remaining components of the feedback loop. Resistor R1, in series with the base of Q1A, limits the current through the programming resistor during rapid voltage turn-down. Diodes CR1 and CR2 form a limiting network which prevent excessive voltage excursions from over driving stage Q1A. Capacitors C1 and C2, shunting the programming resistors, increase the high frequency gain of the input amplifier. Resistor R13, shunting pullout resistor R12, serves as a trimming adjustment for the programming current.

4-20 CONSTANT CURRENT INPUT CIRCUIT

4-21 This circuit is similar in appearance and operation to the constant voltage input circuit. It consists basically of the current programming resistors R16A and B, and a differential amplifier stage (Q2 and associated components). Like transistor Q1 in the voltage input circuit, Q2 consists of two transistors, having matched characteristics, that are housed in a single package.

4-22 The constant current input circuit continuously compares a fixed reference voltage with the voltage drop across the current sampling resistors R54 and R55. If a difference exists, the differential amplifier produces an error voltage which is proportional to this difference. The remaining components in the feedback loop (amplifiers and series regulator) function to maintain the drop across the current sampling resistors, and consequently the output current, at a constant value.

4-23 Stage Q2B is connected to a common (+S) potential through impedance equalizing resistor R26. Resistors R25 and R28 are used to zero bias the input stage, offsetting minor base-to-emitter voltage differences in Q2. Instantaneous changes in output current on the positive line are felt at the current summing point and, hence, the base of Q2A. Stage Q2A varies its conduction in accordance with the polarity of the change at the summing point. The change in Q2A's conduction also varies the conduction of Q2B due to the coupling effects of the common emitter resistor, R22. The error voltage is taken from the collector of Q2B and fed back to the series regulator through OR-gate diode CR4 and the remaining components of the feedback loop. The error voltage then varies the conduction of the regulator so that the output current is maintained at the proper level.

4-24 Resistor R20, in conjunction with R21 and C3 helps stabilize the feedback loop. Diode CR5 limits voltage excursions on the base of Q2A. Resistor R19, shunting the pullout resistor, serves as a trimming adjustment for the programming current flowing through R16.

4-25 VOLTAGE CLAMP CIRCUIT

4-26 During constant current operation the constant voltage programming resistors are a shunt load across the output terminals of the power supply. If the output voltage changed, the current through these resistors would tend to change resulting in an output current change. The clamp circuit is a return path for the voltage programming current, the current that normally flows through the programming resistors. The circuit maintains the current into the constant voltage summing point (A6) constant, thus eliminating the error due to shunting effects of the constant voltage programming resistors.

4-27 The voltage divider, R51, R52, and VR3, back biases CR30 and Q10 during constant voltage operation. When the power supply goes into constant current operation, CR30 becomes forward biased by the collector voltage of Q1A. This results in conduction of Q10 and the clamping of the summing point at a potential only slightly more negative than the normal constant voltage potential. Clamping this voltage at approximately the same potential that exists in constant voltage operation, results in a constant voltage across, and consequently a constant current through the pullout resistor (R12).

4-28 MIXER AND ERROR AMPLIFIERS

4-29 The mixer and error amplifiers amplify the error signal from the constant voltage or constant current input circuit to a level sufficient to drive the series regulator transistors. The emitter bias potential for mixer amplifier Q3 is established by the emitter follower. Transistor Q3 receives the error voltage input from either the constant voltage or constant current circuit via the OR-gate diode (CR3 or CR4) that is conducting at that time. Diode CR3 is forward biased, and CR4 reversed biased, during constant voltage operation. The reverse is true during constant current operation.

4-30 The RC network, composed of C5 and R30, is an equalizing network which provides for high frequency roll off in the loop gain response in order to stabilize the feedback loop. Emitter follower transistors Q4 and Q5 are the error amplifiers serving as the driver and predriver elements, respectively, for the series regulator. Transistor Q4, together with diode CR17, provides a low resistance discharge path for the output capacitance of the power supply during rapid down programming.

4-31 REFERENCE CIRCUIT

4-32 The reference circuit is a feedback power supply similar to the main supply. It provides stable reference voltages which are used throughout the unit. The reference voltages are all derived from smoothed DC obtained from the full wave rectifier (CR22 and CR23) and filter capacitor C10. The +6.2 and -6.2 voltages, which are used in the constant voltage and current input circuits for comparison purposes, are developed across temperature compensated Zener diodes VR1 and VR2. Resistor R43 limits the current through the Zener diodes to establish an optimum bias level.

4-33 The regulating circuit consists of series regulating transistor Q9 and error amplifier Q8. Output voltage changes are detected by Q8 whose base is connected to the junction of a voltage divider (R41, R42) connected directly across the supply. Any error signals are amplified and inverted by Q8 and applied to the base of series transistor Q9. The series element then alters its conduction in the direction and by the amount necessary to maintain the voltage across VR1 and VR2 constant. Resistor R46, the emitter resistor for Q8, is connected in a manner which minimizes changes in the reference voltage caused by variations in the input line. Output capacitor C9 stabilizes the regulator loop.

4-34 METER CIRCUIT

4-35 The meter circuit provides continuous indications of output voltage or current on a single multiple range meter. The meter can be used either as a voltmeter or an ammeter depending upon the position of the METER switch S2 on the front panel of the supply. This switch also selects one of two meter ranges on each scale. The meter circuit consists basically of a selection circuit (switch S2 and associated voltage dividers), stable differential amplifier stages (Q11, Q12, and Q14), and the meter movement.

4-36 The selection circuit determines which voltage divider is connected to the differential amplifier input. When the METER section of S2 is in one of the voltage positions, the voltage across divider R59, R60, and R61 (connected across the output of the supply) is the input to the differential amplifier.

4-37 When S2 is in one of the current positions the voltage across divider R56, R57, and R58 is the input to the differential amplifier. Note that this divider is connected across the sampling resistor network. The amplified output of the differential amplifier is used to deflect the meter.

4-38 The differential amplifier is a stable device having a fixed gain of ten. Stage Q11B of the amplifier receives a negative voltage from the applicable voltage divider when S2 is in one of the voltage positions while stage Q11A is connected to the +S (common) terminal. With S2 in a current position, stage Q11A receives a positive voltage from the applicable voltage divider while stage Q11B is connected to the +S terminal. The differential output of the amplifier is taken from the collectors of Q12 and Q14. Transistor Q15 is a constant current source which sets up the proper bias current for the amplifier. Potentiometer R63 permits zeroing of the meter.

4-39 The meter amplifier contains an inherent current limiting feature which protects the meter movement against overloads. For example, if METER switch S2 is placed in the low current range when the power supply is actually delivering a higher ampere output, the differential amplifiers are quickly driven into saturation limiting the current through the meter to a safe value.

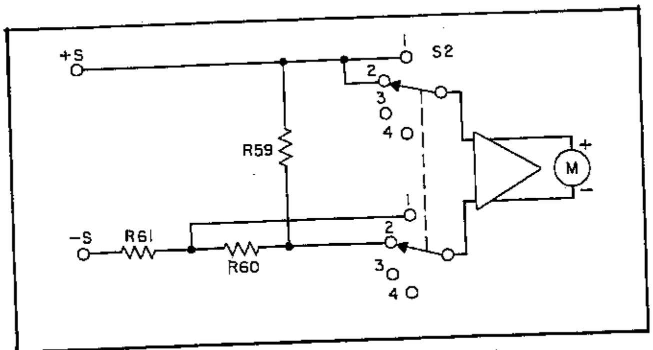


Figure 4-3. Voltmeter Connections, Simplified Schematic

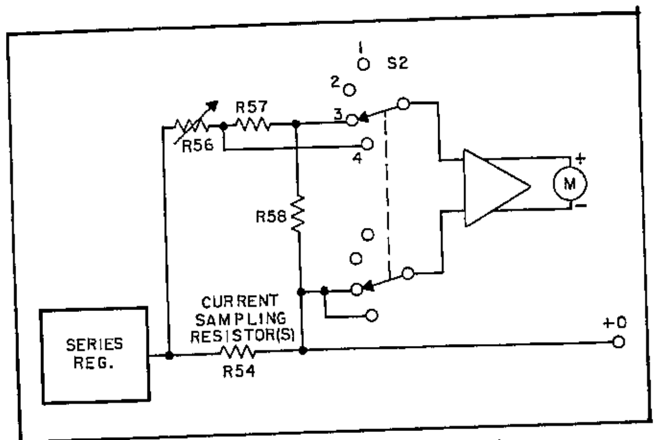


Figure 4-4. Ammeter Connections, Simplified Schematic

4-40 Figures 4-3 and 4-4 show the meter connections when the METER section of S2 is in the higher voltage and current range positions, respectively. For the sake of simplicity, some of the actual circuit components are not shown on these drawings. With the METER switch in the higher voltage range, position 2, the voltage drop across R59 is the input to the meter amplifier and the meter indicates the output voltage across the +S and -S terminals. For low output voltages, S2 can be switched to the low voltage position (1) resulting in the application of a larger percentage of the output voltage (drop across R59 and R60) to the meter amplifier.

4-41 As illustrated in Figure 4-4 with the METER switch in the high current position (3) the voltage drop across R58 is applied to the meter amplifier and the meter indicates the output current which flows through the sampling resistor network. For low values of output current, the METER switch can be set to position 4 and the voltage drop across R57 and R58 is applied to the meter amplifier.

SECTION V
MAINTENANCE

5-1 INTRODUCTION

5-2 Upon receipt of the power supply, the performance check (Paragraph 5-10) should be made. This check is suitable for incoming inspection. If a fault is detected in the power supply while making the performance check or during normal operation, proceed to the troubleshooting procedures (Paragraph 5-41). After troubleshooting and repair (Paragraph 5-46), perform any necessary adjustments and calibrations (Paragraph 5-48). Before returning the power supply to normal operation, repeat the performance check to ensure that the fault has been properly corrected and that no other faults exist. Before doing any maintenance checks, turn on power supply, allow a half-hour warm-up, and read the general information regarding measurement techniques (Paragraph 5-3).

5-3 GENERAL MEASUREMENT TECHNIQUES

5-4 The measuring device must be connected across the sensing leads of the supply or as close to the output terminals as possible when measuring the output impedance, transient response, regulation, or ripple of the power supply in order to achieve valid measurements. A measurement made across the load includes the impedance of the leads to the load and such lead lengths can easily have an impedance several orders of magnitude greater than the supply impedance, thus invalidating the measurement.

5-5 The monitoring device should be connected to the +S and -S terminals (see Figure 3-2) or as shown in Figure 5-1. The performance characteristics should never be measured on the front terminals if the load is connected across the rear terminals. Note that when measurements are made at the front terminals, the monitoring leads are connected at A, not B, as shown in Figure 5-1. Failure to connect the measuring device at A will result in a measurement that includes the resistance of the leads between the output terminals and the point of connection.

5-6 For output current measurements, the current sampling resistor should be a four-terminal resistor. The four terminals are connected as shown in Figure 5-2. In addition, the resistor should be of the low noise, low temperature coefficient (less than 30ppm/^{o}C) type and should be used at no more than 5% of its rated power so that its temperature rise will be minimized.

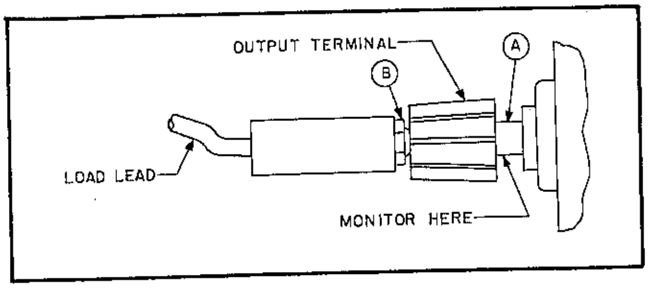


Figure 5-1. Front Panel Terminal Connections

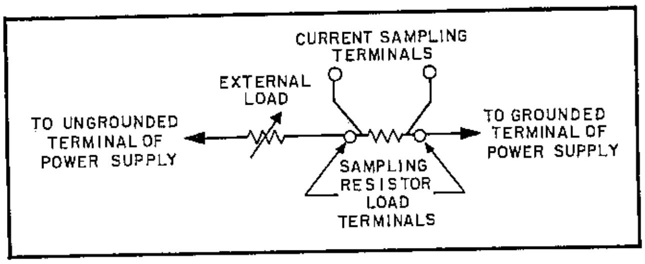


Figure 5-2. Output Current Measurement Technique

5-7 When using an oscilloscope, ground one terminal of the power supply and then ground the case of the oscilloscope to this same point. Make certain that the case is not also grounded by some other means (Power line). Connect both oscilloscope input leads to the power supply ground terminal and check that the oscilloscope is not exhibiting a ripple or transient due to ground loops, pickup, or other means.

5-8 TEST EQUIPMENT REQUIRED

5-9 Table 5-1 lists the test equipment required to perform the various procedures described in this Section.

Table 5-1. Test Equipment Required

TYPE	REQUIRED CHARACTERISTICS	USE	RECOMMENDED MODEL
Differential Voltmeter	Sensitivity: 1mV full scale (min.). Input impedance: 10 megohms (min.).	Measure DC voltages; calibration procedures	ⓗⓟ 3420 (See Note)
Variable Voltage Transformer	Range: 90-130 volts. Equipped with voltmeter accurate within 1 volt.	Vary AC input	---
AC Voltmeter	Accuracy: 2%. Sensitivity: 1mV full scale deflection (min.).	Measure AC voltages and ripple	ⓗⓟ 403B
Oscilloscope	Sensitivity: 100μV/cm. Differential input.	Display transient response waveforms	ⓗⓟ 140A plus 1400A plug-in. 1402A plug-in for spike measurements only.
Oscillator	Range: 5 Hz to 600 kHz. Accuracy: 2%. Output: 10Vrms.	Impedance checks	ⓗⓟ 200 CD
DC Voltmeter	Accuracy: 1%. Input resistance: 20,000 ohms/volt (min.).	Measure DC voltages	ⓗⓟ 412A
Repetitive Load Switch	Rate: 60 - 400 Hz, 2μsec rise and fall time.	Measure transient response	See Figure 5-8.
Resistive Loads	Values: See Paragraph 5-14 and Figure 5-4. ±5%, 75 watts.	Power supply load resistors	---
Current Sampling Resistor	6253A, 6284A: 0.33Ω 6255A, 6289A: 0.66Ω 6281A: 0.2Ω 6294A: 1Ω	Measure current; calibrate meter; cc ripple and noise	See Parts List R54 (R55)
Resistor	1KΩ ±1%, 2 watt non-inductive.	Measure impedance	---
Resistor	100 ohms, ±5%, 10 watt.	Measure impedance	---
Resistor	Value: See Paragraph 5-59. ±0.1%, 1/2 watt.	Calibrate programming current	---
Resistor	Value: See Paragraph 5-62. ±0.1% 1/2 watt.	Calibrate programming current	---
Capacitor	500μf, 50 wVdc.	Measure impedance	---
Decade Resistance Box	Range: 0-500K. Accuracy: 0.1% plus 1 ohm. Make-before-break contacts.	Measure programming coefficients	---

NOTE

A satisfactory substitute for a differential voltmeter is to arrange a reference voltage source and null detector as shown in Figure 5-3. The reference voltage source is adjusted so that the voltage difference between the supply being measured and the reference voltage will have the required resolution for the measurement being made. The voltage difference will be a function of the null detector that is used. Examples of satisfactory null detectors are: ⓗⓟ 419A null detector, a dc coupled oscilloscope utilizing differential input, or a 50mV meter movement with a 100 division scale. For the latter, a 2mV change in voltage will result in a meter deflection of four divisions.

CAUTION

Care must be exercised when using an electronic null detector in which one input terminal is grounded to avoid ground loops and circulating currents.

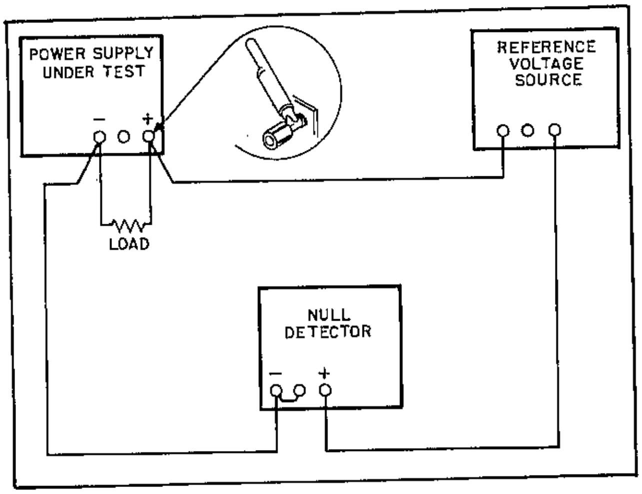


Figure 5-3. Differential Voltmeter Substitute, Test Setup

5-10 PERFORMANCE TEST

5-11 The following test can be used as an incoming inspection check and appropriate portions of the test can be repeated either to check the operation of the instrument after repairs or for periodic maintenance tests. The tests are performed using a 115Vac 60Hz, single phase input power source. If the correct result is not obtained for a particular check, do not adjust any controls; proceed to troubleshooting (Paragraph 5-41).

5-12 CONSTANT VOLTAGE TESTS

5-13 Rated Output and Meter Accuracy.

5-14 Voltage. Proceed as follows:

a. Connect load resistor across rear output terminals of supply. Resistor value to be as follows:

Model	6253A	6255A	6281A	6284A	6289A	6294A
Resistance	6Ω	26Ω	1.5Ω	6Ω	26Ω	60Ω

b. Connect differential voltmeter across +S and -S terminals of supply observing correct polarity.

c. Set METER switch to highest voltage range and turn on supply.

d. Adjust VOLTAGE control(s) until front panel meter indicates exactly the maximum rated output voltage.

e. Differential voltmeter should indicate maximum rated output voltage within ±2%.

5-15 Current. Proceed as follows:

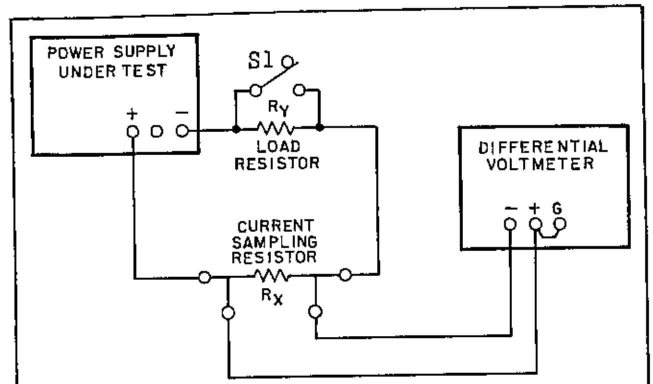
a. Connect test setup as shown in Figure 5-4 leaving switch S1 open.

b. Turn CURRENT controls fully clockwise.

c. Set METER switch to highest current range and turn on supply.

d. Adjust VOLTAGE control(s) until front panel meter indicates exactly the maximum rated output current.

e. Differential voltmeter should read 1.0 ± 0.02 Vdc.



MODEL NO.	RESISTANCE (OHMS) R_X	R_Y
6253A, 6284A	0.33	6
6255A, 6289A	0.66	26
6281A,	0.2	1.3
6294A	1.0	59

Figure 5-4. Output Current Test Setup

5-16. Load Regulation. To check constant voltage load regulation, proceed as follows:

a. Connect test setup as shown in Figure 5-5.

b. Turn CURRENT controls fully clockwise.

c. Set METER switch to highest current range and turn on supply.

d. Adjust VOLTAGE control(s) until front panel meter indicates exactly the maximum rated output voltage.

e. Read and record voltage indicated on differential voltmeter.

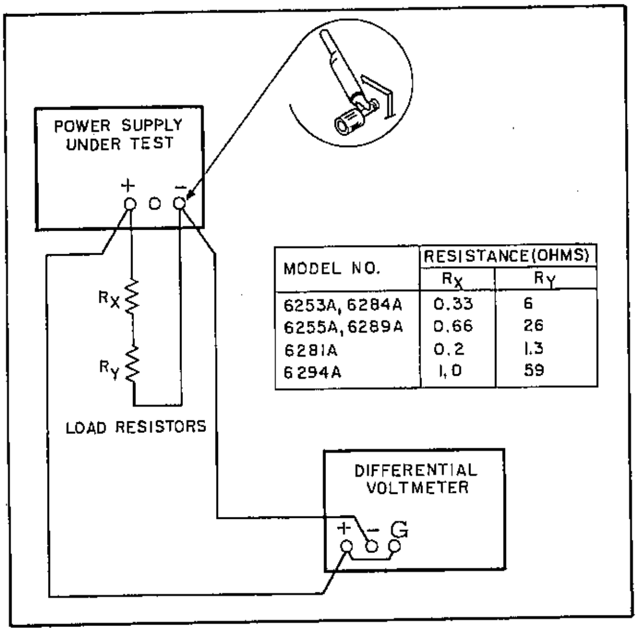
f. Disconnect load resistors.

g. Reading on differential voltmeter should not vary from reading recorded in step e by more than the following:

Model No.	6253A, 6284A	6255A, 6289A
Variation (mVdc)	±6	±6

Model No.	6281A	6294A
Variation (mVdc)	±5	±8

5-17 Line Regulation: To check the line regulation, proceed as follows:



MODEL NO.	RESISTANCE(OHMS)	
	R_X	R_Y
6253A, 6284A	0.33	6
6255A, 6289A	0.66	26
6281A	0.2	1.3
6294A	1.0	59

Figure 5-5. Load Regulation, Constant Voltage Test Setup

a. Connect variable auto transformer between input power source and power supply power input.

b. Turn CURRENT controls fully clockwise.

c. Connect test setup shown in Figure 5-5.

d. Adjust variable auto transformer for 105Vac input.

e. Set METER switch to highest voltage range and turn on supply.

f. Adjust VOLTAGE control(s) until front panel meter indicates exactly the maximum rated output voltage.

g. Read and record voltage indicated on differential voltmeter.

h. Adjust variable auto transformer for 125Vac input.

i. Reading on differential voltmeter should not vary from reading recorded in step g by more than the following:

Model No.	6253A, 6284A	6255A, 6289A
Variation (mVdc)	±4	±6
Model No.	6281A	6294A
Variation (mVdc)	±2.75	±8

5-18 Ripple and Noise. Ripple and noise measurement can be made at any input AC line voltage combined with any DC output voltage and load current within rating.

5-19 The amount of ripple and noise that is present on the power supply output is measured either in terms of the RMS or (preferably) peak-to-peak value. The peak-to-peak measurement is particularly important for applications where noise spikes could be detrimental to a sensitive load, such as logic circuitry. The RMS measurement is not an ideal representation of the noise, since fairly high output noise spikes of short duration could be present in the ripple and not appreciably increase the RMS value.

5-20 The technique used to measure high frequency noise or "spikes" on the output of a power supply is more critical than the low frequency ripple and noise measurement technique; therefore the former is discussed separately in Paragraph 5-28.

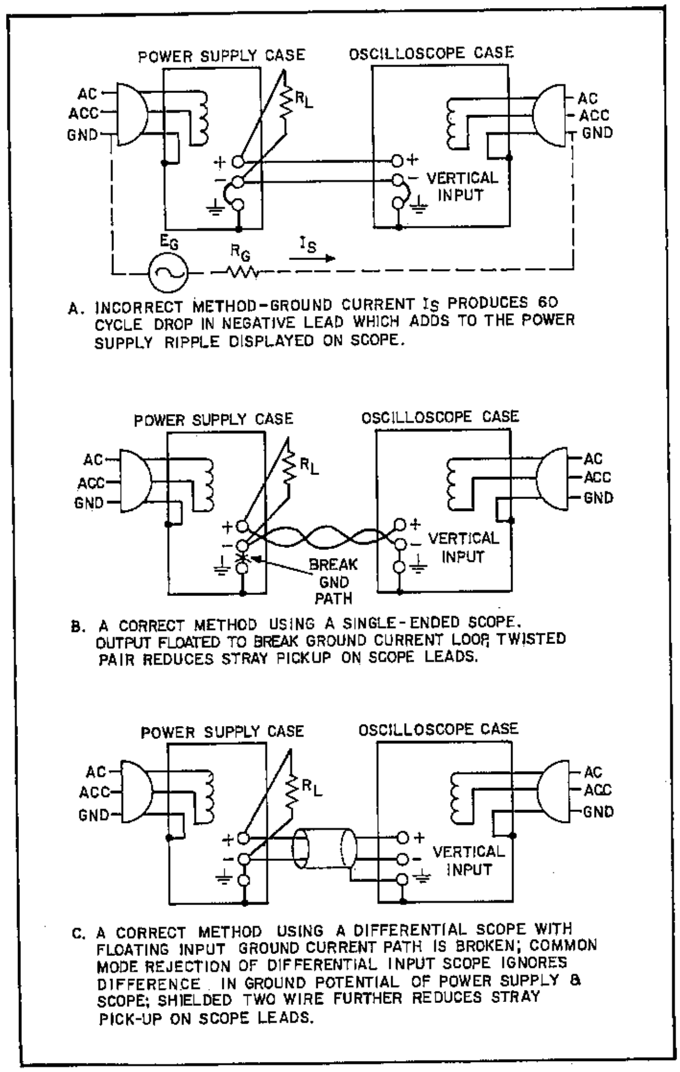


Figure 5-6. CV Ripple and Noise Test Setup

5-21 Ripple and Noise Measurements. Figure 5-6A shows an incorrect method of measuring p-p ripple. Note that a continuous ground loop exists from the third wire of the input power cord of the supply to the third wire of the input power cord of the oscilloscope via the grounded power supply case, the wire between the negative output terminal of the power supply and the vertical input of the scope, and the grounded scope case. Any ground current circulating in this loop as a result of the difference in potential E_G between the two ground points causes an IR drop which is in series with the scope input. This IR drop, normally having a 60Hz line frequency fundamental, plus any pickup on the unshielded leads interconnecting the power supply and scope, appears on the face of the CRT. The magnitude of this resulting noise signal can easily be much greater than the true ripple developed between the plus and minus output terminals of the power supply, and can completely invalidate the measurement.

5-22 The same ground current and pickup problems can exist if an RMS voltmeter is substituted in place of the oscilloscope in Figure 5-6. However, the oscilloscope display, unlike the true RMS meter reading, tells the observer immediately whether the fundamental period of the signal displayed is 8. 3 milliseconds (1/120 Hz) or 16. 7 milliseconds (1/60 Hz). Since the fundamental ripple frequency present on the output of an ⓗ supply is 120 Hz (due to full-wave rectification), an oscilloscope display showing a 120 Hz fundamental component is indicative of a "clean" measurement setup, while the presence of a 60 Hz fundamental usually means that an improved setup will result in a more accurate (and lower) value of measured ripple.

5-23 Figure 5-6B shows a correct method of measuring the output ripple of a constant voltage power supply using a single-ended scope. The ground loop path is broken by floating the supply output. Note that to ensure that no potential difference exists between the supply and the oscilloscope, it is recommended that whenever possible they both be plugged into the same AC power buss. If the same buss cannot be used, both AC grounds must be at earth ground potential.

5-24 Either a twisted pair or (preferably) a shielded two-wire cable should be used to connect the output terminals of the power supply to the vertical input terminals of the scope. When using a twisted pair, care must be taken that one of the two wires is connected to the grounded input terminal of the oscilloscope. When using shielded two-wire, it is essential for the shield to be connected to ground at one end only so that no ground current will flow through this shield, thus inducing a noise signal in the shielded leads.

5-25 To verify that the oscilloscope is not displaying ripple that is induced in the leads or picked up from the grounds, the (+) scope lead should be shorted to the (-) scope lead at the power supply terminals. The ripple value obtained when the leads are shorted should be subtracted from the actual ripple measurement.

5-26 In most cases, the single-ended scope method of Figure 5-6B will be adequate to eliminate non-real components of ripple and noise so that a satisfactory measurement may be obtained. However, in more stubborn cases it may be necessary to use a differential scope with floating input as shown in Figure 5-6C. If desired, two single conductor shielded cables may be substituted in place of the shielded two-wire cable with equal success. Because of its common mode rejection, a differential oscilloscope displays only the difference in signal between its two vertical input terminals, thus ignoring the effects of any common mode signal introduced because of the difference in the AC potential between the power supply case and scope case. Before using a differential input scope in this manner, however, it is imperative that the common mode rejection capability of the scope be verified by shorting together its two input leads at the power supply and observing the trace on the CRT. If this trace is a straight line, the scope is properly ignoring any common mode signal present. If this trace is not a straight line, then the scope is not rejecting the ground signal and must be realigned in accordance with the manufacturer's instructions until proper common mode rejection is attained.

5-27 To check the ripple and noise output, proceed as follows:

a. Connect the oscilloscope or RMS voltmeter as shown in Figures 5-6B or 5-6C.

b. Turn the CURRENT control fully clockwise and adjust VOLTAGE control until front panel meter indicates maximum rated output voltage.

c. The observed ripple and noise should be less than 200μV RMS and 1mV p-p.

5-28 Noise Spike Measurement. When a high frequency spike measurement is being made, an instrument of sufficient bandwidth must be used; an oscilloscope with a bandwidth of 20 MHz or more is adequate. Measuring noise with an instrument that has insufficient bandwidth may conceal high frequency spikes detrimental to the load.

5-29 The test setups illustrated in Figures 5-6A and 5-6B are generally not acceptable for measuring spikes; a differential oscilloscope is necessary. Furthermore, the measurement concept of Figure 5-6C must be modified if accurate spike measurement is to be achieved:

1. As shown in Figure 5-7, two coax cables, must be substituted for the shielded two-wire cable.

2. Impedance matching resistors must be included to eliminate standing waves and cable ringing, and the capacitors must be connected to block the DC current path.

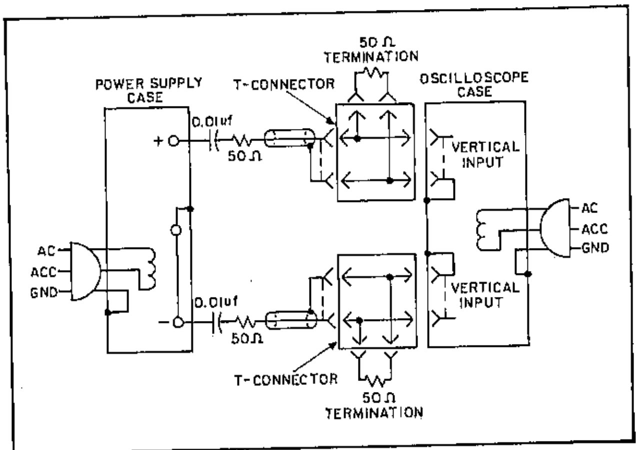


Figure 5-7. CV Noise Spike Test Setup

3. The length of the test leads outside the coax is critical and must be kept as short as possible; the blocking capacitor and the impedance matching resistor should be connected directly from the inner conductor of the cable to the power supply terminals.

4. Notice that the shields of the power supply end of the two coax cables are not connected to the power supply ground, since such a connection would give rise to a ground current path through the coax shield, resulting in an erroneous measurement.

5. The measured noise spike values must be doubled, since the impedance matching resistors constitute a 2-to-1 attenuator.

6. The noise spikes observed on the oscilloscope should be less than 0.5mV p-p.

5-30 The circuit of Figure 5-7 can also be used for the normal measurement of low frequency ripple and noise; simply remove the four terminating resistors and the blocking capacitors and substitute a higher gain vertical plug-in in place of the wide-band plug-in required for spike measurements. Notice that with these changes, Figure 5-7 becomes a two-cable version of Figure 5-6C.

5-31 Transient Recovery Time. To check the transient recovery time proceed as follows:

a. Connect test setup shown in Figure 5-8.

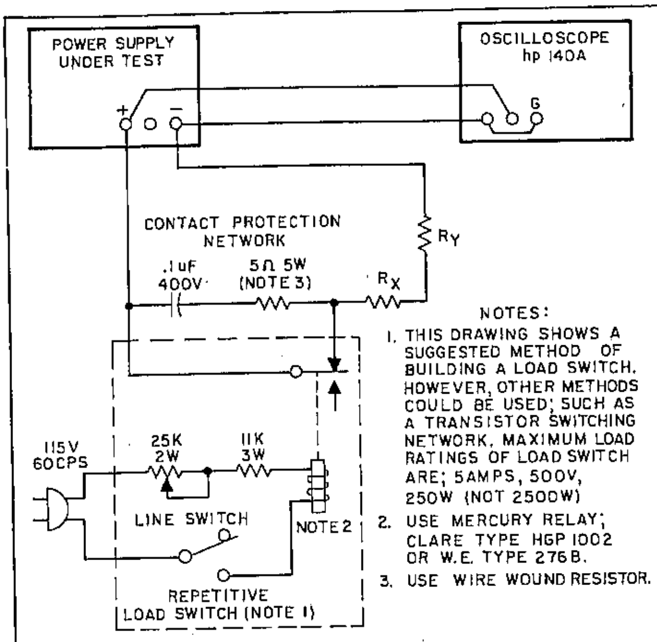
b. Turn CURRENT controls fully clockwise.

c. Set METER switch to highest current range and turn on supply.

d. Adjust VOLTAGE control(s) until front panel meter indicates exactly the maximum rated output voltage.

e. Close line switch on repetitive load switch setup.

f. Adjust 25K potentiometer until a stable display is obrained on oscilloscope. Waveform should be within the tolerances shown in Figure 5-9 (output should return to within 15mV of original value in less than 50 microseconds).



MODEL NO.	RESISTANCE (OHMS) R_X	R_Y
6281A	0.20	1.3
6253A, 6284A	0.33	6
6255A, 6289A	0.66	26
6294A	1.0	59
6299A	1.33	132

Figure 5-8. Transient Response, Test Setup

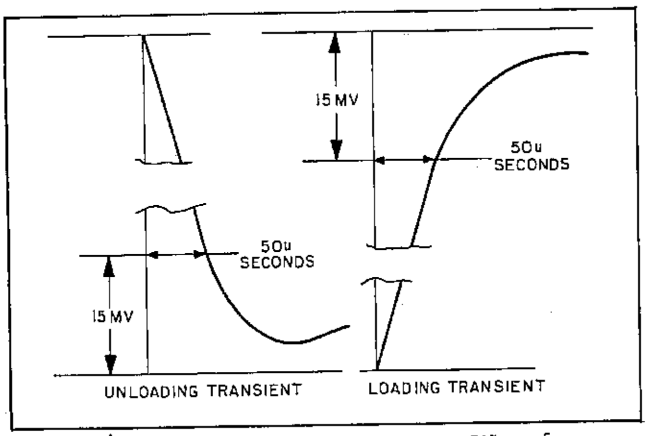
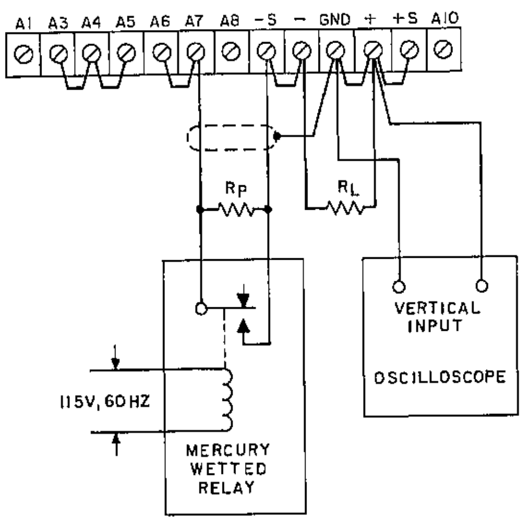


Figure 5-9. Transient Response, Waveforms

5-32 Programming Speed. This measurement is made by monitoring the output voltage with an oscilloscope while rapidly changing the remote programming resistance. For up-programming, the remote resistance is varied from zero ohms to the value that will produce maximum output voltage; and for down-programming, the remote resistance is varied from the value that will produce maximum output voltage to zero ohms. To check the up-programming speed, make the connections indicated in Figure 5-10; for down-programming, simply remove R_L.



MODEL	6253A	6255A	6281A	6284A	6289A	6294A
R_L	6Ω	26Ω	1.5Ω	6Ω	26Ω	60Ω

Figure 5-10. Constant Voltage Programming Speed, Test Setup

The load resistance is included for up-programming and removed for down-programming to present the worst possible conditions for the supply to reach the programmed voltage. Refer to Application Note 90, Power Supply Handbook for further details on remote programming speed. To check the programming speed, proceed as follows:

1. Restrap the rear barrier strip as indicated in Figure 5-10. Note that the jumper between +S and A10 is removed. This disconnects the output capacitor C20 to increase the programming speed. A minimum amount of output capacitance (C19) is permanently wired to the output and should not be removed, because the supply could oscillate under certain load conditions. The programming speed increases by a factor of from 10 to 100 when the output capacitor C20 is removed.

2. Connect the relay, oscilloscope, and programming resistor R_P as illustrated in Figure 5-10. Select the value of the programming resistor that will produce maximum output voltage of the supply. This value is obtained by multiplying the programming coefficient (200 ohms/volt, 300 ohms/volt for Model 6294A) by the maximum rated output voltage of the supply.

3. A mercury-wetted relay is employed to rapidly switch the programming resistance from zero to maximum at a 60 Hz rate. Other automatic switching devices can be used; however, a hand-operated switch connected across the programming resistor is not adequate, because the resulting one-shot displays are difficult to observe on most oscilloscopes.

4. The time (T) required for the output voltage to change from zero volts to maximum rated output or from maximum rated output to zero should be less than 10 milliseconds.

5-33 Output Impedance. To check the output impedance, proceed as follows:

a. Connect test setup as shown in Figure 5-11.

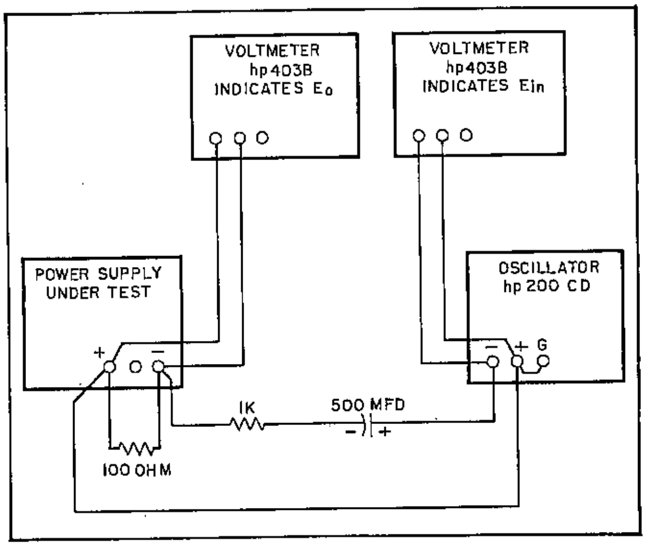


Figure 5-11. Output Impedance, Test Setup

b. Set METER switch to highest voltage range and turn CURRENT controls fully clockwise, and turn on supply.

c. Adjust VOLTAGE control(s) until front panel meter reads 20 volts.

d. Set AMPLITUDE control on Oscillator to 10 volts (E_{in}), and FREQUENCY control to 1 kHz.

e. Record voltage across output terminals of the power supply (E_o) as indicated on AC voltmeter.

f. Calculate the output impedance by the following formula: $Z_{out} = (E_oR)/(E_{in} - E_o)$

E_o = rms voltage across power supply output terminals.

R = 1000.

E_{in} = 10 volts.

g. The output impedance (Z_{out}) should be less than 0.01 ohm.

h. Using formula of step f, calculate output impedance at frequencies of 10kHz, 100kHz, and 1MHz. Values should be less than 0.05 ohm, 0.5 ohm, and 5 ohms, respectively.

5-34 CONSTANT CURRENT TESTS

5-35 Load Regulation. To check the constant current load regulation, proceed as follows:

a. Connect test setup as shown in Figure 5-4.

b. Turn VOLTAGE control(s) fully clockwise.

c. Set METER switch to highest current range