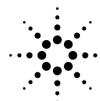


SERVICE MANUAL

**300 WATT SINGLE INPUT
ELECTRONIC LOADS
Agilent Technologies
Model 6060B and 6063B**

**For instruments with serial numbers
Agilent 6060B US37350101 and up
Agilent 6063B US37350101 and up**

**For instruments with higher serial numbers,
a change page may be included.**



Agilent Technologies

CERTIFICATION

Agilent Technologies certifies that this product met its published specifications at time of shipment from the factory. Agilent 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 Agilent Technologies hardware product is warranted against defects in material and workmanship for a period of three years from date of delivery. Agilent Technologies software and firmware products, which are designated by Agilent 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 Agilent Technologies will, at its option, either repair or replace products which prove to be defective. Agilent Technologies does not warrant that the operation of 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 Agilent Technologies. Customer shall prepay shipping charges by (and shall pay all duty and taxes) for products returned to Agilent Technologies for warranty service. Except for products returned to Customer from another country, Agilent Technologies shall pay for return of products to Customer.

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

If Agilent Technologies is unable, within a reasonable time to repair or replace any product to condition as warranted, the Customer shall be entitled to a refund of the purchase price upon return of the product to Agilent Technologies.

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. AGILENT TECHNOLOGIES SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

EXCLUSIVE REMEDIES

THE REMEDIES PROVIDED HEREIN ARE THE CUSTOMER'S SOLE AND EXCLUSIVE REMEDIES. AGILENT TECHNOLOGIES SHALL NOT BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT, OR ANY OTHER LEGAL THEORY.

ASSISTANCE

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

SAFETY SUMMARY

The following general safety precautions must be observed during all phases of operation, service and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Agilent Technologies assumes no liability for the customer's failure to comply with these requirements.

BEFORE APPLYING POWER.

Verify that the product is set to match the available line voltage and the correct fuse is installed.

GROUND THE INSTRUMENT.

This product is a Safety Class 1 instrument (provided with a protective earth terminal). To minimize shock hazard, the instrument chassis and cabinet must be connected to an electrical ground. The instrument must be connected to the ac power supply mains through a three-conductor power cable, with the third wire firmly connected to an electrical ground (safety ground) at the power outlet. For instruments designed to be hard-wired to the ac power lines (supply mains), connect the protective earth terminal to a protective conductor before any other connection is made. 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. If the instrument is to be energized via an external autotransformer for voltage reduction, be certain that the autotransformer common terminal is connected to the neutral (earth pole) of the ac power lines (supply mains).

FUSES.

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 IN AN EXPLOSIVE ATMOSPHERE.

Do not operate the instrument in the presence of flammable gases or fumes.

KEEP AWAY FROM LIVE CIRCUITS.

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made by qualified service personnel. Do not replace components with power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed. To avoid injuries, always disconnect power, discharge circuits and remove external voltage sources before touching components.

DO NOT SERVICE OR ADJUST ALONE.

Do not attempt internal service or adjustment unless another person capable of rendering first aid and resuscitation, is present.

DO NOT EXCEED INPUT RATINGS.

This instrument may be equipped with a line filter to reduce electromagnetic interference and must be connected to a properly grounded receptacle to minimize electric shock hazard. Operation at line voltages or frequencies in excess of those stated on the line rating label may cause leakage currents in excess of 5.0 mA peak.

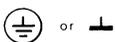
SAFETY SYMBOLS.



Instruction manual symbol: the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual (refer to Table of Contents) .



Indicates hazardous voltages.



Indicate earth (ground) terminal.

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.

DO NOT SUBSTITUTE PARTS OR MODIFY INSTRUMENT.

Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification to the instrument. Return the instrument to an Agilent Technologies Sales and Service Office for service and repair to ensure that safety features are maintained.

Instruments which appear damaged or defective should be made inoperative and secured against unintended operation until they can be repaired by qualified service personnel.

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Introduction

Scope

This manual contains information for troubleshooting and repairing the Agilent Technologies 6060B and 6063B Electronic Load to the component level. Replaceable parts lists and circuit diagrams are also provided. Verification procedures are included to aid in determining the performance level either before or after repair. Calibration procedures and specifications for the Electronic Load are included in the Operating Manual.

Related Documents

The following documents, shipped with each Electronic Load, are referenced in this manual:

| Document | Relevant Information |
|---|--|
| Agilent 6060B/6063B Operating Manual Agilent Part No. 5951-2826 | Calibration procedures, local & specifications remote operation. |
| Electronic Load Family Programming Reference Guide Agilent Part No. 06060-90005 | SCPI programming, status reporting |

It is assumed that you are familiar with, or can obtain, the information in the above documents.

Firmware Revisions

Some information in this manual, and S.A. (signature analysis) information in particular, is associated with specific versions of the Electronic Load firmware. Each Electronic Load returns the revision number of its primary interface firmware in response to the "*IDN?" query. Both primary and secondary interface ROMs have a label that also specifies the firmware revision. See "Signature Analysis" in Chapter 3.

Manual Revisions

Agilent instruments are identified by a two-part, ten-character serial number, such as 2847A-00101. The first five characters (e.g. 2847A) are the serial prefix, which is the same for all identically made instruments. The last five digits (e.g. 00101) is a unique serial number assigned to each instrument. If a significant design change is made, the prefix changes but the last five numbers continue in sequence.

This manual was written for Electronic Loads with the same serial prefix and with serial numbers equal to or higher than the ones shown on the title page. If the prefix number of your Electronic Load is higher than the one on the title page, then the Electronic Load was made after publication of the manual and may have hardware and/or firmware differences not covered in this manual. If there are such differences, they are documented in one or more "Manual Changes" sheets sent with the manual.

Safety Considerations

The Electronic Load is a Safety Class 1 instrument, that has a protective earth terminal. Refer to the Safety Summary page at the beginning of this manual for a summary of general safety procedures and the meaning of safety symbols in the manual and on the Electronic Load.

Electrostatic Discharge

CAUTION

The Electronic Load has components that can be damaged by ESD (electrostatic discharge). Failure to observe standard, anti-static practices can result in serious degradation of performance, even when complete failure does not occur.

When working on the Electronic Load, observe all standard, anti-static 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 an Agilent 9300-0797 conductive table mat.
- Using a conductive wrist strap, such as Agilent 9300-0969 or Agilent 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 Electronic Load before removing or installing components.

Verification

Introduction

This chapter contains test procedures that check the operation and calibration of the Agilent 6060B and 6063B Electronic Loads. The tests are performed from the front panel and can be used to determine which circuits are faulty when troubleshooting. There are some transient, trigger, and pulse functions that require a GP-IB controller and will not be verified with manual testing from the front panel. The following tests will verify, with a high level of confidence, that the Electronic Load is operating properly without testing all of its capabilities.

At the end of this chapter are performance record tables where actual measured values can be recorded.

Test Equipment Required

Table 2-1 lists the test equipment required to perform the tests in this chapter. Test setups for the tests are shown in Figures 2-1 through 2-3. Make sure the sense switch on the rear of the load is set to the LCL position since local sensing is used in all of the test setups. Use adequate wire gauge when making connections (see Chapter 3 in the Operating Manual).

Note The Electronic Load must pass the selftest at power turn-on before the following tests can be performed. If the unit fails selftest, refer to the overall troubleshooting procedures in Figure 3-1 in Chapter 3.

Table 2-1. Test Equipment Required for Verification

| Type | Required Characteristics | Recommended Model |
|---|--|---|
| 120V/60A Source | 0 to 20V/0 to 120A 0 to 60 V/0 to 50A 0 to 500 V/0 to 5A | Agilent 6031A or equivalent Agilent 6032A or equivalent Agilent 6035A or equivalent |
| Current Monitor Resistor | 0.10 ohms @ 15A 0.04% @ 25W | Guideline 9230/15 |
| Current Monitor Resistor | 0.010 ohms @ 100A 0.04% @ 100W | Guideline 9230/100 |
| Digital Voltmeter | dc accuracy of 0.01% 6 digit readout | Agilent 3455A, 3456A, or 3458A |
| Current Probe with Amplifier and Power Supply | Sensitivity of 1mA/10 mV to 50MHz with less than 300µA of noise to 5MHz. | Tektronix A6302 probe, AM503 probe amplifier, and TM501 probe power supply. |
| Oscilloscope | Sensitivity: 1mV Bandwidth: 20MHz | Agilent 54504 |

CC Mode Test

This test verifies that the Electronic Load operates in the CC Mode and that the current programming and readback to the front panel display are within specifications. For each DMM reading, the front panel display should be equal to:

6060B: DMM reading in amps $\pm ((\text{DMM reading in amps} \times 0.0005) + 0.065)$

6063B: DMM reading in amps $\pm ((\text{DMM reading in amps} \times 0.0012) + 0.010)$

If the test readings significantly disagree with the specified values or no readings can be recorded, perform the CC MODE TEST troubleshooting procedures in Figure 3-1 in Chapter 3. If the readings are out of tolerance, calibrate the applicable current range (see Chapter 6 in the Operating Manual).

- a. Connect the Electronic Load, power supply (Agilent 6031A/6032A or equivalent), DMM, and the 0.010 ohm (6060B) or 0.100 ohm (6063B) current monitor resistor as shown in Figure 2-1.

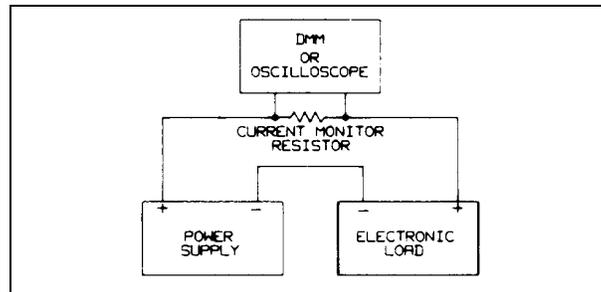


Figure 2-1. Test Setup A

- b. Turn on the Electronic Load.
- c. Check the high amp current range as follows:

1. Press **MODE** **CURR** **Enter** , then

6060B: **CURR** **6** **0** **Enter** .

6063B: **CURR** **1** **0** **Enter** .

2. Turn on the power supply and set for:

6060B: 5V and >60A.

6063B: 5V and >10A.

3. Wait 30 seconds and then record the DMM and front panel display readings. DMM reading should be between:

6060B: 598.7mV (59.865A) and 601.3mV (60.135A).

6063B: 997.5mV (9.975A) and 1.002 V (10.025A).

Note that the Electronic Load's CC annunciator is on.

4. Press **CURR** **1** **Enter** .

5. Wait 30 seconds then record the DMM and front panel display readings. DMM reading should be between:

6060B: 9.24mV (0.924A) and 10.761mV (1.076A).

6063B: 98.85mV (0.9885A) and 101.15mV (1.0115A).

d. Check the low current range as follows:

1. Press

6060B: then .

6063B: then .

2. Wait 10 seconds then record the DMM and front panel display readings. DMM reading should be between:

6060B: 59.19mV (5.919A) and 60.81mV (6.081A.)

6063B: 98.85mV (0.9885A) and 101.15mV (1.0115A.)

3. Press:

6060B: .

6063B: .

4. Wait 10 seconds and record the DMM and front panel display readings. DMM reading should be between:

6060B: 9.24mV (0.924A) and 10.76mV (1.076A).

6063B: 8.985mV (89.85A) and 11.015mV (110.15A).

CV Mode Test

This test verifies that the Electronic Load operates in the CV Mode and that the voltage programming and readback to the front panel display are within specifications. For each DMM reading, the corresponding front panel display should be equal to:

6060B: DMM reading $\pm ((\text{DMM reading} \times 0.0005) + 0.045)$

6063B: DMM reading $\pm ((\text{DMM reading} \times 0.0010) + 0.150)$

Note that if the test readings significantly disagree with the specified values or no readings can be recorded, perform the CV MODE TEST troubleshooting procedures in Figure 3-1, in Chapter 3. If the readings are out of tolerance, calibrate the voltage range (see Chapter 6 in the Operating Manual).

a. Connect the Electronic Load, power supply (Agilent 6035A or equivalent), and DMM as shown in Figure 2-2. Take care in making connections so that contact resistance voltage drop will not affect the readings.

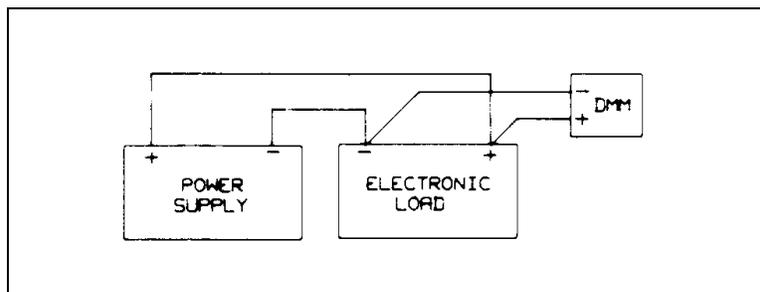


Figure 2-2. Test Setup B

b. Press , then

6060B: .

6063B: .

- c. Set power supply for:
6060B: 61V and 5A.
6063B: 250V and 1A.
- d. Record the DMM and front panel display readings. DMM reading should be between:
6060B: 59.890V and 60.110V.
6063B: 239.59V and 240.408V.

Note that the Electronic Load's CV annunciator is on.

- e. Press .
- f. Record the DMM and front panel display readings. DMM reading should be between:
6060B: 2.947V and 3.053V.
6063B: 2.876V and 3.123V.

CR Mode Test

This test verifies that the Electronic Load operates in the CR Mode and that the resistance programming is within specifications. The programmed resistance values are checked by recording the voltage across the current monitor resistor and the input voltage (voltage across the Electronic Load's input terminals), and then calculating the resistance value as follows:

$$\text{Load resistance} = \text{Input voltage}/(\text{voltage across resistor}/\text{resistor value})$$

Note if the calculation significantly disagrees with the specified range of values, perform the CR MODE TEST troubleshooting procedures in Figure 3-1 in Chapter 3. If the calculation is out of tolerance, calibrate the applicable resistance range (see Chapter 6 in the Operating Manual).

- a. Connect the Electronic Load, power supply (Agilent 6032A/6035A or equivalent), and the 0.100 ohm current monitor resistor as shown in Figure 2-1. Use the DMM to measure the voltage across the monitor resistor and across the Electronic Load's input terminals.
- b. Check the low ohm range as follows:
- Press , then
6060B: ; .
6063B: ; .
 - Turn on power source and set for:
6060B: 15V and 10.9A.
6063B: 15V and 1.82A.
 For the low ohm range test, the power supply will operate in the current limit mode.
 - Measure the voltage across the monitor resistor and across the input terminals, then calculate the Electronic Load resistance. The result should be between:
6060B: 0.984 and 1.016 ohms.
6063B: 23.6 and 24.4 ohms.
 Note that the Electronic Load's CR annunciator is on.
 - Then press:
6060B: .
6063B: .

5. Measure the voltage across the monitor resistor and across the input terminals, then calculate the Electronic Load resistance. The result should be between:

6060B: 0.0416 and 0.0584 ohms.

6063B: 0.792 and 1.208 ohms.

- c. Check the middle ohms range as follows:

1. Press:

6060B: , then .

6063B: , then .

2. Set power supply for:

6060B: 10.9V and 15A.

6063B: 44V and 4A.

3. Measure the voltage across the monitor resistor and across the input terminals, then calculate the Electronic Load resistance. The result should be between:

6060B: 24.1 and 39.6 ohms.

6063B: 433 and 590 ohms.

4. Then press:

6060B: .

6063B: .

5. Measure the voltage across the monitor resistor and across the input terminals, then calculate the Electronic Load resistance. The result should be between:

6060B: 0.989 and 1.011 ohms.

6063B: 23.75 and 24.25 ohms.

- d. Check the high ohms range as follows:

1. Press:

6060B: , then .

6063B: , then .

2. Set power source for:

6060B: 60V and 6A.

6063B: 240V and 2A.

3. Measure the voltage across the monitor resistor and across the input terminals, then calculate the Electronic Load resistance. Calculation should be between:

6060B: 61.1 and 3243 ohms.

6063B: 1247 and 5037 ohms.

4. Then press:

6060B: .

6063B: .

5. Measure the voltage across the monitor resistor and across the input terminals, then calculate the Electronic Load resistance. The result should be between:

6060B: 10.9 and 13.3 ohms.

6063B: 223 and 259 ohms.

Transient Operation and Slew Circuit Test

This test verifies transient and slew circuit operation. The slew circuits cannot be calibrated. If slew rise time and/or fall time are not within specifications or the slew circuits are inoperative, perform either the "Transient Generator Troubleshooting", or the "Slew Circuit Troubleshooting" in Chapter 3.

- a. Use the test setup of Figure 2-1 except connect an oscilloscope across the 0.100 current monitor resistor in place of the DMM. Set power supply for:

6060B: 10V and 10A.

6063B: 10V and 15A.

- b. Recall the factory default values by pressing

.

- c. Select the low current range by pressing

.

- d. Set up transient operation by pressing

, then

6060B: .

6063B: .

- e. Set the slew rate by pressing

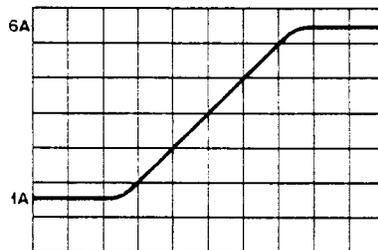
(blue shift key), then

6060B: , then .

6063B: , then .

- f. Adjust the oscilloscope for a single rise or fall time display. Use delayed sweep. The rise time when measured from 10% to 90% or the fall time when measured from 90% to 10% should be between 60 and 100 μ s

Note that the Electronic Load's **Tran** annunciator is on.



20 μ s/DIV

6060B: SLEW 0.05

6063B: SLEW 0.083

- g. Set the slew rate by pressing

(blue shift key), then

6060B: , then

6063B: , then

.

- h. Adjust the oscilloscope for a single rise or fall time display. Use delayed sweep. The rise time when measured from 10% to 90% or the fall time when measured from 90% to 10% should be between 1.2 and 2.0ms.

CC Mode PARD Test

CC mode PARD (periodic and random deviations) is specified as the rms input current in a frequency range 20Hz to 10Mhz. This test checks CC Mode PARD.

- Connect the Electronic Load, power supply (Agilent 6032A or equivalent), DMM, and current probe as shown in Figure 2-3. Set power supply for 10V and >10A.
- Turn the load's ac power off, then on.
- Press .
- DMM reading should be less than:
6060B: 4mA rms
6063B: 1mA rms.

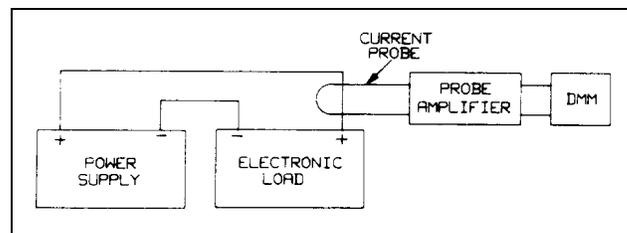


Figure 2-3. Test Setup C

CC Mode Power Limit

This test verifies that the Electronic Load's power limit circuit is operating properly. If the results specified in steps d through i are not obtained, troubleshoot the circuits as described in "Overpower Circuits Troubleshooting" in Chapter 3.

CAUTION If the overpower circuit does not turn the load off within three minutes after performing step d, stop the tests and troubleshoot the overpower circuits.

- Connect the Electronic Load and the power source as shown in Figure 2-2.
 - Turn on the Electronic Load and run for approximately five minutes with no power being dissipated (no input power).
 - Then Press , then
6060B: .
 - 6063B:** .
- Turn on and set the power supply for:
6060B: 34volts and 18mps.
6063B: 45volts and 13mps.

The Electronic Load's front panel should indicate approximately:

6060B: 33 volts and between 13 and 17 amps.

6063B: 45 volts and between 7.2 and 10.9 amps.

The front panel Prot annunciator should also be on.

- e. Press **Meter** to display "--OP", indicating that an overpower condition exists and the Electronic Load is in power limit.
- f. Let the Electronic Load continue running. Within three minutes the Electronic Load should turn its input off, and the display should show "PS--OP" indicating protection shutdown. IF THE OVERPOWER CIRCUIT DOES NOT TURN THE LOAD OFF WITHIN THREE MINUTES, STOP THE TESTS AND TROUBLESHOOT THE OVERPOWER CIRCUITS.
- g. Immediately press **Prot Clear**. The "PS" display should blink and the input will remain shut down, indicating that protection shutdown is latched.
- h. Wait approximately one minute and press **Prot Clear** again. This time the load should turn on with only "OP" displayed.
- i. Reduce the power source output to 20 volts (6060B) or 35 volts (6063B). The display should change to "-- --" indicating that the protection shutdown and overpower conditions are cleared.

PERFORMANCE TEST RECORD - Agilent 6060B ELECTRONIC LOAD (Page 1 of 2)

| | | |
|----------------------------|-----------------------------------|------------------|
| Test Facility: | | Report No. _____ |
| _____ | | Date _____ |
| _____ | | Customer _____ |
| _____ | | Tested by _____ |
| Model Agilent 6060B | Ambient temperature _____ °C | |
| Serial No. _____ | Relative humidity _____ % | |
| Options _____ | Line frequency _____ Hz (nominal) | |
| Firmware Rev. _____ | | |
| Special Notes: | | |
| _____ | | |
| _____ | | |
| _____ | | |

| | Test Equipment Used | | |
|------------------|---------------------------|-----------|---------------|
| Description | Model No. | Trace No. | Cal. Due Date |
| 1. AC Source | _____ | _____ | _____ |
| 2. DC Voltmeter | Agilent 3458A | _____ | _____ |
| 3. Oscilloscope | Agilent 54504A | _____ | _____ |
| 4. Power Source | Agilent 6031A | _____ | _____ |
| 5. Power Source | Agilent 6032A | _____ | _____ |
| 6. Current Probe | _____ | _____ | _____ |
| 7. Current Shunt | Guildline 9230/15 | _____ | _____ |
| 8. Current Shunt | Guildline 9230/100 | _____ | _____ |
| _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ |

PERFORMANCE TEST RECORD - Agilent 6060B ELECTRONIC LOAD (Page 2 of 2)

| | | | |
|-------|---------------|------------------|------------|
| Model | Agilent 6060B | Report No. _____ | Date _____ |
|-------|---------------|------------------|------------|

| Test Description | Minimum Specification | Results | Maximum Specification | Measurement Uncertainty |
|---|-------------------------|----------|-------------------------|-------------------------|
| CONSTANT CURRENT MODE TESTS | | | | |
| 60 Ampere Range Programming and Readback | | | | |
| High Current (60A) | 59.865 | _____ A | 60.135 | 25mA |
| Front Panel Display | A _{OUT} -0.095 | _____ A | A _{OUT} +0.095 | 25mA |
| Low Current (1A) | 0.924 | _____ A | 1.076 | 427μA |
| Front Panel Display | A _{OUT} -0.065 | _____ A | A _{OUT} +0.065 | 427μA |
| 6 Ampere Range Programming and Readback | | | | |
| High Current (6A) | 5.919 | _____ A | 6.081 | 2.4mA |
| Front Panel Display | A _{OUT} -0.068 | _____ A | A _{OUT} +0.068 | 2.4mA |
| Low Current (1A) | 0.924 | _____ A | 1.076 | 427μA |
| Front Panel Display | A _{OUT} -0.065 | _____ A | A _{OUT} +0.065 | 427μA |
| CONSTANT VOLTAGE MODE TESTS | | | | |
| Voltage Programming and Readback | | | | |
| High Voltage (60V) | 59.890 | _____ V | 60.110 | 845μV |
| Front Panel Display | V _{OUT} -0.075 | _____ V | V _{OUT} +0.075 | 845μV |
| Low Voltage (3V) | 2.947 | _____ V | 3.053 | 35μV |
| Front Panel Display | V _{OUT} -0.046 | _____ V | V _{OUT} +0.046 | 35μV |
| CONSTANT RESISTANCE MODE TESTS | | | | |
| Low Resistance Range | | | | |
| Resistance (1 Ω) | 0.984 | _____ Ω | 1.016 | |
| Resistance (0.05Ω) | 0.0416 | _____ Ω | 0.0584 | |
| Middle Resistance Range | | | | |
| Resistance (30Ω) | 24.1 | _____ Ω | 39.6 | |
| Resistance (1 Ω) | 0.989 | _____ Ω | 1.011 | |
| High Resistance Range | | | | |
| Resistance (120Ω) | 61.1 | _____ Ω | 3243 | |
| Resistance (12Ω) | 10.9 | _____ Ω | 13.3 | |
| TRANSIENT SLEW TEST | | | | |
| Fast Slew Transient | | | | |
| Slew Rate 0.05 A/μs | 60 | _____ μs | 100 | |
| Slew Rate 2.5 A/μs | 1.2 | _____ ms | 2.0 | |
| CONSTANT CURRENT PARD TEST | | | | |
| Current (10A) | 0 | _____ mA | 4mA RMS | |

PERFORMANCE TEST RECORD - Agilent 6063B ELECTRONIC LOAD (Page 1 of 2)

| | | |
|----------------------------|-----------------------------------|------------------|
| Test Facility: | | Report No. _____ |
| _____ | | Date _____ |
| _____ | | Customer _____ |
| _____ | | Tested by _____ |
| Model Agilent 6063B | Ambient temperature _____ °C | |
| Serial No. _____ | Relative humidity _____ % | |
| Options _____ | Line frequency _____ Hz (nominal) | |
| Firmware Rev. _____ | | |
| Special Notes: | | |
| _____ | | |
| _____ | | |
| _____ | | |

| Description | Test Equipment Used | | |
|------------------|--------------------------|-----------|---------------|
| | Model No. | Trace No. | Cal. Due Date |
| 1. AC Source | _____ | _____ | _____ |
| 2. DC Voltmeter | Agilent 3458A | _____ | _____ |
| 3. Oscilloscope | Agilent 54504A | _____ | _____ |
| 4. Power Source | Agilent 6032A | _____ | _____ |
| 5. Power Source | Agilent 6035A | _____ | _____ |
| 6. Current Probe | _____ | _____ | _____ |
| 7. Current Shunt | Guildline 9230/15 | _____ | _____ |
| _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ |

PERFORMANCE TEST RECORD - Agilent 6063B ELECTRONIC LOAD (Page 2 of 2)

| | | | |
|-------|---------------|------------------|------------|
| Model | Agilent 6063B | Report No. _____ | Date _____ |
|-------|---------------|------------------|------------|

| Test Description | Minimum Specification | Results | Maximum Specification | Measurement Uncertainty |
|---|-------------------------|----------|-------------------------|-------------------------|
| CONSTANT CURRENT MODE TESTS | | | | |
| 10 Ampere Range Programming and Readback | | | | |
| High Current (10A) | 9.975 | _____ A | 10.025 | 4mA |
| Front Panel Display | A _{OUT} -0.022 | _____ A | A _{OUT} +0.022 | 4mA |
| Low Current (1A) | 0.9885 | _____ A | 1.0115 | 427μA |
| Front Panel Display | A _{OUT} -0.011 | _____ A | A _{OUT} +0.011 | 427μA |
| 1 Ampere Range Programming and Readback | | | | |
| High Current (1A) | 0.9885 | _____ A | 1.0115 | 427μA |
| Front Panel Display | A _{OUT} -0.011 | _____ A | A _{OUT} +0.011 | 427μA |
| Low Current (0.1A) | 0.0899 | _____ A | 1.101 | 56μA |
| Front Panel Display | A _{OUT} -0.010 | _____ A | A _{OUT} +0.010 | 56μA |
| CONSTANT VOLTAGE MODE TESTS | | | | |
| Voltage Programming and Readback | | | | |
| High Voltage (240V) | 239.59 | _____ V | 240.408 | 3mV |
| Front Panel Display | V _{OUT} -0.390 | _____ V | V _{OUT} +0.390 | 3mV |
| Low Voltage (3V) | 2.876 | _____ V | 3.1236 | 35μV |
| Front Panel Display | V _{OUT} -0.153 | _____ V | V _{OUT} +0.153 | 35μV |
| CONSTANT RESISTANCE MODE TESTS | | | | |
| Low Resistance Range | | | | |
| Resistance (24Ω) | 23.6 | _____ Ω | 24.4 | |
| Resistance (1Ω) | 0.792 | _____ Ω | 1.208 | |
| Middle Resistance Range | | | | |
| Resistance (500Ω) | 433 | _____ Ω | 590 | |
| Resistance (24Ω) | 23.75 | _____ Ω | 24.25 | |
| High Resistance Range | | | | |
| Resistance (2000Ω) | 1247 | _____ Ω | 5037 | |
| Resistance (240Ω) | 223.3 | _____ Ω | 259.5 | |
| TRANSIENT SLEW TEST | | | | |
| Fast Slew Transient | | | | |
| Slew Rate 0.083A/μs | 60 | _____ μs | 100 | |
| Slew Rate 0.0042A/μs | 1.2 | _____ ms | 2.0 | |
| CONSTANT CURRENT PARD TEST | | | | |
| Current (10A) | 0 | _____ mA | 1mA RMS | |

Troubleshooting

WARNING

Most of the troubleshooting procedures given in this chapter are performed with power applied and protective covers removed. Such maintenance should be performed only by service-trained personnel who are aware of the hazards (for example, fire and electrical shock).

CAUTION

This instrument uses components which can be damaged or suffer serious performance degradation as of result of ESD (electrostatic discharge). Observe the standard anti-static precautions to avoid damage to the components.

Introduction

This chapter provides troubleshooting and repair information for the Agilent 6060B and 6063B Electronic Loads. Before attempting to troubleshoot the Electronic Load, ensure that the problem is with the load itself and not with an associated circuit, power source, or power line. The verification tests in Chapter 2 enable this to be determined without removing the covers from the Electronic Load.

Overall troubleshooting procedures are provided to isolate a problem to a functional area of circuitry. Once a problem has been isolated to a functional area, additional troubleshooting procedures are given to isolate the problem to the defective component(s).

If a component is found to be defective, replace it and then conduct the verification tests given in Chapter 2. Note that when certain components are replaced, the load must be recalibrated (see "Post Repair Calibration" later in this chapter). If the serial EEPROM chip U211 is replaced, the Electronic Load must be initialized before it is recalibrated. See "EEPROM Initialization" later in this chapter.

Chapter 5 in this manual lists all of the replaceable parts for the Electronic Load.

Test Equipment Required

Table 3-1 lists the test equipment required to troubleshoot the Electronic Load. Recommended models are listed.

Overall Troubleshooting Procedures

Overall troubleshooting procedures for the Electronic Load are given in the flowchart of Figure 3-1. The procedures first ensure that an ac input failure or bias supply failure are not causing the problem and that the load passes the turn-on selftest (no error messages). The normal turn-on selftest indications are described in Chapter 3 of the Operating Manual.

If the load passes selftest, Figure 3-1 directs you to perform the front panel verification procedures in Chapter 2 to determine if any load function(s) are not calibrated or are not operating properly. If the load passes the front panel verification tests, Figure 3-1 checks to see if the load can be programmed from a GP-IB controller. If the load fails any of the tests, you are directed to the applicable troubleshooting procedure. Signature analysis (S.A.) is used to troubleshoot the load's primary and secondary interface circuits. The S.A. mode is also used to generate waveforms which are used to troubleshoot the analog circuits. In addition, a list of test points with signal measurement information is provided to help you troubleshoot.

Table 3-1 Test Equipment Required for Troubleshooting

| Type | Purpose | Recommend Model |
|--------------------|---|---|
| GP-IB Controller | Communicate with the load via the GP-IB | Agilent 9825, Series 85, Series 200/300 |
| Signature Analyzer | Test most of the primary and secondary circuits | Agilent 5005A/B |
| Digital Voltmeter | Check various voltage levels | Agilent 3455A or 3456A |
| Power Source | Provide required input, bias GP-IB Board | Agilent 6032A/6035A |
| Logic Probe | Check data bus lines | Agilent 545A |
| Oscilloscope | Check waveforms and signal levels | Agilent 1741A |
| Clip Leads | Connect IC pins together | AP Products No. LTC |

Selftest Sequence and Error Messages

The turn-on selftest sequence consists of tests on both the primary (GP-IB) and secondary (Electronic Load) interface circuits. If the load fails the selftest, the input will remain disabled and the display should indicate the type of failure. Table 3-2 lists all of the selftest error codes that can appear on the front panel display and provides the appropriate troubleshooting information.

Primary Interface

The turn-on selftest sequence of the primary microprocessor consists of two parts:

1. The selftest is performed by the primary microprocessor (U203) and starts when the primary clear ($\overline{\text{PCLR}}$) signal goes false (High). First, the RAM, ROM, and the microprocessor's internal timer selftests are performed. If any of these tests fail, the front panel display will probably remain blank. The failure can be detected by measuring a square wave on the SA_GATE line at TP201-8 (see Figure 3-2). The type of failure is indicated as follows:

10Hz square wave--indicates a RAM failure.

100Hz square wave--indicates a ROM failure.

1KHz square wave--indicates an internal timer failure.

Square waves will not have a 50% duty cycle. It is also possible for a selftest failure to "lock-up" the microprocessor and cause a blank front panel display and no error square wave to appear on the SA_GATE line. If "lock-up" occurs, try to isolate the problem by performing the Primary Interface S.A. Tests or by replacing U203.

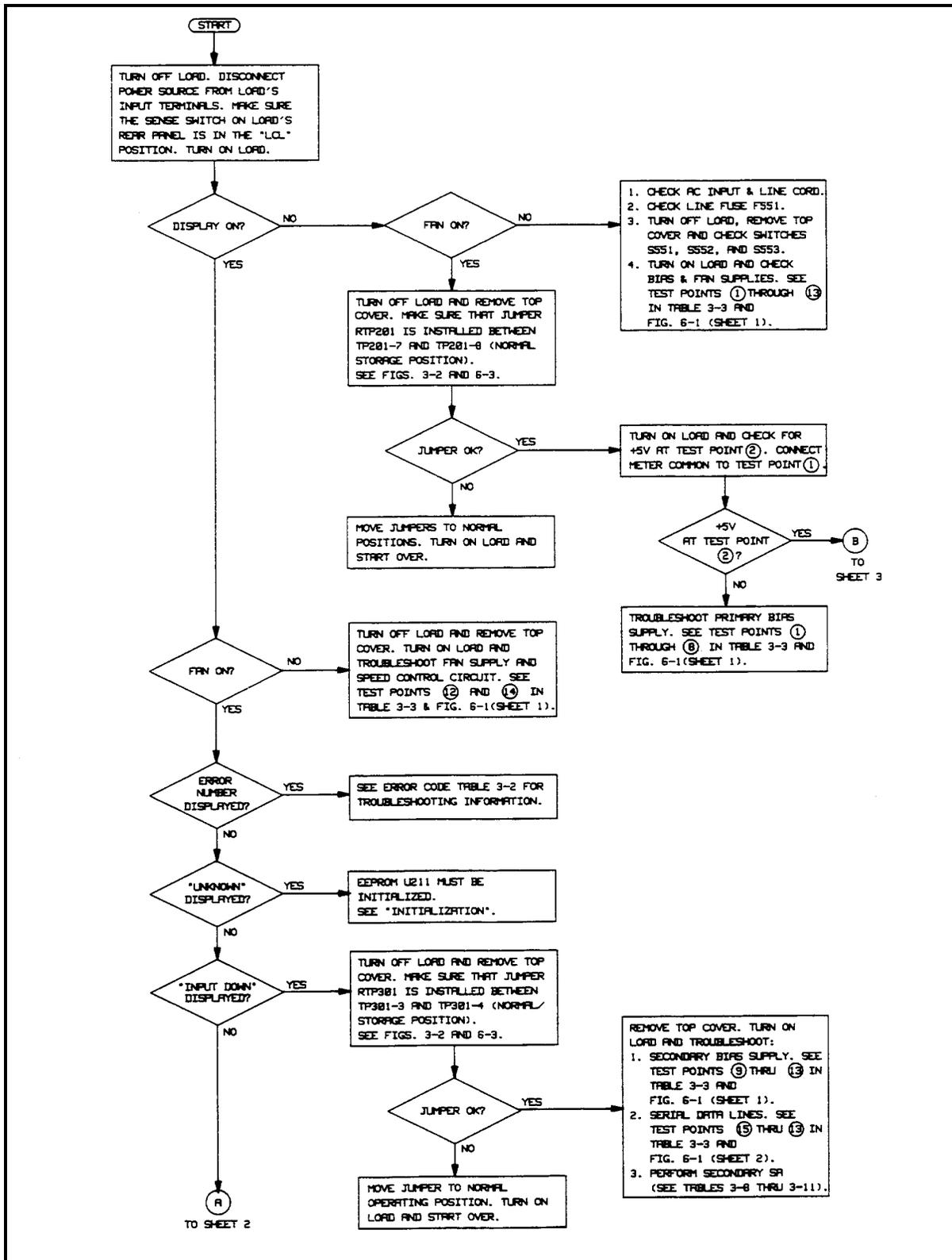


Figure 3-1. Overall Troubleshooting Flowchart (Sheet 1 of 3)

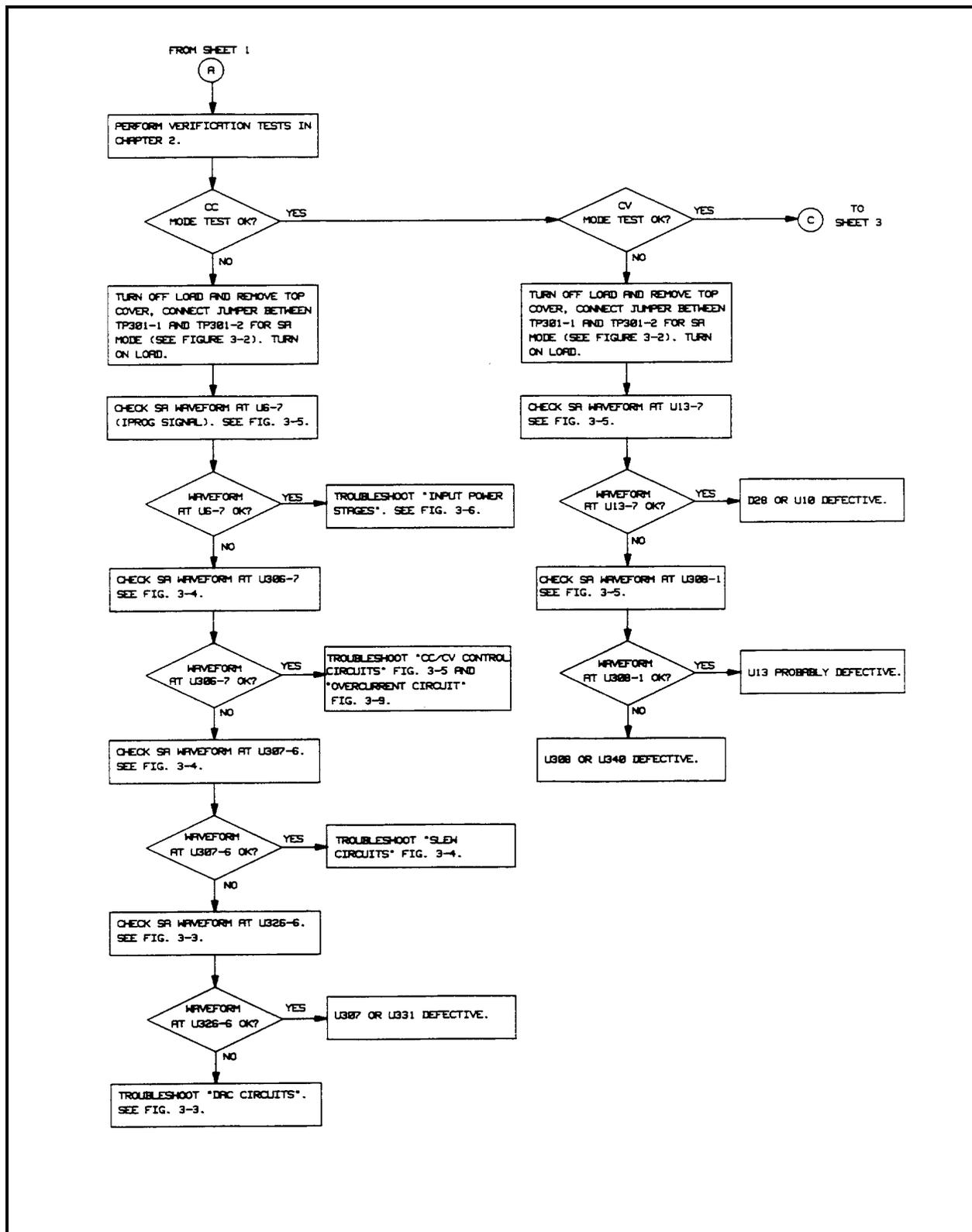


Figure 3-1. Overall Troubleshooting Flowchart (Sheet 2 of 3)

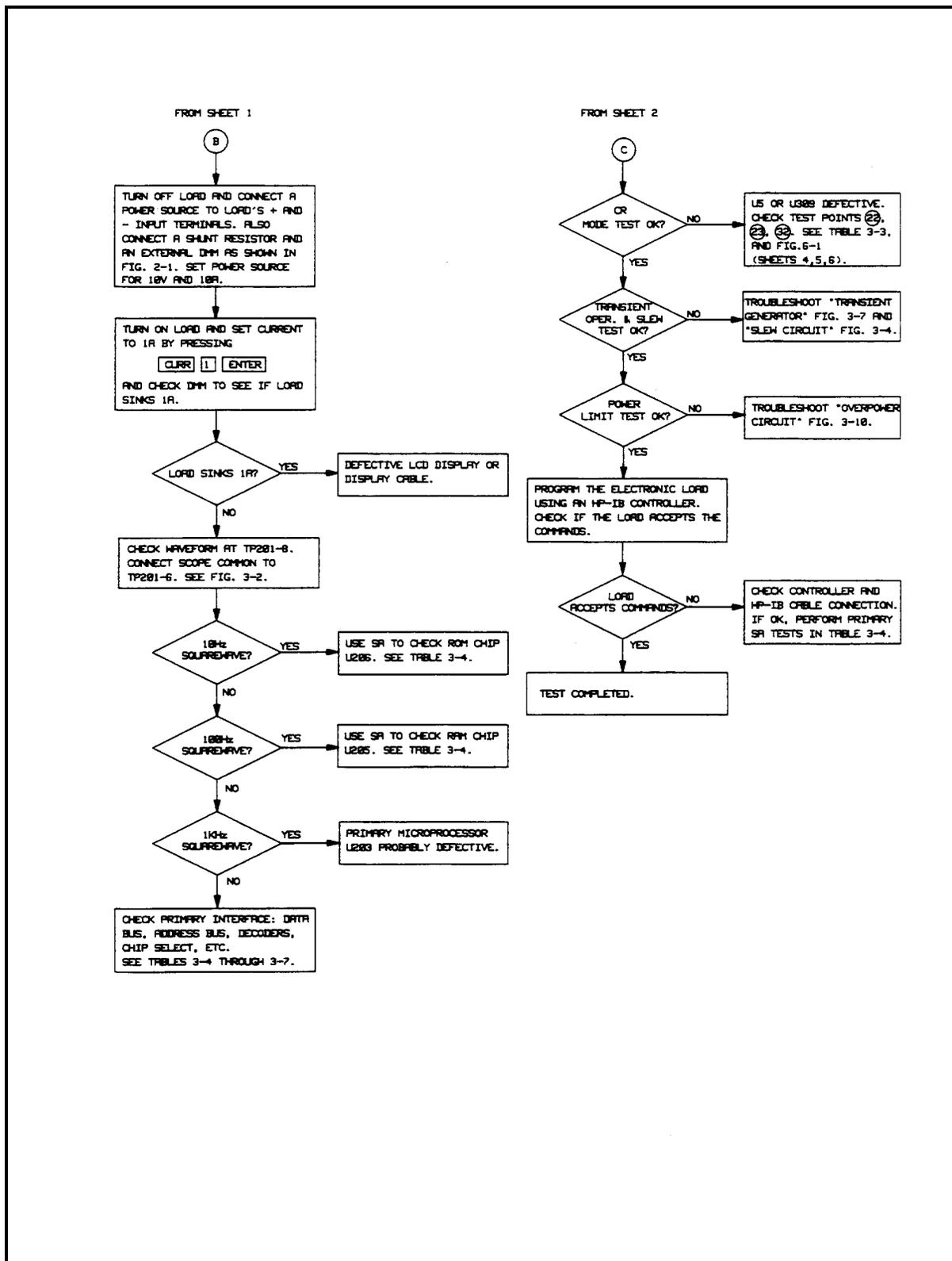


Figure 3-1. Overall Troubleshooting Flowchart (Sheet 3 of 3)

2. If part 1 passes selftest, the test continues and checks the read/write cycles and the internal trigger circuit. If these tests pass, the secondary interface selftest are performed. If the read/write or internal trigger test fails, the front panel displays "ERROR x" for two seconds, then normal voltage/current will be displayed and the **Err** annunciator will turn on. Depressing the (blue shift key) followed by the **Error** key will cause "ERROR -330" to be displayed. If "ERROR -4" was displayed for 2 seconds, the read/write test failed. If "ERROR -5" was displayed for 2 seconds, the internal trigger test failed.

Secondary Interface

The turn-on selftest sequence of the secondary microprocessor consists of two parts:

1. The selftest is performed by the secondary microprocessor (U301) and starts when the secondary power clear ($\overline{\text{SPCLR}}$) signal goes false (High). Any secondary failures are reported to the primary interface. The secondary microprocessor will first check its internal RAM, ROM, and timer. If one of these tests fail, selftest is halted and the following will be displayed:
 "ERROR -101" - RAM failure
 "ERROR -102" - ROM failure
 "ERROR -103" - Timer failure

It is possible for a secondary RAM, ROM, or Timer failure to "lock-up" the secondary processor and no secondary error number is reported. If this occurs try to isolate the problem by performing the Secondary Interface S.A.

2. If part 1 passes selftest, the test continues by checking the secondary EEPROM which stores the load's GP-IB address and model number as well as the constants used in calibrating the load. Next the operation and accuracy of the main and transient DACs are tested. If these tests pass, the volts/amps readings will appear on the display indicating that the selftest has been successfully completed (see Chapter 3 in the Operating Manual).

If the EEPROM or any of the DAC tests fail, the front panel displays "ERROR -xxx" for 2 seconds, then "INP DOWN 1" followed by "INPUT DWN". Finally the **Err** annunciator will turn on. Depressing the (blue shift key) followed by the **Error** key, will cause "ERROR -330" to be displayed. Depressing these keys a second time, will cause "ERROR -240" to be displayed. The error code number that appeared for 2 seconds could be one of the following:

- "ERROR -104" - EEPROM checksum failure
- "ERROR -105" - Main DAC tolerance is high
- "ERROR -106" - Main DAC tolerance is low
- "ERROR -107" - Transient DAC tolerance is high
- "ERROR -108" - Transient DAC tolerance is low

If error "UNKNOWN" is displayed the EEPROM (U211) must be initialized.

Table 3-2. Selftest Error Code

| Code | Error Description | Procedure |
|------|--|---|
| -4 | The primary microprocessor U203 read/write test to the GP-IB talker/listener chip U202 failed. | Use Primary S.A. Test Tables 3-4 and 3-6 to check address and data lines. |
| - 5 | The primary microprocessor U203 test of the internal trigger lines failed. | Use Primary S.A. Test Table 3-7 to check the primary trigger circuit. Then refer to " Trigger Circuit Troubleshooting" and Figure 3-8. |
| -101 | Secondary microprocessor U301 internal RAM failure. | Replace U301. |
| -102 | Secondary microprocessor U301 internal ROM failure, or thermistor RT 551 missing or open. | Check RT 551, replace U301. |
| -103 | Secondary microprocessor U301 internal timer failure. | Replace U301. |
| -104 | EEPROM (U211) checksum error. | Create a checksum by programming: "CAL:MODE ON;:CAL:SAVE" then turn power on. If error code -104 does not appear again, calibrate the load as described in the Operating Manual. If error code -104 does appear again, check the <u>EEPON</u> line (test point ⑦ in Table 3-3). If <u>EEPON</u> is ok, use S.A. Table 3-6 to check the data input and output lines to U211. |
| -105 | Main DAC circuit (U320/U326) zero or full scale point is above the high tolerance level. | Refer to "DAC Circuits Troubleshooting" and Figure 3-3. |
| -106 | Main DAC circuit (U320/U326) zero or full scale point is below the low tolerance level. | Same as above. |
| -107 | Transient DAC circuit (U321/U325) zero or full scale point is above the high tolerance level. | Same as above. |
| -108 | Transient DAC circuit (U321/U325) zero or full scale point is below the low tolerance level. | Same as above. |

Test Points

Table 3-3 lists test points that are referred to in many of the troubleshooting procedures. Each test point is identified by a circled number (e.g., ①⑦), the circuit point (e.g., U308-1), and signal name (e.g., CV PROG). The "Measurement and Conditions" column describes the signal that should be measured and the conditions (e.g. operating mode) required to make the measurement. The circuit locations of the test points are shown on the foldout schematic diagrams (Figure 6-1, sheets 1 through 6) and on some of the troubleshooting diagrams (Figures 3-3 through 3-10). All of the test points are located on the main circuit board as shown on foldout diagram Figure 6-2.

Note: When taking measurements, make sure that you connect the DMM or oscilloscope common to the proper circuit common. Measurements at test points ② through ⑦ are referenced to test point ① (primary/chassis common). Measurements at test points ⑨ through ④⑤ are referenced to test point ⑧ (secondary common).

Table 3-3. Test Points

| Test Point Number | Signal | Measurement and Conditions |
|---|-----------------------------------|---|
| <p>Connect meter or scope common to test point ① when taking measurements at test points ② through ⑦</p> | | |
| ① U502-2 | Primary/Chassis ground | - |
| ② Q501-10 | + 5V (primary bias) | + 5V (4.8 to 5.2V). |
| ③ D503-cath | + 13V (primary bias rectifiers) | + 13V (13 to 17 Vdc). |
| ④ Q501-15 | OPTO_CLR | Held low (0V) for approximately 80ms at power on and then goes high (5V). |
| ⑤ Q501-3 | PCLR | Goes high for approximately 80ms at power on and then goes low. |
| ⑥ Q501-9 | PCLR | Held low for approximately 80ms at power on and then goes high. |
| ⑦ Q501-6 | EEPON | At power on, holds the EEPROM's clock off to protect against accidental data write when power is initially applied. |
| <p>Connect meter common to test point ⑧ when taking measurements at test points ⑨ through ⑮.</p> | | |
| ⑧ C557- | Secondary common | |
| ⑨ C560+ | +5V secondary bias | +5V (4.8 to 5.2V) |
| ⑩ C557+ | + 15V secondary bias | + 15V ± 1V |
| ⑪ C558- | -15V secondary bias | - 15V ± 1V |
| ⑫ D554 - cath | + 26V (secondary bias rectifiers) | + 23V to + 29V |
| ⑬ Q551-12 | SPCLR | Held low for approximately 80ms at power on and then goes high. |
| ⑭ C556 + | Fan voltage | Press the front panel (blue <input type="checkbox"/> shift) key and then the 9 key and note the word "FAN" appears on the display. Now press the number key (0-3) specified below, press Enter key, and take the measurement. Repeat this procedure for each fan speed. FAN 0 = 14.7V ±0.8V FAN 1 = 10.7V ±0.6V FAN 2 = 12.8V ±0.8V FAN 3 = 9.7V ±0.5V |
| ⑮ U213-7 | SRX | SRX (Secondary receive) serial data line. Toggles between 0 and 5V. |
| ⑯ U214-3 | STX | STX (Secondary transmit) serial data line. Toggles between 0 and 5V. |
| ⑰ U308-1 | CV PROG | In VOLT MODE, + 10V with full rated voltage programmed; +0.5V with 3 volts programmed (6060B), or with 12 volts programmed (6063B). In CURR MODE or RES MODE (middle and high ohm ranges), + 13V. In RES MODE (low ohm range), < 1V. |

Table 3-3. Test Points (continued)

| Test Point Number | Signal | Measurement and Conditions |
|-------------------|----------------------|--|
| ⑱ U308-7 | CC PROG | In CURR MODE, + 10V with full rated current programmed. In VOLT MODE, RES MODE (low ohm range), or with INPUT OFF: - 0.5V. In RES MODE (middle and high ohm ranges), 0 to +10V depending upon resistance value programmed. |
| ⑲ U316-10 | TRANS_EN | High level with transient operation programmed on (TRAN ON). Low level with transient operation programmed off (TRAN OFF). |
| ⑳ U331-1 | SLEW | In CURR MODE, -10V with full rated current programmed; 0V with zero current programmed. In VOLT MODE, -10V with full rated voltage programmed; 0V with zero voltage programmed. |
| ㉑ U309-8 | DAC_REF | Low level in CURR or VOLT MODE. High level in RES MODE (any range). |
| ㉒ U309-9 | CR | Low level in RES MODE (low ohm range). High level in CURR, VOLT, or RES (middle or high ohm range) MODE. |
| ㉓ U309-1 | CG | Low level in RES MODE (middle or high ohm range). High level in CURR, VOLT, or RES (low ohm range) MODE. |
| ㉔ TB301-9 | PORT | High level with PORT0 ON programmed. Low level with PROT0 OFF programmed. |
| ㉕ U329-4 | -10 V Ref | -10V (9.95 to 10.05V). |
| ㉖ U331-7 | + 12V Ref | + 12V (11.28 to 11.44V). |
| ㉗ U8-5 | I PROG | Under normal operating conditions (input is regulated) measurement should be approximately: -0.1V X I _{in} (6060B). 0.67V X I _{in} (6063B). With input unregulated or disconnected, the measurement will be: 0V in CURR Mode. +0.9V in VOLT or RES MODE. + 14V when OV condition is false (normal). -13V when OV condition is true. |
| ㉘ D17 -cath | + OV | |
| ㉙ U10-1 | CC Loop Gain control | + 15V when input voltage is more than 2.5V. -15V when input voltage is less than 2.5V. |
| ㉚ | NOT USED | |

Table 3-3. Test Points (continued)

| Test Point Number | Signal | Measurement and Conditions |
|-------------------|---------------------------|---|
| ③① U9-8 | RNG | Low level when the high current range or the middle resistance range is programmed. High level when the low current range, the low resistance range, or the high resistance range is programmed. |
| ③② U5-7 | -VMON | -0.167 X Input Voltage (6060B). -0.0418 X Input Voltage (6063B). |
| ③③ D11 -cath | + OP | - 0.9V (full rated voltage input) to - 6V (zero volts input) when the OP condition is false. Pulses when the OP condition is true. See test point ③④. |
| ③④ U7-1 | -OP | -14V when the OP condition is false. Pulses when the OP condition is true. See Figure 3-10. |
| ③⑤ U12-17 | -VMONA | -0.167 X Input Voltage (6060B). -0.0418 X Input Voltage (6063B). |
| ③⑥ ③⑦ ③⑧ | NOT USED | |
| ③⑨ D12 -cath | OC circuit control | + 13V when OC condition false (normal). + 8V when OC condition is true. |
| ④① Q11-E | OC circuit control | + 10V when OC condition is false (normal). 0V when unregulated or when OC condition is true. |
| ④② D19-K | Input Power Stage Turn on | + 5V when turned on. 0V when turned off. |
| ④③ U1-1 | Input Power Stage 1 | 6.3V (approx.) with full rated input current. -0.5V (approx.) with the input off. |
| ④④ Q1-1 | Input Power Stage 1 | 5.4V (approx.) with full rated input current. 4.0V (approx.) with 10% rated input current. 2.5V (approx.) at zero input current. |
| ④⑤ U14-1 | Input Power Stage 1 | 1.25V for at full input current. |
| ④⑥ U5-1 | -IMON | 10.02V at full input current. |

Signature Analysis

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

Signature analysis tests are provided for most of the digital circuits in the primary and secondary interface circuits of the Electronic Load. There are four primary interface S.A. tests given in Tables 3-4 through 3-7, and five secondary interface tests given in Tables 3-8 through 3-12. Refer to "Firmware Revisions" for information about the valid firmware revisions for the signature analysis tables.

References are made to the appropriate S.A. test table from the troubleshooting flow charts or procedures. The following general rules apply to signature analysis testing of the primary and secondary interface circuits.

1. Be sure to use the correct test setup connections for the specific test. See "Test Setup for Signature Analysis".
2. Note the signatures for Vcc (+ 5V) and common on the IC being examined. If an incorrect signature is the same as that of Vcc or common, that pin (or point in the circuit) is probably shorted to Vcc or ground.
3. If two pins have identical signatures, they are probably shorted together.
4. If two signatures are similar, it is only a coincidence.
5. If a signature is incorrect at an input pin, but is correct at its source (output of previous IC), check for printed circuit track or soldering problems.
6. An incorrect signature at an output could be caused by a faulty component producing the output. It can also be caused by an input short circuit in another component on the board.

Firmware Revisions

The primary interface ROM chip (U205) and the secondary microprocessor chip (U301) are identified with labels that specify the revision of the Electronic Load's firmware.

The signatures given in Primary S.A. Tables 3-4 through 3-7 are valid for ROM chip U205 firmware revision "Rev A.02.01". You can also identify the revision of the U205 firmware using the *IDN? query in the program listed below.

```
10 OUTPUT 705;"*IDN?"  
20 ENTER 705;  
30 DISP L$  
40 END
```

The computer will display the Electronic Load Agilent part number and the firmware revision of the U205 primary ROM chip.

The signatures given in Secondary S.A. Tables 3-8 through 3-12 are valid for secondary interface microprocessor chip U301 revision "Rev A.02.01". Note that the U301 revision is only identified by the label; it cannot be read back using the *IDN? query.

Test Header Jumper Positions

The Electronic Load contains two test headers (connectors TP201 and TP301) with jumper positions for signature analysis testing and for other functions as described below. The test headers are located on the main circuit board (see Figure 6-3) and are accessible when the top cover is removed.

Primary Test Header TP201

| Pins | Description |
|-----------|--|
| 1 and 2 | + 5V (primary interface) test points. |
| 3 and 4 | With jumper RTP201 installed between these pins, the primary interface microprocessor is placed in the S.A. mode. Removing RTP201 takes the microprocessor out of the S.A. mode. |
| 5 and 6 | With jumper RTP201 installed between these pins, the primary interface microprocessor will ignore calibration commands, providing security against unauthorized calibration. With RTP201 removed, the microprocessor will respond to calibration commands. |
| 7 and 8* | S.A. gate test points (normal operating/storage position for RTP201). |
| 9 thru 16 | Test points for the chip select signals $\overline{CSP0}$ through $\overline{CSP7}$. |

*As shipped from the factory, jumper RTP201 is installed between TP201 pins 7 and 8. Both of these pins are connected to the primary S.A. gate signal, which is used as the start/stop signal when taking signatures during primary S.A. testing. See "Test Setup for S. A."

Secondary Test Header TP301 Pins

| Pins | Description |
|----------|--|
| 1 and 2 | With jumper RTP301 installed between these pins, the secondary microprocessor is placed in the S.A. mode. Removing RTP301 takes the microprocessor out of the S.A. mode. |
| 3 and 4* | S.A. gate test points (normal operating/storage position for RTP301). |
| 5 and 7 | With RTP301 installed between these pins, the secondary microprocessor will skip selftest at power-on. With RTP301 removed, the selftest will be performed. |
| 6 | Connected to secondary common. |
| 8 | + 5V (secondary) test point. |

* As shipped from the factory, jumper RTP301 is installed between pins 3 and 4. Both of these pins are connected to the secondary S.A. gate signal, which is used as the start/stop signal when taking signatures during secondary S.A. testing. See "Test Setup for S. A."

Test Setup for Signature Analysis

Figure 3-2 illustrates the primary (TP201) and secondary (TP301) test header connections required to perform the S.A. Tests given in Tables 3-4 through 3-12. The following is a description of the test setup:

- a. Turn off the Electronic Load and gain access to the main circuit board by removing the top cover (see "Disassembly Procedures"). Make sure that the Electronic Load is turned off before continuing with the test setup.
- b. To test the primary interface, use the following test setup.
 1. Connect jumper RTP201 in the S.A. position (SA_MODE) across pins 3 and 4 of the primary test header TP201 (see Figure 3-2).
 2. Set up and connect the signature analyzer's CLOCK, START, STOP, and GND inputs as follows:

| Signature Analyzer Input | Edge Setting | TP201 Connection | |
|--------------------------|---|--|---------|
| CLOCK |  | Connections are listed for each specific test (see Tables 3-4 thru 3-7). | |
| START |  | | TP201-7 |
| STOP |  | | TP201-8 |
| GND |  | | TP201-6 |

- c. To test the secondary interface, use the following test setup.
 1. Connect jumper RTP301 in the S.A. position (SA_EN) across pins 1 and 2 of the primary test header TP301 (see Figure 3-2).
 2. Set up and connect the signature analyzer's CLOCK, START, STOP, and GND inputs as follows:

| Signature Analyzer Input | Edge Setting | TP301 Connection |
|--------------------------|---|------------------|
| CLOCK |  | TP301-7 |
| START |  | TP301-3 |
| STOP |  | TP301-4 |
| GND |  | TP301-6 |

- d. Turn on the signature analyzer and use the signature analyzer probe to take signatures at the applicable IC test points given in the S.A. Test Table.
- e. Upon completion of the S.A. tests, return jumpers RTP201 and/or RTP301 to their normal operating positions of TP201 and TP301 as follows (see Figure 3-2): RTP201 between TP201-7 and TP201-8; RTP301 between TP301-3 and TP301-4.

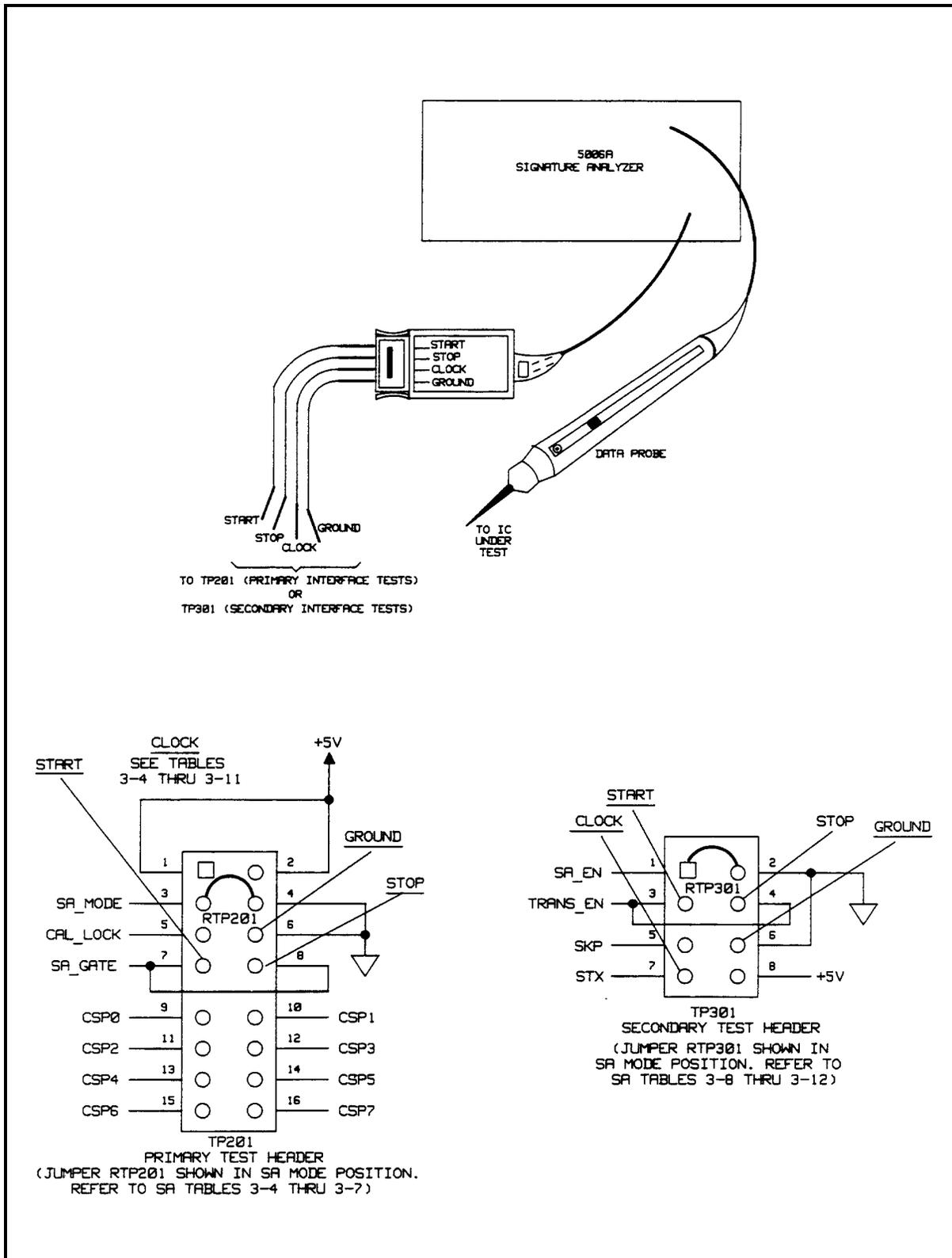


Figure 3-2. Test Headers Test Setup for Signature Analysis

Table 3-4. Primary Interface S.A. Test No. 1

Description: These signatures check primary microprocessor U203, ROM U205, and RAM U206. The signatures are valid for ROM U205 firmware revision "Rev A.02.01". Use the test setup described in "Test Setup for S.A.". Connect the signature analyzer's CLOCK input to U207-11.

| Signal | Signature | μ P U203 | ROM U205 | RAM U206 | Gates |
|--------------------------|-----------|--------------|----------|------------|---------|
| +5V | U961 | U203-4,7,21 | U205-28 | U206-28,14 | |
| Common | | U203-1,9,10 | | | |
| 4 MHz | | U203-2,3 | | | |
| 1 MHz | | U203-40 | U205-22 | U206-26 | |
| $\overline{\text{PLCR}}$ | | U203-6 | | | |
| A(0) | 8799 | U203-13 | U205-10 | U206-10 | |
| A(1) | HF40 | U203-14 | U205-9 | U206-9 | |
| A(2) | 9375 | U203-15 | U205-8 | U206-8 | |
| A(3) | 48PF | U203-16 | U205-7 | U206-7 | |
| A(4) | FF8U | U203-17 | U205-6 | U206-6 | |
| A(5) | PUCP | U203-18 | U205-5 | U206-5 | |
| A(6) | 84C9 | U203-19 | U205-4 | U206-4 | |
| A(7) | 25H3 | U203-20 | U205-3 | U206-3 | U204-1 |
| A(8) | 53P5 | U203-29 | U205-25 | U206-25 | U204-2 |
| A(9) | 1558 | U203-28 | U205-24 | U206-24 | U204-3 |
| A(10) | CAA3 | U203-27 | U205-21 | U206-21 | U218-4 |
| A(11) | PACH | U203-26 | U205-23 | U206-23 | U218-3 |
| A(12) | 1249 | U203-25 | U205-2 | U206-2 | U218-5 |
| A(13) | 1C1H | U203-24 | U205-26 | | U218-2 |
| A(14) | U872 | U203-23 | U205-27 | U206-27 | U218-1 |
| A(15) | 8F8F | U203-22 | U205-1 | | U218-13 |
| D(0) | 7H05 | U203-37 | U205-11 | U206-11 | |
| D(1) | 8P29 | U203-36 | U205-12 | U206-12 | |
| D(2) | U864 | U203-35 | U205-13 | U206-13 | |
| D(3) | 3P59 | U203-34 | U205-15 | U206-15 | |
| D(4) | 44A9 | U203-33 | U205-16 | U206-16 | |
| D(5) | C4P4 | U203-32 | U205-17 | U206-17 | |
| D(6) | 8PUC | U203-31 | U205-18 | U206-18 | |
| D(7) | 2794 | U203-30 | U205-19 | U206-19 | |
| STX | unstable | U203-11 | | | |
| SRX | 2177 | U203-12 | | | |
| R/W | 4A22 | U203-38 | | | |
| CE | C67U | | U205-20 | U207-1 | U218-12 |
| CE1 | 9H41 | Y206-20 | U216-11 | | |
| | 4U1P | U207-2 | U216-13 | | U204-5 |
| | 4AP2 | U207-4 | | | U204-4 |
| | C383 | U207-3 | U216-12 | | U218-6 |

Table 3-5. Primary Interface S.A. Test No. 2

Description: These signatures check the GP-IB talker/listener IC U202. The signatures are valid for ROM U205 firmware revision "Rev A.02.01". Use the test setup described in "Test Setup for S.A." Connect the signature analyzer's CLOCK input to TP201-11.

Signatures:

U202-1 = 7339 pulsing
U202-2 =
U202-3 = 1 MHz "E" clock
U202-4 = OOOO PLCR
U202-5 = OOOO pulsing
U202-6
U202-7 = 7339 + 5V
U202-8 = OOOO common
U202-9 = 7339 pulsing
U202-10 = OOOO pulsing
U202-11 =
U202-12 = OC57
U202-13 = O5AC
U202-14 = 167U
U202-15 = A83P
U202-16 = 69P1
U202-17 = 2O5A
U202-18 = 1427
U202-19 = H6C9
U202-20 = OOOO common
U202-21 = 23UH
U202-22 = 54A6
U202-23 = 8OAO
U202-24 = 7339
U202-25 = 7339
U202-26 = 7339
U202-27 = 713F
U202-28 = 7692
U202-29 = 71PF
U202-30 = U253
U202-31 = 338F
U202-32 = 5363
U202-33 = 6314
U202-34 = 7C2U
U202-35 = 7435
U202-36 = 7339
U202-37 = 7339
U202-38 = 7339
U202-39 = 7435
U202-40 = 7339 + 5V

Table 3-6. Primary Interface S.A. Test No. 3

Description: These signatures check the front panel interface IC's U208 U209, U210 and U212. The signatures are valid for ROM U205 firmware revision "Rev A.02.01". Use the test setup described in "Test Setup for S.A.". Connect the signature analyzer's CLOCK input to the chip select line of the IC under test as specified below.

| U208-U212 Drivers--Connect CLOCK to U207-11 | | | Signatures |
|--|---------|---------|-------------------|
| U208-3 | U209-17 | U210-18 | 7H05 |
| U208-7 | U209-1B | U210-16 | 8P29 |
| U208-4 | U209-14 | U210-14 | U864 |
| U208-8 | U209-13 | U210-12 | 3P59 |
| U208-13 | U209-8 | U210-9 | 44A9 |
| U208-14 | U209-7 | U210-7 | C4P4 |
| U208-17 | U209-4 | U210-5 | 8PUC |
| U208-18 | U209-3 | U210-3 | 2794 |
| U208-1 | U209-1 | | U961 + 5V |
| U208-10 | U209-10 | U210-10 | OOOO common |
| U208-11 | | | U961 |
| | U209-11 | | U961 |
| U208-16 | | | U28H |
| U208-2 | | | 2171 |
| U208-5 | | | 1687 |
| U208-6 | | | 899A |
| U208-9 | | | 1233 |
| U208-12 | | | 762C |
| U208-15 | | | 85F9 |
| U208-19 | | | 5255 |
| | U209-2 | | 6199 |
| | U209-5 | | 3C52 |
| | U209-6 | U212-1 | 5F9A |
| | U209-9 | U212-5 | 62C5 |
| | U209-12 | U212-9 | 2334 |
| | U209-15 | U212-3 | 6873 |
| | U209-16 | U212-13 | 1716 |
| | U209-19 | U212-11 | 99AP |

U210 Keypad Receiver--Connect CLOCK to TP201-13 (CSP4)

| | | |
|--------------|------------------------------------|----------------|
| U210-1,19 | = OOOO pulsing | |
| U210-2 | = 06U1 | |
| U210-3,17,20 | = 07U3 | |
| U210-4 | = 07U3 + 5 V (cal lock when low) | |
| U210-5,15 | = 07U3 press keypad "ADDRESS" | = 07C3 |
| U210-6,14 | = 07U3 press keypad "INPUT" | = 0772 |
| U210-7,13 | = 07U3 press keypad "LOCAL" | = 07C3 |
| U210-8,12 | = 07U3 press keypad "VOLT" | = 07UC |
| U210-9,11 | = 07U3 press keypad "RECALL" | = 07C3 |
| U210-10 | = OOOO common | |
| U210-16 | = 07U3 if CAL LOCK low | = OOOO pulsing |
| U210-18 | = 06U1 pulsing | |

Table 3-7. Primary Interface S.A. Test No. 4

Description: These signatures check the operation of the primary trigger circuits. The signatures are valid for ROM U205 firmware revision "Rev A.02.01". Use the test setup described in "Test Setup for S.A.". Connect the signature analyzer's CLOCK input to TP201-11.

Signatures:

+ 5 V signature = 7339

U202-5 = OOOO pulsing

U207-13 = OOOO pulsing

U207-12 = 7339 pulsing

U209-2 = 73F6

U209-3 = H6C9

U209-4 = 1427

U209-5 = 73F5

U209-11 = 7339 pulsing

U215-3 = 7339 pulsing

U215-7 = OOOO pulsing

Connect Test Point ① (primary common) to Test Point ⑧ (secondary common) for the U215-7 signature. See Test Point Locations Figure 6-2.

U216-4 = 7339 pulsing

U216-5 = 7339 pulsing

U216-6 = 7339 pulsing

U217-1 = OOOO pulsing

U217-2 = 73F6

U217-3 = 7339 pulsing

U217-4 = 7339

U217-5 = 7339 pulsing

U217-6 = OOOO pulsing

U217-8 = U367

U217-9 = 805P

U217-10 = 7339 pulsing

U217-11 = 805P

U217-12 = 73F5

U217-13 = U367

Table 3-8. Secondary Interface S.A. Test No. 1

Description: These signatures check secondary microprocessor U301 and latches U302 and U330. The signatures are valid for U301 firmware revisions "Rev A.02.01". Use the test setup described in "Test Setup for S.A. "

Signatures:

+5V signature = H82C

| | U301 | U302 | U330 |
|--------------|--------------------|----------------|------------------------|
| + 5V | U301-7,4,9,21,39 | U302-20 | U330-20 |
| Common | U301-1 | U302-10 | U330-10 |
| <u>SPCLR</u> | U301-6 = +5V | U302-1 = +5V | U330-1 = +5V |
| 4 MHz | U301-2,3 | | |
| 1 MHz | U301-40 | | |
| SD(7) | U301-30 = HO83 | U302-8 = HO83 | U330-8 = HO83 |
| SD(6) | U301-31 = IUUO | U302-7 = IUUO | U330-7 = IUUO |
| SD(5) | U301-32 = 8A16 | U302-13 = 8A16 | U330-13 = 8A16 |
| SD(4) | U301-33 = 834A | U302-14 = 834A | U330-14 = 834A |
| SD(3) | U301-34 = PO7O | U302-4 = PO7O | U330-4 = PO7O |
| SD(2) | U301-35 = U93A | U302-3 = U93A | U330-3 = U93A |
| SD(1) | U301-36 = AP48 | U302-18 = AP48 | U330-18 = AP48 |
| SD(0) | U301-37 = UFOA | U302-17 = UFOA | U330-17 = UFOA |
| | U301-8 = +5V | U302-2 = 6A19 | U330-2 = 1ACH |
| | U301-10 = H82C | U302-5 = AUH1 | U330-5 = H82C |
| | U301-11 = +5V | U302-6 = OCH8 | U330-6 = HH1A |
| | U301-12 = OOOO | U302-9 = H210 | U330-9 = 64PC |
| | U301-13 = 24A7 | U302-11 = 9457 | U330-11 = H82C pulsing |
| | U301-14 = A264 | U302-12 = 3505 | U330-12 = U746 |
| | U301-15 = OUPA | U302-15 = C1H7 | U330-15 = 746A |
| | U301-16 = HHC8 | U302-16 = A9H8 | U330-16 = 46AH |
| | U301-17 = 41UA | U302-19 = P921 | U330-19 = 6AH2 |
| | U301-18 = 9986 | | |
| | U301-19 = HCA7 | | |
| | U301-20 = 0620 | | |
| | U301-22 = unstable | | |
| | U301-23 = OOOO | | |
| | U301-24 = 77UA | | |
| | U301-25 = OOOO | | |
| | U301-26 = 927H | | |
| | U301-27 = 15C4 | | |
| | U301-28 = 3PAF | | |
| | U301-29 = 4234 | | |
| | U318-11,12 = OOOO | | |
| | U318-13,14 = H82C | | |

Table 3-9. Secondary Interface S.A. Test No. 2

Description: These signatures check main DAC U320, transient DAC U321, and secondary data bus B latches U319. The signatures are valid for U301 firmware revisions "Rev A.02.01". Use the test setup described in "Test Setup for S.A.".

Signatures:

| | U319 | U320 | U321 |
|--------------|--------------------------|---|-------------------------------------|
| Common | U319-20 = +5V U319-10 | U320-20 = +15V U320-1,3,10,12,18 | U321-20 = +15V U321-1,3,10,12,18 |
| <u>SPCLR</u> | U319-1 = +5V | | |
| SD(0) | U319-7 = UFOA | | |
| SD(1) | U319-4 = AP48 | | |
| SD(2) | U319-8 = U93A | | |
| SD(3) | U319-3 = PO7O | | |
| SD(4) | U319-17 = 834A | | |
| SD(5) | U319-14 = 8A16 | | |
| SD(6) | U319-18 = 1UUO | | |
| SD(7) | U319-13 = HO83 | | |
| SDB(0) | U319-6 = F592 | U320-7 = F592 | U321-7 = F592 |
| SDB(1) | U319-5 = F3P2 | U320-6 = F3P2 | U321-6 = F3P2 |
| SDB(2) | U319-9 = 4461 | U320-5 = 4461 | U321-5 = 4461 |
| SD8(3) | U319-2 = 5UA2 | U320-4 = 5UA2 | U321-4 = 5UA2 |
| SDB(4) | U319-16 = 63AU | U320-16 = 63AU | U321-16 = 63AU |
| SDB(5) | U319-15 = 17C1 | U320-15 = 17C1 | U321-15 = 17C1 |
| SDB(6) | U319-19 = 6AOC | U320-14 = 6AOC | U321-14 = 6AOC |
| SDB(7) | U319-12 = P635 | U320-13 = P635 | U321-13 = P635 |
| | U319-11 = 4OH3 | U320-2 = 57A2 U320-17 = 41AH U320-19 = O62O | U321-2 = 1UPU U321-17 = 41AH |
| | | U318-1 = 41AH U318-2 = 9986 U318-8 = 64PC | |

Table 3-10. Secondary Interface S.A. Test No. 3

| | | | | | | | |
|--|---------|----------------|------------------|---------|----------------------------|----------------|----------------|
| Description: These signatures check transient generator IC's U310 through U316. The signatures are valid for U301 | | | | | | | |
| Signatures: | | | | | | | |
| +5V | U311-20 | U310-20 | U313-20 | U312-16 | U316-6,7,8 | U315-16 | U314-14 |
| Common | U311-10 | U310-10 | U313-10 | U312-8 | U316-4,5,18 | U315-8 | U314-7 |
| SD(0) | | U311-3 = UFOA | | | U310-3 = UFOA | | |
| SD(1) | | U311-4 = AP48 | | | U310-4 = AP48 | | |
| SD(2) | | U311-7 = U93A | | | U310-7 = U93A | | |
| SD(3) | | U311-8 = P070 | | | U310-8 = P070 | | |
| SD(4) | | U311-13 = 834A | | | U310-13 = 834A | | |
| SD(5) | | U311-14 = 8A16 | | | U310-14 = 8A16 | | |
| SD(6) | | U311-17 = 1UUO | | | U310-17 = 1UUO | | |
| SD(7) | | U311-18 = H083 | | | U310-18 = H083 | | |
| RCK_LOW | | U311-11 = UP15 | | | | | |
| RCK_HI | | | | | U310-11 = 355F | | |
| OE | | U311-1 = 8986 | | | | U316-12 = 8986 | |
| OE | | | | | U310-1 = 51AH | U316-11 = 51AH | |
| Q1 | | U311-2 = 6P1A | | | U310-2 = 6P1A | | U312-4 = 6P1A |
| Q2 | | U311-5 = A989 | | | U310-5 = A989 | | U312-5 = A989 |
| Q3 | | U311-6 = 486A | | | U310-6 = 486A | | U312-6 = 486A |
| Q4 | | U311-9 = FH57 | | | U310-9 = FH57 | | U312-7 = FH57 |
| Q5 | | U311-12 = U1AC | | | U310-12 = U1AC | | U312-10 = U1AC |
| Q6 | | U311-15 = 8HF6 | | | U310-15 = 8HF6 | | U312-11 = 8HF6 |
| Q7 | | U311-16 = CCU8 | | | U310-16 = CCU8 | | U312-12 = CCU8 |
| Q8 | | U311-19 = 50P3 | | | U310-19 = 50P3 | | U312-13 = 50P3 |
| U349-1,5,8,16 | U350-1 | U351-13 | U352-2,4,6,12,14 | | U353-5,9,11 = 0000 pulsing | | |
| U313-2 = FU49 | | U316-1 = 0CH8 | | | | | |
| U313-3 = 98H4 | | U316-2 = 3505 | | | | | |
| U313-4 = 746A | | U316-3 = H210 | | | | | |
| U313-6 = H82C | | U316-9 = 98H4 | | | | | |
| U313-7 = H8HH | | U316-14 = P9H3 | | | | | |
| U313-9 = 0000 | | U316-15 = H82C | | | | | |
| U313-11 = C1H7 | | | | | | | |
| U313-14 = H82C | | U315-1 = H82C | | | | | |
| U313-15 = FU49 | | U315-5 = H82C | | | | | |
| U313-17 = 4OUU | | U315-9 = OOU6 | | | | | |
| U313-18 = 0000 | | U315-10 = H8HH | | | | | |
| U313-19 = C1H7 | | U315-11 = H82C | | | | | |
| | | U315-13 = H82C | | | | | |
| U312-2 = H82C | | | | | | | |
| U312-3 = P9H3 | | U314-1 = 4OUU | | | | | |
| U312-9 = H82C | | U314-2 = H82C | | | | | |
| U312-14 = FU49 | | U314-3 = C1H7 | | | | | |
| U312-15 = FU49 | | U314-4 = H82C | | | | | |
| | | U314-10 = H82C | | | | | |
| | | U314-12 = H82C | | | | | |
| | | U314-13 = 4OUU | | | | | |

Table 3-11. Secondary Interface S.A. Test No. 4

Description: These signatures check the readback DAC U322, slew rate decoder U305, and analog switch U317. The signatures are valid for U301 firmware versions "Rev A.02.01". Use the test setup described in "Test Setup for S.A.".

Signatures:

| | | | |
|------------|--------------------|----------------|----------------|
| + 15V | U322-20 | | U317-13 |
| - 15V | | | U317-4 |
| +5V | | U305-1,20 | U317-12 |
| Common | U322-1,3,10,12 | U305-10 | U317-5 |
| + 12VREF | U322-8 | | |
| SD(0) | U322-7= UFOA | | |
| SD(1) | U322-6 = AP48 | | |
| SD(2) | U322-5 = U93A | | |
| SD(3) | U322-4 = P070 | | |
| SD(4) | U322-16 = 834A | | |
| SD(5) | U322-15 = 8A16 | | |
| SD(6) | U322-14 = 1UUO | | |
| SD(7) | U322-13 = H083 | | |
| WR1/WR2 | U322-2,18 = P9HA | | |
| B1/B2/XFER | U322-17, 19 = HCA7 | | |
| SDB(0) | | U305-3 = F592 | |
| SDB(1) | | U305-4 = F3P2 | |
| SDB(2) | | U305-7 = 4461 | |
| SDB(3) | | U305-8 = 5UA2 | |
| SDB(4) | | U305-13 = H82C | |
| SDB(5) | | U305-14 = H82C | |
| SDB(6) | | U305-17 = 6AOC | |
| SDB(7) | | U305-18 = H82C | |
| SLW1 | | U305-2 = OU8C | U317-8 = OU8C |
| SLW2 | | U305-5 = 1187 | U317-9 = 1187 |
| SLW3 | | U305-6 = 7P88 | U317-16 = 7P88 |
| SLW4 | | U305-9 = 8PCU | U317-1 = 8PCU |
| CLK | | U305-11 - CCF9 | |
| TOGGLE | | U305-16 - 98H4 | |

Table 3-12. Secondary Interface S.A. Test No. 5

| | | | |
|--|-----------------------|---------|----------------|
| Description: These signatures check the chip select IC U304 and the status readback IC U303. The signatures are valid for U301 firmware revisions "Rev A.02.01". Use the test setup described in the "Test Setup for S.A.". | | | |
| Signatures: | | | |
| +5V | U303-16 | | U304-6,16 |
| Common | U303-8 | | U304-5-8 |
| SD(0) | U303-10 = UFOA | S0 | U304-1 = 24A7 |
| SD(1) | U303-13 = AP48 | S1 | U304-2 = A264 |
| SD(2) | U303-9 = U93A | S2 | U304-3 = OUPA |
| SD(3) | U303-1 = P070 | | |
| | | CS0 | U304-15 = 57A2 |
| LCLR | U303-4,6,12,14 = P921 | CS1 | U304-14 = 1UPU |
| UNREG | U303-11 = H82C | CS2 | U304-13 = CCF9 |
| BO | U303-3 = H82C | CS3 | U304-12 = P9HA |
| OV | U303-7 = H82C | CS4 | U304-11 = 4OH3 |
| OP | U303-15 = H82C | CS5 | U304-10 = 9457 |
| STAT_EN | U303-5 = HH1A | RCK_LOW | U304-9 = UP15 |
| | | RCK_HI | U304-7 = 355F |
| | | STB | U304-4 = HHC8 |

DAC Circuits Troubleshooting (Figure 3-3)

These circuits generate the SLEW signal which controls the input power stages. This analog signal is produced by the combined outputs from the main DAC/amplifier (U320/U326) and the transient DAC/amplifier (U321/U325). The DACs/amplifiers convert the data on bus lines SDB0-7 into analog signals.

The $\overline{\text{HIGH}}$ signal (active LO) from the transient generator (see Figure 3-7) closes switch U309 causing the output of the transient/DAC amplifier to be combined with the output from the main DAC/amplifier. The resulting SLEW signal is sent to the input power control circuit via inverting amplifier U324 and the slew circuits (see Figure 3-4).

The SLEW signal is also read back to microprocessor U301 via comparator U327. Readback DAC/amplifier U322/U328 converts the data on bus lines SD0-7 into a reference signal that allows the microprocessor to successively approximate the value of the SLEW signal. The SLEW readback signal is used during selftest to determine if the DACs are operating properly.

To troubleshoot the DAC circuits, place the Electronic Load in the S.A. mode by connecting the jumpers in test headers TP201 and TP301 in the S.A. mode positions (see Figure 3-2). The waveforms shown in Figure 3-3 can only be generated when the S.A. mode is on.

First, check that the S.A. waveforms shown on Figure 3-3 are correct. If these waveforms are not correct, check the SD0-7 data bus lines to the readback DAC U322 using S.A. Tables 3-10 and 3-13. Next, check the SDB0-7 data lines to the main (U320) and transient (U321) DACs using S.A. Table 3-9. If there is a problem on the data lines, S.A. should isolate the problem to the faulty component.

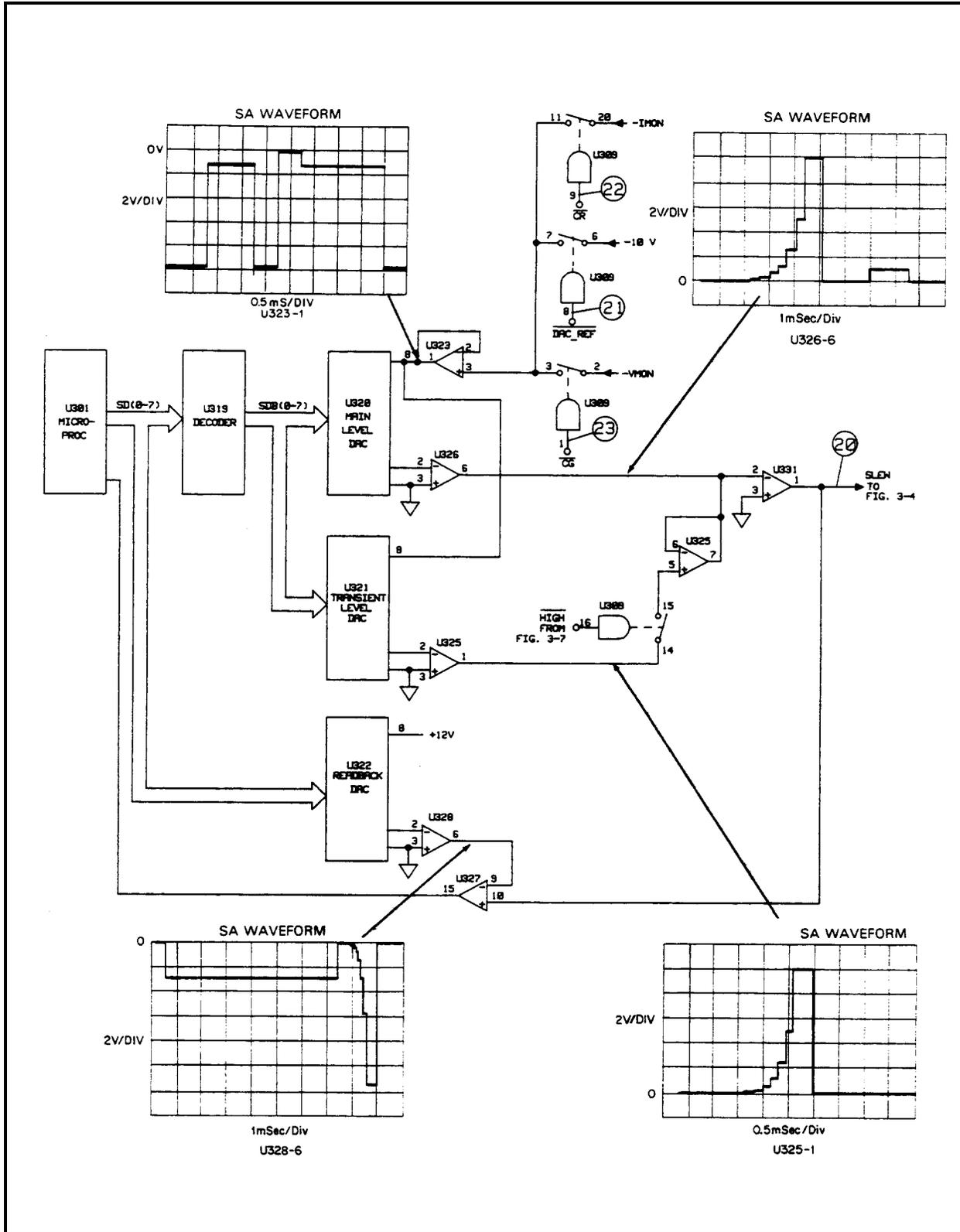


Figure 3-3. DAC Circuits Troubleshooting

If the unit has failed selftest by reporting an error 105-108 at turn-on and no problem can be found using S.A., the IMON adjustment may be at fault. Refer to "POST REPAIR CALIBRATION" and perform the IMON Adjustment.

Also, check if the switches in U309 are operating properly. Turn off the S.A. mode by removing the jumpers. Now check test points (21), (22) and (23) using the measurement conditions specified in Table 3-3. A switch should close when the applicable test point is a Low level. If the switches are operating properly, check test points (45) (- IMON), (25) (-10V), and (32) (- VMON)

If all signatures and test points check out, the DAC or amplifier that is generating the incorrect waveform is probably faulty.

Slew Circuit Troubleshooting (Figure 3-4)

This circuit consists primarily of three operational amplifier stages (U306 and U307) and four analog switches (U317). The four switches determine the slew rate by selecting loop gain and response time combinations. The switches are controlled by the SLW1-SLW4 signals to provide 12 slew rates.

To troubleshoot the slew circuit, place the Electronic Load in the S.A. mode by connecting the jumpers in test headers TP201 and TP301 in the S.A. mode positions (see Figure 3-2). The S.A. waveforms at the top of Figure 3-4 can only be generated when the S.A. mode is on. If the S.A. waveforms are incorrect, check the SDB0-7 data inputs to U305 and the SLW signal outputs from U305 using S.A. Table 3-13. If the signatures are correct, an amplifier or switch is probably defective.

The waveforms at the bottom of Figure 3-4 are generated when various slew rates are programmed. These waveforms check the operation of the slew circuit switches (U317). They are not generated in the S.A. mode. To generate these waveforms, turn the S.A. mode off (remove jumpers) and program 3 different slew rates (.001, 0.5 and 2.5 A/ μ s) from the front panel as shown in the following sequence. Use a scope with delayed sweep to verify the waveforms shown for slew rate in Figure 3-4.

```

MODE = CURR
CURR = 5
Tran Level = 10
Freq = 80
Dcycle = 50
Tran on/off = on
Slew = .001   (Slew Rate #1)
Slew = .5    (Slew Rate #9)
Slew = 2.5   (Slew Rate #11)
}           6060B
           only

```

The three slew rates programmed from the front panel toggle all four switches in the slew circuit. Refer to the following table if you need to check the state of the switches for a specific slew rate. Remember that the front panel is programmed in microseconds. Note that when the SLW signal is LO, the switch is closed; when the SLW signal is HI, the switch is open. If the slew rate tests check out, and a problem still exists, troubleshoot the CC/CV control circuits as described in the next section.

SLEW RATE SWITCH SETTINGS

Refer to Module Operating Manual for Slew Rate Steps

| Slew Rate | SLW1 | SLW2 | SLW3 | SLW4 |
|-----------|------|------|------|------|
| #1 | HI | HI | LO | HI |
| #2 | HI | LO | LO | HI |
| #3 | LO | HI | LO | HI |
| #4 | HI | HI | HI | HI |
| #5 | HI | LO | HI | HI |
| #6 | LO | HI | HI | HI |
| #7 | HI | HI | LO | LO |
| #8 | HI | LO | LO | LO |
| #9 | LO | HI | LO | LO |
| #10 | HI | HI | HI | LO |
| #11 | HI | LO | HI | LO |
| #12 | LO | HI | HI | LO |

CC/CV CONTROL CIRCUIT TROUBLESHOOTING (Figure 3-5)

Depending upon which operating mode (and range in the CR mode) is selected, either the CC or the CV loop controls the conduction of the input power stages. If the CC or CR (middle and high ranges only) mode is selected, the $\overline{CC_EN}$ signal goes low connecting the SLEW signal to the CC control circuit (U308, U6). If the CV or CR (low range only) mode is selected, the $\overline{CV_EN}$ signal goes low connecting the SLEW signal to the CV control circuit (U308, U13).

The overvoltage (OV) circuit (U10, D17) is also shown on Figure 3-5. When an OV condition is detected, the OV circuit generates a negative signal on the PROG signal line via diode D17, which causes the input power stages to increase current flow to attempt to limit input voltage. R64 and D18 latch the OV circuit on. When activated, the OV circuit overrides the CC and CV control circuits.

Normally, the output of U10-7 is held high by the positive bias on input U10-5. This bias is controlled by the output of inverting amplifier U12-7, the output of which varies from 0 to -10 volts as the voltage at the input terminals varies from zero to the rated input voltage. When the voltage at the input terminals exceeds the load's rated input, the output of U12-7 pulls input U10-5 less positive until U10-5 is less positive than U10-6. This causes the output of U10-7 to go low, generating the negative signal on the PROG line.

To troubleshoot the CV or CC circuits, place the Electronic Load in the S.A. mode by connecting the jumpers in test headers TP201 and TP301 in the S.A. mode positions (see Figure 3-2). The waveforms shown in Figure 3-5 can only be generated when S.A. mode is on. If the waveforms are correct but a problem exists, troubleshoot the input power stages as described in the next section.

If the waveforms are incorrect, turn off the S.A. mode (remove jumpers) and check that the CC and CV switches in U340 are operating properly. If the $\overline{CC_EN}$ or $\overline{CV_EN}$ input is LO, the applicable switch should be closed. You can use S.A. Table 3-10 to check the $\overline{CC_EN}$, or $\overline{CV_EN}$ signals. Next, check test points (27) through (31) using the measurement conditions specified in Table 3-3. Also, check test points (32) (- VMON), (45) (- IMON), and (26) (+ 12V ref).

If both the CC and CV control loops have problems, there may be another circuit affecting the CC and CV circuits. Troubleshoot the input power stages, current limit, and power limit circuits as described in subsequent sections.

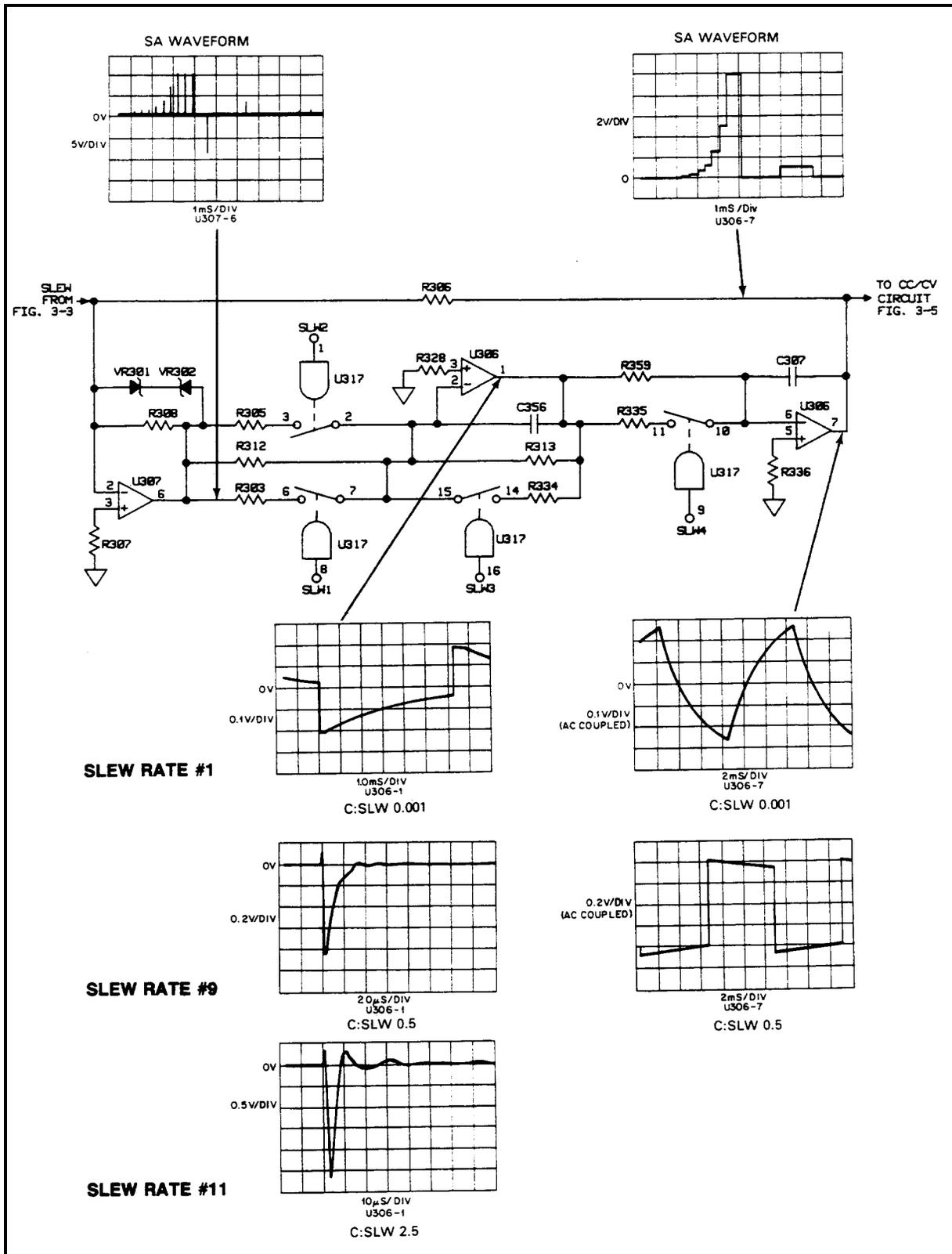


Figure 3-4A. Slew Circuits Troubleshooting for 6060B

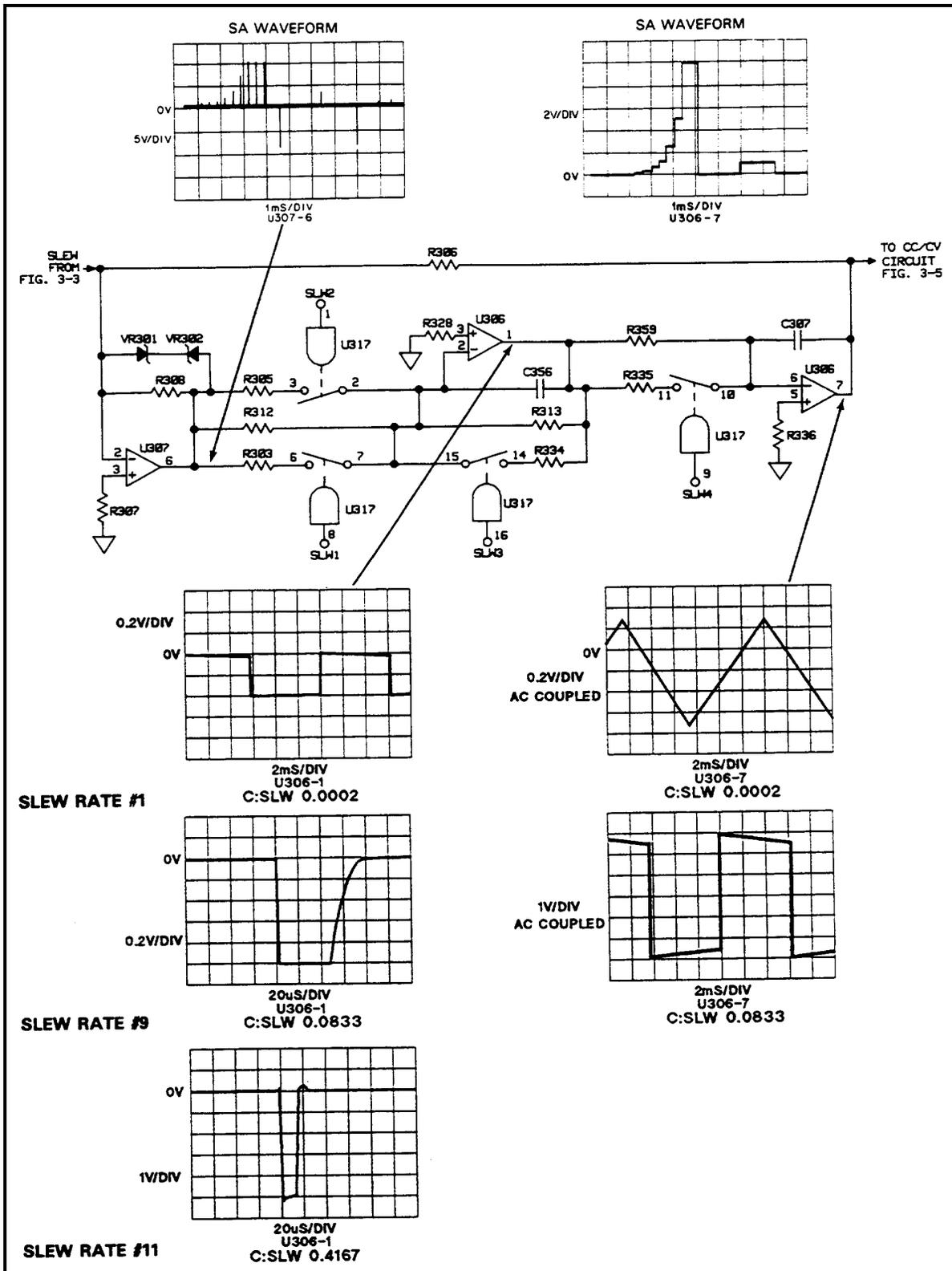


Figure 3-4B. Slew Circuits Troubleshooting for 6063B

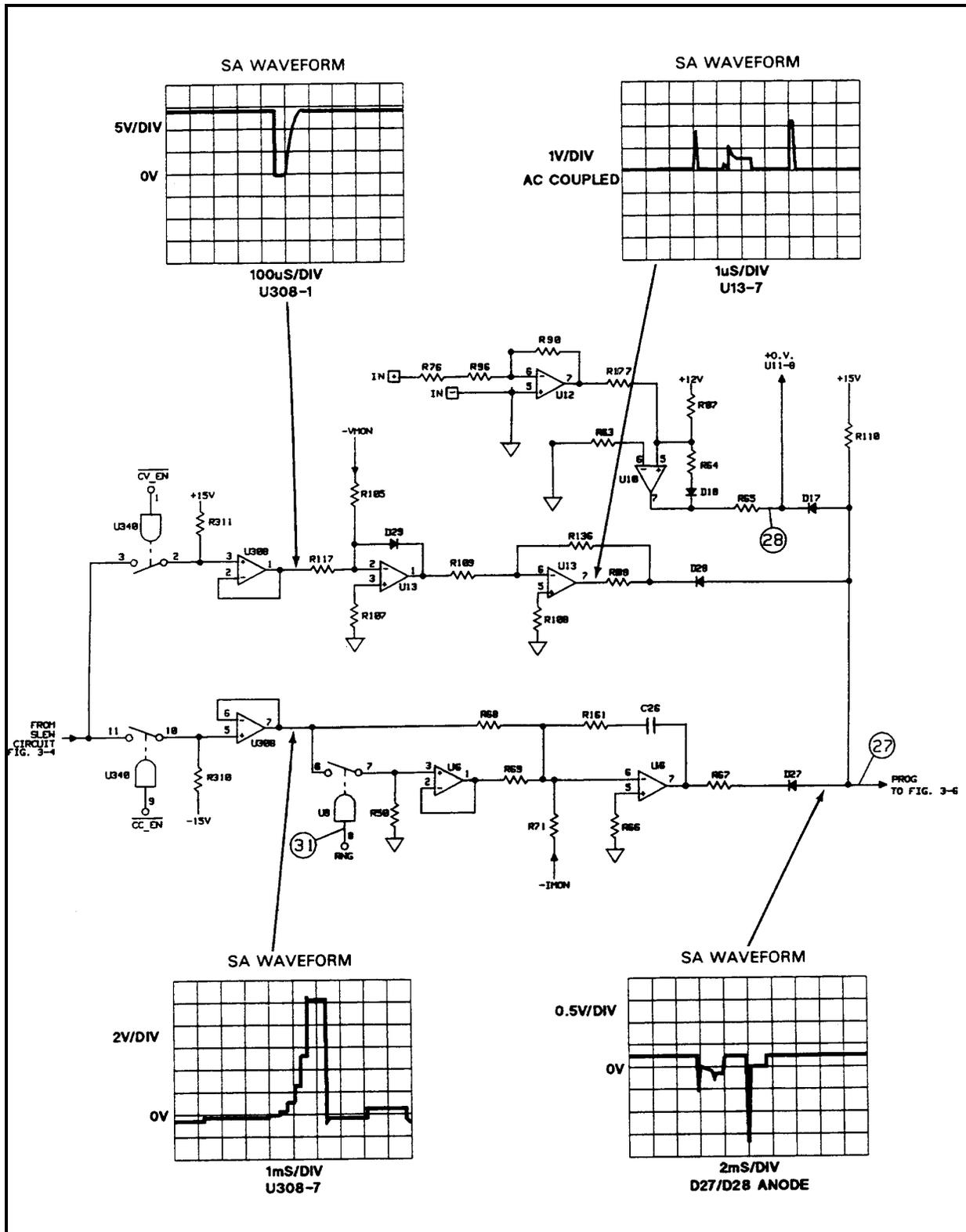


Figure 3-5. CC/CV Control Circuits Troubleshooting

Input Power Stages Troubleshooting (Figure 3-6)

There are eight identical input power stages connected in parallel. Figure 3-6 shows one of the eight. This stage consists primarily of a power FET (in quad array Q1), a monitor amplifier (U14) and an error amplifier (U1). Schematic details are shown on Figure 6-1, sheet 6.

To troubleshoot the input power circuits, place the Electronic Load in the S.A. mode by connecting the jumpers in test headers TP201 and TP301 in the S.A. mode positions (see Figure 3-2). The waveform shown in Figure 3-6 at the output of the error amplifier can only be generated in the S.A. mode. Check that this waveform appears at the output of the error amplifier in each input power stage. Refer to Figure 6-1, sheet 6 to locate the output pin of each error amplifier. Checking each stage may isolate the problem to a specific stage.

If the problem is isolated to a specific stage, turn the S.A. mode off (remove jumpers) and check the test points (41) through (44) that correspond with applicable circuit points in the defective stage. Use the measurement conditions specified in Table 3-3. Also, check the applicable fuses in the specific stage. As shown in Figure 3-6, fuses F1 and F9 are used by stage 1.

If all stages have a problem, check test points (32) and (45) (see Table 3-3). Also, check voltage suppressor (VR9) and diode (D14) which are connected across the + and - INPUT terminals. Make sure that SENSE switch S1 on the rear panel is set to the LCL position if remote sensing is not being used.

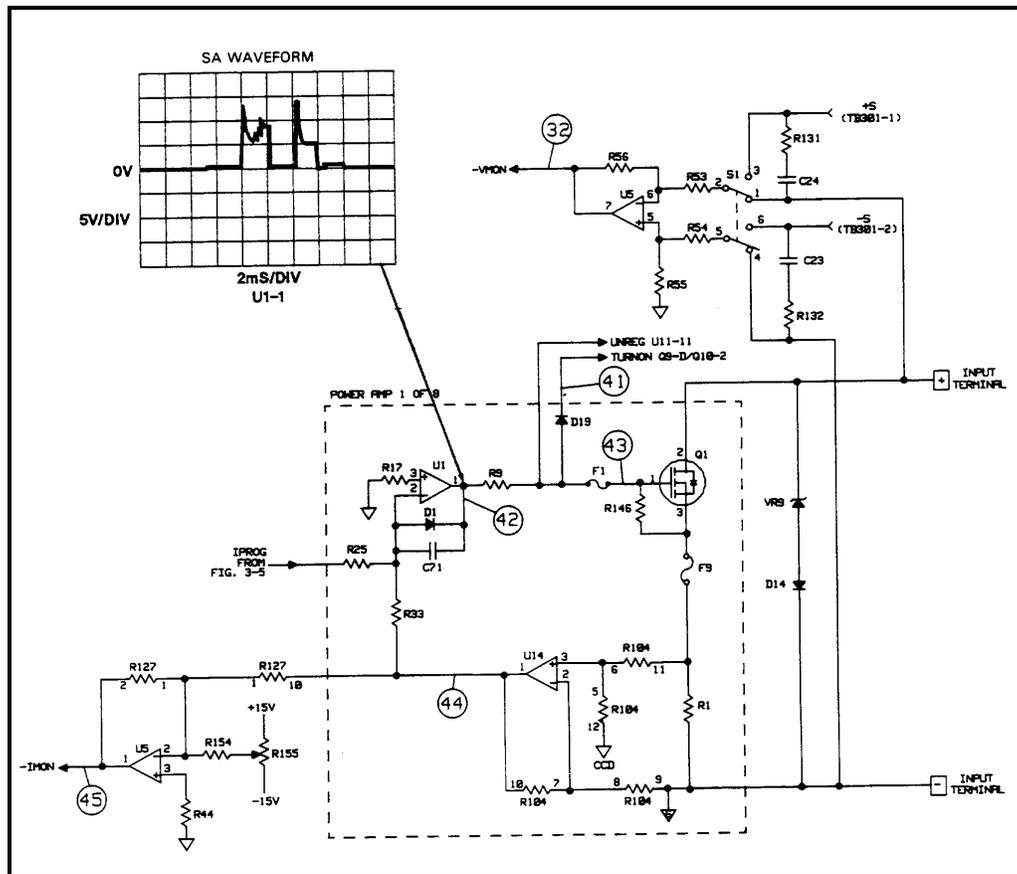


Figure 3-6. Input Power Stages Troubleshooting

Transient Generator Troubleshooting (Figure 3-7)

The transient generator (U310-U316) allows the input power stages to switch between two load levels. It produces the $\overline{\text{HIGH}}$ control which is sent to the DAC circuits to switch the transient DAC output.

Troubleshooting the transient circuit consists of performing the general troubleshooting procedures if the transient circuit will not perform any functions, or performing the frequency or toggle/pulse mode troubleshooting if there is a problem in those areas.

General Troubleshooting

First, check the data bus and internal clock. Use signature analysis to check the SD 0-7 data lines at U310 and U311 (see Table 3-10). Check for the presence of the 1MHz clock signal at U313-1, U312-1, U316-13, and U315-4, 12 (see Figure 3-7).

Next, perform the front panel actions indicated in the Checkout table using a scope and logic probe to monitor the results. Make sure that the unit is at the factory default setting of 1000Hz , 50% duty cycle.

Transient Generator Frequency

If the transient generator will not change frequency, press [TRAN ON] on the front panel and program the transient frequencies according to the FSEL table. Check FSEL inputs at U316-1,2,3 with a logic probe. Check the 1 μ s pulse intervals at U312-14, and U316-14 with a scope.

FSEL TABLE

| Front Panel Frequency | FSEL INPUTS | | | interval between 1 μ s pulses | |
|--------------------------|-------------|----|----|-----------------------------------|-------------|
| | 0 | 1 | 2 | @U312-14 | @U316-14 |
| 10000Hz | LO | LO | LO | LO | 50 μ s |
| 1000Hz | HI | LO | LO | 10 μ s | 500 μ s |
| 100Hz | LO | HI | LO | 100 μ s | 5ms |
| 10Hz | HI | HI | LO | 1ms | 50ms |
| 1Hz | LO | LO | HI | 10ms | 500ms |

Toggle or Pulse Modes

To check the transient generator in toggle and pulse modes, run the following program:

```

10 LOOP
20 OUTPUT 705;"TRAN ON;:TRAN:MODE TOGG"
30 DISP "TRAN:MODE TOGG"
40 PAUSE
50 OUTPUT 705;"TRAN:MODE PULS"
60 DISP "TRAN:MODE PULS"
70 PAUSE
80 END LOOP
90 END

```


During the pauses, use a logic probe to make the following checks:

| | |
|---------------------|--------------------|
| Toggle Mode | Pulse Mode |
| U313-3 = LO | U313-4 = HI |
| U312-3 = LO | U313-14 = toggling |
| U316-9, 11, 14 = LO | U315-13 = toggling |
| U316-12 = HI | |

After the pause, press "Continue" to generate the next trigger.

CHECKOUT TABLE

| FRONT PANEL ACTION | RESULT | | | | | | | |
|---|-----------------|----------------|----------------------------|-----------------------------|---|---|---|---|
| | use scope | | | | use logic probe | | | |
| | TRANS_EN signal | U316-11,12 | U313-2,12,15 | U312-3 | U313-7 | U313-17 | U313-5,8,11,16,19 | U316-17,19 |
| Turn on unit | TTL Lo | 11=LO 12=Hi | Negative pulse every 0.5ms | Negative pulse every 0.01ms | TTL Lo | TTL Hi | | |
| Press TRAN ON | TTL Hi | 1KHz sq. wave | Negative pulse every 0.5ms | Negative pulse every 10µs | TTL Hi | TTL Lo | Positive pulse when TRAN ON pressed. | Negative pulse when TRAN ON pressed. |
| Press FREQ 100 ENTER | TTL Hi | 100Hz sq. wave | Negative pulse every 5ms | Negative pulse every 100µs | Negative pulse when FREQ and ENTER pressed. | Positive pulse when FREQ and ENTER pressed. | Positive pulse when FREQ and ENTER pressed. | Negative pulse when FREQ and ENTER pressed. |
| Press TRAN OFF | TTL Lo | 11=LO 12=Hi | Negative pulse every 5ms | Negative pulse every 100µs | TTL Lo | TTL Hi | | |

Trigger Circuit Troubleshooting (Figure 3-8)

The Electronic Load can receive an internal trigger (command via the GP-IB) or an external trigger signal (TRIG_IN via connector TB201). Either trigger can be used in triggering a preset level (current, voltage or resistance value) or in triggering a pulsed or toggles transient operation. Troubleshooting the trigger circuit consists of running programs that generate trigger pulses and then making sure that the signal lines shown in Figure 3-8 toggle in the direction indicated. If a signal line does not toggle where indicated, the gate or IC that generates that signal is probably defective.

The arrows on Figure 3-8 indicate the signal line activity when using a logic probe and running the programs. Connect TP201-4 to TP301-2 (see Figure 3-2) before troubleshooting this circuit. This provides a common ground across isolation for the logic probe.

The first program continuously toggles all signal lines labeled ON_TRIG when the program is run. Use the logic probe to confirm this (see Figure 3-8).

PROGRAM 1

```

10 OUTPUT 705;"TRAN:MODE PULS"
20 OUTPUT 705;"TRIG:SOUR BUS"
30 OUTPUT 705;"*TRG"
40 WAIT .5
50 GO TO 30
60 END

```

The second program is used to toggle the lines labeled ON_LEV and ON_RUN as well as the ON_TRIG lines on Figure 3-8 when the program is run. However, the lines do not toggle continuously as in program 1, but only at specific points in the program. The ON_RUN signal lines toggle once at the beginning of the program. The ON_TRIG lines all toggle when CONTINUE is pressed after the first pause in the program. The ON_LEV lines all toggle when CONTINUE is pressed after the second pause in the program.

PROGRAM 2

```

10 OUTPUT 705;"CURR:LEV:TRIG 5"
20 OUTPUT 705;"TRIG:SOUR BUS"
30 PAUSE
40 OUTPUT 705;"*TRG"           ! ON TRIG
50 PAUSE
60 OUTPUT 705;"CURR 1"        ! ON LEV
70 END

```

You can also use S.A. Table 3-7 to check operation of the primary trigger circuit.

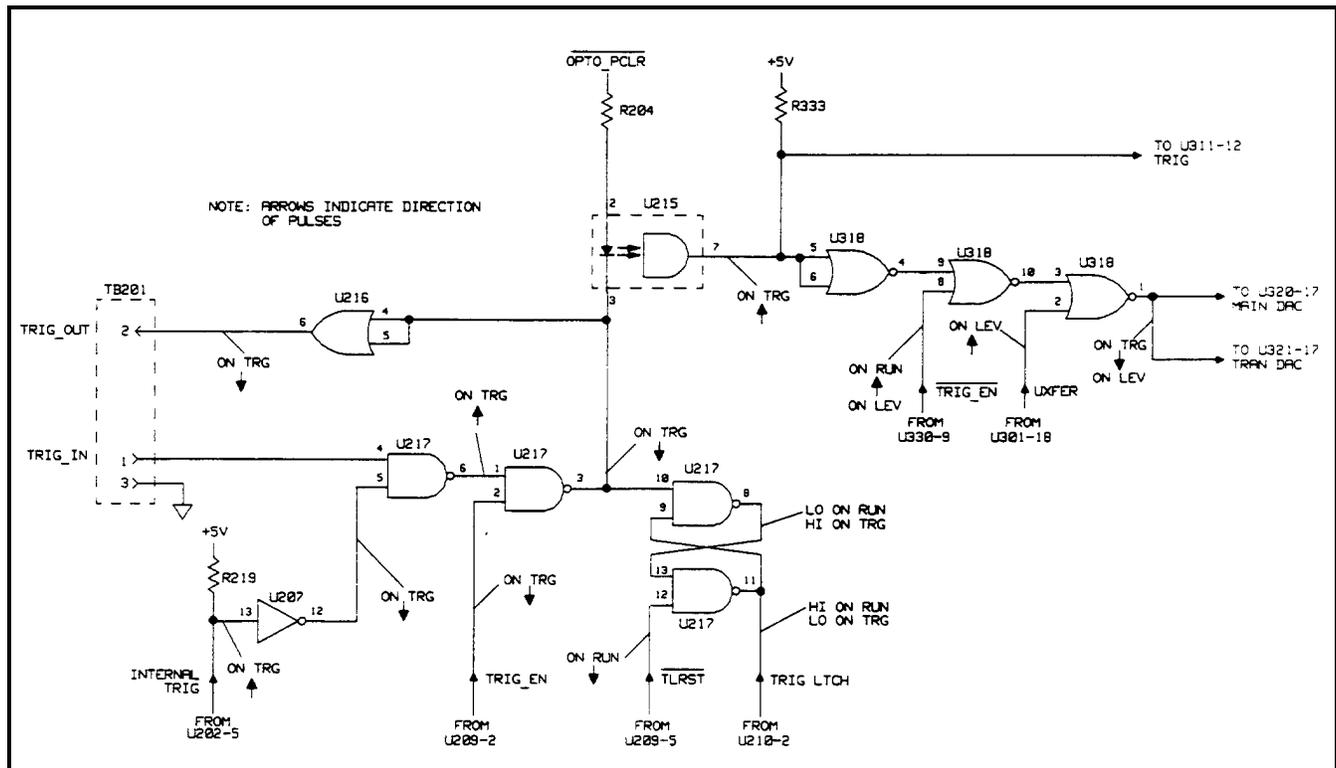


Figure 3-8. Trigger Circuit Troubleshooting

Overcurrent Circuit Troubleshooting (Figure 3-9)

This circuit limits the maximum current the load can sink for different input voltage and/or power conditions. The primary components in this circuit are amplifier U8 and transistors Q11 and Q12.

At power on the secondary power clear ($\overline{\text{SPCLR}}$) signal provides a High level via D9 to drive U8-7 Low turning Q11 on. With Q11 turned on, IPROG goes High (less negative) and turns off the input power FETs (load will not sink current).

When the input voltage is about 6.3V (6060B); 40V (6063B), or lower, diode D6 is forward biased, causing voltage divider R58, R72, R59, and R42 to hold U8-6 at approximately -7V. This clamps the maximum input current capability between 45 and 66 amps (6060B); 10 and 11 amps (6063B)

As the input voltage increases from 6.3 to 65 volts (6060B); 40 to 260 volts (6063B), diode D16 is reversed biased and the input voltage will appear across the voltage divider. This causes the voltage at U8-6 to decrease from -7 volts to -0.8 volts. At an input of 65 volts (6060B); 260 volts (6063B), diode D13 turns on and holds U8-6 at -0.8 volts and limits the maximum input current capability to less than 11 amps (6060B); 2 amps (6063B).

When the input voltage reaches 75 volts (6060B); 287 volts (6063B), the OV circuit goes to -13V and pulls IPROG low (more negative) via diode D17. The input power stages will now attempt to sink more current and decrease the input voltage. If the combination of input voltage and current (power) is greater than the power stages can sink when OV condition occurs, the overpower circuit (see next page) will override the OV circuit and limit the maximum current capability of the load.

The -15VX bias voltage is a delayed bias derived from the normal -15V supply. When the load is first turned on, -15V is not present and U8-6 is at common potential. This causes Q11 to conduct pulling IPROG high. Q12 is also on, connecting Q11 to the +15V bias. When -15VX comes on, Q12 turns off causing U8-6 to go more negative than U8-5. This turns off Q11, allowing IPROG to go negative. VR11 supplies Q11 collector current once -15VX is available.

To troubleshoot the current limit circuit, check test points (27), (33), (39) and (40) using the measurement conditions and readings specified in Table 3-3.

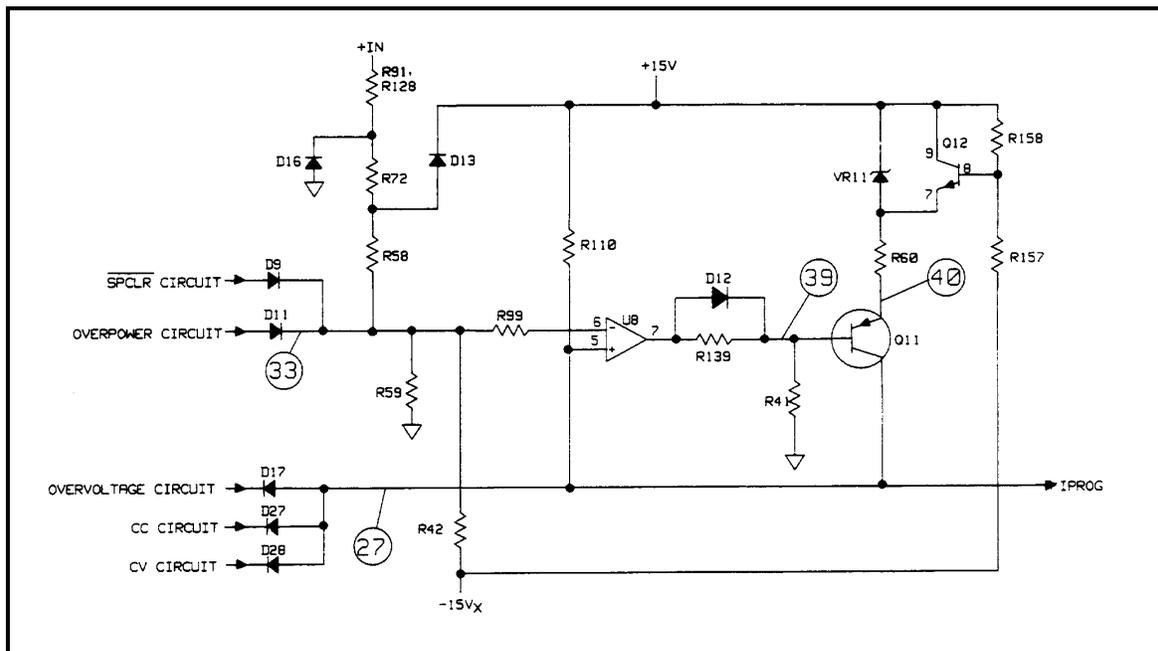


Figure3-9. Overcurrent Circuit Troubleshooting

Overpower Circuit Troubleshooting (Figure 3-10)

This circuit limits the power sinking capability of the load to either one to two minutes or 50 milliseconds, depending on the temperature of the heatsink assembly.

The circuit monitors the input voltage and current to determine if an overpower condition exists. The circuit consists of amplifier U12, the four comparators U7, and summing resistor pack R123. Signal levels representing the input voltage and current are summed with the +12V reference voltage via resistors to determine if an overpower condition exists. The signal levels are scaled to allow different combinations of voltage and current to be compared (e.g. high voltage/low current; high current/low voltage; etc). If the load is operating in overpower and the EPU bit is false, the load may operate in overpower for up to two minutes until the EPU bit goes true. If EPU is true, the load will only operate in the overpower state for 50 milliseconds before going to power shutdown. The EPU bit (bit 9) setting is dependent on the temperature of the heatsink assembly.

To check the status of the EPU bit, send the string "STAT:CHAN:COND?".

When the overpower circuit is active, limiting input power capability, the comparator circuit becomes a relaxation oscillator and its output voltage at test point (34) will go between -14V and 0V (see waveform on Figure 3-10).

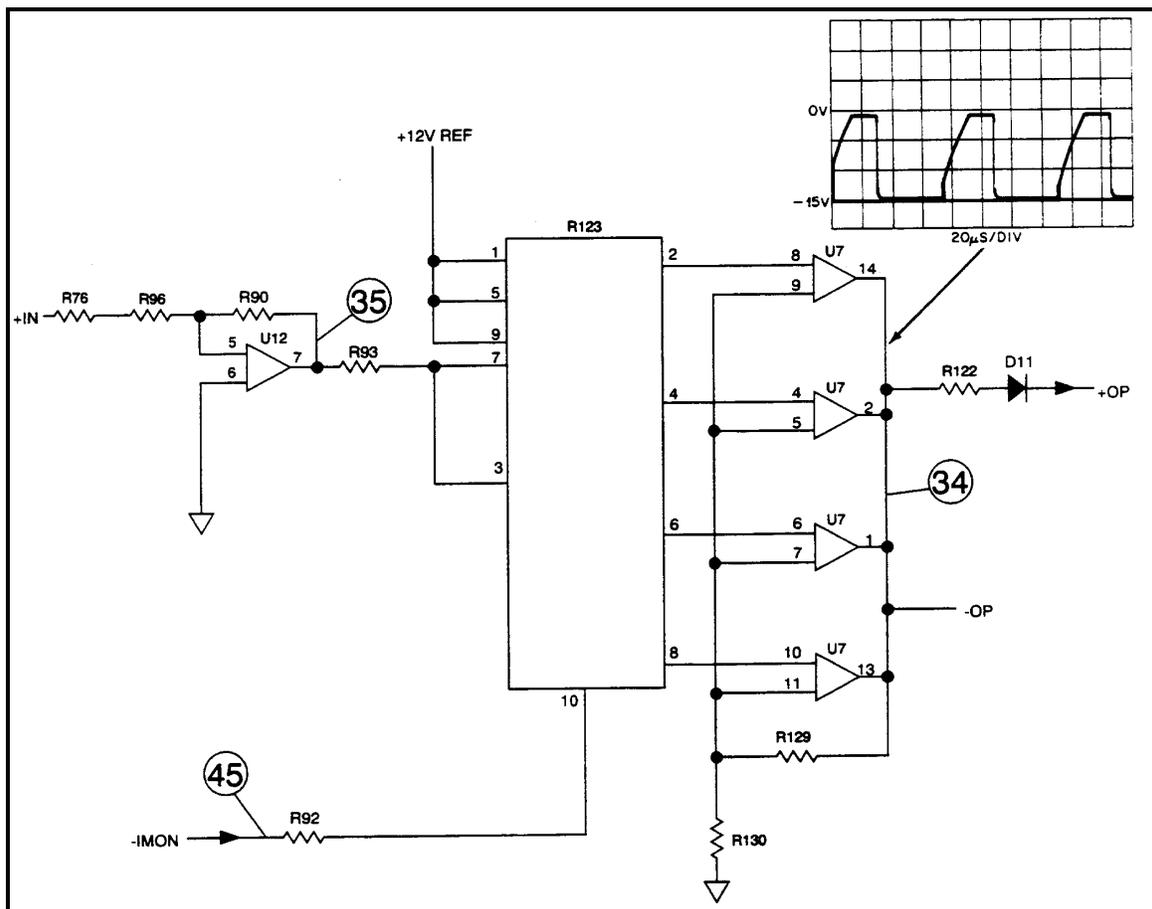


Figure 3-10. Overpower Circuit Troubleshooting

Troubleshooting the power limit circuit consists of checking test points (34), (35), and (45) using the measurement conditions and readings specified in table 3-3. Also check the +12V reference, the U7 comparator, resistor pack R123 and temperature monitor circuit RT551, U327.

Post Repair Calibration

Calibration is required annually and whenever certain components are replaced. If certain control circuit components (U5, U6, U13, U306-308, U320-323, U325, U326, U329, U331) are replaced, the Electronic Load must be recalibrated as described in Chapter 6 of the Operating Manual. If any input power stage component (see Figure 6-1, sheet 6) is replaced, the Current Monitor (IMON) circuit must be recalibrated. The IMON adjustment procedure is as follows:

- a. Turn load off, disconnect any connections to the input terminals, remove top cover.
- b. Connect DMM between the IMON adjustment test points shown on Figure 6-2.
- c. Turn Electronic Load on and adjust R155 (see Figure 6-2) for a reading of 0 ± 0.5 millivolts on the DMM.

If the serial EEPROM chip U211 is replaced, the Electronic Load must be initialized first and then recalibrated.

EEPROM Initialization

Serial EEPROM chip U211 stores the Electronic Load's GP-IB address and model number as well as other constants. These constants are required to program the load correctly and to calibrate the load. The load was initialized (the EEPROM programmed) with the proper constants before the load was shipped from the factory. If the main PC board assembly or the EEPROM chip (U211) is replaced, the load must be reinitialized with the proper constants by programming the following commands in the order indicated. After it has been initialized, the Electronic Load must be recalibrated as described in Chapter 6 of the Operating Manual.

```
6060B
"CAL 1 "           !      turn calibration mode on
"CAL:INIT 60,60"   !      initialize default calibration parameters
"CAL:SAVE"         !      store calibration constants in EEROM
"DIAG:CAL 0,6060"  !      model number
"DIAG:CAL 1,16901" !      model number suffix and GP-IB address 5
"DIAG:CAL 21,0"    !      initial *SRE value
"DIAG:CAL 22,0"    !      initial *ESE value
"DIAG:CAL 23,1"    !      initial *PSE value
"DIAG:CAL 26,1"    !      module width ( 6060 = 1 CHANNEL )
"DIAG:CAL 27,1"    !      module type
"DIAG:CAL 28,17804" !      voltage for soft over power
"DIAG:CAL 29,17804" !      current for soft over power
"*RST"            !      reset factory default state
"CURR:SLEW 1.0E6 " !      turn on slew rate
"*SAV 0"          !      to location 0
"CAL 0"          !      turn calibration mode off
```

```

6063B
"CAL 1"           !      turn calibration mode on
"CAL:INIT 240,60" !      initialize default calibration parameters
"CAL:SAVE"       !      store calibration constants in EEROM
"DIAG:CAL 0,6063" !      model number
"DIAG:CAL 1,16901" !      model number suffix and GP-IB address 5
"DIAG:CAL 21,0"  !      initial *SRE value
"DIAG:CAL 22,0"  !      initial *ESE value
"DIAG:CAL 23,1"  !      initial *PSE value
"DIAG:CAL 26,1"  !      module width ( 6063 = 1 CHANNEL )
"DIAG:CAL 27,1"  !      module type
"DIAG:CAL 28,5000" !      voltage for soft over power
"DIAG:CAL 29,5200" !      current for soft over power
"*RST"          !      reset factory default state
"CURR:SLEW 0.167E6" !      turn on slew rate
"*SAV 0"        !      to location 0
"CAL 0"         !      turn calibration mode off

```

Disassembly Procedures

The following disassembly procedures are listed in alphabetical order. Before proceeding with any disassembly, disconnect the ac power cord, remove the four cover screws, and remove the cover. Then proceed to the applicable disassembly procedure.

Refer to Figure 5-1 for the location of the Electronic Load's mechanical components.

AC Receptacle

1. Record the color code and location of each wire connected to the ac receptacle.
2. Disconnect the push-on connectors from the receptacle terminals.
3. Unsolder the ground wire.
4. Release the locking tabs by pressing them inward against the body of the receptacle and remove the receptacle.

Fan

1. Remove the six screws securing heatsink cover and remove heatsink cover.
2. Disconnect the fan cable from J554.
3. Remove the two screws securing the fan to the main heat sinks and remove the fan.

Front Panel

1. Remove the two front feet.
2. Disconnect the keypad cable from J203, the LCD display cable from J202, and the power cable from J553.

Note: When reconnecting the front panel display and keypad cables, be sure to line up the cable stripes as indicated on the main pc board.

3. Remove the grounding nut behind the front panel.
4. If the Electronic Load has optional front panel binding posts, remove the two screws securing the bus wires to the front panel binding posts.
5. Remove the two small plastic covers on the sides of the front panel.
6. Remove two screws securing front panel to chassis and remove the front panel.

Keypad

1. Remove the front panel.
2. Remove the six nuts securing the keypad to the front panel and remove the keypad pc board.
3. The keypad comes out when the pc board is removed.

CAUTION

The keypad cable connector located on the keypad pc board is fragile. Only remove the cable from the board if replacing the board or cable. When reinstalling the cable, be sure to line up the cable stripe over the hole marked with a square.

LCD Display and Window

1. Remove the front panel.
2. Remove the two nuts securing the LCD display to the front panel and remove the LCD display.
3. The display window comes out when the display is removed.

CAUTION

The display cable connector located on the back of the display is fragile. Only remove the cable from the display if replacing the display or cable. When reinstalling the cable, be sure to line up the cable stripe over the hole marked with a square.

Line Switch

1. For easier access to the switch, remove the front panel.
2. Record the color code and location of each wire connected to the switch.
3. Disconnect the wires from switch terminals.
4. Release the locking tabs by pressing them inward against the body of the switch and remove the switch.

Heat Sinks

Follow the same procedure for each heat sink.

1. Remove the six screws securing the heatsink cover and remove the cover.
2. Remove the fan.
3. Remove the two screws securing the heat sink to the pc board.
4. Remove the three screws securing Q1 or Q2 to the heat sink and remove the heat sink.

Note: When reinstalling the heat sink, remember to install the plastic spacer between the heatsinks.

PC Board

1. Remove the six screws securing the heatsink cover and remove the cover.
2. Disconnect the keypad cable from J203, the display cable from J202, and the power cable from J553.
3. Disconnect push-on connectors from the ac receptacle (record the color code and location of each wire connected to receptacle).
4. Remove the two screws securing the bus bars to the binding posts.
5. Remove the two hex standoffs securing the GP-IB receptacle to the chassis.
6. Remove the two quick-disconnect terminal blocks.
7. Remove the five screws securing the pc board to the bottom of the chassis and remove the pc board.

FETs Q1 and Q2

Power FETs Q1 and Q2 are comprised of subassemblies containing four FETs each. *If any one of the four FETs fail, the entire subassembly must be replaced.*

1. For easier access to the subassemblies, remove the six screws securing the heatsink cover and remove the cover.
2. Cut the leads (three from each FET) close to the FET bodies.
3. Remove the three screws securing the subassembly to the heat sink and remove the subassembly.
4. Unsolder the 12 cut leads from the PC board and clean the corresponding mounting holes.

Note: When replacing the subassembly, be sure to apply heat-conducting grease to the back of the subassembly.

Principles Of Operation

Introduction

Figure 4-1 is a block diagram illustrating the major circuits contained within the Electronic Load. Each block on the diagram identifies the schematic diagram sheet where the circuits are shown in detail. The schematic diagram (Figure 6-1) consists of fold out sheets which are located in Chapter 6 at the end of this manual. The following paragraphs give a general description of these circuits (refer to Figure 4-1).

Bias Supplies

The Electronic Load contains a primary bias supply and a secondary bias supply. The primary supply is referenced to chassis ground and provides dc bias voltages and start-up signals to operate the primary interface. The secondary supply is referenced to load common and provides dc voltages to operate the secondary interface, DAC circuits, and the input power stages. A fan power speed control circuit, also referenced to load common, receives control signals from the secondary interface which vary the speed of the fan depending upon temperature conditions.

Primary Interface

This block of circuitry provides the interface between the user and the Electronic Load. It allows the user to control the load from a GP-IB controller or from the load's front panel. The primary interface interprets commands from the GP-IB or from the front panel keypad to control the load's input current. The primary interface also processes measurement and status data received from the input power circuits via the secondary interface circuits. This data may be read back to the controller over the GP-IB and/or displayed on the load's front panel.

The primary interface contains an EEPROM (electrically erasable programmable memory) which stores the load's GP-IB address and model number as well as constants used in calibrating the load. the EEPROM is non-volatile allowing it to retain stored information after power is cycled off and on. The load is calibrated over the GP-IB using the calibration commands (see Chapter 6 in the Operating Manual).

Certain load operations can be initiated by an external trigger (TRIG IN signal) or an internal trigger (GP-IB trigger command). The primary interface sends the trigger to the secondary interface to initiate the applicable operations. The trigger (external or internal) is also routed out (TRIG OUT signal) of the primary interface so it can be used to trigger an external scope or DVM.

Front Panel

Most of the remote operations that can be performed via the GP-IB can also be performed from the load's front panel. The front panel contains an ac line ON/OFF switch, an LCD display, and a keypad. The LCD display consists of an alphanumeric display and status annunciators. The LCD normally displays the load's actual input voltage and input current or the computed power value. When programming from the front panel keypad, the function being programmed and the present value will be displayed. The annunciators give GP-IB and Electronic Load status information. The keypad allows control of the load's system functions as well as control the load's input. Note that the load's GP-IB address must be set via the front panel; it cannot be set via the GP-IB. Detailed instructions on using the front panel are given in the Operating Manual.

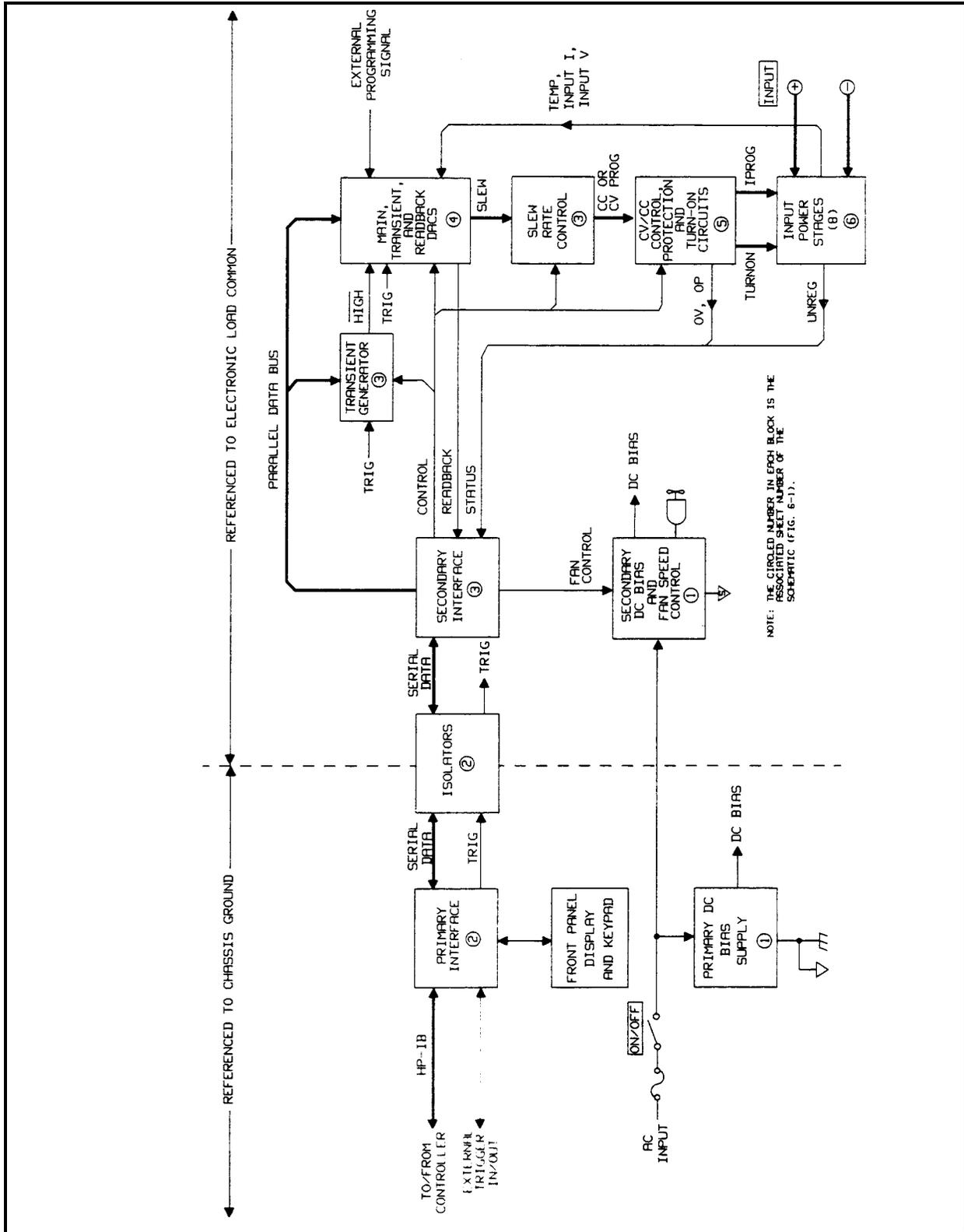


Figure 4-1. Agilent 6060A Electronic Load, Block Diagram

Isolators

Data is transferred serially between the primary interface and the secondary interface via optical isolators. As described above, the primary interface circuits are referenced to chassis ground while the secondary interface and input power circuits are reference to load common. Neither of the load's input terminals (+ or -) can exceed $\pm 240\text{Vdc}$ from ground.

The trigger signal is also transferred from the primary interface via an optical isolator. The trigger signal can be used to control data transfers into the DAC circuits and can also be used in transient operation.

Secondary Interface

The secondary interface circuit translates the serial data received from the primary interface into a parallel data bus and other control signals. The data bus and control signals are sent to the power control circuits to control the input power stages in accordance with the programmed parameters. Status and measurement information is also read back to the GP-IB controller and/or the front panel display via the secondary and primary interfaces.

DACs and Slew Rate Control

Programmable main and transient DAC circuits convert the programmed data into an analog signal (PROG) that controls the conduction of the input power stages. Depending upon the mode of operation, the main DAC circuit converts the programmed value of current, resistance, or voltage into an analog signal to control the input power stages. The conversion can be initiated by a GP-IB command or by a trigger (GP-IB or external).

The transient DAC circuit and a programmable generator allow transient operation in the selected mode. Transient operation causes the input power stages to switch between two load levels. Transient operation can be programmed at a continuous rate or can be triggered (programmed trigger or an external trigger signal) to produce a transient pulse or to switch between two load levels. Programmable slew rate control circuits allow a controlled transition from one load setting to another.

An external programming signal can also be used to control conduction of the input power stages in the CC or CV mode. A 0 to 10V external programming signal corresponds to the 0 to full scale input rang in the CC or CV mode. The external signal is combined with the programmed values from the main and transient DAC circuits.

A readback DAC circuit returns the input current, input voltage, and heatsink temperature values to the secondary microprocessor. The DAC circuit along with a comparator circuit are controlled by the secondary microprocessor to successively approximate the value of the monitored signal to 12-bit resolution. The readback DAC and comparator circuit also return a test signal to the microprocessor during self test to determine if the DAC circuits are operating properly.

CC/CV Control

Depending upon which operating mode (and range in the CR mode) is selected, either the CC or the CV loop controls the conduction of the input power stages. If the CC or CR (middle or high resistance ranges only) mode is selected, the CC loop controls the conduction of the input power stages according to the selected mode and the programmed value of current or resistance. A range control signal is sent to the CC control circuit to provide the proper scaling for the low and high current ranges or the middle and high resistance ranges.

If the CV or CR (low resistance range) mode is selected, the CV loop controls the conduction of the input power stages according to the selected mode and the programmed value of voltage or resistance.

Protection Circuits

The load includes overvoltage (OV), overpower (OP), overcurrent (OC) and overtemperature (OT) protection.

The OV circuit takes control of the input power stages when an overload condition occurs. If the input voltage exceeds 75V, the overload circuit will cause the input stages to increase current flow in order to limit the input voltage. The OV circuit does not turn off the input power stages. An OV signal is sent back to the microprocessor to indicate the status of the circuit. The OV circuit is reset by the microprocessor when a Reset or a Protection Clear command is executed or when power is cycled.

The OP circuit limits the current drawn by the input power stages when an overpower condition occurs. Once the power has been returned to a safe operating area, the circuit allows the current to rise again. An OP signal is sent back to the microprocessor to indicate the status of the circuit. A thermistor, located near the input power heat sinks, provides the temperature signal (OT) to the microprocessor via the readback DAC as previously described.

The OC circuit limits the load's input current to a value within its rating. The circuit is set at a value slightly above the current rating of the supply. The circuit is also activated to limit input current when an overpower condition occurs and at power turn on. In addition, the load allows the user to define a current protection limit in software (see Operating Manual).

Turn-On/Clear Circuit

This circuit ensures that the input stages are held off (non-conducting) when power is initially turned on. After the load's circuits have stabilized, the input power stages are turned on. This circuit also generates the signal to clear the OV circuit as described above.

Input Power Stages

There are eight input power stages connected in parallel. Each stage consists mainly of a power FET, an error amplifier, and an input current monitor amplifier. Each FET is connected across the load's + and - INPUT terminals along with a 15A fuse and current monitoring resistor. Depending upon the value of the IPROG signal from the CC/CV control circuits and the value of the input current, the error amplifier in each stage produces an error signal which will cause each FET to increase or decrease current flow.

The eight input power FET stages are controlled in accordance with the selected mode of operation. In the CC mode, the input power stages will sink a current in accordance with the programmed value of current regardless of the input voltage. In the CR mode, the input power stages will sink a current linearly proportional to the input voltage in accordance with the programmed resistance value. In the CV mode, the input stages will attempt to sink enough current to control the source voltage to the programmed voltage level.

The UNREG signal, which is sent back to the secondary processor, indicates if the power input stages are unregulated. The TURN ON signal is held off (low) at power on to prevent the input stages from conducting as previously described.

Replaceable Parts

Introduction

Tables 5-3 lists the electrical components and Table 5-4 lists the mechanical components for the Agilent 6060B and 6063B Electronic Loads. These tables provide the following information:

- Reference designation (see Table 5-1)
- Agilent part number
- Description of part (see Table 5-2)

Refer to Figures 5-1 and 6-2 for component locations.

Table 5-1. Reference Designators

| | | | |
|----|------------------|-----|--------------------------|
| A | Assembly | RTB | Removable Terminal Block |
| B | Blower | RTP | Removable Jumper |
| C | Capacitor | S | Switch |
| D | Diode | T | Transformer |
| F | Fuse | TB | Terminal Block |
| J | Terminal Jack | TBP | Terminal Binding Post |
| MP | Mechanical Part | TP | Test Pin |
| P | Terminal Plug | U | Integrated Circuit |
| Q | Transistor | VR | Voltage Regulator |
| RT | Thermal Resistor | W | Cable Assembly |
| | | Y | Oscillator |

Table 5-2. Part Description Abbreviations

| | | | |
|----------|--------------------------|------|-------------------------|
| AL | Aluminum | PE | Polyester |
| CC | Carbon Composition | PD | Power Dissipation |
| CER | Ceramic | PP | Polypropylene |
| DIP | Dual In-Line Package | PWR | Power |
| DPDT | Double Pole Double Throw | RECT | Rectifier |
| FXD | Fixed | SIP | Single In-Line Package |
| GEN-PURP | General Purpose | TA | Tantalum |
| IC | Integrated Circuit | TC | Temperature Coefficient |
| MACH | Machine | TF | Thin Film |
| MO | Metal Oxide | W/ | With |

How To Order Parts

You can order parts from your local Agilent Technologies sales office (refer to the list at the end of this manual for the office nearest you). when ordering parts, include the following information:

- Agilent part number
- Description of the part
- Quantity desired
- Electronic Load model number (Agilent 6060B)

Table 5-3. Agilent 6060B/6063B Parts List - Electrical

| Reference Designation | Models | Agilent Part Number | Description |
|-----------------------|--------|---------------------|---------------------------------|
| A1 | 6060B | 06060-60024 | MAIN BOARD |
| A1 | 6063B | 06063-60024 | MAIN BOARD |
| C1-8 | BOTH | 0160-4820 | CAP-FXD 1800pF $\pm 5\%$ 100V |
| C9 | BOTH | 0160-5098 | CAP-FXD 0.22uF $\pm 10\%$ 50V |
| C10 | 6060B | 0160-4833 | CAP-FXD 0.022uF $\pm 10\%$ 100V |
| C10 | 6063B | 0160-2569 | CAP-FXD 0.02uF $\pm 20\%$ 2 kV |
| C11-22 | BOTH | 0160-5422 | CAP-FXD 0.047uF $\pm 20\%$ 50V |
| C23 | 6060B | 0160-4834 | CAP-FXD 0.047uF $\pm 10\%$ 100V |
| C23 | 6063B | 0160-5422 | CAP-FXD 0.047uF $\pm 20\%$ 50V |
| C24 | 6060B | 0160-4834 | CAP-FXD 0.047uF $\pm 10\%$ 1WV |
| C24 | 6063B | 0150-0052 | CAP-FXD 0.05uF $\pm 20\%$ 400V |
| C25 | 6060B | 0160-7024 | CAP-FXD 2.0uF $\pm 10\%$ 100V |
| C25 | 6063B | 0160-7369 | CAP-FXD 1uF $\pm 10\%$ 400V |
| C26 | BOTH | 0160-4831 | CAP-FXD 4700pF $\pm 10\%$ 100V |
| C27 | BOTH | 0160-4835 | CAP-FXD 0.1uF $\pm 10\%$ 50V |
| C28 | BOTH | 0160-4830 | CAP-FXD 2200pF $\pm 10\%$ 100V |
| C29-32 | BOTH | 0160-5422 | CAP-FXD 0.047uF $\pm 20\%$ 50V |
| C33 | BOTH | 0160-4800 | CAP-FXD 120pF $\pm 5\%$ 100V |
| C34 | BOTH | 0160-4048 | CAP-FXD 0.022uF $\pm 20\%$ 0V |
| C35 | BOTH | 0160-5422 | CAP-FXD 0.047uF $\pm 20\%$ 50V |
| C36 | BOTH | 0160 5469 | CAP-FXD 1uF $\pm 10\%$ 50V |
| C37 | BOTH | 0160-4048 | CAP-FXD 0.022uF $\pm 20\%$ 0V |
| C38-44 | BOTH | 0160-5422 | CAP-FXD 0.047uF $\pm 20\%$ 50V |
| C45 | BOTH | 0160-4801 | CAP-FXD 100pF $\pm 5\%$ 100V |
| C46 | BOTH | 0160-4831 | CAP-FXD 4700pF $\pm 10\%$ 100V |
| C47,48 | BOTH | 0160-5422 | CAP-FXD 0.047uF $\pm 20\%$ 50V |
| C49-56 | BOTH | 0160-4810 | CAP-FXD 330pF $\pm 5\%$ 100V |
| C57 | BOTH | 0160-4835 | CAP-FXD 0.1uF $\pm 10\%$ 50V |
| C58 | BOTH | 0160-4833 | CAP-FXD 0.022uF $\pm 10\%$ 100V |
| C59 | BOTH | 0160-4831 | CAP-FXD 4700pF $\pm 10\%$ 100V |
| C60 | BOTH | 0160-5422 | CAP-FXD 0.047uF $\pm 20\%$ 50V |
| C61 | BOTH | 0160-4832 | CAP-FXD 0.01uF $\pm 10\%$ 100V |
| C65 | BOTH | 0160-4833 | CAP-FXD 0.022uF $\pm 10\%$ 100V |
| C66 | 6060B | 0160-4833 | CAP-FXD 0.022uF $\pm 10\%$ 100V |
| C66 | 6063B | 0160-5166 | CAP-FXD 0.015uF $\pm 20\%$ 100V |
| C67 | BOTH | 0160-4833 | CAP-FXD 0.022uF $\pm 10\%$ 100V |
| C68 | 6060B | 0160-4835 | CAP-FXD 0.1uF $\pm 10\%$ 50V |
| C69 | BOTH | 0160-4832 | CAP-FXD 0.01uF $\pm 10\%$ 100V |
| C70 | BOTH | 0160-5349 | CAP-FXD 200pF $\pm 5\%$ 100V |
| C71 | 6060B | 0160-4805 | CAP-FXD 47pF $\pm 5\%$ 100V |
| C71 | 6063B | 0160-4807 | CAP-FXD 33pF $\pm 5\%$ 100V |
| C72 | 6060B | 0160-4787 | CAP-FXD 22pF $\pm 5\%$ 100V |
| C72 | 6063B | 0160-4807 | CAP-FXD 33pF $\pm 5\%$ 100V |
| C73 | 6060B | 0160-4787 | CAP-FXD 22pF $\pm 5\%$ 100V |
| C73 | 6063B | 0160-4807 | CAP-FXD 33pF $\pm 5\%$ 100V |
| C74 | 6060B | 0160-4787 | CAP-FXD 22pF $\pm 5\%$ 100V |
| C74 | 6063B | 0160-4807 | CAP-FXD 33pF $\pm 5\%$ 100V |

Table 5-3. Agilent 6060B/6063B Parts List - Electrical (continued)

| Reference Designation | Models | Agilent Part Number | Description |
|-----------------------|--------|---------------------|---------------------------------------|
| C75 | 6060B | 0160-4787 | CAP-FXD 22pF $\pm 5\%$ 100V |
| C75 | 6063B | 0160-4807 | CAP-FXD 33pF $\pm 5\%$ 100V |
| C76 | 6060B | 0160-4787 | CAP-FXD 22pF $\pm 5\%$ 100V |
| C76 | 6063B | 0160-4807 | CAP-FXD 33pF $\pm 5\%$ 100V |
| C77 | 6060B | 0160-4787 | CAP-FXD 22pF $\pm 5\%$ 100V |
| C77 | 6063B | 0160-4807 | CAP-FXD 33pF $\pm 5\%$ 100V |
| C78 | 6060B | 0160-4787 | CAP-FXD 22pF $\pm 5\%$ 100V |
| C78 | 6063B | 0160-4807 | CAP-FXD 33pF $\pm 5\%$ 100V |
| C79 | BOTH | 0160-4821 | CAP-FXD 1200pF $\pm 5\%$ 100V |
| C201 | BOTH | 0160-5422 | CAP-FXD 0.047 μ F $\pm 20\%$ 50V |
| C202 | BOTH | 0160-4808 | CAP-FXD 470pF $\pm 5\%$ 100V |
| C203 | BOTH | 0160-4800 | CAP-FXD 120pF $\pm 5\%$ 100V |
| C204 | BOTH | 0160-5422 | CAP-FXD 0.047 μ F $\pm 20\%$ 50V |
| C205,206 | BOTH | 0160-4807 | CAP-FXD 33pF $\pm 5\%$ 100V |
| C207-211 | BOTH | 0160-5422 | CAP-FXD 0.047 μ F $\pm 20\%$ 50V |
| C212 | BOTH | 0160-4800 | CAP-FXD 120pF $\pm 5\%$ 100V |
| C213 | BOTH | 0160-5422 | CAP-FXD 0.047 μ F $\pm 20\%$ 50V |
| C214 | BOTH | 0180-0405 | CAP-FXD 1.8 μ F $\pm 10\%$ 20V |
| C215,216 | BOTH | 0160-5422 | CAP-FXD 0.047 μ F $\pm 20\%$ 50V |
| C217,218 | BOTH | 0160-4832 | CAP-FXD 0.01 μ F $\pm 10\%$ 100V |
| C301 | BOTH | 0180-0405 | CAP-FXD 1.8 μ F $\pm 10\%$ 20V |
| C302 | BOTH | 0160-5422 | CAP-FXD 0.047 μ F $\pm 20\%$ 50V |
| C303,304 | BOTH | 0160-4807 | CAP-FXD 33pF $\pm 5\%$ 100V |
| C305 | BOTH | 0160-5422 | CAP-FXD 0.047 μ F $\pm 20\%$ 50V |
| C306 | BOTH | 0160-4835 | CAP-FXD 0.1 μ F $\pm 10\%$ 50V |
| C307 | BOTH | 0160-6579 | CAP-FXD 2200pF $\pm 2.5\%$ 100V |
| C310 | BOTH | 0160-4835 | CAP-FXD 0.1 μ F $\pm 10\%$ 50V |
| C312 | BOTH | 0160-5349 | CAP-FXD 200pF $\pm 5\%$ 100V |
| C314-317 | BOTH | 0160-5422 | CAP-FXD 0.047 μ F $\pm 20\%$ 50V |
| C320-322 | BOTH | 0160-4835 | CAP-FXD 0.1 μ F $\pm 10\%$ 50V |
| C323,324 | BOTH | 0160-5422 | CAP-FXD 0.047 μ F $\pm 20\%$ 50V |
| C325 | BOTH | 0160-4835 | CAP-FXD 0.1 μ F $\pm 10\%$ 50V |
| C326-329 | BOTH | 0160-5422 | CAP-FXD 0.047 μ F $\pm 20\%$ 50V |
| C330 | BOTH | 0160-4787 | CAP-FXD 22pF $\pm 5\%$ 100V |
| C331-337 | BOTH | 0160-5422 | CAP-FXD 0.047 μ F $\pm 20\%$ 50V |
| C339 | BOTH | 0160-4787 | CAP-FXD 22pF $\pm 5\%$ 100V |
| C340-342 | BOTH | 0160-5422 | CAP-FXD 0.047 μ F $\pm 20\%$ 50V |
| C344,345 | BOTH | 0160-5422 | CAP-FXD 0.047 μ F $\pm 20\%$ 50V |
| C348 | BOTH | 0160-4787 | CAP-FXD 22pF $\pm 5\%$ 100V |
| C349 | BOTH | 0160-5422 | CAP-FXD 0.047 μ F $\pm 20\%$ 50V |
| C350 | BOTH | 0160-4822 | CAP-FXD 1000pF $\pm 5\%$ 100V |
| C352 | BOTH | 0160-4820 | CAP-FXD 1800pF $\pm 5\%$ 100V |
| C353,354 | BOTH | 0160-5422 | CAP-FXD 0.047 μ F $\pm 20\%$ 50V |
| C355 | 6060B | 0160-4833 | CAP-FXD 0.022 μ F $\pm 10\%$ 100V |
| C355 | 6063B | 0160-4831 | CAP-FXD 4700pF $\pm 10\%$ 100V |
| C356 | BOTH | 0160-4791 | CAP-FXD 10pF $\pm 5\%$ 100V |

Table 5-3. Agilent 6060B/6063B Parts List - Electrical (continued)

| Reference Designation | Models | Agilent Part Number | Description |
|-----------------------|--------|---------------------|---|
| C357 | BOTH | 0160-4820 | CAP-FXD 1800pF $\pm 5\%$ 100V |
| C358 | BOTH | 0160-4829 | CAP-FXD 680pF $\pm 10\%$ 100V |
| C370 | BOTH | 0160-4832 | CAP-FXD 0.01 μ F $\pm 10\%$ 100V |
| C501 | BOTH | 0180-2980 | CAP-FXD 1000 μ F $\pm 20\%$ 35V |
| C502 | BOTH | 0180-0376 | CAP-FXD 0.47 μ F $\pm 10\%$ 35V |
| C503 | BOTH | 0160-4835 | CAP-FXD 0.1 μ F $\pm 10\%$ 50V |
| C504 | BOTH | 0160-4787 | CAP-FXD 22pF $\pm 5\%$ 100V |
| C506,507 | BOTH | 0160-4835 | CAP-FXD 0.1 μ F $\pm 10\%$ 50V |
| C551,552 | BOTH | 0160-4281 | CAP-FXD 2200pF $\pm 20\%$ 250V |
| C553 | BOTH | 0160-4259 | CAP-FXD 0.22 μ F $\pm 10\%$ 0V |
| C554 | BOTH | 0180-3458 | CAP-FXD 4700 μ F +30% -10% 50V |
| C555 | BOTH | 0180-3298 | CAP-FXD 2200 μ F +30% -10% 50V |
| C556 | BOTH | 0180-4136 | CAP-FXD 10 μ F $\pm 10\%$ 20V |
| CS57,558 | BOTH | 0180-3804 | CAP-FXD 47 μ F $\pm 20\%$ 35V |
| C559 | BOTH | 0160-4787 | CAP-FXD 22pF $\pm 5\%$ 100V |
| C560 | BOTH | 0180-4131 | CAP-FXD 4.7 μ F $\pm 10\%$ 35V |
| C561 | BOTH | 0180-0376 | CAP-FXD 0.47 μ F $\pm 10\%$ 35V |
| C562 | BOTH | 0160-4835 | CAP-FXD 0.1 μ F $\pm 10\%$ 50V |
| C601 | BOTH | 0160-5422 | CAP-FXD 0.047 μ F $\pm 20\%$ 50V |
| D9-13 | BOTH | 1901-0033 | DIODE-GEN PRP 180V 200MA DO-35 |
| D14 | BOTH | 1901-0731 | DIODE-PWR RECT 400V 1A |
| D16-28 | BOTH | 1901-0033 | DIODE-GEN PRP 180V 200MA |
| D29-32 | BOTH | 1901-0880 | DIODE-GEN PRP 200MA |
| D35 | BOTH | 1901-0880 | DIODE-GEN PRP 200MA |
| D36 | BOTH | 1901-0033 | DIODE-GEN PRP 180V 200MA |
| D202 | BOTH | 1901-0033 | DIODE-GEN PRP 180V 200MA |
| D204 | BOTH | 1901-0033 | DIODE-GEN PRP 180V 200MA |
| D300 | BOTH | 1901-0880 | DIODE-GEN PRP 200MA |
| D303 | BOTH | 1901-0033 | DIODE-GEN PRP 180V 200MA |
| D304 | BOTH | 1901-0033 | DIODE-GEN PRP 180V 200MA |
| D306 | BOTH | 1901-0033 | DIODE-GEN PRP 180V 200MA |
| D308 | BOTH | 1901-0033 | DIODE-GEN PRP 180V 200MA |
| D310-313 | BOTH | 1901-0033 | DIODE-GEN PRP 180V 200MA |
| D501-504 | BOTH | 1901-0731 | DIODE-PWR RECT 400V 1A |
| D505 | BOTH | 1901-0033 | DIODE-GEN PRP 180V 200MA |
| D551-555 | BOTH | 1901-0731 | DIODE-PWR RECT 400V 1A |
| D556 | BOTH | 1901-0033 | DIODE-GEN PRP 180V 200MA DO-35 |
| FI-8 | BOTH | 2110-0757 | FUSE-SUBMINIATURE .063A 125V |
| F9-16 | 6060B | 2110-0697 | FUSE-SUBMINIATURE 15A 32 V |
| F9-16 | 6063B | 2110-0685 | FUSE-SUBMINIATURE 7A 125V |
| J201 | BOTH | 1252-0268 | CONN-RECT MICRORBN 24-CKT 24-CONT |
| J202,203 | BOTH | 1251-4927 | CONN-POST TYPE .100-PIN-SPCG 16-CONT |
| J553 | BOTH | 1252-0056 | CONN-POST TYPE .156-PIN-SPCG 4-CONT |
| J554 | BOTH | 1252-0063 | CONN-POST TYPE .100-PIN-SPCG 3-CONT |
| LI-32 | 6063B | 9170-1499 | CORE-TOROID 5NH/TT (2 ea. 9170-1499 mounted on each end of R1-R8 sense resistors) |

Table 5-3. Agilent 6060B/6063B Parts List - Electrical (continued)

| Reference Designation | Models | Agilent Part Number | Description |
|-----------------------|--------|---------------------|---------------------------------------|
| Q1,2 | 6060B | 1858-0137 | TRANSISTOR - FET ASSEMBLY |
| Q1,2 | 6063B | 1855-0819 | TRANSISTOR - FET ASSEMBLY |
| Q9 | BOTH | 1855-0386 | TRANSISTOR J-FET 2N4392 N-CHAN D-MODE |
| Q10 | BOTH | 1854-0635 | TRANSISTOR NPN SI |
| Q11 | BOTH | 1853-0281 | TRANSISTOR PNP 2N2907A |
| Q12 | BOTH | 1858-0054 | TRANSISTOR ARRAY |
| Q501 | BOTH | 1858-0054 | TRANSISTOR ARRAY |
| Q551 | BOTH | 1858-0054 | TRANSISTOR ARRAY |
| R1-8 | 6060B | 06060-80014 | RESISTOR 0.050 \pm 2% 6W |
| R1-8 | 6063B | 0811-3845 | RESISTOR 0.3 \pm 1% 3W |
| Rg-16 | BOTH | 0698-3430 | RESISTOR 21.5 \pm 1% .125W |
| R17-24 | BOTH | 0757-0441 | RESISTOR 8.25K \pm 1% .125W |
| R25-32 | BOTH | 0757-0458 | RESISTOR 51.1K \pm 1% .125W |
| R33-40 | BOTH | 0757-0442 | RESISTOR 10K \pm 1% .125W |
| R41 | BOTH | 0757-0278 | RESISTOR 1.78K \pm 1% .125W |
| R42 | 6060B | 0698-5089 | RESISTOR 33K \pm 1% .125W |
| R42 | 6063B | 0698-3160 | RESISTOR 31.6K \pm 1% .125W |
| R43 | BOTH | 1810-0316 | NETWORK-RES 16-DIP 10.0K OHM X 8 |
| R44 | BOTH | 0698-0084 | RESISTOR 2.15K \pm 1% .125W |
| R45 | BOTH | 0757-0439 | RESISTOR 6.81K \pm 1% .125W |
| R46 | BOTH | 0757-0438 | RESISTOR 5.11K \pm 1% .125W |
| R47 | BOTH | 8159-0005 | RESISTOR 0 CWM |
| R48 | BOTH | 0698-4479 | RESISTOR 14K \pm 1% .125W |
| R49 | BOTH | 0698-0084 | RESISTOR 2.15K \pm 1% .125W |
| R50 | BOTH | 0757-0458 | RESISTOR 51.1K \pm 1% .125W |
| R53 | 6060B | 8159-0005 | RESISTOR 0 CWM |
| R53 | 6063B | 0698-6620 | RESISTOR 150K \pm 0.1% .125W |
| R54 | 6060B | 0698-6629 | RESISTOR 60K \pm 0.1% .125W |
| R54 | 6063B | 0698-6332 | RESISTOR 300K \pm 0.1% .125W |
| R55 | 6060B | 0698-6360 | RESISTOR 10K \pm 0.1% .125W |
| R55 | 6063B | 0698-6533 | RESISTOR 12.5K \pm 0.1% .125W |
| R56 | 6060B | 0698-6360 | RESISTOR 10K \pm 0.1% .125W |
| R56 | 6063B | 0698-6533 | RESISTOR 12.5K \pm 0.1% .125W |
| R57 | BOTH | 0757-0278 | RESISTOR 1.78K \pm 1% .125W |
| R58 | 6060B | 0698-3450 | RESISTOR 42.2K \pm 1% .125W |
| R58 | 6063B | 0698-4496 | RESISTOR 45.3K \pm 1% .125W |
| R59 | 6060B | 0757-0457 | RESISTOR 47.5K \pm 1% .125W |
| R59 | 6063B | 0698-4496 | RESISTOR 45.3K \pm 1% .125W |
| R60 | BOTH | 0698-4457 | RESISTOR 576 \pm 1% .125W |
| R63 | BOTH | 0757-0458 | RESISTOR 51.1K \pm 1% .125W |
| R64 | BOTH | 0757-0455 | RESISTOR 36.5K \pm 1% .125W |
| R65 | BOTH | 0757-0438 | RESISTOR 5.11K \pm 1% .125W |
| R66 | BOTH | 0698-0084 | RESISTOR 2.15K \pm 1% .125W |
| R67 | BOTH | 0757-0427 | RESISTOR 1.5K \pm 1% .125W |
| R68 | BOTH | 0698-6630 | RESISTOR 20K \pm 0.1% .125W |
| R69 | BOTH | 0699-0620 | RESISTOR 2.222K \pm 0.1% .1W |
| R70 | BOTH | 0757-0438 | RESISTOR 5.11K \pm 1% .125W |

Table 5-3. Agilent 6060B/6063B Parts List - Electrical (continued)

| Reference Designation | Models | Agilent Part Number | Description |
|-----------------------|--------|---------------------|---------------------------------|
| R71 | BOTH | 0699-0486 | RESISTOR 2K \pm 0.1% .1W |
| R72 | 6060B | 0698-3450 | RESISTOR 42.2K \pm 1% .125W |
| R72 | 6063B | 0757-0458 | RESISTOR 51.1K \pm 1% .125W |
| R73 | 6060B | 0698-6629 | RESISTOR 60K \pm 0.1% .125W |
| R73 | 6063B | 0698-6620 | RESISTOR 150K \pm 0.1% .125W |
| R74 | BOTH | 0757-0442 | RESISTOR 10K \pm 1% .125W |
| R76 | 6060B | 0698-6629 | RESISTOR 60K \pm 0.1% .125W |
| R76 | 6063B | 0698-6620 | RESISTOR 150K \pm 0.1% .125W |
| R77,78 | BOTH | 0757-0463 | RESISTOR 82.5K \pm 1% .125W |
| R79 | BOTH | 0757-0442 | RESISTOR 10K \pm 1% .125W |
| R83 | BOTH | 0757-0444 | RESISTOR 12.1K \pm 1% .125W |
| R84 | BOTH | 0757-0442 | RESISTOR 10K \pm 1% .125W |
| R85 | BOTH | 0698-3226 | RESISTOR 6.49K \pm 1% .125W |
| R86 | 6060B | 0757-0463 | RESISTOR 82.2K \pm 1% .125W |
| R86 | 6063B | 0757-0442 | RESISTOR 10K \pm 1% .125W |
| R87 | BOTH | 0757-0458 | RESISTOR 51.1K \pm 1% .125W |
| R88 | 6060B | 0811-3574 | RESISTOR 3.9 \pm 1% 5W |
| R88 | 6063B | 0811-1760 | RESISTOR 4.3 \pm 5% 2W |
| R89 | BOTH | 0757-0427 | RESISTOR 1.5K \pm 1% .125W |
| R90 | 6060B | 0698-6360 | RESISTOR 10K \pm 0.1% .125W |
| R90 | 6063B | 0698-6533 | RESISTOR 12.5K \pm 0.1% .125W |
| R91 | 6060B | 0757-0462 | RESISTOR 75K \pm 1% .125W |
| R91 | 6063B | 0757-0270 | RESISTOR 249K \pm 1% .125W |
| R92 | 6060B | 0698-0083 | RESISTOR 1.96K \pm 1% .125W |
| R92 | 6063B | 0698-3153 | RESISTOR 3.83K \pm 1% .125W |
| R93 | 6060B | 0698-0083 | RESISTOR 1.96K \pm 1% .125W |
| R93 | 6063B | 0698-3153 | RESISTOR 3.83K \pm 1% .125W |
| R94 | BOTH | 0757-0449 | RESISTOR 20K \pm 1% .125W |
| R95 | BOTH | 0757-0280 | RESISTOR 1K \pm 1% .125W |
| R96 | 6060B | 8159-0005 | RESISTOR 0 CWM |
| R96 | 6063B | 0698-6620 | RESISTOR 150K \pm 0.1% .125W |
| R98 | BOTH | 0698-3160 | RESISTOR 31.6K \pm 1% .125W |
| R99 | BOTH | 0757-0280 | RESISTOR 1K \pm 1% .125W |
| R100 | 6060B | 0811-3574 | RESISTOR 3.9 \pm 1% 5W |
| R100 | 6063B | 0811-1760 | RESISTOR 4.3 \pm 5% 2W |
| R101-104 | BOTH | 1810-1261 | NETWORK-RES 16-DIP |
| R105 | 6060B | 0698-6360 | RESISTOR 10K \pm 0.1% .125W |
| R105 | 6063B | 0698-6320 | RESISTOR 5K \pm 0.1% .125W |
| R106 | BOTH | 0698-3572 | RESISTOR 60.4K \pm 1% .125W |
| R107 | 6060B | 0698-3359 | RESISTOR 12.7K \pm 1% .125W |
| R107 | 6063B | 0757-0438 | RESISTOR 5.11K \pm 1% .125W |
| R108 | BOTH | 0757-0438 | RESISTOR 5.11K \pm 1% .125W |
| R109 | BOTH | 0757-0449 | RESISTOR 20K \pm 1% .125W |
| R110 | BOTH | 0698-3160 | RESISTOR 31.6K \pm 1% .125W |
| R112 | BOTH | 0698-3156 | RESISTOR 14.7K \pm 1% .125W |
| R113 | BOTH | 0757-0442 | RESISTOR 10K \pm 1% .125W |
| R114 | BOTH | 0757-0447 | RESISTOR 16.2K \pm 1% .125W |

Table 5-3. Agilent 6060B/6063B Parts List - Electrical (continued)

| Reference Designation | Models | Agilent Part Number | Description |
|-----------------------|--------|---------------------|----------------------------------|
| R115 | BOTH | 0757-0416 | RESISTOR 511 \pm 1% .125W |
| R116 | BOTH | 0757-0472 | RESISTOR 200K \pm 1% .125W |
| R117 | 6060B | 0698-6360 | RESISTOR 10K \pm 0.1% .125W |
| R117 | 6063B | 0698-6320 | RESISTOR 5K \pm 0.1% .125W |
| R118-121 | BOTH | 0757-0442 | RESISTOR 10K \pm 1% .125W |
| R122 | BOTH | 0757-0280 | RESISTOR 1K \pm 1% .125W |
| R123 | BOTH | 1810-1274 | NETWORK-RES 10-SIP |
| R124 | BOTH | 0757-0447 | RESISTOR 16.2K \pm 1% .125W |
| R125 | BOTH | 0757-0439 | RESISTOR 6.81K \pm 1% .125W |
| R126 | BOTH | 0757-0440 | RESISTOR 7.5K \pm 1% .125W |
| R127 | BOTH | 1810-1260 | NETWORK-RES 10-SIP 20.0K OHM X 9 |
| R128 | 6060B | 8159-0005 | RESISTOR 0 CWM |
| R128 | 6063B | 0698-3456 | RESISTOR 287K \pm 1% .125W |
| R129 | BOTH | 0698-3160 | RESISTOR 31.6K \pm 1% .125W |
| R130-132 | BOTH | 0683-0475 | RESISTOR 4.7 \pm 5% .25W |
| R133 | BOTH | 0699-0924 | RESISTOR 11K \pm 0.1% .125W |
| R134 | BOTH | 0757-0436 | RESISTOR 4.32K \pm 1% .125W |
| R135 | BOTH | 0757-0438 | RESISTOR 5.11K \pm 1% .125W |
| R136 | BOTH | 0757-0449 | RESISTOR 20K \pm 1% .125W |
| R137,138 | BOTH | 0757-0442 | RESISTOR 10K \pm 1% .125W |
| R139 | BOTH | 0698-4479 | RESISTOR 14K \pm 1% .125W |
| R140 | BOTH | 0757-0441 | RESISTOR 8.25K \pm 1% .125W |
| R141 | 6060B | 0699-0486 | RESISTOR 2K \pm 1% .1W |
| R141 | 6063B | 0757-0317 | RESISTOR 1.33K \pm 1% .125W |
| R142,143 | BOTH | 0757-0472 | RESISTOR 200K \pm 1% .125W |
| R144 | 6060B | 0757-0412 | RESISTOR 365 \pm 1% .125W |
| R144 | 6063B | 0757-0401 | RESISTOR 100 \pm 1% .125W |
| R145 | 6060B | 0757-0439 | RESISTOR 6.81K \pm 1% .125W |
| R145 | 6063B | 0757-0429 | RESISTOR 1.82K \pm 1% .125W |
| R146-153 | BOTH | 0757-0465 | RESISTOR 100K \pm 1% .125W |
| R154 | BOTH | 0698-8827 | RESISTOR 1M \pm 1% .125W |
| R155 | BOTH | 2100-3282 | RESISTOR-TRMR 25K 10% |
| R156 | BOTH | 0683-1065 | RESISTOR 10M \pm 5% .25W |
| R157 | BOTH | 0757-0439 | RESISTOR 6.81K \pm 1% .125W |
| R158 | BOTH | 0757-0279 | RESISTOR 3.16K \pm 1% .125W |
| R159 | BOTH | 0757-0405 | RESISTOR 162 \pm 1% .125W |
| R161 | BOTH | 0757-0274 | RESISTOR 1.21K \pm 1% .125W |
| R162-169 | BOTH | 0698-8827 | RESISTOR 1M \pm 1% .125W |
| R170 | BOTH | 0698-8913 | RESISTOR 1.5M \pm 1% .125W |
| R171 | BOTH | 0698-0064 | RESISTOR 9.31K \pm 1% .125W |
| R172 | BOTH | 0757-0464 | RESISTOR 90.9K \pm 1% .125W |
| R175 | BOTH | 0698-8913 | RESISTOR 1.5M \pm 1% .125W |
| R176 | BOTH | 0698-4536 | RESISTOR 340K \pm 1% .125W |
| R177 | 6060B | 0757-0459 | RESISTOR 56.2K \pm 1% .125W |
| R177 | 6063B | 0757-0458 | RESISTOR 51.1K \pm 1% .125W |
| R201 | BOTH | 1810-0560 | NETWORK-RES 16-DIP 5.6K OHM X 8 |
| R202 | BOTH | 0698-3359 | RESISTOR 12.7K \pm 1% .125W |

Table 5-3. Agilent 6060B/6063B Parts List - Electrical (continued)

| Reference Designation | Models | Agilent Part Number | Description |
|-----------------------|--------|---------------------|----------------------------------|
| R203,204 | BOTH | 0757-0280 | RESISTOR 1K \pm 1% .125W |
| R205 | BOTH | 0757-0442 | RESISTOR 10K \pm 1% .125W |
| R208 | BOTH | 0698-3633 | RESISTOR 390 \pm 5% 2W MO |
| R209 | BOTH | 0698-3644 | RESISTOR 5.1K \pm 5% 2W MO |
| R210 | BOTH | 0757-0280 | RESISTOR 1K \pm 1% .125W TF |
| R214 | BOTH | 1810-0280 | NETWORK-RES 10-SIP 10.0K OHM X 9 |
| R215 | BOTH | 0698-3644 | RESISTOR 5.1K \pm 5% 2W MO |
| R217-219 | BOTH | 0757-0442 | RESISTOR 10K \pm 1% .125W |
| R220 | BOTH | 0757-0442 | RESISTOR 10K \pm 1% .125W |
| R221 | BOTH | 0757-0401 | RESISTOR 100 \pm 1% .125W |
| R222 | BOTH | 0699-1797 | RESISTOR 10M \pm 1% .25W |
| R300, 301 | BOTH | 0757-0401 | RESISTOR 100 \pm 1% .125W |
| R302 | BOTH | 0698-3430 | RESISTOR 21.5 \pm 1% .125W |
| R303 | BOTH | 0698-4486 | RESISTOR 24.9K \pm 1% .125W |
| R304 | BOTH | 0757-0280 | RESISTOR 1K \pm 1% .125W |
| R305 | BOTH | 0698-4503 | RESISTOR 66.5K \pm 1% .125W |
| R306 | BOTH | 0698-6320 | RESISTOR 5K \pm 0.1% .125W |
| R307 | BOTH | 0698-0085 | RESISTOR 2.61K \pm 1% .125W |
| R308 | BOTH | 0757-0462 | RESISTOR 75K \pm 1% .125W |
| R309 | BOTH | 0698-6320 | RESISTOR 5K \pm 0.1% .125W |
| R310,311 | BOTH | 0698-8827 | RESISTOR 1M \pm 1% .125W |
| R312 | BOTH | 0757-0465 | RESISTOR 100K \pm 1% .125W |
| R313 | BOTH | 0757-0449 | RESISTOR 20K \pm 1% .125W |
| R314 | BOTH | 0757-0465 | RESISTOR 100K \pm 1% .125W |
| R315 | BOTH | 0698-0085 | RESISTOR 2.61K \pm 1% .125W |
| R316 | BOTH | 0699-0924 | RESISTOR 11K \pm 0.1% .125W |
| R317,318 | BOTH | 0757-0438 | RESISTOR 5.11K \pm 1% .125W |
| R319,320 | BOTH | 0698-6360 | RESISTOR 10K \pm 0.1% .125W |
| R321,322 | BOTH | 0757-0438 | RESISTOR 5.11K \pm 1% .125W |
| R323,324 | BOTH | 0698-6360 | RESISTOR 10K \pm 0.1% .125W |
| R325-327 | BOTH | 0757-0438 | RESISTOR 5.11K \pm 1% .125W |
| R328 | BOTH | 0757-0442 | RESISTOR 10K \pm 1% .125W |
| R329 | BOTH | 0757-0416 | RESISTOR 511 \pm 1% .125W |
| R330,331 | BOTH | 0757-0472 | RESISTOR 200K \pm 1% .125W |
| R332 | BOTH | 0757-0280 | RESISTOR 1K \pm 1% .125W |
| R333 | BOTH | 1810-0280 | NETWORK-RES 10-SIP 10.0K OHM X 9 |
| R334 | BOTH | 0698-0084 | RESISTOR 2.15K \pm 1% .125W |
| R335 | 6060B | 0698-3382 | RESISTOR 5.49K \pm 1% .125W |
| R335 | 6063B | 0698-3279 | RESISTOR 4.99K \pm 1% .125W |
| R336 | BOTH | 0698-4443 | RESISTOR 4.53K \pm 1% .125W |
| R337 | BOTH | 0757-0280 | RESISTOR 1K \pm 1% .125W |
| R338 | BOTH | 0699-0924 | RESISTOR 11K \pm 0.1% .125W |
| R339,340 | BOTH | 0698-6360 | RESISTOR 10K \pm 0.1% .125W |
| R341 | BOTH | 0757-0438 | RESISTOR 5.11K \pm 1% .125W |
| R342 | BOTH | 0757-0449 | RESISTOR 20K \pm 1% .125W |
| R343 | BOTH | 0698-4443 | RESISTOR 4.53K \pm 1% .125W |

Table 5-3. Agilent 6060B/6063B Parts List - Electrical (continued)

| Reference Designation | Models | Agilent Part Number | Description |
|-----------------------|--------|---------------------|----------------------------------|
| R344 | BOTH | 0757-0449 | RESISTOR 20K $\pm 1\%$.125W |
| R345 | BOTH | 0699-0924 | RESISTOR 11K $\pm 0.1\%$.125W |
| R346 | BOTH | 0698-6533 | RESISTOR 12.5K $\pm 0-1\%$.125W |
| R347 | BOTH | 0757-0438 | RESISTOR 5.11K $\pm 1\%$.125W |
| R348 | BOTH | 0698-8827 | RESISTOR 1M $\pm 1\%$.125W |
| R349 | BOTH | 1810-0280 | NETWORK-RES 10-SIP 10.0K OHM X 9 |
| R350 | BOTH | 0757-0442 | RESISTOR 10K $\pm 1\%$.125W |
| R351,352 | BOTH | 0698-3633 | RESISTOR 390 $\pm 5\%$ 2W |
| R353 | BOTH | 0699-1797 | RESISTOR 10M $\pm 1\%$.25W |
| R357 | BOTH | 0757-0442 | RESISTOR 10K $\pm 1\%$.125W |
| R358 | BOTH | 0757-0465 | RESISTOR 100K $\pm 1\%$.125W |
| R359 | 6060B | 0699-1254 | RESISTOR 536K $\pm 1\%$.125W |
| R359 | 6063B | 0698-3215 | RESISTOR 499K $\pm 1\%$.125W |
| R361,362 | BOTH | 0757-0442 | RESISTOR 10K $\pm 1\%$.125W |
| R501 | BOTH | 0757-0436 | RESISTOR 4.32K $\pm 1\%$.125W |
| R502 | BOTH | 0698-4443 | RESISTOR 4.53K $\pm 1\%$.125W |
| R503 | BOTH | 0757-0442 | RESISTOR 10K $\pm 1\%$.125W |
| R504 | BOTH | 0757-0280 | RESISTOR 1K $\pm 1\%$.125W |
| R505 | BOTH | 0757-0472 | RESISTOR 200K $\pm 1\%$.125W |
| R506 | BOTH | 0757-0438 | RESISTOR 5.11K $\pm 1\%$.125W |
| R507 | BOTH | 0698-8827 | RESISTOR 1M $\pm 1\%$.125W |
| R508 | BOTH | 0757-0472 | RESISTOR 200K $\pm 1\%$.125W |
| R509 | BOTH | 0757-0280 | RESISTOR 1K $\pm 1\%$.125W |
| R510 | BOTH | 0757-0442 | RESISTOR 10K $\pm 1\%$.125W |
| R511 | BOTH | 0757-0420 | RESISTOR 750 $\pm 1\%$.125W |
| R512,513 | BOTH | 0757-0455 | RESISTOR 36.5K $\pm 1\%$.125W |
| R514 | BOTH | 0698-8672 | RESISTOR 243.4 $\pm 0.1\%$.125W |
| R515,516 | BOTH | 0698-0085 | RESISTOR 2.61K $\pm 1\%$.125W |
| R517 | BOTH | 0698-8672 | RESISTOR 243.4 $\pm 0.1\%$.125W |
| R551 | BOTH | 0698-0085 | RESISTOR 2.61K $\pm 1\%$.125W |
| R552 | BOTH | 0698-8672 | RESISTOR 243.4 $\pm 0.1\%$.125W |
| R553 | BOTH | 0698-3226 | RESISTOR 6.49K $\pm 1\%$.125W |
| R555 | BOTH | 0698-3156 | RESISTOR 14.7K $\pm 1\%$.125W |
| R556 | BOTH | 0757-0442 | RESISTOR 10K $\pm 1\%$.125W |
| R557,558 | BOTH | 0757-0436 | RESISTOR 4.32K $\pm 1\%$.125W |
| R563,564 | BOTH | 0757-0436 | RESISTOR 4.32K $\pm 1\%$.125W |
| R565 | BOTH | 0757-0442 | RESISTOR 10K $\pm 1\%$.125W |
| R566,567 | BOTH | 0757-0472 | RESISTOR 200K $\pm 1\%$.125W |
| R568 | BOTH | 0757-0280 | RESISTOR 1K $\pm 1\%$.125W |
| R569 | BOTH | 0698-8827 | RESISTOR 1M $\pm 1\%$.125W |
| R570 | BOTH | 0757-0436 | RESISTOR 4.32K $\pm 1\%$.125W |
| R571 | BOTH | 0698-0084 | RESISTOR 2.15K $\pm 1\%$.125W |
| R572 | BOTH | 0757-0420 | RESISTOR 750 $\pm 1\%$.125W |
| R573 | BOTH | 0757-0442 | RESISTOR 10K $\pm 1\%$.125W |
| R574,575 | BOTH | 0757-0455 | RESISTOR 36.5K $\pm 1\%$.125W |
| R576,577 | BOTH | 0757-0458 | RESISTOR 51.1K $\pm 1\%$.125W |

Table 5-3. Agilent 6060B/6063B Parts List - Electrical (continued)

| Reference Designation | Models | Agilent Part Number | Description |
|-----------------------|--------|---------------------|--|
| R600 | BOTH | 0698-8827 | RESISTOR 1M \pm 1% .125W |
| R601 | BOTH | 1810-0278 | NETWORK-RES 10-SIP 3.3K OHM X 9 |
| RT201 | BOTH | 0837-0412 | THERMISTOR TUB WITH AXL LEADS 10K-OHM |
| RT551 | BOTH | 0837-0397 | THERMISTOR CYL CHIP 10K-OHM |
| RTP201,301 | BOTH | 1258-0209 | JUMPER-REMOVABLE 2 POSITION; .250 IN |
| S1 | BOTH | 3101-3012 | SWITCH-SL DPDT STD 3A 125VAC PC |
| S552 | BOTH | 3101-2828 | SWITCH-SL DPDT STD 5A 250VAC PC |
| S553 | BOTH | 3101-2828 | SWITCH-SL DPDT STD 5A 250VAC PC |
| T501 | BOTH | 9100-4718 | XFMR-PWR 100/120/220/240V IEC-950 |
| T551 | BOTH | 9100-4719 | XFMR-PWR 100/120/220/240V IEC-348 |
| TB201 | BOTH | 0360-2312 | TERMINAL BLOCK 4-TERM .039 IN SQUARE |
| TB301 | BOTH | 0360-2348 | TERMINAL BLOCK 10 TERM .039 IN SQUARE |
| TP201 | BOTH | 1251-4927 | CONN-POST TYPE .100-PIN-SPCG 16-CONT |
| TP301 | BOTH | 1251-4926 | CONN-POST TYPE .100-PIN-SPCG 8-CONT |
| U1-4 | BOTH | 1826-1533 | IC OP AMP H-SLEW-RATE DUAL 8 PIN DIP |
| U5,6 | BOTH | 1826-2252 | IC OP AMP LOW-NOISE DUAL 8 PIN DIP |
| U7 | BOTH | 1826-0138 | IC COMPARATOR GP QUAD 14 PIN DIP |
| U8 | BOTH | 1826-1533 | IC OP AMP H-SLEW-RATE DUAL 8 PIN DIP |
| U9 | BOTH | 1826-0850 | ANALOG SWITCH-PIN |
| U10 | BOTH | 1826-0962 | IC OP AMP LOW-BIAS-H-IMPED DUAL 8 PIN |
| U11 | BOTH | 1826-1370 | IC COMPARATOR QUAD 16 PIN DIP |
| U12 | BOTH | 1826-0346 | IC OP AMP GP DUAL 8 PIN DIP |
| U13 | BOTH | 1826-0962 | IC OP AMP LOW-BIAS-H-IMPED DUAL 8 PIN |
| U14-17 | BOTH | 1826-2252 | IC OP AMP LOW-NOISE DUAL 8 PIN DIP |
| U200 | BOTH | 1820-6170 | IC GPIB transceiver 75160N |
| U201 | BOTH | 1820-6045 | IC GPIB transceiver 75161N |
| U202 | BOTH | 1821-1740 | IC GPIB talker/listener |
| U203 | BOTH | 1821-3617 | IC-8-BIT CMOS MPU W/128 RAM, I/O, 1MHz |
| U204 | BOTH | 1820-5978 | IC DCDR CMOS/AC BIN 3-TO-8-LINE |
| U205 | BOTH | 06063-80004 | IC ROM Programmed |
| U206 | BOTH | 1818-3183 | IC 64K SRAM 15-NS CMOS |
| U207 | BOTH | 1820-2921 | IC INV CMOS/HC HEX |
| U208,209 | BOTH | 1820-3399 | IC FF CMOS/HC D-TYPE POS-EDGE-TRIG COM |
| U210 | BOTH | 1820-3297 | IC DRVR CMOS/HC BUS OCTL |
| U211 | BOTH | 1818-4932 | IC 1K EEPROM 250-NS CMOS |
| U212 | BOTH | 1820-4053 | IC INV CMOS/HC HEX |
| U213-215 | BOTH | 1990-0996 | OPTO-ISOLATOR LED-IC GATE IF=10MA-MAX |
| U216 | BOTH | 1820-3298 | IC GATE CMOS/HC OR QUAD 2-INP |
| U217 | BOTH | 1820-2922 | IC GATE CMOS/HC NAND QUAD 2-INP |
| U218 | BOTH | 1820-3098 | IC GATE CMOS/HC NOR TPL 3-INP |
| U219 | BOTH | 1820-2998 | IC MC74HC373N |
| U301 | BOTH | 5080-2516 | IC MPU Masked |
| U302 | BOTH | 1820-3399 | IC FF CMOS/HC D-TYPE POS-EDGE-TRIG COM |
| U303 | BOTH | 1820-2228 | IC LCH CMOS NAND R-S QUAD |
| U304 | BOTH | 1820-3079 | IC DCDR CMOS/HC BIN 3-TO-8-LINE |
| U305 | BOTH | 1820-3399 | IC FF CMOS/HC D-TYPE POS-EDGE-TRIG COM |
| U306 | BOTH | 1826-1845 | IC OP AMP PRCN DUAL 8 PIN DIP |
| U307 | BOTH | 1826-1317 | IC OP AMP LOW-NOISE 8 PIN DIP |
| U308 | BOTH | 1826-0962 | IC OP AMP LOW-BIAS-H-IMPED DUAL 8 PIN |

Table 5-3. Agilent 6060B/6063B Parts List - Electrical (continued)

| Reference Designation | Models | Agilent Part Number | Description |
|-----------------------|--------|---------------------|--|
| U309 | BOTH | 1826-0850 | ANALOG SWITCH-PIN |
| U310,311 | BOTH | 1820-3082 | IC FF CMOS/HC D-TYPE POS-EDGE-TRIG COM |
| U312 | BOTH | 1820-6774 | IC CNTR CMOS/HC BIN SYNCHRO |
| U313 | BOTH | 5080-2137 | IC GAL programmed |
| U314 | BOTH | 1820-3081 | IC FF CMOS/HC D-TYPE POS-EDGE-TRIG |
| U315 | BOTH | 1820-3172 | IC FF CMOS/HC J-K BAR POSEGE-TRIG |
| U316 | BOTH | 5080-2121 | IC GAL programmed |
| U317 | BOTH | 1826-0850 | ANALOG SWITCH-PIN |
| U318 | BOTH | 1820-2924 | IC GATE CMOS/HC NOR QUAD 2-INP |
| U319 | BOTH | 1820-3399 | IC FF CMOS/HC D-TYPE POS-EDGE-TRIG COM |
| U320 | BOTH | 1826-1488 | D/A 12-BIT 20-CERDIP CMOS |
| U321 | BOTH | 1826-1068 | D/A 8-BIT 20-PLASTIC CMOS |
| U322 | BOTH | 1826-1488 | D/A 12-BIT 20-CERDIP CMOS |
| U323-325 | BOTH | 1826-0962 | IC OP AMP LOW-BIAS-H-IMPED DUAL 8 PIN |
| U326 | BOTH | 1826-1081 | IC OP AMP PRCN 8 PIN DIP |
| U327 | BOTH | 1826-1370 | IC COMPARATOR QUAD 16 PIN DIP |
| U328 | BOTH | 1826-1081 | IC OP AMP PRCN 8 PIN DIP |
| U329 | BOTH | 1826-1369 | IC V RGLTR-V-REF-FXD 9.95/10.05V 8-DIP |
| U330 | BOTH | 1820-3399 | IC FF CMOS/HC D-TYPE POS-EDGE-TRIG COM |
| U331 | BOTH | 1826-1845 | IC OP AMP PRCN DUAL 8 PIN DIP |
| U340 | BOTH | 1826-0850 | ANALOG SWITCH-PIN |
| U501 | BOTH | 1826-0412 | IC COMPARATOR PRCN DUAL 8 PIN DIP |
| U502 | BOTH | 5060-2948 | IC V RGLTR LM7805 5V (with heatsink) |
| U503 | BOTH | 1826-1343 | IC V RGLTRV-REF-ADJ 2.5/36V |
| U551,552 | BOTH | 5060-2942 | IC V RGLTR LM317 ADJ 1.2/45V (with heatsink) |
| U553 | BOTH | 5060-2943 | IC V RGLTR LM337 ADJ -1.2/-45V (with heatsink) |
| U558 | BOTH | 5060-2948 | IC V RGLTR LM7805 5V (with heatsink) |
| U559 | BOTH | 1826-0412 | IC COMPARATOR PRCN DUAL 8 PIN DIP |
| U560 | BOTH | 1826-1343 | IC V RGLTR-V-REF-ADJ 2.5/36V 8-DIP |
| VR9 | 6060B | 1901-1284 | DIODE-VOLTAGE SUPPRESSOR 75V |
| VR9 | 6063B | 0837-0277 | DIODE-VOLTAGE SUPPRESSOR 300V |
| VR10 | BOTH | 1902-0783 | DIODE-ZNR 16V 5% PD-1W IR-5UA |
| VR11 | BOTH | 1902-0761 | DIODE-ZNR IN821 6.2V 5% DO-7 PD.4W |
| VR12 | BOTH | 1902-0957 | DIODE-ZNR 9.1V 5% DO-35 PD.4W TC+.069% |
| VR201,202 | BOTH | 1902-0799 | DIODE-ZNR 7.5V 5% PD 1W IR 10UA |
| VR301,302 | BOTH | 1902-0957 | DIODE-ZNR 9.1V 5% DO-35 PD.4W TC+.069% |
| VR303,304 | BOTH | 1902-0783 | DIODE-ZNR 16V 5% PD 1W IR 5UA |
| Y201,301 | BOTH | 0410-1944 | CRYSTAL-QUARTZ 4.0000 MHZ |
| | BOTH | 06060-00001 | CHASSIS |
| B1 | BOTH | 06632-60002 | FAN ASSEMBLY / with CABLE |
| F551 | BOTH | 2110-0803 | FUSE (METRIC) .5A 250V (for 100/120 VAC line) |
| F551 | BOTH | 2110-0817 | FUSE (METRIC) .25A 250V (for 220/240 VAC line) |
| J551 | BOTH | 1252-0029 | AC POWER RECEPTABLE - LINE FILTER |
| RTB1 | BOTH | 0360-2345 | MATING PLUG FOR TB301 (control connector) |
| RTB2 | BOTH | 1252-1488 | MATING PLUG FOR TB201 (trigger) |
| TBPI,2 | BOTH | 1510-0134 | BINDING POST |

Table 5-3. Agilent 6060B/6063B Parts List - Electrical (continued)

| Reference Designation | Models | Agilent Part Number | Description |
|-----------------------|--------|---------------------|--|
| A2 | BOTH | 06063-60001 | FRONT PANEL ASSEMBLY |
| A3 | BOTH | 5020-2693 | PC BOARD (keypad) |
| W1 | BOTH | 5061-3473 | LCD DISPLAY |
| W1 | BOTH | 5060-3193 | WIRE KIT (main board to J551 ac receptacle) |
| W1 | BOTH | 06060-60052 | WIRE KIT (J551 to chassis ground) |
| W1 | BOTH | 0360-0378 | TERMINAL SOLDER LUG (ground lug) |
| W2 | BOTH | 06632-80002 | AC CABLE ASSY (S551 to J553) |
| W3 | BOTH | 8120-4944 | CABLE ASSY (LCD display to main board) |
| W4 | BOTH | 06060-80001 | CABLE RIBBON (keypad to main board) |
| S2 | BOTH | 06060-40001 | KEYPAD |
| S551 | BOTH | 3101-2862 | SWITCH- ON/OFF |
| TBP3,4 | BOTH | 1510-0134 | FRONT PANEL OPTION (#020) BINDING POST |
| W5 | BOTH | 06060-80015 | CABLE ASSEMBLY (#8 AWG red/black) |

Table 5-4. Agilent 6060B/6063B Parts List - Mechanical

| Reference Designators | Models | Part Number | Description |
|-----------------------|--------|-------------|---|
| A1 | 6060B | 06060-60022 | MAIN BOARD |
| A1 | 6063B | 06063-60022 | MAIN BOARD |
| MP1 | BOTH | 0515-1114 | SCREW-MACH M4 X 0.710MM-LG (heatsink to A1 board) |
| MP2 | BOTH | 0515-1285 | SCREW-MACH M3.5 X 0.6 35MM-LG (fan to heatsink) |
| MP3 | BOTH | 2190-0585 | WASHER-LK HLCL (fan) |
| MP4 | BOTH | 3050-0892 | WASHER-FL METALLIC (fan) |
| MP5 | BOTH | 0380-0181 | SPACER-.75 IN (fan) |
| MP6 | BOTH | 3050-0003 | WASHER-FL NONMETALLIC (fan) |
| MP7 | BOTH | 06060 20001 | HEAT SINK (Q2) |
| MP8 | BOTH | 06060-20004 | HEAT SINK (Q1) |
| MP9 | BOTH | 06060-20005 | SPACER STRIP (between heat sinks) |
| MP10 | BOTH | 0515-1374 | SCREW-MACH M4 X 0.7 30MM-LG (heatsink to A1 board) |
| MP11 | BOTH | 0380-1999 | STANDOFF-HEX 33-MM-LG M4.0 X 0.7-THD (heatsink) |
| MP12 | BOTH | 0515-0210 | SCREW-MACH M4 X 0.7 8MM-LG (FETS to heatsink) |
| MP13 | BOTH | 0340-1217 | INSULATOR THRM-CNDCT (for left heatsink) |
| MP14 | BOTH | 06060-00003 | BUS BAR |
| MP15 | BOTH | 0535-0082 | NUT-HEX W/LKWR (bus bar to pc board) |
| MP16 | BOTH | 0535-0031 | NUT-HEX W/LKWR M3 X 0.5 2.4MM-THK (Ref GPIB) |
| MP17 | BOTH | 0380-0643 | STANDOFF-HEX (GP-IB connector) |
| MP18 | BOTH | 2190-0586 | WASHER-LK HLCL (J201) |
| | BOTH | 1205-0743 | THERMAL INTERFACE PAD (Q1, Q2 to heatsink) |
| | BOTH | 1400-0307 | TIE WRAP (ac cable) |
| | BOTH | 06060-00001 | CHASSIS |
| MP1 | BOTH | 0515-1114 | SCREW-MACH M4 X 0.710MM-LG (pc board to chassis & safety ground) |
| MP19 | BOTH | 0515-0155 | SCREW-MACH M5 X 0.8 12MM-LG (bus bar to binding post) |
| MP20 | BOTH | 2190-0629 | LOCKWASHER (binding post) |
| | BOTH | 5063-4827 | Ferrite bead kit |

Table 5-4. Agilent 6060B/6063B Parts List - Mechanical (continued)

| Reference Designators | Models | Part Number | Description |
|-----------------------|--------|-------------|---|
| MP21 | BOTH | 0535-0020 | NUT (binding post) |
| MP22 | BOTH | 3050-1320 | WASHER - SPRING STEEL (binding post) |
| MP23 | BOTH | 06060-00006 | BRACKET (heatsink) |
| MP24 | BOTH | 0515-0896 | SCREW-MACH M4 X 0.710MM-LG (heatsink bracket & spacer) |
| MP25 | BOTH | 06060 20003 | COVER SAFETY (RTB1) |
| MP26 | BOTH | 0515-1655 | SCREW-MACHINE ASSEMBLY M4 X 0.7 12MM-LG (safety cover & front frame to ground) |
| MP27 | BOTH | 06060-00002 | COVER |
| MP28 | BOTH | 0515-1117 | SCREW-MACH M5 X 0.8 10MM-LG (cover to left side) |
| MP29 | BOTH | 5062-3702 | STRAP HANDLE ASSEMBLY |
| MP30 | BOTH | 0515-1132 | SCREW-MACH M5 X 0.8 10MM-LG (strap handle) |
| MP31 | BOTH | 5041-8819 | STRAP HANDLE CAP (front) |
| MP32 | BOTH | 5041-8820 | STRAP HANDLE CAP (rear) |
| MP33 | BOTH | 06060-80010 | LABEL - REAR PANEL |
| MP34 | BOTH | 5041-8801 | FOOT |
| | BOTH | 06063-60001 | FRONT PANEL ASSEMBLY |
| MP6 | BOTH | 3050-0003 | WASHER- NON-MATALIC (LCD display) |
| MP15 | BOTH | 0535-0082 | NUT W/LOCKWASHER (front panel ground) |
| MP26 | BOTH | 0515-1655 | SCREW-MACH M4x0.7 12MM-LG (front panel to chassis) |
| MP35 | BOTH | 5040-5448 | WINDOW (LCD display) |
| MP36 | BOTH | 06060 40002 | FRONT PANEL FRAME |
| MP37 | BOTH | 5001-6733 | SCREENED FRONT PANEL |
| MP38 | BOTH | 0590-0534 | NUT-SELF THREADING (LCD display & keypad) |
| MP39 | BOTH | 5001-0538 | SIDE TRIM |
| | 6060B | 06060-80016 | NAMEPLATE (front panel identification) |
| | 6063B | 06063-80003 | NAMEPLATE (front panel identification) |
| | | | FRONT PANEL OPTION (#020) |
| MP19 | BOTH | 0515-0155 | SCREW-MACH M5x0.8 12MM-LG (cable to binding post) |
| MP20 | BOTH | 2190-0629 | LOCKWASHER (binding post) |
| MP21 | BOTH | 0535-0020 | NUT (binding post) |
| MP22 | BOTH | 3050-1320 | WASHER - SPRING STEEL (binding post) |
| MP37 | BOTH | 5001-6737 | SCREENED FRONT PANEL |
| MP40 | BOTH | 06060-40003 | LABEL PANEL (binding post) |
| MP41 | BOTH | 1400-0308 | CABLE TIE (W5) |
| | | | MISCELLANEOUS |
| | BOTH | 5951-2826 | OPERATING MANUAL 6060B/6063B |
| | BOTH | 06060-90005 | PROGRAM GUIDE |
| | BOTH | 06060-80012 | FLOATER |
| | BOTH | 9211-6168 | SHIPPING CARTON |

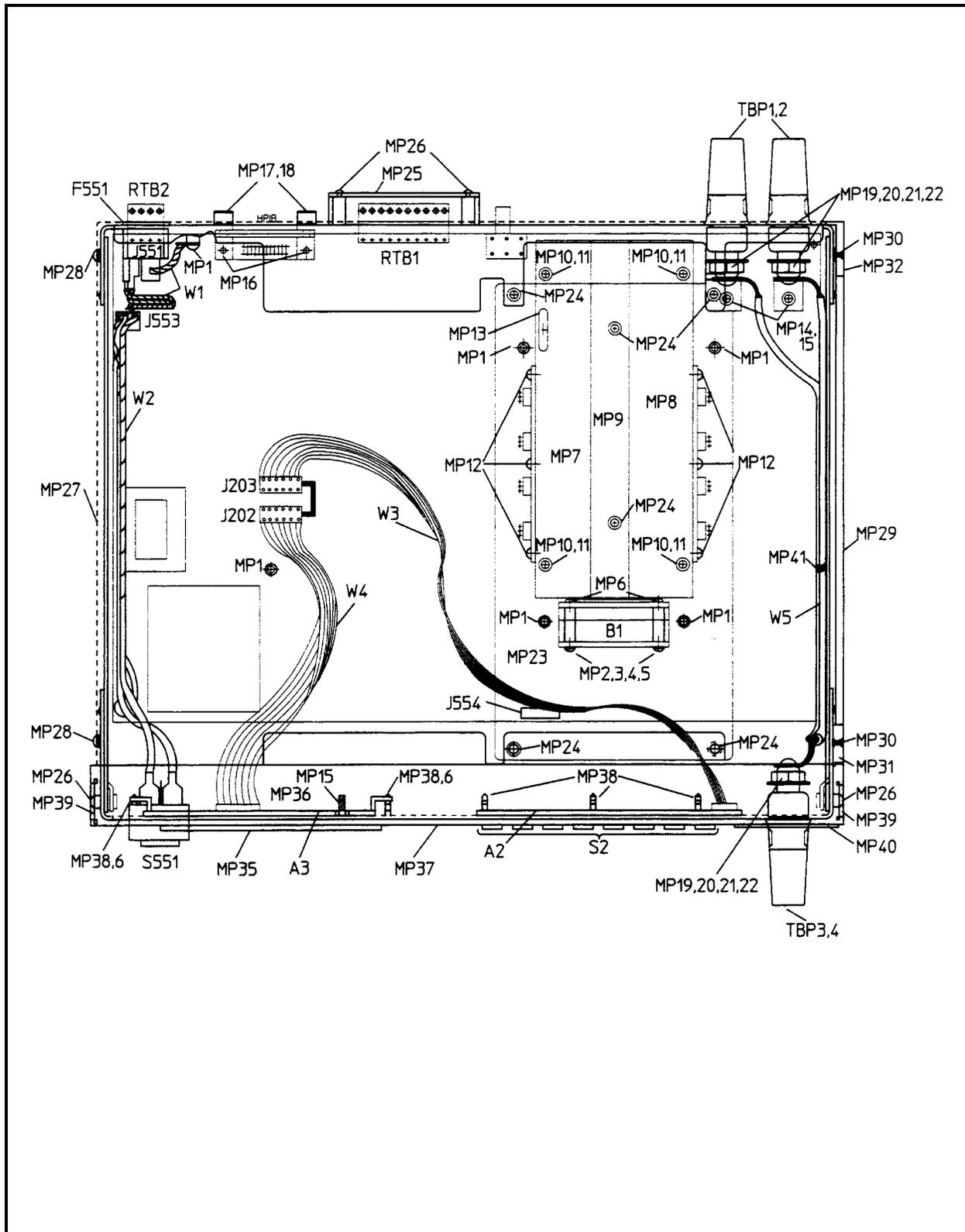


Figure 5-1. Chassis Mounted Component Locations

Diagrams

Introduction

This chapter contains the schematic diagrams, test point location diagram, component location diagrams, and related tabular information useful for maintenance of the Electronic Load. For wiring connections to external equipment, see the Operating Manual.

Schematic Diagram

Figure 6-1 is the schematic diagram (foldout sheets) of the Electronic load. Notes that apply to all of the schematic sheets are given in Table 6-1. The circled numbers on the schematic sheets show the location of test points used in troubleshooting (see Chapter 3). Circuit functions are also identified on each sheet as follows:

- Sheet 1 — AC Input, DC Bias Supplies, and Fan Speed Control
- Sheet 2 — Primary Interface (GP-IB Interface, Microprocessor, RAM, ROM, Front Panel Interface)
- Sheet 3 — Secondary Interface, Transient Generator, and Slew Rate Control
- Sheet 4 — Main, Transient, and Readback DACs
- Sheet 5 — CV/CC Control, OV, OC, OF, and Turn-on Circuits
- Sheet 6 — Input Power Stages (8)

The block diagram description in Chapter 4 shows the functional relationship of the schematic diagram sheets and provides a general description of circuit operation.

Inter-Sheet Connections

Table 6-2 shows all signals that are common to more than one sheet of the schematic. The signal mnemonics are listed alphabetically and, to aid you in locating each signal, the sector (coordinates) on the sheets where the signal is located are given. Coordinates in a box indicate the origin of the signal. For example, CS1* which selects the Transient DAC, originates at U304 (coordinates **1D**) of sheet 3) and is applied to U321 (coordinates 7C of sheet 4).

Intra-Sheet Connections

Table 6-3 shows all the signals that appear in more than one place on any given sheet. The table is organized first by sheet number and then alphabetically under each number. For example on sheet 3, SPCLR* (secondary power-on clear) is applied as follows:

| Coordinates | Circuit | Coordinates | Circuit |
|-------------|---------|-------------|---------|
| 1B | U340 | 6D | U302 |
| 5D | U330 | 7D | U301 |

The flag next to SPCLR* in area 7D indicates that this signal is coming from another sheet. By referring to Table 6-2, you can find that SPCLR* originates on sheet 1 **1C** and is also applied to sheets 3, 4, and 5.

Test Point Locations

Figure 6-2 is a foldout diagram that illustrates the location of 45 test points on the main circuit board. The test points are described in Table 3-3 and are used in various troubleshooting procedures provided in Chapter 3.

Component Location Diagram

Figure 6-2 is a foldout diagram that will aid you in locating electrical components on the main board assembly. The diagram is divided into a numerical matrix of columns and rows. Table 5-4 gives the part number and description of each electrical part .

Table 6-1. Schematic Diagram Notes

1. All resistors are in ohms $\pm 1\%$, 1/8 W, unless otherwise specified.
2. All capacitors are in microfarads unless otherwise specified.
3. All unmarked capacitors are 0.047 μ F.
4. An asterisk negates a signal name. For example, $\overline{CS2}$ appears on the schematic as CS2*.
5. Signal lines that are terminated by flags continue on other sheets (see Table 6-2). Note that flags do not indicate signal flow direction.



6. Unterminated signal lines simply go to another location of the same schematic sheet (see Table 6-3). The following is an example of such a signal.



7. Values of resistors and capacitors that are enclosed by a heavy rectangle  apply to model 6060B only. Refer to the parts list for the model 6063B values.

Table 6-2. Schematic Diagram, Inter-Sheet Signal Connections

| Mnemonic | Signal Function ¹ | Sheet and Coordinates | | | | | |
|----------|--|-----------------------|----|----|----|----|----|
| | | 1 | 2 | 3 | 4 | 5 | 6 |
| ACLR* | Analog circuits clear (D) | | | 4D | | 1A | |
| CC_PROG | Programming voltage for CC mode (A) | | | 3B | | 8C | |
| CCVTST | Comparator output, main DAC self-test (D) | | | 6D | 3A | | |
| CG* | 1 k/10 k Ω range select (D) | | | 5D | 4D | | |
| CV_PROG | Programming voltage for CV mode (A) | | | 2C | | 7D | |
| CR* | 1 Ω range select (D) | | | 5D | 3C | 8D | |
| CS0* | Main DAC chip select (D) | | | 1D | 8D | | |
| CS1* | Transient DAC chip select (D) | | | 1D | 7C | | |
| CS3* | Readback DAC chip select (D) | | | 1D | 8B | | |
| CS4* | Select secondary data bus buffer latch (D) | | | 1D | 8D | | |
| DAC_REF* | Main DAC CC/CV reference enable (D) | | | 5D | 3C | | |
| EEPON* | EEPROM power-on disable (D) | 2A | 2A | | | | |
| EXT_PROG | External programming (A) from (TB301-6) | | | | 1B | | |
| FAN1 | Fan speed control bit (D) | 3C | | 6D | | | |
| FAN2 | Fan speed control bit (D) | 3C | | 6D | | | |
| HIGH* | Enable transient DAC output (D) | | | 4A | 8C | | |
| H/L* | Main DAC transfer control (D) | | | 7D | 8D | | |
| H/L_AD | Readback DAC transfer control (D) | | | 7D | 8B | | |
| IMON* | Input current monitor (A) | | | | 3D | 6B | 8A |
| IMONR | Current monitor comparator output (D) | | | 6D | 3A | | |
| +IN | Input bus (A) (binding post +) | | | | | 8A | 5A |
| -IN | Input bus (A) (binding post -) | | | | | 8A | 5A |
| IPROG | Power driver programming signal (A) | | | | | 1D | 8D |
| BO* | Brown-out status (D) | | | 3D | | 8B | |
| OP* | Overpower status (D) | | | 3D | | 8A | |

¹(A) = analog (D) = digital nx = signal origin

Table 6-2. Schematic Diagram, Inter-Sheet Signal Connections (continued)

| Mnemonic | Signal Function ¹ | Sheet and Coordinates | | | | | |
|------------|---|-----------------------|----|----|----|----|----|
| | | 1 | 2 | 3 | 4 | 5 | 6 |
| OPTO_PCLR* | Opto couplers power-on disable (D) | 2B | 5D | | | | |
| OV* | Overvoltage status (D) | | | 3D | | 8B | |
| PCLR | Primary power-on clear (D) | 2A | 6A | | | | |
| PCLR* | Primary power-on clear (D) | 2A | 4A | | | | |
| PORT | PORT output (D) | | | 3D | 1B | | |
| RNG | Range select (D) | | | 7C | | 8C | |
| +S | Input bus +sense (A) from (TB301-1) | | | | 1C | 1D | |
| - S | Input bus - sense (A) from (TB301-2) | | | | 1C | 1D | |
| SD(0:7) | Data bus (D) | | | 2D | 8C | | |
| SDB(0:7) | Buffered data bus (D) | | | 8C | 8C | | |
| SLEW | Slew programming reference voltage (A) | | | 6B | 4C | | |
| SPCLR* | Secondary power-on clear (D) | 1C | | 7D | 8D | 1B | |
| SRX | Secondary processor receiver (D) | | 4D | 8D | | | |
| STX | Secondary processor transmitter (D) | | 4C | 7D | | | |
| TEMP | Temperature reference (A) | 3D | | | 5A | | |
| TRIG | Trigger (D) | | 4D | 6A | 8D | | |
| TRIG_EN* | Main DAC trigger enable (D) | | | 4D | 8D | | |
| TMONR | Temperature monitor comparator output (D) | | | 6D | 3A | | |
| TURNON | Power-on output disable (D) | | | | | 1B | 8D |
| UNREG | Input to overshoot circuits (A) | | | | | 8A | 8D |
| UNREG* | Output of unregulated-output comparator (D) | | | 3D | | 8A | |
| UXFER | Main & Transient DACs transfer control (D) | | | 7C | 8D | | |
| VMON* | Input voltage monitor (A) | | | | 3C | 7D | |
| VMONR | Voltage monitor comparator output (D) | | | 6D | 3A | | |
| VOFF | Voltage off | | | | | 4C | 8D |
| VOLT_FLT | Over or reverse voltage fault state (D) | | | 3D | 1B | | |
| -10 VREF | 10 volts reference | 3D | | | 4D | | |
| + 12 VREF | 12 volts reference | | | | 3D | 5B | |

¹(A) = analog (D) = digital nx = signal origin

Table 6-3. Schematic Diagram, Intra-Sheet Signals

| Mnemonic | Signal Function ¹ | Location | |
|----------|--|----------|------------------------|
| | | Sheet | Coordinates |
| CAL_LOCK | Software calibration lockout (D) | 2 | 2D, 8C |
| CSP0* | Test point | 2 | 5C , 8C |
| CSP1* | GP-IB interface write (D) | 2 | 5C , 6B, 8C |
| CSP2* | GP-IB interface read (D) | 2 | 5C , 6B, 8C |
| CSP3* | Keyboard readback chip select (D) | 2 | 3D, 5C , 6B |
| CSP4* | Keyboard driver chip select (D) | 2 | 3C, 5C , 8C |
| CSP5* | Display driver (D) chip select bit (D) | 2 | 3B, 5C , 8C |
| CSP6* | Test point | 2 | 5C , 8C |
| CSP7* | Test point | 2 | 5C , 8C |
| EEPON* | EEPROM power-on disable (D) | 2 | 2A, 8A |
| EP | Primary μ P clock (D) | 2 | 4A , 5B, 5C, 6B |
| L0 | Logic zero (ground) | 2 | 6B, 7B, 8B |
| L1 | Logic one (+ 5 V) | 2 | 4A, 8B |
| PCLR | Primary power-on clear (D) | 2 | 7B, 8A |
| PCLR* | Primary power-on (D) | 2 | 1A, 4A, 3C, 8A |
| R/W* | RAM read/write enable (D) | 2 | 4A , 6B |
| SA GATE | Primary μ P SA gate (D) | 2 | 4C , 8C |
| SA MODE | Primary μ P SA mode enable (D) | 2 | 4A, 8C |
| TLRST* | Trigger latch reset (D) | 2 | 3C , 6D |
| TRIGEN | Trigger enable/disable (D) | 2 | 3C , 7C |
| TRIG IN | External trigger input (D) | 2 | 2A , 8D |
| TRIG OUT | Trigger output (D) | 2 | 2A, 7D |
| CC_EN* | CC mode enable (D) | 3 | 3C, 6D |
| CS2* | Slew rate latch select (D) | 3 | 1D , 8C |
| CS5* | Control signals latch select (D) | 3 | 1D , 6D |
| CS6* | Control signals latch select (D) | 3 | 5D, 7D |
| CV_EN* | Enable CV mode (D) | 3 | 3C, 6D |
| E | Secondary μ P clock (D) | 3 | 6D , 6A, 5A, 4A |
| FSEL0 | Transient generator frequency select bit (D) | 3 | 5D , 4A |
| FSEL1 | Transient generator frequency select bit (D) | 3 | 5D , 4A |
| FSEL2 | Transient generator frequency select bit (D) | 3 | 5D , 4A |
| HIGH* | Enable transient DAC output (D) | 3 | 4A , 7A |
| LCLR* | Clear status latch (D) | 3 | 3D, 5D |
| P_TRIG | Pulse trigger (D) | 3 | 5D , 6A |
| PULSE_EN | Enable pulse mode (D) | 3 | 6A, 4D |
| RCK_LOW* | Loads transient generator counter (D) | 3 | 1D , 7A |

¹(A) = analog (D) = digital **nx** = signal origin

Table 6-3. Schematic Diagram, Intra-Sheet Signals (continued)

| Mnemonic | Signal Function ¹ | Location | |
|------------|--|----------|----------------------------|
| | | Sheet | Coordinates |
| RCK_HI* | Loads transient generator counter (D) | 3 | 1D , 7A |
| S0, S1, S2 | Chip select decoder input (D) | 3 | 2D, 7C |
| SA_EN* | Enable SA(D) | 3 | 1C , 8D |
| SKP | Skip self test input signal (D) | 3 | 1C, 6D |
| SLW1 | Slew circuit switch control (D) | 3 | 8B, 8C |
| SLW2 | Slew circuit switch control (D) | 3 | 8C, 8C |
| SLW3 | Slew circuit switch control (D) | 3 | 8B, 8C |
| SLW4 | Slew circuit switch control (D) | 3 | 6C, 8C |
| SPCLR* | Secondary circuit power-on clear | 3 | 1B, 5D, 6D, 7D |
| STAT_EN | Enable status latch (D) | 3 | 3D, 4D |
| STB* | Enable chip select decoder (D) | 3 | 2D, 7C |
| STX | Provides skip self test signal (D) | 3 | 1C, 7D |
| TOGGLE* | Enable toggle mode (D) | 3 | 4A , 6A |
| TRANS_EN | Enable transient generator(D) | 3 | 4D , 4A |
| | SA start/stop (D) | 3 | 1C, 4D |
| EXT_PROG | External programming input(A) | 4 | 1B , 3B |
| IMON | Current monitor, buffered (A) | 4 | 1B , 1D |
| IMON* | Current monitor input to comparator (A) | 4 | 5A |
| | VREF input for 1-Ω CR range (A) | 4 | 4C |
| SLEW | Comparator input, main DAC self-test (A) | 4 | 4C , 5A |
| VMON | Voltage monitor, buffered (A) | 4 | 1B, 1C |
| VMON* | VREF input for 1-k & 10-k CR ranges (A) | 4 | 6D |
| | Voltage monitor input to comparator (A) | 4 | 5A |
| VREF | Voltage reference for DACs (A) | 4 | 6D, 8B |
| 12 VREF | +12 volts reference | 4 | 3D , 6A, 7A |
| AA | Electrical connection | 5 | 5B , 8A |
| BO* | Brown out | 5 | 2A , 6A |
| +IN | Input + (A) | 5 | 8A , 2C, 1D |
| -IN | Input- (A) | 5 | 8A , 1D |
| IPROG | Power driver programming (A) | 5 | 1D |
| | Overtoltage reference (A) | 5 | 6B |
| +O.P. | Overpower comparator input (A) | 5 | 3B , 8B |
| -O.P. | Overpower comparator input (A) | 5 | 3A , 8B |
| +O.V. | Overtoltage comparator input (A) | 5 | 3D , 8B |
| UNREG | Input to overshoot circuits (A) | 5 | 8A , 8C, 5C, 7D, 4B |
| +IN | Input + (A) | 6 | 5A |
| -IN | Input - (A) | 6 | 5A |

¹(A) = analog (D) = digital **nx** = signal origin

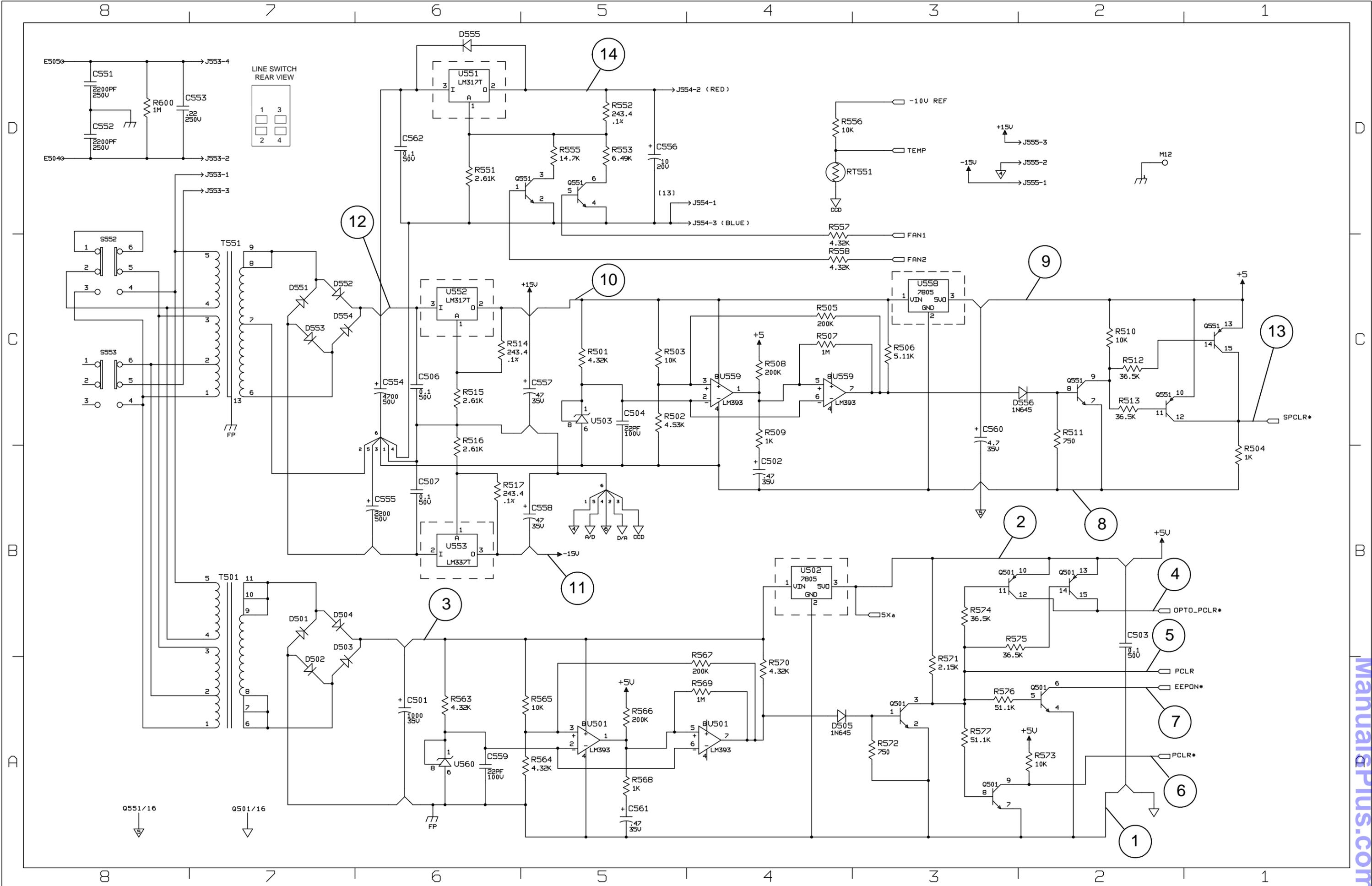


Figure 6-1. 6060B/6063B Electronic Load Schematic (Sheet 1 of 6)

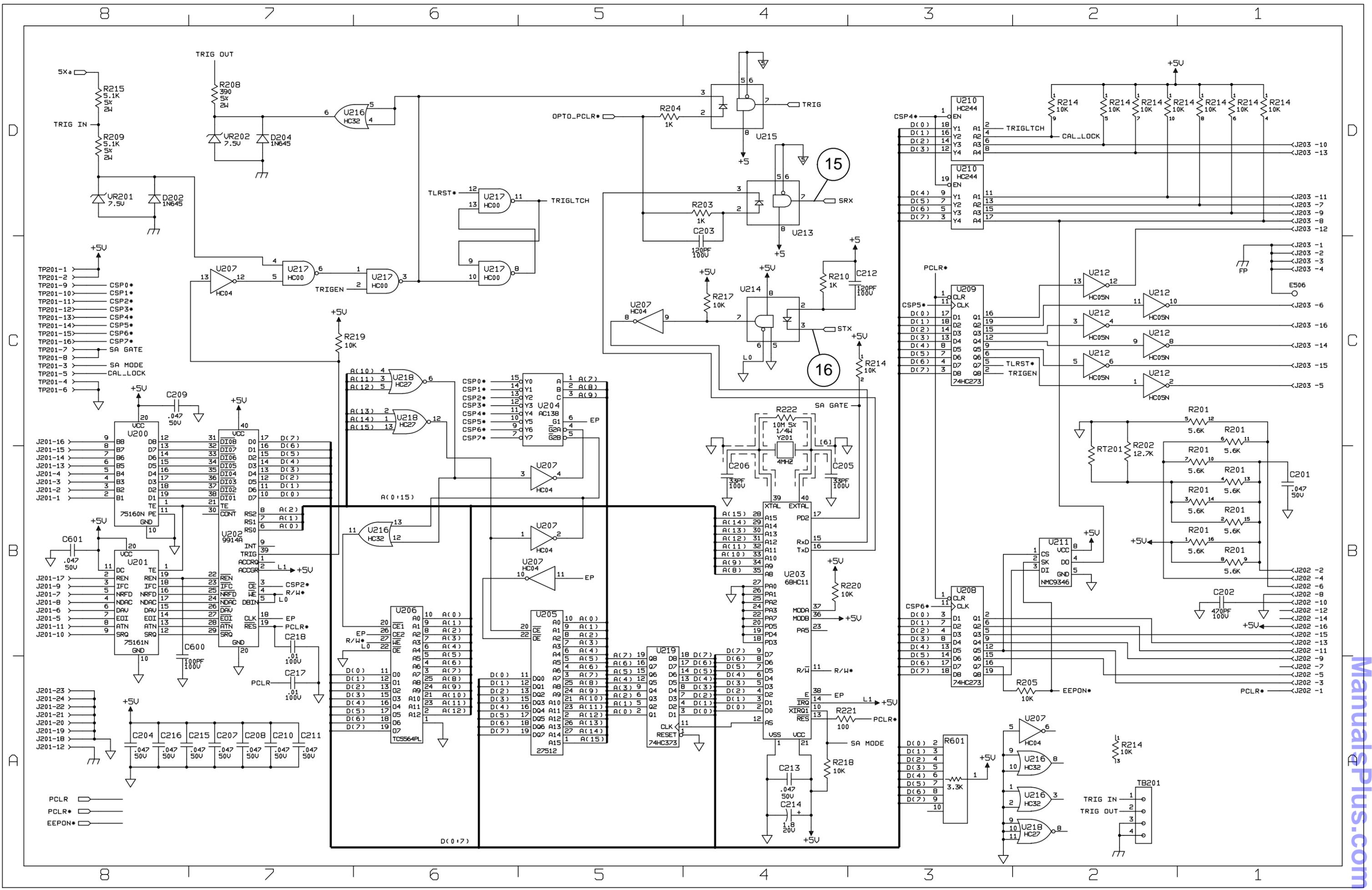


Figure 6-1. 6060B/6063B Electronic Load Schematic (Sheet 2 of 6)

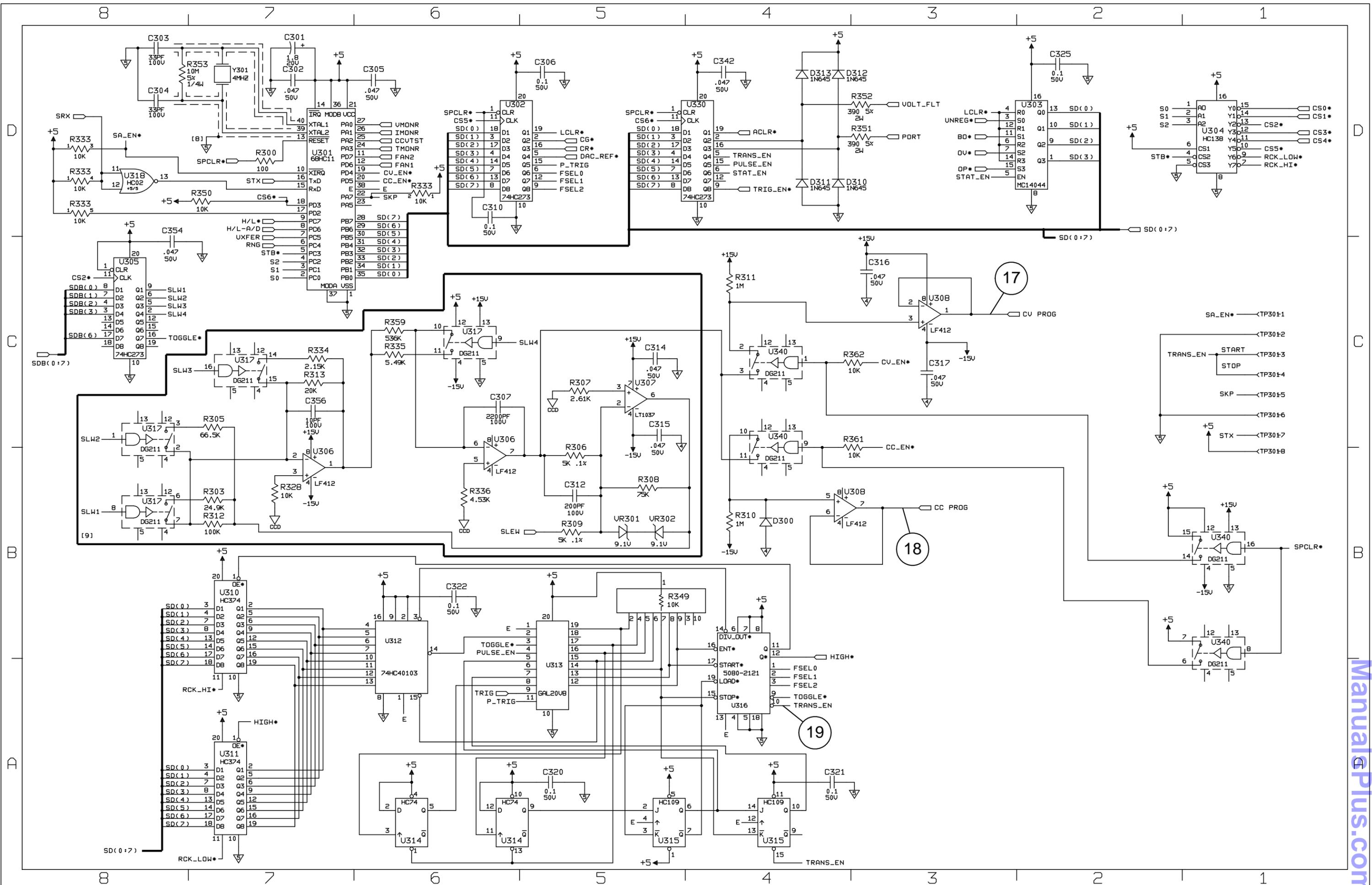


Figure 6-1. 6060B/6063B Electronic Load Schematic (Sheet 3 of 6)

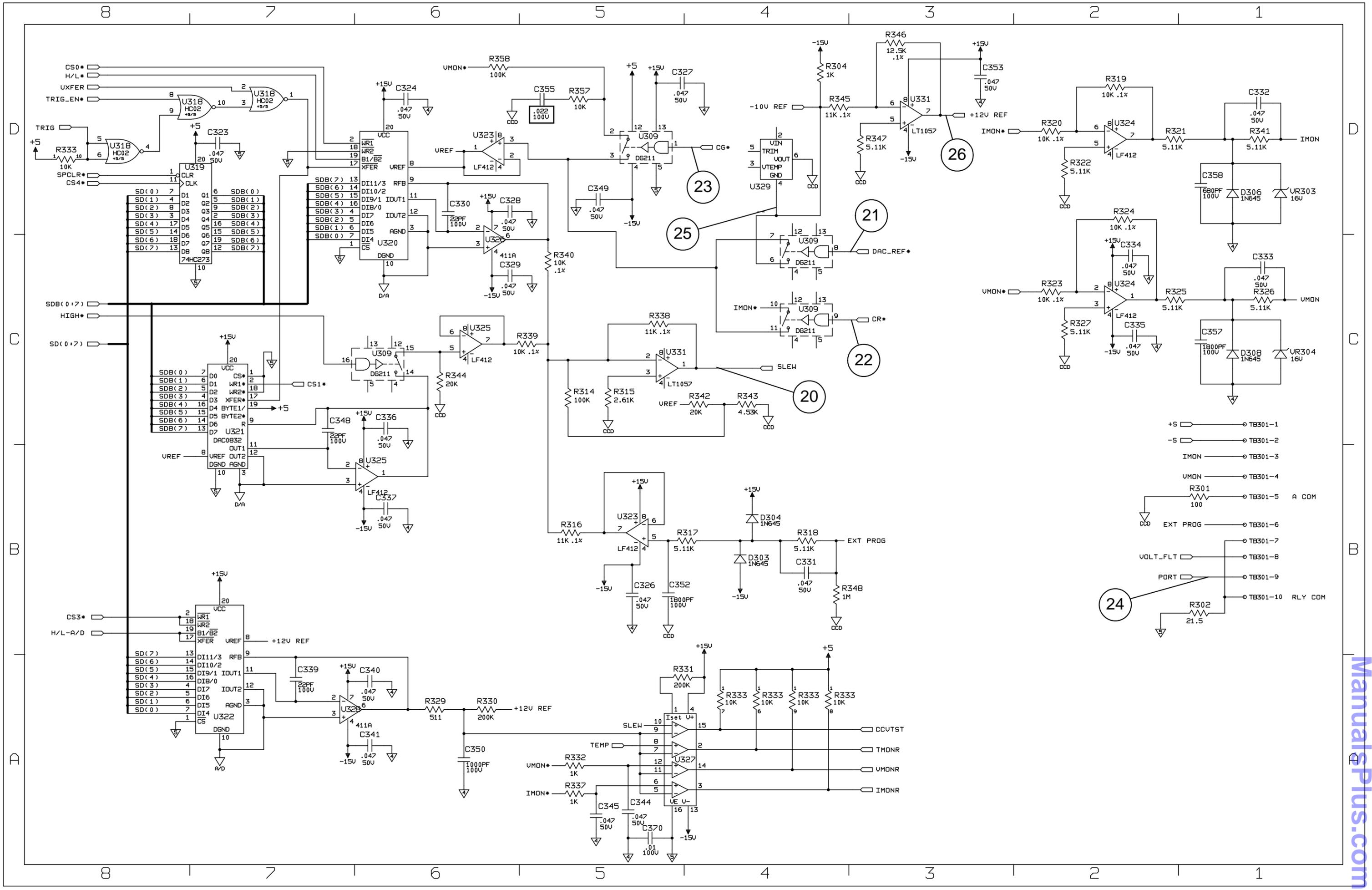


Figure 6-1. 6060B/6063B Electronic Load Schematic (Sheet 4 of 6)

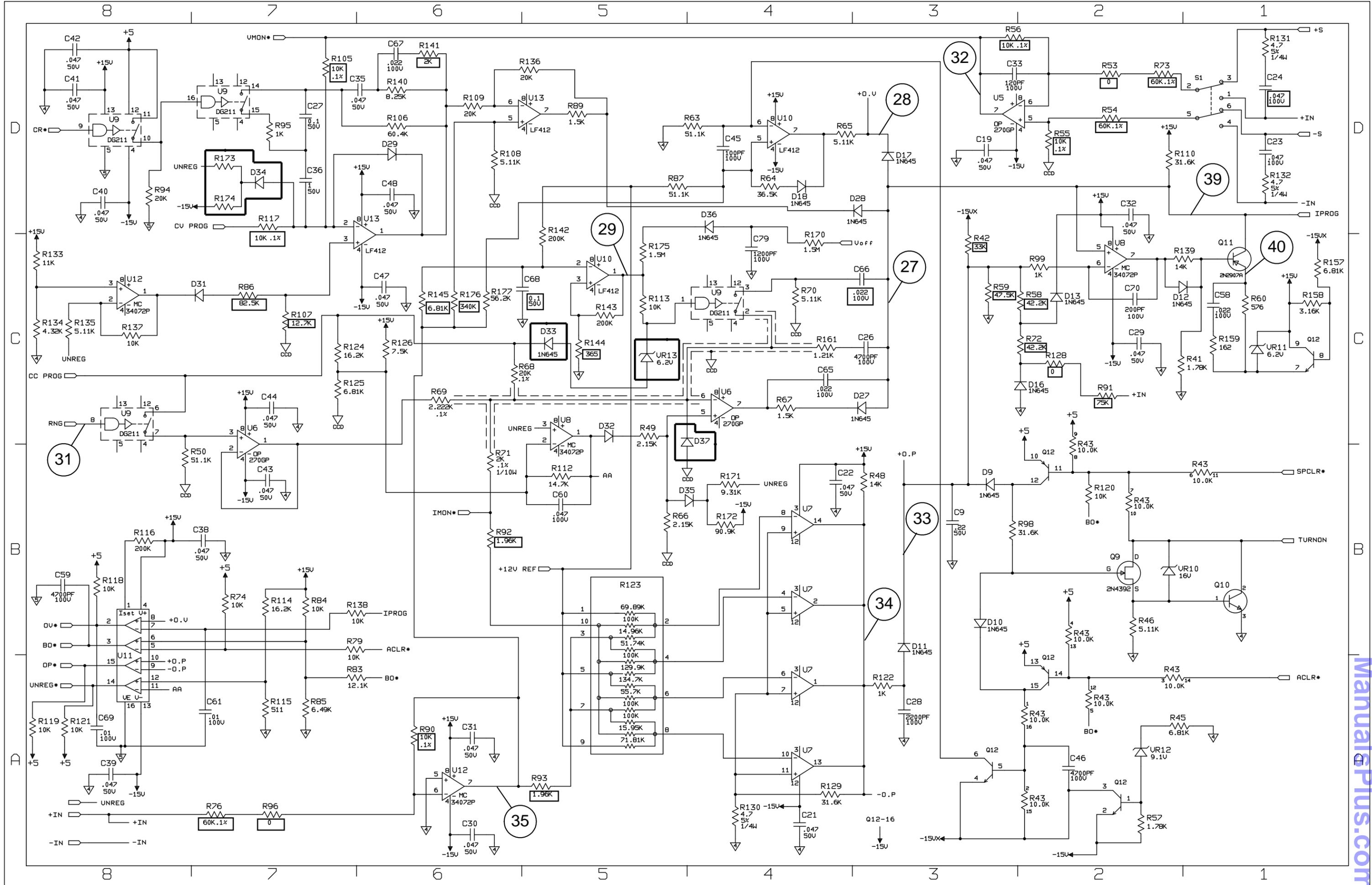


Figure 6-1. 6060B/6063B Electronic Load Schematic (Sheet 5 of 6)

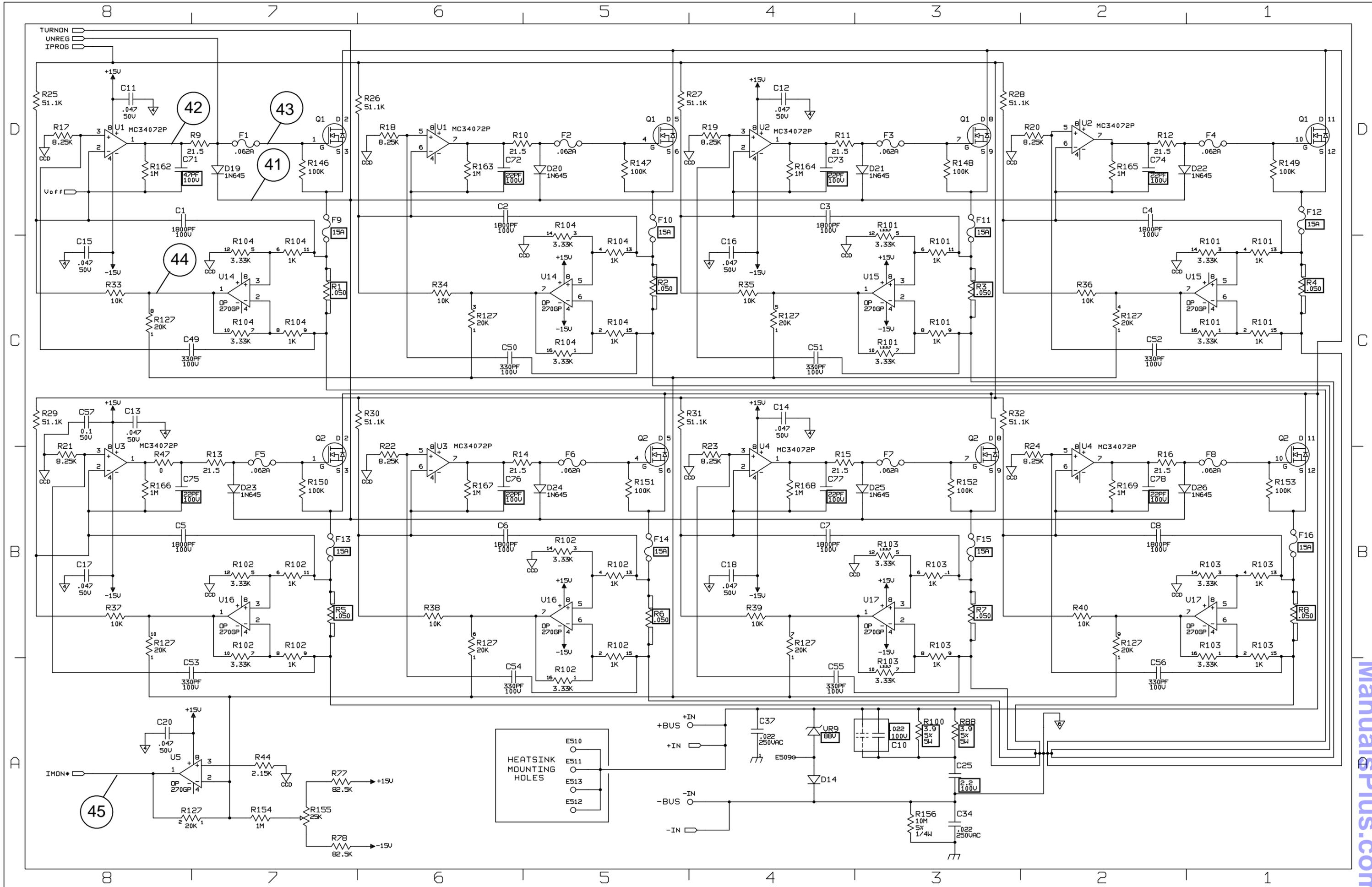


Figure 6-1. 6060B/6063B Electronic Load Schematic (Sheet 6 of 6)

DMM COMMON
IMON ADJUST

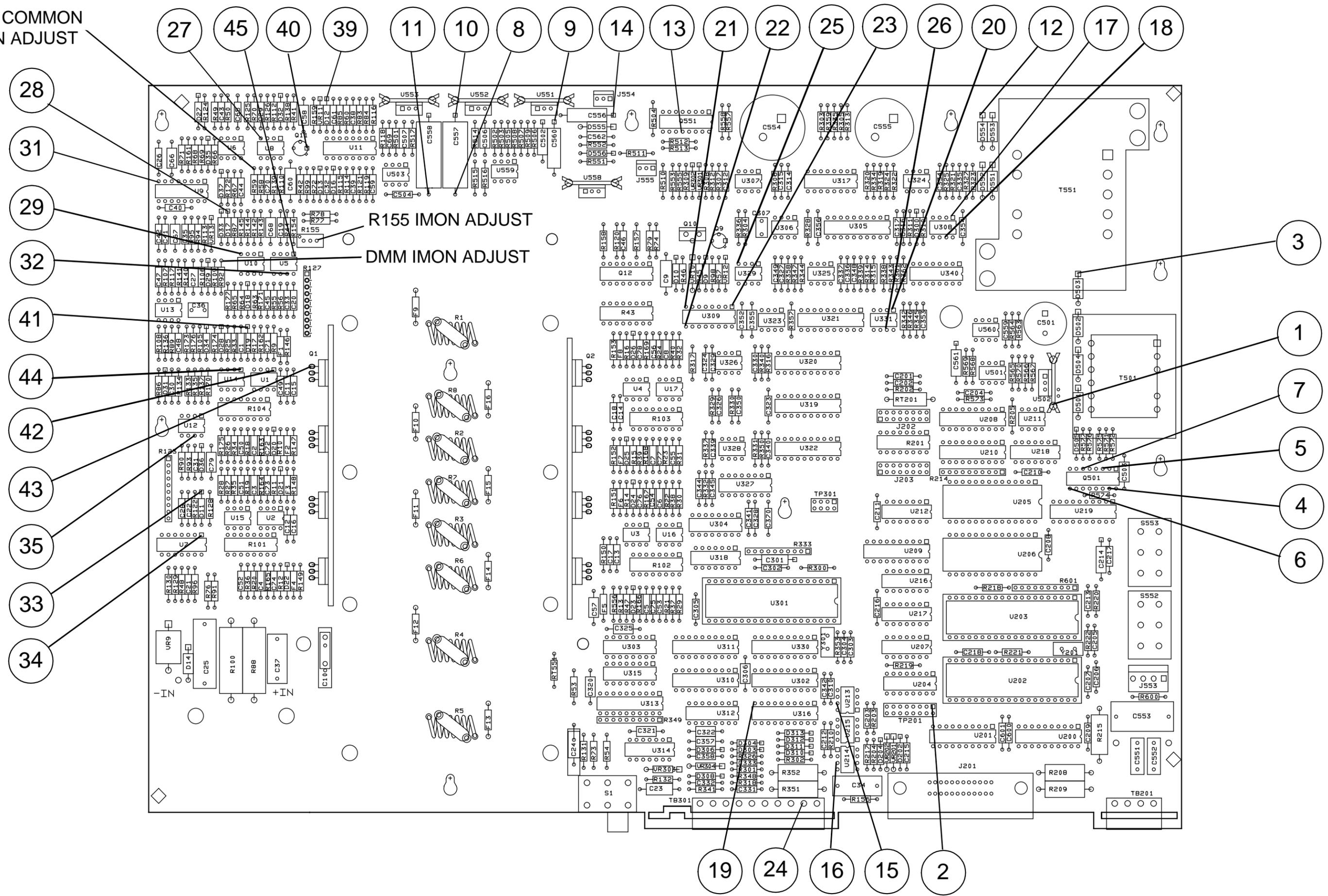


Figure 6-2. Main Circuit Board Component Locations

Manual Backdating

This section describes changes that must be made to the manual so that it applies to instruments with serial numbers lower than those listed on the title page. Look in the following table for the serial number of your instrument, and make only those changes listed for your instrument. Note that for some changes, you may be instructed to update the instrument if certain components are being replaced during repair.

| Serial Prefix | <u>6060B</u> Serial Number | Changes |
|----------------------|---------------------------------------|----------------|
| 3119A | 00101-00775 | 1 - 3 |
| 3326A | 00776-01205 | 1, 2 |
| 3436A | 01206-02435 | 1 |
| | <u>6063B</u> Serial Number | |
| 3117A | 00101-00256 | 1-3 |
| 3249A | 00257-00306 | 1-3 |
| 3326A | 00307-00391 | 1, 2 |
| 3434A | 00392-01016 | 1 |

Change 1

Make the following changes in Table 5-3:

Change: A1 (6060B) main board to p/n 06060-60023

A1 (6063B) main board to p/n 06063-60023

U202 to p/n 1820-2549

U203 to p/n 1820-3367

U205 to p/n 06063-80002

U301 to p/n 1820-7673

Delete: C218, 0.01uF, p/n 0160-4832

R222,353 10M, p/n 0699-1797

R220 10K, p/n 0757-0442

R221, 300 100 p/n 0757-0401

R601, NETWORK-RES p/n 1810-0278

U219 IC MC74HC373N p/n 1820-2998

In Table 5-4, delete ferrite bead kit.

Change 2

Make the following changes in Table 5-3:

Change: A1 (6060B) main board to p/n 06060-60022

A1 (6063B) main board to p/n 06063-60022

Delete: U201, p/n 1820-6045.

U200, p/n 1820-6170.

C601, .047uF, p/n 0160-5422.

Add: U201, p/n 1LH4-0001.

Change 3

In Table 5-3, delete R600.

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Technical data is subject to change.