



1310

DC Power Supply

Instruction Manual



1310
DC POWER SUPPLY
Operation Manual

80-01-0538
S/90



GLOBAL SPECIALTIES



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PCB Components	1310-PS-MAIN PCB
Ref Designator	Value
<u>DIODES</u>	
D5	1N751 (5.1V)
D17	1N4148
D18	1N4148
D25	1N4148
D26	1N4148
D1	1N4007
D2	1N4007
D3	1N4007
D4	1N4007
D10	1N4007
D11	1N4007
D13	1N4007
D14	1N4007
D15	1N4007
D16	1N4007
D19	1N4007
D20	1N4007
D21	1N4007
D22	1N4007
D23	1N4007
D24	1N4007
D27	1N4007
D28	1N4007
D6	1N5408
D7	1N5408
D8	1N5408
D9	1N5408

PCB Components	1310 DISPLAY PCB
Ref Designator	Value
<u>FNDs</u>	
FND1	RED FND COMM. ANNODE.
FND2	RED FND COMM. ANNODE.
FND3	RED FND COMM. ANNODE.

Ref Designator	Value
<u>CAPACITORS</u>	
C1	22 μ F, 50V, ELE
C2	22 μ F, 50V, ELE
C3	1000 μ F, 35V, ELE
C4	0.1 μ F, 100V, MP
C5	22 μ F, 16V, ELE
C6	0.1 μ F, 100V, MP
C7	22 μ F, 16V, ELE
C8	0.1 μ F, 100V, MP
C9	4700 μ F, 16V, ELE
C10	0.1 μ F, 100V, MP
C11	22 μ F, 16V, ELE
C12	22 μ F, 16V, ELE
C13	0.1 μ F, 100V, MP
C14	2200 μ F, 35V, ELE
C15	0.1 μ F, 100V, MP
C16	22 μ F, 16V, ELE
C17	22 μ F, 50V, ELE
C18	0.1 μ F, 100V, MP
C19	2200 μ F, 35V, ELE
C20	0.1 μ F, 100V, MP
C21	0.1 μ F, 100V, MP
C22	22 μ F, 50V, ELE
C23	0.1 μ F, 100V, MP
C24	0.22 μ F, 100V, MP
C25	0.47 μ F, 100V, MP
C26	0.1 μ F, 100V, MP
C27	0.1 μ F, 100V, MP
C28	100pF, 500V, CD
C29	0.1 μ F, 100V, MP
C30	0.022 μ F, 400V, VDC, MPAX
<u>TRANSISTORS</u>	
Q1	2N3906
Q2	2N3904
Q3	2N3904
<u>ICs</u>	
U1	LM317
U2	LM354
U3	LM317
U4	78S05
U5	7107

SECTION - 1 INTRODUCTION

POWER SUPPLY : MODEL 1310

The 1310 Power Supply is a versatile triple-output unit which can be used in both digital and analog circuit applications. It consists of three independent power supplies: a fixed 5 volt supply rated at 1.0 amps maximum, and two variable 1.3 to 20 volt supplies each rated at 250 milliamps maximum. The three digit display allows the voltage of the variable supplies to be quickly and accurately set, and current flow can be monitored with 1 milliamp resolution.

All three supplies are completely isolated from each other, and from earth ground. A circuit or piece of equipment connected to any one of the supplies may be floated to DC level different from the other two supplies. In addition, any two - or all three - supplies may be connected to the chassis and earth ground is provided. And, of course, each supply is protected against short circuit and thermal overloads.

The 1310 is an excellent general purpose power supply for engineering lab applications, bread-boarding, and prototyping. The triple-output voltages make it ideal for working with all disciplines, from microcomputer components to op-amps. Priced economically, the 1310 is the perfect choice for production lines, service shops, hobbyists, and whenever a compact, reliable DC power supply is needed.

**SECTION - 2
SPECIFICATIONS**

POWER REQUIREMENTS : 108 to 132V AC, 50 to 60Hz (215 to 250VAC, 50 to 60Hz model available)

OUTPUTS (All floating via Transformer Isolation) :

5V Power Supply :

Voltage : 5V DC (±0.2V) fixed.

Current : 1.0A Maximum.

Regulation :

Line : 0.2%.

Load : 1.0%.

Ripple : 0.1% 5mV Maximum

A Power Supply :

Voltage : 1.3 to 20V DC (continuously variable)

Current : 250mA Maximum.

Regulation :

Line : 0.1%.

Load : 0.2%.

Ripple : 10mV Maximum.

B Power Supply :

Voltage : 1.3 to 20V DC (continuously variable)

Current : 250mA Maximum.

Regulation :

Line : 0.1%.

Load : 0.2%.

Ripple : 10mV Maximum.

CONTROLS : Power ON/OFF, variable voltage adjust (A), variable voltage adjust (B), meter select Volts, Amps, meter selectA/B.

**SECTION - 7
PART LIST & SCHEMATICS**

PCB Components 1310-PS-MAIN PCB

Ref Designator	Value
<u>RESISTORS</u>	
R1	1K, ¼W, 1%, MFR
R2	1E, ½W, 1%, MFR
R3	1E, ½W, 1%, MFR
R4	1K, ¼W, 1%, MFR
R5	1K, ¼W, 1%, MFR
R6	100E, ½W, 1%, MFR
R7	300E, ¼W, 1%, MFR
R8	1K, ¼W, 1%, MFR
R9	1E, ½W, 1%, MFR
R9a	1E, ½W, 1%, MFR
R11	150E, ¼W, 1%, MFR
R13	82K, ¼W, 1%, MFR
R14	1K, ¼W, 1%, MFR
R16	82E, ¼W, 1%, MFR
R18	270K, ¼W, 1%, MFR
R19	220E, ¼W, 1%, MFR
R21	1K, ¼W, 1%, MFR
R22	1E, ½W, 1%, MFR
R22a	1E, ½W, 1%, MFR
R23	82E, ¼W, 1%, MFR
R24	220E, ¼W, 1%, MFR
R26	1K, ¼W, 1%, MFR
R27	82K, ¼W, 1%, MFR
R31	270K, ¼W, 1%, MFR
R32	220E, ¼W, 1%, MFR
R34	1K, ¼W, 1%, MFR
R56	47K, ¼W, 1%, MFR
R57	100K, ¼W, 1%, MFR
R59	22K, ¼W, 1%, MFR
R60	100K, ¼W, 1%, MFR
R61	1K, ¼W, 1%, MFR
R62	1K, ¼W, 1%, MFR
<u>PRESETS</u>	
R12	100E (H) Preset Pot
R20	100E (H) Preset Pot
R25	100E (H) Preset Pot
R33	100E (H) Preset Pot
R58	1K (H) Preset Pot
R15	50K (H) Preset Pot
R28	50K (H) Preset Pot
VR1	1K Carbon Lin Pot Metal Shaft
VR2	1K Carbon Lin Pot Metal Shaft

The board can now be removed by lifting the PC board, front panel, and rear panel straight upward from the case as a unit. If desired, the connectors may be unplugged from the PC board to facilitate service; note the position of each connector and mark them to ensure proper reassembly.

6.4 CASE REASSEMBLY :

The reassemble the case, refer to figure 7 (Case Assembly) and proceed as follows:

1. Remove all connections to the binding posts and unplug the 1310 from the AC supply. Ensure that both upper and lower case halves are clean and free of debris.
2. If the PC board has been removed from the upper case half, replace it as follows :
 - a) If the front and rear panels have been disconnected from the PC board: slide the front panel and rear panels into the appropriate grooves (the front of the case is the beveled side) in the upper half of the case, while allowing the main PC board to drop into the case
 - b) If the front and rear panels have been disconnected from the PC board: set the PC board into the upper case half, observing orientation (i.e., while facing the front [beveled side] of the upper case half, the heat sinkds on the PC board should be to the right). Install the front and rear panels into their appropriate grooves, noting that they should be "upside-down", and plug the panel connectors into the main PC board.
 - c) Loosely install the four hex stand offs that hold the main PC board to the upper case half.
 - d) Install the self-tapping screw in the center of the PC board, being careful not to over tighten.
 - e) Now tighten the four hex stand offs holding the main PC board.
3. Gently slide the lower case half straight down into position atop the upper case half, making sure that the beveled sides face the front and that the front and rear panels are fitting properly in the case panel grooves.
4. Position the flip-up leg and the foot assemblies. The flip-up leg assembly should be to the front, and the leg should fold rearward.
5. Replace the Philips-head screw in each foot assembly, taking care not to over-tighten.
6. Replace the stick-on rubber feet.
7. Return the 1310 to the upright position.

MONITORS : 3 digit LED display. Voltage or current display selectd by V/A switch. A or B supply display by A / B switch. Display accuracy $\pm 0.5\%$, ± 1 digit. Resolution of 1mA when displaying current, 0.1V when displaying voltage LED indicates overload on 5V supply

SHORT CIRCUIT PROTECTION : All supplies current limited (external short circuit will not damage power supplies).

LINE CORD : 3 Wire with American Plug.

DIMENSION (H x W x D) : 70mm x 265mm x 322mm.

WEIGHT : 2.585 Kgs.

SECTION - 3 OPERATING INSTRUCTION

3.1 LOCATION & DESCRIPTION OF OPERATING CONTROLS:

The properly use the full capabilities of the 1310, it is highly recommended that the user become familiar with the instrument's controls and their function (See figure 1).

- 1 - **Power ON / OFF Switch :**
Rocker Switch. The digital display will light to indicate power is on.
- 2 - **A Adjust Control :**
Adjust the output voltage of a supply from 1.3 to 20 volts. Clockwise rotation increases the voltage.
- 3 - **B Adjust Control :**
Adjust the output voltage of the B supply from 1.3 to 20 volts. Clockwise rotation increases the vltage.
- 4 - **A/B Meter Switch :**
When switched to A, the digital display will show the output, either voltage or current (as selected by the VOLT / AMP METER Switch,q.v.), of the A Supply. Similarly, when switched to B, the output of the B supply will be displayed.
- 5 - **Volt / Amp Meter Switch :**
When switched to V, the display will indicate the voltage output of the supply selected by the A/B Meter Swith. When switched to A, the current output of the selected supply will be displayed.
- 6 - **Display :**
Three digit LED display shows the output current or voltage of the A or B supply, depending on the settings of the Volt / Amp Meter switch and A/B Meter Switch.

- 27) Set the VOLT / AMP METER SWITCH to the A position and adjust trimpot R₂₅ until the 1310 display reads 250.
- 28) Set the A / B METER SWITCH to the B position and adjust trimpot R₁₂ until the display once again reads 250.
- 29) Turn power off, disconnect all equipment, and reassemble the 1310 as outlined under the CASE REASSEMBLY section of this manual.

6.3 CASE DISASSEMBLY :

Figure 7 : Case Assembly

Should access to the inside of the unit be required, refer to figure 7 and proceed as follows:

1. Disconnect all cables and equipment from the front panel binding posts of the 1310.
2. Disconnect the power cord from the AC outlet.
3. Turn the 1310 upside-down on a soft or padded surface.
4. Remove the stick-on rubber feet from the foot assemblies. Place them aside, non-sticky side down.
5. Remove the Philips-head screw from each of the four foot asemblies.
6. Remove the foot assemblies and the flip-up leg.
7. Gently slide the lower half of the case straight upward until it is clear of the unit. The PC board will now be visible.
8. If necessary, the PC board can be taken out of the upper case half in the following manner :
 - a) Remove the self-tapping screw from the center of the PC board.
 - b) Remove the four hex standoffs that hold the PC board to the upper case half.

- 4) Adjust trimpot R₅₈ to obtain a reading of 100.0 millivolts.
- 5) Set VOLT / AMP METER SWITCH of the 3310 to the V (Volt) position.
- 6) Set the A / B METER SWITCH of the 1310 to the A position.
- 7) Connect the digital multimeter to the A supply binding posts, with the positive lead on the red binding post and the negative lead on the black binding post.
- 8) Set the A ADJUST CONTROL for a reading of 20.0 volts on the digital multimeter.
- 9) Adjust trimpot R₃₃ to obtain a reading of 20.0 volts on the 1310 display.
- 10) Set the A / B METER SWITCH of the 1310 to the B position.
- 11) Connect the digital multimeter to the B supply binding posts, with the positive lead on the red binding post and the negative lead on the black binding post.
- 12) Set the B ADJUST CONTROL for a reading of 20.0 volts on the digital multimeter.
- 13) Adjust trimpot R₂₀ to obtain a reading of 20.0 on the 1310 display.
- 14) Disconnect the digital multimeter from the binding posts and set the VOLT / AMP METER SWITCH to the A position.
- 15) Adjust trimpot R₁₅ to obtain a reading of 000 on the display.
- 16) Set the A / B METER SWITCH to the A position.
- 17) Adjust trimpot R₂₈ to once again obtain a reading of 000 on the display.
- 18) Set the VOLT / AMP METER SWITCH to the V position, and turn the 1310 off.
- 19) Connect a jumper from the positive (Red) binding post of the A supply to the negative (Black) binding post of the B supply.
- 20) Set the A and B ADJUST CONTROLS to their fully counterclockwise position.
- 21) Connect one end of an 80 Ohm resistor to the positive binding post of the B supply.
- 22) Connect the other end of the 80 Ohm resistor to the positive lead of the digital multimeter.
- 23) Connect the negative lead of the digital multimeter to the negative binding post of the A supply.
- 24) Set the digital multimeter to measure and display current.
- 25) Turn the 1310 on and, while monitoring the A supply voltage on the 1310 display, set the A supply for a 10 volt output.
- 26) Increase the output of the B supply until the digital multimeter reads 250 milliamps.

- 7 - **Flip-up Leg :**
Easily raised or folded, this will elevate the front of the power supply approximately 1 inch for better visibility.
- 8 - **Ground terminal :**
Binding post connected to the chassis and to earth ground through the third wire of the AC power line cord.
- 9 - **B Terminals :**
Output terminals for variable supply B. The red terminal is positive (+); the black terminal is negative (-).
- 10 - **A Terminals :**
Output terminals for variable supply A. The Red terminal is positive (+), the black terminal is negative (-).
- 11 - **5 Volt Terminals :**
Output terminals for the 5 volt DC supply. The Red terminal is positive (+), the black terminal is negative (-).
- 12 - **Overload Indicator :**
LED lights when 5 volt supply current exceeds approximately 1 amp.

3.2 INITIAL INSPECTION and CHECKOUT

Plug the line cord into a suitable 3-wire AC outlet. Note : if a 2-wire to 5 wire adapter must be used. be sure the groundwire or tab of the adapter is attached to a good earth ground. This promotes safe operation by keeping the case, chassis, and earth ground binding post at true earth potential.

With no load connected, turn on the power supply by pressing the POWER switch; display will light to indicate the power is applied. Turn both the A & B voltage controls fully counter-clockwise to their minimum settings. Set the A / B meter switch to the A position. Set the V / A meter switch to the V setting. Slowly increase the A supply output voltage by rotating the A supply voltage control clockwise.

The display should show an increase from 1.3 volts (or less) at the minimum setting to 20.0 volts (or more) at the maximum setting. Check the variable supply B by setting the A / B meter switch to B and rotating the B supply voltage control clockwise. Again the display should show an increase from 1.3 volts to 20.0 volts.

The fixed 5 volt supply may be checked by attaching an external voltmeter to the 5 V output terminals. The voltmeter should read between 4.8 and 5.2 volts.

SECTION - 6 MAINTENANCE AND CALIBRATION

3.3 PRECAUTIONS :

The Power supply is ideally suited to virtually any type of IC breadboarding from TTL, CMOS, and ECL to op-amps, audio and video amps, phase-locked loops, and microprocessor circuitry. However, certain normal breadboarding precautions should be taken to avoid ground loops and inadvertent loading. Observance of correct load polarity is also important, since most ICs may be damaged by improper power supply connections.

3.4 Polarity :

Observe proper polarity when connecting the power supplies to the load, especially if the load is polarity sensitive and does not have reverse polarity protection.

3.5 Ground Loops :

A ground loop is voltage drop on a ground bus caused by a power stage output entering the ground bus some distance away from the power supply ground binding post.

This small voltage drop, though only millivolts or microvolts, is part of the output load. If a preamplifier input or circuit ground is connected to a portion of this ground bus, feedback and oscillation may occur. To prevent this, all output stages should be positioned as close as possible to the ground terminal, with preamps being far away. Many audio ICs have separate input and output grounds to prevent ground loops.

Even though the power supplies are tightly regulated, a short length of power bus can prevent enough inductance to cause linear IC oscillation at high frequencies. For this reason, effective bypass capacitors are needed to bypass the power busses as possible to the power supply pins of the IC. Disc ceramics ($0.1\mu\text{F}$) work well and should be placed across as many ICs as possible. Do not use electrolytic or paper capacitors because they have high inductances and cease to act as bypasses above one or two megahertz. Bypassing is required with digital ICs also; problems such as inability to reset or to clear and false triggering can occur if bypass capacitors are not installed.

3.6 Ventillation :

The heat generated in the power supply is convected through the ventilation slots in the bottom and top of the case. For best ventilation, always leave a few inches of space around the unit. Never allow any object to block the ventilation holes or reduce the clearance provided by the feet on the bottom of the case.

6.1 FUSE REPLACEMENT :

The 1310 uses a type 3AG, $\frac{1}{2}\text{A}$ ($\frac{1}{4}\text{A}$ for 230 volt units), 250 volt slow acting power fuse. If replacement becomes necessary, follow this procedure :

- Disconnect all cables and connections to the 1310.
- Unplug the power cord at the AC outlet.
- Unscrew the fuse holder cap from the fuse holder (found on the rear panel).
- Remove the defective fuse and replace it with one of an identical type and rating.
- Reinstall the fuse holder cap, making sure that it is tightened securely.

If any additional maintenance or repair is required, it is recommended that the unit be returned to Global Specialties for service (see FACTORY SERVICE and REPAIR).

6.2 CALIBRATION :

The 1310 has been designed to provide years of trouble-free service, but to maintain the accuracy of the digital display the unit should be returned to the factory on an annual basis, or whenever the accuracy of the display is in question. If this is not possible or practical, the following calibration can be performed in the field :

6.2.1 Equipment Required :

- (1) Digital multimeter, $3\frac{1}{2}$ digits or greater, with an accuracy of 0.25% or better.
- (2) 80 Ohms, 5 Watt (or greater) resistor.

WARNING : During the course of this procedure, power will be applied and potentially lethal voltages will be present. Exercise extreme caution during all phases of the calibration, and particularly when adjustments are being made.

6.2.2 Procedure :

- 1) Open the case of the 3310, following the procedure outlined under the CASE DISASSEMBLY section of this manual.
- 2) Apply power to the 3310, allowing at least 15 minutes for warm-up.
- 3) Connect the digital multimeter to pins 35 and 36 of U_5 with the positive lead on pin 35 and the negative lead on pin 36.

Specifications subject to change without notice.

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CASE DISASSEMBLY AND ASSEMBLY

WARNING

Potentially lethal AC power is present whenever the line cord is plugged into the AC outlet, even when the power switch is OFF. Always disconnect the power cord when opening the case. Avoid touching the fuse post on the inside of the unit.

Should access to the inside of the unit be required, proceed as follows:

1. Remove the line cord from the AC outlet before disassembly.
2. To disassemble the case, remove the screws that secure the cover to the chassis and lift the cover off.
3. To reassemble the case, place the cover on the chassis, line up the screw holes, and replace the screws.

MAINTENANCE AND RECALIBRATION

ADJUSTMENTS

All circuitry is factory-calibrated. No user adjustments are required.

FUSE REPLACEMENT

Remove the line cord from the AC outlet before changing fuses. Using a screwdriver, remove the fuse holder cap. Replace the fuse with another fuse of identical type and current rating. Replace the fuse holder cap.

3.7 OPERATION :

Proper operation of most circuitry depends on correct voltage. It is recommended that the variable supplies be set to the required voltage levels with their loads disconnected. When the desired voltage is set (using the A or B voltage control), turn the AC power off, connect each load to the proper supply, and turn the AC power on.

Output voltage may be continuously monitored by setting the V / A meter switch to the V position, setting the A / B switch to the desired supply position, and reading the output voltage on the digital display, Output current may be read by simply changing the V / A switch from the V to the A position.

3.8 GROUNDING

All three power supplies are isolated and may be operated without any reference to earth ground. If an earth reference is required, one terminal (either + or -) from any one, two, or all three supplies may be connected to the earth ground binding post.

3.9 CURRENT LIMITING :

Each power supply is protected against output short circuit. If any output is short-circuited, the voltage drops to zero and the current is limited to a safe value.

3.10 COMBINING POWER SUPPLY :

Each of the three supplies may be used independently, or in a combination of any two or all three. These combinations, outlined in figure 2 and described below, can yield increased voltage ranges, increased current capability, or a split plus and minus supply such as frequently used in analog circuitry.

Power Supply	Connection	Voltage Range	Max. Current
5V	--	5 Volts	1.0 Amps
A (variable)	--	1.3 to 20Volts	250 Milliamps
B (variable)	--	1.3 to 20Volts	250 Milliamps
A + B	Parallel	1.3 to 20Volts	500 Milliamps
A + B	Series	2.6 to 40Volts	250 Milliamps
5V + A or B	Series	6.3 to 25Volts	250 Milliamps
5V + A + B	Series	7.6 to 20Volts	250 Milliamps
A + B	Split Supply	+1.3 to +20Volts, -1.3 to -20V	250 Milliamps

Figure 2 : Power Supply Interconnections

3.11 Series Connection :

The output of the variable supplies may be connected in series to provide a variable 2.6 to 40 Volt output at currents of up to 250 milliamps (see figure 3). The total voltage may be determined by adding the separate voltage readings for each variable supply. Load current may be monitored from the output of either variable supply.

Figure 3 : 2.6 to 40 Volt Series Connection

NOTE : When the variable supplies are connected in series, each supply should be set to one-half the desired combined voltage. This will assure even power distribution between the supplies. For example, to achieve an output voltage of 35 volts, set each variable supply to 17.5 volts.

The highest output voltage may be realized by connecting the two variable supplies in series with the fixed 5V supply, giving a range of 7.6 to 45 volts with a maximum current of 250 milliamps (see figure 4). Again, the total voltage may be determined by adding the individual output voltage, and the current may be monitored from the output of either variable supply.

Figure 4 : 7.6 to 45 Volt Series connection

SECTION - 5 SERVICE AND WARRANTY INFORMATION FACTORY SERVICE AND REPAIR

Global Specialties will service and repair this instrument free of charge for a period of one full year, subject to the warranty conditions stated below.

To obtain a return merchandise authorisation (RMA) required for all returns, phone our Customer Service Department for a RMA and all shipping instructions:



GLOBAL SPECIALTIES

**Test Equipment
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WARRANTY

Global Specialties warrants this device to be free from defective material or workmanship for a period of one full year from the date of original purchase.

Global Specialties under this warranty is limited to repairing the defective device when returned to the factory, shipping charges prepaid, within one full year from the date of original purchase. Units returned to Global Specialties that have been subject to abuse, misuse damage or accident, or have been connected, installed or adjusted contrary to the instructions furnished by Global Specialties, or that have been repaired by unauthorized persons will not be covered by this warranty.

Global Specialties reserves the right to discontinue models, change specifications price or design of this device at any time without incurring any obligation whatsoever.

The purchaser agrees to assume all liabilities for any damages and/or bodily injury which may result from the use or misuse of this device by the purchaser, his employees or agents.

This warranty is in lieu of all other representations or warranties expressed or implied and no agent or representative of Global Specialties is authorized to assume any other obligation in connection with the sale and purchase of this device.

DIGITAL DISPLAY :

Display of voltage and current is accomplished by U₅, an ICL7107 3½ digit A / D converter LED display driver. Power for this device is supplied by a separate transformer, T₁. The center-tapped output of this transformer is full-wave rectified by diodes D₁ through D₄ and filtered by capacitors C₁ through C₄. The +5V supply, used only by U₅, is created by U₁, a 7805 three-terminal 5 volt regulator, whose output is further filtered by capacitors C₅ and C₇. The -5A supply, also used only by U₅, is produced by zener diode D₅, with filter capacitors C₆ and C₇.

The A / D converter is calibrated for a full scale range of 200mV. The current and voltage outputs of the variable supplies are therefore scaled to accommodate this range, and the signals are routed to the A / D converter through switches S₂ (the A / B supply switch) and S₃ (the V / A select switch). This yields a display of 000 - 250 to represent a current flow from the variable supplies of 0 to 250 milliamps, and a display of 013 - 200 to represent an output voltage of 1.3 to 20.0 volts. When in the voltage range, the proper decimal point on the LED display is illuminated by the action of switch S₃ to correctly indicate the voltage.

3.12 SPLIT SUPPLY :

A split supply may be arranged by connecting the positive (+) terminal of one supply to the negative (-) terminal of any other supply (see figure 5). These connected terminals are then used as circuit ground (also called circuit common). This arrangement is often used with op-amps which require a +V and -V supply.

Figure 5 : Split Supply "Connection

CAUTION : The power supplies should not be connected in any manner which causes electron current to flow out of a positive (+) terminal or into a negative (-) terminal. This would be a series subtraction configuration, and could damage the 1310.

3.13 PARALLEL CONNECTION :

The variable supplies may be connected in parallel to increase the available load current, giving an output of 1.3 to 20 volts at up to 500 milliamps. However, current-equalizing resistors must be used (see figure 6)

Figure 6 : Parallel Connection

For best results, set the variable supplies to the desired voltage before any connections are made. If the current equalizing resistors are not well matched, current balance may be achieved by slightly unbalancing the supplies while measuring the current output of each supply. The voltage applied to the load must be monitored with an external meter, since the current balancing resistors will introduce a voltage drop, and will also adversely affect voltage regulation. For these reasons, it is best to keep the value of the current balancing resistors as low as possible. However, the lower value, the more difficult it will be to balance the supplies. Each circuit powered this way will require its own tradeoffs.

SECTION - 4 CIRCUIT DESCRIPTION

For the following circuit description, refer to the schematic.

5V SUPPLY :

Diodes D_6 through D_9 make up a full-wave bridge which rectifies the 10 volt AC secondary winding of transformer T_2 used for the 5 volt DC supply. This rectified output is filtered by capacitors C_9 and C_{10} and serves as the input to U_2 , an LM317 adjustable three-terminal regulator. The output of U_2 is fixed at 5 volts by R_6 and R_7 , with C_{11} , C_{12} , and C_{13} further filtering the output and improving transient load response. Diode D_{11} protects U_2 from destructive current flow into its adjust pin, such as might occur if the output is shorted. Diode D_{10} provides additional protection for U_2 from the inadvertent application of voltage to the 5V terminals.

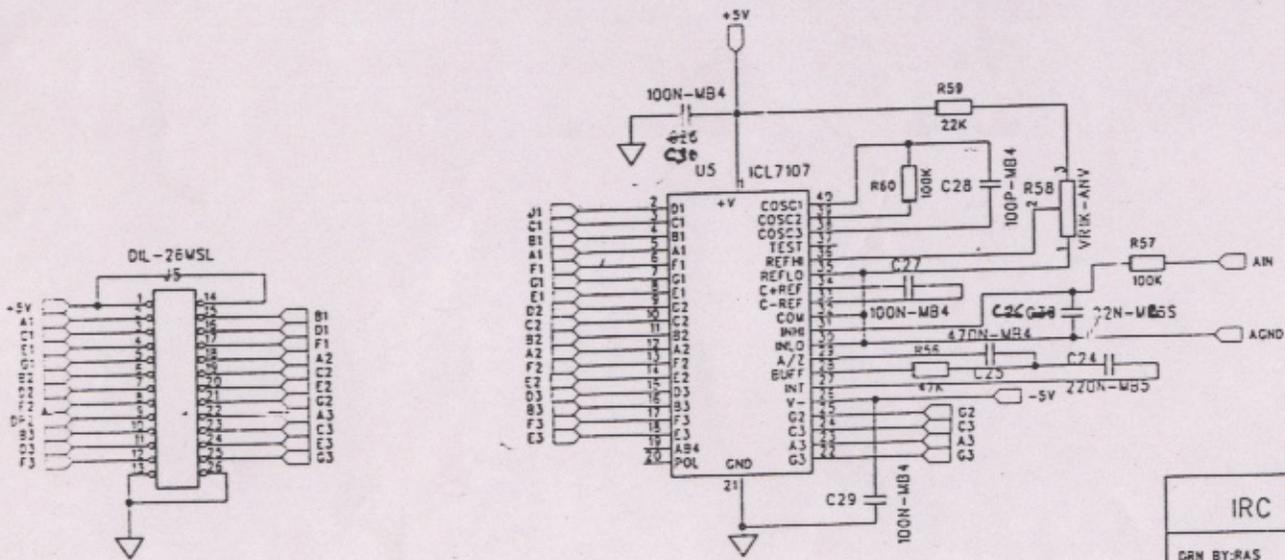
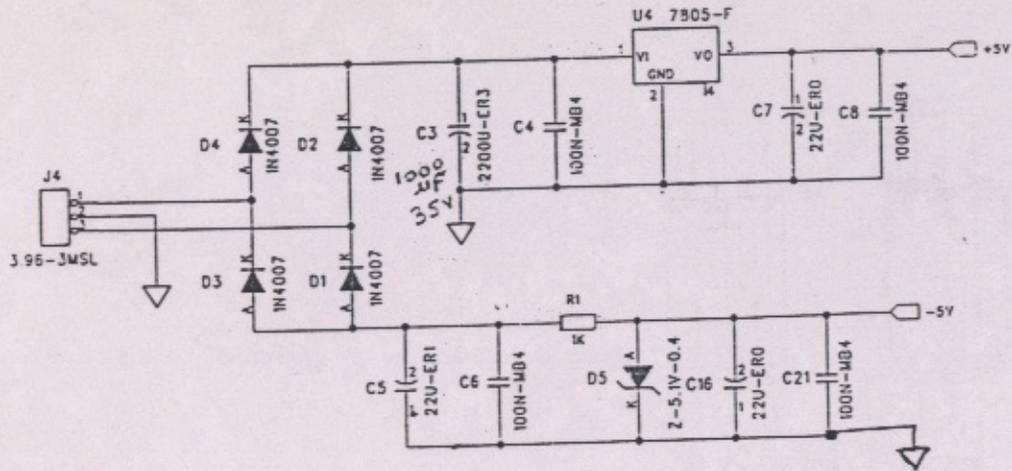
Resistors R_2 and R_3 are used to sense current flow into, and therefore out of, the regulator. When currents exceed approximately 1 amp, the voltage drop across these resistors will be sufficient to turn on transistor Q_1 , which in turn lights D_{12} , the OVERLOAD LED. Current flow is ultimately limited by U_2 to a safe level.

VARIABLE SUPPLIES :

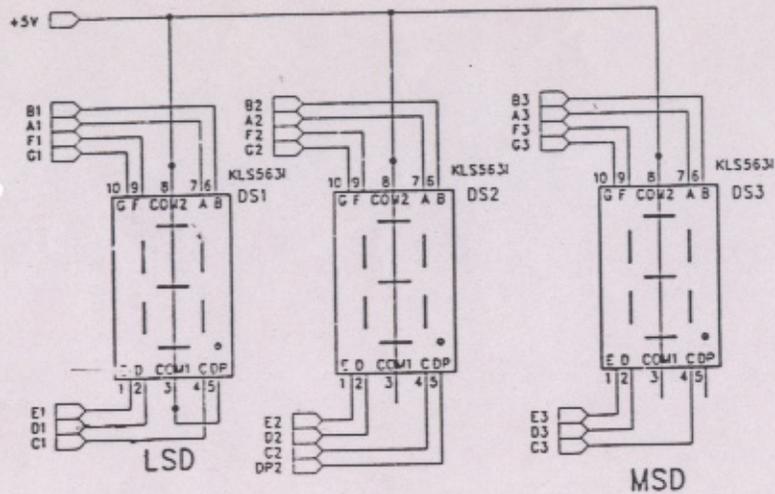
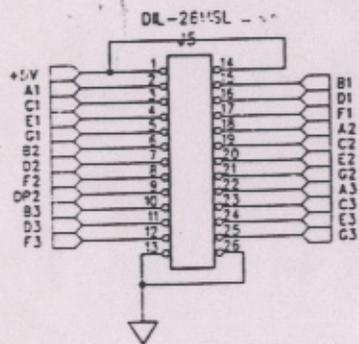
Since the operation of both variable supplies is identical, the following discussion will deal only with the B variable supply.

The transformer secondary is rectified by the full-wave bridge comprising D_{13} through D_{16} , and is filtered by capacitors C_{14} and C_{15} . This serves as the unregulated input to U_3 , an LM317 adjustable three-terminal regulator. The output of U_3 is set by fixed resistor R_{16} and variable resistor R_{17} the B ADJUST control. Capacitors C_{16} , C_{17} , and C_{18} accomplish additional filtering for the output, and improve the transient load response. Diode D_{19} protects the regulator from the current flow that would occur into its adjust pin if the output becomes shorted, and diode D_{20} protects the regulator from the condition of its output being raised above its input voltage.

Resistors R_9 and R_{10} sense current flow through the supply, creating a voltage drop that ultimately is used for the current reading on the digital display. As there is a constant current flowing in the supply circuitry even when there is no load attached, it is necessary to subtract this so that the display shows true load current. This is done by the constant current sink made up of transistor Q_2 , resistors R_{13} , R_{14} , and R_{15} , and diodes D_{17} and D_{18} . Resistors R_8 , R_{11} , and R_{12} scale this resulting voltage to supply a 0.1mV / mA signal to display circuitry. Similarly, resistors R_{18} , R_{19} , and R_{20} scale the final supply output voltage to produce a 1mV / V signal for the display circuitry.



IRC 2071	MODEL:1310
DRN BY:RAS DATE: 01-02-2005	Title: DIGITAL PANEL-METER
VERIFIED BY: UYS DATE: 01-02-2005	File Ref.: 1310MAIN_VER1.0.SCH
Rev. 1.0	4 of 4



IRC 2073	MODEL: 1310
DRN BY: RJG DATE: 12/12/05	Title: DISPLAY BOARD COMMON ANODE
VERIFIED BY: UVS DATE: 12/12/05	File Ref.: 1310DISP_VER1.0.SCH
	Rev. 1.0
	1 of 1

235mm x 127mm

