

A18 Power Supply Assembly

The information in this section should be used to isolate faulty subblocks in the A18 power supply assembly. All procedures assume that you have used the Fault Isolation procedures in Section VII to determine this board has failed, and that you understand the Circuit Descriptions in Section VI.

Warning



Service procedures described in this section are performed with the protective covers removed and power applied. Hazardous voltage and energy available at many points can, if contacted, result in personal injury. Servicing must be performed only by trained service personnel who are aware of the hazards involved (such as fire and electrical shock).

Caution



Do not insert or remove any circuit board in the HP 3563A with the line power turned on. Power transients caused by Insertion or removal may damage the circuit boards. Many of the parts are static sensitive. Use the appropriate precautions when removing, handling, and installing all parts to avoid unnecessary damage.

How to Use This Section

Start

Start troubleshooting by using figure 8-11. This procedure diagram describes the best order to perform the troubleshooting tests based on the symptoms observed.

Reference

The component locator and schematic follow the "After-Repair Adjustments and Tests" table. For the location of cables and boards refer to figure 4-1 in Section IV.

Verify

Use table 8-37 to verify the power supply is operating correctly. Use the oscilloscope waveforms in table 8-38 to see correct operation at various test points in the assembly.

After-Repair

Use table 8-39 to determine which adjustments and tests need to be done to complete instrument service.

Troubleshooting Hints

1. The power supply must have a load to operate. Putting jumper A18 J100 in the test position provides a load for the +5V supply. The secondary connectors W11 (rear of display unit), W13 (A18 J1), W16(A18 J400), W22, and W23 can be disconnected and the power supply serviced independently of the other boards.
2. If the power supply intermittently powers down or fails to turn on, check the powerdown circuit. A18 R1 may be out of adjustment. Refer to Section III for the adjustment procedure.
3. If the instrument cold starts but then fails to turn on when power is cycled later, the most likely cause is the pulse width modulator (U101).

Table 8-37. Power Supply Nominal Values
Return Location is A18 TP13

Supply Name	Output Location	Nominal Voltage	Voltage Tolerance	Ripple Tolerance
+30V	A18 J1-1	+30V	$\pm 1.8V$	10 mV
-30V	A18 J1-2	-30V	$\pm 1.8V$	10 mV
+15A	A18 J1-3	+15V	$\pm 0.9V$	10 mV
-15A	A18 J1-4	-15V	$\pm 0.9V$	10 mV
+5S	A18 J1-5	+5V*	$\pm 0.3V$	50 mV
+2.6V	A18 J1-6	+2.6V	$\pm 0.16V$	50 mV
+8S1	A18 J1-7	+8V	$\pm 0.48V$	25 mV
+8S2	A18 J1-8	+8V	$\pm 0.48V$	25 mV
+15S	A18 J1-9	+15V	$\pm 0.9V$	25 mV
-15S	A18 J1-10	-15V	$\pm 0.9V$	25 mV

*Note: If secondary connectors are disconnected and J100 is in test (T) position, the +5S supply equals $+5.2 \pm 0.1V$.

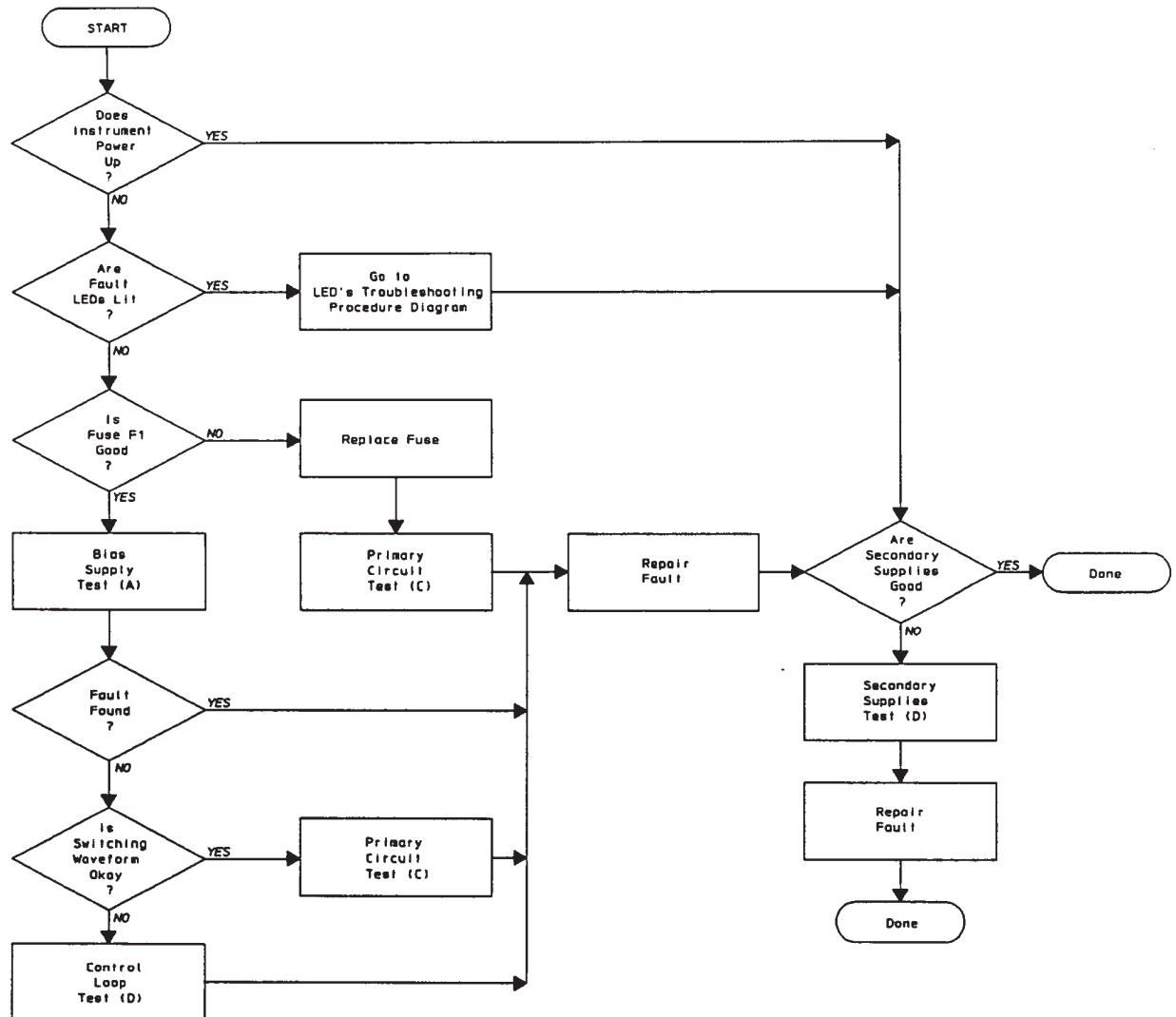


Figure 8-11. Power Supply Troubleshooting Procedure Diagram

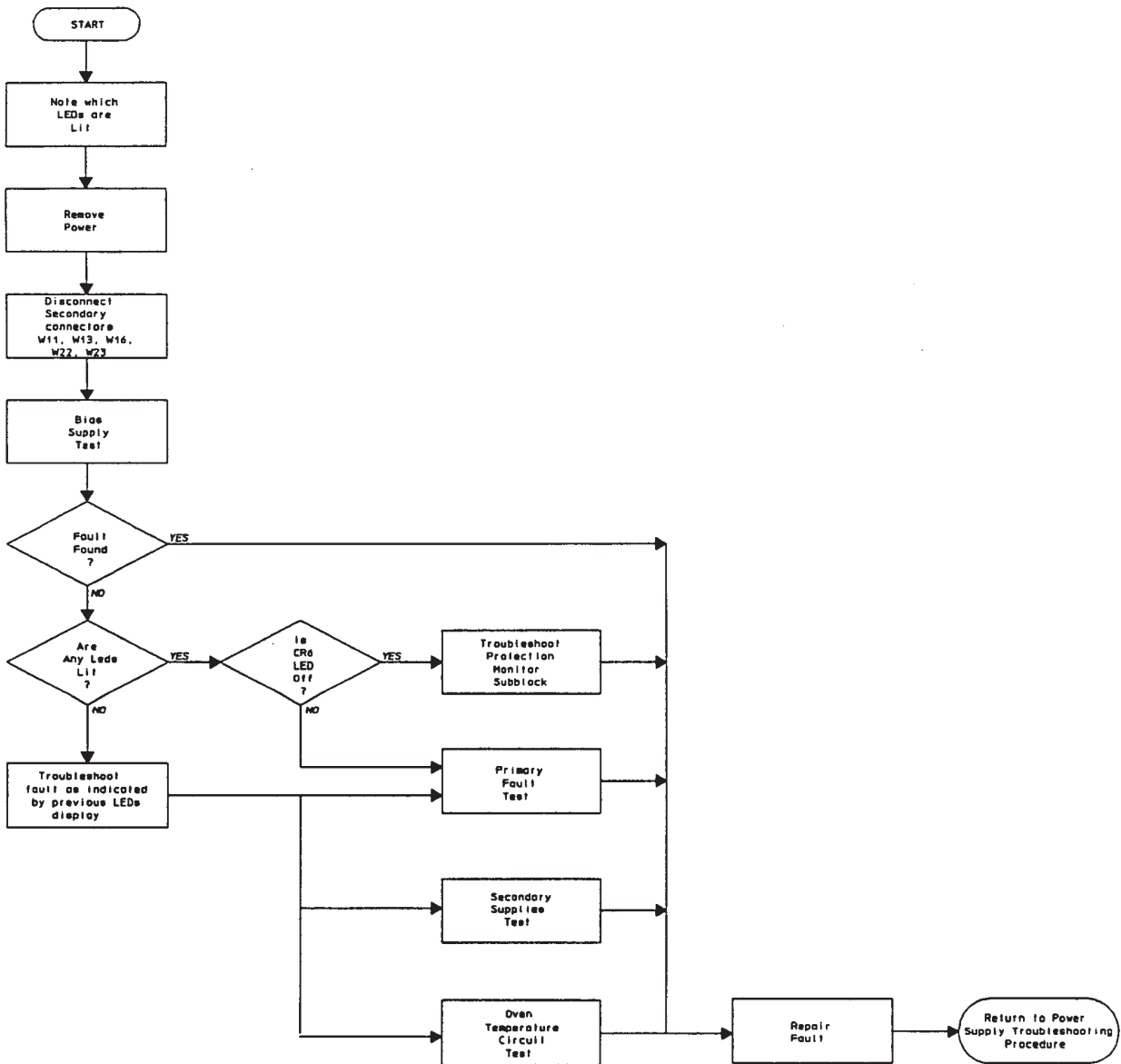


Figure 8-12. Fault LEDs Troubleshooting Procedure Diagram

Bias Supply Test

1. Disconnect the power cord from the rear panel. Remove the bottom cover and the power supply shield of the HP 3563A.

Warning

Even with power removed, energies capable of personal injury are present in this circuit. With the jumpers in the TEST position, these voltages will discharge to relatively safe levels after approximately sixty seconds.

2. Connect the power cable and press the line switch ON.
3. Connect the voltmeter negative terminal to the HP 3563A chassis.
4. Connect the voltmeter positive terminal to A18 TP11. The dc voltage should be $+12 \pm 0.72\text{V}$.
5. Connect the voltmeter positive terminal to A18 TP10. The dc voltage should be $-12 \pm 0.72\text{V}$.
6. If this test fails, troubleshoot the bias supply subblock back to the line filter.
7. If the test passes, the bias supply subblock is all right. Return to the troubleshooting procedure diagrams.

Primary Fault Test

1. Disconnect the power cord from the rear panel. Remove the bottom cover and the power supply shield of the HP 3563A.

Warning



Even with power removed, energies capable of personal injury are present in this circuit. With the jumpers in the TEST position, these voltages will discharge to relatively safe levels after approximately sixty seconds.

2. Using insulated, needle-nose pliers, set jumpers A18 J401, A18 J402, and A18 J100 to the test (T) position. It is not necessary for A18 J100 to have a jumper. Connect center pin and pin closest to the center of the instrument for the test (T) position.
3. Connect the voltmeter from the gate to drain of A18 Q400. Note resistance measurement.
4. Connect the voltmeter from the gate to drain of A18 Q401. Note resistance measurement.
5. If the resistance measurement of either FET is equal to or less than 20 k, replace the FET. Check the following resistors and replace any that are not the correct-value:

Resistor	Value
A18 R409	$18 \pm 1 \Omega$
A18 R410	$3.9k \pm 200 \Omega$
A18 R403	$18 \pm 1 \Omega$
A18 R404	$3.9k \pm 200 \Omega$

6. Set jumpers A18 J401 and A18 J402 to normal position and the rear panel voltage selector switch to 115V.

Caution



If the rear panel voltage selector switch is changed from the 220V position to the 115V position, it must be changed back after completing this test.

7. Connect the triple output supply to the bias supply subblock as follows:
 - +15 Vdc to (+) side of A18 C107
 - 15 Vdc to (-) side of A18 C100
 - +5 Vdc to A18 U2 pin 4
 - Ground to A18 TP13
8. Check Waveform #4 at A18 TP5 and A18 TP6. If the waveforms are incorrect, go to the "Control Loop Test" procedure.
9. Connect the variable ac power supply to the power line connector. Set supply to 25 ± 2 Vac.
10. Check Waveforms #5, #6, and #8. If the waveforms are incorrect, troubleshoot the primary transformer and diode circuits.
11. If the Waveforms #5, #6, and #8 are all right, connect the voltmeter to the +5V regulator A18 U502 pin 1.
12. Slowly increase the variable ac power supply until A18 U502 regulates or the variable ac power supply reaches 129 Vrms.
13. If the voltmeter reading is greater than 5.3 Vdc or A18 U502 did not regulate, go to the "Control Loop Test".
14. If the voltmeter reading is 5 ± 0.3 Vdc, go to the "Slow Start Test".

Caution

If the rear panel voltage selector switch was changed from the 220V position to the 115V position, it must be changed back to the 220V position.

Primary Circuit Test

1. Disconnect the power cord from the rear panel. Remove the bottom cover and the power supply shield of the HP 3563A.

Warning



Even with power removed, energies capable of personal injury are present in this circuit. With the jumpers in the TEST position, these voltages will discharge to relatively safe levels after approximately sixty seconds.

2. Using insulated, needle-nose pliers, set jumpers A18 J401 and A18 J402 to the test(T) position.
3. Connect the voltmeter from the gate to drain of A18 Q400. Note resistance measurement.
4. Connect the voltmeter from the gate to drain of A18 Q401. Note resistance measurement.
5. If the resistance of either FET is equal to or less than 20 k Ω , replace the FET. Check the following resistors and replace any that are not the correct value:

Resistor	Value
A18 R409	$18 \pm 1 \Omega$
A18 R410	$3.9k \pm 200 \Omega$
A18 R403	$18 \pm 1 \Omega$
A18 R404	$3.9k \pm 200 \Omega$

6. Set jumpers A18 J401 and A18 J402 to normal position and the rear panel voltage selector switch to 115V.
7. Disconnect the secondary connectors W11 (rear of the display unit), W13 (A18 J1), and W16 (A18 J400). Unscrew W22 and W23 from the A14 mother board.
8. Set jumper A18 J100 to the test (T) position.
9. Connect A18 TP13 (ground) to A18 TP2.
10. Connect the variable ac power supply to the power line connector.
11. Connect the voltmeter positive lead to the +Vdc side of A18 C406.

12. Connect the voltmeter negative lead to the – Vdc side of A18 C402.
13. Slowly increase the voltage of the variable ac power supply to 129 Vrms while monitoring the voltmeter reading.
14. If the voltmeter reading is 360 ± 20 Vdc when the variable ac power supply is 129 Vrms, the bulk supply is all right.
15. Disconnect A18 TP2 from A18 TP13. Disconnect the test instruments from the HP 3563A.
16. Connect secondary connectors W11 (rear of the display unit), W13 (A18 J1), W16(A18 J400), W22, and W23.
17. Set A18 J100 to the normal (N) position.
18. Return to the troubleshooting procedure diagrams.

Control Loop Test

1. Disconnect the power cord from the rear panel. Remove the bottom cover and the power supply shield of the HP 3563A.

Warning



Even with power removed energies capable of personal injury are present in this circuit. With the jumpers in the TEST position, these voltages will discharge to relatively safe levels after approximately sixty seconds.

2. Using insulated, needle-nose pliers, set jumpers A18 J401 and A18 J402 to the test (T) position.
3. Disconnect the secondary connectors W11 (rear of the display unit), W13 (A18 J1), and W16 (A18 J400). Unscrew W22 and W23 from the A14 mother board.
4. Put A18 J100 in the test (T) position.
5. Connect the dc power supply negative lead to W23 and the dc power supply positive lead to W22.
6. Connect the voltmeter negative terminal to the HP 3563A chassis and the positive terminal to A18 TP7.
7. Connect the power cord and press the line switch on.
8. Vary the dc power supply and monitor the control voltage at A18 TP7. When the dc supply is greater than 5.2V the control voltage should be $0.6 \pm 0.05\text{V}$. When the dc supply is less than 5.2V the control voltage should be $4.5 \pm 0.4\text{V}$.
9. If the control voltage does not respond correctly as the dc supply voltage is varied, troubleshoot the current monitor and error voltage subblocks.
10. Connect Channel 1 of the oscilloscope to A18 TP5 and Channel 2 to A18 TP6.
11. Vary the dc power supply and monitor the switching waveform (Waveform #4). When the dc supply is greater than 5.2V the switching waveform pulse width should be zero. When the dc supply voltage is less than 5.2V the switching waveform pulse width should be maximum (45% or $2.4 \mu\text{s}$).
12. If the switching waveform does not respond correctly as the dc supply voltage is varied, troubleshoot the pulse width modulator and chopper isolation/driver subblocks.

13. Disconnect the power cord. Connect the secondary connectors W11 (rear of the display unit), W13 (A18 J1), W16 (A18 J400), W22 and W23.
14. Put jumper A18 J100 in the normal position.
15. Return to the troubleshooting procedure diagrams.

Slow Start Test

1. Disconnect the power cord from the rear panel. Remove the bottom cover and the power supply shield of the HP 3563A.

Warning



Even with power removed, energies capable of personal injury are present in this circuit. With the jumpers in the TEST position, these voltages will discharge to relatively safe levels after approximately sixty seconds.

2. Using insulated, needle-nose pliers, set jumpers A18 J401 and A18 J402 to the test (T) position.
3. Using 10:1 scope probes, connect channel 1 to A18 TP5 and channel 2 to A18 TP6. Set the two channel oscilloscope as follows:

Mode	A & B
CH1 V/Div	500 mV/Div
CH2 V/Div	500 mV/Div
CH1 Coupling	dc
CH2 Coupling	dc
Time/Div	2.00 μ s/Div
EXT Trigger	EXT + 1
—	A18 TP1

4. Refer to Waveform #4 (Power Supply Signal Waveforms section). Monitor the oscilloscope while cycling the power on the HP 3563A.
5. The switching waveforms duty cycle should increase from 0% to 45% in 0.1s. The control voltage at A18 TP7 should also go from 0V to 4.5 ± 0.4 V in 0.2s.

Secondary Supplies Test

Caution



Do not attempt this test if the Over Temperature LED or the Primary Fault Fault LED is lit when the HP 3563A is turned on. Also verify that the Bias Supply is operating correctly. Grounding A18 TP9 defeats the protection monitor which may result in damage to the HP 3563A circuit boards.

1. Disconnect the power cord from the rear panel. Remove the bottom cover and the power supply shield of the HP 3563A.
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Warning



Even with power removed energies capable of personal injury are present in this circuit. These voltages will discharge to relatively safe levels after approximately one minute.

2. Jumpers A18 J401 and A18 J402 should be in the normal position.
3. Disconnect the secondary connectors W11 (rear of the display unit), W13 (A18 J1), and W16 (A18 J400). Unscrew W22 and W23 from the A14 mother board.
4. Put jumper A18 J100 in test (T) position.
5. Connect the power cord and press the line switch ON.
6. Compare the output voltages to table 8-37. The +5S supply should be 5.2 ± 0.1 Vdc.
7. If all the voltages are within specification, perform the following:
 - a. Ground A18 TP12 briefly to reset the HP 3563A.
 - b. If any LEDs are lit, troubleshoot the comparators in the protection monitor subblock.
 - c. If no LEDs are lit, troubleshoot the fault as indicated by the previous LED display.

8. If the voltages are not within specification, perform the following:
 - a. Starting with the +5V supply check each secondary regulator (A18 U500 to A18 U508) to by measuring the following points:
 - Voltage at pin 1 should be 2.5V greater than voltage at pin 0.
 - Voltage at pin A should be 1.25V greater than voltage at pin 0.
 - Replace any faulty regulators.
 - If voltages are now in specification, go to step 9.
 - b. Check the + 5V secondary Waveform #9 and the secondary supplies Waveform #10.
 - c. If waveforms are all right, troubleshoot the secondary supplies back to the primary transformer. If problem is not found, go to the "Control Loop Test" procedure.
 - d. If the waveforms are incorrect, troubleshoot back to the chopper switches starting with the secondary diodes A18 CR300, A18 CR301, A18 CR512 to A18 CR514, A18 CR600 to CR603.
9. Disconnect the power cord. Connect the secondary connectors W11 (rear of the display unit), W13 (A18 J1), W16 (A18 J400), W22 and W23.
10. Put jumper A18 J100 in the normal position.
11. Return to troubleshooting procedure diagrams.

Over Temperature Circuit Test

1. Disconnect the power cord from the rear panel. Remove the bottom cover and the power supply shield of the HP 3563A.

Warning



Even with power removed, energies capable of personal injury are present in this circuit. These voltages will discharge to relatively safe levels after approximately one minute.

2. Jumpers A18 J401 and A18 J402 should be in the normal position.
3. Allow 20 minutes for all components to cool off.
4. Disconnect secondary connectors W11 (rear of the display unit), W13 (A18 J1), W16 (A18 J400). Unscrew W22 and W23 from the A14 mother board.
5. Put A18 J100 in the test (T) position.
6. Connect power cord and press the line switch on.
7. If the OTEMP LED is not lit, the over temperature circuit is operating correctly. First check that the fan is operating. If the fan is operating, check each subblock of the power supply starting with the bias supply (see "Bias Supply Test") until the fault is found.
8. If the OTEMP LED is lit, the over temperature circuit is faulty. Perform the following steps:
 - a. Check the voltage of U104 pin 14. It should be $+5.0 \pm 0.3$ Vdc.
 - b. If the voltage is correct, ground A18 TP12 briefly to reset the HP 3563A. If the LED is on, replace U100.
 - c. Check the inputs of U104. At 25° centigrade pin 8 of U104 should equal 3 ± 0.2 Vdc and pin 9 of U104 should equal 3.5 ± 0.2 Vdc.
 - d. Replace faulty part.

9. Disconnect the power cord.

Warning

Even with power removed, energies capable of personal injury are present in this circuit. These voltages will discharge to relatively safe levels after approximately one minute.

10. Connect the secondary connectors W11 (rear of the display unit), W13 (A18 J1), W16 (A18 J400), W22 and W23.
11. Put jumper A18 J100 in the normal position.
12. Return to troubleshooting procedure diagrams.

Power Supply Signal Waveforms

The oscilloscope plots are used for troubleshooting the A18 Power Supply. Note that all the measurements are taken with a 10:1 probe. Other notes unique to a measurement are written next to the waveform.

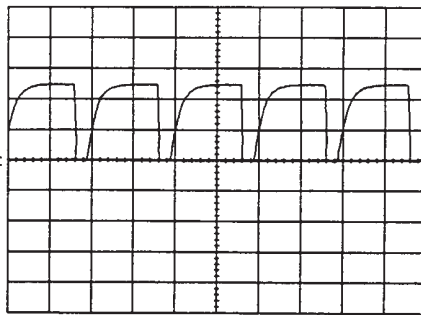
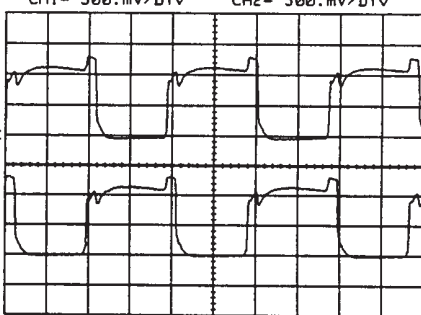
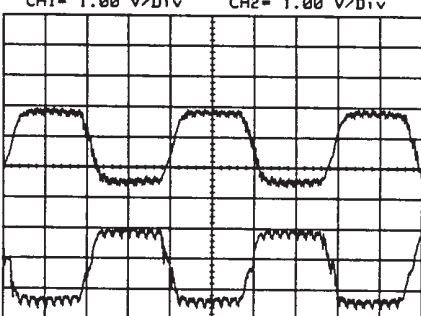
Warning

Service procedures described in this section are performed with the protective covers removed and power applied. Energy available at many points can, if contacted, result in personal injury. Servicing must be performed only by trained service personnel who are aware of the hazards involved (such as fire and electrical shock).

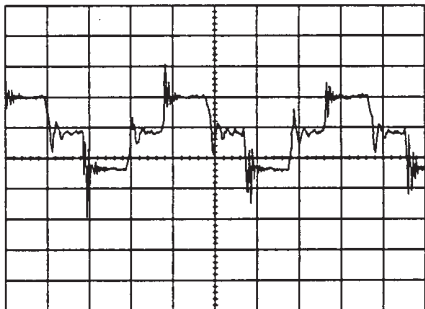
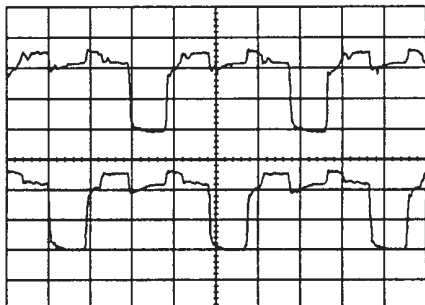
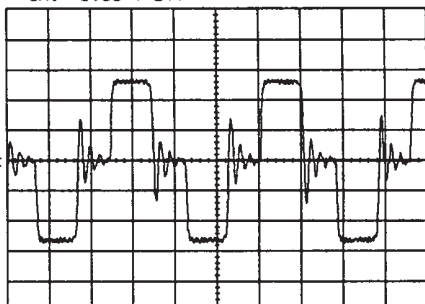
Table 8-38. Power Supply Signal Waveforms

Remove power Jumpers in test position: A18 J401 A18 J402 Connect ground to A18 TP13 Probe type 10:1 Power ON		
Setup	Parameters	Waveforms
U2 Connect CH1 to A18 U2 pin 4 Connect CH2 to A18 U2 pin 6 Oscilloscope: Mode A & B CH1 V/Div 200 mV/Div CH2 V/Div 50 mV/Div CH1 Coupling dc CH2 Coupling dc Time/Div 2 ms/Div Trigger CH1	Pulse shape Amplitude Time Relationship	<div> CH1 CPLG=DC CH2 CPLG=DC CH1= 200.mV/Div CH2= 50.0mV/Div </div> <div> MT=CH1 MAIN= 2.00ms/Div #1 </div>
Driver and PWM Clock Connect CH1 to A18 TP5 Connect CH2 to A18 TP1 Oscilloscope: Mode A & B CH1 V/Div 500 mV/Div CH2 V/Div 100 mV/Div CH1 Coupling dc CH2 Coupling dc Time/Div 2 μs/Div Trigger CH1	Pulse shape Duty cycle Time Relationship The triangle wave must start at 0 ± 0.200 Vdc	<div> CH1 CPLG=DC CH2 CPLG=DC CH1= 500.mV/Div CH2= 100.mV/Div </div> <div> MT=CH1 MAIN= 2.00μs/Div #2 </div>

Power Supply Signal Waveforms continued

Remove power Jumpers in test position: A18 J401 A18 J402 Connect ground to A18 TP13 Probe type 10:1 Power ON		
Setup	Parameters	Waveform
SYNC Connect CH1 to A18 TP3 Oscilloscope: Mode A CH1 V/Div 200 mV/Div CH1 Coupling dc Time/Div 2 μ s/Div Trigger CH1	Pulse shape Duty cycle	CH1 CPLG=DC CH1 = 200.mV/Div  MT=CH1 MAIN= 2.00uS/Div #3
Test Switching Waveform Connect CH1 to A18 TP5 Connect CH2 to A18 TP6 Oscilloscope: Mode A & B CH1 V/Div 500 mV/Div CH2 V/Div 500 mV/Div CH1 Coupling dc CH2 Coupling dc Time/Div 2 μ s/Div Trigger CH1	Pulse shape Time Relationship	CH1 CPLG=DC CH2 CPLG=DC CH1 = 500.mV/Div CH2 = 500.mV/Div  MT=CH1 MAIN= 2.00uS/Div #4
Power FET Gates Connect CH1 to the gate of A18 Q401 Connect CH2 to the gate of A18 Q400 Oscilloscope: Mode A & B CH1 V/Div 1 V/Div CH2 V/Div 1 V/Div CH1 Coupling dc CH2 Coupling dc Time/Div 2 μ s/Div Trigger CH1	Pulse shape Time Relationship Note: Signals will be noisy	CH1 CPLG=DC CH2 CPLG=DC CH1 = 1.00 V/Div CH2 = 1.00 V/Div  MT=CH1 MAIN= 2.00uS/Div #5

Power Supply Signal Waveforms continued

Remove power Jumpers in test position. All jumpers in normal position Connect ground to A18 R800 Probe type 10:1 Power ON		
Setup	Parameters	Waveform
Transformer T2 (Primary Current) Connect CH1 to A18 TP8 Oscilloscope: Mode A CH1 V/Div 20 mV/Div CH1 Coupling dc Time/Div 2 μ s/Div Trigger EXT 1,A18TP1	Pulse shape Duty cycle	CH1 CPLG=DC CH1= 20.0mV/Div  MT=EXT MAIN= 2.00 μ s/Div #6
Normal Switching Waveforms Connect CH1 to A18 TP5 Connect CH2 to A18 TP6 Oscilloscope: Mode A & B CH1 V/Div 500 mV/Div CH2 V/Div 500 mV/Div CH1 Coupling dc CH2 Coupling dc Time/Div 2 μ s/Div Trigger CH1	Pulse shape Only one signal on at a time (0V)	CH1 CPLG=DC CH2 CPLG=DC CH1= 500.mV/Div CH2= 500.mV/Div  MT=CH1 MAIN= 2.00 μ s/Div #7
FA - FB (T1, primary voltage) Connect CH1 to FA of A18 T1 Connect CH2 to FB of A18 T1 (across primary transformer) Oscilloscope: Mode A & B CH1 V/Div 5 V/Div CH2 V/Div 5 V/Div CH1 Coupling dc CH2 Coupling dc Time/Div 2 μ s/Div Trigger CH1	Pulse shape Duty cycle	CH1 CPLG=DC CH1= 5.00 V/Div  MT=EXT MAIN= 2.00 μ s/Div #8

Power Supply Signal Waveforms continued

Remove Power Jumpers in test position: All jumpers in normal position Connect ground to A18 TP13 Probe: 10:1 Power On		
Setup	Parameters	Waveform
+ 5V Secondary Connect CH1 to A18 CR300 Anode Connect CH2 to A18 CR300 Cathode Oscilloscope: Mode A & B CH1 V/Div 1 V/Div CH2 V/Div 1 V/Div CH1 Coupling dc CH2 Coupling dc Time/Div 1 μs/Div Trigger CH1	Pulse shape	<p>#9</p>
Secondary Supplies Connect CH1 to A18 CR601 Anode Connect CH2 to A18 CR601 Cathode Oscilloscope: Mode A & B CH1 V/Div 5 V/Div CH2 V/Div 5 V/Div CH1 Coupling dc CH2 Coupling dc Time/Div 1 μs/Div Trigger CH1	Pulse shape	<p>#10</p>

Power Supply After-Repair Adjustments and Tests

Table 8-39. After-Repair Adjustments and Tests

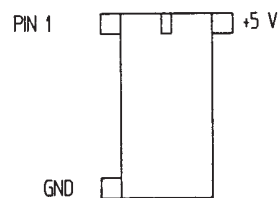
Perform the following:*	Section
Diagnostic Tests: TESTALL	VII
Adjustments: Do the power-down adjustment only if a component was changed in the power-down or bias supply subblocks.	III
Operational Verification: None	—
Performance Tests: None	—

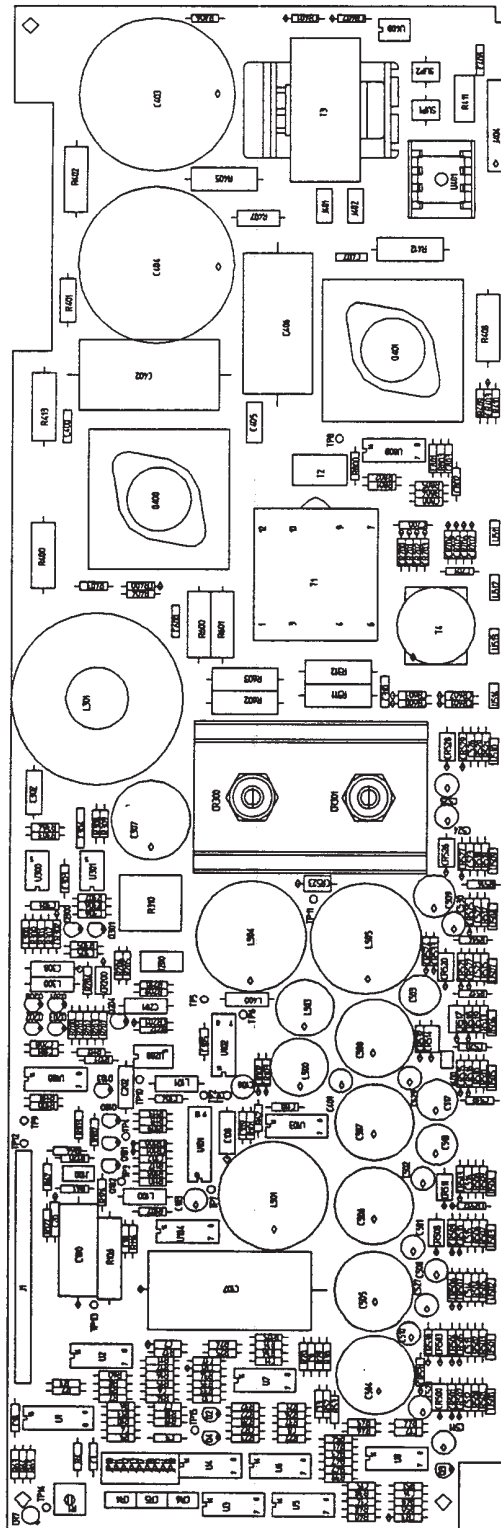
*Return all jumpers to the normal (N) position

REFERENCE TABLE

IC	GND	+5VB	CAPS	-12B	+12B
U1	8	15,16			
U2	12				3
U7	12				3
U8	12				3
U100	7	14	C101		
U101	6,7 15,11				17
U102	7				
U103	7	14	C110		
U104	12				3
U200				4	7
U300				4(C300)	7(C306)
U301				4	7
U800	3,8	11	C803	6(C802)	

ALL INTEGRATED CIRCUITS ARE CORNER POWERED EXCEPT THOSE SHOWN IN THE REFERENCE TABLE. CORNER POWERED ICs HAVE GROUND CONNECTED TO THE LOWER LEFT PIN, AND +5 V CONNECTED TO THE UPPER RIGHT PIN, REGARDLESS OF THE TOTAL PIN COUNT (e.g. FOR A 16 PIN DIP, GROUND IS CONNECTED TO PIN 8 AND +5 V IS CONNECTED TO PIN 16).





A18 Power Supply Component Locator
P/N 03562-66518 Rev C
Page 2 of 3

