

## ***SERVICE MANUAL***

### **GPIB DC Power Supplies Agilent Series 668xA**

#### **For instruments with Serial Numbers:**

**Agilent Model 6680A: US36480101 and Above \***

**Agilent Model 6681A: US36400101 and Above \***

**Agilent Model 6682A: US36440101 and Above \***

**Agilent Model 6683A: US36420101 and Above \***

**Agilent Model 6684A: US36410101 and Above \***

\* This manual also applies to instruments with the older serial number format described on page 7.  
For instruments with higher serial numbers, a change page may be included.  
For instruments with lower serial numbers, see Appendix A.



**Agilent Technologies**

## CERTIFICATION

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## SAFETY CONSIDERATIONS

**GENERAL.** This is a Safety Class 1 instrument (provided with terminal for connection to protective earth ground).

**OPERATION.** BEFORE APPLYING POWER verify that the product is set to match the available line voltage, the correct line fuse is installed, and all safety precautions (see following warnings) are taken. In addition, note the instrument's external markings described under "Safety Symbols".

### WARNING.

- Servicing instructions are for use by service-trained personnel. To avoid dangerous electrical shock, do not perform any servicing unless you are qualified to do so.
- BEFORE SWITCHING ON THE INSTRUMENT, the protective earth terminal of the instrument must be connected to the protective conductor of the (mains) power cord. The mains plug shall be inserted only in an outlet socket that is provided with a protective earth contact. This protective action must not be negated by the use of an extension cord (power cable) that is without a protective conductor (grounding). Grounding one conductor of a two-conductor outlet is not sufficient protection.
- If this instrument is to be energized via an auto-transformer (for voltage change), make sure the common terminal is connected to the earth terminal of the power source.
- Any interruption of the protective (grounding) conductor (inside or outside the instrument), or disconnecting of the protective earth terminal will cause a potential shock hazard that could result in personal injury.
- Whenever it is likely that the protective earth connection has been impaired, this instrument must be made inoperative and be secured against any unintended operation.
- Only fuses with the required rated current, voltage, and specified type (normal blow, time delay, etc.) should be used. Do not use repaired fuses or short-circuited fuseholders. To do so could cause a shock or fire hazard.
- Do not operate this instrument in the presence of flammable gases or fumes.
- Do not install substitute parts or perform any unauthorized modification to this instrument.
- Some procedures described in this manual are performed with power supplied to the instrument while its protective covers are removed. If contacted, the energy available at many points may result in personal injury.
- Any adjustment, maintenance, and repair of this instrument while it is opened and under voltage should be avoided as much as possible. When this is unavoidable, such adjustment, maintenance, and repair should be carried out only by a skilled person who is aware of the hazard involved.
- Capacitors inside this instrument may hold a hazardous electrical charge even if the instrument has been disconnected from its power source.

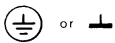
### SAFETY SYMBOLS.



Instruction manual symbol. The instrument will be marked with this symbol when it is necessary for you to refer to the instruction manual in order to protect against damage to the instrument.



This sign indicates hazardous voltages.



This sign indicates an earth terminal (sometimes used in the manual to indicate circuit common connected to a ground chassis).

### WARNING

The WARNING sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.

### CAUTION

The CAUTION sign denotes a hazard. It calls attention to an operating procedure, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.

| Safety Symbol Definitions                                                           |                                                                                                                                             |                                                                                     |                                                                                                                                                                                                                                                                 |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Symbol                                                                              | Description                                                                                                                                 | Symbol                                                                              | Description                                                                                                                                                                                                                                                     |
|    | Direct current                                                                                                                              |    | Terminal for Line conductor on permanently installed equipment                                                                                                                                                                                                  |
|    | Alternating current                                                                                                                         |    | Caution, risk of electric shock                                                                                                                                                                                                                                 |
|    | Both direct and alternating current                                                                                                         |    | Caution, hot surface                                                                                                                                                                                                                                            |
|    | Three-phase alternating current                                                                                                             |    | Caution (refer to accompanying documents)                                                                                                                                                                                                                       |
|    | Earth (ground) terminal                                                                                                                     |    | In position of a bi-stable push control                                                                                                                                                                                                                         |
|    | Protective earth (ground) terminal<br>(Intended for connection to external protective conductor.)                                           |    | Out position of a bi-stable push control                                                                                                                                                                                                                        |
|    | Frame or chassis terminal                                                                                                                   |    | On (supply)                                                                                                                                                                                                                                                     |
|   | Terminal for Neutral conductor on permanently installed equipment                                                                           |   | Off (supply)                                                                                                                                                                                                                                                    |
|  | Terminal is at earth potential<br>(Used for measurement and control circuits designed to be operated with one terminal at earth potential.) |  | Standby (supply)<br>Units with this symbol are not completely disconnected from ac mains when this switch is off. To completely disconnect the unit from ac mains, either disconnect the power cord or have a qualified electrician install an external switch. |

## Printing History

The edition and current revision of this manual are indicated below. Reprints of this manual containing minor corrections and updates may have the same printing date. Revised editions are identified by a new printing date. A revised edition incorporates all new or corrected material since the previous printing date. Changes to the manual occurring between revisions are covered by change sheets shipped with the manual. Also, if the serial number prefix of your power supply is higher than those listed on the title page of this manual, then it may or may not include a change sheet. That is because even though the higher serial number prefix indicates a design change, the change may not affect the content of the manual.

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# Introduction

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## Scope

## Organization

This manual contains information for troubleshooting and repairing to the component level Agilent Series 668xA, 5-kilowatt power supplies. The remaining chapters of this manual are organized as follows:

| Chapter    | Description                                                                                                                                                                          |
|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Chapter 2  | Verification procedures to determine the performance level of the supply either before or after repair.                                                                              |
| Chapter 3  | Troubleshooting procedures for isolating a problem, procedures for replacing the defective component and, if required, post-repair calibration and EEPROM initialization procedures. |
| Chapter 4  | Principles of power supply operation on a block-diagram level.                                                                                                                       |
| Chapter 5  | Replaceable parts, including parts ordering information.                                                                                                                             |
| Chapter 6  | Diagrams, including schematics, component location drawings, and troubleshooting test points.                                                                                        |
| Appendix A | Backdating information for power supplies with serial numbers below those listed in the title page of this manual.                                                                   |

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## Instrument Identification

Agilent Technologies instruments are identified by a 10-digit serial number. The format is described as follows: first two letters indicate the country of manufacture. The next four digits are a code that identify either the date of manufacture or of a significant design change. The last four digits are a sequential number assigned to each instrument.

| Item | Description                                                                                               |
|------|-----------------------------------------------------------------------------------------------------------|
| US   | The first two letters indicates the country of manufacture, where US = USA.                               |
| 3648 | This is a code that identifies either the date of manufacture or the date of a significant design change. |
| 0101 | The last four digits are a unique number assigned to each power supply.                                   |

If the serial number prefix on your unit differs from that shown on the title page of this manual, a yellow Manual Change sheet may be supplied with the manual. It defines the differences between your unit and the unit described in this manual. The yellow change sheet may also contain information for correcting errors in the manual.

Older serial number formats used with these instruments had a two-part serial number, i.e. 2701A-00101. This manual also applies to instruments with these older serial number formats. Refer to Appendix A for backdating information.

## Related Documents

### Change Sheet

There may or may not be a *Manual Change* sheet included with this manual (see Manual Revisions). If one is included, be sure to examine it for changes to this manual.

### Operating Manual

Each power supply is shipped with an operating manual (see Replaceable Parts, Chapter 5 for part numbers) that covers the following topics:

- Options, accessories, specifications, supplementary characteristics, output characteristic curve, typical output impedance curves.
- Connecting the power cord, load, and remote sensing.
- Connecting power supplies in series or autoparallel.
- Connecting the remote controller and setting the GPIB address.
- Configuring the digital port for remote inhibit, relay link, or digital I/O operation.
- Connecting the analog port for external voltage programming control.
- Turn-on tests, including selftest errors and runtime errors.
- Front panel operation.
- SCPI programming, an introduction to syntax, language dictionary, and status register operation.
- Compatibility-language programming for operation with Agilent Series 603xA power supplies.
- Replacement of line fuse and conversion of line voltage.
- Calibration procedure (front panel and remote).

## Manual Revisions

This manual was written for power supplies that have the same serial prefixes (first part) as those listed on the title page and whose serial numbers (second part) are equal to or higher than those listed in the title page.

---

### Note

- 1) If the serial prefix of your supply is higher than that shown in the title page then the supply was made after the publication of this manual and may have hardware and/or firmware differences not covered in the manual.
  - 2) If they are significant to the operation and/or servicing of the power supply, those differences are documented in one or more Manual Changes sheets included with this manual.
  - 3) If the serial prefix on the power supply is lower than that shown on the title page, then the supply was made before the publication of this manual and can be different from that described here. Such differences are covered in "Appendix A – Manual Backdating Changes".
- 

## Firmware Revisions

The power supply's firmware resides in the A10 control board microprocessor chip and in ROM chips on the A2 GPIB and A1 Front Panel boards. You can obtain the firmware revision number by either reading the integrated circuit label, or query the power supply using the GPIB \*IDN query command (see Chapter 3 - Troubleshooting). Also, see Chapter 3, Firmware Revisions for the actual Agilent BASIC program that does this.

---

## Safety Considerations

This power supply is a Safety Class I instrument, which means it has a protective earth terminal. This terminal must be connected to earth ground through a power source equipped with a 4-wire, ground receptacle. Refer to the "Safety Summary" page at the beginning of this manual for general safety information. Before operation or repair, check the power supply and review this manual for safety warnings and instructions. Safety warnings for specific procedures are located at appropriate places in the manual.

---

**WARNING**

Hazardous voltage exist within the power supply chassis, at the output terminals, and at the analog programming terminals.

---

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## Conventions

- In diagrams, the name of a complementary signal is sometimes shown with a bar above the signal mnemonic. In other diagrams and in the text, complementary signals are shown with an asterisk (\*) after the mnemonic (such as PCLR\*). A mnemonic with a bar over it or an asterisk after it represents the same signal.
- In this manual, all Agilent 668xA series supplies are referred to as *system* supplies.

---

## Electrostatic Discharge

---

**CAUTION**

The power supply has components that can be damaged by ESD (electrostatic discharge). Failure to observe standard, antistatic practices can result in serious degradation of performance, even when an actual failure does not occur.

---

When working on the power supply observe all standard, antistatic work practices. These include, but are not limited to:

- working at a static-free station such as a table covered with static-dissipative laminate or with a conductive table mat (Agilent P/N 9300-0797, or equivalent).
- using a conductive wrist strap, such as Agilent P/N 9300-0969 or 9300-0970.
- grounding all metal equipment at the station to a single common ground.
- connecting low-impedance test equipment to static-sensitive components only when those components have power applied to them.
- removing power from the power supply before removing or installing printed circuit boards.

## Verification

---

### Introduction

This chapter provides test procedures for checking the operation of Agilent Series 668xA power supplies. The required test equipment is specified and sample performance test record sheets are included. Instructions are given for performing the tests either from the front panel or from a controller over the GPIB.

---

### Tests

Two types of procedures are provided: Operation Verification tests and Performance tests.

| Type of Test           | Purpose                                                                                                                                 |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| Operation Verification | These tests do not check all parameters, but comprise a short procedure to verify that the power supply is performing properly.         |
| Performance            | These tests verify all the Specifications (not Supplementary Characteristics) listed in Table 1-1 of the Power Supply Operating Manual. |

If you encounter failures or out-of-specification test results, see Troubleshooting Procedures (Chapter 3). The procedures will determine if repair and/or calibration is required.

---

|             |                                                                                                                                                       |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Note</b> | The power supply must pass the selftest at power-on before the following tests can be performed. If the power supply fails selftest, go to Chapter 3. |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|

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### Test Equipment Required

#### List of Equipment

Table 2-1 lists the equipment required to perform the tests given in this chapter. Only the equipment marked with the superscript "<sup>1</sup>" is needed for the Operation Verification test.

#### Current-Monitoring Resistor

The four-terminal, current-monitoring resistor (current shunt) listed in Table 2-1 is required to eliminate output current measurement error caused by voltage drops in leads and connections. The specified current shunts have special current-monitoring terminals inside the load connection terminals. The accuracy of the current shunt must be 0.04% or better. When using the 1000 amp 0.05% current shunt the measurement uncertainty should be stated for all calibrations. Connect the current monitor directly to these current-monitoring terminals.

**Table 2-1. Test Equipment Required**

| Type                                               | Required Characteristics                                                                                                                                                                                                                                                                                                       | Recommended Model                                                             |
|----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|
| <b>Digital Voltmeter<sup>1</sup></b>               | Resolution: 10 nV @ 1V<br>Readout: 8 1/2 digits<br>Accuracy: 20 ppm                                                                                                                                                                                                                                                            | Agilent 3458A                                                                 |
| <b>Current Monitor Resistor<sup>1</sup></b>        | Agilent 6682A, 6683A, Agilent 6684A:<br>0.001Ω ± 0.04%, 300A, 100W<br><br>Agilent 6680A, 6681A<br>100 μΩ ± 0.05%, 1000A                                                                                                                                                                                                        | Guildline 9230/300<br><br>Burster Type 1280                                   |
| <b>DC Power Supply</b>                             | DC Power Source with current capability equal to UUT                                                                                                                                                                                                                                                                           | Agilent 6680A                                                                 |
| <b>Electronic Load</b><br><br><b>Resistor Load</b> | Range: Voltage and current range must exceed that of supply under test. Power: 5.4KW minimum<br>or<br>5 Kilowatt minimum<br>Agilent 6680A = 5.7 milliohms 4375W<br>Agilent 6681A = 13.8 milliohms 4640W<br>Agilent 6682A = 87.5 milliohms. 5040W<br>Agilent 6683A = 200 milliohms 5120W<br>Agilent 6684A = 312 milliohms 5120W | 3 each Agilent 6050A, w/3 each Agilent 60504B per Agilent 6050A for all units |
| <b>Oscilloscope</b>                                | Sensitivity: 1mV<br>Bandwidth Limit: 20MHz<br>Probe: 1:1 with RF tip                                                                                                                                                                                                                                                           | Agilent 54504A                                                                |
| <b>RMS Voltmeter</b>                               | True RMS Bandwidth: 20MHz<br>Sensitivity: 100 μV                                                                                                                                                                                                                                                                               | Agilent 3400B                                                                 |
| <b>Current Transformer</b>                         | 0.1Volt per ampere: 1Hz to 20MHz                                                                                                                                                                                                                                                                                               | Pearson Model 411                                                             |
| <b>Variable-Voltage Transformer (AC Source)</b>    | Power: 3 Phase 24KVA; Range: 180-235V 47 - 63Hz; 360- 440V 47 - 63Hz                                                                                                                                                                                                                                                           | Superior Powerstat<br>1156DT-3Y, 0-280V, 50A,<br>24.2 KVA or equivalent .     |
| <b>GPIO Controller<sup>2</sup></b>                 | Full GPIO capabilities                                                                                                                                                                                                                                                                                                         | HP Series 200/300                                                             |

<sup>1</sup> Required for Operation Verification Tests.

<sup>2</sup> Required for remote testing of 668xA models.

## Electronic Load

Many of the test procedures require the use of a variable load capable of dissipating the required power. If a variable resistor is used, switches must be used for connecting, disconnecting, and shorting the load resistor. For most tests, an electronic load (see Table 2-1) is easier to use than a variable resistor. However, an electronic load may not be fast enough for testing transient recovery time or may be too noisy for testing noise (PARD). In these cases, fixed load resistors of suitable power dissipation can be used with minor changes to the test procedures given in this chapter.

---

## Programming The Tests

### General Considerations

Procedures are given for programming these tests either from the front panel keypad or from a GPIB controller. The procedures assume you know how to use the front panel keypad or how to program over the GPIB (see the Power Supply Operating Manual for more information). When using computer-controlled tests, you may have to consider the relatively slow (compared to computer and system voltmeters) settling times and slew rates of the power supply. Suitable WAIT statements can be inserted into the test program to give the power supply time to respond to the test commands.

**WARNING**

This power supply can provide more than 240VA at more than 2 volts. If the output connections touch each other, severe arcing can occur resulting in burns, ignition or welding of parts. **DO NOT ATTEMPT TO MAKE CONNECTIONS WHILE OUTPUT POWER IS ON.** These connections should be performed only by qualified electronics personnel.

---

### Programming Parameters

Table 2-2 lists the programming voltage and current values for each model. You can enter these values either from the front panel or from a controller over the GPIB.

**Table 2-2. Programming Voltage and Current Values**

| Agilent Model | Full Scale Voltage | Max. Prog. Voltage | Full Scale Current | Max. Prog. Current | Max. Prog. Overvoltage |
|---------------|--------------------|--------------------|--------------------|--------------------|------------------------|
| Agilent 6680A | 5V                 | 5.125V             | 875A               | 895A               | 6.25V                  |
| Agilent 6681A | 8V                 | 8.190V             | 580A               | 592A               | 10.0V                  |
| Agilent 6682A | 21V                | 21.50V             | 240A               | 246A               | 25.2V                  |
| Agilent 6683A | 32V                | 32.75V             | 160A               | 164A               | 38.4V                  |
| Agilent 6684A | 40V                | 41.00V             | 128A               | 131A               | 48.0V                  |

---

### General Measurement Techniques

Figure 2-1 shows the setup for the Constant Voltage tests. Measure the dc output voltage directly at the sense (+S and -S) terminals. Connect these terminals for remote sensing (to the +S and -S terminals). Connect these terminals for local sensing. Be certain to use load leads of sufficient wire gauge to carry the output current (see Chapter 4 of the Power Supply Operating Manual). To avoid noise pickup, use coaxial cable or shielded pairs for the test leads. If you use more than one meter or a meter and an oscilloscope, connect separate leads for each instrument to avoid mutual-coupling effects.

---

### Performance Test Record Sheets

When performing the tests in this chapter, refer to the Performance Test Record sheets supplied at the end of this chapter. Table 2-6 is for recording common information, such as, the test equipment used and the environmental conditions. Tables 2-7 through 2-11 are dedicated to specific models. Each sheet lists the acceptable test ranges for the model and provides a place to record the results of the test.

**Note**

It is recommended that before you perform the tests in either Table 2-4 or Table 2-5, that you first locate the appropriate Performance Test Record sheet from Tables 2-7 through Table 2-11 for your specific model. Make a copy of this sheet, and record the actual observed values in it while performing the tests. Use the sheets in Tables 2-7 through Table 2-11 as master reference sheets to run copies at any time.

---

---

## Operation Verification Tests

Table 2-3 lists the requirements for operation verification, which is a subset of the performance tests.

**Table 2-3. Operation Verification Tests**

| Test                                                                                        | Refer To                      |
|---------------------------------------------------------------------------------------------|-------------------------------|
| 1 Turn-On Checkout                                                                          | Power Supply Operating Manual |
| 2 Voltage Programming and Readback Accuracy                                                 | Table 2-4                     |
| 3 Current Programming and Readback Accuracy                                                 | Table 2-5                     |
| Note: Record the results of Tests 2 and 3 in the appropriate Performance Test Record sheets |                               |

---

## Performance Tests

Performance tests check all the specifications of the power supply. The tests are grouped into constant-voltage mode tests (Table 2-4) and constant-current mode tests (Table 2-5).

### Constant Voltage (CV) Tests

#### Test Setup

Connect your dc voltmeter leads to only +S and -S (see Figure 2-1), because the power supply regulates the voltage between these points, not between the + and - output terminals .

#### Test Procedures

Perform the test procedures in Table 2-4. The CV tests are:

- Voltage Programming and Readback Accuracy
- CV Load Effect
- CV Source Effect
- CV Noise (PARD)
- Transient Recovery Time

---

|             |                                                              |
|-------------|--------------------------------------------------------------|
| <b>Note</b> | The tests are independent and may be performed in any order. |
|-------------|--------------------------------------------------------------|

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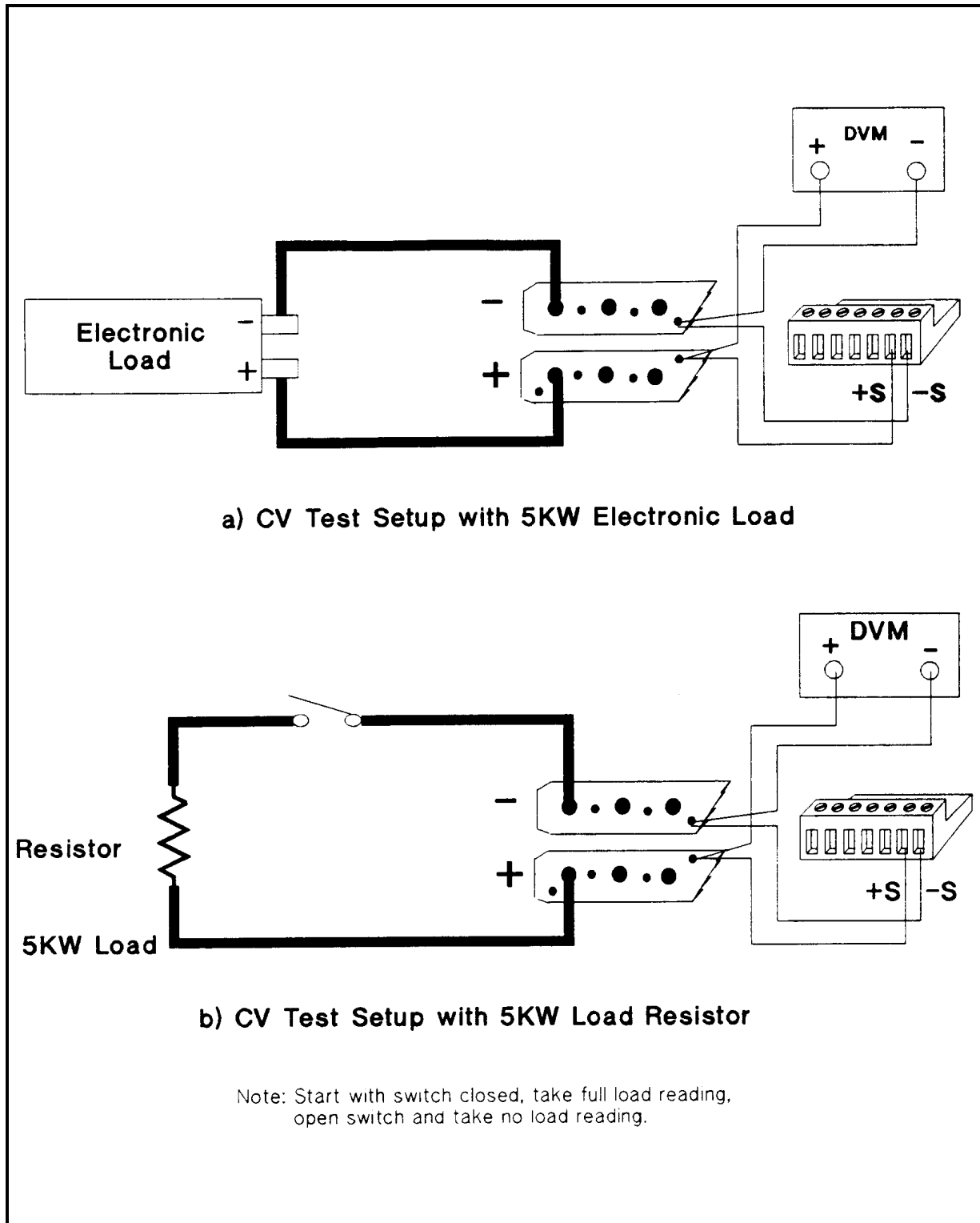


Figure 2-1. Constant Voltage (CV) Test Setup

**Table 2-4. Constant Voltage (CV) Tests**

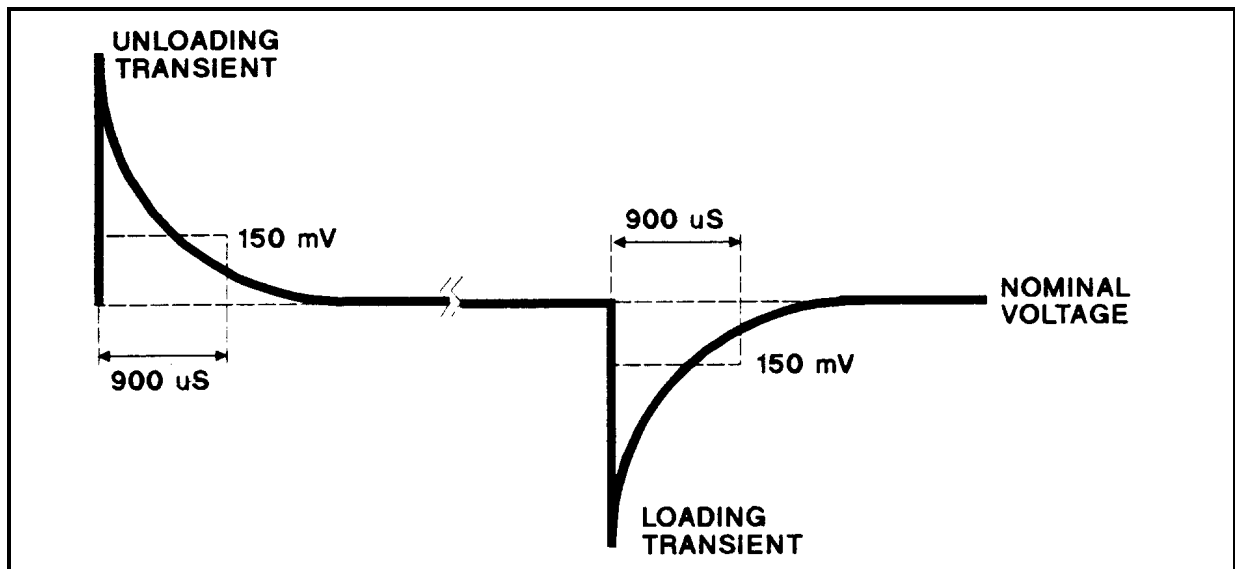
|                                                                                                                                                                                                                                                                                                                                         | Action                                                                                                                                      | Normal Result                                                                                                             |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|
| <b>Voltage Programming and Readback Accuracy</b><br>This test verifies that the voltage programming, GPIB readback (GPIB system power supplies only), and front panel display functions are within specifications. With system power supplies, values read back over the GPIB should be the same as those displayed on the front panel. |                                                                                                                                             |                                                                                                                           |
| 1                                                                                                                                                                                                                                                                                                                                       | Turn off the power supply and connect a DVM across +S and -S (see Fig. 2-1).                                                                |                                                                                                                           |
| 2                                                                                                                                                                                                                                                                                                                                       | Turn on the power supply with no load and program the output for 0 volts and maximum programmable current (see Table 2-2).                  | CV annunciator on. Output current near 0.                                                                                 |
| 3                                                                                                                                                                                                                                                                                                                                       | Record voltage readings at DVM and on front panel display.                                                                                  | Readings within specified Low Voltage limits.                                                                             |
| 4                                                                                                                                                                                                                                                                                                                                       | Program voltage to full scale (see Table 2-2).                                                                                              |                                                                                                                           |
| 5                                                                                                                                                                                                                                                                                                                                       | Record voltage readings of DVM and on front panel display.                                                                                  | Readings within specified High Voltage limits.                                                                            |
| <b>CV Load Effect</b><br>This test measures the change in output voltage resulting from a change in output current from full-load to no-load.                                                                                                                                                                                           |                                                                                                                                             |                                                                                                                           |
| 1                                                                                                                                                                                                                                                                                                                                       | Turn off the power supply and connect a DVM across +S and -S (see Fig. 2-1).                                                                |                                                                                                                           |
| 2                                                                                                                                                                                                                                                                                                                                       | Turn on the power supply and program the current to its maximum programmable value and the voltage to its full-scale value (see Table 2-2). |                                                                                                                           |
| 3                                                                                                                                                                                                                                                                                                                                       | Adjust the load to produce full-scale current (see Table 2-2) as shown on the front panel display.                                          | CV annunciator is on. If it is not, adjust the load to slightly reduce the output current until the annunciator comes on. |
| 4                                                                                                                                                                                                                                                                                                                                       | Record voltage reading of the DVM.                                                                                                          |                                                                                                                           |
| 5                                                                                                                                                                                                                                                                                                                                       | Adjust load to draw 0 amperes (open load). Record voltage reading of the DVM.                                                               |                                                                                                                           |
| 6                                                                                                                                                                                                                                                                                                                                       | Check test result.                                                                                                                          | The difference between the DVM readings in steps 4 and 5 are within the specified Load Effect limits.                     |
| <b>CV Source Effect</b><br>This test measures the change in output voltage resulting from a change in ac line voltage from its minimum to maximum value within the line voltage specifications.                                                                                                                                         |                                                                                                                                             |                                                                                                                           |
| 1                                                                                                                                                                                                                                                                                                                                       | Turn off the power supply and connect the ac power input through a variable-voltage transformer.                                            |                                                                                                                           |

**Table 2-4. Constant Voltage (CV) Tests (continued)**

|                                                                                                                                                                                                                                                                                     | Action                                                                                                                                                                                                                                         | Normal Result                                                                                                             |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|
| <b>CV Source Effect (cont)</b>                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                |                                                                                                                           |
| 2                                                                                                                                                                                                                                                                                   | Set the transformer to the nominal ac line voltage. Connect the DVM across +S and -S (see Fig. 2-1).                                                                                                                                           | CV annunciator is on. If it is not, adjust the load to slightly reduce the output current until the annunciator comes on. |
| 3                                                                                                                                                                                                                                                                                   | Turn on the power supply and program the current to its maximum programmable value and the voltage to its full-scale value (see Table 2-2).                                                                                                    |                                                                                                                           |
| 4                                                                                                                                                                                                                                                                                   | Adjust the load to produce full-scale current (see Table 2-2) as shown on the front panel display.                                                                                                                                             |                                                                                                                           |
| 5                                                                                                                                                                                                                                                                                   | Adjust the transformer to decrease the ac input voltage to the low- line condition (174Vac or 191Vac). Record the output voltage reading of the DVM.                                                                                           |                                                                                                                           |
| 6                                                                                                                                                                                                                                                                                   | Adjust the transformer to increase the ac input voltage to the high-line condition (220Vac or 250Vac). Record the output voltage reading on the DVM.                                                                                           |                                                                                                                           |
| 7                                                                                                                                                                                                                                                                                   | Check test result.                                                                                                                                                                                                                             | The difference between the DVM readings in steps 5 and 6 are within the specified Source Effect limits.                   |
| <b>CV Noise (PARD)</b>                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                |                                                                                                                           |
| Periodic and random deviations (PARD) in the output (ripple and noise) combine to produce a residual ac voltage superimposed on the dc output voltage. This test measures CV PARD, specified as the rms and peak-to-peak output voltages over the frequency range of 20Hz to 20MHz. |                                                                                                                                                                                                                                                |                                                                                                                           |
| 1                                                                                                                                                                                                                                                                                   | Turn off the power supply and connect an a-c coupled oscilloscope across the + and -output terminals (see Fig. 2-1). Set the oscilloscope bandwidth limit to 20MHz (30MHz for the Agilent 54504A) and use an RF tip on the oscilloscope probe. | CV annunciator is on. If it is not, adjust the load to slightly reduce the output current until the annunciator comes on. |
| 2                                                                                                                                                                                                                                                                                   | Turn on the power supply and program the current to its maximum programmable value and the voltage to its full-scale value (see Table 2-2).                                                                                                    |                                                                                                                           |
| 3                                                                                                                                                                                                                                                                                   | Adjust the load to produce full-scale current (see Table 2-2) as shown on the front panel display.                                                                                                                                             |                                                                                                                           |
| 4                                                                                                                                                                                                                                                                                   | Record the amplitude of the waveform.                                                                                                                                                                                                          | Amplitude is within the specified PARD Peak-to-Peak limits.                                                               |
| 5                                                                                                                                                                                                                                                                                   | Replace the oscilloscope connection with an ac rms voltmeter.                                                                                                                                                                                  | Amplitude is within the specified PARD rms limits.                                                                        |
| 6                                                                                                                                                                                                                                                                                   | Record the reading obtained in Step 5.                                                                                                                                                                                                         |                                                                                                                           |

**Table 2-4. Constant Voltage (CV) Tests (continued)**

|                                                                                                                                                                                                                                                                                                                                                                | Action                                                                                                                                                                                                                                                                                                                                                                              | Normal Result                                                                               |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| <p align="center"><b>Transient Recovery Time</b></p> <p>This test measures the time required for the output voltage to return to within 100mV of its final value following a 50% change in output load current. Measurements are made on both the unloading transient (from full load to 1/2 load) and the loading transient (from 1/2 load to full load).</p> |                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                             |
| 1                                                                                                                                                                                                                                                                                                                                                              | Turn off the power supply and connect an oscilloscope across +S and -S (see Fig. 2-1).                                                                                                                                                                                                                                                                                              | <p>See Fig. 2-2.</p> <p>Specified voltage level is reached within 900<math>\mu</math>s.</p> |
| 2                                                                                                                                                                                                                                                                                                                                                              | Turn on the power supply and program the current to its maximum programmable value and the voltage to its full-scale value (see Table 2-2).                                                                                                                                                                                                                                         |                                                                                             |
| 3                                                                                                                                                                                                                                                                                                                                                              | Program the Electronic Load as follows: <ul style="list-style-type: none"> <li>Operating mode to constant current.</li> <li>Input load current to 1/2 the supply's full rated output current.</li> <li>Transient current level to the supply's full rated output current.</li> <li>Transient generator frequency = 100Hz.</li> <li>Transient generator duty cycle = 50%.</li> </ul> |                                                                                             |
| 4                                                                                                                                                                                                                                                                                                                                                              | Turn on the transient and adjust the oscilloscope to display response waveform.                                                                                                                                                                                                                                                                                                     |                                                                                             |
| 5                                                                                                                                                                                                                                                                                                                                                              | Measure both the loading and unloading transients by triggering the oscilloscope on both the negative and positive slopes of the transient. Record the voltage level obtained at the 900- $\mu$ s interval.                                                                                                                                                                         |                                                                                             |

**Figure 2-2. Transient Response Waveform**

## Constant Current (CC) Tests

### Test Setup

Connect the appropriate current monitoring resistor (see Table 2-1) as shown in Fig. 2-3. The accuracy of the resistor must be as specified in the table.

### Test Procedures

The test procedures are given in Table 2-5. The tests are independent and may be performed in any order. The CC tests are:

- Current Programming and Readback Accuracy.
- CC Load Effect.
- CC Source Effect.
- CC Noise (PARD).

**Table 2-5. Constant Current (CC) Tests**

|                                                                                                                                                                                                                                                                     | Action                                                                                                                                      | Normal Result                                                                                                                                                             |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Current Programming and Readback Accuracy</b>                                                                                                                                                                                                                    |                                                                                                                                             |                                                                                                                                                                           |
| This test verifies that the current programming and readback are within specification.                                                                                                                                                                              |                                                                                                                                             |                                                                                                                                                                           |
| 1                                                                                                                                                                                                                                                                   | Turn off the power supply and connect the current monitoring resistor as shown in Fig. 2-3. Connect a DVM across the resistor .             | Value within specified Low Current limits.<br><br>Value within specified readback limits.<br><br>Both current readings within specified High Current and readback limits. |
| 2                                                                                                                                                                                                                                                                   | Turn on the power supply and program the output for 5 volts and 0 amperes.                                                                  |                                                                                                                                                                           |
| 3                                                                                                                                                                                                                                                                   | Short the load.                                                                                                                             |                                                                                                                                                                           |
| 4                                                                                                                                                                                                                                                                   | Observe the DVM voltage reading. Divide this by the resistance of the current monitor resistor. Record the result as the Low Current value. |                                                                                                                                                                           |
| 5                                                                                                                                                                                                                                                                   | Record the front panel display readback.                                                                                                    |                                                                                                                                                                           |
| 6                                                                                                                                                                                                                                                                   | Program output current to full scale (see Table 2-2).                                                                                       |                                                                                                                                                                           |
| 7                                                                                                                                                                                                                                                                   | Repeat Steps 4 and 5.                                                                                                                       |                                                                                                                                                                           |
| <b>CC Noise (PARD)</b>                                                                                                                                                                                                                                              |                                                                                                                                             |                                                                                                                                                                           |
| Periodic and random deviations (PARD) in the output (ripple and noise) combine to produce a residual ac current superimposed on the dc output current. This test measures CC PARD, specified as the rms output current over the frequency range of 20 Hz to 20 MHz. |                                                                                                                                             |                                                                                                                                                                           |
| 1                                                                                                                                                                                                                                                                   | Turn off the power supply and connect the current transformer, resistor, capacitor and rms voltmeter (see Fig. 2-4).                        |                                                                                                                                                                           |

**Table 2-5. Constant Current (CC) Tests (continued)**

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Action                                                                                                                                                                                                                     | Normal Result                                                                                                                                                                                    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CC Noise (PARD) (cont)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                            |                                                                                                                                                                                                  |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Measure the residual noise on the DVM with the power supply turned off. Noise generated by other equipment may affect this measurement and should be removed or factored out.                                              | The power supply output current should be at its full-scale value and the CC annunciator on. If it is not, adjust the load to slightly reduce the output voltage until the annunciator comes on. |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Turn on the power supply and program the current to its full scale value and the voltage to its maximum programmable value (see Table 2-2).                                                                                |                                                                                                                                                                                                  |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Adjust the load in the CV mode for full-scale voltage (see Table 2-2) as shown on the front panel display.                                                                                                                 |                                                                                                                                                                                                  |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Observe the reading on the rms voltmeter. Multiply rms voltage by 0.1 to obtain the rms noise current.                                                                                                                     | Current is within the specified PARD rms limits (see Table 2-6).                                                                                                                                 |
| <b>CC Load Effect</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                            |                                                                                                                                                                                                  |
| <p>This test measures the change in output current resulting from a change in load from full-load voltage to a short circuit. It is recommended that you use averaged readings for Steps 5 and 6 of this test (see Averaging AC Measurements at the end of this chapter).</p> <p><b>Note:</b> Refer to Figure 2-4. If you are using Agilent 60504B Eloads, a series DC power source is required to supply the minimum 3 volt input required by the Agilent 60504B Eloads. The series DC source must be capable of 3VDC at a current level greater than the output current of the supply being tested. A switch can be used in place of the series supply if the Eloads are used in place of a load resistor as shown in Fig. 2-4(b).</p> |                                                                                                                                                                                                                            |                                                                                                                                                                                                  |
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Turn off the power supply and connect a DVM across the current monitoring resistor (see Fig. 2-3).                                                                                                                         | Power supply output current is full scale and its CC annunciator is on. If not, reduce the Electronic Load voltage slightly until the annunciator comes on.                                      |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Turn on the power supply and program the current to its full scale value and the voltage to its maximum programmable value (see Table 2-2).                                                                                |                                                                                                                                                                                                  |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Set the Electronic Load to CV mode and its voltage to full scale as indicated on its front panel display. Set the series supply for 3VDC and a current greater than that being tested. Series source should be in CV mode. |                                                                                                                                                                                                  |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Observe the DVM reading. Divide this by the resistance of the current monitoring resistor to obtain the output current. Record the result.                                                                                 | You may want to use an averaged reading for this measurement.                                                                                                                                    |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Program the Electronic Load input to 3 volts or short the Electronic Load input and repeat Step 5.                                                                                                                         | You may want to use averaged reading for this measurement.                                                                                                                                       |
| 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Check the result.                                                                                                                                                                                                          | The difference between the current readings taken in Step 5 and Step 6 must be within specified "Load Effect" limits (see Table 2-2).                                                            |

**Table 2-5. Constant Current (CC) Tests (continued)**

|                                                                                                                                                                                                                                                                                                                                                                              | Action                                                                                                                                             | Normal Result                                                                                                                                                   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p align="center"><b>CC Source Effect</b></p> <p>This test measures the change in output current resulting from a change in ac line voltage from its minimum to its maximum value within the line voltage specifications. It is recommended that you use averaged readings for Steps 6 and 8 of this test (see "Averaging AC Measurements" at the end of this chapter) .</p> |                                                                                                                                                    |                                                                                                                                                                 |
| 1                                                                                                                                                                                                                                                                                                                                                                            | Turn off the power supply and connect the ac power input through a variable-voltage transformer.                                                   | The power supply output current is full scale and its CC annunciator is on. If not, reduce the Electronic Load voltage slightly until the annunciator comes on. |
| 2                                                                                                                                                                                                                                                                                                                                                                            | Set the transformer to the nominal ac line voltage. Connect the DVM across the current monitoring resistor (see Fig. 2-3).                         |                                                                                                                                                                 |
| 3                                                                                                                                                                                                                                                                                                                                                                            | Turn on the power supply and program the current to its full-scale value and the voltage to its maximum programmable value (see Table 2-2).        |                                                                                                                                                                 |
| 4                                                                                                                                                                                                                                                                                                                                                                            | Set the Electronic Load to CV mode and its voltage to full scale.                                                                                  |                                                                                                                                                                 |
| 5                                                                                                                                                                                                                                                                                                                                                                            | Adjust the transformer to decrease the ac input voltage to the low-line condition (180Vac or 360Vac).                                              |                                                                                                                                                                 |
| 6                                                                                                                                                                                                                                                                                                                                                                            | Observe the DVM reading. Divide this voltage by the resistance of the current monitoring resistor to obtain the output current. Record the result. | You may want to use an averaged reading for this measurement.                                                                                                   |
| 7                                                                                                                                                                                                                                                                                                                                                                            | Adjust the transformer to increase the ac input voltage to the high-line condition (235Vac or 440Vac).                                             | You may want to use an averaged reading for this measurement.                                                                                                   |
| 8                                                                                                                                                                                                                                                                                                                                                                            | Observe the DVM reading. Divide this voltage by the resistance of the current monitoring resistor to obtain the output current. Record the result. |                                                                                                                                                                 |
| 9                                                                                                                                                                                                                                                                                                                                                                            | Check the test result.                                                                                                                             |                                                                                                                                                                 |
|                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                    | The difference between the current readings found in Step 6 and Step 8 is within the specified current Source Effect limits.                                    |

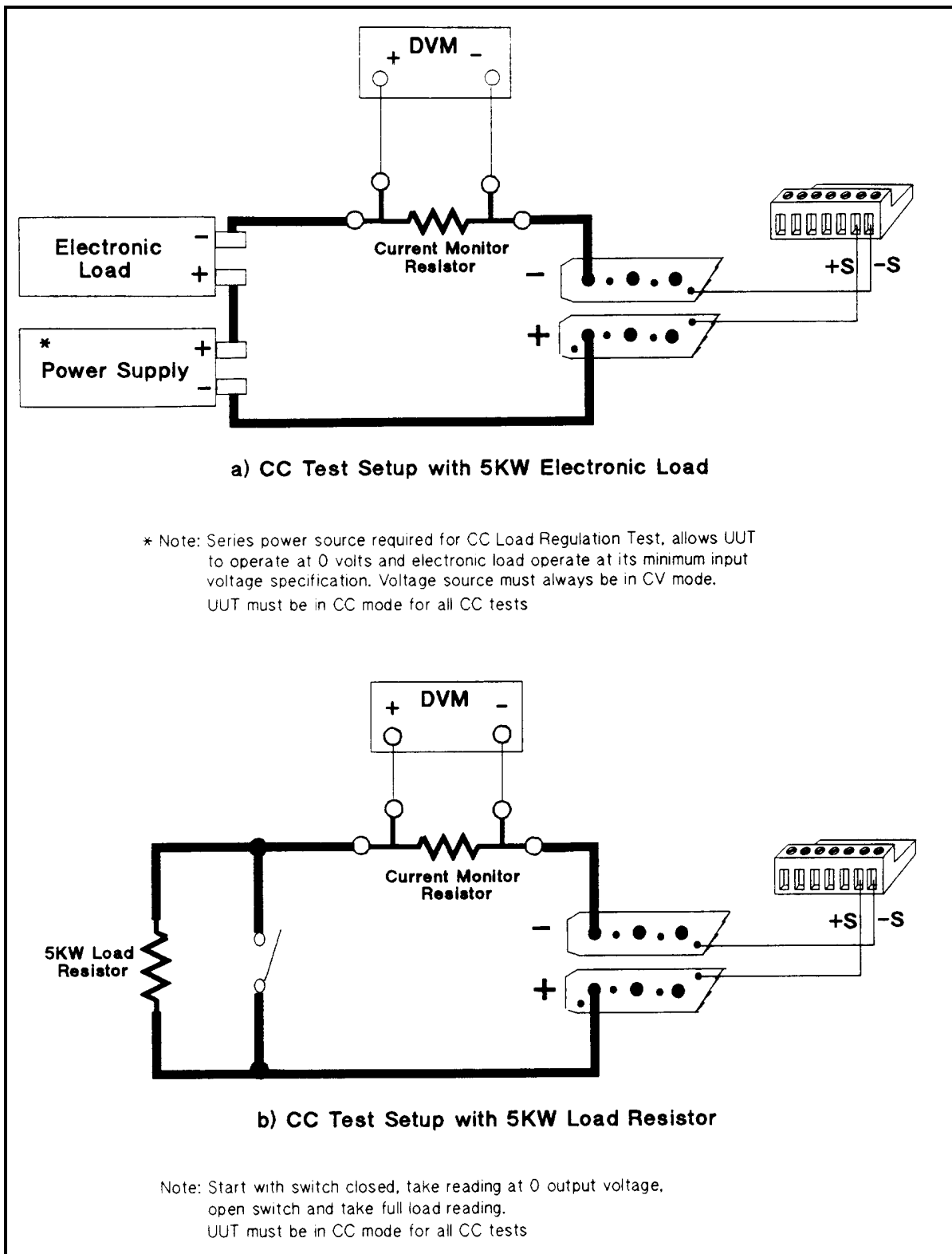
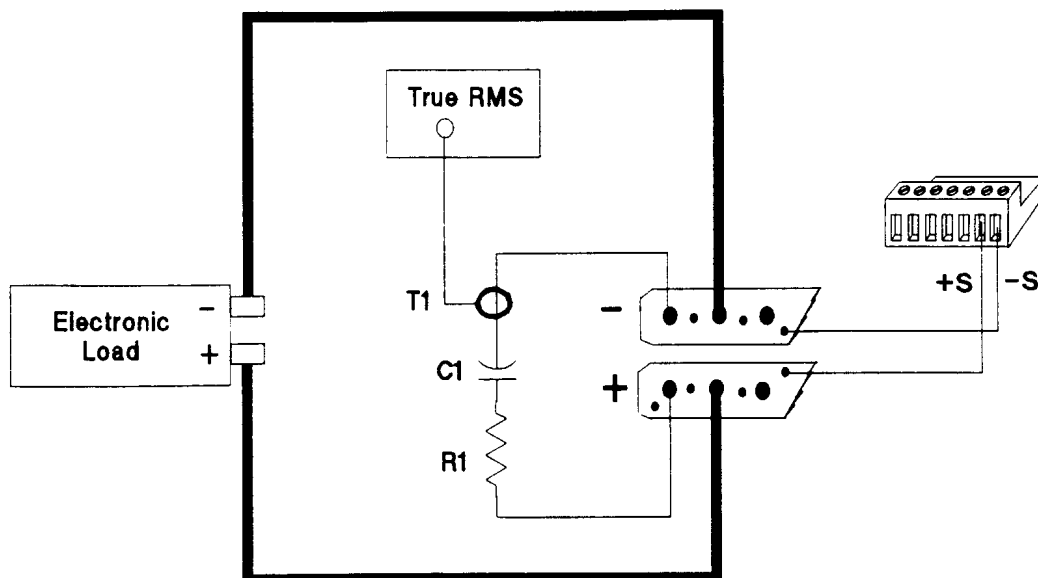


Figure 2-3. CC Load Effect Test Setup



|       | R1             | C1              | R1 / C1 construction                                         |
|-------|----------------|-----------------|--------------------------------------------------------------|
| 6680A | 4.0 milliohms  | 132,000 $\mu$ F | 4 * 33,000 $\mu$ F ( 0180-4516 ) + 2 ea. 7 inch 12 AWG leads |
| 6681A | 6.0 milliohms  | 88,000 $\mu$ F  | 4 * 22,000 $\mu$ F ( 0180-4532 ) + 2 ea. 7 inch 14 AWG leads |
| 6682A | 4.42 milliohms | 36,000 $\mu$ F  | 5 * 7200 $\mu$ F ( 0180-4597 ) + 2 ea. 8 inch 10 AWG leads   |
| 6683A | 6.12 milliohms | 26,000 $\mu$ F  | 2 * 13,000 $\mu$ F ( 0180-4596 ) + 2 ea. 6 inch 10 AWG leads |
| 6684A | 11.1 milliohms | 14,400 $\mu$ F  | 2 * 7200 $\mu$ F ( 0180-4597 ) + 2 ea. 11 inch 14 AWG leads  |

1. T1 = Pearson Type 411 ( see Table 2-1 ).
2. R1 = ESR of capacitor + wire lead resistance.
3. Parallel capacitor connections should be made with copper sheet and wire leads should be soldered to copper sheet to reduce series resistance.
4. Fixed load resistor may be used in place of electronic load.
5. Electronic load consists of: 11-60504Bs in CC mode and 1-60504B in CR mode for the 6680A / 6681A.  
12-60504Bs in CR mode for the 6682A / 6683A / 6684A.

**Figure 2-4. CC rms Noise Test Setup**

## Averaging the CC Measurements

The CC Load Effect and CC Source Effect tests measure the dc regulation of the power supply's output current. When doing these tests, you must be sure that the readings taken are truly dc regulation values and not instantaneous ac peaks of the output current ripple. You can do this by making each measurement several times and then using the average of the measurements as your test value. Voltmeters such as the Agilent 3458A System Voltmeter can be programmed to take just such statistical average readings as required by these tests.

The following steps show how to set up the voltmeter from its front panel to take a statistical average of 100 readings.

 represents the unlabeled shift key in the FUNCTION/RANGE group.

1. Program 10 power line cycles per sample by pressing **NPLC** **1** **0** **Enter**.
2. Program 100 samples per trigger by pressing **N Rds/Trig** **1** **0** **0** **Enter**.
3. Set up voltmeter to take measurements in the statistical mode as follows:
  - a. Press  **f0**  **N**.
  - b. Press **▲** until MATH function is selected, then press **▶**.
  - c. Press **▲** until STAT function is selected, then press **Enter**.
4. Now set up voltmeter to read the average of the measurements as follows:
  - a. Press  **f1**  **N**.
  - b. Press **▼** until RMATH function is selected, then press **Enter**.
  - c. Press **▲** until MEAN function is selected, then press **Enter**.
5. Execute the average reading program by pressing **f0** **Enter** **TRIG** **Enter**.
6. Wait for 100 readings and then read the average measurement by pressing **f1** **Enter**.

Record this as your result.

### Table 2-6. Performance Test Record Form

Test Facility:

Model

Serial No.

Options

Firmware Revision

Report No.

Date

Customer

Tested By

Ambient Temperature (°C)

Relative Humidity (%)

Nominal Line Frequency (Hz)

Special Notes:

Test Equipment Used:

| Description                 | Model No. | Trace No. | Cal. Due Date |
|-----------------------------|-----------|-----------|---------------|
| 1. AC Source                |           |           |               |
| 2. DC Voltmeter             |           |           |               |
| 3. RMS Voltmeter            |           |           |               |
| 4. Oscilloscope             |           |           |               |
| 5. Electronic Load          |           |           |               |
| 6. Current Monitoring Shunt |           |           |               |

Table 2-7. Performance Test Record for Agilent Model 6680A

|                                                           |                            |           |                            |                         |
|-----------------------------------------------------------|----------------------------|-----------|----------------------------|-------------------------|
| MODEL Agilent _____                                       | Report No. _____           |           | Date _____                 |                         |
| Test Description                                          | Minimum Spec.              | Results * | Maximum Spec.              | Measurement Uncertainty |
| <b>Constant Voltage Tests</b>                             |                            |           |                            |                         |
| <b>Voltage Programming and Readback</b>                   |                            |           |                            |                         |
| Low Voltage (0V) $V_{out}$                                | -5mV                       | _____ mV  | +5mV                       | 1.6 $\mu$ V             |
| Front Panel Display Readback                              | $V_{out} - 7.5\text{mV}$   | _____ mV  | $V_{out} + 7.5\text{mV}$   | 1.6 $\mu$ V             |
| High Voltage (5V) $V_{out}$                               | 4.993V                     | _____ V   | 5.007V                     | 56 $\mu$ V              |
| Front Panel Display Readback                              | $V_{out} - 10\text{mV}$    | _____ mV  | $V_{out} + 10\text{mV}$    | 56 $\mu$ V              |
| <b>Load Effect</b>                                        | $V_{out} - 0.3\text{mV}$   | _____ mV  | $V_{out} + 0.3\text{mV}$   | 750 nV                  |
| <b>Source Effect</b>                                      | $V_{out} - 0.3\text{mV}$   | _____ mV  | $V_{out} + 0.3\text{mV}$   | 750 nV                  |
| <b>PARD (Ripple and Noise)</b>                            |                            |           |                            |                         |
| Peak-to-Peak                                              | 0                          | _____ mV  | 10mV                       | 904 $\mu$ V             |
| RMS                                                       | 0                          | _____ mV  | 1.5mV                      | 150 $\mu$ V             |
| <b>Transient Response Time (at 900 <math>\mu</math>s)</b> | 0                          | _____ mV  | 150mV                      | 23mV                    |
| <b>Constant Current Tests</b>                             |                            |           |                            |                         |
| <b>Current Programming and Readback</b>                   |                            |           |                            |                         |
| Low Current (0A) $I_{out}$                                | -450mA                     | _____ mA  | +450mA                     | 15 $\mu$ A              |
| Front Panel Display Readback                              | $I_{out} - 600\text{mA}$   | _____ mA  | $I_{out} + 600\text{mA}$   | 15 $\mu$ A              |
| High Current (875A) $I_{out}$                             | 873.675A                   | _____ A   | +876.325A                  | 462mA                   |
| Front Panel Display Readback                              | $I_{out} - 1.475\text{mA}$ | _____ mA  | $I_{out} + 1.475\text{mA}$ | 462mA                   |
| <b>PARD (Ripple and Noise)</b>                            | 0                          | _____ mA  | 290mA                      | 3.8mA                   |
| RMS                                                       |                            |           |                            |                         |
| <b>Load Effect</b>                                        | $I_{out} - 108\text{mA}$   | _____ mA  | $I_{out} + 108\text{mA}$   | 937 $\mu$ A             |
| <b>Source Effect</b>                                      | $I_{out} - 108\text{mA}$   | _____ mA  | $I_{out} + 108\text{mA}$   | 937 $\mu$ A             |
| *Enter your test results in this column.                  |                            |           |                            |                         |

Table 2-7. Performance Test Record for Agilent Model 6681A

| MODEL Agilent _____                                       | Report No. _____  |           | Date _____        |                         |
|-----------------------------------------------------------|-------------------|-----------|-------------------|-------------------------|
| Test Description                                          | Minimum Spec.     | Results * | Maximum Spec.     | Measurement Uncertainty |
| <b>Constant Voltage Tests</b>                             |                   |           |                   |                         |
| <b>Voltage Programming and Readback</b>                   |                   |           |                   |                         |
| Low Voltage (0V) $V_{out}$                                | -8mV              | _____ mV  | +8mV              | 1.6 $\mu$ V             |
| Front Panel Display Readback                              | $V_{out}$ - 12mV  | _____ mV  | $V_{out}$ + 12mV  | 1.6 $\mu$ V             |
| High Voltage (8V) $V_{out}$                               | 7.988V            | _____ V   | 8.011V            | 88 $\mu$ V              |
| Front Panel Display Readback                              | $V_{out}$ - 16mV  | _____ mV  | $V_{out}$ + 16mV  | 88 $\mu$ V              |
| <b>Load Effect</b>                                        | $V_{out}$ - 0.5mV | _____ mV  | $V_{out}$ + 0.5mV | 900 nV                  |
| <b>Source Effect</b>                                      | $V_{out}$ - 0.5mV | _____ mV  | $V_{out}$ + 0.5mV | 900 nV                  |
| <b>PARD (Ripple and Noise)</b>                            |                   |           |                   |                         |
| Peak-to-Peak                                              | 0                 | _____ mV  | 10mV              | 904 $\mu$ V             |
| RMS                                                       | 0                 | _____ mV  | 1.5 mV            | 150 $\mu$ V             |
| <b>Transient Response Time (at 900 <math>\mu</math>s)</b> | 0                 | _____ mV  | 150mV             | 23mV                    |
| <b>Constant Current Tests</b>                             |                   |           |                   |                         |
| <b>Current Programming and Readback</b>                   |                   |           |                   |                         |
| Low Current (0A) $I_{out}$                                | -300mA            | _____ mA  | +300mA            | 15mA                    |
| Front Panel Display Readback                              | $I_{out}$ -400mA  | _____ mA  | $I_{out}$ +400mA  | 15mA                    |
| High Current (580A) $I_{out}$                             | 579.120A          | _____ A   | +580.880A         | 311mA                   |
| Front Panel Display Readback                              | $I_{out}$ -980mA  | _____ A   | $I_{out}$ + 980mA | 311mA                   |
| <b>PARD (Ripple and Noise)</b>                            |                   |           |                   |                         |
| RMS                                                       | 0                 | _____ mA  | 190mA             | 3.8mA                   |
| <b>Load Effect</b>                                        | $I_{out}$ - 69mA  | _____ mA  | $I_{out}$ +69mA   | 790 $\mu$ A             |
| <b>Source Effect</b>                                      | $I_{out}$ - 69mA  | _____ mA  | $I_{out}$ + 69mA  | 790 $\mu$ A             |
| *Enter your test results in this column.                  |                   |           |                   |                         |

Table 2-7. Performance Test Record for Agilent Model 6682A

| MODEL Agilent _____                                       | Report No. _____  |           | Date _____        |                         |
|-----------------------------------------------------------|-------------------|-----------|-------------------|-------------------------|
| Test Description                                          | Minimum Spec.     | Results * | Maximum Spec.     | Measurement Uncertainty |
| <b>Constant Voltage Tests</b>                             |                   |           |                   |                         |
| <b>Voltage Programming and Readback</b>                   |                   |           |                   |                         |
| Low Voltage (0V) $V_{out}$                                | -21mV             | _____ mV  | +21mV             | 1.7 $\mu$ V             |
| Front Panel Display Readback                              | $V_{out}$ - 32mV  | _____ mV  | $V_{out}$ + 32mV  | 1.7 $\mu$ V             |
| High Voltage (21V) $V_{out}$                              | 20.970V           | _____ V   | 21.029V           | 347 $\mu$ V             |
| Front Panel Display Readback                              | $V_{out}$ -42mV   | _____ mV  | $V_{out}$ + 42mV  | 347 $\mu$ V             |
| <b>Load Effect</b>                                        | $V_{out}$ - 1mV   | _____ mV  | $V_{out}$ + 1mV   | 20 $\mu$ V              |
| <b>Source Effect</b>                                      | $V_{out}$ - 1mV   | _____ mV  | $V_{out}$ +1mV    | 20 $\mu$ V              |
| <b>PARD (Ripple and Noise)</b>                            |                   |           |                   |                         |
| Peak-to-Peak                                              | 0                 | _____ mV  | 10mV              | 904 $\mu$ V             |
| RMS                                                       | 0                 | _____ mV  | 1.75 mV           | 150 $\mu$ V             |
| <b>Transient Response Time (at 900 <math>\mu</math>s)</b> | 0                 | _____ mV  | 150mV             | 23 $\mu$ V              |
| <b>Constant Current Tests</b>                             |                   |           |                   |                         |
| <b>Current Programming and Readback</b>                   |                   |           |                   |                         |
| Low Current (0A) $I_{out}$                                | -125mA            | _____ mA  | +125mA            | 1.5mA                   |
| Front Panel Display Readback                              | $I_{out}$ - 165mA | _____ mA  | $I_{out}$ + 165mA | 1.5mA                   |
| High Current (240A) $I_{out}$                             | 239.635A          | _____ A   | +240.365A         | 84mA                    |
| Front Panel Display Readback                              | $I_{out}$ - 405mA | _____ mA  | $I_{out}$ + 405mA | 84mA                    |
| <b>PARD (Ripple and Noise)</b>                            |                   |           |                   |                         |
| RMS                                                       | 0                 | _____ mA  | 80mA              | 0.8mA                   |
| <b>Load Effect</b>                                        | $I_{out}$ - 24mA  | _____ mA  | $I_{out}$ + 24mA  | 172 $\mu$ A             |
| <b>Source Effect</b>                                      | $I_{out}$ - 24mA  | _____ mA  | $I_{out}$ + 24mA  | 172 $\mu$ A             |
| *Enter your test results in this column.                  |                   |           |                   |                         |

Table 2-7. Performance Test Record for Agilent Model 6683A

|                                                           |                   |           |                   |                         |
|-----------------------------------------------------------|-------------------|-----------|-------------------|-------------------------|
| MODEL Agilent _____                                       | Report No. _____  |           | Date _____        |                         |
| Test Description                                          | Minimum Spec.     | Results * | Maximum Spec.     | Measurement Uncertainty |
| <b>Constant Voltage Tests</b>                             |                   |           |                   |                         |
| <b>Voltage Programming and Readback</b>                   |                   |           |                   |                         |
| Low Voltage (0V) $V_{out}$                                | -32mV             | _____ mV  | +32mV             | 1.9 $\mu$ V             |
| Front Panel Display Readback                              | $V_{out}$ - 48mV  | _____ mV  | $V_{out}$ + 48mV  | 1.9 $\mu$ V             |
| High Voltage (32V) $V_{out}$                              | 31.995V           | _____ V   | 32.044V           | 488 $\mu$ V             |
| Front Panel Display Readback                              | $V_{out}$ - 64mV  | _____ mV  | $V_{out}$ + 64mV  | 488 $\mu$ V             |
| <b>Load Effect</b>                                        | $V_{out}$ - 1.7mV | _____ mV  | $V_{out}$ + 1.7mV | 26 $\mu$ V              |
| <b>Source Effect</b>                                      | $V_{out}$ - 1.7mV | _____ mV  | $V_{out}$ + 1.7mV | 26 $\mu$ V              |
| <b>PARD (Ripple and Noise)</b>                            |                   |           |                   |                         |
| Peak-to-Peak                                              | 0                 | _____ mV  | 10mV              | 904 $\mu$ V             |
| RMS                                                       | 0                 | _____ mV  | 2.0mV             | 150 $\mu$ V             |
| <b>Transient Response Time (at 900 <math>\mu</math>s)</b> | 0                 | _____ mV  | 150mV             | 23 $\mu$ V              |
| <b>Constant Current Tests</b>                             |                   |           |                   |                         |
| <b>Current Programming and Readback</b>                   |                   |           |                   |                         |
| Low Current (0A) $I_{out}$                                | -85mA             | _____ mA  | +85mA             | 1.5mA                   |
| Front Panel Display Readback                              | $I_{out}$ - 110mA | _____ mA  | $I_{out}$ + 110mA | 1.5mA                   |
| High Current (160A) $I_{out}$                             | 159.755A          | _____ A   | +160.245A         | 36mA                    |
| Front Panel Display Readback                              | $I_{out}$ - 270mA | _____ mA  | $I_{out}$ + 270mA | 36mA                    |
| <b>PARD (Ripple and Noise)</b>                            | 0                 | _____ mA  | 55mA              | 0.56mA                  |
| RMS                                                       |                   |           |                   |                         |
| <b>Load Effect</b>                                        | $I_{out}$ - 18mA  | _____ mA  | $I_{out}$ + 18mA  | 148 $\mu$ A             |
| <b>Source Effect</b>                                      | $I_{out}$ - 18mA  | _____ mA  | $I_{out}$ + 18mA  | 148 $\mu$ A             |
| *Enter your test results in this column.                  |                   |           |                   |                         |

Table 2-7. Performance Test Record for Agilent Model 6684A

| MODEL Agilent _____                                       | Report No. _____  |           | Date _____        |                         |
|-----------------------------------------------------------|-------------------|-----------|-------------------|-------------------------|
| Test Description                                          | Minimum Spec.     | Results * | Maximum Spec.     | Measurement Uncertainty |
| <b>Constant Voltage Tests</b>                             |                   |           |                   |                         |
| <b>Voltage Programming and Readback</b>                   |                   |           |                   |                         |
| Low Voltage (0V) $V_{out}$                                | -40mV             | _____ mV  | +40mV             | 2 $\mu$ V               |
| Front Panel Display Readback                              | $V_{out} - 60mV$  | _____ mV  | $V_{out} + 60mV$  | 2 $\mu$ V               |
| High Voltage (40V) $V_{out}$                              | 39.944V           | _____ V   | 40.056V           | 590 $\mu$ V             |
| Front Panel Display Readback                              | $V_{out} - 80mV$  | _____ mV  | $V_{out} + 80mV$  | 590 $\mu$ V             |
| <b>Load Effect</b>                                        | $V_{out} - 2.3mV$ | _____ mV  | $V_{out} + 2.3mV$ | 30 $\mu$ V              |
| <b>Source Effect</b>                                      | $V_{out} - 2.3mV$ | _____ mV  | $V_{out} + 2.3mV$ | 30 $\mu$ V              |
| <b>PARD (Ripple and Noise)</b>                            |                   |           |                   |                         |
| Peak-to-Peak                                              | 0                 | _____ mV  | 10mV              | 904 $\mu$ V             |
| RMS                                                       | 0                 | _____ mV  | 2.5mV             | 150 $\mu$ V             |
| <b>Transient Response Time (at 900 <math>\mu</math>s)</b> | 0                 | _____ mV  | 150mV             | 23 $\mu$ V              |
| <b>Constant Current Tests</b>                             |                   |           |                   |                         |
| <b>Current Programming and Readback</b>                   |                   |           |                   |                         |
| Low Current (0A) $I_{out}$                                | -65mA             | _____ mA  | +65mA             | 1.5mA                   |
| Front Panel Display Readback                              | $I_{out} - 90mA$  | _____ mA  | $I_{out} + 90mA$  | 1.5mA                   |
| High Current (128A) $I_{out}$                             | 127.807A          | _____ A   | +128.193A         | 24mA                    |
| Front Panel Display Readback                              | $I_{out} - 218mA$ | _____ mA  | $I_{out} + 218mA$ | 24mA                    |
| <b>PARD (Ripple and Noise)</b>                            | 0                 | _____ mA  | 45mA              | 0.23mA                  |
| RMS                                                       |                   |           |                   |                         |
| <b>Load Effect</b>                                        | $I_{out} - 15mA$  | _____ mA  | $I_{out} + 15mA$  | 138mA                   |
| <b>Source Effect</b>                                      | $I_{out} - 15mA$  | _____ mA  | $I_{out} + 15mA$  | 138mA                   |
| *Enter your test results in this column.                  |                   |           |                   |                         |

## Troubleshooting

**WARNING**

**Shock Hazard:** Most of the procedures in this chapter must be performed with power applied and protective covers removed. These procedures should be done only by trained service personnel aware of the hazard from electrical shock.

**CAUTION**

This instrument uses components that can be damaged or suffer serious performance degradation due to ESD (electrostatic discharge). Observe standard antistatic precautions to avoid damage to the components (see Chapter 1).

### Introduction

#### Localizing the Problem

This chapter provides troubleshooting and repair information for the power supply. Before beginning troubleshooting procedures, make certain the problem is in the power supply and not with an associated circuit, the GPIB controller (for GPIB system power supplies), or ac input line. Without removing the covers, you can use the Verification tests in Chapter 2 to determine if the power supply is operating normally.

#### Chapter Organization

The information in this chapter is organized as follows:

| Topic                      | Information Given                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Equipment Required    | Equipment required for completing all the tests in this chapter.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Troubleshooting Procedures | <p>A series of flow charts for systematic location of defective boards, circuits, and components. An explanation of the error codes and messages generated during the power-on selftest. Signature analysis techniques for troubleshooting the digital circuits on the front panel, primary GPIB, and secondary interface circuits. Specific paragraphs for:</p> <ul style="list-style-type: none"> <li>• Checking the bias and reference supplies.</li> <li>• Troubleshooting the CV/CC status annunciators.</li> <li>• Troubleshooting the A3 FET board.</li> </ul> |
| Post-Repair Adjustments    | Calibration and EEPROM initialization procedures required after the replacement of certain critical components.                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Disassembly Procedures     | Gaining access to and/or replacing components.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

## Test Equipment Required

**Table 3-1. Test Equipment Required**

| Equipment             | Purpose                                                               | Recommended Model                                                                              |
|-----------------------|-----------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| Logic Probe           | To check states of data lines.                                        | Agilent 545A                                                                                   |
| Test Clips            | To gain access to IC pins.                                            | AP Products No. LTC                                                                            |
| Ammeter/Current Shunt | To measure output current.                                            | Agilent 6680A & 6681A:<br>Burstner 1280<br>Agilent 6682A, 6683A & 6684A:<br>Guildline 9230/300 |
| Oscilloscope          | To check waveforms and signal levels.                                 | Agilent 54504A                                                                                 |
| Signature Analyzer    | To troubleshoot most of the primary and secondary interface circuits. | Agilent 5005A/B                                                                                |
| GPIB Controller       | To communicate with power supply via the GPIB (for system units).     | Agilent BASIC series                                                                           |
| DC Voltmeter          | To measure output voltage and current, bias and references.           | Agilent 3458A                                                                                  |

## Troubleshooting Procedures

### Power-On Selftest

#### Description

The procedures in the troubleshooting charts make use of the power-on selftest. The power-on selftest tests the front panel, GPIB interface (for GPIB system power supplies), and secondary interface circuits. If the power supply fails the selftest, the output remains disabled (turned off) and the front panel normally displays an error code or message (see Table 3-2). The message is displayed indefinitely and the power supply will not accept GPIB or front panel commands.

#### Disabling The Power-On Selftest

In order to perform troubleshooting procedures that require programming of the power supply, you must disable the power-on self test. Do this as follows:

1. Turn off the power supply.
2. Hold down the **7** key and turn on the supply.
3. Continue holding down the **7** for 2 seconds and wait until the **PWR ON INIT** indicator goes off.
4. The power supply is now on without executing power-on selftest.

#### Using the \*TST? Query (GPIB Systems Supplies Only)

You can get the power supply to execute a partial selftest by sending it the GPIB **\*TST?** query command. Table 3-2 shows the tests that are performed in response to this command. These tests do not interfere with normal operation or cause the output to change. The command returns a value of "0" if all tests pass. Otherwise, the command returns the error code of the first test that failed. No error codes are displayed on the front panel and the power supply will attempt to continue normal operation.

**Table 3-2. Selftest Error Codes/Messages**

| <b>Code and/or Message</b>                                                                                                                     | <b>Description</b>                                                    | <b>Probable Cause Selftest Error Codes/Messages</b>                                                                                                                                                                                                        |
|------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| E1 FP RAM                                                                                                                                      | Front panel RAM test failed (power-on).                               | Microprocessor AIU3                                                                                                                                                                                                                                        |
| E2 FP ROM                                                                                                                                      | Front panel ROM test failed (power-on and *TST?).                     | ROM AIU4 or address latches AIU8                                                                                                                                                                                                                           |
| E3 EE CHKSM                                                                                                                                    | Front panel EEPROM checksum test failed (power-on and *TST?).         | Possibly due to power loss during a write operation. See Checksum Errors in Chapter 3 of Operating Manual. If power loss is not the problem, EEPROM AIU6 could be defective. (If you replace AIU6, the power supply must be reinitialized and calibrated.) |
| E4 PRI XRAM                                                                                                                                    | Primary interface external RAM test failed (power-on).                | RAM A2U108                                                                                                                                                                                                                                                 |
| E5 PRI IRAM                                                                                                                                    | Primary interface internal RAM test failed (power-on).                | Microprocessor A2U114                                                                                                                                                                                                                                      |
| E6 PRI ROM                                                                                                                                     | Primary interface ROM test failed (power-on and *TST?).               | ROM A2U106                                                                                                                                                                                                                                                 |
| E7 GPIB                                                                                                                                        | GPIB interface test failed (power-on).                                | Talker/listener A2U117                                                                                                                                                                                                                                     |
| E8 SEC RAM                                                                                                                                     | Secondary interface RAM test failed (power-on).                       | Microprocessor AI0U506                                                                                                                                                                                                                                     |
| E9 SEC ROM                                                                                                                                     | Secondary interface ROM test failed (power-on and *TST?).             | Microprocessor AI0U506                                                                                                                                                                                                                                     |
| E10 SEC 5V                                                                                                                                     | Secondary interface 5 volt readback test failed (power-on and *TST?). | Comparators AI0U516, AI0U517 readback DAC AI0U512/U515, or secondary bias supply (5Vs A4U304)                                                                                                                                                              |
| E11 TEMP                                                                                                                                       | Ambient temperature readback test failed (power-on and *TST?).        | Thermistor AI0RT500 or comparator AI0U517                                                                                                                                                                                                                  |
| E12 DACS                                                                                                                                       | CV or CC DAC tests failed (power-on).                                 | CV DAC AI0U510/U513 or CC DAC AI0U511/U514 (see Figure 3-7).                                                                                                                                                                                               |
| <b>NOTE:</b> The following error messages can appear due to a failure occurring either while the power supply is operating or during selftest. |                                                                       |                                                                                                                                                                                                                                                            |
| SERIAL TIMOUT                                                                                                                                  | Serial data line failure on A2 board.                                 | See Figure 3-10 (system) or Figure 3-11 (bench).                                                                                                                                                                                                           |
| SERIAL DOWN                                                                                                                                    | Serial data line failure on A2 board.                                 | See Figure 3-10 (system) or Figure 3-11 (bench).                                                                                                                                                                                                           |
| UART PARITY                                                                                                                                    | UART failed.                                                          | UART A2U112                                                                                                                                                                                                                                                |
| UART FRAMING                                                                                                                                   | UART failed.                                                          | UART A2U112                                                                                                                                                                                                                                                |
| UART OVERRUN                                                                                                                                   | UART failed.                                                          | UART A2U112                                                                                                                                                                                                                                                |
| SBUF OVERRUN                                                                                                                                   | Serial buffer failure UART.                                           | UART A2U112 defective or GPIB board is in SA mode                                                                                                                                                                                                          |
| SBUF FULL                                                                                                                                      | Serial buffer failure.                                                | UART A2U112 defective or GPIB board is in SA mode                                                                                                                                                                                                          |
| EE WRITE ERR                                                                                                                                   | EEPROM write failure.                                                 | EEPROM AIU6 defective or calibration error                                                                                                                                                                                                                 |
| SECONDARY DN                                                                                                                                   | Serial data line failure on Main board.                               | See Figure 3-12.                                                                                                                                                                                                                                           |

## Troubleshooting Charts

Figure 3-1 gives overall troubleshooting procedures to isolate the fault to a circuit board or particular circuit (see Figure 3-20 for the location of the circuit boards). These procedures include the use of power-on selftest (Table 3-2) and signature analysis techniques (Table 3-5 through Table 3-7). Some results of Figure 3-1 lead to more detailed troubleshooting charts that guide you to specific components. The troubleshooting charts are organized as follows:

| Chart       | Trouble or Circuit                                                                                                                                                                                    |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Figure 3-1  | Overall procedure checks selftest errors, calibration errors, ac input circuit, fan, readback circuits, A10 Control Board, GPIB cable, digital port, serial link, rotary controls, current amplifier. |
| Figure 3-2  | No display (from Figure 3-1).                                                                                                                                                                         |
| Figure 3-3  | OV circuit not firing (from Figure 3-1).                                                                                                                                                              |
| Figure 3-4  | OV circuit is on at turn on (from Figure 3-1).                                                                                                                                                        |
| Figure 3-5  | Output level is held low (from Figure 3-1).                                                                                                                                                           |
| Figure 3-6  | Output level is held high (from Figure 3-1).                                                                                                                                                          |
| Figure 3-7  | DAC circuits (from Figure 3-1).                                                                                                                                                                       |
| Figure 3-8  | DAC test waveforms.                                                                                                                                                                                   |
| Figure 3-9  | CV and CC DAC and amplifiers (from Figure 3-1).                                                                                                                                                       |
| Figure 3-10 | Serial Down circuit (from Figure 3-1).                                                                                                                                                                |
| Figure 3-11 | Secondary interface circuit (from Figure 3-1).                                                                                                                                                        |
| Figure 3-12 | Slow downprogramming circuit (from Figure 3-1).                                                                                                                                                       |

## Troubleshooting Test Points

The troubleshooting charts reference test points listed in Table 6-3 of Chapter 6. Test points are identified by an encircled number (such as ⑤ in schematic diagrams and component location drawings, also in Chapter 6).

## Bias and Reference Supplies

Many of the following troubleshooting procedures begin by checking the bias and/or reference voltages. Table 6-3 lists the test points for these voltages and gives the correct reading for each. The circuit board component location diagrams identify these points on each board.

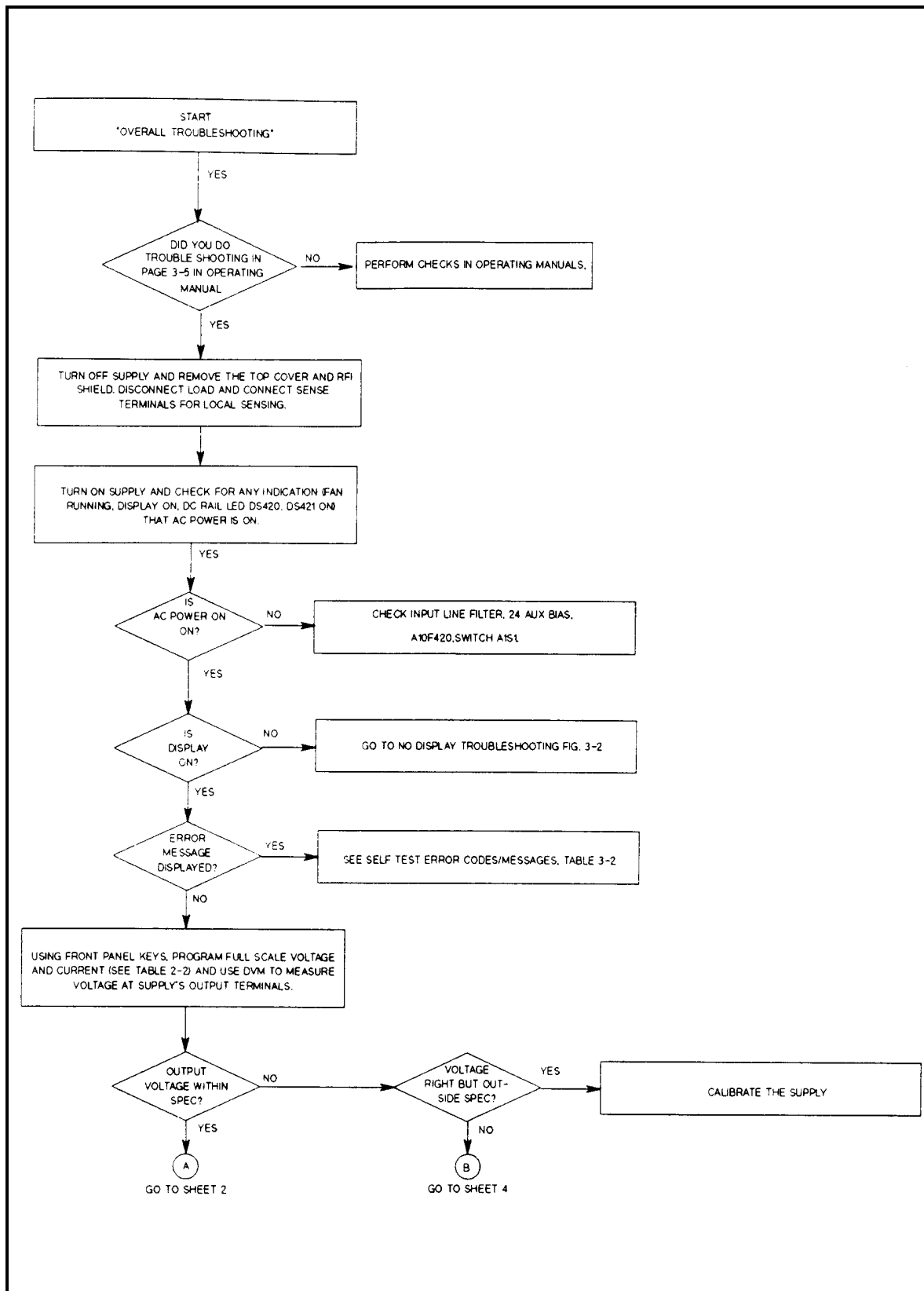


Figure 3-1. Overall Troubleshooting (Sheet 1 of 4)

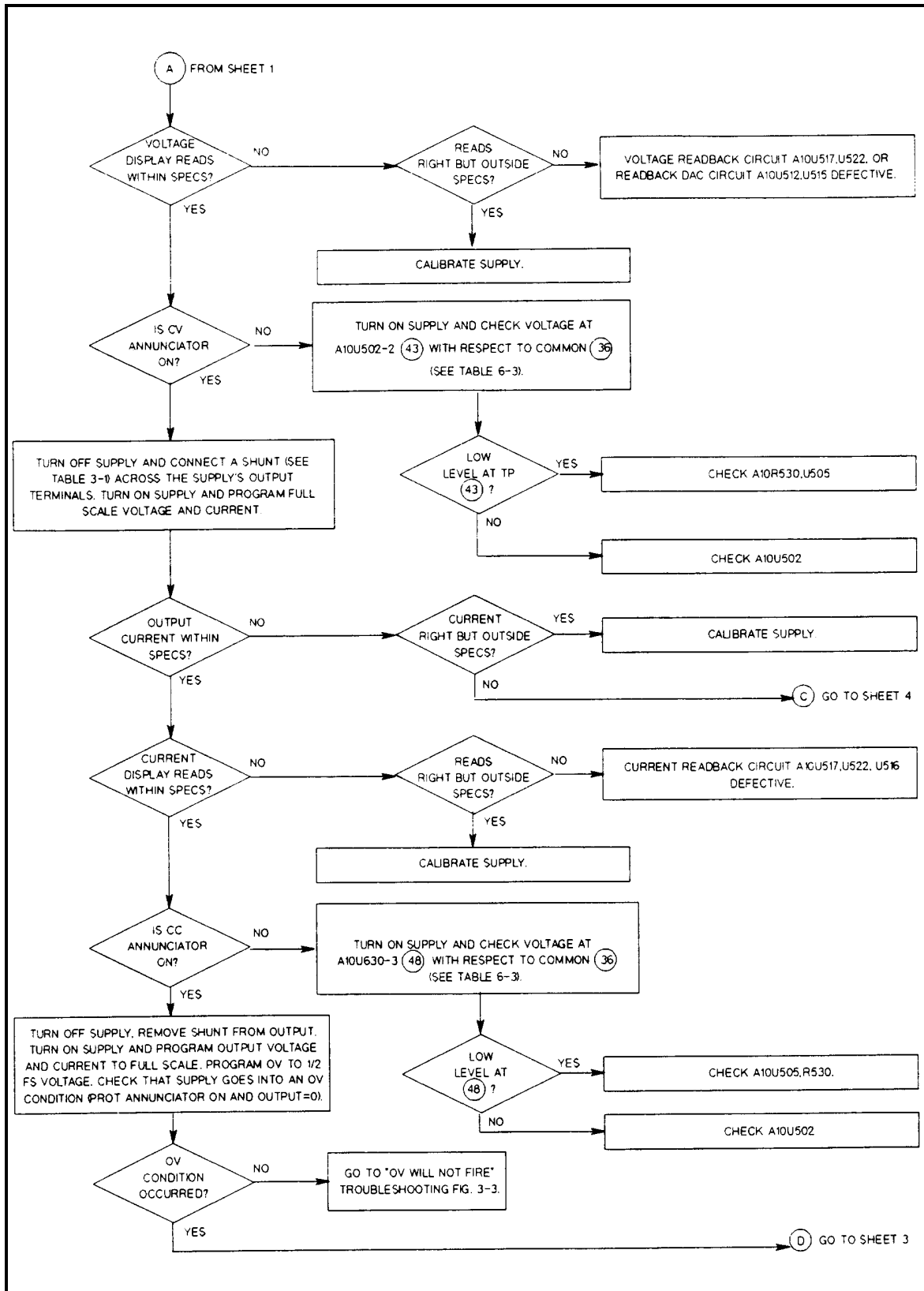


Figure 3-1. Overall Troubleshooting (Sheet 2 of 4)

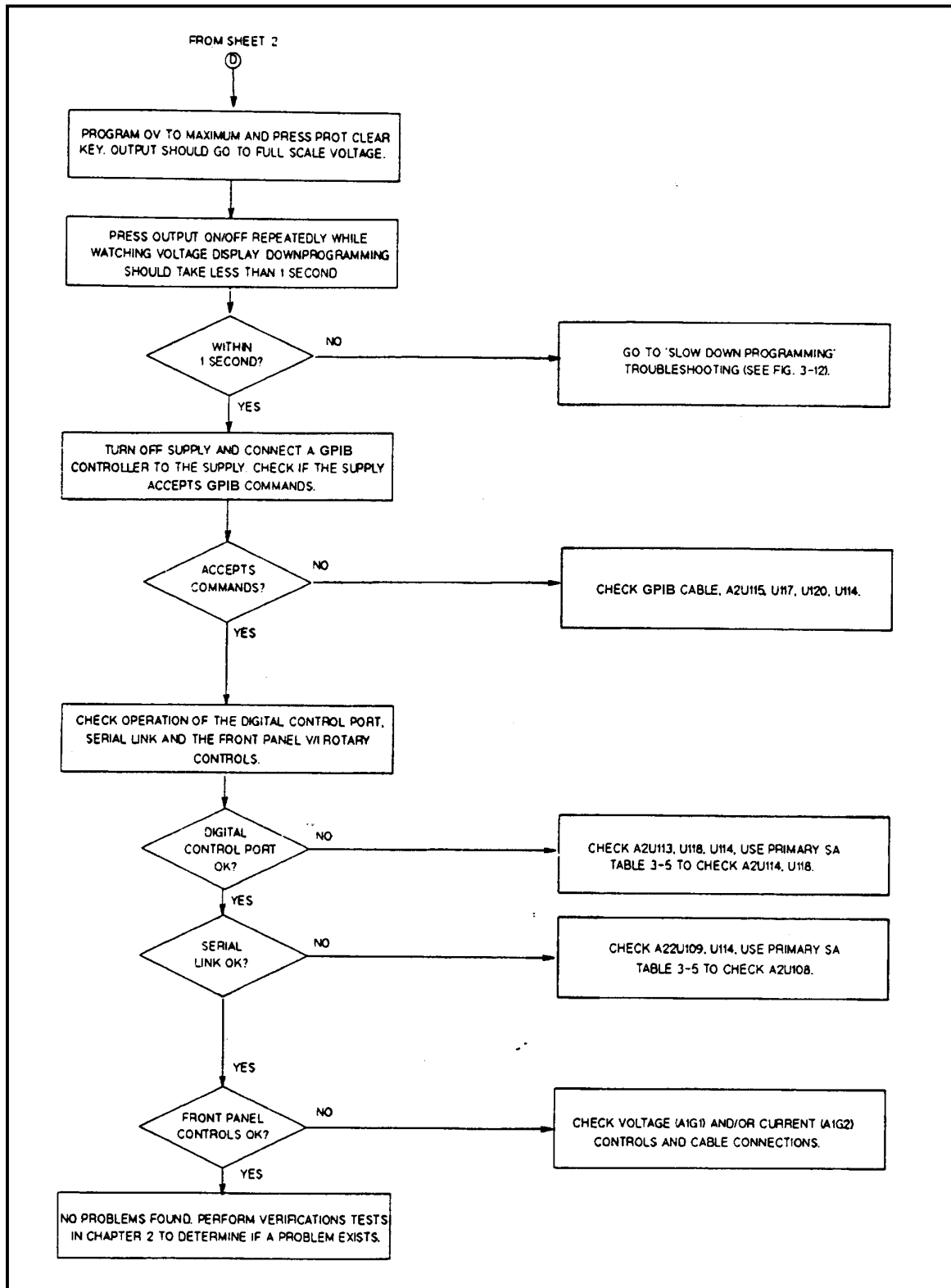


Figure 3-1. Overall Troubleshooting (Sheet 3 of 4)

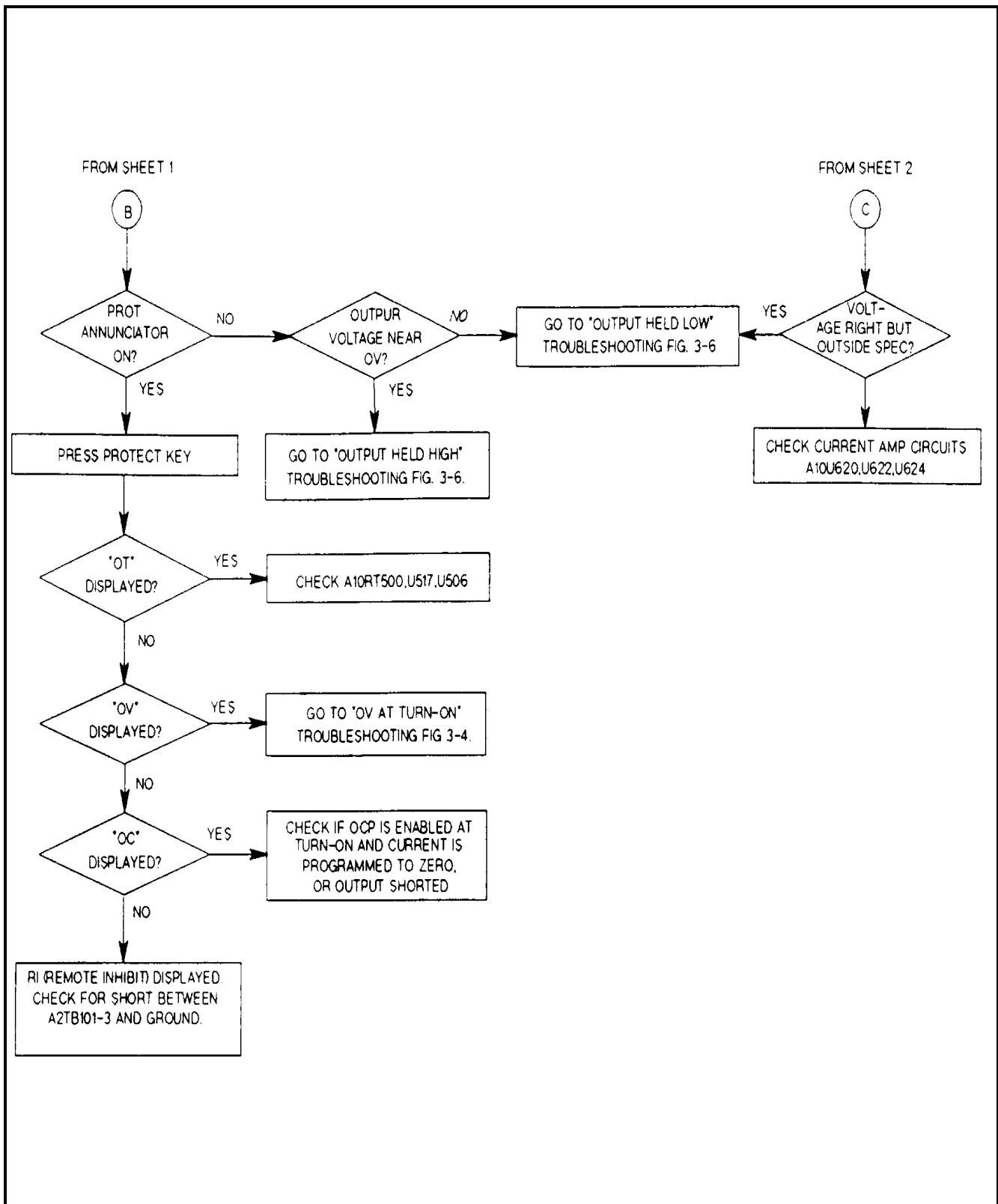


Figure 3-1. Overall Troubleshooting (Sheet 4 of 4)

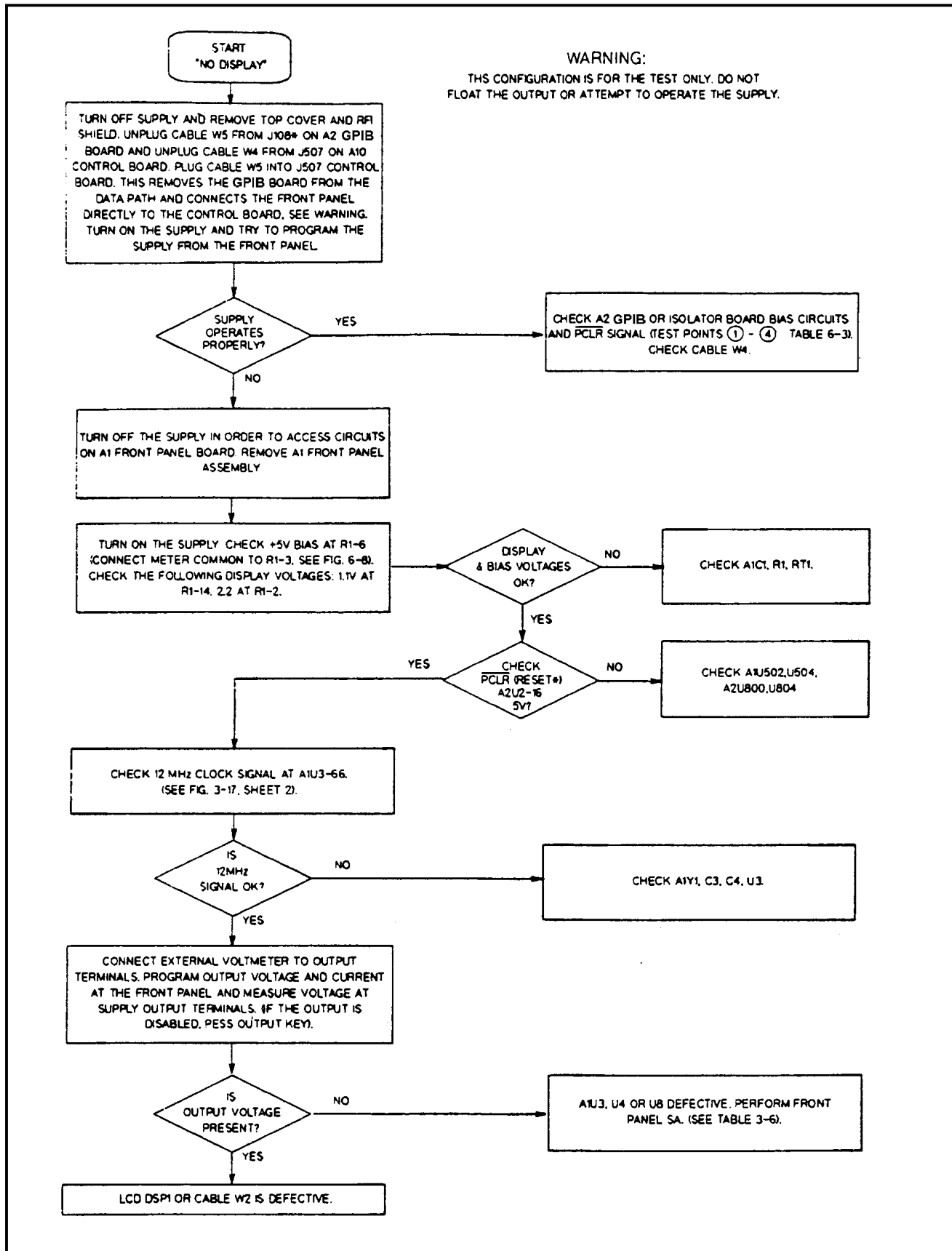


Figure 3-2. No Display Troubleshooting

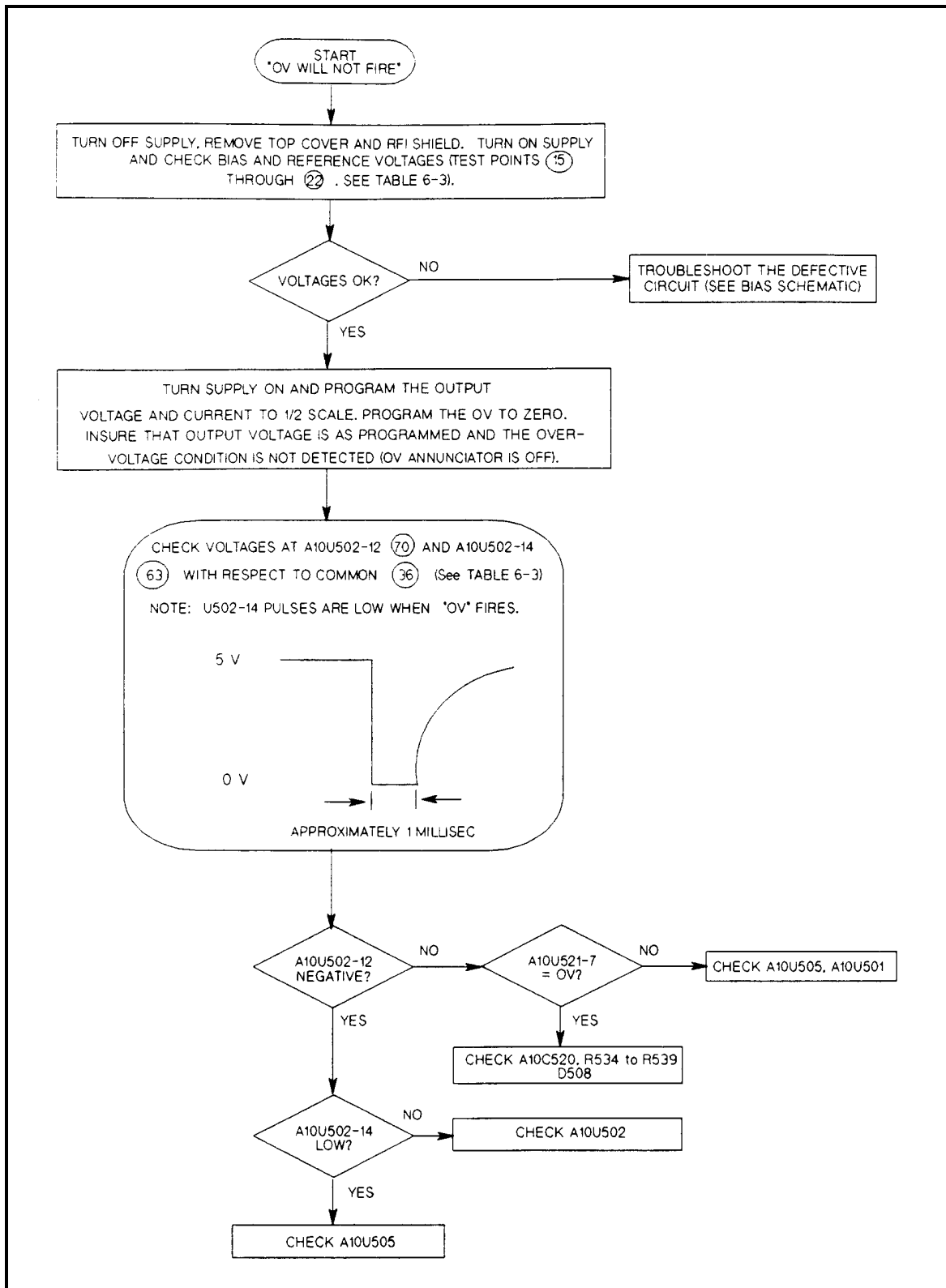


Figure 3-3. OV Will Not Fire Troubleshooting

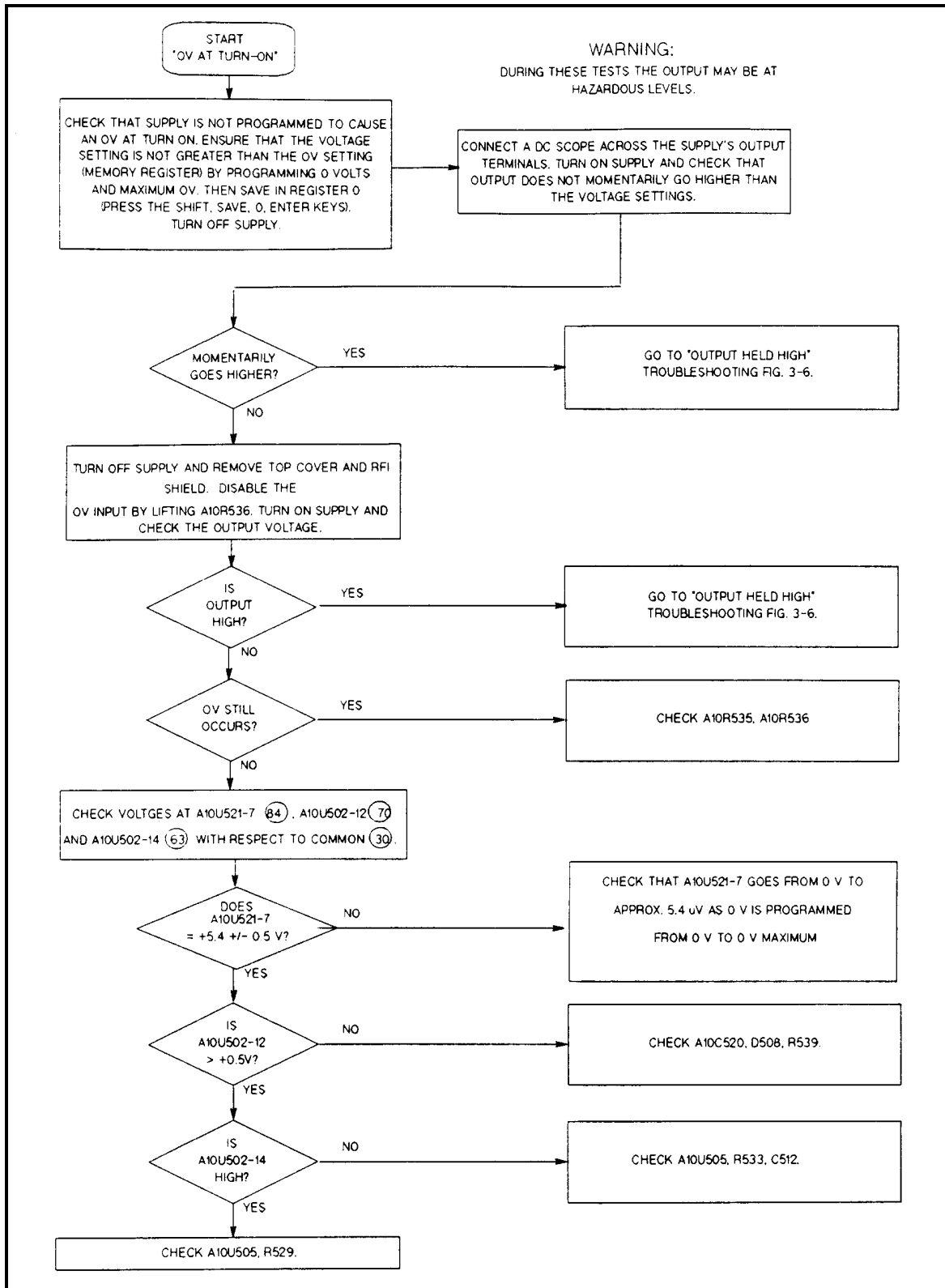


Figure 3-4. OV At Turn-On Troubleshooting

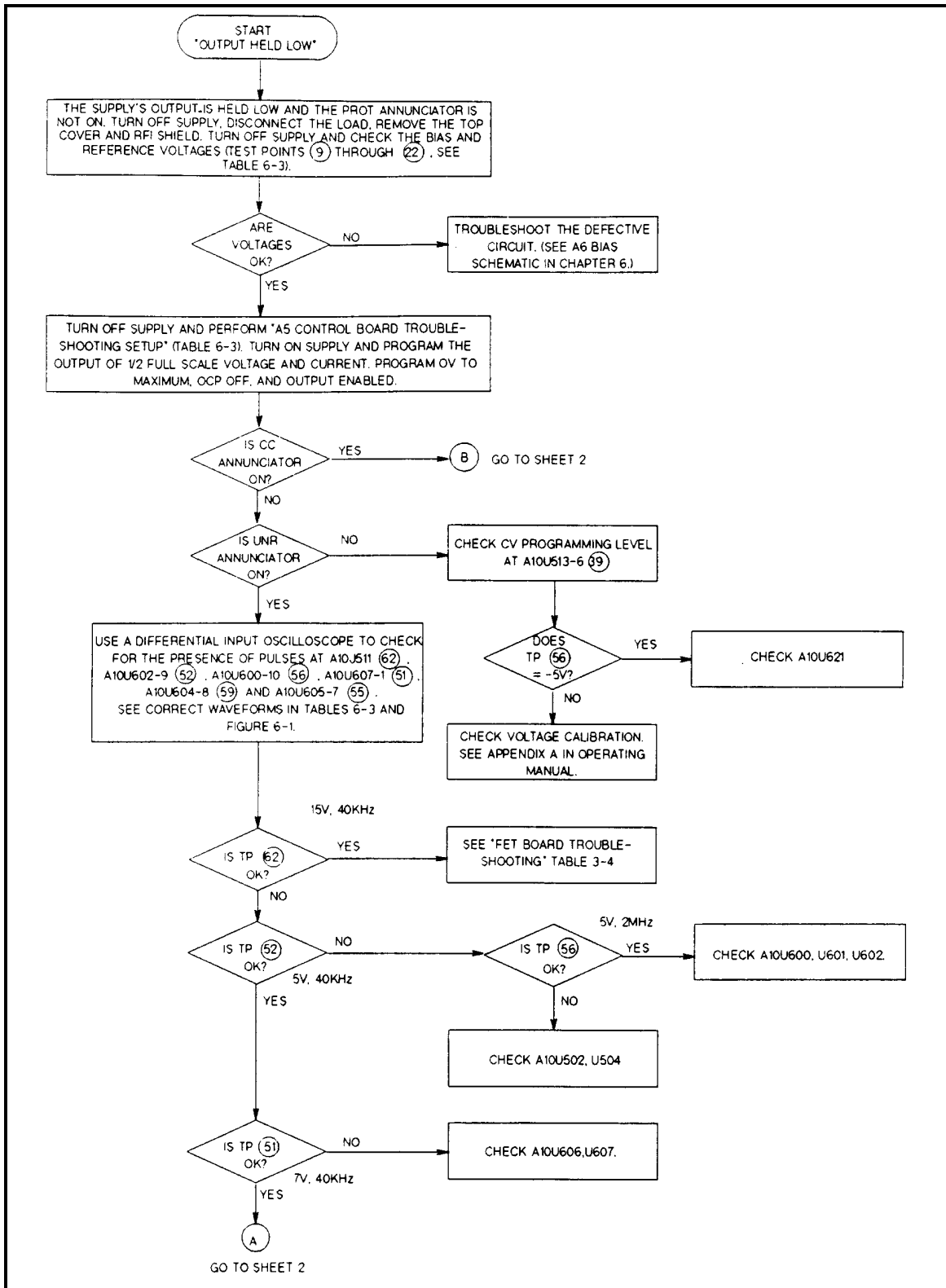


Figure 3-5. Output Held Low Troubleshooting (Sheet 1 of 2)

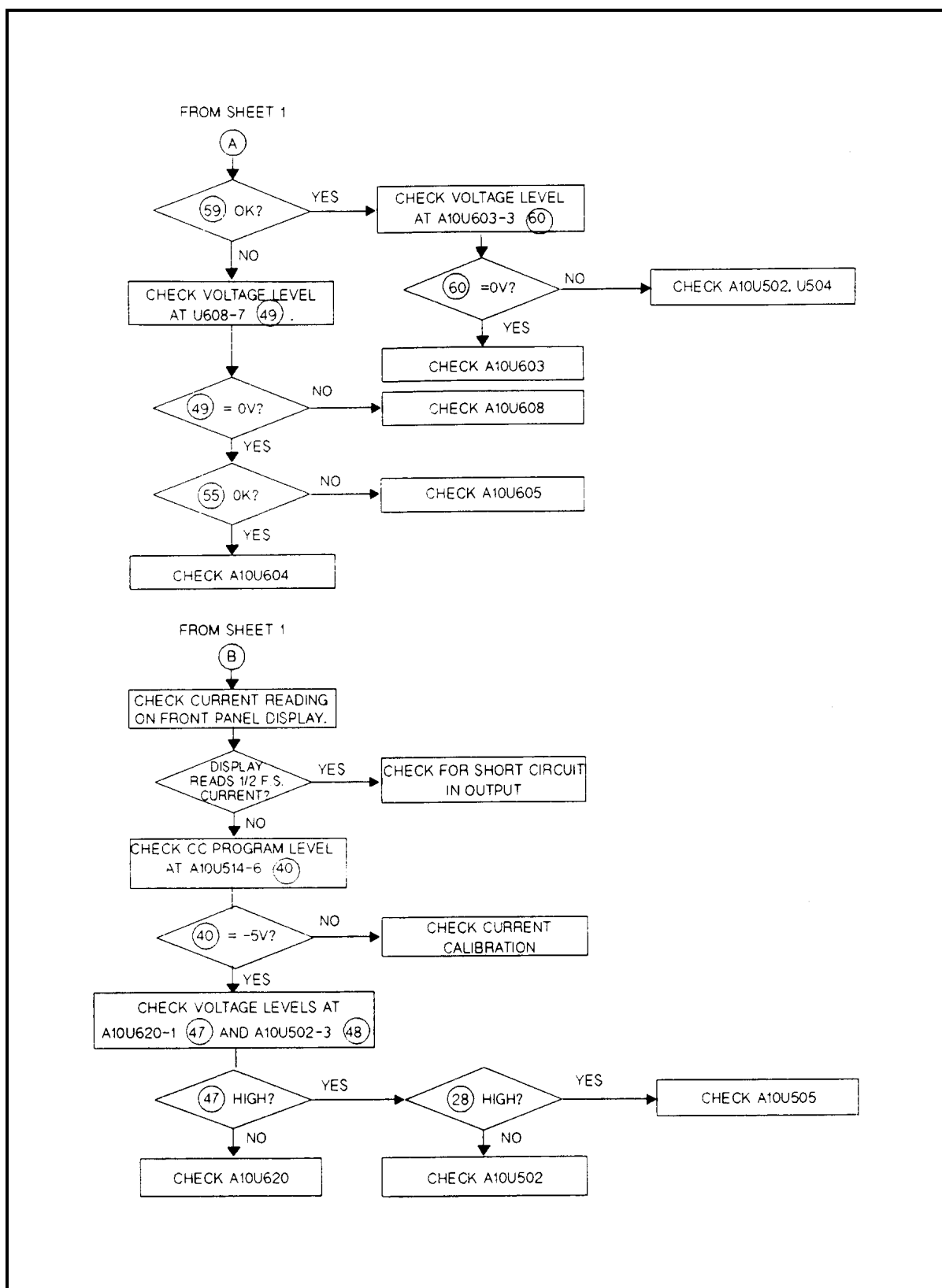


Figure 3-5. Output Held Low Troubleshooting (Sheet 2 of 2)

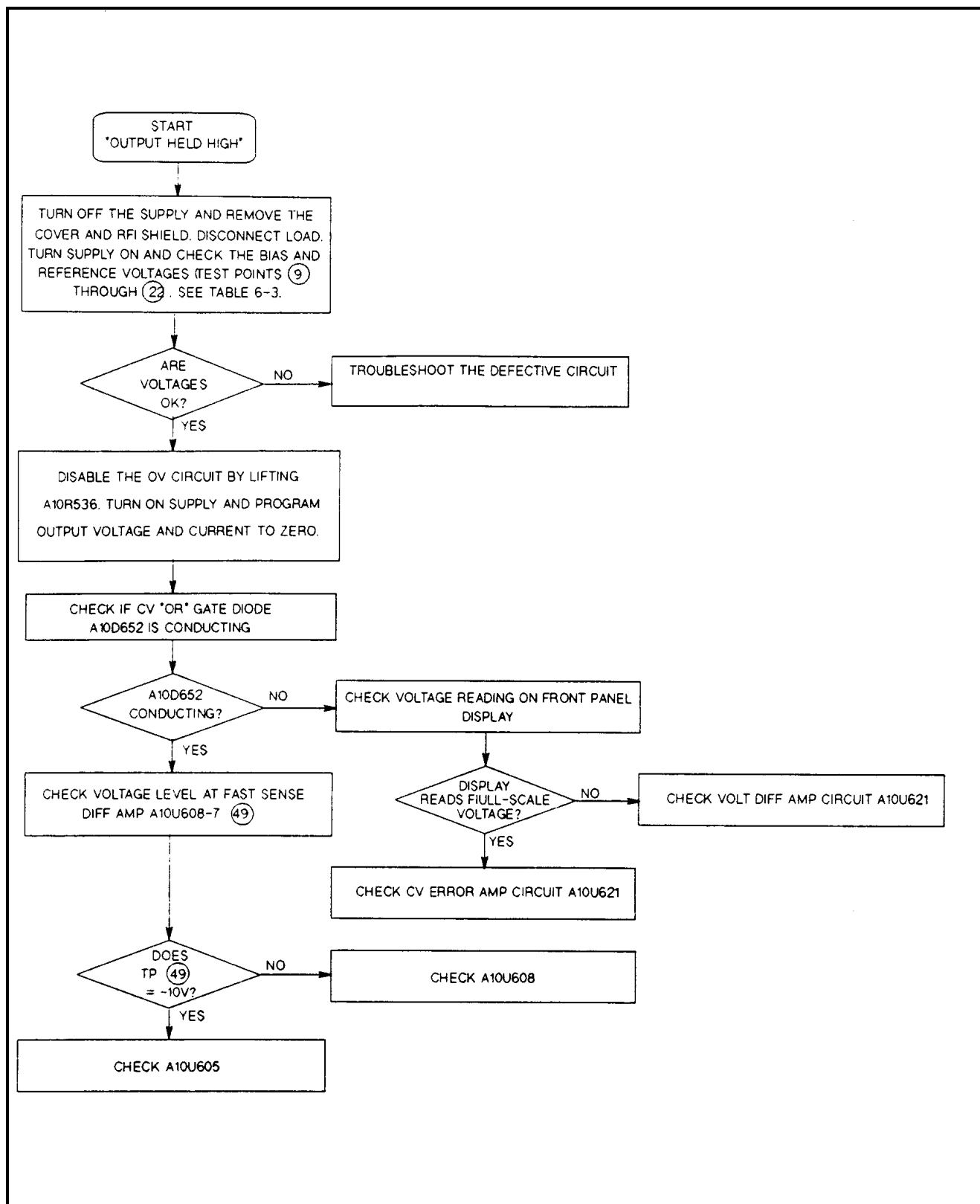


Figure 3-6. Output Held High Troubleshooting

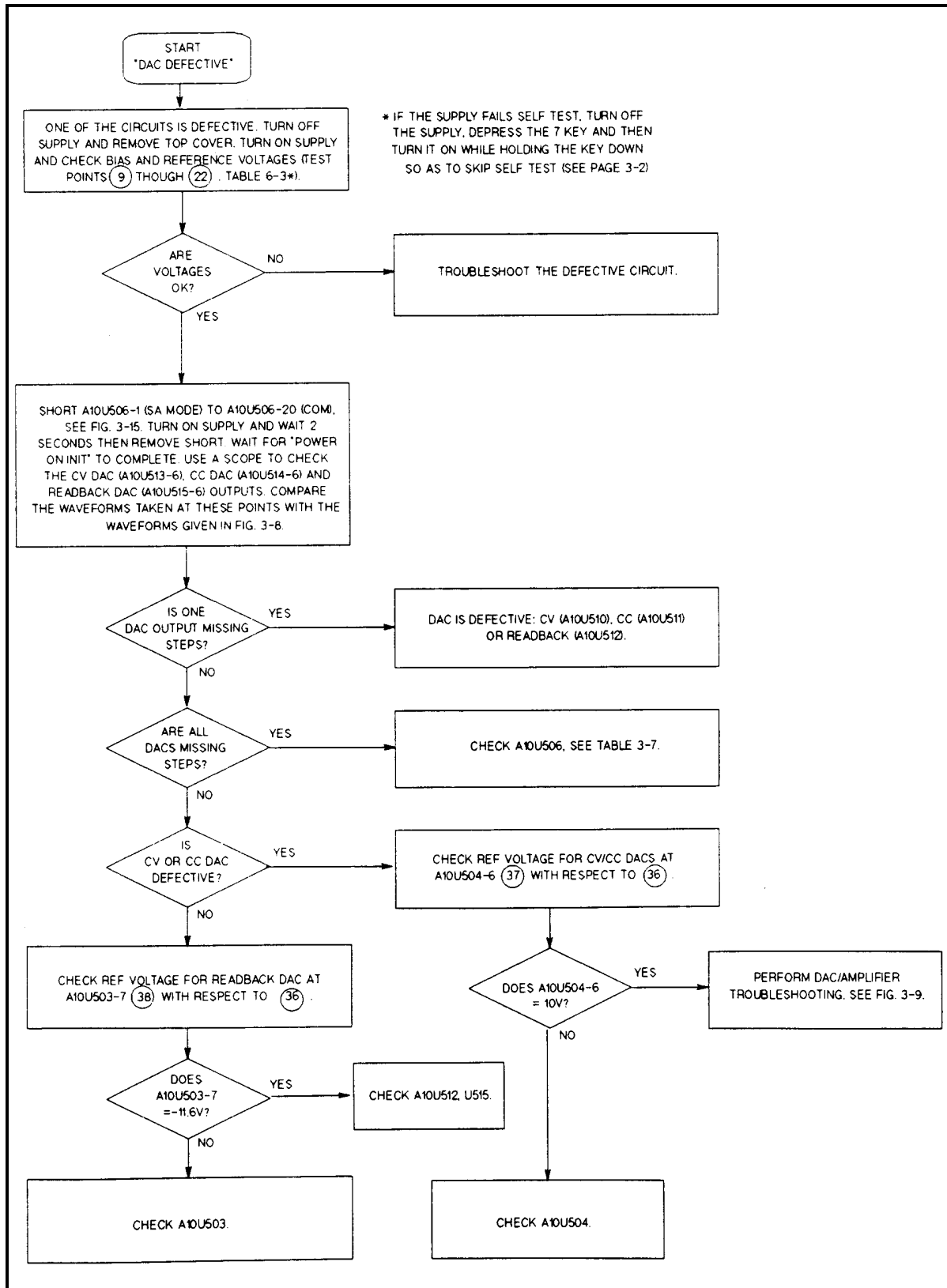
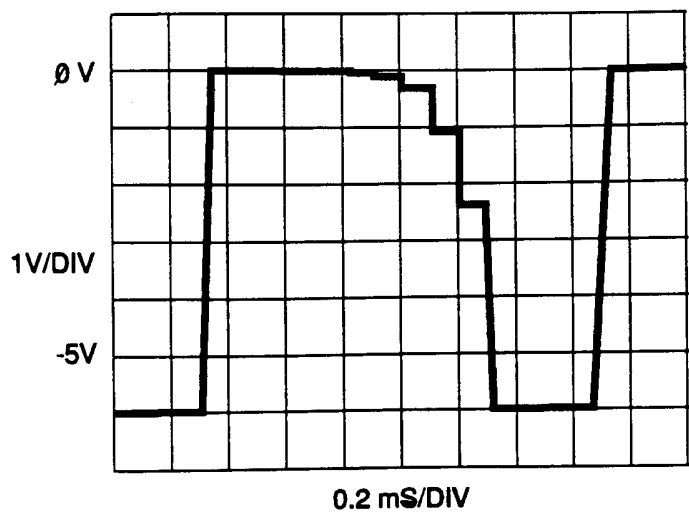
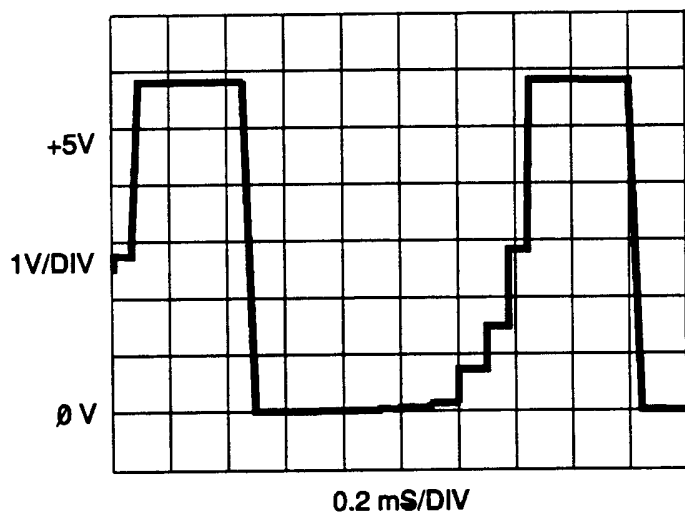


Figure 3-7. DAC Circuits Troubleshooting



A. CV DAC (U508-6) AND  
CC DAC (U510-6) OUTPUTS



B. READBACK DAC (U512-6) OUTPUT

Figure 3-8. DAC Test Waveforms

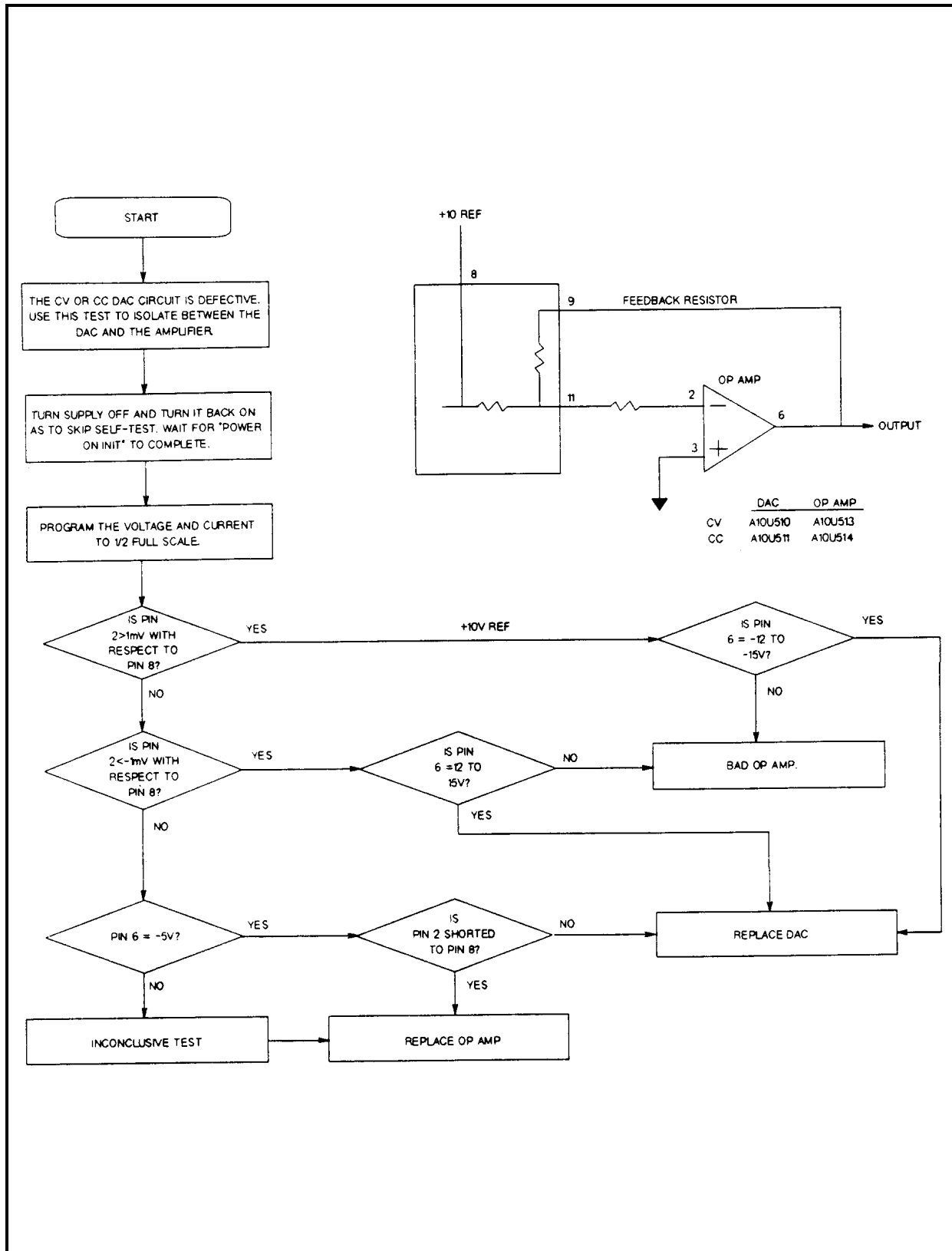


Figure 3-9. CV/CC DAC and Amplifier Circuit Troubleshooting

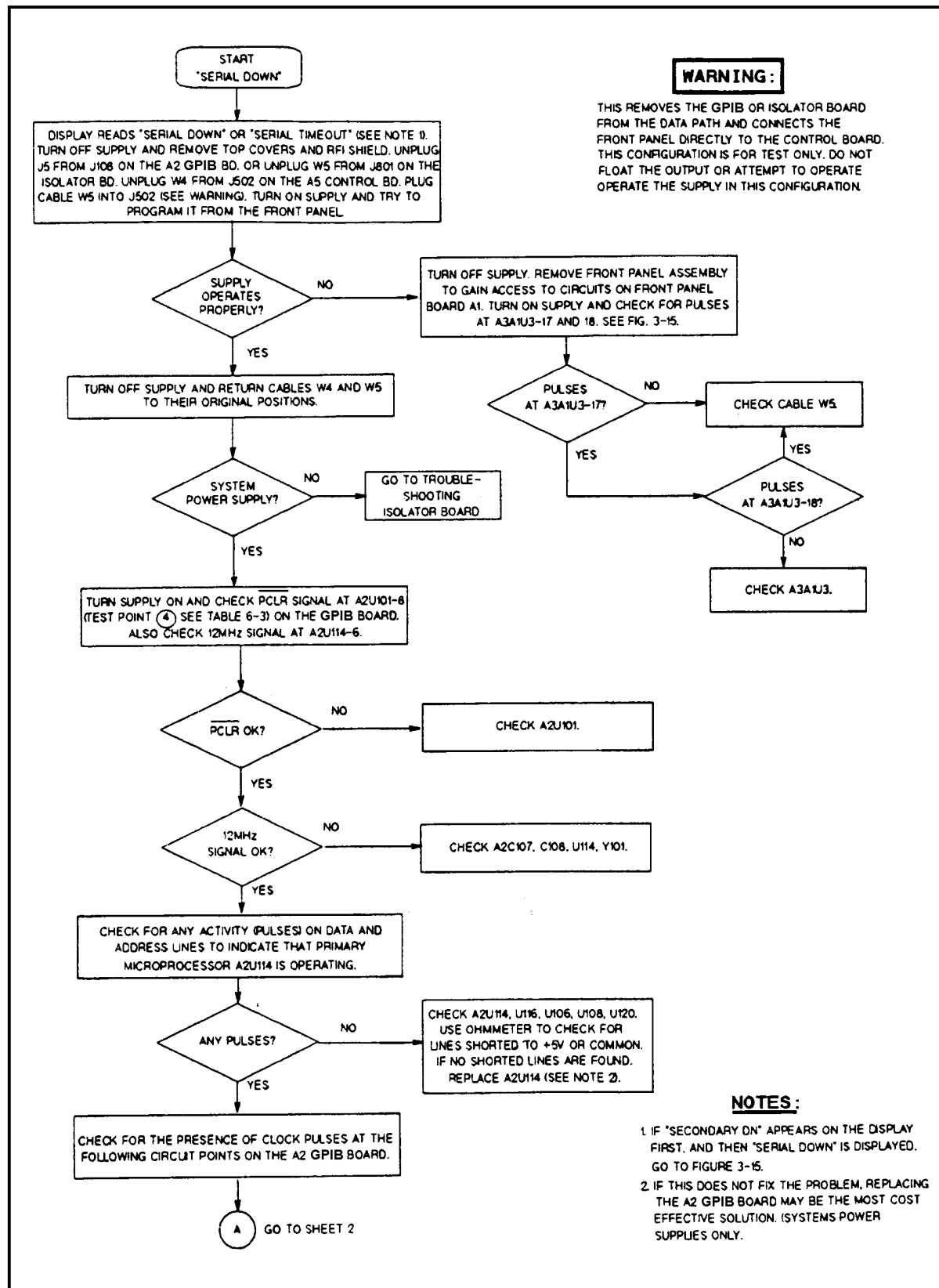


Figure 3-10. Serial Down Troubleshooting (Sheet 1 of 2)

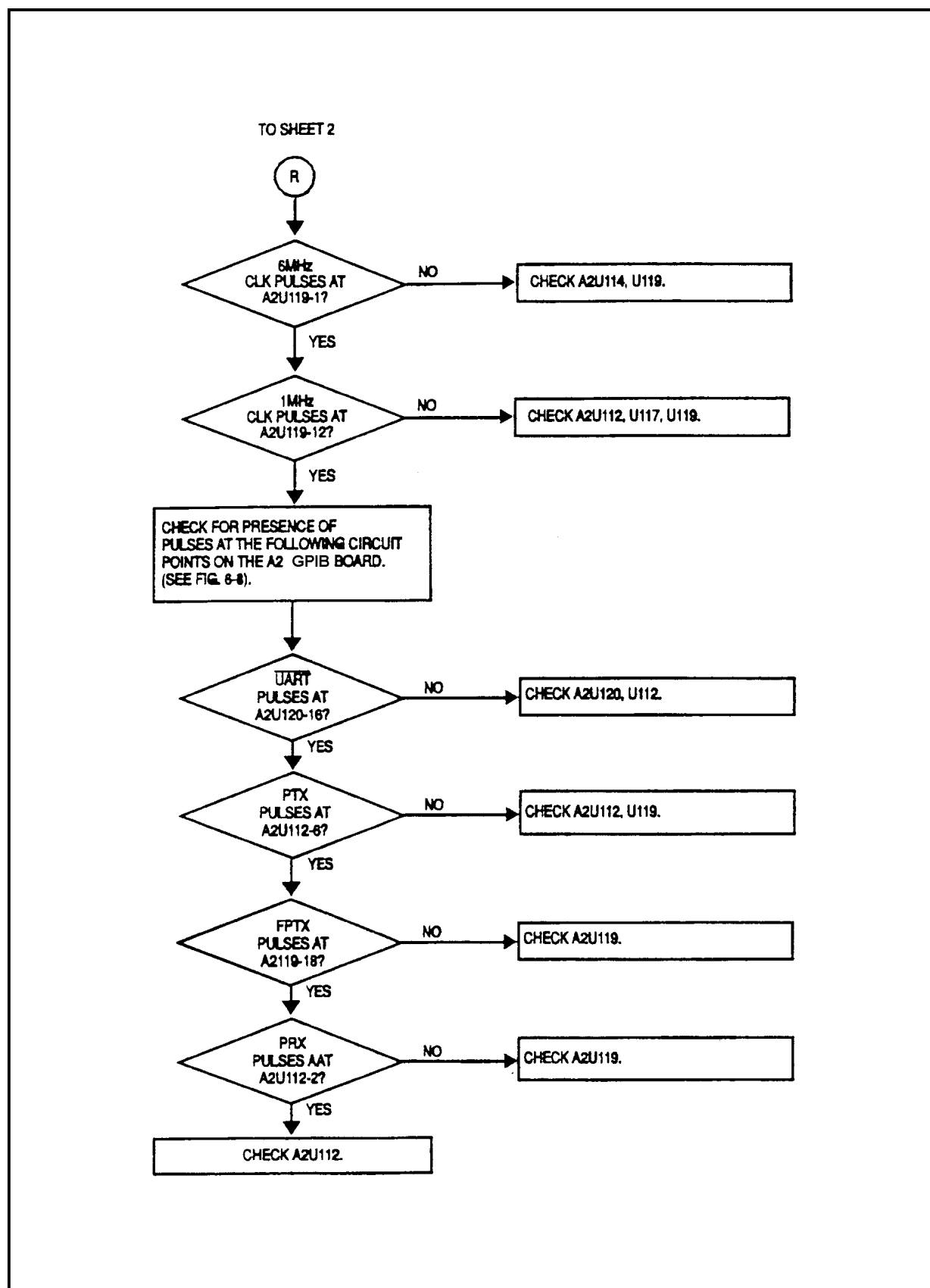


Figure 3-10. Serial Down Troubleshooting (Sheet 2 of 2)

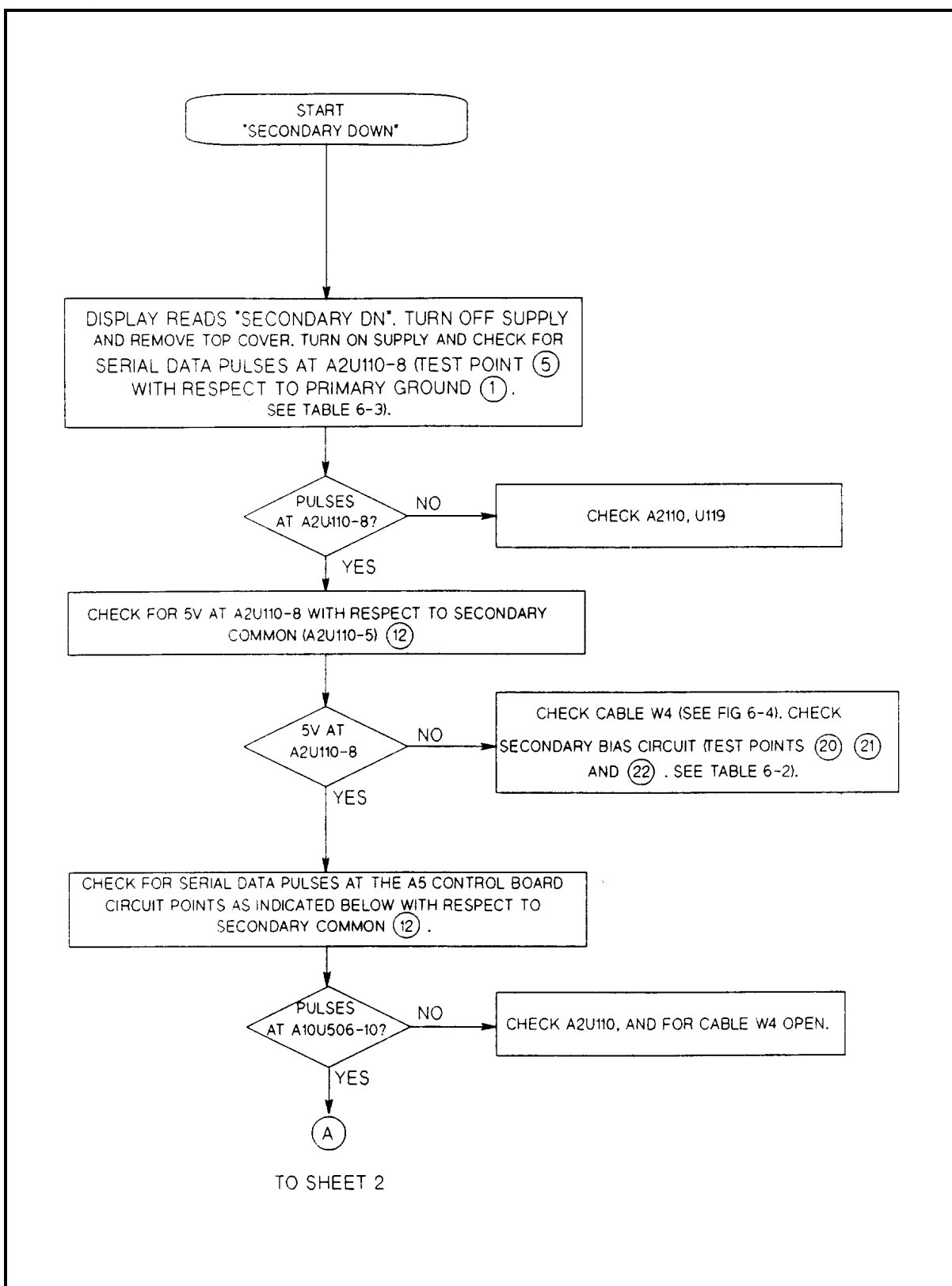


Figure 3-11. Secondary Interface Down (Sheet 1 of 2)

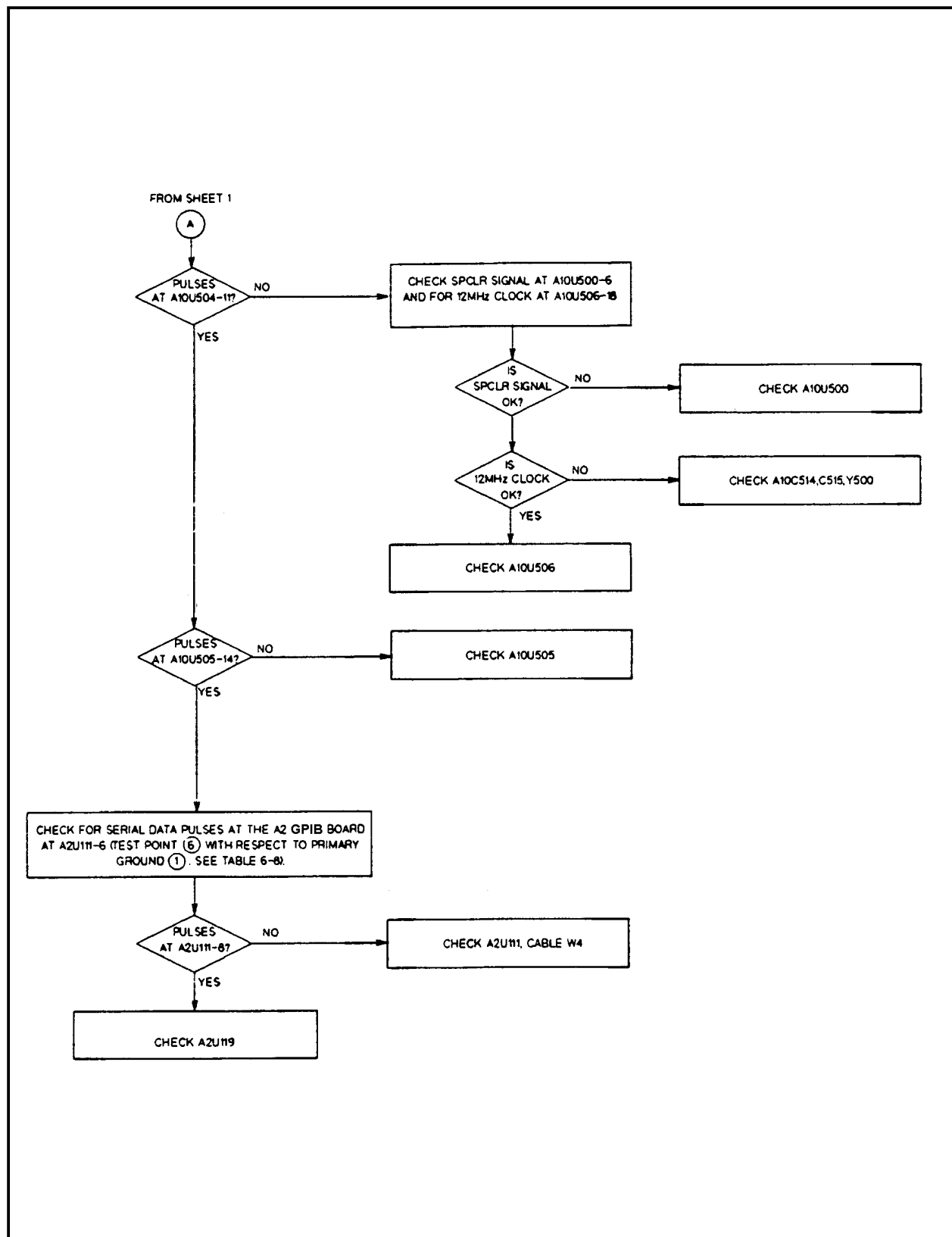


Figure 3-11. Secondary Interface Down (Sheet 2 of 2)

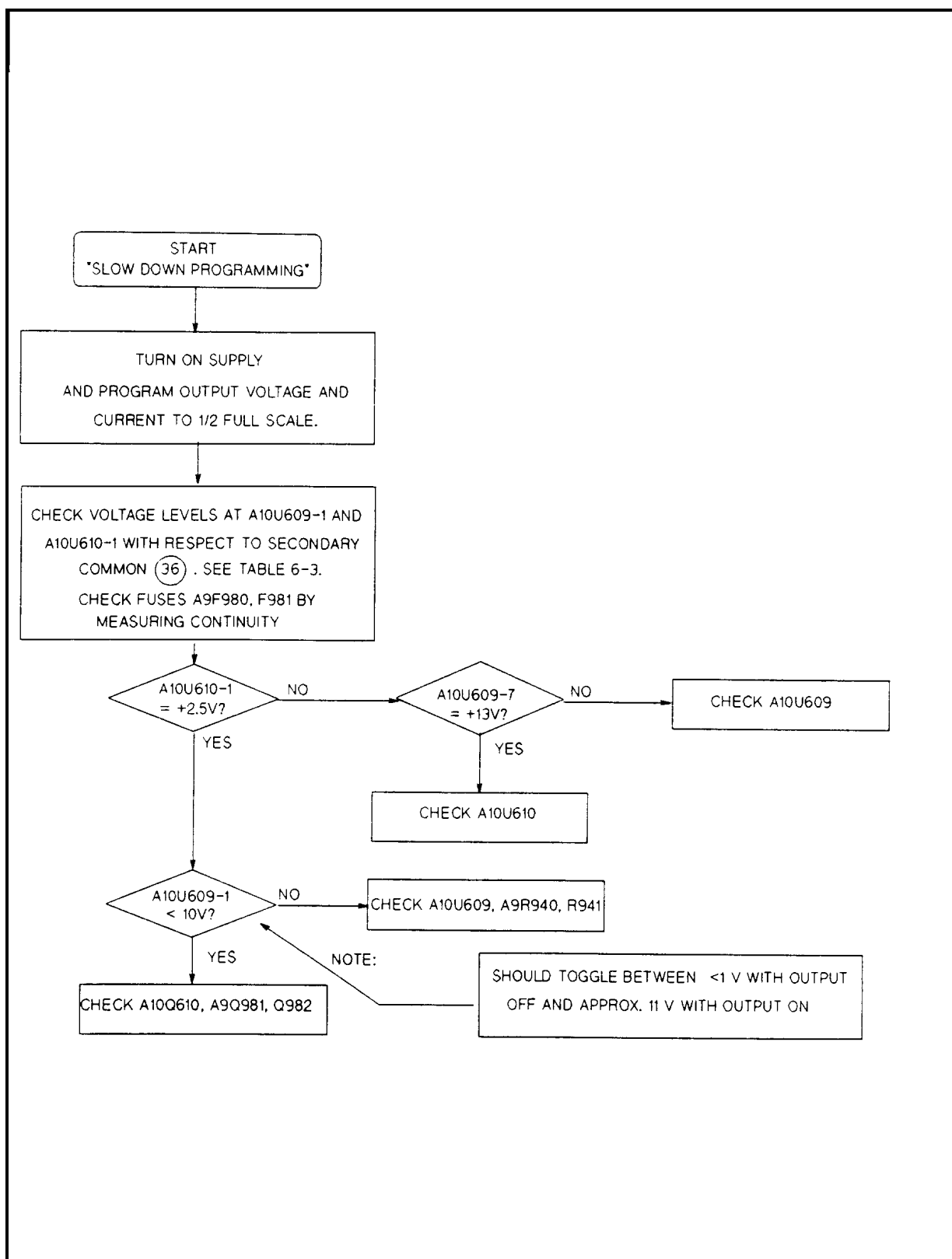


Figure 3-12. Slow Downprogramming Troubleshooting

## CV/CC Status Annunciators Troubleshooting

When troubleshooting the CV/CC status annunciators or status readback circuits, first measure the voltage drop across the gating diodes, which are A10D651 for the CC circuit and A10D652 for the CV circuit (see A10, Sheet 2). A conducting diode indicates an active (ON) control circuit. This forward drop is applied to the input of the associated status comparator (A10U502) and drives the output low. The low signal indicates an active status which is sent to the secondary microprocessor A10U506 via Programmed GAL A10U505 (see schematic Sheet 1). The front panel CV annunciator lights when the CV mode is active (CV is low) and the CC annunciator lights when the CC mode is active (CC is low). If neither is active, the UNREGULATED (Unr) annunciator comes on.

## A3 FET Board Troubleshooting

Because test points on the FET board are not accessible when the board is installed, troubleshooting must be performed with the board removed from the power supply. Both static (power removed) and dynamic (power applied) troubleshooting procedures are provided. The location of different test points are shown by encircled numbers on the A3 FET Board schematic and component location diagrams (see Chapter 6). There are two isolated FET bridge assemblies (see schematic in Fig. 6-10 sheets 1 and 2). Test each FET bridge individually.

---

**Note** If any power FET (Q201-204, Q301-304, Q211, Q311, Q222, Q322, Q233, Q333, Q244, Q344) is defective, you must replace all eight with a matched set.

---

**Table 3-4. FET Troubleshooting Chart**

| Procedure                                                                                                                                               | Result                                                                                |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| <b>Static Troubleshooting</b>                                                                                                                           |                                                                                       |
| 1. Turn the power supply off and remove the A3 FET board with its heatsink assembly attached (see "Disassembly Procedures").                            |                                                                                       |
| 2. Measure the resistance between the + Rail (E202 & E302) and the - Rail (E201 & E301).                                                                | $\geq 20M\Omega$ .                                                                    |
| 3. Measure the resistance between the gate of each FET (Q201-204, Q211, Q222, Q233, Q244, and Q301-304, Q311, Q322, Q333, and Q344) and common (-Rail). | $>15K\Omega$ .                                                                        |
| 4. Measure the resistance across capacitor C201 & C301.                                                                                                 | $\approx 150\Omega$ .                                                                 |
| 5. Measure the resistance across the 15V bias input (E206 to E207 and E306 to E307).                                                                    | $\approx 1K\Omega$ in the forward direction and $490\Omega$ in the reverse direction. |
| <i>Continue with Dynamic Troubleshooting on the next page</i>                                                                                           |                                                                                       |

**Table 3-4. FET Troubleshooting Chart (continued)**

| Procedure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Result                                                                                                                           |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| <b>Dynamic Troubleshooting</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                  |
| 1. Turn off the power supply and remove the A3 FET Board with its heat sink assembly.                                                                                                                                                                                                                                                                                                                                                                                                            | See "Disassembly Procedures"                                                                                                     |
| 2. Short the collectors of Q251 and Q253 or Q351 and Q353 by connecting the collector (case) of each transistor to common ( E507) .                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                  |
| 3. Connect waveform generator to J200-1 and J200-2.                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                  |
| 4. Set generator to produce a 20 kHz, 20V p-p triangular waveform                                                                                                                                                                                                                                                                                                                                                                                                                                | See Figure 3-14A.                                                                                                                |
| 5. Connect 15V from an external supply to E206 or E306 (positive) and E207 or E307 (common).                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                  |
| e: All of the following measurements are taken with respect to E207/E307 common, test point (26) on A3 FET Board schematic diagram                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                  |
| 6. Check bias voltage at U203-1/U303-1 (27) .                                                                                                                                                                                                                                                                                                                                                                                                                                                    | +5V                                                                                                                              |
| 7. While adjusting the external 15V supply input, check the bias trip point at U204-1/U304-1 (28) .                                                                                                                                                                                                                                                                                                                                                                                              | Voltage goes from low (0V) to high (5V) at an input of approximately 12V; and from high to low at an input of approximately 13V. |
| 8. Set external supply input to + 15V and check drive 1 waveform at U201-10/U301-10 (29) and drive 2 waveform at U201-12/U301-12 (30) .                                                                                                                                                                                                                                                                                                                                                          | See Figure 3-14B.                                                                                                                |
| 9. Check that pulses are present at U201-1 (31) , U201-7/U301-7 (32) and U302-1, U202-1 (33) , U202-7/U302-7 (34) .                                                                                                                                                                                                                                                                                                                                                                              | See Figure 3-14C.                                                                                                                |
| 10. Pulses should be present on both sides of inductors L201-204 or L301-304 and L213-216 or L313-316 as follows:<br><br>Check the pulses on the driver transistor side (Q251-Q254/Q351-Q354) of each inductor.<br><br>Check the pulses on the FET regulator side (Q201-Q204, Q301-Q304, Q211, Q311, Q222, Q322, Q233, Q333 and Q244, Q344) of each inductor.<br><br>If the waveforms do not have the fast step as shown in Figure 3-14, then the associated FET gate input has an open circuit. | See Figure 3-14D.<br><br>See Figure 3-14E.                                                                                       |
| 11. Measure the VREF voltage at U205-2 (35) .                                                                                                                                                                                                                                                                                                                                                                                                                                                    | ≈ 1.7V                                                                                                                           |
| Check the peak current limit by connecting a 68KΩ resistor from +5V (U201-9) to U205-3 or U304-5.                                                                                                                                                                                                                                                                                                                                                                                                | All pulses turn off.                                                                                                             |

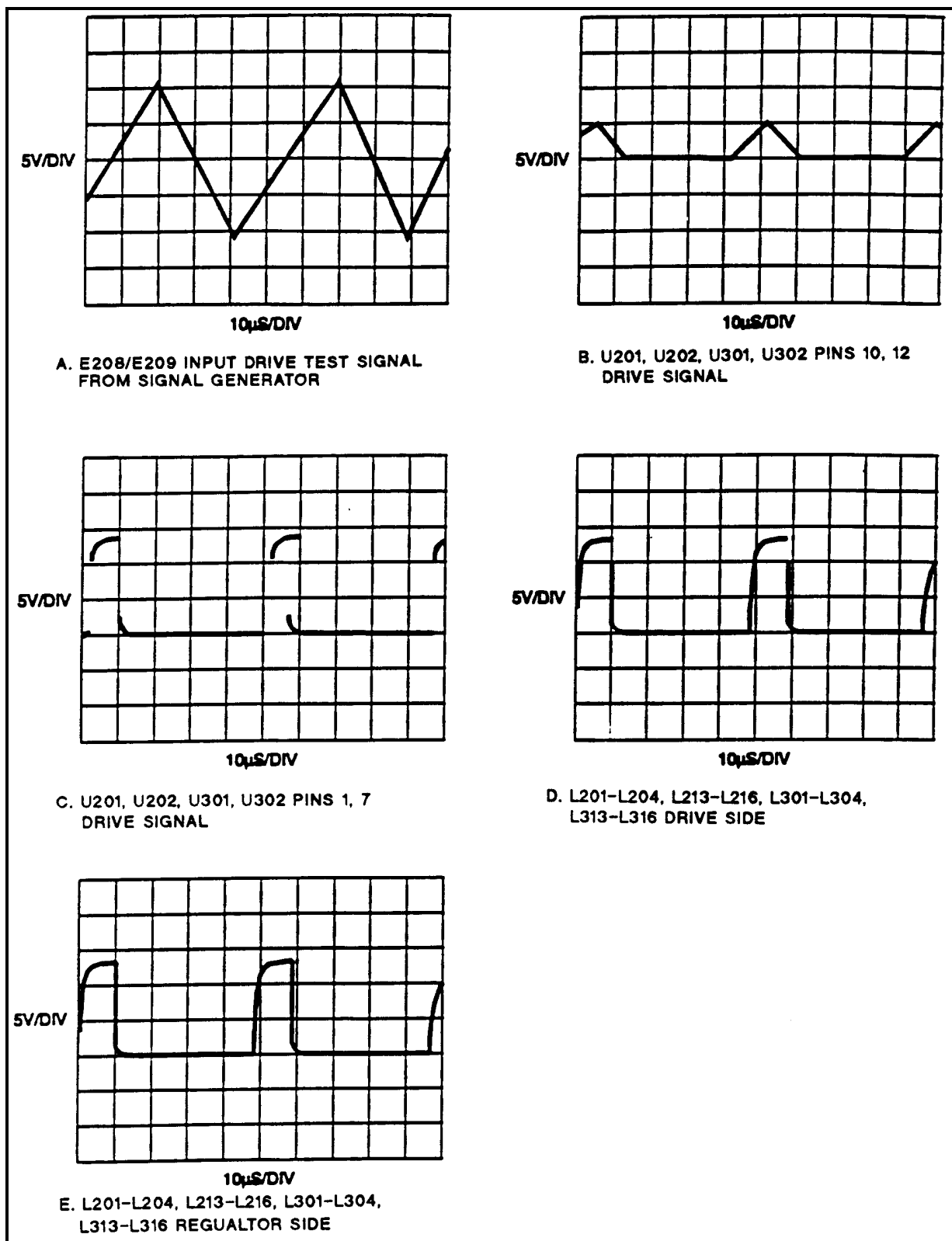


Figure 3-13. A3 FET Board Test Waveforms

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## Signature Analysis

### Introduction

The easiest and most efficient method of troubleshooting microprocessor-based instruments is with signature analysis (SA). This technique is similar to signal tracing with an oscilloscope in linear circuits. Part of the microprocessor memory is dedicated to SA, and a known bit stream is generated to stimulate as many nodes as possible within a circuit. Because it is virtually impossible to analyze a bit stream with an oscilloscope, a signature analyzer is used to compress the bit stream into a four-character signature. By comparing the signatures of the IC under test to the correct signature for each node, you can isolate faults to one or two components .

The following general rules apply to signature analysis testing:

1. Be sure to use the correct test setup connections for the specific test.
2. When examining an IC, note the correct signatures for Vcc (+5V) and for common. If an incorrect signature matches either one, it probably indicates a short to that part of the circuit.
3. If two IC pins have identical signatures, they are probably shorted.
4. If two IC signatures are similar, it is only a coincidence.
5. If an input pin of an IC has an incorrect signal but the signal source (output of the previous IC) is correct, then look for an open printed circuit track or soldering problems.
6. If the output signature of an IC is incorrect, it could be caused by that IC. However, it could also be caused by a short at another component that is connected to that output.

### Firmware Revisions

Each signature analysis table in this chapter shows the power supply firmware revision for which the table is valid. If needed, for a Bench Supply you can confirm the firmware revision of your power supply by checking the label on the Front panel ROM, AIU3, and on the Secondary microprocessor, A5U504. You can obtain the revisions on a Systems Supply with the GPIB \*IDN? query command. The following sample Agilent BASIC program does this:

```
10 ALLOCATE L$(52)
20 OUTPUT 705;"*IDN?"
30 ENTER 705;L$
40 DISP L$
50 END
```

For a typical Model 6681A, the controller will return a string with four comma-separated fields, as follows:

**"Agilent Technologies ,6681A,O,fA.01.05sA.01.04pA.01.02"**

The first three fields in the string are the manufacturer, model number and 0. The last field gives the firmware information as follows:

f= front panel firmware revision (A.01.05).  
s= secondary interface firmware revision (A.01.04).  
p= primary interface firmware revision (A.01.02).

---

#### Note

The firmware revisions numbers shown here may not match the firmware revision of your instrument. Firmware revision numbers are subject to change whenever the firmware is updated.

---

## Test Headers

The power supply has two test headers as shown in Figure 3-15, each with a jumper that can be moved to different positions for SA testing and for other functions. To gain access to the headers, remove the power supply top cover.

| Pins                                                                   | Description                                                                                                                                                                                       |
|------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Primary Interface Test Connector A2J106 (Systems Supplies Only)</b> |                                                                                                                                                                                                   |
| 7 and 8 (FLT/INH)                                                      | Normal operating (and storage) position. DIG CNTL port** is configured for fault indicator (FLT) output and remote inhibit (RI) input .                                                           |
| 1 and 2 (SA Mode)                                                      | Install jumper here for SA mode.                                                                                                                                                                  |
| 3 and 4 (DIG I/O)                                                      | Install jumper here to configure DIG CNTL port** for digital I/O operation .                                                                                                                      |
| 5 and 6 (RELAY LINK)                                                   | Install jumper here to configure DIG CNTL port** for control of external relay accessories.<br>** See Appendix D in power supply Operating Manual for information about the digital control port. |
| <b>Front Panel Test Connector A1J3</b>                                 |                                                                                                                                                                                                   |
| 7 and 8 (NORM)                                                         | Normal operating (and storage) position of jumper.                                                                                                                                                |
| 1 and 2 (SA Mode)                                                      | Install jumper here for SA mode.                                                                                                                                                                  |
| 3 and 4 (INHIBIT CAL)                                                  | Install jumper here to disable calibration commands and prohibit calibration.                                                                                                                     |
| 5 and 6 (FACTORY PRESET CAL)                                           | Install jumper here to restore original factory calibration constants.                                                                                                                            |

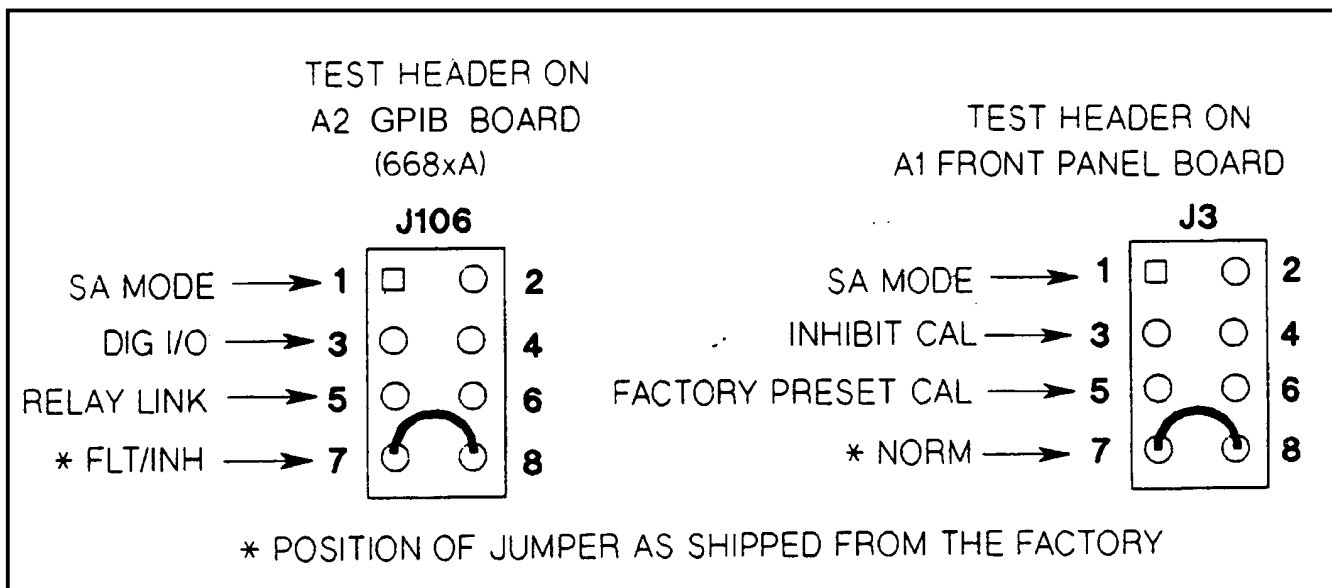


Figure 3-14. Test Header Jumper Positions

**Table 3-5. Primary Interface SA Test**

|                                                                                                                                                                                                                                                                                                                                                                                                                          |  |  |  |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|
| <b>Description:</b> These signatures check some primary interface circuits on the Systems Supply A2 GPIB Board.<br><b>Valid A2U106 ROM Firmware Revision:</b> A.01.06<br><b>Test Setup:</b> See Figure 3-17.                                                                                                                                                                                                             |  |  |  |  |
| 1. Turn off the power supply and remove the top cover.                                                                                                                                                                                                                                                                                                                                                                   |  |  |  |  |
| 2. Connect SA jumper of connector J106 on A2 GPIB Board (see Figure 3-15).                                                                                                                                                                                                                                                                                                                                               |  |  |  |  |
| 3. Connect signature analyzer CLOCK, START, STOP, and GROUND inputs as show in Figure 3-16 .                                                                                                                                                                                                                                                                                                                             |  |  |  |  |
| 4. Turn on the power supply and use the signature analyzer probe to take the following signatures:<br>Power: 5V = 9FFP<br>Serial Link: A2U109-3 = 0104<br>Microprocessor: A2U114-24 = 9FFP<br>A2U114-25 = UF39<br>Digital Control Interface: A2U118-1 = 9AF1<br>A2U118-9 = 40A5<br>A2U118-10 = 1029<br>A2U118-15 = 0010<br>A2U118-16 = 040A<br>Gated Array Logic: A2U119-2 = 0A55<br>A2U119-5 = 0040<br>A2U119-15 = 0040 |  |  |  |  |
| 5. After completing the tests, be sure to return the J106 jumper to its original position.                                                                                                                                                                                                                                                                                                                               |  |  |  |  |

| Signature Analyzer Input | Edge Setting                                                                        | A2 Board Connection | A1A1 Front Panel Board Connection | A10 Board Connection |
|--------------------------|-------------------------------------------------------------------------------------|---------------------|-----------------------------------|----------------------|
| CLOCK                    |  | J106-5              | J2-9                              | U504-32              |
| START                    |  | J106-6              | J2-11                             | U502-7               |
| STOP                     |  | J106-6              | J2-11                             | U502-7               |
| GROUND                   |  | J106-4              | J2-8                              | U502-10              |

**Figure 3-15. Signature Analysis Signal Inputs**

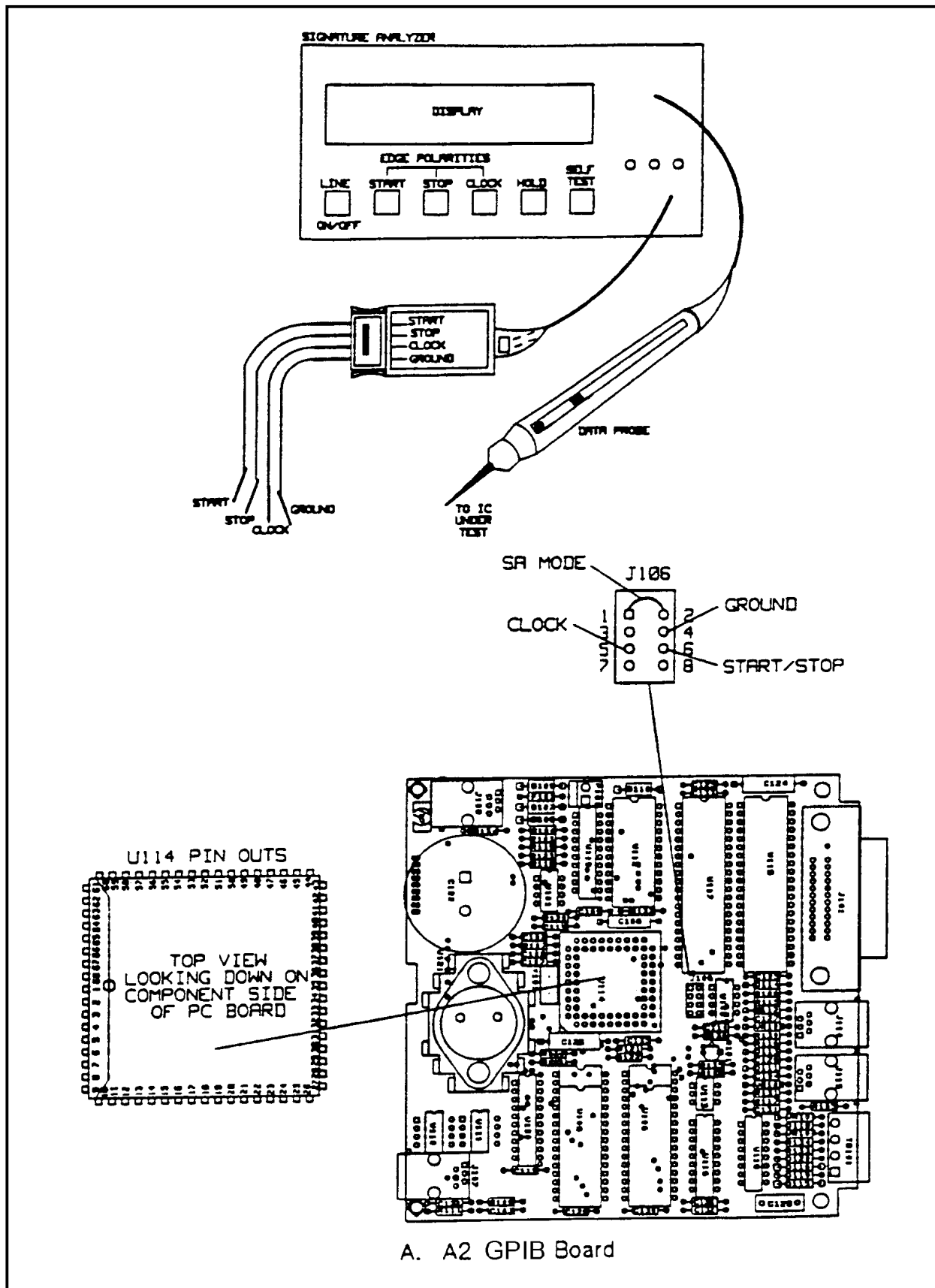


Figure 3-16. Signature Analysis Connections, (Sheet 1 of 2)

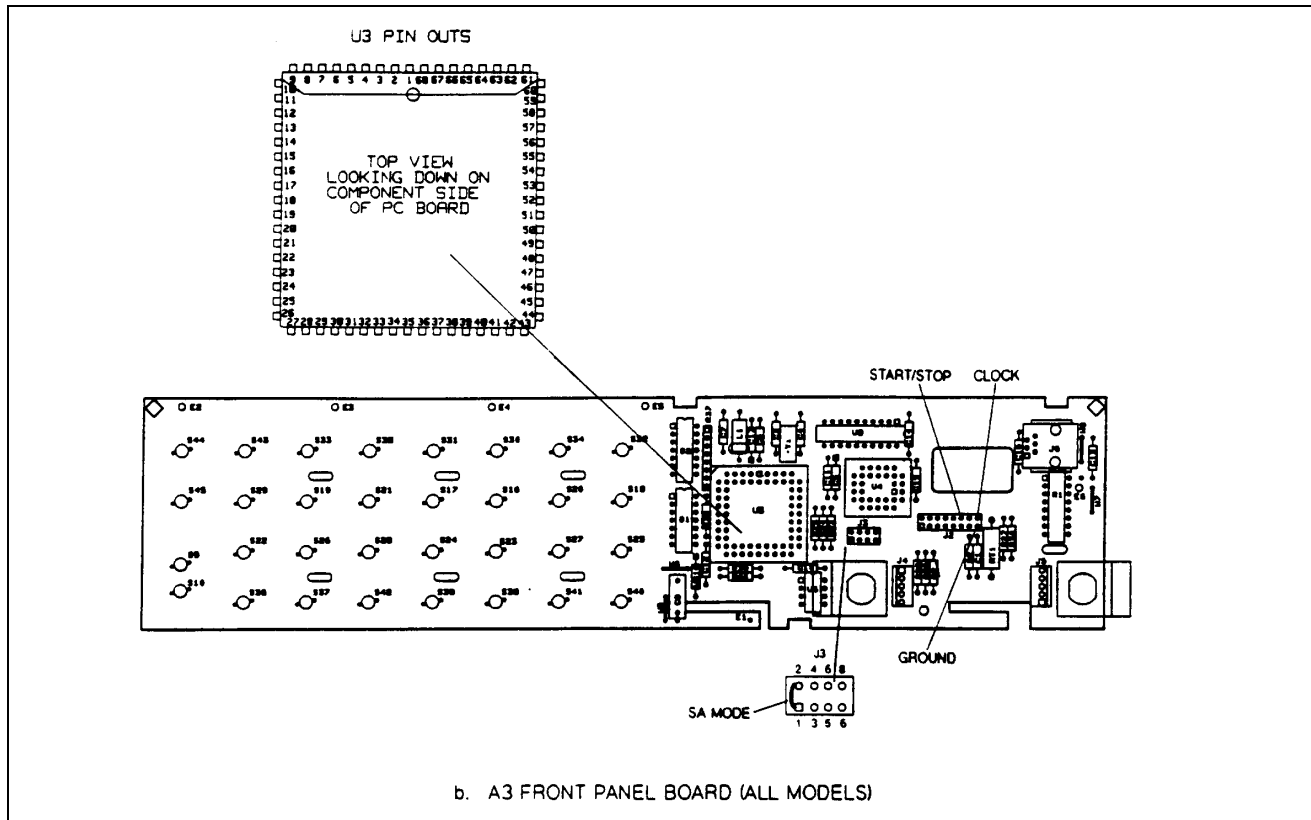


Figure 3-16. Signature Analysis Connections, (Sheet 2 of 2)

Table 3-6. Front Panel SA Test

|                                                                             |                                                                                                                                                        |                |
|-----------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| <b>Description:</b> These signatures check front panel microprocessor AIU3. |                                                                                                                                                        |                |
| <b>Valid AIU4 ROM Firmware Revision:</b> A.01.07                            |                                                                                                                                                        |                |
| <b>Test Setup:</b> See Figure 3-17.                                         |                                                                                                                                                        |                |
| 1.                                                                          | Turn off the power supply and remove the top cover.                                                                                                    |                |
| 2.                                                                          | To gain access to A1 Front Panel Board, perform steps 1 and 2 of the disassembly procedure for A1 Front Panel Assembly (see "Disassembly Procedures"). |                |
| 3.                                                                          | Connect SA jumper of connector J3 on A1 Front Panel Board (see Figure 3-15).                                                                           |                |
| 4.                                                                          | Connect signature analyzer CLOCK, START, STOP, and GROUND inputs and setup as shown in Figure 3-16.                                                    |                |
| 5.                                                                          | Turn on the power supply and use the signature analyzer probe to take the following signatures:                                                        |                |
|                                                                             | Power:                                                                                                                                                 | 5V = 3395      |
|                                                                             | Microprocessor:                                                                                                                                        | AIU3-15 = 3395 |
|                                                                             |                                                                                                                                                        | AIU3-19 = 552U |
|                                                                             |                                                                                                                                                        | AIU3-20 = 954C |
|                                                                             |                                                                                                                                                        | AIU3-21 = A552 |
|                                                                             |                                                                                                                                                        | AIU3-22 = 2954 |
|                                                                             |                                                                                                                                                        | AIU3-23 = 0A55 |
|                                                                             |                                                                                                                                                        | AIU3-24 = 3395 |
|                                                                             |                                                                                                                                                        | AIU3-25 = 3395 |
|                                                                             |                                                                                                                                                        | AIU3-26 = 0000 |
|                                                                             |                                                                                                                                                        | AIU3-27 = 0000 |
|                                                                             |                                                                                                                                                        | AIU3-28 = 40A5 |
|                                                                             |                                                                                                                                                        | AIU3-29 = 1029 |
|                                                                             |                                                                                                                                                        | AIU3-30 = 0295 |
|                                                                             |                                                                                                                                                        | AIU3-31 = 0000 |
|                                                                             |                                                                                                                                                        | AIU3-32 = 3395 |
|                                                                             |                                                                                                                                                        | AIU3-33 = 0008 |
|                                                                             |                                                                                                                                                        | AIU3-34 = 040A |
|                                                                             |                                                                                                                                                        | AIU3-35 = 0102 |
|                                                                             |                                                                                                                                                        | AIU3-38 = 0002 |
|                                                                             |                                                                                                                                                        | AIU3-39 = 0020 |
|                                                                             |                                                                                                                                                        | AIU3-42 = 3395 |
| 6.                                                                          | After completing the tests, be sure to return the J3 jumper to its original position.                                                                  |                |

**Table 3-7. Secondary Interface SA Test**

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <b>Description:</b> These signatures check the secondary microprocessor A5U504.<br><b>Valid A5U504 ROM Firmware Revision:</b> A.01.04<br><b>Test Setup:</b> See Figure 3-17.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |
| 1. Turn off the power supply and remove the top cover.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |
| 2. To obtain a setup that allows access to components and test points on the A5 Control Board, follow the procedure given in Table 3-3 under "A5 Control Board Setup".                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |
| 3. Connect signature analyzer CLOCK, START, STOP, and GROUND inputs and setup as shown in Figure 3-15.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |
| 4. To place the secondary interface in the SA mode, turn on the power supply while momentarily (for 2 seconds) shorting A5U504-1 to A5U504-20 (common).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |
| 5. Use the signature analyzer probe to take the following signatures: <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="width: 45%;"> Power: 5V = IC4C<br/> Microprocessor: A5U504-1 = F77H<br/> A5U504-2 = C98P<br/> A5U504-3 = 1573<br/> A5U504-4 = P42A<br/> A5U504-5 = UHF8<br/> A5U504-6 = F5UC<br/> A5U504-7 = UH8C<br/> A5U504-8 = 23UC<br/> A5U504-9 = 0000<br/> A5U504-10 = IC4C<br/> A5U504-11 = IC4C<br/> A5U504-12 = C76F<br/> A5U504-13 = U042<br/> A5U504-14 = 2189<br/> A5U504-15 = IC4C<br/> A5U504-16 = IC45<br/> A5U504-17 = 0010<br/> A5U504-18 = IC4C<br/> A5U504-19 = IC4C<br/> A5U504-20 = 0000 </div> <div style="width: 45%;"> A5U504-21 = 0C98<br/> A5U504-22 = 5PC7<br/> A5U504-23 = 0000<br/> A5U504-24 = 6CAP<br/> A5U504-25 = A339<br/> A5U504-26 = A319<br/> A5U504-27 = A339<br/> A5U504-28 = 0C98<br/> A5U504-29 = IC4C<br/> A5U504-30 = 0000<br/> A5U504-31 = IC4C<br/> A5U504-32 = 0000<br/> A5U504-33 = 0000<br/> A5U504-34 = IC47<br/> A5U504-35 = 0000<br/> A5U504-36 = 0UPU<br/> A5U504-37 = UF7P<br/> A5U504-38 = 347F<br/> A5U504-39 = CP47<br/> A5U504-40 = IC4C </div> </div> |  |
| 6. After completing the tests, be sure to return the J3 jumper to its original position.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |

**Note**

After completing this test, you can exit the SA mode only by performing a power-on reset.

## Post-Repair Calibration

### When Required

Calibration is required annually and also whenever certain components are replaced. If components in any of the circuits listed below are replaced, the supply must be recalibrated.

---

**Note** For calibration procedures, see Appendix A of the Operating Manual.

---

| Location            | Component                                                                                                                                                                                                    |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A10 Control Board   | CV/CC DACs/operational amplifiers, CV/CC control circuit amplifiers, readback DAC/operational amplifier, readback comparators.                                                                               |
| A1 Front Panel Assy | A1 Front Panel Board or EEPROM AIU6.<br><b>Note:</b> If either of these front panel components is replaced, the power supply must first be reinitialized before calibration (see "EEPROM Initialization" ) . |

### Inhibit Calibration Jumper

If **CAL DENIED** appears on the display when front panel calibration is attempted (or error code 1 occurs when GPIB calibration is attempted on a Systems Supply), the INHIBIT CAL jumper (see Figure 3-15) is installed. This prevents the power supply calibration from being changed. To calibrate the power supply first move this jumper from the INHIBIT CAL position to the NORM position.

### Calibration Password

In order to enter the calibration mode, you must use the correct password as described in Appendix A of the Operating Manual. As shipped from the factory, the supply's model number (e.g., "6681") is the password. If you use an incorrect password, **PASSWD ERROR** appears on the display during front panel calibration, or error code 2 occurs during GPIB calibration, and the calibration mode is disabled. If you do not know the password, you can recover the calibration function by restoring the preset factory calibration constants as described below.

### Restoring Factory Calibration Constants

This procedure allows you to recover the factory calibration constants. The ability to do this allows you to operate the power supply for troubleshooting and/or to recalibrate it as required. To restore the original factory calibration constants, proceed as follows:

1. Turn off the supply and remove the top cover.
2. Move the jumper in test header J3 on the A1 Front Panel Board from the **NORM** to the **FACTORY PRESET CAL** position (see Figure 3-15).
3. Turn on the power supply and note that **ADDR 5** and then **PWR ON INIT** appear briefly on the front panel display.
4. When **PWR ON INIT** no longer appears, the supply's factory calibration constants have been restored and the password has been changed to 0. There is no longer any password protection. You can now turn off the supply and restore the calibration jumper to the **NORM** position (see Figure 3-15).
5. Turn on the supply. You may now set a new password (if desired) and recalibrate the power supply.

---

## EEPROM Initialization

EEPROM AIU6 on the A1 Front Panel Board stores the supply's GPIB address, model number, and constants required to program and calibrate the power supply. If either the front panel board or the EEPROM is replaced, the power supply must be reinitialized with the proper constants by running the program listed in Figure 3-18.

When the program pauses and asks you to make a selection, respond as follows:

### **Initialization (I) or Factory Preset Replacement (F)? I**

After the power supply has been initialized, it must be calibrated as described in Appendix A of the Operating Manual. After calibration, transfer the new calibration constants to the EEPROM's "Factory Cal" locations as described next.

---

## Transferring Calibration Constants To Factory Preset Locations

A newly initialized and calibrated power supply has calibration constants in operating locations but does not have the new factory calibration constants stored in EEPROM. This procedure transfers the calibration constants into the EEPROM FACTORY PRESET CAL locations by running the program listed in Figure 3-18.

When the initialization program pauses and asks you to make a selection, respond as follows:

### **Initialization (I) or Factory Preset Replacement (F)? F**

The new calibration constants will then be stored. Pre-initialized and tested A1 Front Panel boards are available for Analog Programmable "bench" series supplies. (See Chapter 5, Table 5-4 for part numbers.)

A Bench Series Supply can be initialized and the new Factory Preset calibration constants loaded by temporarily replacing the A2 Isolator board with an A2 GPIB board. Then follow the instructions above for "EEPROM INITIALIZATION" and also "TRANSFERRING CALIBRATION CONSTANTS TO THE FACTORY PRESET LOCATIONS" described above.

After the supply has been Initialized, Calibrated, and the new Factory Presets stored, remove the GPIB board and reinstall the original Isolator board.

```

10  !   Program to initialize EPROM or move factory preset data in 668xA
20  !   power supplies.
30  !   RE-STORE " INIT_668X"
40  !   Rev A.00.00 dated 09 Nov 1993
50  !
60    DIM Init_data(1:49),Model$(5),Idn$(21),Cal_data$(40)
70    INTEGER Addr(1:49),Length(1:49)
80    ASSIGN @Ps TO 705                                ! Supply must be at address 705
90    CLEAR SCREEN
100   !
110  Eprom_data_addr:                                ! Data address
120    DATA 2,6,10,14,18,19,20,24,28,32
130    DATA 36,37,38,42,46,50,54,55,56,57
140    DATA 64,68,72,76,80,116,152,153,154,155
150    DATA 156,158,160,162,163,164,165,166,167,168
160    DATA 169,170,171,172,174,176,180,184,188
170    !
180  Eprom_data_len:                                ! Data for word length
190    DATA 4,4,4,4,1,1,4,4,4,4
200    DATA 1,1,4,4,4,4,1,1,1,1
210    DATA 4,4,4,4,4,1,1,1,1,1
220    DATA 2,2,2,1,1,1,1,1,1,1
230    DATA 1,1,1,2,1,4,4,4,4
240    !
250  Eprom_data_6680:                                ! EEPROM data for 6680A
260    DATA 729,71,5.125,0.83,0.4,235,72,895,0
270    DATA 98,3,36,17,6.25,0.83,255,20,10
280    DATA 6680,708,94,4.13,92,128,5,255,0,0
290    DATA 1296,6680,0,20,180,20,180,175,33,98
300    DATA 115,30,20,1,58,.002701,.2,.0017346,10.2286
310    !
320  Eprom_data_6681:                                ! EEPROM data for 6681A
330    DATA 463,75,8.19,0.83,0.6,333,70,592,0
340    DATA 98,3,22,16,17,75,10,0,0,.83,255,20,10
350    DATA 6681,430,95,6.3645,92,128,5,255,0,0
360    DATA 1296,6681,0,20,180,20,180,175,33,98
370    DATA 115,30,20,1,58,.002701,.2,.0017346,10.2286
380    !
390  Eprom_data_6682:                                ! EEPROM data for 6682A
400    DATA 175,74,21.5,0.83,0.15,73,246,0
410    DATA 98,21,8.7,10,26.3,0.83,255,20,10
420    DATA 6682,162,96,15,96,128,5,255,0,0
430    DATA 1296,6682,0,20,180,20,180,175,33,98
440    DATA 115,30,20,1,127,.002701,.2,.000307,10.25
450    !
460  Eprom_data_6683:                                ! EPROM data for 6683A
470    DATA 116,74,32.8,0.83,0.23,75,164,0
480    DATA 98,21,5.5,10,40,0,0.83,255,20,10
490    DATA 6683,108,96,23,97,128,5,255,0,0
500    DATA 1296,6683,0,20,180,20,180,175,33,98

```

**Figure 3-17. Initialization and Factory Preset Replacement Program Listing (Sheet 1 of 5)**

```

510 DATA 115,30,20,1,127,.002701,.2,.00042,10.25
520 !
530 Eprom_data_6684: ! ! EEPROM data for 6684A
540 DATA 93,74,41,0,83,0,29,70,131,0
550 DATA 98,21,4,6,10,50,0,83,255,20,10
560 DATA 6684,87,97,28,93,128,5,255,0,0
570 DATA 1296,6684,0,20,180,20,180,175,33,98
580 DATA 115,30,20,1,127,.002701,.2,.000333,10.234375
590 !
600 !
610 INPUT "Input Power Supply model number. Example: ""6681A""",Model$
620 CLEAR SCREEN
630 !
640 RESTORE Eprom_data_addr
650 !
660 FOR I=1 TO 49
670 READ Addr(I)
680 NEXT I
690 !
700 RESTORE Eprom_data_len
710 !
720 FOR I=1 TO 49
730 READ Length(I)
740 NEXT I
750 !
760 SELECT TRIM$(UPC$(Model$)) ! Delete leading/trailing zeros and set to uppercase
770 CASE "6680A"
780 RESTORE Eprom_data_6680
790 CASE "6681A"
800 RESTORE Eprom_data_6681
810 CASE "6682A"
820 RESTORE Eprom_data_6682
830 CASE "6683A"
840 RESTORE Eprom_data_6683
850 CASE "6684A"
860 RESTORE Eprom_data_6684
870 !
880 CASE ELSE
890 PRINT "Model number not found. Program is for models"
900 PRINT "Agilent 6680A, 6681A, 6682A, 6683A and 6684A only"
910 STOP
920 END SELECT
930 !
940 FOR I=1 TO 49 ! Read model dependent data
950 READ Init_data(I)
960 NEXT I
970 !
980 OUTPUT @Ps;"*CLS" ! Clears power supply registers
990 !
1000 OUTPUT @Ps;"CAL;STATE ON," ! Turn on cal mode, "0" passcode
1010 !

```

**Figure 3-17. Initialization and Factory Preset Replacement Program Listing (Sheet 2 of 5)**

```

1020 GOSUB Ps_error                ! Error if passcode is not "0"!
1030 IF Err THEN
1040     OUTPUT @Ps;"*IDN?"        ! Get data from model # location
1050     ENTER @Ps;Idn$
1060     Model=VAL(Idn$[POS(Idn$,"")+1])
1070 ELSE
1080     GOTO Start
1090 END IF
1100 !
1110 OUTPUT @Ps;"CAL:STATE ON,";Model    ! Turn on cal mode, passcode =
1120                                     ! data at model number location
1130 !
1140 GOSUB Ps_error                ! Error if passcode is not same as
1150                                     ! data at model # location
1160 IF Err THEN
1170     OUTPUT @Ps;"CAL:STATE ON,";Model$[1,4]    ! Turn on cal mode, passcode =
1180                                             ! model #
1190     GOSUB Ps_error
1200     IF Err THEN
1210         PRINT "Change pass code to the power supply model # or zero then restart the program."
1220         STOP
1230     ELSE
1240         GOTO Start
1250     END IF
1260 END IF
1270 !
1280 Start:    !
1290          !
1300          !
1310 INPUT "Select Initialization (I) or Factory preset replacement (F).",Sel$
1320 CLEAR SCREEN
1330 SELECT (UPC$(Sel$))
1340 CASE "I"                ! Select Initialization
1350     GOTO Init_eeprom
1360 CASE "F"                ! Select install new factory data
1370     GOTO Fact_preset
1380 CASE ELSE
1390     BEEP
1400     GOTO Start
1410 END SELECT
1420 !
1430 Init_eeprom:    !
1440 PRINT "Initializing EEPROM"
1450 !
1460 FOR I=1 TO 49
1470     OUTPUT @Ps;"DIAG:EEPR ";Addr(I);",";Length(I);",";Init_data(I)
1480 NEXT I
1490 GOTO Cal_off
1500 !
1510 !
1520 Fact_preset:    !

```

Figure 3-17. Initialization and Factory Preset Replacement Program Listing (Sheet 3 of 5)

```

1530  CLEAR SCREEN
1540  PRINT "This program should ONLY be completed if your power supply"
1550  PRINT "EEPROM has been replaced or a component that will effect"
1560  PRINT "the calibration AND the alignment of voltage, overvoltage"
1570  PRINT "and current is complete AND unit has passed the performance"
1580  PRINT "test.           Enter C to continue, any other key to abort."
1590  INPUT Cont_prog$
1600  IF (UPC$(Cont_prog$))<>"C" THEN GOTO Cal_off
1610  !
1620  CLEAR SCREEN
1630  PRINT "Transferring calibration data to factory preset locations."
1640  !
1650  Fact_cal_sour:      ! Address of factory calibration data source
1660  DATA 2,6,68,72,20,24,76,80,150
1670  !
1680  Fact_cal_dest      :  ! Address of factory calibration data destination
1690  DATA 84,88,92,96,100,104,108,112,116
1700  !
1710  Fact_cal_len:      ! Length of factory calibration data
1720  DATA 4,4,4,4,4,4,4,4,1
1730  !
1740  RESTORE Fact_cal_sour
1750  FOR I=1 TO 9
1760  READ Cal_sour_addr(I)
1770  NEXT I
1780  !
1790  RESTORE Fact_cal_dest
1800  FOR I=1 TO 9
1810  READ Cal_dest_addr(I)
1820  NEXT I
1830  !
1840  RESTORE Fact_cal_len
1850  FOR I=1 TO 9
1860  READ Cal_length(I)
1870  NEXT I
1880  !
1890  FOR I=1 TO 9                                ! Locations of good data
1900  OUTPUT @Ps;"DIAG:EEPR? ";Cal_sour_addr(I);",";Cal_length(I)  ! Read good data
1910  ENTER @Ps;Cal_data$                                ! Enter good data
1920  OUTPUT @Ps;"DIAG:EEPR";Cal_dest_addr(I);",";Cal_length(I);",";Cal_data$
! Write good data to factory preset locations
1930  NEXT I
1940  !
1950  !
1960  Cal_off
1970  CLEAR SCREEN
1980  OUTPUT @Ps;"CaL:STATE OFF"                    ! Turn off cal mode
1990  !
2000  GOSUB Ps_error                                ! Check for errors

```

**Figure 3-17. Initialization and Factory Preset Replacement Program Listing (Sheet 4 of 5)**

```

2010 IF Err THEN
2020     PRINT "An error occurred during the EEPROM read/write, Check for"
2030     PRINT "programming errors. Initialization data may be incorrect."
2040     STOP
2050 END IF
2060 !
2070 PRINT "Operation complete. Program stopped."
2080 STOP
2090 !
2100 Ps_error:                                ! Error handling subroutine
2110     OUTPUT @Ps;"SYST:ERR?"                ! Check for errors
2120     ENTER @Ps;Err
2130     RETURN
2140     !
2150     END

```

**Figure 3-17. Initialization and Factory Preset Replacement Program Listing (Sheet 5 of 5)**

## Disassembly Procedures

### WARNING

**Shock Hazard:** To avoid the possibility of personal injury, remove the power supply from service before removing the top cover. Turn off the ac power and disconnect the line cord, GPIB cable, load leads, and remote sense leads before attempting any disassembly. Any disassembly work must only be performed by a qualified support technician.

Observe that the DC RAIL assembly LEDs (DS420 & DS421) are fully extinguished (no live voltages present) before attempting any disassembly work. Any disassembly work must only be performed by a qualified support technician.

Cable connections are shown in Figure 6-2 of Chapter 6 and component part numbers are given in Chapter 5. Reassembly procedures are essentially the reverse of the corresponding disassembly procedures.

## Tools Required

- ⌘ TORX screwdriver size T-15 (for most all retaining screws).
- ⌘ TORX screwdriver size T-20 (for power supply carry straps).
- ⌘ Seven (7) mm metric hex driver (to remove GPIB read connector).
- ⌘ Pencil, paper, and labels to make notes to aid in the reinstallation of components.
- ⌘ Work at a static-free station such as a table covered with static-dissipative laminate or with a conductive table mat (Agilent P/N 9300-0797, or equivalent) using a conductive wrist strap where necessary, such as, Agilent P/N 9300-0969 or 9300-0970.

## Top Cover

1. Remove the four screws that secure the carrying straps (two TORX 20 screws on each side). These same screws secure the cover to the chassis.
2. Spread the bottom rear of the cover, and then pull the cover backwards towards the rear of the power supply to disengage it from the front panel.

### WARNING

**Shock Hazard:** Hazardous voltage can exist inside the power supply even after it has been turned off. Check the INPUT RAIL LED (A4CR402) under the RFI shield (see Figure 3-18 end of this section for LED location). If the LED is on, there is still hazardous voltage inside the supply. Wait until the LED goes off (*approximately 7 minutes after power is removed*) before proceeding.

## Removing Protective RFI Shield (Galvanized Sheet Metal)

Once you remove the top cover of the power supply, you will see the RFI galvanized sheet metal cover preventing the power supply from emanating RFI fields. The RFI shield covers most components and circuit boards, as well as, many of the chassis-mounted components. You must remove this shield in order to gain access to the inside of the power supply. Remove the shield as follows:

1. There are approximately 21 screws holding the cover to the frame.
2. There are two screws at the top of the shield that secure a retaining clip for the GPIB board. You do not need to remove these screws, simply loosen the screws and slide the GPIB retaining clip backwards free of the GPIB board.
3. Remove all shield securing screws using a TORX T-15 screwdriver and save for later reinstallation .
4. Lift the RF shield out of the chassis.
5. When DC RAIL LEDs are extinguished, it is safe to work inside the power supply. (See Warning note above.)

### Note

The following procedures describe the removal of most of the circuit boards within the power supply. Once the GPIB board is removed, you will have access to the A4 AC Input Assembly and the A5 DC Rail Assembly. Similarly, once the A10 control board is removed along with the Rectifier HS you will have access to other components and boards within the supply.

It is recommended that when you disconnect any wires and/or cable connectors you should immediately label them to simplify their reinstallation later.

## GPIB Board

To remove the GPIB board, disconnect the cables from the following connectors at the GPIB board:

1. Disconnect the cable going to connector P101.
2. Disconnect phone cable going to J107.
3. Disconnect phone cable going to J107.
4. Disconnect phone cable going to J108.
5. Remove two (2) holding screws at rear of chassis holding GPIB board in place.
6. Using a 7 mm driver, remove the two (2) screws holding the GPIB connector at rear of chassis.
7. The GPIB board can now be lifted out from the chassis.

## A4 AC Input Assembly

To remove the A4 AC Input Board first remove the GPIB board then disconnect these cables from the following connectors at the GPIB board:

1. Disconnect the cables going to connector J417 and J420.
2. Disconnect the cable going to connector J419.
3. Remove the three (3) fuse assemblies inside rear of power supply to free the wires going to E400, E401, and E402 on the AC Input Board.
4. Remove the holding screw at the center of board just to the left of the 3-phase choke.
5. Disconnect phone cable going to J108.
6. Slide the board to the right and lift out.
7. Other wires going to the board can now be removed/unsoldered.

## A5 DC RAIL Assembly

Disconnect these cables from the following connectors at the A5 DC RAIL board:

1. Disconnect the cables going to four connectors: J430, J431, J432, and J433.
2. Disconnect the cable going to connector J440.
3. Remove the four (4) holding screws TORX T-15 holding the A5 DC RAIL board in place.
4. Lift the board out and remove/desolder any other wires preventing the board from being removed.

## A6 BIAS Assembly

Disconnect the cables from the following connectors at the A6 BIAS Assembly board:

1. Disconnect cables from connectors J809, J821, J830, and J831 on the A6 BIAS Board.
2. Remove two (2) holding screws at top side of board.
3. Slide board upward until board is free of slotted standoffs. There is one of these standoffs at the top of the board and two at the bottom. Wiggle the board slightly to clear all three standoffs then lift the board out.
4. Once the board is free from its restraining standoffs, you can proceed to remove/unsolder any other wires/cables as necessary to remove the A6 BIAS Board entirely.

---

### Note

It is recommended that you label any connectors you disconnect from the A6 BIAS Board to facilitate the reinstallation of these cables/wires back to their correct locations later. If you should have trouble later in determining which cable goes to which connector during reinstallation, refer to the cabling diagram in Chapter 6.

---

## A3 FET Board

Follow this procedure to remove the A3 FET Board:

1. Remove the four (4) holding screws that secure the two black caps over the Rectifier HS assembly.
2. Once these caps are removed, you can remove the Rectifier HS which faces the A3 FET Board.
3. Disconnect two connectors, P430 and P431, at the A5 DC RAIL assembly.
4. Disconnect two connectors P/O cable assemblies P/N 5080-2283, at the A5 DC RAIL assembly.
5. You can now lift out the A3 FET board and remove/unsolder any other wires necessary to fully remove the A3 board.

## A10 Control Assembly

Disconnect the cables from the following connectors at the A10 DC RAIL board:

1. Disconnect the ribbon cable going from to the A6 Bias board. This cable connects to J509 on the A10 board but it is easier to disconnect it at the A6 Bias Board.
2. Disconnect cables from connector J507 (phone) and connectors J510, J511, J512, and J513 on the A10 Control Board.
3. At rear of power supply, remove holding screw directly above fan. This screw holds the frame and A10 control board in place.
4. At rear of power supply unplug connector DIG CNTL from A10 Control Board.
5. Move board to the right and lift board and associated steel frame out of chassis.

## Front Panel Assembly

1. Peel off vinyl trim (one strip on each side of front panel) to access the four screws that secure the front panel assembly to the chassis.
2. Remove the four screws (two on each side) using a size T-10 TORX.
3. Disconnect phone cable W5 from J6 on the A1 Front Panel Board.
4. Record the color code and the location of each of the four wires connected to line switch S1.
5. Disconnect the wires from the switch assembly.
6. Remove the front panel assembly.

## S1 Line Switch

1. Remove Front Panel Assembly and disconnect switch wires as described in that procedure.
2. Release the switch locking tabs by pressing them inward against the body of the switch and removing the switch.

## A1 Front Panel Board

1. Remove the Front Panel Assembly and disconnect the switch as described under "Front Panel Assembly".
2. Disconnect LCD display ribbon cable W2 from J2 on the A1 Front Panel Board.

---

**Note** When reinstalling the LCD ribbon cable, be sure to line up the "stripe" of the ribbon cable with pin 1 on J2.

---

3. Use a small Allen wrench (0.050") to loosen the set screws that are inset in the knobs. (These are the AIG1 and AIG2 Voltage/Current control shafts that extend through the front panel.) Remove knobs and shaft bushings.

---

**Note** Be careful not to unscrew the knob set screws too far out as they can easily fall out of the knob and become lost.

---

4. Remove screw (if installed) that secures board to the Front Panel Assembly. The screw is located near J4 on the Front Panel Board.
5. Lift tab (near J6 on front panel board) and slide left to release board from the A1 Front Panel Assembly and remove board.

### A1DSP1 LCD Display

1. Remove the A1 Front Panel Board as described in that procedure.
2. Remove the nuts securing the LCD display to the front panel assembly and remove the LCD and attached ribbon cable (see CAUTION below). (When reinstalling this cable, be sure to line up the cable stripe over the LCD connector pin marked with a square.)

---

**CAUTION**

The display connector is fragile. When removing the cable from the LCD display, carefully rock the cable connector back and forth while gently pulling it back.

---

### A1G1 and A1G2 Rotary Controls

1. Remove the A1 Front Panel Board as described in that procedure.
2. Remove the A1G1 and A1G2 cables from connectors A1J4 and A1J5.
3. Remove nuts securing the A1G1 A1G2 controls to the board and remove controls.

### A1KPD Keypad

1. Remove the A1 Front Panel Board as described in that procedure.
2. With board removed, keypad can easily be lifted out of the Front Panel Assembly.

### Output Bus Boards A7, A81 and A9 & Chassis Components

---

**Note**

To remove the A7 Snubber Board, A8 Fast Sense Assembly, A9 Downprogrammer and other chassis mounted components, first remove the A10 Control Board frame assembly and the two Rectifier Heat Sinks described earlier. Once the heat sinks are removed you will have access to the A7, A8, and A9 boards as well as other chassis mounted components.

Should you have any difficulty in removing power supply components or boards, contact the Agilent Technologies Support Line for help.

---

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**WARNING**

**Shock Hazard:** Hazardous voltage can exist inside the power supply even after it has been turned off. Check the INPUT RAIL LED (A4CR402) under the RFI shield (see Figure 3-18 end of this section for LED location). If the LED is on, there is still hazardous voltage inside the supply. Wait until the LED goes off (*approximately 7 minutes after power is removed*) before proceeding.

---

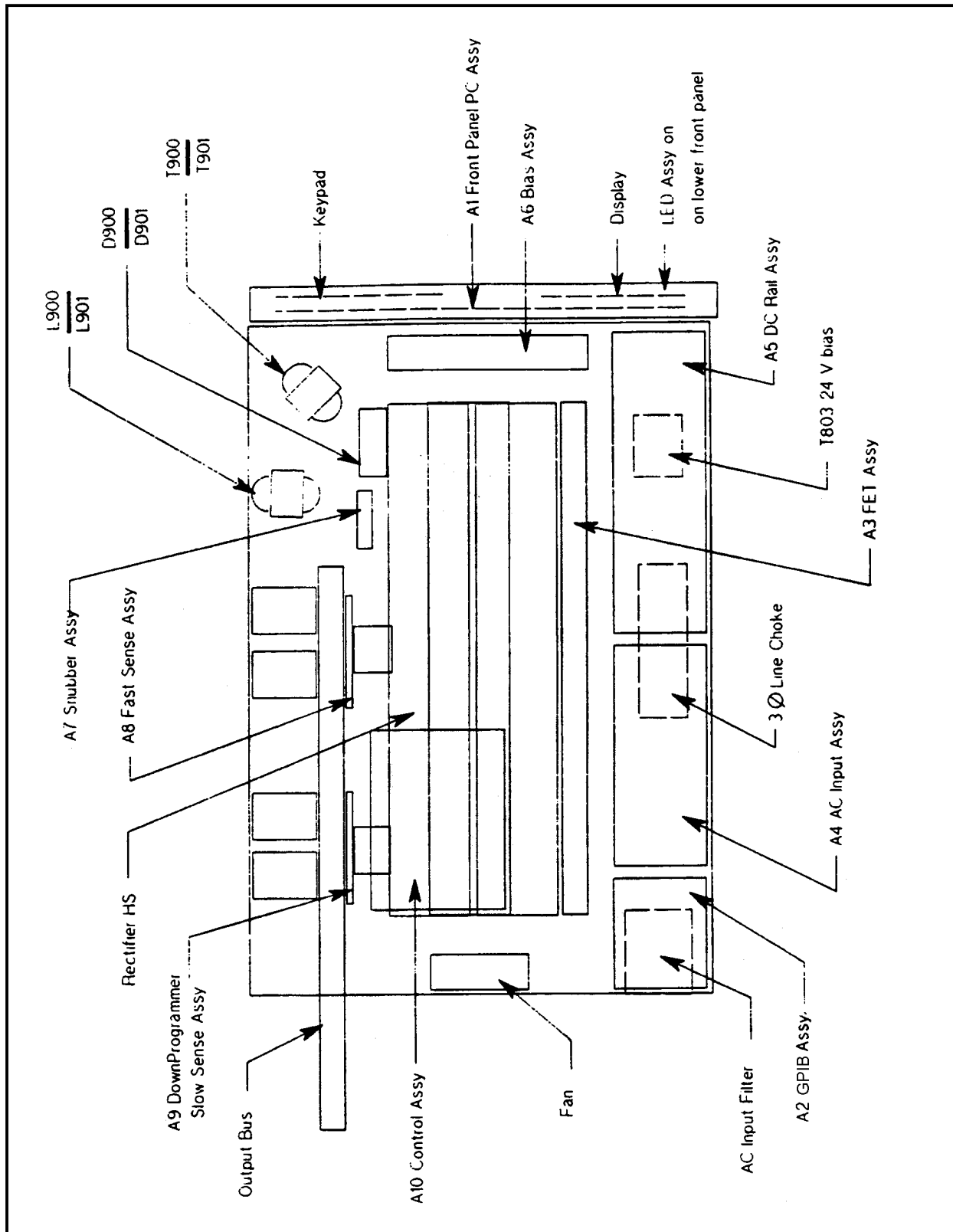


Figure 3-18. Component Locations (Top Cover and RFI Shield Removed)

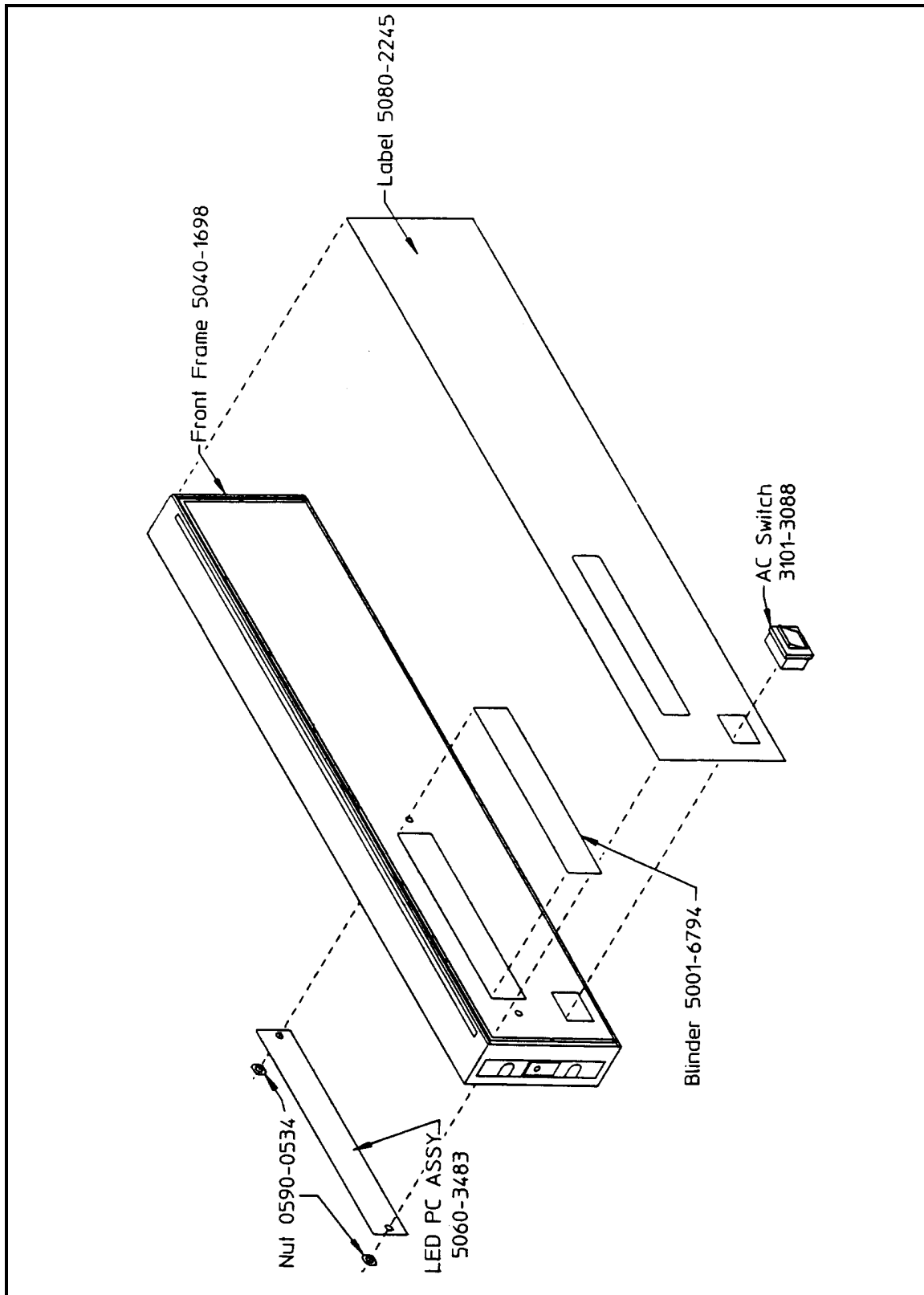


Figure 3-19. 5-Inch Front Panel Frame Assembly

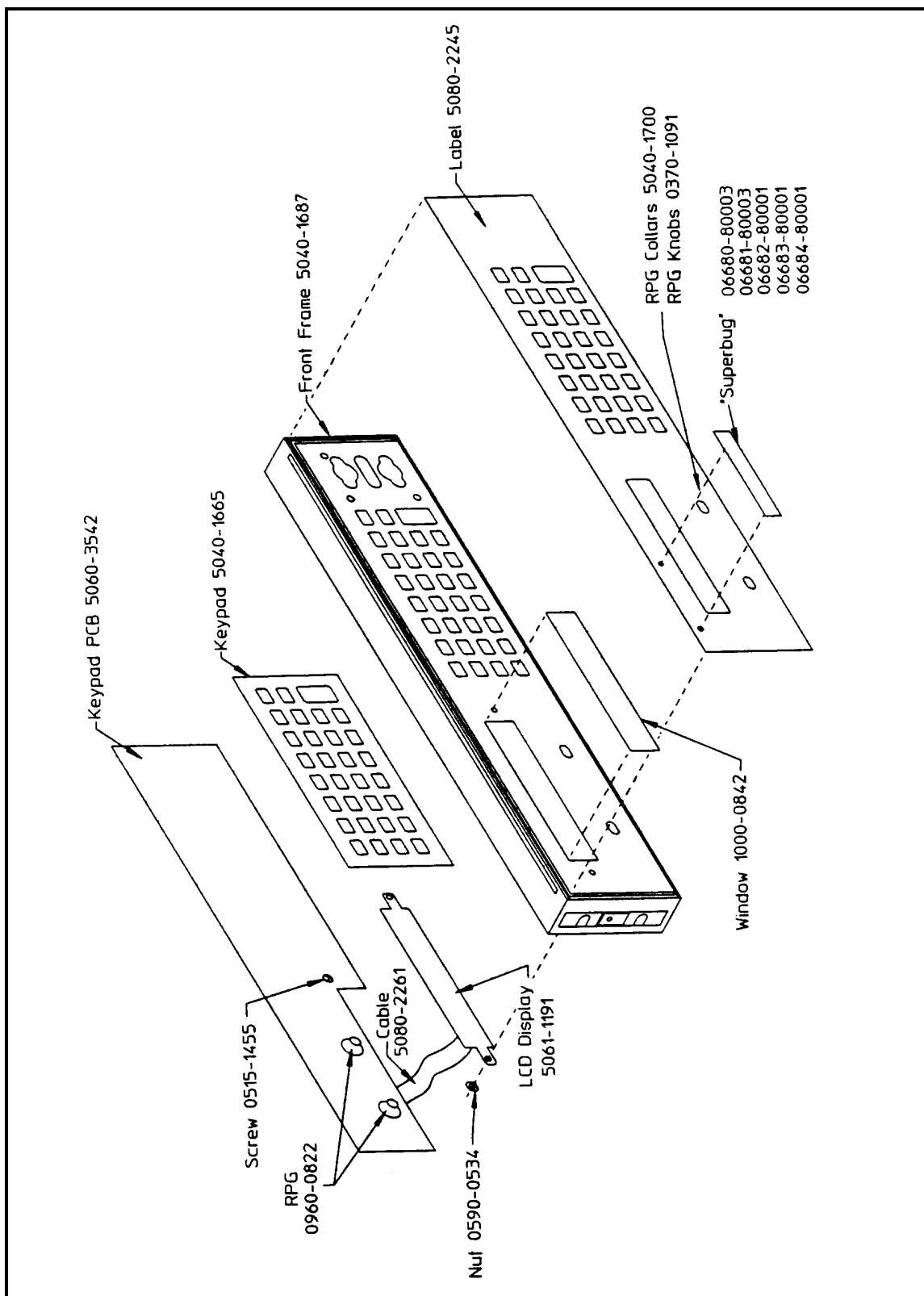


Figure 3-20. 3-Inch Front Panel Frame Assembly

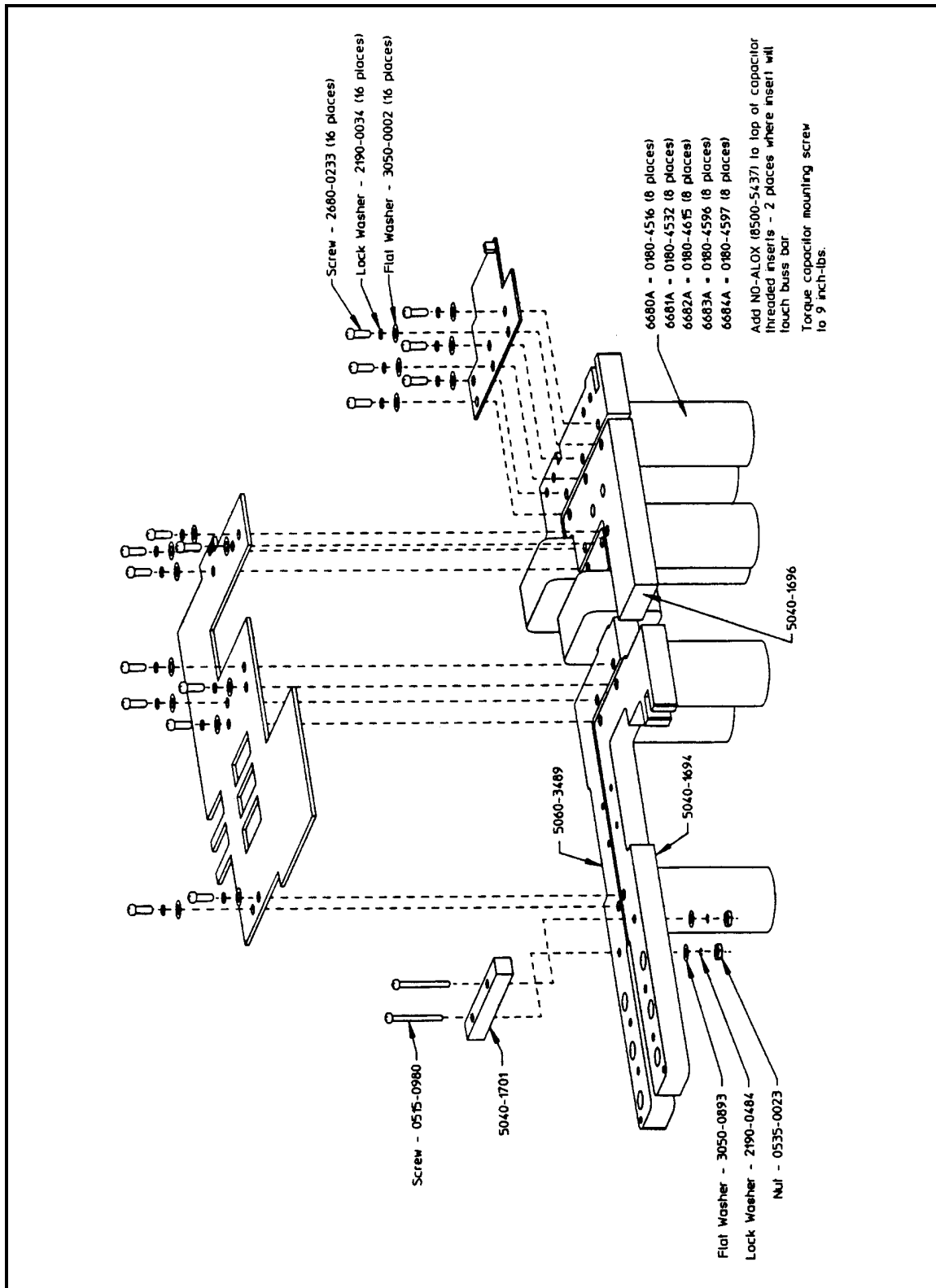


Figure 3-21. Assembly A10, Exploded View

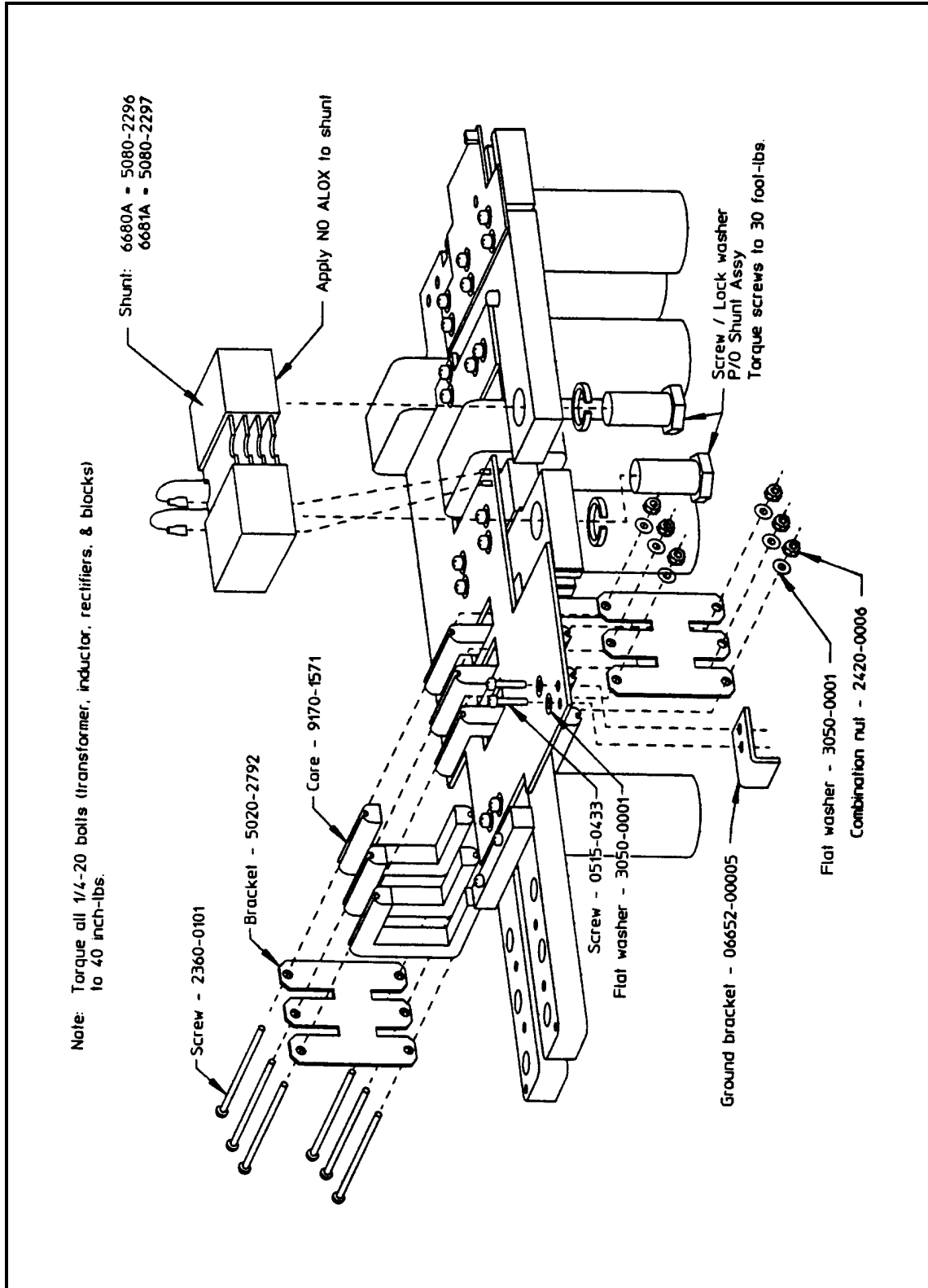


Figure 3-22. Assembly A10, Exploded View (6680A, 6681A)

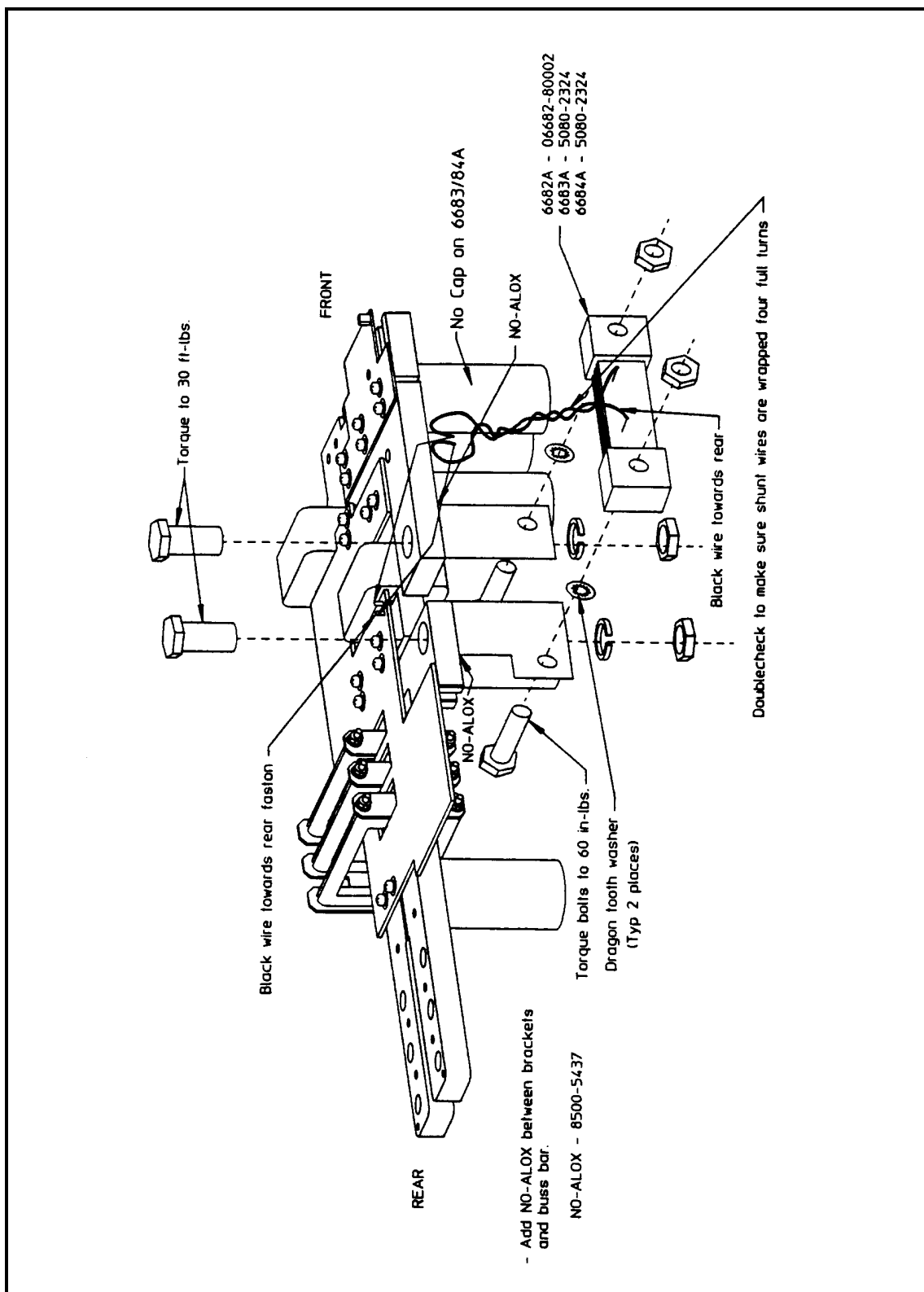


Figure 3-23. Assembly A10, Exploded View (6682A, 6683A, 6684A)

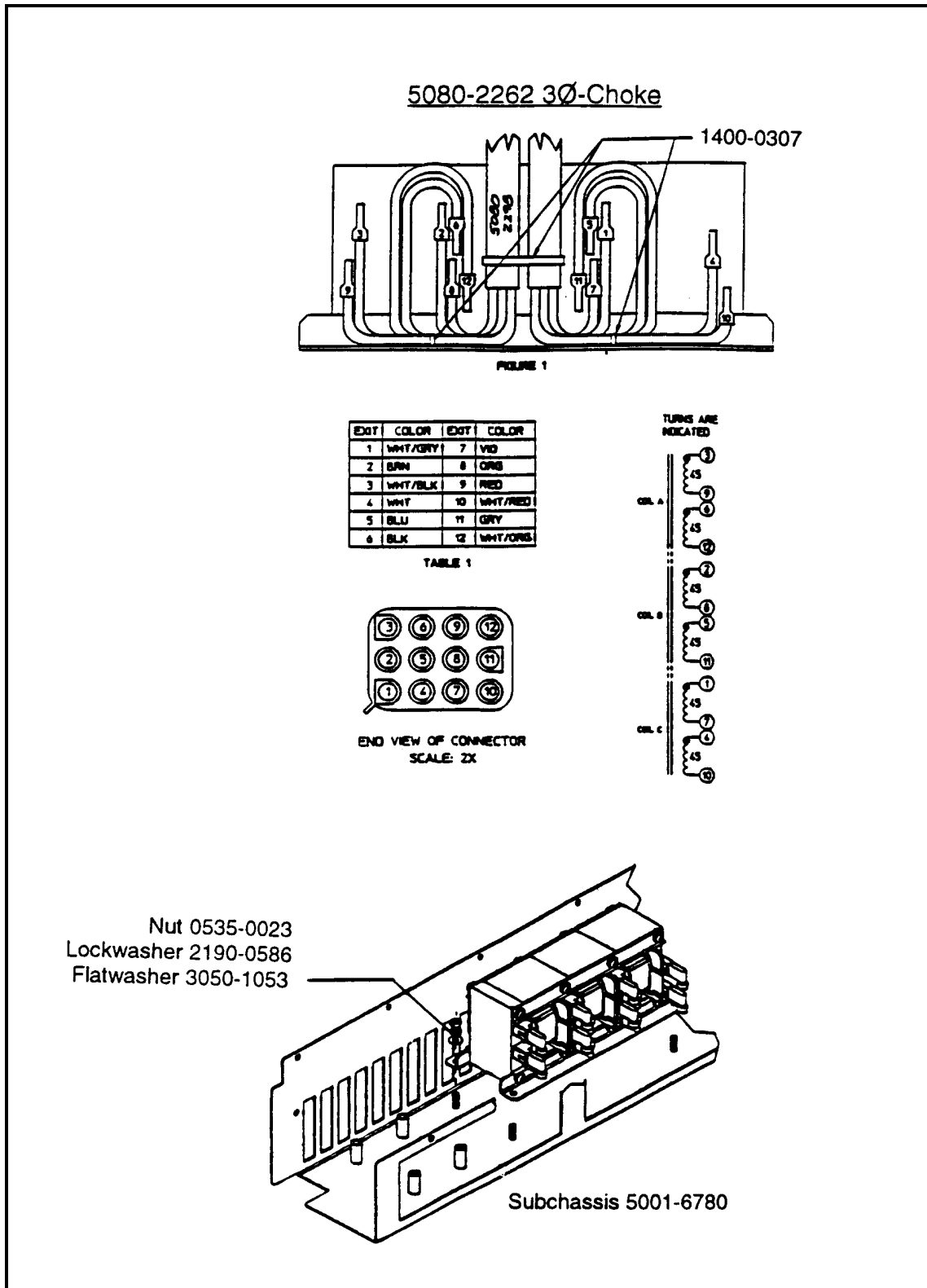


Figure 3-24. Three-Phase Line Choke Subchassis Wiring

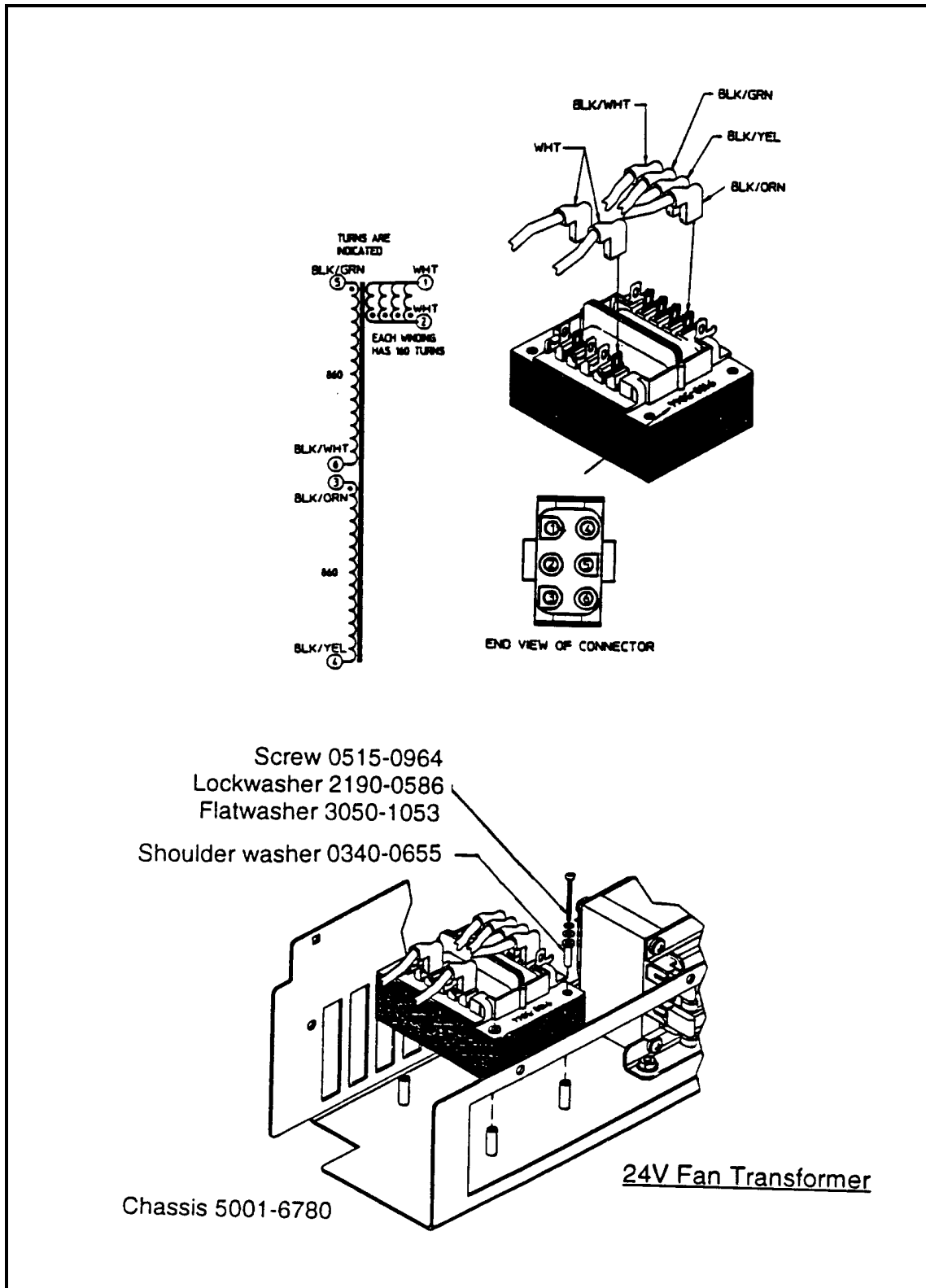


Figure 3-25. 24 Volt Fan Transformer

# Principles Of Operation

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## Introduction

Figure 4-3 (at the end of this chapter) is a block diagram showing the major circuits within the power supply. The power supply consists of the following circuits:

- A1 Front Panel Board ckts.
- A2 GPIB ckts.
- A10 Control Board including the secondary interface ckts, CV/CC control ckts, switching/downprogramming control ckts.
- Power circuits on the A4 AC Input Board.
- A3 FET Assembly ckts.
- A5 DC Rail Board ckts.
- Output bus circuits which include the A7 Snubber Board, A8 Slow Sense Board, and A9 Downprogrammer Board ckts.
- Output rectifiers and filter capacitors.
- Ferrite cores mounted on the output bus form the output filter inductors.
- A6 Bias Board supply which supplies low-voltage, low-power, bias voltages where required.

Each block in Figure 4-3 identifies a schematic diagram in Chapter 6 where the circuits are shown in detail. You can refer to the component location diagrams in Chapter 6 to locate specific components mentioned in this description. Chapter 6 also has a cabling diagram showing the circuit board interconnections.

---

## A2 GPIB Board

Circuits on the A2 GPIB board provide the interface between the GPIB controller and the power supply. All communications between the power supply and the GPIB controller are processed by the GPIB interface and primary microprocessor circuits on the A2 board.

The primary microprocessor circuits (microprocessor, U114, ROM U106, and RAM U108) decode and execute all instructions and control all data transfers between the GPIB controller and the Secondary Interface on the A10 Control Board. The primary microprocessor also processes measurement and status data received from the Secondary Interface.

A UART (universal asynchronous receive/transmit) IC (U112) on the A2 board converts data between the primary microprocessor's 8-bit, parallel bus and the serial I/O port. The serial data is transferred between the primary interface and the secondary interface via a programmed GAL (gated array logic) IC (U119) and optical isolator ICs (U110/U111). These ICs isolate the primary interface circuits (referenced to earth ground) from the secondary interface circuits (referenced to power supply common). The GAL IC also provides a serial I/O port to the A1 Front Panel Board to enable front panel control of the power supply.

A serial link interface IC (U109) on the A2 GPIB Board allows up to sixteen supplies to be connected together and programmed from one GPIB address. The first supply is the only supply connected directly to the GPIB controller and is set to the primary GPIB address. The remaining supplies are set to secondary addresses and are linked (daisy chained) together via the J1/J2 phone jacks at the rear of each supply. The serial link configuration is described in the Power Supply Operating Manual.

A digital control interface on the A2 GPIB Board provides the following power supply functions:

- Relay link.
- Digital I/O.
- Remote inhibit (INH).
- Discrete fault indicator (FLT).

An optical isolator IC (U113) isolates the FLT output signal common from the external fault circuit common. The desired digital interface function is selected by placing a jumper in a header (J106) on the A2 GPIB Board. Appendix D in the Power Supply Operating Manual describes how to select one of these functions and how to make the appropriate external connections to the DIG CNTL connector on the supply's rear panel. Another jumper position on the header selects the SA (signature analysis) mode, which is used for troubleshooting (see Chapter 3).

The A2 Board has a bias supply regulator IC (U121) that provides +5V (with respect to earth ground) for the primary interface circuits and the bias voltage for the front panel board circuits, the LCD, and the keypad. The A2 Board also has a line or bias voltage detector IC (U101) that generates a power clear signal (PCLR). This signal initializes certain primary interface and front panel circuits when normal ac line voltage is applied, and also shuts these circuits down when the line voltage drops below the required minimum.

---

## A1 Front Panel Assembly

The power supply A1 Front Panel Assembly contains a circuit board, keypad, liquid crystal display (LCD), and the power on/off switch.

The Front Panel Circuit Board A1 contains microprocessor circuits (microprocessor U3 and ROM U4) that decode and execute all front panel keypad commands. These are transferred to the power supply output via the serial I/O port to the A2 board GAL (gated-array logic) IC and isolators, and to the secondary interface circuits on the A10 Control Board. The front panel microprocessor circuits also process power supply measurement and status data received from the serial I/O port. This data is displayed on the LCD.

IC EEPROM, U6, (electrically-erasable, programmable, read-only memory) on the A1 Front Panel Board stores data and configuration information. This information includes calibration constants, GPIB address, the present programming language, and model-dependent data such as the minimum and maximum values of voltage and current.

One of the EEPROM storage locations holds a checksum value used to verify the integrity of this EEPROM data. Access to the calibration data in the EEPROM is controlled by the combination of a password and jumper options on a header (J3) located on the A1 board (see Post-Repair Calibration in Chapter 3).

The power supply can be calibrated manually using the front panel keys, or via the GPIB bus with SCPI (Standard Commands for Programmable Instruments) commands. The calibration procedure is in Appendix A of the Power Supply Operating Manual).

---

## A10 Control Board

The A10 Control Board contains the Secondary Interface, CV/CC Control Circuits, Readback Circuits, PWM Switching Circuits and OV/Downprogramming Circuits. These circuits are shown schematically in the A10 Control Board schematic.

### Secondary Interface (P/O A10 Board)

These circuits are shown in detail on the A10 Control Board schematic and include the Secondary Microprocessor (U506), Programmed GAL (U505), three DAC/OpAmp circuits (U510-U515), Readback Comparator circuits (U516, U517) and OV/Shunt DAC OpAmp circuit, (U520, U521).

The Secondary Microprocessor translates serial data received from the A2 board into parallel 12 bit data. The data bus is connected directly to the four DAC/OpAmp circuits. Under control of the  $\mu$ P the selected DAC converts the bus data into an analog signal. The DAC reference circuit (U503, U504) provides a +10V reference for the CV and CC DACs and a -11.6V reference for the readback DAC. Zener VR501 provides a -6.2V reference for the OV Shunt DAC.

The CV DAC/OpAmp (U510, U513) converts the programmed voltage value from the bus or front panel into the CVPROG signal. CVPROG is sent to the CV Error Amp and compared with the VMON signal to control the magnitude of the output voltage in the CV mode. The range of CVPROG is 0 volts to -10 volts, which corresponds to the zero-to-full-scale output voltage range of the supply.

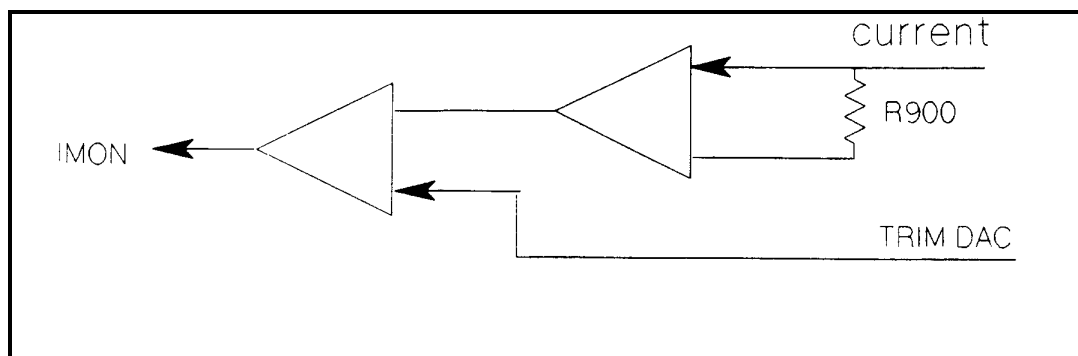
The CC DAC/OpAmp (U511, U514) converts the programmed current value from the bus or front panel into the CCPROG signal. CCPROG is sent to the CC Error Amp and is compared with the IMON signal to control the magnitude of the output current in the CC mode. The range of CCPROG is 0 volts to -10 volts, which corresponds to the zero-to-full-scale output current range of the supply.

The Readback Comparators (U516, U517) operate with the Readback DAC/OpAmp (U512, U515) to return the following signals to the  $\mu$ P:

- The monitored output voltage (VMON).
- The monitored output current (IMON).
- The ambient temperature (AMB\_SENSE).
- The programmed voltage value (CVPROG).
- The programmed current value (CCPROG).
- The fan detector (FAN\_DEW).

The readback DAC circuit is controlled by the  $\mu$ P to successively approximate (to 12-bit resolution) the value of each signal monitored. The CVPROG and CCPROG signals are used during selftest to check DAC/OpAmp operation. The  $\mu$ P monitors the fan speed and ambient temperature and generates the FAN\_PWM control signal to adjust fan speed depending upon the ambient temperature measured internally in the power supply.

A dual DAC, Shunt-Trim/OV, Amplifier circuit (U520, U521) performs two functions. One is to convert the programmed overvoltage value from the bus or front panel into the OVREF signal. The OVREF signal is compared by U502 with the output voltage. Second, the Shunt Trim DAC calibrates the IMON signal by sampling the current flowing through current-sense resistor (R900) on the output power bus together with the TRIM input signal.



**Figure 4-1. AC Calibration of IMON**

During power initiation, the secondary processor generates PWM DISABLE to the power supply's output off for 10 seconds. After 10 seconds PWM DISABLE is removed and the supply's output can be programmed.

CV/CC Control (P/O A10 Board) These circuits are shown in detail on the A10 Control Board schematic and include the CV (constant voltage) and CC (constant current) control loops. The power supply must act as either a CV or CC supply for

any value of load impedance. Switching between CV and CC is done automatically by the CV/CC control circuits at a value of load impedance equal to the ratio of the programmed voltage value to the programmed current value.

A low-level CV or CC signal is generated by the applicable status comparator (P/O U502) and returned to the secondary processor to indicate that the corresponding mode, CV or CC, is in effect.

In CV mode, an OR gate diode (D652) conducts and the CV loop regulates the output voltage. A CV error amplifier (P/O U621) compares the programmed voltage signal CVPROG to VMON which is the output signal from the V<sub>DIF</sub> amplifier (P/O U621). The range of VMON is 0 volts to +10 volts which corresponds to the zero-to-full-scale output voltage of the supply. If the output voltage exceeds the programmed voltage the OR GATE signal goes low causing the output voltage to decrease to the programmed value.

Conversely, if the output voltage is less than the programmed voltage, the OR GATE signal goes high causing the output voltage to increase to the programmed value. An externally applied dc signal, VPROG, can be used to program the output voltage. A 0 volt to -5 volt VP level produces a proportional zero-to-full-scale output voltage.

In CC mode, an OR gate diode (D651) conducts and the CC loop regulates the output voltage. A CC error amplifier (P/O U620) compares the programmed voltage signal CCPROG to IMON which is the output signal of 2nd I<sub>AMP</sub> (P/O U620). The range of IMON is 0 volts to +10 volts which corresponds to the zero-to-full-scale output voltage of the supply. If the output current exceeds the programmed current, the OR GATE signal goes low causing the output current to decrease to the programmed value.

Conversely, if the output current is less than the programmed current, the OR GATE signal goes high causing the output current to increase to the programmed value. An externally applied dc signal, IPROG, can be used to program the output current. A 0 volt to -5 volt IP level produces a proportional zero-to-full-scale output current.

Switching/Downprogramming Control (P/O A10) These circuits include a Ramp Generator, Divider /Deadtime Latch, Fast Sense Differential Amplifier, Pulse Width Modulator, Summing Comparator, Down-Programmer Control and OV Comparator circuits.

The Divider/Deadtime Latch (U600, U601, U602) divides the 2-MHz ALE<sub>CK</sub> signal from the Secondary  $\mu$ P and supplies 40 KHz pulses to the Ramp Generator (U607) and ON Latch (U604).

The OR-GATE signal (CV or CC control signal as previously described) is summed with the 40 KHz triangular waveform produced by the Ramp Generator. An input from the Fast Sense Differential Amplifier is also summed to compensate for a sudden transient in the rectified output.

The width of the output pulses from the Summing Amplifier vary as the OR-GATE control signal increases or decreases. These pulses are applied to the Pulse-Width Modulator (U603) via the On Latch. The PWM generates the square wave pulses that are applied to the A3 FET assembly to turn the FET switches on and off. The Deadtime Latch resets the ON Latch to provide a minimum off time for the FET switches.

The OV circuit compares the output voltage level with the OVREF signal which represents the programmed overvoltage level. When the output voltage exceeds the programmed OV value, the downprogrammer circuits are activated and the FET switches are turned off.

The Downprogrammer control circuit generates control signal DP CONTROL whenever an OV or disable condition has been detected, or when the output voltage exceeds the programmed value. DP CONTROL causes the downprogrammer FETs (Q980, Q981) on the A9 Downprogrammer/Fast Sense board to conduct and conduct current away from the load.

---

## A4 AC Input Board

The A4 Input Board contains the Inrush-Current Limit relay (K401), Main Power Relay (K402), current-limiting resistors (R407, R408) and open-fuse-detect resistor circuit (R400-R405). On power-on, the current-limit relay (K401) closes allowing the dc rail capacitors to charge under a controlled condition. This applies ac voltage to the A6 Bias Board. After the turn-on initialization period (approximately 10 seconds), the main relay (K402) closes, shorting out the current-limit resistor.

The open-fuse resistors supply partial ac voltage to the front panel LED board. An open-fuse causes an unbalanced voltage to be supplied to the open-fuse detect circuit causing the front panel **Check Fuses** LED to flash. If all three fuses are good, or if all three are open, the **Check Fuse** does not flash. The three-phase line inductor is connected to the A4 Input board via J417 (Range 1, 180-235Vac) or J418 (Range 2, 360-440Vac).

---

## A5 DC Rail Board

The A5 DC Rail board contains the full-wave, three-phase, rectifiers and the input filter circuits. The ac mains are full-wave rectified by D420-D425 and converted to two, 300-volt dc rails by filter capacitors, C423-C426, and by two range select connectors. In range 1 (180-235Vac), J438 connects the two DC rails, called Rail #1 and Rail #2, in parallel. Each rail supplies 300Vdc to the A3 FET board via J430 and J431. In Range 2 (360-440Vac), J439 connects the two DC rails in series. Each rail still supplies 300 Vdc to the A3 FET board via J430 and J431.

The A5 DC Rail board also contains the bias transformer and primary range select connectors J436 (Range 1) and J437 (Range 2). There are two LEDS (DS420, DS421) which light when more than 40Vdc is present on the dc rails.

|                |
|----------------|
| <b>WARNING</b> |
|----------------|

As a precaution always disconnect power supply from ac mains and wait 7 minutes before handling dc rail board. Be certain that the LEDs are completely extinguished.

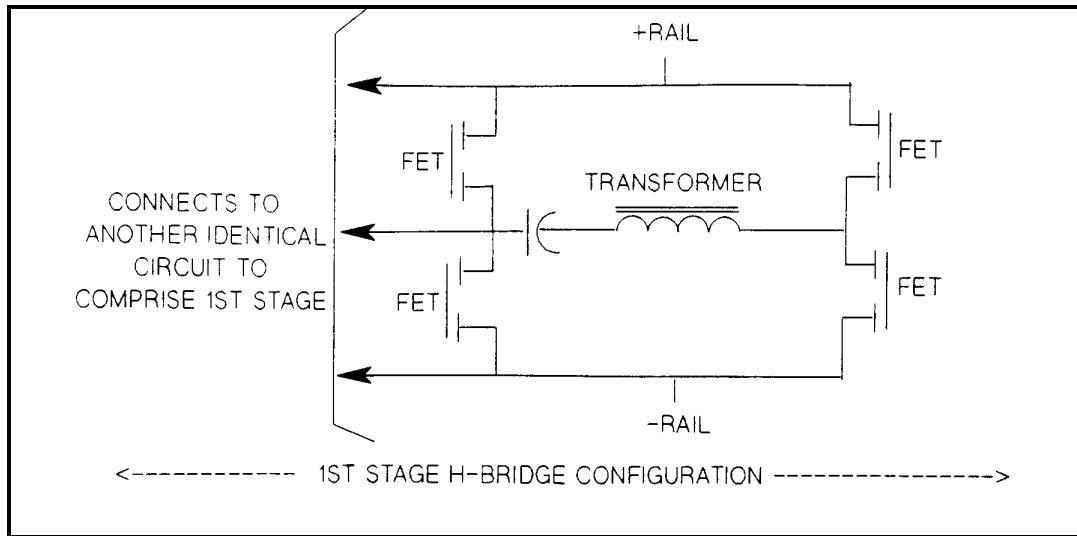
The +24 auxiliary bias fuse, F420, and the standard bias fuse, F421, are located on the dc rail board.

---

## A3 FET Board

The A3 FET board consists of two power FET stages connected between the +rail and -rail voltages, and connected across the FET stages is a chassis mounted power transformer. The entire circuit represents an H-bridge configuration. A complete stage consists of eight, power FETs and two, bridge-driver ICs. The power FETs are mounted on but isolated from the heat sink assembly. The two power FET stages are isolated from each other.

The DRIVE1A, 1B and DRIVE2A, 2B pulses, received from the A10 Control board, are used by the bridge drivers (U201, U202, U301, U302) to derive control pulses for the FET switches. The width of the pulses determines the ON time of the FET switches, thereby determining the magnitude of the output voltage or current. DRIVE1A pulses turn on one set of +RAIL (Q301, Q311) and -RAIL (Q303, Q333) FETs, causing current to flow through power transformer, T900, in one direction. DRIVE2A pulses turn on the other set of +RAIL (Q304, Q344) and -RAIL (Q302, Q322) FETs causing current to flow through T900 in the opposite direction. The FET on/off periods are controlled by the duty-cycle detect and the peak-current detection circuits. If the output attempts to change, regulation is accomplished by the CV/CC control circuits on the A10 Control board. These circuits vary the width of the drive pulses and the duration of the FET on/off periods.



**Figure 4-2. 1ST Stage of the FET H-Bridge Configuration**

## Output Circuits

The output circuits include the following circuits:

- Chassis mounted components.
- Two power transformers, T900/T901.
- Two inductors, L900/L901.
- Four rectifiers, D900 through D903.
- Output capacitors.
- A7 Snubber board mounted to the heat sink.
- A8 Fast Sense board.
- A9 Slow/Downprogrammer board and output bus bars.

Each combination of power transformers, T900/T901, and rectifiers, D900/D903, couples the output pulses from the A3 FET board. The output of each transformer/rectifier combination is connected in parallel before being applied to the output filter. The output filter assembly consists of bus bars with the filter capacitors bolted to them. The filter chokes, L902 through L906, consist of ferrite cores enclosing the bus bar. The current-sense resistor, R900, is part of the positive-output bus bar.

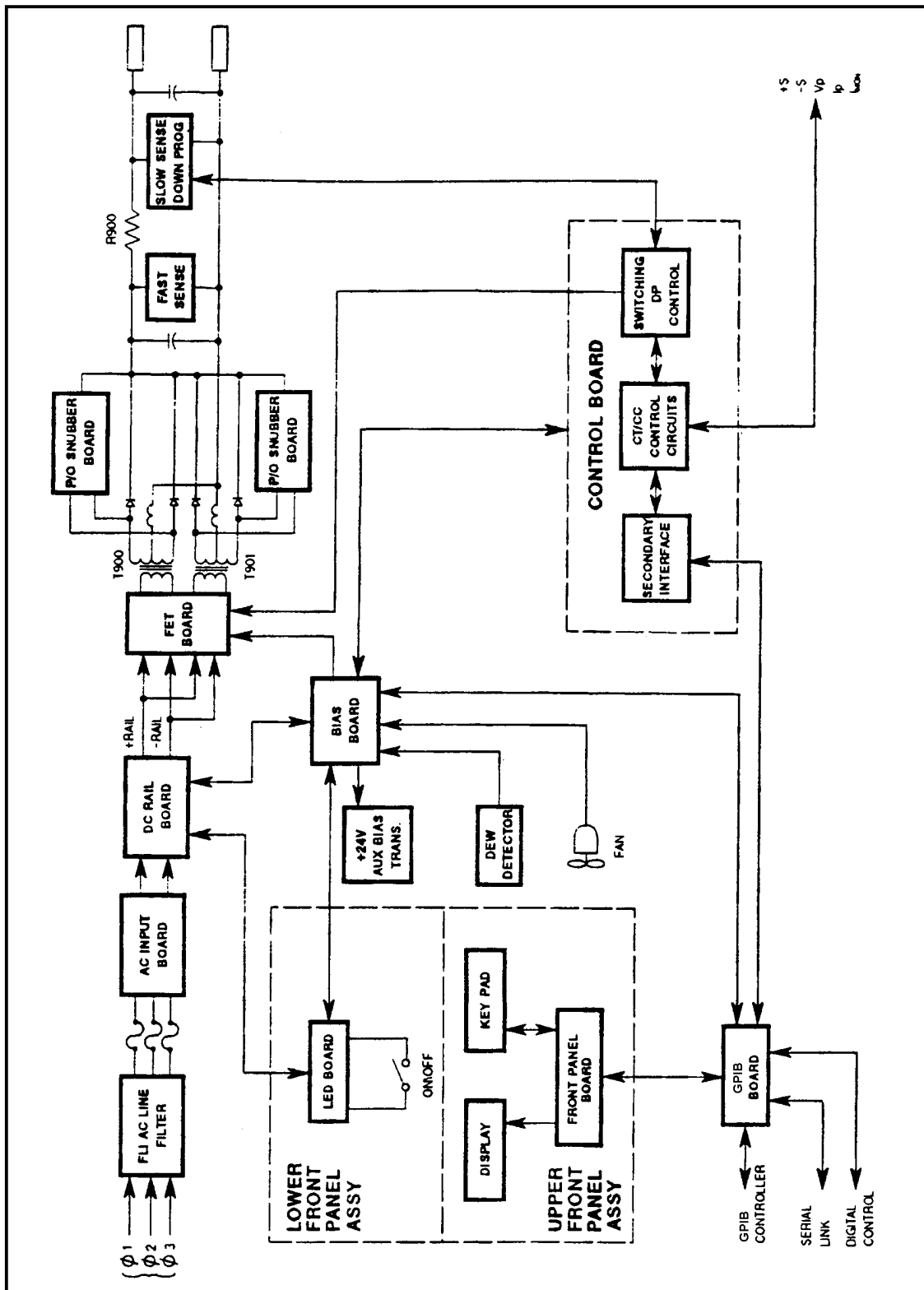


Figure 4-3. Agilent Series 668xA Power Supply, Block Diagram

## Replaceable Parts

### INTRODUCTION

#### Chapter Organization

This section lists the replaceable electrical and mechanical parts for the Agilent 668xA series power supplies. (Component location diagrams are located in Chapter 6.) The lists consist of tables organized by assemblies as follows:

| Assembly                                                                                          | See        |
|---------------------------------------------------------------------------------------------------|------------|
| Main chassis *                                                                                    | Table 5-3  |
| A1 Front Panel EBoard                                                                             | Table 5-4  |
| LED Board                                                                                         | Table 5-5  |
| A2 GPIB Board                                                                                     | Table 5-6  |
| A3 FET Board                                                                                      | Table 5-7  |
| A4 AC Input Board                                                                                 | Table 5-8  |
| A5 DC Rail Board                                                                                  | Table 5-9  |
| A6 Bias Board                                                                                     | Table 5-9  |
| A7 Snubber Board                                                                                  | Table 5-11 |
| A8 Fast Sense Board                                                                               | Table 5-9  |
| A9 Down Programming/Slow Sense Board                                                              | Table 5-9  |
| A10 Control Board                                                                                 | Table 5-10 |
| * The locations of circuit board assemblies and chassis-mounted components are shown in Fig 3-20. |            |

#### Reading the Tables

Each table lists electrical components alphabetically by reference designator and provides the Agilent part number followed by the part description. Mechanical parts are placed after the electrical parts and listed alphabetically by part description. Unless otherwise specified, a listed part is used in all models of the series. Model-specific parts are tabulated by model number under the reference designator. The reference designators are defined in Table 5-1. Abbreviations used in parts descriptions are explained in Table 5-2.

**Table 5-1. Part Reference Designators**

|     |               |    |                  |    |                    |
|-----|---------------|----|------------------|----|--------------------|
| A   | assembly      | J  | jack             | SW | switch             |
| B   | blower (fan)  | K  | relay            | T  | transformer        |
| C   | capacitor     | L  | inductor         | TB | terminal block     |
| CR  | thyristor/SCR | P  | plug             | U  | integrated circuit |
| D   | diode         | Q  | transistor       | VR | voltage regulator  |
| DSP | display (LCD) | R  | resistor         | W  | cable or jumper    |
| F   | fuse          | RT | thermal resistor | Y  | crystal oscillator |

**Table 5-2. Part Description Abbreviations**

|      |            |     |            |        |              |      |             |
|------|------------|-----|------------|--------|--------------|------|-------------|
| assy | assembly   | M   | metric     | sq     | square       | w/o  | without     |
| bd   | board      | mch | machine    | submin | subminiature | xfmr | transformer |
| blvl | belleville | mm  | millimeter | thk    | thick        | xtal | crystal     |
| gnd  | ground     | mtg | mounting   | thrd   | thread       |      |             |
| lg   | long       | PCB | pc board   | w/     | with         |      |             |

## How to Order Parts

You can order parts from your local Agilent Technologies, Inc. Sales and Support Office (see the list of offices in the back of this manual). When ordering a part, please include the following information:

- the Agilent part number
- the desired quantity
- the part description
- the model number of the power supply (for example, Agilent 6682A)

**Table 5-3. Main Chassis, Replaceable Parts**

| Ref. Desig.                           | Agilent Part No. | Description                     |
|---------------------------------------|------------------|---------------------------------|
| <b>ASSEMBLIES &amp; SUBASSEMBLIES</b> |                  |                                 |
| A1                                    | 5060-3553        | TESTED FRONT PANEL/KEYPAD       |
|                                       | 5060-3542        | TESTED KEYPAD PCB ASSY.         |
| A2                                    | 5060-3591        | TESTED GPIB PC ASSY.            |
| A3                                    | 5060-3540        | TESTED FET ASSY.                |
| A4                                    | 5060-3543        | TESTED AC INPUT BOARD ASSY.     |
| A5                                    | 5060-3544        | TESTED DC RAIL BOARD ASSY.      |
| A6                                    | 5060-3541        | TESTED BIAS PC ASSY.            |
| A7                                    |                  |                                 |
| 6680A                                 | 06680-60021      | SNUBBER PCB ASSY.               |
| 6681A                                 | 06681-60021      | SNUBBER PCB ASSY.               |
| 6682A                                 | 06682-60021      | SNUBBER PCB ASSY.               |
| 6683A                                 | 06683-60021      | SNUBBER PCB ASSY.               |
| 6684A                                 | 06684-60021      | SNUBBER PCB ASSY.               |
| A8                                    |                  | FAST SENSE PCB                  |
| A9                                    |                  |                                 |
| 6680A                                 | 06680-60022      | DOWN PROGRAMMER / SLOW SENSE PC |
| 6681A                                 | 06681-60022      | DOWN PROGRAMMER / SLOW SENSE PC |
| 6682A                                 | 06682-60022      | DOWN PROGRAMMER / SLOW SENSE PC |
| 6683A                                 | 06683-60022      | DOWN PROGRAMMER / SLOW SENSE PC |
| 6684A                                 | 06684-60022      | DOWN PROGRAMMER / SLOW SENSE PC |
| A10                                   |                  |                                 |
| 6680A                                 | 06681-61020      | TESTED CONTROL PCB ASSY.        |
| 6681A                                 | 06681-61020      | TESTED CONTROL PCB ASSY.        |
| 6682A                                 | 06682-61020      | TESTED CONTROL PCB ASSY.        |
| 6683A                                 | 06683-61020      | TESTED CONTROL PCB ASSY.        |
| 6684A                                 | 06684-61020      | TESTED CONTROL PCB ASSY.        |
| <b>ELECTRICAL PARTS</b>               |                  |                                 |
| C423, 424, 425, 426                   | 0180-4369        | C-F 1500uF 400V                 |
| C900                                  |                  |                                 |
| 6680A                                 | 0180-4516        | CAP 33000uF 7.5V                |
| 6681A                                 | 0180-4532        | CAP 22000uF 16V                 |
| 6682A                                 | 0180-4615        | CAP 18000uF 28V                 |
| C901, 902, 903, 904, 905              |                  |                                 |
| 6680A                                 | 0180-4516        | CAP 33000uF 7.5V                |
| 6681A                                 | 0180-4532        | CAP 22000uF 16V                 |
| 6682A                                 | 0180-4615        | CAP 18000uF 28V                 |
| 6683A                                 | 0180-4596        | CAP 13000uF 45V                 |
| 6684A                                 | 0180-4597        | CAP 7.200uF 55V                 |
| C906                                  |                  |                                 |
| 6680A                                 | 0180-4516        | CAP 33000uF 7.5V                |
| 6681A                                 | 0180-4532        | CAP 22000uF 16V                 |

**Table 5-3. Main Chassis, Replaceable Parts**

| Ref. Desig.               | Agilent Part No. | Description                             |
|---------------------------|------------------|-----------------------------------------|
| C907                      |                  |                                         |
| 6680A                     | 0180-4516        | CAP 33000uF 7.5V                        |
| 6681A                     | 0180-4532        | CAP 22000uF 16V                         |
| 6682A                     | 0180-4615        | CAP 18000uF 28V                         |
| 6683A                     | 0180-4596        | CAP 13000uF 45V                         |
| 6684A                     | 0180-4597        | CAP 7.200uF 55V                         |
| C920, 921,922,923,924,925 |                  |                                         |
| 6682A, 6683A, 6684A       | 0160-4183        | CAP 1000pF 250V                         |
| D900                      |                  |                                         |
| 6680A, 6681A              | 1906-0396        | SHOTTY RECTIFIER                        |
| D900A,B                   |                  |                                         |
| 6682A                     | 1906-0397        | SHOTTY RECTIFIER                        |
| 6683A, 6684A              | 1906-0398        | SHOTTY RECTIFIER                        |
| D901                      |                  |                                         |
| 6680A, 6681A              | 1906-0396        | SHOTTY RECTIFIER                        |
| D901A,B                   |                  |                                         |
| 6682A                     | 1906-0397        | SHOTTY RECTIFIER                        |
| 6683A, 6684A              | 1906-0398        | SHOTTY RECTIFIER                        |
| D902, 903                 |                  |                                         |
| 6680A, 6681A              | 1906-0396        | SHOTTY RECTIFIER                        |
| L900, 901                 |                  |                                         |
| 6680A, 6681A              | 06681-80001      | CHOKE - OUTPUT                          |
| 6682A                     | 06681-80004      | CHOKE - OUTPUT                          |
| 6683A                     | 06681-80005      | CHOKE - OUTPUT                          |
| 6684A                     | 06681-80006      | CHOKE - OUTPUT                          |
| L902, 903                 | 5080-2257        | CORE                                    |
| L904, 905, 906            | 9170-1571        | CORE                                    |
| Q981, 982                 | 1855-0834        | POWER MOSFET                            |
| R900                      |                  |                                         |
| 6680A                     | 5080-2296        | SHUNT-CURRENT                           |
| 6681A                     | 5080-2297        | SHUNT-CURRENT                           |
| 6682A                     | 06682-80002      | SHUNT-CURRENT                           |
| 6683A                     | 5080-2324        | SHUNT-CURRENT                           |
| 6684A                     | 5080-2324        | SHUNT-CURRENT                           |
| T900, 901                 |                  |                                         |
| 6680A                     | 9100-5042        | POWER TRANSFORMER                       |
| 6681A                     | 9100-5043        | POWER TRANSFORMER                       |
| 6682A                     | 9100-5086        | POWER TRANSFORMER                       |
| 6683A                     | 9100-5085        | POWER TRANSFORMER                       |
| 6684A                     | 9100-5076        | POWER TRANSFORMER                       |
| <b>MECHANICAL PARTS</b>   |                  |                                         |
|                           | 06652-00005      | BUS BAR                                 |
|                           | 06680-20001      | BUSS BAR BLOCK                          |
|                           | 06680-20002      | BUSS/FET BLOCK                          |
|                           | 06680-80003      | NAMEPLATE front panel model description |
|                           | 06681-80003      | NAMEPLATE front panel model description |
|                           | 06682-80001      | NAMEPLATE front panel model description |
|                           | 06683-80001      | NAMEPLATE front panel model description |
|                           | 06684-80001      | NAMEPLATE front panel model description |
|                           | 0960-0882        | SENSOR-MOISTURE                         |
|                           | 1252-1488        | TERM-BLK-4 POS                          |
|                           | 1252-3698        | CONNECTOR                               |

**Table 5-3. Main Chassis, Replaceable Parts (continued)**

| Ref. Desig. | Agilent Part No. | Description                                           |
|-------------|------------------|-------------------------------------------------------|
|             | 2110-0910        | FUSE (see 5060-3513 )                                 |
|             | 2110-0911        | FUSE (see 5060-3512 )                                 |
|             | 3160-0419        | FAN FINGER GUARD                                      |
|             | 3160-0571        | FAN-TUBEAXIAL                                         |
|             | 5001-0538        | TRIM-SIDES                                            |
|             | 5001-0539        | TRIM SIDES,FRENCH GRAY                                |
|             | 5001-6776        | CHASSIS, BASE                                         |
|             | 5001-6778        | PANEL, REAR                                           |
|             | 5001-6779        | COVER-OUTSIDE                                         |
|             | 5001-6780        | INPUT SUB-CHASSIS (see 5060-3490 )                    |
|             | 5001-6781        | OUTPUT SUB-CHASSIS                                    |
|             | 5001-6782        | CHASSIS-TOP (inside cover )                           |
|             | 5001-6783        | INPUT DECK                                            |
|             | 5001-6784        | OUTPUT DECK                                           |
|             | 5001-6791        | TRAY (control board )                                 |
|             | 5001-6792        | SHIELD                                                |
|             | 5001-6793        | GPIB-BRACKET (chassis top )                           |
|             | 5020-2783        | HEATSINK-DIODE                                        |
|             | 5020-2785        | HEATSINK-FET                                          |
|             | 5020-2797        | SHIELD-ISOLATION                                      |
|             | 5020-2808        | INSULATOR                                             |
|             | 5040-1688        | BUSS-BEZEL                                            |
|             | 5040-1689        | BUSS BAR SUPPORT                                      |
|             | 5040-1690        | BRACKET-HS                                            |
|             | 5040-1691        | HS-PLEN                                               |
|             | 5040-1694        | BUSS BAR, PLUS, output end (large)                    |
|             | 5040-1696        | BUSS BAR, PLUS, internal end (small)                  |
|             | 5040-1697        | BLOCK-TOP COVER                                       |
|             | 5040-1700        | COLLAR-MOLDED                                         |
|             | 5040-1701        | BUSS BAR BRACE                                        |
|             | 5041-880 1       | FOOT                                                  |
|             | 5041-8819        | CAP-STRAP HANDLE                                      |
|             | 5041-8820        | CAP-STRAP HANDLE                                      |
|             | 5060-3237        | AC INPUT COVER ASSY.                                  |
|             | 5060-3490        | AC SUB-CHASSIS ASSY.                                  |
|             | 5060-3489        | NEGATIVE OUTPUT BUSS BAR ASSY.<br>with L902/L903 CORE |
|             | 5001-6780        | SUB-CHASSIS                                           |
|             | 5080-2262        | 3 PHASE LINE CHOKE                                    |
|             | 5080-2298        | CABLE - 3 phase line choke/AC input assy              |
|             | 9100-5044        | FAN TRANSFORMER                                       |
|             | 5060-3492        | WIRE KIT (+/- sense leads)                            |
|             | 5060-3512        | 400VAC/16A FUSE KIT                                   |
|             | 2110-0911        | 3 ea. FUSE 16AM 400VAC                                |
|             | 5060-3513        | 208VAC/30A FUSE KIT                                   |
|             | 2110-0910        | 3 ea. FUSE 30AM 500V                                  |
|             | 5062-3705        | STRAP HANDLE                                          |
|             | 5080-2038        | LABEL-WARNING (no operator serviceable)               |
|             | 5080-2148        | CABLE (chaining- 2 meters)                            |
|             | 5080-2168        | CABLE-ASSY.                                           |
|             | 5080-2277        | SUL-THERMAL                                           |
|             | 5080-2280        | CABLE- BIAS/CONTROL                                   |
|             | 5080-2282        | CABLE - AC/RFI FILTER                                 |
|             | 5080-2285        | CABLE- GPIB/FAN                                       |

**Table 5-3. Main Chassis, Replaceable Parts (continued)**

| Ref. Desig. | Agilent Part No. | Description                                      |
|-------------|------------------|--------------------------------------------------|
|             | 1400-0611        | CABLE CLAMP (GPIB/FAN)                           |
|             | 5080-2299        | LABEL REAR PANEL                                 |
|             | 5080-2413        | CRATE ( shipping container )                     |
|             | 5080-2414        | SKID ( shipping container )                      |
|             | 5080-2415        | FOAM PAD ( shipping container )                  |
|             | 5080-2314        | EDGE PROTECTOR 12 inches ( shipping container )  |
|             | 5080-2315        | EDGE PROTECTOR 2.5 inches ( shipping container ) |
|             | 5080-2316        | CABLE ASSY.                                      |
|             | 5960-5588        | MANUAL-OPERATING                                 |
|             | 6681A#400        | 400V OPERATION                                   |
|             | 6681A#601        | BUS BAR COVER                                    |
|             | 6681A#602        | BUS BAR SPACER                                   |
|             | 5060-3514        | BB SPCR KIT #602                                 |
|             | 6681A#861        | CABLE-UL/CSA                                     |
|             | 8120-6203        | L CORD 10AWG300V                                 |
|             | 6681A#862        | CABLE-HARMONIZED                                 |
|             | 8120-6204        | L CORD 2.5mm450V                                 |
|             | 6681A#908        | RACK MOUNT KIT                                   |
|             | 5062-3974        | RACK MTG KIT                                     |
|             | 5062-3977        | RACK MOUNT KIT                                   |
|             | 6681A#909        | RACK MOUNT KIT W/HANDLES                         |
|             | 5062-3974        | RACK MTG KIT                                     |
|             | 5062-3983        | RACK MOUNT KIT                                   |
|             | 7120-6153        | LABEL-WARNG                                      |
|             | 9135-0493        | FILTER-RFI                                       |

**Table 5-4. A1 Front Panel Board, Replaceable Parts**

| Ref. Desig.             | Agilent Part No. | Description                     |
|-------------------------|------------------|---------------------------------|
| <b>ELECTRICAL PARTS</b> |                  |                                 |
| C1                      | 0160-5422        | Capacitor 0.047 $\mu$ F 20%     |
| C2                      | 0160-4808        | Capacitor 470pF 5%              |
| C4                      | 0160-4787        | Capacitor 22pF 5% 100V          |
| C5                      | 0180-0155        | Capacitor 2.2 $\mu$ F 20V       |
| C6,7                    | 0160-5422        | Capacitor 0.047 $\mu$ F 20%     |
| C8                      | 0160-4835        | Capacitor 0.1 $\mu$ F 10% 50V   |
| C10-12, C14-16          | 0160-5422        | Capacitor 0.047 $\mu$ F 20%     |
| C17                     | 0180-0155        | Capacitor 2.2 $\mu$ F 20V       |
| D1,2                    | 1906-0229        | Diode array 50V                 |
| L1                      | 9140-0158        | COIL IUH 10%                    |
| J2                      | 1251-4927        | Receptacle LCD display          |
| J3                      | 1251-4926        | Receptacle test header          |
| J4,5                    | 1252-0718        | Receptacle (A3G1, A3G2)         |
| J6                      | 1251-8184        | Receptacle phone (GPIB board)   |
| L1                      | 9140-0158        | Inductor 1 $\mu$ H 10%          |
| R1                      | 1810-0560        | Resistor network DIP            |
| R2                      | 0698-3359        | Resistor 12.7K 1%               |
| R23-25,27-30            | 0698-3155        | Resistor 4.64K 1%               |
| R37                     | 1810-0371        | Resistor network SIP            |
| R38                     | 0698-3441        | Resistor 215 $\Omega$ 1% 0.125W |
| R39,40                  | 0698-3155        | Resistor 4.64K 1%               |
| RT1                     | 0837-0412        | Thermistor                      |

**Table 5-4. A1 Front Panel Board, Replaceable Parts (continued)**

| Ref. Desig.             | Agilent Part No. | Description                                                  |
|-------------------------|------------------|--------------------------------------------------------------|
| S1                      | 3101-3088        | Line switch                                                  |
| VR16                    | 1902-0950        | Diode Zener 4.7V 5                                           |
| U3                      | 1820-6721        | IC MPU                                                       |
| U4                      | 5080-2466        | ROM programmed front panel                                   |
| U6                      | 1818-4792        | IC memory                                                    |
| U8                      | 1820-2724        | IC SN74ALS573BN                                              |
| W3                      | 1258-0209        | Jumper (J3)                                                  |
| W5                      | 0811-3590        | Jumper                                                       |
| Y1                      | 0410-2159        | Crystal 10 MHz                                               |
| Z16                     | 1902-0950        | Diode Zener 4.7V 5%                                          |
| <b>MECHANICAL PARTS</b> |                  |                                                              |
| --                      | 1200-1274        | Socket IC (U3)                                               |
| --                      | 1200-1417        | Socket IC (U4)                                               |
| --                      | 0340-1277        | Insulator (Y1)                                               |
| --                      | 0370-3238        | KNOB Ref: RPG                                                |
| --                      | 0515-1455        | SCREW - Ref: keypad PCB to front frame                       |
| --                      | 0590-0534        | NUT - SELFTREAD -<br>Ref: Display & LED board to front panel |
| --                      | 0960-0912        | RPG - OPTICAL ENCODER                                        |
| --                      | 5063-3408        | PCA (KEYPAD)                                                 |
| --                      | 1000-0842        | WINDOW Ref: 3 inches front frame                             |
| --                      | 5001-6794        | BLINDER Ref: 5 inches front frame                            |
| --                      | 5040-1665        | KEYPAD                                                       |
| --                      | 5040-1687        | FRONT FRAME - 88.1mm ( 3.5 inches )                          |
| --                      | 5040-1698        | FRONT FRAME - 132.6mm ( 5.25 inches )                        |
| --                      | 5063-3473        | LCD DISPLAY                                                  |
| --                      | 5080-2245        | LABEL Ref: 3.5 inches & 5 inches front frame                 |
| --                      | 5080-2261        | CABLE Ref: Keypad PCB to LCD display                         |

**Table 5-5. Front Panel Board LED Assy, Replaceable Parts**

| Ref. Desig.             | Agilent Part No. | Description                                               |
|-------------------------|------------------|-----------------------------------------------------------|
| <b>ELECTRICAL PARTS</b> |                  |                                                           |
| C450                    | 0180-4132        | CAP 6.8uF 35V                                             |
| C451                    | 0160-4808        | CAP 470pF 5%                                              |
| D450, 451, 452, 453     | 1901-1098        | DIO-1N4150                                                |
| R450                    | 0698-3444        | RES 316 1% .125W                                          |
| R451                    | 0757-0401        | RES 100 1% .125W                                          |
| R452                    | 0698-3156        | RES 14.7K 1%                                              |
| R453                    | 0698-8827        | RES 1M 1% .125W                                           |
| R454                    | 0698-3156        | RES 14 7K 1%                                              |
| R455                    | 0757-0280        | RES 1K 1% .125W                                           |
| U450                    | 1858-0076        | XSTR ARY 14P-DIP                                          |
| U451                    | 1858-0077        | XSTR ARY 14P DIP                                          |
| Z450                    | 1902-0562        | DIO-ZNR 22.1V 5%                                          |
| <b>MECHANICAL PARTS</b> |                  |                                                           |
|                         | 5080-2281        | CABLE LINE SWITCH Ref: E456=E457 to S1                    |
|                         | 5080-2283        | CABLE LED AC INPUT<br>Ref: E450-E451 to DC RAIL J440      |
|                         | 5080-2286        | CABLE DEW/S1 CONNECTION<br>Ref: E452-E455 to DC RAIL J441 |

**Table 5-6. A2 GPIB Board, Replaceable Parts (see Note)**

| Ref. Desig.                                                                   | Agilent Part No. | Description                        |
|-------------------------------------------------------------------------------|------------------|------------------------------------|
| <b>ELECTRICAL PARTS</b>                                                       |                  |                                    |
| C122                                                                          | 0180-4606        | Capacitor 10,000 $\mu$ F           |
| C128                                                                          | 0160-4281        | Capacitor 2,200pF                  |
| F101                                                                          | 2110-0699        | Fuse Subminiature 5AM              |
| J101                                                                          | 1252-2320        | Connector Receptacle (GPIB)        |
| J106                                                                          | 1251-4926        | Connector Receptacle (Test Header) |
| J107, 108, 114, 115                                                           | 1251-7330        | Connector Receptacle               |
| P101                                                                          | 1251-4245        | Connector Plug 2-pin (AC Bias)     |
| U110, U111                                                                    | 1990-0444        | IC Optoisolator                    |
| U113                                                                          | 1990-0543        | IC Optoisolator                    |
| U117                                                                          | 1820-2549        | IC Optoisolator                    |
| U118                                                                          | 1820-4185        | IC Optoisolator                    |
| U121                                                                          | 1820-0430        | IC Voltage regulator               |
| TB101                                                                         | 0360-2312        | Terminal Block (Digital Control)   |
| <b>MECHANICAL PARTS</b>                                                       |                  |                                    |
| --                                                                            | 1205-0758        | Heatsink (U121)                    |
| --                                                                            | 0535-0031        | Nut hex w/lockwasher (J101)        |
| --                                                                            | 0515-0642        | Screw (U121)                       |
| --                                                                            | 0515-0911        | Screw M3x0 5 (J101)                |
| <b>Note: All other parts are surface mounted and are not field repairable</b> |                  |                                    |

**Table 5-7. A3 FET Assembly, Replaceable Parts**

| Ref. Desig.             | Agilent Part No. | Description            |
|-------------------------|------------------|------------------------|
| <b>ELECTRICAL PARTS</b> |                  |                        |
| C201                    | 0160-7505        | 7 $\mu$ F+ - 5% 200V   |
| C202                    | 0180-4132        | CAP 6.8 $\mu$ F 35V    |
| C203                    | 0160-4835        | CAP .1 $\mu$ F 10% 50V |
| C204, 205               | 0160-5098        | CAP .22 $\mu$ F 10%    |
| C206                    | 0180-4132        | CAP 6.8 $\mu$ F 35V    |
| C207, 208, 209          | 0160-2006        | CAP 100pF 10%          |
| C210, 211, 213, 214,    | 0160-6838        | CAP 2200pF 1KV         |
| C215, 216               | 0160-2006        | CAP 100pF 10%          |
| C217                    | 0160-5098        | CAP .22 $\mu$ F 10%    |
| C218                    | 0160-4835        | CAP .1 $\mu$ F 10% 50V |
| C219                    | 0160-2006        | CAP 100pF 10%          |
| C220                    | 0180-4132        | CAP 6.8 $\mu$ F 35V    |
| C221                    | 0160-5098        | CAP .22 $\mu$ F 10%    |
| C222                    | 0180-4132        | CAP 6.8 $\mu$ F 35V    |
| C226                    | 0160-4791        | CAP 10pF 5% 100V       |
| C227                    | 0160-4835        | CAP .1 $\mu$ F 10% 50V |
| C228                    | 0160-2301        | CAP 2000pF 100V        |
| C229                    | 0160-4918        | CAP .022 $\mu$ F 50V   |
| C230                    | 0160-4831        | CAP 4700pF 10%         |
| C231                    | 0160-2301        | CAP 2000pF 100V        |
| C235, 236, 237, 238     | 0160-4832        | CAP .01 $\mu$ F 10%    |
| C239                    | 0160-4791        | CAP 10pF 5% 100V       |
| C240                    | 0160-4832        | CAP .01 $\mu$ F 10%    |
| C242, 243               | 0160-5098        | CAP .22 $\mu$ F 10%    |

Table 5-7. A3 FET Assembly, Replaceable Parts (continued)

| Ref. Desig.              | Agilent Part No. | Description      |
|--------------------------|------------------|------------------|
| C244, 245                | 0160-6806        | CAP .1uF 400V    |
| C248                     | 0160-4832        | CAP .01uF 10%    |
| C258                     | 0180-4132        | CAP 6.8uF 35V    |
| C301                     | 0160-7505        | 7uF+ - 5% 200V   |
| C302                     | 0180-4132        | CAP 6.8uF 35V    |
| C303                     | 0160-4835        | CAP .1uF 10% 50V |
| C304, 305                | 0160-5098        | CAP .22uF 10%    |
| C306                     | 0180-4132        | CAP 6.8uF 35V    |
| C307, 308, 309           | 0160-2006        | CAP 100pF 10%    |
| C310, 311, 313, 314      | 0160-6838        | CAP 2200pF 1KV   |
| C315, 316                | 0160-2006        | CAP 100pF 10%    |
| C317                     | 0160-5098        | CAP .22uF 10%    |
| C318                     | 0160-4835        | CAP .1uF 10% 50V |
| C319                     | 0160-2006        | CAP 100pF 10%    |
| C320                     | 0180-4132        | CAP 6.8uF 35V    |
| C321                     | 0160-5098        | CAP .22uF 10%    |
| C322                     | 0180-4132        | CAP 6.8uF 35V    |
| C326                     | 0160-4791        | CAP 10pF 5% 100V |
| C329                     | 0160-5098        | CAP .22uF 10%    |
| C330                     | 0160-4832        | CAP .01uF 10%    |
| C331                     | 0160-4835        | CAP .1uF 10% 50V |
| C335, 336, 337, 338      | 0160-4832        | CAP .01uF 10%    |
| C339                     | 0160-4791        | CAP 10pF 5% 100V |
| C340                     | 0160-4832        | CAP .01uF 10%    |
| C342, 343                | 0160-5098        | CAP .22uF 10%    |
| C344, 345                | 0160-6806        | CAP .1uF 400V    |
| C346                     | 0160-4800        | CAP 120pF 5%     |
| D201, 202                | 1901-0050        | DIO-SWITCHING    |
| D202                     | 1901-1065        | DIO-IN4936 PWR   |
| D203, 204                | 1901-0050        | DIO-SWITCHING    |
| D205                     | 1901-1065        | DIO-IN4936 PWR   |
| D206, 207, 208, 209, 210 | 1901-0050        | DIO-SWITCHING    |
| D213, 214, 215, 216, 217 | 1901-0050        | DIO-SWITCHING    |
| D220, 221, 222, 223      | 1901-0050        | DIO-SWITCHING    |
| D224                     | 1901-0731        | DIO-PWR RECT     |
| D301, 302                | 1901-0050        | DIO-SWITCHING    |
| D302                     | 1901-1065        | DIO-IN4936 PWR   |
| D303, 304                | 1901-0050        | DIO-SWITCHING    |
| D305                     | 1901-1065        | DIO-IN4936 PWR   |
| D306, 307, 308, 309, 310 | 1901-0050        | DIO-SWITCHING    |
| D313, 314, 315, 316, 317 | 1901-0050        | DIO-SWITCHING    |
| D320, 321, 322, 323      | 1901-0050        | DIO-SWITCHING    |
| D324                     | 1901-0731        | DIO-PWR RECT     |
| L201, 202, 203, 204      | 9170-1454        | CORE-SHLD-BEAD   |
| L205, 206, 207, 208, 209 | 9170-1510        | CORE-MAGNETIC    |
| L210, 211, 212           | 9170-1510        | CORE-MAGNETIC    |
| L213, 214, 215, 216      | 9170-1454        | CORE-SHLD-BEAD   |
| L301, 302, 303, 304      | 9170-1454        | CORE-SHLD-BEAD   |
| L305, 306, 307, 308, 309 | 9170-1510        | CORE-MAGNETIC    |
| L310, 311, 312           | 9170-1510        | CORE-MAGNETIC    |
| L313, 314, 315, 316      | 9170-1454        | CORE-SHLD-BEAD   |
| Q201, 202, 203, 204      | 1855-0859        | MOSFET 500V 20A  |
| Q211, 222, 233, 244      | 1855-0859        | MOSFET 500V 20A  |
| Q251, 252, 253, 254      | 1853-0363        | D45H5/D45H8/363  |

Table 5-7. A3 FET Assembly, Replaceable Parts (continued)

| Ref. Desig.         | Agilent Part No. | Description       |
|---------------------|------------------|-------------------|
| Q301, 302, 303, 304 | 1855-0859        | MOSFET 500V 20A   |
| Q311, 322, 333, 344 | 1855-0859        | MOSFET 500V 20A   |
| Q351, 352, 353, 354 | 1853-0363        | D45H5/D45H8/363   |
| R201                | 0811-3903        | RES 150 Ohm 5W NI |
| R202                | 0699-0208        | RES 1 5% .25W CF  |
| R203                | 0683-5615        | RES 560 5% .25W   |
| R205                | 0683-0625        | RES 6.2 5% .25W   |
| R206                | 0683-7505        | RES 75 5% .25W    |
| R207                | 0683-0335        | RES 3.3 5% .25W   |
| R208                | 0683-3305        | RES 33 5% .25W    |
| R209                | 0683-0625        | RES 6.2 5% .25W   |
| R210                | 0683-8205        | RES 82 5% .25W    |
| R211, 212           | 0683-1535        | RES 15K 5% .25W   |
| R213, 214, 216, 217 | 0811-3903        | RES 150 Ohm 5W NI |
| R220, 221           | 0811-3903        | RES 150 Ohm 5W NI |
| R222                | 0811-2556        | RES 1.25 1% 4W    |
| R224, 225           | 0811-3903        | RES 150 Ohm 5W NI |
| R226                | 0683-1535        | RES 15K 5% .25W   |
| R227                | 0698-3159        | RES 26.1K 1%      |
| R228                | 0683-8205        | RES 82 5% .25W    |
| R229                | 0683-0625        | RES 6.2 5% .25W   |
| R230                | 0683-3305        | RES 33 5% .25W    |
| R231                | 0683-7505        | RES 75 5% .25W    |
| R232                | 0683-0335        | RES 3.3 5% .25W   |
| R233                | 0683-0625        | RES 6.2 5% .25W   |
| R237                | 0757-0437        | RES 4.75K 1%      |
| R238                | 0757-0280        | RES 1K 1% .125W   |
| R239                | 0757-0437        | RES 4.75K 1%      |
| R240                | 0757-0280        | RES 1K 1% .125W   |
| R241, 242           | 0757-0437        | RES 4.75K 1%      |
| R243                | 0683-1535        | RES 15K 5% .25W   |
| R244                | 0698-4457        | RES 576 1% .125W  |
| R245                | 0683-1015        | RES 100 5% .25W   |
| R246                | 0683-1555        | RES 1.5M 5% .25W  |
| R247                | 0757-0462        | RES 75K 1%        |
| R248                | 0698-3159        | RES 26.1K 1%      |
| R249                | 0757-0444        | RES 13.1K 1%      |
| R250                | 0698-3572        | RES 60.4K 1%      |
| R251                | 0757-0288        | RES 9.09K 1%      |
| R252                | 0698-3225        | RES 1.43K 1%      |
| R253                | 0698-6533        | RES 12.5K 1%      |
| R254                | 0698-3279        | RES 4.99K 1%      |
| R255                | 0683-1015        | RES 100 5% .25W   |
| R256                | 0698-3432        | RES 26.1 1%       |
| R257                | 0698-3430        | RES 21.5 1%       |
| R258                | 0683-1035        | RES 10K 5% .25W   |
| R260, 261           | 0683-8205        | RES 82 5% .25W    |
| R262                | 0683-1215        | RES 120 5% .25W   |
| R263, 264, 265      | 0683-8205        | RES 82 5% .25W    |
| R266                | 0683-1215        | RES 120 5% .25W   |
| R267                | 0683-8205        | RES 82 5% .25W    |
| R268                | 0698-3572        | RES 60.4K 1%      |
| R269                | 0698-4121        | RES 11.3K 1%      |
| R270                | 0757-0440        | RES 7.5K 1%       |

Table 5-7. A3 FET Assembly, Replaceable Parts (continued)

| Ref. Desig.         | Agilent Part No. | Description       |
|---------------------|------------------|-------------------|
| R271                | 0757-0200        | RES 5.62K 1%      |
| R272                | 0757-0442        | RES 10K 1% .125W  |
| R273, 274, 275      | 0757-0437        | RES 4.75K 1%      |
| R277                | 0698-3633        | RES 3905% 2W MO   |
| R301                | 0811-3903        | RES 150Ohm 5W NI  |
| R302                | 0699-0208        | RES 1 5% .25W CF  |
| R303                | 0683-5615        | RES 5605% .25W    |
| R304                | 0698-4435        | RES 2.49K 1%      |
| R305                | 0683-0625        | RES 6.25% .25W    |
| R306                | 0683-7505        | RES 75 5% .25W    |
| R307                | 0683-0335        | RES 3.3 5% .25W   |
| R308                | 0683-3305        | RES 33 5% .25W    |
| R309                | 0683-0625        | RES 6.2 5% .25W   |
| R310                | 0683-8205        | RES 82 5% .25W    |
| R311                | 0683-1535        | RES 15K 5% .25W   |
| R312                | 0683-1535        | RES 15K 5% .25W   |
| R313, 314, 316, 317 | 0811-3903        | RES 150 Ohm 5W NI |
| R320, 321           | 0811-3903        | RES 150 Ohm 5W NI |
| R322                | 0811-2556        | RES 1.25 1% 4W    |
| R324, 325           | 0811-3903        | RES 150 Ohm 5W NI |
| R326                | 0683-1535        | RES 15K 5% .25W   |
| R327                | 0683-1555        | RES 1.5M 5% .25W  |
| R328                | 0683-8205        | RES 82 5% .25W    |
| R329                | 0683-0625        | RES 6.2 5% .25W   |
| R330                | 0683-3305        | RES 33 5% .25W    |
| R331                | 0683-7505        | RES 75 5% .25W    |
| R332                | 0683-0335        | RES 3.3 5% .25W   |
| R333                | 0683-0625        | RES 6.2 5% .25W   |
| R337                | 0757-0437        | RES 4.75K 1%      |
| R338                | C757-0280        | RES 1K 1% .125W   |
| R339                | 0757-0437        | RES 4.75K 1%      |
| R340                | 0757-0280        | RES 1K 1% .125W   |
| R341, 342           | 0757-0437        | RES 4.75K 1%      |
| R343                | 0683-1535        | RES 15K 5% .25W   |
| R354                | 0757-0442        | RES 10K 1% .125W  |
| R355                | 0698-3136        | RES 17.8K 1%      |
| R356, 357           | 0757-0382        | RES 16.21%        |
| R360, 361           | 0683-8205        | RES 82 5% .25W    |
| R362                | 0683-1215        | RES 120 5% .25W   |
| R363, 364, 365      | 0683-8205        | RES 82 5% .25W    |
| R366                | 0683-1215        | RES 120 5% .25W   |
| R367                | 0683-8205        | RES 82 5% .25W    |
| R368                | 0698-3572        | RES 60.4K 1%      |
| R369                | 0698-4121        | RES 11.3K 1%      |
| R370                | 0757-0440        | RES 7.5K 1%       |
| R371                | 0757-0200        | RES 5.62K 1%      |
| R372                | 0757-0442        | RES 10K 1% .125W  |
| R373, 374, 375      | 0757-0437        | RES 4.75K 1%      |
| R377                | 0698-3633        | RES 390 5% 2W MO  |
| R378                | 0757-0274        | RES 1.21K 1%      |
| R379                | 0683-1005        | RES 10 5% .25W    |
| R380                | 0757-0437        | RES 4.75K 1%      |
| R381                | 0698-0085        | RES 2.61K 1%      |
| R382                | 0683-1015        | RES 100 5% .25W   |

**Table 5-7. A3 FET Assembly, Replaceable Parts (continued)**

| Ref. Desig.             | Agilent Part No. | Description                                                                   |
|-------------------------|------------------|-------------------------------------------------------------------------------|
| R383                    | 0757-0442        | RES 10K 1% .125W                                                              |
| R384, 385               | 8159-0005        | RES-ZERO OHMS                                                                 |
| T202                    | 9100-4350        | XFMR-CURRENT                                                                  |
| T204                    | 06624-80091      | XFMR-PULSE                                                                    |
| T205                    | 5080-2238        | XFMR-CUR SHARING                                                              |
| T302                    | 9100-4350        | XFMR-CURRENT                                                                  |
| T304                    | 06624-80091      | XFMR-PULSE                                                                    |
| U201, 202               | 1820-8433        | PWM I.C. IR2110                                                               |
| U203                    | 1826-1343        | IC-VOLTAGE REG TL431CP                                                        |
| U204                    | 1826-0138        | IC COMPARATOR LM339N                                                          |
| U205                    | 1826-1475        | VOLTAGE COMPTR LT101HCN8                                                      |
| U301, 302               | 1820-8433        | PWM I.C. IR2110                                                               |
| U303                    | 1826-1343        | IC-VOLTAGE REG TL431CP                                                        |
| U304                    | 1826-0412        | IC LM393N                                                                     |
| U305                    | 1990-0996        | OPTO-ISOLATOR HCPL-2200                                                       |
| Z201, 301               | 1902-1377        | DIO-ZNR 6 19V                                                                 |
| <b>MECHANICAL PARTS</b> |                  |                                                                               |
|                         | 5080-2279        | CABLE FET CONTROL<br>Ref: E208-E209 to CONTROL J511                           |
|                         | 5080-2283        | CABLE +15V BIAS<br>Ref: E206-E207 to BIAS J831<br>Ref: E306-E307 to BIAS J830 |
|                         | 5080-2291        | CABLE FET RAIL A<br>Ref: E201-E202 to DCRAIL J430                             |
|                         | 5080-2295        | CABLE FET RAIL B<br>Ref: E301-E302 to DCRAIL J431                             |

**Table 5-8. A4 AC Input Assembly, Replaceable Parts**

| Ref. Desig.                   | Agilent Part No. | Description                                |
|-------------------------------|------------------|--------------------------------------------|
| <b>ELECTRICAL PARTS</b>       |                  |                                            |
| C420                          | 0160-7606        | CAP 1uF 275V                               |
| C428, 429, 430                | 0160-7898        | CAP 0.01uF 440V                            |
| J417, 418                     | 1251-5422        | CONNECTOR                                  |
| J419                          | 1251-6832        | CONNECTOR                                  |
| J420                          | 1251-3819        | CONNECTOR                                  |
| K401                          | 0490-1908        | RELAY 24V COIL                             |
| K402                          | 5060-3593        | CONTACTOR, 3 POLE                          |
| R400, 401, 402, 403, 404, 405 | 0764-0027        | RES 75K 5% 2W MO                           |
| R407, 408                     | 0699-3191        | RES 27 OHM 5% 20W                          |
| R435, 436, 437                | 0698-3609        | RES 22 OHM 5% 2W                           |
| <b>MECHANICAL PARTS</b>       |                  |                                            |
|                               | 5060-3493        | WIRE KIT (E403-E408 to F1,F2,F3)           |
|                               | 5080-2284        | CABLE RELAY CNTRL (E411-E413 to BIAS J827) |

**Table 5-9. A5 DC Rail Assembly, Replaceable Parts**

| Ref. Desig.                   | Agilent Part No. | Description                                             |
|-------------------------------|------------------|---------------------------------------------------------|
| <b>ELECTRICAL PARTS</b>       |                  |                                                         |
| C418                          | 0160-4048        | CAP 0.022uF 20%                                         |
| C420, 421, 422                | 0160-7606        | CAP 1uF 275V                                            |
| C427                          | 0160-7743        | C-F .047uF 380V                                         |
| D420, 421, 422, 424, 425      | 5060-3516        | ASSY.-RECTIFIER                                         |
| DS420, 421                    | 1990-0517        | LED                                                     |
| F420                          | 2110-1107        | FUSE CLIPS                                              |
| F420                          | 2110-0934        | FUSE .5AM, 500V                                         |
| F421                          | 2110-1107        | FUSE CLIPS                                              |
| F421                          | 2110-0934        | FUSE .5AM, 500V                                         |
| J430, 431                     | 1251-7616        | CONNECTOR                                               |
| J432                          | 1251-6832        | CONNECTOR                                               |
| J433                          | 1251-3819        | CONNECTOR                                               |
| J436, 437, 438, 439           | 1251-3837        | CONNECTOR                                               |
| J440                          | 1252-0055        | CONNECTOR                                               |
| J441                          | 1252-0056        | CONNECTOR                                               |
| L420, 421                     | 5080-2300        | INDUCTOR-NM                                             |
| R420, 421, 422                | 0698-3611        | RES 27 5% 2W MO                                         |
| R423, 424, 425, 426, 427, 428 | 0764-0044        | RES 8.2K 5% 2W                                          |
| R429, 430, 431, 432, 433, 434 | 0764-0044        | RES 8.2K 5% 2W                                          |
| <b>MECHANICAL PARTS</b>       |                  |                                                         |
|                               | 5080-2286        | CABLE BIAS 24V SECONDARY<br>Ref: E440-E443 to BIAS J816 |
|                               | 5080-2288        | CABLE AC POWER<br>Ref: E420-E425 to ACINPUT J420        |
|                               | 5080-2289        | CABLE AC BIAS<br>Ref: E430-E434 to ACINPUT J419         |
|                               | 5080-2293        | CABLE BIAS LINE SELECT<br>Ref: E444-E447 to J436/J437   |
|                               | 5080-2294        | CABLE RAIL LINE SELECT<br>Ref: E448-451 to J438/J439    |

**Table 5-10. A6 Bias Assembly, Replaceable Parts**

| Ref. Desig.             | Agilent Part No. | Description     |
|-------------------------|------------------|-----------------|
| <b>ELECTRICAL PARTS</b> |                  |                 |
| C800                    | 0160-4834        | CAP .047uF 10%  |
| C801                    | 0180-4140        | CAP 1800 uF 63V |
| C803                    | 0160-5422        | CAP .047uF 20%  |
| C804                    | 0180-4131        | CAP 4.7uF 35V   |
| C805                    | 0160-7743        | C-F .047uF 380V |
| C806                    | 0160-4834        | CAP .047uF 10%  |
| C807                    | 0180-3587        | CAP 1000uF 50V  |
| C808                    | 0180-0230        | C-F 1uF 50V     |
| C809, 810               | 0180-4129        | CAP 1uF 35V     |
| C811, 812               | 0160-4834        | CAP .047uF 10%  |
| C813                    | 0180-2980        | C-F 1000uF 50V  |
| C814, 815               | 0180-4129        | CAP 1uF 35V     |
| C816, 817               | 0180-4405        | CAP 470 uF 50V  |
| C818, 819               | 0180-0230        | C-F 1uF 50V     |
| C820, 821, 822          | 0180-4129        | CAP 1uF 35V     |

**Table 5-10. A6 Bias Assembly, Replaceable Parts (continued)**

| Ref. Desig.                | Agilent Part No. | Description                            |
|----------------------------|------------------|----------------------------------------|
| C823                       | 0180-4131        | CAP 4.7uF 35V                          |
| C824, 825                  | 0180-3298        | C-F 2200uF 50V                         |
| C826                       | 0160-4834        | CAP .047uF 10%                         |
| C827                       | 0180-3587        | CAP 1000uF 50V                         |
| C828                       | 0180-0230        | C-F 1uF 50V                            |
| C829, 830, 831             | 0180-4129        | CAP 1uF 35V                            |
| C841                       | 0180-4397        | C-F 100uF 63V                          |
| C842                       | 0180-4131        | CAP 4.7uF 35V                          |
| C843, 844, 845             | 0160-4835        | CAP .1uF 10% 50V                       |
| C846                       | 0180-4131        | CAP 4.7uF 35V                          |
| C847                       | 0180-0228        | C-F 22uF 15V                           |
| D800, 801, 802,803,804,805 | 1901-0731        | DIO-PWR RECT                           |
| D806, 807, 808,809,810,811 | 1901-0731        | DIO-PWR RECT                           |
| D812, 813, 814,815,816,817 | 1901-0731        | DIO-PWR RECT                           |
| D818, 819                  | 1901-0731        | DIO-PWR RECT                           |
| D820                       | 1902-0018        | DIO-ZNR 1N941                          |
| D830                       | 1901-1098        | DIO-IN4150                             |
| D832                       | 1902-3393        | DIO-ZNR 75V 55°o                       |
| F800                       | 2110-0712        | FU-SUBMIN 4A                           |
| F803, 804, 805, 806        | 2110-0679        | FUSE 1.5AM, 125V                       |
| J801                       | 1252-1670        | CONNECTOR                              |
| J809                       | 1252-8837        | CONNECTOR                              |
| J816                       | 1252-0056        | CONNECTOR                              |
| J821                       | 1252-5230        | CONNECTOR                              |
| J827                       | 1251-7070        | CONNECTOR                              |
| J830, 831                  | 1252-0055        | CONNECTOR                              |
| Q818, 819                  | 5060-3245        | HEAT SINK-TRANSISTOR (1854-0828) ASSY. |
| Q820, 821, 822             | 5060-3527        | HEAT SINK-TRANSISTOR (1854-0828) ASSY. |
| R800                       | 0683-3025        | RES 3K 5% .25W                         |
| R801, 802                  | 0683-0475        | RES 4.7 5% .25W                        |
| R803                       | 0698-0084        | RES 2.15K 1%                           |
| R804                       | 0698-3440        | RES 196 1% .125W                       |
| R805, 806                  | 8159-0005        | RES-ZERO OHMS                          |
| R807, 808, 809             | 0698-0084        | RES 2.15K 1%                           |
| R810                       | 0698-3440        | RES 196 1% .125W                       |
| R811                       | 0699-0208        | RES 1 5% .25W CF                       |
| R812, 813, 814, 815, 816   | 8159-0005        | RES-ZERO OHMS                          |
| R817                       | 0757-0442        | RES 10K 1% .125W                       |
| R818                       | 0698-6392        | RES 22K .1%.125W                       |
| R819                       | 0698-6631        | RES 2.5K .1%                           |
| R820                       | 0699-0070        | RES 3.16M 1%                           |
| R821                       | 0698-4493        | RES 34K 1% .125W                       |
| R822                       | 0757-0290        | RES 6.19K 1%                           |
| R823                       | 0757-0283        | RES 2K 1% .125W                        |
| R824                       | 0699-0070        | RES 3.16M 1%                           |
| R825                       | 0757-0444        | RES 12.1K 1%                           |
| R827                       | 0757-0274        | RES 1.21K 1%                           |
| R828                       | 0757-0444        | RES 12.1K 1%                           |
| R831                       | 0757-0290        | RES 6.19K 1%                           |
| R833                       | 0757-0280        | RES 1K 1% .125W                        |
| R834                       | 0757-0442        | RES 10K 1% .125W                       |
| R835                       | 0698-0085        | RES 2.61K 1%                           |
| R836                       | 0757-0442        | RES 10K 1% .125W                       |
| R841                       | 0698-6363        | RES 40K .1%                            |

**Table 5-10. A6 Bias Assembly, Replaceable Parts (continued)**

| Ref. Desig.             | Agilent Part No. | Description                                         |
|-------------------------|------------------|-----------------------------------------------------|
| R842                    | 0698-6360        | RES 10K .1%                                         |
| R843                    | 0757-0472        | RES 200K 1%                                         |
| R844                    | 0698-6977        | RES 30K .1% .125                                    |
| R845, 847               | 0698-6360        | RES 10K .1%                                         |
| R848                    | 0698-6977        | RES 30K .1% .125                                    |
| R849                    | 0683-3325        | RES 3.3K 5% .25W                                    |
| R850                    | 0698-6977        | RES 30K .1% .125                                    |
| R851                    | 0698-4037        | RES 46.4 1%                                         |
| R852                    | 0683-3325        | RES 3.3K 5% .25W                                    |
| R853, 854, 855          | 0683-1005        | RES 10 5% .25W                                      |
| R856                    | 0698-3152        | RES 3.48K 1%                                        |
| R857                    | 0698-4037        | RES 46.4 1%                                         |
| R858, 859, 860          | 0683-1005        | RES 10 5% .25W                                      |
| R861                    | 0698-8234        | RES 12.1K 1%                                        |
| R862                    | 0699-0070        | RES 3.16M 1%                                        |
| R863                    | 0757-0469        | RES 150K 1%                                         |
| R864                    | 0699-0070        | RES 3.16M 1%                                        |
| R865                    | 0757-0464        | RES 90.9K 1%                                        |
| R867                    | 0757-0290        | RES 6.19K 1%                                        |
| R868                    | 0757-0199        | RES 21.5K 1%                                        |
| R869                    | 0757-0281        | RES 2.74K 1%                                        |
| R870                    | 8159-0005        | RES-ZERO OHMS                                       |
| R871                    | 0698-3440        | RES 196 1% .125W                                    |
| R872                    | 0698-0084        | RES 2.15K 1%                                        |
| R873                    | 8159-0005        | RES-ZERO OHMS                                       |
| R874                    | 0757-0274        | RES 1.21K 1%                                        |
| R875                    | 0698-4037        | RES 46.4 1%                                         |
| R876, 877, 878          | 0683-1005        | RES 10 5% .25W                                      |
| R879, 880               | 8159-0005        | RES-ZERO OHMS                                       |
| T801                    | 9100-5040        | XFMR- GPIB                                          |
| T802                    | 9100-5041        | XFMR-BIAS                                           |
| U801                    | 5060-2942        | HEAT SINK-LM317T REGULATOR ASSY.                    |
| U802                    | 5060-2948        | HEAT SINK-UA7805UC REGULATOR ASSY.                  |
| U803                    | 5060-2942        | HEAT SINK-LM317T REGULATOR ASSY.                    |
| U804                    | 5060-2943        | HEAT SINK-LM337T REGULATOR ASSY.                    |
| U805                    | 5060-2942        | HEAT SINK-LM317T REGULATOR ASSY.                    |
| U806                    | 1826-0544        | IC-V RGLTR 2.5V MC1403U                             |
| U807                    | 1826-0138        | IC COMPARATOR LM339N                                |
| U808                    | 1858-0047        | XSTR ARY 16P-DIP                                    |
| U809, 810, 811          | 1990-1074        | OPTO-ISOLATOR 4N35                                  |
| U812                    | 1826-0161        | IC LM324N                                           |
| U813                    | 1990-1074        | OPTO-ISOLATOR 4N35                                  |
| <b>MECHANICAL PARTS</b> |                  |                                                     |
|                         | 5080-2292        | CABLE PRIMARY BIAS<br>Ref: E800-E804 to DCRAIL J432 |

**Table 5-11. A7 Snubber Assembly, Replaceable Parts**

| Ref. Desig.              | Agilent Part No. | Description                                         |
|--------------------------|------------------|-----------------------------------------------------|
| <b>ELECTRICAL PARTS</b>  |                  |                                                     |
| C910, 911, 912, 913      |                  |                                                     |
| 6680A, 6681A             | 0160-0162        | CAP .022uF 10%                                      |
| 6682A                    | 0160-6896        | CAP .015uF 10%                                      |
| 6683A                    | 0160-4845        | CAP 6800pF 10%                                      |
| 6684A                    | 0160-6162        | CAP 4700pF 10%                                      |
| R910, 911, 912, 913      |                  |                                                     |
| 6680A, 6681A             | 0698-3601        | RES 10 5% 2W MO                                     |
| 6682A                    | 0698-3611        | RES 27 5% 2W MO                                     |
| 6683A                    | 0764-0013        | RES 56 5% 2W MO                                     |
| 6684A                    | 0698-3614        | RES 43 5% 2W MO                                     |
| R914, 915, 916, 917, 918 |                  |                                                     |
| 6680A, 6681A             | not used         |                                                     |
| 6682A                    | 0698-3611        | RES 27 5% 2W MO                                     |
| 6683A                    | 0764-0013        | RES 56 5% 2W MO                                     |
| 6684A                    | 0698-3614        | RES 43 5% 2W MO                                     |
| R919, 920, 921           |                  |                                                     |
| 6680A, 6681A             | not used         |                                                     |
| 6682A                    | 0698-3611        | RES 27 5% 2W MO                                     |
| 6683A                    | 0764-0013        | RES 56 5% 2W MO                                     |
| 6684A                    | 0698-3614        | RES 43 5% 2W MO                                     |
| <b>MECHANICAL PARTS</b>  |                  |                                                     |
| 6680A, 6681A             | 5060-3327        | WIRE KIT ( 2 required )<br>Ref: D900,D901,D902,D903 |
| 6682A, 6683A, 6684A      | 5060-3365        | WIRE KIT<br>Ref: D900A,B,D901A,B                    |

**Table 5-12. A7 Fast Sense Assembly, Replaceable Parts**

| Ref. Desig.             | Agilent Part No. | Description                                                                |
|-------------------------|------------------|----------------------------------------------------------------------------|
| <b>ELECTRICAL PARTS</b> |                  |                                                                            |
| CI000                   | 06680-60023      | FAST SENSE PC ASSEMBLY<br>Ref:6680A POWER SUPPLY                           |
|                         | 06681-60023      | FAST SENSE PC ASSEMBLY<br>Ref:6681A POWER SUPPLY                           |
|                         | 06682-60023      | FAST SENSE PC ASSEMBLY<br>Ref:6682A POWER SUPPLY                           |
|                         | 06683-60023      | FAST SENSE PC ASSEMBLY<br>Ref:6683A POWER SUPPLY<br>Ref:6681A POWER SUPPLY |
|                         | 06684-60023      | FAST SENSE PC ASSEMBLY<br>Ref:6684A POWER SUPPLY                           |
|                         | 0160-5468        | CAP 0.47uF 50V                                                             |
|                         |                  |                                                                            |
| <b>MECHANICAL PARTS</b> |                  |                                                                            |
|                         | 5080-2287        | CABLE Ref: EI001-EI003 to CONTROL J512                                     |

**Table 5-13. A9 Down Programmer/Slow Sense, Replaceable Parts**

| Ref. Desig.                                   | Agilent Part No. | Description                     |
|-----------------------------------------------|------------------|---------------------------------|
| <b>ELECTRICAL PARTS</b>                       |                  |                                 |
| C950, 951                                     | 0160-4259        | CAP .22uF 10%                   |
| C952, 953                                     | 0160-4048        | CAP .022uF 20%                  |
| C956, 957                                     | 0160-4065        | CAP .1uF 20%                    |
| C958, 980                                     | 0160-4835        | CAP .1uF 10% 50V                |
| D980, 981                                     | 1901-1098        | DIO-IN4150                      |
| F980, 981                                     |                  |                                 |
| 6680A, 6681A                                  | 2110-0697        | FU-SUBMIN 15A                   |
| 6682A, 6683A, 6684A                           | 2110-0916        | FU-SUBMIN 7A                    |
| Q980                                          | 1853-0510        | XSTR PNP                        |
| R940                                          |                  |                                 |
| 6680A, 6681A                                  | 0811-3705        | RES .01 3W                      |
| 6682A, 6683A                                  | 0811-3691        | RES .025 3W                     |
| 6684A                                         | 0699-1060        | RES .05 3W                      |
| R941                                          |                  |                                 |
| 6680A, 6681A                                  | 0811-3705        | RES .01 3W                      |
| 6682A                                         | 0811-3691        | RES .025 3W                     |
| 6683A, 6684A                                  | 0699-1060        | RES .05 3W                      |
| R945, 946                                     |                  |                                 |
| 6680A                                         | 0698-3609        | RES 22 5% 2W MO                 |
| 6681A                                         | 0698-3614        | RES 43 5% 2W MO                 |
| 6682A                                         | 0698-3633        | RES 390 5% 2W MO                |
| 6683A                                         | 0698-3637        | RES 820 5% 2W MO                |
| 6684A                                         | 0698-3338        | RES 1.5K 5% 2W MO               |
| R950, 951, 952, 953                           | 0683-5605        | RES 56 5% .25W                  |
| R954, 955, 958, 959                           | 0699-0208        | RES 1 5% .25W CF                |
| R960                                          | 0683-2755        | RES 2.7M 5% .25W                |
| R961                                          | not used         |                                 |
| R980                                          | 0757-0451        | RES 24.3K 1%                    |
| R981                                          | 0698-4416        | RES 169 1% .125W                |
| R982                                          | 0757-0273        | RES 3.01K 1%                    |
| R983, 984                                     | 0698-0082        | RES 464 1% .125W                |
| U900                                          |                  |                                 |
| 6680A 6681A                                   | 1826-0890        | IC 358A                         |
| 6682A, 6683A, 6684A                           | 1826-1409        | LT1013                          |
| Z900, 901                                     | 1902-0960        | DIO ZNR 12V 5%                  |
| Q981, 982*                                    |                  |                                 |
| 6680A, 6681A                                  | 1855-0874        | POWER MOSFET                    |
| 6682A, 6683A, 6684                            | 1855-1003        | POWER MODFET                    |
|                                               | 0340-1507        | INSULATOR (REF Q981,982)        |
|                                               | 5080-2212*       | CABLE Ref: J910 to CONTROL J510 |
| * not supplied as part of downprogrammer assy |                  |                                 |

**Table 5-14. A10 Control Assembly, Replaceable Parts**

| Ref. Desig.             | Agilent Part No. | Description      |
|-------------------------|------------------|------------------|
| <b>ELECTRICAL PARTS</b> |                  |                  |
| C500, 501, 502          | 0180-4129        | CAP 1uF 35V      |
| C503                    | 0160-4835        | CAP .1uF 10% 50V |
| C504                    | 0180-4129        | CAP 1uF 35V      |
| C505                    | 0180-4131        | CAP 4.7uF 35V    |
| C506                    | 0160-4835        | CAP .1uF 10% 50V |
| C507                    | 0180-4136        | CAP 10uF 20V     |
| C508                    | 0160-4831        | CAP 4700pF 10%   |
| C509, 510               | 0180-4129        | CAP 1uF 35V      |
| C511                    | 0160-5422        | CAP .047uF 20%   |
| C512                    | 0160-5644        | CAP .033uF 10%   |
| C513                    | 0160-4789        | CAP 15pF 5% 100V |
| C514, 515               | 0160-4805        | CAP 47pF 5% 100V |
| C516                    | 0160-5422        | CAP .047uF 20%   |
| C517                    | 0180-4129        | CAP 1uF 35V      |
| C518, 519               | 0160-4835        | CAP 1uF 10% 50V  |
| C520                    | 0160-4822        | CAP 1000pF 5%    |
| C521                    | 0160-4832        | CAP .01uF 10%    |
| C530, 531, 532          | 0160-5422        | CAP .047uF 20%   |
| C533, 534, 534          | 0160-4801        | CAP 100pF 5%     |
| C536, 537, 538          | 0160-5422        | CAP .047uF 20%   |
| C539                    | 0160-4846        | CAP 1500pF 100V  |
| C540, 541, 542, 543     | 0160-5469        | C-F 1uF 10% 50V  |
| C544                    | 0160-4835        | CAP .1uF 10% 50V |
| C545, 546               | 0160-4801        | CAP 100pF 5%     |
| C547                    | 0180-2264        | C-F 3.3uF 15V    |
| C548                    |                  |                  |
| 6680A, 6681A            | 0160-4855        | CAP 0.1uF 50V    |
| C556, 560               | 0160-4835        | CAP .1uF 10% 50V |
| C561                    | 0160-4904        | CAP 6800pF 5%    |
| C562                    | 0160-4791        | CAP 10pF 5% 100V |
| C563, 564               | 0160-4835        | CAP .1uF 10% 50V |
| C565                    | 0160-4791        | CAP 10pF 5% 100V |
| C566                    | 0160-4795        | CAP 4.7pF        |
| C567                    | 0160-4904        | CAP 6800pF 5%    |
| C568, 569               | 0160-4787        | C-F 22pF 5% 100V |
| C570                    | 0160-4795        | CAP 4.7pF        |
| C571                    | 0180-4129        | CAP 1uF 35V      |
| C572                    | 0180-4131        | CAP 4.7uF 35V    |
| C573                    | 0160-4835        | CAP .1uF 10% 50V |
| C574                    | 0160-4805        | CAP 47pF 5% 100V |
| C575, 576               | 0160-5098        | CAP .22uF 10%    |
| C577, 578               | 0160-4824        | CAP 680pF 100v   |
| C579, 580               | 0160-4835        | CAP .1uF 10% 50V |
| C581                    | 0160-4797        | CAP 3.3pF        |
| C583                    | 0160-4807        | CAP 33pF 5% 100V |
| C584                    | 0160-4797        | CAP 3.3pF        |
| C585                    | 0160-4834        | CAP .047uF 10%   |
| C586                    | 0160-4835        | CAP .1uF 10% 50V |
| C587                    |                  |                  |
| 6680A                   | 0160-4814        | CAP 150pF 5%     |
| 6681A                   | 0160-4801        | CAP 100pF 5%     |
| 6682A, 683A, 6684A      | 0160-4813        | CAP 180pF 5%     |

**Table 5-14. A10 Control Assembly, Replaceable Parts (continued)**

| Ref. Desig.         | Agilent Part No. | Description        |
|---------------------|------------------|--------------------|
| C588                | 0160-4799        | CAP 2.2pF 5%       |
| C589, 590           |                  |                    |
| 6680A, 6681A        | not used         |                    |
| 6682A, 6683A, 6684A | 0160-4824        | CAP 680pF 5%       |
| C591                |                  |                    |
| 6680A               | 0160-4814        | CAP 150pF 5%       |
| 6681A               | 0160-4801        | CAP 100pF 5%       |
| 6682A, 683A, 6684A  | 0160-4813        | CAP 180pF 5%       |
| C592                | 0160-4835        | CAP .1uF 10% 50V   |
| C594                | 0160-4799        | CAP 2.2pF          |
| C595                | 0160-5098        | CAP .22uF 10%      |
| C596                |                  |                    |
| 6680A, 6681A        | 0160-4811        | CAP 270pF 5%       |
| 6682A, 683A, 6684A  | 0160-4831        | CAP 4700pF 5%      |
| C597                | 0160-4795        | CAP 4.7pF          |
| C598                |                  |                    |
| 6680A, 6681A        | 0160-4831        | CAP 4700pF 10%     |
| 6682A, 6683A        | 0160-4830        | CAP 2200pF 10%     |
| 6684A               | 0160-4831        | CAP 4700pF 10%     |
| C599, 600, 601      | 0160-4835        | CAP .1uF 10% 50V   |
| C621                | 0160-4795        | CAP 4.7pF          |
| C622                | 0160-5534        | CAP 0.1uF 10% 63V  |
| C624                |                  |                    |
| 6680A               | 0160-5267        | CAP 4700pF 5%      |
| 6681A               | 0160-5410        | CAP 3300pF 5%      |
| 6682A               | 0160-4904        | CAP 6800pF 5%      |
| 6683A, 6684A        | 0160-5267        | CAP 4700pF 5%      |
| C625                |                  |                    |
| 6680A               | 0160-4819        | CAP 2200pF 100V    |
| 6681A               | 0160-4846        | CAP 1500pF 100V    |
| 6682A               | 0160-4821        | CAP 1200pF 100V    |
| 6683A               | 0160-4824        | CAP 680pF 10V      |
| 6684A               | 0160-4808        | CAP 470pF 10V      |
| C626, 627           | 0180-4136        | CAP 10uF 20V       |
| C628                | 0160-4835        | CAP .1uF 10% 50V   |
| C629                | 0160-4799        | CAP 2.2pF          |
| C630                |                  |                    |
| 6680A               | 0160-4904        | CAP 6800pF 5%      |
| 6681A               | 0160-5410        | CAP 3300pF 5%      |
| 6682A               | 0160-4812        | CAP 220pF 5%       |
| 6683A, 6684A        | 0160-4810        | CAP 330pF 5%       |
| C631                |                  |                    |
| 6680A               | 0160-5534        | CAP 0.1uF 10%      |
| 6681A               | 0160-5892        | CAP 0.22uF 10%     |
| 6682A, 6683A, 6684A | 0160-5469        | CAP 1uF 10%        |
| C632, 633           | 0160-4791        | CAP 10pF 5% 100V   |
| C635, 636           |                  |                    |
| 6680A               | 0160-5468        | CAP 0.47uF 10% 50V |
| 6681A               | 0160-5469        | CAP 1uF 10% 50V    |
| 6682A               | 0160-5892        | CAP 0.22uF 10% 50V |
| 6683A, 6684A        | 0160-5468        | CAP 0.47uF 10% 50V |
| C637                |                  |                    |
| 6680A, 6681A        | 0160-4808        | CAP 470pF 5%       |
| 6682A, 6683A, 6684A | 0160-4812        | CAP 220pF 5%       |

Table 5-14. A10 Control Assembly, Replaceable Parts (continued)

| Ref. Desig.                   | Agilent Part No. | Description      |
|-------------------------------|------------------|------------------|
| C639                          | 0160-4795        | CAP 4.7pF        |
| C640                          | 0160-4835        | CAP .1uF 10% 50V |
| C641                          | 0160-5410        | CAP 3300pF 5%    |
| C645                          | 0160-4805        | CAP 47pF 5% 100V |
| C648                          | 0160-4831        | CAP 4700pF 10%   |
| C650                          | 0160-4833        | CAP .022uF 10%   |
| C651                          | 0160-7277        | CAP 2.2uF 50V    |
| C652                          | 0160-4832        | CAP .01uF 10%    |
| C653                          | 0160-5892        | CAP 0.22uF 10%   |
| C654, 655                     | 0160-4183        | CAP 1000pF 20%   |
| C656                          |                  |                  |
| 6680A, 6681A                  | 0160-5892        | CAP 0.22uF 10%   |
| 6682A, 6683A, 6684A           | 0160-5469        | CAP 1uF 10% 50V  |
| C657                          |                  |                  |
| 6680A, 6681A                  | not used         |                  |
| 6682A, 6683A, 6684A           | 0160-5534        | CAP 0.1uF 10%    |
| C658, 659                     | 0160-4183        | CAP 1000pF 20%   |
| C710, 711                     | 0160-4835        | CAP .1uF 10% 50V |
| C715                          |                  |                  |
| 6680A, 6681A                  | not used         |                  |
| 6682A, 6683A, 6684A           | 0160-4824        | CAP 680pF 5%     |
| C735                          | 0683-1005        | RES 10 5% .25W   |
| D500, 501, 502                | 1901-0731        | DIO-PWR RECT     |
| D503, 504, 505, 506, 507, 508 | 1901-1098        | DIO-1N4150       |
| D530, 531, 532, 533, 534, 535 | 1901-1098        | DIO-1N4150       |
| D536, 538                     | 1901-1098        | DIO-1N4150       |
| D539                          | 1901-0880        | DIO GEN PRP      |
| D540                          | 1901-1098        | DIO-1N4150       |
| D560, 561                     | 1901-0880        | DIO GEN PRP      |
| D637                          | 1901-1098        | DIO-1N4150       |
| D651, 652                     | 1901-1098        | DIO-1N4150       |
| D653, 654                     | 1901-0880        | DIO GEN PRP      |
| D655, 656                     | 1901-1098        | DIO-1N4150       |
| D657                          | 1901-0880        | DIO GEN PRP      |
| D658, 659                     | 1901-1098        | DIO-1N4150       |
| D670                          | 1901-0880        | DIO GEN PRP      |
| D671                          | 1901-1098        | DIO-1N4150       |
| D672, 673, 674, 675, 676      | 1901-0880        | DIO GEN PRP      |
| D677, 678, 679, 680           | 1901-1098        | DIO-1N4150       |
| J507                          | 1251-7330        | PHONE RECEPTABLE |
| J509                          | 1252-1992        | CONNECTOR 16 pin |
| J510                          | 1252-1152        | CONNECTOR 10 pin |
| J511                          | 1252-0055        | CONNECTOR 2 pin  |
| J512                          | 1252-0056        | CONNECTOR 4 pin  |
| J513                          | 1252-3693        | CONNECTOR 7 pin  |
| L500                          | 9140-0158        | COIL IUH 10%     |
| Q610                          | 1853-0510        | XSTR PNP         |
| Q621, 622, 623                | 1855-0413        | J-FET P-CHAN     |
| R500                          | 0757-0346        | RES 10 1% .125W  |
| R501, 502                     | 0698-3155        | RES 4.64K 1%     |
| R503                          | 0757-0273        | RES 3.01K 1%     |
| R504                          | 0757-0442        | RES 10K 1% .125W |
| R505                          | 0757-0434        | RES 3.65K 1%     |

**Table 5-14. A10 Control Assembly, Replaceable Parts (continued)**

| Ref. Desig.         | Agilent Part No. | Description        |
|---------------------|------------------|--------------------|
| R506                | 0757-0289        | RES 13.3K 1%       |
| R507                | 0698-3155        | RES 4.64K 1%       |
| R508                | 0698-6323        | RES 100.1%         |
| R509                | 0757-0442        | RES 10K 1% .125W   |
| R510                | 0757-0289        | RES 13.3K 1%       |
| R511                | 0698-3155        | RES 4.64K 1%       |
| R512                | 0757-0472        | RES 200K 1%        |
| R513                | 0757-0199        | RES 21.5K 1%       |
| R514                | 0698-3279        | RES 4.99K 1%       |
| R515                | 0757-0472        | RES 200K 1%        |
| R516                | 0698-3456        | RES 287K 1%        |
| R517                | 0698-3279        | RES 4.99K 1%       |
| R518                | 0757-0442        | RES 10K 1% .125W   |
| R519                | 0698-3279        | RES 4.99K 1%       |
| R520                | 0757-0442        | RES 10K 1% .125W   |
| R521                | 0757-0465        | RES 100K 1%        |
| R522                | 0757-0289        | RES 13.3K 1%       |
| R523, 524           | 0757-0280        | RES 1K 1% .125W    |
| R525, 526           | 0757-0442        | RES 10K 1% .125W   |
| R527                | 0699-1212        | RES 19K .1%        |
| R528                | 0698-6392        | RES 22K .1%.125W   |
| R529                | 0757-0283        | RES 2K 1% .125W    |
| R530                | 1810-0305        | NETWORK-RES SIP    |
| R531                | 0698-4446        | RES 267 1% .125W   |
| R532                | 0757-0273        | RES 3.01K 1%       |
| R533                | 0698-3155        | RES 4.64K 1%       |
| R534                | 0699-0070        | RES 3.16M 1%       |
| R535                | 0757-0468        | RES 130K 1%        |
| R536                |                  |                    |
| 6680A               | 0757-0290        | RES 6.19K 1% .125W |
| 6681A               | 0757-0442        | RES 10K 1% .125W   |
| 6682A               | 0698-4486        | RES 24.9K 1%       |
| 6683A               | 0698-6076        | RES 39K 1%         |
| 6684A               | 0757-0457        | RES 47.5K 1%       |
| R537                |                  |                    |
| 6680A               | 8159-0005        | RES 0.0            |
| 6681A               | 0698-8827        | RES 1M 1%          |
| 6682A, 6683A        | 0699-0070        | RES 3.16M 1%       |
| 6684A               | not used         |                    |
| R538                |                  |                    |
| 6680A, 6681A        | 0698-8827        | RES 1M 1%          |
| 6682A               | 0699-1972        | RES 1.74M 1%       |
| 6683A               | 0699-0070        | RES 3.16K          |
| R539                | 0757-0438        | RES 5.11K 1%       |
| R540                | 0757-0428        | RES 1.62K 1%       |
| R550, 551, 552      | 0757-0401        | RES 100 1% .125W   |
| R553, 554           | 0757-0465        | RES 100K 1%        |
| R555                | 0757-0462        | RES 75K 1% .125W   |
| R556                | 0698-3450        | RES 42.2K 1%       |
| R557                | 0757-0280        | RES 1K 1% .125W    |
| R558, 559           | 0698-3456        | RES 287K 1%        |
| R560, 561, 562, 563 | 0698-4486        | RES 24.9K 1%       |
| R564, 565, 566, 567 | 0699-0642        | RES 10K .1% .1W    |
| R568, 569           | 0698-3279        | RES 4.99K 1%       |

Table 5-14. A10 Control Assembly, Replaceable Parts (continued)

| Ref. Desig.  | Agilent Part No. | Description      |
|--------------|------------------|------------------|
| R570, 580    | 0757-0424        | RES 1.1K 1%      |
| R581         | 0757-0407        | RES 200 1% .125W |
| R582, 583    | 0698-4486        | RES 24.9K 1%     |
| R584         | 0757-0472        | RES 200K 1%      |
| R585         | 0757-0434        | RES 3.65K 1%     |
| R586         | 0757-0472        | RES 200K 1%      |
| R587         | 0757-0407        | RES 200 1% .125W |
| R588, 589    | 0757-0442        | RES 10K 1% .125W |
| R590         | 0699-0070        | RES 3.16M 1%     |
| R591, 592    | 0757-0472        | RES 200K 1%      |
| R593         | 0699-0070        | RES 3.16M 1%     |
| R594         | 0757-0280        | RES 1K 1% .125W  |
| R595         | 0757-0273        | RES 3.01K 1%     |
| R596         | 0757-0442        | RES 10K 1% .125W |
| R597         | 0757-0199        | RES 21.5K 1%     |
| R598         | 0757-0273        | RES 3.01K 1%     |
| R599, 600    | 0757-0427        | RES 1.5K 1%      |
| R601, 602    | 0757-0401        | RES 100 1% .125W |
| R603         | 0698-4446        | RES 267 1% .125W |
| R604         | 0698-3279        | RES 4.99K 1%     |
| R605, 606    | 0698-3430        | RES 21.5 1%      |
| R607         | 0698-4479        | RES 14K 1% .125W |
| R608, 609    | 0757-0429        | RES 1.82K 1%     |
| R610         |                  |                  |
| 6680A        | 0757-0462        | RES 75K 1%       |
| 6681A, 6682A | 0757-0465        | RES 100K 1%      |
| 6683A, 6684A | 0757-0465        | RES 100K 1%      |
| R611         | 0698-3450        | RES 42.2K 1%     |
| R612         | 0757-0442        | RES 10K 1% .125W |
| R613         | 0698-3155        | RES 4.64K 1%     |
| R614         | 0698-3279        | RES 4.99K 1%     |
| R615         | 0698-3162        | RES 46.4K 1%     |
| R616         | 0757-0410        | RES 301 1% .125W |
| R617         | 0698-0082        | RES 464 1% .125W |
| R618         | 0757-0410        | RES 301 1% .125W |
| R619         | 0757-0453        | RES 30.1K 1%     |
| R620         |                  |                  |
| 6680A, 6681A | not used         |                  |
| 6682A        | 0698-3136        | RES 17.8K 1%     |
| 6683A, 6684A | 0757-0446        | RES 15K 1%       |
| R621         |                  |                  |
| 6680A, 6681A | 0757-0453        | RES 30.1K 1%     |
| 6682A        | 0757-0462        | RES 75K 1%       |
| 6683A        | 0757-0467        | RES 121K 1%      |
| 6684A        | 0757-0469        | RES 150K 1%      |
| R622         |                  |                  |
| 6680A, 6681A | not used         |                  |
| 6682A        | 0698-3136        | RES 17.8K 1%     |
| 6683A, 6684A | 0757-0446        | RES 15K 1%       |
| R623         |                  |                  |
| 6680A, 6681A | 0757-0453        | RES 30.1K 1%     |
| 6682A        | 0757-0462        | RES 75K 1%       |
| 6683A        | 0757-0467        | RES 121K 1%      |
| 6684A        | 0757-0469        | RES 150K 1%      |

**Table 5-14. A10 Control Assembly, Replaceable Parts (continued)**

| <b>Ref. Desig.</b>  | <b>Agilent Part No.</b> | <b>Description</b> |
|---------------------|-------------------------|--------------------|
| R624                | 0757-0453               | RES 30.1K 1%       |
| R625                |                         |                    |
| 6680A, 6681A        | 0698-3455               | RES 261K 1%        |
| 6682A               | 0757-0461               | RES 68.1K 1%       |
| 6683A, 6684A        | 0699-1972               | RES 1.74M 1%       |
| R626                |                         |                    |
| 6680A, 6681A        | 0698-3455               | RES 261K 1%        |
| 6682A               | 0699-0088               | RES 1.21M 1%       |
| 6683A, 6684A        | 0757-0480               | RES 432K 1%        |
| R627, 628           | 0698-3455               | RES 261K 1%        |
| R629                | 0698-4479               | RES 14K 1% .125W   |
| R632                | 0757-0273               | RES 3.01K 1%       |
| R633                | 0757-0465               | RES 100K 1%        |
| R634                | 0757-0442               | RES 10K 1% .125W   |
| R635                | 0698-3450               | RES 42.2K 1%       |
| R636                | 0757-0280               | RES 1K 1% .125W    |
| R637                |                         |                    |
| 6680A, 6681A, 6682A | 0757-0465               | RES 100K 1%        |
| 6683A               | 0757-0466               | RES 110K 1%        |
| 6684A               | 0757-0464               | RES 90.0K 1%       |
| R638                | 0698-3279               | RES 4.99K 1%       |
| R639                |                         |                    |
| 6680A, 6681A        | 0757-0463               | RES 82.5K 1%       |
| 6682A               | 0757-0464               | RES 90.9K 1%       |
| 6683A               | 0757-0466               | RES 110K 1%        |
| 6684A               | 0757-0464               | RES 90.9K 1%       |
| R640                | 0698-3279               | RES 4.99K 1%       |
| R641                |                         |                    |
| 6680A, 6681A        | 0757-0452               | RES 27.4K 1%       |
| 6682A, 6683A, 6684A | 0698-3156               | RES 14.7K 1%       |
| R642                | 0757-0410               | RES 301 1%         |
| R643                | 0757-0429               | RES 1.82K 1%       |
| R644                | 0757-0434               | RES 3.65K 1%       |
| R645                |                         |                    |
| 6680A               | 0698-8827               | RES 1M 1%          |
| 6681A, 6682A        | 0699-0070               | RES 3.16M 1%       |
| 6683A, 6684A        | 0699-0070               | RES 3.16M 1%       |
| R646                |                         |                    |
| 6680A, 6681A        | 0699-0088               | RES 1.2M 1%        |
| 6682A, 6683A, 6684A | 0698-3215               | RES 499K 1%        |
| R658, 659           | 0757-0278               | RES 1.78K 1%       |
| R660                | 0698-8827               | RES 1M 1% .125W    |
| R661                |                         |                    |
| 6680A               | 0757-0433               | RES 3.32K 1%       |
| 6681A               | 0757-0430               | RES 2.21K 1%       |
| 6682A               | 0757-0427               | RES 1.5K 1%        |
| 6683A, 6684A        | 0757-0280               | RES 1K 1%          |
| R662                | 0757-0273               | RES 3.01K 1%       |
| R663                | 0698-3456               | RES 287K 1%        |
| R664                | 0698-3155               | RES 4.64K 1%       |
| R665                | 0757-0273               | RES 3.01K 1%       |

**Table 5-14. A10 Control Assembly, Replaceable Parts (continued)**

| Ref. Desig.  | Agilent Part No. | Description      |
|--------------|------------------|------------------|
| R666         |                  |                  |
| 6680A        | 0698-8913        | RES 1.5M 1%      |
| 6681A, 6682A | 0683-2255        | RES 2.2M 1%      |
| 6683A        | 0683-4755        | RES 4.7M 1%      |
| 6684A        | 0683-5655        | RES 5.6M 1%      |
| R667         |                  |                  |
| 6680A        | 0757-0465        | RES 100K 1       |
| 6681A        | 0757-0462        | RES 75K 1%       |
| 6682A, 6683A | 0698-3455        | RES 261K 1%      |
| 6684A        | 0757-0473        | RES 221K 1%      |
| R668         | 0698-3279        | RES 4.99K 1      |
| R669         |                  |                  |
| 6680A        | 0757-0462        | RES 75K 1%       |
| 6681A        | 0698-4503        | RES 66.5K 1%     |
| 6682A        | 0757-0273        | RES 3.01K 1%     |
| 6683A        | 0757-0480        | RES 432K 1%      |
| 6684A        | 0698-3456        | RES 287K 1%      |
| R670         |                  |                  |
| 6680A        | 0699-1742        | RES 70K 1%       |
| 6681A, 6682A | 0699-1211        | RES 95K 1%       |
| 6683A, 6684A | 0699-0460        | RES 85K 1%       |
| R671         | 0699-0070        | RES 3.16M 1%     |
| R672         |                  |                  |
| 6680A        | 0698-8093        | RES 40K 1%       |
| 6681A, 6682A | 0699-0118        | RES 20K 1%       |
| 6683A, 6684A | 0699-0461        | RES 30K .1%      |
| R673         | 0699-2247        | RES 121K .05%    |
| R674         | 0699-0461        | RES 30K .1% .1W  |
| R675         | 0698-3279        | RES 4.99K 1%     |
| R677         | 0699-0461        | RES 30K .1% .1W  |
| R678, 679    |                  |                  |
| 6680A        | 0699-3414        | RES 45K          |
| 6681A, 6682A | 0699-2246        | RES 25K 0.05%    |
| 6683A, 6684A | 0699-2246        | RES 25K 0.05%    |
| R680         |                  |                  |
| 6680A, 6681A | 0699-3103        | RES 19K 0.05%    |
| 6682A        | 0699-2248        | RES 47.5K 0.05%  |
| 6683A        | 0699-2879        | RES 80K 0.05%    |
| 6684A        | 0699-3416        | RES 100K 0.05%   |
| R681         |                  |                  |
| 6680A, 6681A | 0699-3103        | RES 19K 0.05%    |
| 6682A        | 0699-2248        | RES 47.5K 0.05%  |
| 6683A        | 0699-2879        | RES 80K 0.05%    |
| 6684A        | 0699-3416        | RES 100K 0.05%   |
| R682         |                  |                  |
| 6680A        | 0698-6322        | RES 4K 0.1%      |
| 6681A        | 0698-7163        | RES 2.0081K 0.1% |
| 6682A        | 0698-8061        | RES 8.25K 0.1%   |
| 6683A, 6684A | 0698-6322        | RES 4K 0.1%      |
| R683         |                  |                  |
| 6680A        | 0698-6322        | RES 4K 0.1%      |
| 6681A        | 0698-7163        | RES 2.0081K 0.1% |
| 6682A        | 0698-8061        | RES 8.25K 0.1%   |
| 6683A, 6684A | 0698-6322        | RES 4K 0.1%      |

**Table 5-14. A10 Control Assembly, Replaceable Parts (continued)**

| Ref. Desig.  | Agilent Part No. | Description      |
|--------------|------------------|------------------|
| R684         |                  |                  |
| 6680A        | 0757-0280        | RES 1K 1%        |
| 6681A        | 0757-0289        | RES 1K 1%        |
| 6682A        | 0757-0430        | RES 2.21K 1%     |
| 6683A        | 0698-3496        | RES 3.57K 1%     |
| 6684A        | 0757-0436        | RES 4.32K 1%     |
| R685         |                  |                  |
| 6680A        | 0757-0280        | RES 1K 1%        |
| 6681A        | 0757-0289        | RES 1K 1%        |
| 6682A        | 0757-0430        | RES 2.21K 1%     |
| 6683A        | 0698-3496        | RES 3.57K 1%     |
| 6684A        | 0757-0436        | RES 4.32K 1%     |
| R686         |                  |                  |
| 6680A        | 8159-0005        | RES 0.0          |
| 6682A        | 0698-8911        | RES 1.3K .1%     |
| 6683A        | 0699-0486        | RES 2.0K .1%     |
| 6684A        | 8159-0005        | RES 0.0          |
| R687         | 0698-8093        | RES 40K .1% .1W  |
| R689         | 0698-5365        | RES 3.48K .1%    |
| R690         |                  |                  |
| 6680A, 6681A | 0757-0395        | RES 56.2         |
| 6682A, 6683A | 0757-0403        | RES 121          |
| 6684A        | 0698-6362        | RES 1.0K .1%     |
| R691         |                  |                  |
| 6680A, 6681A | 0699-1011        | RES 3.32K .1%    |
| 6682A        | 0698-8911        | RES 1.3K .1%     |
| 6683A        | 0698-7163        | RES 2.0081K .1%  |
| 6684A        | 0698-8911        | RES 1.3K .1%     |
| R692         | 0698-6620        | RES 150K .1%     |
| R693, 694    | 0698-3430        | RES 21.5 1%      |
| R695         | 0698-8093        | RES 40K .1% .1W  |
| R696, 697    | 0698-6414        | RES 1K .1% .1W F |
| R698, 699    | 0698-6323        | RES 100 1%       |
| R701, 702    | 0757-0442        | RES 10K 1% .125W |
| R703         |                  |                  |
| 6680A        | 0757-0446        | RES 15K 1%       |
| 6681A, 6682A | 0757-0443        | RES 11K 1%       |
| 6683A, 6684A | 0757-0443        | RES 11K 1%       |
| R704         | 0683-1065        | RES 10M 5% .25W  |
| R705         |                  |                  |
| 6680A        | 0699-0070        | RES 3.16M        |
| 6681A, 6682A | 0683-2255        | RES 2.2M         |
| 6683A, 6684A | 0683-2255        | RES 2.2M         |
| R706         | 8159-0005        | RES-ZERO OHMS    |
| R707         |                  |                  |
| 6680A        | 0699-0088        | RES 1.21M        |
| 6681A, 6682A | 0698-8826        | RES 825K         |
| 6683A, 6684A | 0698-8826        | RES 825K         |
| R708         |                  |                  |
| 6680A        | 0698-3459        | RES 383K         |
| 6681A, 6682A | 0698-3455        | RES 261K         |
| 6683A, 6684A | 0698-3455        | RES 261K         |

**Table 5-14. A10 Control Assembly, Replaceable Parts (continued)**

| Ref. Desig.         | Agilent Part No. | Description      |
|---------------------|------------------|------------------|
| R709                |                  |                  |
| 6680A               | 0757-0468        | RES 130K         |
| 6681A, 6682A        | 0757-0464        | RES 90.9K        |
| 6683A, 6684A        | 0757-0464        | RES 90.9K        |
| R710                |                  |                  |
| 6680A               | 0698-5091        | RES 45K          |
| 6681A, 6682A        | 0698-3160        | RES 31.6K        |
| 6683A, 6684A        | 0698-3160        | RES 31.6K        |
| R711                | 0698-5091        | RES 45K          |
| R712                | 0698-0082        | RES 464 1% .125W |
| R713                | 0757-0442        | RES 10K 1% .125W |
| R714                | 0757-0349        | RES 22.6K 1%     |
| R715                | 0757-0447        | RES 16.2K 1%     |
| R716                | 0698-3449        | RES 28.7K 1%     |
| R717                |                  |                  |
| 6680A, 6681A        | not used         |                  |
| 6682A, 6683A, 6684A | 0757-0442        | RES 10K          |
| R718                | 0698-3162        | RES 46.4K 1%     |
| R719                | 0757-0458        | RES 51.1K 1%     |
| R720                | 0698-8093        | RES 40K .1% .1W  |
| R721                | 0698-6630        | RES 20K .1%      |
| R724                | 0698-3279        | RES 4.99K 1%     |
| R725                |                  |                  |
| 6680A, 6681A        | not used         |                  |
| 6682A, 6683A, 6684A | 0757-0199        | RES 21.5K        |
| R726                | 0698-6359        | RES 80K .1%      |
| R727, 728           | 0698-6630        | RES 20K .1%      |
| R729                | 0698-6359        | RES 80K .1%      |
| R730, 731           | 0698-6630        | RES 20K .1%      |
| R732                | 0698-6619        | RES 15K .1%      |
| R733                | 0699-0489        | RES 16.15K .1%   |
| R734                | 0683-2255        | RES 2.2M 5% .25W |
| R738                | 0698-8959        | RES 619K 1%      |
| R741                |                  |                  |
| 6680A               | 0757-0429        | RES 1.82K        |
| 6681A               | 0698-3496        | RES 3.57K        |
| 6682A               | 0757-0436        | RES 4.32K        |
| 6683A               | 0698-3496        | RES 3.57K        |
| 6684A               | 0698-3151        | RES 2.87K        |
| R742                | 0698-4509        | RES 80.6K 1%     |
| R743                | 0698-8093        | RES 40K .1% .1W  |
| R744                | 0683-0475        | RES 4.7 5% .25W  |
| R745                | 0698-6630        | RES 20K .1%      |
| RT500               | 0837-0397        | Thermistor       |
| S500                | 3101-1973        | SW-SL 7-1A       |
| U500                | 1826-2341        | IC-REG TL7702BCP |
| U501, 502           | 1826-1370        | IC 365           |
| U503                | 1826-0346        | IC OP AMP        |
| U504                | 1826-1369        | IC-VOLTAGE REG   |

**Table 5-14. A10 Control Assembly, Replaceable Parts (continued)**

| <b>Ref. Desig.</b> | <b>Agilent Part No.</b> | <b>Description</b> |
|--------------------|-------------------------|--------------------|
| U506               | 5080-2305               | PRGMD-IC, SEC      |
| U507               | 1820-3079               | IC MC74HC138N      |
| U510, 511, 512     | 1826-2187               | IC-CONVERTER,DIA   |
| U513, 514, 515     | 1826-1896               | IC-LINEAR          |
| U516, 517          | 1826-1370               | IC 365             |
| U518               | 1820-3081               | IC MC74HC74N       |
| U520               | 1826-1231               | DIA 8-DGT          |
| U521, 522          | 1826-1409               | IC 1013            |
| U600               | 1820-3199               | IC MC74HC4040N     |
| U601               | 1820-2922               | IC MC74HC00N       |
| U602               | 1820-3081               | IC MC74HC74N       |
| U603               | 1826-2343               | IC-VRGLTR,SWG      |
| U604               | 1820-2922               | IC MC74HC00N       |
| U605               | 1826-0065               | IC 311             |
| U606               | 1858-0083               | XSTR ARY 14P-DIP   |
| U607, 608          | 1826-0962               | IC 412             |
| U609               | 1826-0890               | IC 358A            |
| U610               | 1826-1343               | IC-VOLTAGE REG     |
| U620, 621          | 1826-1409               | IC 1013            |
| U622               | 1826-1895               | PRECISION OP-AMP   |
| U623               | 1826-1896               | IC-LINEAR          |
| U624               | 1826-0161               | IC 324             |
| Z500               | 1902-3114               | DIO-ZNR 6.19V 2%   |
| Z501               | 1902-0777               | DIO-ZNR IN825      |
| Z641               | 1902-1377               | DIO-ZNR 6.19V      |

# Diagrams

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## Introduction

This chapter contains drawings and diagrams for troubleshooting and maintaining Agilent Series 668xA Power Supplies. Unless otherwise specified, a drawing or diagram applies to all models of the series. Wiring connections to external equipment are shown in the Power Supply Operating Manual.

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## Chapter Organization

Table 6-1 summarizes the contents of this chapter.

**Table 6-1. Summary of Chapter Contents**

| Function         | Description                                                                                                                                                                                                                                                                                                                                                                                                              | See         |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| Interconnections | Drawing identifying each circuit board, the cables between boards, and schematic diagram for each board.                                                                                                                                                                                                                                                                                                                 | Figure 6-2  |
| Schematics       | Show test points, signal mnemonics, component-location grid coordinates, and specific notes. General notes applicable to all schematics are given in Table 6-4.<br>A1 Front Panel Board.<br>LED Board.<br>A2 GPIB Board.<br>A3 FET Board.<br>A4 AC Input Power Board.<br>A5 DC Rail Board.<br>A6 Bias Board.<br>A7 Snubber Board.<br>A8 Fast Sense Board.<br>A9 Down Programming/Slow Sense Board.<br>A10 Control Board. |             |
| Signal names     | Table of signal name mnemonics                                                                                                                                                                                                                                                                                                                                                                                           | Table 6-2   |
| Parts location   | A drawing that shows the location of components on a circuit board is located next to the above circuit board schematic diagram.<br><br>A drawing showing location of each circuit board in the chassis is in Chapter 3.                                                                                                                                                                                                 | Figure 3-18 |
| Test points      | Description of each test point. Location of each test point is shown on the appropriate schematic and its associated parts location drawing.                                                                                                                                                                                                                                                                             | Table 6-3   |

Table 6-2. Signal Name Mnemonics

| Mnemonic       | Description                        | Mnemonic | Description                                |
|----------------|------------------------------------|----------|--------------------------------------------|
| A(0)--A(15)    | Address lines                      | MSRQ     | Microprocessor service request             |
| AD (0)--AD(7)  | Address bus                        | NDAC     | Not data accepted (GPIB)                   |
| AMB_SENSE      | Ambient temperature sense          | NEG_IMON | Negative current monitor                   |
| ANA(0)--ANA(7) | Analog Signal readback bus         | NRFD     | Not ready or data (GPIB)                   |
| ATN            | Attention (GPIB)                   | OV       | Overvoltage                                |
| BIAS_OK        | ±15V bias supplies have stabilized | OV_CLR   | Overvoltage clear                          |
| BOVPROG        | BuFfered OV programming            | OVCMP    | Overvoltage comparator                     |
| BSTX           | BuFfered secondary transmit        | OVP_BIAS | Overvoltage protection bias                |
| cc             | Constant current status            | OVPROG   | Overvoltage programming                    |
| CCPROG         | Constant current programming       | OVSCR    | Overvoltage SCR (crowbar)                  |
| cv             | Constant voltage status            | PCLR     | Primary power clear                        |
| CVPROG         | Constant voltage programming       | PREF     | Primary reference voltage (2.53V)          |
| D(0)_D(7)      | Data lines                         | PREF_2   | Primary reference voltage (1.0V)           |
| D101--DI08     | Data lines (GPIB)                  | PREN     | Primary remote enable                      |
| DAV            | Data valid (GPIB)                  | PRX      | Primary receive serial data                |
| DFI            | Discrete fault indicator           | PTX      | Primary transmit serial data               |
| DFI-EN         | Discrete fault indicator enable    | PWM_EN   | Pulse width modulator enable               |
| DPS            | Downprogramming shunt              | RAM      | Random access memory                       |
| DN_PGM         | Down programming                   | RDY      | Ready                                      |
| DRIVE_A/B      | FET drive signals                  | REN      | Remote enable                              |
| EOI            | End or identify (GPIB)             | RI       | Remote inhibit                             |
| FAC_CAL        | Factory calibration                | ROM      | Read only memory                           |
| FAN_PWM        | Fan pulse width modulation         | SPCLR    | Secondary power clear                      |
| FPRX           | Front panel receive serial data    | RX       | Receive serial data                        |
| FPTX           | Front panel transmit serial data   | RxD      | Receive Serial Data                        |
| FS             | Fast sense                         | SA       | Signature analysis                         |
| HSRQ           | GPIB service request               | SRQ      | Service request (GPIB)                     |
| IFC            | Interface clear (GPIB)             | SRX      | Secondary receive serial data              |
| IMON           | Current monitor                    | STX      | Secondary transmit serial data             |
| INH_CAL        | Inhibit calibration                | TxD      | Transmit Serial Data                       |
| IP             | External current programming       | UART     | Universal asynchronous<br>receive/transmit |
| IPROG          | Current programming                | VMON     | Voltage monitor                            |
| ISEN           | Current sense                      | vos      | Voltage offset                             |
| ISRQ           | Interface service request          | VPROG    | Voltage programming                        |
| KO(0)-KO(5)    | Keypad output data bus             | WR       | Write                                      |
| KI(0)--KI(5)   | Keypad input data bus              |          |                                            |

Table 6-3. Test Points

| TEST POINT No. & Loc.                                                                                                                                                                                                                                                | Signal Tested                                                                                                                                                                | Measurement and Conditions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                              |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|
| A2 GPIB BOARD                                                                                                                                                                                                                                                        |                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                              |
| <b>1</b> J106-4<br><br><b>2</b> U101- 1<br><b>3</b> U101-6<br><br><b>4</b> U101-8<br><br><b>5</b> U110-3<br><br><b>6</b> U111-6<br><br><b>7</b> U119-4<br><br><b>8</b> U119-18                                                                                       | Primary/chassis ground<br><br>+ 5V primary bias<br><b>PCLR</b><br><br><b>PCLR*</b><br><br><b>STX</b><br><br><b>SRX</b><br><br><b>FPRX</b><br><br><b>FPTX</b>                 | Connect meter or scope common here. Then make measurements at test points <b>2</b> through <b>8</b> .<br>+ 5V ± 0.2V<br>Goes high for approximately 40 ms at power on, then goes low.<br>Held low for approximately 40 ms at power on, then goes high.<br>Primary transmit to secondary serial data line. Toggles between 0 and +5V.<br>Primary receive from secondary serial data line. Toggles between 0 and +5V.<br>Primary receive from front panel serial data line. Toggles between 0 and +5V.<br>Primary transmit to front panel serial data line. Toggles between 0 and +5V. |                                                              |
| AC Input Board                                                                                                                                                                                                                                                       |                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                              |
| Connect meter between TP <b>9</b> and <b>10</b> , or <b>9</b> and <b>11</b> , or <b>10</b> and <b>11</b> , and measure approximately 220VAC or 440VAC. Measurements at test points ②through ⑧.                                                                       |                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                              |
| <b>9</b> J418-1/J417-7<br><b>10</b> J418-2/J417-8<br><b>11</b> J418-3/J417-9<br><b>12</b> K402 coil                                                                                                                                                                  | AC Mains Voltage<br>AC Mains Voltage<br>AC Mains Voltage<br>24VDC Coil Voltage                                                                                               | Turns on PS, and after power-on initialization test, reads approximately 24VDC.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                              |
| DC Rail Board                                                                                                                                                                                                                                                        |                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                              |
| <b>13</b> J430-1 (+) to J430-2 (-)<br><b>14</b> J431-1 (+) to J431-2 (-)                                                                                                                                                                                             | Rail #1 Voltage<br>Rail #2 Voltage                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Measure approximately 290VDC<br>Measure approximately 290VDC |
| Bias Board                                                                                                                                                                                                                                                           |                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                              |
| <b>15</b> J801-4 to J801-5<br><b>16</b> J801-1 (+) to J801-2 (-)<br><b>17</b> J827-1 (+) to J827-2 (-)<br><b>18</b> J827-1 (+) to J827-3 (-)<br><br><b>19</b> R331<br><b>16</b> R330<br><b>17</b> +C354<br><b>18</b> U310-16<br><b>18</b> U308-6<br><b>20</b> U308-7 | GPIB 5V Bias<br>Fan voltage<br>Inrush relay coil<br>Rail relay coil<br><br>24V Primary<br>-15Vs secondary bias<br>-25V<br><b>RELAY ON*</b><br><b>RESET</b><br><b>BIAS OK</b> | +15 ± 0.9V measure approx. 11VAC<br>Measure 24VDC<br>Measure 24VDC<br>Measure 24VDC after power-on initialization test.<br>Measure approximately 34VAC<br>-15 ± 0.9V<br>-22.5V to -27.5V<br>0V<br>0V<br>+5V                                                                                                                                                                                                                                                                                                                                                                          |                                                              |

Table 6-3. Test Points (continued)

| TEST POINT No. & Loc.                                                                                                                                                                                         | Signal Tested                                                                   | Measurement and Conditions                                    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|---------------------------------------------------------------|
| <b>Bias Board (continued)</b>                                                                                                                                                                                 |                                                                                 |                                                               |
| <b>(21)</b> U308-1                                                                                                                                                                                            | <b>PREF</b>                                                                     | +2.5V                                                         |
| <b>(22)</b> U308-5                                                                                                                                                                                            | <b>RESET*</b>                                                                   | Held low for approximately 50 ms at power-on, then goes high. |
| <b>(23)</b> U311-7                                                                                                                                                                                            | <b>FAN DETECT</b>                                                               | +3V                                                           |
| <b>(24)</b> D317                                                                                                                                                                                              | -25V                                                                            | +3V                                                           |
| <b>(25)</b> U311-2                                                                                                                                                                                            | <b>FAN_PWN</b>                                                                  | +0.6V                                                         |
| <b>A3 FET Board</b>                                                                                                                                                                                           |                                                                                 |                                                               |
| Test points <b>(26)</b> through <b>(35)</b> are on the A3 FET Board. Troubleshooting procedures at these points are given under Dynamic Troubleshooting section of the FET Troubleshooting Chart (Table 3-4). |                                                                                 |                                                               |
| <b>A10 Control Board</b>                                                                                                                                                                                      |                                                                                 |                                                               |
| <b>(36)</b> +C500                                                                                                                                                                                             | Secondary common (Sheet 1)                                                      |                                                               |
| <b>(37)</b> U504-6                                                                                                                                                                                            | CC/CC DACs reference (Sheet 1)                                                  |                                                               |
| <b>(38)</b> U503-7                                                                                                                                                                                            | Readback DAC reference (Sheet 1)                                                |                                                               |
| <b>(39)</b> U513-6                                                                                                                                                                                            | <b>CVPROG</b> (Sheets 2,4)                                                      |                                                               |
| <b>(40)</b> U514-6                                                                                                                                                                                            | <b>CVPROG</b> (Sheets 2,4)                                                      |                                                               |
|                                                                                                                                                                                                               | <b>NOTE:</b>                                                                    |                                                               |
|                                                                                                                                                                                                               | Measurements at test points through where taken under the following conditions: |                                                               |
|                                                                                                                                                                                                               | 1. Programming                                                                  | a. Voltage = ½ scale                                          |
|                                                                                                                                                                                                               |                                                                                 | b. Current = ½ scale                                          |
|                                                                                                                                                                                                               |                                                                                 | c. OV = full scale                                            |
|                                                                                                                                                                                                               | 2. First measurement in CV mode with no load.                                   |                                                               |
|                                                                                                                                                                                                               | 3. Second measurement in CC mode with output shorted.                           |                                                               |
| <b>(41)</b> U621-1                                                                                                                                                                                            | <b>VMON</b> (Sheet 4)                                                           |                                                               |
| <b>(42)</b> U621-7                                                                                                                                                                                            | <b>CV CONTROL</b> (Sheet 4)                                                     |                                                               |
| <b>(43)</b> U502-2                                                                                                                                                                                            | <b>CV*</b> (Sheet 4)                                                            | CV mode = 0V      CC mode = 5V                                |
| <b>(44)</b> U624-1                                                                                                                                                                                            | CC CLAMP AMP output (Sheet 4)                                                   | CV mode = +2.2V      CC mode = +2.2V                          |
| <b>(45)</b> U622-6                                                                                                                                                                                            | 1ST I AMP output (Sheet 4)                                                      | CV mode = 0V      CC mode = -0.4V                             |
| <b>(46)</b> U620-7                                                                                                                                                                                            | 2ND I AMP output (Sheet 4)                                                      | CV mode = 0V      CC mode = +4.5V                             |
| <b>(47)</b> U620-1                                                                                                                                                                                            | <b>CC CONTROL</b> (Sheet 4)                                                     | CV mode = +10V      CC mode = +0.4V                           |
| <b>(48)</b> U502-3                                                                                                                                                                                            | <b>CC*</b> (Sheet 4)                                                            | CV mode = +5V      CC mode = 0V                               |
| <b>(49)</b> Y608-7                                                                                                                                                                                            | FAST SENSE AMP (Sheet 3)                                                        | CV mode = -4V      CC mode = 0V                               |
| <b>(50)</b> U607-7                                                                                                                                                                                            | RAMP GEN (Sheet 3)                                                              | See Figure 6-1                                                |
| <b>(51)</b> U607-1                                                                                                                                                                                            | RAMP GEN (Sheet 3)                                                              | See Figure 6-1                                                |
| <b>(52)</b> U602-9                                                                                                                                                                                            | DIVIDER output (Sheet 3)                                                        | See Figure 6-1                                                |
| <b>(53)</b> U605-3                                                                                                                                                                                            | SUMMING POINT (Sheet 3)                                                         | See Figure 6-1                                                |
| <b>(54)</b> U602-6                                                                                                                                                                                            | DEADTIME LATCH (Sheet 3)                                                        | See Figure 6-1                                                |
| <b>(55)</b> U605-7                                                                                                                                                                                            | SUMMING COMPARATOR (Sheet 3)                                                    | See Figure 6-1                                                |

**Table 6-3. Test Points (continued)**

| TEST POINT No. & Loc.                | Signal Tested                                                                              | Measurement and Conditions                                         |
|--------------------------------------|--------------------------------------------------------------------------------------------|--------------------------------------------------------------------|
| <b>A10 Control Board (continued)</b> |                                                                                            |                                                                    |
| <b>56</b> U600-10                    | DIVIDER CLOCK (Sheet 3)                                                                    | See Figure 6-1                                                     |
| <b>57</b> U601-6                     | DIVIDER RESET (Sheet 3)                                                                    | See Figure 6-1                                                     |
| <b>58</b> U601-3                     | ON LATCH CLOCK (Sheet 3)                                                                   | See Figure 6-1                                                     |
| <b>59</b> U604-3                     | ON LATCH (Sheet 3)                                                                         | See Figure 6-1                                                     |
| <b>60</b> U603-3                     | PWM_EN (Sheet 3)                                                                           | Held high for approximately 12 seconds at power-on, then goes low. |
| <b>61</b> U603-13                    | VOS (Sheet 3)                                                                              | +5 ± 0.2V                                                          |
| <b>62</b> J511-1,2                   | NOTE: Temporarily move both scope leads to J511 for TP <b>62</b><br>DRV A, DRV B (Sheet 3) | See Figure 6-1                                                     |
| <b>63</b> U502-14                    |                                                                                            | +5V                                                                |
| <b>64</b> U501-7                     | OVREF (Sheets 1,3)                                                                         | +5.4V                                                              |
| <b>65</b> Q602,C                     | DP CONTROL (Sheet 3)                                                                       | CV Mode CC Mode<br>Not Applicable -0.14V                           |
| <b>66</b> U608-7                     | DP CONTROL (Sheet 3)                                                                       | CV Mode CC Mode<br>+13V 0V                                         |
| <b>67</b> U630-11                    | PREF_2 (Sheets 1,3)                                                                        | +1V                                                                |
| <b>68</b> U630-12                    | DN PGM (Sheets 1,3)                                                                        | 0V                                                                 |
| <b>69</b> D660-AN                    | DP_TST (Sheet 3)                                                                           | 0V                                                                 |
| <b>70</b> U502-12                    | OV COMPARATOR (Sheet 3)                                                                    | CV Mode CC Mode<br>+1.5V +3.25V                                    |

## General Schematic Notes

The following table lists summary information about notes appearing in schematic diagrams.

**Table 6-4. General Schematic Notes**

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |               |             |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-------------|--|
| <ol style="list-style-type: none"> <li>All resistors are in ohms ±1%, 1/8W, unless otherwise specified.</li> <li>All capacitors are in microfarads unless otherwise specified.</li> <li>Signal lines that are terminated by flags continue on other sheets, and may also go to other locations on the same sheet. Example: CVPROG (SH.2 8C); "SH.2 8C" indicates the sheet number and the coordinates on that sheet where the CVPROG signal line goes.</li> <li>Unterminated signal lines go to a least one other location on the same sheet.</li> <li>Unless otherwise noted, bias connections to integrated-circuit packages are as follows:</li> </ol> |               |             |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Common</b> | <b>+ 5V</b> |  |
| 14-pin packages                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | pin 7         | pin 14      |  |
| 16-pin packages                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | pin 8         | pin 16      |  |
| 20-pin packages                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | pin 10        | pin 20      |  |

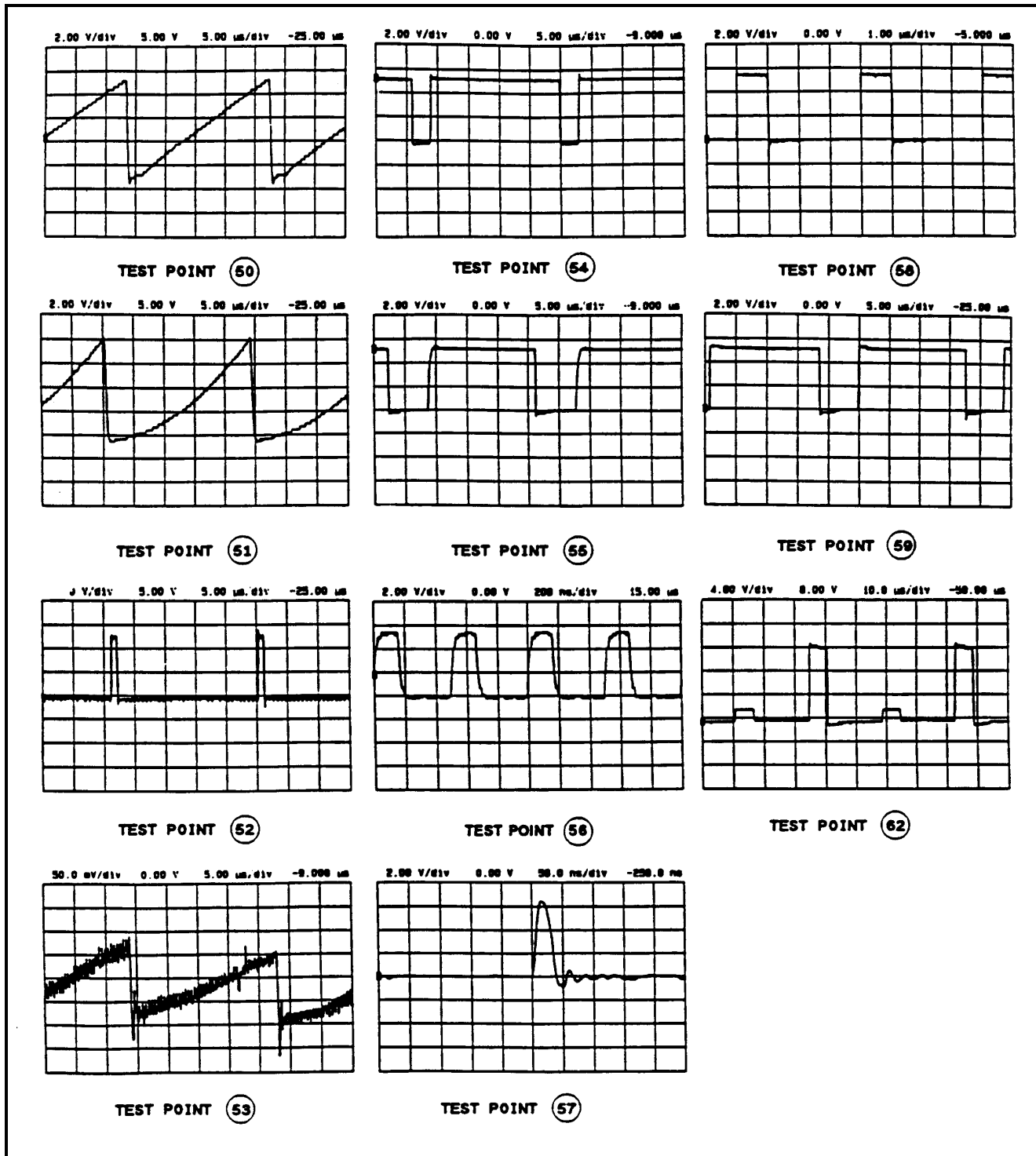


Figure 6-1. Test Point Waveforms for Table 6-3

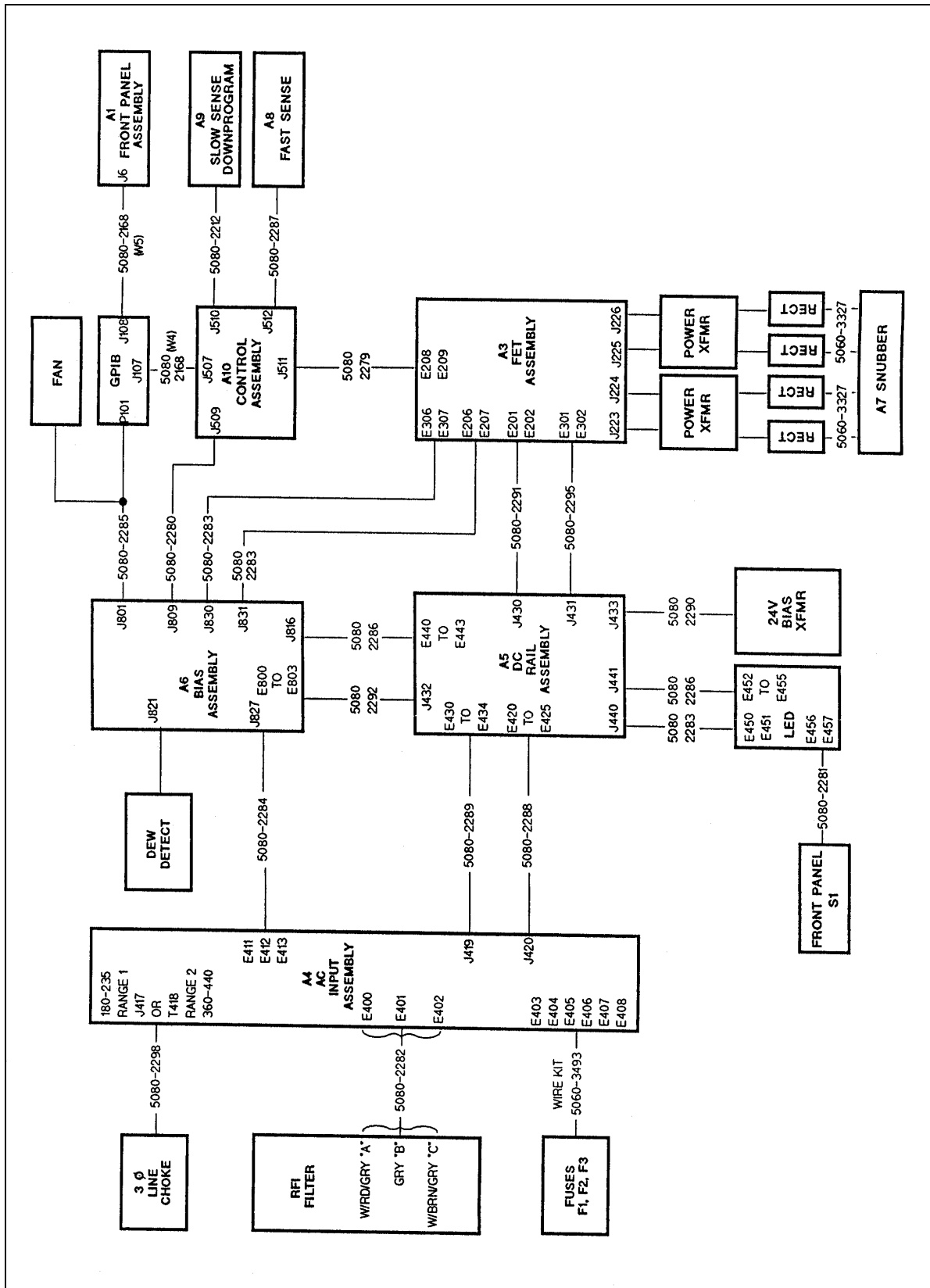


Figure 6-2. Circuit Board Cabling Diagram

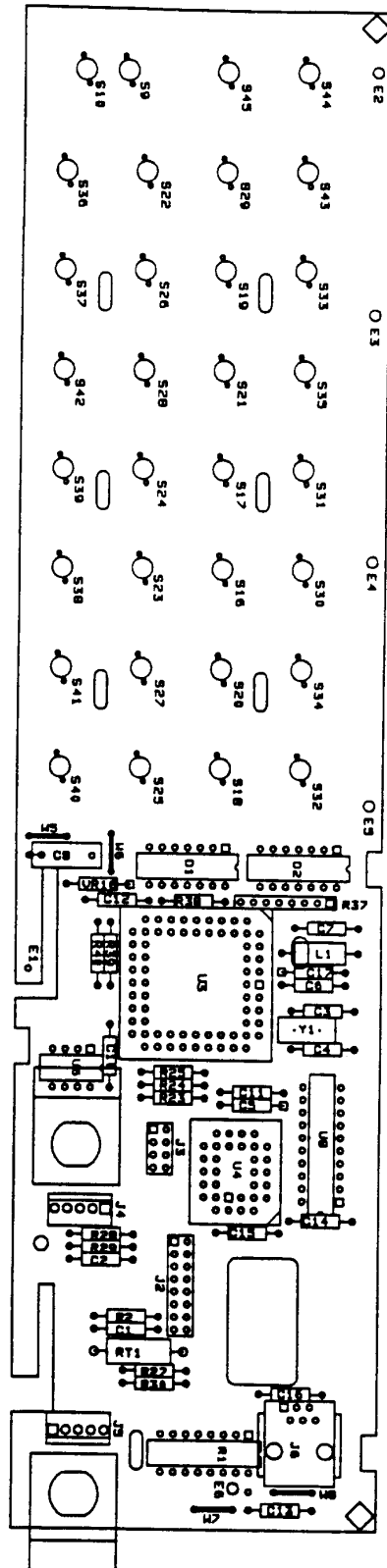


Figure 6-3. A1 Front Panel Board, Component and Test Point Location

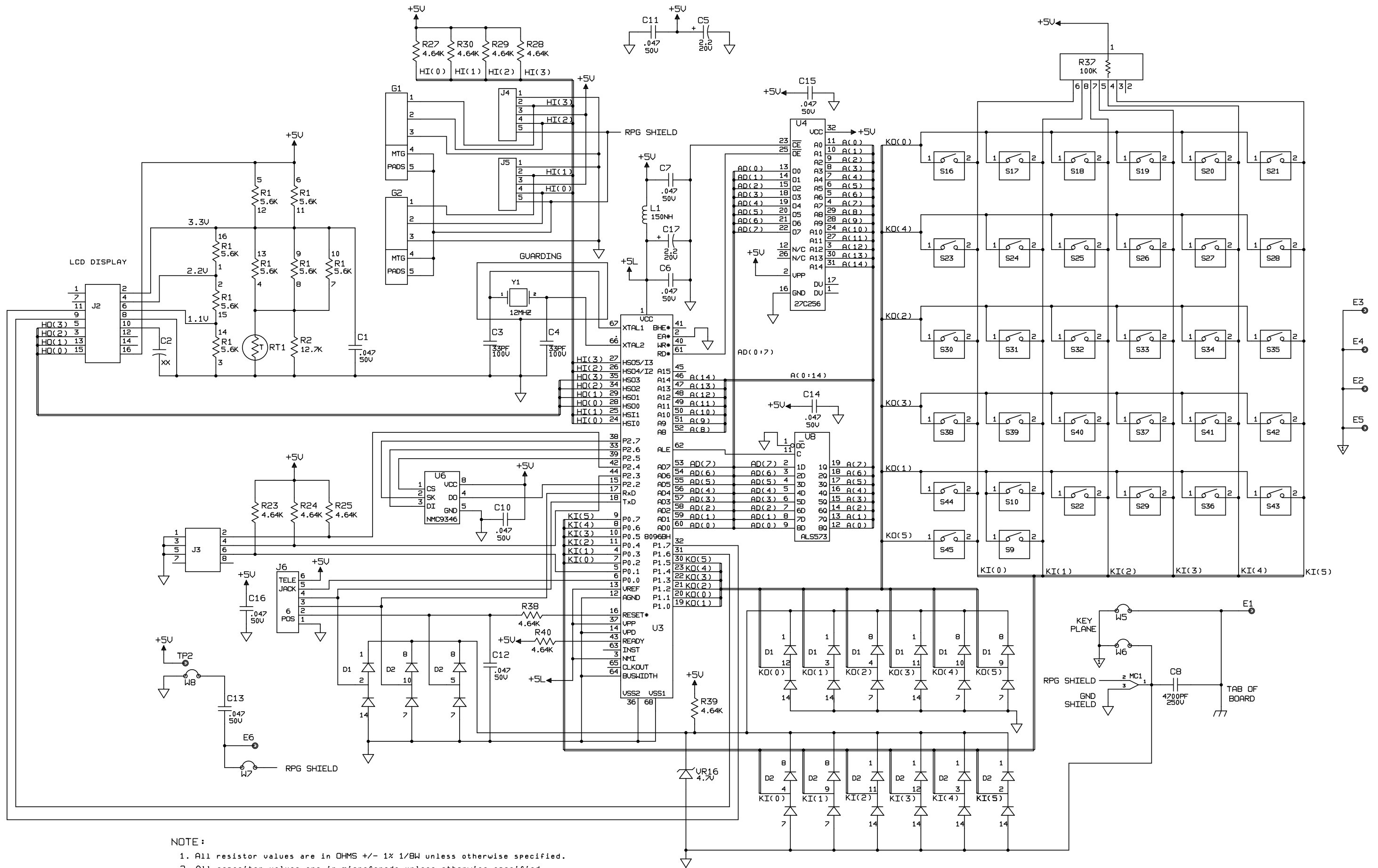


Figure 6-4. A1 Front Panel Board, Schematic Diagram

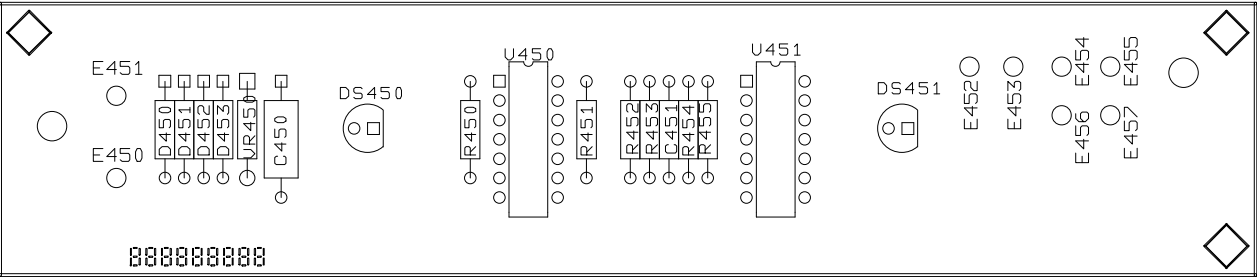


Figure 6-5. LED Board, Component and Test Point Location

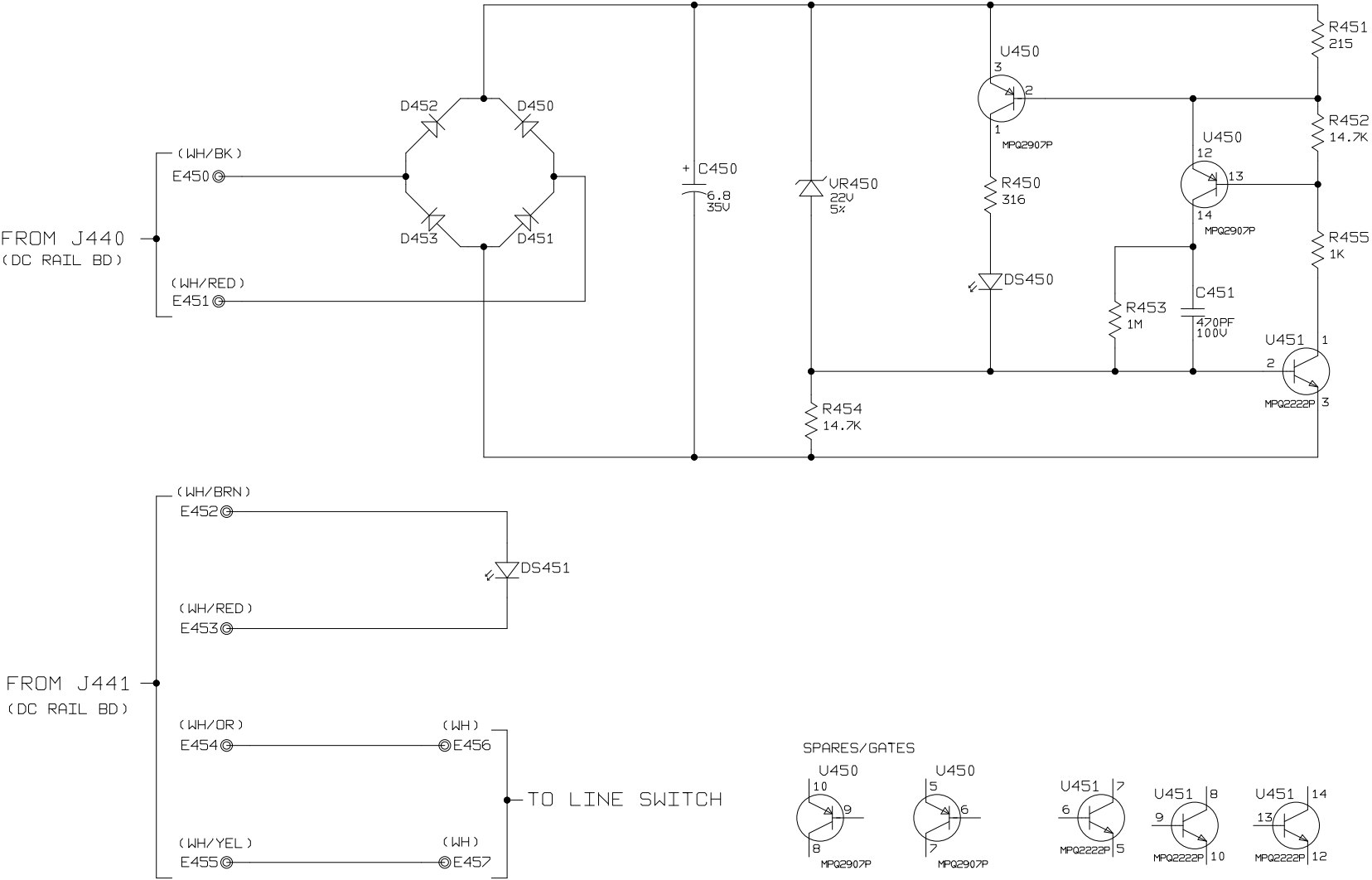


Figure 6-6. LED Board, Schematic Diagram

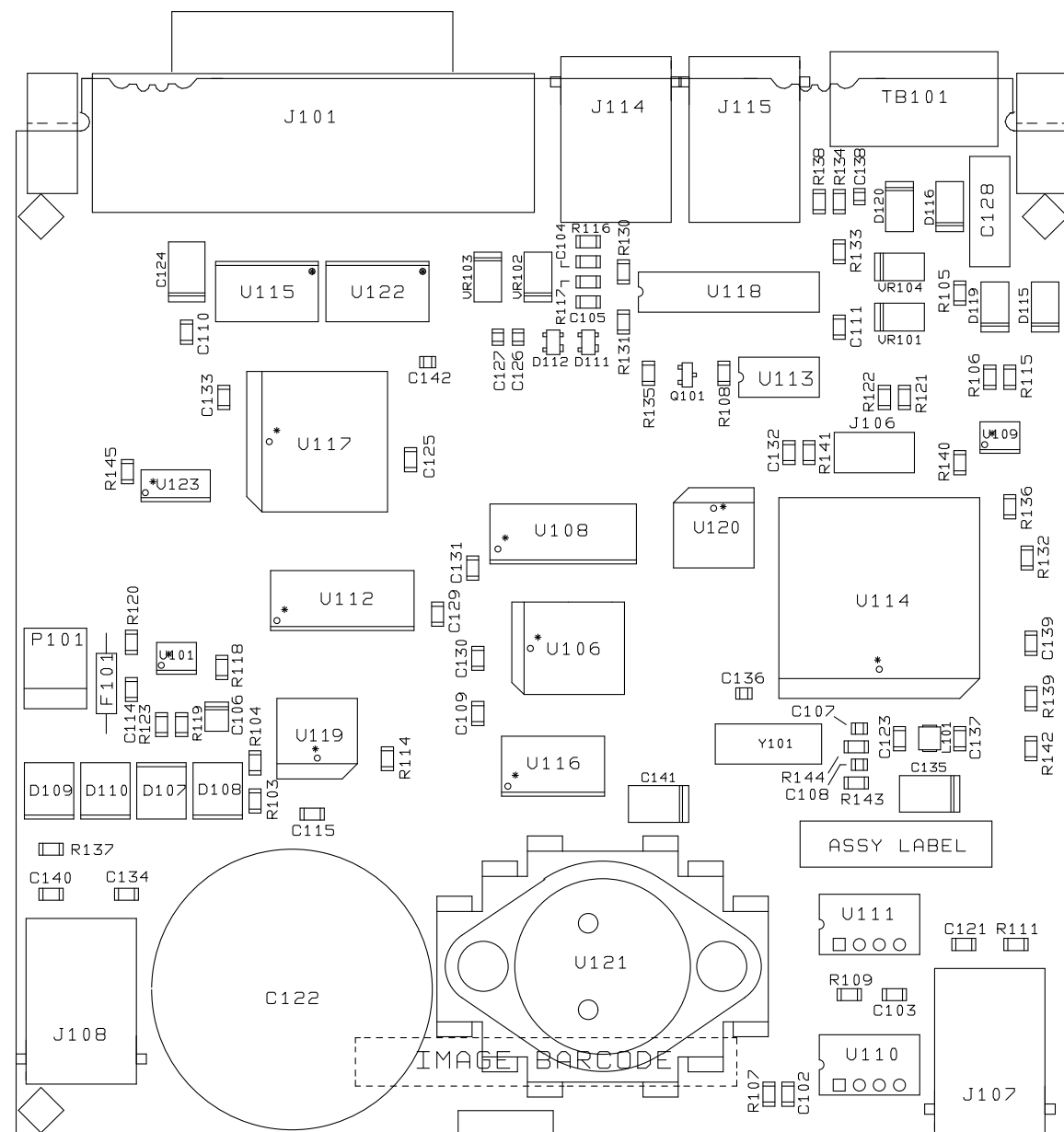
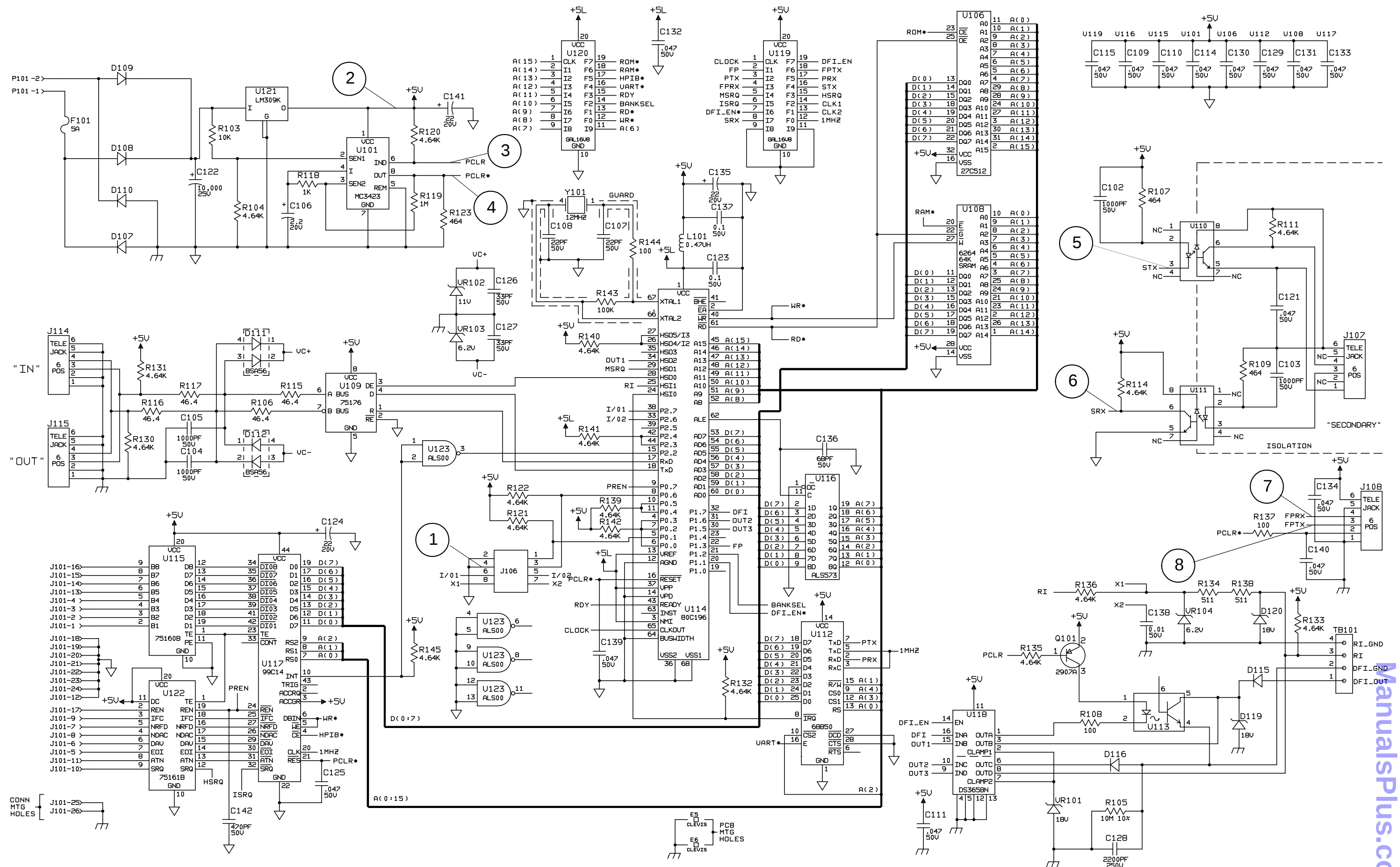


Figure 6-7. A2 GPIB Board, Component Location



**Figure 6-8. A2 GPIB Board, Schematic Diagram**



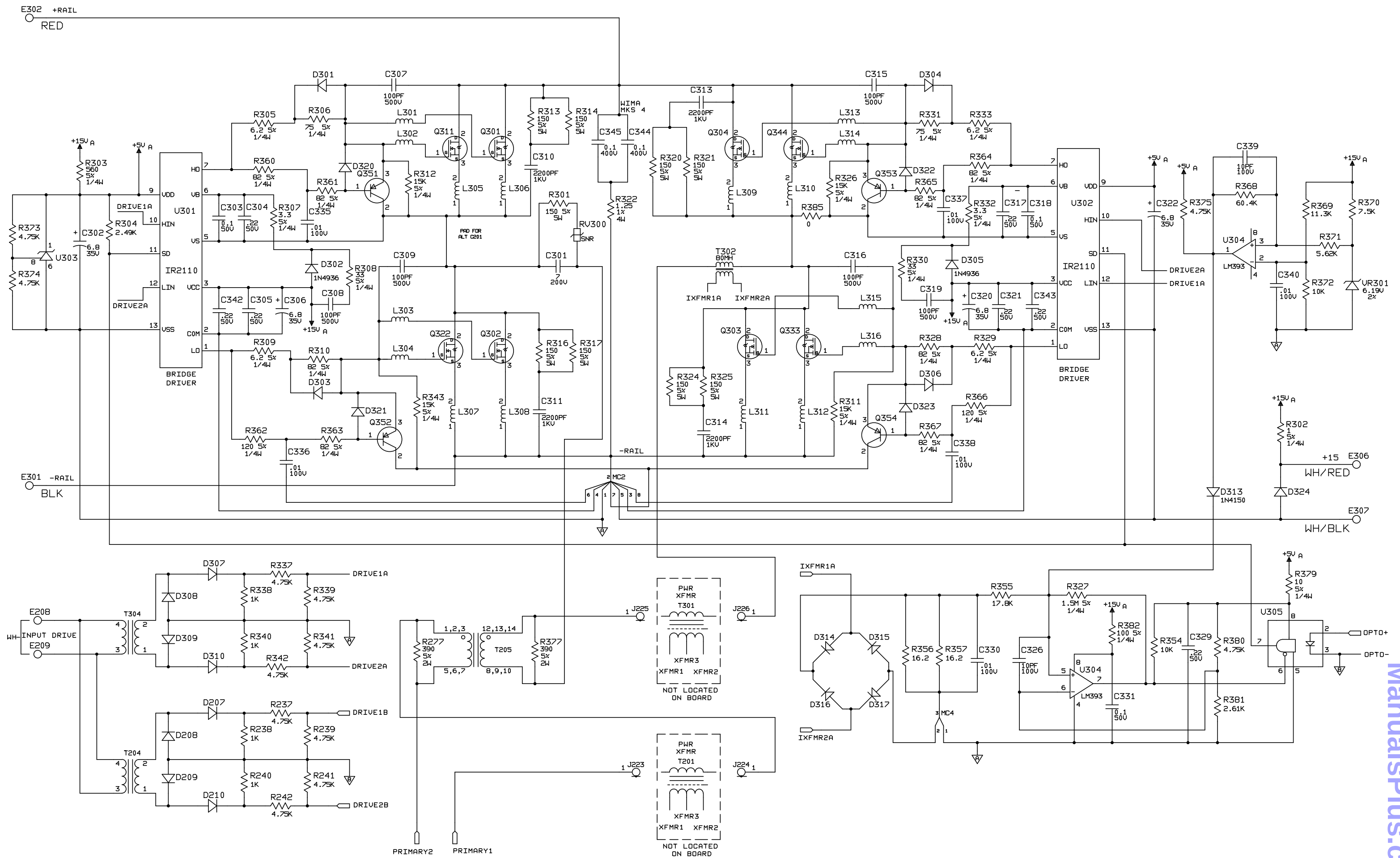


Figure 6-10. A3 FET Board, Schematic Diagram (sheet 1 of 2)



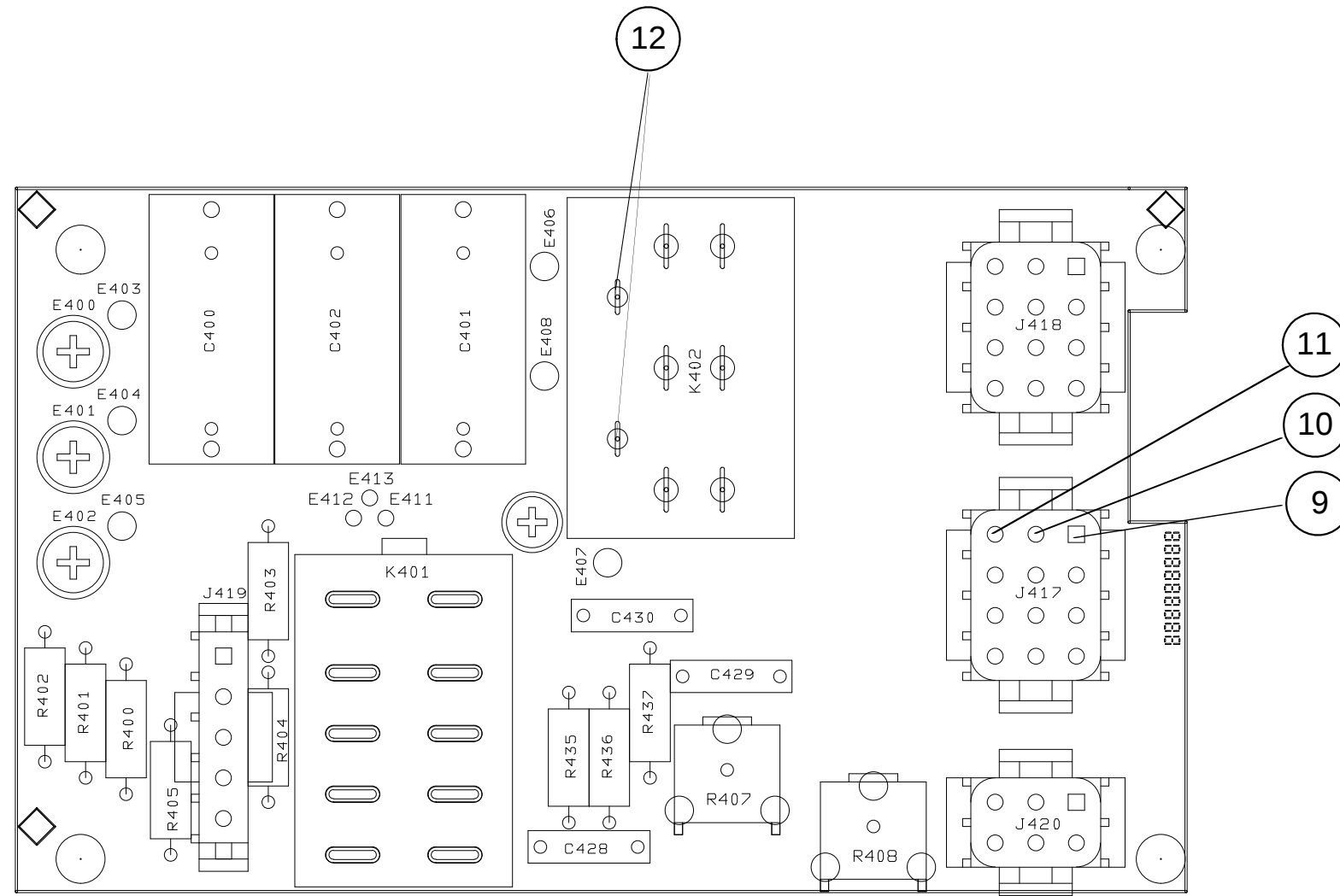


Figure 6-11. A4 AC Input Board, Component and Test Point Location

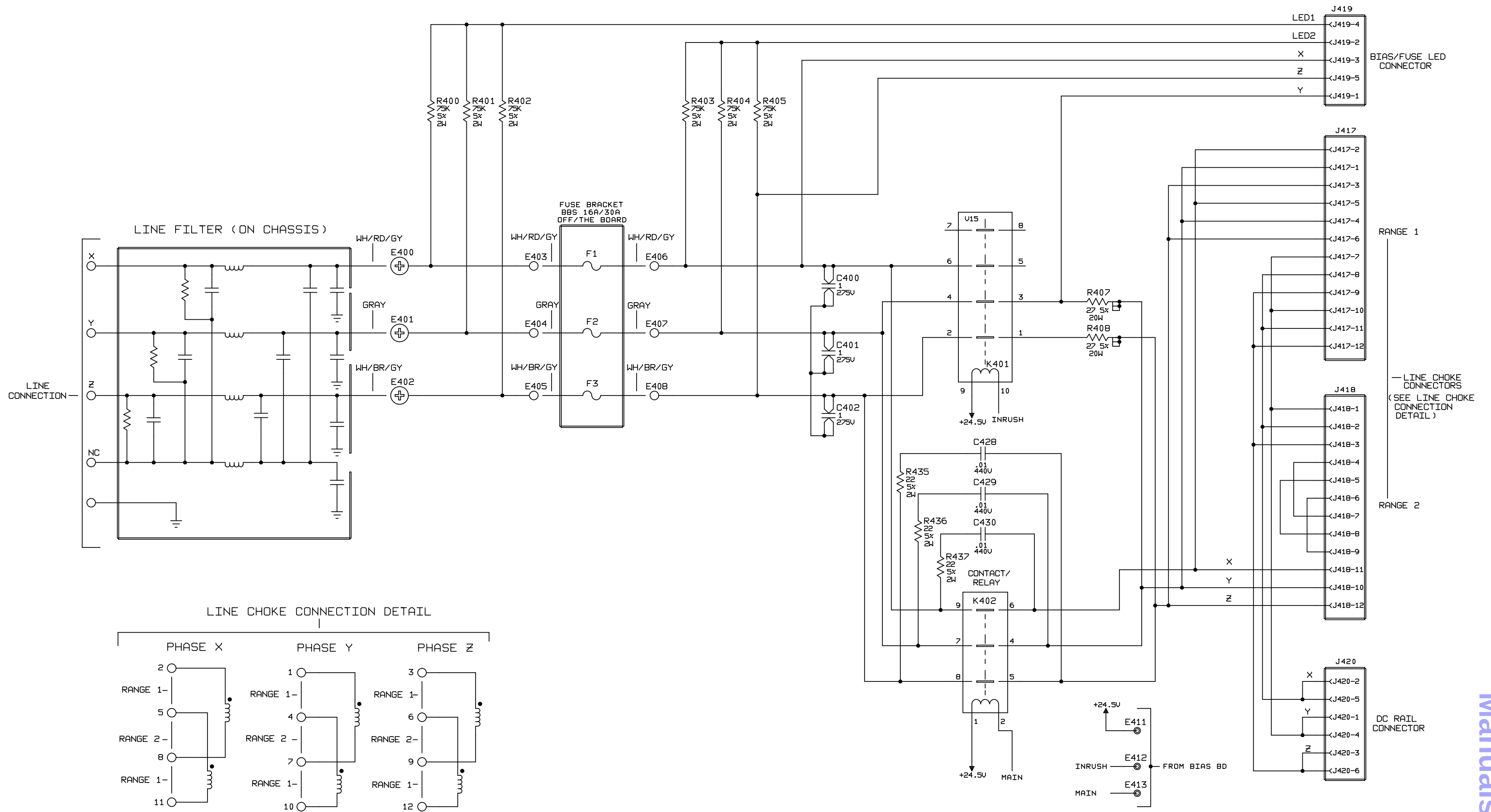


Figure 6-12. A4 AC Input Board, Schematic Diagram

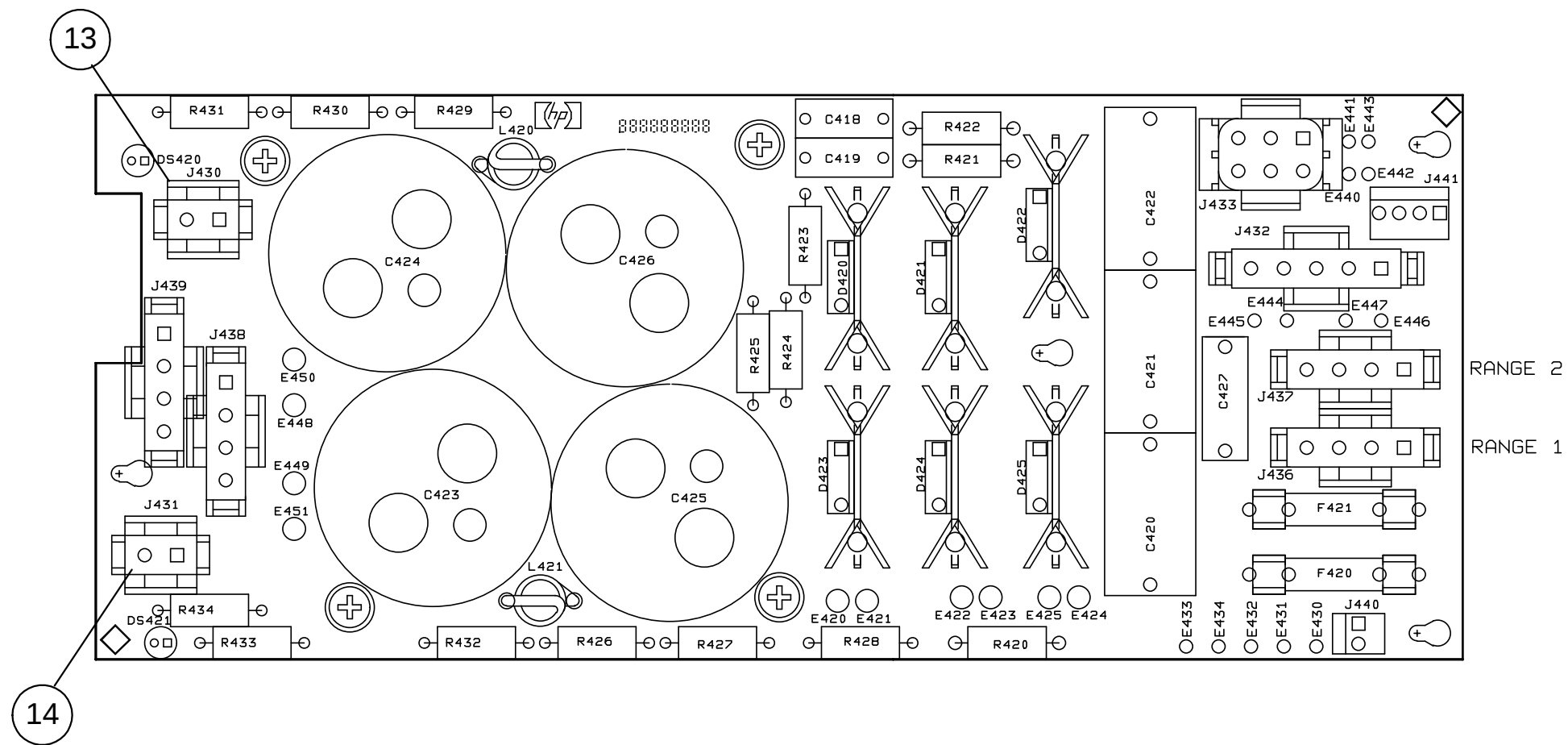


Figure 6-13. A5 DC Rail Board, Component and Test Point Location

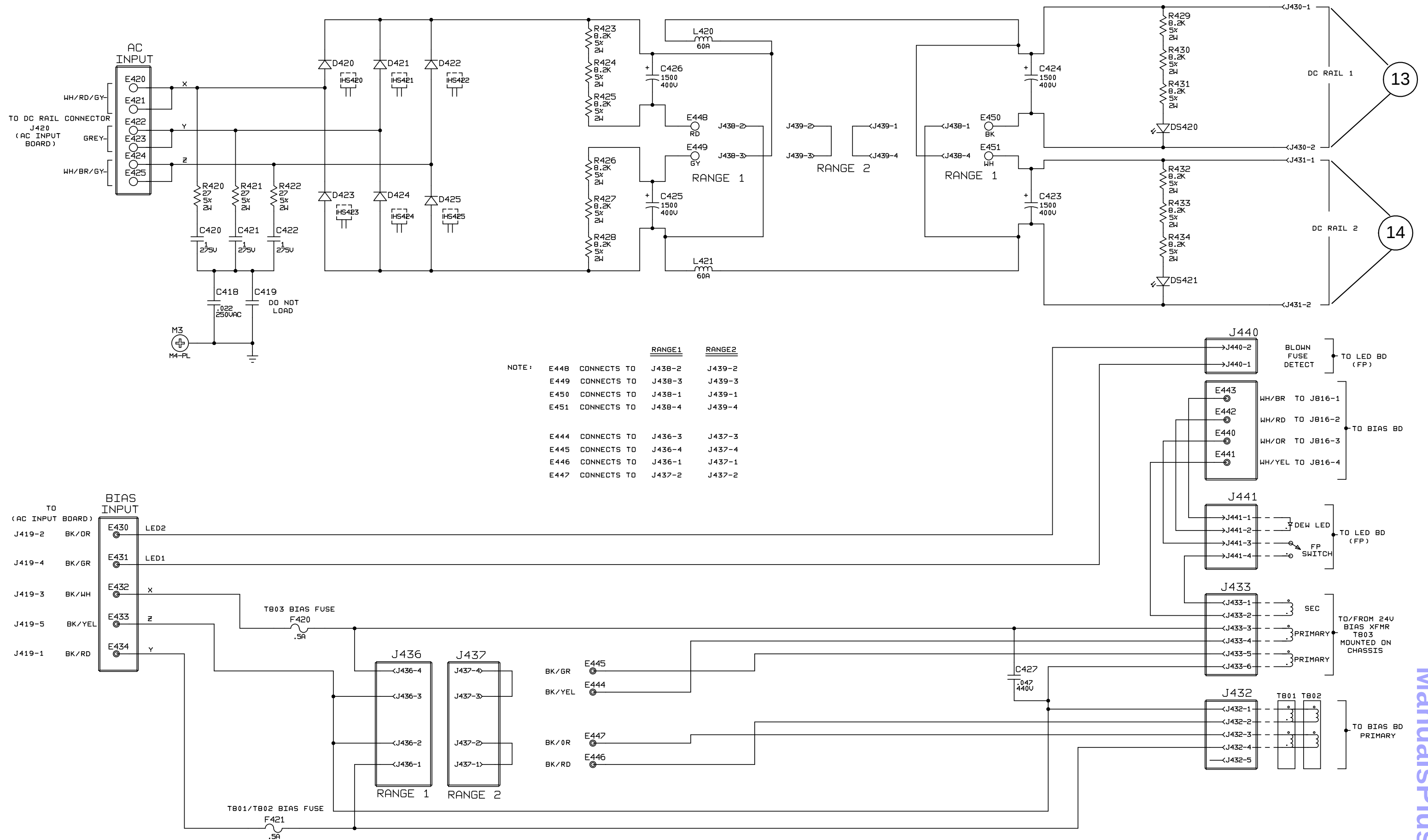


Figure 6-14. A5 DC Rail Board, Schematic Diagram

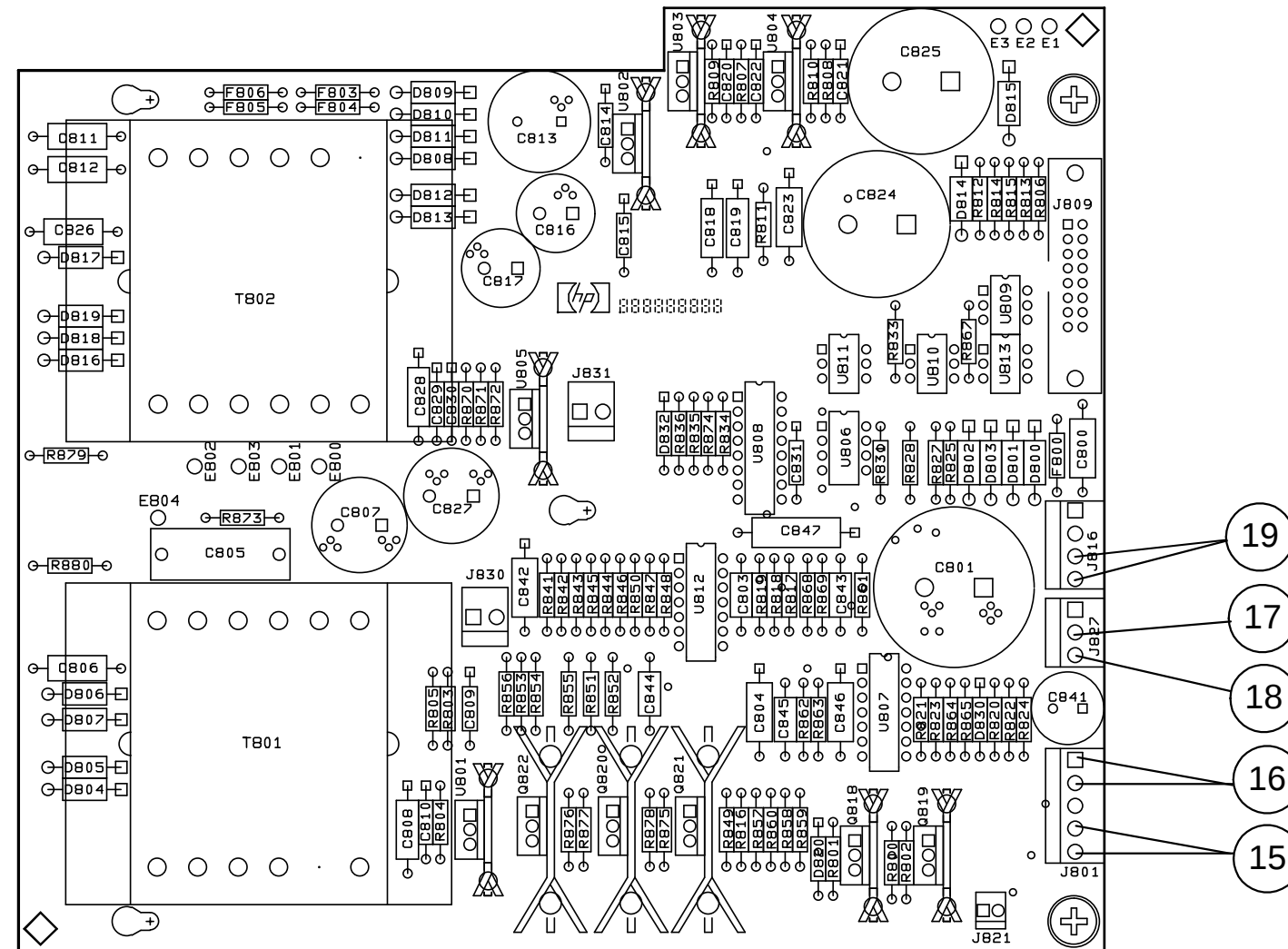


Figure 6-15. A6 Bias Board, Component and Test Point Location

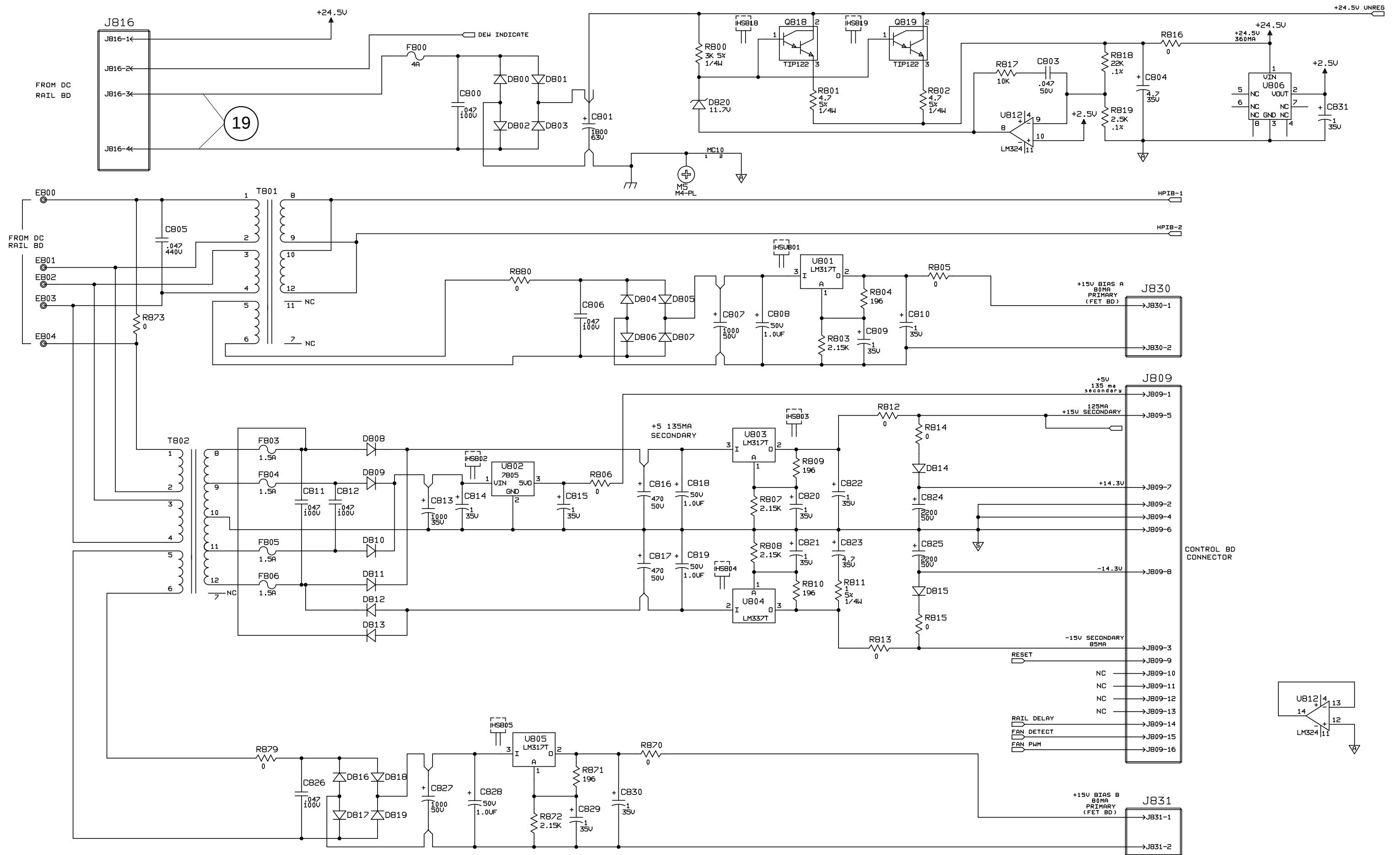


Figure 6-16. A6 Bias Board, Schematic Diagram (Sheet 1 of 2)



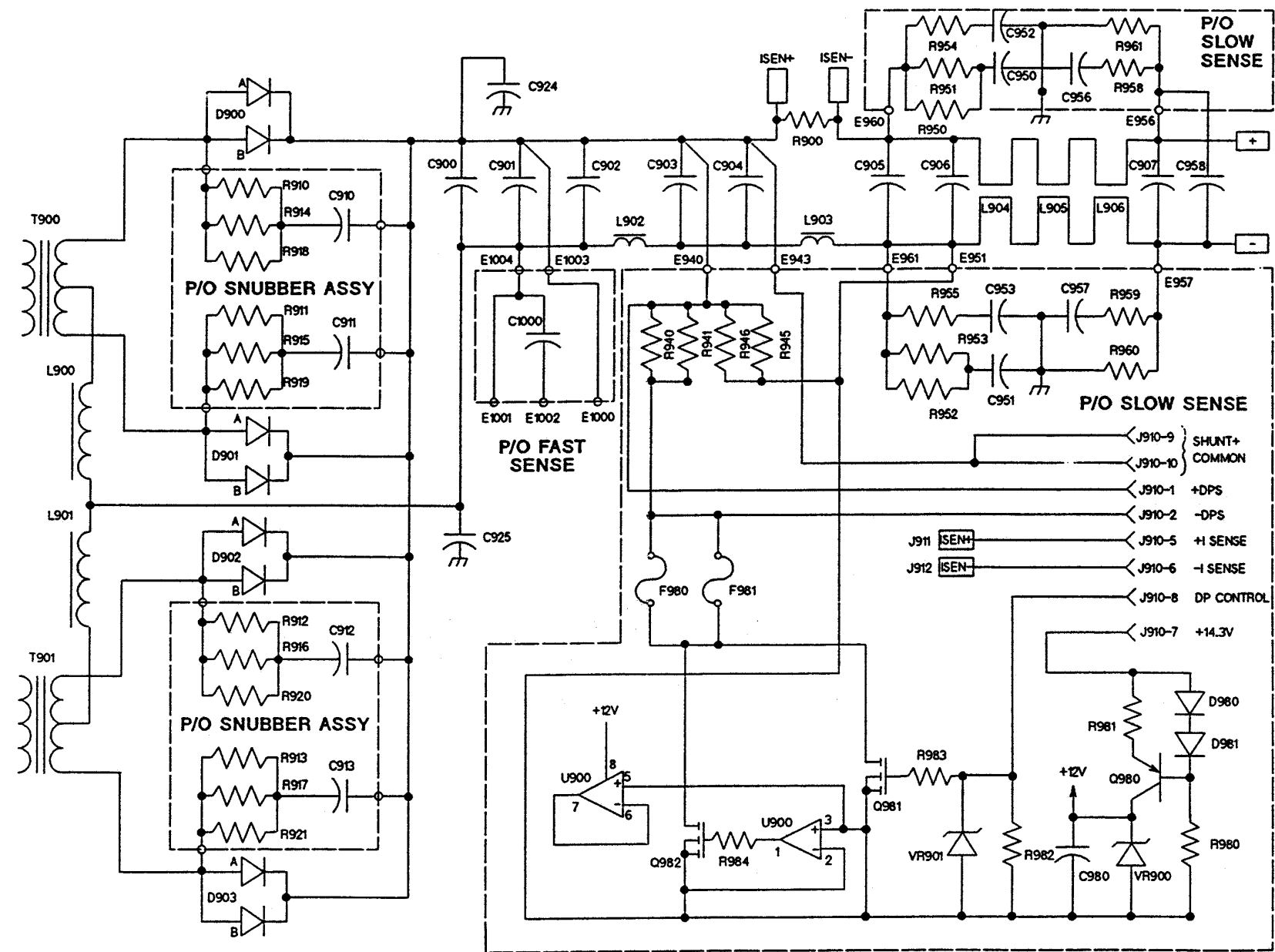


Figure 6-17. Power Mesh, Schematic Diagram, Models 6680A, 6681A Only

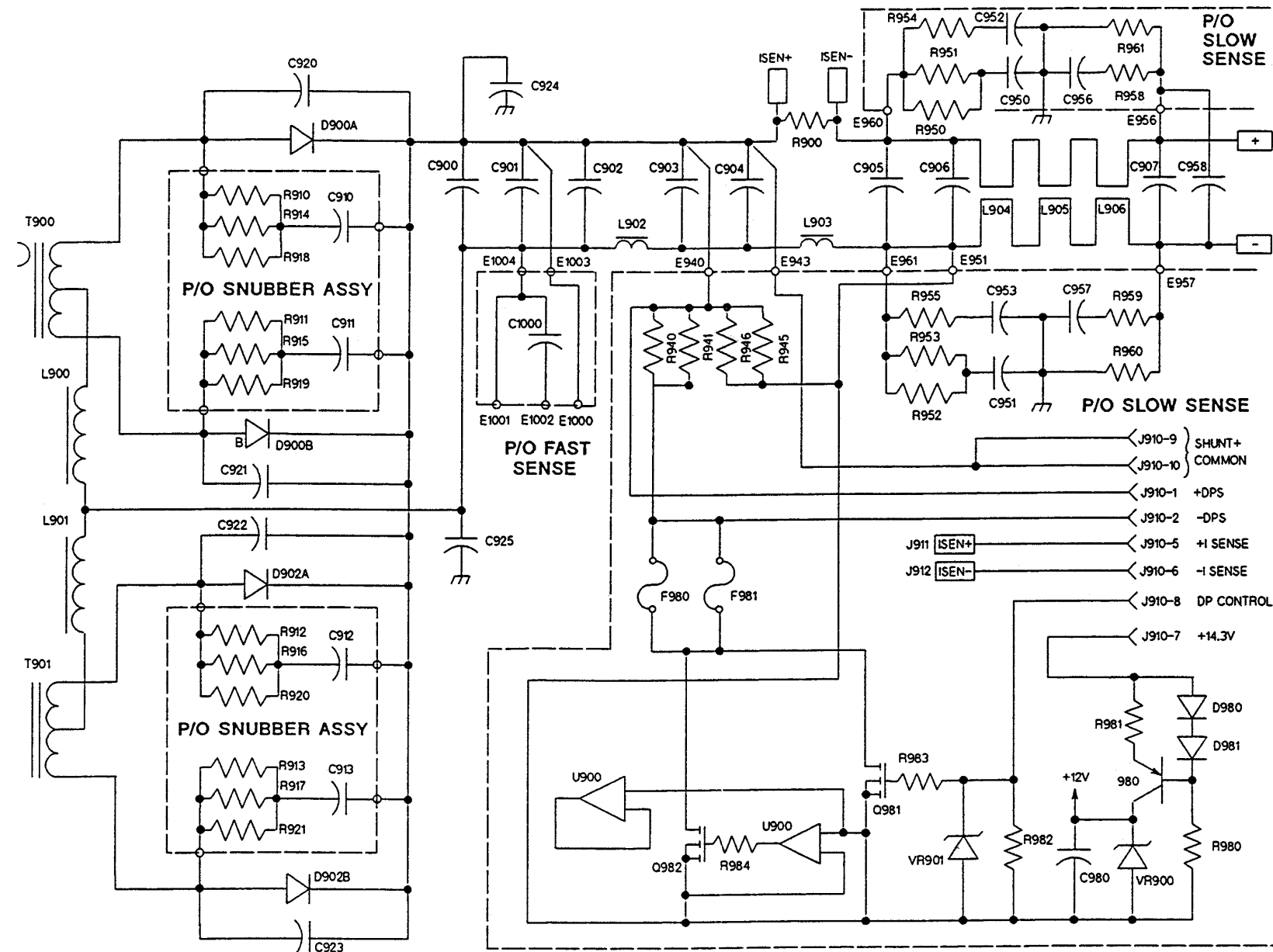


Figure 6-18. Power Mesh, Schematic Diagram Models 6682A, 6683A, 6684A Only

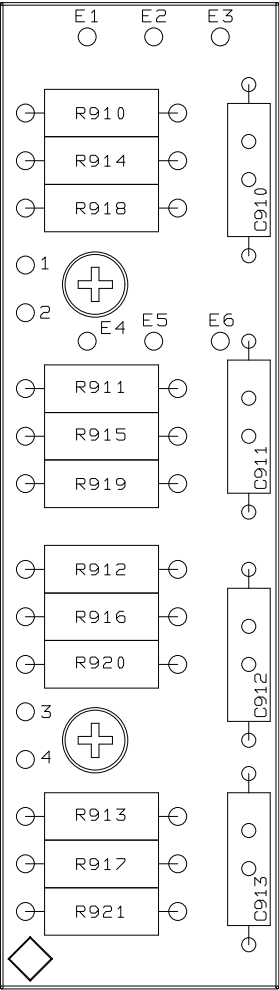


Figure 6-19. A7 Snubber Board, Component Location

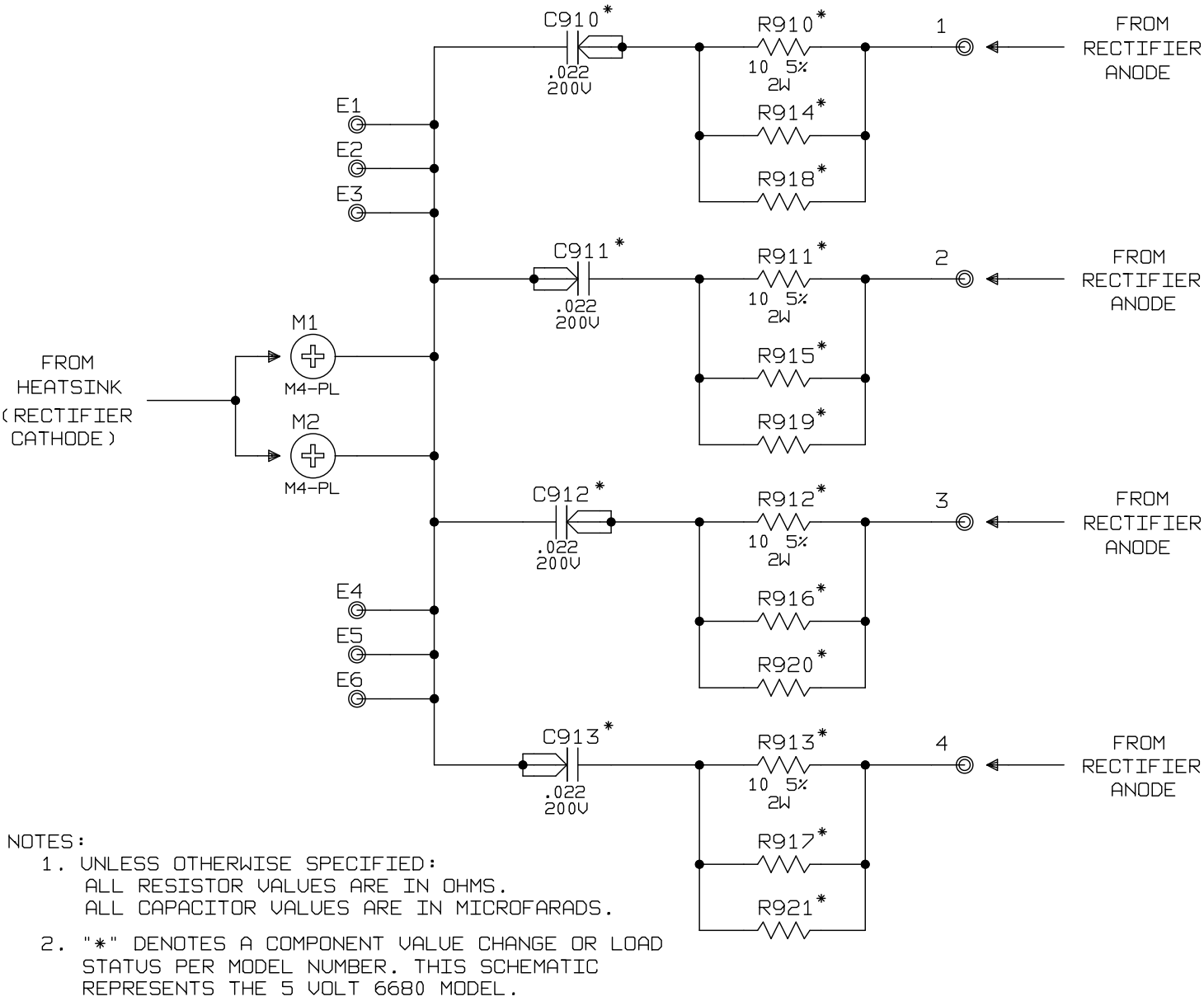


Figure 6-20. A7 Snubber Board, Schematic Diagram

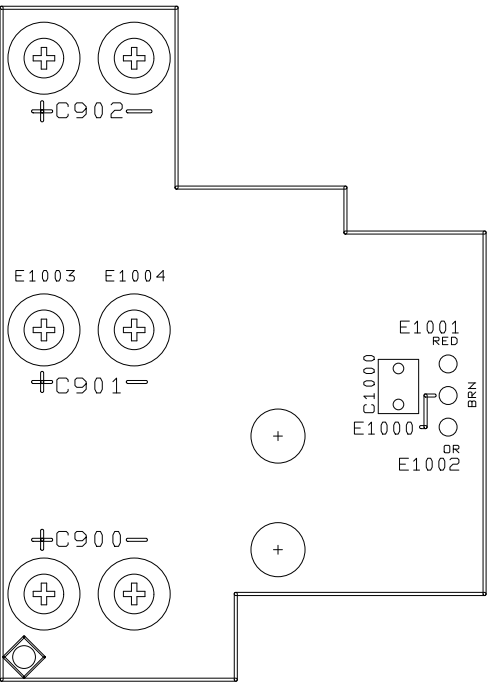


Figure 6-21. A8 Fast Sense Board, Component Location

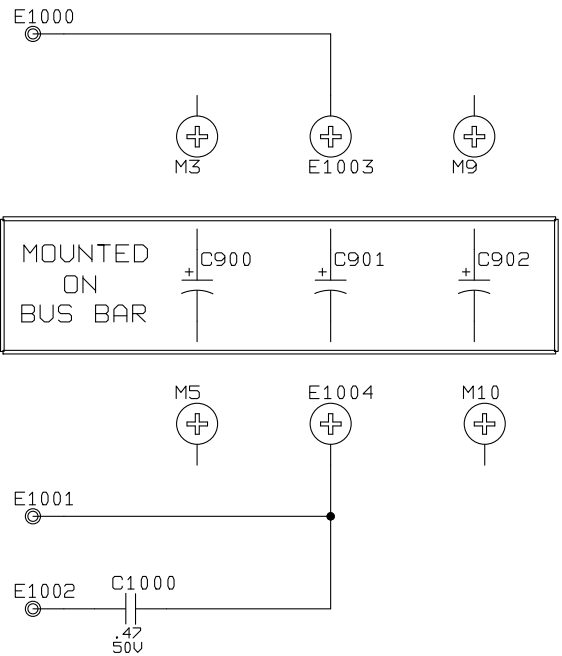


Figure 6-22. A8 Fast Sense Board, Schematic Diagram

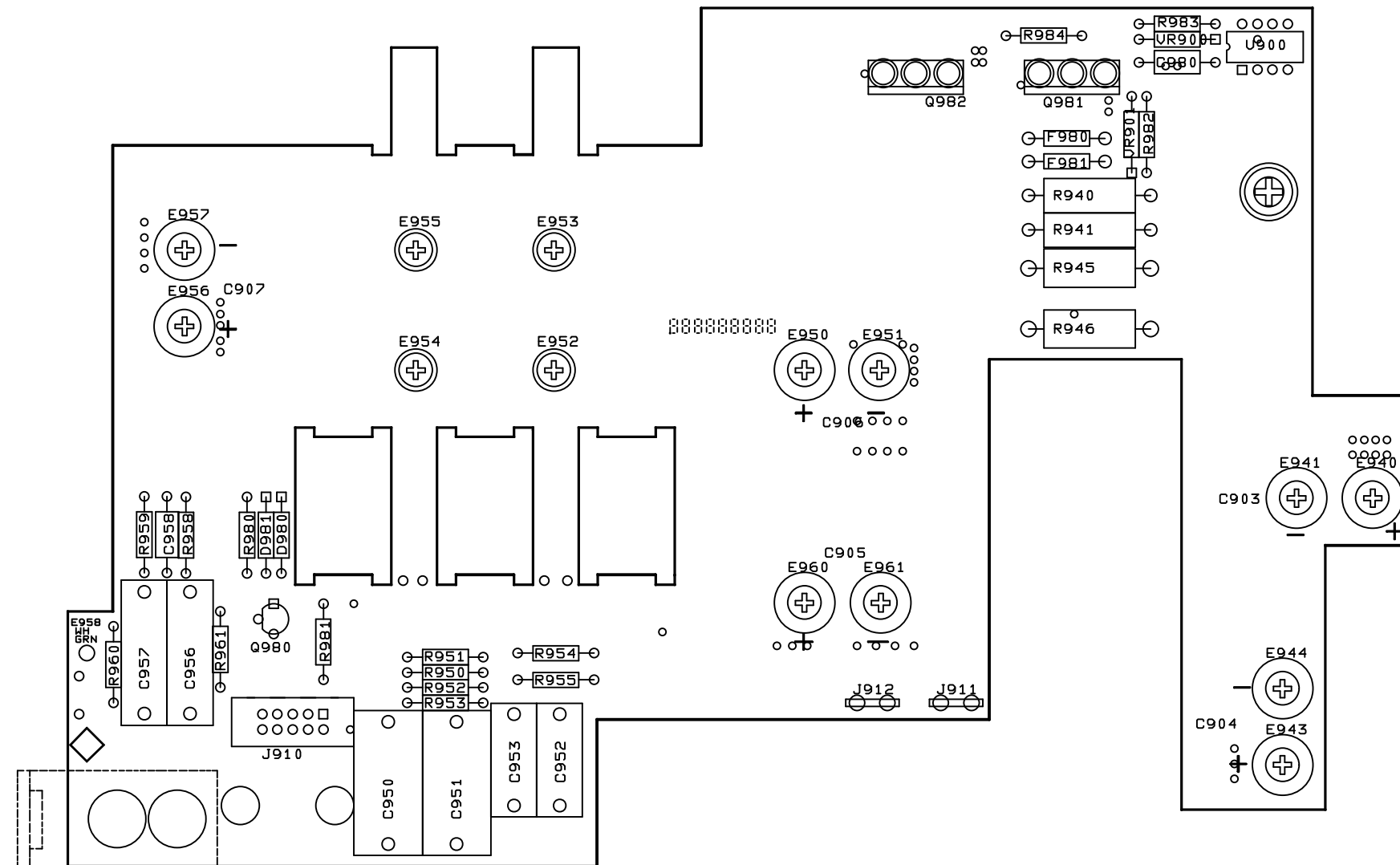


Figure 6-23. A9 Down Programming/Slow Sense, Component Location

NOTE: THIS CONNECTION IS MADE  
ON THE BUSS BAR

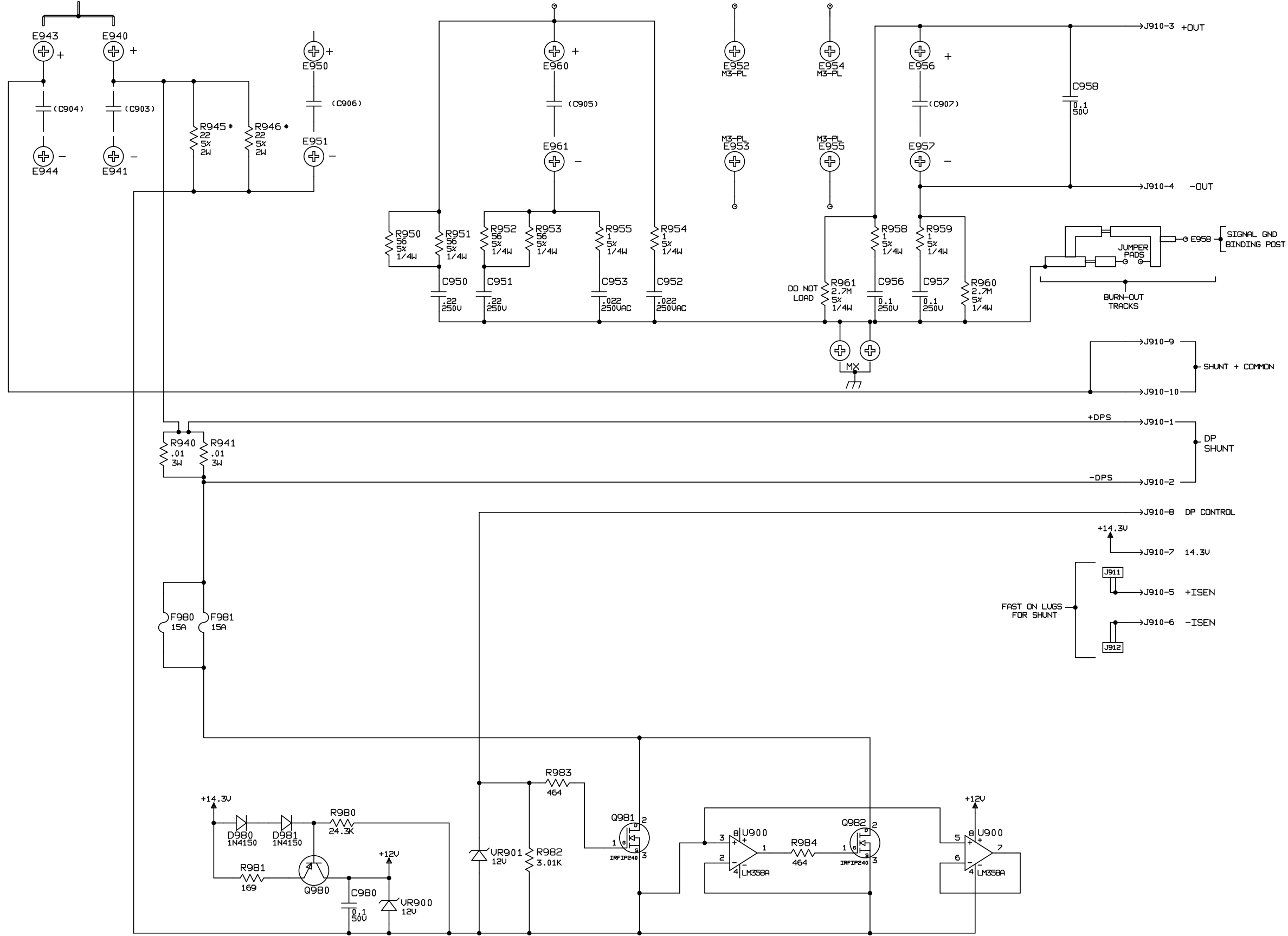


Figure 6-24. A9 Down Programming/Slow Sense, Schematic Diagram

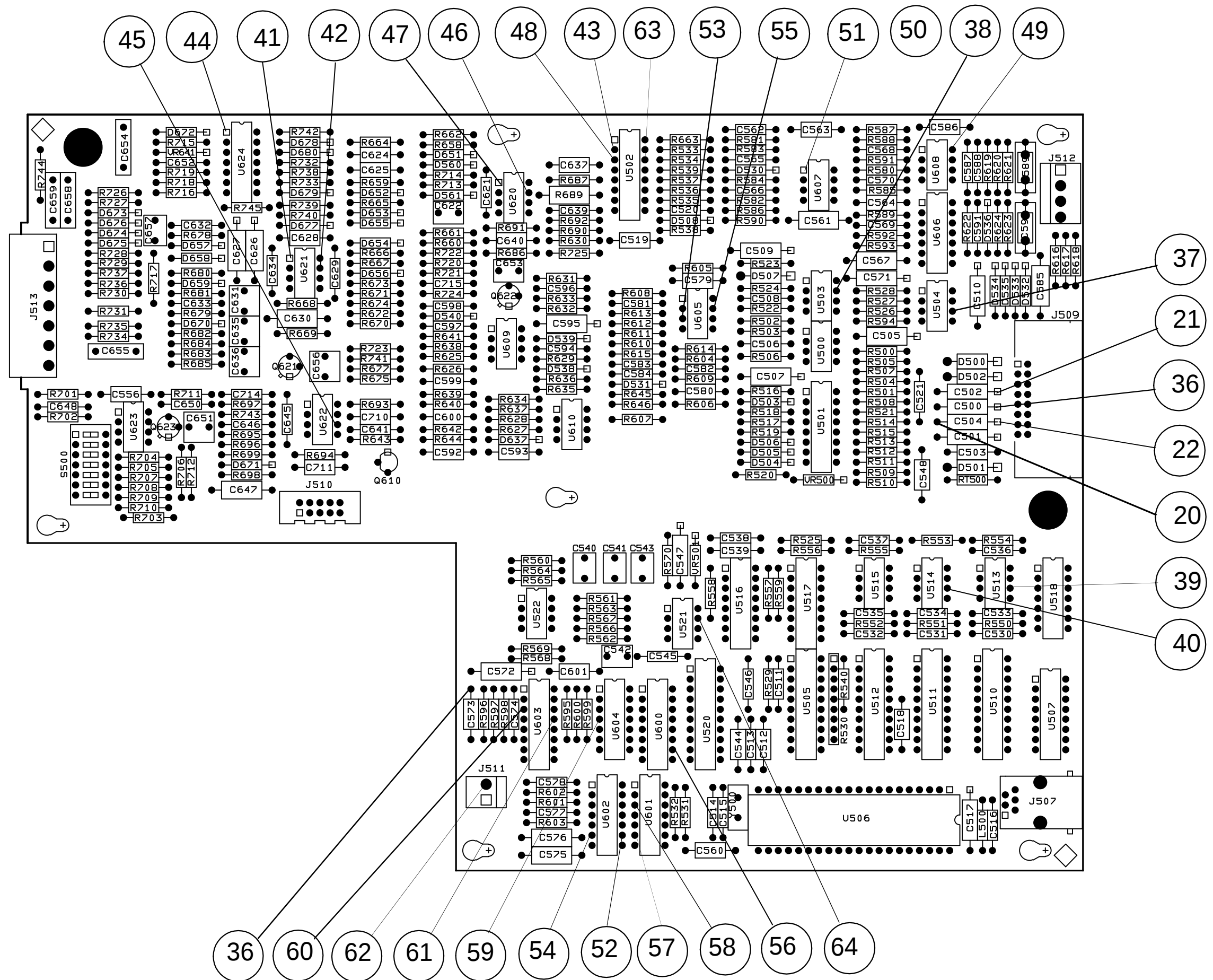


Figure 6-25. A10 Control Board, Component and Test Point Location



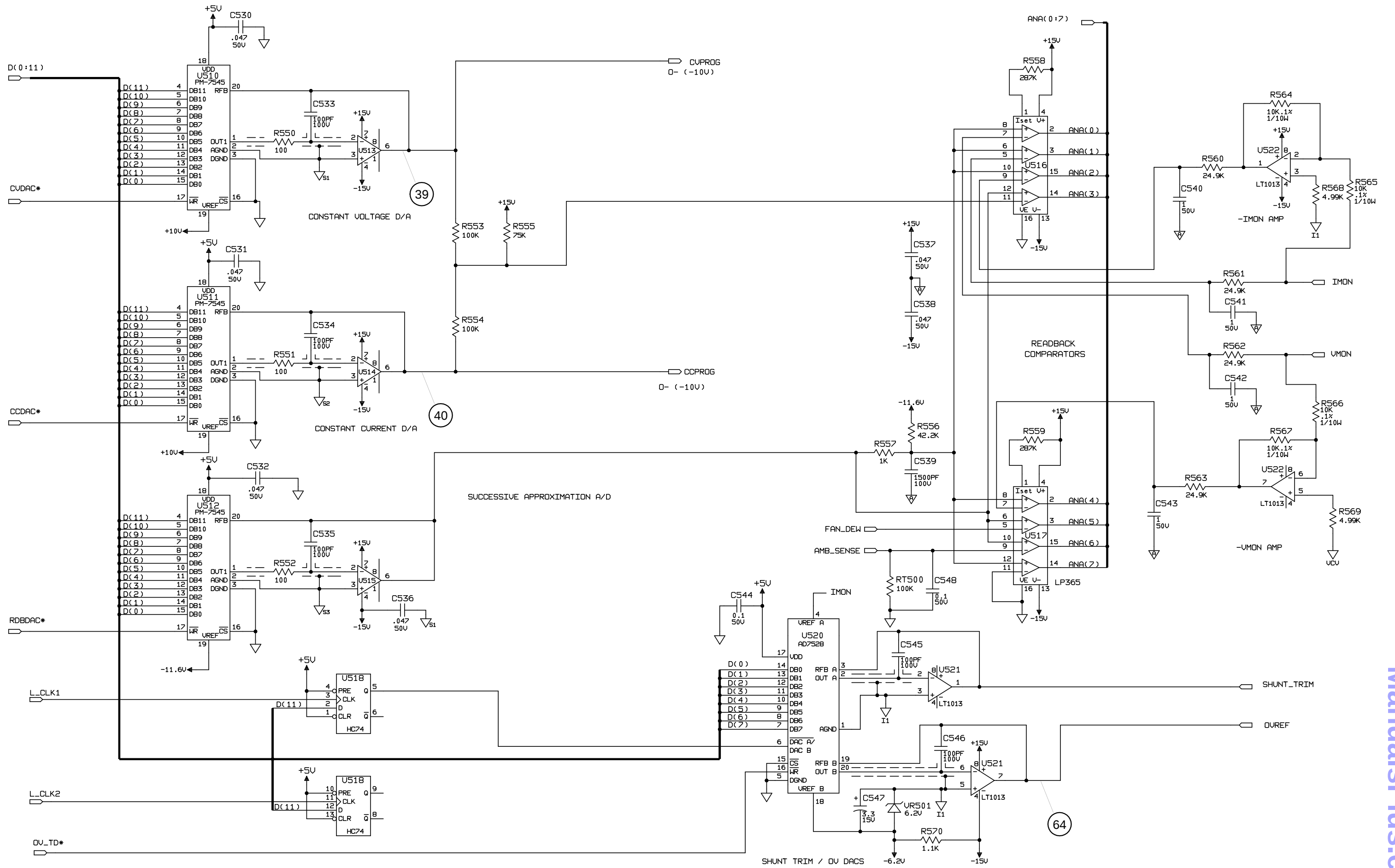
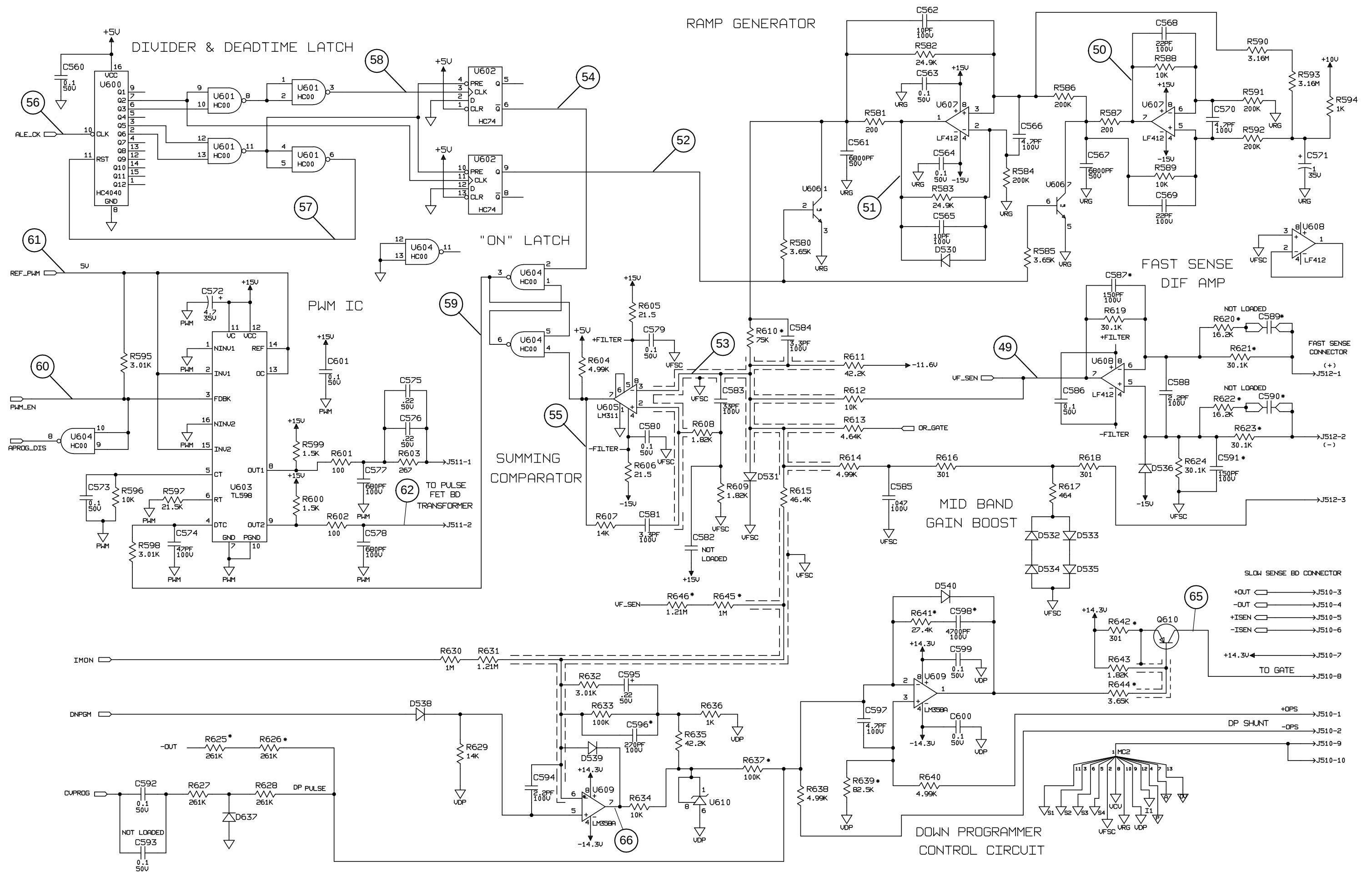


Figure 6-26. A10 Control Board, Schematic Diagram (Sheet 2 of 4)



**Figure 6-26. A10 Control Board, Schematic Diagram (Sheet 3 of 4)**

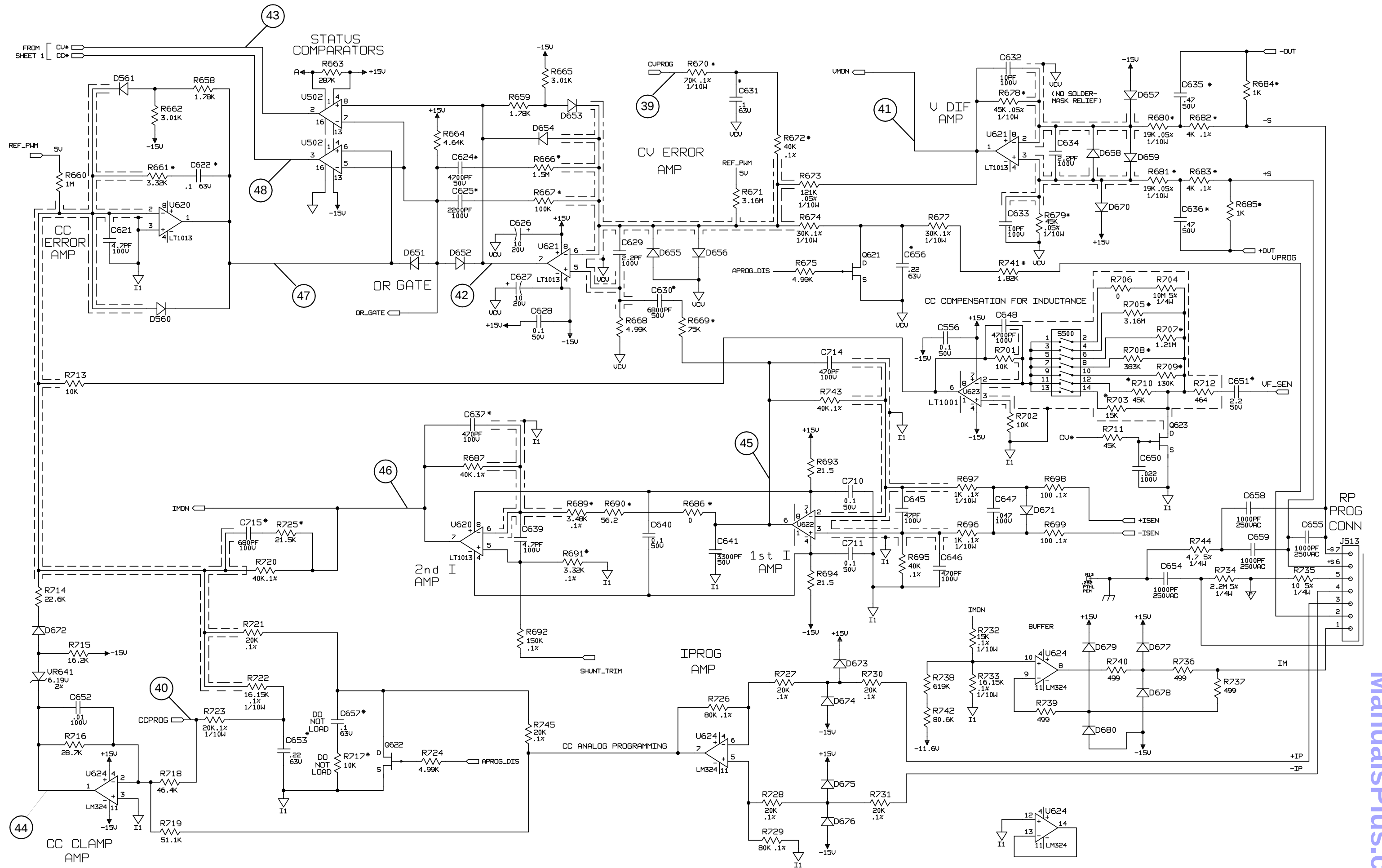


Figure 6-26. A10 Control Board, Schematic Diagram (Sheet 4 of 4)

## A

## Backdating

Manual backdating describes changes that must be made to this manual for power supplies whose serial numbers are lower than those listed in the title page to this manual.

Look in the following table and locate your Agilent model. Then look at each serial number listed for this group. If the serial number of your power supply is **prior** to any of the serial number(s) listed, perform the change indicated in the **Change** column. Note that, several changes can apply to your supply.

| Serial Numbers     | Change        |
|--------------------|---------------|
| <b>Model 6680A</b> |               |
| 3318A 00111        | 1, 2, 4, 5, 6 |
| 3318A 00116        | 3             |
| 3502A 00126        | 7             |
| 3619A 00167        | 9             |
| <b>Model 6681A</b> |               |
| 3319A 00154        | 4             |
| 3336A 00164        | 1             |
| 3350A 00172        | 2, 6          |
| 3350A 00183        | 5             |
| 3350A 00193        | 3             |
| 3506A 00218        | 7             |
| 3619A 00383        | 9             |
| <b>Model 6682A</b> |               |
| 3349A 00104        | 6             |
| 3349A 00108        | 3             |
| 3514A 00123        | 7             |
| 3514A 00168        | 8             |
| 3624A 00193        | 9             |

| Serial Numbers     | Change |
|--------------------|--------|
| <b>Model 6683A</b> |        |
| 3349A 00104        | 6      |
| 3349A 00108        | 3      |
| 3514A 00123        | 7      |
| 3514A 00178        | 8      |
| 3619A 00203        | 9      |
| <b>Model 6684A</b> |        |
| 3339A 00103        | 5      |
| 3405A 00108        | 3      |
| 3405A 00109        | 6      |
| 3514A 00118        | 7      |
| 3514A 00188        | 8      |
| 3514A 00257        | 9      |

### CHANGE 1

**In Table 5-14 A10 Control Board**

**DELETE** C548, 0.1uF 50V, Agilent P/N 0160-4835 in parallel with RT500.

### CHANGE 2

**In Table 5-7 A3 FET Board**

**DELETE** C228 & 231, 2000pF 100V P/N 0160-2301.

**ADD** C228, 6800pF 100V P/N 0160-4904.

**CHANGE** R247, from 75K P/N 0757-0462, to 42.2K 1% 1/8W P/N 0698-3450.  
 R249, from 13.1K P/N 0757-0444, to 7.5K 1% 1/8W P/N 0757-0440  
 R250, from 60.4K P/N 0698-3572 to 40.2K 1% 1/8W P/N 0698-3499.  
 R253, from 12.5K P/N 0698-6533 to 17.8K 1% 1/8W P/N 0698-3136.  
 C229, from 0.022uF P/N 0160-4918 to 0.01uF 100V Ceramic P/N 0160-4832.

**In Table 5-9 A5 DC Rail Board**

|               |                                                                                                        |
|---------------|--------------------------------------------------------------------------------------------------------|
| <b>DELETE</b> | C418, 0.022uF 250VAC "Y" rated P/N 0160-4048<br>Fuse Clips, REF F420 & 421 1/4" P/N 2110-0726, qty. 4. |
| <b>ADD</b>    | Fuse Holder, REF F420 & 421, 5 x 30mm P/N 2110-0689, qty 2.                                            |
| <b>CHANGE</b> | F420 & 421, from 0.5A 500V P/N 2110-0934 to 0.5A 500V 5x30mm P/N 2110-0921.                            |

**CHANGE 3****In Table 5-14 A10 Control Board**

|               |                                                                                                                 |
|---------------|-----------------------------------------------------------------------------------------------------------------|
| <b>DELETE</b> | C548, 0.1uF 50V P/N 0160-4835. in parallel with RT500.<br>RT500, P/N 0837-0412.<br>Pins, P/N 0360-1498, qty. 2. |
|---------------|-----------------------------------------------------------------------------------------------------------------|

**CHANGE 4****In Table 5-14 A10 Control Board**

|               |                                                                                                          |
|---------------|----------------------------------------------------------------------------------------------------------|
| <b>DELETE</b> | ASSEMBLY, relay contactor P/N 5060-3593, qty. 1.                                                         |
| <b>ADD</b>    | Dust cover for relay, P/N 9222-1870.<br>Retainer clip for relay, P/N 1460-2317.<br>Relay, P/N 0490-1919. |

**CHANGE 5****In Table 5-8 A4 AC Input Board**

|               |                                                                          |
|---------------|--------------------------------------------------------------------------|
| <b>DELETE</b> | C428, 429, and 430, P/N 0160-7898.<br>R435, 436, and 437, P/N 0698-3609. |
|---------------|--------------------------------------------------------------------------|

**CHANGE 6****In Table 5-6 A2 GPIB Board**

|               |                                                                                   |
|---------------|-----------------------------------------------------------------------------------|
| <b>CHANGE</b> | A2 GPIB board from P/N 5060-3591 to P/N 5060-3552. (see Table A-1 and Figure A-1) |
|---------------|-----------------------------------------------------------------------------------|

**CHANGE 7****In Table 5-6 A2 GPIB Board**

|               |                                                   |
|---------------|---------------------------------------------------|
| <b>CHANGE</b> | U114 from P/N 1826-0536, to LM309K P/N 1820-0430. |
|---------------|---------------------------------------------------|

**CHANGE 8****In Table 5-13 A9 Downprogrammer/Slow Sense Board**

|               |                                                              |
|---------------|--------------------------------------------------------------|
| <b>CHANGE</b> | Q981, 982 from P/N 1855-1003, to POWER MOSFET P/N 1855-0835. |
| <b>DELETE</b> | Insulator, REF Q981, 982.                                    |

**CHANGE 9****In Table 5-10 A1 Front Panel Board**

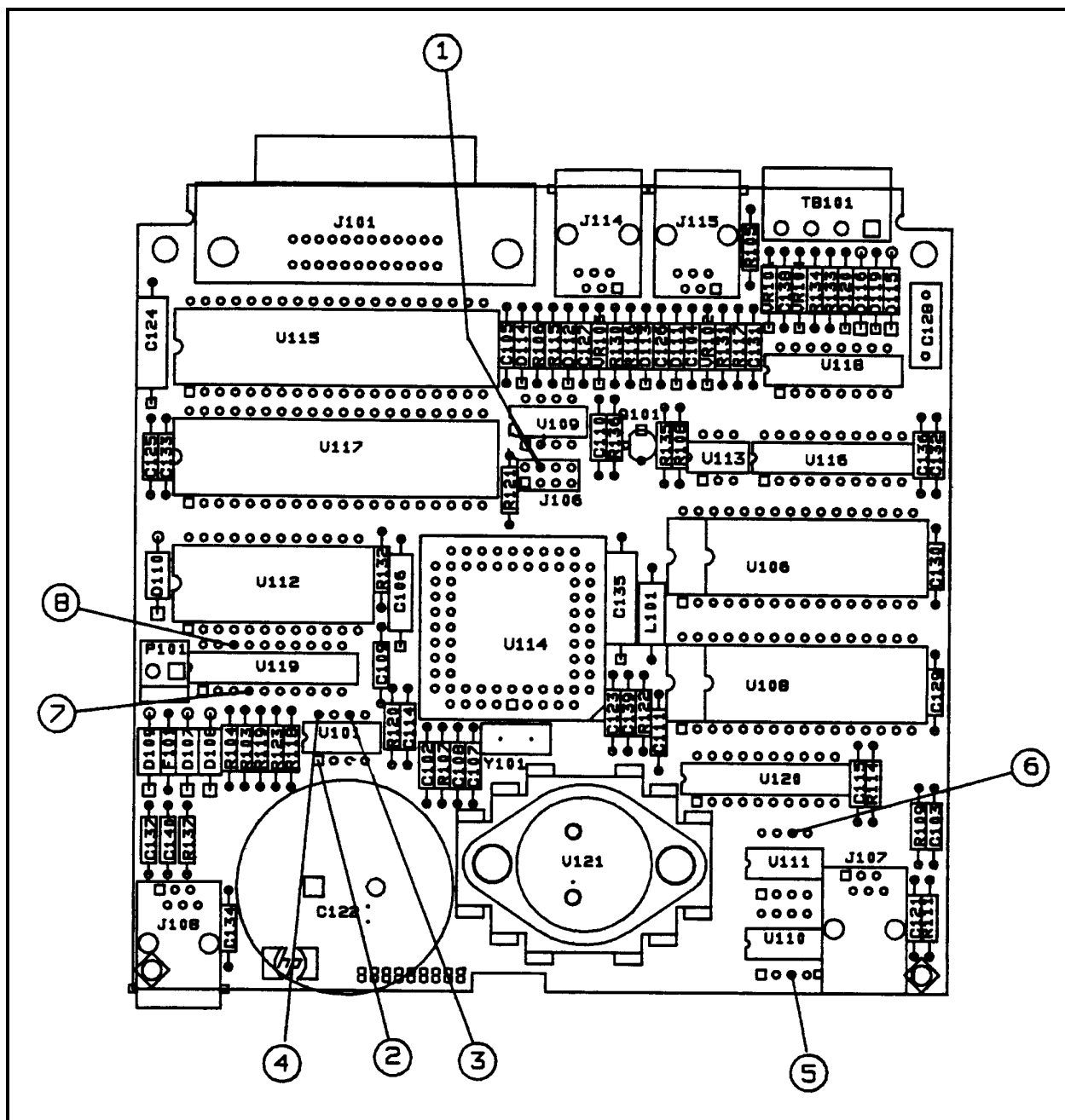
|               |                                                                                                                                                             |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CHANGE</b> | KNOB (Ref. RPG) from P/N 0370-3238, to P/N 10370-1091.<br>RPG - OPTICAL ENCODER from P/N 0960-0912 to P/N 0960-0822.<br>U4 from 5080-2466 to P/N 5080-2304. |
| <b>DELETE</b> | PCA (keypad), P/N 5063-3407.                                                                                                                                |

Table A-1. A2 GPIB Parts List

| Ref Desig.              | Agilent Part No. | Description                        |
|-------------------------|------------------|------------------------------------|
| <b>ELECTRICAL PARTS</b> |                  |                                    |
| C102-105                | 0160-4822        | Capacitor 1000pF 5%                |
| C106                    | 0180-0155        | Capacitor 2.2 $\mu$ F 20V          |
| C107,108                | 0160-4787        | Capacitor 22pF 5% 100V             |
| C109-111,114,115,121    | 0160-5422        | Capacitor 0.047 $\mu$ F 20%        |
| C122                    | 0180-3325        | Capacitor 25V                      |
| C123                    | 0160-4822        | Capacitor 1000pF 5%                |
| C124                    | 0180-0228        | Capacitor 22 $\mu$ F 15V           |
| C125                    | 0160-5422        | Capacitor 0.047 $\mu$ F 20%        |
| C126,127                | 0160-4807        | Capacitor 33pF 5% 100V             |
| C128                    | 0160-4281        | Capacitor 2200pF 20%               |
| C129-134                | 0160-5422        | Capacitor 0.047 $\mu$ F 20%        |
| C135                    | 0180-0228        | Capacitor 22 $\mu$ F 15V           |
| C136                    | 0160-4803        | Capacitor 68pF 5% 100V             |
| C138-140                | 0160-5422        | Capacitor 0.047 $\mu$ F 20%        |
| D107-110                | 1901-0731        | Diode power rectifier              |
| D111-114                | 1901-1098        | Diode 1N4150                       |
| D115,116                | 1901-1080        | Diode 1N5817                       |
| D119,120                | 1902-0766        | Diode zener 18.2V 5%               |
| F101                    | 2110-0699        | Fuse subminiature 5AM, 125V        |
| J101                    | 1252-0268        | Connector receptacle (GPIB)        |
| J106                    | 1251-4926        | Connector receptacle (test header) |
| J107,108,114,115        | 1251-7330        | Connector receptacle phone         |
| L101                    | 9100-1610        | Inductor 150nH 20%                 |
| P101                    | 1251-4245        | Connector plug 2-pin (ac bias)     |
| Q101                    | 1853-0089        | Transistor PNP 2N4917              |
| R103                    | 0757-0442        | Resistor 10K 1% 0.125W             |
| R104                    | 0698-3155        | Resistor 4.64K 1%                  |
| R105                    | 0683-1065        | Resistor 10M 5% 0.25 W             |
| R106                    | 0698-4037        | Resistor 46.4 $\Omega$ 1%          |
| R107                    | 0698-0082        | Resistor 464 $\Omega$ 1% 0.125W    |
| R108                    | 0757-0401        | Resistor 100 $\Omega$ 1% 0.125W    |
| R109                    | 0698-0082        | Resistor 464 $\Omega$ 1% 0.125W    |
| R111,114                | 0698-3155        | Resistor 4.64K 1%                  |
| R115-117                | 0698-4037        | Resistor 46.4 1%                   |
| R118                    | 0757-0280        | Resistor 1K 1% 0.125W              |
| R119                    | 0698-8827        | Resistor 1M 1% 0.125W              |
| R120-122                | 0698-3155        | Resistor 4.64K 1%                  |
| R123                    | 0698-0082        | Resistor 464 $\Omega$ 1% 0.125W    |
| R130-133                | 0698-3155        | Resistor 4.64K 1%                  |
| R134                    | 0683-1015        | Resistor 100 $\Omega$ 5% 0.25W     |
| R135,136                | 0698-3155        | Resistor 4.64K 1%                  |
| R137                    | 0757-0401        | Resistor 100 $\Omega$ 1% 0.125W    |

**Table A-1. A2 GPIB Parts List (continued)**

| Ref Desig.              | Agilent Part No. | Description                      |
|-------------------------|------------------|----------------------------------|
| <b>ELECTRICAL PARTS</b> |                  |                                  |
| TB101                   | 0360-2312        | Terminal block (digital control) |
| U101                    | 1826-0468        | IC MC3423PI                      |
| U106                    | 5080-2152        | IC DROM GPIB                     |
| U108                    | 1818-4111        | IC MCM 6164C55                   |
| U109                    | 1820-6789        | IC interface                     |
| U110,111                | 1990-0444        | IC Opto isolator                 |
| U112                    | 1820-3210        | IC 68B50                         |
| U113                    | 1990-0543        | IC Opto isolator                 |
| U114                    | 1821-1479        | IC MPU                           |
| U115                    | 1LH4-0001        | IC GP-IB transceiver             |
| U116                    | 1820-2724        | IC SN74ALS573BN                  |
| U117                    | 1820-2549        | IC 8291A                         |
| U118                    | 1820-4185        | IC interface                     |
| U119                    | 5080-2153        | IC GAL programmed GPIB           |
| U120                    | 5080-2154        | IC GAL programmed IPIB           |
| U121                    | 1820-0430        | IC LM309K                        |
| VR101                   | 1902-0766        | Diode zener 18.2V 5%             |
| VR102                   | 1902-0959        | Diode zener 11V 5%               |
| VR103,104               | 1902-0049        | Diode zener 6.19V 5%             |
| W101                    | 1258-0209        | Jumper                           |
| Y101                    | 0410-2109        | Crystal oscillator 12.000MHz     |
| <b>MECHANICAL PARTS</b> |                  |                                  |
| --                      | 1205-0758        | Heatsink (U121)                  |
| --                      | 0340-1277        | Insulator (Y101)                 |
| --                      | 0535-0031        | Nut hex w/lockwasher (J101)      |
| --                      | 0515-0642        | Screw (U121)                     |
| --                      | 0515-0911        | Screw M3x0.5 (J101)              |
| --                      | 1200-0567        | Socket IC 28-pin (U106)          |
| --                      | 1200-0639        | Socket IC 20-pin (U119,120)      |
| --                      | 1200-1274        | Socket IC (U114)                 |



### Figure A-1. A2 GPIB Component Parts List

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