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

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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.

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LIMITATION OF WARRANTY

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

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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.

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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.

or

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.

Table of Contents

1

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.

2

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 ± ((DMM reading in amps X 0.0005) + 0.065)
6063B: DMM reading in amps ± ((DMM reading in amps X 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.

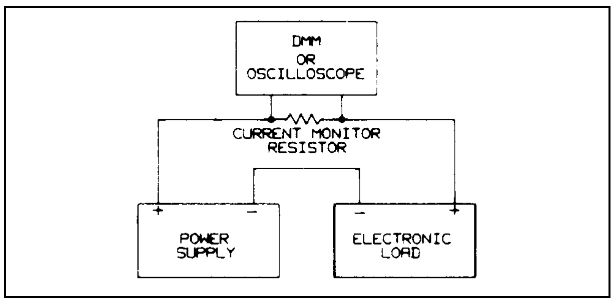


Figure 2-1. Test Setup A

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 annunicator 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: [Range] [6] [0] [Enter] then [CURR] [6] [Enter] .
      6063B: [Range] [1] [0] [Enter] then [CURR] [1] [Enter] .

   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: [CURR] [1] [Enter] .
      6063B: [Range] [0] [.] [1] [Enter] .

   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 ± ((DMM reading X 0.0005) + 0.045)
6063B: DMM reading ± ((DMM reading X 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.

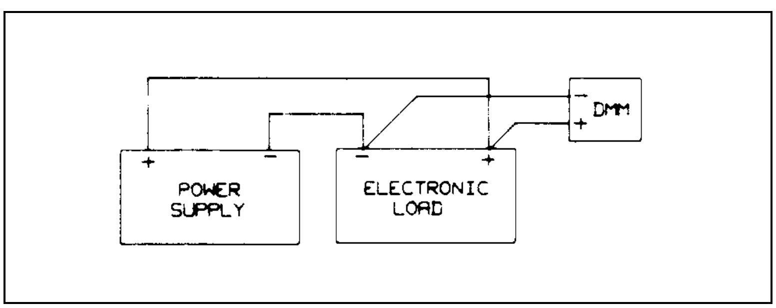


Figure 2-2. Test Setup B

b. Press [MODE] [VOLT] [Enter] , then
   6060B: [VOLT] [6] [0] [Enter] .
   6063B: [VOLT] [2] [4] [0] [Enter] .

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 [VOLT] [3] [Enter] .

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:

Load resistance = Input voltage/(voltage across resistor/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:
   1. Press [MODE] [RES] [Enter] , then
      6060B: [Range] [0] [.] [9] [Enter] ; [RES] [1] [Enter] .
      6063B: [Range] [1] [Enter] ; [RES] [2] [4] [Enter] .

   2. 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.

   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: 0.984 and 1.016 ohms.
   6063B: 23.6 and 24.4 ohms.
   Note that the Electronic Load's CR annunciator is on.

   4. Then press:
      6060B: [RES] [0] [.] [0] [5] [Enter] .
      6063B: [RES] [1] [Enter] .

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: Range 1 0 Enter , then RES 3 0 Enter .
   6063B: Range 2 5 Enter , then RES 5 0 0 Enter .

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: RES 1 Enter .
   6063B: RES 2 4 Enter .

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: Range 1 0 0 1 Enter , then RES 1 2 0 Enter .
   6063B: RES 1 2 0 Enter , then RES 2 0 0 0 Enter .

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: RES 1 2 Enter .
   6063B: RES 2 4 0 Enter .

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.

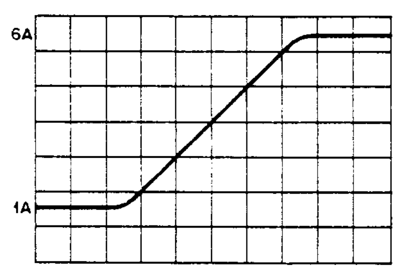
b. Recall the factory default values by pressing
[Recall] [7] [Enter] .

c. Select the low current range by pressing
[Range] [6] [Enter] .

d. Set up transient operation by pressing
[CURR] [1] [Enter] , then
6060B: [Tran Level] [6] [Enter] .
6063B: [Tran Level] [9] [.] [4] [Enter] .

e. Set the slew rate by pressing
[ ] (blue shift key), then
6060B: [Slew] [0] [.] [0] [5] [Enter] , then [Tran on/off] .
6063B: [Slew] [0] [.] [0] [8] [3] [Enter] , then [Tran on/off] .

f. Adjust the oscilloscope for a single rise or fall time display. Use delayed sweep. The rise time when measures from 10% to 90% or the fall time when measured from 90% to 10% should be between 60 and 100µs
Note that the Electronic Load's **Tran** annunciator is on.



20µs/DIV
6060B: SLEW 0.05
6063B: SLEW 0.083

g. Set the slew rate by pressing
[ ] (blue shift key), then
6060B: [Slew] [0] [.] [0] [0] [2] [5] [Enter] , then
6063B: [Slew] [0] [.] [0] [0] [4] [2] [Enter] , then
[Freq] [6] [0] [Enter] .

h. Adjust the oscilloscope for a single rise or fall time display. Use delayed sweep. The rise time when measures 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.

a. 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.

b. Turn the load's ac power off, then on.

c. Press CURR 1 0 Enter .

d. DMM reading should be less than:
6060B: 4mA rms
6063B: 1mA rms.

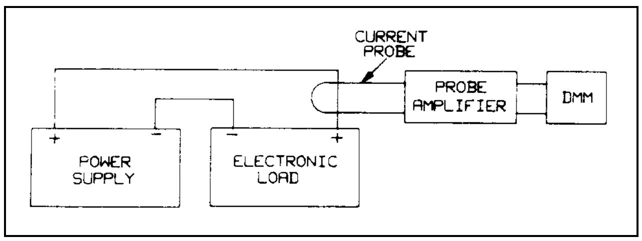


Figure 2-3. Test Setup C

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.

a. Connect the Electronic Load and the power source as shown in Figure 2-2.

b. Turn on the Electronic Load and run for approximately five minutes with no power being dissipated (no input power).

c. Then Press MODE VOLT Enter , then
6060B: VOLT 2 0 Enter .
6063B: VOLT 3 5 Enter .

a. 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 $\boxed{\text{Meter}}$ 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 $\boxed{\text{Prot Clear}}$. 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 $\boxed{\text{Prot Clear}}$ 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**

Serial No. ______________________________

Options ______________________________

Firmware Rev. ______________________________

Ambient temperature ______________________________ °C

Relative humidity ______________________________ %

Line frequency ______________________________ Hz (nominal)

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 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	

3

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.

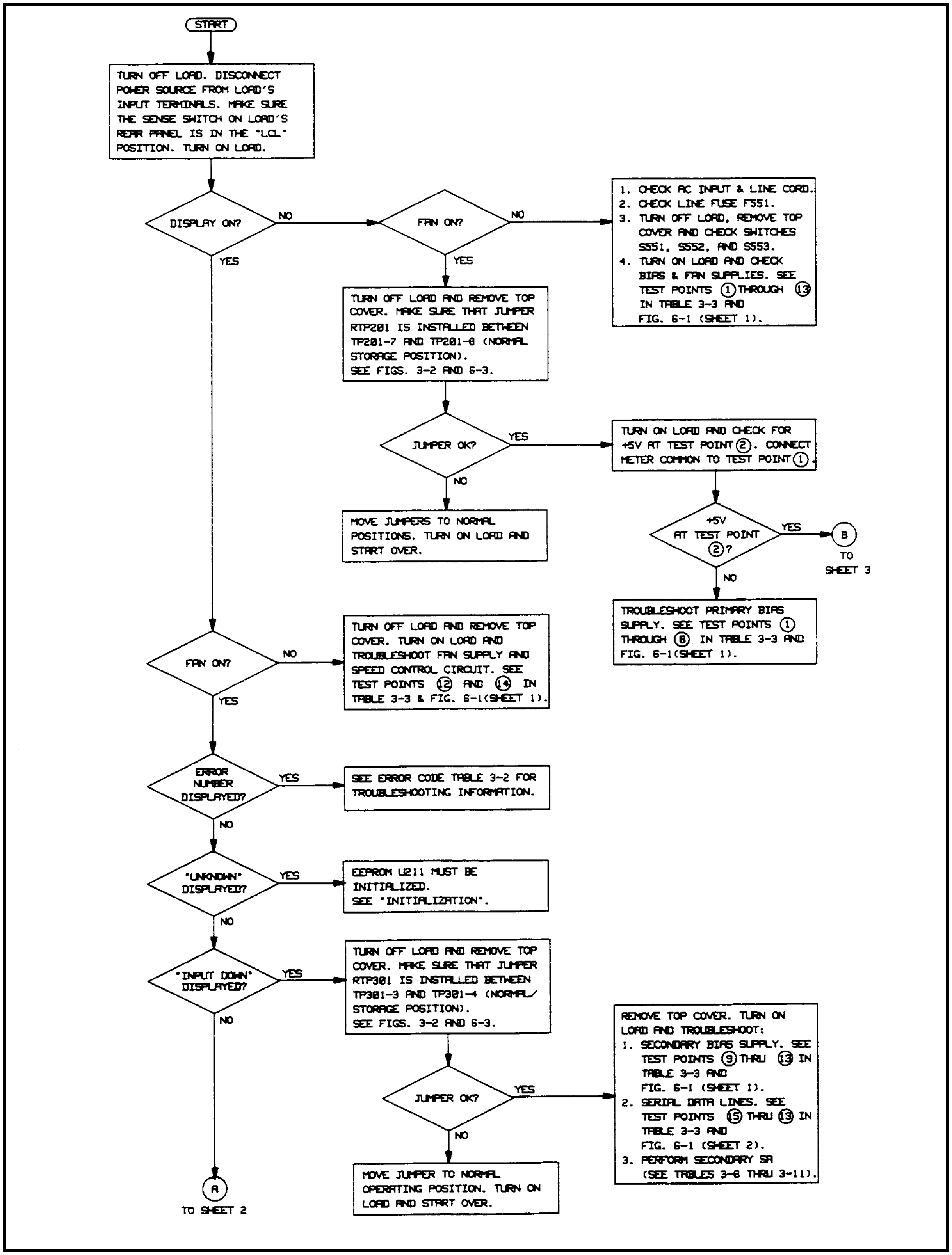


Figure 3-1. Overall Troubleshooting Flowchart (Sheet 1 of 3)

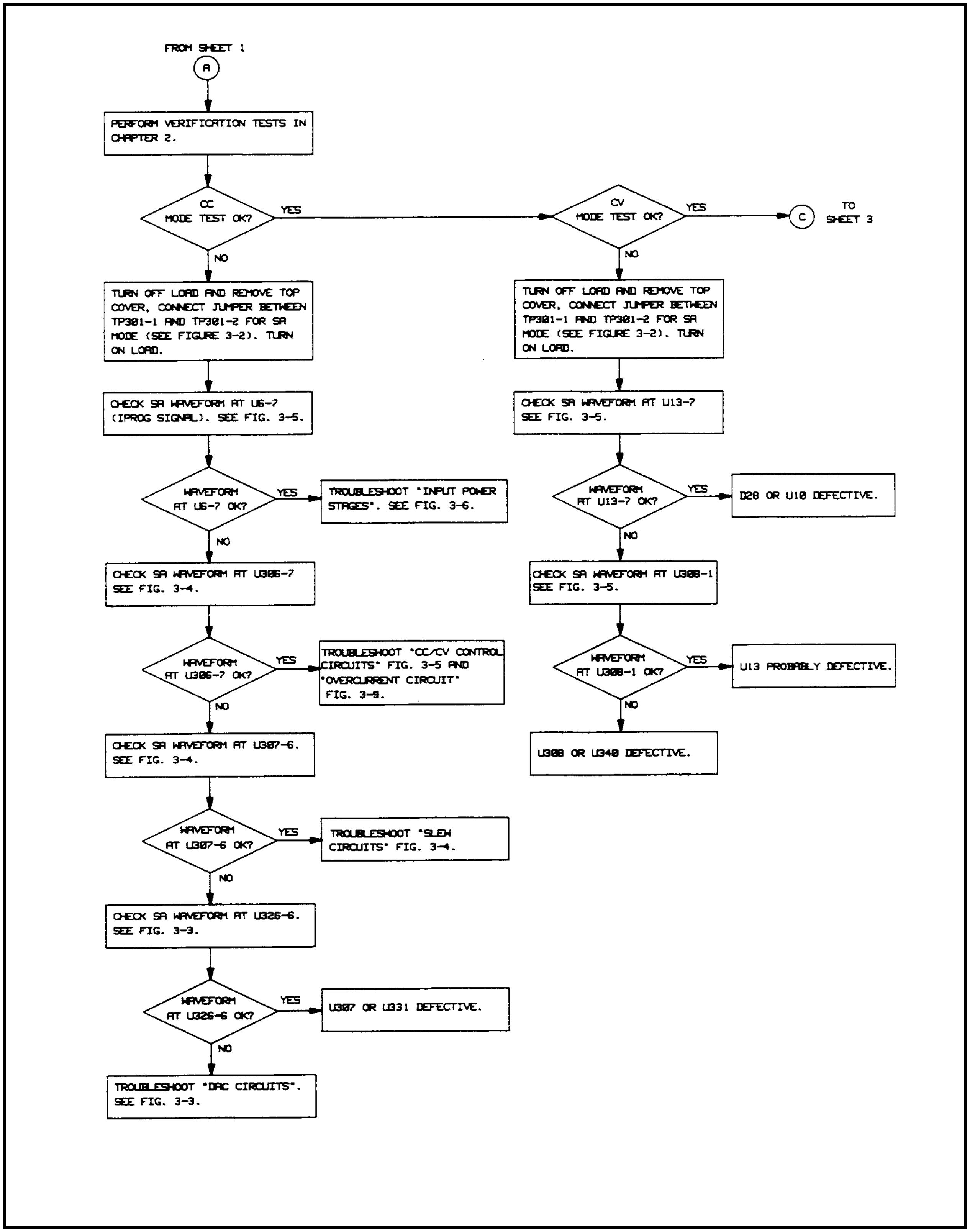


Figure 3-1. Overall Troubleshooting Flowchart (Sheet 2 of 3)

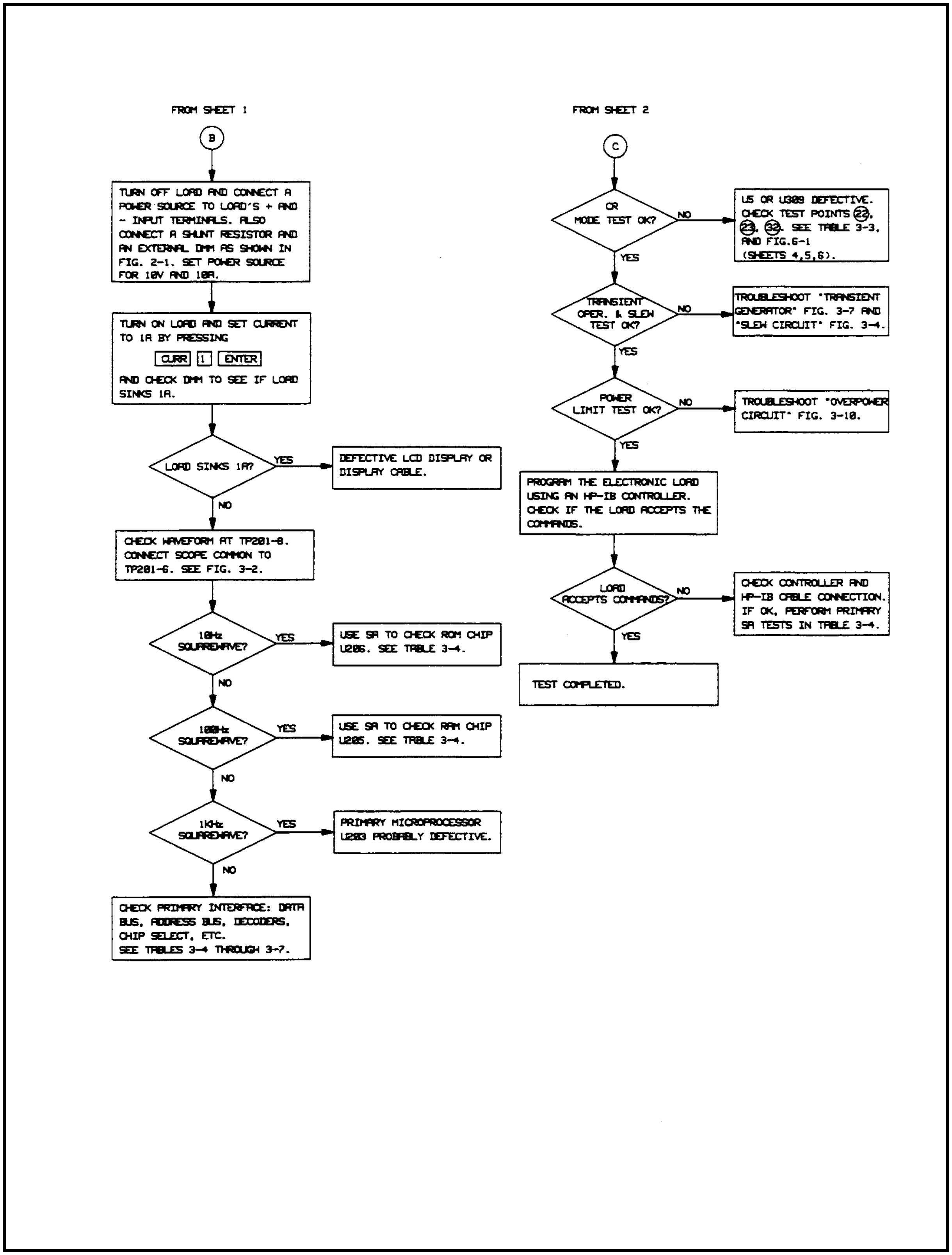


Figure 3-1. Overall Troubleshooting Flowchart (Sheet 3 of 3)

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 $\overline{\text{EEPON}}$ line (test point 7 in Table 3-3). If $\overline{\text{EEPON}}$ 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

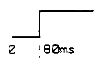
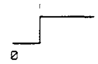
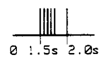
Test Point Number	Signal	Measurement and Conditions
Connect meter or scope common to test point ① when taking measurements at test points ② through ⑦		
① U502-2	Primary/Chassis ground	-
② Q501-10	+ 5V (primary bias)	+ 5V (4.8 to 5.2V).
③ D503-cath	+ 13V (primary bias rectifiers)	+ 13V (13 to 17 Vdc).
④ Q501-15	$\overline{\text{OPTO\_CLR}}$ 	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	$\overline{\text{PCLR}}$ 	Held low for approximately 80ms at power on and then goes high.
⑦ Q501-6	$\overline{\text{EEPON}}$ 	At power on, holds the EEPROM's clock off to protect against accidental data write when power is initially applied.
Connect meter common to test point ⑧ when taking measurements at test points ⑨ through ㊺.		
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	$\overline{\text{SPCLR}}$ 	Held low for approximately 80ms at power on and then goes high.
⑭ C556 +	Fan voltage	Press the front panel (blue [ ] 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	IPROG	Under normal operating conditions (input is regulated) measurement should be approximately: -0.1V X Iin (6060B). 0.67V X Iin (6063B). With input unregulated or disconnected, the measurement will be: 0V in CURR Mode. +0.9V in VOLT or RES MODE.
28 D17 -cath	+ OV	+ 14V when OV condition is false (normal). -13V when OV condition is true.
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.
40 Q11-E	OC circuit control	+ 10V when OC condition is false (normal). 0V when unregulated or when OC condition is true.
41 D19-K	Input Power Stage Turn on	+ 5V when turned on. 0V when turned off.
42 U1-1	Input Power Stage 1	6.3V (approx.) with full rated input current. -0.5V (approx.) with the input off.
43 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.
44 U14-1	Input Power Stage 1	1.25V for at full input current.
45 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	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): RPT201 between TP201-7 and TP201-8; RTP301 between TP301-3 and TP301-4.

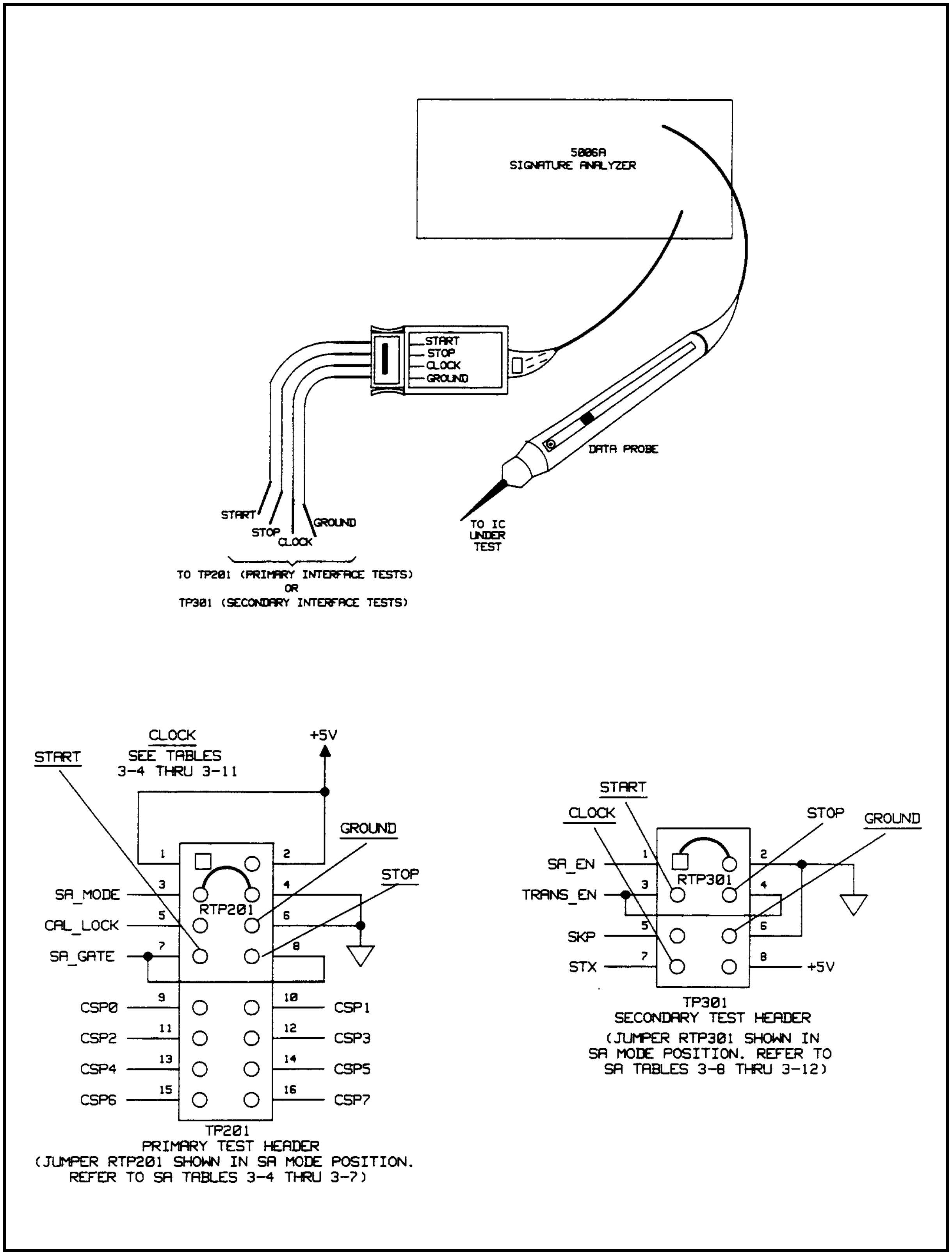


Figure 3-2. Test Headers Test Setup for Signature Analysis

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	μP 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 firrnware 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-lB	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"	= O7C3
U210-6,14	= 07U3 press keypad "INPUT"	= O772
U210-7,13	= 07U3 press keypad "LOCAL"	= O7C3
U210-8,12	= 07U3 press keypad "VOLT"	= O7UC
U210-9,11	= 07U3 press keypad "RECALL"	= O7C3
U210-10	= OOOO common	
U210-16	= O7U3 if CAL LOCK low	= OOOO pulsing
U210-18	= O6U1 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 (prirnary cornrnon) 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 firrnware 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
$\overline{\text{SPCLR}}$	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 = 1UUO	U330-7 = 1UUO
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
	U319-20 = +5V	U320-20 = +15V	U321-20 = +15V
Common	U319-10	U320-1,3,10,12,18	U321-1,3,10,12,18
$\overline{\text{SPCLR}}$	U319-1 = +5V		
SD(0)	U319-7 = UFOA		
SD(l)	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(l)	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	U321-2 = 1UPU
		U320-17 = 41AH	U321-17 = 41AH
		U320-19 = O62O	
		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.

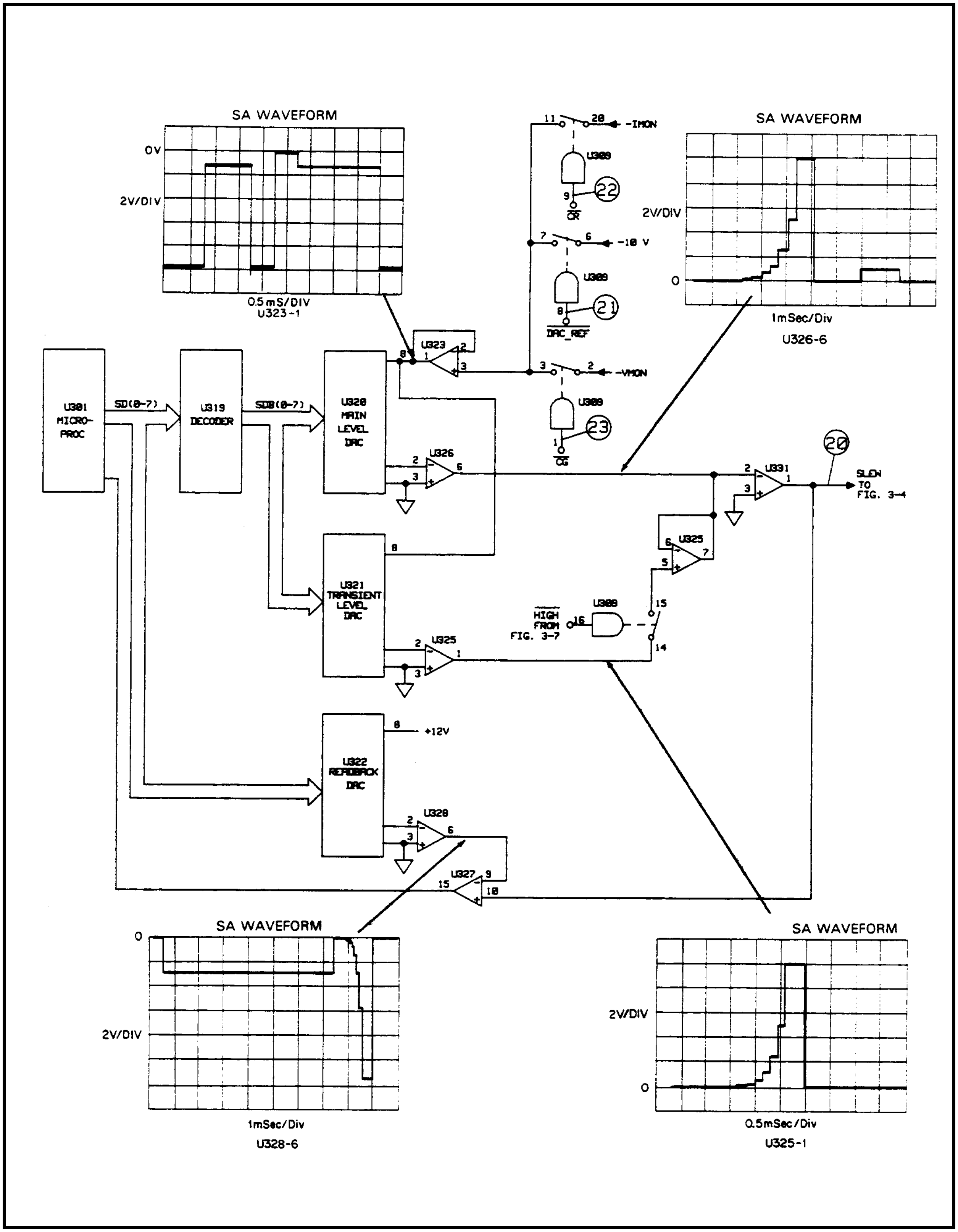


Figure 3-3. DAC Circuits Troubleshooting

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/µs) 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)	6060B only
Slew = 2.5	(Slew Rate #11)	

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 $\overline{\mathrm{CC\_EN}}$ 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 $\overline{\mathrm{CV\_EN}}$ 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 $\overline{\mathrm{CC\_EN}}$ or $\overline{\mathrm{CV\_EN}}$ input is LO, the applicable switch should be closed. You can use S.A. Table 3-10 to check the $\overline{\mathrm{CC\_EN}}$, or $\overline{\mathrm{CV\_EN}}$ 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.

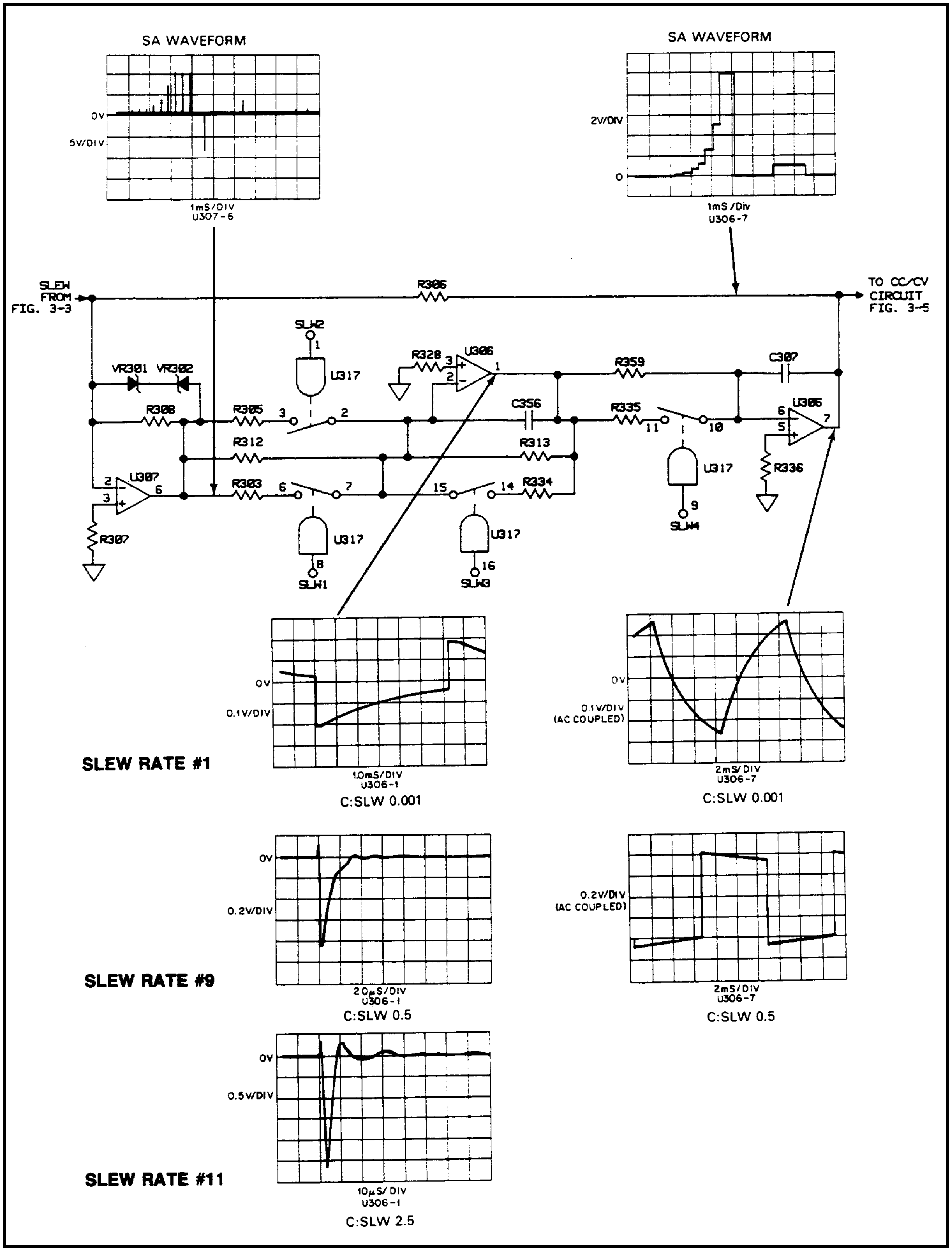


Figure 3-4A. Slew Circuits Troubleshooting for 6060B

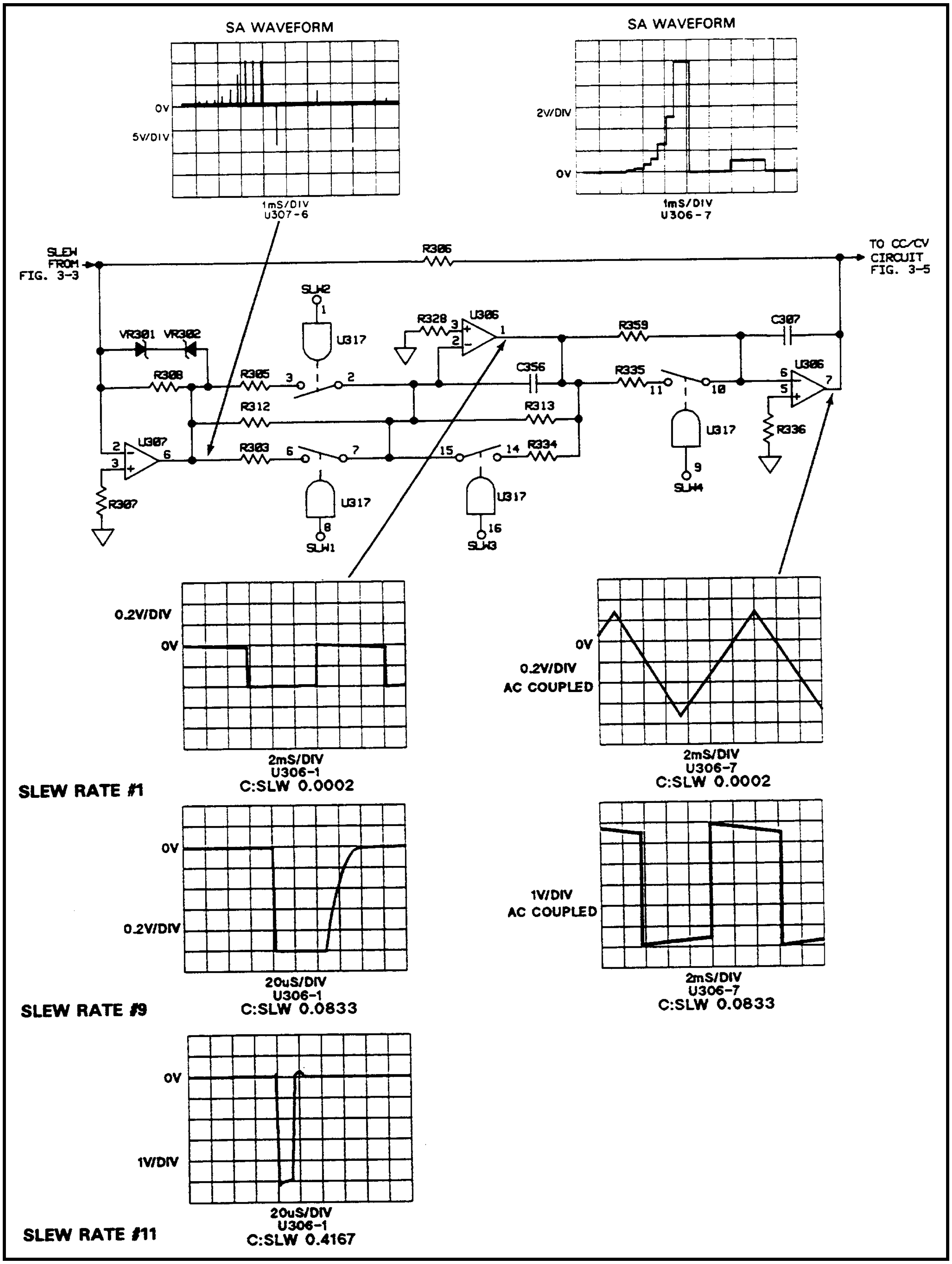


Figure 3-4B. Slew Circuits Troubleshooting for 6063B

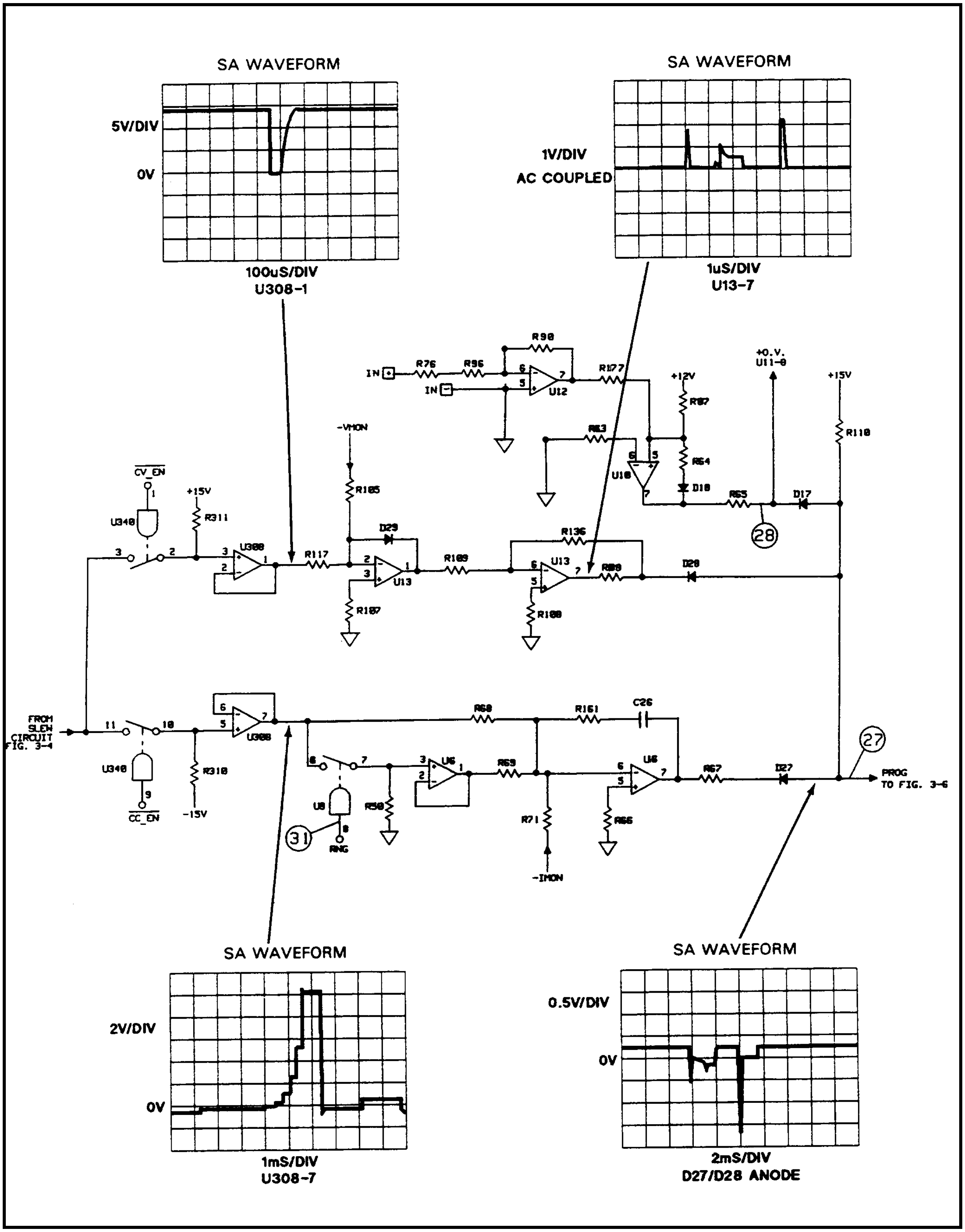


Figure 3-5. CC/CV Control Circuits Troubleshooting

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 toFigure 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.

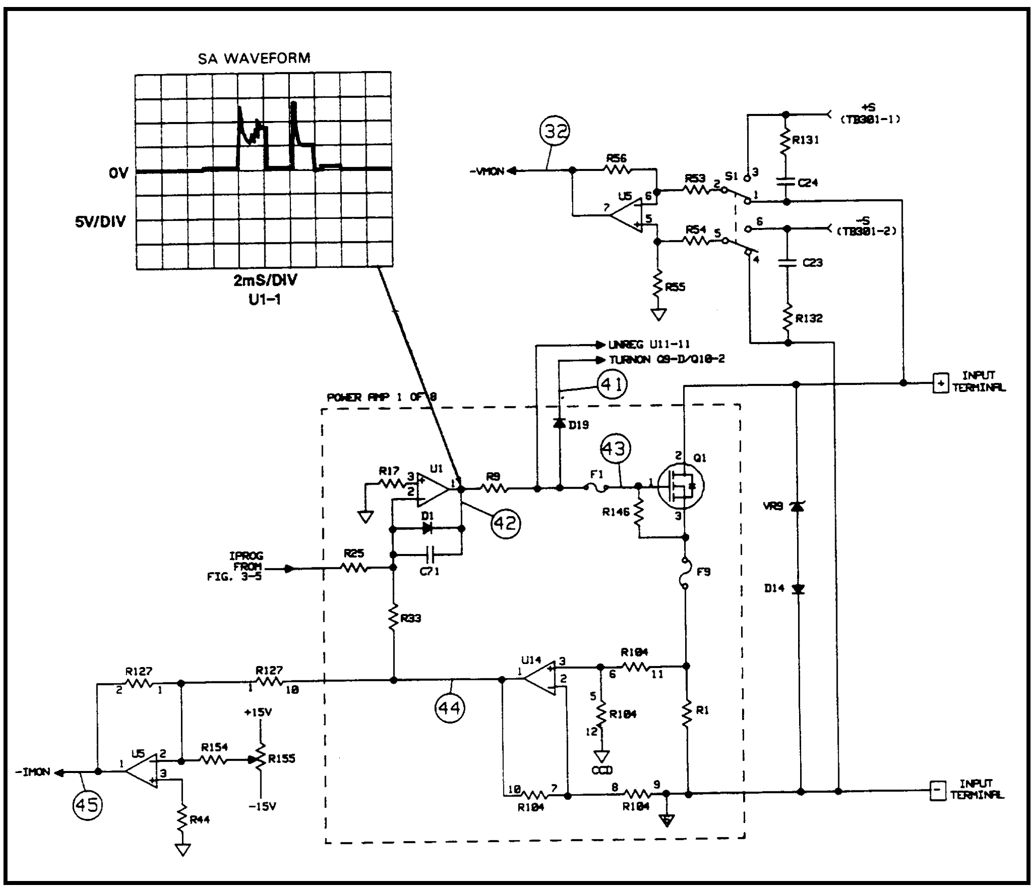


Figure 3-6. Input Power Stages Troubleshooting

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 1µs pulse intervals at U312-14, and U316-14 with a scope.

FSEL TABLE

Front Panel	FSEL INPUTS			interval between 1µs pulses	
Frequency	0	1	2	@U312-14	@U316-14
10000Hz	LO	LO	LO	LO	50µs
1000Hz	HI	LO	LO	10µs	500µs
100Hz	LO	HI	LO	100µs	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
```

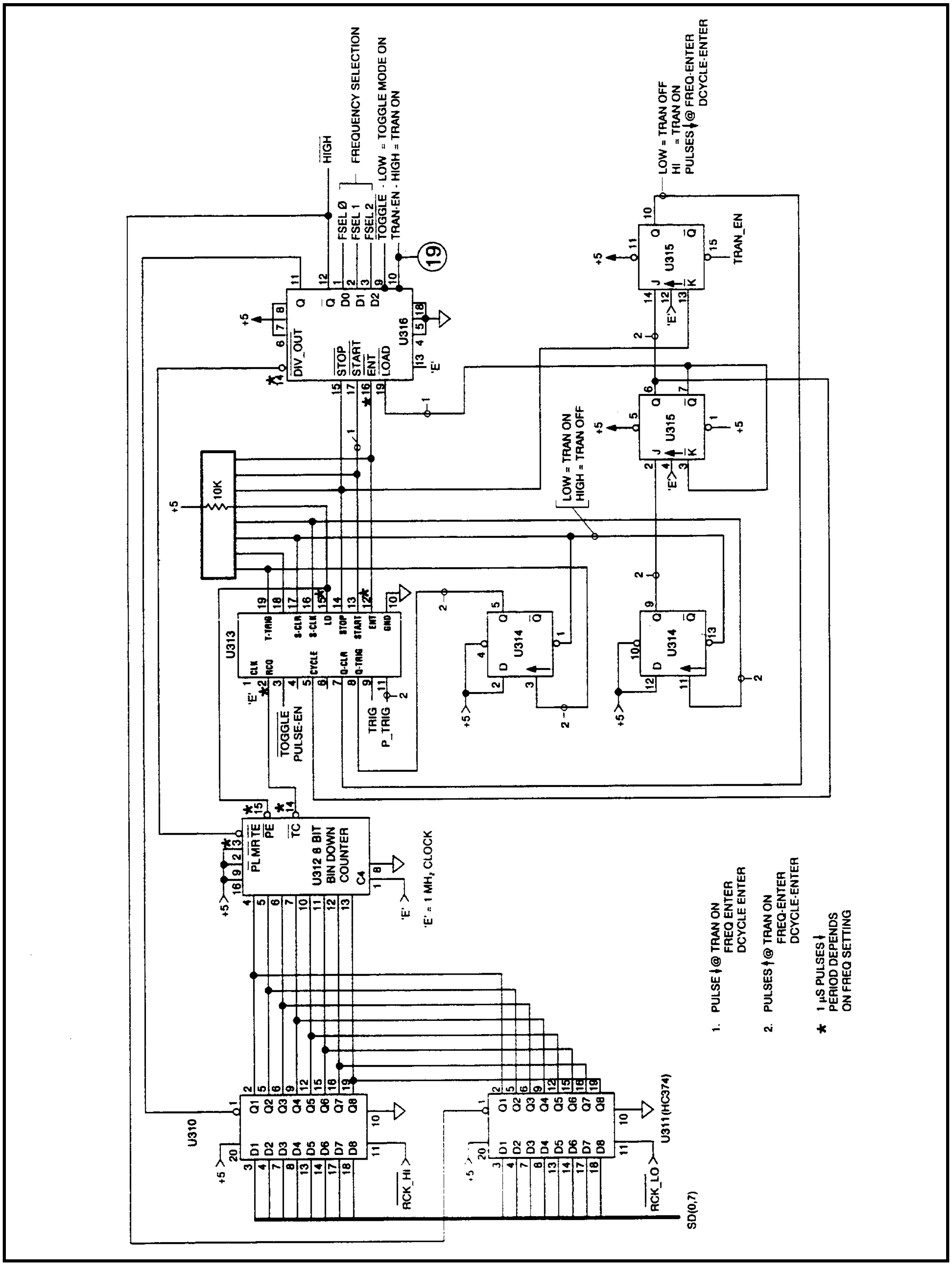


Figure 3-7. Transient Generator Troubleshooting

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				RESULT: 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 1 0 0 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.

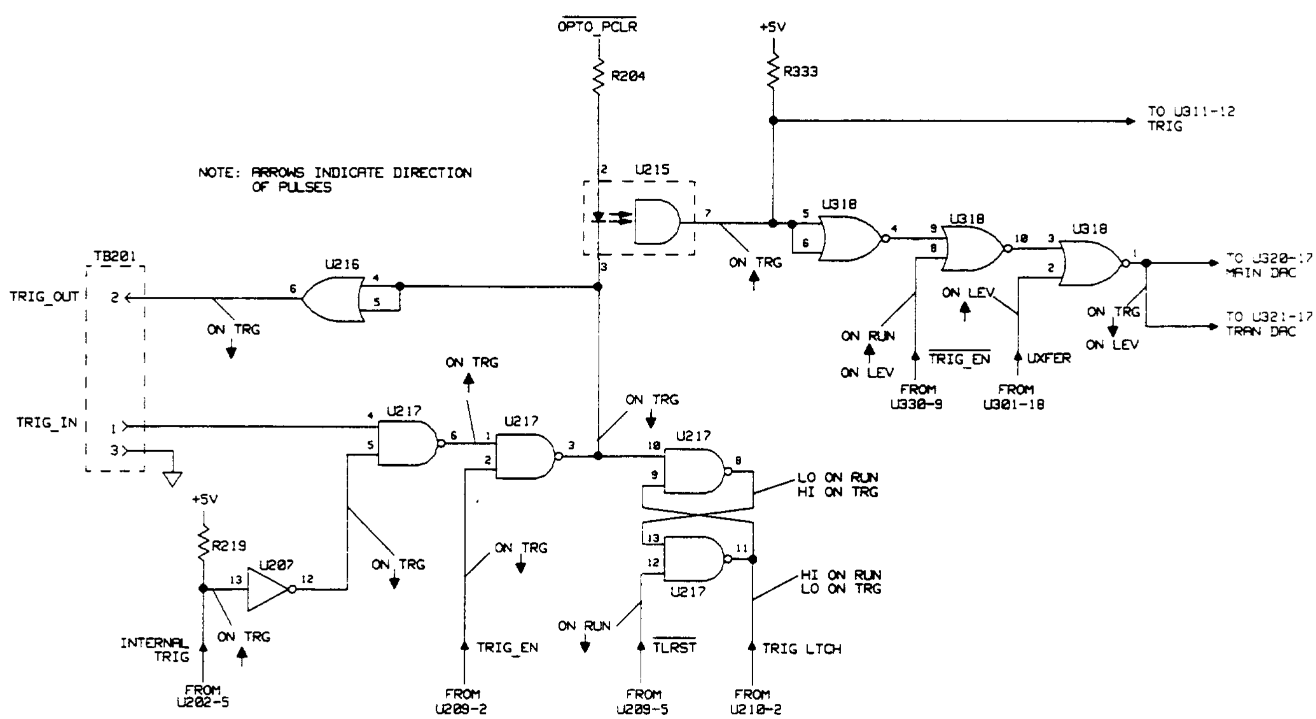


Figure 3-8. Trigger Circuit Troubleshooting

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.

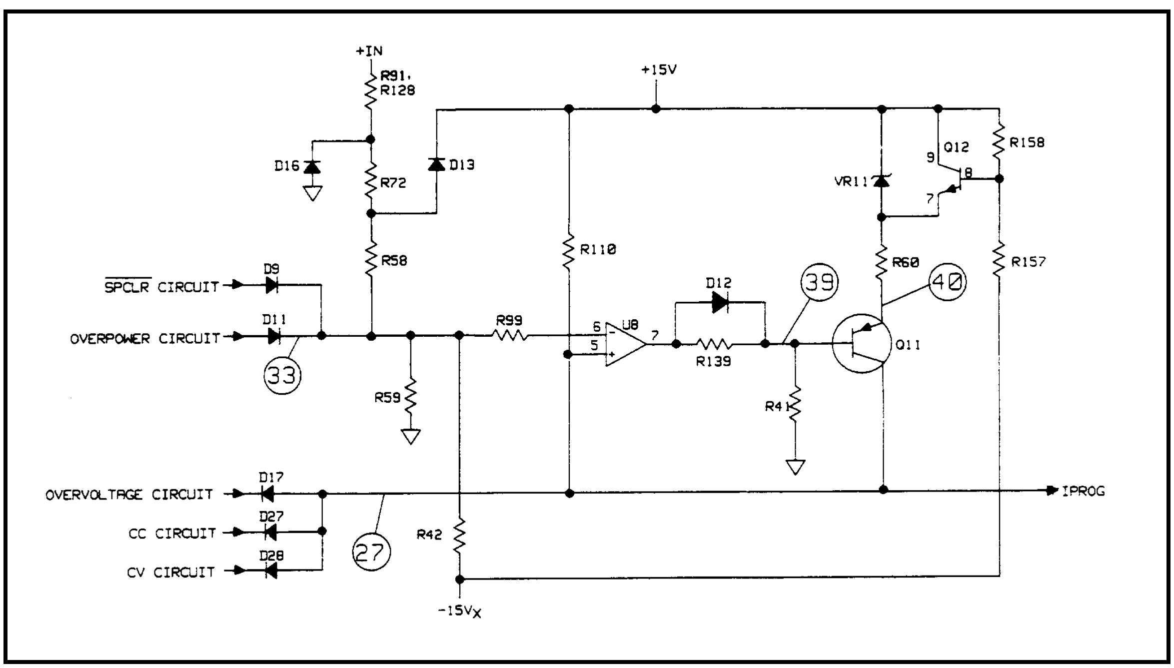


Figure3-9. Overcurrent Circuit Troubleshooting

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).

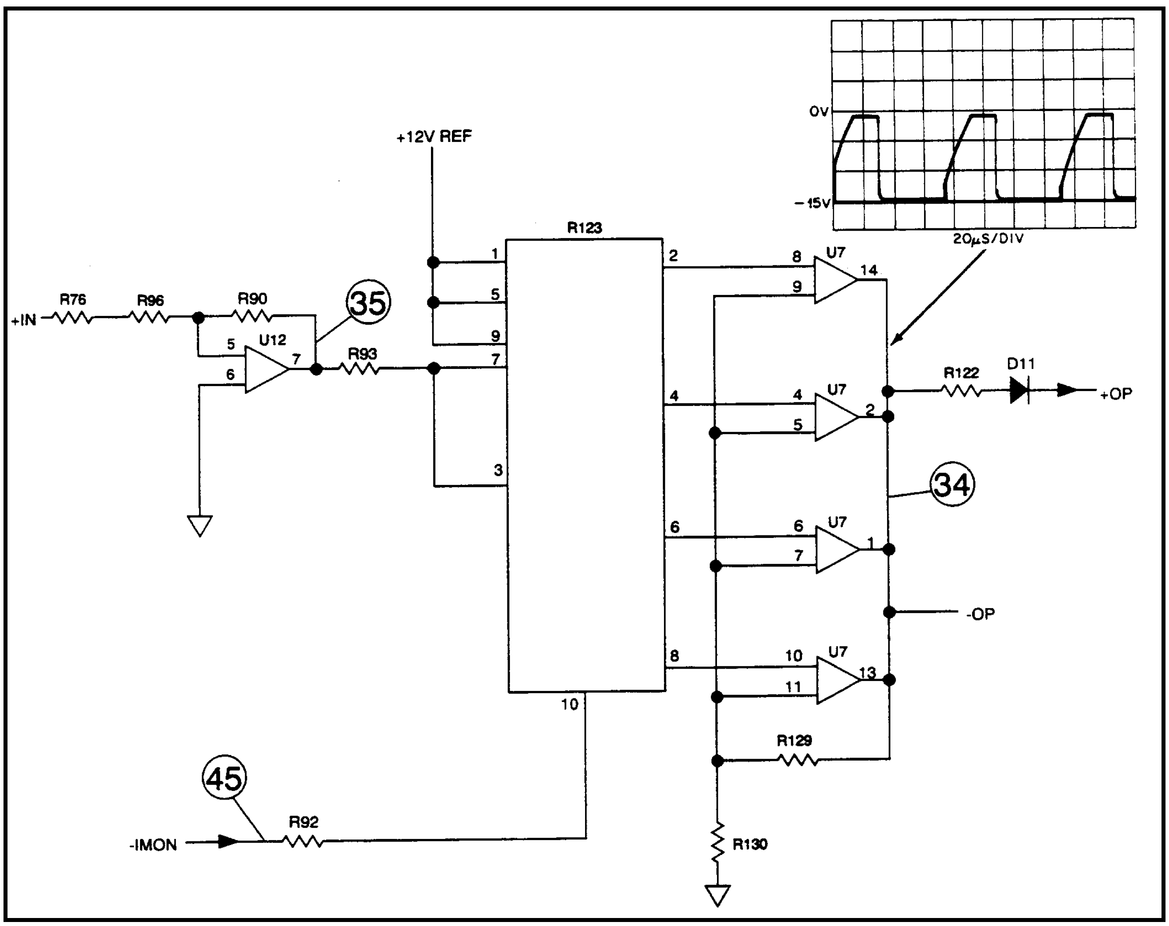


Figure 3-10. Overpower Circuit Troubleshooting

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 l.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 2l,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.

4

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.

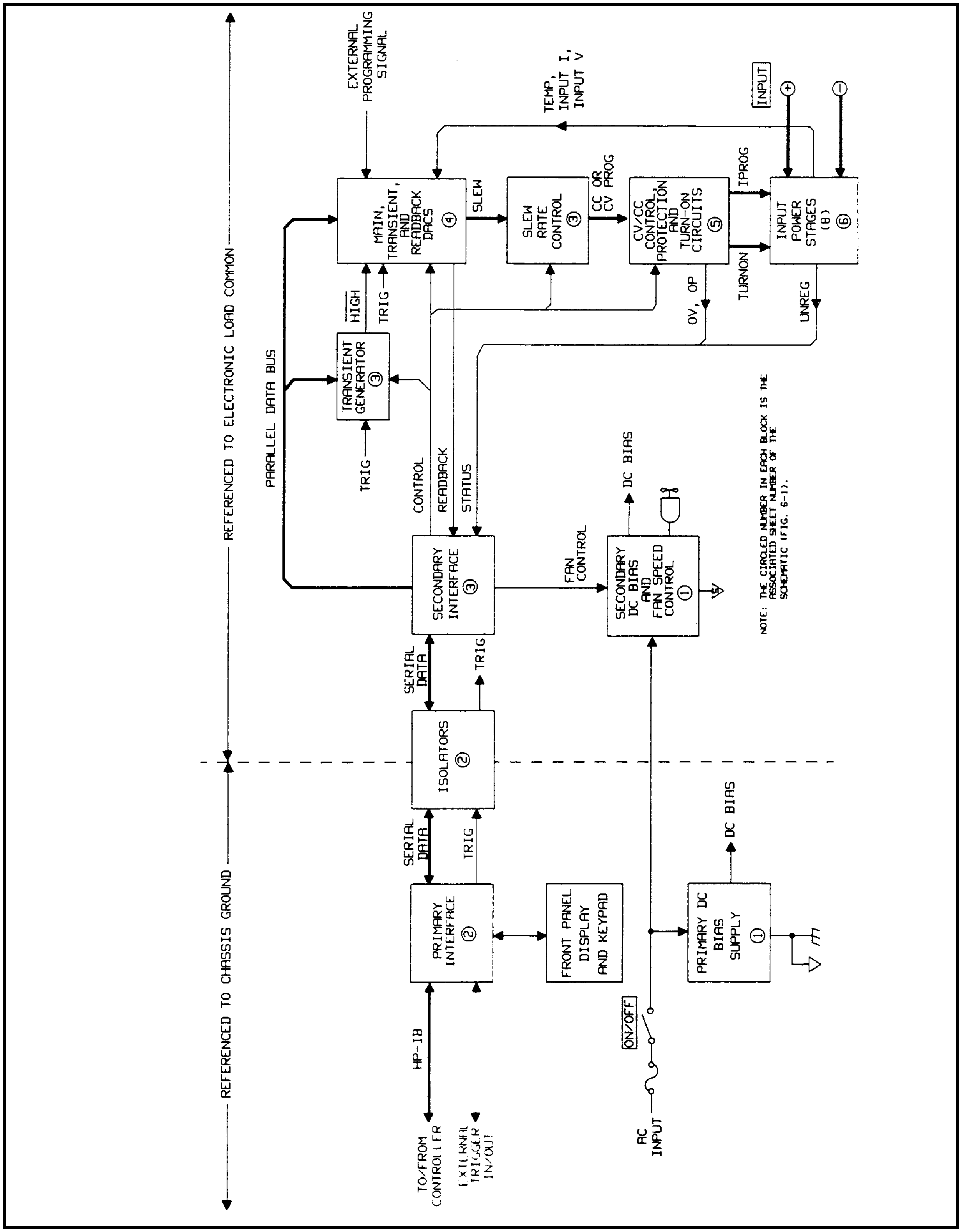


Figure 4-1. Agilent 6060A Electronic Load, Block Diagram

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 ± 240Vdc 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.

5

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 P1ug	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	Meta1 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 ±5% 100V
C9	BOTH	0160-5098	CAP-FXD 0.22uF ±10% 50V
C10	6060B	0160-4833	CAP-FXD 0.022uF ±10% 100V
C10	6063B	0160-2569	CAP-FXD 0.02uF ±20% 2 kV
C11-22	BOTH	0160-5422	CAP-FXD 0.047uF ±20% 50V
C23	6060B	0160-4834	CAP-FXD 0.047uF ±10% 100V
C23	6063B	0160-5422	CAP-FXD 0.047uF ±20% 50V
C24	6060B	0160-4834	CAP-FXD 0.047uF ±10% 1WV
C24	6063B	0150-0052	CAP-FXD 0.05uF ±20% 400V
C25	6060B	0160-7024	CAP-FXD 2.0uF ±10% 100V
C25	6063B	0160-7369	CAP-FXD 1uF ±10% 400V
C26	BOTH	0160-4831	CAP-FXD 4700pF ±10% 100V
C27	BOTH	0160-4835	CAP-FXD 0.1uF ±10% 50V
C28	BOTH	0160-4830	CAP-FXD 2200pF ±10% 100V
C29-32	BOTH	0160-5422	CAP-FXD 0.047uF ±20% 50V
C33	BOTH	0160-4800	CAP-FXD 120pF ±5% 100V
C34	BOTH	0160-4048	CAP-FXD 0.022µF ±20% 0V
C35	BOTH	0160-5422	CAP-FXD 0.047µF ±20% 50V
C36	BOTH	0160 5469	CAP-FXD 1µF ±10% 50V
C37	BOTH	0160-4048	CAP-FXD 0.022µF ±20% 0V
C38-44	BOTH	0160-5422	CAP-FXD 0.047µF ±20% 50V
C45	BOTH	0160-4801	CAP-FXD 100pF ±5% 100V
C46	BOTH	0160-4831	CAP-FXD 4700pF ±10% 100V
C47,48	BOTH	0160-5422	CAP-FXD 0.047µF ±20% 50V
C49-56	BOTH	0160-4810	CAP-FXD 330pF ±5% 100V
C57	BOTH	0160-4835	CAP-FXD 0.1µF ±10% 50V
C58	BOTH	0160-4833	CAP-FXD 0.022µF ±10% 100V
C59	BOTH	0160-4831	CAP-FXD 4700pF ±10% 100V
C60	BOTH	0160-5422	CAP-FXD 0.047µF ±20% 50V
C61	BOTH	0160-4832	CAP-FXD 0.01µF ±10% 100V
C65	BOTH	0160-4833	CAP-FXD 0.022µF ±10% 100V
C66	6060B	0160-4833	CAP-FXD 0.022µF ±10% 100V
C66	6063B	0160-5166	CAP-FXD 0.015µF ±20% 100V
C67	BOTH	0160-4833	CAP-FXD 0.022µF ±10% 100V
C68	6060B	0160-4835	CAP-FXD 0.1µF ±10% 50V
C69	BOTH	0160-4832	CAP-FXD 0.01µF ±10% 100V
C70	BOTH	0160-5349	CAP-FXD 200pF ±5% 100V
C71	6060B	0160-4805	CAP-FXD 47pF ±5% 100V
C71	6063B	0160-4807	CAP-FXD 33pF ±5% 100V
C72	6060B	0160-4787	CAP-FXD 22pF ±5% 100V
C72	6063B	0160-4807	CAP-FXD 33pF ±5% 100V
C73	6060B	0160-4787	CAP-FXD 22pF ±5% 100V
C73	6063B	0160-4807	CAP-FXD 33pF ±5% 100V
C74	6060B	0160-4787	CAP-FXD 22pF ±5% 100V
C74	6063B	0160-4807	CAP-FXD 33pF ±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 ±5% l00V
C75	6063B	0160-4807	CAP-FXD 33pF ±5% 100V
C76	6060B	0160-4787	CAP-FXD 22pF ±5% 100V
C76	6063B	0160-4807	CAP-FXD 33pF ±5% 100V
C77	6060B	0160-4787	CAP-FXD 22pF ±5% 100V
C77	6063B	0160-4807	CAP-FXD 33pF ±5% 100V
C78	6060B	0160-4787	CAP-FXD 22pF ±5% 100V
C78	6063B	0160-4807	CAP-FXD 33pF ±5% 100V
C79	BOTH	0160-4821	CAP-FXD 1200pF ±5% 100V
C201	BOTH	0160-5422	CAP-FXD 0.047µF ±20% 50V
C202	BOTH	0160-4808	CAP-FXD 470pF ±5% 100V
C203	BOTH	0160-4800	CAP-FXD 120pF ±5% l00V
C204	BOTH	0160-5422	CAP-FXD 0.047µF ±20% 50V
C205,206	BOTH	0160-4807	CAP-FXD 33pF ±5% 100V
C207-211	BOTH	0160-5422	CAP-FXD 0.047µF ±20% 50V
C212	BOTH	0160-4800	CAP-FXD 120pF ±5% 100V
C213	BOTH	0160-5422	CAP-FXD 0.047µF ±20% 50V
C214	BOTH	0180-0405	CAP-FXD 1.8µF ±10% 20V
C215,216	BOTH	0160-5422	CAP-FXD 0.047µF ±20% 50V
C217,218	BOTH	0160-4832	CAP-FXD 0.01µF ±10% 100V
C301	BOTH	0180-0405	CAP-FXD 1.8µF ±10% 20V
C302	BOTH	0160-5422	CAP-FXD 0.047µF ±20% 50V
C303,304	BOTH	0160-4807	CAP-FXD 33pF ±5% 100V
C305	BOTH	0160-5422	CAP-FXD 0.047µF ±20% 50V
C306	BOTH	0160-4835	CAP-FXD 0.1µF ±10% 50V
C307	BOTH	0160-6579	CAP-FXD 2200pF ±2.5% 100V
C310	BOTH	0160-4835	CAP-FXD 0.1µF ±10% 50V
C312	BOTH	0160-5349	CAP-FXD 200pF ±5% 100V
C314-317	BOTH	0160-5422	CAP-FXD 0.047uF ±20% 50V
C320-322	BOTH	0160-4835	CAP-FXD 0.1µF ±10% 50V
C323,324	BOTH	0160-5422	CAP-FXD 0.047µF ±20% 50V
C325	BOTH	0160-4835	CAP-FXD 0.1µF ±10% 50V
C326-329	BOTH	0160-5422	CAP-FXD 0.047µF ±20% 50V
C330	BOTH	0160-4787	CAP-FXD 22pF ±5% 100V
C331-337	BOTH	0160-5422	CAP-FXD 0.047µF ±20% 50V
C339	BOTH	0160-4787	CAP-FXD 22pF ±5% 100V
C340-342	BOTH	0160-5422	CAP-FXD 0.047µF ±20% 50V
C344,345	BOTH	0160-5422	CAP-FXD 0.047µF ±20% 50V
C348	BOTH	0160-4787	CAP-FXD 22pF ±5% 100V
C349	BOTH	0160-5422	CAP-FXD 0.047µF ±20% 50V
C350	BOTH	0160-4822	CAP-FXD 1000pF ±5% 100V
C352	BOTH	0160-4820	CAP-FXD 1800pF ±5% 100V
C353,354	BOTH	0160-5422	CAP-FXD 0.047µF ±20% 50V
C355	6060B	0160-4833	CAP-FXD 0.022µF ±10% 100V
C355	6063B	0160-4831	CAP-FXD 4700pF ±10% 100V
C356	BOTH	0160-4791	CAP-FXD 10pF ±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 ±5% 100V
C358	BOTH	0160-4829	CAP-FXD 680pF ±10% 100V
C370	BOTH	0160-4832	CAP-FXD 0.01µF ±10% 100V
C501	BOTH	0180-2980	CAP-FXD 1000µF ±20% 35V
C502	BOTH	0180-0376	CAP-FXD 0.47µF ±10% 35V
C503	BOTH	0160-4835	CAP-FXD 0.1µF ±10% 50V
C504	BOTH	0160-4787	CAP-FXD 22pF ±5% 100V
C506,507	BOTH	0160-4835	CAP-FXD 0.1µF ±10% 50V
C551,552	BOTH	0160-4281	CAP-FXD 2200pF ±20% 250V
C553	BOTH	0160-4259	CAP-FXD 0.22µF ±10% 0V
C554	BOTH	0180-3458	CAP-FXD 4700µF +30% -10% 50V
C555	BOTH	0180-3298	CAP-FXD 2200µF +30% -10% 50V
C556	BOTH	0180-4136	CAP-FXD 10uF ±10% 20V
CS57,558	BOTH	0180-3804	CAP-FXD 47uF ±20% 35V
C559	BOTH	0160-4787	CAP-FXD 22pF ±5% 100V
C560	BOTH	0180-4131	CAP-FXD 4.7µF ±10% 35V
C561	BOTH	0180-0376	CAP-FXD 0.47µF ±10% 35V
C562	BOTH	0160-4835	CAP-FXD 0.1µF ±10% 50V
C601	BOTH	0160-5422	CAP-FXD 0.047µF ±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
Fl-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
Ll-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
Ql,2	6060B	1858-0137	TRANSISTOR - FET ASSEMBLY
Ql,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
Rl-8	6060B	06060-80014	RESISTOR 0.050 ±2% 6W
Rl-8	6063B	0811-3845	RESISTOR 0.3 ±1% 3W
Rg-16	BOTH	0698-3430	RESISTOR 21.5 ±1% .125W
R17-24	BOTH	0757-0441	RESISTOR 8.25K ±1% .125W
R25-32	BOTH	0757-0458	RESISTOR 51.1K ±1% .125W
R33-40	BOTH	0757-0442	RESISTOR 10K ±1% .125W
R41	BOTH	0757-0278	RESISTOR 1.78K ±1% .125W
R42	6060B	0698-5089	RESISTOR 33K ±1% .125W
R42	6063B	0698-3160	RESISTOR 31.6K ±1% .125W
R43	BOTH	1810-0316	NETWORK-RES 16-DIP 10.0K OHM X 8
R44	BOTH	0698-0084	RESISTOR 2.15K ±1% .125W
R45	BOTH	0757-0439	RESISTOR 6.81K ±1% .125W
R46	BOTH	0757-0438	RESISTOR 5.11K ±1% .125W
R47	BOTH	8159-0005	RESISTOR 0 CWM
R48	BOTH	0698-4479	RESISTOR 14K ±1% .125W
R49	BOTH	0698-0084	RESISTOR 2.15K ±1% .125W
R50	BOTH	0757-0458	RESISTOR 51.1K ±1% .125W
R53	6060B	8159-0005	RESISTOR 0 CWM
R53	6063B	0698-6620	RESISTOR 150K ±0.1% .125W
R54	6060B	0698-6629	RESISTOR 60K ±0.1% .125W
R54	6063B	0698-6332	RESISTOR 300K ±0.1% .125W
R55	6060B	0698-6360	RESISTOR 10K ±0.1% .125W
R55	6063B	0698-6533	RESISTOR 12.5K ±0.1% .125W
R56	6060B	0698-6360	RESISTOR 10K ±0.1% .125W
R56	6063B	0698-6533	RESISTOR 12.5K ±0.1% .125W
R57	BOTH	0757-0278	RESISTOR 1.78K ±1% .125W
R58	6060B	0698-3450	RESISTOR 42.2K ±1% .125W
R58	6063B	0698-4496	RESISTOR 45.3K ±1% .125W
R59	6060B	0757-0457	RESISTOR 47.5K ±1% .125W
R59	6063B	0698-4496	RESISTOR 45.3K ±1% .125W
R60	BOTH	0698-4457	RESISTOR 576 ±1% .125W
R63	BOTH	0757-0458	RESISTOR 51.1K ±1% .125W
R64	BOTH	0757-0455	RESISTOR 36.5K ±1% .125W
R65	BOTH	0757-0438	RESISTOR 5.11K ±1% .125W
R66	BOTH	0698-0084	RESISTOR 2.15K ±1% .125W
R67	BOTH	0757-0427	RESISTOR 1.5K ±1% .125W
R68	BOTH	0698-6630	RESISTOR 20K ±0.1% .125W
R69	BOTH	0699-0620	RESISTOR 2.222K ±0.1% .1W
R70	BOTH	0757-0438	RESISTOR 5.11K ±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 ±0.1% .1W
R72	6060B	0698-3450	RESISTOR 42.2K ±1% .125W
R72	6063B	0757-0458	RESISTOR 51.1K ±1% .125W
R73	6060B	0698-6629	RESISTOR 60K ±0.1% .125W
R73	6063B	0698-6620	RESISTOR 150K ±0.1% .125W
R74	BOTH	0757-0442	RESISTOR 10K ±1% .125W
R76	6060B	0698-6629	RESISTOR 60K ±0.1% .125W
R76	6063B	0698-6620	RESISTOR 150K ±0.1% .125W
R77,78	BOTH	0757-0463	RESISTOR 82.5K ±1% .125W
R79	BOTH	0757-0442	RESISTOR 10K ±1% .125W
R83	BOTH	0757-0444	RESISTOR 12.1K ±1% .125W
R84	BOTH	0757-0442	RESISTOR 10K ±1% .125W
R85	BOTH	0698-3226	RESISTOR 6.49K ±1% .125W
R86	6060B	0757-0463	RESISTOR 82.2K ±1% .125W
R86	6063B	0757-0442	RESISTOR 10K ±1% .125W
R87	BOTH	0757-0458	RESISTOR 51.1K ±1% .125W
R88	6060B	0811-3574	RESISTOR 3.9 ±1% 5W
R88	6063B	0811-1760	RESISTOR 4.3 ±5% 2W
R89	BOTH	0757-0427	RESISTOR 1.5K ±1% .125W
R90	6060B	0698-6360	RESISTOR 10K ±0.1% .125W
R90	6063B	0698-6533	RESISTOR 12.5K ±0.1% .125W
R91	6060B	0757-0462	RESISTOR 75K ±1% .125W
R91	6063B	0757-0270	RESISTOR 249K ±1% .125W
R92	6060B	0698-0083	RESISTOR 1.96K ±1% .125W
R92	6063B	0698-3153	RESISTOR 3.83K ±1% .125W
R93	6060B	0698-0083	RESISTOR 1.96K ±1% .125W
R93	6063B	0698-3153	RESISTOR 3.83K ±1% .125W
R94	BOTH	0757-0449	RESISTOR 20K ±1% .125W
R95	BOTH	0757-0280	RESISTOR 1K ±1% .125W
R96	6060B	8159-0005	RESISTOR 0 CWM
R96	6063B	0698-6620	RESISTOR 150K ±0.1% .125W
R98	BOTH	0698-3160	RESISTOR 31.6K ±1% .125W
R99	BOTH	0757-0280	RESISTOR 1K ±1% .125W
R100	6060B	0811-3574	RESISTOR 3.9 ±1% 5W
R100	6063B	0811-1760	RESISTOR 4.3 ±5% 2W
R101-104	BOTH	1810-1261	NETWORK-RES 16-DIP
R105	6060B	0698-6360	RESISTOR 10K ±0.1% .125W
R105	6063B	0698-6320	RESISTOR 5K ±0.1% .125W
R106	BOTH	0698-3572	RESISTOR 60.4K ±1% .125W
R107	6060B	0698-3359	RESISTOR 12.7K ±1% .125W
R107	6063B	0757-0438	RESISTOR 5.11K ±1% .125W
R108	BOTH	0757-0438	RESISTOR 5.11K ±1% .125W
R109	BOTH	0757-0449	RESISTOR 20K ±1% .125W
R110	BOTH	0698-3160	RESISTOR 31.6K ±1% .125W
R112	BOTH	0698-3156	RESISTOR 14.7K ±1% .125W
R113	BOTH	0757-0442	RESISTOR 10K ±1% .125W
R114	BOTH	0757-0447	RESISTOR 16.2K ±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 ±1% .125W
R116	BOTH	0757-0472	RESISTOR 200K ±1% .125W
R117	6060B	0698-6360	RESISTOR 10K ±0.1% .125W
R117	6063B	0698-6320	RESISTOR 5K ±0.1% .125W
R118-121	BOTH	0757-0442	RESISTOR 10K ±1% .125W
R122	BOTH	0757-0280	RESISTOR 1K ±1% .125W
R123	BOTH	1810-1274	NETWORK-RES 10-SIP
R124	BOTH	0757-0447	RESISTOR 16.2K ±1% .125W
R125	BOTH	0757-0439	RESISTOR 6.81K ±1% .125W
R126	BOTH	0757-0440	RESISTOR 7.5K ±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 ±1% .125W
R129	BOTH	0698-3160	RESISTOR 31.6K ±1% .125W
R130-132	BOTH	0683-0475	RESISTOR 4.7 ±5% .25W
R133	BOTH	0699-0924	RESISTOR 11K ±0.1% .125W
R134	BOTH	0757-0436	RESISTOR 4.32K ±1% .125W
R135	BOTH	0757-0438	RESISTOR 5.11K ±1% .125W
R136	BOTH	0757-0449	RESISTOR 20K ±1% .125W
R137,138	BOTH	0757-0442	RESISTOR 10K ±1% .125W
R139	BOTH	0698-4479	RESISTOR 14K ±1% .125W
R140	BOTH	0757-0441	RESISTOR 8.25K ±1% .125W
R141	6060B	0699-0486	RESISTOR 2K ±.1% .1W
R141	6063B	0757-0317	RESISTOR 1.33K ±1% .125W
R142,143	BOTH	0757-0472	RESISTOR 200K ±1% .125W
R144	6060B	0757-0412	RESISTOR 365 ±1% .125W
R144	6063B	0757-0401	RESISTOR 100 ±1% .125W
R145	6060B	0757-0439	RESISTOR 6.81K ±1% .125W
R145	6063B	0757-0429	RESISTOR 1.82K ±1% .125W
R146-153	BOTH	0757-0465	RESISTOR 100K ±1% .125W
R154	BOTH	0698-8827	RESISTOR 1M ±1% .125W
R155	BOTH	2100-3282	RESISTOR-TRMR 25K 10%
R156	BOTH	0683-1065	RESISTOR 10M ±5% .25W
R157	BOTH	0757-0439	RESISTOR 6.81K ±1% .125W
R158	BOTH	0757-0279	RESISTOR 3.16K ±1% .125W
R159	BOTH	0757-0405	RESISTOR 162 ±1% .125W
R161	BOTH	0757-0274	RESISTOR 1.21K ±1% .125W
R162-169	BOTH	0698-8827	RESISTOR 1M ±1% .125W
R170	BOTH	0698-8913	RESISTOR 1.5M ±1% .125W
R171	BOTH	0698-0064	RESISTOR 9.31K ±1% .125W
R172	BOTH	0757-0464	RESISTOR 90.9K ±1% .125W
R175	BOTH	0698-8913	RESISTOR 1.5M ±1% .125W
R176	BOTH	0698-4536	RESISTOR 340K ±1% .125W
R177	6060B	0757-0459	RESISTOR 56.2K ±1% .125W
R177	6063B	0757-0458	RESISTOR 51.1K ±1% .125W
R201	BOTH	1810-0560	NETWORK-RES 16-DIP 5.6K OHM X 8
R202	BOTH	0698-3359	RESISTOR 12.7K ±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 ±1% .125W
R205	BOTH	0757-0442	RESISTOR 10K ±1% .125W
R208	BOTH	0698-3633	RESISTOR 390 ±5% 2W MO
R209	BOTH	0698-3644	RESISTOR 5.1K ±5% 2W MO
R210	BOTH	0757-0280	RESISTOR 1K ±1% .125W TF
R214	BOTH	1810-0280	NETWORK-RES 10-SIP 10.0K OHM X 9
R215	BOTH	0698-3644	RESISTOR 5.1K ±5% 2W MO
R217-219	BOTH	0757-0442	RESISTOR 10K ±1% .125W
R220	BOTH	0757-0442	RESISTOR 10K ±1% .125W
R221	BOTH	0757-0401	RESISTOR 100 ±1% .125W
R222	BOTH	0699-1797	RESISTOR 10M ±1% .25W
R300, 301	BOTH	0757-0401	RESISTOR 100 ±1% .125W
R302	BOTH	0698-3430	RESISTOR 21.5 ±1% .125W
R303	BOTH	0698-4486	RESISTOR 24.9K ±1% .125W
R304	BOTH	0757-0280	RESISTOR 1K ±1% .125W
R305	BOTH	0698-4503	RESISTOR 66.5K ±1% .125W
R306	BOTH	0698-6320	RESISTOR 5K ±0.1% .125W
R307	BOTH	0698-0085	RESISTOR 2.61K ±1% .125W
R308	BOTH	0757-0462	RESISTOR 75K ±1% .125W
R309	BOTH	0698-6320	RESISTOR 5K ±0.1% .125W
R310,311	BOTH	0698-8827	RESISTOR 1M ±1% ·125W
R312	BOTH	0757-0465	RESISTOR 100K ±1% .125W
R313	BOTH	0757-0449	RESISTOR 20K ±1% ·125W
R314	BOTH	0757-0465	RESISTOR 100K ±1% .125W
R315	BOTH	0698-0085	RESISTOR 2.61K ±1% .125W
R316	BOTH	0699-0924	RESISTOR 11K ±0.1% .125W
R317,318	BOTH	0757-0438	RESISTOR 5.11K ±1% .125W
R319,320	BOTH	0698-6360	RESISTOR 10K ±0.1% .125W
R321,322	BOTH	0757-0438	RESISTOR 5.11K ±1% .125W
R323,324	BOTH	0698-6360	RESISTOR 10K ±0.1% .125W
R325-327	BOTH	0757-0438	RESISTOR 5.11K ±1% .125W
R328	BOTH	0757-0442	RESISTOR 10K ±1% .125W
R329	BOTH	0757-0416	RESISTOR 511 ±1% .125W
R330,331	BOTH	0757-0472	RESISTOR 200K ±1% .125W
R332	BOTH	0757-0280	RESISTOR 1K ±1% .125W
R333	BOTH	1810-0280	NETWORK-RES 10-SIP 10.0K OHM X 9
R334	BOTH	0698-0084	RESISTOR 2.15K ±1% .125W
R335	6060B	0698-3382	RESISTOR 5.49K ±1% .125W
R335	6063B	0698-3279	RESISTOR 4.99K ±1% .125W
R336	BOTH	0698-4443	RESISTOR 4.53K ±1% .125W
R337	BOTH	0757-0280	RESISTOR 1K ±1% .125W
R338	BOTH	0699-0924	RESISTOR 11K ±0.1% .125W
R339,340	BOTH	0698-6360	RESISTOR 10K ±0.1% .125W
R341	BOTH	0757-0438	RESISTOR 5.11K ±1% .125W
R342	BOTH	0757-0449	RESISTOR 20K ±1% .125W
R343	BOTH	0698-4443	RESISTOR 4.53K ±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 ±1% .125W
R345	BOTH	0699-0924	RESISTOR 11K ±0.1% .125W
R346	BOTH	0698-6533	RESISTOR 12.5K ±0-1% .125W
R347	BOTH	0757-0438	RESISTOR 5.11K ±1% .125W
R348	BOTH	0698-8827	RESISTOR 1M ±1% .125W
R349	BOTH	1810-0280	NETWORK-RES 10-SIP 10.0K OHM X 9
R350	BOTH	0757-0442	RESISTOR 10K ±1% .125W
R351,352	BOTH	0698-3633	RESISTOR 390 ±5% 2W
R353	BOTH	0699-1797	RESISTOR 10M ±1% .25W
R357	BOTH	0757-0442	RESISTOR 10K ±1% .125W
R358	BOTH	0757-0465	RESISTOR 100K ±1% .125W
R359	6060B	0699-1254	RESISTOR 536K ±1% .125W
R359	6063B	0698-3215	RESISTOR 499K ±1% .125W
R361,362	BOTH	0757-0442	RESISTOR 10K ±1% .125W
R501	BOTH	0757-0436	RESISTOR 4.32K ±1% .125W
R502	BOTH	0698-4443	RESISTOR 4.53K ±1% .125W
R503	BOTH	0757-0442	RESISTOR 10K ±1% .125W
R504	BOTH	0757-0280	RESISTOR 1K ±1% .125W
R505	BOTH	0757-0472	RESISTOR 200K ±1% .125W
R506	BOTH	0757-0438	RESISTOR 5.11K ±1% .125W
R507	BOTH	0698-8827	RESISTOR 1M ±1% .125W
R508	BOTH	0757-0472	RESISTOR 200K ±1% .125W
R509	BOTH	0757-0280	RESISTOR 1K ±1% .125W
R510	BOTH	0757-0442	RESISTOR 10K ±1% .125W
R511	BOTH	0757-0420	RESISTOR 750 ±1% .125W
R512,513	BOTH	0757-0455	RESISTOR 36.5K ±1% .125W
R514	BOTH	0698-8672	RESISTOR 243.4 ±0.1% .125W
R515,516	BOTH	0698-0085	RESISTOR 2.61K ±1% .125W
R517	BOTH	0698-8672	RESISTOR 243.4 ±0.1% .125W
R551	BOTH	0698-0085	RESISTOR 2.61K ±1% .125W
R552	BOTH	0698-8672	RESISTOR 243.4 ±0.1% .125W
R553	BOTH	0698-3226	RESISTOR 6.49K ±1% .125W
R555	BOTH	0698-3156	RESISTOR 14.7K ±1% .125W
R556	BOTH	0757-0442	RESISTOR 10K ±1% .125W
R557,558	BOTH	0757-0436	RESISTOR 4.32K ±1% .125W
R563,564	BOTH	0757-0436	RESISTOR 4.32K ±1% .125W
R565	BOTH	0757-0442	RESISTOR 10K ±1% .125W
R566,567	BOTH	0757-0472	RESISTOR 200K ±1% .125W
R568	BOTH	0757-0280	RESISTOR 1K ±1% .125W
R569	BOTH	0698-8827	RESISTOR 1M ±1% .125W
R570	BOTH	0757-0436	RESISTOR 4.32K ±1% .125W
R571	BOTH	0698-0084	RESISTOR 2.15K ±1% .125W
R572	BOTH	0757-0420	RESISTOR 750 ±1% .125W
R573	BOTH	0757-0442	RESISTOR l0K ±1% .125W
R574,575	BOTH	0757-0455	RESISTOR 36.5K ±1% .125W
R576,577	BOTH	0757-0458	RESISTOR 51.1K ±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 ±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 l6-CONT
TP301	BOTH	1251-4926	CONN-POST TYPE .100-PIN-SPCG 8-CONT
Ul-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-IMPD 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-BIASH-IMPD 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-IMPD 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 POSEDGE-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-IMPD 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-lW IR-5UA
VR11	BOTH	1902-0761	DIODE-ZNR lN821 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 lW 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 lW 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)
TBPl,2	BOTH	1510-0134	BINDING POST

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

Reference Designation	Models	Agilent Part Number	Description
	BOTH	06063-60001	**FRONT PANEL ASSEMBLY**
A2	BOTH	5020-2693	PC BOARD (keypad)
A3	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
			FRONT PANEL OPTION (#020)
TBP3,4	BOTH	1510-0134	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
Al	6060B	06060-60022	**MAIN BOARD**
Al	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)
MPl9	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

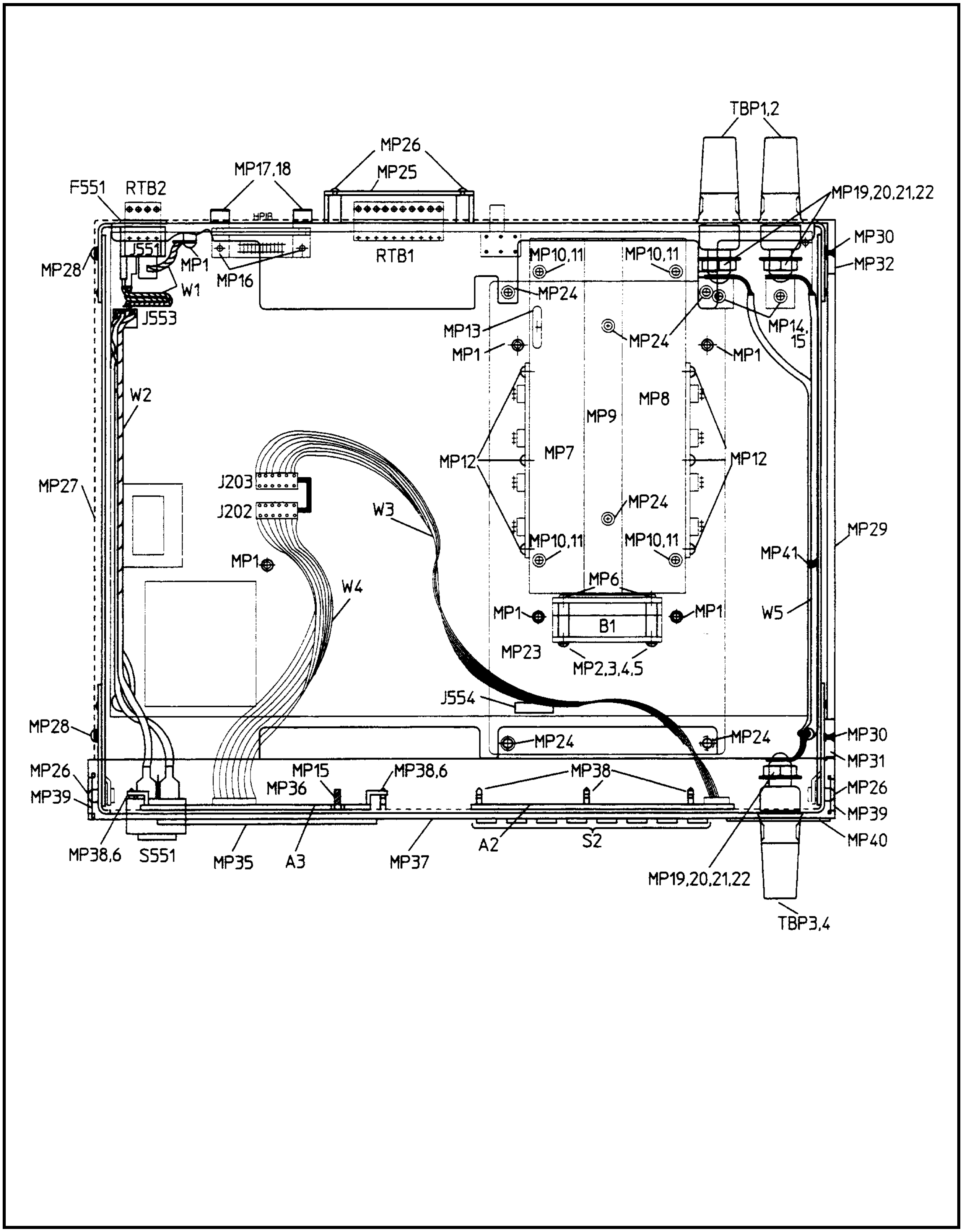


Figure 5-1. Chassis Mounted Component Locations

6

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 $\boxed{\text{1D}}$ 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 $\boxed{\text{1C}}$ 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

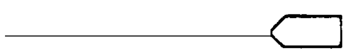
1. All resistors are in ohms ±1%, 1/8 W, unless otherwise specified.

2. All capacitors are in microfarads unless otherwise specified.

3. All unmarked capacitors are 0.047µF.

4. An asterisk negates a signal name. For example, $\overline{\text{CS2}}$ 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.


SPCLR*

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.

TRIG

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

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

[1](A) = analog (D) = digital $\boxed{nx}$ = signal origin

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

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

[1](A) = analog (D) = digital $\boxed{nx}$ = signal origin

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

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

[1](A) = analog (D) = digital $\boxed{nx}$ = signal origin

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

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

[1](A) = analog (D) = digital $\boxed{nx}$ = signal origin

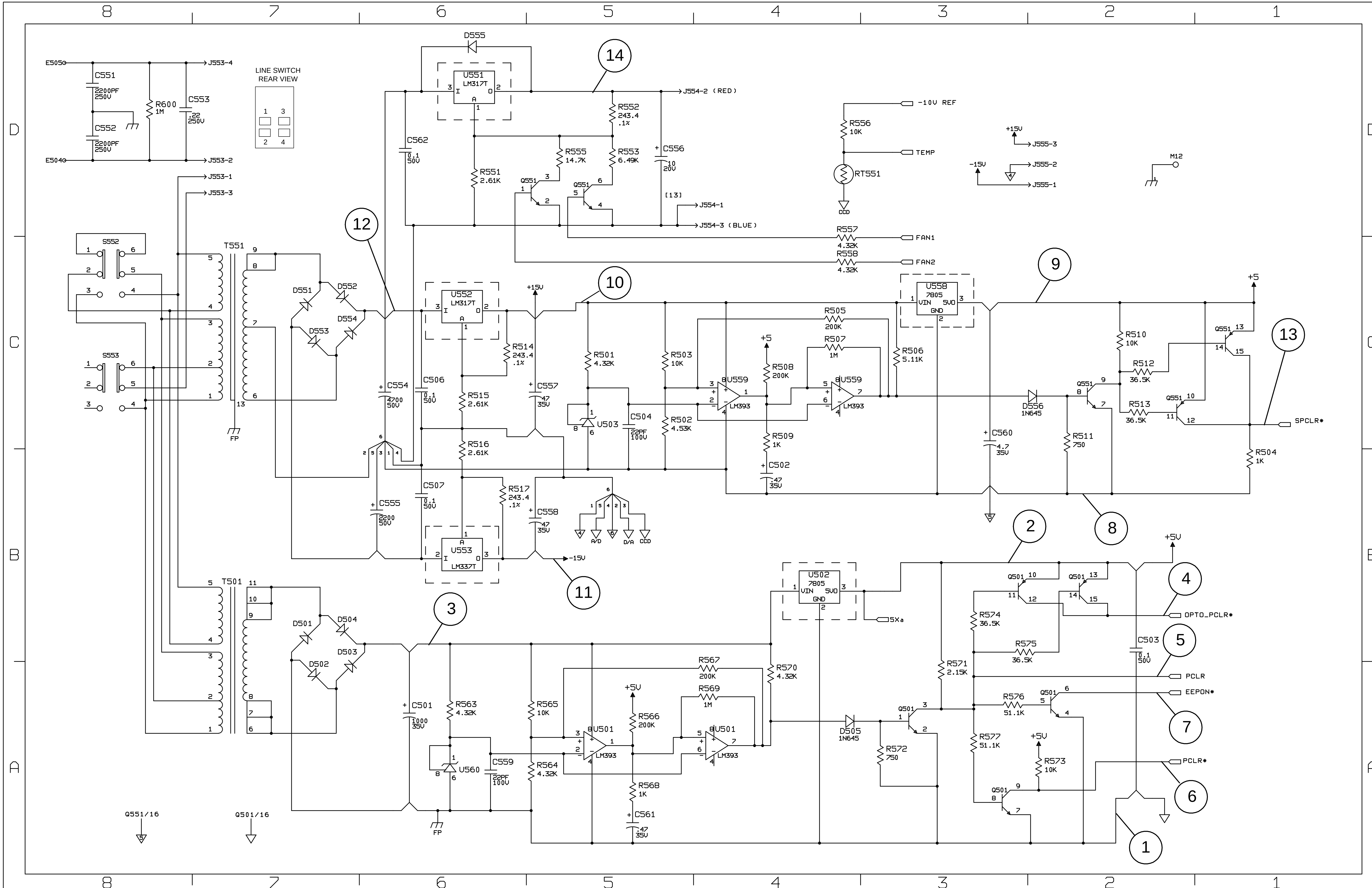


Figure 6-1. 6060B/6063B Electronic Load Schematic (Sheet 1 of 6)

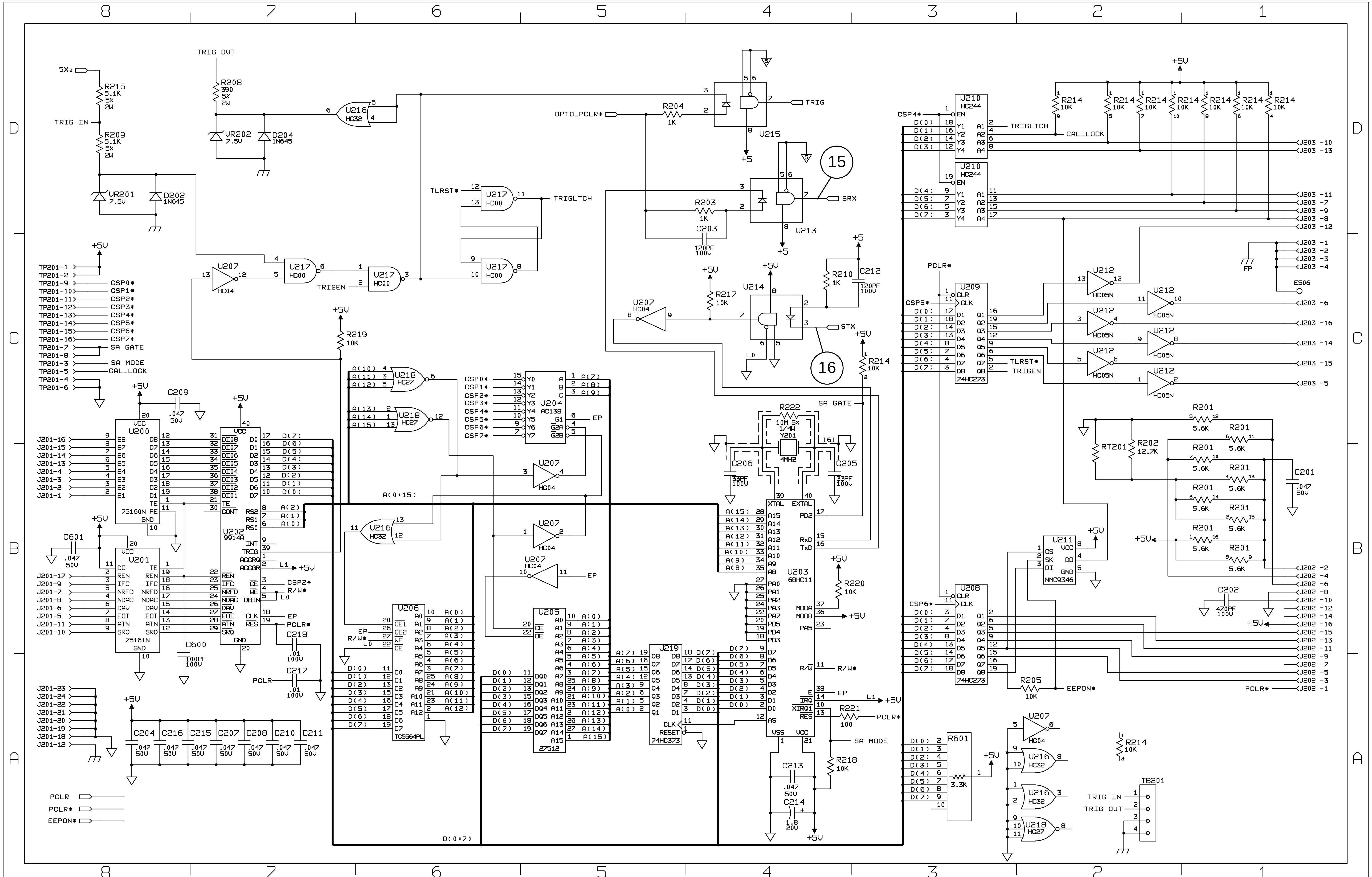


Figure 6-1. 6060B/6063B Electronic Load Schematic (Sheet 2 of 6)

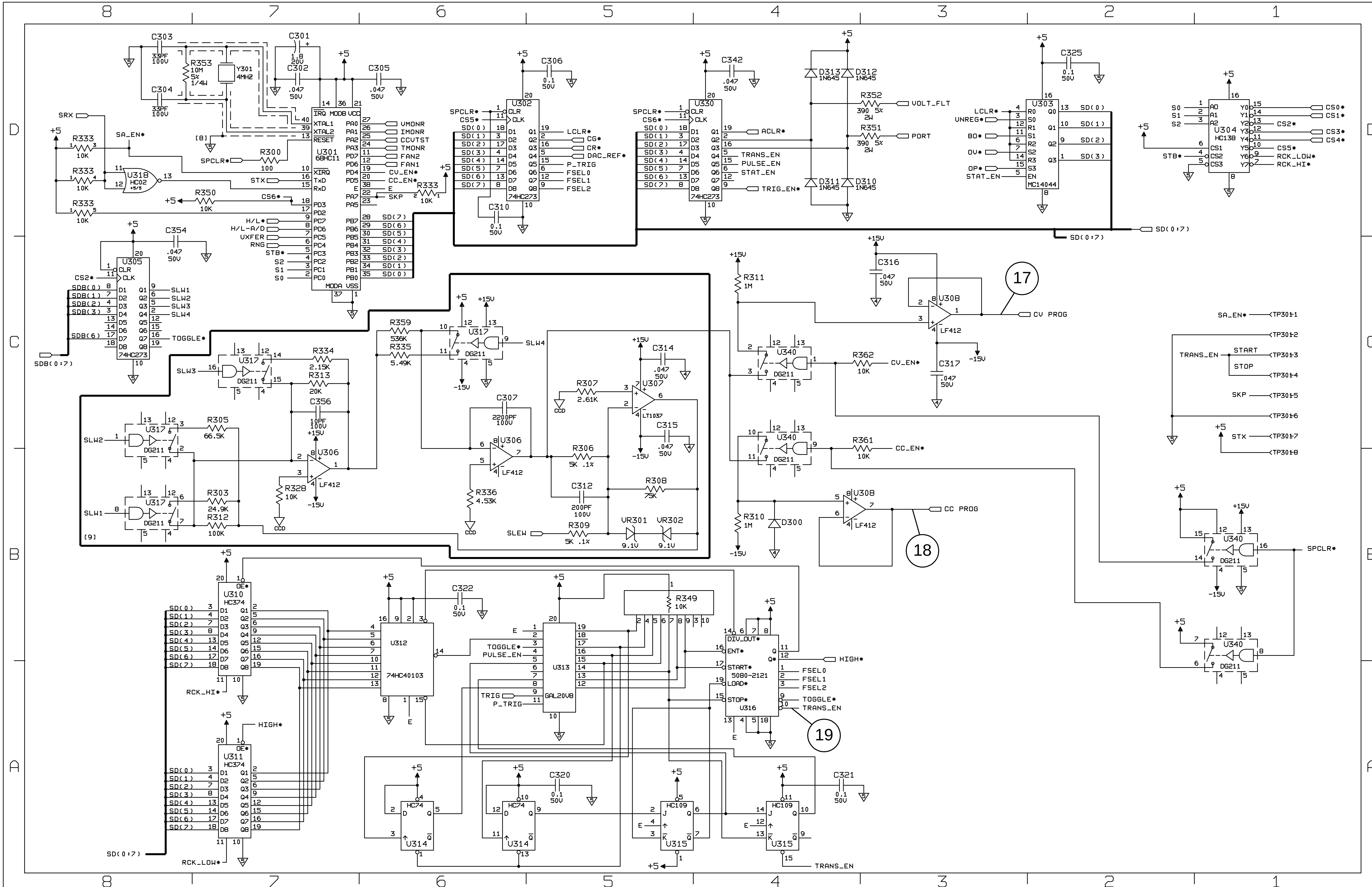


Figure 6-1. 6060B/6063B Electronic Load Schematic (Sheet 3 of 6)

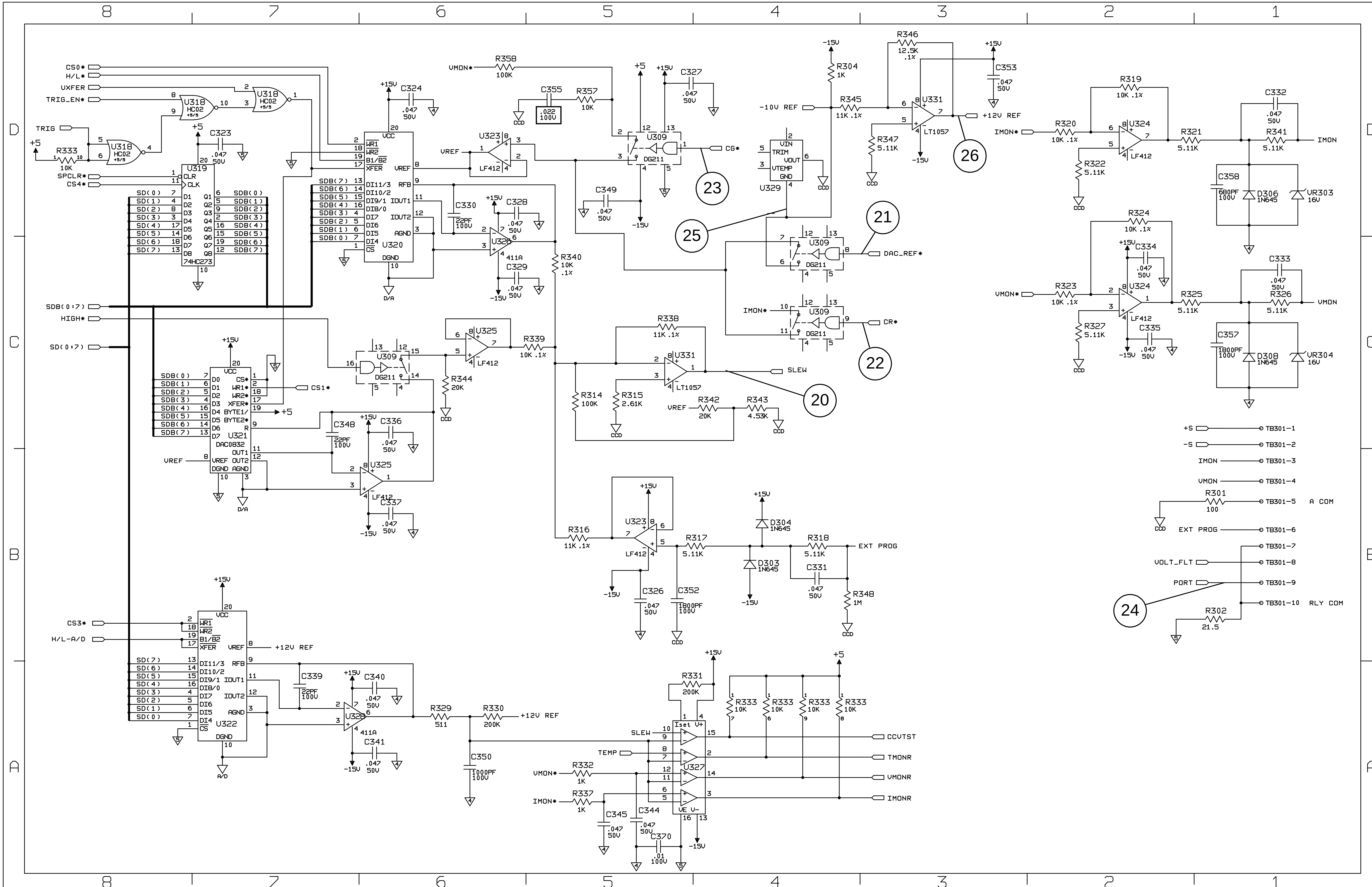


Figure 6-1. 6060B/6063B Electronic Load Schematic (Sheet 4 of 6)

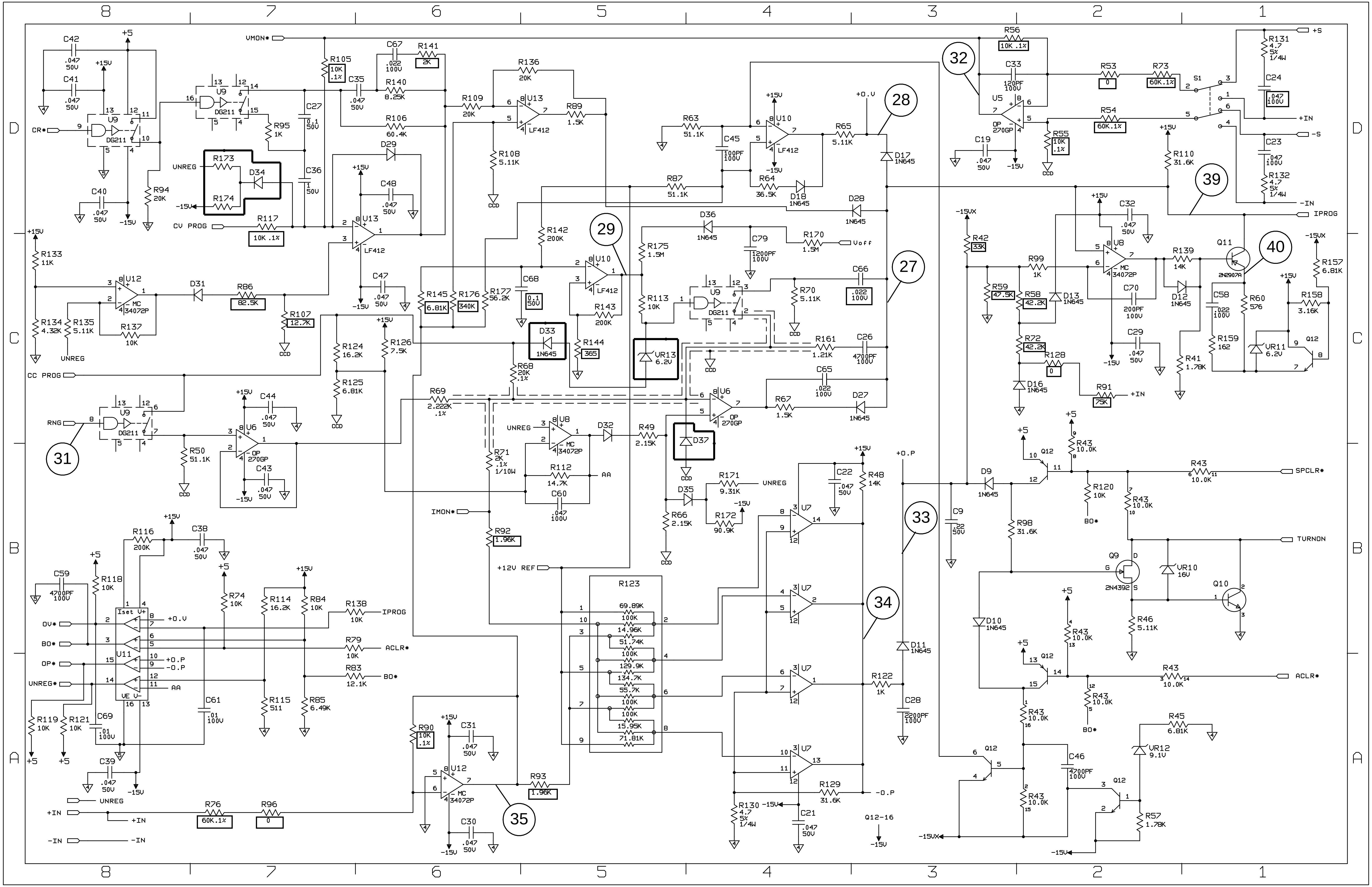


Figure 6-1. 6060B/6063B Electronic Load Schematic (Sheet 5 of 6)

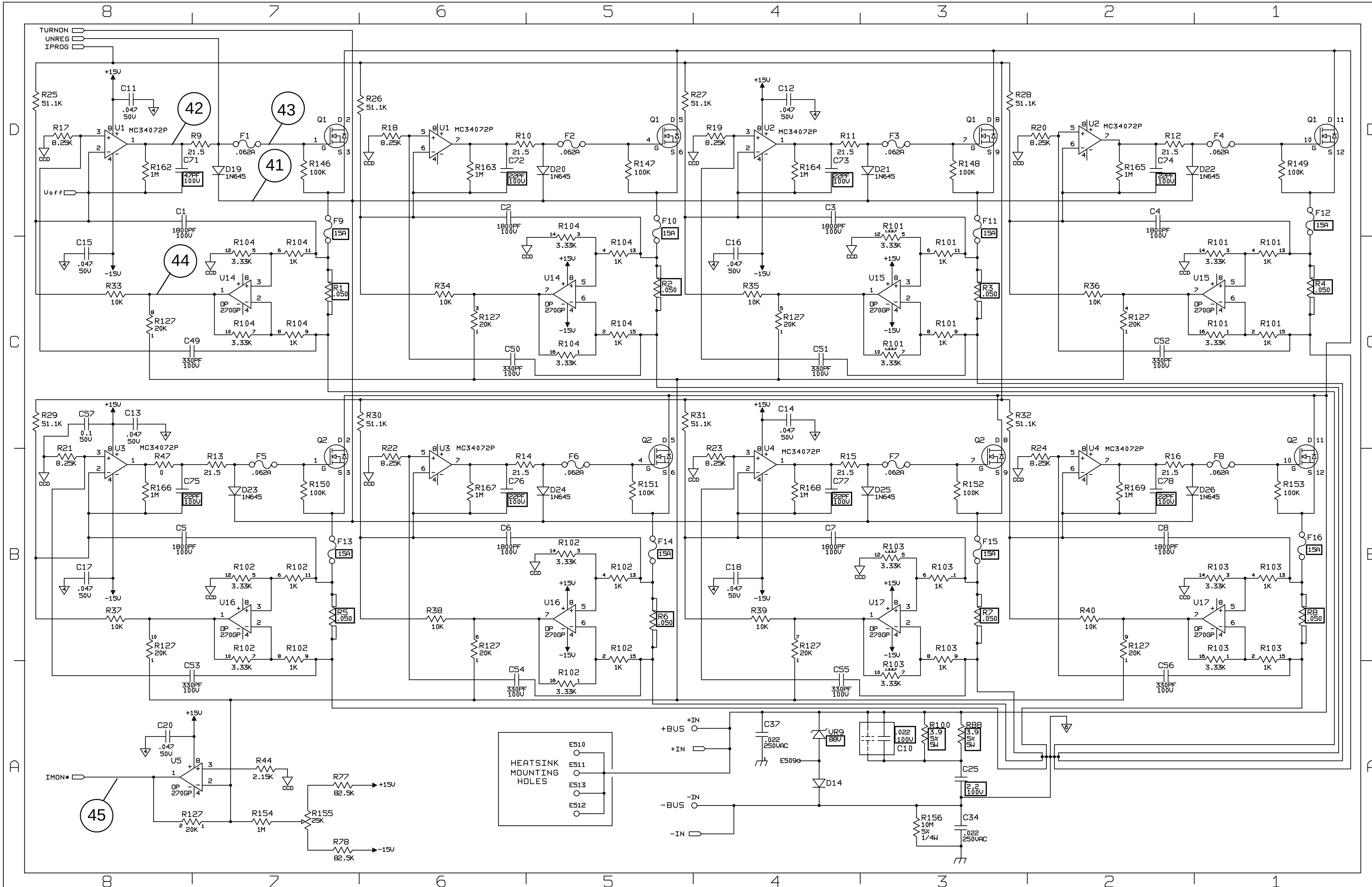


Figure 6-1. 6060B/6063B Electronic Load Schematic (Sheet 6 of 6)

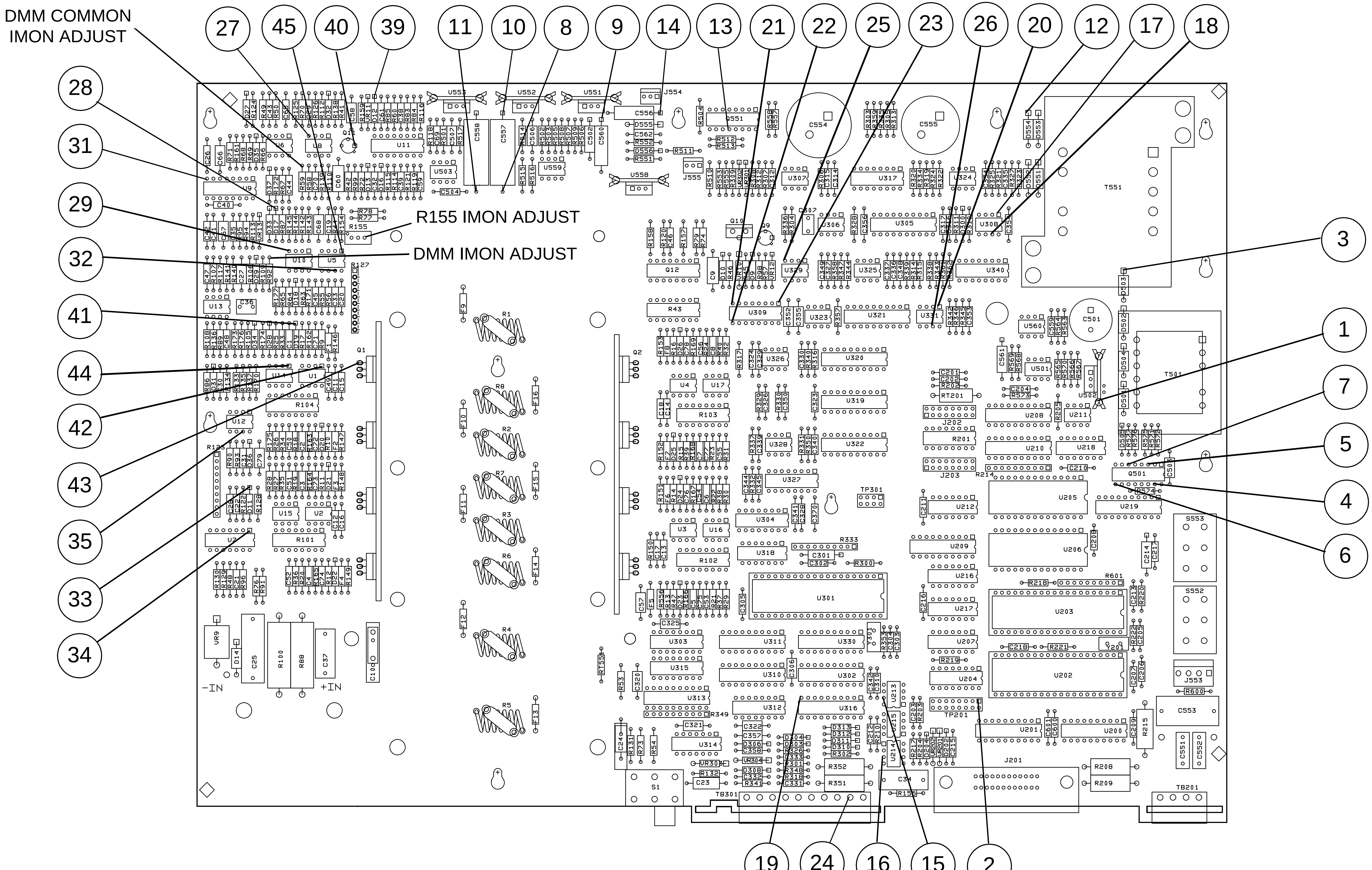


Figure 6-2. Main Circuit Board Component Locations

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	6060B Serial Number	Changes
3119A	00101-00775	1 - 3
3326A	00776-01205	1, 2
3436A	01206-02435	1
	6063B 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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