

Keysight Models 6811A, 6812A,  
6813A, 6811B, 6812B, and 6813B  
AC Power Source/Analyzers  
Keysight Models 6841A and 6842A  
Harmonic/Flicker Test Systems

Service Manual

NOTICE: This document contains references to Agilent Technologies. Agilent's former Test and Measurement business has become Keysight Technologies. For more information, go to **[www.keysight.com](http://www.keysight.com)**.



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# Warranty Information

## CERTIFICATION

*Keysight Technologies certifies that this product met its published specifications at time of shipment from the factory. Keysight Technologies further certifies that its calibration measurements are traceable to the United States National Bureau of Standards, to the extent allowed by the Bureau's calibration facility, and to the calibration facilities of other International Standards Organization members.*

## WARRANTY

This Keysight Technologies hardware product is warranted against defects in material and workmanship for a period of three years from date of delivery. Keysight Technologies software and firmware products, which are designated by Keysight Technologies for use with a hardware product and when properly installed on that hardware product, are warranted not to fail to execute their programming instructions due to defects in material and workmanship for a period of 90 days from date of delivery. During the warranty period Keysight Technologies will, at its option, either repair or replace products which prove to be defective. Keysight Technologies does not warrant that the operation for the software firmware, or hardware shall be uninterrupted or error free.

For warranty service, with the exception of warranty options, this product must be returned to a service facility designated by Keysight Technologies. Customer shall prepay shipping charges by (and shall pay all duty and taxes) for products returned to Keysight Technologies. for warranty service. Except for products returned to Customer from another country, Keysight Technologies shall pay for return of products to Customer.

Warranty services outside the country of initial purchase are included in Keysight Technologies' product price, only if Customer pays Keysight Technologies international prices (defined as destination local currency price, or U.S. or Geneva Export price).

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## LIMITATION OF WARRANTY

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by the Customer, Customer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation and maintenance. NO OTHER WARRANTY IS EXPRESSED OR IMPLIED. KEYSIGHT TECHNOLOGIES. SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

## EXCLUSIVE REMEDIES

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## ASSISTANCE

The above statements apply only to the standard product warranty. Warranty options, extended support contacts, product maintenance agreements and customer assistance agreements are also available. Contact your nearest Keysight Technologies Sales and Service office for further information on Keysight Technologies' full line of Support Programs.

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## Safety Summary

### GENERAL

This is a Safety Class 1 instrument (provided with a 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 below) are taken. Also note the instrument's external markings described under "Safety Symbols"

### WARNING -

- **SHOCK HAZARD, EQUIPMENT DAMAGE, PERSONAL INJURY**

This product is a high-energy instrument, which means that it converts large amounts of energy during normal operation. This can result in catastrophic component damage (rapid, violent, component disassembly) if certain components fail during operation. When covers are removed, always wear a face shield and ear protection when powering up this instrument. Only repair units in a controlled area with no unprotected personnel present.

- 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 or disconnection 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 the 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 charge even if the instrument has been disconnected from its power source.

### SAFETY SYMBOLS

Refer to the table on the following page

**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. |

## Notice

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# Introduction

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## Organization

This manual contains information for troubleshooting and repairing to the component level models Keysight 6811A/B, 6812A/B, and 6813A/B Power Source/Analyzers, and models Keysight 6841A and 6842A Harmonic Flicker Test Systems. All models will hereafter be referred to as the ac source. This manual is organized as follows:

|                  |                                                  |
|------------------|--------------------------------------------------|
| <b>Chapter 1</b> | Introduction                                     |
| <b>Chapter 2</b> | Performance tests                                |
| <b>Chapter 3</b> | Principles of operation on a block-diagram level |
| <b>Chapter 4</b> | Troubleshooting                                  |
| <b>Chapter 5</b> | Replaceable parts                                |
| <b>Chapter 6</b> | Diagrams                                         |

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## Safety Considerations

This ac power source 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 (3-wire for Keysight 6811A/B), ground receptacle. Refer to the "Safety Summary" page at the beginning of this manual for general safety information. Before operation or repair, check the ac source and review this manual for safety warnings and instructions. Safety warnings for specific procedures are located at appropriate places in the manual.

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**WARNING:** ***SHOCK HAZARD, EQUIPMENT DAMAGE, PERSONAL INJURY*** - Hazardous voltages exist within the ac power source chassis, at the output terminals, and at the analog programming terminals. Only qualified personnel who have been trained in working with high voltage power equipment are to service this unit.

This product is a high-energy instrument, which means that it converts large amounts of energy during normal operation. This can result in catastrophic component damage (rapid, violent, component disassembly) if certain components fail during operation. When covers are removed, always wear a face shield and ear protection when powering up this instrument. Only repair units in a controlled area with no unprotected personnel present.

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## Related Documents

The following documents are shipped with your ac source:

- a Quick-Start Guide, to help you quickly get started using the ac source
- a User's Guide, containing detailed installation, checkout, and front panel information
- a Programming Guide, containing detailed GPIB programming information
- a Quick Reference Card, designed as a memory jogger for the experienced user

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## Revisions

### Instrument Identification

The ac source is identified by a 10-digit serial number. The items in this serial number are explained as follows:

|             |                                                                                                            |
|-------------|------------------------------------------------------------------------------------------------------------|
| <b>US</b>   | The first two letters indicates the country of manufacture, where US = USA.                                |
| <b>3729</b> | This is a code that identifies either the date of manufacture, or the date of a significant design change. |
| <b>0101</b> | The last four digits are a unique number assigned to each unit.                                            |

### Manual Revisions

This manual was written for ac sources that have the same or higher serial numbers as those listed on the title page.

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**NOTE:** If the serial number of your unit is higher than that shown on the title page, your unit was made after the publication of this manual and may have hardware or firmware differences not covered in this manual. If they are significant to the operation and/or servicing of the ac source, those differences are documented in one or more Manual Change sheets included with this manual.

If the serial number of your unit is lower than those shown on the title page, your unit was made before the publication of this manual and can be different from that described here. The previous versions of this manual (print date October, 1995 or July, 1997) applies to these units.

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### Firmware Revisions

You can obtain the firmware revision number by either reading the integrated circuit label, or query the ac source using the GPIB \*IDN?" query command (see Chapter 4, Troubleshooting).

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## Electrostatic Discharge

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**CAUTION:** The ac source 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.

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When working on the ac source, 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 (Keysight P/N 9300-0797, or equivalent).
- Using a conductive wrist strap, such as Keysight 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 ac source before removing or installing printed circuit boards.

## Performance Tests

### Introduction

This chapter provides test procedures for checking the operation of a model Keysight 6811AB, 6812A/B, 6813A/B AC Power Source/Analyzer and Keysight 6841A, 6842A Harmonic/Flicker Test System. The required test equipment is specified and sample performance test record sheets are included. Instructions are given for performing the tests using the front panel keypad.

### Test Equipment Required

Table 2-1 lists the equipment required to perform the performance tests in this chapter. A test record sheet with specification limits and measurement uncertainties (when test using the recommended test equipment) may be found at the back of this section.

**WARNING:**     **SHOCK HAZARD.** These tests should only be performed by qualified personnel. During the performance of these tests, hazardous voltages may be present at the output of the unit.

**Table 2-1. Test Equipment Required for Verification and Performance Tests**

| Type                           | Specifications                                                                                                                     | Recommended Model           |
|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| Digital Voltmeter              | Resolution: 10 nV @ 1V<br>Readout: 8 1/2 digits<br>Accuracy: 20 ppm                                                                | Keysight 3458A              |
| Current Monitor                | 0.01 ohms +/-200 ppm 10 Watts                                                                                                      | Guildline 7320/15           |
| Audio Analyzer                 | Input Voltage: 50mV TO 300V<br>Distortion Accuracy: +/-1db 20Hz to 20khz<br>Residual Distortion/Noise: -80db (0.01%) 20Hz to 20kHz | Keysight 8903A              |
| Frequency Counter              | Accuracy @1 KHZ < 0.001%                                                                                                           | Keysight 5316B              |
| Ratio Transformer <sup>1</sup> | 30:1 ratio < 50 ppm                                                                                                                |                             |
| Variable-Voltage Transformer   | Power: 1 Phase 3.4KVA<br>Range: 104-127V 47-63 Hz / 207-253V 47-63 Hz                                                              | Superior Powerstat          |
| Load Resistors                 | 20 ohms, 5 A, 1000 W minimum<br>250 ohms, 2 A, 500 W minimum<br>120 ohms, 2.5 A, 750 W minimum<br>51 ohms, 6 A, 1800 W minimum     |                             |
| GPIO Controller                | Full GPIO capabilities                                                                                                             | HP Series 300 or equivalent |

<sup>1</sup>A ratio transformer is not required for a valid MIL-STD-5622A 4:1 test. The 30:1 ratio transformer is only required when a 4:1 test equipment ratio is desired using the Keysight 3458A voltmeter in the 1000 volt range.

## 2 - Performance Tests

### Current Monitoring Resistor

A 4-terminal current monitoring resistor (current shunt ) listed in Table 2-1 is required to eliminate output current measurement error caused by voltage drops in the load leads and connections.

### Constant Voltage Tests

If more than one meter or a meter and an oscilloscope are used, connect each to the sense terminals by separate leads to avoid mutual coupling effects.

Tables 2-2 through 2-8 provide the test procedures for verifying the 6811A/B, 6812A/B, 6813A/B, and the 6841A, 6842A compliance with the specifications given in Appendix A of the User's Guide. Please refer to the CALIBRATION PROCEDURE or TROUBLESHOOTING if you observe out-of specification performance. The performance test specifications are listed in the Performance Test Records at the end of this chapter. You can record the actual measured values in the columns provided. When performing the load tests select an adequate gauge wire using the procedures given in the User's Guide for connecting the load.

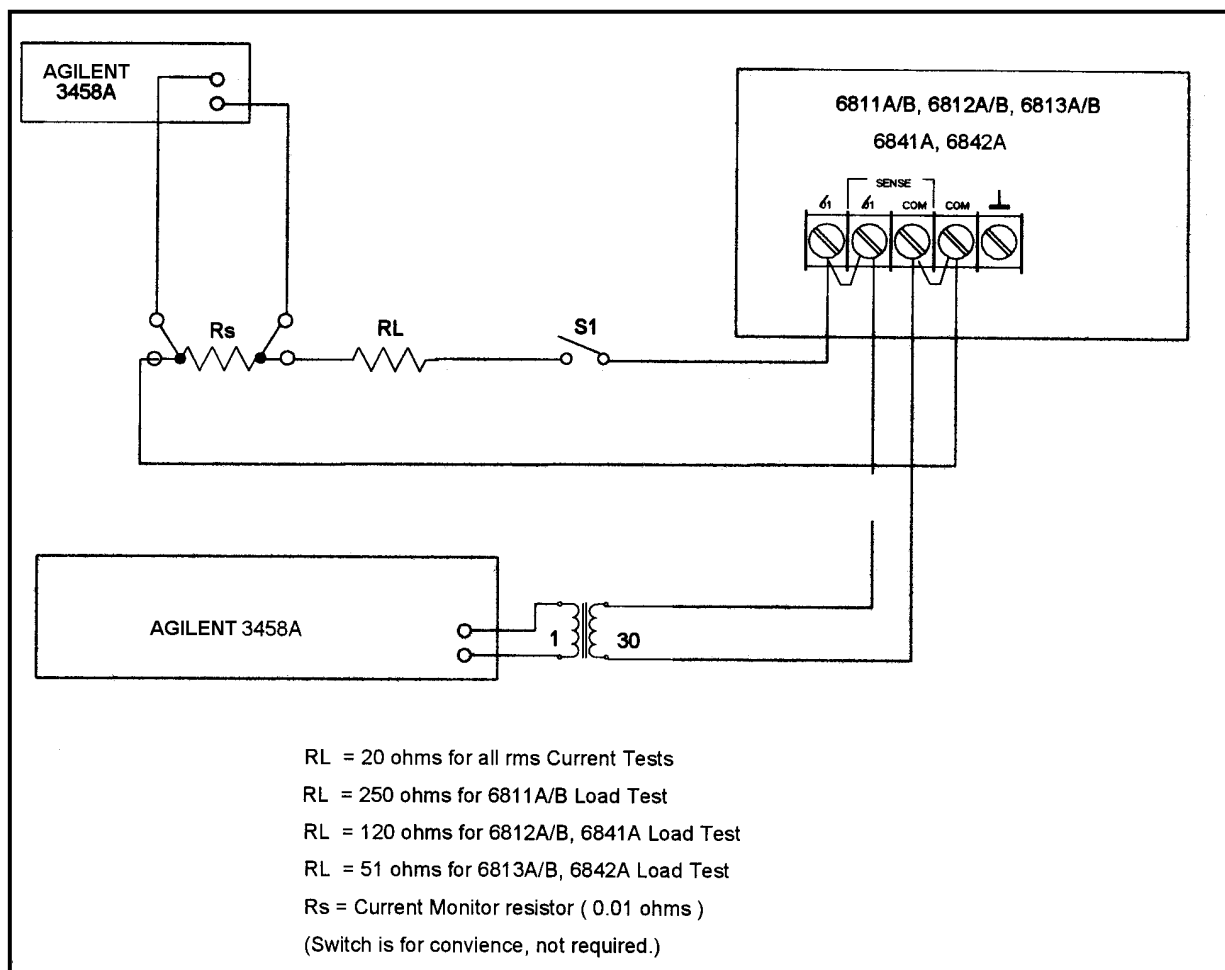


Figure 2-1. Test Setup

## Procedures

In the following procedures the term "UUT" means "unit under test" which can be either the 6811A/B, 6812A/B, 6813A/B, 6841A, or 6842A AC Source.

**Table 2-2. Voltage Programming and Readback Accuracy**

| Step                                                                                                                              | Action                                                                                                          | Normal Result                                              |
|-----------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|
| This procedure verifies that the voltage programming / GPIB readback and Front Panel display functions are within specifications. |                                                                                                                 |                                                            |
| 1                                                                                                                                 | Turn off the UUT and connect DVM and Ratio Transformer as shown in Test Setup Figure 2-1.<br>Switch S1 is open. |                                                            |
| 2                                                                                                                                 | Turn on the UUT. Recall factory defaults with *RST then program output to<br>VOLT 300, FREQ 45, SHAPE:SIN       | CV annunciator on<br>Output current near zero              |
| 3                                                                                                                                 | Record voltage readings at DMM and on front panel display.                                                      | Reading within specified high range<br>300V / 45Hz limits  |
| 4                                                                                                                                 | Program FREQ 400                                                                                                |                                                            |
| 5                                                                                                                                 | Record voltage readings at DMM and on front panel display.                                                      | Reading within specified high range<br>300V / 400Hz limits |
| 6                                                                                                                                 | Program FREQ 1000, CURR:PEAK 40                                                                                 |                                                            |
| 7                                                                                                                                 | Record voltage readings at DMM and on front panel display.                                                      | Reading within specified high range<br>300V / 1KHz limits  |

**Table 2-3. Constant Voltage Load Effect**

| Step                                                                                                                                         | Action                                                                                                                                  | Normal Result                                                                                                   |
|----------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|
| This test measures the change in output voltage resulting from a change in output current from full-load to no-load or no-load to full-load. |                                                                                                                                         |                                                                                                                 |
| 1                                                                                                                                            | Turn off the UUT and connect DMM, Load Resistors, Current shunt and Ratio Transformer as shown in Test Setup Figure 2-1 with S1 closed. |                                                                                                                 |
| 2                                                                                                                                            | Turn on the UUT. Recall factory defaults with *RST. Set ALC:DET RMS to rms then program output to VOLT 300, FREQ 60, SHAPE:SIN          | CV annunciator on, output current near:<br>1.2 amps for 6811A/B<br>2.5 amps for 6812A/B<br>5.8 amps for 6813A/B |
| 3                                                                                                                                            | Record voltage reading of DMM.                                                                                                          |                                                                                                                 |
| 4                                                                                                                                            | Open S1                                                                                                                                 | Output current near zero.                                                                                       |
| 5                                                                                                                                            | Record voltage readings at DMM.                                                                                                         |                                                                                                                 |
| 6                                                                                                                                            | Check test results                                                                                                                      | The difference between the DMM readings in Step 3 & 5 are within specified load effect limits.                  |

## 2 - Performance Tests

**Table 2-4. Constant Voltage Source Effect**

| Step                                                                                                                                                                   | Action                                                                                                                                  | Normal Result                                                                                                                 |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| This test measures the change in output voltage resulting from a change in AC Mains Input voltage from minimum to maximum value within the line voltage specification. |                                                                                                                                         |                                                                                                                               |
| 1                                                                                                                                                                      | Turn off the UUT and connect DMM, Load Resistors, Current shunt and Ratio Transformer as shown in Test Setup Figure 2-1 with S1 closed. |                                                                                                                               |
| 2                                                                                                                                                                      | Connect UUT AC input through a variable voltage transformer                                                                             |                                                                                                                               |
| 3                                                                                                                                                                      | Turn on the UUT. Recall factory defaults with *RST. Set ALC:DET RMS to rms then program output to VOLT 300, FREQ 60, SHAPE:SIN,         | CV annunciator on, output current near:<br>1.2 amps for 6811A/B<br>2.5 amps for 6812A/B, 6841A<br>5.9 amps for 6813A/B, 6842A |
| 4                                                                                                                                                                      | Adjust variable voltage transformer to low line condition ( 104 or 207 VAC )                                                            |                                                                                                                               |
| 5                                                                                                                                                                      | Record voltage reading of DMM.                                                                                                          |                                                                                                                               |
| 6                                                                                                                                                                      | Adjust variable voltage transformer to high line condition ( 127 or 253 VAC )                                                           |                                                                                                                               |
| 7                                                                                                                                                                      | Record voltage readings at DMM.                                                                                                         |                                                                                                                               |
| 8                                                                                                                                                                      | Check test results                                                                                                                      | The difference between the DMM readings in Step 3 & 5 are within specified line effect limits.                                |

**Table 2-5. RMS Current Accuracy Test**

| Step                                                                     | Action                                                                                                                                                                                                                                         | Normal Result                                                                                                    |
|--------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|
| This test verifies the measurement accuracy of the rms current readback. |                                                                                                                                                                                                                                                |                                                                                                                  |
| 1                                                                        | Turn off the UUT and connect an 20 ohm Load Resistor, current shunt and DMM as shown in Test Setup Figure 2-1 with S1 closed.                                                                                                                  |                                                                                                                  |
| 2                                                                        | Turn on the UUT. Recall factory defaults with *RST. Set ALC:DET RMS to rms and then program output voltage to VOLT 60, FREQ 60 SHAPE:SIN, CURR 2.50 for 6811A/B; VOLT 120, FREQ 60 SHAPE:SIN, CURR 5.00 for the 6812A/B, 6813A/B, 6841A, 6842A | CC annunciator on, output current near 2.5 amps for 6811A/B - near 5 amps for the 6812A/B, 6813A/B, 6841A, 6842A |
| 3                                                                        | Record DVM reading and calculate rms current                                                                                                                                                                                                   | Readings are within specified current high range limits.                                                         |
| 4                                                                        | Program CURR:RANGE LOW                                                                                                                                                                                                                         | CC annunciator on, output current near 2.5 or 5.0 amps                                                           |
| 5                                                                        | Record DVM reading and calculate rms current                                                                                                                                                                                                   | Readings are within specified current low range limits.                                                          |

**Table 2-6. Harmonic Distortion Test**

| Step                                                                                  | Action                                                                                               | Normal Result                                                                                                           |
|---------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| This test measures the total harmonic distortion of the output sinewave at full power |                                                                                                      |                                                                                                                         |
| 1                                                                                     | Turn off the UUT. Connect load resistor and DMM as shown in Test Setup Figure 2-1 with S1 closed.    |                                                                                                                         |
| 2                                                                                     | Turn on the UUT. Program output voltage to VOLT 300, FREQ 60, SHAPE:SIN, CURR MAX                    | CV annunciator on, Output current at 1.2 amps for 6811A/B<br>2.5 amps for 6812A/B, 6841A<br>5.8 amps for 6813A/B, 6842A |
| 3                                                                                     | Record the total harmonic distortion reading from the audio analyzer and front panel display of UUT. | Readings are less than maximum specified limits.                                                                        |

**Table 2-7. Frequency Accuracy Test**

| Step                                                                                                  | Action                                                                                                                                                                          | Normal Result                                 |
|-------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| This test verifies the frequency programming and measurement accuracy of the output voltage waveform. |                                                                                                                                                                                 |                                               |
| 1                                                                                                     | Turn off the UUT. Connect the audio analyzer directly to the UUT output terminals. Connect the frequency counter to the Monitor Output on the rear panel of the audio analyzer. |                                               |
| 2                                                                                                     | Turn on the UUT. Program output voltage to VOLT 100, FREQ 400, SHAPE:SIN, CURR MAX                                                                                              | CV annunciator on.                            |
| 3                                                                                                     | Select AC Level on the audio analyzer. Record the output frequency reading from counter and front panel display of UUT.                                                         | Readings are within specified limits @ 400Hz. |

**Table 2-8. DC Voltage Programming and Readback Accuracy**

| Step                                                                                                        | Action                                                                                                                                                           | Normal Result                                                         |
|-------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|
| This test verifies the DC voltage programming and front panel readback functions are within specifications. |                                                                                                                                                                  |                                                                       |
| 1                                                                                                           | Turn off the UUT. Connect DVM directly to the output terminals. DVM negative lead is connected to COM output terminal. Disconnect the 30:1 transformer. Open S1. |                                                                       |
| 2                                                                                                           | Turn on UUT. Program output voltage to VOLT 0, OUTP:COUP DC, OFFSET 425                                                                                          | Output voltage at +425 Vdc, output current near zero.                 |
| 3                                                                                                           | Record dc voltage at DVM and readback from front panel display.                                                                                                  | Readings within specified dc voltage programming and readback limits. |
| 4                                                                                                           | Program output voltage OFFSET -425                                                                                                                               | Output voltage at -425 Vdc, output current near zero.                 |
| 5                                                                                                           | Record dc voltage at DVM and readback from front panel display.                                                                                                  | Readings within specified DC voltage programming and readback limits. |

## 2 - Performance Tests

**Table 2-9. Performance Test Record - Keysight 6811A/B**

| Model                                                 | Report No:            | Date:     |                       |               |
|-------------------------------------------------------|-----------------------|-----------|-----------------------|---------------|
| Test Description                                      | Minimum Specification | Results   | Maximum Specification | Meas. Uncert. |
| <b>Voltage Programming &amp; Readback Accuracy</b>    |                       |           |                       |               |
| 300Vrms @ 45Hz                                        | 299.250               | _____ V   | 300.750               | 140mV         |
| Front Panel Display                                   | Vrms -190mV           | _____ V   | Vrms +190mV           | (1.2mV)       |
| 300Vrms @ 400Hz                                       | 298.200               | _____ V   | 301.800               | 140mV         |
| Front Panel Display                                   | Vrms -400mV           | _____ V   | Vrms +400mV           | (1.2mV)       |
| 300Vrms @ 1KHz                                        | 296.700               | _____ V   | 303.300               | 140mV         |
| Front Panel Display                                   | Vrms -700mV           | _____ V   | Vrms +700mV           | (1.2mV)       |
| CV Load Effect                                        | Vout - 1.5V           | _____ V   | Vout + 1.5V           |               |
| CV Line Effect                                        | Vout - 0.3V           | _____ V   | Vout + 0.3V           |               |
| <b>rms Current Readback</b>                           |                       |           |                       |               |
| Front Panel Display High Range (A models)             | Io-0.0175A            | _____ A   | Io+0.0175A            | 1mA           |
| Front Panel Display Low Range (A models)              | Io-0.0045A            | _____ A   | Io+0.0045A            | 1mA           |
| Front Panel Display High Range (B models)             | Io-0.01125A           | _____ A   | Io+0.01125A           | 1mA           |
| Front Panel Display Low Range (B models)              | Io-0.00275A           | _____ A   | Io+0.00275A           | 1mA           |
| <b>Total Harmonic Distortion</b>                      |                       |           |                       |               |
| Audio Analyzer                                        | 0                     | _____ %   | 1%                    |               |
| Front Panel Display                                   | 0                     | _____ %   | 1%                    |               |
| <b>Frequency Programming &amp; Readback Accuracy</b>  |                       |           |                       |               |
| Program 400 Hz                                        | 399.960 Hz            | _____ Hz  | 400.040 Hz            | 0.005Hz       |
| Front Panel Display                                   | Fo - 0.040 Hz         | _____ Hz  | Fo + 0.040 Hz         |               |
| <b>DC Voltage Programming &amp; Readback Accuracy</b> |                       |           |                       |               |
| +425 VDC Output                                       | 424.075 Vdc           | _____ Vdc | 425.925 Vdc           | 4.4mV         |
| Front Panel Display                                   | Vo-0.363 Vdc          | _____ Vdc | Vo+0.363Vdc           |               |
| -425 VDC Output                                       | -424.075 Vdc          | _____ Vdc | 425.925 Vdc           | 4.4mV         |
| Front panel Display                                   | Vo-0.363 Vdc          | _____ Vdc | Vo+0.363 Vdc          |               |

Note: 1. Measurement uncertainties are only valid when using test equipment listed in Table 2-1.

2. Voltage Programming and Readback measurement uncertainties are for a 3458A DMM in the 1000 volt range.

3. Measurement uncertainties in parenthesis are only if a 30:1 ratio transformer is used with the 3458A DMM.

**Table 2-10. Performance Test Record - Keysight 6812A/B, 6841A**

| Model                                                 | Report No:            | Date:     |                       |               |
|-------------------------------------------------------|-----------------------|-----------|-----------------------|---------------|
| Test Description                                      | Minimum Specification | Results   | Maximum Specification | Meas. Uncert. |
| <b>Voltage Programming &amp; Readback Accuracy</b>    |                       |           |                       |               |
| 300Vrms @ 45Hz                                        | 299.250               | _____ V   | 300.750               | 140mV         |
| Front Panel Display                                   | Vrms -190mV           | _____ V   | Vrms +190mV           | (1.2mV)       |
| 300Vrms @ 400Hz                                       | 298.200               | _____ V   | 301.800               | 140mV         |
| Front Panel Display                                   | Vrms -400mV           | _____ V   | Vrms +400mV           | (1.2mV)       |
| 300Vrms @ 1KHz                                        | 296.700               | _____ V   | 303.300               | 140mV         |
| Front Panel Display                                   | Vrms -700mV           | _____ V   | Vrms +700mV           | (1.2mV)       |
| CV Load Effect                                        | Vout - 1.5V           | _____ V   | Vout + 1.5V           |               |
| CV Line Effect                                        | Vout - 0.3V           | _____ V   | Vout + 0.3V           |               |
| <b>rms Current Readback</b>                           |                       |           |                       |               |
| Front Panel Display High Range (A models)             | Io-0.0175A            | _____ A   | Io+0.0175A            | 1mA           |
| Front Panel Display Low Range (A models)              | Io-0.0045A            | _____ A   | Io+0.0045A            | 1mA           |
| Front Panel Display High Range (B models)             | Io-0.0125A            | _____ A   | Io+0.0125A            | 1mA           |
| Front Panel Display Low Range (B models)              | Io-0.0040A            | _____ A   | Io+0.0040A            | 1mA           |
| <b>Total Harmonic Distortion</b>                      |                       |           |                       |               |
| Audio Analyzer                                        | 0                     | _____ %   | 1%                    |               |
| Front Panel Display                                   | 0                     | _____ %   | 1%                    |               |
| <b>Frequency Programming &amp; Readback Accuracy</b>  |                       |           |                       |               |
| Program 400 Hz                                        | 399.960 Hz            | _____ Hz  | 400.040 Hz            | 0.005Hz       |
| Front Panel Display                                   | Fo - 0.040 Hz         | _____ Hz  | Fo + 0.040 Hz         |               |
| <b>DC Voltage Programming &amp; Readback Accuracy</b> |                       |           |                       |               |
| +425 VDC Output                                       | 424.075 Vdc           | _____ Vdc | 425.925 Vdc           | 4.4mV         |
| Front Panel Display                                   | Vo-0.363 Vdc          | _____ Vdc | Vo+0.363Vdc           |               |
| -425 VDC Output                                       | -424.075 Vdc          | _____ Vdc | 425.925 Vdc           | 4.4mV         |
| Front panel Display                                   | Vo-0.363 Vdc          | _____ Vdc | Vo+0.363 Vdc          |               |

Note: 1. Measurement uncertainties are only valid when using test equipment listed in Table 2-1.

2. Voltage Programming and Readback measurement uncertainties are for a 3458A DMM in the 1000 volt range.

3. Measurement uncertainties in parenthesis are only if a 30:1 ratio transformer is used with the 3458A DMM.

## 2 - Performance Tests

**Table 2-11. Performance Test Record - Keysight 6813A/B, 6842A**

| Model                                                 | Report No:            | Date:     |                       |               |
|-------------------------------------------------------|-----------------------|-----------|-----------------------|---------------|
| Test Description                                      | Minimum Specification | Results   | Maximum Specification | Meas. Uncert. |
| <b>Voltage Programming &amp; Readback Accuracy</b>    |                       |           |                       |               |
| 300Vrms @ 45Hz                                        | 299.250               | _____ V   | 300.750               | 140mV         |
| Front Panel Display                                   | Vrms -190mV           | _____ V   | Vrms +190mV           | (1.2mV)       |
| 300Vrms @ 400Hz                                       | 298.200               | _____ V   | 301.800               | 140mV         |
| Front Panel Display                                   | Vrms -400mV           | _____ V   | Vrms +400mV           | (1.2mV)       |
| 300Vrms @ 1KHz                                        | 296.700               | _____ V   | 303.300               | 140mV         |
| Front Panel Display                                   | Vrms -700mV           | _____ V   | Vrms +700mV           | (1.2mV)       |
| CV Load Effect                                        | Vout - 1.5V           | _____ V   | Vout + 1.5V           |               |
| CV Line Effect                                        | Vout - 0.3V           | _____ V   | Vout + 0.3V           |               |
| <b>rms Current Readback</b>                           |                       |           |                       |               |
| Front Panel Display High Range (A models)             | Io-0.0175A            | _____ A   | Io+0.0175A            | 1mA           |
| Front Panel Display Low Range (A models)              | Io-0.0045A            | _____ A   | Io+0.0045A            | 1mA           |
| Front Panel Display High Range (B models)             | Io-0.0125A            | _____ A   | Io+0.0125A            | 1mA           |
| Front Panel Display Low Range (B models)              | Io-0.0040A            | _____ A   | Io+0.0040A            | 1mA           |
| <b>Total Harmonic Distortion</b>                      |                       |           |                       |               |
| Audio Analyzer                                        | 0                     | _____ %   | 1%                    |               |
| Front Panel Display                                   | 0                     | _____ %   | 1%                    |               |
| <b>Frequency Programming &amp; Readback Accuracy</b>  |                       |           |                       |               |
| Program 400 Hz                                        | 399.960 Hz            | _____ Hz  | 400.040 Hz            | 0.005Hz       |
| Front Panel Display                                   | Fo - 0.040 Hz         | _____ Hz  | Fo + 0.040 Hz         |               |
| <b>DC Voltage Programming &amp; Readback Accuracy</b> |                       |           |                       |               |
| +425 VDC Output                                       | 422.575 Vdc           | _____ Vdc | 427.425 Vdc           | 4.4mV         |
| Front Panel Display                                   | Vo-0.363 Vdc          | _____ Vdc | Vo+0.363Vdc           |               |
| -425 VDC Output                                       | -422.575 Vdc          | _____ Vdc | 427.425 Vdc           | 4.4mV         |
| Front panel Display                                   | Vo-0.363 Vdc          | _____ Vdc | Vo+0.363 Vdc          |               |

Note: 1. Measurement uncertainties are only valid when using test equipment listed in Table 2-1.

2. Voltage Programming and Readback measurement uncertainties are for a 3458A DMM in the 1000 volt range.

3. Measurement uncertainties in parenthesis are only if a 30:1 ratio transformer is used with the 3458A DMM.

# Principles of Operation

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## Introduction

Figure 3-1 at the end of this chapter is a block diagram showing the major circuits within the AC Power Source /Analyzer and Harmonic / Flicker Test System. These units consist of the following modules.

- A1 Front Panel Assembly
- A2 GPIB Assembly
- A3 AC FET Assembly
- A4 AC Input Assembly
- A5 DC Rail Assembly
- A6 Bias Assembly
- A7 Inverter Assembly
- A8 DSP Assembly
- A9 Output Filter Assembly
- A10 Control Assembly
- A11 Trigger Assembly

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## General Description

The 6811A/B, 6812A/B, and 6813A/B are 375VA, 750VA and 1750VA AC Source/Analyzers whereas the 6841A and 6842A are 750VA and 1750VA power sources are used as Harmonic / Flicker Test Systems. The 6811A/B, 6812A/B and 6841A can operate from 120, 220 or 240 volt AC input main while the 6813A/B and 6842A only operate from 220/240 volt AC input mains. All deliver regulated AC voltage and/or current from 45 to 1000 hertz. They can operate below 45 hertz to DC at derated output power. (See Users Guide for operation below 45 hertz ). They can generate sine, square, clipped sine or arbitrary waveforms. The output waveform can be controlled from the front panel keypad or computer via GPIB or RS-232. The output characteristics or measurements ( voltage, current, frequency, power factor, etc. ) can be readback via the front panel, GPIB or RS-232.

### A1 Front Panel Assembly

The A1 Intelligent Front Panel assembly contains a circuit board, a vacuum florescent display assembly, keypad and rotary pulse generators ( RPG ). The circuit board contains digital logic circuits including a CPU, ROM and RAM. The front panel CPU decodes operator keystrokes and transmits the information to the A8 DSP assembly. The front panel receives information from the A8 DSP assembly to update the display. The front panel assembly is a surface mount ( SMT ) assembly and is not component level repairable. The A1 front panel assembly is common to all models.

### 3 - Principles of Operation

#### A2 GPIB / RS-232 Interface Assembly

The A2 GPIB / RS-232 interface assembly contains the CPU and GPIB interface controller for communicating with a GPIB controller. The A2 interface assembly also contains the logic for communicating with a computer via RS-232. The interface type, GPIB or RS-232, is determined by the operator using front panel keystrokes. When using the RS-232 interface the operator can select the baud rate and parity using the front panel keypad. The GPIB / RS-232 interface assembly is an SMT assembly and is not component level repairable. The A2 assembly is common to all models.

#### A3 FET Assembly

The 6813A/B and 6842A A3 FET assembly contains 8 power FETs and 2 bridge driver ICs. The power FETs and power transformer form an H-Bridge converter. The A3 FET H-Bridge converts the 320 volt DC rail from the AC Input assembly to 500 volts DC on the A9 Output assembly via the A5 DC Rail assembly. The A3 assembly power FETs switching frequency is synchronized with the switching frequency of the A7 Inverter assembly. The A3 FET switching frequency is approximately 42 KHz, 1/2 that of the A7 Inverter assembly.

The 6811A/B, 6812A/B and 6842A ACFET assemblies, having lower output power ratings than the 6813A/B and 6842A/B, use only 4 power FETs in the H-Bridge. Earlier ac source models used through-hole FET assemblies. Updated surface-mount FET assemblies (refer to the parts list) are the recommended replacement part for all previous version FET assemblies. The surface-mount FET assemblies are **not** component-level repairable. The 6811A/B, 6812A/B and 6841A use one common assembly, the 6813A and 6842A use a different unique assembly.

#### A4 AC Input Assembly

The AC input mains voltage is connected on the rear panel via J1049 to the A4 AC Input board. The AC input board converts the AC mains to a nominal 320 volt DC rail for use by the AC FET assembly. Relays K1040 and K1041 prevent the DC rail from energizing until the front panel on/off switch closed. Resistors R1040, R1041, R1045 and R1046 limit turn-on surge current to the input filter capacitors C1060 thru C1067. Relay K1040 bypasses the current limit resistors when energized. Relay K1040 is controlled by FET Q1040 who is driven by the input\_rly\_iso signal derived from the DSP assembly. Wire jumper J1047 connects the full wave bridge rectifier D1060 and input capacitors C1060 thru C1067 as either a voltage doubler for 120 volt mains or full wave bridge for 220/240 volt mains. Fuse F1020 is the main AC line fuse and F1080 protects the 320 volt DC rail to the AC FET assembly. The A4 assembly is component level repairable and there are 3 unique assemblies. One for the 6811A/B, another for the 6812A/B and 6841A and another for the 6813A/B and 6842A.

#### A5 DC Rail Assembly

The A5 DC Rail assembly contains U447 the CV error amplifier, U491 PWM driver, U462 PWM comparator and U475 ramp generator to control the FET H-bridge on the A3 ACFET assembly. The chassis mounted power transformer connects the 42 KHz AC from the A3 ACFET assembly to input rectifiers D400 thru D407 on the A5 DC Rail board.

Chassis mounted rail filter 5080-2329 and capacitors C500 to C503 and C508 to C509 located on the A9 Output Filter board convert the 42 KHz AC to a 503 volt DC rail for use by the A7 Inverter assembly. It also contains U423 bias voltage detector and high/low 503 volt rail voltage detection circuit. There is a red LED on the right side of the A5 DC Rail assembly to warn when high voltages are present, this LED can be seen from the right side of the AC Source without removing any covers. This assembly is component level repairable but extreme caution must be used when troubleshooting as 1100 volts peak / 503VDC is present. The A5 DC Rail assembly is common to all models.

## A6 Bias Assembly

The A6 Bias assembly receives the AC input mains voltage via connector J1035 from the A4AC Input assembly. The bias transformer primaries for models 6811A/B, 6812A/B, or 6841A can be configured for either 100, 120, 200 or 230 volt nominal input and models 6813A/B and 6842A can only be configured for 200 or 230 volt nominal inputs. The input voltage range is configured by moving jumpers on J353. A J353 jumper configuration diagram is located on the bias assembly next to J353. Regulator U300 supplies +15 volts to the AC input relays and bias to the ACFET assembly. Regulators U311 and U3121 supply +5 volts to the GPIB and front panel assemblies. Opto-coupler U362 transmits the input\_rly\_iso signal to relay K1040 on the AC input assembly. J337 supplies +5 and +/- 15 volts to the control assembly via the Output Filter assembly and 48 volts AC via E336 to the DC rail assembly. The A6 assembly is a component level repairable assembly. There is one unique assembly for the 6811A/B, 6812A/B and 6841A and another unique assembly for the 6813A/B and 6842A.

## A7 Inverter Assembly

The A7 Inverter (output amplifier) assembly is a switching H-bridge FET assembly operating at approximately 83 KHz. It receives its switching logic from the A10 control assembly. The A7 Inverter assembly can provide a sine, square, clipped sine, arbitrary waveform or DC level to the A9 Output Filter assembly. The Keysight 6813A/B and 6842A uses twice as many power FETs as the Keysight 6811A/B, 6812A/B and 6841A assembly. *Slow start* procedures, disconnecting the 503 volt DC rail, should be used when troubleshooting the Inverter assembly. See Inverter troubleshooting for more complete information on *slow start* procedures. Earlier ac source models used a through-hole inverter assembly. An updated surface-mount inverter assembly (refer to the parts list) is the recommended replacement part for all previous version ac source inverter assemblies. The surface-mount inverter assembly is **not** component-level repairable.

## A8 Digital Signal Processing (DSP) Assembly

The A8 DSP assembly contains the CPU, ROMs, Digital-to Analog ( DACs ) circuits that control the output voltage and output current settings. It contains Analog-to-Digital ( ADCs ) circuits to readback actual output voltage and current. It contains all logic circuits for generating arbitrary waveforms, frequency changes and transient or pulse level changes. At power on the A8 DSP assembly performs a self test and reports any failures via the front panel display. The A8 assembly is an SMT assembly and is not component level repairable except for the ROMs which are installed in sockets and are replaceable for ROM upgrades. There is one unique assembly for models 6811A/B, 6812A/B, and 6813A/B and another unique assembly for models 6841A and 6842A.

## A9 Output / Filter Assembly

The A9 Output filter assembly contains U500 the remote sense amplifier and K501 remote sense relay. The rms and peak current sense resistors, overvoltage divider and output disconnect relays K502 and K503 ( older manufactured units use one output disconnect relay K500 ). The A9 Output assembly contains 2 notch filters to reduce the inverter switching frequency noise in the output. It provides a communication path between the A10 Control assembly, A5 DC rail assembly and A6 Bias assembly. The A9 assembly is component level repairable. There is one unique assembly for model 6811A/B and another unique assembly for models 6812A/B, 6813A/B, 6841A and 6842A.

### 3 - Principles of Operation

#### A10 Control Assembly

The A10 Control assembly contains the PWM comparator and ramp generator for controlling the A7 Inverter assembly power FETs. It contains the voltage and current rms/dc converter circuits, voltage and current readback amplifiers and all other analog circuits required to interface the output voltage , output current and frequency programming and measurement capabilities with the A8 DSP assembly. The A10 assembly is an SMT assembly and is not component lever repairable. There are three unique A10 Control assemblies, one for model 6811A/B, one for models 6812A/B, and 6841A and one for models 6813A/B, and 6842A.

#### A11 Trigger ( BNC ) Assembly

The A11 Trigger or BNC assembly provides the communication and isolation path for trigger out ( U157 ) and trigger in signals ( U156 ). The A11 assembly provides the isolation ( optical couplers ) between the A2 GPIB interface assembly ( U153 & U154 ) and A8 DSP assembly ( J115 ). The A11 assembly is an SMT assembly and is common to all models.

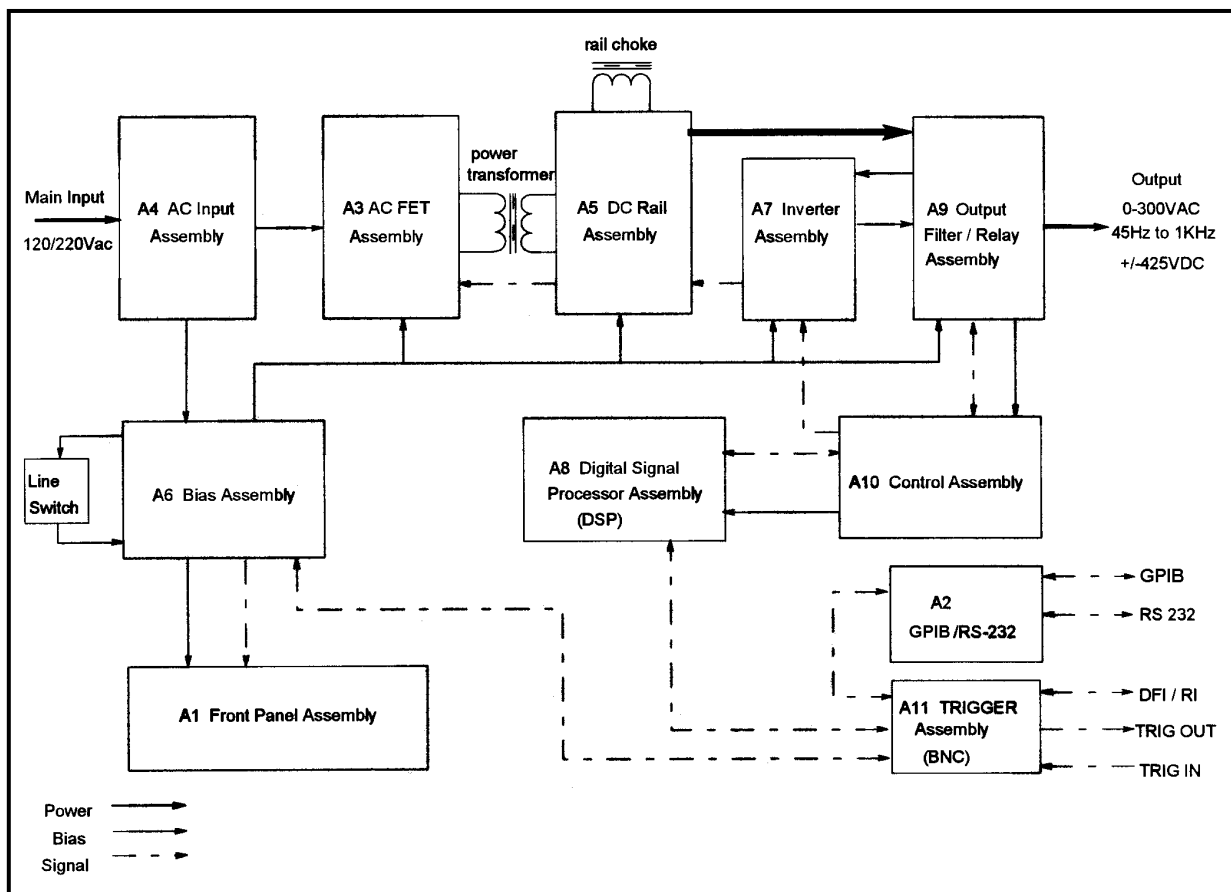


Figure 3-1. AC Power Source/Analyzer Block Diagram

# Troubleshooting

## Introduction

**WARNING: *SHOCK HAZARD, EQUIPMENT DAMAGE, PERSONAL INJURY*** - Some troubleshooting procedures in this chapter are performed with power applied and protective covers removed. These procedures should be performed only by trained personnel who are aware of the hazards.

This product is a high-energy instrument, which means that it converts large amounts of energy during normal operation. This can result in catastrophic component damage (rapid, violent, component disassembly) if certain components fail during operation. When covers are removed, always wear a face shield and ear protection when powering up this instrument. Only repair units in a controlled area with no unprotected personnel present.

**CAUTION:** This instrument uses components which can either be damaged or suffer serious performance degradation as a result of ESD (electrostatic discharge). Observe the standard antistatic precautions to avoid damage to the components. An ESD summary is given in Chapter 1.

This chapter provides troubleshooting and repair information for the AC Power Source. Before beginning troubleshooting procedures make certain the problem is in the AC Power Source and not with an associated circuit , the GPIB controller or AC input lines. Without removing the covers you can use the verification tests in Chapter 2 to determine if the AC Power Source is operating normally.

## Test Equipment Required

**Table 4-1. Test Equipment Requirements for Troubleshooting**

| Equipment          | Characteristics                              | Recommended Model                      |
|--------------------|----------------------------------------------|----------------------------------------|
| GPIB Controller    | Communicate with AC Source via GPIB or RS232 | HP Series 200/300 controller or equiv. |
| Digital Voltmeter  | Check voltages /resistances                  | Keysight 3458A or equivalent           |
| Function Generator | Generate waveforms                           | Keysight 3312A or equivalent           |
| Oscilloscope       | Observe waveforms                            | Keysight 54504A or equivalent          |
| Current Shunt      | Check output current                         | 0.01 ohm 10 watt                       |
| Logic Probe        | Check data lines                             | Keysight 545A or equivalent            |

## Troubleshooting Hints

- Service kit 5063-2330 contains 2 PC board holders to hold the A5 DC Rail board in a vertical position for troubleshooting, and a PC board extender that raises the A8 DSP and A10 Control boards above the chassis for troubleshooting.  
     Extender board   part number 5063-2331  
     PC B holder      part number 5020-8458
- Locate and observe the 2 red LEDs, one on each side of the unit, which indicate when high voltage is present on the A4 AC input board, A5 DC rail board, and A9 output board. Wait for the LEDs to extinguish before removing or installing assemblies.
- If both CV and CC annunciators are on, the peak current limit is may be set too low.

## Power-on Self-test Failures

The power-on self-test sequence tests of most of the digital and DAC circuits. If the supply fails self-test, the display "ERR" annunciator will come on. You can then query the unit to find out what the error(s) are. When an error is detected, the output is not disabled so you can still attempt to program the supply to help troubleshoot the unit. Table 4-2 lists the self test errors and gives a possible remedy for each error. Table 4-3 lists the run-time errors that can occur at any time while the unit is running.

**NOTE:** A partial self test is performed when the \*TST? query is executed. Those tests that interfere with normal interface operation or cause the output to change are not performed by \*TST?. The return value of \*TST? will be zero if all tests pass, or the error code of the first test that failed. The power supply will continue normal operation if \*TST? returns a non-zero value.

**Table 4-2. Self-Test Errors**

| Error # | Description                                                                                                                                                                                                                                                                                                                                            | Possible Remedy |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| 0       | No error                                                                                                                                                                                                                                                                                                                                               | -               |
| 1       | Non-volatile RAM RD0 section checksum failed                                                                                                                                                                                                                                                                                                           | A               |
| 2       | Non-volatile RAM CONFIG section checksum failed                                                                                                                                                                                                                                                                                                        | A               |
| 3       | Non-volatile RAM CAL section checksum failed                                                                                                                                                                                                                                                                                                           | A               |
| 4       | Non-volatile RAM WAVEFORM section checksum failed                                                                                                                                                                                                                                                                                                      | A               |
| 5       | Non-volatile RAM STATE section checksum failed                                                                                                                                                                                                                                                                                                         | A               |
| 6       | Non-volatile RAM LIST section checksum failed                                                                                                                                                                                                                                                                                                          | A               |
| 7       | Non-volatile RAM RST section checksum failed                                                                                                                                                                                                                                                                                                           | A               |
| 10      | RAM selftest                                                                                                                                                                                                                                                                                                                                           | B               |
| 11 - 31 | DAC selftest error, expected <n>, read <reading><br>Errors 11, 12, 13, 14, 15 apply to DAC12 1A and 1B<br>Errors 16, 17, 18 apply to DAC12 2A<br>Errors 19, 20, 21 apply to DAC12 2B<br>Errors 22, 23 apply to DAC12 4A<br>Errors 24, 25 apply to DAC12 4B<br>Errors 26, 27, 28 apply to DAC12 3A and 3B<br>Errors 29, 30, 31 apply to DAC12 5A and 5B | B               |
| 40      | Voltage selftest error                                                                                                                                                                                                                                                                                                                                 | C               |
| 43      | Current selftest error                                                                                                                                                                                                                                                                                                                                 | C               |
| 70      | Fan voltage failure                                                                                                                                                                                                                                                                                                                                    | D               |
| 80      | Digital I/O selftest error                                                                                                                                                                                                                                                                                                                             | D               |

- A Re-initialize unit and re-calibrate. If unit still has RAM error replace A8 DSP board.
- B Check A8 DSP and A10 Control assemblies
- C \*TST? programs 50 volts, expected readback 50+/-1volt 0+/-1amp
- D Check fan and/or fan voltage or replace A8 DSP assembly.

## Run-Time Errors

Run-time errors do not occur during self-test, but can occur at any time while the unit is running. (See Table 4-3).

**Table 4-3. Run-Time Errors**

| <b>Error #</b> | <b>Description</b>                                                    | <b>Possible Remedy</b> |
|----------------|-----------------------------------------------------------------------|------------------------|
| 200            | Outgrd not responding                                                 | E                      |
| 201            | Front panel not responding                                            | F                      |
| 210            | Ingrd receiver framing error                                          | E                      |
| 211            | Ingrd uart overrun status                                             | E                      |
| 212            | Ingrd received bad token                                              | E                      |
| 213            | Ingrd receiver buffer overrun                                         | E                      |
| 214            | Ingrd input buffer overrun                                            | E                      |
| 215            | Outgrd output buffer overrun                                          | E                      |
| 216            | RS-232 receiver framing error                                         | G                      |
| 217            | RS-232 receiver parity error                                          | G                      |
| 218            | RS-232 receiver overrun error                                         | G                      |
| 219            | Ingrd inbuf count sync error                                          | E                      |
| 220            | Front panel uart overrun                                              | F                      |
| 221            | Front panel uart framing                                              | F                      |
| 222            | Front panel uart parity                                               | F                      |
| 223            | Front panel buffer overrun                                            | F                      |
| 224            | Front panel timeout                                                   | F                      |
| 401            | CAL switch prevents calibration                                       | H                      |
| 402            | CAL password is incorrect                                             | H                      |
| 403            | CAL not enabled                                                       | J                      |
| 404            | Computed readback cal constants are incorrect                         | J                      |
| 405            | Computed programming cal constants are incorrect                      | J                      |
| 406            | Incorrect sequence of calibration commands                            | J                      |
| 600            | Systems in mode:list have different list lengths                      | K                      |
| 601            | Requested voltage and waveform exceeds peak voltage capability        | K                      |
| 602            | Requested voltage and waveform exceeds transformer volt-second rating | K                      |
| 603            | Command only applies to RS-232 interface                              | K                      |
| 604            | Trigger received before requested number of pre-trigger readings      | K                      |
| 605            | Requested RMS current too high for voltage range                      | K                      |
| 606            | Waveform data not defined                                             | K                      |
| 607            | VOLT, VOLT:SLEW, and FUNC:SHAP modes incompatible                     | K                      |
| 608            | Measurement overrange                                                 | K                      |
| 609            | Output buffer overrun                                                 | K                      |
| 610            | Command cannot be given with present SYST:CONF setting                | K                      |

- E Communication error between A1 GPIB, A8 DSP and/or A11 trigger assemblies.
- F Communication error between A3 front panel, A8 DSP and /or A11 Trigger assemblies.
- G RS-232 communication or programming error.
- H Check CAL switch positions (see Figure 4-11).
- J See Appendix B in User's Guide for calibration procedure.
- K Programming error (see applicable programming command in Programming Guide).

## Overall Troubleshooting Flowchart

Figure 4-1 gives the overall procedures to isolate a fault to a circuit board or particular circuit. See Figure 6-1 for the location of the circuit boards.

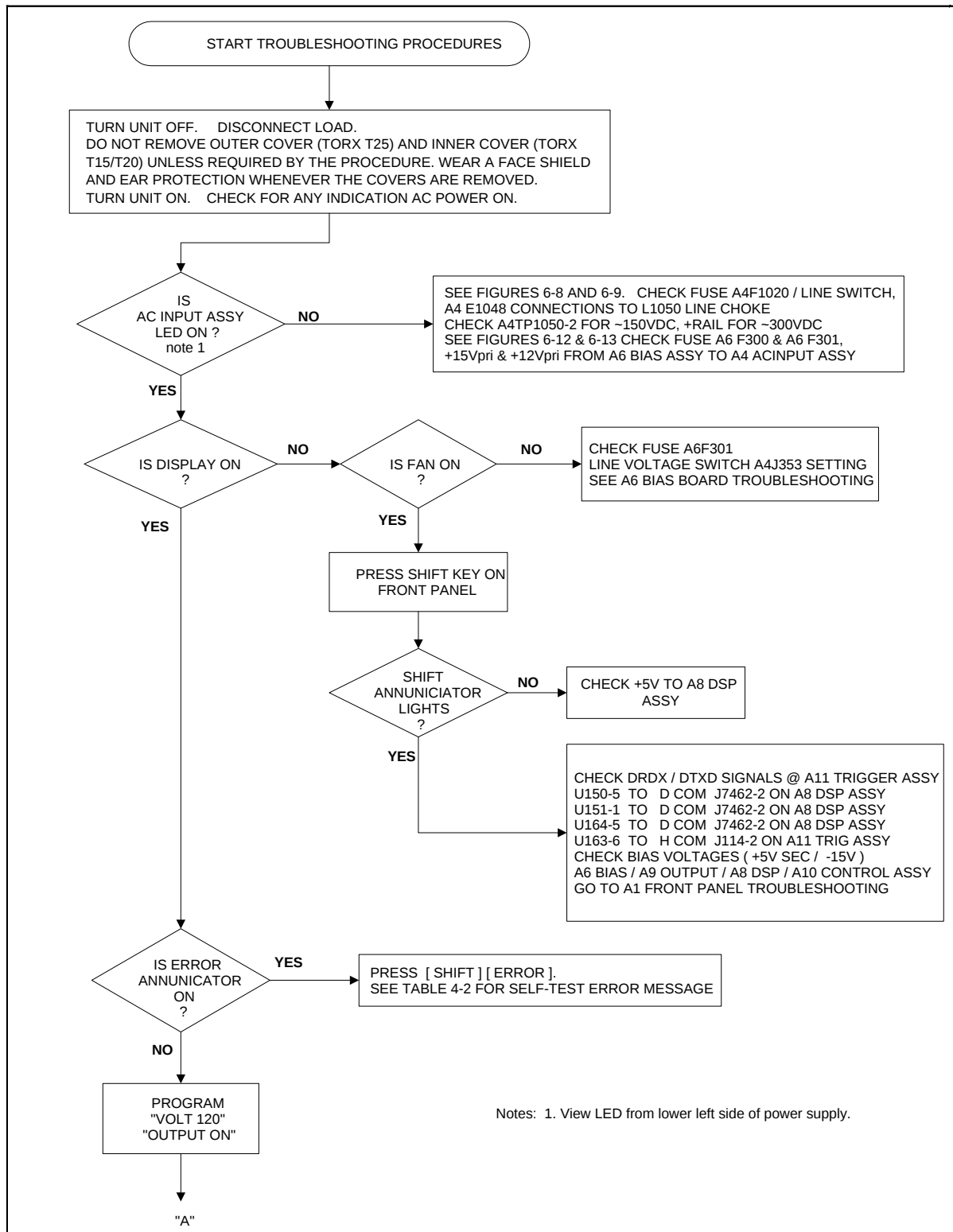


Figure 4-1. Overall Troubleshooting Procedures (sheet 1 of 2)

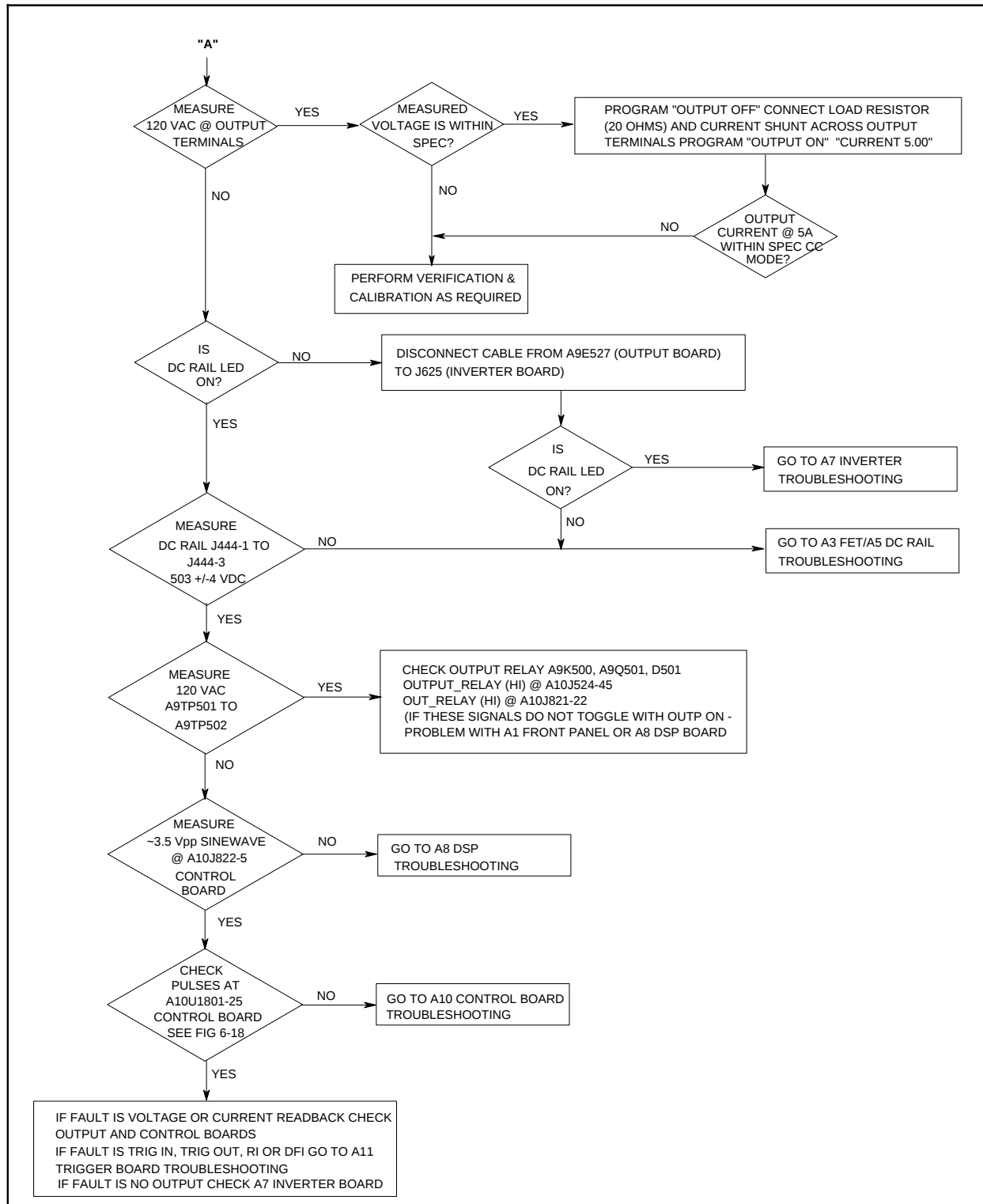


Figure 4-1. Overall Troubleshooting Procedures (sheet 2 of 2)

## A1 Front Panel Assembly Troubleshooting

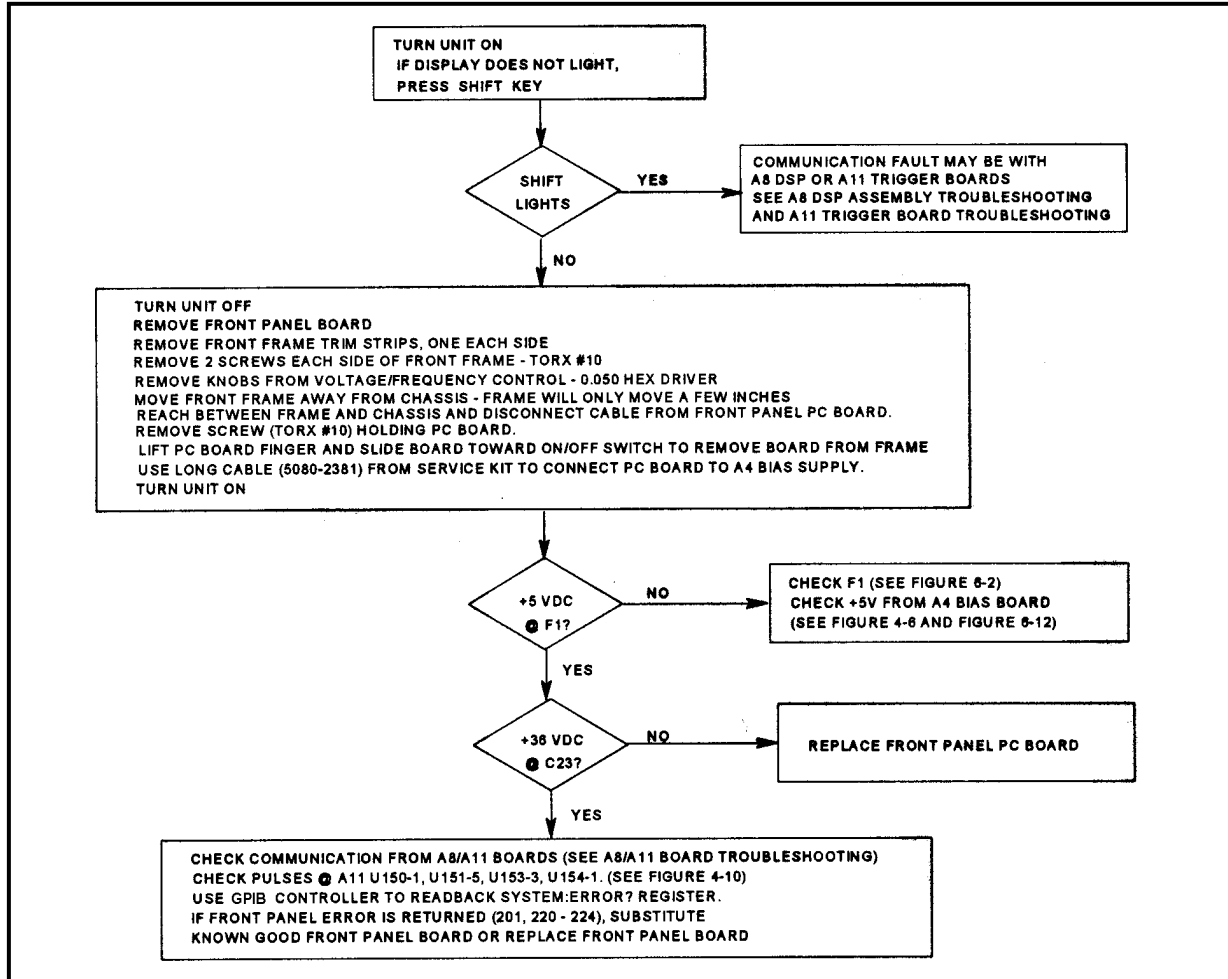


Figure 4-2. Front Panel Assembly Troubleshooting

## A2 GPIB/RS-232 Board Troubleshooting

**WARNING:** Disable the 500 Vdc rail by disconnecting cable 5080-2365 from A5-J400. Then connect a jumper from A5-J445-4 to A5-J445-10. This disables the RAIL\_LOW\_FAULT signal. Also place an insulator over the A5 DC Rail board.

Table 4-4. GPIB/RS232 Board Troubleshooting

| Step | Procedure                                                                                                                                              | Waveform                                                                                                                                                                                                 |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.   | Check for +5 Vdc at L100 (see Figure 6-5 for location).                                                                                                | <div style="display: flex; justify-content: space-around;"> <span>2.00 V/div</span> <span>50.0 ns/div</span> <span>-250.0 ns</span> </div> <div style="text-align: center;"> <p>HP-IB CRYSTAL</p> </div> |
| 2.   | Check for clock waveform at Y100.                                                                                                                      |                                                                                                                                                                                                          |
| 3.   | Connect the unit to a GPIB or RS232 controller to check the GPIB/RS232 transceivers. Note that GPIB and RS232 use separate communication transceivers. |                                                                                                                                                                                                          |

## A3 FET Board Troubleshooting

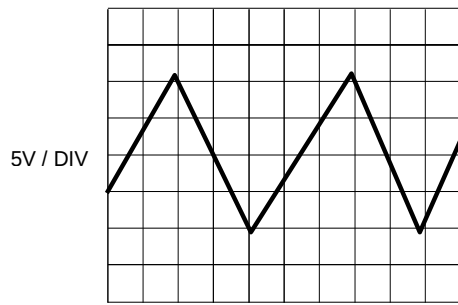
Because test points on the FET board are not accessible when the board is installed, troubleshooting must be performed with the board removed from the power supply. Troubleshooting procedures are provided with both power removed and power applied. The location of different test points are shown by encircled numbers on the A3 FET Board schematic and component location diagrams.

**NOTE:** Earlier ac source models used through-hole FET assemblies. Updated surface-mount FET assemblies (refer to the parts list) are the recommended replacement part for all previous version FET assemblies. The surface-mount FET assemblies are **not** component-level repairable.

**Table 4-5. FET Board Troubleshooting**

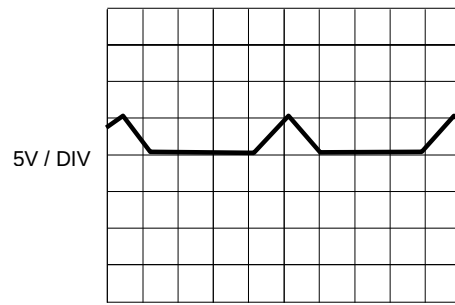
| Step                                                        | Procedure                                                                                                                                                                                                                                                                                                                                                                                                  | Result                                                                                                                |
|-------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| <b>With all power removed</b>                               |                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                       |
| 1                                                           | Turn the power supply off and remove the A3 FET board with its heatsink assembly attached (see Disassembly Procedures).                                                                                                                                                                                                                                                                                    | See Disassembly Procedures                                                                                            |
| 2                                                           | Measure the resistance between the +Rail (E502) and the - Rail (E501) and common (-Rail).                                                                                                                                                                                                                                                                                                                  | Value should be >20 MΩ                                                                                                |
| 3                                                           | Measure the resistance between the gate of each FET (Q201-204, Q211, Q222, Q233, and Q244) and common (-Rail).                                                                                                                                                                                                                                                                                             | Value should be >15 kΩ                                                                                                |
| 4                                                           | Measure the resistance across capacitor C201.                                                                                                                                                                                                                                                                                                                                                              | Value should be approx. 150Ω                                                                                          |
| 5                                                           | Measure the resistance across the 15 V bias input (E506 to E507).                                                                                                                                                                                                                                                                                                                                          | Value should be approx. 1 kΩ in the forward direction and 490Ω reversed.                                              |
| <b>With signal from external waveform generator applied</b> |                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                       |
| 6                                                           | Short the collectors of Q251 and Q252 by connecting the collector (case) of each transistor to common (E507).                                                                                                                                                                                                                                                                                              |                                                                                                                       |
| 8                                                           | Connect a waveform generator to J200-1 and J200-2.                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                       |
| 9                                                           | Set generator to produce a 20kHz, 20Vp-p triangular waveform.                                                                                                                                                                                                                                                                                                                                              | See Figure 4-3A.                                                                                                      |
| 10                                                          | Connect 15 V from an external supply to E506 (positive) and E507 (common).<br><b>Note:</b> All of the following measurements are taken with respect to E507 common (same as TP 26 on A3 FET Board).                                                                                                                                                                                                        | Value should be approx. 1 kΩ in the forward direction and 490Ω reversed.                                              |
| 11                                                          | Check bias voltage at U203-1 (TP 27).                                                                                                                                                                                                                                                                                                                                                                      | +5V                                                                                                                   |
| 12                                                          | While adjusting the external 15 V supply input, check the bias trip point at U204-1 (TP 28).                                                                                                                                                                                                                                                                                                               | Voltage goes from low of 0V to high of 5V at an input of approx. 12V, and from high to low at an input of approx. 13V |
| 13                                                          | Set external supply input to + 15V and check drive 1 waveform at U201-10 (TP 29), and drive 2 waveform at U201-12 (TP 30).                                                                                                                                                                                                                                                                                 | See Figure 4-3B.                                                                                                      |
| 14                                                          | Check that pulses are present at U201-1(TP 31), U201-7 (TP 32), U202-1 (TP 33), and U202-7 (TP 34)                                                                                                                                                                                                                                                                                                         | See Figure 4-3C.                                                                                                      |
| 15                                                          | Pulses should be present on both sides of inductors L201-204 and L213-216 as follows:<br>Check the pulses on the driver transistor side (Q251-Q254) of each inductor.<br>Check the pulses on the FET regulator side (Q201-Q204, Q211,Q222, Q233, and Q244) of each inductor.<br>If the waveforms do not have the fast step as shown in Figure 4-3, then the associated FET gate input has an open circuit. | See Figure 4-3D.<br><br>See Figure 4-3E.                                                                              |
| 16                                                          | Measure the VREF voltage at U204-4 (TP 35).                                                                                                                                                                                                                                                                                                                                                                | approx. 1.7 V.                                                                                                        |
| 17                                                          | Check the peak current limit by connecting a 68 kΩ resistor from +5 V (U201-9) to U204-5.                                                                                                                                                                                                                                                                                                                  | All pulses turned off.                                                                                                |

## 4 - Troubleshooting



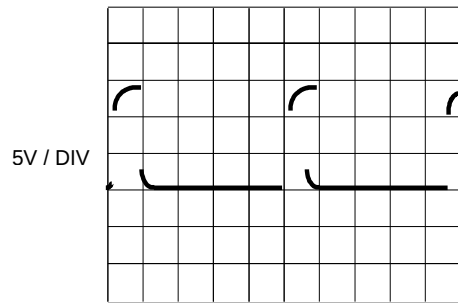
10 uS / DIV

A. J200 TEST SIGNAL FROM  
SIGNAL GENERATOR



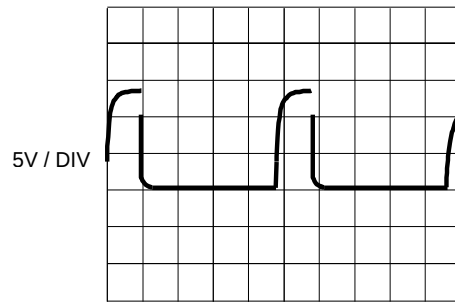
10 uS / DIV

B. U201/U202 PINS 10, 12  
DRIVE SIGNAL



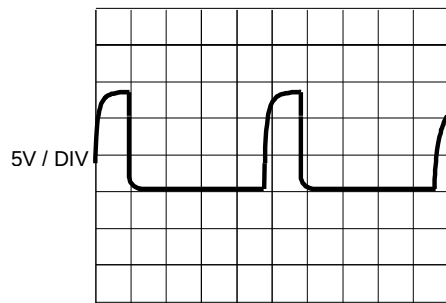
10 uS / DIV

C. U201/202 PINS 1, 7  
DRIVE SIGNAL



10 uS / DIV

D. L201-L204, L213-216  
DRIVE SIDE



10 uS / DIV

E. L201-L203, L213-L216  
REGULATOR SIDE

## A5 DC Rail Assembly Troubleshooting

**WARNING:** This board contains hazardous voltages during some troubleshooting procedures.

Use extreme caution.

When covers are removed, always wear a face shield and ear protection when powering up this instrument. Only repair units in a controlled area with no unprotected personnel present.

Before troubleshooting the A5 DC Rail board, refer to the previous procedure and determine that the A3 AC FET Assembly is good. The 503 Vdc rail (+/-4Vdc) is generated from the 300 Vac input board rail, the A3 FET board, and the power transformer. The A5 DC Rail board contains the PWM and CV error amplifiers for controlling the FET switches. Troubleshooting the bias, PWM, and CU error amplifiers must be done with the 300 Vdc rail disconnected from the A3 FET assembly.

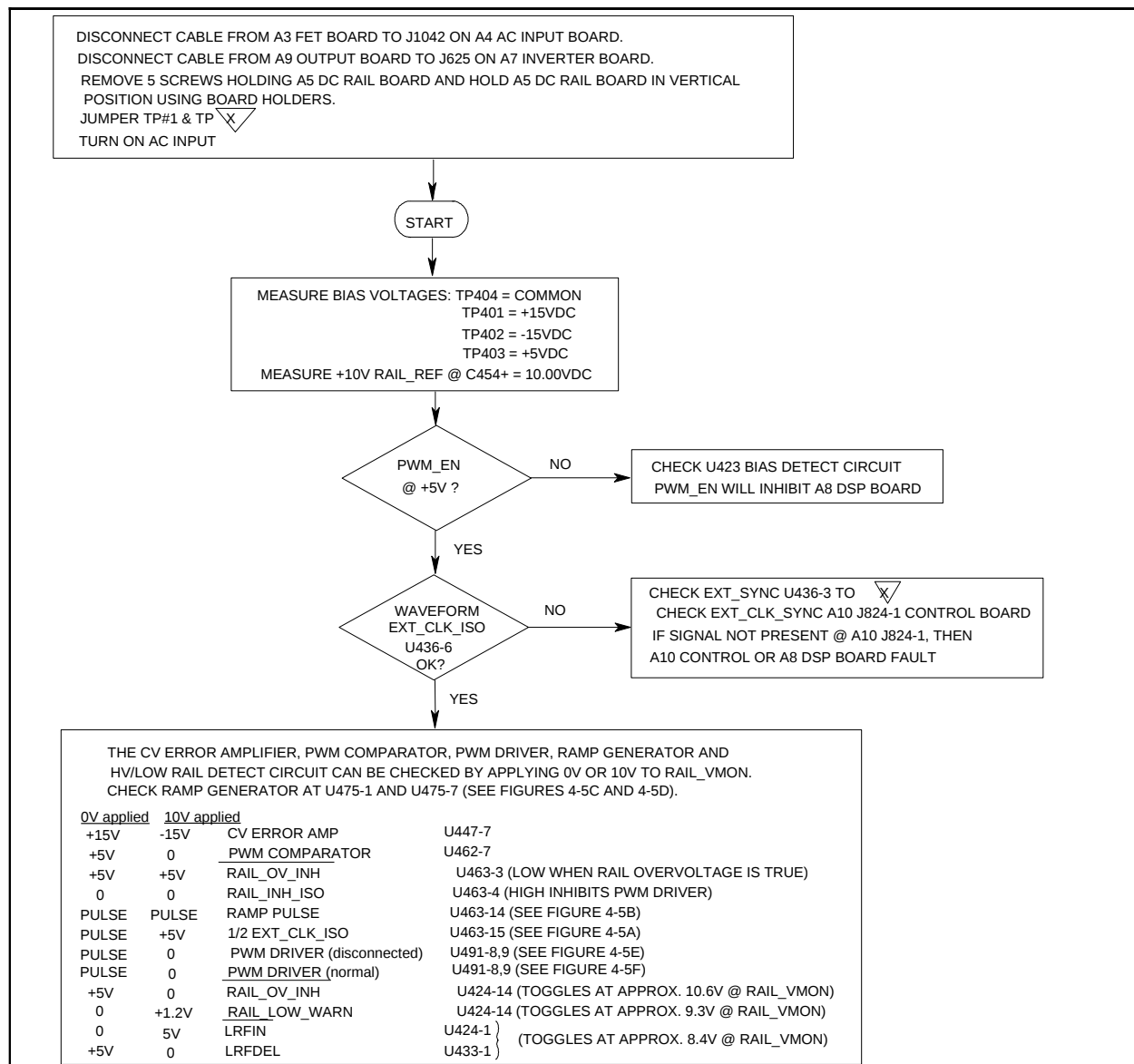
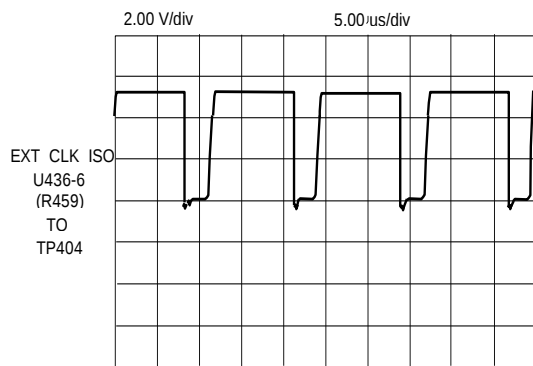
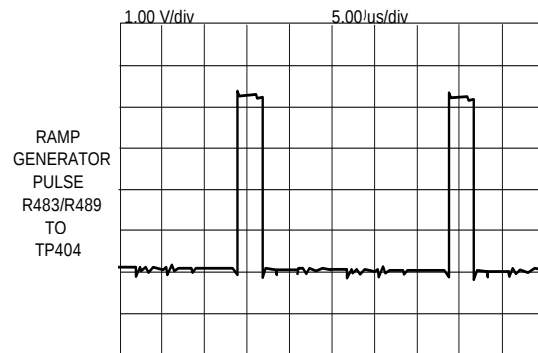


Figure 4-4. DC Rail Assembly Troubleshooting



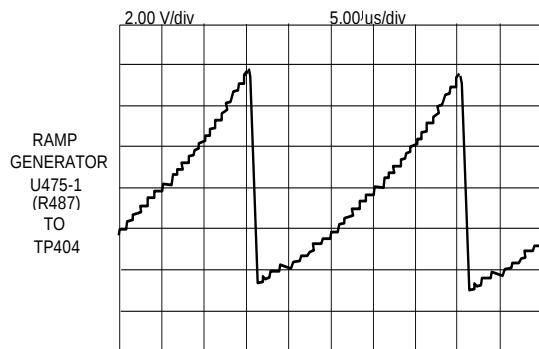
83 kHz EXTERNAL CLOCK

**A**



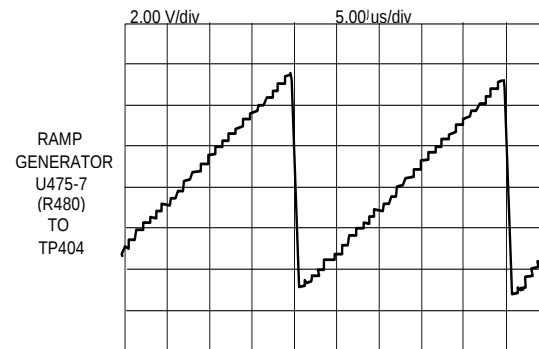
RAMP PULSE

**B**



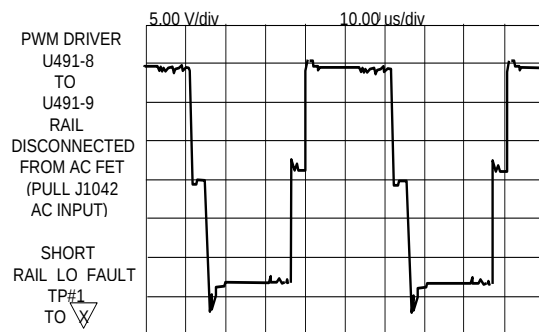
RAMP GENERATOR NO. 2

**C**



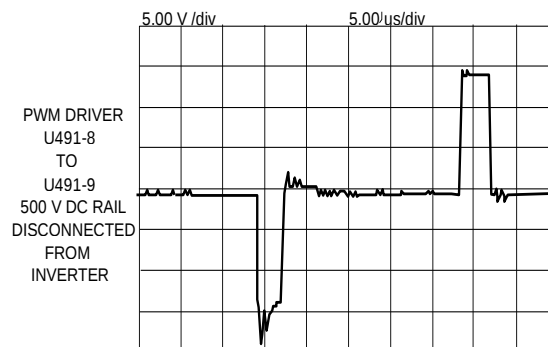
RAMP GENERATOR NO. 1

**D**



PWM DRIVER - AC FET RAIL DISCONNECTED

**E**



PWM DRIVER - NORMAL OPERATION

**F**

## A6 Bias Assembly Troubleshooting

Checking the A6 Bias Assembly consists of checking the bias voltages and the fan speed control circuit.

**WARNING:** Disable the 500 Vdc rail by disconnecting cable 5080-2365 from A5-J400. Then connect a jumper from A5-J445-4 to A5-J445-10. This disables the RAIL\_LOW\_FAULT signal. Also place an insulator over the DC Rail board.

**NOTE:** You can determine if any of the bias voltage regulators are operating in current limit mode by disconnecting the cable going to the circuit where the bias is used. If the bias voltage returns to normal with the cable disconnected, most likely the bias circuit is OK.

**Table 4-6. Bias Assembly Troubleshooting**

| Step | Procedure                                                                                                                                                                                                                                                                                                                                                                                          | Result                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | Check F301                                                                                                                                                                                                                                                                                                                                                                                         | If open, replace fuse. If fuse blows again, troubleshoot the bias circuits.                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 2    | Check the bias voltages at the following locations. Measure at the indicated points:<br><u>Test point</u> <u>Common point</u><br>C314+ and C302- (P)<br>C304+ and C302- (P)<br>C313+ and C317- (H)<br>U312 tab and C317- (H)<br>U311 tab and C317- (H)<br>U322 tab and C329+ (Y)<br>C331 tab and C329+ (Y)<br>E346-2 and D322 (F)<br>E346-1 and D322 (F)<br>E336-2 and E336-3<br>E336-1 and E336-3 | +12 Vdc (+12V PRI to A4 Input board)<br>+15 Vdc (+15V PRI to A3 FET board)<br>+12 to 15 Vdc (+5V UNREG to U311, U312)<br>+5 Vdc (+5VDC to A1 Front Panel)<br>+5 Vdc (+5V DC to A2 GPIB board)<br>+15 Vdc (+15VSEC to A8 DSP, A9 Output, A10 Control boards)<br>-15 Vdc (-15VSEC to A8 DSP, A9 Output, A10 Control boards)<br>+25 to 30 Vdc (+25 V UNREG to A7 Inverter, A8 DSP boards)<br>+5 V (+5 V SEC to A7 Inverter, A8 DSP boards)<br>~22 Vac (~22Vac to dc rail bias regulator)<br>~44 Vac (~44Vac to dc rail bias regulator) |
| 3    | Check the fan speed supply by measuring the voltage at:<br><u>Test point</u> <u>Common point</u><br>C361+ and D322 (F)                                                                                                                                                                                                                                                                             | 4.7 Vdc (in AUTO mode)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 3    | Change the fan speed and check for the correct voltage as follows:<br>Press <b>0</b> and <b>9</b> simultaneously.<br>Press <b>▲</b> twice, <b>↑</b> once, and <b>ENTER</b><br>Press <b>0</b> and <b>9</b> simultaneously.<br>Press <b>▲</b> once.<br>Enter a fan speed, then <b>ENTER</b>                                                                                                          | EE INIT <model><br>FAN:MODE MAN<br>EE INIT <model><br>FAN:SPEED <n><br>10 = 5.7 Vdc<br>50 = 9.6 Vdc<br>100 = 14.6 Vdc                                                                                                                                                                                                                                                                                                                                                                                                               |
| 4    | After the fan speed test, enter the following command:<br><b>SHIFT OUTPUT ▼ ENTER</b><br>This restores the fan speed to automatic mode.                                                                                                                                                                                                                                                            | *RST                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

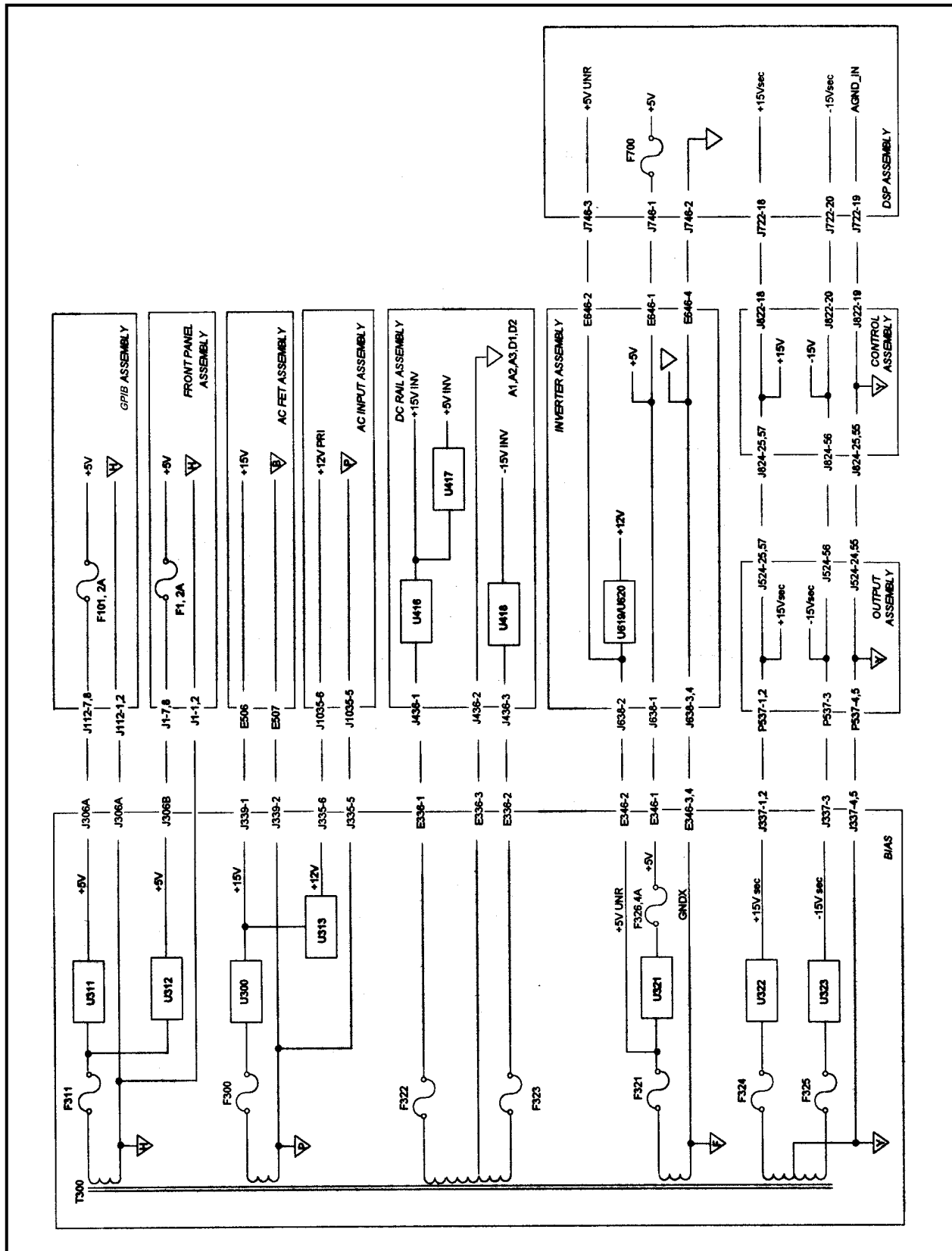


Figure 4-6. Bias Assembly Voltage Distribution

## A7 Inverter Assembly Troubleshooting

**WARNING:** *SHOCK HAZARD, EQUIPMENT DAMAGE, PERSONAL INJURY*

Failure to first follow the slow-start procedure after replacing the A7 inverter board may result in catastrophic component damage when powering up the instrument.

When covers are removed, always wear a face shield and ear protection when powering up this instrument. Only repair units in a controlled area with no unprotected personnel present.

**NOTE:** Earlier ac source models used a through-hole inverter assembly. An updated surface-mount inverter assembly (refer to the parts list) is the recommended replacement part for all previous version ac source inverter assemblies. The surface-mount inverter assembly is **not** component-level repairable.

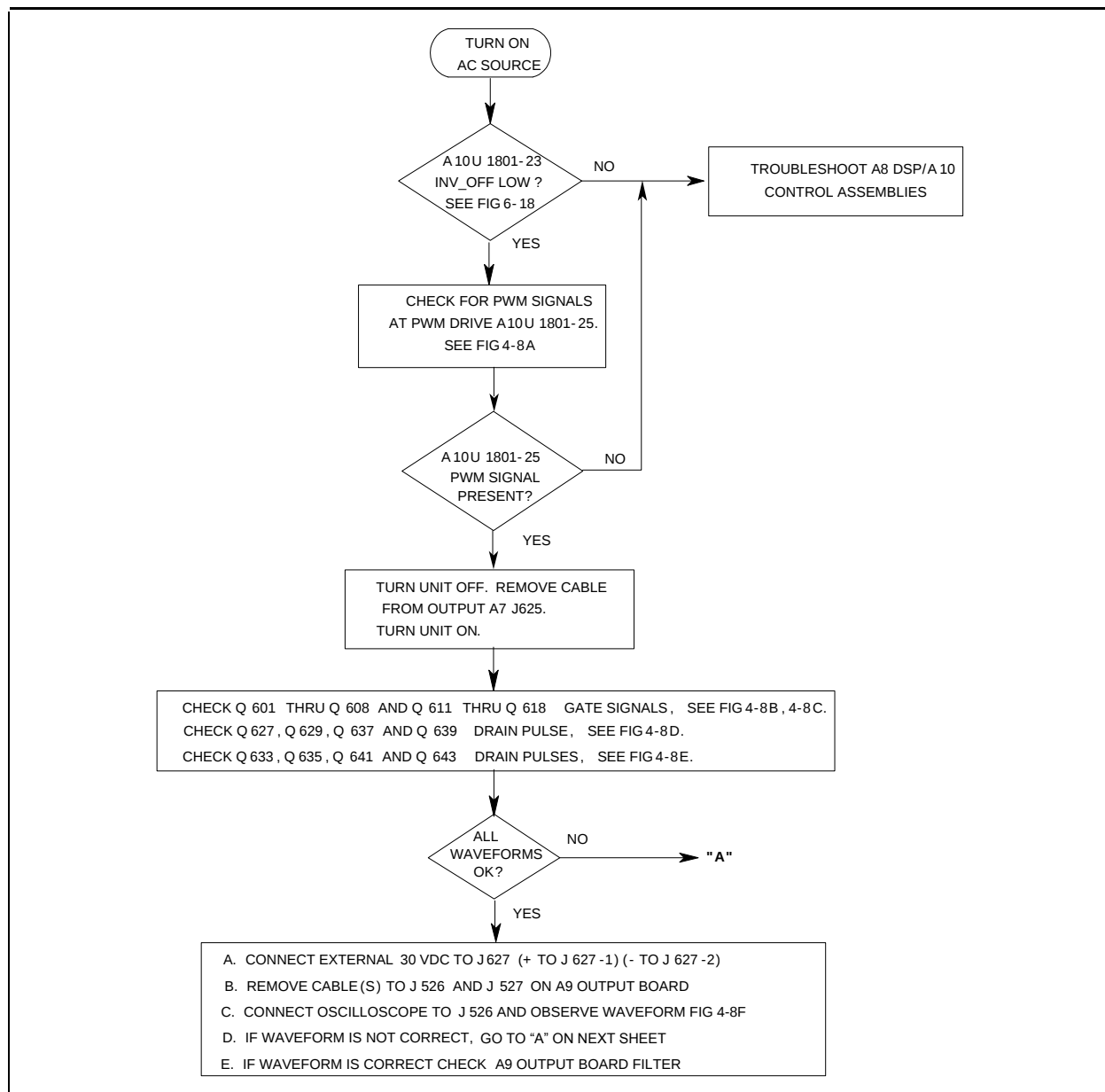
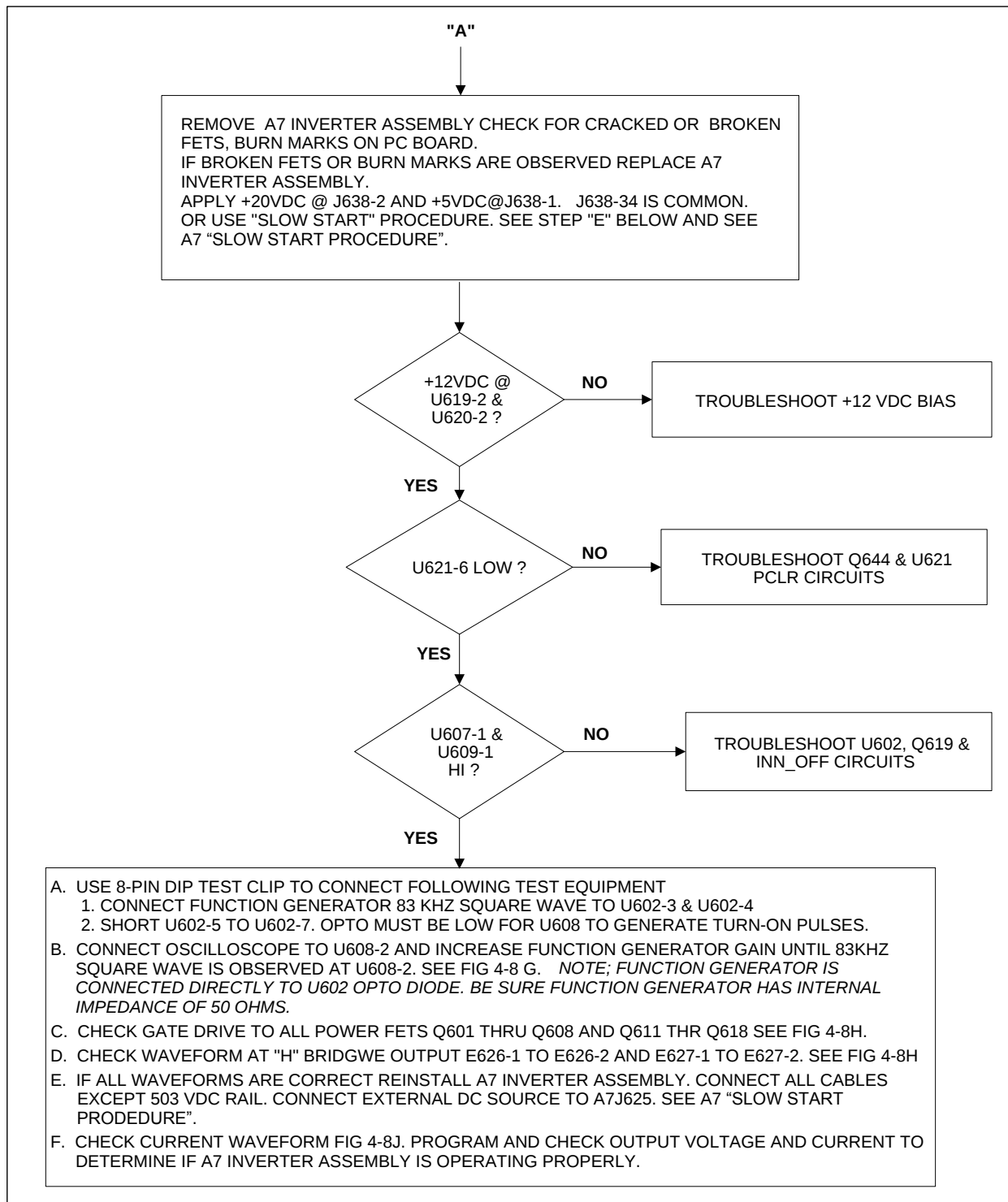


Figure 4-7. Inverter Assembly Troubleshooting (sheet 1 of 2)

## 4 - Troubleshooting

**NOTE:** The procedure below references the Slow Start Procedure. This procedure should be used whenever the A7 Inverter board is replaced to prevent destruction of the replacement inverter assembly if the original cause of the failure did not originate on the A7 inverter assembly.



**Figure 4-7. Inverter Assembly Troubleshooting (sheet 2 of 2)**

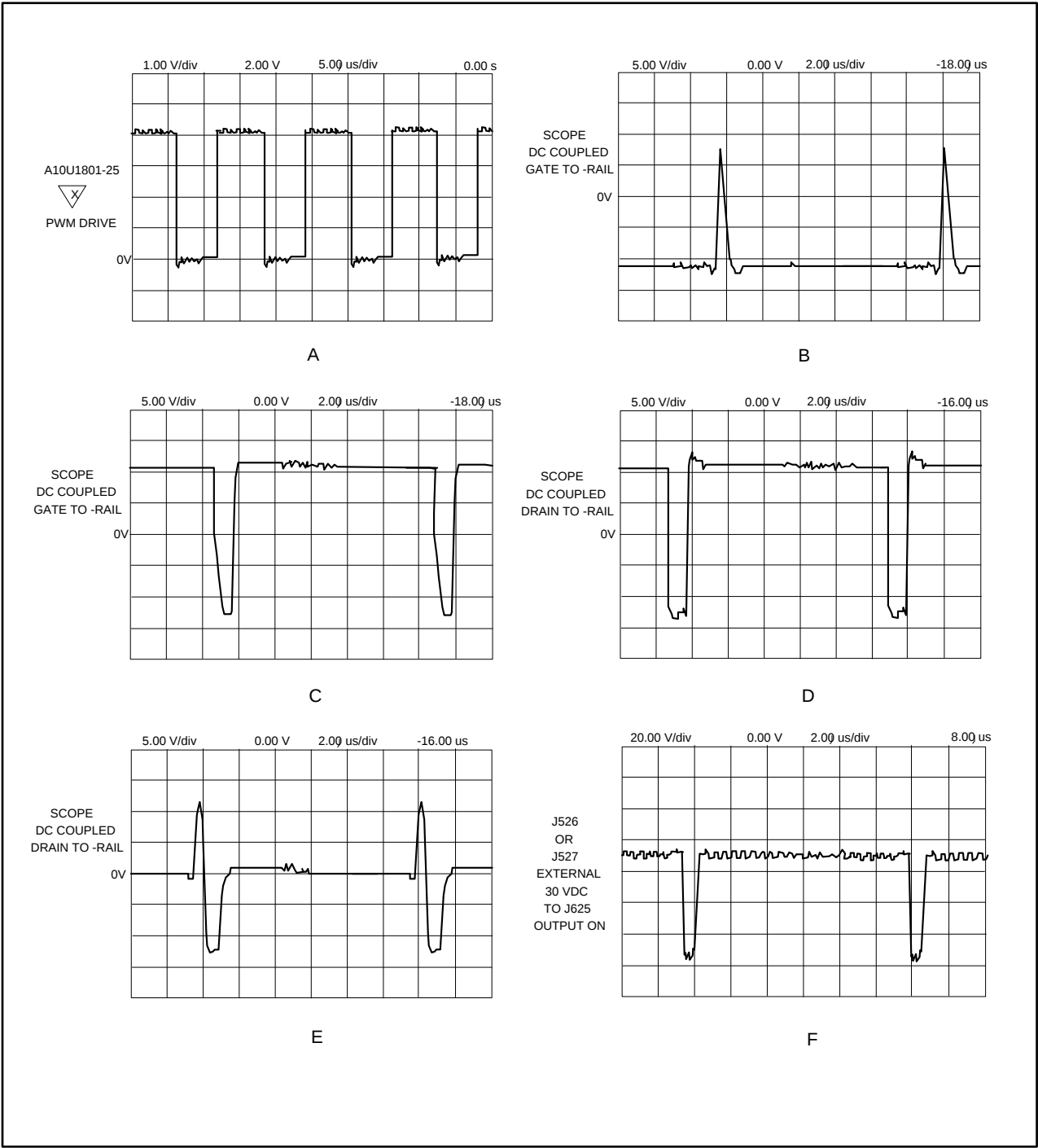


Figure 4-8. Inverter Assembly - Test Waveforms (sheet 1 of 2)

4 - Troubleshooting

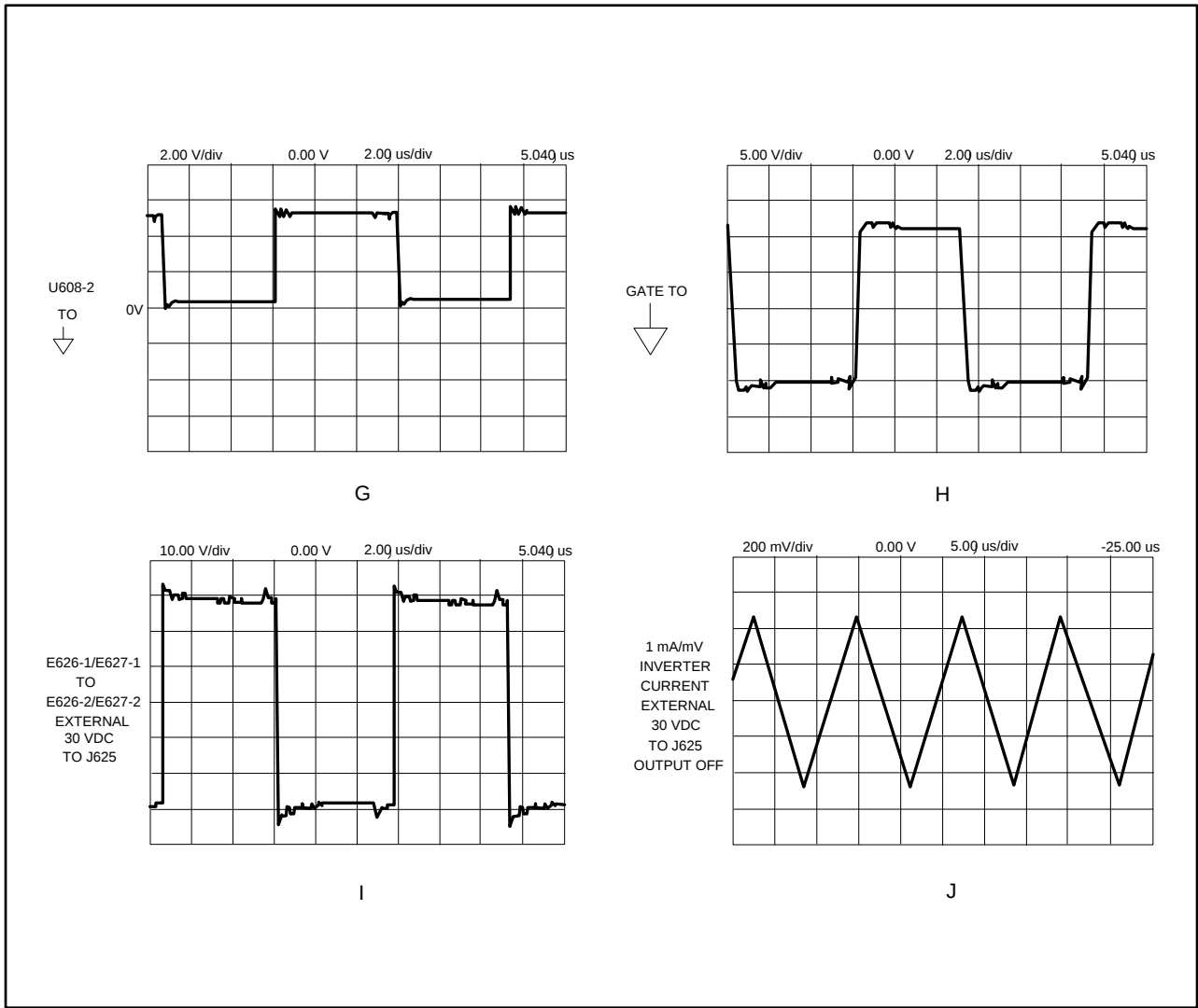


Figure 4-8. Inverter Assembly - Test Waveforms (sheet 2 of 2)

## Slow-Start Procedure

---

**WARNING:** ***SHOCK HAZARD, EQUIPMENT DAMAGE, PERSONAL INJURY***

**Failure to first follow the slow-start procedure after replacing the A7 inverter board may result in catastrophic component damage when powering up the instrument.**

When covers are removed, always wear a face shield and ear protection when powering up this instrument. Only repair units in a controlled area with no unprotected personnel present.

---

The A7 *Slow-Start* troubleshooting procedure allows testing the A7 inverter assembly and A10 control assembly voltage and current loops using an external DC power supply in place of the AC source 500 Vdc rail. Service Kit 5063-2330 will be required to perform both procedures.

1. Turn off the UUT (AC source ) and remove cable 5080-2698 from A7-J625. This cable disconnects the 500 Vdc rail from the A7 Inverter assembly.

---

**WARNING:** ***SHOCK HAZARD. Unless you perform step #2, the 500 Vdc rail will still be present on the A5 dc rail assembly during the slow-start procedure.***


---

2. To disable the 500 Vdc rail during the following tests, disconnect cable 5080-2365 from A5-J400. This will remove the PWM drive to the A3 AC FET assembly and disable the 500 Vdc rail. Then connect a jumper from A5-J445-4 to A5-J445-10. This disables the RAIL\_LOW\_FAULT signal and allows the DSP assembly to function.
3. Use the extender board from the service kit and raise the A8 DSP and A10 Control assemblies from the unit. Verify that the A8 and A10 assemblies are functioning properly. Refer to the A8 DSP and A10 Control assembly troubleshooting procedures.
4. If the A8 DSP and A10 Control assemblies check good, turn off the unit and re-install the A8 and A10 assemblies in the unit.
5. Using cable 5080-2381 (remove from defective A7 PCA. Or order this cable), connect an external ( 60V/2A minimum ) DC power supply to the A7 Inverter assembly A7-J625.
6. Turn on the unit and DC power supply.
7. Set the external DC supply for 0 volts and 2 amps current limit.
8. Slowly increase the external DC supply voltage to 60 Vdc observing the current from the external supply. The external supply should go to 60 Vdc with only 200 to 300 milliamperes current from the external supply. If the current raises immediately check for shorted FETs on the A7 Inverter assembly.
9. Connect an oscilloscope to the unit's output terminal block. Enable the output. Using the front panel knob, increase the output voltage while observing the oscilloscope. A harmonic free sine wave should appear on the oscilloscope until the output voltage reaches approximately 30-35 volts. At this time the sine wave will develop a flat top. This test verifies the voltage control loop.
10. Disable the output and connect a load resistor ( 20 ohms ) capable of sinking 1.5 to 2 amps to the output terminals of the unit.
11. Enable the output and set CURR:LEV to 1 amp. The unit should current limit at 1 ampere and the CC annunciator should come on. The response of the RMS ( CURR:LEV ) loop is slow so you will have to wait a moment. Set the CURR:LEV to 3 amps and set CURR:PEAK to 1 amp. Both the CV and CC annunciators should come on. These tests verify both the RMS and PEAK current loops.
12. If the A7 Inverter assembly passes the above tests, the voltage and current PWM loops are functioning properly. If the A7 assembly fails when the internal 500 Vdc rail is applied it may be due to high voltage breakdown on either FETs or capacitors on the A7 assembly or the A9 output assembly.

## A8 DSP and A10 Control Assembly Troubleshooting

**WARNING:** These assemblies contain hazardous voltages during some troubleshooting procedures. Use extreme caution.  
Disconnect the 500V dc rail between the A9 Output board and the A7 Inverter board by disconnecting the cable from J625. Also place an insulator over the DC Rail board.

**NOTE:** To troubleshoot the A8 DSP board and the A10 Control board, it is recommended to use the extender board from Service Kit 5063-2330. The extender raises the A8 and A10 boards from the unit to access the J822/J722 and the J864 connectors.

Table 4-7 lists the general troubleshooting procedure. All analog voltage levels or digital signals can be generated using the front panel keypad. Use an oscilloscope to easily distinguish the ac rms measurements from the dc measurements. Tables 4-8 and 4-9 describe the expected input/output signals between the DSP and the Control boards.

**Table 4-7. DSP/Control Assembly Troubleshooting**

| Step                                                                                         | Procedure                                                                                                                                                                                                                                               | Result                                                                                                                                                                                                                                                                                                                               |
|----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>With the cable to J625 disconnected</b>                                                   |                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                      |
| 1                                                                                            | To check the J822 analog voltages, enter the following commands from the front panel:<br><b>VOLTAGE VOLT 300 ENTER      OUTPUT ON</b>                                                                                                                   | J822-31 -3.8 Vdc      J822-32 -0.8 Vdc<br>J822-23 +1.0 Vac      J822-22 +5.0 Vdc<br>J822-15 -4.0 Vdc      J822-20 -15.0 Vdc<br>J822-13 +6.0 Vdc      J822-18 +15.0 Vdc<br>J822-9 -2.5 Vdc      J822-16 -1.5 Vdc<br>J822-5 +3.0 Vac      J822-12 -5.0 Vdc<br>J822-1 0 Vac      J822-10 +6.0 Vdc<br>J822-8 +5.0 Vdc<br>J822-6 +6.0 Vdc |
| 2                                                                                            | To check the J822 offset voltages, enter the following commands from the front panel:<br><b>SHIFT OUTPUT OUTP:COUP DC ENTER</b><br><b>VOLTAGE OFFSET 425 ENTER      OUTPUT ON</b><br><b>VOLTAGE OFFSET -425 ENTER</b><br><b>SHIFT OUTPUT *RST ENTER</b> | J822-9 -4.6 Vdc (for +425 Vout)<br>J822-9 near 0 V (for -425 Vout)                                                                                                                                                                                                                                                                   |
| <b>With the cable to J625 connected so that the ac source can output voltage and current</b> |                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                      |
| 3                                                                                            | Enter the following commands from the front panel:<br><b>VOLTAGE VOLT 300 ENTER      OUTPUT ON</b><br><b>VOLTAGE ALC:DET RMS ENTER</b><br><b>VOLTAGE VOLT 0 ENTER</b><br><b>SHIFT OUTPUT *RST ENTER</b>                                                 | J822-1 3 Vac<br>J822-12 -3.0 Vdc<br>J822-12 near 0 V                                                                                                                                                                                                                                                                                 |
| <b>With a short across the output terminals</b>                                              |                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                      |
| 4                                                                                            | Enter the following commands from the front panel:<br><b>VOLTAGE VOLT 5 ENTER      OUTPUT ON</b><br><b>SHIFT CURRENT CURR:LEV 4 ENTER</b><br><b>SHIFT OUTPUT *RST ENTER</b><br>Remove the short from across the output terminals                        | J822-3 -0.75 Vac<br>J822-3 -0.23 Vac                                                                                                                                                                                                                                                                                                 |

**Table 4-8. Voltage Measurements at J822 (viewed from circuit side of A10 control board)**

| range                                      | signal                | pin | pin | signal                   | range                                                   |
|--------------------------------------------|-----------------------|-----|-----|--------------------------|---------------------------------------------------------|
| 5 to 0.02V                                 | waveform trim         | 33  | 34  | Z inductance program     | -0.1 to 2.5V = 20 to 1000 $\mu$ H                       |
| 0.8 to 4.9V ,normally 3.8V                 | HS_MON                | 31  | 32  | fan monitor              | 0.5 to 2V(0 - 100% fan speed)<br>normally 0.7 to 1V     |
| 0V = 0A out; 4.9V = 85A out                | I_MON_RMS             | 29  | 30  | VA monitor               | 0 to 4.98V                                              |
| -2.5 to 2.4V                               | ramp trim             | 27  | 28  | 8-bit DAC common         |                                                         |
|                                            | Z DAC reference       | 25  | 26  | Z resistance program     | 0 to 2.5V = 0 to 1 $\Omega$                             |
| See bias troubleshooting                   | FAN_PROG              | 23  | 24  | DC trim                  | -2.5 to 2.4V                                            |
| -2.5 to 2.5V                               | rms voltage trim      | 21  | 22  | OV program               | 5 to 0.02V = 448 to 2V pk out                           |
|                                            | bias common           | 19  | 20  | -15V bias                |                                                         |
|                                            | rms current common    | 17  | 18  | +15V bias                |                                                         |
| 0V = 0A out; -4.99V = 13A out              | I_RMS_PROG            | 15  | 16  | I_PEAK_PROG              | -4.99Vdc =<br>0 to 40 or 80Apeak out                    |
| 0 to 5V                                    | rms voltage modu      | 13  | 14  | rms voltage prog. common |                                                         |
|                                            | DC program common     | 11  | 12  | V_RMS_PROG               | 0V = 0V out; -3V = 300V out<br>ALC:RTIME = always -4.9V |
| -4.99 to 0V =<br>-425V to +425V out        | WFDC_PROG             | 9   | 10  | waveform DC modu         | 0 to 5V                                                 |
|                                            | waveform ampl. common | 7   | 8   | waveform DC offset       | 0 to 5V                                                 |
| 0V = 0V out; 3V = 300V out                 | WFAC_PROG             | 5   | 6   | waveform ac modu         | 0 to 5V                                                 |
| -5 to 4.99V ac/dc =<br>full current output | current monitor       | 3   | 4   | current monitor common   |                                                         |
| -5 to 4.99V ac/dc =<br>+/-425Vdc or 300Vac | voltage monitor       | 1   | 2   | voltage monitor common   |                                                         |

## 4 - Troubleshooting

**Table 4-9. Voltage Measurements at J821 (viewed from circuit side of A10 control board)**

| range                          | signal               | pin | pin | signal                   | range                                             |
|--------------------------------|----------------------|-----|-----|--------------------------|---------------------------------------------------|
| hi                             | SUB_A2               | 33  | 34  | DDS down                 |                                                   |
| hi                             | SUB_A0               | 31  | 32  | SUB_A1                   | normally hi                                       |
|                                | +5 volt bias         | 29  | 30  | digital common (D10 & X) |                                                   |
| normally hi; low true          | RESET                | 27  | 28  | INPUT_RELAY              | 1.5V @ 10 seconds after power-on                  |
| normally low                   | SUB_ENB              | 25  | 26  | PCLR                     | normally hi; low true                             |
| ALC:INT = low;<br>ALC:EXT = hi | SENSE_RELAY          | 23  | 24  | SUB_D                    | normally low                                      |
|                                | +5 volt bias         | 21  | 22  | OUTPUT_RELAY             | output enabled = 4.95 V<br>output disabled = 2 mV |
| normally hi; low true          | INHIBIT              | 19  | 20  | PROT_CLEAR               | pulses hi @ PROT CLEAR                            |
| normally low; hi true          | RAIL_INHIBIT         | 17  | 18  | IPCL_Test                |                                                   |
| normally low                   | VA_LIMIT             | 15  | 16  | REG_FAULT                | normally hi                                       |
|                                | digital common (D10) | 13  | 14  | AC_FAULT_MODE            | normally low                                      |
| normally hi; low true          | SOA_FAULT            | 11  | 12  | SPARE_IN                 |                                                   |
| normally low; hi true          | RAIL_LO_FAULT        | 9   | 10  | RAIL_LO_WARN             | not used                                          |
| normally hi; low true          | DIODE_R_PCLR         | 7   | 8   | RAIL_HI_FAULT            | normally low; hi true                             |
|                                | digital common (D10) | 5   | 6   | CV_REALTIME              | RMS = low; RTIME = hi                             |
| hi when CC true                | CL_RMS               | 3   | 4   | CL_PEAK                  | normally high;<br>pulsing low true                |
| normally low; hi true          | OVP_FAULT            | 1   | 2   | CV_LEVELING              | RMS = hi; RTIME = low                             |

# A9 Output/Filter/Relay Assembly Troubleshooting

**WARNING:** These assemblies contain hazardous voltages during some troubleshooting procedures. Use extreme caution. When covers are removed, always wear a face shield and ear protection when powering up this instrument. Only repair units in a controlled area with no unprotected personnel present.

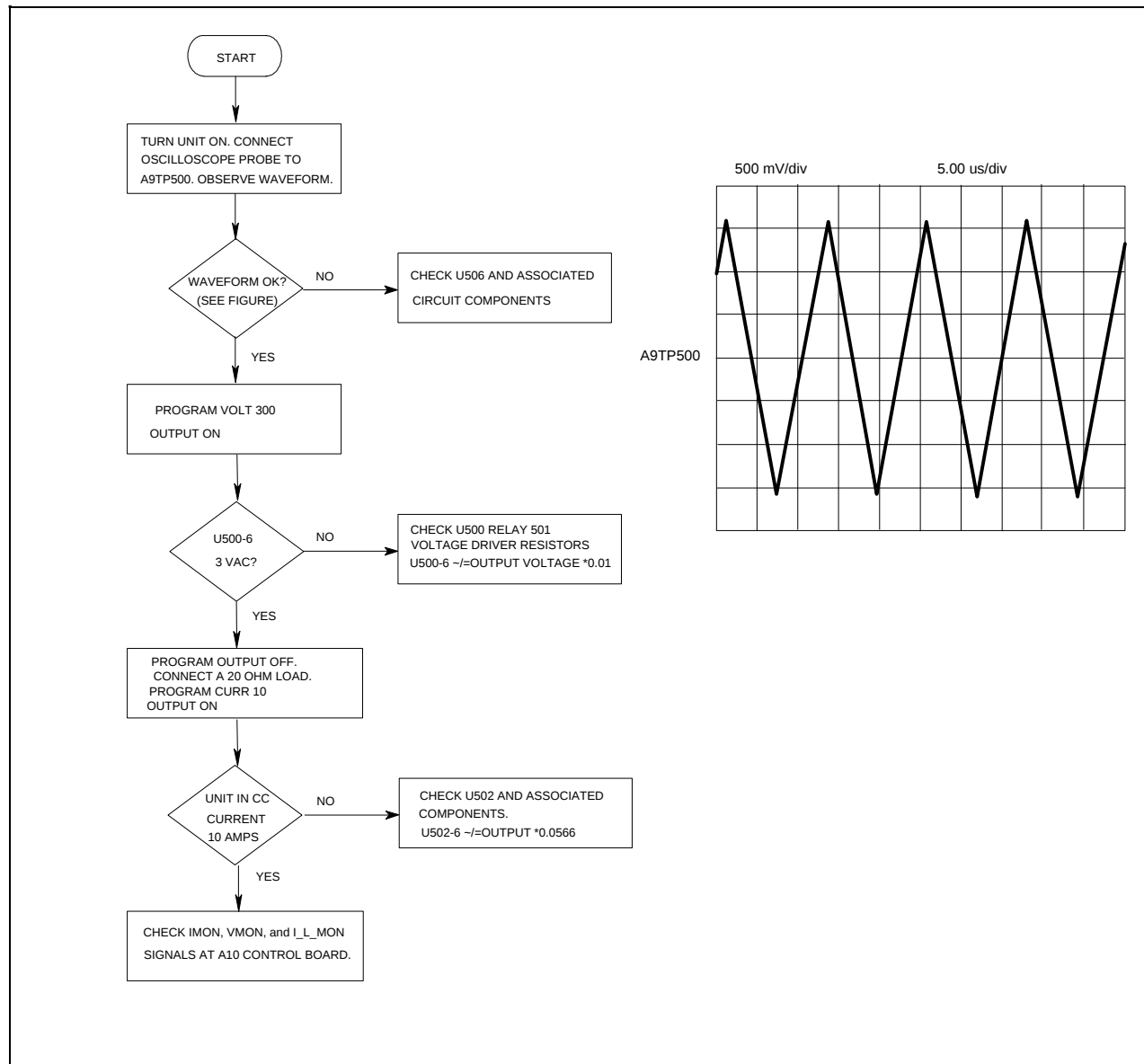


Figure 4-9. Output/Filter/Relay Troubleshooting

## A11 Trigger/BNC Board Troubleshooting

**WARNING:** This board contains hazardous voltages during some troubleshooting procedures. Use extreme caution.  
When covers are removed, always wear a face shield and ear protection when powering up this instrument. Only repair units in a controlled area with no unprotected personnel present.

**Table 4-10. Trigger/BNC Board Troubleshooting**

| Step                                | Procedure                                                                                                                                                                                                                                                             | Result                                                                                                                                                                   |               |                   |     |    |    |     |
|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-------------------|-----|----|----|-----|
| Communications Troubleshooting      |                                                                                                                                                                                                                                                                       |                                                                                                                                                                          |               |                   |     |    |    |     |
| 1.                                  | Turn on unit with no voltage or current programmed, and the output off. Use an oscilloscope and check for pulses at U150-1, U151-5, U153-3, and U154-1.                                                                                                               | See Figure 4-10A, B, C, D. As long as waveforms are similar, communications are OK. A problem exists if waveforms never go high or low.                                  |               |                   |     |    |    |     |
| Trigger Out Troubleshooting         |                                                                                                                                                                                                                                                                       |                                                                                                                                                                          |               |                   |     |    |    |     |
| 1.                                  | Connect an oscilloscope to the Trig Out BNC and enter the following front panel commands:<br><b>SHIFT OUTPUT TTL:STATE ON ENTER</b><br><b>TRIGGER CONTROL INIT:CONT ENTER</b><br>Then enter <b>SHIFT TRIGGER</b> .                                                    | Check for a trigger output pulse every time the <b>SHIFT TRIGGER</b> command is entered (see Figure 4-10E).                                                              |               |                   |     |    |    |     |
| 2.                                  | If no output is observed, trace the signal from the A8 DSP board at:   A11 U165-12<br>A11 U157-12/U165-13<br>A11 U165-12/U164-10<br>A11 U164-11                                                                                                                       | Negative pulse (referenced to H common)<br>Positive pulse (referenced to H common)<br>Positive pulse (referenced to D common)<br>Negative pulse (referenced to D common) |               |                   |     |    |    |     |
| Trigger In Troubleshooting          |                                                                                                                                                                                                                                                                       |                                                                                                                                                                          |               |                   |     |    |    |     |
| 1.                                  | Connect an oscilloscope to the Trig Out BNC and enter the following front panel commands:<br><b>SHIFT OUTPUT TTL:STATE ON ENTER</b><br><b>TRIGGER CONTROL INIT:CONT ENTER</b><br><b>TRIGGER CONTROL TRIG:SOUR EXT ENTER</b><br>Then short the Trig In BNC (pull low). | Check for a trigger output pulse every time the Trig In BNC is shorted (see Figure 4-10E).                                                                               |               |                   |     |    |    |     |
| 2.                                  | If no output is observed, trace the signal from the A8 DSP board at:   A11 U165-12<br>A11 U157-12/U165-13<br>A11 U165-12/U164-10<br>A11 U164-11                                                                                                                       | Negative pulse (referenced to H common)<br>Positive pulse (referenced to H common)<br>Positive pulse (referenced to D common)<br>Negative pulse (referenced to D common) |               |                   |     |    |    |     |
| RI (Remote Inhibit) Troubleshooting |                                                                                                                                                                                                                                                                       |                                                                                                                                                                          |               |                   |     |    |    |     |
| 1.                                  | Enter the following front panel commands:<br><b>VOLTAGE VOLT 100 ENTER OUTPUT ON</b>                                                                                                                                                                                  | 100 Vac at the output terminals                                                                                                                                          |               |                   |     |    |    |     |
| 2.                                  | Short the RI terminals together (J113-3 to J113-4).                                                                                                                                                                                                                   | Ouput goes to 0 Vac; Output relay opens; PROT annunciator comes on                                                                                                       |               |                   |     |    |    |     |
| 3.                                  | If the output does not disable, trace the signal from the A8 DSP board at the following locations:<br>A11 U165-6<br>A11 U161-5                                                                                                                                        | <table><tr><td><u>Normal</u></td><td><u>RI Shorted</u></td></tr><tr><td>LOW</td><td>HI</td></tr><tr><td>HI</td><td>LOW</td></tr></table>                                 | <u>Normal</u> | <u>RI Shorted</u> | LOW | HI | HI | LOW |
| <u>Normal</u>                       | <u>RI Shorted</u>                                                                                                                                                                                                                                                     |                                                                                                                                                                          |               |                   |     |    |    |     |
| LOW                                 | HI                                                                                                                                                                                                                                                                    |                                                                                                                                                                          |               |                   |     |    |    |     |
| HI                                  | LOW                                                                                                                                                                                                                                                                   |                                                                                                                                                                          |               |                   |     |    |    |     |

Table 4-10. Trigger/BNC Board Troubleshooting - continued

| Step                                           | Procedure                                                                                                                                                                      | Result                                                                                                                                         |               |                 |        |     |     |        |
|------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------------|--------|-----|-----|--------|
| DFI (Discrete Fault Indicator) Troubleshooting |                                                                                                                                                                                |                                                                                                                                                |               |                 |        |     |     |        |
| 1                                              | Connect a +5 Vdc source to the DFI terminals via a 5K resistor.                                                                                                                | See Figure 4-10F.                                                                                                                              |               |                 |        |     |     |        |
| 2                                              | Connect a controller to the GPIB connector and send the following GPIB commands:<br>OUTPUT 705;"OUTP:DFI ON"<br>OUTPUT 705;"OUTP:SOUR:QUES"<br>OUTPUT 705;"STAT:QUES:ENAB 512" |                                                                                                                                                |               |                 |        |     |     |        |
| 3                                              | Connect a voltmeter between J113-1 and J113-2.                                                                                                                                 | Voltmeter should read +5 Vdc                                                                                                                   |               |                 |        |     |     |        |
| 4                                              | Short the RI terminals together (J113-3 to J113-4).                                                                                                                            | Voltmeter should read LOW (<0.07 Vdc)                                                                                                          |               |                 |        |     |     |        |
| 5                                              | Enter the following front panel commands:<br><b>SHIFT STATUS QUES:EVEN? ENTER</b>                                                                                              | Voltmeter should read HIGH (+5 Vdc)                                                                                                            |               |                 |        |     |     |        |
| 6                                              | If J113-1 does not go low, trace the signal from the A8 DSP board at the following locations:<br>A11 U164-13/U165-3<br>A11 U164-12/U165-4                                      | <table><tr><td><u>Normal</u></td><td><u>DFI True</u></td></tr><tr><td>+5 Vdc</td><td>LOW</td></tr><tr><td>LOW</td><td>+5 Vdc</td></tr></table> | <u>Normal</u> | <u>DFI True</u> | +5 Vdc | LOW | LOW | +5 Vdc |
| <u>Normal</u>                                  | <u>DFI True</u>                                                                                                                                                                |                                                                                                                                                |               |                 |        |     |     |        |
| +5 Vdc                                         | LOW                                                                                                                                                                            |                                                                                                                                                |               |                 |        |     |     |        |
| LOW                                            | +5 Vdc                                                                                                                                                                         |                                                                                                                                                |               |                 |        |     |     |        |

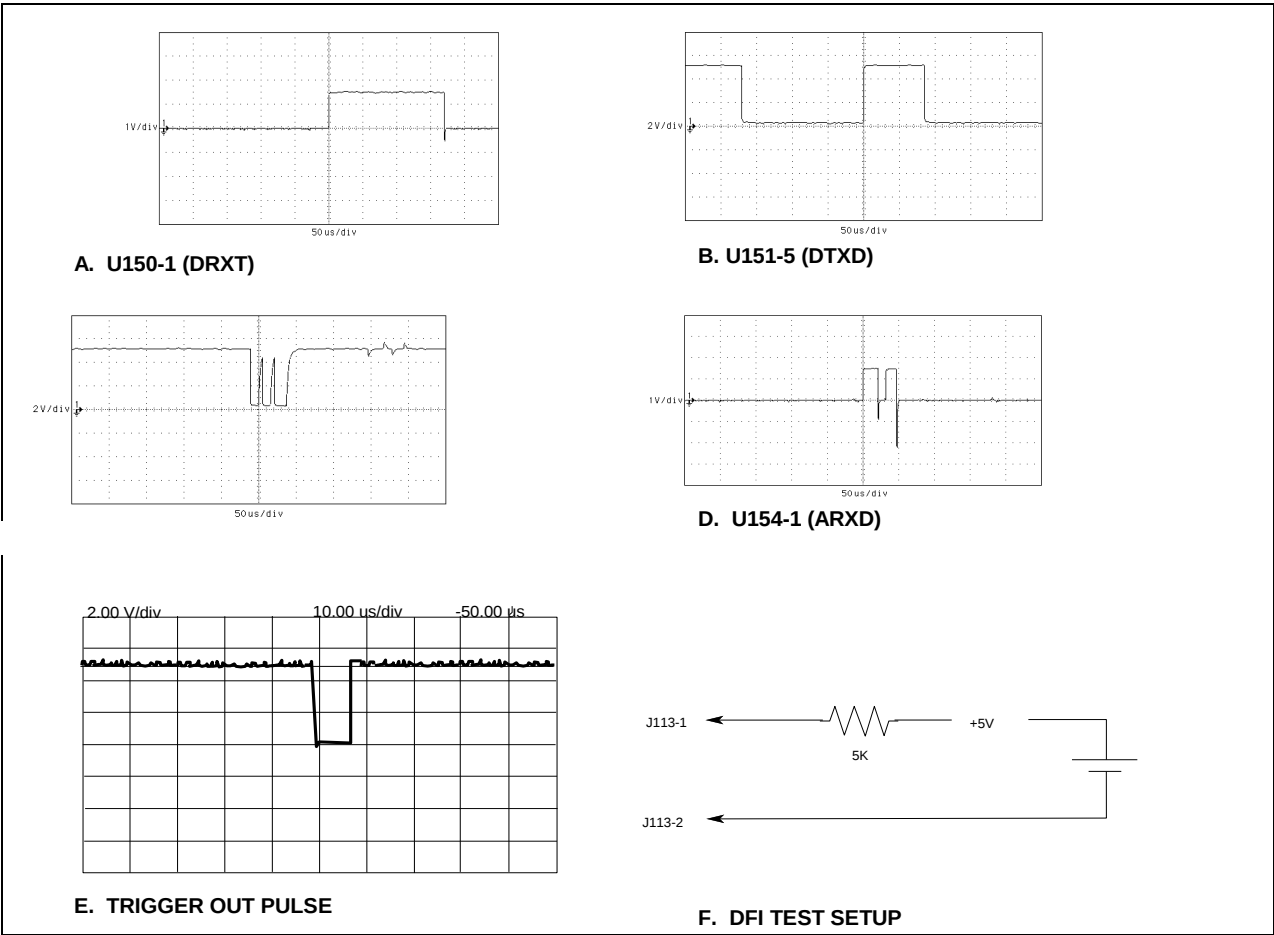


Figure 4-10. Trigger/BNC Assembly - Test Waveforms

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# Initialization

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**NOTE:** Initializing the unit erases all calibration, waveform, and list data

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Instruments that are being initialized for the first time or have suffered non-volatile memory corruption should be initialized with the front panel EEINIT command. To initialize the unit perform the following:

1. Turn the unit on, then do the front panel **CAL ON** command.
2. Press **0** and **9** keys simultaneously, **EEINIT <model>** should now be displayed.
3. Scroll to the correct model number and press **ENTER**.

If the command is successful, the front panel display will go through a normal power-on sequence.

---

## ROM Upgrade

### Identifying the Firmware

The model number, then firmware revision is displayed on the front panel for approximately 10 seconds when AC line switch is turned on. The firmware revision is also accessible via the GPIB using the \*IDN? query. The following sample Keysight BASIC program does this.

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

The computer will display the string "**KEYSIGHT TECHNOLOGIES**",<model >,0,<revision>".

### Upgrade Procedure

It is possible to update to newer ROM versions without destroying the calibration data. To update the unit to newer ROM revisions perform the following.

1. Turn input power off, remove the old ROMs and install the new ROMS.
2. Turn the unit on, then do the front panel **CAL ON** command.
3. Press **0** and **9** keys simultaneously, then scroll to the **ROMUPD** command.
4. Scroll to the correct model number and press **ENTER**.

If the command is successful, the front panel display will go through a normal power-on sequence. If "OUT OF RANGE" error is displayed, then the instrument will have to be re-initialized with the EEINIT command and re-calibrated. This can occur if the instrument was previously initialized with a QA firmware revision ( QA.xx.xx ), or if non-volatile memory has become corrupted for any reason.

## Post-Repair Calibration

Calibration is required annually and whenever certain components are replaced. If components in any of the circuits listed below are replaced, the supply must be re-calibrated as described in Appendix B of the User's Guide.

- a. A8 DSP Assembly
- b. A9 Output Filter/Relay Assembly
- c. A10 Control Assembly

If the A8 DSP Assembly is replaced, the supply must be initialized first (see "Initialization" previously discussed in this chapter) and then be calibrated.

## Inhibit Calibration Switch

If "CAL DENIED" appears on the display when calibration is attempted, or if error code 401 occurs when calibrating over the GPIB, the internal INHIBIT CAL switch has been set. This switch setting prevents unauthorized or inadvertent power supply calibration. You must reset this switch in order to calibrate the supply.

The internal calibration switches are located on the A8 DSP board and are accessible by removing the top cover, inner cover then lifting the A10 control board and A8 DSP board assembly. Switches 1 and 2 set the calibration configuration. The three switch positions are illustrated as follows:

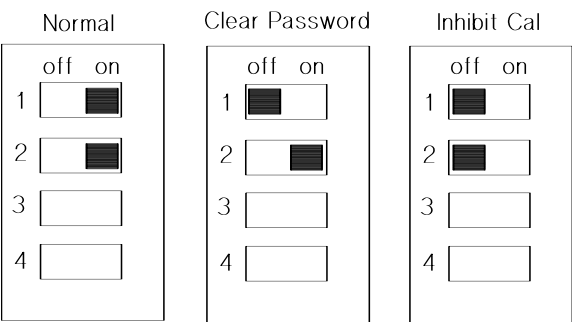


Figure 4-11. Calibration Switches

**Normal** This is the default switch position. The calibration functions are accessible after entering a numeric password. The default password is 0 and is changeable by the user.

**Clear Password** The calibration password is reset to 0 and the remote programming language is set to SCPI. This option is useful if the user has forgotten the password.

**Inhibit Cal** In this position the calibration of the power source cannot be changed. All calibration commands are disabled. If the CAL ON command is sent with the switch in this position an *Out Of Range* error will be displayed on the front panel. This option is useful in installations where calibration access is guarded by instrument seals.

## Disassembly Procedures

The following paragraphs provide instructions on how to disassemble various components of the ac source. Once disassembled, the components can be reassembled by performing the disassembly instructions in reverse order. Figure 4-12 shows the location of the major components of the unit.

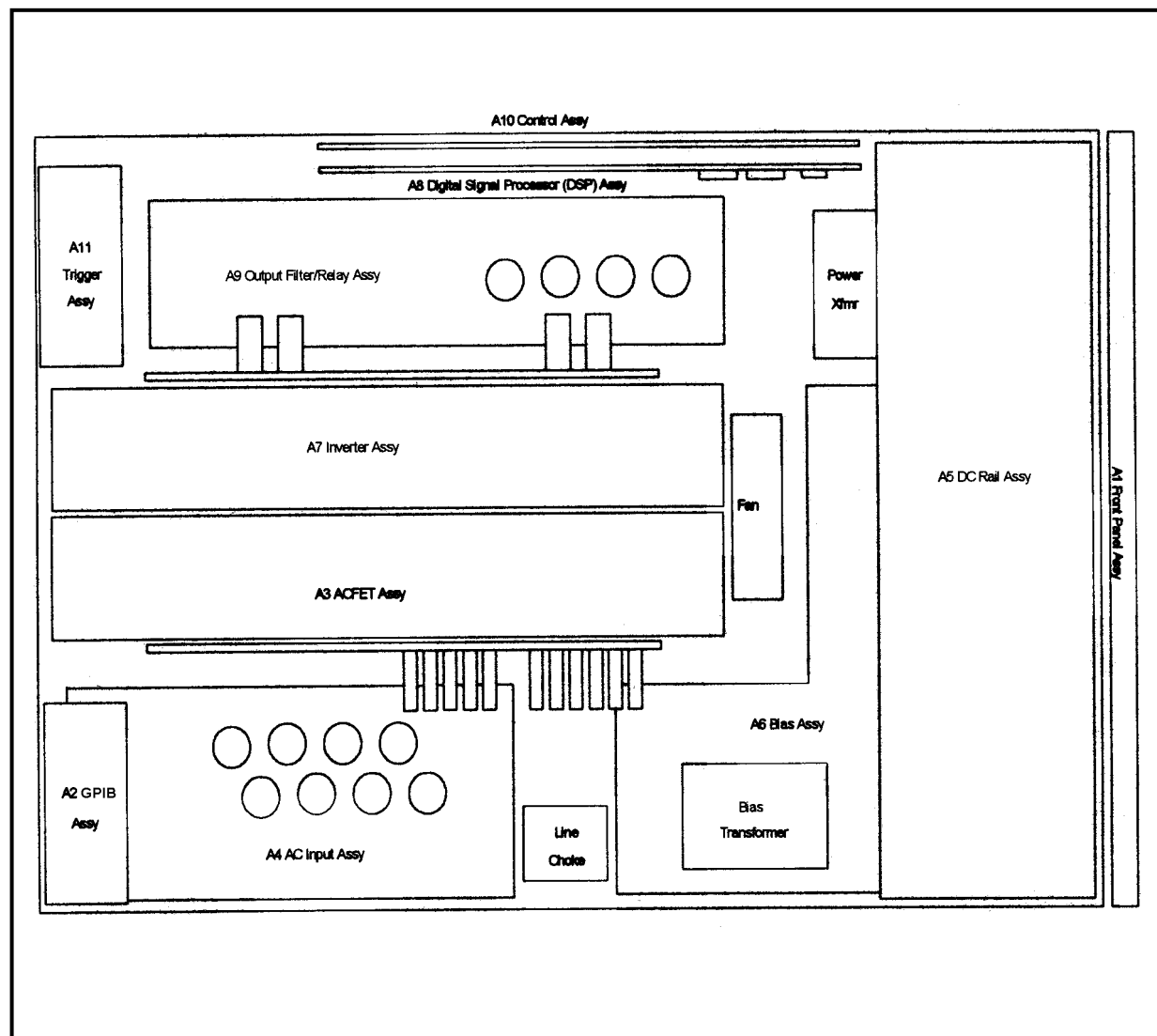


Figure 4-12. Component Locations

**CAUTION:** Most of the attaching hardware is metric. Use of other types of fasteners will damage threaded inserts. Refer to list of required tools when performing disassembly and replacement.

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**WARNING:**     ***SHOCK HAZARD.*** To avoid the possibility of personal injury, turn off AC power and disconnect the line cord before removing the top cover. Disconnect the GPIB cable, any loads and remote sense leads before attempting disassembly.

---

## List of Required Tools

- T10, T15 and T25 Torx screwdrivers.
- Allen wrench 0.050 inch.
- 2PT. Pozidriv screwdriver.
- #2 Phillips screwdriver.
- 3/16 inch flat blade screwdriver.
- 7mm and 10mm Hex drivers
- 5/8 inch Hex driver or box wrench
- Static free workstation and antistatic wrist discharge strap.

## Top Cover ( outer cover ) Removal

- a. Using a T25 Torx screwdriver remove the screws holding the carrying straps on each side of the AC source. Total of 4 screws.
- b. To remove, slide cover toward rear of unit to disengage it from front panel, spread bottom of cover to lift it from the unit.
- c. When replacing the outer cover carefully align front of cover with front frame and rear bottom corners with rectangular blocks mounted on the chassis.

## Inner Top Cover Removal

- a. Using a T15 Torx screwdriver remove 4 screws holding the top of the inner cover, 3 screws holding the left side and 4 screws holding the right side.
- b. Lift the inner cover straight up and off the unit.

## A1 Front Frame / Panel Assembly Removal and Replacement

- a. Remove the top cover as described earlier.
- b. Locate and carefully peel off the vinyl trim strips (one on each side of the frame ) to gain access to the side screws the secure the front frame to the chassis.
- c. Using a T10 Torx screwdriver remove 2 screws from each side of the front frame.
- d. Move the front frame forward a few inches and disconnect the phone type cable from connector A1J6 located on the front panel PC board.
- e. Move the right side of the front frame forward, pivoting on the left corner to gain access to S1 on / off switch.
- f. Disconnect the wires going to switch S1 noting the color code of the wires and the respective switch terminals to which they connect for subsequent reconnection.
- g. The front frame can now be removed from the AC source.
- h. To remove the PC board from the front frame, use a T10 Torx to remove the screw. Find the PC board finger that keeps the PC board from sliding in the direction of switch S1. Lift the PC board finger, slide the PC board off the plastic fingers and remove the PC board from the frame.
- j. To reinstall the front panel PC board and front frame perform the above steps in reverse order.

## 4 - Troubleshooting

### A2 GPIB / RS 232 Board Removal and Replacement

- a. Remove the outer and inner top covers as described earlier.
- b. Remove the two ( 2 ) 7 mm Hex screws that hold the GPIB connector place.
- c. Using a T15 Torx screwdriver remove the screw holding the PC board to the rear chassis.
- d. Disconnect the phone type cable from J112.
- e. To reinstall the A2 GPIB PC board perform the above steps in reverse order.

### A3 AC FET Assembly Removal and Replacement

- a. Remove the outer and inner top covers as described earlier.
- b. Remove DC rail cable from A4J1042 on AC input board.
- c. Remove bias cables between A3J200 and A5J400 on A5 DC rail board and from A6J339 on the A6 bias board.
- d. Lift fan straight up from unit and rest on A5 DC rail board.
- e. Remove Litz wire cables from power transformer that connect to TB201 on A3 assembly.
- f. Use T15 Torx screwdriver to remove screw holding A3 ACFET assembly to rear panel.
- g. Slide A3ACFET assembly toward front of AC source and lift assembly up and out of unit.
- h. To reinstall the A3 ACFET assembly, perform the above steps in reverse order.

### A4 AC Input Board Removal and Replacement

- a. Remove the outer and inner top covers as described earlier.
- b. Remove the A2 GPB board as described earlier.
- c. Remove the A3 ACFET assembly as described earlier.
- d. Use 10mm Hex driver to disconnect ground wire connected to rear panel, located under A2 GPIB board.
- e. Remove red and black wires going to line choke.
- f. Remove cable between J1035 and J335 on A6 Bias board.
- g. Using a T15 Torx screwdriver, remove 3 screws holding A4 AC Input board to chassis.
- h. Slide A4 AC Input board toward the front of the unit and lift from chassis.
- j. To reinstall the A4 AC Input board perform the above steps in reverse order.

### A5 DC Rail Board Removal and Replacement

- a. Remove the outer and inner top covers as described earlier.
- b. Disconnect cables at J436, J400, J444 and J445.
- c. Using T15 Torx screwdriver remove 5 screws holding A5 DC rail board to chassis.
- d. Disconnect cable to J1232 or J1233 on power transformer board. Mark which connector the cable was removed from.
- e. Disconnect wires from rail choke 5080-2329 at A5 DC rail board. The A5 DC rail board is labeled with wire color code.
- f. To reinstall the A5 DC rail board perform the above steps in reverse order taking care to reconnect the rail choke wires to the correct terminals and the power transformer cable to the correct receptacle.

## **A6 Bias Board Removal and Replacement**

- a. Remove the outer and inner top covers as described earlier.
- b. Remove A5 DC rail board as described earlier.
- c. Disconnect cables from J306A, J306B, J335, J337, J339 and J343.
- d. Disconnect wires going to S1 on/off switch. Record where wires terminate at switch.
- e. Using T15 Torx screwdriver remove 1 screw holding A6 bias board to chassis.
- f. Using 2PT posidrive screwdriver remove 4 screws holding bias transformer and A6 bias board to chassis.
- h. Slide A6 bias board to the left and lift from chassis.
- j. To reinstall the A6 Bias board perform the above steps in reverse order.

## **A7 Inverter Assembly Removal and Replacement**

- a. Remove outer and inner top covers as described earlier.
- b. Lift fan out of chassis and rest on A5 dc rail board.
- c. Disconnect cables to J526 and J527 on A9 output board.
- d. Disconnect cables to J625 from A9 output board and J638 from A6 bias board.
- e. Disconnect cables to J828 and J855 on A10 control board.
- f. Disconnect cable at J444 on A5 DC rail board to help in removal of A7 Inverter assembly.
- g. Using T15 Torx screwdriver remove screw holding A7 Inverter assembly to rear chassis.
- h. Slide A7 Inverter assembly toward front of unit and lift from chassis.
- j. To reinstall the A7 Inverter assembly perform the above steps in reverse order.

## **A8 DSP Board and A10 Control Board Removal and Replacement**

- a. Remove outer and inner top covers as described earlier.
- b. Disconnect cable from A7 Inverter assembly to J746 on the A8 DSP board.
- c. Disconnect cables to J828 and J855 on A10 control board.
- d. Disconnect cable to J115 on the A11 Trigger board.
- e. Using T15 Torx screwdriver remove 3 screws holding A10 Control board to right side of chassis.
- f. Lift A10 Control board from chassis.
- g. Using T15 Torx screwdriver remove 6 screws holding A8 DSP board to A10 Control board.
- h. To reinstall the A8 DSP and A10 control boards perform the above steps in reverse order.

## 4 - Troubleshooting

### **A11 Trigger ( BNC ) Board Removal and Replacement**

- a. Remove outer and inner top covers as described earlier.
- b. Disconnect cable from A10 control board to J115.
- c. Disconnect cables to J106 and J112. Mark cables to J106 and J112 before removing. If the cables are reversed during replacement, the ac source will not pass turn-on self test.
- d. Use 5/8 inch socket/box wrench to remove nuts holding BNC connectors to rear panel.
- e. Remove A11 Trigger board from unit.
- j. To reinstall the A11 Trigger ( BNC ) board perform the above steps in reverse order

### **A9 Output Board Removal and Replacement**

- a. Remove outer and inner top covers as described earlier.
- b. Remove A7 Inverter assembly, A8 DSP, A10 Control and A11 Trigger boards as described earlier.
- c. Disconnect cable going to J337 on the A6 bias board.
- d. Disconnect cable going to J445 on the A5 DC rail board.
- e. Using T15 Torx screwdriver remove 4 screws holding A9 output board to chassis.
- f. Slide A9 output board toward the front of the unit and lift from chassis.
- g. To reinstall the A9 output board perform the above steps in reverse order

## Replaceable Parts List

### Introduction

This section lists the replaceable electrical and mechanical parts for the Keysight Series 6611A/B, 6612A/B, 6613A/B AC Power Source/Analyzers, and Keysight Series 6841A, 6842A Harmonic Flicker Test Systems.

### Reading the Tables

Each table lists electrical components alphabetically by reference designator and provides the Keysight 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.

Note that the word “All” in the Applicability column in any of these tables means that the item is applicable to all models.

#### Part Reference Designators

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

#### Part Description Abbreviations

|      |          |     |            |        |              |      |             |
|------|----------|-----|------------|--------|--------------|------|-------------|
| assy | assembly | m   | metric     | PCB    | PC board     | W/   | with        |
| bd   | board    | mch | machine    | sq     | square       | w/o  | without     |
| gnd  | ground   | mm  | millimeter | submin | subminiature | xfmr | transformer |
| lg   | long     | mtg | mounting   | thrd   | thread       | xtal | crystal     |

### How to Order Parts

You can order parts from your local Keysight Technologies Sales and Support Office. When ordering a part, please include the following information:

- the Keysight part number
- the part description
- the model number of the unit.

## 5 - Replaceable Parts

**Table 5-1. Parts List for Main Assembly**

| Ref Desig.                      | Applicability                  | Keysight Part No. | Description                      |
|---------------------------------|--------------------------------|-------------------|----------------------------------|
| TESTED CIRCUIT BOARD ASSEMBLIES |                                |                   |                                  |
| A1 <sup>1</sup>                 | All                            | 5060-3596         | Front Panel Board Tested         |
| A2                              | All                            | 5063-2376         | GPIB/RS-232 Board Tested         |
| A3                              | 6811A/B,6812A/B,6841A          | 06812-61001       | AC FET Board Tested              |
| A3                              | 6813A/B,6842A                  | 5063-2316         | AC FET Board Tested              |
| A4                              | 6811A/B                        | 06811-61020       | AC Input Board Tested            |
| A4                              | 6812A/B,6841A                  | 06812-61020       | AC Input Board Tested            |
| A4                              | 6813A/B,6842A                  | 06813-61020       | AC Input Board Tested            |
| A5                              | All                            | 5063-2313         | DC Rail Board Tested             |
| A6                              | 6811A/B,6812A/B,6841A          | 06812-61021       | Bias Board Tested                |
| A6                              | 6813A/B,6842A                  | 06813-61021       | Bias Board Tested                |
| A7                              | All                            | 5064-0110         | Inverter Board Tested            |
| A8                              | 6811A,6812A,6813A              | 5063-2315         | DSP Board Tested                 |
| A8                              | 6811B, 6812B,6813B,6841A,6842A | 5063-2367         | DSP Board Tested                 |
| A9                              | 6811A/B                        | 06811-61022       | Output/Relay/Filter Board tested |
| A9                              | 6812A/B,6813A/B,6841A,6842A    | 5063-2314         | Output/Relay/Filter Board Tested |
| A10                             | 6811A/B                        | 5063-3482         | Control Board Tested             |
| A10                             | 6812A/B,6841A                  | 5063-2369         | Control Board Tested             |
| A10                             | 6813A/B,6842A                  | 5063-2370         | Control Board Tested             |
| A11                             | All                            | 5060-3597         | Trigger (BNC) Board              |
| A12                             | All                            | 5060-3590         | Thermistor Board                 |
| T1                              | All                            | 9100-5145         | Power Transformer Assembly       |
| MECHANICAL PARTS                |                                |                   |                                  |
| M1 <sup>1</sup>                 | All                            | 5040-1702         | KEYPAD - AC SOURCE               |
| M2 <sup>1</sup>                 | All                            | 5040-1703         | FRONT FRAME                      |
| M3 <sup>1</sup>                 | All                            | 5080-2333         | WINDOW                           |
| M4 <sup>1</sup>                 | All                            | 5001-6795         | FRONT PANEL LABEL                |
| M5 <sup>1</sup>                 | All                            | 0370-3238         | KNOB 6mm                         |
| M6 <sup>1</sup>                 | 6811A                          | 06811-80001       | NAMEPLATE                        |
|                                 | 6811B                          | 06811-80007       | NAMEPLATE                        |
|                                 | 6812A                          | 06812-80001       | NAMEPLATE                        |
|                                 | 6812B                          | 06812-80003       | NAMEPLATE                        |
|                                 | 6813A                          | 06813-80001       | NAMEPLATE                        |
|                                 | 6813B                          | 06813-80006       | NAMEPLATE                        |
|                                 | 6841A                          | 06841-80001       | NAMEPLATE                        |
|                                 | 6842A                          | 06842-80001       | NAMEPLATE                        |
| <sup>1</sup> Refer to           | All                            | 0360-2190         | JUMPER-BARR BLK                  |
| Figure 5-1                      | All                            | 0360-2191         | CVR-TERM BLK-DC                  |
| at the end of                   | All                            | 0515-1085         | SCREW DC COVER                   |
| this chapter                    | All                            | 06813-20001       | INV HEAT SINK                    |
| for location                    | All                            | 06813-80002       | FET PAD INVERTER DFL/RI          |
| information.                    | All                            | 1252-1488         | TERM-BLK- 4 POS                  |
|                                 | All                            | 1400-0493         | CABLE TIE                        |
|                                 | All                            | 1400-0611         | CLAMP-CABLE (rail choke)         |
|                                 | All                            | 3101-3088         | LINE SWITCH                      |
|                                 | All                            | 5001-0539         | TRIM SIDES,FR GY                 |
|                                 | All                            | 5001-6745         | COVER                            |
|                                 | All                            | 5001-6799         | CHASSIS INVERTER                 |
|                                 | All                            | 5001-9801         | CHASSIS AC FET                   |

Table 5-1. Main Assembly - continued

| Ref Desig. | Applicability   | Keysight Part No. | Description                      |
|------------|-----------------|-------------------|----------------------------------|
| L1050      | All             | 5001-9803         | CHASSIS TOP                      |
|            | All             | 5001-9804         | PANEL-REAR                       |
|            | All             | 5001-9805         | BRACKET-FAN                      |
|            | All             | 5001-9808         | FET CLIP                         |
|            | All             | 5001-9809         | BRACKET DC RAIL                  |
|            | All             | 5040-1676         | SAF-CVR-AC INPUT                 |
|            | All             | 5040-1697         | BLOCK-TOP COVER                  |
|            | All             | 5040-1704         | AC SAFETY COVER                  |
|            | All             | 5041-8801         | FOOT                             |
|            | All             | 5041-8819         | CAP-STRAP HANDLE                 |
|            | All             | 5041-8820         | CAP-STRAP HANDLE                 |
|            | All             | 5060-3570         | CHASSIS ASSY                     |
|            | All             | 5062-3705         | STRAP HANDLE                     |
|            | All             | 5080-2328         | CHOKE-LINE                       |
|            | All             | 5080-2329         | CHOKE-RAIL                       |
|            | All             | 5080-2339         | LABEL-REAR PANEL                 |
|            | All             | 5080-2341         | XFMR INSULATOR                   |
|            | All             | 5080-2342         | INSULATOR                        |
|            | All             | 5080-2348         | CABLE ASSEMBLY                   |
|            | All             | 5080-2353         | CABLE ASSEMBLY                   |
|            | All             | 5080-2356         | CABLE ASSEMBLY                   |
|            | All             | 5080-2362         | ASSY-FAN                         |
|            | All             | 5080-2365         | CABLE                            |
|            | All             | 5080-2373         | INSULATOR INVERTER               |
|            | All             | 5080-2380         | CABLE ASSEMBLY                   |
|            | All             | 5080-2381         | CABLE ASSEMBLY                   |
|            | All             | 5080-2397         | CABLE ASSEMBLY                   |
|            | All             | 5062-3977         | RACK MOUNT KIT (without handles) |
|            | All             | 5062-3983         | RACK MOUNT KIT (with handles)    |
|            | All             | 7120-8214         | LABEL-WARNING                    |
|            | All             | 7121-2794         | LABEL-ID SN                      |
|            | All             | 9100-5145         | XFMR-SWITCH POWER                |
|            | All             | 8120-5573         | PWR CORD OPT 831                 |
|            | 6813A/B,6842A   | 8120-6502         | PWR CORD OPT 832                 |
|            | 6811A/B         | 8120-8605         | POWER CORD OPT 900               |
|            | 6811A/B         | 8120-8606         | POWER CORD OPT 901               |
|            | 6811A/B         | 8120-8607         | POWER CORD OPT 902               |
|            | 6811A/B         | 8120-8608         | POWER CORD OPT 912               |
|            | 6811A/B         | 8120-8609         | POWER CORD OPT 903, 918          |
|            | 6811A/B         | 8120-8610         | POWER CORD OPT 904               |
|            | 6811A/B         | 8120-8611         | POWER CORD OPT 917               |
|            | 6812A/B,6841A   | 8120-5568         | POWER CORD OPT 833               |
|            | 6812A/B,6841A   | 8120-5566         | POWER CORD OPT 834.              |
|            | 6812A/B,6813A/B | 8120-6505         | POWER CORD/PLUG OPT 841          |
|            | 6841A,6842A     | 8120-6505         | POWER CORD/PLUG OPT 841          |
|            | 6813A/B,6842A   | 8120-6506         | POWER CORD OPT 842               |
|            | 6813A/B,6842A   | 8120-6507         | POWER CORD/PLUG OPT 844          |
|            | 6812A/B,6841A   | 8120-6508         | POWER CORD/PLUG OPT 845          |
|            | 6812A/B,6841A   | 8120-6509         | POWER CORD/PLUG OPT 846          |
|            | 6812A/B,6841A   | 8120-5567         | POWER CORD/PLUG OPT 847          |
|            | 6812A/B,6841A   | 8120-6511         | POWER CORD/PLUG OPT 848          |

## 5 - Replaceable Parts

**Table 5-2. Parts List for Technical Manuals**

| Reference Desig. | Applicability | Keysight Part No. | Description                         |
|------------------|---------------|-------------------|-------------------------------------|
|                  | All           | 5962-0885         | REFERENCE CARD                      |
|                  | All           | 5962-0829         | GUIDE-USER                          |
|                  | All           | 5962-0883         | GUIDE-QUICK START ENGLISH           |
|                  | All           | 5962-0889         | GUIDE-PROGRAMMING                   |
|                  | All           | 5962-0837         | GUIDE-QUICK START FRENCH.           |
|                  | All           | 5962-0839         | GUIDE-QUICK START ITALIAN           |
|                  | All           | 5962-0841         | GUIDE-QUICK START SPANISH           |
|                  | All           | 5962-0843         | GUIDE-QUICK START CHINESE (TAIWAN.) |
|                  | All           | 5962-0845         | GUIDE-QUICK START KOREAN.           |
|                  | All           | 5962-0847         | GUIDE-QUICK START GERMAN.           |
|                  | All           | 5962-8101         | GUIDE-QUICK START JAPANESE          |
|                  | All           | 5961-5190         | GUIDE-USER JAPANESE                 |
|                  | All           | 5962-8113         | GUIDE -QUICK START CHINESE (PRC)    |
|                  | All           | 5962-8115         | GUIDE-USER CHINESE (PRC )           |

**Table 5-3. Parts List for AC Input Board**

| Reference Desig.     | Applicability         | Keysight Part No. | Description      |
|----------------------|-----------------------|-------------------|------------------|
| ELECTRICAL PARTS     |                       |                   |                  |
| C1010,1011           | All                   | 0160-4183         | CAP 1000 pF 20%  |
| C1012-1016           | All                   | 0160-7606         | CAP 1uF 275V     |
| C1020,1021           | All                   | 0160-3969         | CAP .015 uF 20%  |
| C1022,1023,1080      | All                   | 0160-4439         | CAP 4700 pF 20%  |
| C1040                | All                   | 0160-4355         | CAP .01uF 10%    |
| C1050                | All                   | 0160-4065         | CAP 1uF 20%      |
| C1051,1052           | All                   | 0160-7606         | CAP 1uF 275V     |
| C1060,1061           | 6813A/B,6842A         | 0180-4641         | CAP 2700 uF 200V |
| C1062-1065           | 6811A/B               | 0180-4528         | CAP 1800 uF 200V |
| C1062-1065           | 6812A/B,6841A         | 0180-4641         | CAP 2700 uF 200V |
| C1066,1067           | 6813A/B,6842A         | 0180-4641         | CAP 2700 uF 200V |
| D1060                | All                   | 1906-0389         | FWB KPC3506/356  |
| D1061                | All                   | 1901-1098         | DIO-IN4150       |
| DS1080               | All                   | 1990-0517         | LED-VISIBLE      |
| E1047                | 6811A/B,6812A/B,6841A | 5060-3586         | ASSY-WIRE KIT    |
| E1051                | All                   | 66000-60051       | ASSY-WIRE KIT    |
| F1020                | 6811A/B,6812A/B,6841A | 2110-0910         | FUSE 30AM 500V   |
| F1020                | 6813A/B,6842A         | 2110-0849         | FUSE 25AM 250V   |
| F1080                | All                   | 2110-0098         | FUSE 20AM 250V   |
| HS1060               | All                   | 1205-0861         | HEAT SINK        |
| J1035                | All                   | 1252-2672         | CONN-POST-TP-HDR |
| J1042                | All                   | 1251-4781         | CONN-UTIL        |
| J1047                | All                   | 1251-5613         | CONN-SGL CONN    |
| J1049                | All                   | 0360-2421         | BARRIER-BLOCK    |
| K1040,1041           | All                   | 0490-1834         | RLY 1C 12VDC     |
| L1020                | 6811A/B               | 06811-80003       | CHOKE-INPUT      |
| L1020                | 6812A/B,6841A         | 66000-80004       | CHOKE-INPUT      |
| L1060,1061           | All                   | 06012-80095       | CHOKE-OUTPUT     |
| Q1040                | All                   | 1855-0665         | MOSFET RFP 2N12L |
| R1010                | All                   | 0698-8827         | RES 1M 1%.125W   |
| R1040,1041,1045,1046 | All                   | 0811-3932         | RESISTOR-FIXED   |
| R1042                | All                   | 0698-4150         | RES 115 1%.25W   |
| R1043,R1044          | All                   | 0698-0092         | RES 2.61K 1%     |
| R1050                | All                   | 0698-3620         | RES 100 5% 2W MO |
| R1051                | All                   | 0811-1666         | RES 1 5% 2W PW   |
| R1060,1061,1080,1081 | All                   | 0811-1866         | RES IOK 1% 5W PW |
| R1082                | All                   | 0757-0418         | RES 619 1%.125W  |

Table 5-4. Parts List for Bias Board

| Reference Desig.                  | Applicability         | Keysight Part No. | Description      |
|-----------------------------------|-----------------------|-------------------|------------------|
| ELECTRICAL PARTS                  |                       |                   |                  |
| C300,311,321,350                  | All                   | 0160-4834         | CAP .047 uF 10%  |
| C301,328                          | All                   | 0180-3298         | C-F 2200uF 50V   |
| C302,313,325,329                  | All                   | 0180-0230         | C-F 1uF 50V      |
| C303,304,314,315,317,C326,327,330 | All                   | 0180-4129         | CAP 1 uf 35V     |
| C312                              | All                   | 0180-4137         | CAP 1200 uf 35V  |
| C322                              | All                   | 0180-4462         | CAP 1200 uF 63V  |
| C323                              | All                   | 0180-4398         | C-F 470 uf 63V   |
| C324                              | All                   | 0180-3458         | CAP 4700 uF 50V  |
| C331                              | All                   | 0180-4131         | CAP 4.7 uf 35 V  |
| C361                              | All                   | 0180-4136         | CAP 1 uf 20V     |
| D300-303,331-334,351              | All                   | 1901-0731         | DIO-IN4004/10GO4 |
| D321-324,362-365                  | All                   | 1901-1087         | DIO-PWR 856      |
| D325                              | All                   | 1901-0992         | DIODE 40V 3A     |
| D352                              | All                   | 1901-1098         | DIO-IN4150       |
| E334                              | All                   | 5080-2355         | CABLE            |
| E336                              | All                   | 5080-2357         | CABLE            |
| E338                              | All                   | 5080-2358         | CABLE            |
| F300,322,323                      | All                   | 2110-0688         | FUSE 3AM 125V    |
| F301                              | All                   | 2110-0002         | FUSE 2AM 250V    |
| F311,321                          | All                   | 2110-0685         | FU-SUBMIN 7AM    |
| F324,325                          | All                   | 2110-0699         | FU-SUBMIN 5AM    |
| F326                              | All                   | 2110-0712         | FU-SUBMIN 4AM    |
| HS300,311,312,322,351             | All                   | 1205-0350         | HEAT SINK        |
| HS321,323                         | All                   | 1205-0282         | HEAT SINK        |
| J306,314                          | All                   | 1252-1999         | MOD PHONE RCPT   |
| J335                              | All                   | 1252-2672         | CONN-POST-TP-HDR |
| J337                              | All                   | 1251-8139         | CONN-POST-TP-HDR |
| J339                              | All                   | 1252-0063         | CONN-POST-TP-HDR |
| J343                              | All                   | 1252-0055         | CONN-POST-TP HDR |
| J353                              | All                   | 1251-5439         | CONN-POST-TP-HDR |
| L321                              | All                   | 5080-2321         | CHOKE-OUTPUT     |
| Q351                              | All                   | 1854-0828         | XSTR NPN SI      |
| R300,326,329                      | All                   | 0698-8672         | RES 243.4 .1%    |
| R301                              | All                   | 0698-0085         | RES 2.61K 1%     |
| R311,313                          | All                   | 0699-0083         | RES 681 .1%.1W   |
| R314                              | All                   | 0699-1982         | RES 1.055K . 1%  |
| R323                              | All                   | 0757-0279         | RES 3.16K 1%     |
| R324                              | All                   | 0757-0280         | RES 1K 1%.125W   |
| R325                              | All                   | 8159-0005         | RES-ZERO OHMS    |
| R327,328                          | All                   | 0757-0281         | RES 2.74K 1%     |
| R330                              | All                   | 0699-0208         | RES 1 5%.25W CF  |
| R351                              | All                   | 0698-3155         | RES 4.64K 1%     |
| R354                              | All                   | 0686-2225         | RES 2.2K 5% .5W  |
| R372                              | All                   | 0757-0463         | RES 82.5K 1%     |
| R373                              | All                   | 0757-0419         | RES 681 1%.125W  |
| T300                              | 6811A/B,6812A/B,6841A | 9100-5143         | XFMR-BIAS        |
| T300                              | 6813A/B,6842A         | 9100-5144         | XFNR-BIAS        |
| T301                              | 6811A/B,6812A/B,6841A | 9100-5141         | TRANSFORMER-GPIB |
| T301                              | 6813A/B,6842A         | 9100-5142         | TRANSFORMER-GPIB |
| U300,311,312,322                  | All                   | 1826-0393         | IC LM317T        |
| U313                              | All                   | 1826-0147         | IC 7812/340T-12  |
| U321                              | All                   | 1826-2505         | IC LM2576T-ADJT  |
| U323                              | All                   | 1826-0527         | IC LM337T        |
| U362                              | All                   | 1990-1074         | OPTO-ISOLATOR    |
| VR351                             | All                   | 1902-0955         | DIO-ZNR 7.5V 5%  |
| VR352                             | All                   | 1902-0957         | DIO-ZNR 9.1 V 5% |

## 5 - Replaceable Parts

**Table 5-5. Parts List for Inverter Board**

| Reference Desig.                                                                                                                                                                                                                     | Applicability | Keysight Part No. | Description        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-------------------|--------------------|
|                                                                                                                                                                                                                                      | All           | 0160-7505         | Cable - thermistor |
|                                                                                                                                                                                                                                      | All           | 5080-2699         | Cable - 3 wire     |
|                                                                                                                                                                                                                                      | All           | 5081-4971         | Cable - 4 wire     |
| <b>NOTE:</b> Earlier ac source models used a different (through-hole) inverter board. This surface-mount inverter board assembly (5064-0110) is the recommended replacement part for all previous version ac source inverter boards. |               |                   |                    |

**Table 5-6. Parts List for FET Board**

| Reference Desig.                                                                                                                                                                                                                                                  | Applicability | Keysight Part No. | Description  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-------------------|--------------|
|                                                                                                                                                                                                                                                                   | All           | 5080-2365         | Cable (J200) |
|                                                                                                                                                                                                                                                                   | All           | 5188-4204         | Cable (J201) |
|                                                                                                                                                                                                                                                                   | All           | 5188-4209         | Cable (J202) |
| <b>NOTE:</b> Earlier ac source models used a different (through-hole) FET board. This surface-mount FET board assembly (06812-61001 for models 6811B/6812B or 5063-2316 for model 6813B) is the recommended replacement part for all previous version FET boards. |               |                   |              |

**Table 5-7. Parts List for DC RAIL Board**

| Reference Desig.                          | Applicability | Keysight Part No. | Description        |
|-------------------------------------------|---------------|-------------------|--------------------|
| ELECTRICAL PARTS                          |               |                   |                    |
| C400-405                                  | All           | 0160-7640         | C-F 330pF 1600V    |
| C409,411,413,419,454,475                  | All           | 0180-4129         | CAP 1uf 35V        |
| C416                                      | All           | 0160-4834         | CAP .047UF 10%     |
| C417                                      | All           | 0180-3458         | CAP 4700UF 50V     |
| C418                                      | All           | 0180-4405         | CAP 470 uf 50V     |
| C425, 427-429, 433-442, 449, 453, 465-468 | All           | 0160-5422         | CAP .047 UF 20%    |
| C426,444,473                              | All           | 0180-4136         | CAP 10uf 20V       |
| C432                                      | All           | 0150-0050         | CAP 1000PF +80     |
| C447,451,495,498                          | All           | 0160-5098         | CAP .22UF 10%      |
| C448                                      | All           | 0160-4799         | CAP 2.2PF          |
| C452                                      | All           | 0160-4808         | CAP 470PF 100V     |
| C455                                      | All           | 0160-4831         | CAP 4700PF 10%     |
| C456                                      | All           | 0160-4823         | CAP 820PF 5%       |
| C459                                      | All           | 0160-4810         | CAP 330PF 5%       |
| C462,464                                  | All           | 0160-4797         | CAP 3.3PF          |
| C463                                      | All           | 0160-4807         | CAP 33PF 5% 100V   |
| C476,480                                  | All           | 0160-4795         | CAP 4.7PF          |
| C477,478                                  | All           | 0160-4787         | C-F 22PF 5% 100V   |
| C481,485                                  | All           | 0160-4904         | CAP 6800PF 5%      |
| C482,483,492                              | All           | 0160-4835         | CAP .1UF 10% 50V   |
| C484,489                                  | All           | 0160-4791         | CAP 10PF 5% 100V   |
| C491                                      | All           | 0180-4131         | CAP 4.7uf 35 V     |
| C493                                      | All           | 0160-4805         | CAP 47PF 5% 100V   |
| C494                                      | All           | 0160-4822         | CAP 1000PF 5%      |
| C496,497                                  | All           | 0160-4824         | CAP 680pf 100v     |
| D400-407                                  | All           | 1901-1543         | DIODE              |
| D416-419                                  | All           | 1901-0731         | DIODE-1N4004/10G04 |
| D420,475                                  | All           | 1901-1098         | DIODE-1N4150       |
| D423                                      | All           | 1902-0951         | DIODE-ZENER        |
| DS400                                     | All           | 1990-0517         | LED-VISIBLE        |

Table 5-7. DC RAIL Board - continued

| Reference Desig.                            | Applicability | Keysight Part No. | Description      |
|---------------------------------------------|---------------|-------------------|------------------|
| ELECTRICAL PARTS                            |               |                   |                  |
| E430-1,2,3,4                                | All           | 1251-5613         | CONN-SGL CONN    |
| E432                                        | All           | 5080-2354         | CABLE            |
| E454                                        | All           | 1251-0600         | CONTACT-CONN M   |
| HS400, 402-404, 406, 407                    | All           | 1205-0298         | HEAT SINK        |
| J400                                        | All           | 1252-2503         | CONN-POST-TP-HDR |
| J436                                        | All           | 1251-8606         | CONN-POST-TP-HDR |
| J444                                        | All           | 1251-5980         | CONN-UTIL        |
| J445                                        | All           | 1252-1707         | CONN-POST-TP-PST |
| Q450,491                                    | All           | 1855-0727         | MOSFET 2N7000    |
| Q475,476                                    | All           | 1854-0477         | XSTR NPN 2N2222A |
| R1408                                       | All           | 0698-3499         | RES 40.2K 1%     |
| R1409                                       | All           | 0757-0465         | RES 100K 1%      |
| R400,401,406,407                            | All           | 0699-3196         | RES 150 5% 10W   |
| R403,404                                    | All           | 0811-1914         | RES 5K 5% 10W PW |
| R408,410                                    | All           | 0811-1708         | RES 7K 5%5W 5PWI |
| R412                                        | All           | 0811-1826         | RES .05 10% 3W   |
| R413                                        | All           | 0812-0050         | RES 3K 5% 5W PW  |
| R414,425,449                                | All           | 0698-3279         | RES 4.99K 1%     |
| R415,420                                    | All           | 0698-8672         | RES 243.4 .1%    |
| R416,419,422                                | All           | 0757-0281         | RES 2.74K 1%     |
| R417, 418, 421, 469, 407,<br>1417, 1418     | All           | 8159-0005         | RES-ZERO OHMS    |
| R423                                        | All           | 0698-3637         | RES 820 5% 2W MO |
| R424,432,493                                | All           | 0757-0199         | RES 21.5K 1%     |
| R426, 427, 429, 451, 459, 471,<br>1401-1405 | All           | 0698-3155         | RES 4.64K 1%     |
| R428,463                                    | All           | 0757-0446         | RES 15K 1% .125W |
| R430                                        | All           | 0698-8827         | RES 1M 1% .125W  |
| R431                                        | All           | 0698-3159         | RES 26.1K 1%     |
| R433                                        | All           | 0698-8807         | RES 39K .1%      |
| R434,435                                    | All           | 0698-6369         | RES 1M .1% .25W  |
| R436                                        | All           | 0698-6614         | RES 7.5K .1%     |
| R437                                        | All           | 0699-0721         | RES 33K .1%      |
| R439                                        | All           | 0698-6977         | RES 30K .1% .125 |
| R440, 444, 450, 458, 1415                   | All           | 0757-0419         | RES 681 1% .125W |
| R441                                        | All           | 0757-0420         | RES 750 1% .125W |
| R445                                        | All           | 0698-6376         | RES 200K .1%     |
| R446                                        | All           | 0698-0085         | RES 2.61K 1%     |
| R447                                        | All           | 0698-6392         | RES 22K .1%.125W |
| R448                                        | All           | 0698-3700         | RES 715 1% .125W |
| R452                                        | All           | 0683-2255         | RES 2.2M 5% .25W |
| R453                                        | All           | 0698-0083         | RES 1.96K 1%     |
| R454                                        | All           | 0699-0486         | RES 2K .1% .1W F |
| R456, 468, 470, 499, 1411                   | All           | 0698-3430         | RES 21.5 1%      |
| R457                                        | All           | 0698-3486         | RES 232 1% .125W |
| R460                                        | All           | 0698-8816         | RES 2.15 1%      |
| R462                                        | All           | 0757-0462         | RES 75K 1% .125W |
| R464                                        | All           | 0757-0274         | RES 1.21K 1%     |
| R465                                        | All           | 0757-0467         | RES 121K 1%      |
| R467                                        | All           | 0698-4479         | RES 14K 1% .125W |
| R475,476                                    | All           | 0699-0070         | RES 3.16M 1%     |

## 5 - Replaceable Parts

**Table 5-7. DC RAIL Board - continued**

| Reference Desig.    | Applicability | Keysight Part No. | Description      |
|---------------------|---------------|-------------------|------------------|
| ELECTRICAL PARTS    |               |                   |                  |
| R477                | All           | 0757-0280         | RES 1K 1% .125W  |
| R478, 482, 484, 485 | All           | 0757-0472         | RES 200K 1%      |
| R479, 481, 491      | All           | 0757-0442         | RES 10K 1% .125W |
| R480, 487, 1410     | All           | 0757-0407         | RES 200 1% .125W |
| R483,489            | All           | 0757-0434         | RES 3.65K 1%     |
| R486,488            | All           | 0698-4486         | RES 24.9K 1%     |
| R490                | All           | 0698-4446         | RES 267 1% .125W |
| R492                | All           | 0757-0273         | RES 3.01K 1%     |
| R494,496            | All           | 0757-0427         | RES 1.5K 1%      |
| R495,497            | All           | 0757-0401         | RES 100 1% .125W |
| REF U463            | All           | 1200-0639         | SKT-IC 20-CONT   |
| T491                | All           | 06624-80091       | XFMR-PULSE       |
| TP401-404           | All           | 1251-5380         | POST-TP-HDR 6603 |
| U416                | All           | 5060-3212         | ASSY-HS 317T     |
| U417                | All           | 1826-0122         | IC 7805/340T-5   |
| U418                | All           | 1826-0527         | IC LM337T        |
| U423                | All           | 1826-2341         | IC-REG TL7702BCP |
| U424                | All           | 1826-0138         | IC-COM LM339N    |
| U433,434            | All           | 1990-0732         | OPTO-ISOLATOR    |
| U435                | All           | 1990-1502         | OPTO-ISOLATOR    |
| U436                | All           | 1990-0429         | OPTO-ISOLATOR    |
| U447,475            | All           | 1826-1533         | IC 34072         |
| U449                | All           | 1826-1437         | IC               |
| U462                | All           | 1826-0065         | IC LM311         |
| U463                | All           | 5080-2405         | PRGMD GAL, DIR   |
| U464                | All           | 1820-3673         | IC MM74HC123N    |
| U491                | All           | 1826-2343         | IC-REG TL598CN   |
| W400                | All           | 7175-0057         | WIRE 22          |

**Table 5-8. Parts List for Output Board**

| Reference Desig.  | Applicability                                               | Keysight Part No. | Description       |
|-------------------|-------------------------------------------------------------|-------------------|-------------------|
| ELECTRICAL PARTS  |                                                             |                   |                   |
| C500-503          | All                                                         | 0180-4649         | CAP 2500 uf 300V  |
| C506              | All                                                         | 0160-7197         | CAP 0.33 uF 630 V |
| C508-516          | All                                                         | 0160-7640         | C-F 330 pF 1600V  |
| C533,534,541,544, | All                                                         | 0160-5422         | CAP .047 uF 20%   |
| C540,543          | All                                                         | 0160-4803         | CAP 68 pF 5% IOOV |
| C542,554          | All                                                         | 0160-4795         | CAP 4.7 pF        |
| C545,547          | All                                                         | 0160-4814         | CAP 150 pF 5%     |
| C546              | All                                                         | 0160-4825         | CAP 560 uf 100V   |
| C548,549,575,576  | All                                                         | 0160-5422         | CAP .047 uF 20%   |
| C550              | 6811A/B                                                     | 0160-4824         | CAP 680 pF        |
| C550              | 6812A/B,6813A/B,<br>6841A, 6842A                            | 0160-4809         | CAP 390 pF 100V   |
| C553,555          | All                                                         | 0160-4789         | CAP 15 pF 5% 100V |
| C556,557          | All                                                         | 0160-4819         | CAP 2200 pF 5%    |
| C564,565          | All                                                         | 0180-4136         | CAP 10uf 20V      |
| C568,569          | All                                                         | 0160-7934         | 2 uF 300 vac 2%   |
| C570              | All                                                         | 0160-4918         | CAP .022 uf 10%   |
| C571              | All                                                         | 0160-4835         | CAP 1 uF 10% 50V  |
| C578,579,580      | All                                                         | 0160-5422         | CAP 0.047 uF 20%  |
| D501,502          | All                                                         | 1901-1098         | DIO-IN4150        |
| Red, Black        | All                                                         | 5080-2698         | CABLE             |
| J524              | All                                                         | 1252-1052         | DIN-CONN-MALE     |
| J526,527          | All                                                         | 1251-7616         | CONN-UTIL MT-LK   |
| K500              | See Rev C assembly<br>replacement parts at<br>end of table. |                   |                   |
| K501              | All                                                         | 0490-1405         | RELAY 2C 12 VDC   |
| K502,503          | All                                                         | 0490-1961         | RELAY 1C 12VDC    |
| L500,501          | 6811A/B                                                     | 06811-80004       | CHOKE             |
| L500,503          | 6812A/B,6813A/B,<br>6841A,6842A                             | 5080-2331         | CHOKE             |
| L504              | 6811A/B                                                     | 06811-80005       | CHOKE             |
| L504,505          | 6812A/B,6813A/B,<br>6841A,6842A                             | 5080-2332         | CHOKE             |
| L507,508          | All                                                         | 5080-2330         | INDUCTOR          |
| L509              | All                                                         | 5080-2368         | INDUCTOR-RESON    |
| L512,513          | All                                                         | 9135-0481         | INDUCTOR-CM       |
| L514              | All                                                         | 5080-2461         | INDUCTOR          |
| P527              | All                                                         | 5080-2351         | CABLE             |
| P537              | All                                                         | 5080-2346         | CABLE             |
| P544              | All                                                         | 5080-2363         | CABLE             |
| P545              | All                                                         | 5080-2350         | CABLE             |
| Q501,502          | All                                                         | 1855-0665         | MOSFET RFP 2N12L  |
| R502              | All                                                         | 0698-3547         | RES 1 5%.5W CC    |
| R503,565,576,577  | All                                                         | 0811-1832         | RES 5 1% 3W PW    |
| R506,507,512-515  | All                                                         | 0683-1065         | RES IOM 5%.25W    |
| R508,509,566,567  | All                                                         | 0699-1060         | RES .05 1% 3W     |

## 5 - Replaceable Parts

**Table 5-8. Output Board - continued**

| Reference Desig.                                                                                 | Applicability                   | Keysight Part No. | Description        |
|--------------------------------------------------------------------------------------------------|---------------------------------|-------------------|--------------------|
| R510                                                                                             | 6811A/B                         | 06811-80006       | RES SHUNT W/PIN    |
| R510                                                                                             | 6812A/B,6813A/B,<br>6841A,6842A | 5080-2383         | RES SHUNT W/PIN    |
| R511,543,549                                                                                     | All                             | 0699-0222         | RES 10.5K .1%      |
| R520,R523                                                                                        | All                             | 0698-3152         | RES 3.48K 1%       |
| R521,522                                                                                         | All                             | 0757-0414         | RES 432 1% .125W   |
| R529,R530                                                                                        | All                             | 0698-6414         | RES 1K.1%.1W F     |
| R531,536,539-542                                                                                 | All                             | 0699-1743         | RES 345K .1%       |
| R532,533                                                                                         | All                             | 0699-1741         | RES 5.657K.1%      |
| R535                                                                                             | All                             | 0699-4307         | RESISTOR-FIXED     |
| R537,544-546,595,596                                                                             | All                             | 0757-0401         | RES 100 1%.125W    |
| R547                                                                                             | 6811A/B                         | 0757-1100         | RES 600 1% .125w   |
| R547                                                                                             | 6812A/B,6813A/B,<br>6841A,6842A | 0698-4463         | RES 845 1%.125W    |
| R500,501,592,593                                                                                 | All                             | 0698-3260         | RES 464K 1%        |
| R550,555,558,559                                                                                 | All                             | 0698-8826         | RES 825K 1%        |
| R551,554                                                                                         | All                             | 0757-0279         | RES 3.16K 1%       |
| R552,553                                                                                         | All                             | 0698-3156         | RES 14.7K 1%       |
| R560                                                                                             | All                             | 0698-OG64         | RES 9.31K 1%       |
| R568                                                                                             | All                             | 0698-3609         | RES 22 5% 2W MO    |
| R571,572                                                                                         | All                             | 0699-3420         | RES 56K 5% 5W      |
| R573,574                                                                                         | All                             | 0698-3279         | RES 4.99K 1% .125W |
| R575                                                                                             | All                             | 0698-4446         | RES 267 1% .125W   |
| R569                                                                                             | All                             | 0757-0407         | RES 200 1% .125W   |
| R578                                                                                             | All                             | 0698-3430         | RES 21.5 1%        |
| R579,580                                                                                         | All                             | 0698-8812         | RES 1 1%.125W F    |
| R581                                                                                             | All                             | 0683-0475         | RES 4.7 5% .25W    |
| R584-591                                                                                         | All                             | 0811-1810         | RES 3.6K 5% 3W     |
| R594                                                                                             | All                             | 0683-1015         | RES 100 5% .25W    |
| RT501                                                                                            | All                             | 0837-0397         | THERMISTOR         |
| TB552                                                                                            | All                             | 0360-2578         | BARRIER BLOCK      |
| TP500                                                                                            | All                             | 1250-1918         | TEST JACK          |
| U500                                                                                             | All                             | 1826-1081         | IC LF411A          |
| U502,506                                                                                         | All                             | 1826-1135         | IC OP-27           |
| U503                                                                                             | All                             | 1826-0412         | IC LM393N          |
| W501                                                                                             | All                             | 7175-0057         | WIRE 2             |
| <b>NOTE:</b> The following parts are used only in Output Filter assemblies Revision C and below. |                                 |                   |                    |
| K500                                                                                             | 6812A/B,6813A/B,<br>6841A,6842A | 5063-3494         | RELAY-ASSEMBLY     |
| L510,511                                                                                         | 6812A/B,6813A/B,<br>6841A,6842A | 9140-1743         | CHOKE 82uH MOLDED  |
| R500,501                                                                                         | 6812A/B,6813A/B,<br>6841A,6842A | 0698-3260         | RES 464k 1%        |
| R503                                                                                             | 6812A/B,6813A/B,<br>6841A,6842A | 0812-0047         | RES 5 5% 5W PW     |
| R584-591                                                                                         | 6812A/B,6813A/B,<br>6841A,6842A | 0811-1810         | RES 3.6K 5% 3W     |

**Table 5-9. Parts List for Control Board**

| Reference Desig. | Applicability | Keysight Part No. | Description            |
|------------------|---------------|-------------------|------------------------|
| U985             | All           | 5080-2410         | Programmed GAL Freq    |
| U988             | All           | 5080-2408         | programmed GAL Status  |
| U991             | All           | 5080-2409         | Programmed GAL Protect |
| U1801            | All           | 5080-2407         | Programmed GAL PWM/RLY |

**Table 5-10. Parts List for Front Panel**

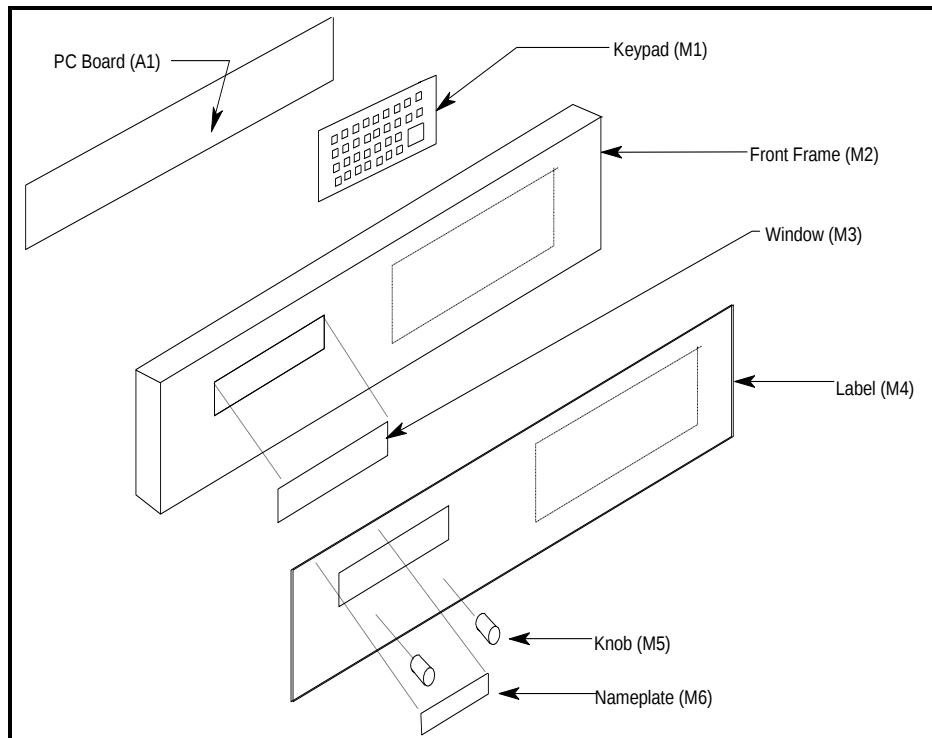
| Reference Desig. | Applicability | Keysight Part No. | Description                |
|------------------|---------------|-------------------|----------------------------|
| G1, G2           | All           | 0960-0912         | RPG                        |
| U004             | All           | 5080-2384         | Programmed ROM front panel |

**Table 5-11. Parts List for DSP Board**

| Reference Desig. | Applicability                 | Keysight Part No. | Description    |
|------------------|-------------------------------|-------------------|----------------|
| U714             | 6841A,6842A                   | 5080-2421         | Programmed GAL |
| U715             | 6841A,6842A                   | 5080-2422         | Programmed GAL |
| U716             | 6841A,6842A                   | 5080-2423         | Programmed GAL |
| U734             | 6811A,6812A,6813A             | 5080-2411         | Programmed ROM |
| U734             | 6811B,6812B,6813B,6841A,6842A | 5080-2424         | Programmed ROM |
| U735             | 6811A,6812A,6813A             | 5080-2412         | Programmed ROM |
| U735             | 6811B,6812B,6813B,6841A,6842A | 5080-2425         | Programmed ROM |

**Table 5-12. Parts List for Thermistor Board**

| Reference Desig. | Applicability | Keysight Part No. | Description |
|------------------|---------------|-------------------|-------------|
| RT1              |               |                   |             |





# Diagrams

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## Introduction

This chapter contains drawings and diagrams for troubleshooting and maintaining the Keysight Series 6611A/B 6612A/B 6613A/B AC Power Source/Analyzers, and Keysight Series 6841A/6842A/6843A Harmonic Flicker Test Systems. Unless otherwise specified, a drawing or diagram applies to all models of the series (see general schematic note #1). Wiring connections to external equipment are shown in the ac source User's Guide.

## General Schematic Notes

- Not all components or values shown on the schematic apply to all ac source models. The parts lists in Chapter 5 contains information about components that are model-specific.
- All resistors are in ohms 1%, 1/8 W, unless otherwise specified.
- All capacitors are in microfarads unless otherwise specified.
- Signal lines that are terminated by flags continue on other sheets and may go to other locations on the same sheet. For example: CVPROG (SH.2 8C) on sheet 2 location 8C) the same location All resistors are in ohms 1%, 1/8 W, unless otherwise specified.
- All resistors are in ohms 1%, 1/8 W, unless otherwise specified.
- Unless otherwise noted, bias connections to integrated-circuit packages are as follows:

|                 | <u>Common</u> | <u>5 V</u> |
|-----------------|---------------|------------|
| 14-pin packages | pin 7         | pin 14     |
| 16-pin packages | pin 8         | pin 16     |
| 20-pin packages | pin 10        | pin 20     |

## 6 - Diagrams

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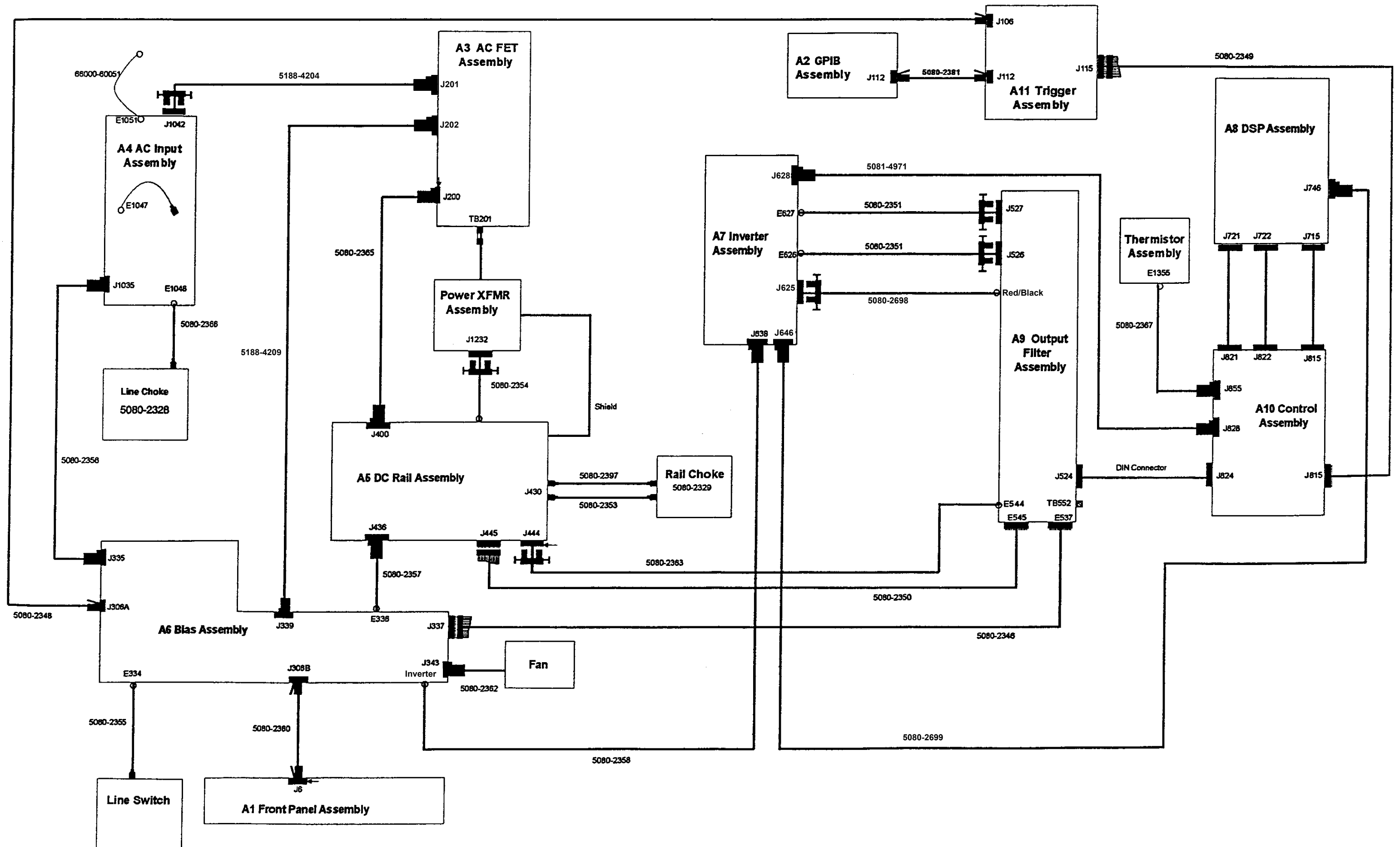


Figure 6-1. Interconnect Diagram

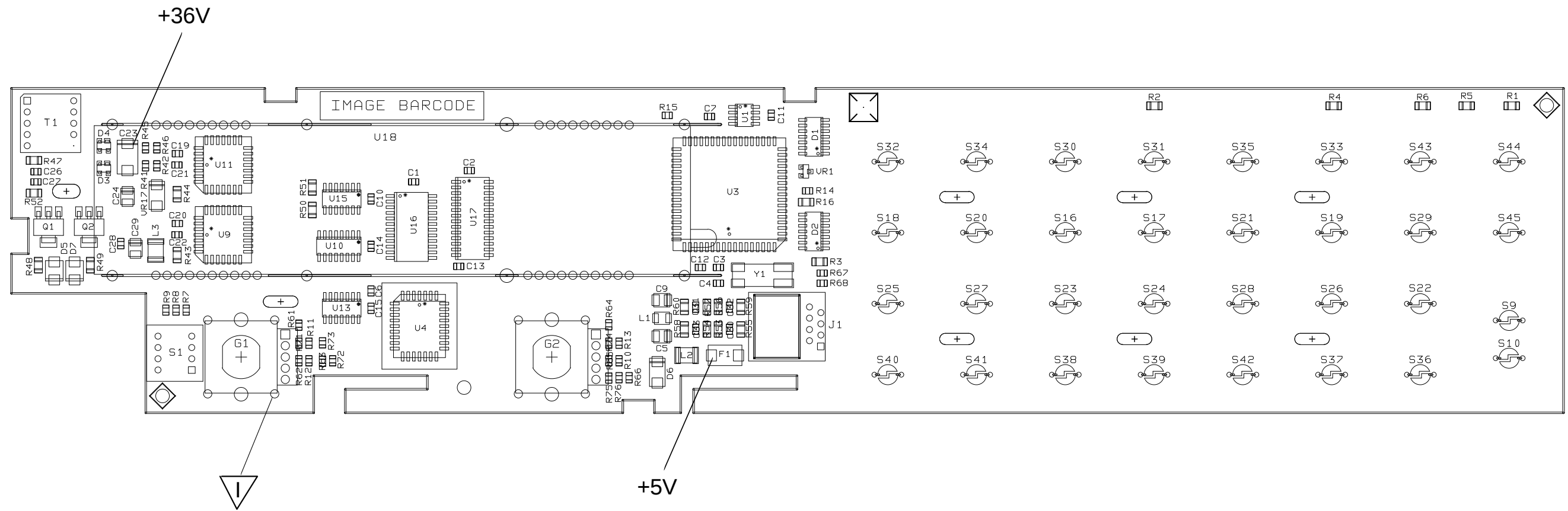


Figure 6-2. Front Panel Assembly, Component Locations

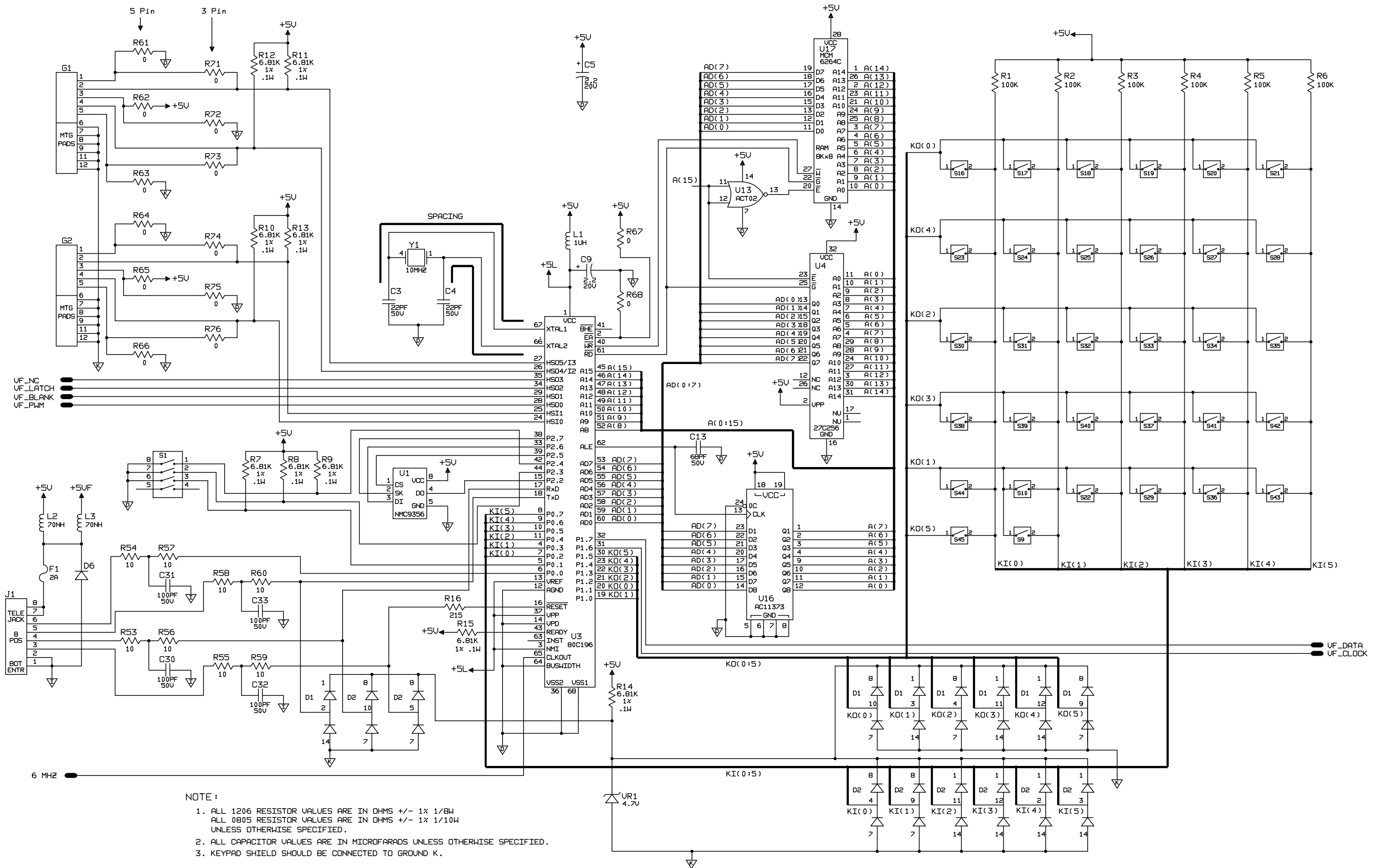


Figure 6-3. Intelligent Front Panel Assembly, Schematic Diagram (sheet 1 of 2)

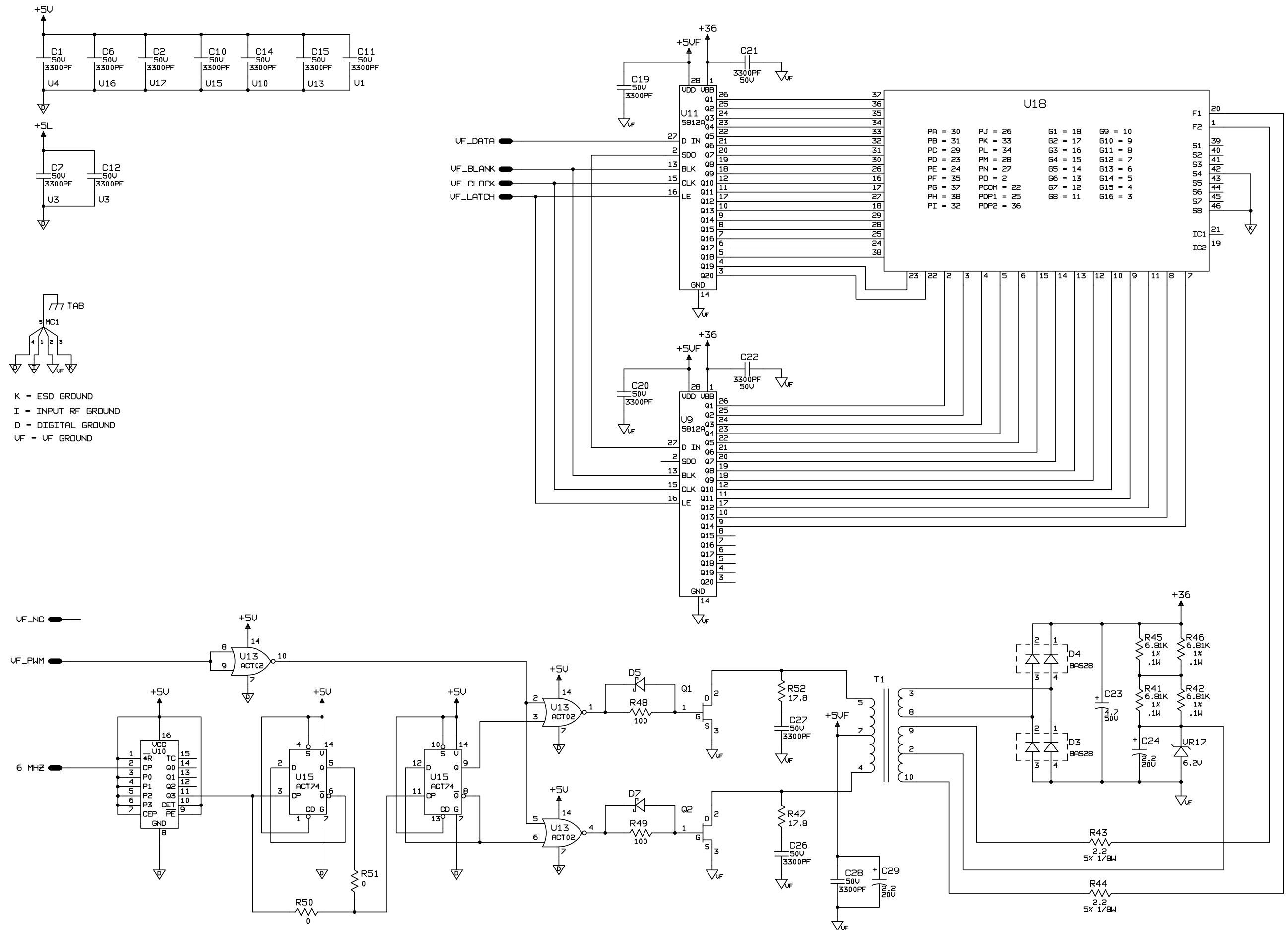


Figure 6-3. Intelligent Front Panel Assembly, Schematic Diagram (sheet 2 of 2)

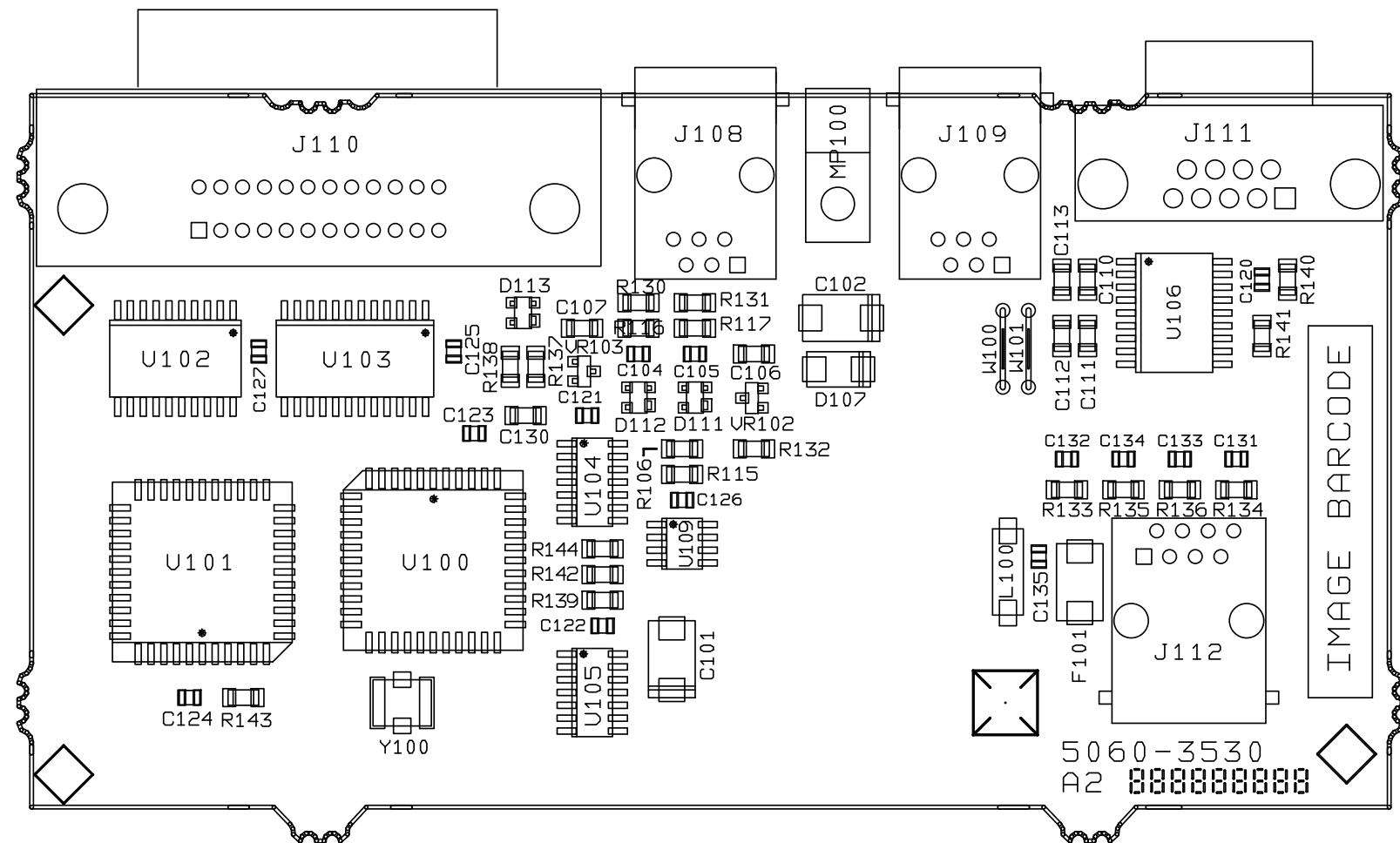


Figure 6-4. GPIB Assembly, Component Locations

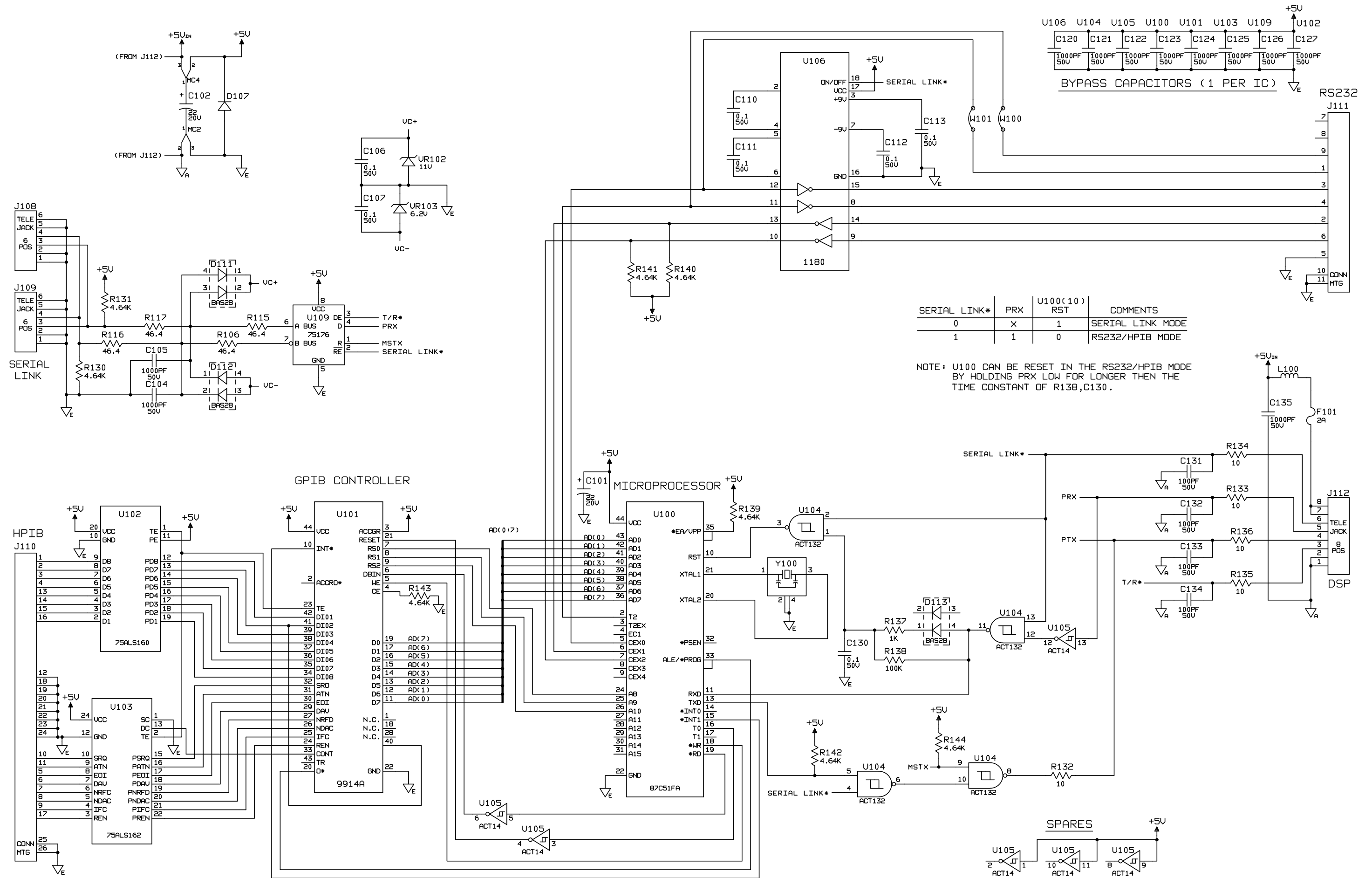
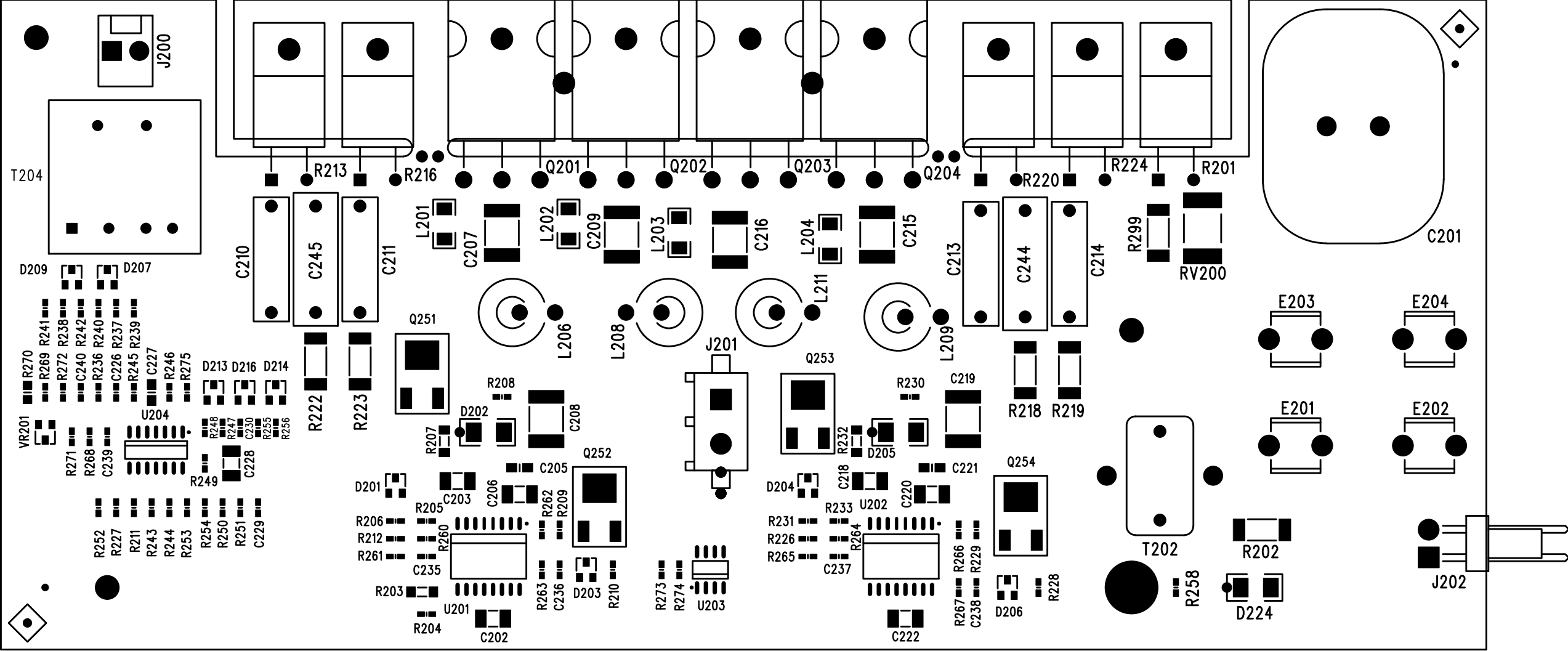


Figure 6-5. GPIB Assembly, Schematic Diagram



LAYER 1 - COMPONENT SIDE

Figure 6-6. FET Assembly, Component Locations



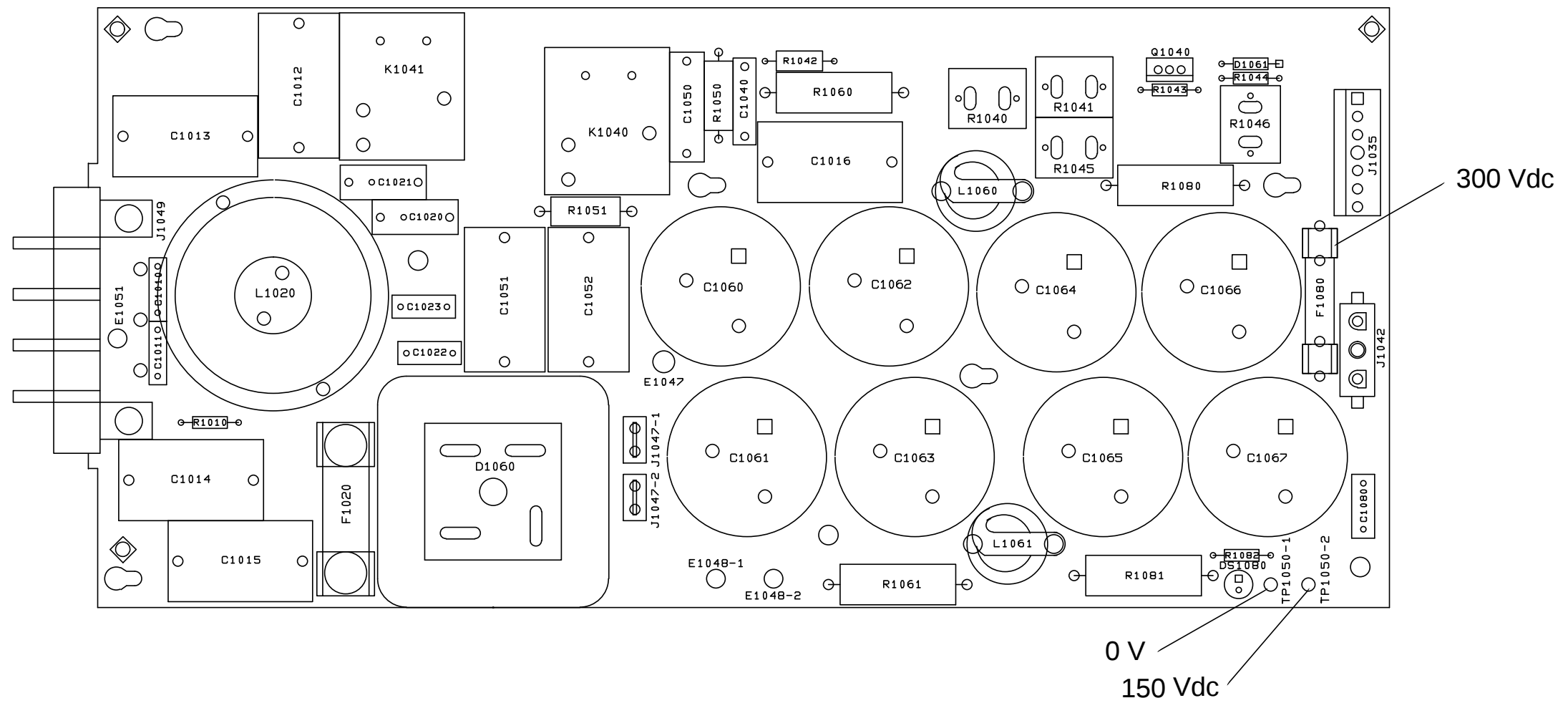


Figure 6-8. AC Input Assembly, Component Locations

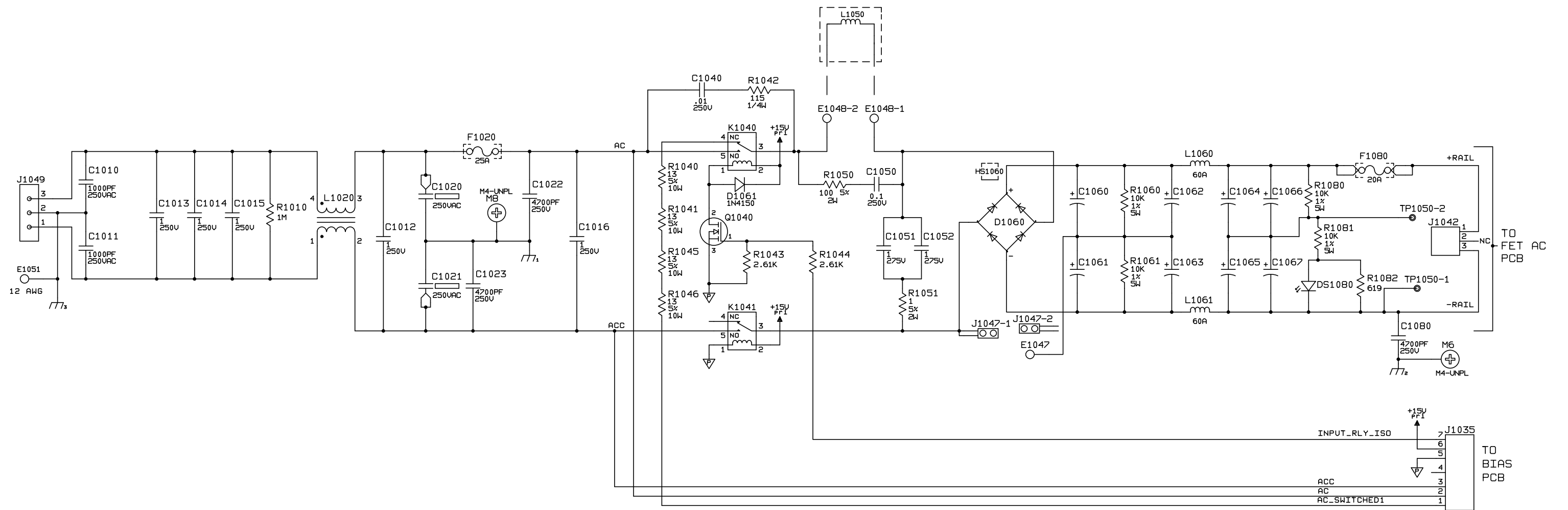


Figure 6-9. AC Input Assembly, Schematic Diagram

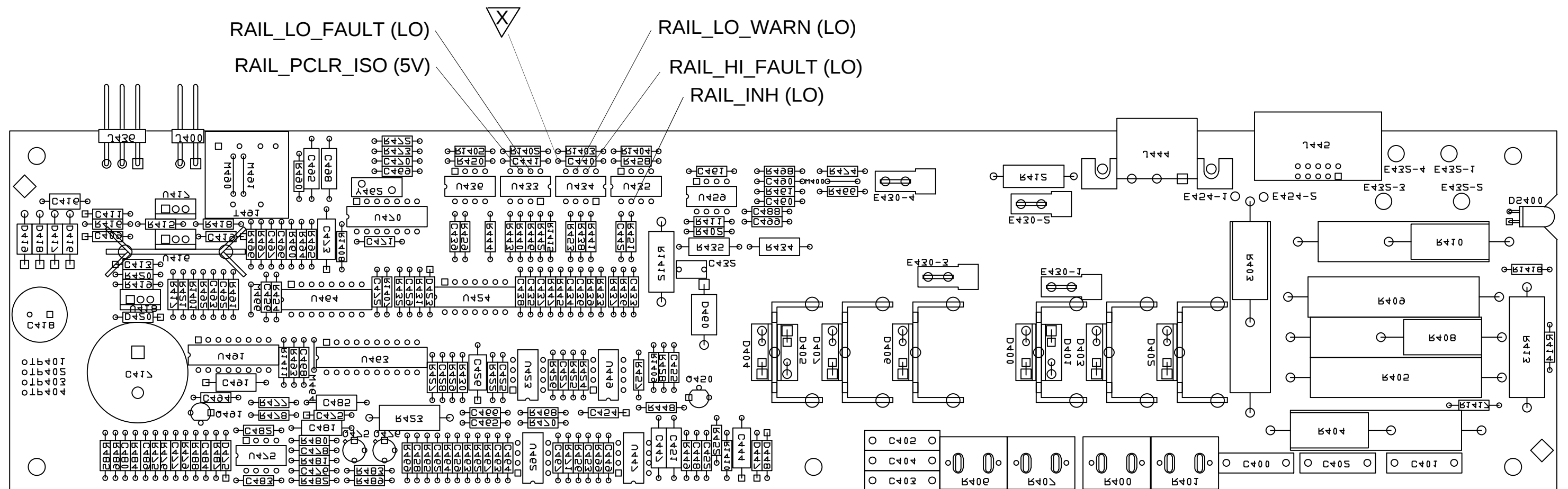


Figure 6-10. DC Rail/Diode Assembly, Component Locations (sheet 1 of 2)

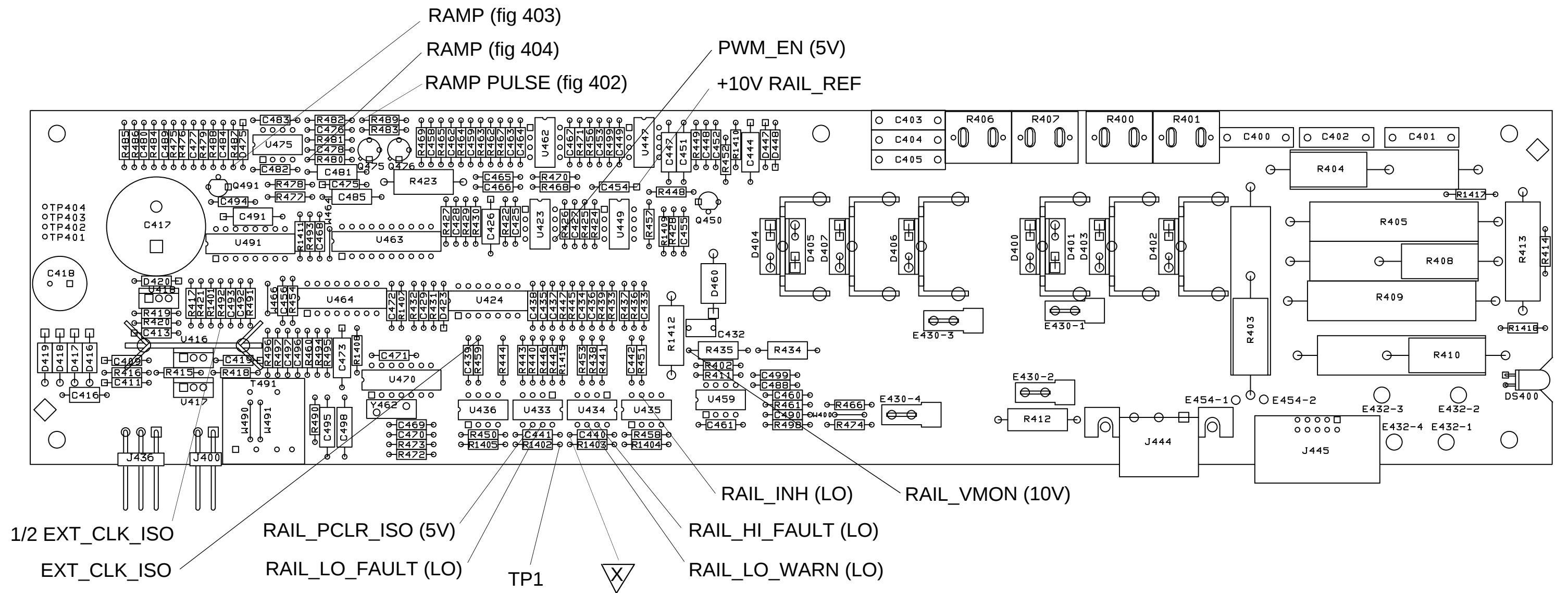


Figure 6-10. DC Rail/Diode Assembly, Component Locations (sheet 2 of 2)



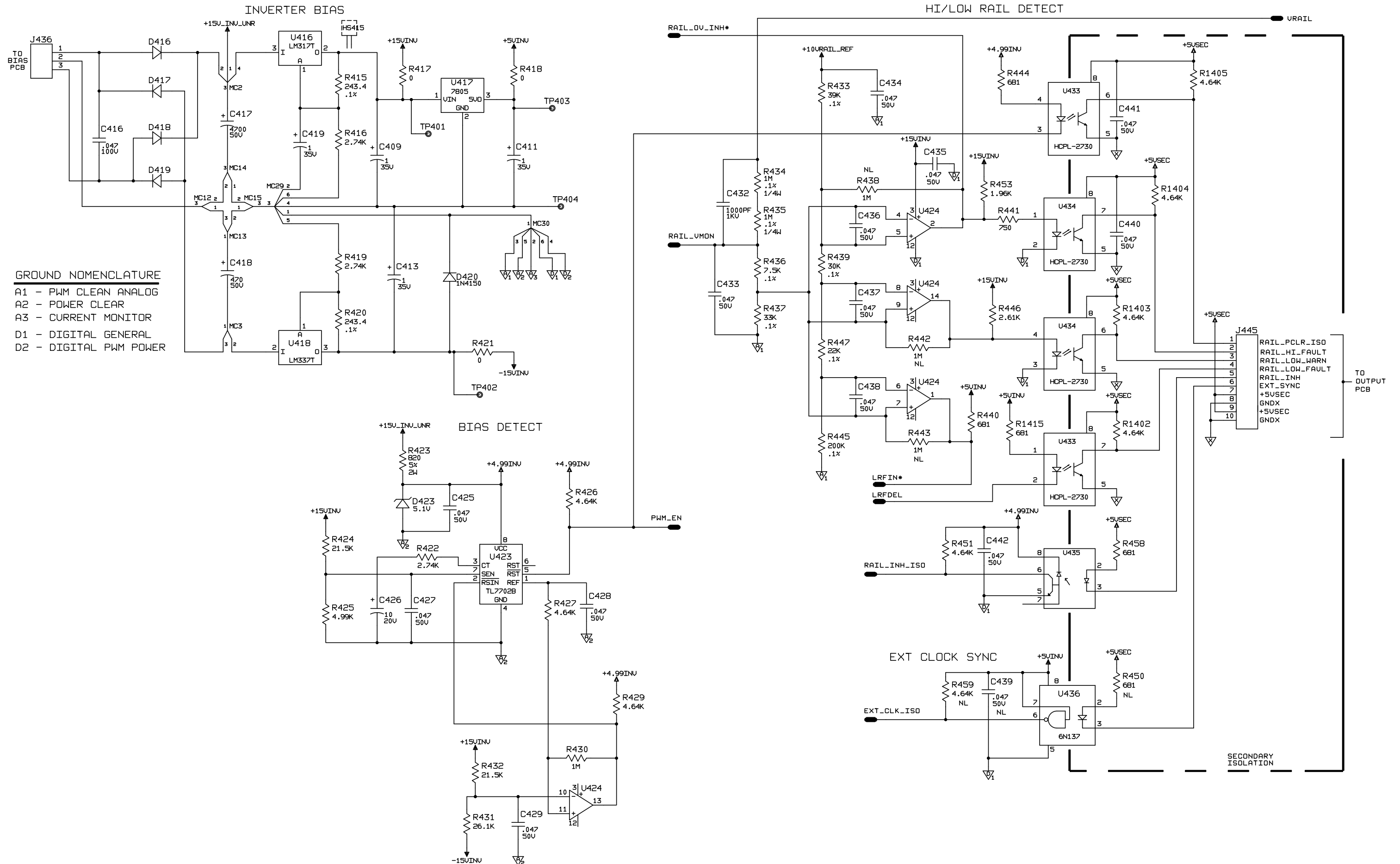
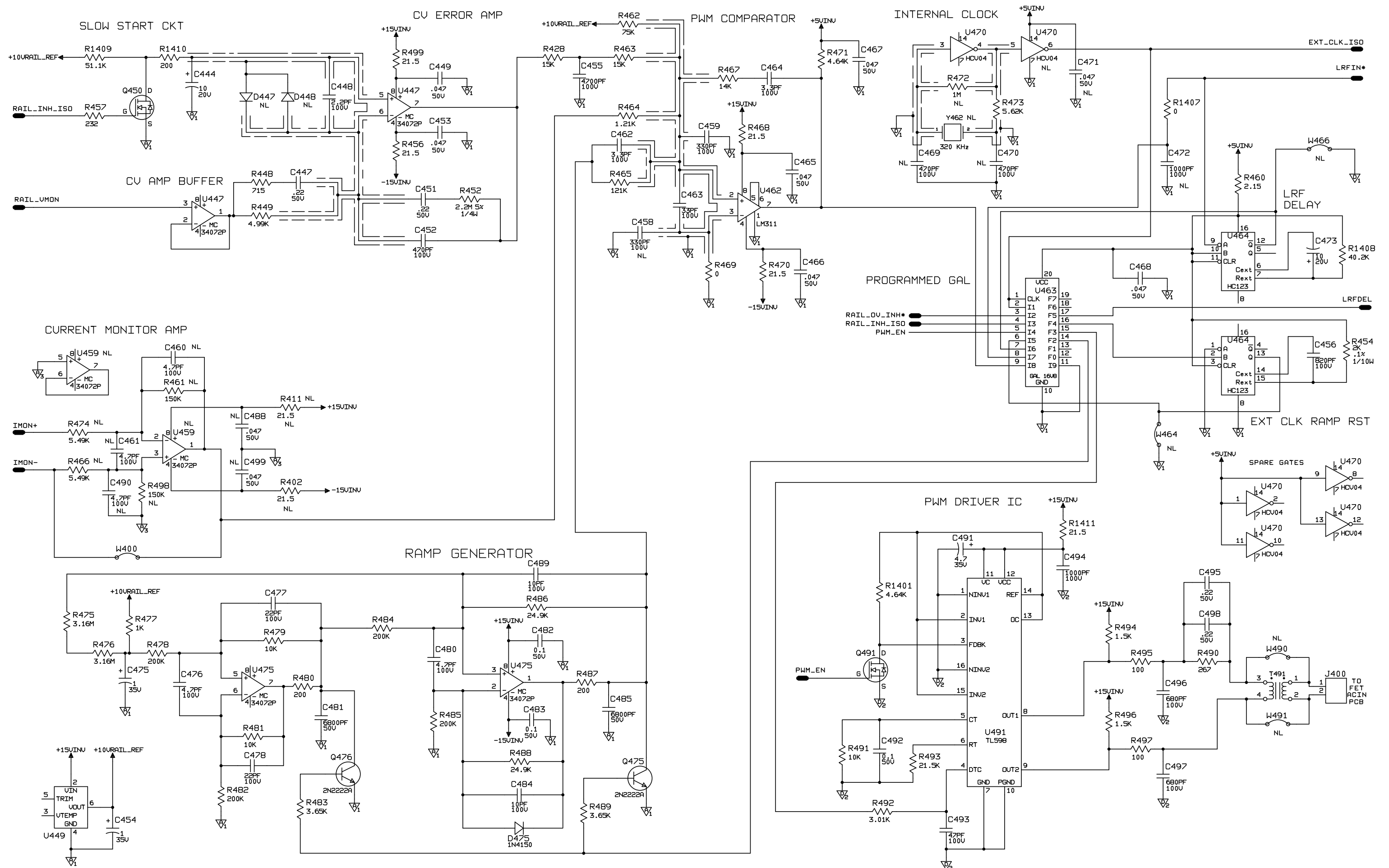


Figure 6-11. DC Rail/Diode Assembly, Schematic Diagram (sheet 2 of 3)



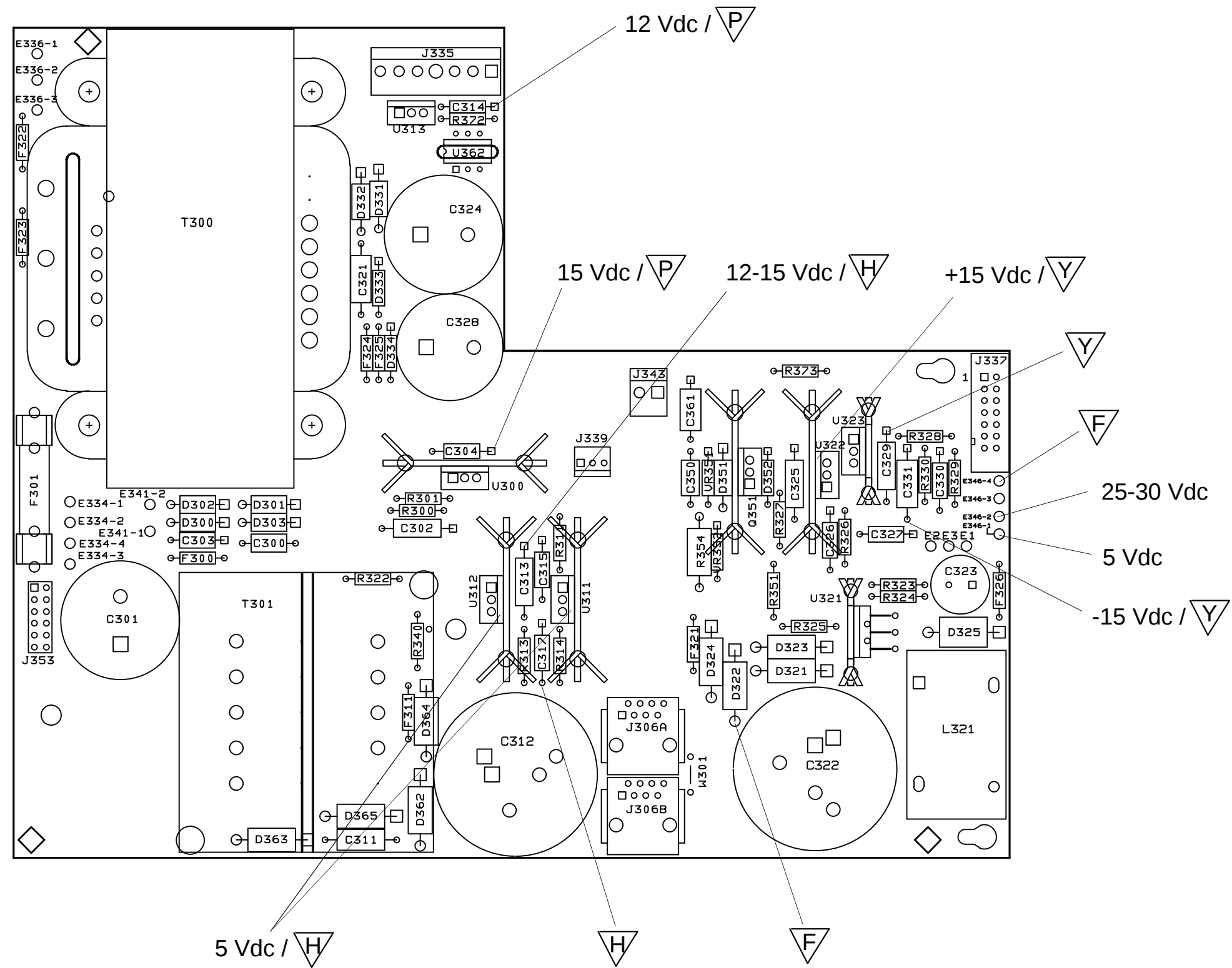


Figure 6-12. Bias Assembly, Component Locations

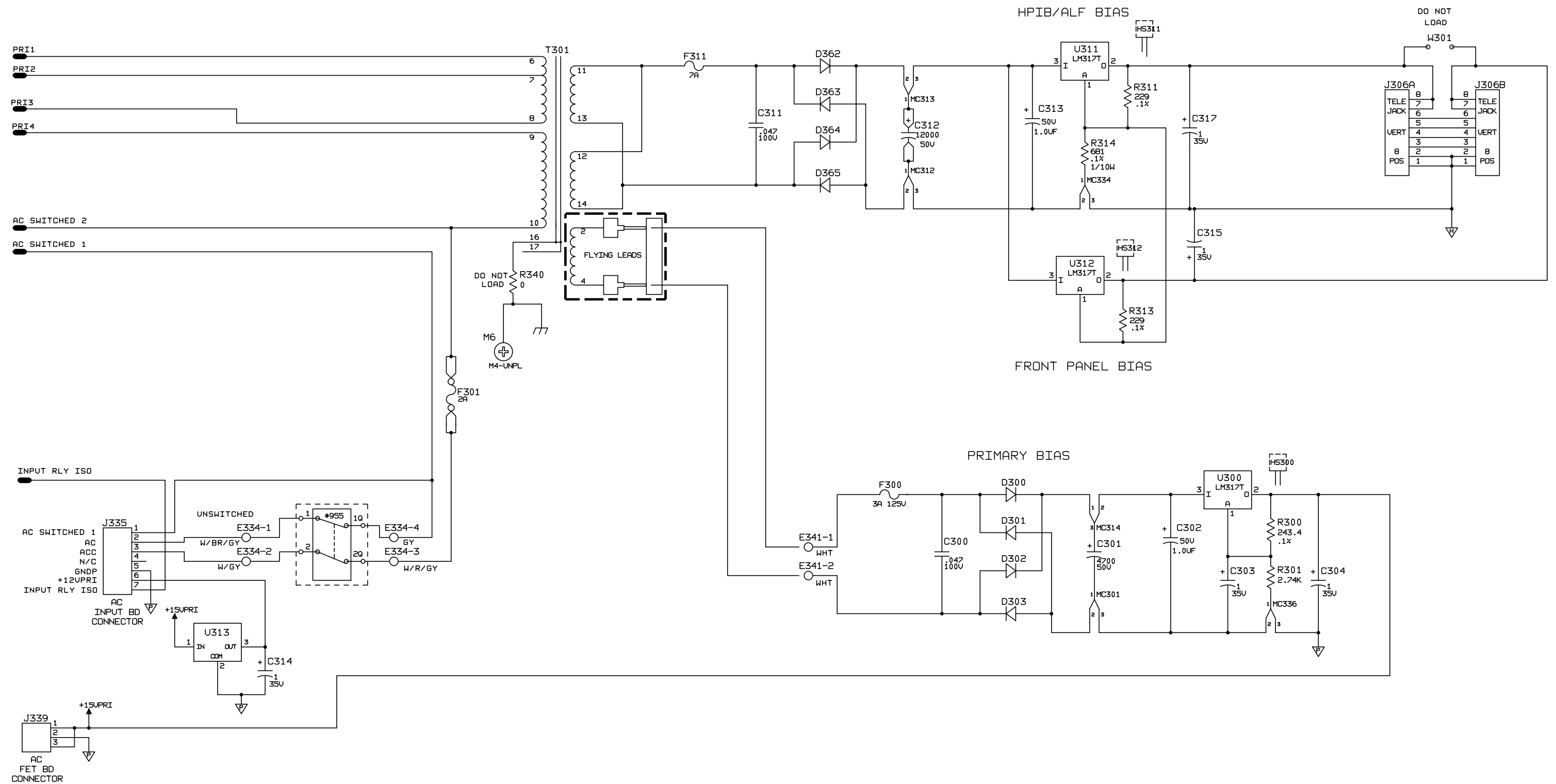


Figure 6-13. Bias Assembly, Schematic Diagram (sheet 1 of 2)

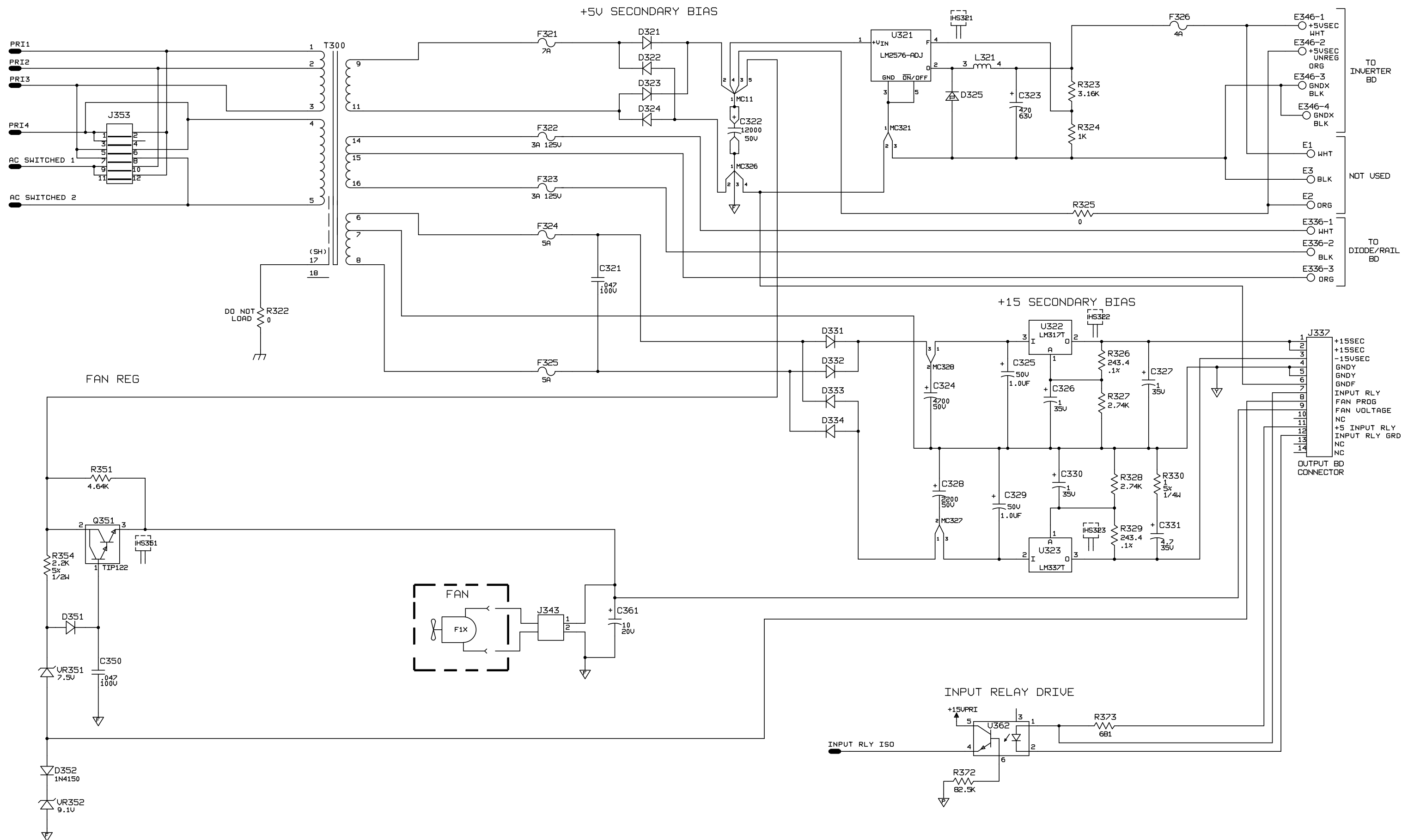


Figure 6-13. Bias Assembly, Schematic Diagram (sheet 2 of 2)

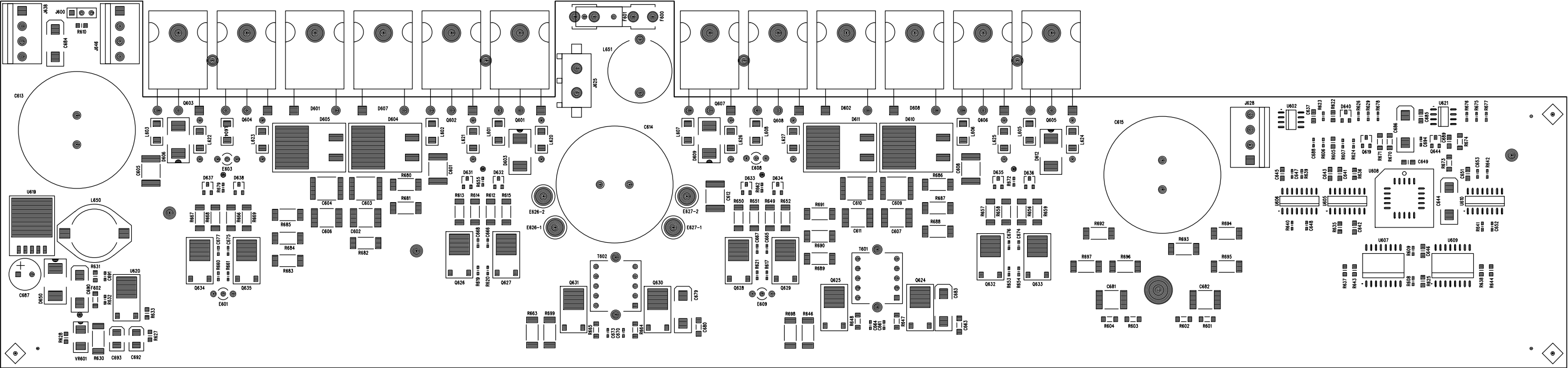


Figure 6-14. Inverter Assembly, Component Locations





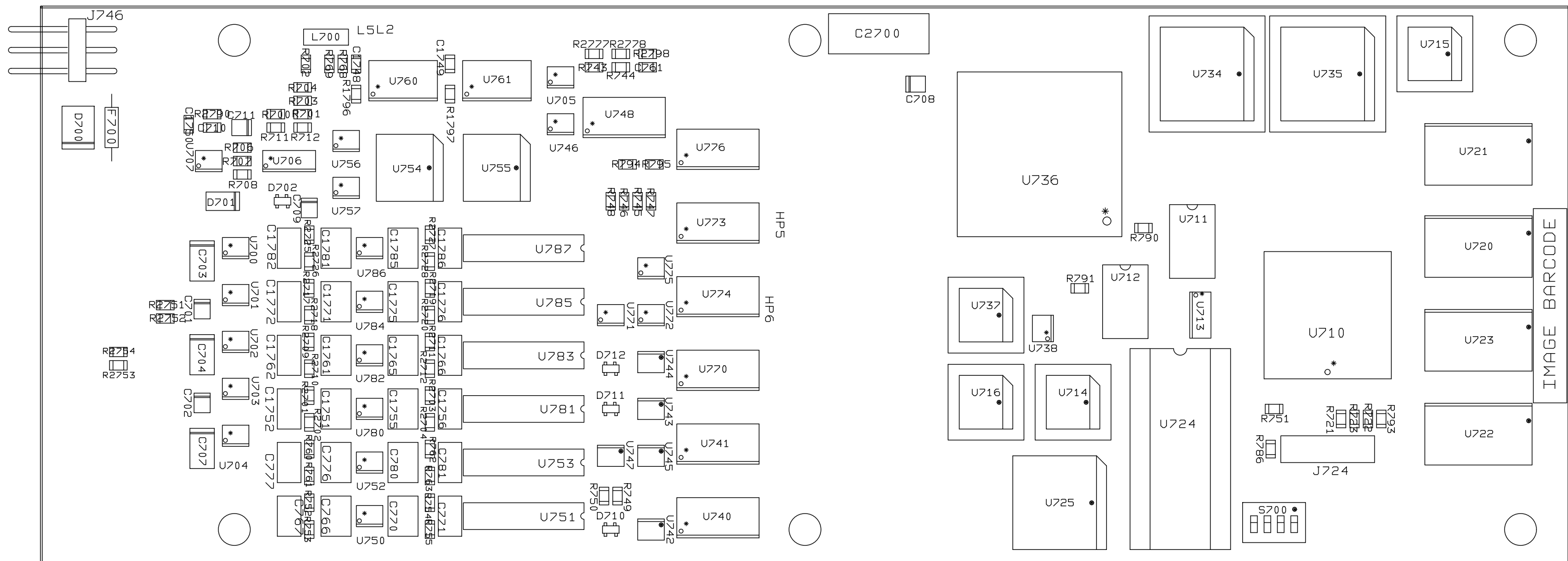


Figure 6-16. DSP Assembly, Component Locations (sheet 1 of 2)



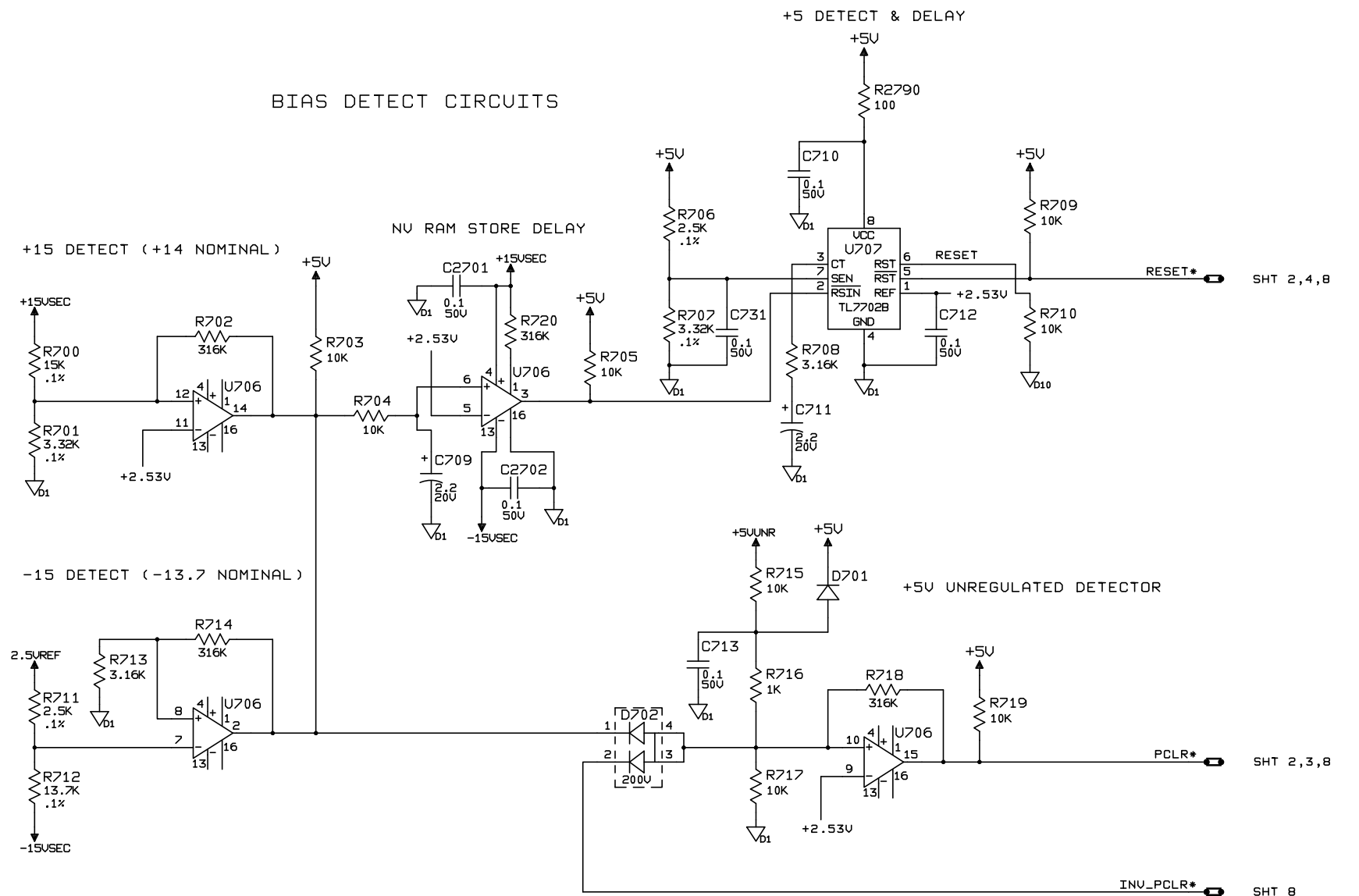
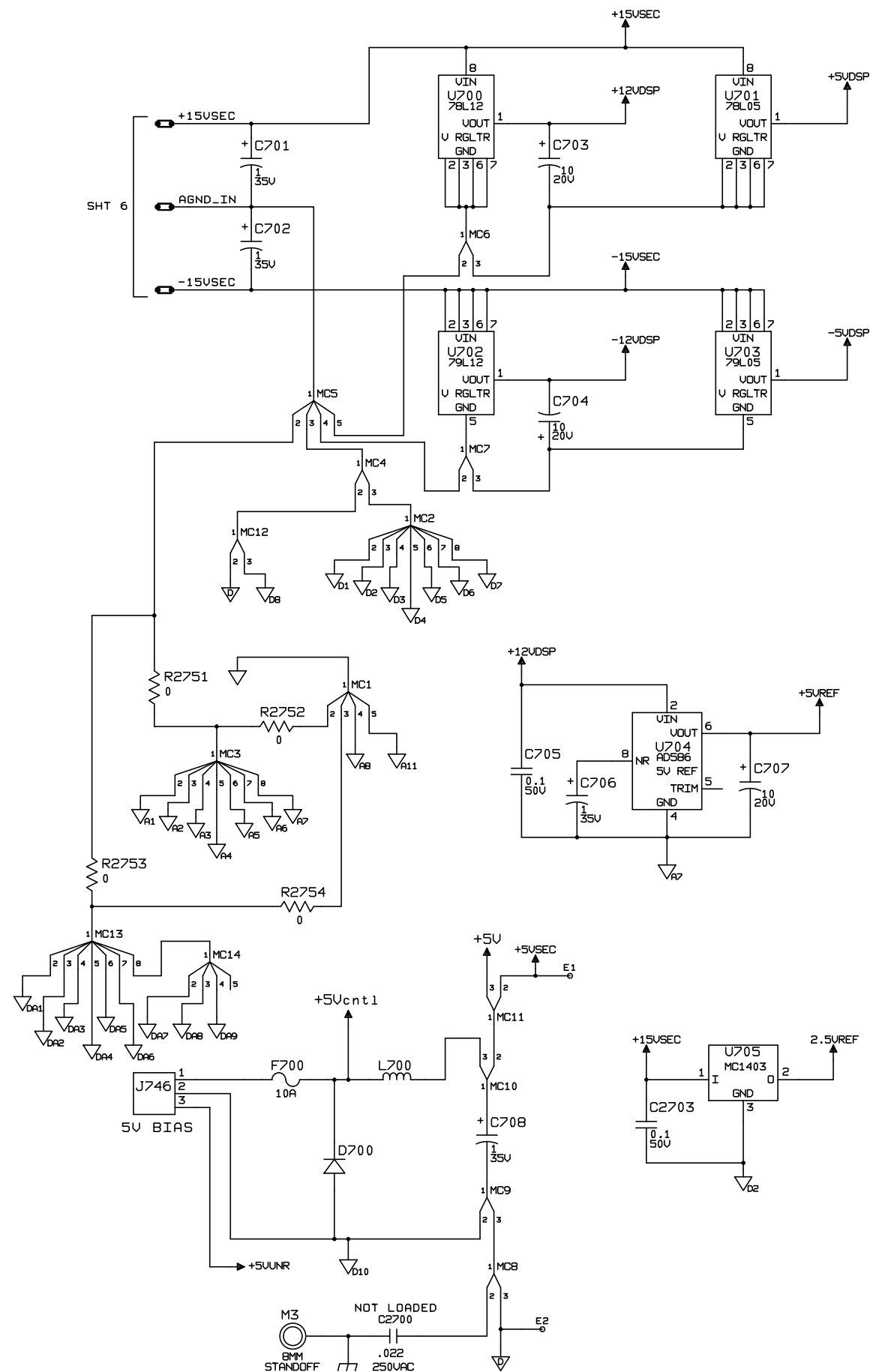


Figure 6-17. DSP Assembly, Schematic Diagram (sheet 1 of 10)

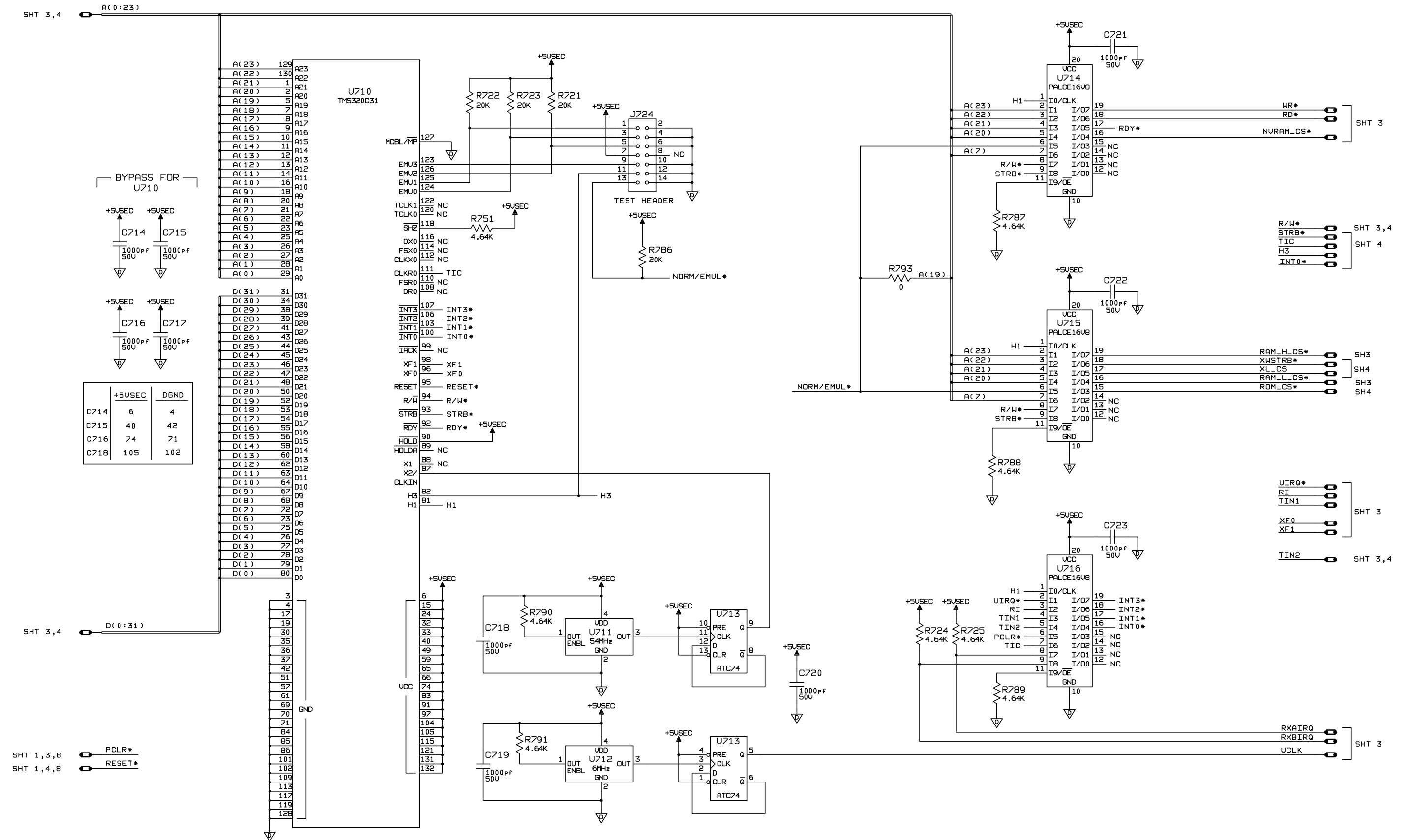
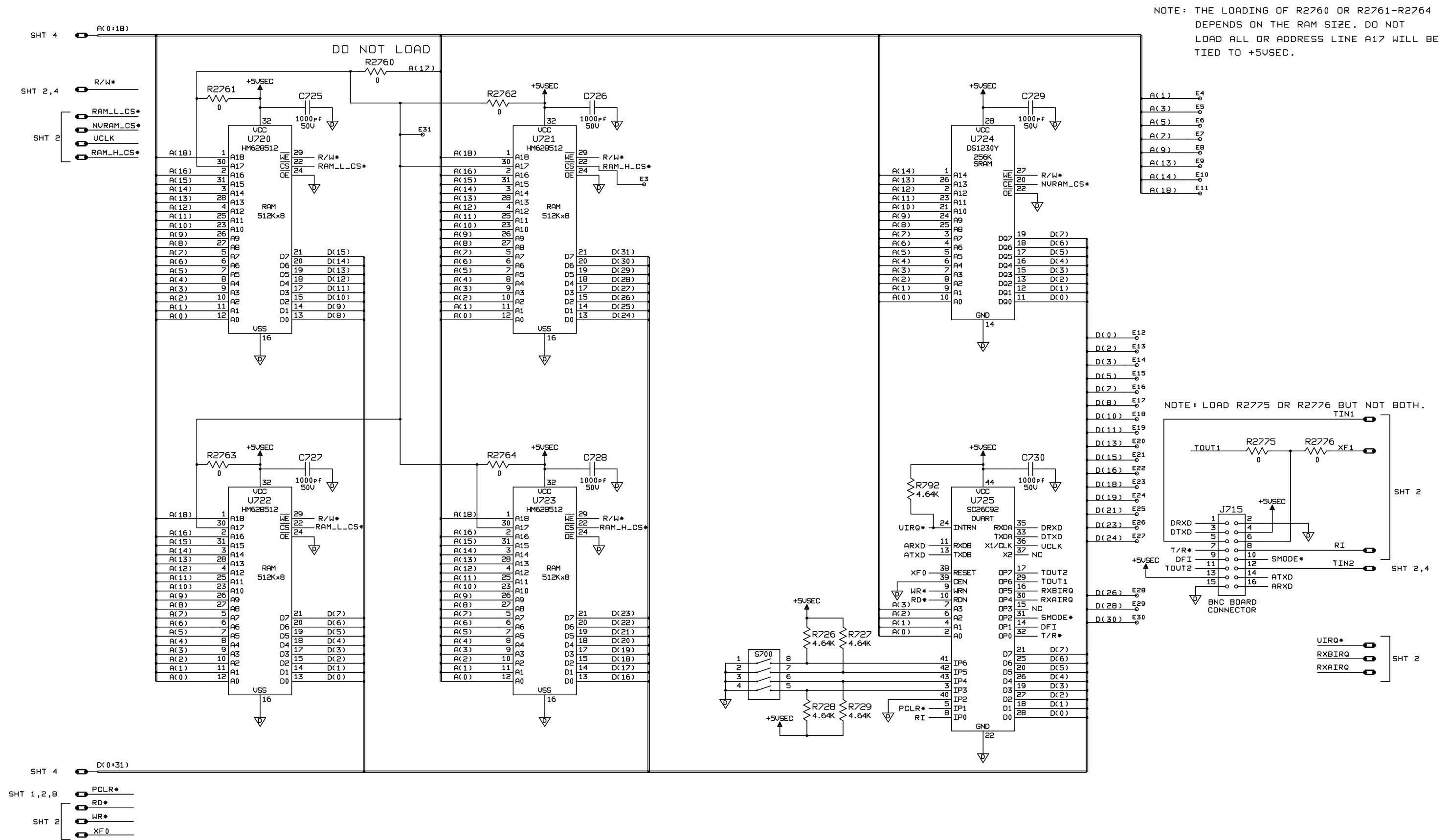


Figure 6-17. DSP Assembly, Schematic Diagram (sheet 2 of 10)



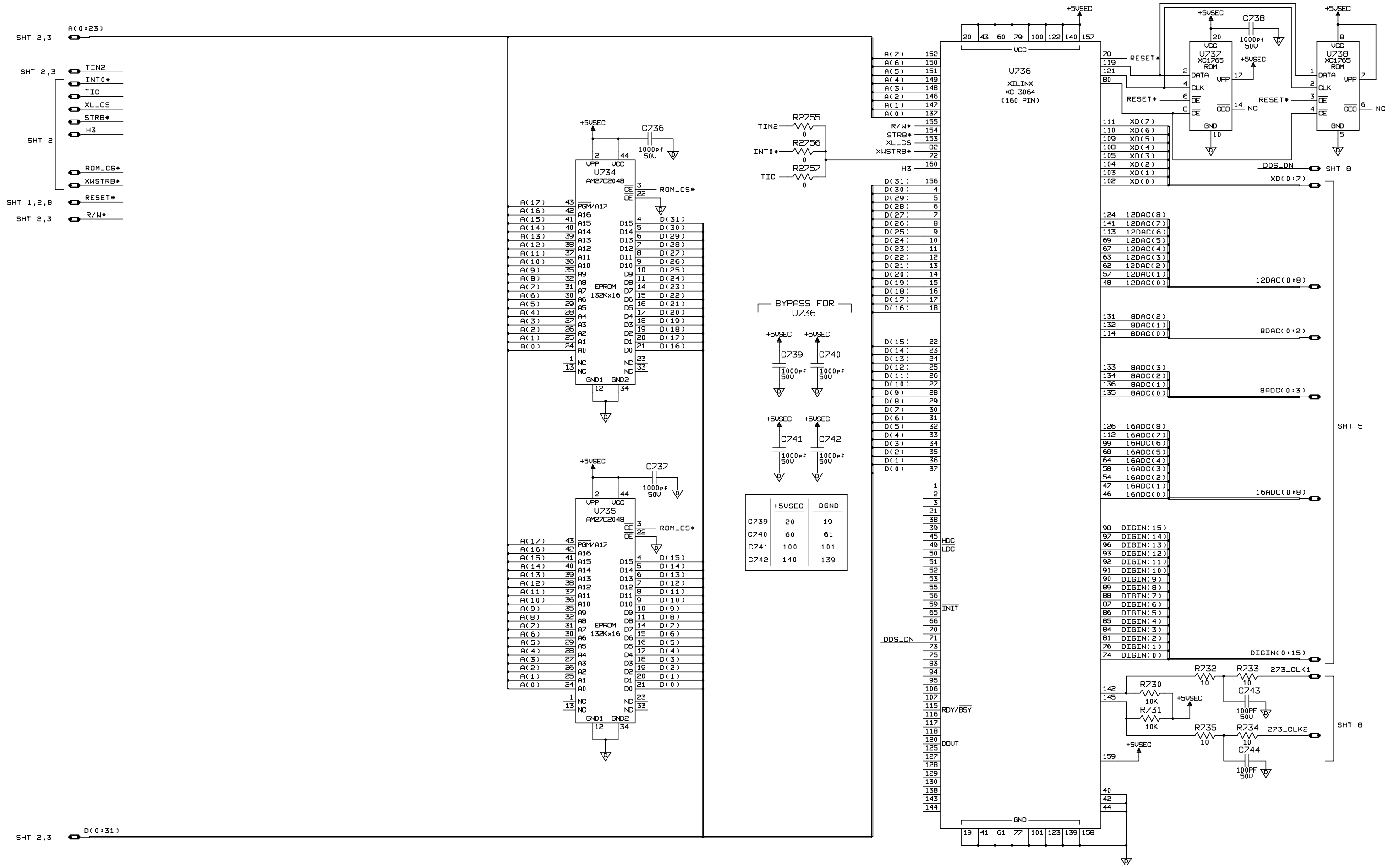


Figure 6-17. DSP Assembly, Schematic Diagram (sheet 4 of 10)

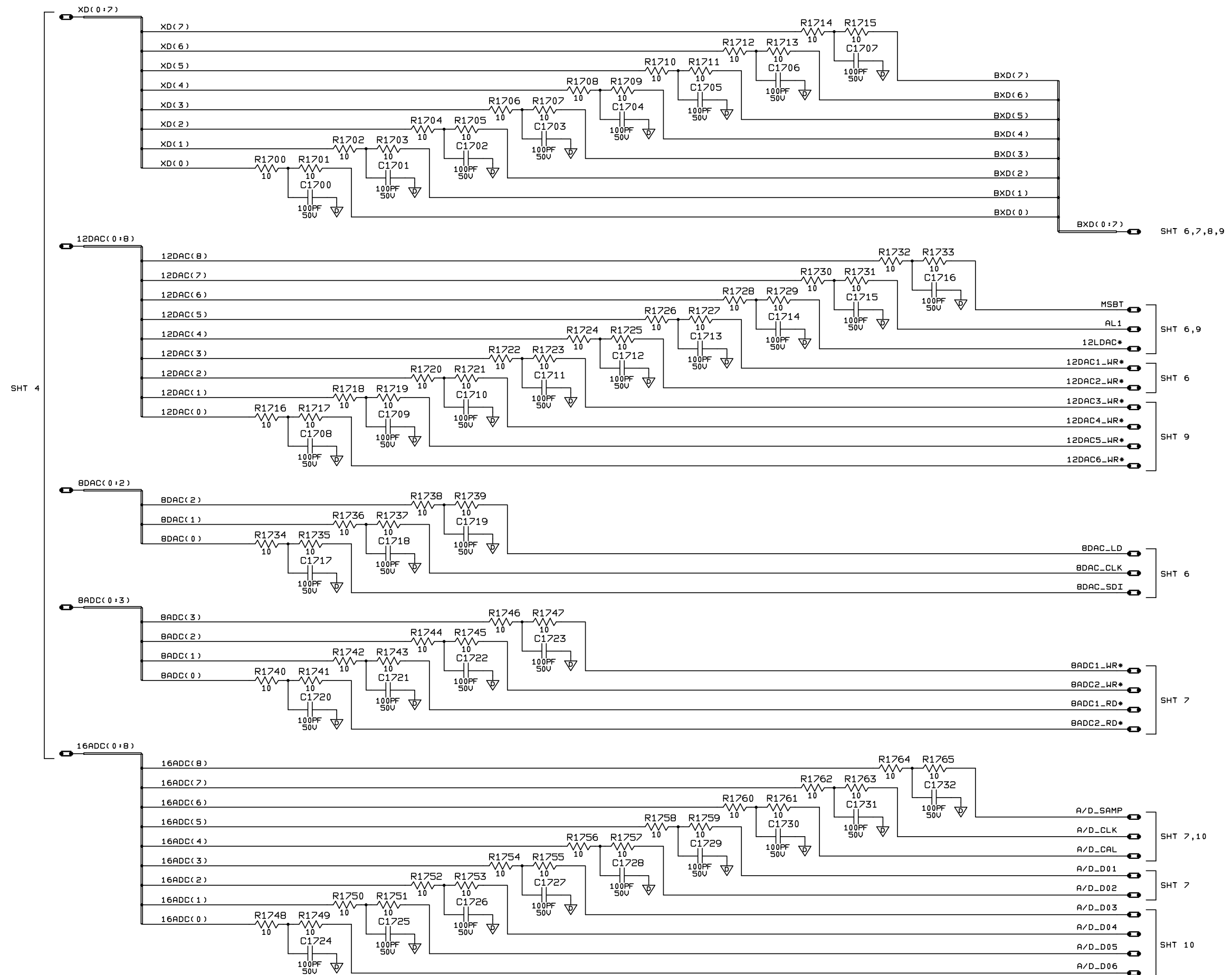


Figure 6-17. DSP Assembly, Schematic Diagram (sheet 5 of 10)

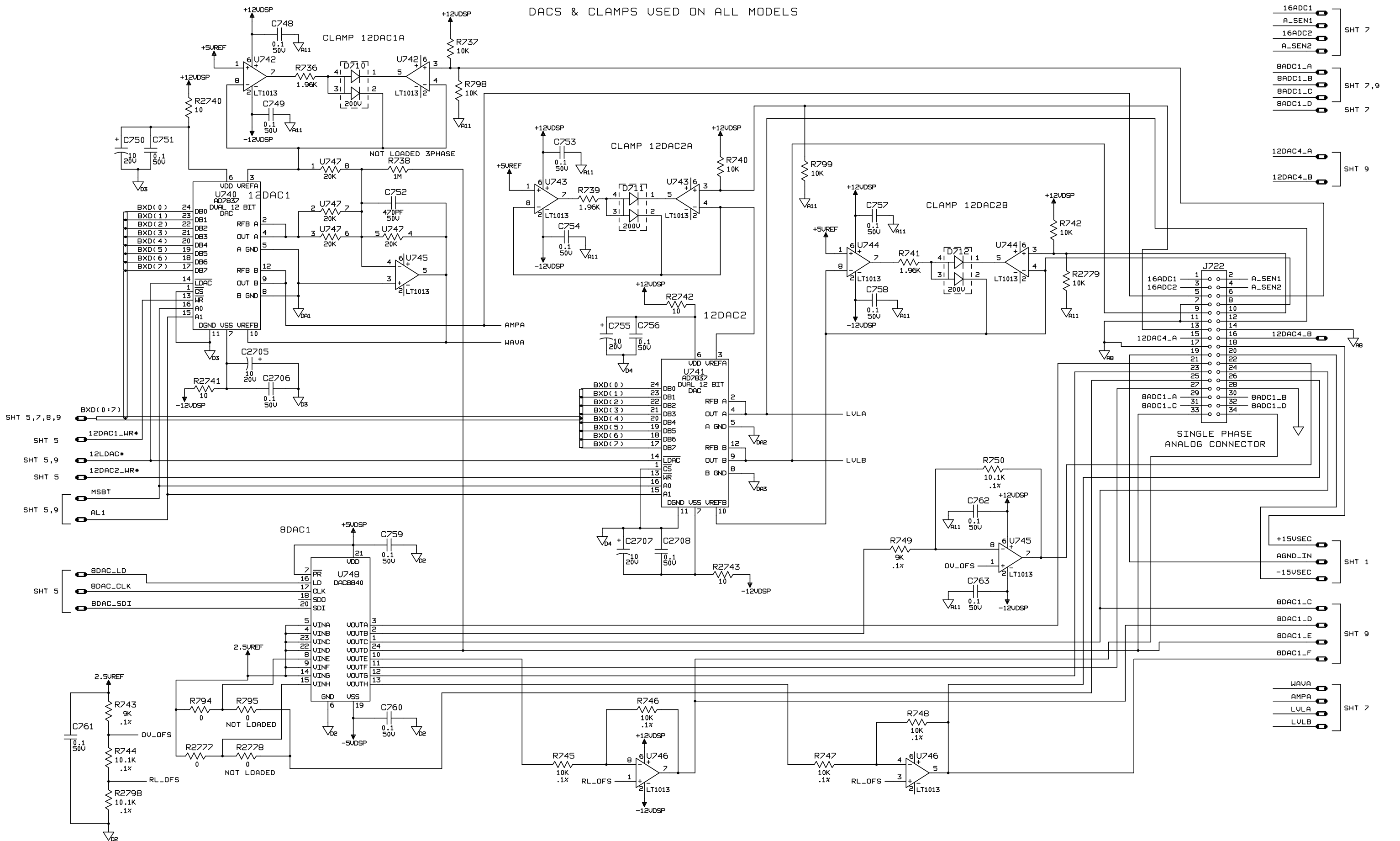


Figure 6-17. DSP Assembly, Schematic Diagram (sheet 6 of 10)

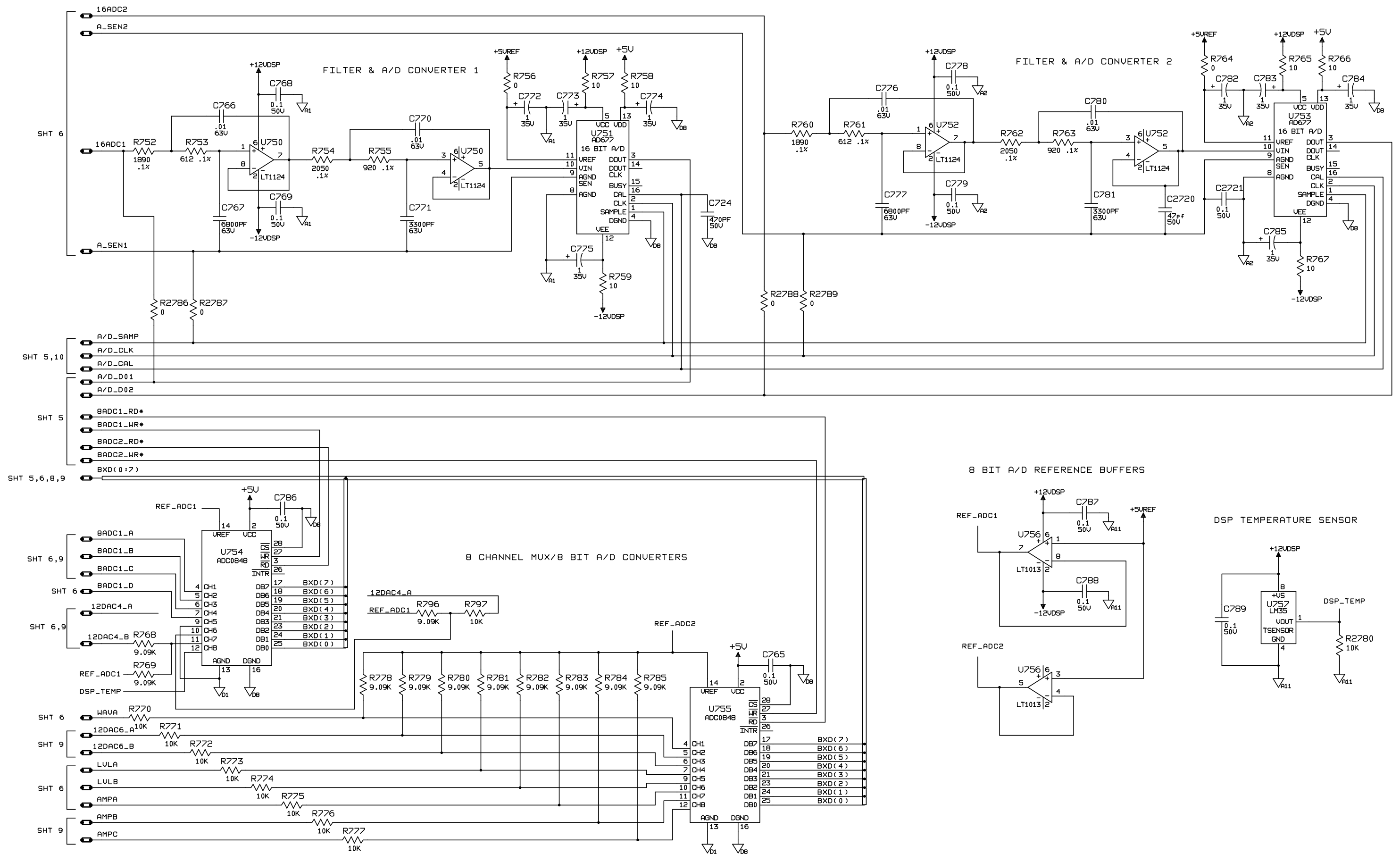


Figure 6-17. DSP Assembly, Schematic Diagram (sheet 7 of 10)

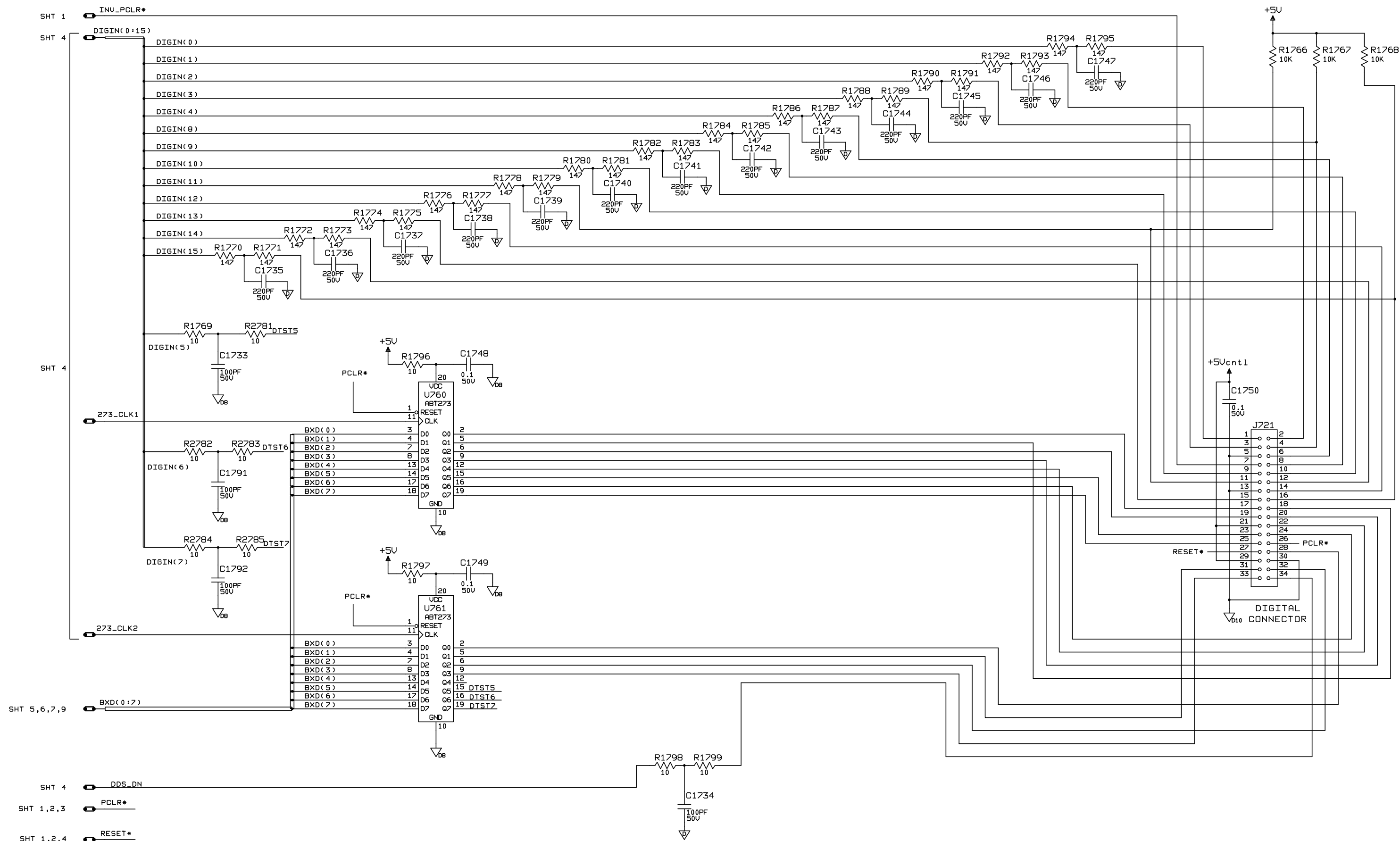


Figure 6-17. DSP Assembly, Schematic Diagram (sheet 8 of 10)

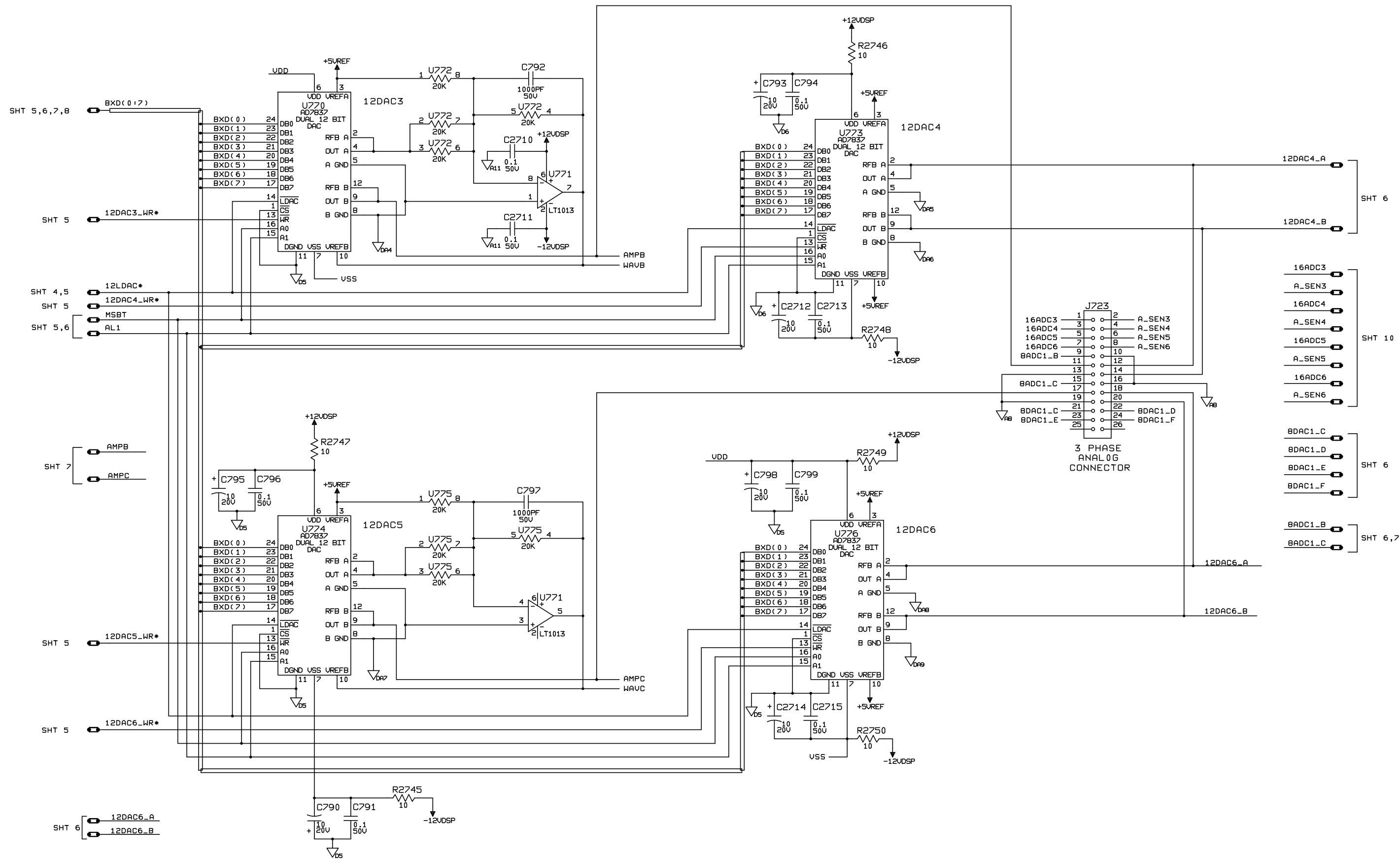


Figure 6-17. DSP Assembly, Schematic Diagram (sheet 9 of 10)

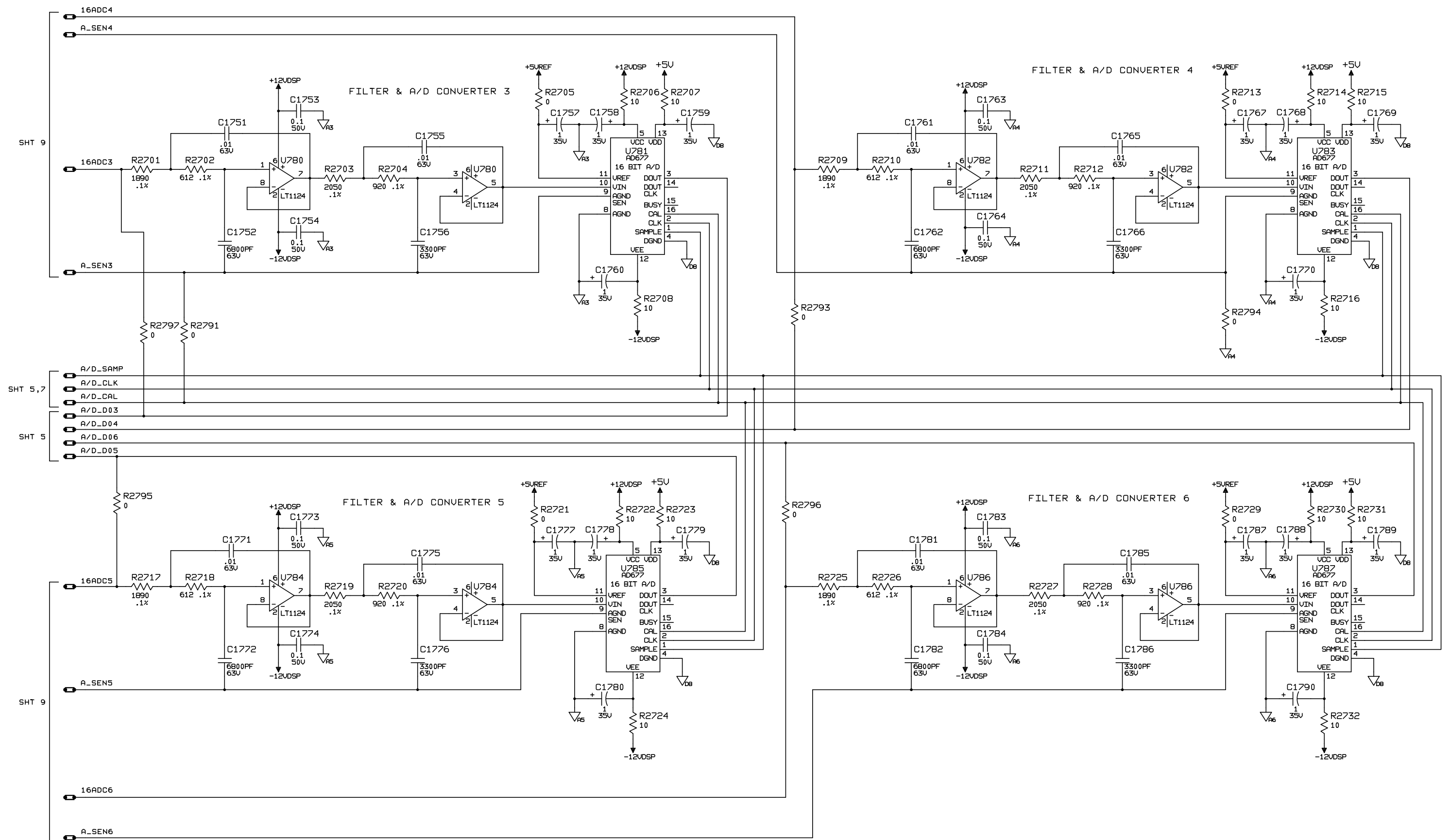


Figure 6-17. DSP Assembly, Schematic Diagram (sheet 10 of 10)



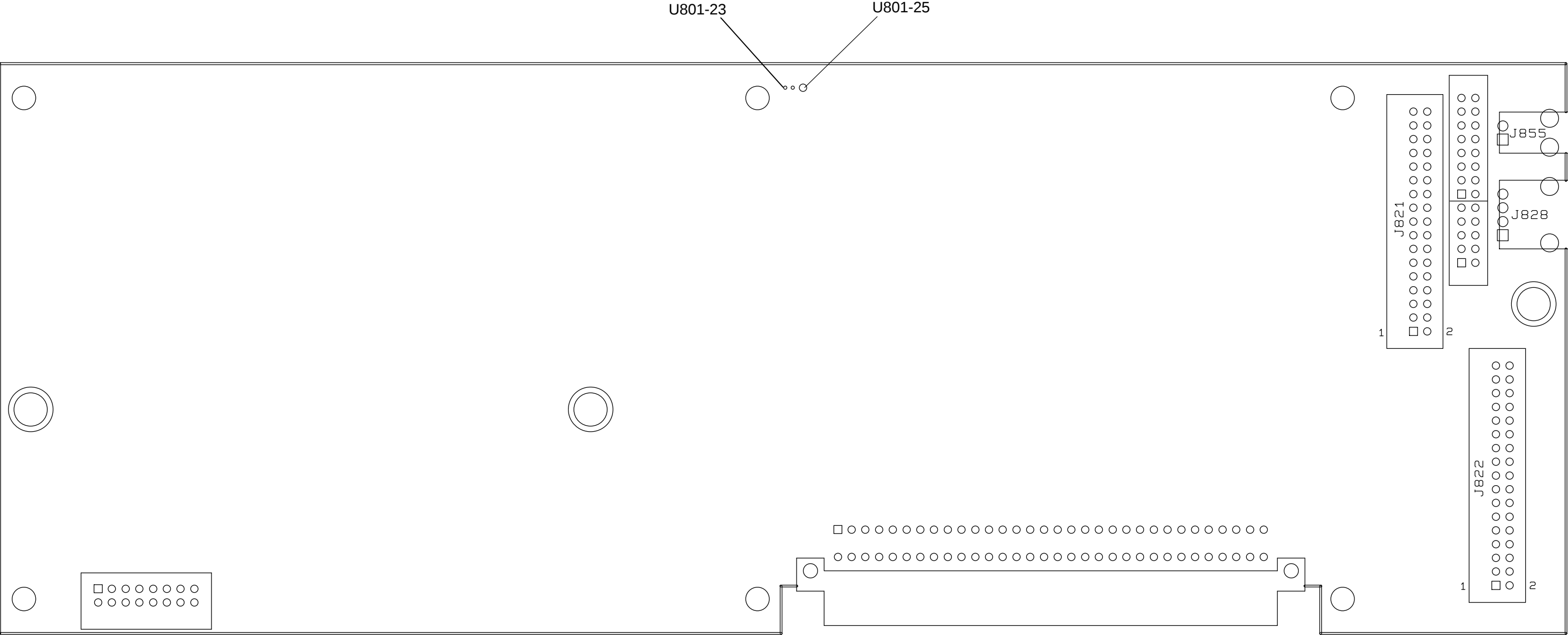


Figure 6-18. Control Board, Component Locations (sheet 2 of 2)

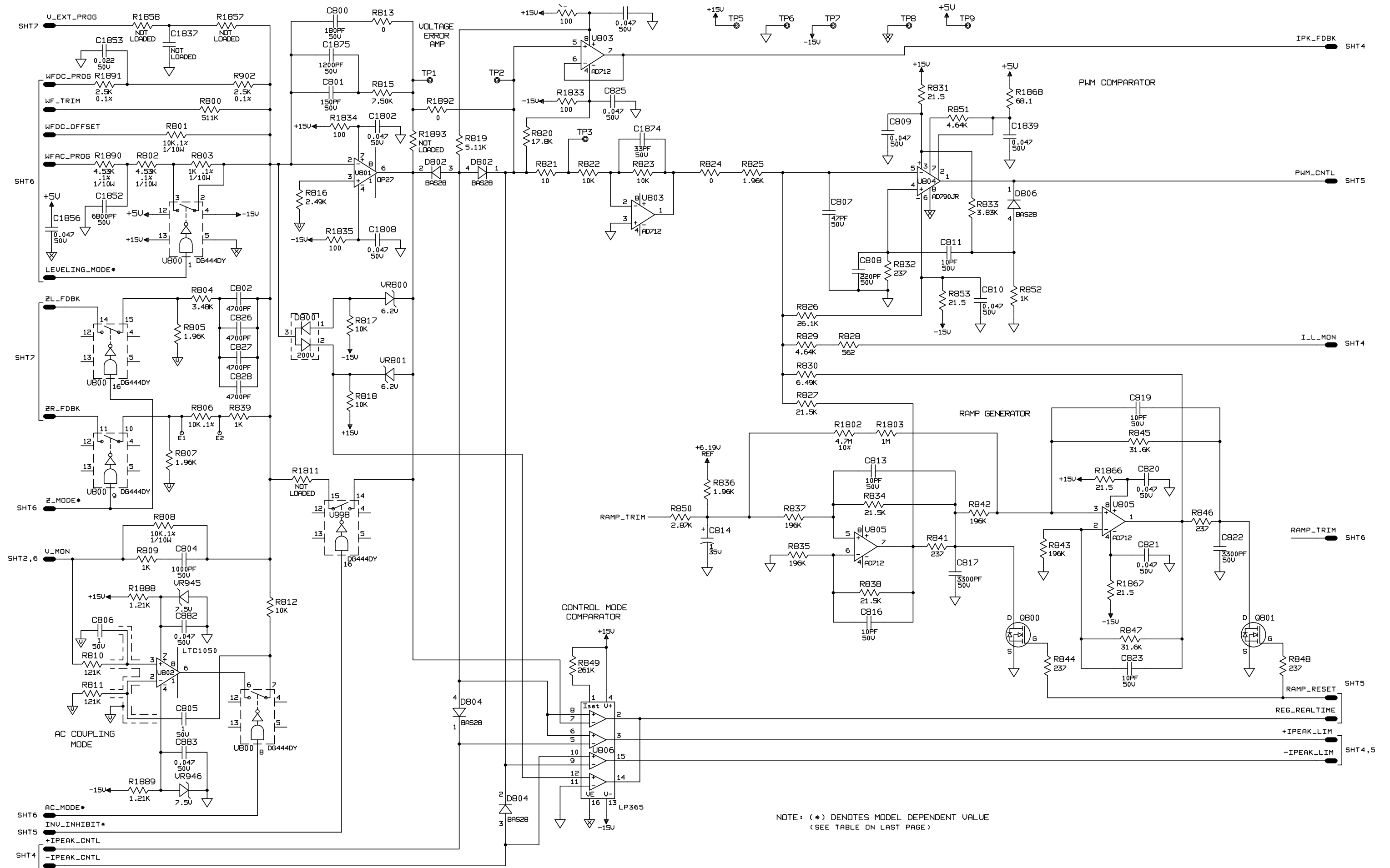
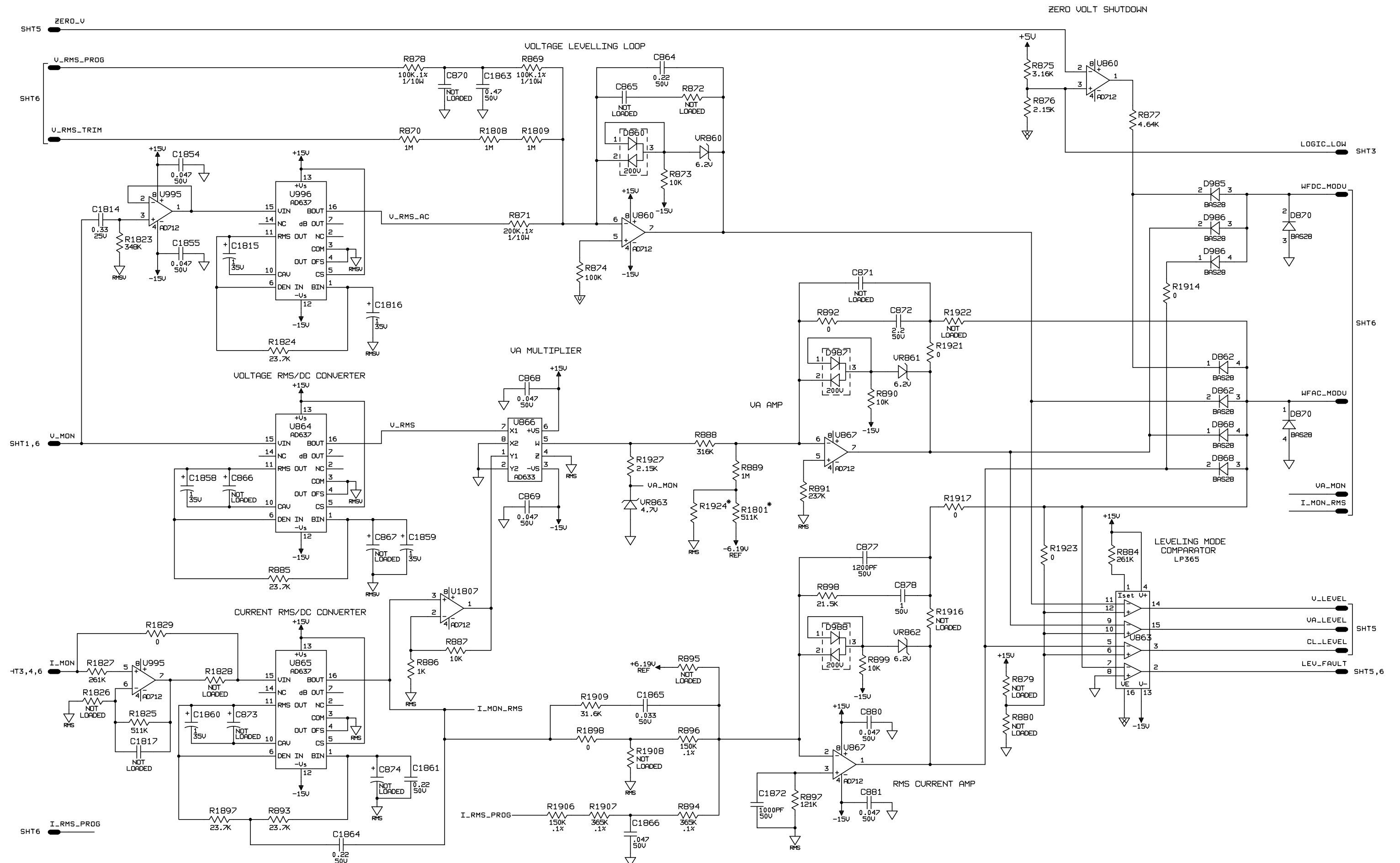


Figure 6-19. Control Assembly, Schematic Diagram (sheet 1 of 7)



FET JUNCTION TEMPERATURE CIRCUITS

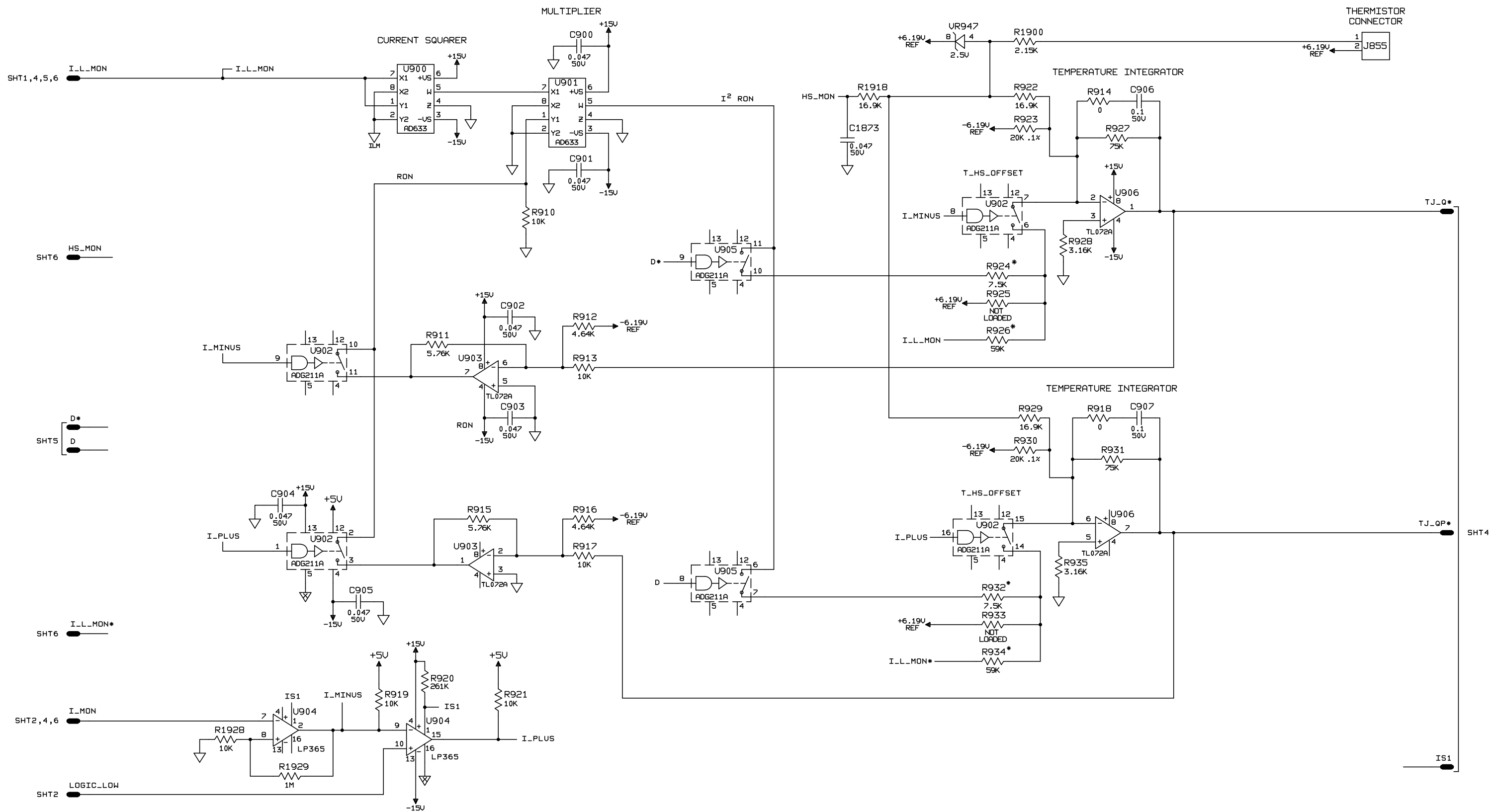


Figure 6-19. Control Assembly, Schematic Diagram (sheet 3 of 7)

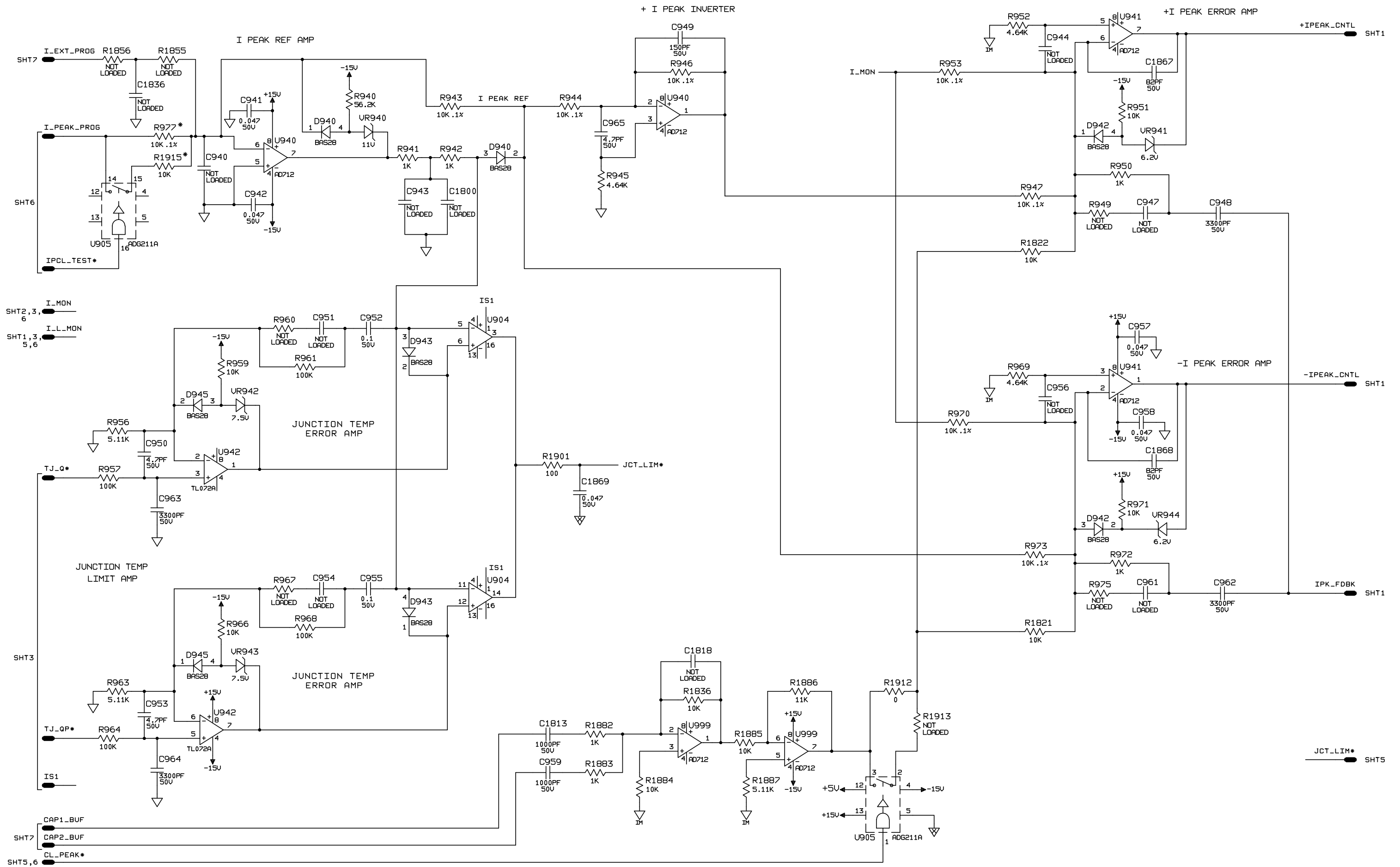


Figure 6-19. Control Assembly, Schematic Diagram (sheet 4 of 7)



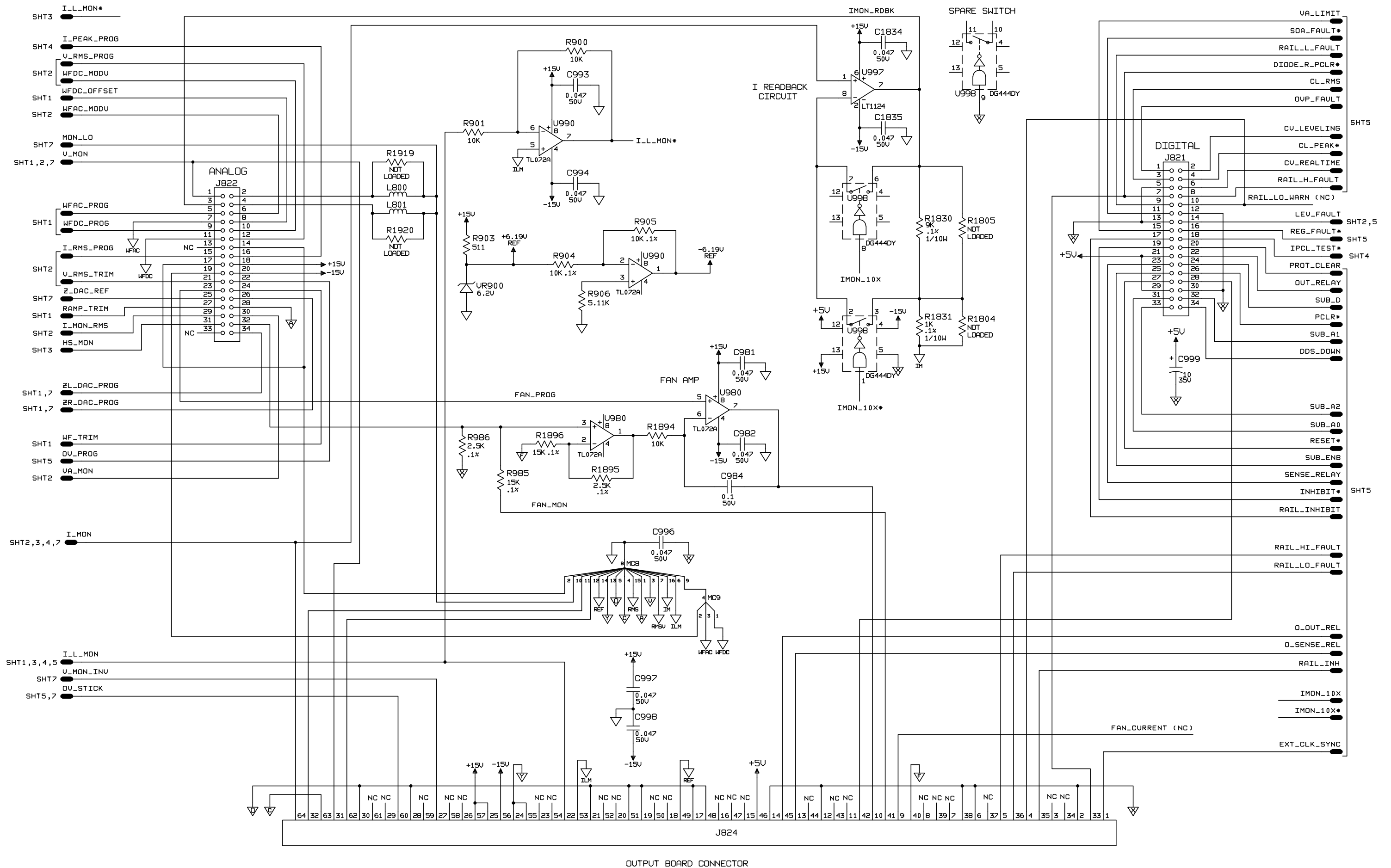
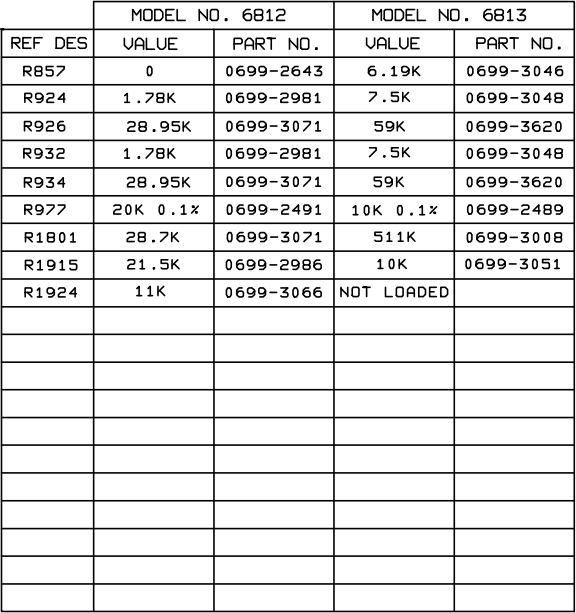


Figure 6-19. Control Assembly, Schematic Diagram (sheet 6 of 7)



**Figure 6-19. Control Assembly, Schematic Diagram (sheet 7 of 7)**

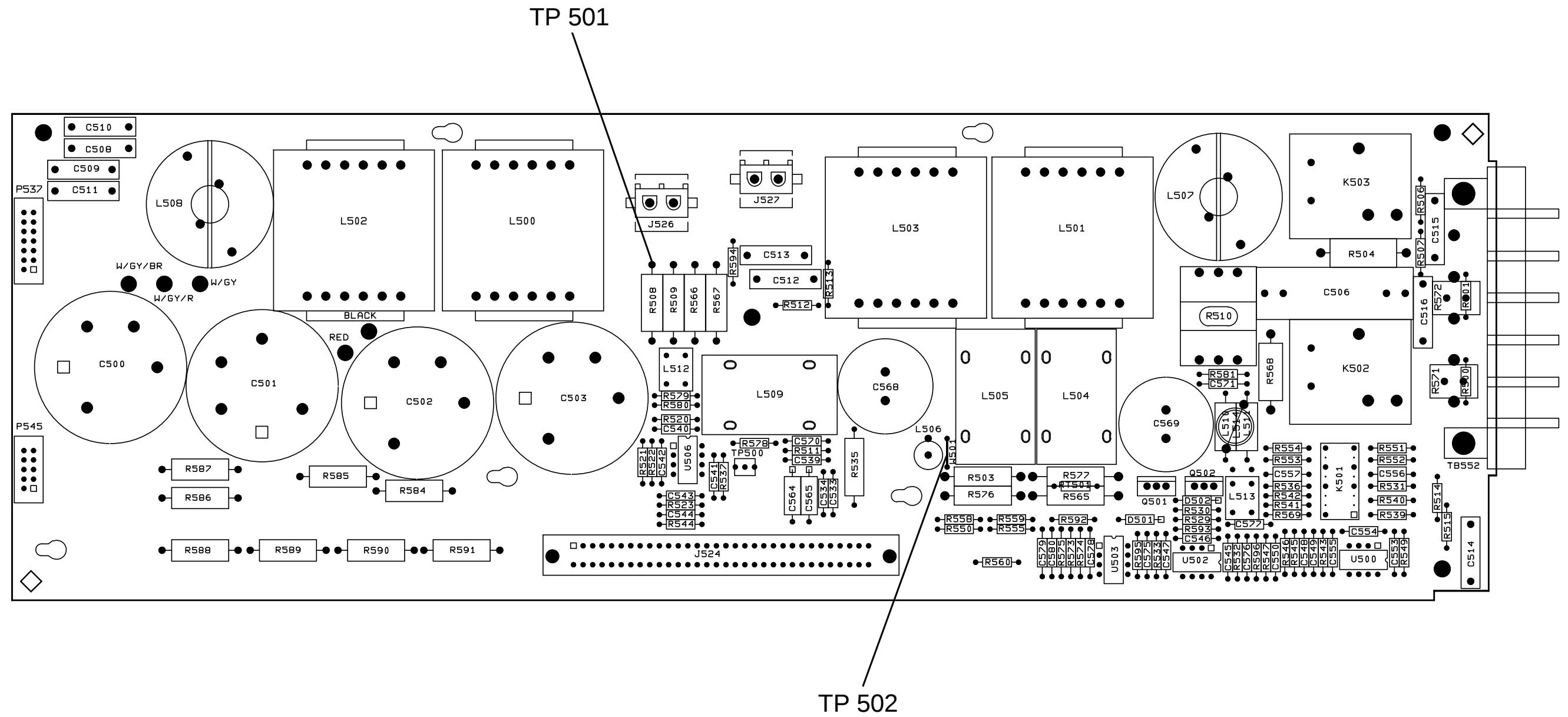
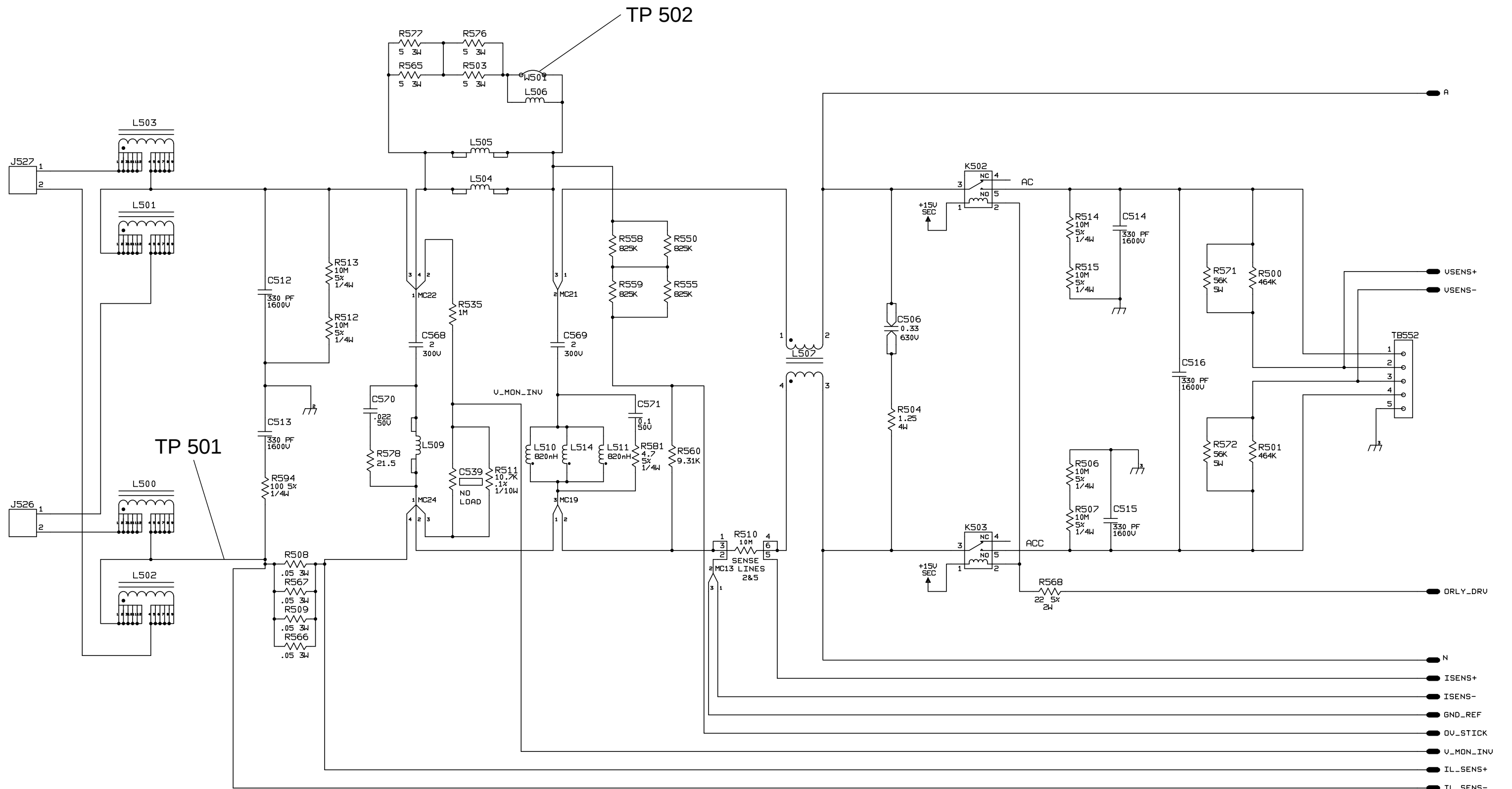
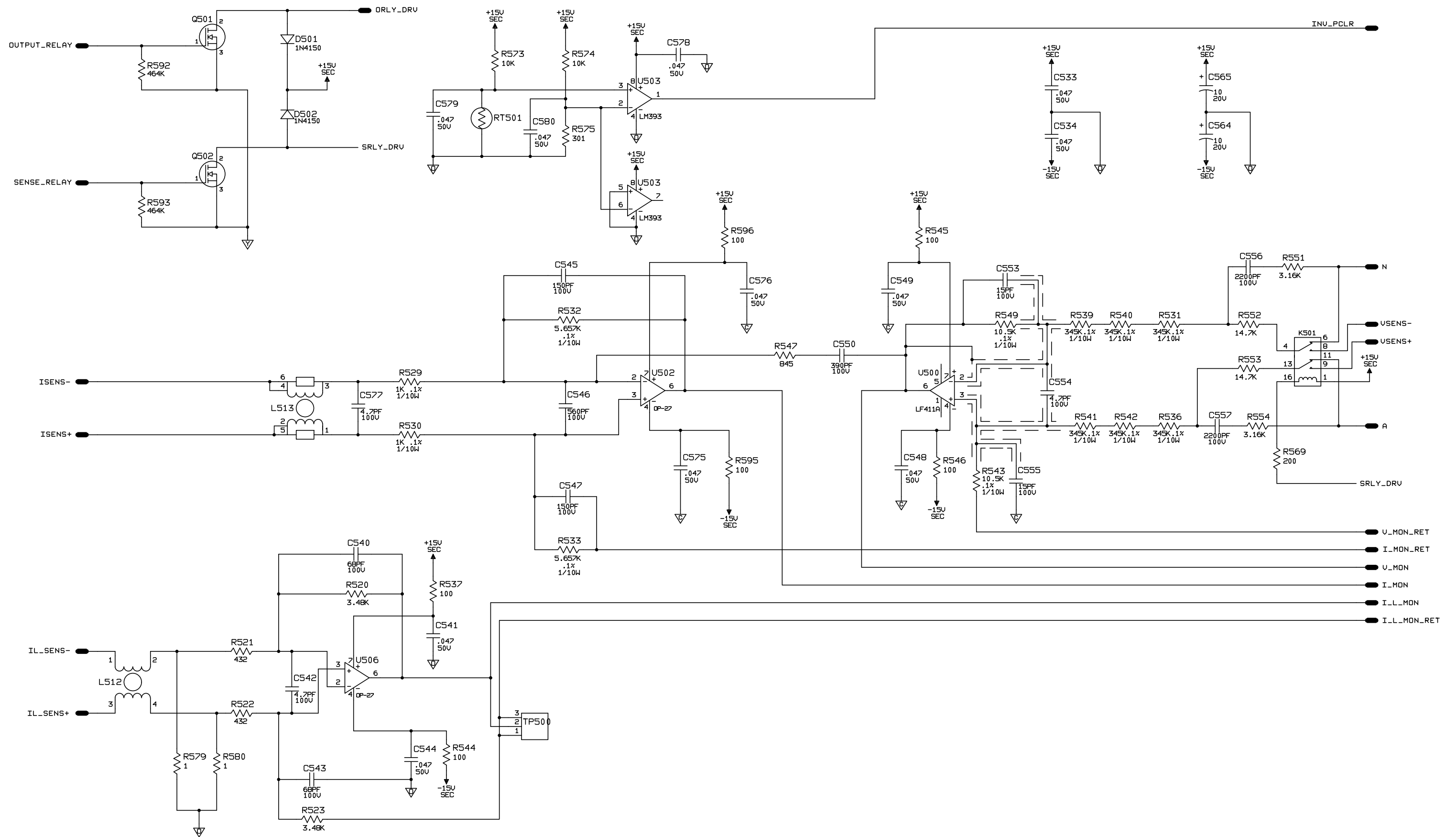


Figure 6-20. Output Board, Component Locations





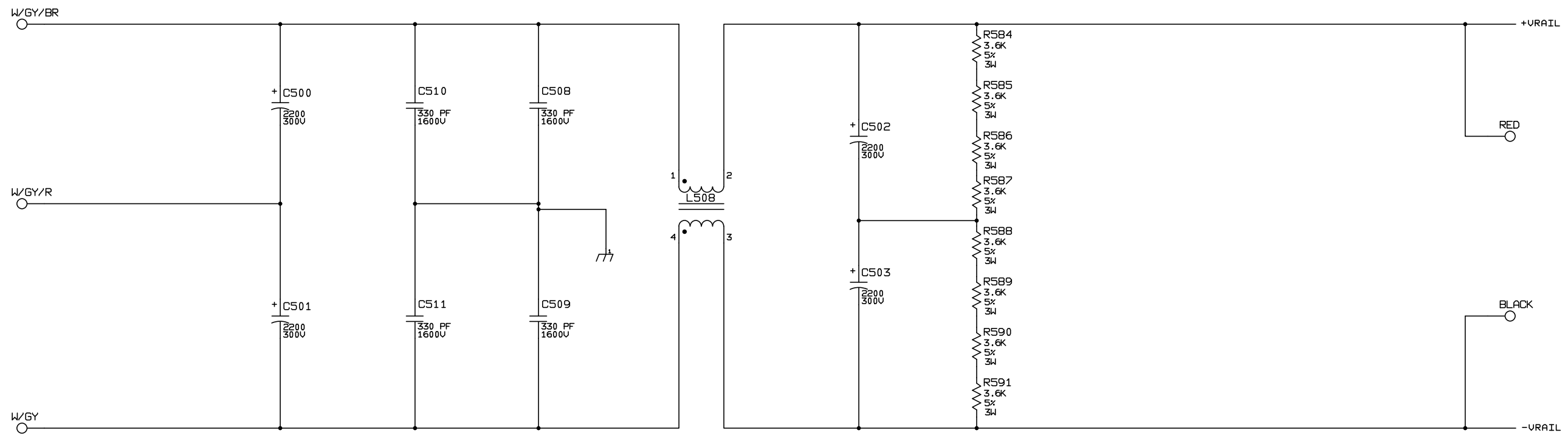


Figure 6-21. Output Assembly, Schematic Diagram (sheet 3 of 4)

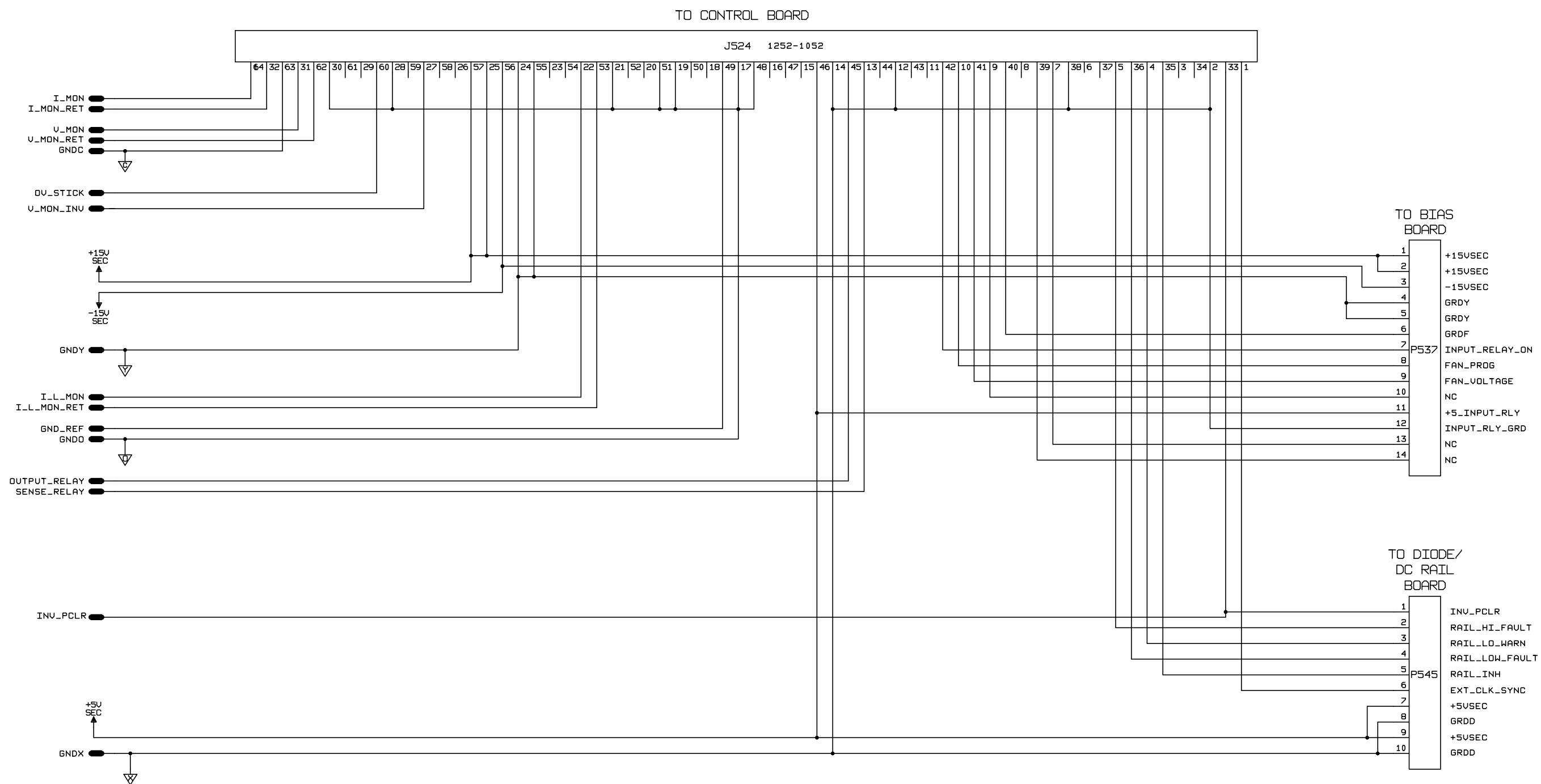


Figure 6-21. Output Assembly, Schematic Diagram (sheet 4 of 4)

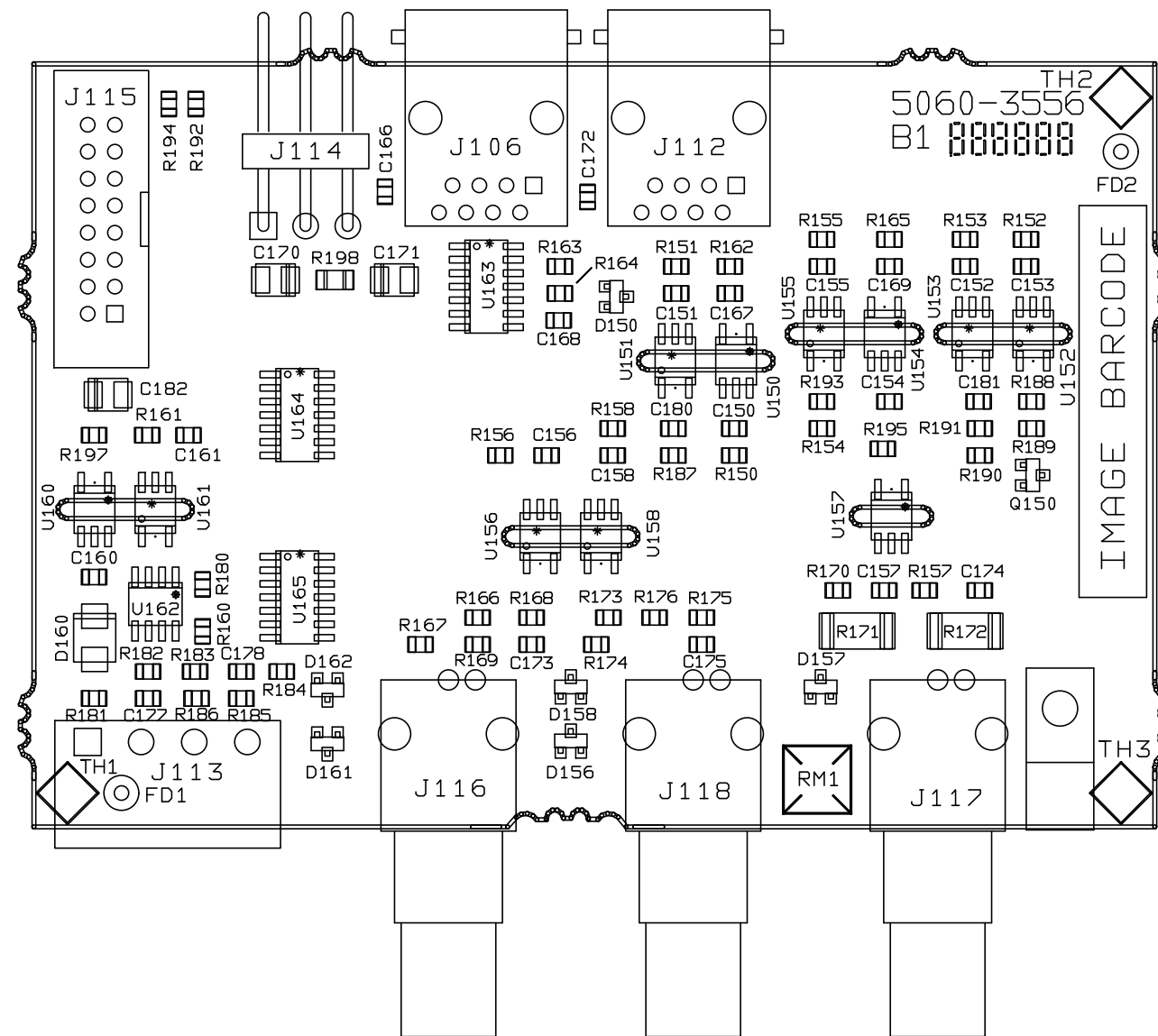
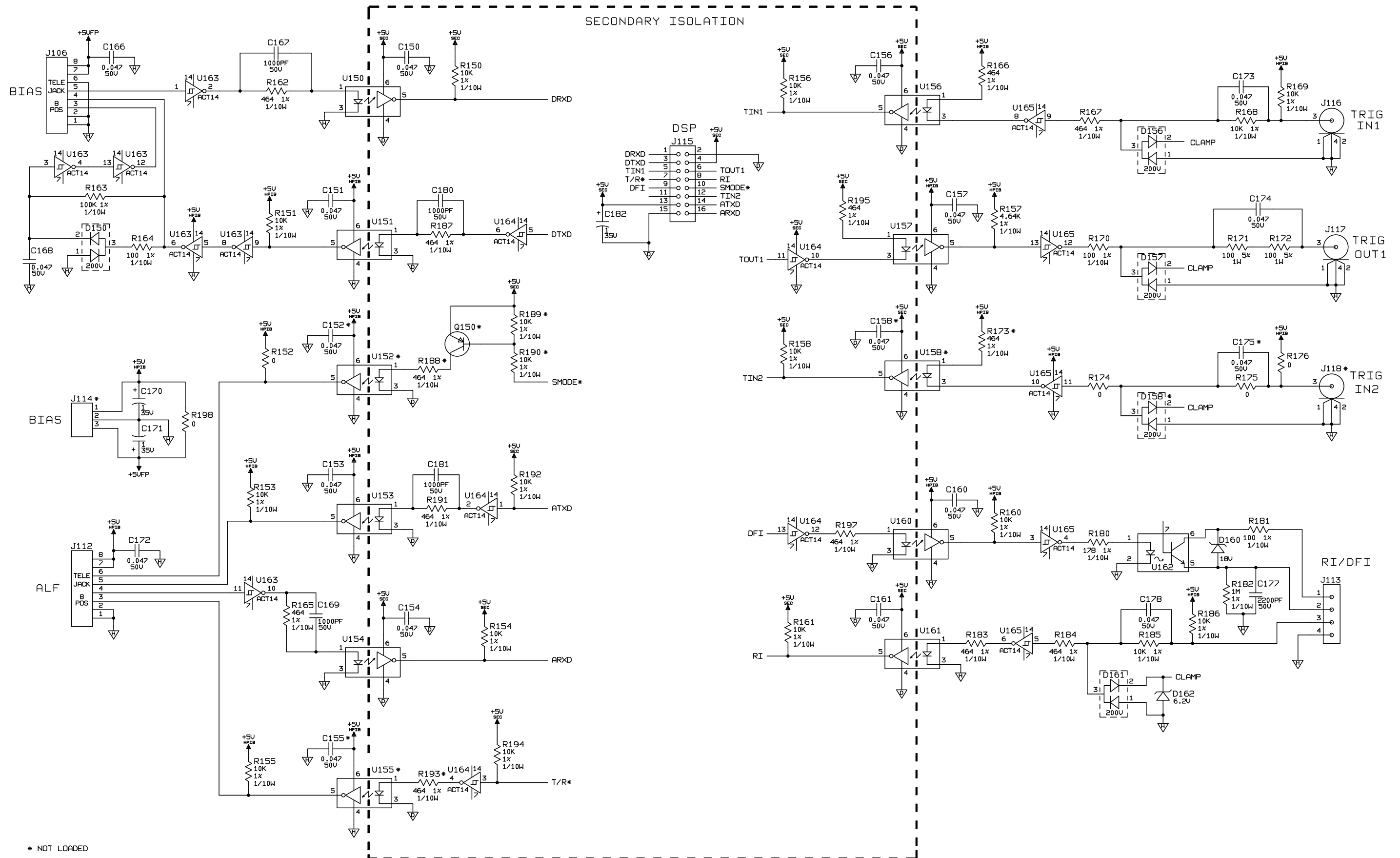


Figure 6-22. Trigger Board, Component Locations



\* NOT LOADED

Figure 6-23. Trigger Assembly, Schematic Diagram

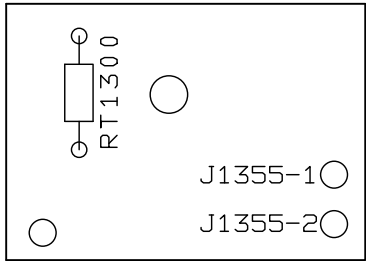


Figure 6-24. Thermistor Assembly, Component Locations

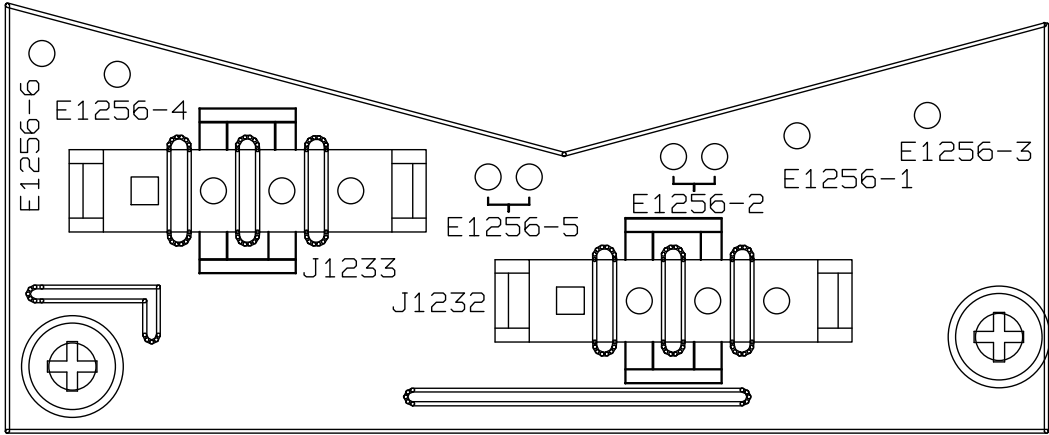


Figure 6-26. Transformer Assembly, Component Locations

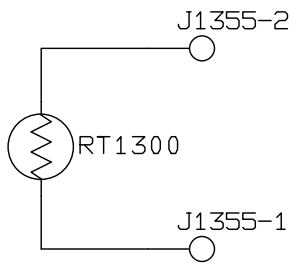


Figure 6-25. Thermistor Assembly, Schematic Diagram

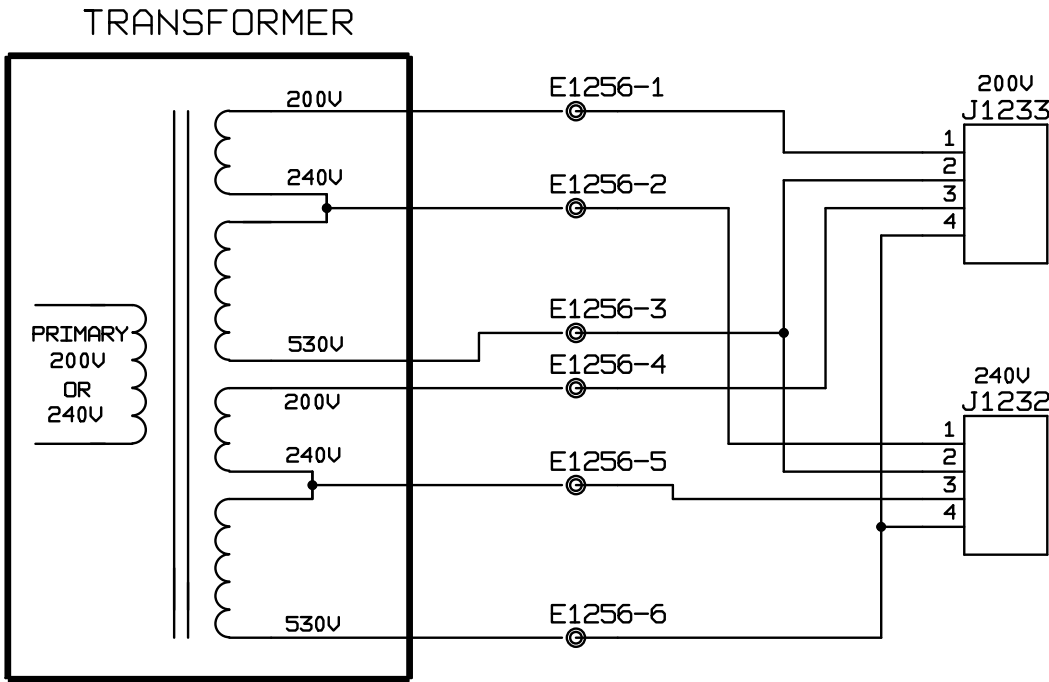


Figure 6-27. Transformer Assembly, Schematic Diagram

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KEYSIGHT 6812B: US38390451 and up  
KEYSIGHT 6813A: US37290101 and up  
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