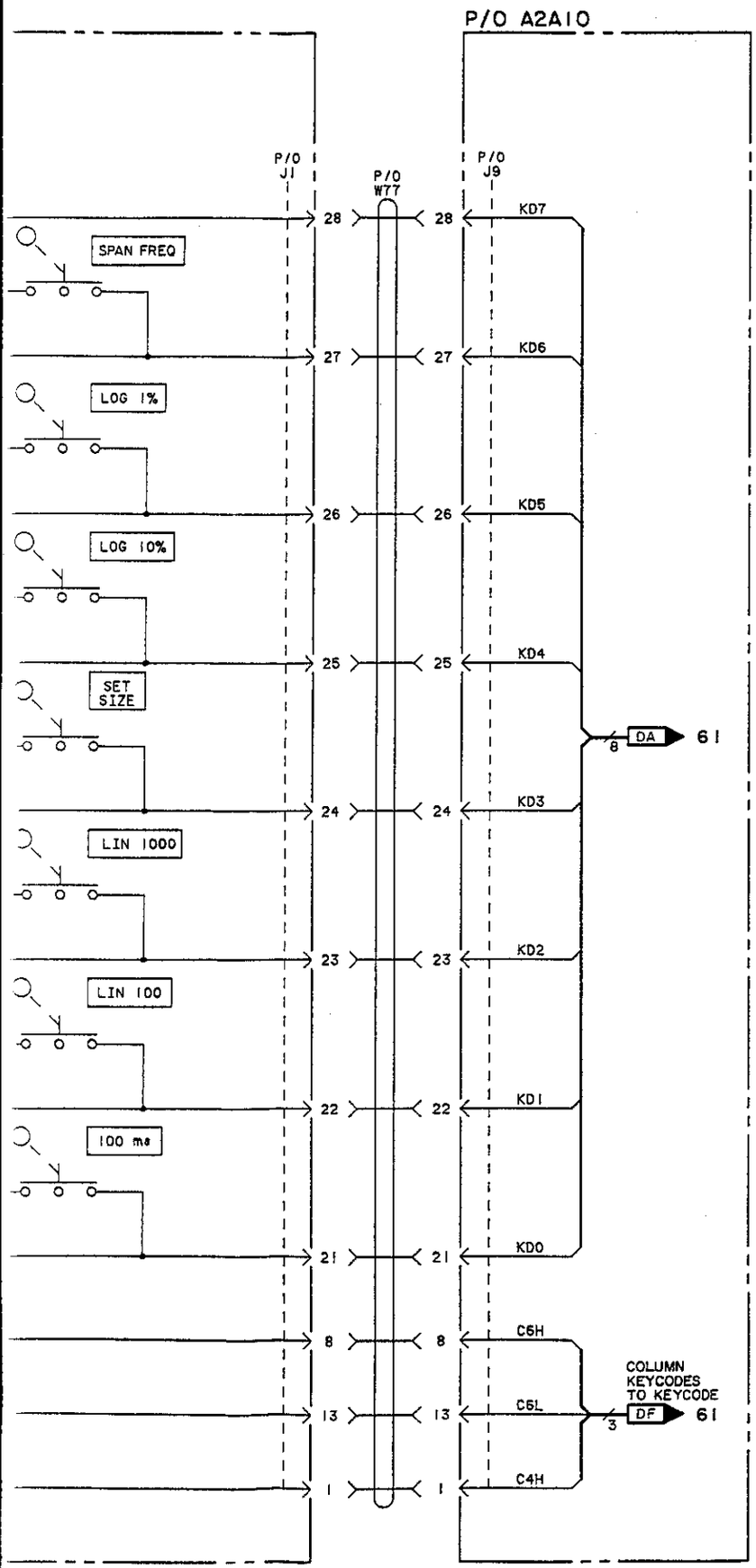


Fig 8-745
Sht 3 of 3



1. REFER TO TABLE 8-102 FOR SCHEMATIC DIAGRAM NOTES.
2. TROUBLESHOOTING VALUES ARE TYPICAL. THEY ARE ACTUAL MEASURED VALUES. YOUR MEASUREMENTS MIGHT BE SLIGHTLY DIFFERENT THAN WHAT IS SHOWN.
3. BLUE KEY FUNCTIONS ARE INDICATED IN PARENTHESES.

REFERENCE DESIGNATIONS

NO PREFIX	A2A10
W77	J1
A1A2	
DS1-20 J1 R1-20 S1-23	

A1A2 LEFT KEYBOARD KEY CODE CHART

KEY		KEY CODE DISPLAY		
		421	8421	HEX
SWEEP	START FREQ	100	1000	48
	STOP FREQ	100	1001	49
	SPAN FREQ	110	1110	6E
STEPS	LIN 100	110	1001	69
	LIN 1000	110	1010	6A
	SET SIZE	110	1011	6B
	LOG 10%	110	1100	6C
	LOG 1%	110	1101	6D
TIME/STEP	0.5 ms	110	0100	64
	1ms	110	0101	65
	2ms	110	0110	66
	10ms	110	0111	67
	100ms	110	1000	68
MODE	OFF	110	0000	60
	AUTO	110	0001	61
	MANUAL	110	0010	62
	SINGLE	110	0011	63
MARKERS	1	100	1010	4A
	2	100	1011	4B
	3	100	1100	4C
	4	100	1101	4D
	5	100	1110	4E
	OFF(ALL OFF)	100	1111	4F

SERVICE SHEET A1A2 60

Figure 8-745. A1A2 Sweep Keyboard Schematic

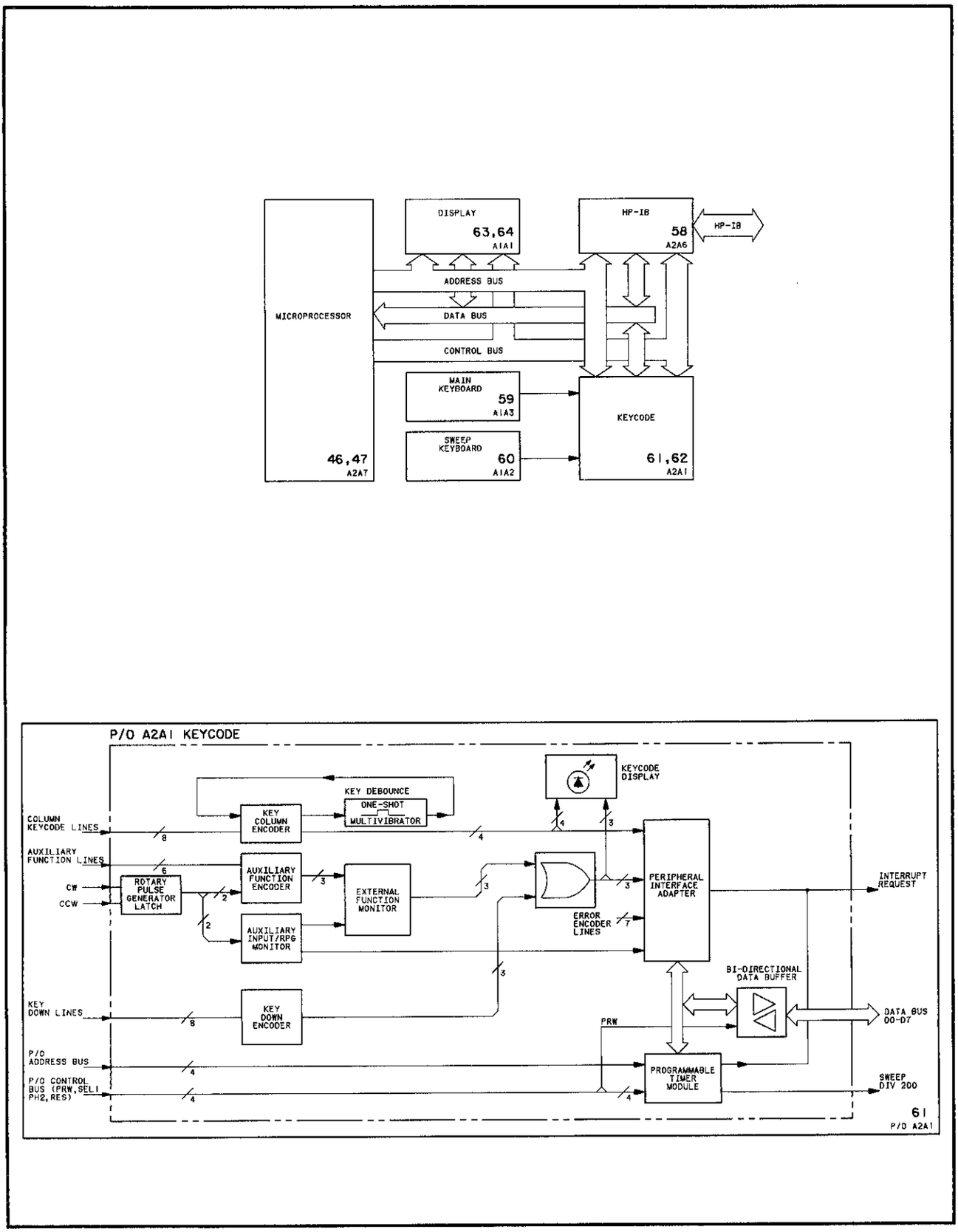


Figure 8-746. P/O A2A1 Keycode Assembly Block Diagrams

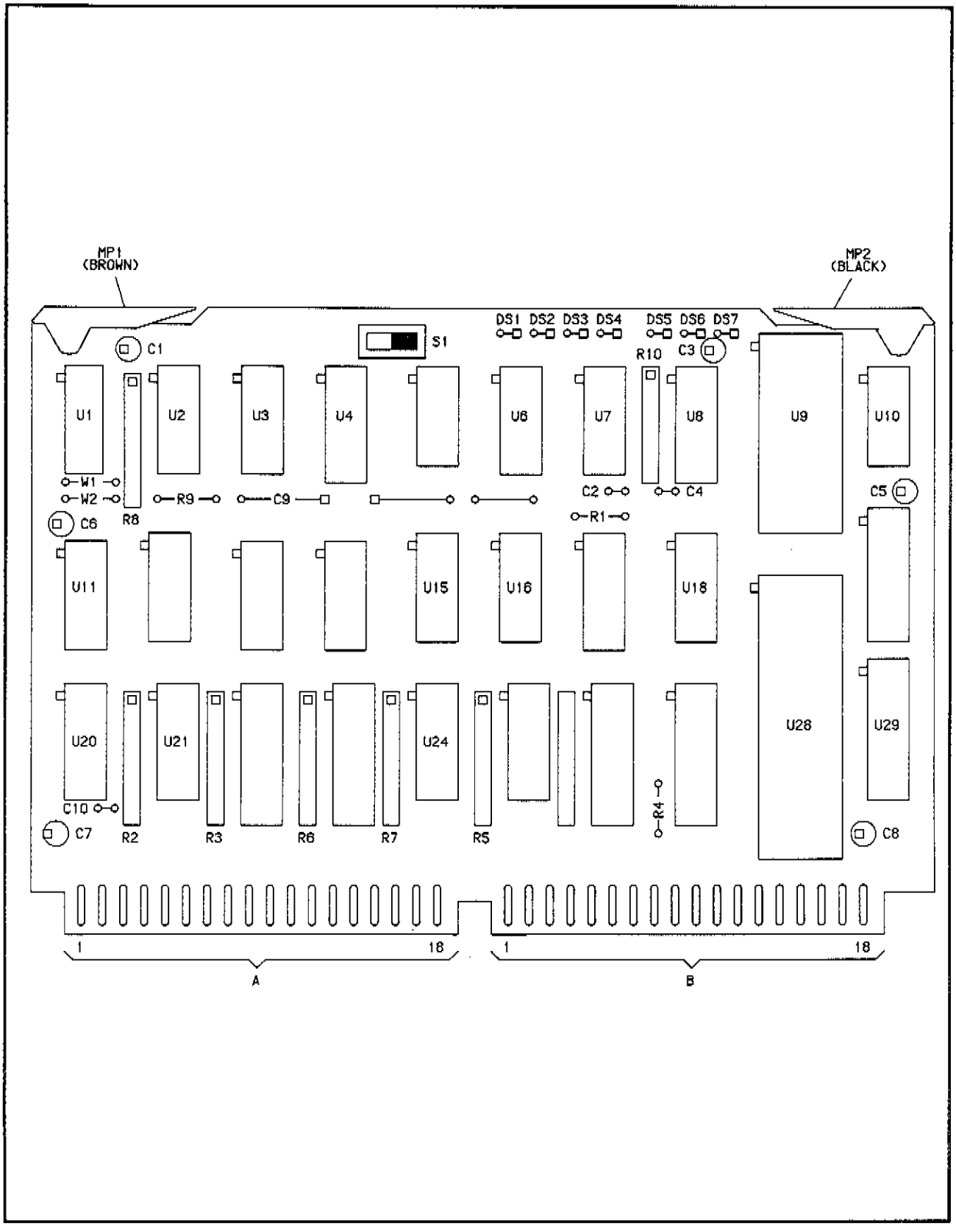
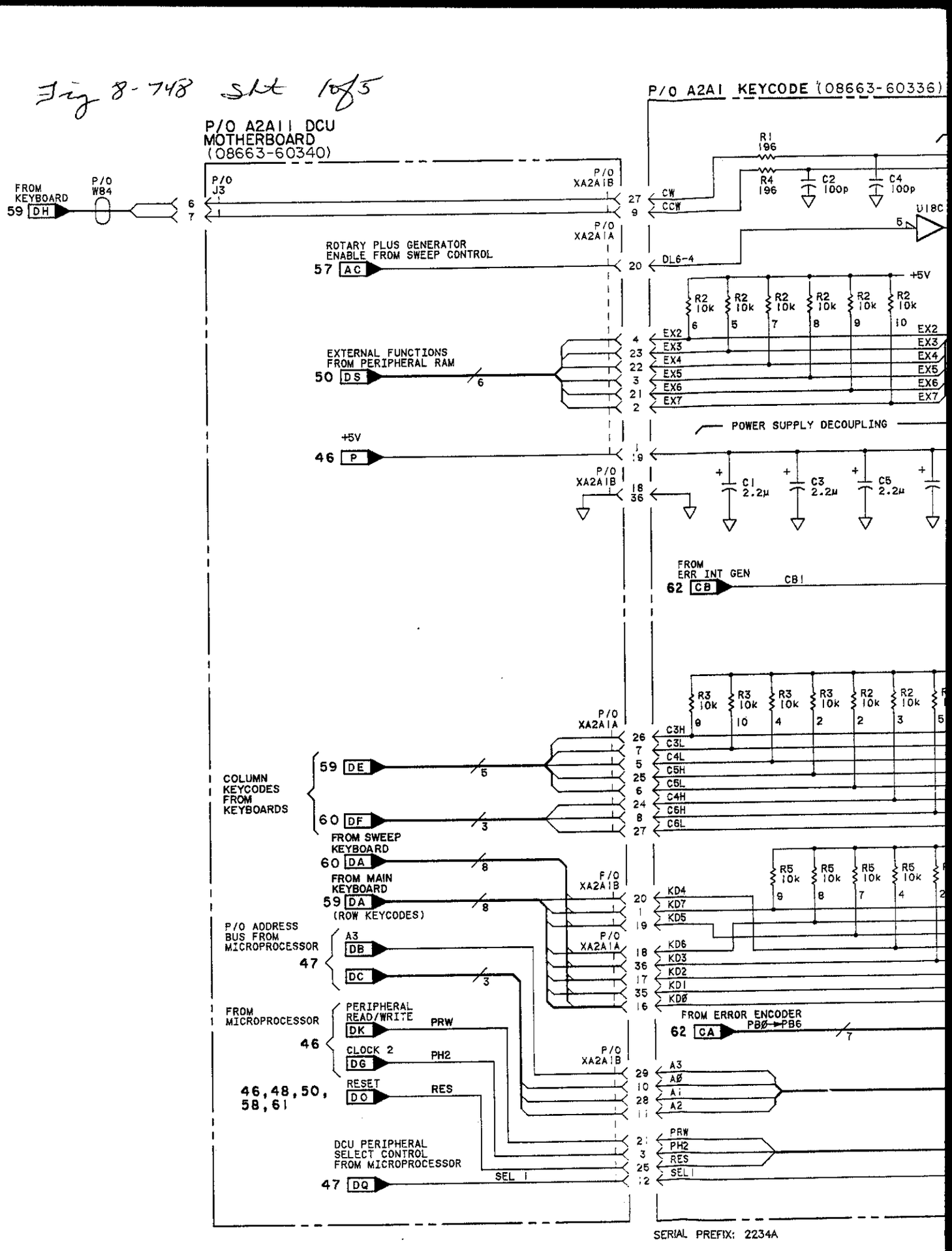
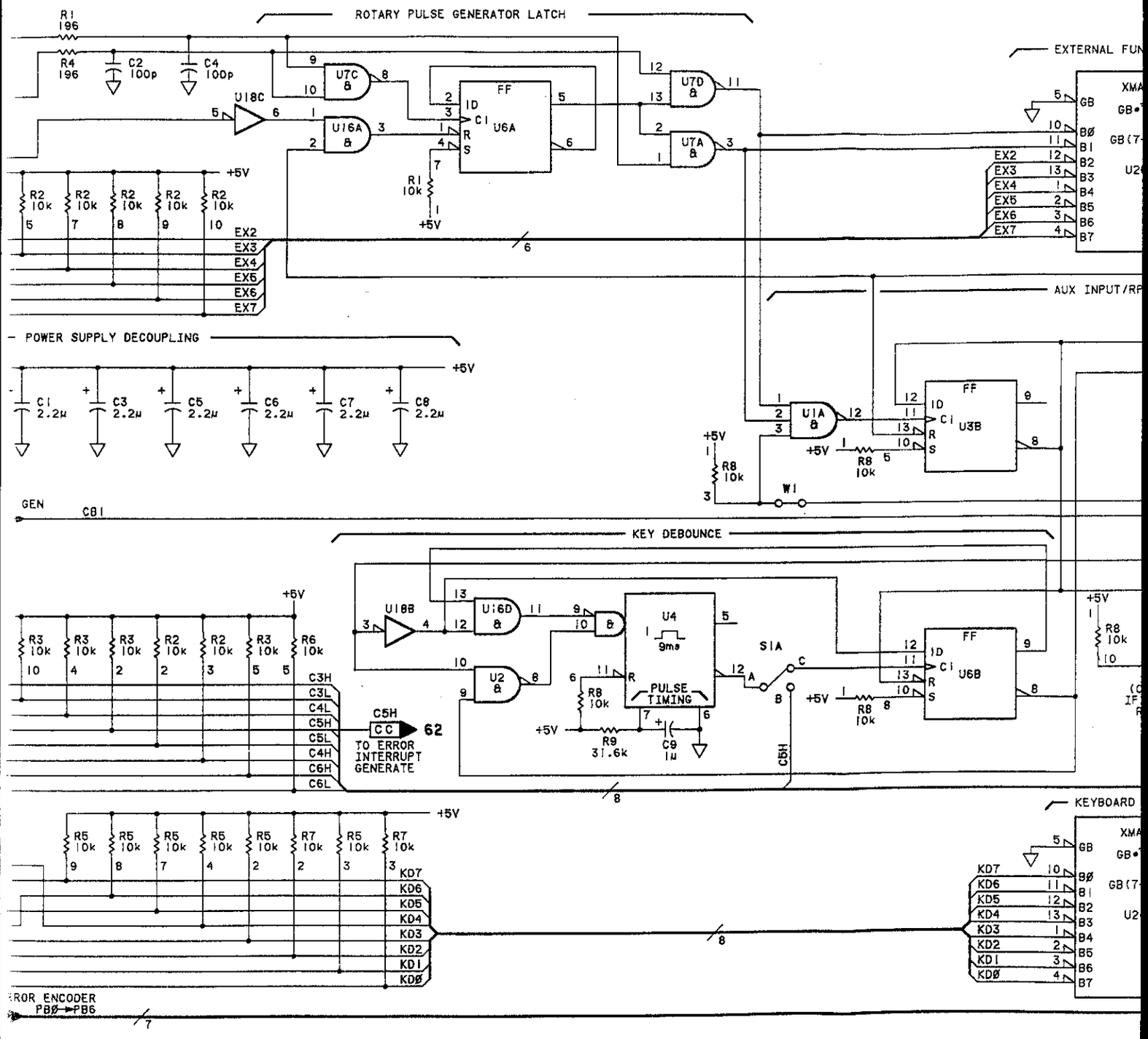


Figure 8-747. P/O A2A1 Keycode Assembly Component Locator

Fig 8-748 Sht 10/5



1 KEYCODE (08663-60336) Fig 8-748 Sht 2 of 5



X: 2234A

Fig 8-748 Sht 3 of 5

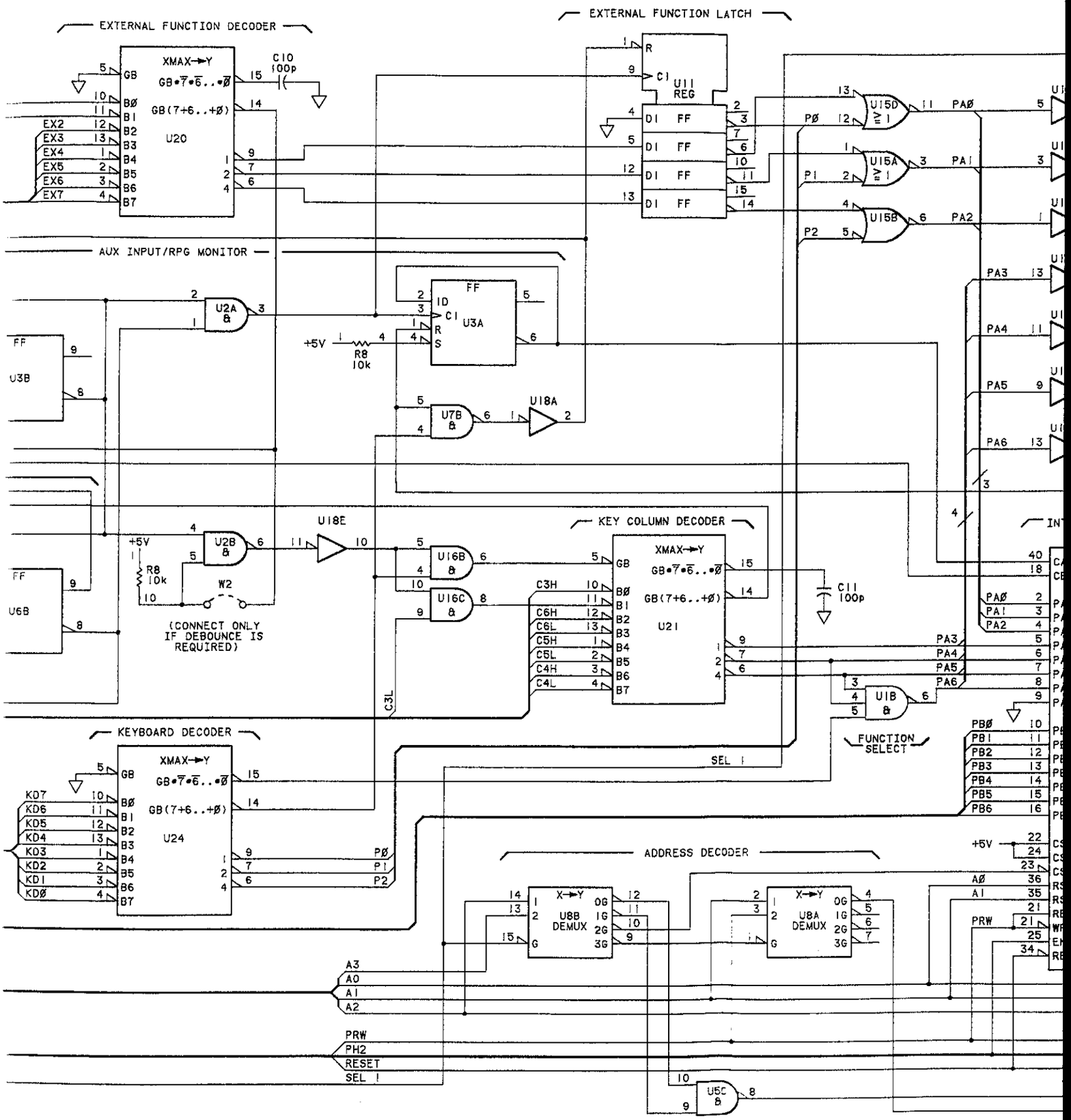
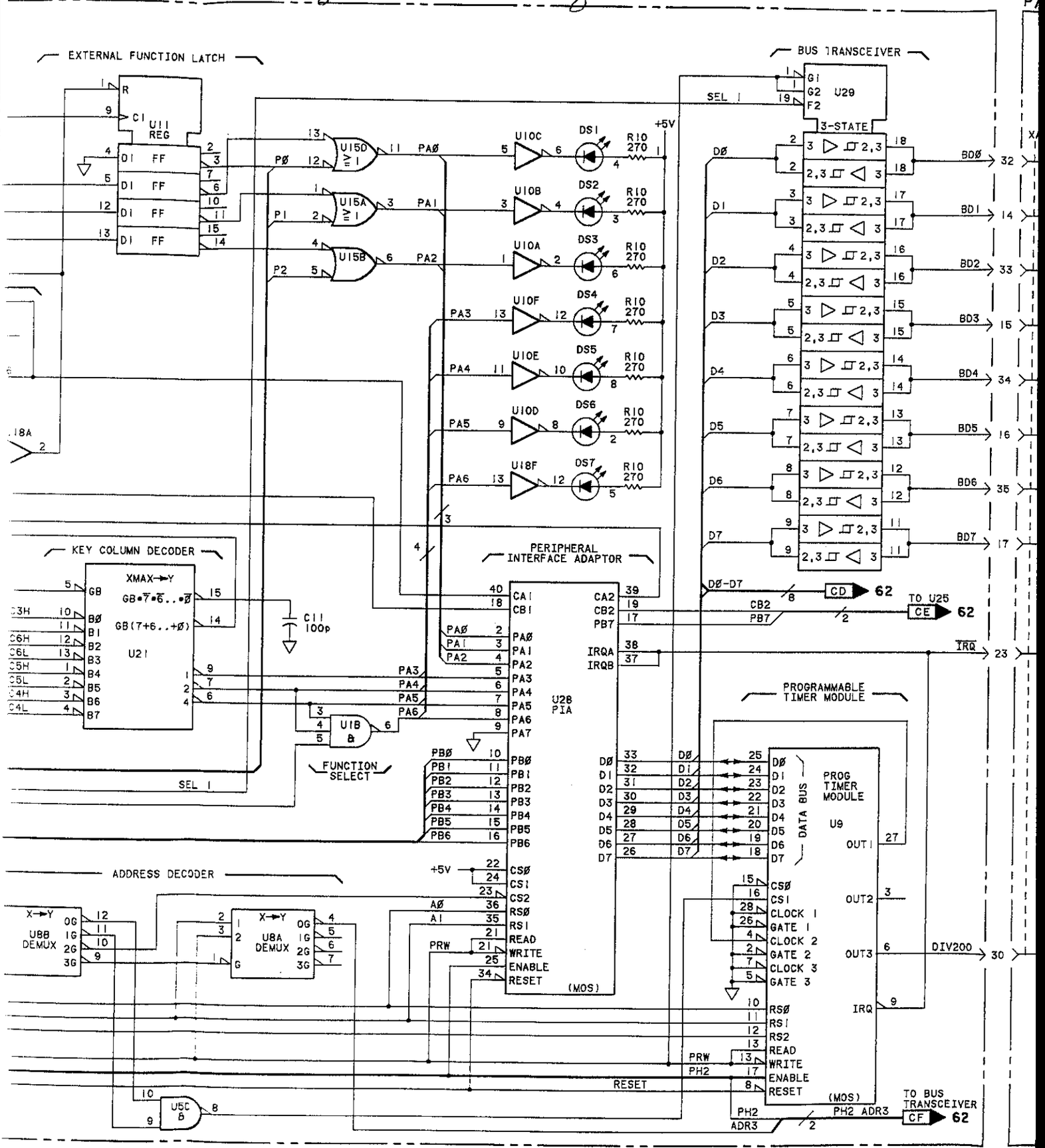


Fig 8-748 Sht 4 of 5



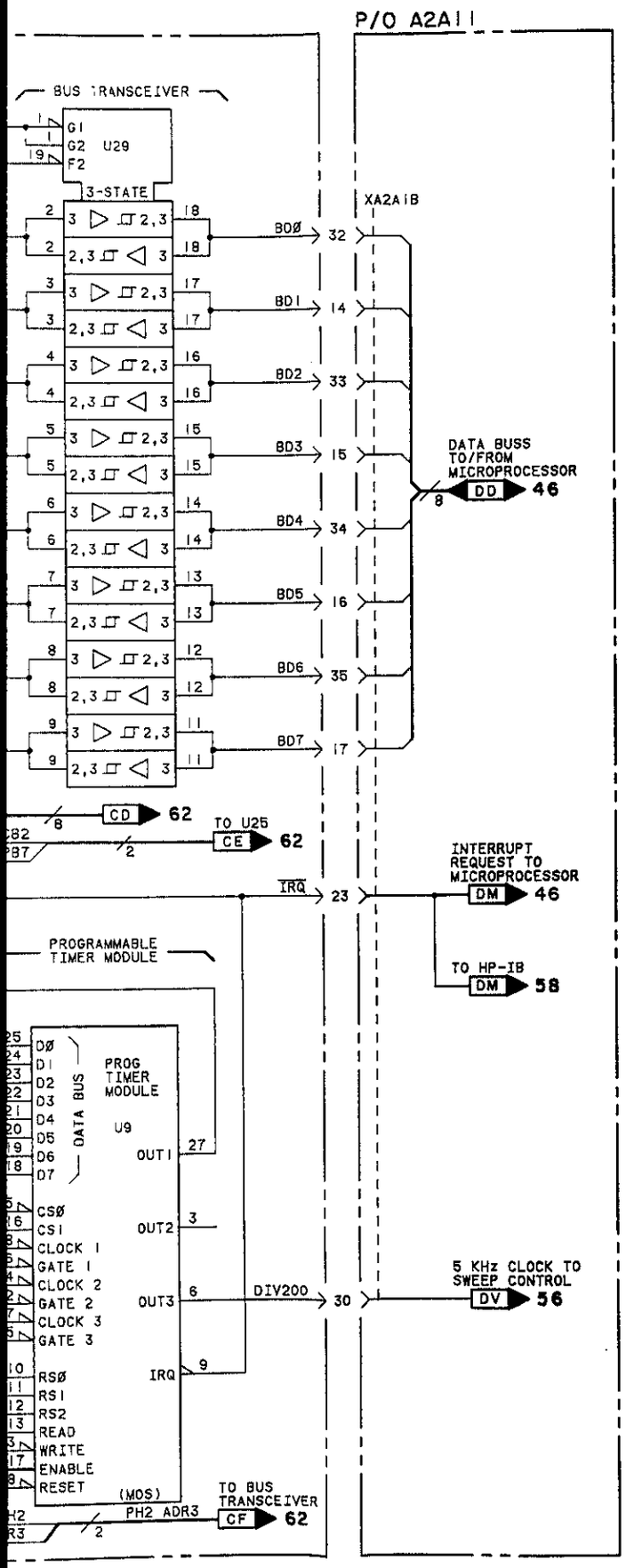


Fig 8-748
Sht 5 of 5

SERVICE SHEET 61

P/O A2A1

Figure 8-748. P/O A2A1 Keycode Assembly Schematic

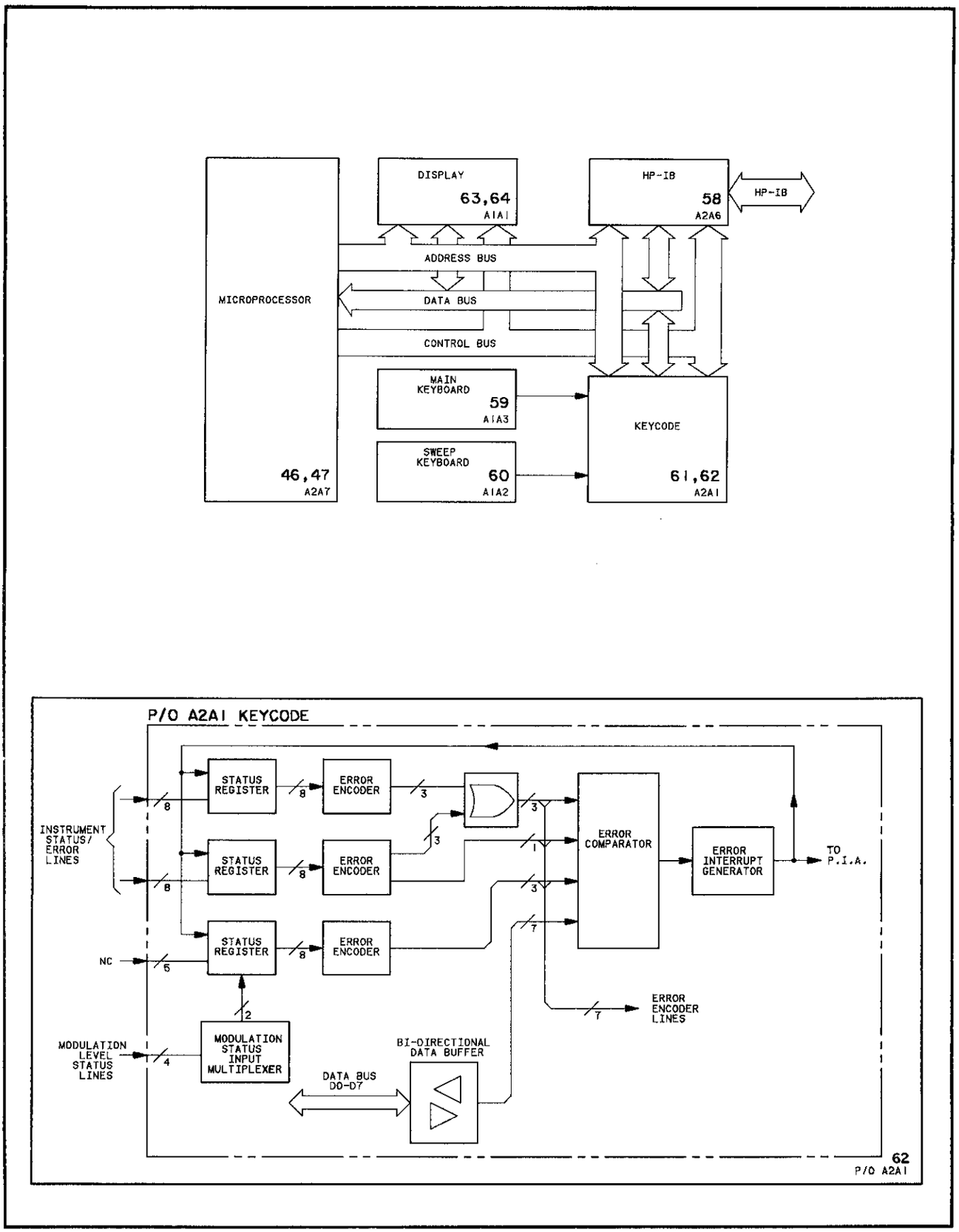


Figure 8-749. P/O A2A1 Keycode Assembly Block Diagrams

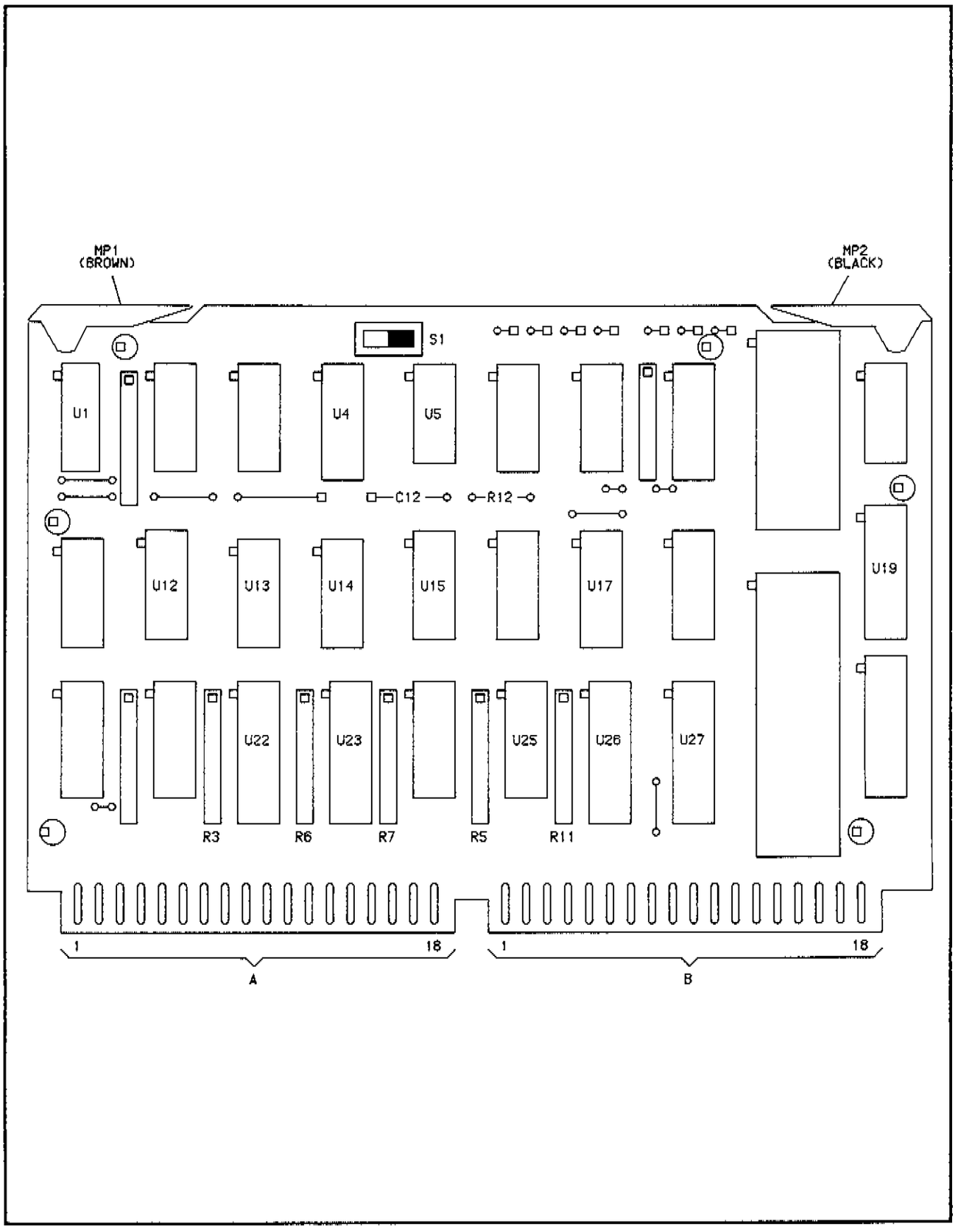


Figure 8-750. P/O A2A1 Keycode Assembly Component Locator

Fig 8-751
Sht 1 of 3

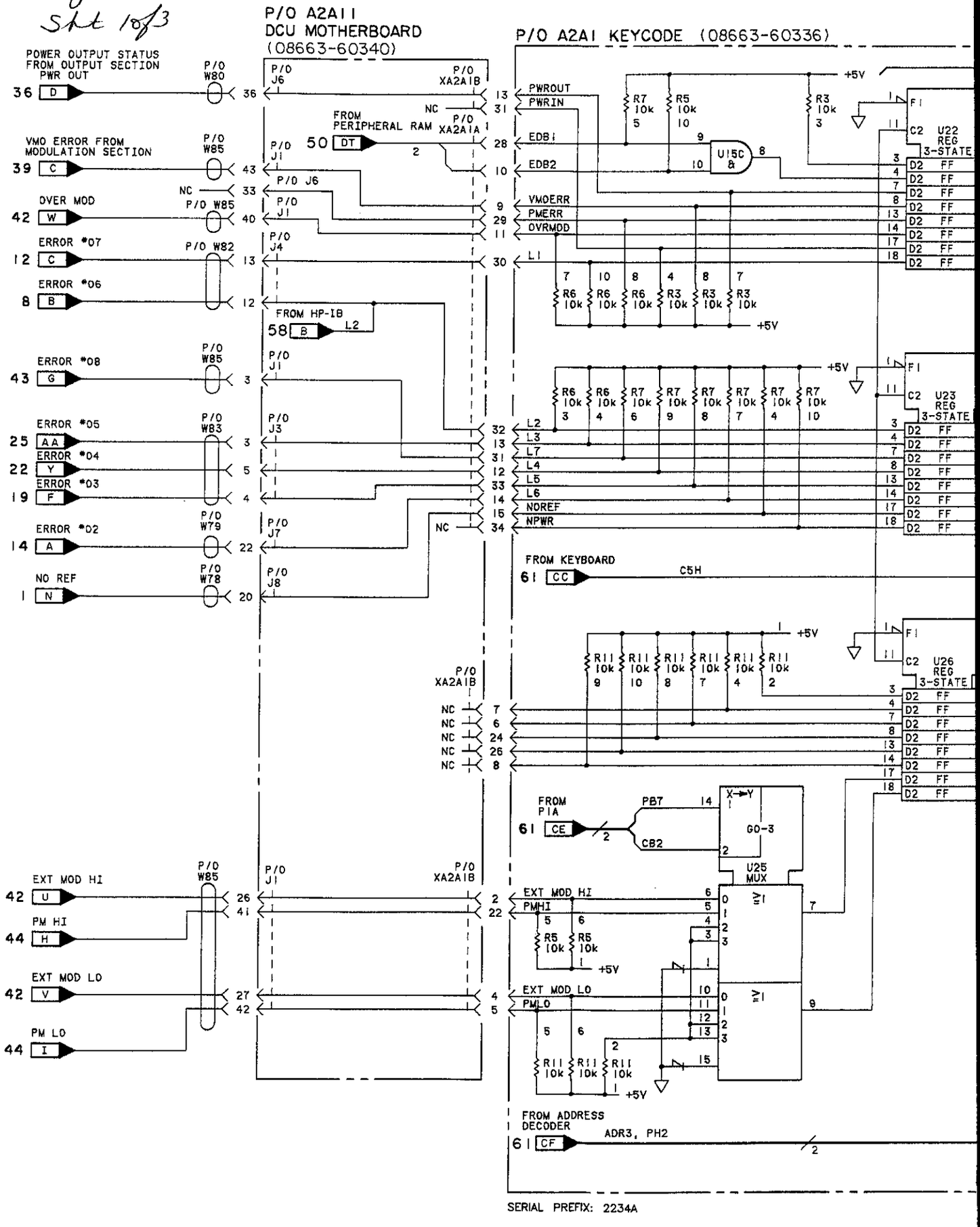


Fig 8-751 sht 2 of 3

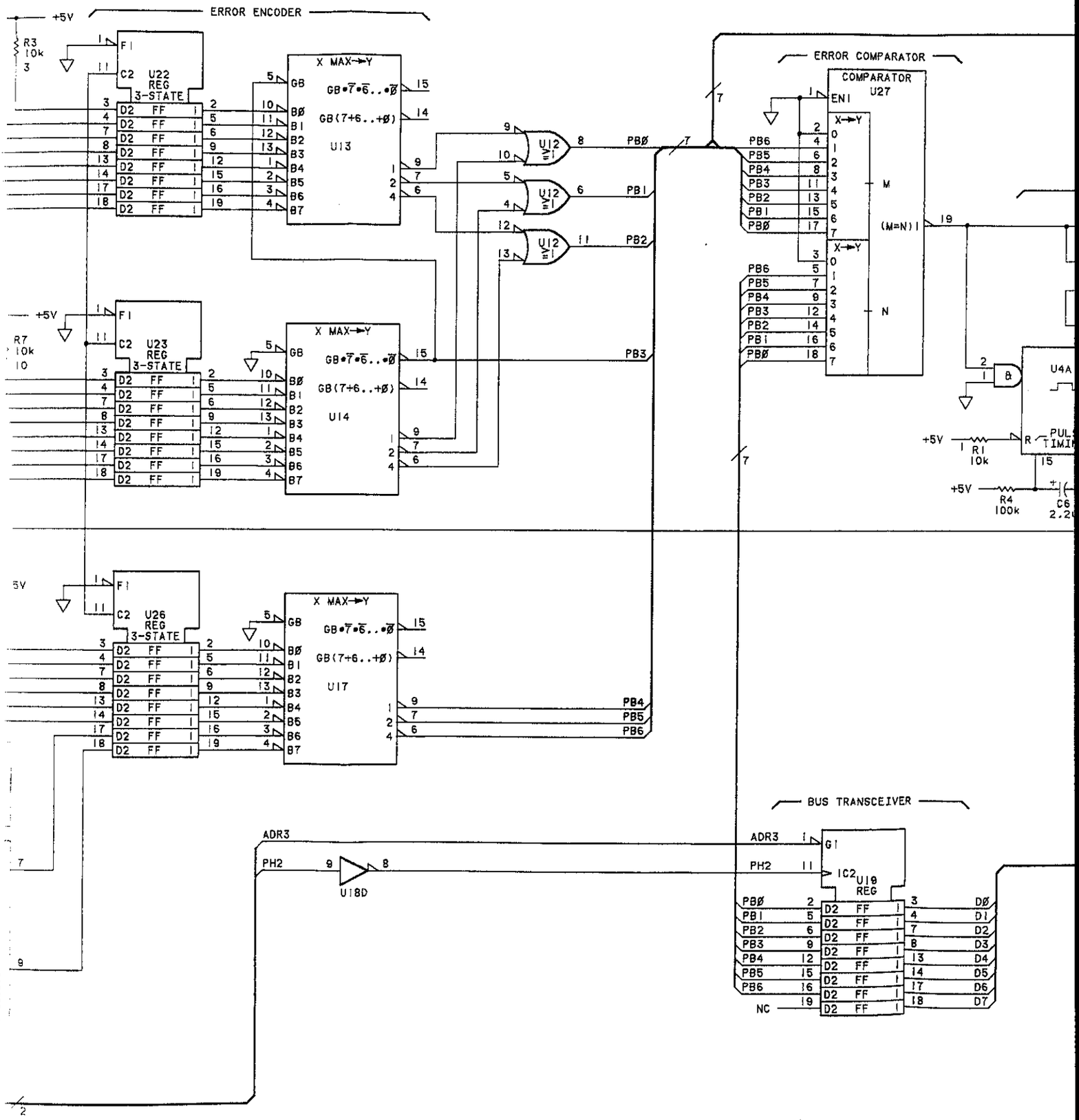
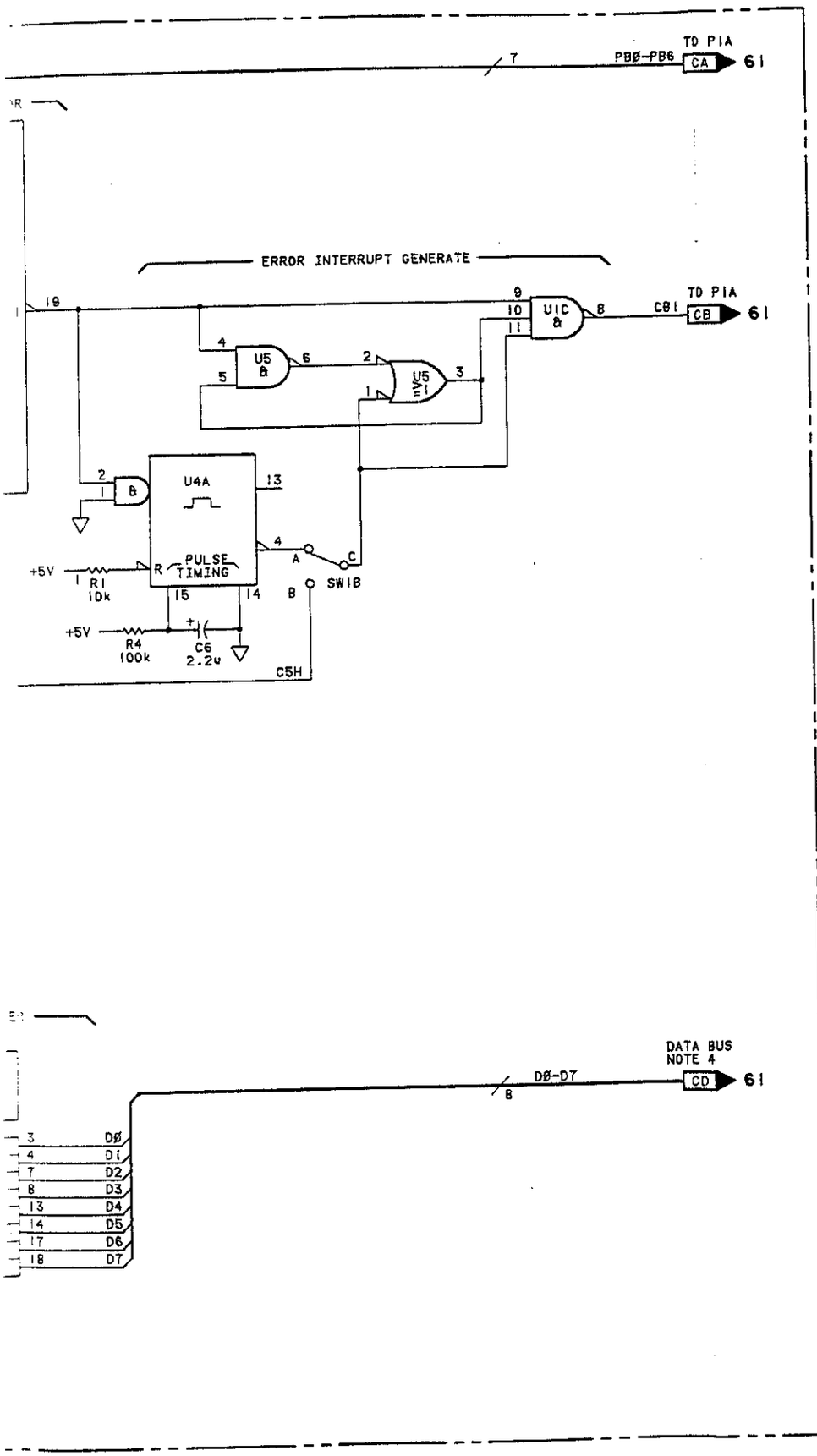


Fig 8-751
Sht 3 of 3



SERVICE SHEET 62

P/O A2A1

Figure 8-751. P/O A2A1 Keycode Assembly Schematic

8-767/768

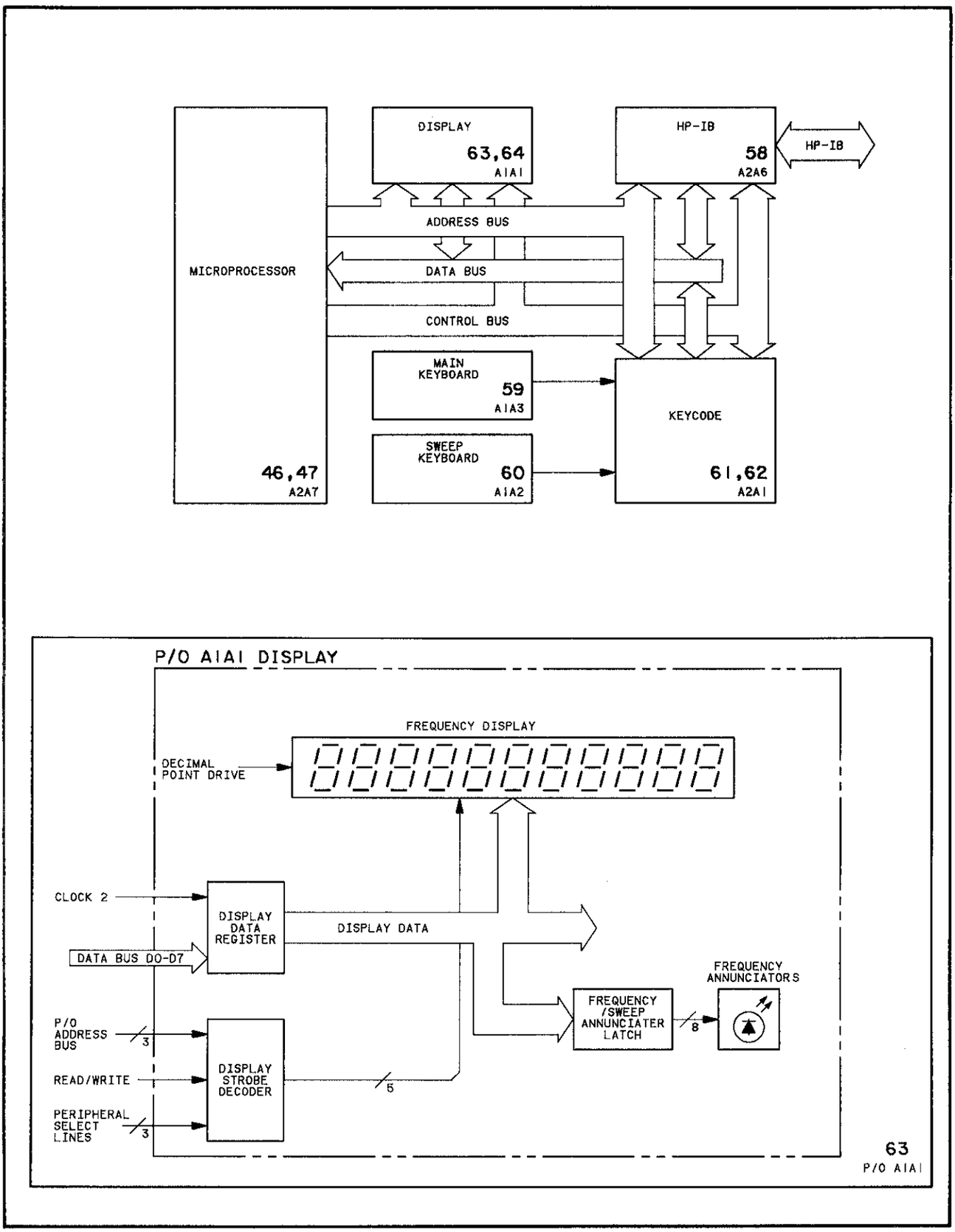


Figure 8-752. P/O A1A1 Display Assembly Block Diagrams

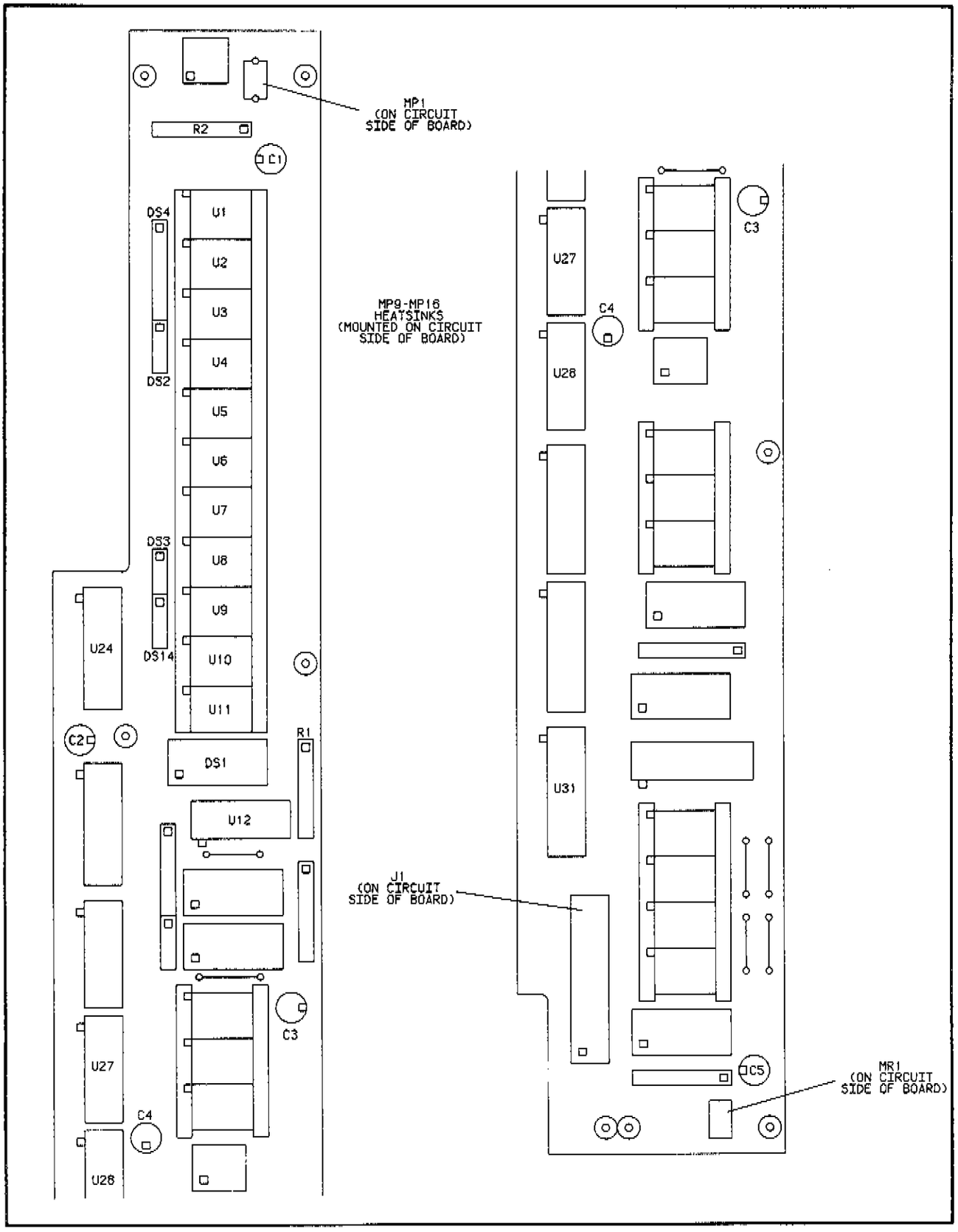


Figure 8-753. P/O A1A1 Display Assembly Component Locator

CHANGES

All serial prefixes

On the A1A1 component locator:

- A1A1C6 - Add C6 to the right of and slightly below connector J1.

On the A1A1 schematic:

- A1A1C6 - In the lower left portion of the schematic, in the circuitry labeled POWER SUPPLY DECOUPLING, add capacitor C6 (2200p) from +5V to ground.

Fig 8-754
Sht 1 of 5

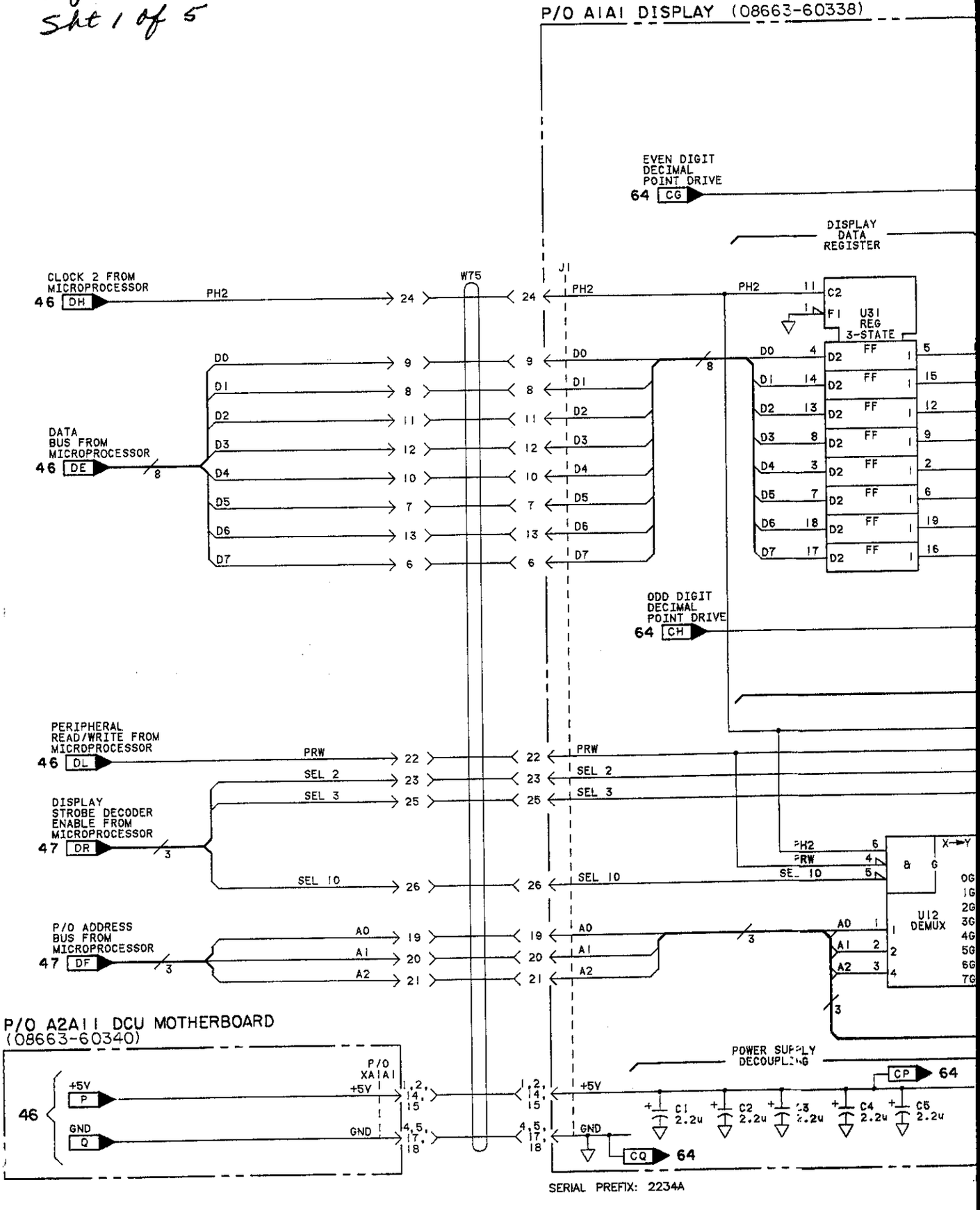


Fig 8-754
Sht 2 of 5

8)

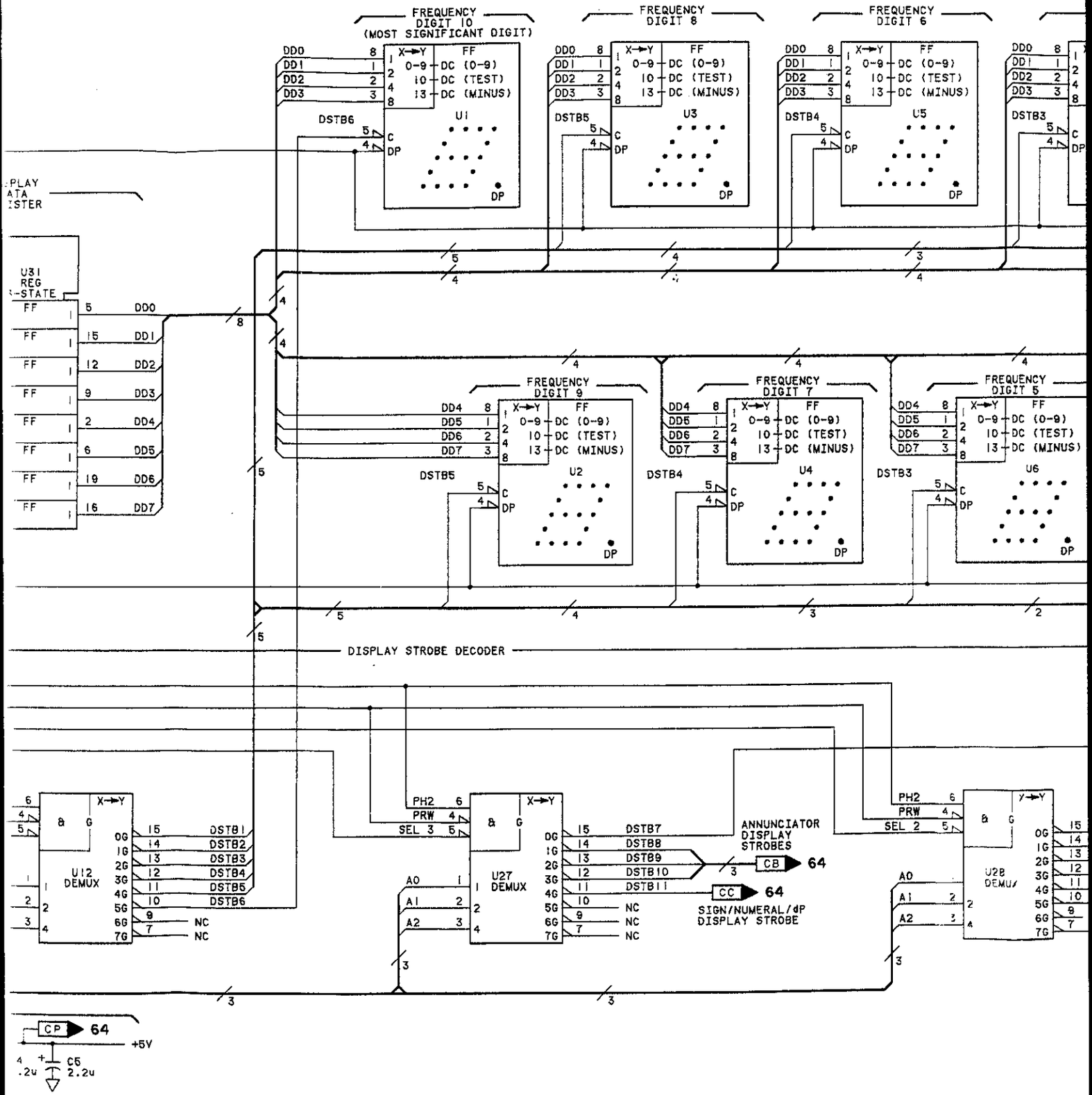


Fig 8-754
Sht 3 of 5

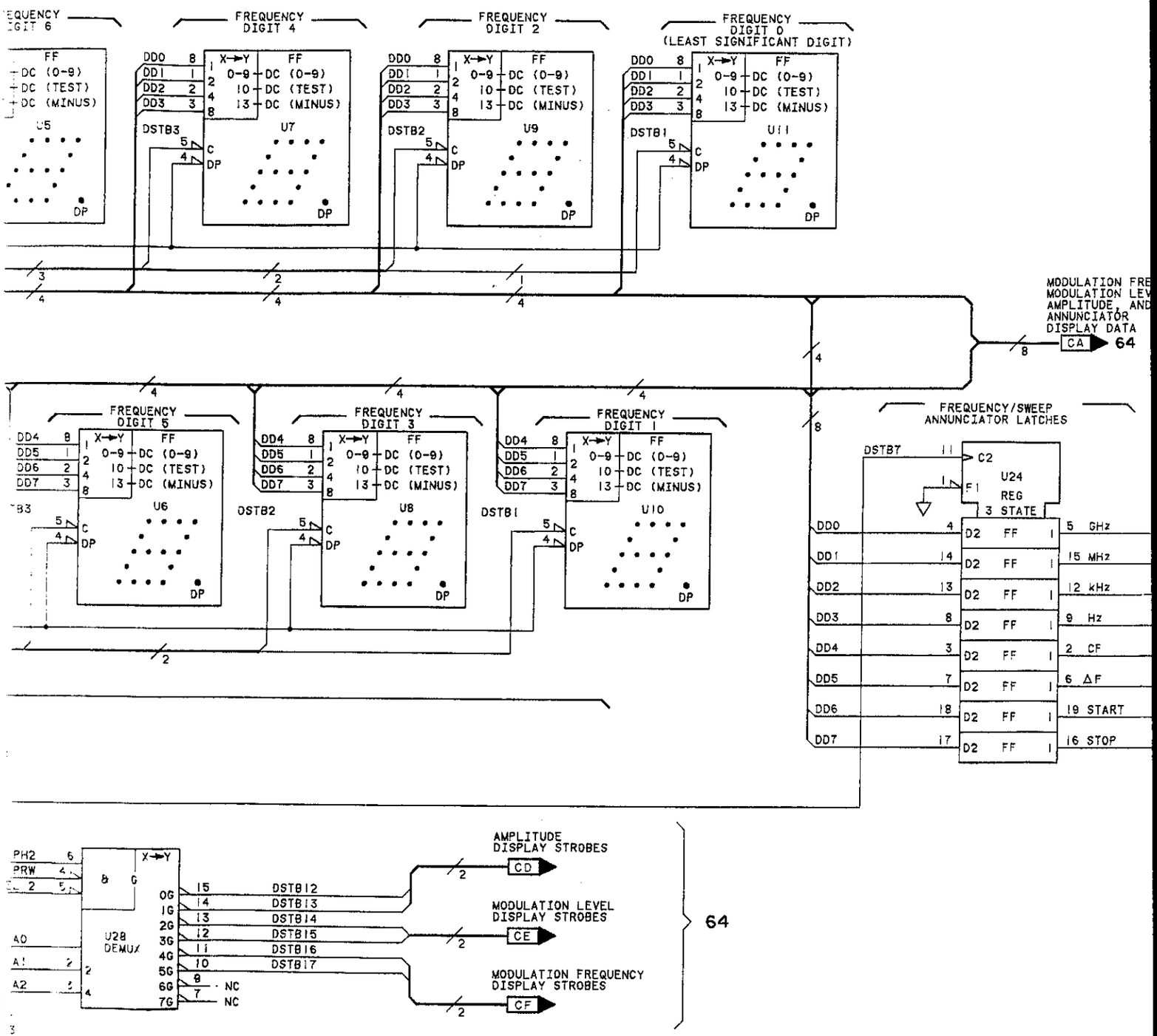


Fig 8-754
Sht # of 5

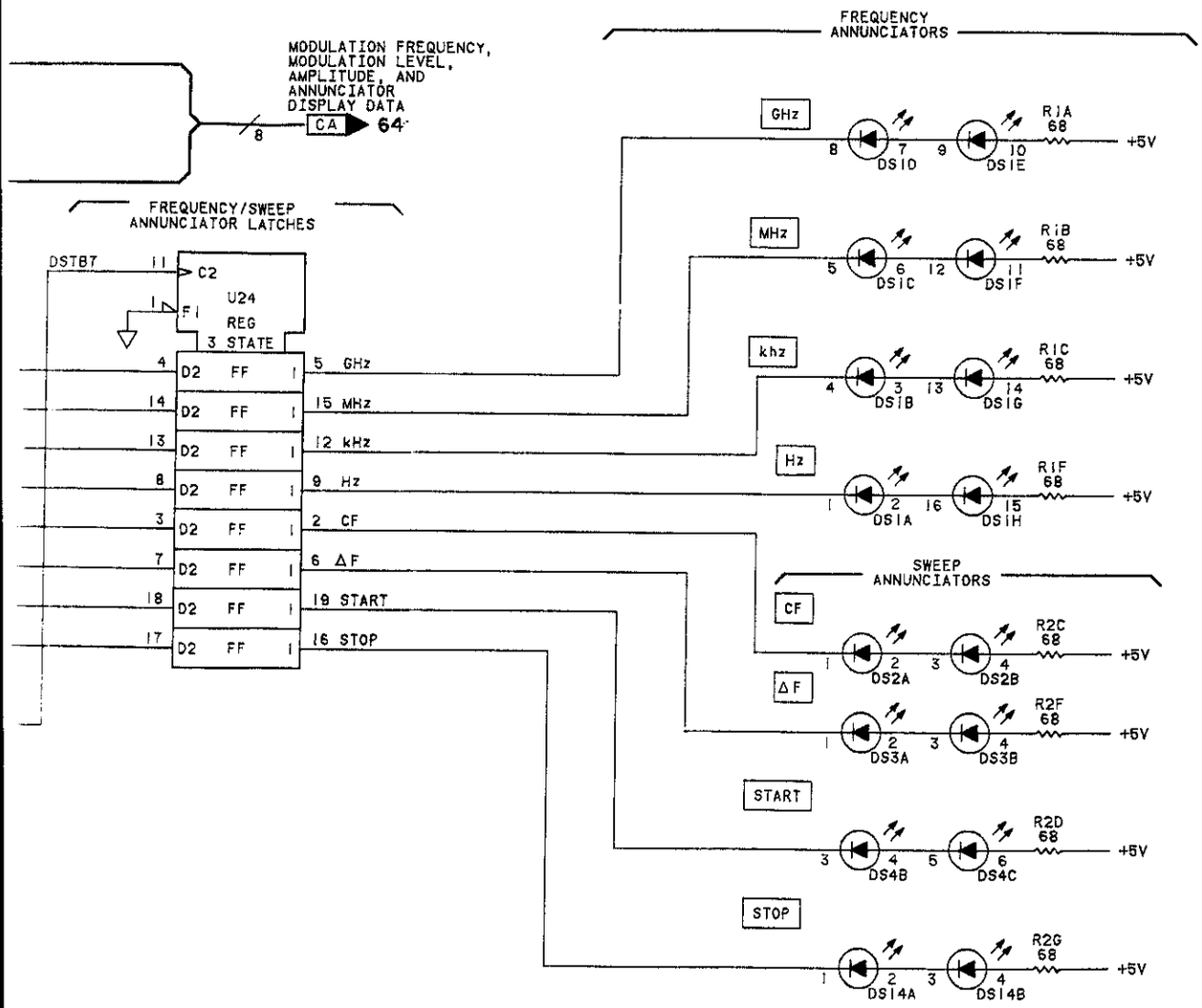


Fig 8-754
Sht 5 of 5

NOTES

1. SEE TABLE 8- FOR SCHEMATIC DIAGRAM NOTES.
2. TROUBLESHOOTING VALUES ARE TYPICAL. THEY ARE ACTUAL MEASURED VALUES. YOUR MEASUREMENTS MAY BE SLIGHTLY DIFFERENT THAN WHAT IS SHOWN.

REFERENCE DESIGNATIONS

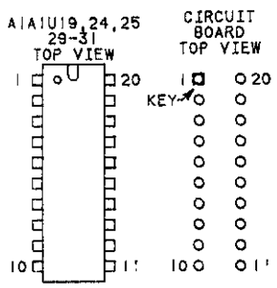
NO PREFIX	A1A1
W75	J6
A1A1	
C1-5 DS1-14 J1 R1-11 U1-31	

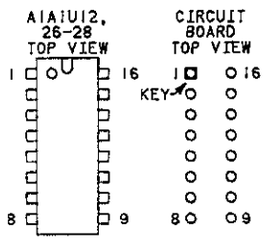
INTEGRATED CIRCUIT VOLTAGE AND GROUND CONNECTIONS

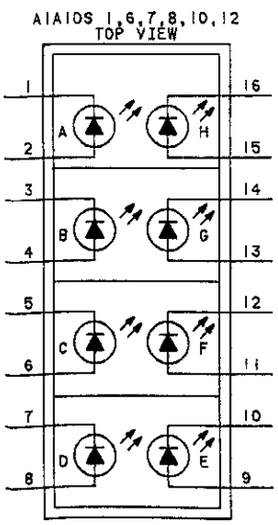
REFERENCE DESIGNATIONS	PIN NUMBERS
U1-11,13-18, 21-23	+5V - 7 ⏚ - 6
U12,26-28	+5V - 16 ⏚ - 8
U19,24,25, 29-31	+5V - 10 ⏚ - 20
U20	+5V - 7 ⏚ - 14

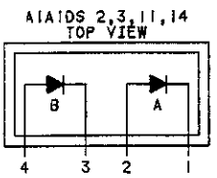
INTEGRATED CIRCUIT PART NUMBERS

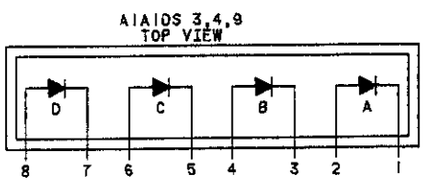
REFERENCE DESIGNATIONS	PART NUMBERS
U1-11,13-18 21-23	1990-0330
U12,26-28	1820-1216
U19,24,25 29,30	1820-1997
U20	1990-0399
U31	1820-2102

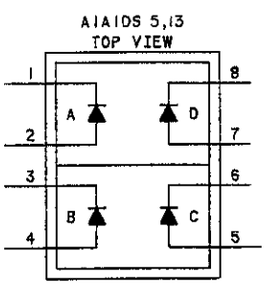












SERVICE SHEET 63

P/O A1A1

Figure 8-754. P/O A1A1 Display Assembly Schematic

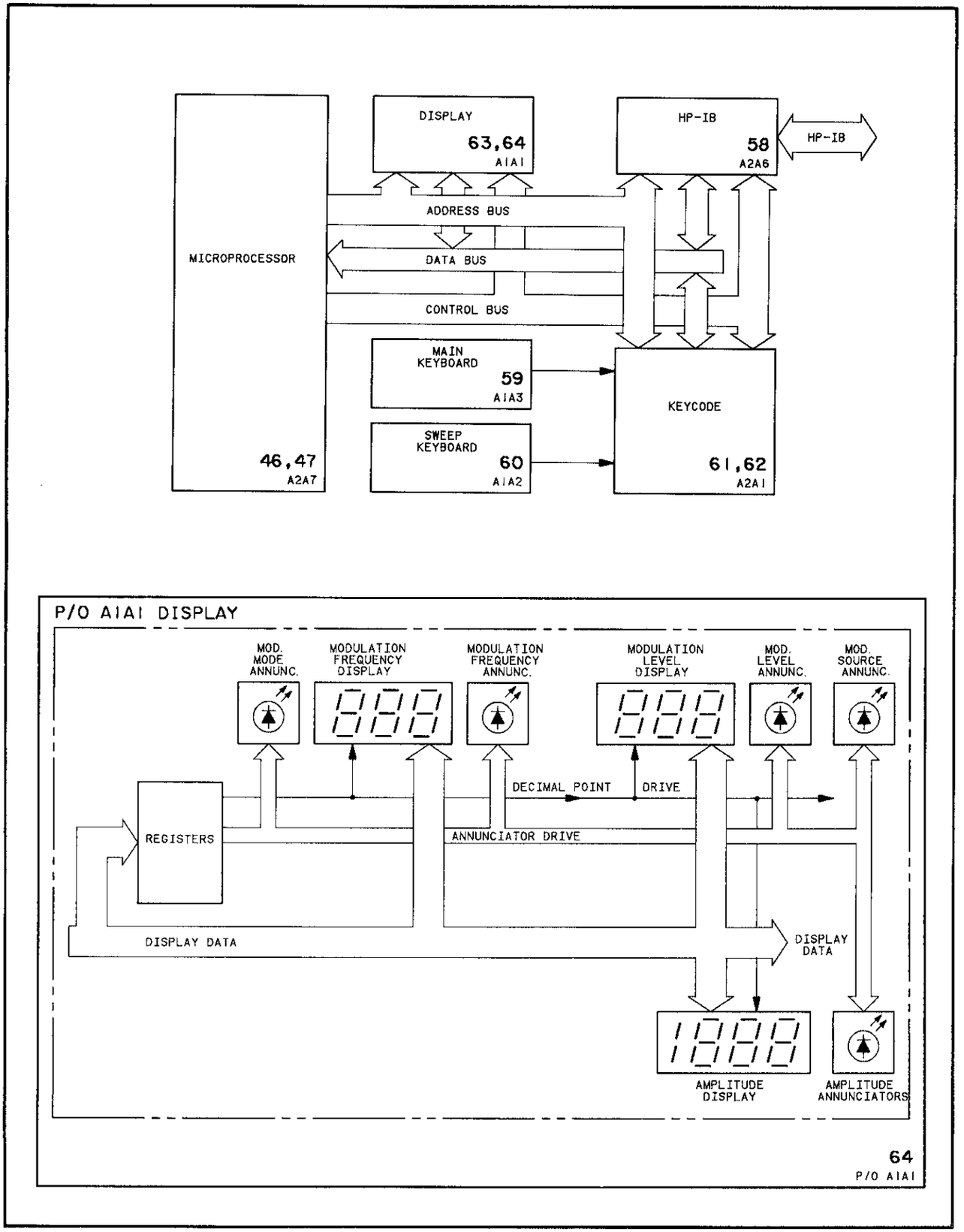


Figure 8-755. P/O A1A1 Display Assembly Block Diagrams

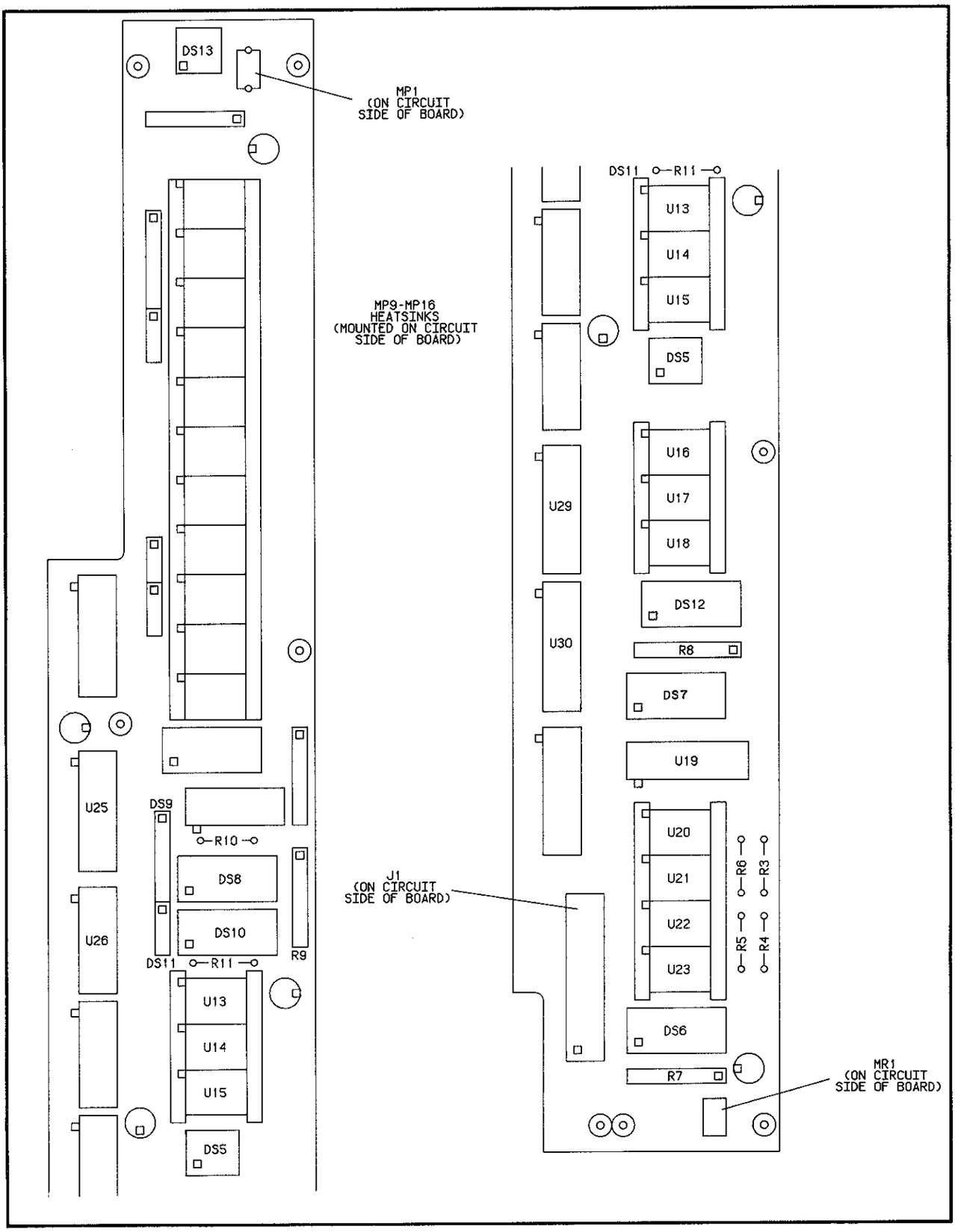


Figure 8-756. P/O A1A1 Display Assembly Component Locator

CHANGES

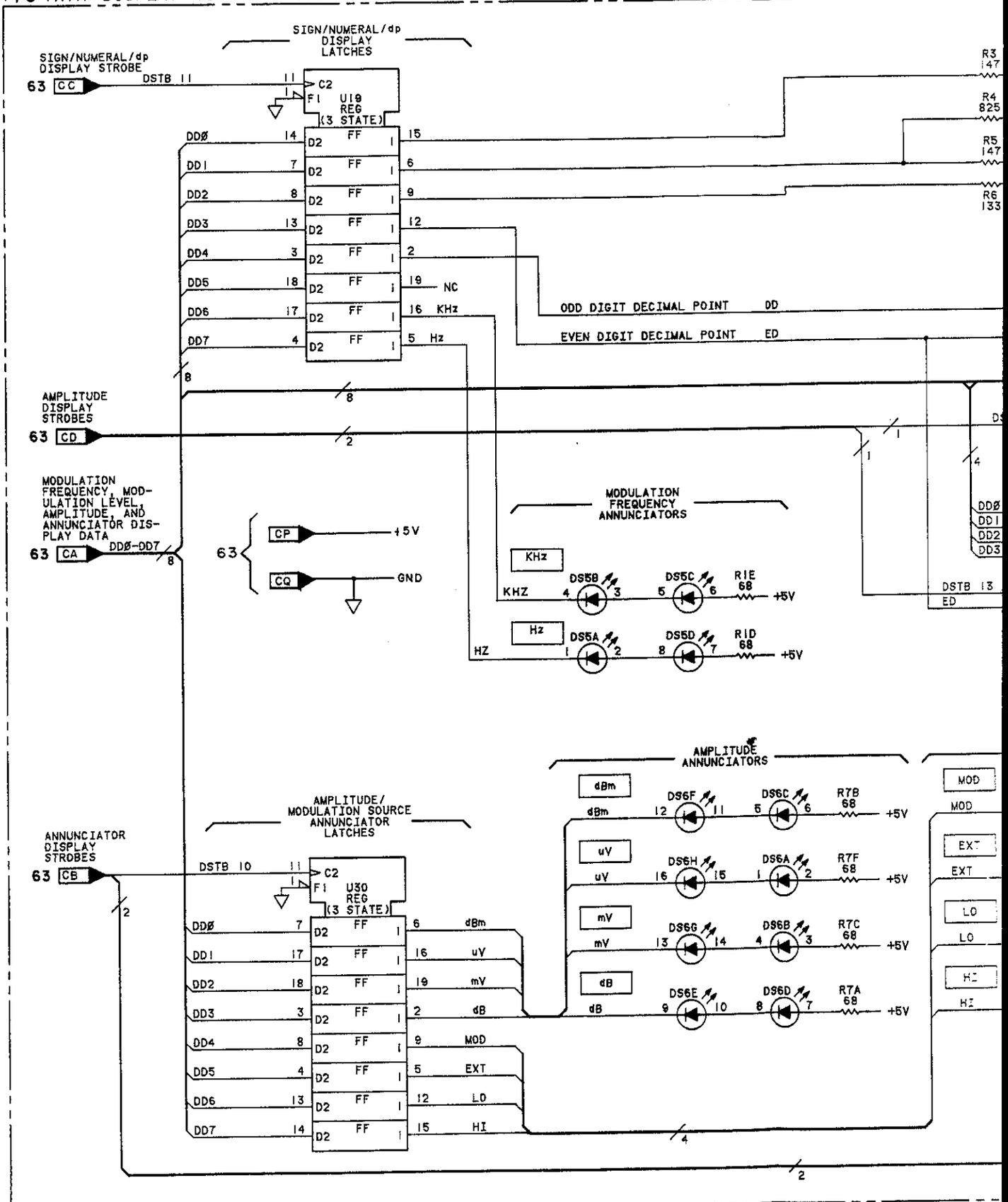
On the schematic

On the A1A1 schematic:

- A1A1 - Under **MODULATION MODE ANNUNCIATORS**, change R7G to R1G.

Fig 8-757
Sht 1 of 5

P/O A1A1 DISPLAY (08663-60338)



SERIAL PREFIX: 2234A

Fig 8-757
Sht 2 of 5

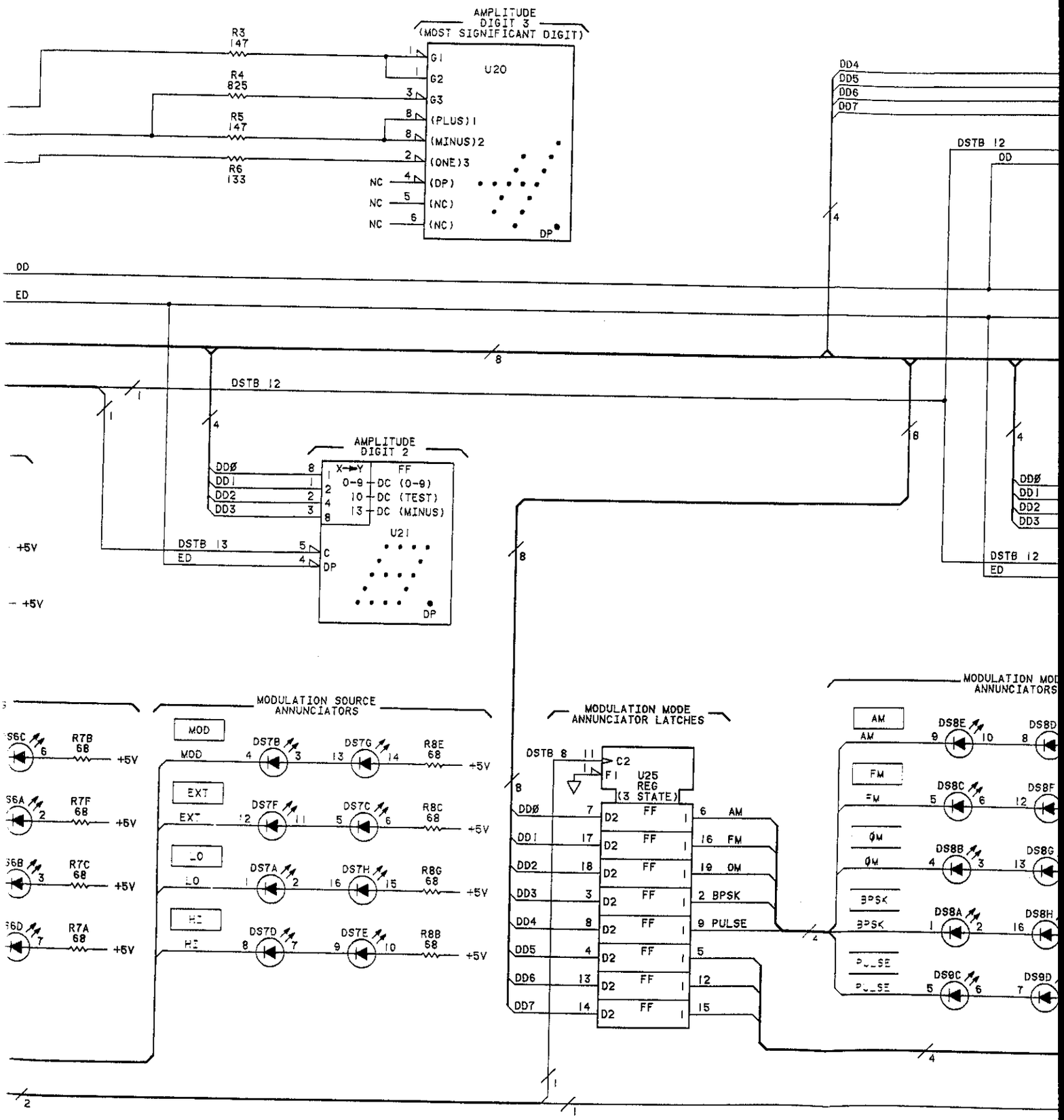


Fig 8-757
Sht 3 of 5

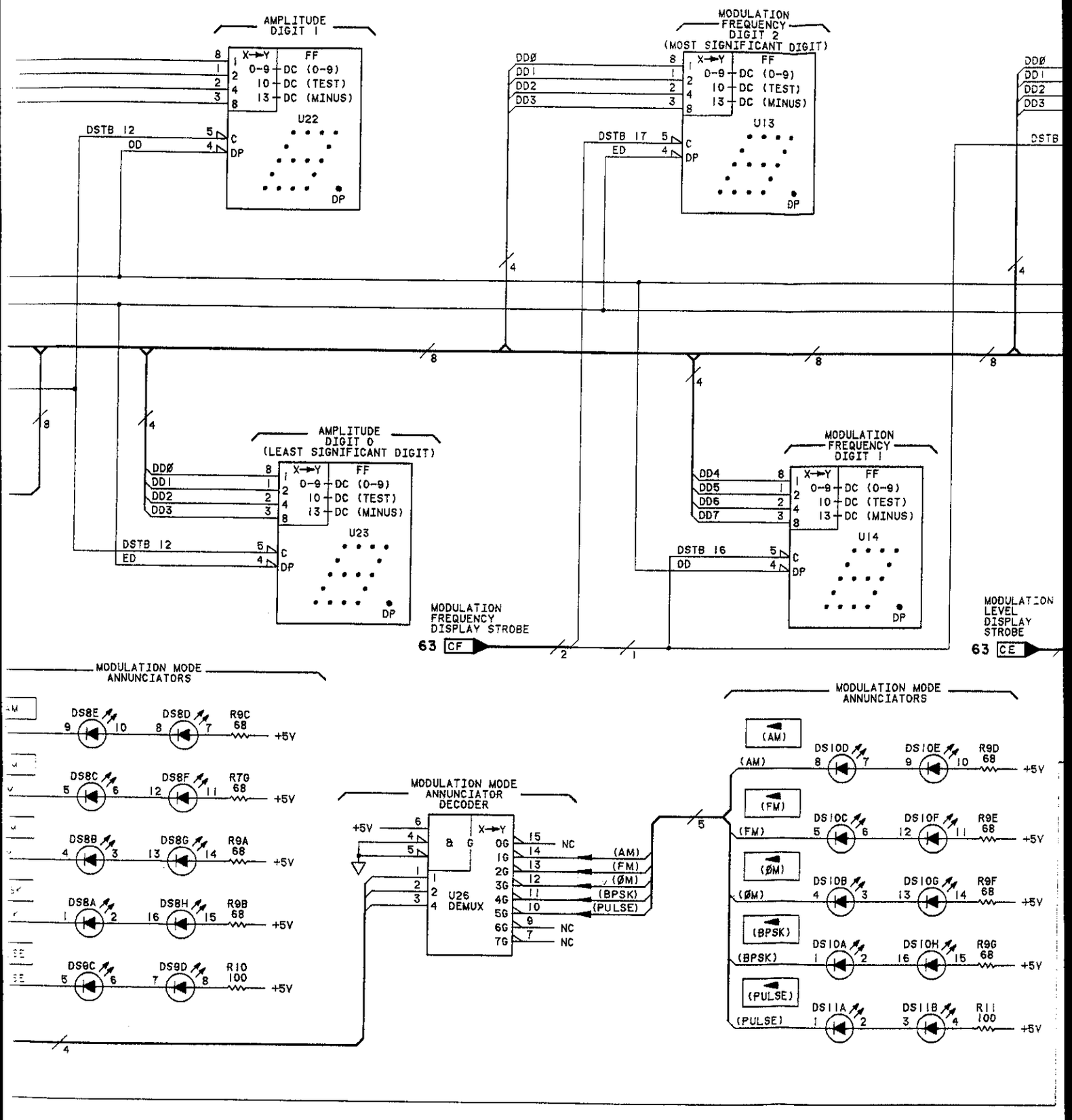


Fig 8-757
Sht 4 of 5

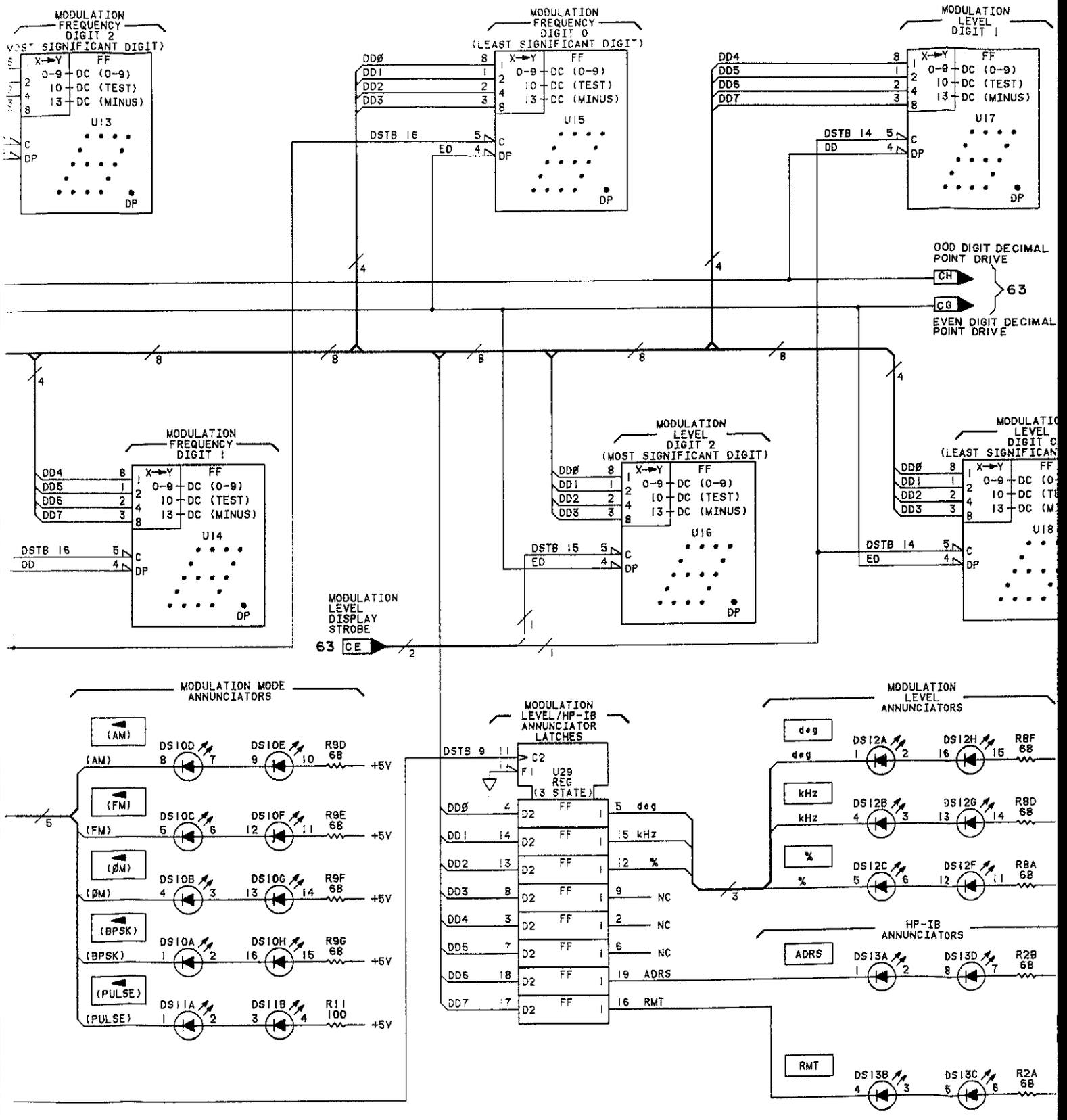
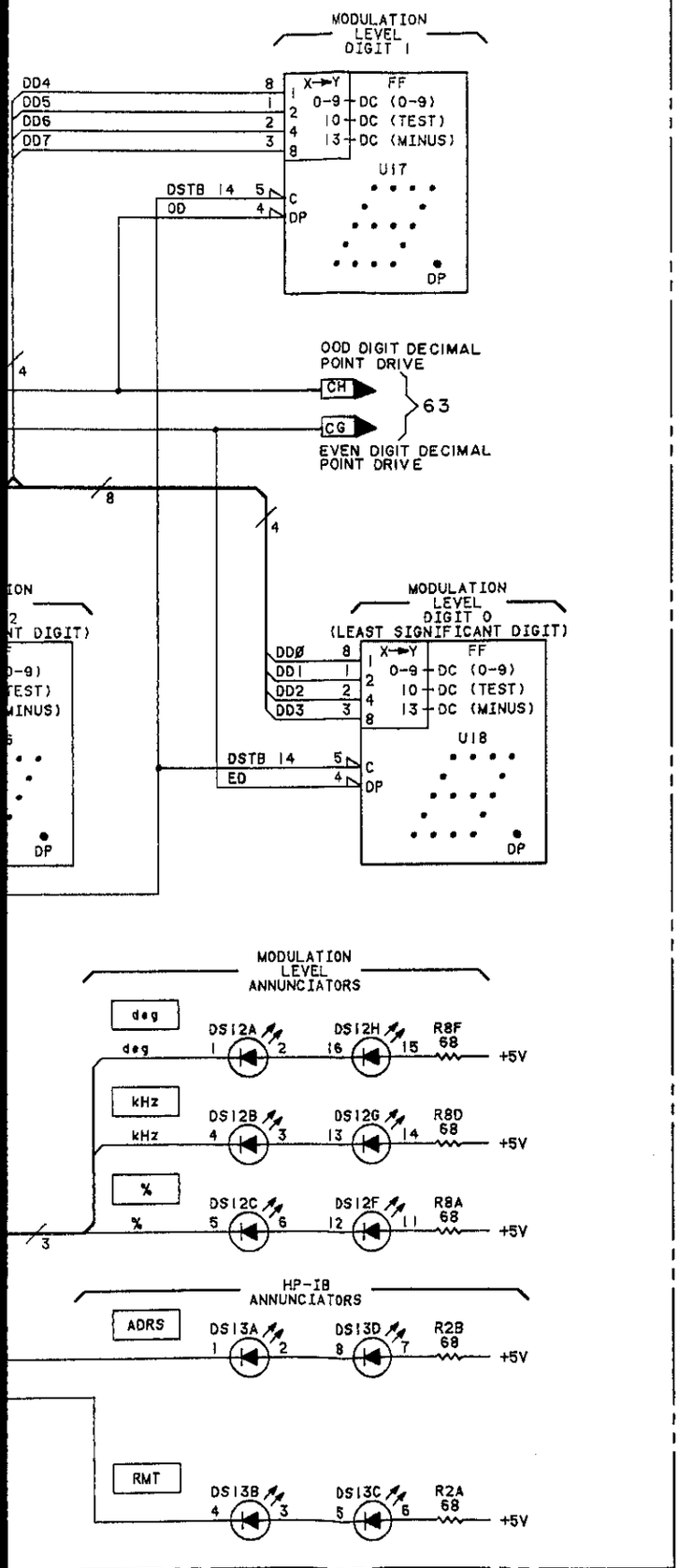


Fig 8-757
Sht 5 of 5



SERVICE SHEET 64

P/O A1A1

Figure 8-757. P/O A1A1 Display Assembly Schematic

8-775/776

SERVICE SHEET 65
A7A3 AND A7A4 POWER SUPPLY MOTHERBOARD AND INVERTER

REFERENCE BLOCK DIAGRAM 10
Table 4-1. Recommended Performance Tests After Adjustments or Repairs.
Table 5-2. Post-Repair Adjustment Procedures.

PRINCIPLES OF OPERATION

General

Circuitry on the Power Supply Motherboard and Inverter Board rectify and invert the ac line voltage prior to regulation. Before reaching these boards, the line voltage is passed through a filter assembly (A10) and a voltage selection switch (S2), which allow operation at 115 Vac or 220 Vac. Power entering the Supply Motherboard via pins 7-9 is rectified and coarsely filtered to produce ±160 Vdc. In the case of 115 Vac operation, voltage doubling is implemented during rectification. The ±160 Vdc is then chopped by inverter/regulator switches Q3 and Q4 to drive the main power supply transformer (A7A3T3).

The ac voltages at the multiple secondary taps of the transformer are rectified, filtered, and sent to the Linear Regulator Board (Service Sheet 66). The +5.2 Vdc line is regulated exclusively by the switching action of the supply. Fast and slow sense lines, as well as foldback and feedback sense lines, are derived from various points along the +5.2 Vdc line. These sense lines are sent to the Control Board (Service Sheet 67) which uses the information they provide to generate two pulse-width modulated signals (180° out of phase) that are fed back to drive the inverter/regulator circuitry (formed by Q1, Q2, Q3, and Q4) on the Inverter Assembly.

The output voltage of the 30 Vac transformer (T1) is rectified, filtered,and regulated to supply the dc oven heater voltage for the 10 MHz reference crystal oscillator and to power sections of the Linear Regulator and Control Boards. Circuitry within the auxiliary regulator section on the Control Board (Service Sheet 67) prevents the instrument from being operated when the line voltage falls below 80 Vac (for 115 Vac operation), or 160 Vac (for 220 Vac operation).

Rectifier, Filter, and Voltage Doubler Circuitry (A7A4)

With the input voltage selection switch in the 220 Vac position, input voltage is full-wave rectified by the bridge formed by CR1, CR2, CR3 and CR4 and is coarsely filtered by capacitors C2 and C3 to produce ± 160 Vdc. When the selection switch is in the 115 Vac position, CR2 and CR3 form a bridge rectifier and voltage doubler. Here again, the result is ± 160 Vdc. CR5 and CR6 serve to protect capacitors C2 and C3 from reverse voltage generated during foldback current limiting.

Overvoltage Crowbar

The overvoltage protection circuitry (crowbar) disables the instrument in the event that the rectified dc voltage exceeds ±185 Vdc. At this point Q1 fires and switches 5 ohms across the input line, blowing line fuse F1.

Switch Drivers and Inverter/Regulator Switches (A7A3)

In order to drive T3, pulses from the pulse-width modulation circuitry (duty-cycle control logic) on the Control Board are transformer coupled (via A7A3T1 and A7A3T2) to the inverter/regulator switch driver circuitry formed by Q1 and Q2 . Q1 and Q2 are turned alternately ON and OFF to drive Q3 and Q4 180° out of phase. This action switches the ±160 Vdc to produce a 20 kHz alternating drive current through the primary of T3 (see Figure 8-901 below). Q3 and Q4 are turned on by about 350 mA of current at their bases. To reduce the turn-off time of the two transistors, however, two amperes of reverse current is required to turn them off.

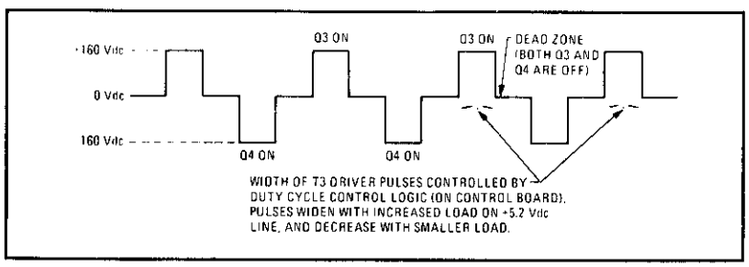


Figure 8-901. Switching Waveform at the primary of T3
(See also Figure 8-218, Simplified Power Supply Block Diagram)

A resistive-capacitive divider formed by R1, R2, C1, and C2 indirectly references the primary of T3 to ground, isolating the high voltage section from chassis ground and preventing T3 from overheating due to dc currents caused by imbalances in the switching circuits that drive T3. The circuit formed by R11, R12, and C5 serves to lower the Q of the inductance associated with T3, cutting down on ringing at the emitter of Q3 and the collector of Q4.

Secondary Isolation/Stepdown Transformer (T3) Outputs

Voltages at the secondary taps of T3 are referenced to the +5.2 Vdc supply ground. They are full-wave rectified, coarsely filtered , preregulated, and sent to the Linear Regulator Assembly for final regulation. These unregulated voltages are +23 volts, -13 volts, and - 45 volts.

The fast and slow sense lines, as well as the foldback and feedback sense lines, are derived from the +5.2 Vdc supply line. The duty cycle control logic on the Control Board regulates the +5.2 Vdc supply by varying the duty cycle of the signals which drive

inverter/regulator switches Q3 and Q4. Regulation of the +5.2 Vdc supply is accomplished exclusively through the switching action of the supply; no linear regulators are used on this line.

TROUBLESHOOTING

When a power supply problem has been traced through the block diagram troubleshooting procedure to this assembly, use the following procedure to isolate the cause of the problem.

CAUTION

If the LINE fuse is blown, do not insert a new fuse until the cause of the failure has been determined. Inserting a new fuse could cause additional damage if the problem is a shorted diode or transistor on the Power Supply Inverter Assembly (A7A3). Perform steps 1 through 6 before inserting a new FUSE.

1. Disconnect the line cord from the rear panel of the Generator.
2. Remove the top cover of the instrument.
3. Remove the top cover of the power supply (at left-rear of instrument).
4. Pull out the A7A3 Inverter Assembly.
5. Use an ohm meter or continuity checker to check the following components for shorts:

CR5	CR9	CR13
CR6	CR10	Q3
CR7	CR11	Q4
CR8	CR12	

6. If none of these components is shorted, it is safe to install another LINE fuse and continue normal troubleshooting.
7. Disconnect the line cord from the rear panel of the Generator.

WARNING

When the A7A3 Inverter Assembly is mounted on its extender board, +160V and -160V are exposed on the traces on this board. Use extreme care.

CAUTION

Removing and installing power supply boards with the line cord plugged in can damage these boards because high voltage is present whenever the line cord is plugged in.

Remove the A7A3 Inverter Assembly from the power supply. Insert the extender board for A7A3 (set the switch on the extender board to the "in" position to allow high voltage to appear on the top edge connector of the extender board). Plug in the line cord. Measure the high voltage at the edge connector of the extender board. Use a DVM with the common lead connected to the chassis.

Pin 5 V = -160 ± 20 Vdc
Pin 7 V = +160 ± 20 Vdc

These values are for 115 VAC line voltage. Higher or lower line voltages produce proportionally more or less dc voltage. If this voltage is not correct, the problem is with the high voltage rectifiers and associated circuitry on A7A4. Troubleshoot this circuitry to find the cause. Otherwise, the problem is on the A7A3 assembly so continue troubleshooting with Step 8.

8. Look at the waveform at pin 3 of transformer T3. This is the output of the switching transistors. The waveform should be as shown in the Figure 8-902, below.

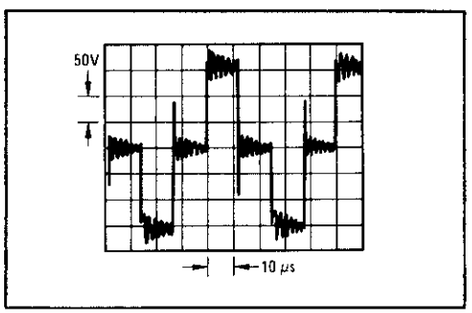


Figure 8-902. Waveform at Pin 2 of T3

If this waveform is normal, the problem is on the secondary side of transformer T3 so continue troubleshooting with step 10 below. If this waveform is not correct, the problem is with the switching transistor circuitry so continue troubleshooting with step 9.

9. Disconnect the line cord from the rear panel of the Generator. Set the switch on the A7A3 extender board to the "out" position. With the switch in this position, no high voltage reaches the A7A3 assembly and the drive signals to the switching transistors can be observed. Compare the actual waveforms to those in Figure 8-903 below.

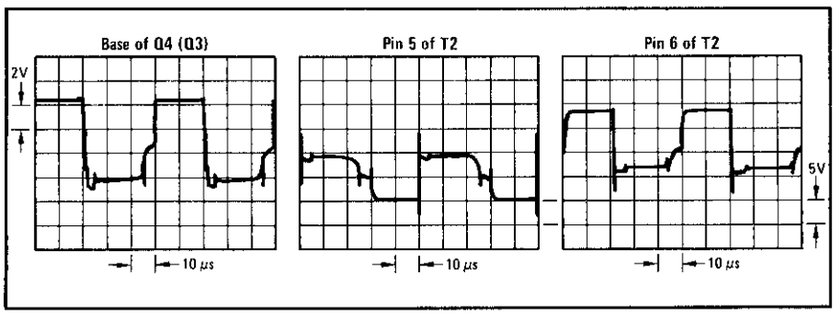


Figure 8-903. Switching Transistor Drive Signals

10. Compare the waveforms at the outputs of the rectifiers on the secondary of transformer T3 to those shown in Figure 8-904 below.

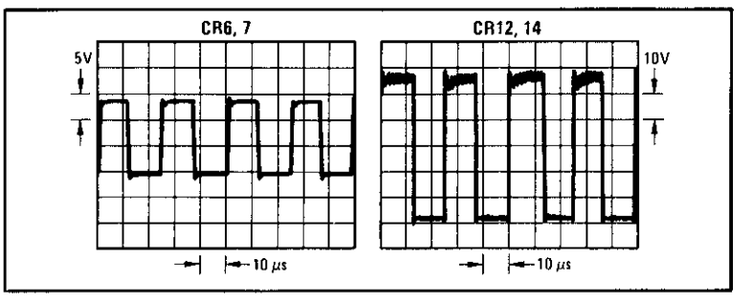


Figure 8-904. Transformer (T3) Secondary Waveforms

If any waveform is different, there is a problem with rectifier diodes or the transformer. The magnitude and duty cycle of the pulses will vary with line voltage, but the pulse width at the output of all rectifiers should be the same.

11. Measure the outputs of the rectifier filters at the bottom edge connector of A7A3. Normal values are:

Rectifier Filter Outputs

A7A3 Connector Pin	DVM DC Reading	DVM AC Reading
21	>+22.5	<0.05
22	More Negative than -12.50	<0.20
20	More Negative than -44.00	<0.20
17	>+5.40	<0.040
14, 15, 16	≥+5.20	<0.025

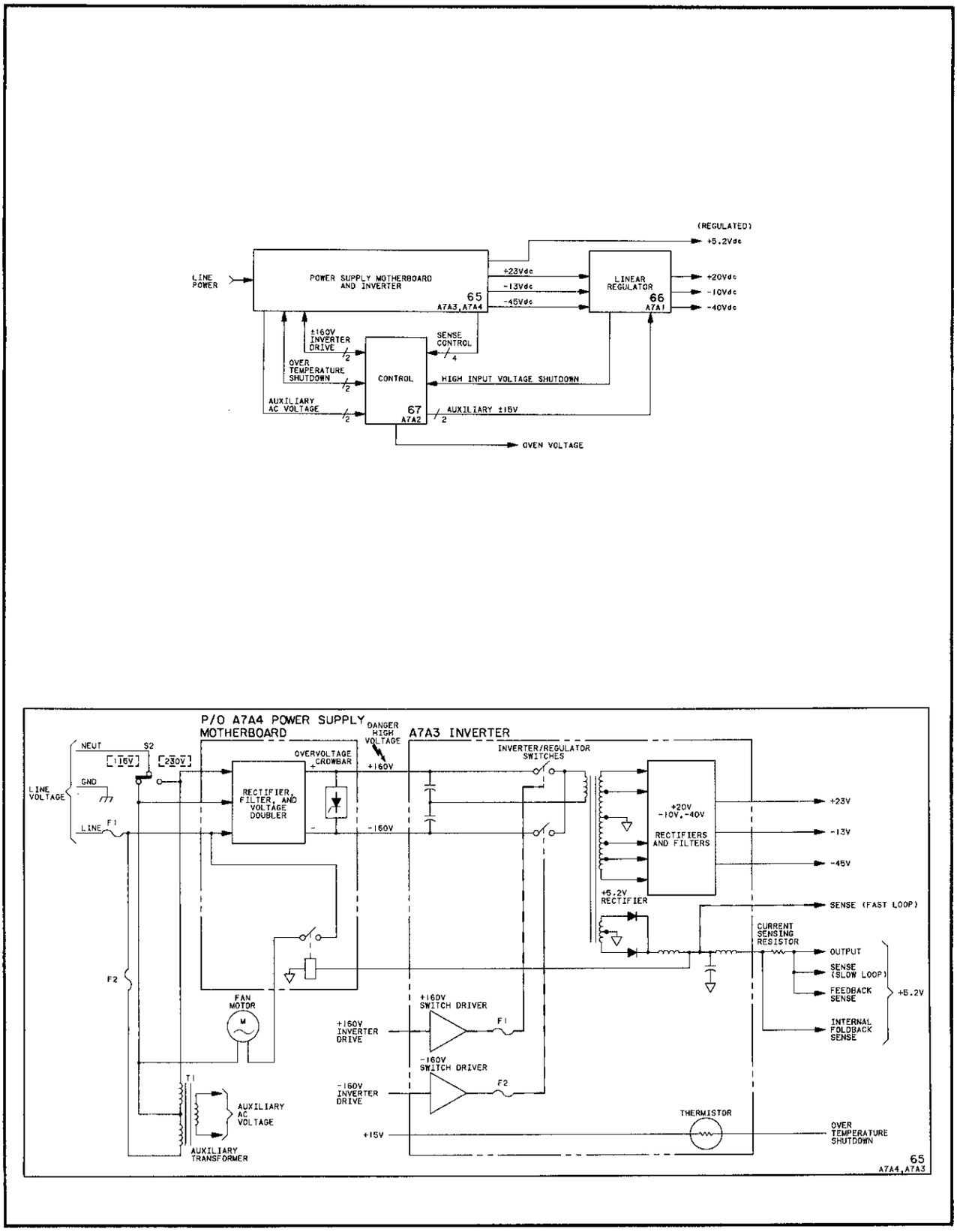


Figure 8-905. Power Supply Inverter, Motherboard & Line Filter Block Diagrams

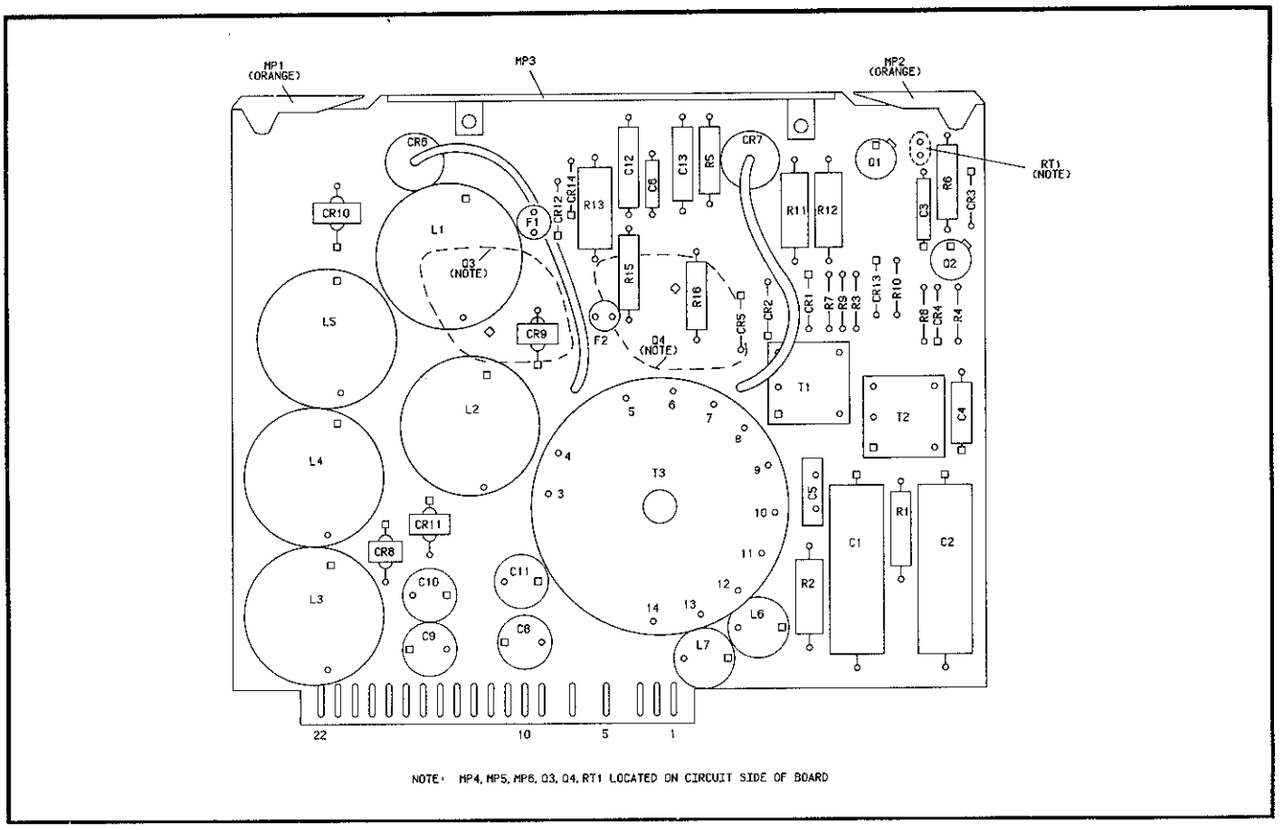


Figure 8-906. A7A3 Power Supply Inverter Component Locator

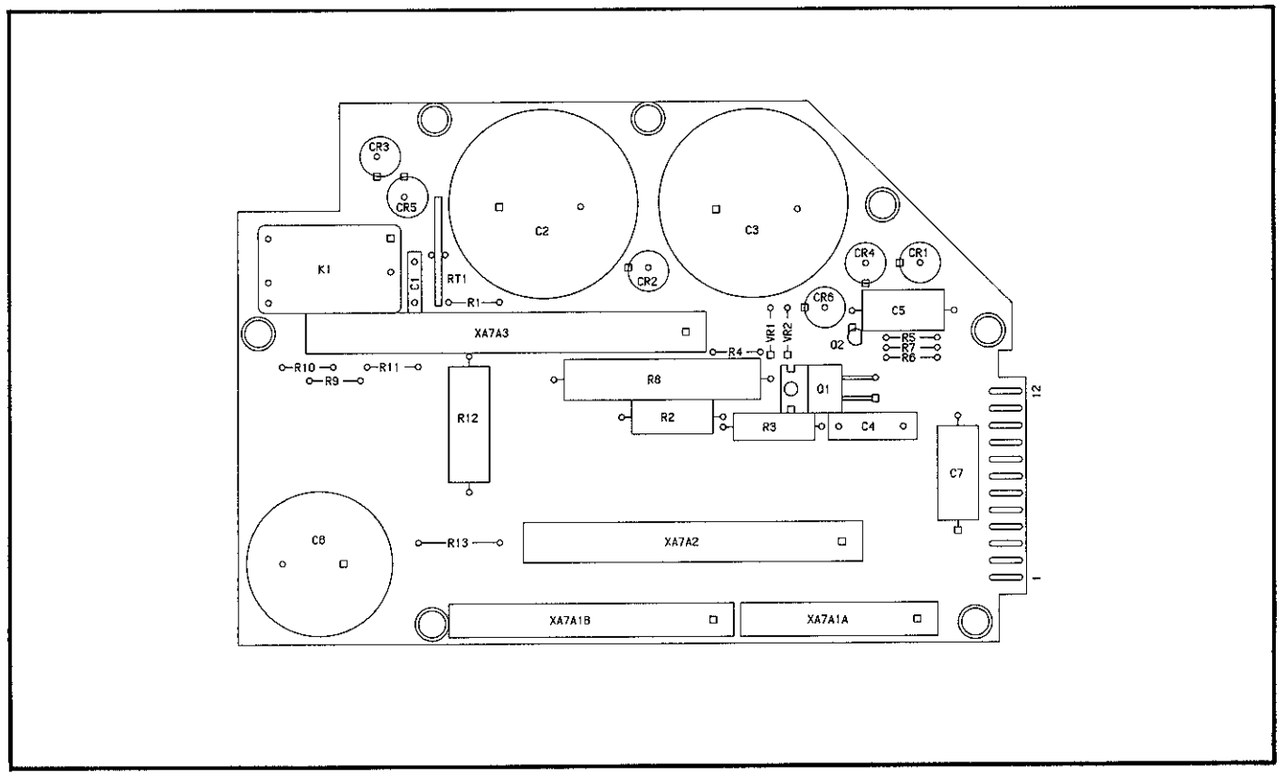


Figure 8-907. A7A4 Power Supply Motherboard Component Locator

CHANGES

2342A and Above

On the A7A3 schematic:

- A7A3 - Modify the schematic as shown in the partial schematic "P/O Figure 8-908. A7A3 Power Supply Inverter, Motherboard & Line Filter Schematic (2342A)" on page 8-908.3.

2510A and Above

On the A7A3 schematic:

- A7A3 - Modify the schematic as shown in the partial schematic "P/O Figure 8-908. A7A3 Power Supply Inverter, Motherboard & Line Filter Schematic (2510A)" on page 8-908.4.

2545A and Above

On the A7A4 schematic:

- A7A4 - Change the part number of the A7A4 Assembly to 08662-60376.

WARNING

If replacing the old A7A4 Power Supply Motherboard with the new board (08662-60376), extreme care should be exercised as the connections are arranged in a different order on the 08662-60376 board. For information regarding installing a new A7A4 Assembly (08662-60376) in an older instrument, refer to Installation Instructions -- HP Part Number 08662-90069. The wiring codes and board labels shown on the schematic are correct.

2651A and Above

On the A7A1 schematic:

A7A1 - Change the part number of the A7A1 Assembly to 08662-60347.

- A7A1 - Change the part number of Q4, Q6, Q8 to 1884-0330 in the table "Transistors and Integrated Circuit Part Numbers."

INSTALLATION INSTRUCTIONS

November 14, 1985

HP MODEL 8662A/8663A SYNTHESIZED SIGNAL GENERATORS

Serial Prefix 2537A and Below

INSTRUCTIONS FOR INSTALLING NEW STYLE A7A4 POWER SUPPLY MOTHERBOARD HP PART NUMBER 08662-60376 (REPLACES 08662-60156)

WARNING

Due to wiring configuration changes, product damage or shock hazard could result if the following installation procedure is not followed. Before attempting this procedure, remove the power cord from the signal generator.

PROCEDURE

The input power wiring configuration for HP Part Number 08662-60156 (Serial Prefixes 2537A and below) is different from the wiring configuration of HP Part Number 08662-60376 (Serial Prefixes 2545A and above). Figure 1 (below) shows the proper wiring configuration when installing the new A7A4 Power Supply Motherboard, HP part number 08662-60376.

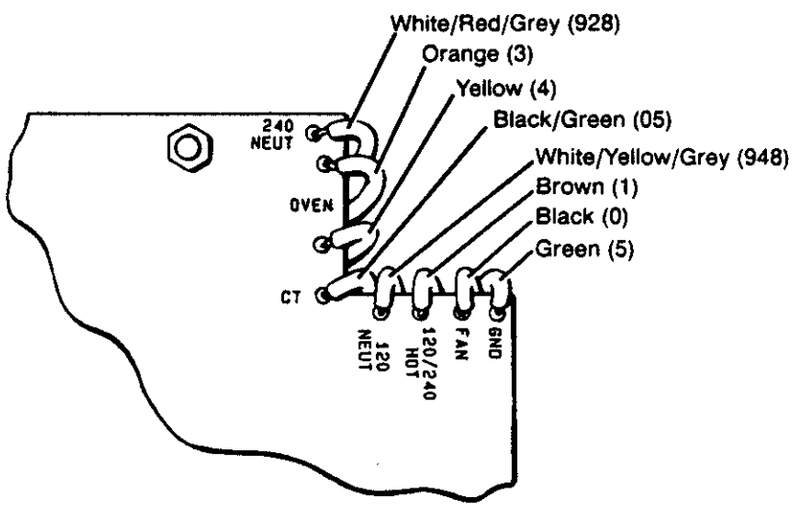


Figure 1. *Wiring Connections for 08662-60376 Power Supply Motherboard (A7A4)*

Printed in U.S.A.
HP Part Number 08662-90069

HEWLETT PACKARD

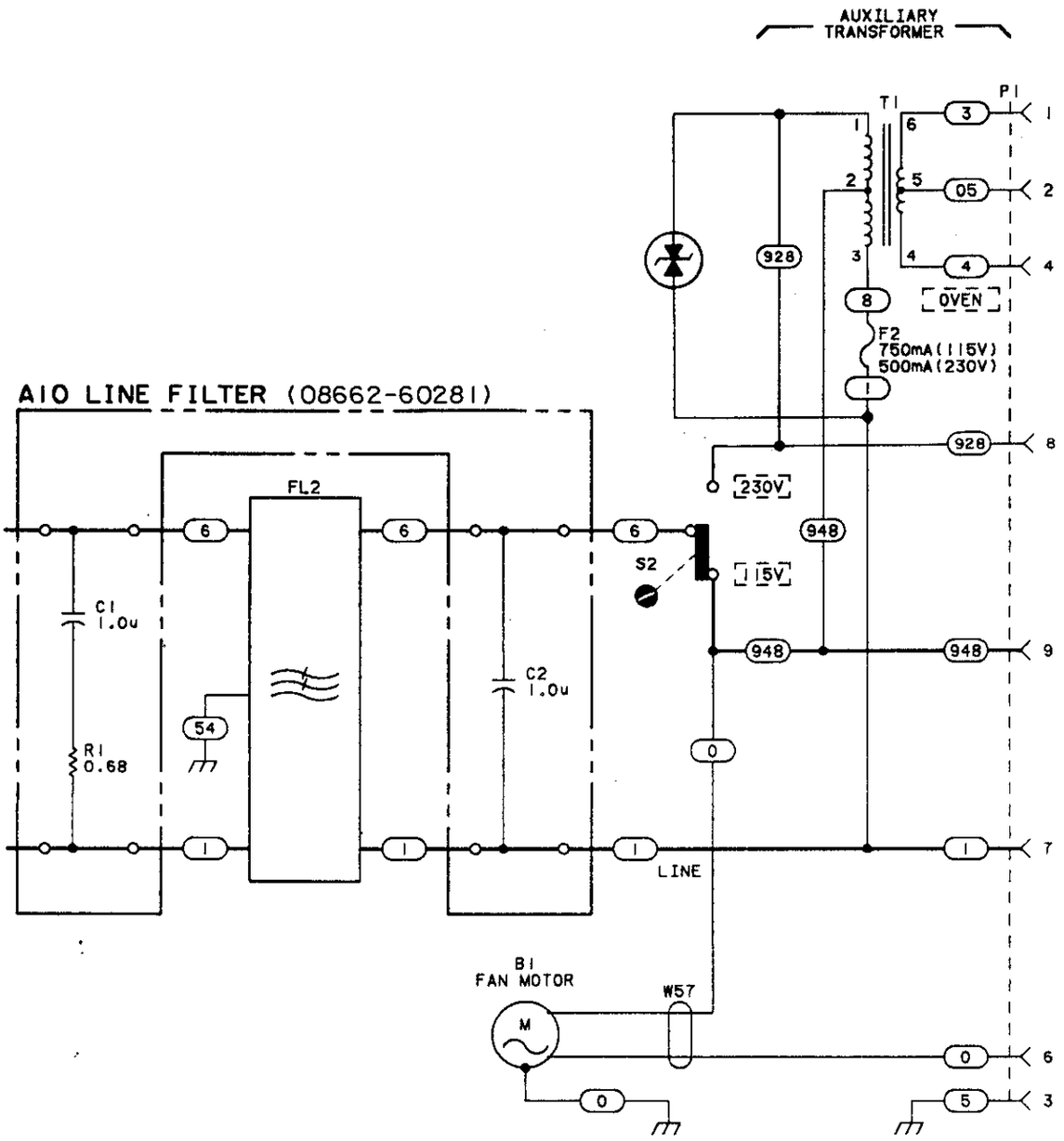
SS65

CHANGES

2342A to 2846A	**On the A7A3 schematic:** • A7A3 - Modify the schematic as shown in the partial schematic "P/O Figure 8-908, A7A3 Power Supply Inverter, Motherboard & Line Filter Schematic (2342A to 2846A)" on page 8–908.5
2510A to 2846A	**On the A7A3 schematic:** • A7A3 - Modify the schematic as shown in the partial schematic "P/O Figure 8-908, A7A3 Power Supply Inverter, Motherboard & Line Filter Schematic (2510A to 2846A)" on page 8–908.6
2545A and above	**On the A7A4 schematic:** • 08662-60376 - Change the part number of the A7A4 Assembly to 08662-60376. **NOTE** *If replacing the old A7A4 power supply motherboard with the new board (08662-60376), extreme care should be excercised as the connections are arranged in a different order on the 08662-60376 board. For information regarding installing a new A7A4 Assembly (08662-60376) in an older instrument, refer to Installation Instructions on page 8-908.1 – HP Part number 08662-90069. The wiring codes and board labels shown on the schematic are correct.*
2651A and above	**On the A7A1 schematic:** • 08662-60347 - Change the part number of the A7A1 Assembly to 08662-60347. • Q4, Q6, Q8 - Change the part number of Q4, Q6, and Q8 to 1884-0330 in the "Table of Transistor and Integrated Circuit Part Numbers."
2846A and below	**On the schematic:** • B1 - This assembly is not individually backwards compatible except as a total kit – the Fan Replacement Kit is available as HP part number 08662-60383. If your rear panel frame is damaged and your fan needs to be replaced, order the Rear Panel Kit, HP part number 08662-60384. See section 7 for further information.

CHANGES

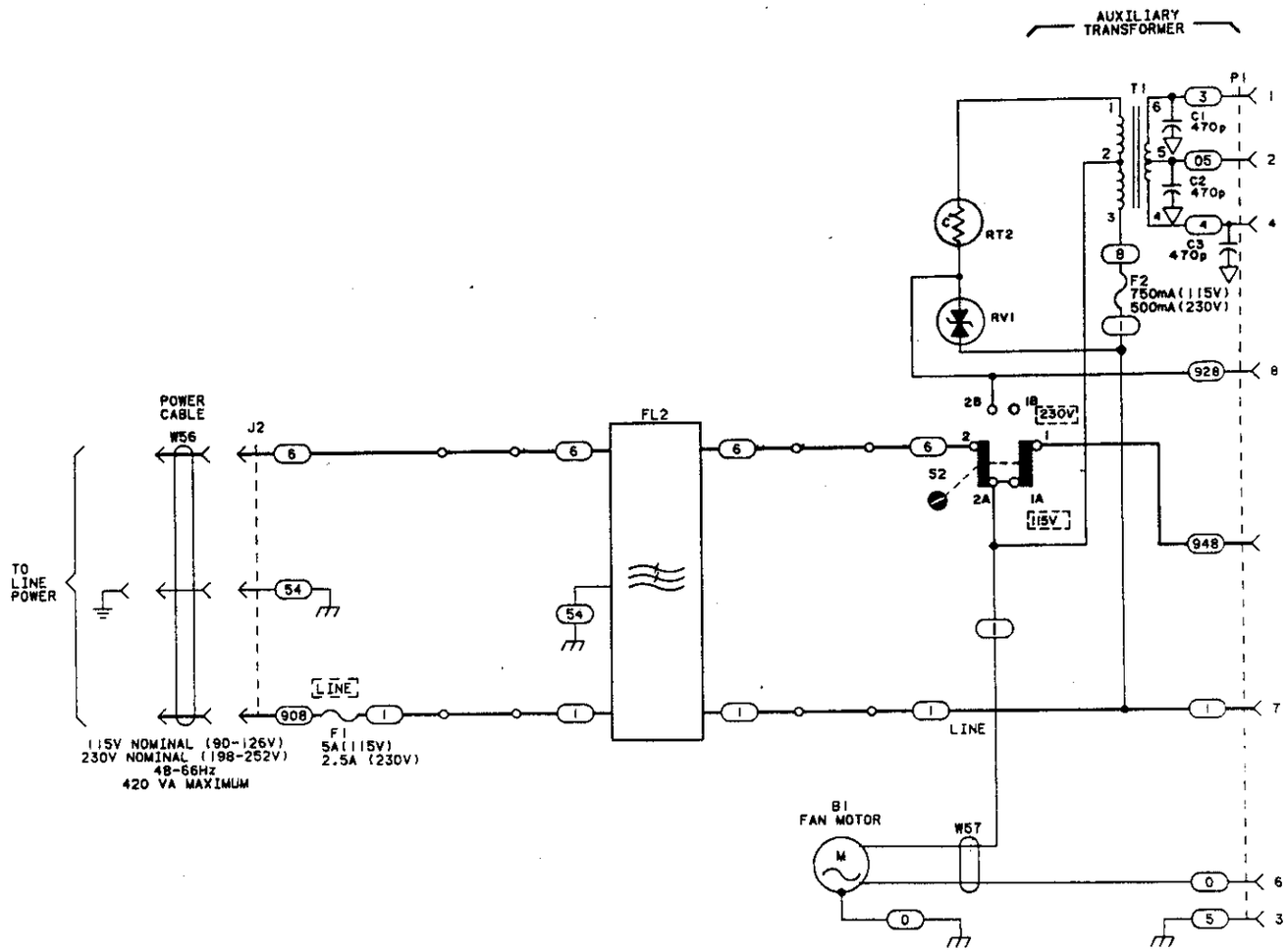
2918A to 3003A	**On the A7A3 schematic:** • B1 - Use the partial schematic on page 8-908.7. • A7A3 - In A7A3 INVERTER, under FULL-WAVE RECTIFIERS AND RIPPLE FILTERS, draw an on-page connector extending upward from the node of C9. Label it "A" +23 V. "A" connects to the partial schematic on page 8-908.7.
3017A and above	**On the A7A3 schematic:** • A7A3C1, C2 - Change the value of A7A3C1 and C2 to 22uf.



A7A3 Schematic Partial, (2342A to 2510A).

NOTE

The circuitry shown on this page for the B1 Fan Motor is no longer accurate. For the current circuitry, see page 8-908.7, 2918A and above. See section 7 for more details.

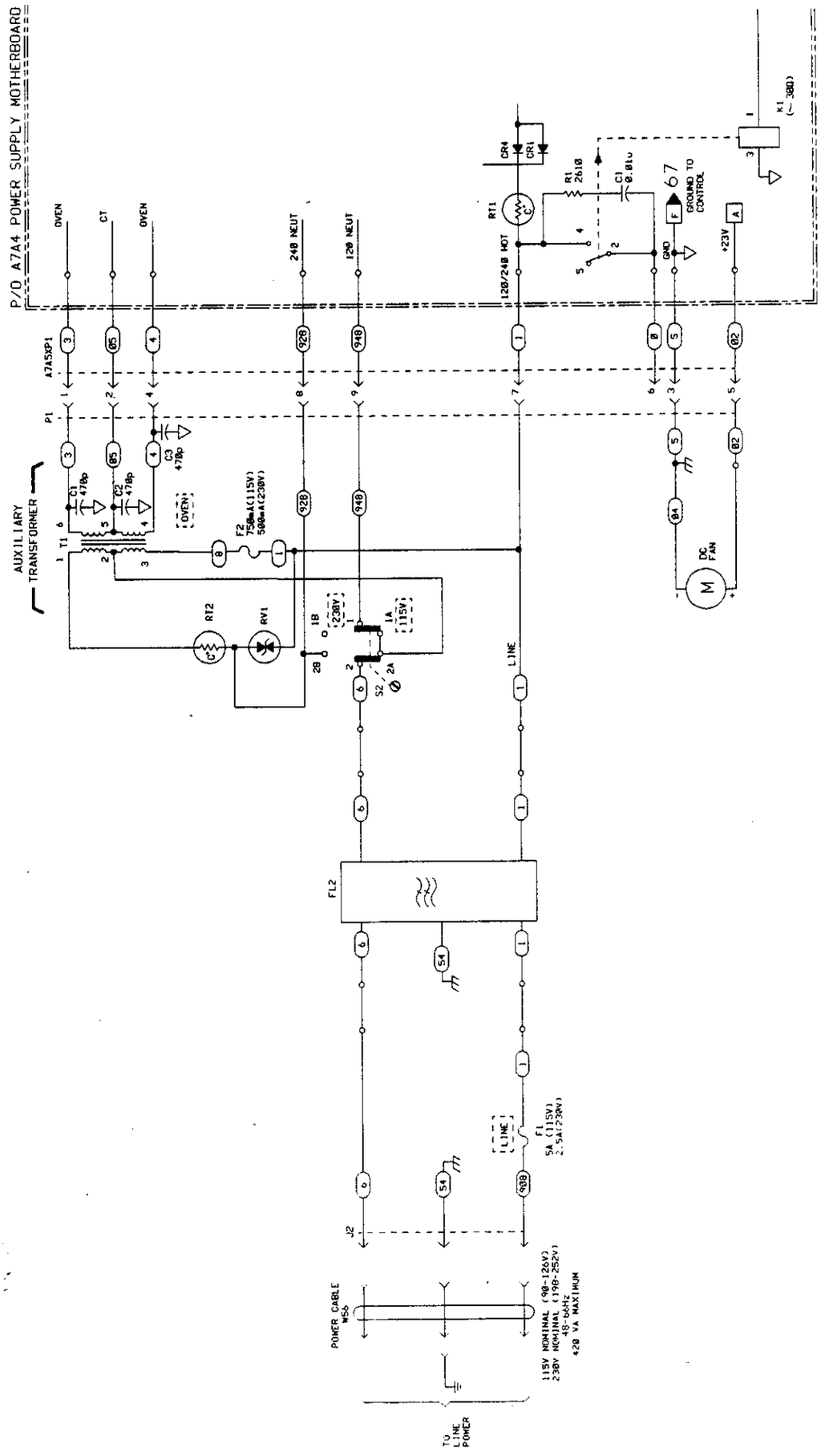


Schematic Partial, (RT2 was added). See section 7 (2510A and above).

NOTE

The circuitry shown on this page for the B1 Fan Motor is no longer accurate. For the current circuitry, see page 8-908.7, 2918A and above. See section 7 for more details.

SS65



Partial Schematic for the B1 Fan Change (2918A and above).

Fig 8-908
Sht 1 of 5

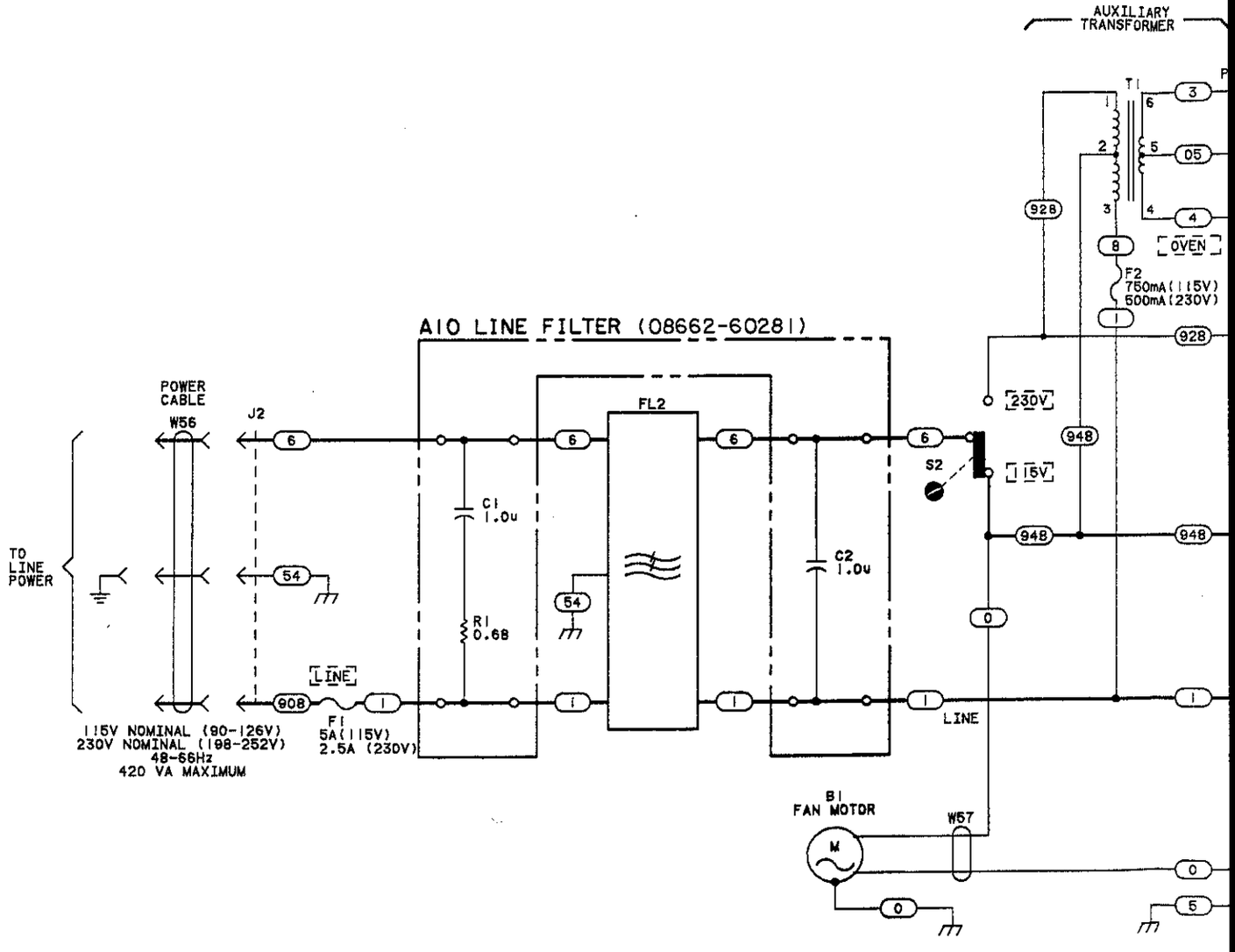


Fig 8-908
Sht 2 of 5

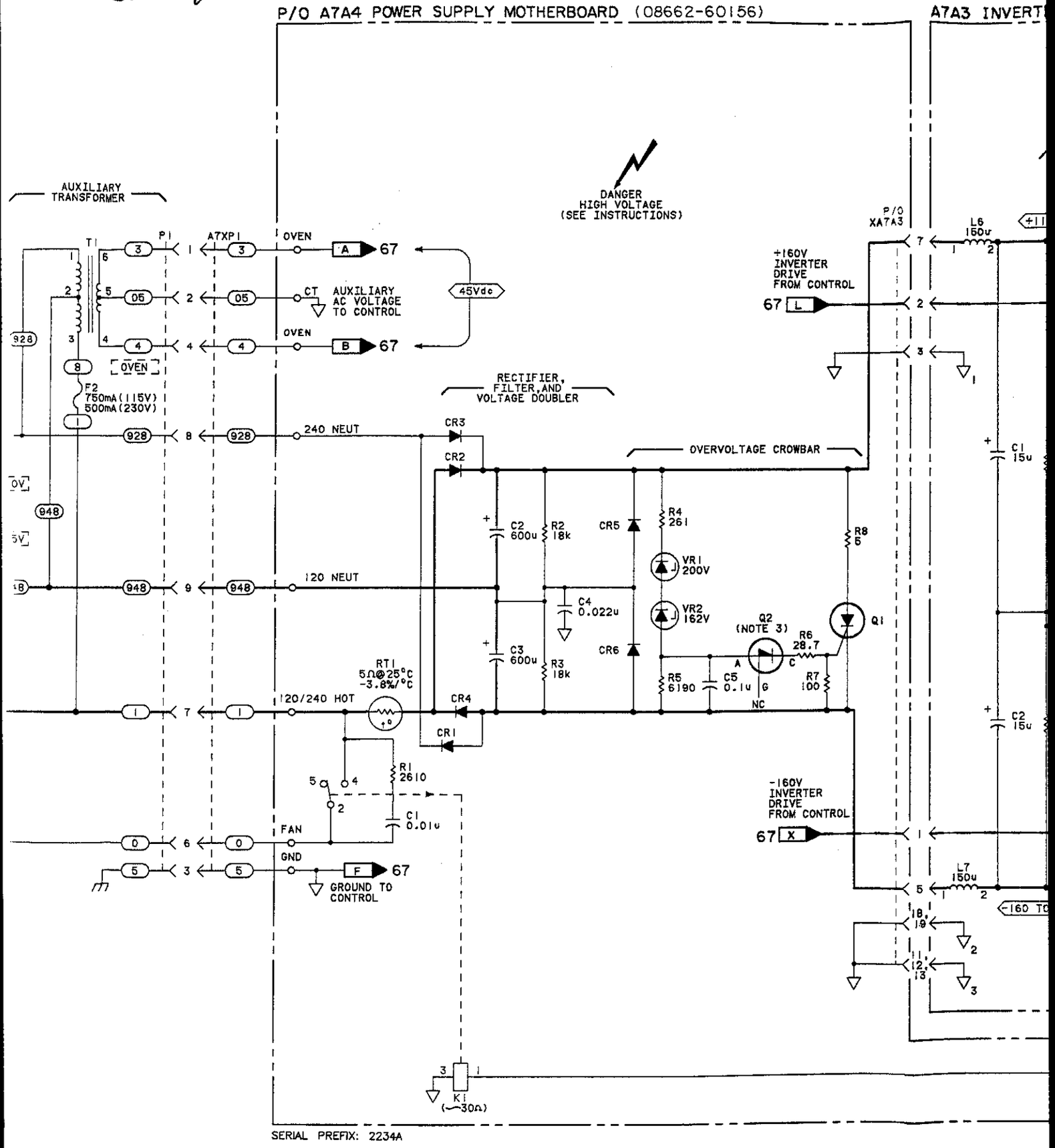


Fig 8-908
Sht 3 of 5

A7A3 INVERTER (08662-60289)

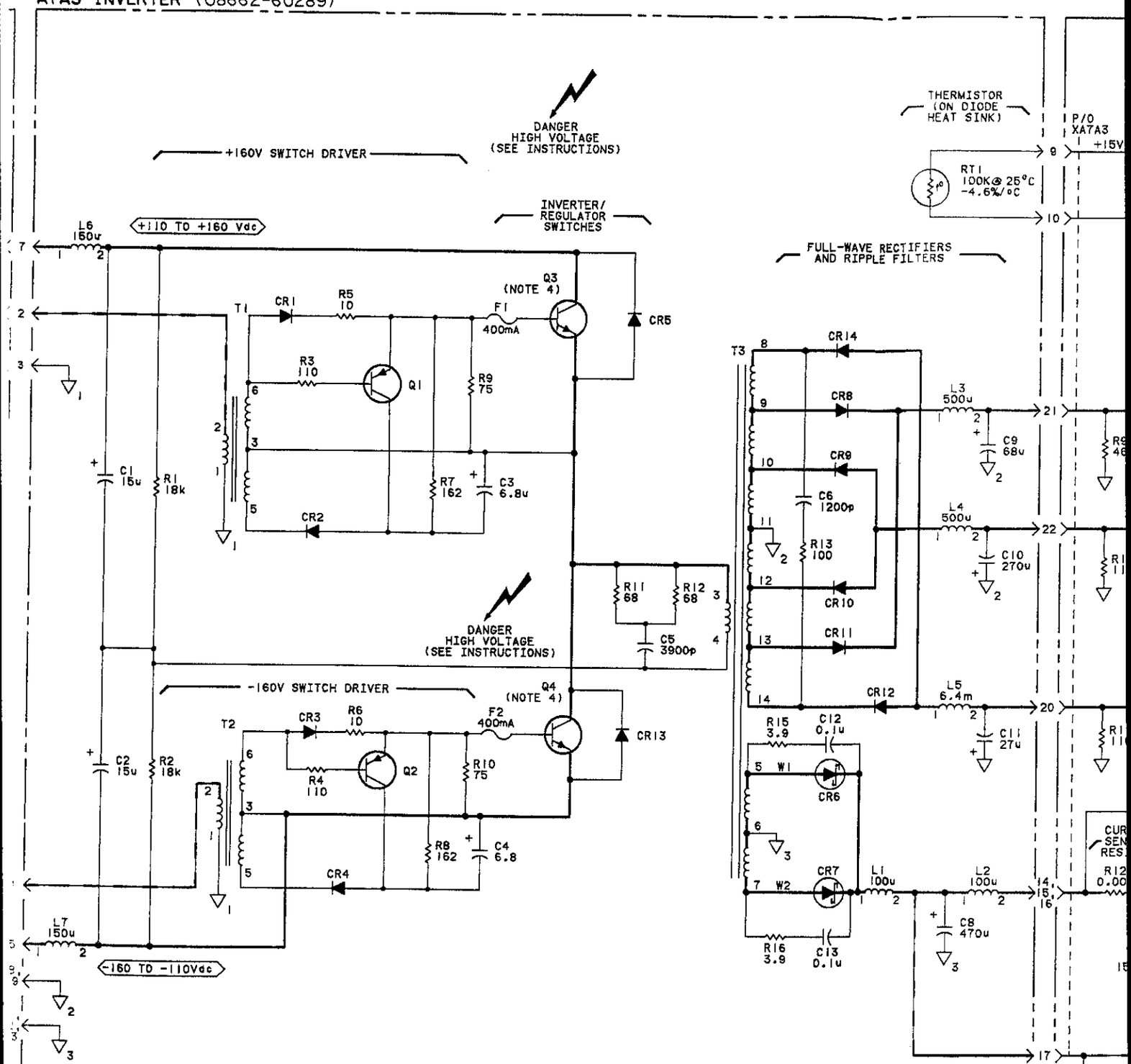


Fig 8-908
Sht 4 of 5

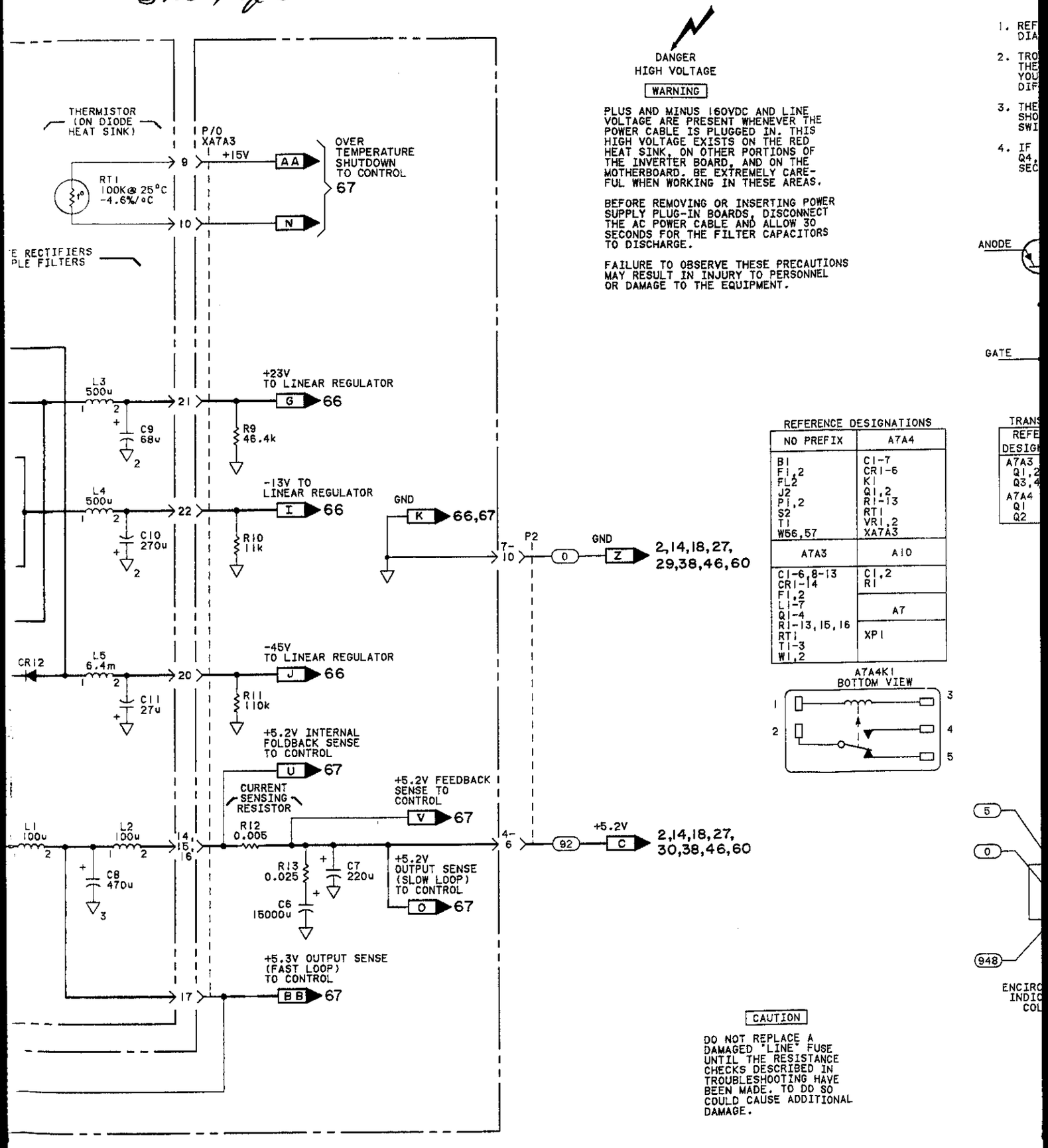


Fig 8-908
Sht 5 of 5

DANGER
HIGH VOLTAGE

WARNING

PLUS AND MINUS 160VDC AND LINE VOLTAGE ARE PRESENT WHENEVER THE POWER CABLE IS PLUGGED IN. THIS HIGH VOLTAGE EXISTS ON THE RED HEAT SINK, ON OTHER PORTIONS OF THE INVERTER BOARD, AND ON THE MOTHERBOARD. BE EXTREMELY CAREFUL WHEN WORKING IN THESE AREAS.

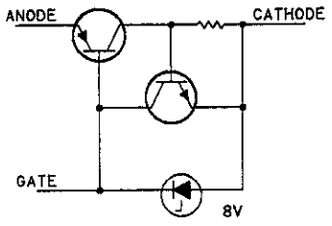
BEFORE REMOVING OR INSERTING POWER SUPPLY PLUG-IN BOARDS, DISCONNECT THE AC POWER CABLE AND ALLOW 30 SECONDS FOR THE FILTER CAPACITORS TO DISCHARGE.

FAILURE TO OBSERVE THESE PRECAUTIONS MAY RESULT IN INJURY TO PERSONNEL OR DAMAGE TO THE EQUIPMENT.

NOTES

1. REFER TO TABLE 8-102 FOR SCHEMATIC DIAGRAM NOTES.
2. TROUBLESHOOTING VALUES ARE TYPICAL. THEY ARE ACTUAL MEASURED VALUES. YOUR MEASUREMENTS MAY BE SLIGHTLY DIFFERENT THAN WHAT IS SHOWN.
3. THE EQUIVALENT CIRCUIT FOR A7A4Q2 IS SHOWN BELOW (A SILICON UNILATERAL SWITCH).
4. IF REPLACING TRANSISTOR SWITCH A7A3Q3 OR Q4, ALSO CHECK THE RECTIFIERS AT THE SECONDARY OF T3.

A7A4Q2
EQIVALENT CIRCUIT



REFERENCE DESIGNATIONS

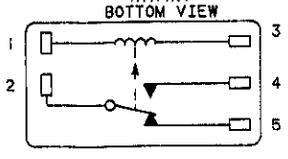
NO PREFIX	A7A4
B1 F1,2 FL2 J2 P1,2 S2 T1 W56,57	C1-7 CR1-6 K1 Q1,2 R1-13 RT1 VR1,2 XA7A3
A7A3	A10
C1-6,8-13 CR1-14 F1,2 L1-7 Q1-4 R1-13,15,16 RT1 T1-3 W1,2	C1,2 R1 A7 XP1

TRANSISTOR PART NUMBERS

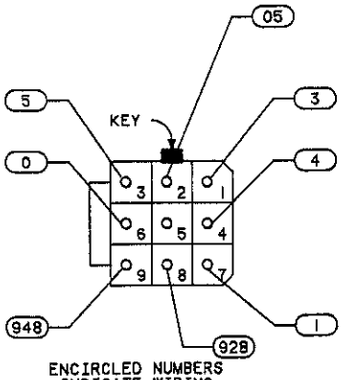
REFERENCE DESIGNATIONS	PART NUMBERS
A7A3	
Q1,2	1853-0442
Q3,4	1854-0657
A7A4	
Q1	1884-0268
Q2	1884-0091

GND
Z
2,14,18,27,
29,38,46,60

A7A4K1
BOTTOM VIEW



A7XP1
REAR VIEW



ENCIRCLED NUMBERS
INDICATE WIRING
COLOR CODE

+5.2V
C
2,14,18,27,
30,38,46,60

CAUTION

DO NOT REPLACE A DAMAGED "LINE" FUSE UNTIL THE RESISTANCE CHECKS DESCRIBED IN TROUBLESHOOTING HAVE BEEN MADE. TO DO SO COULD CAUSE ADDITIONAL DAMAGE.

SERVICE SHEET 65
A7A3

Figure 8-908. A7A3 Power Supply Inverter, Motherboard & Line Filter Schematic

SERVICE SHEET 66
A7A1 LINEAR REGULATOR ASSEMBLY

REFERENCE BLOCK DIAGRAM 10
Table 4-1. Recommended Performance Tests After Adjustments or Repairs.
Table 5-2. Post-Repair Adjustment Procedures.

PRINCIPLES OF OPERATION

General

The Linear Regulator board regulates the rectified and coarsely filtered dc voltages sent from the Inverter Board (Service Sheet 65). There are three series regulator circuits on this board, the outputs of which are +20 Vdc (at 2.5 amperes), -10 Vdc (at 2.5 amperes), and -40 Vdc (at 0.5 amperes). Additional features incorporated into the regulator circuits are foldback current limiting, transient and high input voltage shutdown, and bi-directional crowbar protection.

Linear Regulator Circuits

Each of the series regulators is designed around an integrated comparator amplifier (regulator). U1 and U2 are LM204 equivalents; U3 is a LM305 equivalent. A compound PNP/NPN transistor pair is used in each circuit to boost its current handling capability. Potentiometers R18, R20, and R39 are adjusted to trim the output voltages of the -40 Vdc, -10 Vdc, and +20 Vdc lines, respectively. Transistors Q11 and Q10 control the current limiting action of U2 and U1 in the -10 Vdc and -40 Vdc regulator circuits. Current limiting for the +20 Vdc line is sensed by a resistive divider formed by R23, R24, R27, and R28. Each regulator circuit has a green LED lamp which indicates that voltage is present at its output.

Bi-Directional Crowbar Protection

A crowbar circuit shunts the output of each of the three linear regulators found on this assembly. Each crowbar protects the circuitry fed by its respective regulator should the regulator fail. When the output of a regulation circuit exceeds its nominal output voltage by more than 3 to 4 volts, or falls more than one volt below ground (one volt above ground for the negative supplies), a triac is turned ON, shorting the output to ground. This puts the supply in a current-limit mode.

High Input Voltage Shutdown Circuitry

The high input voltage detector circuitry protects the regulators against excessive input voltage resulting from transients, open circuit conditions, or malfunctions in the switching-regulator circuitry. If the input line voltage even momentarily exceeds a

preset value, the high input-voltage shutdown lamp will latch ON and a signal will be sent to the inverter-drive circuitry, shutting down the power supply.

TROUBLESHOOTING

When a power supply problem has been traced through the block diagram troubleshooting procedure to this assembly, use the procedure below to isolate the cause of the problem.

There are two basic types of problems that are covered by this procedure:

1. If red LED in the upper left hand corner of the board is lit indicating the input voltage from the A7A3 Inverter Assembly was too high, and the supply was shut down, it is most likely a problem with the regulator not drawing enough current.

2. The input voltage is normal, but the output voltage is not regulated.

Inverter Input Voltage High

1. Disconnect the line cord form the rear panel of the 8663A.

CAUTION

Removing and installing power supply boards with the line cord plugged in can damage these boards because high voltage is present whenever the line cord is plugged in.

Install the A7A1 Linear Regulator Assembly on its extender board. Then plug in the line cord.

If the red LED in the upper left hand corner lights when the POWER switch is turned on, continue troubleshooting with step 2. Otherwise, continue troubleshooting with step 3.

2. Connect a short jumper between the collector of Q16 and ground. This will allow the control board to turn on. Turn the line switch to ON and measure the voltage at the test points in the table below, to identify which supply is malfunctioning.

Linear Regulator Inputs

Measure	Normal Voltage
TP4	<+30.0
TP5	<-16.0*
TP6	<-55.0*

*The sign < in this case means lower magnitude or more positive than.

When the malfunctioning supply is identified, troubleshoot the regulator circuitry to find the cause of the problem.

Inverter Input Voltage Normal

3. Turn the POWER switch to ON. To determine if any of the supplies are in current limit, measure the voltage across the current sensing resistors specified in the table below.

Current Limiting Check

Resistor	Max Reading (VDC)	Supply
R27, 28	1.25	+20V
R36	0.60	-10V
R37	0.60	-40V

If any reading is above the maximum value given in the table, that supply is current limited so continue troubleshooting with step 4. If the readings are normal, there is a problem with the regulator circuitry so troubleshoot to find the cause.

4. The supply could be in current limit because the load is drawing too much current or because the overvoltage crowbar has triggered. Turn the POWER switch to STANDBY and monitor the output of the supply being tested with an oscilloscope. Set the scope to trigger when the supply turns on and watch how high the voltage rises when the line switch is turned on. Compare this value to the numbers in the table below.

Crowbar Trigger Voltage

Supply	Crowbar Trigger Voltage
+20V	23.7V
-10V	11.0V
-40V	46.4V

If the actual supply voltage exceeded the trigger voltage, the regulator is defective so troubleshoot the regulator circuitry to find the cause of the problem. Otherwise, the load is drawing too much current so look for the problem in one of the other sections of the instrument.

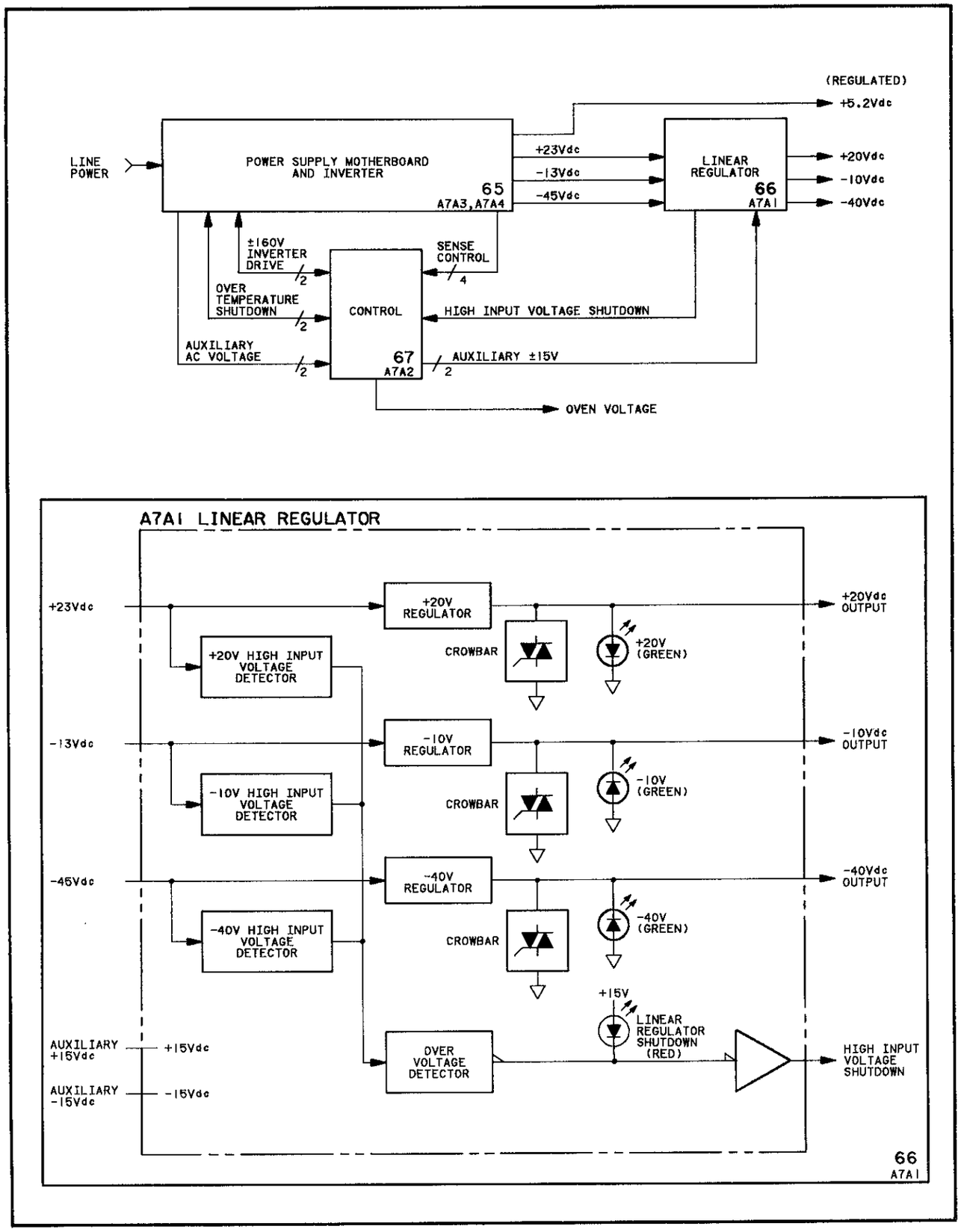


Figure 8-909. A7A1 Power Supply Linear Regulator Block Diagrams

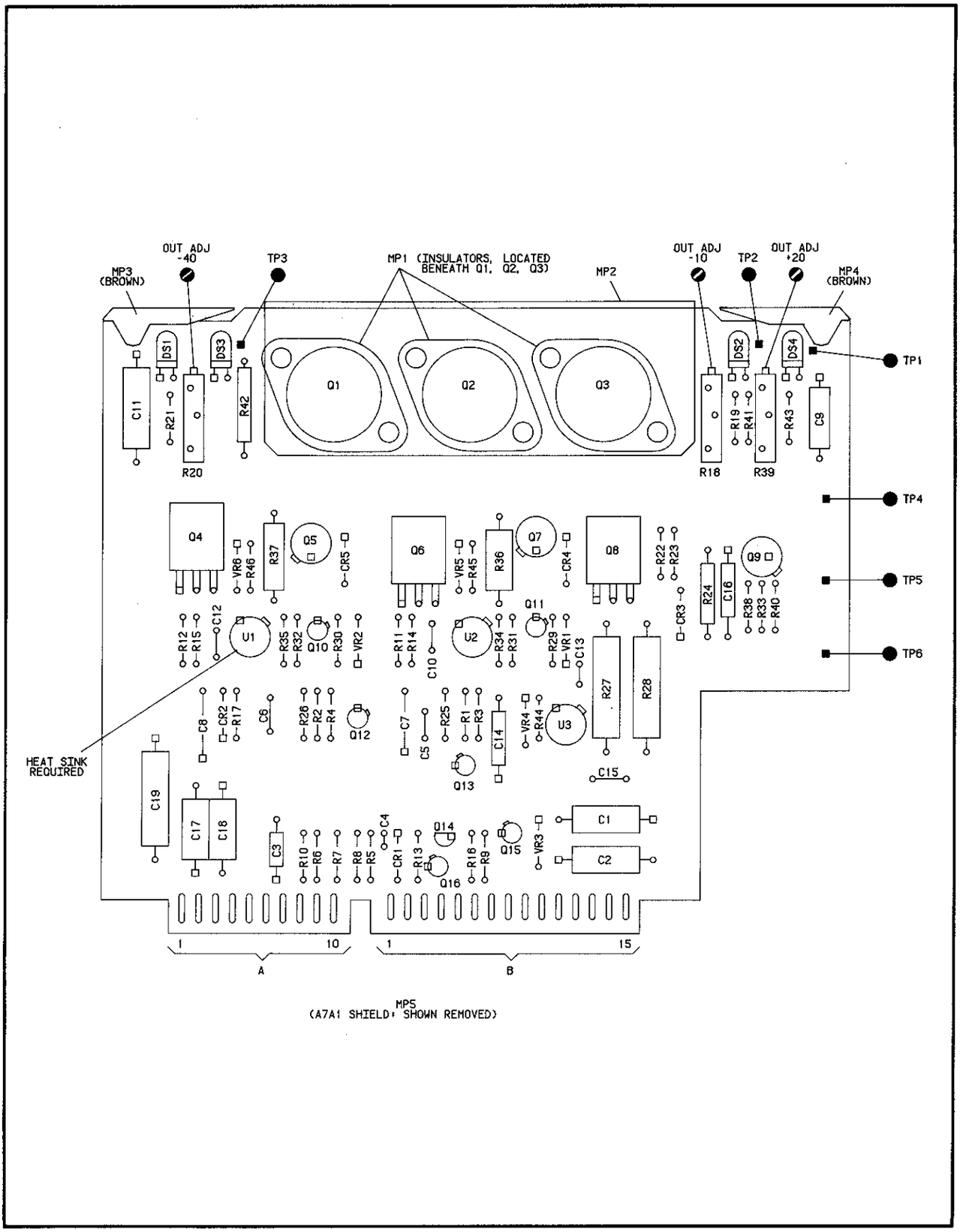


Figure 8-910. A7A1 Power Supply Linear Regulator Component Locator

CHANGES

2419A and Above

On the schematic:

- A7A1U1 - In the table of Transistor and Integrated Circuit Part Numbers, change the part number for U1 to 1826-0016.

SERVICE SHEET 67
A7A2 CONTROL ASSEMBLY

REFERENCE BLOCK DIAGRAM 10
Table 4-1. Recommended Performance Tests After Adjustments or Repairs.
Table 5-2. Post-Repair Adjustment Procedures.

PRINCIPLES OF OPERATION

General

The Control Board contains the 40 kHz oscillator circuitry, duty-cycle control logic, inverter/regulator drivers, malfunction-disable circuitry, and auxiliary supply regulators.

Oscillator Circuitry

The switching frequency of the supply is established by a free-running multivibrator (U2) which generates a 40 kHz asymmetrical waveform having a 4:1 duty cycle (20 us to 5 us). The 2.5 MHz clock formed by U1 provides update clocking for flip-flops U4A and U4B. The 40 kHz generator is locked to a sub-multiple of the 2.5 MHz oscillator frequency by trigger pulses which reach pin 6 via C21. This assures synchronous operation of the two oscillators, eliminating spurs at the operating frequency of the synthesizer.

Within the pulse-width modulator (duty-cycle control logic formed by U6A and U6B), the 5 us "off" period of the 40 kHz oscillator serves two functions. First, it alternates routing of turn-on trigger pulses from the turn-on level comparator (formed by Q15 and Q18) to the switchihg transistors. Second, it establishes a 5 us "safety band" which disables both drive signals, assuring that both switching transistors are never turned ON at the same time. Any time during the 20 us period, a drive signal can be started by a turn-on trigger pulse, but it will always be terminated at the next 5 us period. The period of the drive signals depends on the position of the turn-on trigger pulse in the 20 us frame. If it occurs early in the frame, the drive pulse will be wide. If it occurs late in the frame, the drive pulses will be narrow.

Duty Cycle Control Logic

The duty cycle control logic generates the pulse-width modulated signals that ultimately drive A7A3T3 (service sheet 65). This circuitry is composed of buffer flip-flops U4A and U4B, driver flip-flops U6A and U6B, and associated NAND gate circuitry (U5 and U7). Flip-flops U4A and U4B act as switching buffers between the duty cycle generator, loop gain amplifier, current foldback limiter, malfunction disable gate, and the driver flip-flops. They assure that control signals to the driver flip-flops are synchronized to occur at the proper times.

The pulse-width modulator circuitry is set up in a quad-state logic arrangement. U4B disables the ±160 volt driver flip-flops whenever it changes state. U4A enables one of the two driver flip-flops whenever it changes state, but never allows both flip-flops to turn on at the same time. Furthermore, no driver flip-flop is allowed to turn ON twice in a row.

Fast and Slow Sense Circuits

Whenever a change in power demand occurs, the fast and slow loops effect a change in power delivered to the input of T3 by varying the duty cycle of the 20 kHz inverter. The fast sense circuit is a direct duty cycle modulated loop which turns the level comparator (Q15 and Q18) ON and OFF for fast and slow reactions to load changes; it also helps to diminish the 120 Hz component on the +5.2 volt line.

The slow sense circuit is an analog loop which senses the output of the +5.2 volt section. The slow loop provides precise (and relatively slow) regulation of the output, while the fast loop handles faster regulation demands. (See the two following circuit descriptions.)

Turn-On Level Comparator (Duty Cycle Trigger)

The turn-on trigger pulses are generated by the level comparator formed by Q15 and Q18. This circuit compares the fast sense line at the junction of the first L-C filter on the +5.2 volt line (Service Sheet 65) with the dc reference voltage obtained from the loop gain amplifier (U9). The voltage on the +5.2 volt fast sense line has a triangular ripple component which slopes positively when a switching transistor is ON and negatively when both transistors are OFF. When the sense voltage falls slightly below the reference voltage, the comparator generates a turn-on trigger pulse. Immediately, one of the switching transistors turns ON and the output starts to rise again. If load demands increase, the sensed voltage drops more rapidly, the trigger pulses are generated earlier, and the switching transistors stay ON for longer periods to supply the increased power demand. Conversely, a reduced load lengthens the negative slope, causing the turn-on trigger pulses to occur later, and the switching transistors conduct for shorter periods.

Constant Voltage Comparator (Loop Gain Amplifier)

To improve regulation of the +5.2 volt supply, losses occurring between the fast sense point on the +5.2 volt line and the final dc output are factored into a level comparison voltage by the loop gain amplifier (U9). This circuit compares the +5.2 volt zener reference voltage with the +5.2 volt output slow loop sense line (Service Sheet 65). Any difference between the two voltages is amplified, slowly varying the dc reference to the turn-on level comparator.

Current Foldback Limiter

The current limit comparator (U8) monitors the output current of the supply by sensing the voltage drop across R12 (service sheet 65). If the load current exceeds a preset limit (due to a short-circuit condition) the circuit is energized and acts to reduce the dc reference voltage applied to the level comparator. This in turn causes the output voltage to drop to a level that holds the supply current at a maximum of 3 amperes.

Stabilizing Waveform Shaper (Exponentiator)

The exponentiator (U10) generates a limit-cycle-regulation waveform which is applied to the base of Q18 in the level comparator. If the output of U6A were HI and duty cycle control logic was producing a duty cycle of less than 50% at the 40 kHz rate, the system would become unstable and oscillator U2 could be forced to drop to 20 kHz operation (resulting in a 10 kHz switching rate). Summation of the output of the stabilizing waveform exponentiator shaper with the +5.2 volt slow loop sense line at the base of Q18 causes the trip point of the compatator to be changed just enough to make sure that comparison is made at 40 kHz rather than 20 kHz as would otherwise happen.

Malufunction Disable Gate

Signals from the overvoltage and overtemperature detector circuits are gated by U5B to disable the inverter drive circuitry whenever a shutdown condition arises. This results in power being turned off to all parts of the system except those powered by the auxiliary supply.

Auxiliary Supply

The auxiliary supply circuitry receives 45 Vac from transformer T1 (Service Sheet 65) located within the power supply on the rear panel of the Signal Generator. The ac is rectified, producing a dc voltage that powers the A8A3 Reference Oscillator oven and drives the $\pm$ 15 volt regulators. CR1 through CR4 form a bridge rectifier which produces a positive and negative voltage with reference to ground. The front panel line switch has no effect on this circuitry and these voltages will be present whenever the Signal Generator is connected to the ac power lines.

When the POWER switch is in the STANDBY position, Q6 is ON, turning Q7 OFF. When Q7 is OFF, Q3, Q4, and Q5 are also OFF, shutting down the $\pm$15 volt supplies. When the POWER switch is turned ON, Q6 turns OFF and allows current (flowing through Q8) to turn ON Q7 and thus turn ON Q3, Q4, and Q5, which brings up the $\pm$ 15 volt supplies. If the ac line voltage decreases, a point will be reached where Q8 is biased OFF. This will turn OFF Q7, which shuts down the $\pm$ 15 volt supplies.

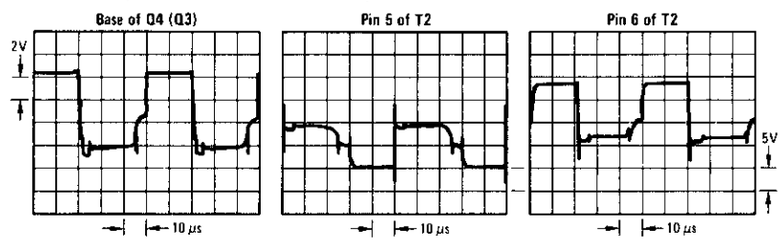
TROUBLESHOOTING

When a power supply problem has been traced through the block diagram troubleshooting procedure to this assembly, use the following procedure to find the defective component. Problem symptoms can be divided into two classes:

1. No pulses at TP6 and TP7 (shutdown).
2. +5.2V supply not regulated (too high or too low).

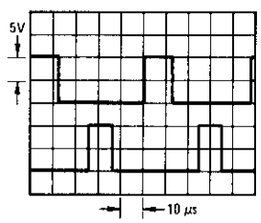
No Pulses at TP6 or TP7.

Check	Normal Condition	If Abnormal,
1. Edge connector A7A2 pin 9	+15.0 ± 1.0 Vdc	Troubleshoot auxiliary supply.
2. Edge connector A7A2 pin 8	−15.0 ± 1.0 Vdc	Troubleshoot auxiliary supply.
3. U1 pin 5	CMOS logic high (+10 Vdc)	Either the overtemperature or 5.2V overvoltage detector has triggered. The overvoltage detector is the most likely. Remove Q9. If U1 pin 5 is still low, Q19 has triggered which means the +5.2 V supply voltage went above 6V. This is an indication that the A7A2 Control board is not regulating properly. If the overtemperature detector has triggered, determine if the detector circuitry is faulty or if the heat sink on the A7A3 is really overheating. Turning the instrument off for awhile will cool everything and the detector shouldn't trigger when the instrument is first turned on.
4. Waveforms on TP2, TP3, TP9	As shown in the figure below	Troubleshoot the digital circuitry which produces these waveforms.



Maximum Duty Cycle Generator Waveforms

5. U5 Pin 5	COMS logic high (+10 Vdc when 5.2 V supply = 0)	Comparator circuitry is defective. Continue troubleshooting in the +5.2 V supply.
6. Waveforms on U7 pins 3 and 11	As shown in the figure below	The problem is in the duty cycle control logic. Inputs are correct and outputs defective.



Duty Cycle Control Logic Outputs

7. At this point if there are no pulses on TP6 and TP7, the problem is in the inverter/regulator drivers on A7A2 or the switch circuits on A7A3. Remove the line cord and then remove the A7A3 assembly from the power supply. Now the waveforms at TP6 and TP7 should be like the waveforms in Figure 2 except amplitude should be +15 V. If there are still no waveforms, the drive circuits are defective. If the waveforms are there now, the problem is in the switch circuitry on A7A3. So continue troubleshooting with service sheet 55.

5.2V Supply Not Regulated

1. Turn the line switch to STANDBY, remove the power cord, and remove the A7A3 Inverter Assembly from the power supply.

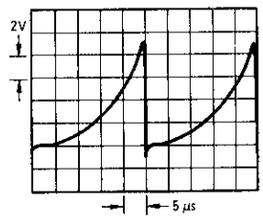
2. Remove the bottom cover from the 8663A. Remove the small pc board that connects the wiring harness to the Power Supply Motherboard. This disconnects the power supply from the rest of the instrument.

3. Install the A7A2 Control Board on its extender board. Connect a jumper form TP8 to ground (the top [negative] leads of capacitors C3,4,9,10 in the center of the board make good ground points). Having this jumper connected is the same as turning the line switch on.

4. Set an adjustable power supply to +5.2 ±0.1 Vdc and connect the "+" terminal to TP1 and the "-" terminal to ground on A7A2.

5. Plug in the power cord and follow the procedure in the following table.

Check	Normal Condition	If Abnormal,
1. Q17 Emitter	>5.4 Vdc	Current foldback limiter circuit is defective. No current should be flowing through the current sensing resistor on A7A4 so U8 should produce a positive output.
2. U9 Pin 3	5.20 ± 0.02 Vdc	If the voltage is between 4.6 and 5.8 Vdc, adjust the 5.2V supply pot to bring the voltage into spec. If the voltage is not close or cannot be adjusted, troubleshoot the reference circuit to find the cause of the problem.
3. Waveform on TP11	As shown in the figure below	There is a problem with U10 or associated circuitry.
4. Set power supply connected to TP1 ≤5.10 Vdc U9 pin 6 U4 pin 5	 >13.0 Vdc CMOS logic high (+10 Vdc)	 Loop gain amplifier defective. Comparator circuitry defective.
5. Set power supply connected to TP1 ≥5.30 Vdc U9 pin 6 U4 pin 5	 < 0V CMOS logic low (0V)	 Loop gain amplifier defective. Comparator circuitry defective.



Exponentiator Waveform

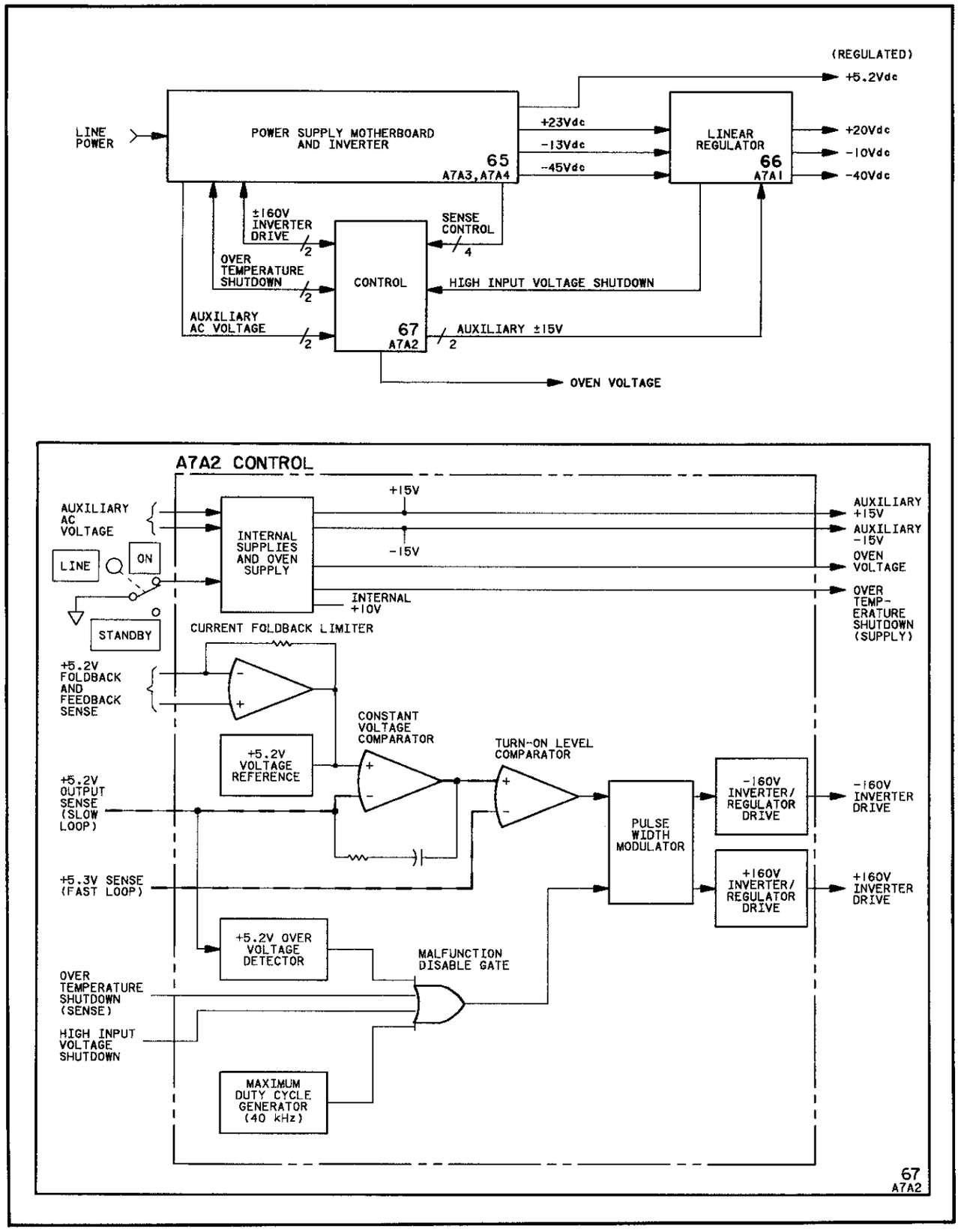


Figure 8-912. A7A2 Power Supply Control Board Block Diagrams

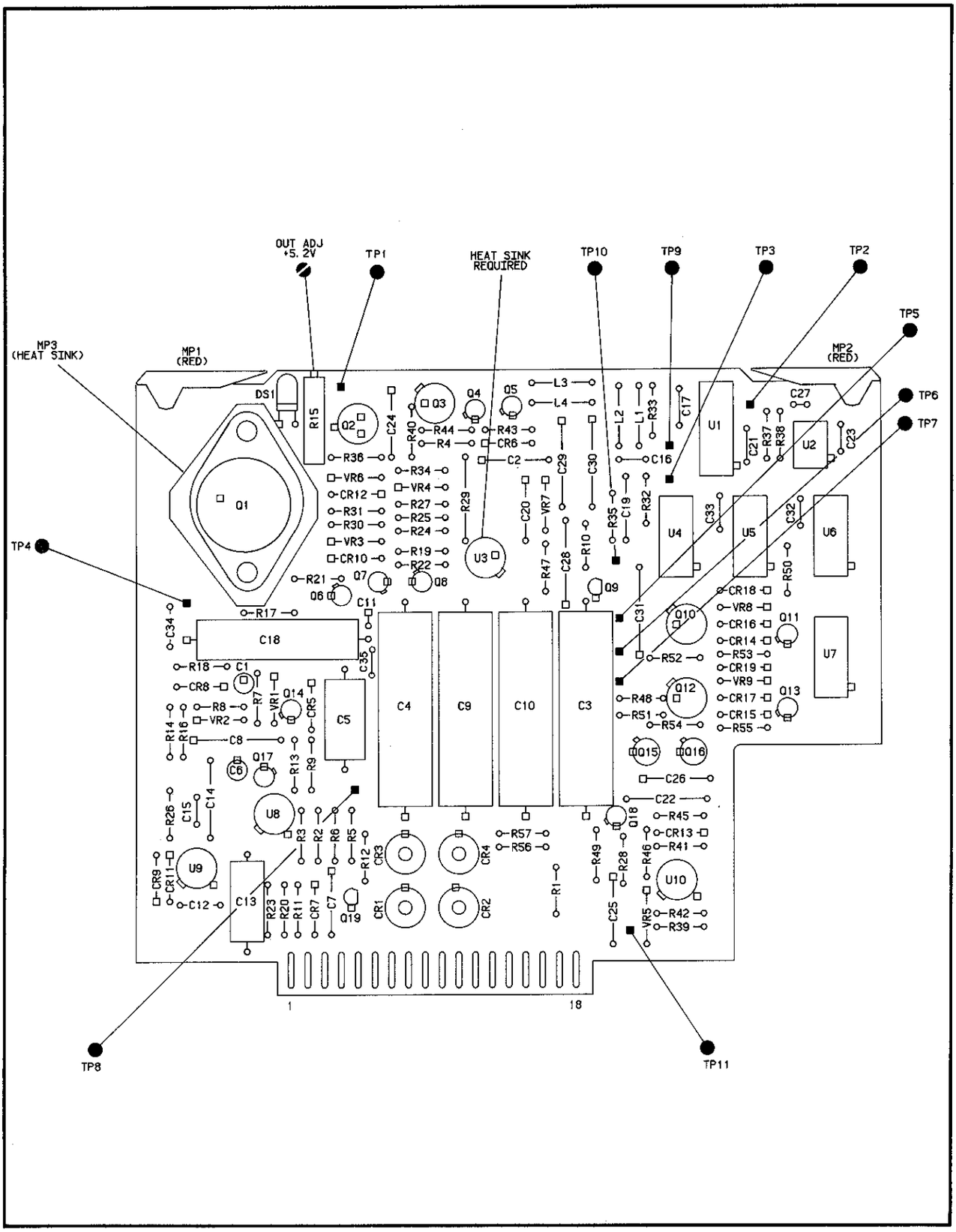


Figure 8-913. A7A2 Power Supply Control Board Component Locator

CHANGES

All serial prefixes

2601A and Above

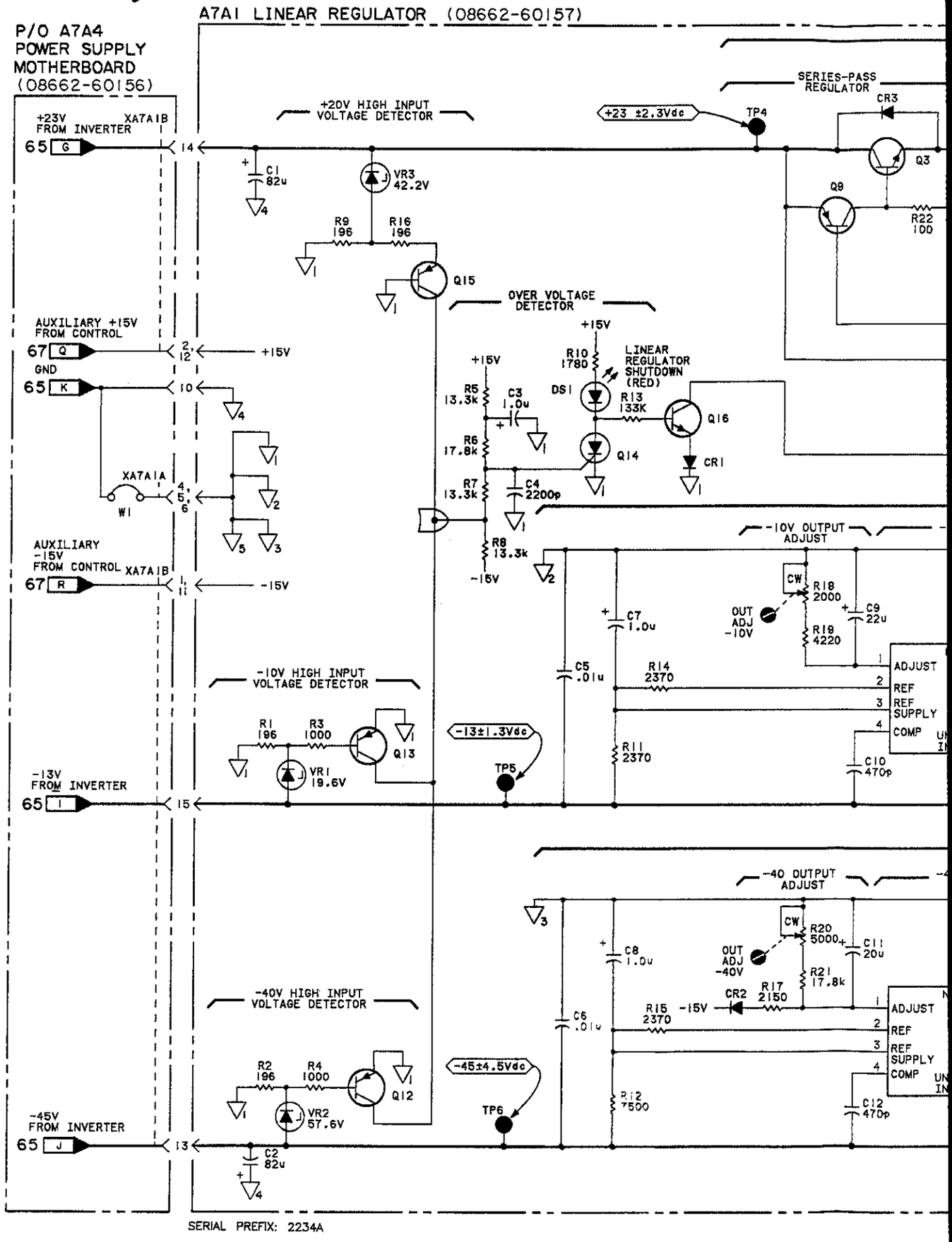
On the A7A2 schematic:

- A7A2R37 - Change the value of R37 to 21.5k.

On the schematic:

- A7A2Q2 - In the Table of Transistor and Integrated Circuit Part Numbers, change the part number of Q2 to 1854-1046.

Fig 8-911
Sht 1 of 4



SERIAL PREFIX: 2234A

Fig 8-911
Sht 2 of 4

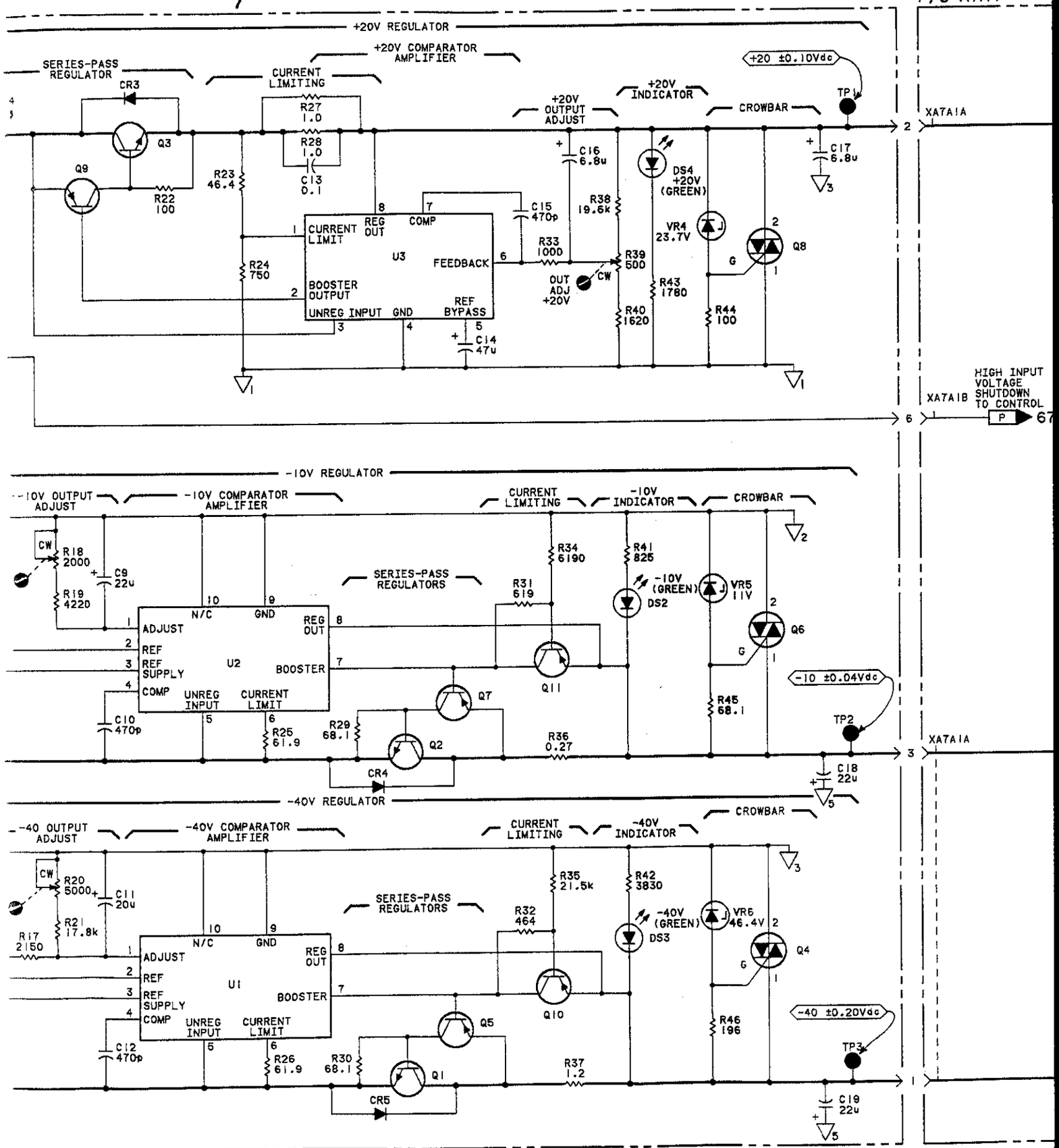


Fig 8-911
Sht 3 of 4

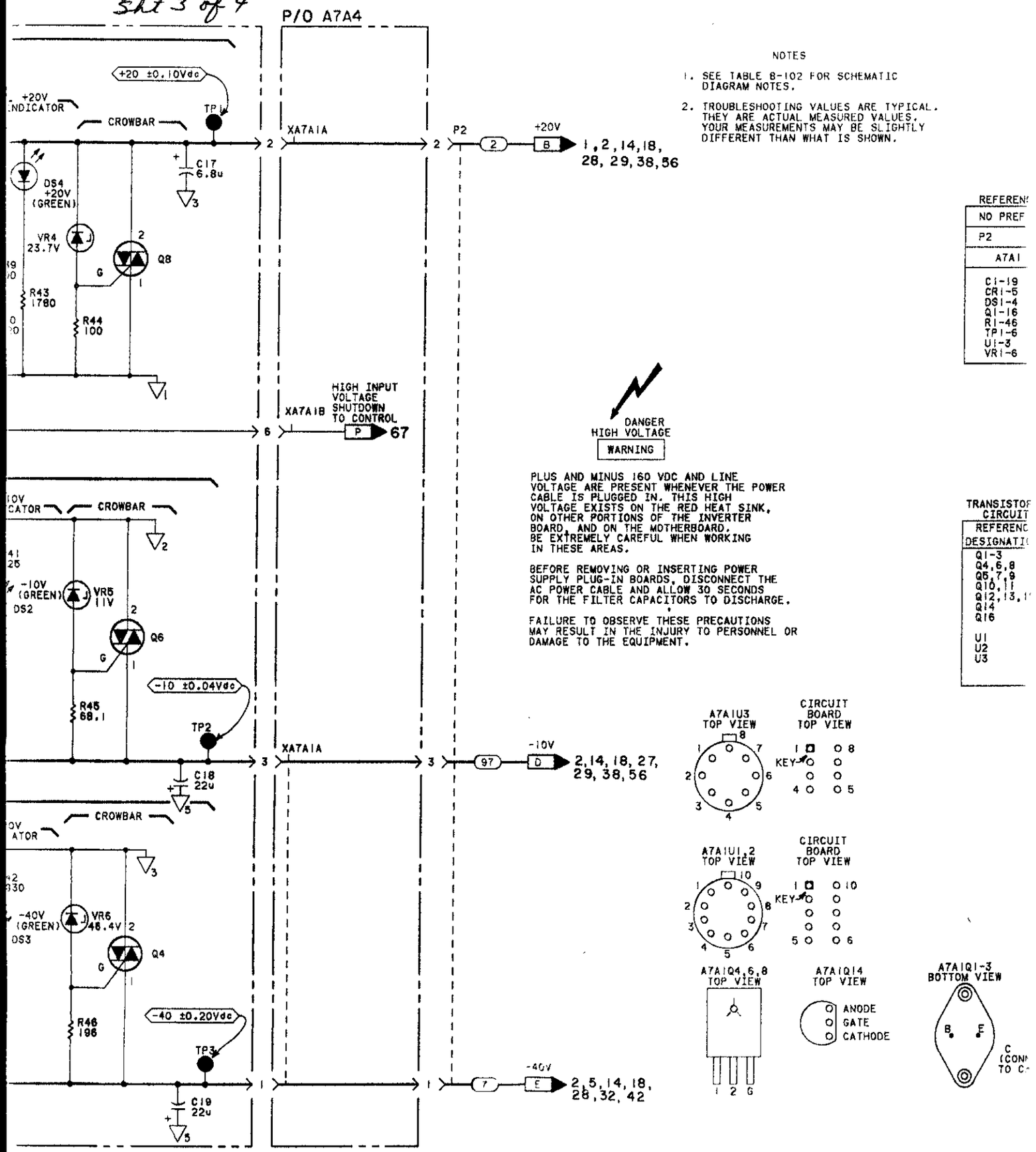


Fig 8-911
Sht 4 of 4

NOTES

1. SEE TABLE 8-102 FOR SCHEMATIC DIAGRAM NOTES.
2. TROUBLESHOOTING VALUES ARE TYPICAL. THEY ARE ACTUAL MEASURED VALUES. YOUR MEASUREMENTS MAY BE SLIGHTLY DIFFERENT THAN WHAT IS SHOWN.

1,2,14,18, 28, 29, 38,56

REFERENCE DESIGNATIONS

NO PREFIX	A7A4
P2	XA7A1A,B W1
A7A1	
C1-19 CR1-5 DS1-4 Q1-16 R1-46 TP1-6 U1-3 VR1-6	

DANGER
HIGH VOLTAGE

WARNING

) MINUS 160 VDC AND LINE
ARE PRESENT WHENEVER THE POWER
S PLUGGED IN. THIS HIGH
EXISTS ON THE RED HEAT SINK,
R PORTIONS OF THE INVERTER
AND ON THE MOTHERBOARD.
SMELY CAREFUL WHEN WORKING
AREAS.

REMOVING OR INSERTING POWER
PLUG-IN BOARDS, DISCONNECT THE
CABLE AND ALLOW 30 SECONDS
FILTER CAPACITORS TO DISCHARGE.

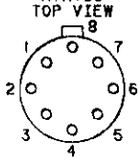
TO OBSERVE THESE PRECAUTIONS
ULT IN THE INJURY TO PERSONNEL OR
TO THE EQUIPMENT.

TRANSISTOR AND INTEGRATED CIRCUIT PART NUMBERS

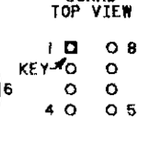
REFERENCE DESIGNATIONS	PART NUMBERS
Q1-3	1854-0845
Q4,6,8	1884-0217
Q5,7,9	1853-0012
Q10,11	1853-0007
Q12,13,15	1853-0020
Q14	1884-0201
Q16	1854-0071
U1	1826-0473
U2	1826-0016
U3	1820-0247

2,14,18,27, 29,38,56

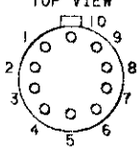
A7A1U3 TOP VIEW



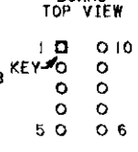
CIRCUIT BOARD TOP VIEW



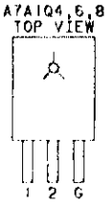
A7A1U1,2 TOP VIEW



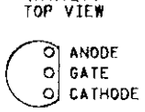
CIRCUIT BOARD TOP VIEW



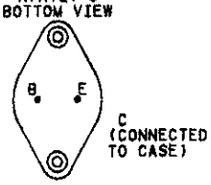
A7A1Q4,6,8 TOP VIEW



A7A1Q14 TOP VIEW



A7A1Q1-3 BOTTOM VIEW

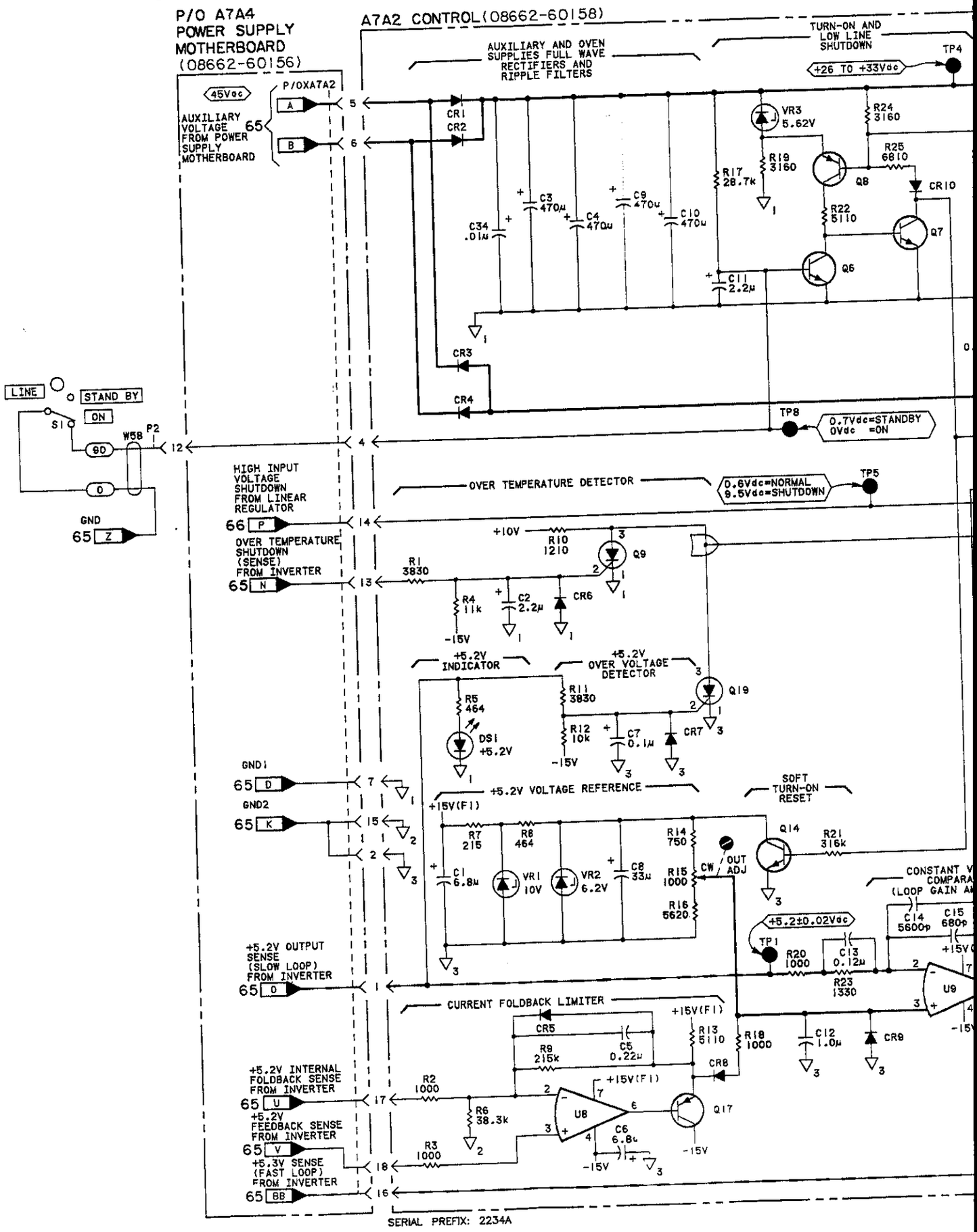


5,14,18, 8,32,42

SERVICE SHEET A7A1 66

Figure 8-911. A7A1 Power Supply Linear Regulator Schematic

Fig 8-914
Sht 1 of 4



SERIAL PREFIX: 2234A

Fig 8-914
Sht 2 of 4

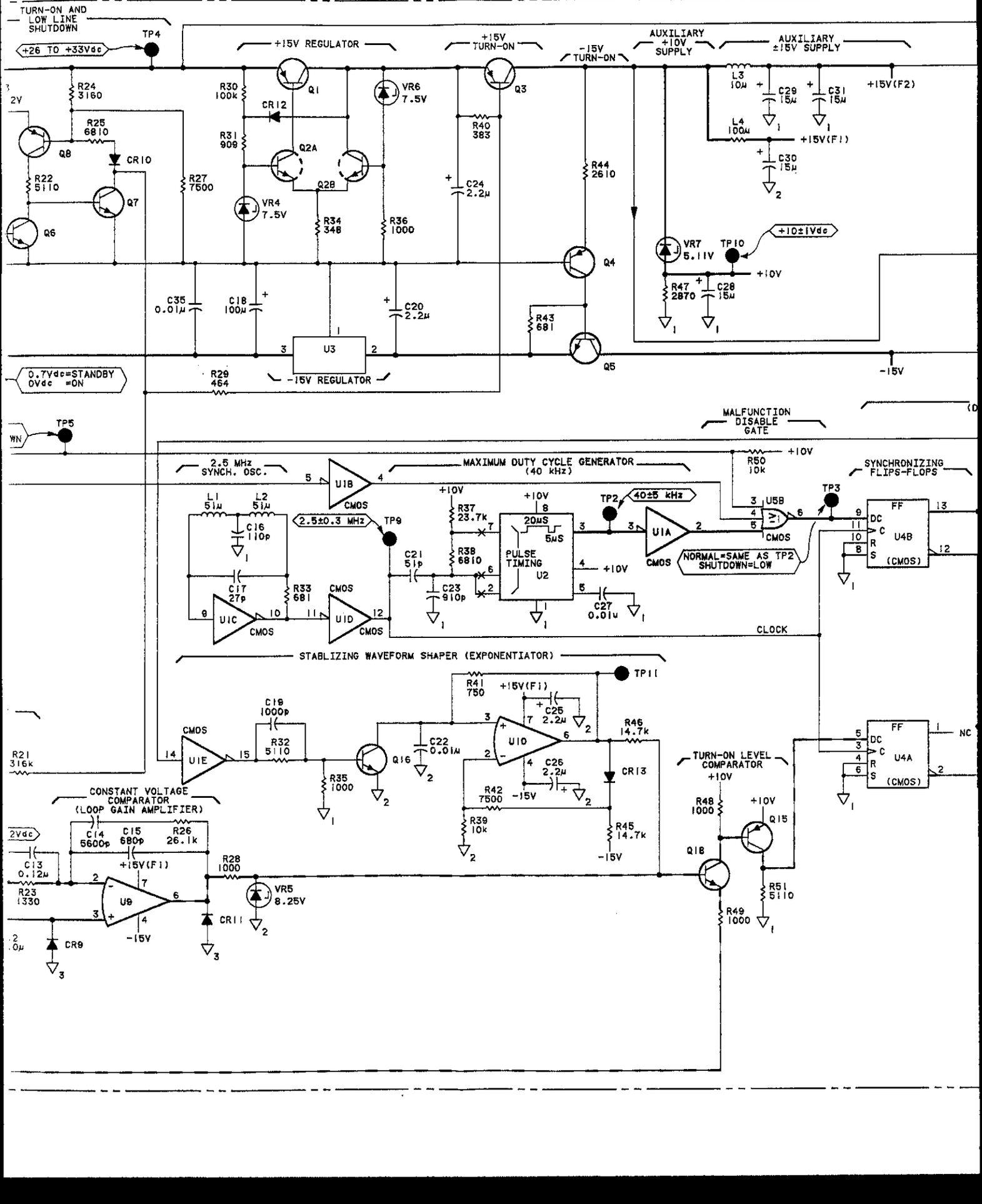
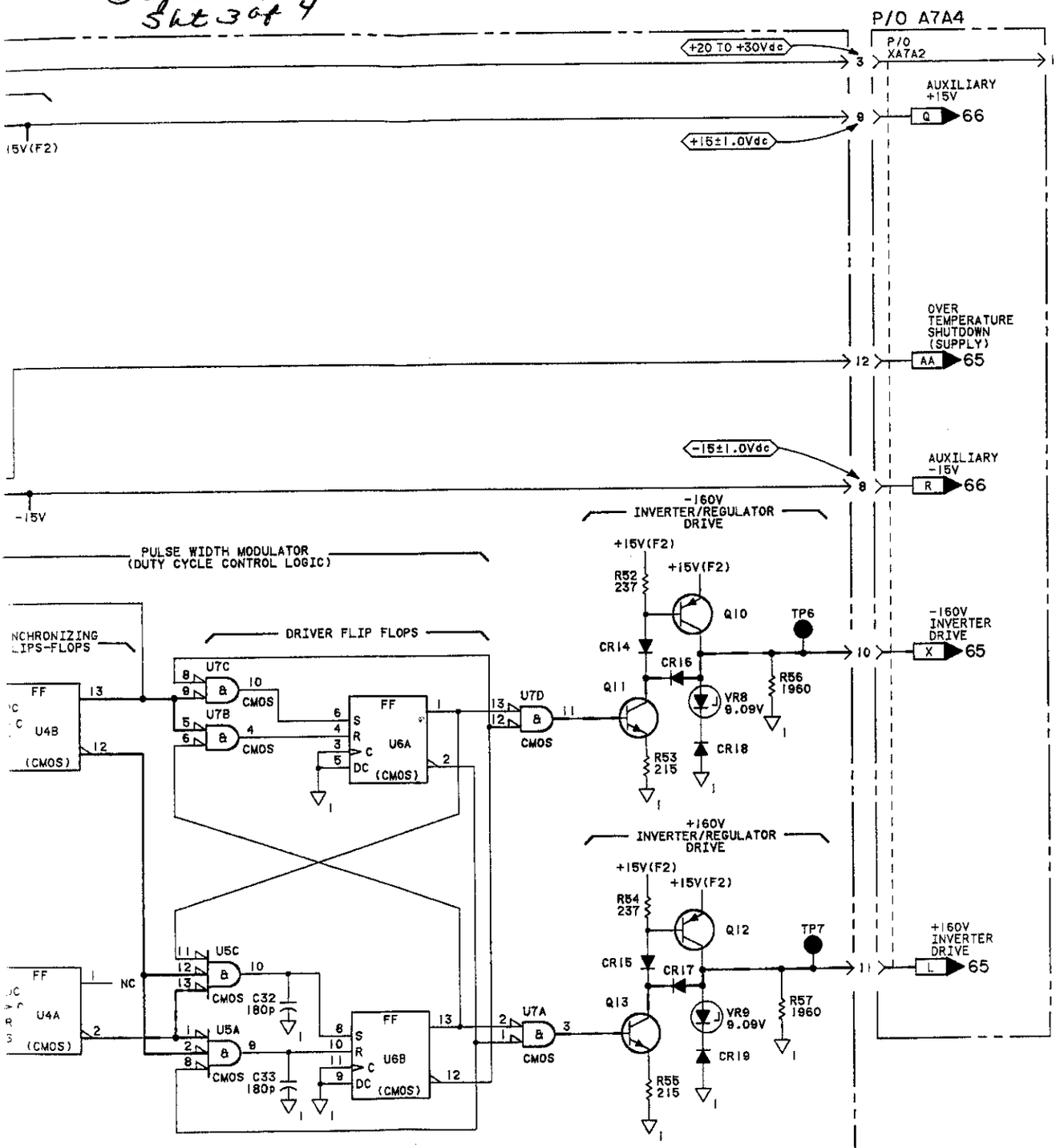


Fig 8-914
Sht 3 of 4



NOTES

1. REFER TO TABLE 8- DIAGRAM NOTES.
2. TROUBLESHOOTING VA THEY ARE ACTUAL ME YOUR MEASUREMENTS DIFFERENT THAN WHA

REFERENCE DESIG	
NO PREFIX	A7
P2 S1 W58	L Q R TP U VR
A7A2	
C1-35 CR1-18 DS1	XA

LOGIC LEVE	
	TTL
HIGH	>+2V
LOW	<+0.8V
< IS MORE NEG	
> IS MORE POS	
OPEN	HIGH
GROUND	LOW

TRANSISTOR
INTEGRATED C
PART NUMBE

REFERENCE DESIGNATIONS	N
Q1	185
Q2	185
Q3	185
Q4,8,15,17	185
Q5-7,11,13 16,18	185
Q9,19	188
Q10,12	185
Q14	185
U1	182
U2	182
U3	182
U4,6	182
U5	182
U7	182
U8	182
U9,10	182

INTEGRATED C
VOLTAGE A
GROUND CONNE

REFERENCE DESIGNATIONS	
U1	
U4-7	

DANGER
HIGH VOLTA

WARNING

PLUS AND MINUS 160V
ARE PRESENT WHENEVE
IS PLUGGED IN. THIS
ON THE RED HEAT SIN
OF THE INVERTER BOA
MOTHERBOARD. BE EXT
WHEN WORKING IN THE

BEFORE REMOVING OR
SUPPLY PLUG-IN BOAR
AC POWER CABLE AND
FOR THE FILTER CAPA

FAILURE TO OBSERVE
MAY RESULT IN INJUR
DAMAGE TO EQUIPMENT

Fig 8-914
Sht 4 of 4

NOTES

1. REFER TO TABLE 8- FOR SCHEMATIC DIAGRAM NOTES.
2. TROUBLESHOOTING VALUES ARE TYPICAL. THEY ARE ACTUAL MEASURED VALUES. YOUR MEASUREMENTS MIGHT BE SLIGHTLY DIFFERENT THAN WHAT IS SHOWN.

REFERENCE DESIGNATIONS

NO PREFIX	A7A2 CONT
P2 S1 W58	L1-4 Q1-19 R1-67 TP1-11 U1-10 VR1-9
A7A2	
C1-35 CR1-19 DS1	A7A4
	XA7A2

LOGIC LEVELS

	TTL	CMOS
HIGH	>+2V	>+3.5V
LOW	<+0.8V	<+1.5V
< IS MORE NEG. THAN > IS MORE POS. THAN		
OPEN	HIGH	LOW
GROUND	LOW	HIGH

TRANSISTOR AND INTEGRATED CIRCUIT PART NUMBERS

REFERENCE DESIGNATIONS	PART NUMBERS
Q1	1853-0053
Q2	1854-0475
Q3	1853-0442
Q4,8,15,17	1853-0007
Q5-7,11,13 16,18	1854-0210
Q9,19	1884-0201
Q10,12	1853-0012
Q14	1854-0404
U1	1820-1746
U2	1826-0180
U3	1826-0192
U4,6	1820-1963
U5	1820-1965
U7	1820-1745
U8	1826-0013
U9,10	1826-0488

INTEGRATED CIRCUIT VOLTAGE AND GROUND CONNECTIONS

REFERENCE DESIGNATIONS	PIN NUMBERS
U1	+10V - 1 ⏚ - 8
U4-7	+10V - 14 ⏚ - 7

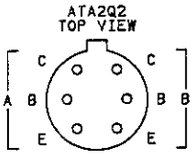
DANGER
HIGH VOLTAGE

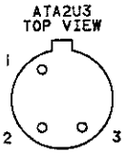
WARNING

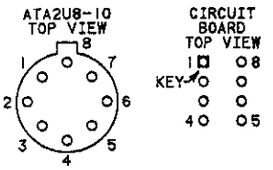
PLUS AND MINUS 160VDC AND LINE VOLTAGES ARE PRESENT WHENEVER THE POWER CABLE IS PLUGGED IN. THIS HIGH VOLTAGE EXISTS ON THE RED HEAT SINK, ON OTHER PORTIONS OF THE INVERTER BOARD, AND ON THE MOTHERBOARD. BE EXTREMELY CAREFUL WHEN WORKING IN THESE AREAS.

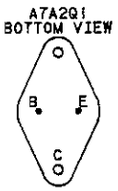
BEFORE REMOVING OR INSERTING POWER SUPPLY PLUG-IN BOARDS, DISCONNECT THE AC POWER CABLE AND ALLOW 30 SECONDS FOR THE FILTER CAPACITORS TO DISCHARGE.

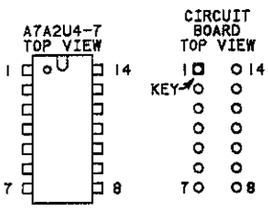
FAILURE TO OBSERVE THESE PRECAUTIONS MAY RESULT IN INJURY TO PERSONNEL OR DAMAGE TO EQUIPMENT.

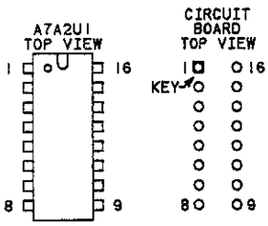


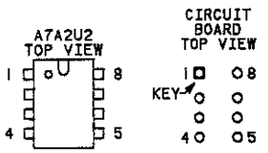












SERVICE SHEET A7A2 67

Figure 8-914. A7A2 Power Supply Control Board Schematic

8-927/928