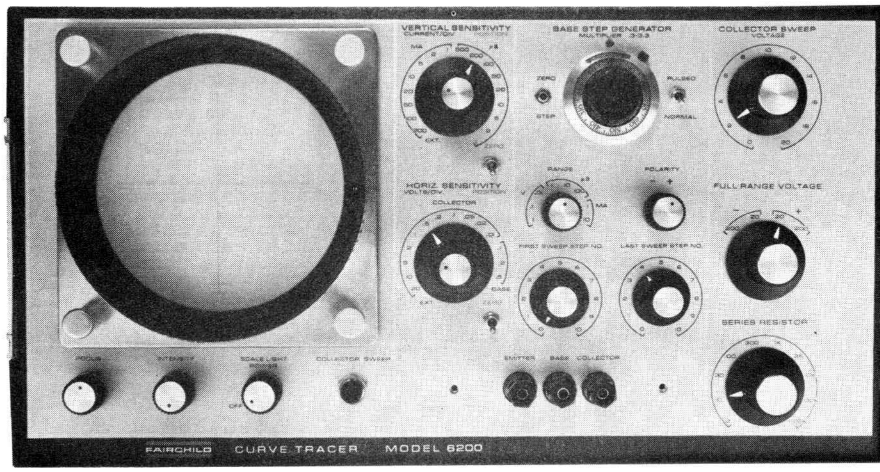
FAIRCHILD

INSTRUMENTATION

INSTRUCTION MANUAL
CURVE TRACER
MODEL 6200 A

PALO ALTO, CALIFORNIA

FAIRCHILD
INSTRUMENTATION



INSTRUCTION MANUAL
CURVE TRACER
MODEL 6200

FAIRCHILD INSTRUMENTATION — WESTERN OPERATIONS

A Division of Fairchild Camera and Instrument Corporation

844 Charleston Road   Palo Alto, California

Printed December 1965

LIST OF EFFECTIVE PAGES

Insert latest changed pages, destroy superseded pages.

TOTAL NUMBER OF PAGES OF THIS PUBLICATION IS 90, CONSISTING OF THE FOLLOWING:

Page No.	
Title	Original - April 65
A	Revision A - Jan 66
i through vi	Original - April 65
1-1 through 1-3	Original - April 65
1-4	Revision A - Jan 66
2-1	Original - April 65
2-2	Revision A - Jan 66
2-3 and 2-4	Original - April 65
3-1	Revision A - Jan 66
3-2 through 3-4	Original - April 65
3-5 through 3-8	Revision A - Jan 66
4-1 through 4-7	Original - April 65
4-8	Revision A - Jan 66
4-9 through 4-12	Original - April 65
5-1 and 5-2	Original - April 65
5-3	Revision - Jan 66
5-4 through 5-5	Original - April 65
5-6	Revision A - Jan 66
5-7 through 5-28	Original - April 65
6-1 through 6-26	Original - April 65

Additional copies of this publication may be obtained from Fairchild Instrumentation, 844 Charleston Road, Palo Alto, California

TABLE OF CONTENTS

TABLE OF CONTENTS (CONT)

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS (CONT)

LIST OF TABLES

FAIRCHILD INSTRUMENTATION

EQUIPMENT WARRANTY

Seller warrants equipment of its manufacture against defective materials or workmanship for a period of one year from date of shipment.

The liability of Seller under this warranty is limited, at Seller's option, solely to repair, replacement with equivalent Fairchild equipment, or an appropriate credit adjustment not to exceed the original equipment sales price, of equipment returned to the Seller provided that:

a. Seller is promptly notified in writing by Buyer upon discovery of defects,

b. The defective equipment is returned to Seller, transportation charges prepaid by Buyer, and,

c. Seller's examination of such equipment discloses to its satisfaction that defects were not caused by negligence, misuse, imporper installation, accident, or unauthorized repair or alteration by the Buyer.

This warranty does not include mechanical parts failing from normal usage nor does it cover limited life electrical components which deteriorate with age such as vacuum tubes, chopper, lamps, etc. In the case of accessories, i.e., card punches, typewriters, etc., not manufactured by the Seller, but which are furnished with the Seller's equipment, Seller's liability is limited to whatever warranty is extended by the manufacturers thereof and transferable to the Buyer.

This warranty is applicable to the original Buyer only and constitutes the sole and exclusive warranty of Seller.

No other warranty is made, expressed or implied.

SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION

1-2. The Fairchild Curve Tracer Model 6200 is a self-contained, portable, benchtop or rack-mounted instrument displaying on a five inch cathode ray tube the dynamic characteristics of semiconductor devices. Although it will test any device responsive to curve trace analysis, it is particularly suited to testing low power devices being used with increasing favor by circuit designers.

1-3. The Model 6200 design is the result of combining thoroughly field tested circuits with the most recent developments in packaging. Its rugged construction and convenient size make it a useful instrument for laboratory, production, quality control operations. The flexibility and simplicity of the controls makes it equally acceptable to the advanced engineer and the semi-skilled operator.

1-4. GENERAL DESCRIPTION

1-5. The curve tracer is a test instrument consisting of two synchronized power supplies and a cathode ray tube monitor. The base step generator provides current or voltage to the input of the device under test in adjustable increments. The collector sweep generator provides collector voltage from zero to full range voltage. A calibrated oscilloscope display monitors collector volts or base volts on the horizontal scale and collector current on the vertical scale. This provides a family of curves for analysis.

1-6. The Base Step Generator is discretely adjustable for the first and last step allowing the operator to select pertinent curves. The value of the base input is selected by two controls. The current/voltage selector provides current in five ranges from 1 μa to 10 ma per step or voltage in three ranges from 10 mv to 1 v per step. The second control is a vernier multiplier which allows infinite variation of the base input-per-step from 0.3 to 3.3 times the range setting. The two controls permit selection of any current from 330 nano amps to 33 ma per step or 3.3 mv to 3.3 volts per step.

1-7. A front panel toggle switch gives selection of either continuous or pulsed base input. This feature provides testing with a reduced duty factor.

1-8. Sensitivity of the deflection amplifiers is controlled by front panel selector switches. The vertical amplifier is adjustable from 1 μa to 200 ma per division.

1-8A. See change sheet in front of manual.

1-9. The horizontal amplifier is adjustable to the following value-per-division: collector voltage display from .01 to ~~20~~ 100 v; base voltage display from .1 v to .5 v.

1-10. The peak collector sweep voltage is adjusted with two front panel controls. The first is a ~~four~~ six position switch which selects the full range value and polarity. The second is continuously adjustable to allow any level between 0% and 100% of the full range value to be applied to the device under test. ~~The variable control is roughly calibrated for the ±20 v range. When using ±200 v ranges, the calibration marks should be multiplied by 10.~~ See change sheet in front of manual.

1-11. The series resistor in the collector sweep circuit is selected with a front panel switch. Values are from 3 Ω to 100 k.

1-12. REMOTE PROGRAMING

1-13. A cable connector in the rear panel provides remote programing capability for the deflection amplifier sensitivity. When this mode is used the two control switches are set to EXT position.

1-14. MECHANICAL DATA

1-15. The Model 6200 is completely contained in a single chassis which can be rack mounted or used as a bench instrument. The rack mounting hardware is offered as optional equipment. All operating controls are front panel mounted. The dimensions of the unit are as follows:

Width	16 3/4 inches
Length	18 inches
Height	8 3/4 inches
Weight	38 lbs. (approx.)

Table 1-1 Model 6200 Electrical Specifications

BASE STEP GENERATOR

Frequency:	Twice line frequency	
Number of Steps:	Maximum of 10. First and last steps independently variable between 0 and 10.	
Type of Steps:	Current or Voltage	
Polarity	+ or -	
Pulsed Condition:	A "pulsed base" setting reduces duty factor of device under test to approximately 10%.	
	Current	Voltage
Ranges:	1 μa/step 10 μa/step 100 μa/step 1 ma/step 10 ma/step	0.01 volt/step 0.10 volt /step 1.00 volt/step
Multiplier:	0.3 to 3.3 continuously adjustable multiplier on all ranges	0.3 to 3.3 continuously adjustable multiplier on all ranges
Programing Accuracy:	±3% of programed value	±4% of programed value

COLLECTOR SWEEP GENERATOR

Frequency:	Twice line frequency
Sweep Voltage:	Continuously variable
Range	0 to 20 volts, 2 amp. max. 0 to 200 volts, 200 ma max.

Table 1-1 Model 6200 Electrical Specifications (Cont)

COLLECTOR SWEEP GENERATOR (cont)

Polarity:	Positive or negative	
Overload Protection:	Magnetic relay	
VERTICAL DISPLAY		
Display:	Collector current	
Sensitivity:	1 μa/div to 200 ma/div in 1, 2, 5 sequence	
Accuracy:	±3% of reading on all ranges	
HORIZONTAL DISPLAY		
Display:	Collector voltage or base voltage	
	Collector Voltage	Base Voltage
Sensitivity:	10 mv to 20 v/div in 1, 2, 5 sequence	100 mv/div, 200 mv/div, 500 mv/div.
Accuracy:	±3% of reading on all ranges	±3% of reading on on all ranges

REMOTE PROGRAMING PROVISIONS

All ranges are programable by contact closure to internally supplied voltage.

POWER REQUIREMENTS

115 vac ±10 %, 50 to 60 cps, 100 watts

SECTION II
INSTALLATION

2-1. SCOPE OF SECTION

2-2. This section contains instruction for initial inspection and preliminary checkout of the Model 6200. Reshipment instructions are included to provide for return of the instrument to Fairchild Instrumentation, if required.

2-3. INITIAL INSPECTION

2-4. It is the responsibility of the customer to inspect the crated instrument before releasing the shipper. Any sign of external damage must be noted by both and called to the attention of the insurance investigator.

2-5. UNCRATING

2-6. Any damage discovered during uncrating must be noted and uncrating stopped until insurance investigator has determined extent of damage and liability. Do not proceed with uncrating of a damaged instrument without instructions from insurance investigator.

2-7. After uncrating, place instrument on a bench or cart and remove top cover plate. Make visual check of components for evidence of damage. Give particular attention to transformer, tubes and sockets. It is not necessary to remove lower plate for inspection since physical damage is apparent from top. Loosened or damaged components on bottom board are detected by checkout. Replace top cover plate.

2-8. PRELIMINARY CHECK

2-9. The purpose of this check is to ensure that all components and circuits are in operating condition. To perform check, carry out following steps:

a. Set front panel controls as detailed below:

INTENSITY	fully clockwise
VERTICAL POSITION	mid-range
HORIZ. POSITION	mid-range
FULL RANGE VOLTAGE	+20
COLLECTOR SWEEP VOLTAGE	0
HORIZ. SENSITIVITY	2 v/div
VERTICAL SENSITIVITY	2 ma/div
SCALE LIGHT POWER	OFF

b. Connect instrument to 115 VAC 50-60 cps power source and set SCALE LIGHT/POWER switch to ON.

c. After approximately 30 seconds a spot should appear on cathode ray tube. Adjust FOCUS and

INTENSITY controls for smallest dot possible at normal intensity.

d. Move dot to lower left-hand corner of graticule with VERTICAL and HORIZ. POSITION controls.

e. Rotate COLLECTOR SWEEP VOLTAGE control to 20. Check that a horizontal trace, 10 divisions or more, appears on CRT.

f. Set SERIES RESISTOR to 100 Ω and connect jumper between collector and emitter terminals on front panel. Check that vertical trace is off graticule.

g. Remove shorting link and set front panel controls as follows:

RANGE	.1 v
POLARITY	+
FIRST SWEEP STEP NO.	0
LAST SWEEP STEP NO.	10
BASE STEP MULTIPLIER	1.00
HORIZ. SENSITIVITY	.1 BASE

h. Check that CRT presentation consists of 11 dots, equally spaced, on horizontal axis of graticule.

i. Set PULSED/NORMAL switch to PULSED. Note that 0 dot on presentation remains bright and dots 1 through 10 have low intensity.

2-10. If all conditions described in paragraph 2-9 are met, the instrument is ready for service.

2-11. POWER REQUIREMENTS

2-13. The Model 6200 is designed to operate from a source of 115 volt, two wire, single phase, 50 or 60 cps power. Do not connect the instrument to a power source with incorrect voltage or inadequate current rating.

2-13. The Model 6200 is equipped with a three-conductor power cable which grounds the instrument when the connector is plugged into an appropriate receptacle.

2-14. To preserve the safety feature when operating with a two-contact outlet, use an adapter and connect the pigtail on the adapter to a suitable ground.

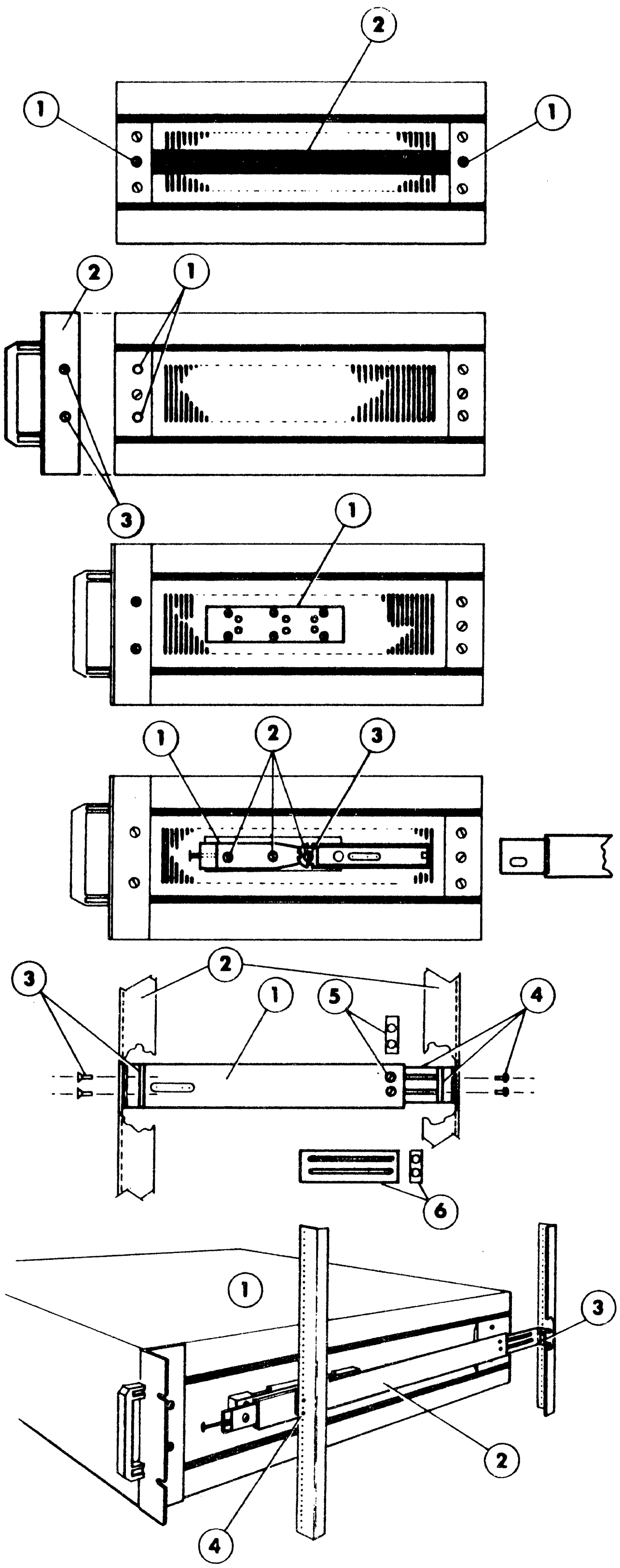
2-15. <u>RACK MOUNT CONVERSION</u>

2-16. The Model 6200 is shipped as a bench instrument when bought as a single unit. It can be converted to a 19 inch rack mounting by installing the Rack Mount Kit C609274-7. Instructions for conversion are contained in figure 2-1.

2-17. <u>RESHIPMENT</u>

2-18. When an instrument is damaged in shipping, the insurance investigator can order it returned. The responsibility for recrating and reshipment is insurance company's. Neither the customer or Fairchild are required to assume such responsibility without specific understanding with the insurance company through proper representatives.

2-19. When an undamaged operational tester is to be returned, an agreement will be made between Fairchild and the customer as to procedure.



a. Remove screws (1) and handle strap (2). Replace screws.

b. Remove screws (1) from front of instrument. Place rack handle (2) in position and replace screws with flat head screws.

c. Mount adapter (1) using six no. 4 screws. Note spacing on detail.

d. Remove center section (1) from slides. Mount adapter in lower set of holes using shoulder screws (2). Use screw with longer shoulder for pivot point (3).

e. Mount front of slide with flat head screws and bar nut (3). Mount angle bracket (4) using binder head screws and bar nut (5). If additional length is required use expander plate (6). Do not secure screws tightly at this time.

f. Place instrument (1) in rack (2) and insert fully into rack. Tighten screws (3) at rear. Withdraw instrument approximately six inches and adjust rack until it is level. secure screws (4) on front.

Figure 2-1 Rack Mount Conversion Instructions

SECTION III
OPERATION

3-1. SCOPE OF SECTION

3-2. Section III contains a description of the front panel controls on the Model 6200 and their function. In addition, the operation of the instrument is described using examples of basic curve trace analysis.

3-3. FRONT-PANEL CONTROLS

3-4. All operating controls of the Model 6200 are mounted on the front panel of the instrument and the following describes each control and its function. (See figure 3-1 for location of controls.)

1. Cathode Ray Tube (CRT) is 5 " Dumont 5AQP1A medium persistence tube.

2. FOCUS potentiometer controls sharpness of trace.

3. INTENSITY potentiometer controls brightness of trace.

4. SCALE LIGHT/POWER potentiometer/switch controls illumination of graticule and primary power to instrument.

5. VERTICAL SENSITIVITY CURRENT/DIV 18-position rotary switch selects current-per-division to be viewed on vertical axis of CRT. Current settings per graticule division are 1 μa, 2 μa, 5 μa, 10 μa, 20 μa, 50 μa, 100 μa, 200 μa, 500 μa, 1 ma, 2 ma, 5 ma, 10 ma, 20 ma, 50 ma, 100 ma, and 200 ma. EXT position allows switch settings to be remotely programed.

6. VERTICAL POSITION potentiometer positions trace vertically on CRT.

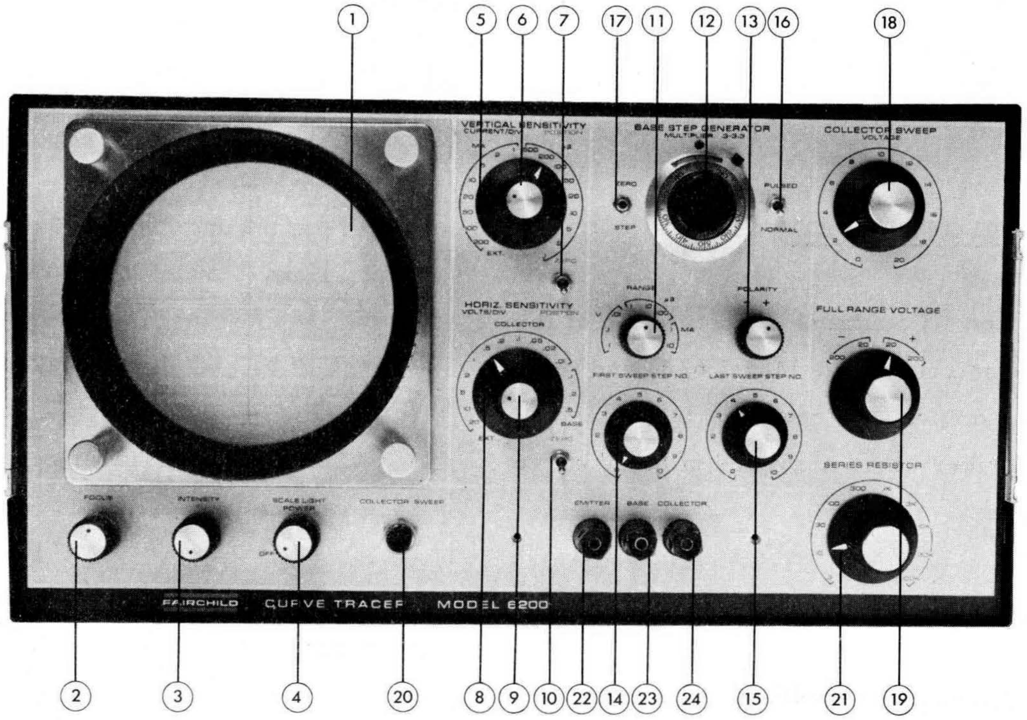
7. ZERO toggle switch grounds input of vertical amplifier.

8. HORIZ. SENSITIVITY VOLTS/DIV 15-position toggle switch selects volts-per-division to be viewed on horizontal axis of CRT. Two sources can be viewed: COLLECTOR or BASE. COLLECTOR settings per graticule division are .01 v, .02 v, .05 v, .1 v, .2 v, .5 v, 1 v, 2 v, 5 v, 10 v and 20 v; BASE settings per division are .1 v, .2 v and .5 v. EXT position allows switch settings to be remotely programed.

9. HORIZ. POSITION potentiometer positions trace horizontally on CRT.

10. ZERO toggle switch grounds input of horizontal amplifier.

11. RANGE 11-position rotary switch sets value-per step of base step generator. VOLTAGE positions are .01 v, .1 v, and 1 v per step; CURRENT positions are 1 μa, 10 μa, 100 μa, 1 ma and 10 ma per step.



1. Cathode Ray tube
2. FOCUS potentiometer
3. INTENSITY potentiometer
4. SCALE LIGHT/POWER control
5. VERTICAL SENSITIVITY CURRENT/DIV switch
6. VERTICAL POSITION potentiometer
7. ZERO switch
8. HORIZ. SENSITIVITY VOLTS/DIV switch
9. HORIZ. POSITION potentiometer
10. ZERO switch
11. RANGE switch
12. BASE STEP GENERATOR MULTIPLIER vernier
13. POLARITY switch
14. FIRST SWEEP STEP NO. switch
15. LAST SWEEP STEP NO. switch
16. PULSED/NORMAL switch
17. ZERO STEP screwdriver adjustment
18. COLLECTOR SWEEP VOLTAGE control
19. FULL RANGE VOLTAGE switch
20. COLLECTOR SWEEP pushbutton
21. SERIES RESISTOR switch
22. EMITTER test terminal
23. BASE test terminal
24. COLLECTOR test terminal

Figure 3-1 Model 6200 Front Panel Controls

12. BASE STEP GENERATOR MULTIPLIER vernier is used with RANGE switch setting to program base step generator value-per-step. Upper scale is in units - 0 to 3, and lower scale is in 1/100's. Multiplier factor is sum of two scale readings. For example, with 1 on upper scale and 35 on lower, multiplier is 1.35. With a RANGE setting of .1 v, the value-per-step is .135 v (.1 v x 1.35).

13. POLARITY 2-position rotary switch selects polarity of base step generator signal.

14. FIRST SWEEP STEP NO. 11-position rotary switch selects first step of base step generator.

15. LAST SWEEP STEP NO. 11-position rotary switch selects last step of base step generator.

16. PULSED/NORMAL toggle switch selects base drive mode of testing. In PULSED position, application of base drive is limited to the time when collector sweep voltage is near its maximum, producing a duty cycle of 5 - 15%. In NORMAL setting, base drive is continuous.

17. ZERO STEP screwdriver pre-set adjustment sets zero step of base step generator.

18. COLLECTOR SWEEP VOLTAGE variable auto transformer selects amplitude of collector sweep voltage. In ±20 volt settings of FULL RANGE switch below, amplitude equals scale markings. In ±200 volt positions of RANGE switch, amplitude is scale marking x 10.

19. FULL RANGE VOLTAGE 4-position rotary switch selects full scale range and polarity of collector sweep voltage. Settings are +20 v, +200 v, -20 v and -200 v.

20. COLLECTOR SWEEP pushbutton resets overload circuit breaker in collector sweep circuit.

21. SERIES RESISTOR 10-position rotary switch connects a series resistor in collector sweep circuit. Values available are: 3 Ω, 10 Ω, 30 Ω, 100 Ω, 300 Ω, 1 k, 3 k, 10 k, 30 k, and 100 k.

22, 23, 24. EMITTER/BASE/COLLECTOR connectors are terminals for device under test.

3-5. REMOTE PROGRAMING

3-6. Connector J1, located at the rear of the instrument, permits the settings on the front panel VERTICAL SENSITIVITY CURRENT/DIV and HORIZ. SENSITIVITY VOLTS/DIV switches to be remotely programed. Figure 3-2 is a basic diagram of the remote control system. Leads from the relays controlled by each position of the two switches are connected to pins on J1 (see table 3-1). When the switches are set to EXT, the +65 volt energising power for the relays is also connected to J1. The desired sensitivity settings may then be selected by contact closure between the +65 volt pins and the appropriate relay pins.

3-7. The Fairchild Instrumentation Model 3510 Programer is designed for remote operation of the Model 6200. The Model 3510 can be programed to select both vertical and horizontal sensitivity values automatically in repeat or step modes.

Table 3-1 J1 Pin Designation, VERT. and HORIZ. SENSITIVITY Remote Programing

J1 Pin Designation	VERT. and HORIZ. SENSITIVITY Service Settings	
18	VERT. SENS.	EXT (+65 v relay power)
1		1 μa/div
3		2 μa/div
5		5 μa/div
7		10 μa/div
9		20 μa/div
11		50 μa/div
13		100 μa/div
15		200 μa/div
17		500 μa/div
2		1 na/div
4		2 na/div
6		5 ma/div
8		10 ma/div
10		20 ma/div
12		50 ma/div
14		100 ma/div
16	VERT. SENS.	200 ma/div
33	HORIZ. SENS.	EXT (+65 v relay power)
19		.01 v/div COLLECTOR
20		.02 v/div
21		.05 v/div
22		.1 v/div
23		.2 v/div
24		.5 v/div
25		1 v/div
26		2 v/div
27		5 v/div
28		10 v/div
29		20 v/div COLLECTOR
30		.1 v/div BASE
31		.2 v/div
32	HORIZ. SENS.	.5 v/div BASE

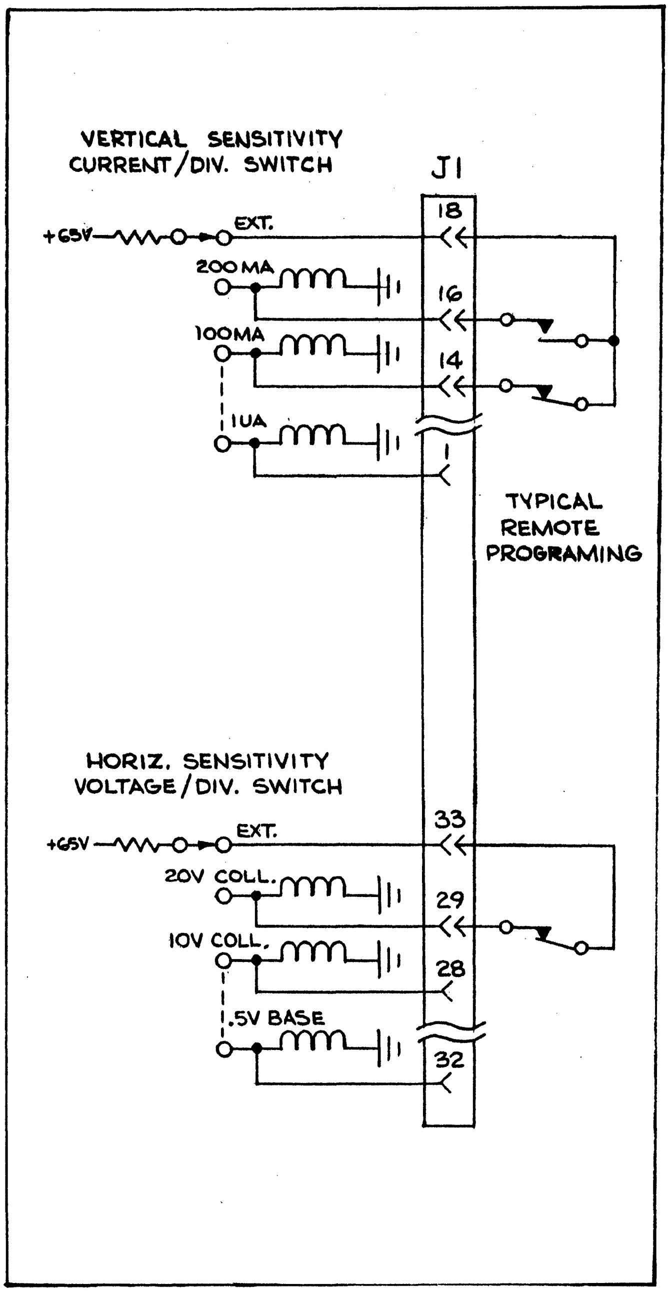


Figure 3-2 Remote Programing Basic Diagram

3-8. TYPICAL TESTS

3-9. Figures 3-2 through 3-17 are examples of tests made with the Model 6200. The captions indicate the type of device and the control settings for each test.

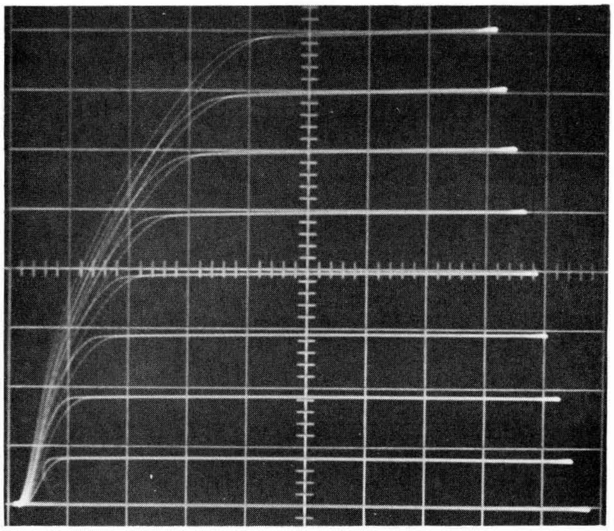


Figure 3-3 I_C vs V_{CE} NPN Transistor

HORIZ. SENSITIVITY:	0.5 v/div
VERT. SENSITIVITY:	5 ma/div
BASE STEP INCREMENT:	50 μa
SERIES RESISTOR:	10 Ω

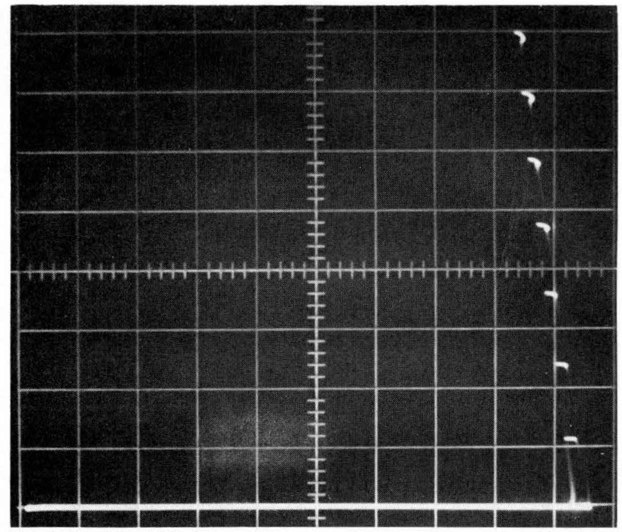


Figure 3-5 I_C vs V_{CE} NPN Transistor

HORIZ SENSITIVITY:	1 v/div
VERT. SENSITIVITY:	10 ma/div
BASE STEP INCREMENT:	100 μa (pulsed mode)
SERIES RESISTOR:	10 Ω

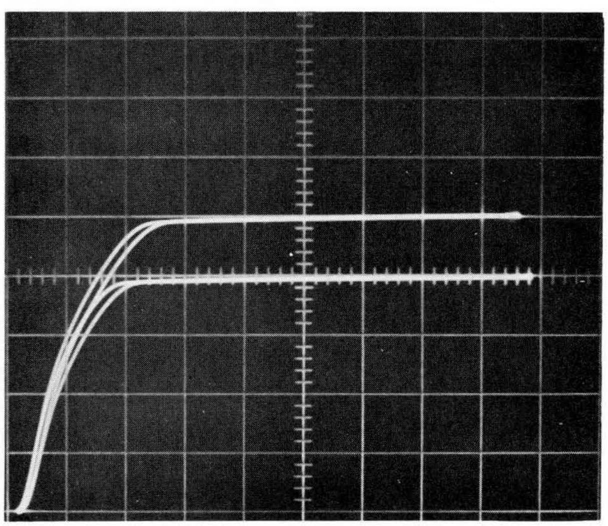


Figure 3-4 I_C vs V_{CE} NPN Transistor

HORIZ. SENSITIVITY:	0.5 v/div
VERT. SENSITIVITY:	5 ma/div
BASE STEP INCREMENT: (Steps 4 and 5 only)	50 μa
SERIES RESISTOR:	10 Ω

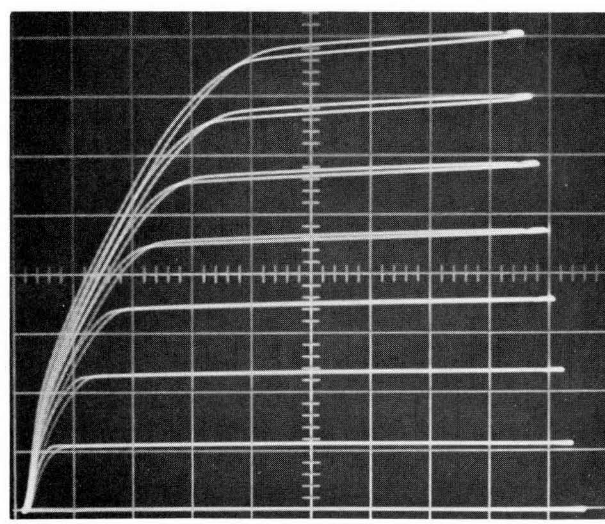


Figure 3-6 I_C vs V_{CE} NPN Transistor

HORIZ. SENSITIVITY:	1 v/div
VERT. SENSITIVITY:	10 ma/div
BASE STEP INCREMENT:	100 μa
SERIES RESISTOR:	10 Ω

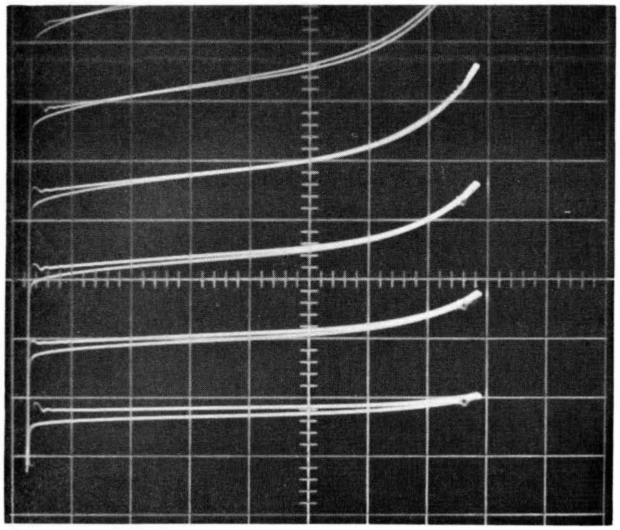


Figure 3-7 I_C vs V_{CE} NPN Transistor

HORIZ. SENSITIVITY:	10 v/div
VERT. SENSITIVITY:	1 ma/div
BASE STEP INCREMENT:	10 μa
SERIES RESISTOR:	10 Ω

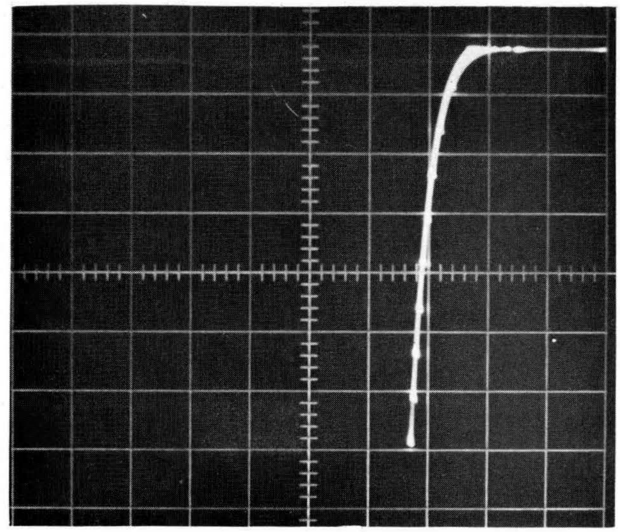


Figure 3-9 I_C vs V_{BE} PNP Transistor

HORIZ. SENSITIVITY:	0.1 v/div
VERT. SENSITIVITY:	2 ma/div
BASE STEP INCREMENT:	14.4 μa
SERIES RESISTOR:	10 Ω

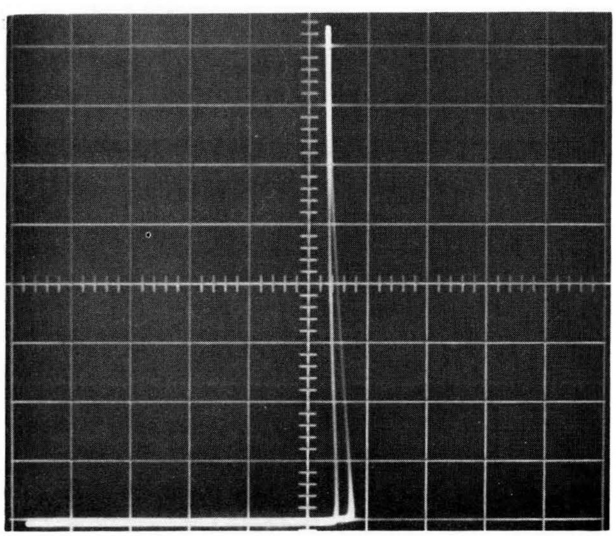


Figure 3-8 I_C vs V_{CE} Showing BV_{CEX} NPN Transistor

HORIZ. SENSITIVITY:	20 v/div
VERT. SENSITIVITY:	1 ma/div
BASE STEP INCREMENT: (First and last step 0)	10 μa
SERIES RESISTOR:	1 k

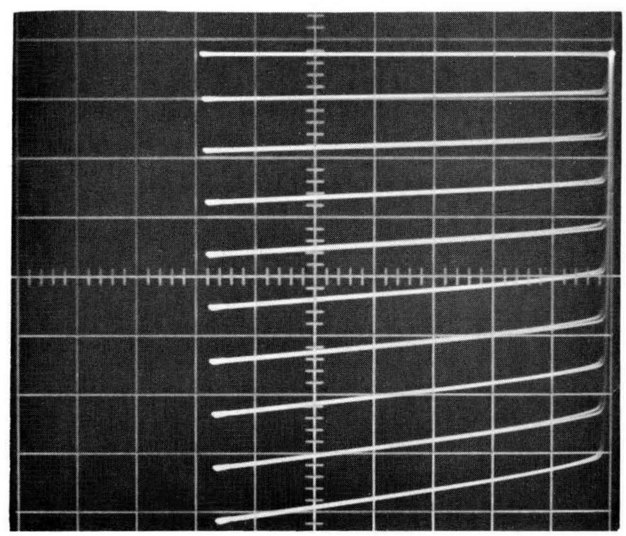


Figure 3-10 I_{CE} vs V_{CE} PNP Transistor

HORIZ. SENSITIVITY:	2 v/div
VERT. SENSITIVITY:	1 ma/div
BASE STEP INCREMENT:	14.4 μa
SERIES RESISTOR:	10 Ω

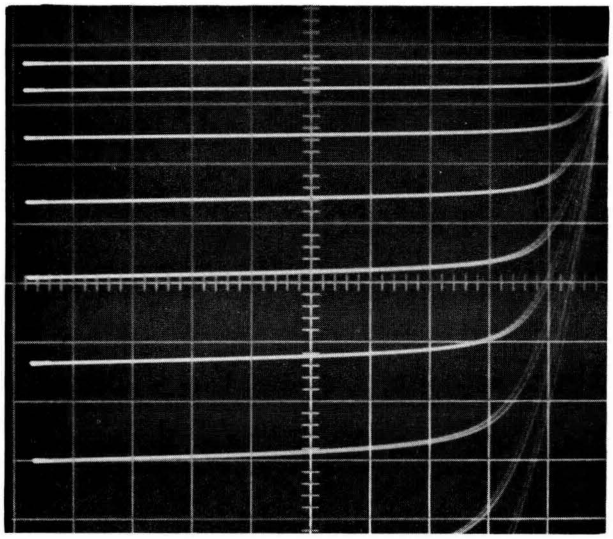


Figure 3-11 I_D vs V_{DS} P-FET Device

HORIZ. SENSITIVITY: 2 v/div

VERT. SENSITIVITY: 50 μa/div

BASE STEP INCREMENT: +0.5 v
(Gate)

SERIES RESISTOR: 10 Ω

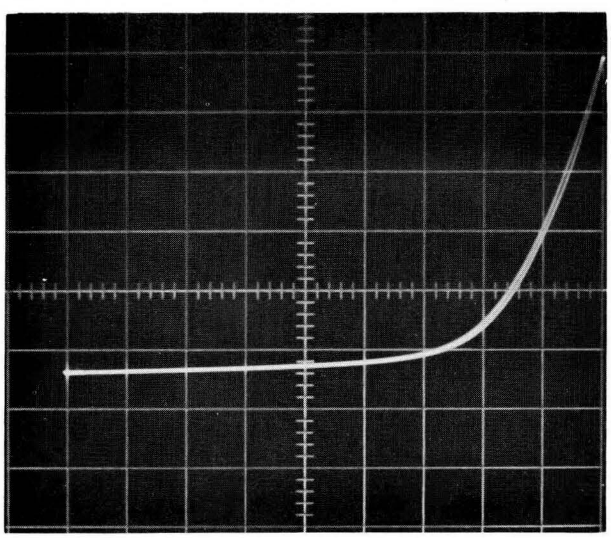


Figure 3-12 I_D vs V_{DS} P-FET Device

HORIZ. SENSITIVITY: 2 v/div

VERT. SENSITIVITY: 50 μa/div

BASE STEP INCREMENT: +0.5 v
(Gate, first and last step 0)

SERIES RESISTOR: 1 k

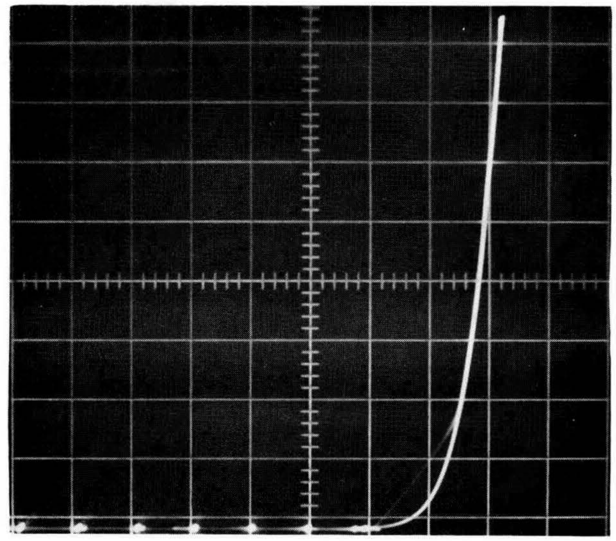


Figure 3-13 I_F vs V_G SCR Device

HORIZ. SENSITIVITY: 0.1 v/div
(Base)

VERT. SENSITIVITY: 50 ma/div

BASE STEP INCREMENT: +0.1 v
(Gate)

SERIES RESISTOR: 300 Ω

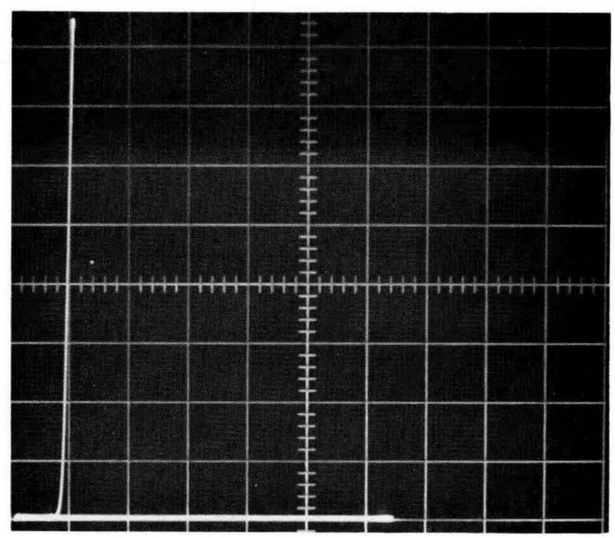


Figure 3-14 I_F vs V_F SCR Device

HORIZ. SENSITIVITY: 1.0 v/div
(Cathode to Anode)

VERT. SENSITIVITY: 100 ma/div

BASE STEP INCREMENT: +0.1 v
(Gate)

SERIES RESISTOR: 3 Ω

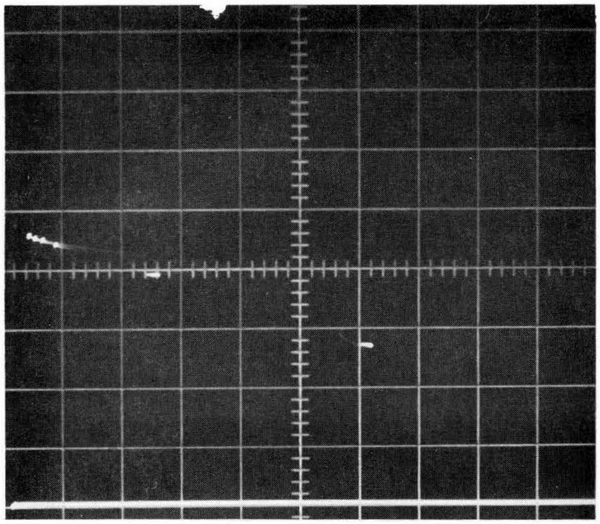


Figure 3-15 I_{CE} vs V_{CE} NPN Power Transistor

HORIZ. SENSITIVITY:	1.0 v/div
VERT. SENSITIVITY:	100 ma/div
BASE STEP INCREMENT: (Pulsed)	1 ma
SERIES RESISTOR:	300 Ω

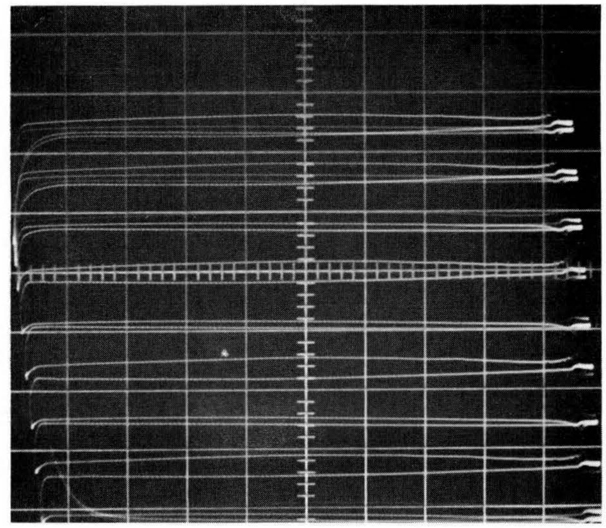


Figure 3-17 V_{CE} vs V_{CE} NPN Transistor Grounded Base

HORIZ. SENSITIVITY:	1.0 v/div
VERT. SENSITIVITY:	1 ma/div
BASE STEP INCREMENT: (Emitter)	1 μa
SERIES RESISTOR:	30 k Ω

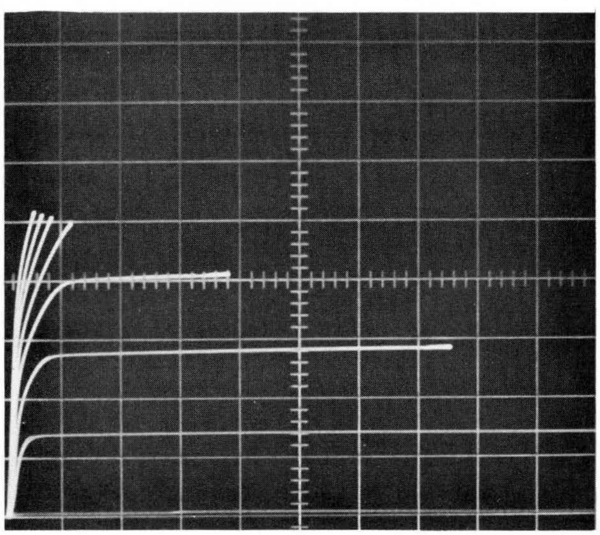


Figure 3-16 I_C vs V_{CE} NPN Power Transistor

HORIZ. SENSITIVITY:	1.0 v/div
VERT. SENSITIVITY:	100 ma/div
BASE STEP INCREMENT:	1 ma
SERIES RESISTOR:	300 Ω

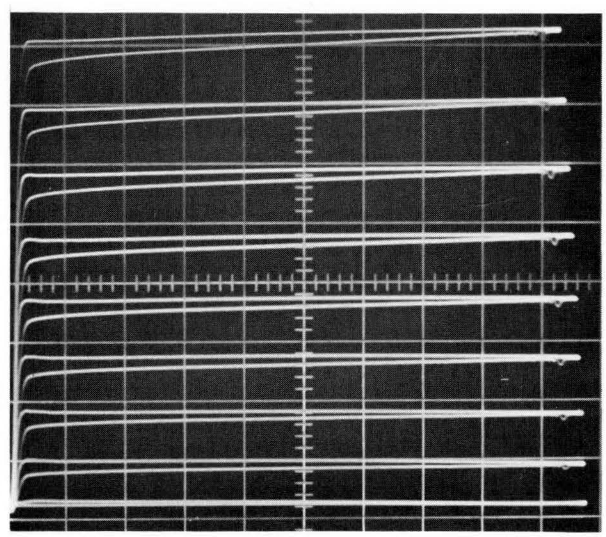


Figure 3-18 I_C vs V_{CE} NPN Transistor

HORIZ. SENSITIVITY:	1.0 v/div
VERT. SENSITIVITY:	50 μa/div
BASE STEP INCREMENT:	1 μa
SERIES RESISTOR:	100 Ω

SECTION IV
THEORY OF OPERATION

4-1. SCOPE OF SECTION

4-2. This section contains a discussion of the design and operating principles of the Model 6200. A curve tracer is usually operated and maintained by personnel having a sound background in electronic theory so this portion of the manual is limited to information required to familiarize trained personnel with the instrument.

4-3. GENERAL DESCRIPTION

4-4. The Model 6200 is a single-chassis, self-contained unit. It uses 115 vac, 50 - 60 cycle, for primary power. At the customer's option, the Model 6200 can be equipped to serve as a bench tester or as a rack mounted instrument for permanent installation.

4-5. The Model 6200 can be used for curve trace analysis of any two or more lead devices if the leads are responsive to power inputs: and, if the bias conditions are compatible to the tester circuits.

4-6. CIRCUIT DESCRIPTION

4-7. The transistor under test is inserted into a common emitter test circuit. (See figure 4-1.) The collector has a sweep voltage applied while

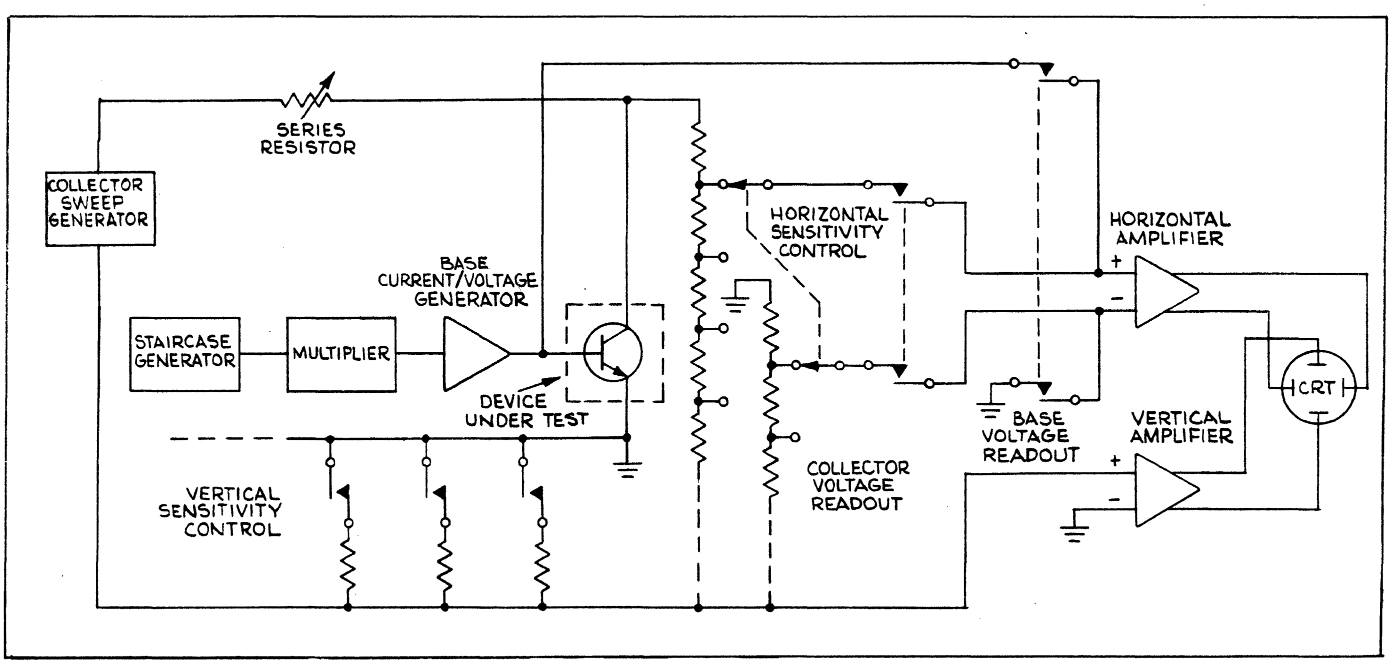


Figure 4-1 Model 6200 Block Diagram

a step voltage or current is applied to the base. Collector voltages sweep from zero to full range and return. The ranges are + or - 20 volts or + or - 200 volts. These voltages are produced by the Sweep Generator. The Base Step Generator applies a selected number of steps -- from zero to ten -- to the base of the device to produce a sequence of curves. The incremental value of the steps is controlled by a front panel range switch and variable multiplier which allows an infinite variation of values from 0.3 to 3.3 volts per step. Each sequence of steps produces one family of characteristic curves.

4-8. Signals used for vertical and horizontal deflection on the CRT are voltage/current values taken from the collector or base in the transistor test circuit. A selected vertical signal can be plotted against a selected horizontal signal to trace the desired semiconductor characteristic curve. Selection of the deflection signal source is done with the front panel controls. Horizontal deflection sources are the transistor collector or base. Vertical deflection source is the transistor collector current.

4-9. COLLECTOR SWEEP

4-10. The function of the Collector Sweep circuit is to provide a voltage to the collector of the device under test. The selected voltage sweeps from zero to full range at double the frequency of the primary power source. The collector current resulting from the collector sweep voltage and the base input is the vertical trace on the CRT. Since the base input remains fixed during the collector voltage sweep the vertical trace reflects the collector current at all points from zero voltage to full range. To aid in curve analysis, the collector sweep voltage is calibrated in CRT divisions. In the 1 v/div range, for example, each division on the horizontal trace represents an increase of 1 volt in the collector sweep voltage. Each division on the vertical trace represents a selected current value.

4-11. Two standard displays are available: a) Collector current (I_C) versus collector voltage (V_C) as function of base input - current or voltage, and b) Collector current (I_C) versus base voltage (V_B) as function of base input - current or voltage.

4-12. COLLECTOR VOLTAGE CONTROL

4-13. The front panel controls (see figure 3-1) - COLLECTOR SWEEP VOLTAGE and FULL RANGE VOLTAGE are used to establish the voltage value of the collector sweep. The COLLECTOR SWEEP VOLTAGE control operates autotransformer T2 whose input is 115 vac primary power and whose output is applied across circuit breaker CB1 to the primary winding of T3 (see figure 4-3). The secondary windings of T3 are connected to full

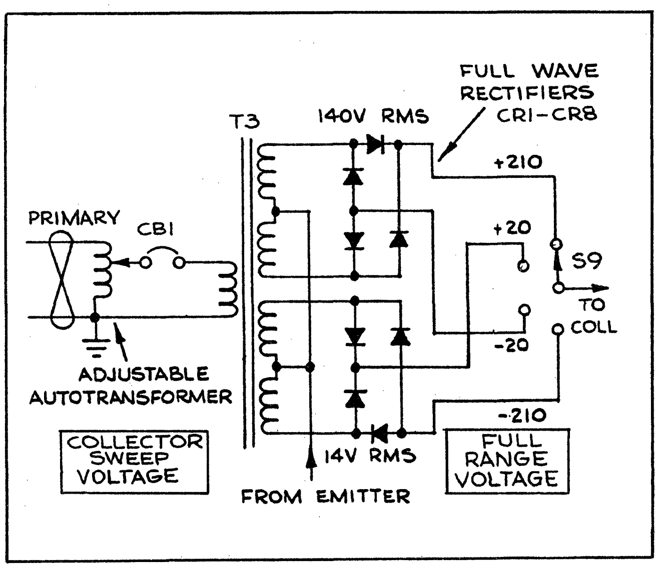


Figure 4-2 Collector Voltage Control

wave rectifiers CR1 through CR8 which provide dc outputs of ±20 volts and ±200 volts. FULL RANGE VOLTAGE switch S9 selects the output level and polarity. The COLLECTOR SWEEP VOLTAGE control is continuously variable but the front panel scale is engraved with even numbered designators from 0 to 20. In the ±20 volt ranges, the scale indicates the voltage being used; in the ±200 volt ranges, the scale indicates 1/10 of the voltage.

4-14. SERIES RESISTOR

4-15. In order to establish the test conditions for a curve trace analysis, a V_{CC} is selected and a resistor in series with the collector of the device under test. The resistance is selected by front panel SERIES RESISTOR switch S10 as a current limiting device. (See figure 5-1.) Ten values of resistance are available from 3 Ω (the internal impedance of the rectifier and transformer circuits) to 100 kΩ. The fixed resistor for the 10Ω setting is 5 Ω and 25 Ω for the 30 Ω setting. In both cases, the fixed value plus the internal impedance gives the required series resistance.

4-16. HORIZONTAL AMPLIFIER

4-17. The horizontal amplifier (see figure 4-3) converts the single-ended output of the Collector Sweep circuit into the push-pull configuration needed to drive the horizontal deflection plates

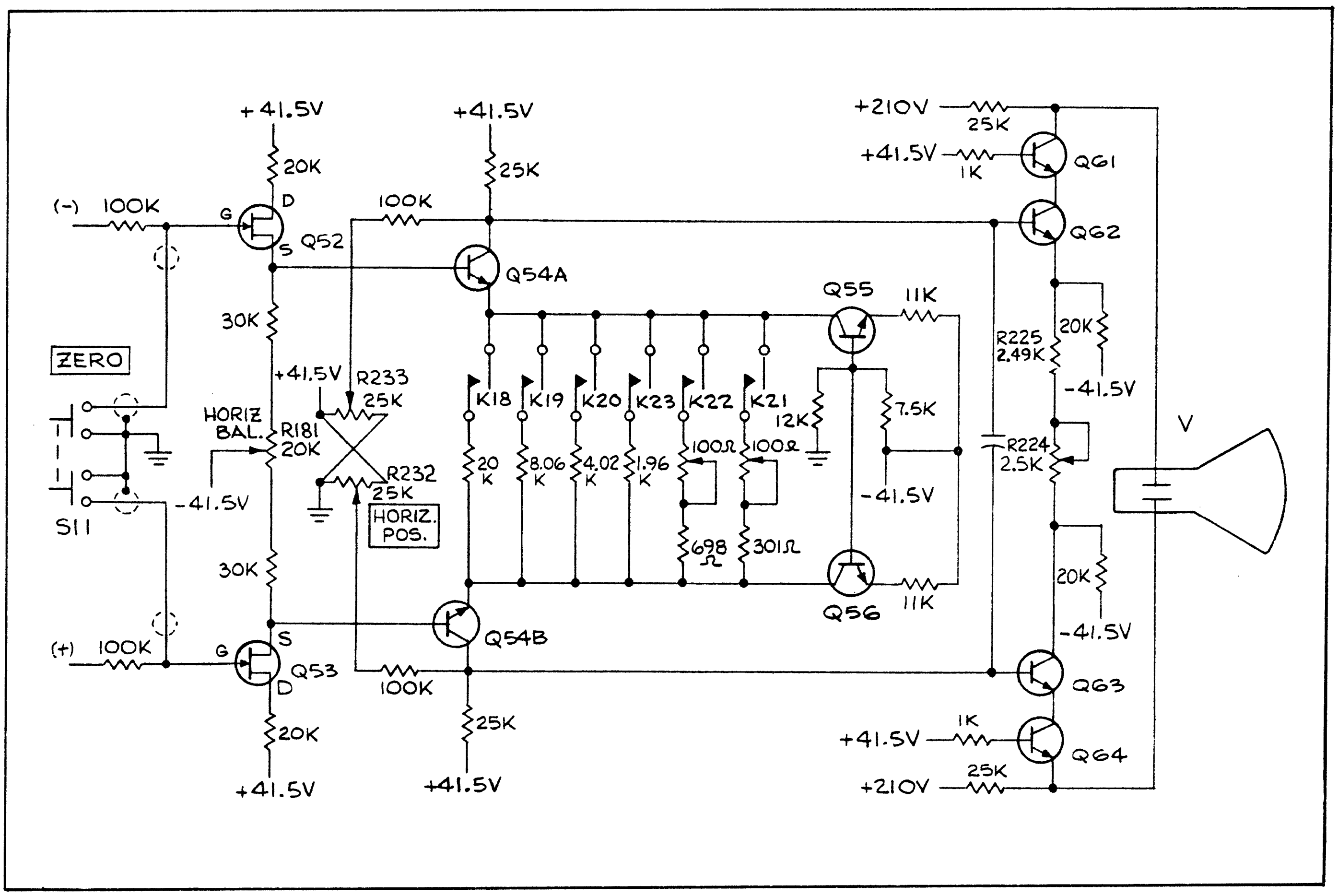


Figure 4-3 Horizontal Amplifier

of cathode ray tube V1.

4-18. Two N-type field effect transistors are used as input gates. Q53 is connected to ground across compensation resistors R171 through R177 and Q52 is connected to the collector voltage source through input attenuator R162 through R169, (See figure 5-1 for full schematic.) The FET's are used as source followers. Horizontal Balance potentiometer R181 adjusts the source currents to make the source/gate voltages equal (DC balance type control). This adjustment ensures that there is no horizontal movement when HORIZONTAL SENSITIVITY switch S8 is operated. ZERO switch S11 provides ground reference to both FET gates to allow setting zero reference on the CRT.

4-19. Transistors Q54A and Q54B function as a differential amplifier with a normal gain of 5. The emitter currents are supplied by Q55 and Q56 which serve as constant current sources. Gain is controlled by the emitter resistance selected. For a sensitivity of 100 mv/per screen division, K20 is closed; for collector voltage ranges requiring a sensitivity of 10 mv, 20 mv and 50 mv/per-screen division, K21, K22, and K23 are closed. For base voltage range sensitivities of 200 mv and 500 mv/per screen division, K18 and K19 are closed. HORIZONTAL POSITION potentiometers R232/R233 unbalance the collector voltages of Q54A and Q54B to provide an adjustable DC level on the CRT deflection plates.

4-20. Q62 and Q63 are a differential pair with the gain controlled by R224 and R225. Normal gain for this stage is 11. Potentiometer R224 is used for calibration purposes. Q61 and Q64 are high voltage transistors used in the grounded base configuration to provide the large signals needed to drive the deflection plates in the CRT. Normal output is +125 vdc and 5.5 v/CRT division.

4-21. PLUS AND MINUS INPUT ATTENUATORS

4-22. The horizontal sensitivity is controlled by two relay operated input attenuators. The relays, in turn, are enabled by front panel HORIZONTAL SENSITIVITY VOLTS/DIV switch S8. Each range setting on the control pulls in a resistor value which is combined with the gain control to give the desired sensitivity to the horizontal trace. In the base voltage configuration, the input attenuators are dropped out and the sensitivity control operates gain control relays K18, K19, and K20 in the amplifier. The upper end of the plus input attenuator is connected to the collector sweep source in series with the series resistor. The upper end of the minus input attenuator is connected to ground at the emitter of the device under test. The lower end of both input attenuators are connected to the center tap of T3. (See figure 4-4.)

4-23. The voltage at point "A" with respect to ground (see figure 4-4) contains the algebraic sum

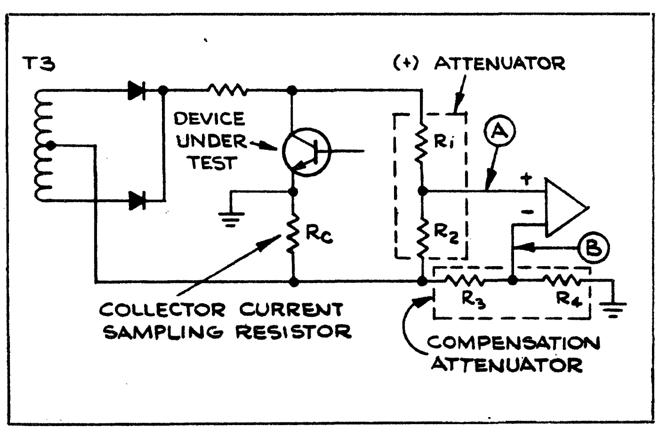


Figure 4-4 Horizontal Attenuator

of collector voltage plus the product of collector current times resistor R. The voltage at point "B" contains only the collector current times R. The combined inputs to the horizontal amplifier are +A and -B. Since A-B leaves a difference of only the collector voltage component, the horizontal amplifier responds only to collector voltage. Thus:

$$A = V_{CE} \frac{R_1}{R_1 + R_2} + I_C R_C \frac{R_2}{R_1 + R_2}$$

$$B = I_C R_C \frac{R_4}{R_3 + R_4}$$

$$\frac{R_2}{R_1 + R_2} = \frac{R_4}{R_3 + R_4}$$

$$\therefore \; A - B = V_{CE} \frac{R_1}{R_1 + R_2}$$

4-24. VERTICAL AMPLIFIER

4-25. The vertical amplifier circuit (see figure 4-5) is similar to the horizontal amplifier circuit. Gate Q48 is grounded and gate Q47 is connected to the emitter of the device through the current sensing circuit.

4-26. The input sensitivity is 50 mv/screen division with K15 closed. K16 is closed only in the 200 ma, 100 ma, and 50 ma/screen division ranges to decrease the sensitivity to 500 mv/screen division. Normal gain is approximately 10. The

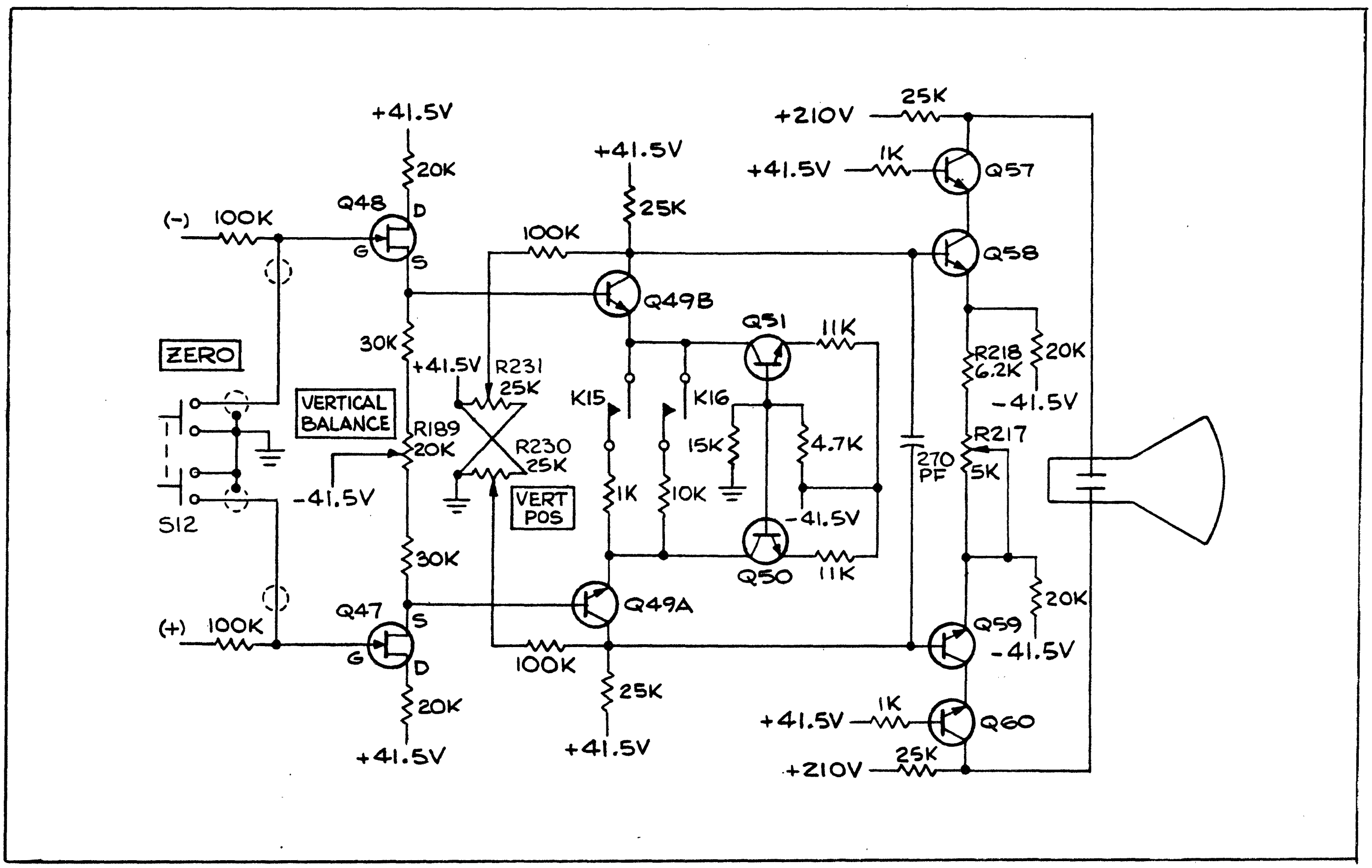


Figure 4-5 Vertical Amplifier

gain of the second stage (Q57 and Q60) is approximately 14. Normal output is +125 vdc and (approximately) 7 1/2 v/screen division.

4-27. Collector current. I_C is sensed by the vertical amplifier by applying the voltage drop across sensing resistors R148 through R161 as an input to the vertical amplifier. These resistors, selected by relays K1 through K14, are enabled by front panel VERTICAL SENSITIVITY CURRENT/DIV switch S7.

4-28. Since I_C is the only current flowing through R_C, input to the vertical amplifier is directly proportional to the values of I_C and R_C. R_C is a precision resistor resulting in a calibrated collector current sensitivity or deflection. The current sensing resistor is connected to the grounded emitter of the device under test (see figure 4-6) and the center tap of the collector sweep transformer.

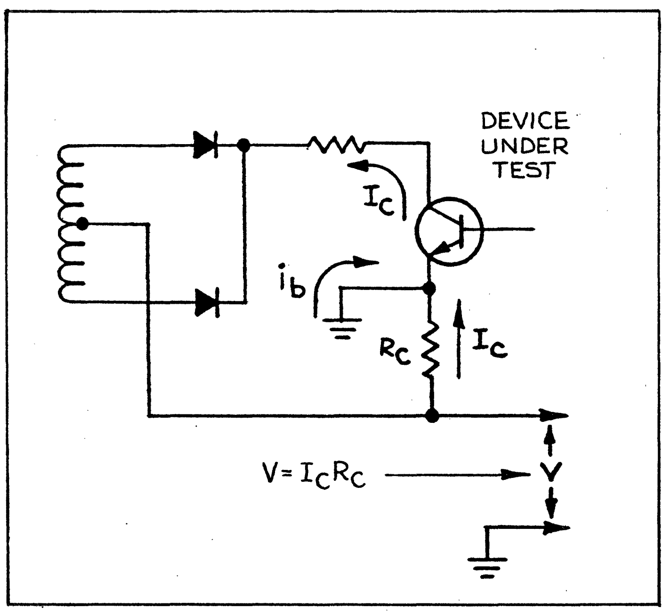


Figure 4-6 Basic Circuit, Sensing Resistors

4-29. STAIRCASE GENERATOR

4-30. The staircase generator (see figure 4-7) is four cascaded flip-flops whose cycle is ten counts. The generator is triggered by the primary ac power sine wave. The trigger circuit is designed to pulse as the sine wave passes zero so the trigger rate is twice the frequency of the primary power input. One output of each flip-flop is connected across coded resistors to the multiplier circuit. This output is clamped to +40 volts and resistors are selected to produce approximately 0.1 volt increments for the ten steps.

4-31. On step 1, the input is produced by dropping +40 volts across 402 kΩ and a 1 kΩ multiplier potentiometer in series. The other three resistors are, in effect, in parallel with the 1 kΩ so this resistance is reduced to somewhat less than its nominal value. The approximate signal that appears is +40 volts/400 kΩ = 0.1 volt. The second signal is +40 volts across 200 kΩ or 0.2 volts. The third is 40 volts across 200 kΩ and 100 kΩ but this is not a parallel situation but a summing so that the actual signal is 0.3 volts. This continues to 1.0 volts for the 10th step.

4-32. FIRST STEP DECODER

4-33. Selection of the first step is made with FIRST SWEEP STEP NO. switch S3 on the front panel. (See figure 3-1.) This control is a rotary switch with four ganged wafers. Each wafer consists of two sets of ten contacts. The set and reset inputs of one flip-flop are controlled by one set of contacts on each rotary switch. When the control is turned to the selected first step number, the coded rotary switches set and reset the four flip-flops to start the sweep at the indicated point.

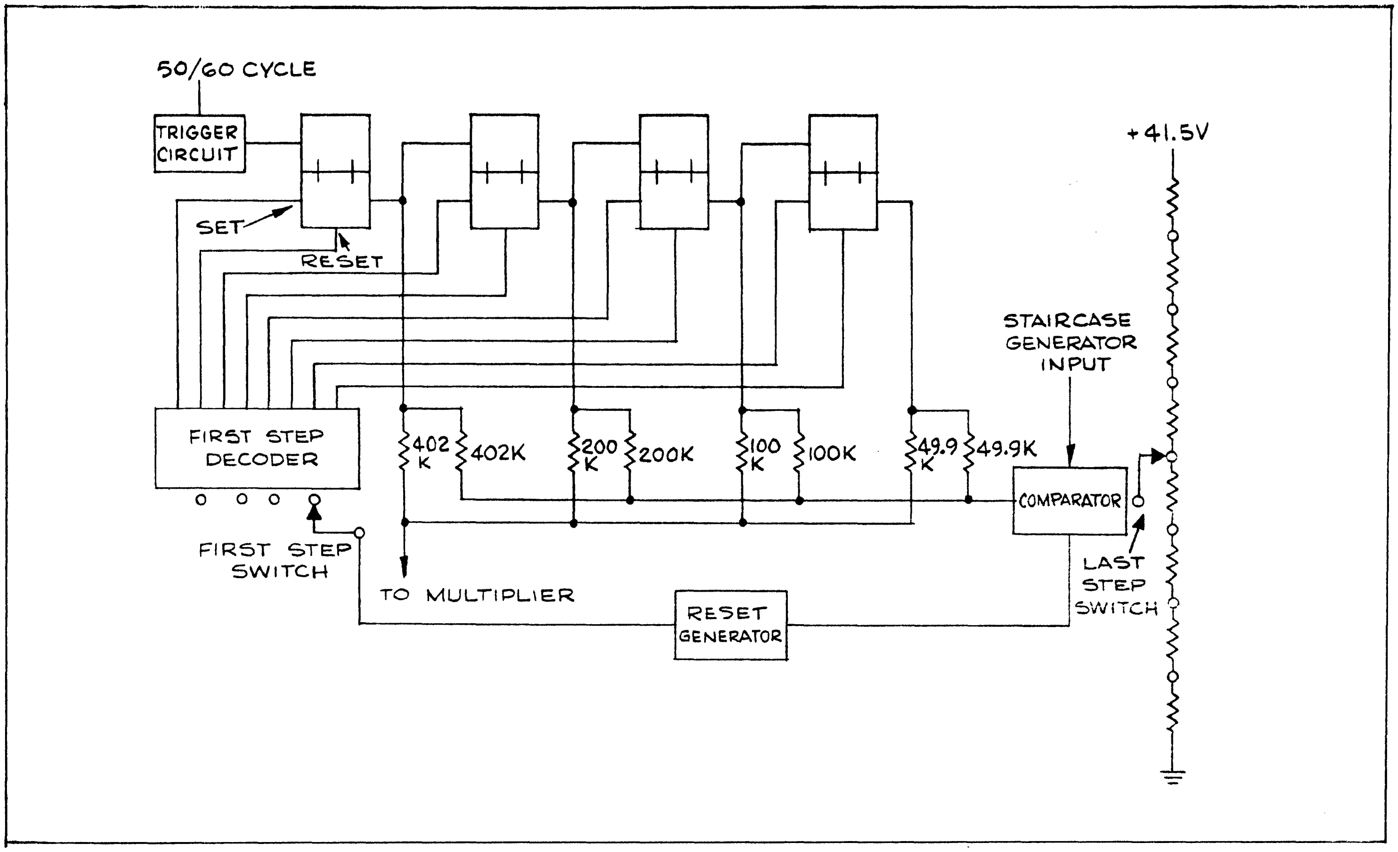


Figure 4-7 Staircase Generator

4-34. LAST STEP SELECTION

4-35. Selection of the last step is made with front panel LAST SWEEP STEP NO switch S2. (See figure 3-1.) This control is connected by one contact to a string of resistors serving as a voltage divider. The other contact is connected to a comparator. Outputs of the flip-flops are connected to the other input of the comparator. When the output of the flip-flops match the value selected on the voltage divider, the comparator pulses the reset generator which returns the first step decoder to the condition selected for the first step.

4-36. BASE STEP GENERATOR

4-37. The base step generator provides a programed current or voltage to the base of the device under test. Programing accuracy is ±3% of setting for current outputs, and ±4% for voltage-outputs.

4-38. The components of the generator (see figure 4-8) are: a reference input provided by the multiplier, amplifier A1, programed resistance (R_{prog}), and compensation amplifier A2.

4-39. MULTIPLIER

4-40. Q42A and Q42B are a differential pair with the plus input applied to Q42A. (See figure 4-9.) Q42B is biased with ZERO STEP potentiometer R106 so that the level at the collector of Q41 (input to POLARITY switch S5) is approximately zero when the circuit is quiescent. An input at the base of Q42A appears at the collector of Q41 as the difference between the input value and the zero

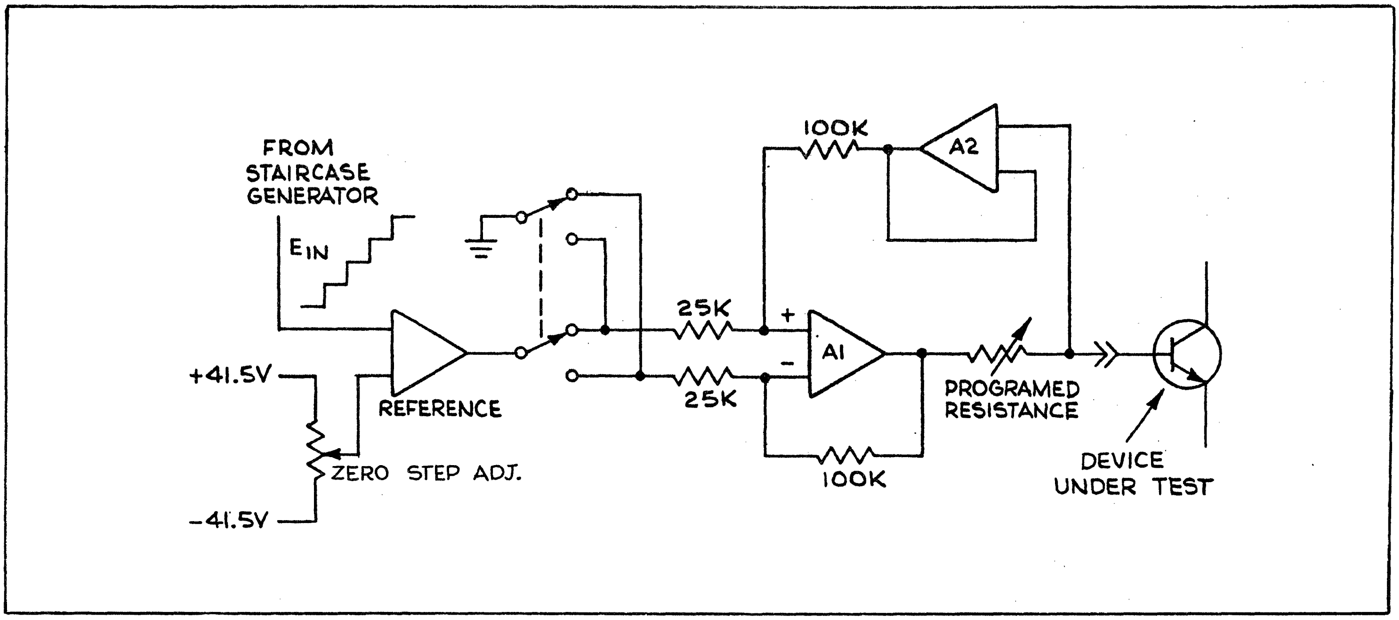


Figure 4-8 Base Step Generator

adjustment value in the same phase. Q41 serves as an inverting amplifier that furnishes a signal directly proportional to the input to Q42A and of sufficient amplitude to drive the base step generator. Potentiometer R100 (front-panel control) establishes the value of the input to Q42A.

4-41. The inputs to A1 are selected by front panel POLARITY switch S5. The + inputs are applied to the non-inverting side of the amplifier and the - inputs are applied to the inverting side. The feedback is connected from the single-end output of the amplifier to the inverting side. A second function of the POLARITY switch is to ground the unused side of the amplifier.

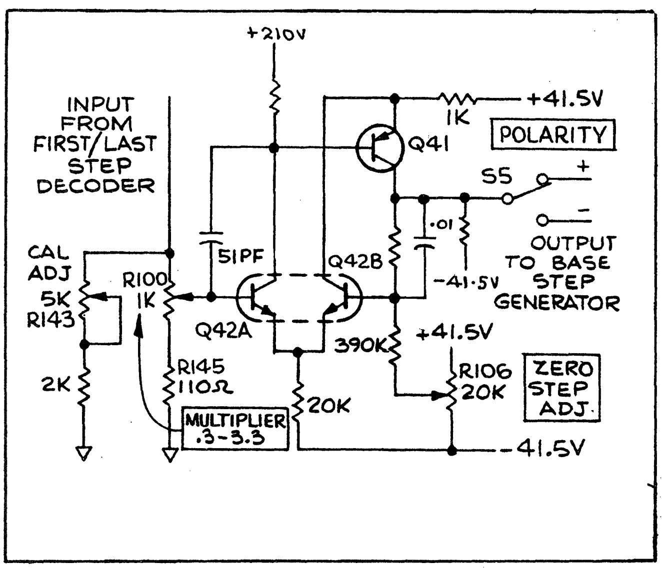


Figure 4-9 Multiplier

4-42. Programed resistance is selected by RANGE switch S6 on the front panel. The value of the resistance and the ranges designated are based on the design formula:

Current output equals:

$$\frac{\text{input from multiplier X gain of amplifier}}{\text{programed resistance}}$$

When the MULTIPLIER control is set at 1, the base step generator will deliver current in increments determined by RANGE switch S6 setting. For other settings on the MULTIPLIER and for current delivered at a chosen step, the range value is multiplied by both the MULTIPLIER setting and the STEP number. The programed resistance can be used as base resistors when they are connected in series with the base of the device under test. This gives four ranges of I_B --- 1 μa, 10 μa, 1 ma, and 100 ma. When the generator is used to apply a selected base voltage, a parallel resistor is grounded to form a voltage source. Three ranges of voltage are available --- .01 volts, 0.1 volts, and 1.0 volts.

4-43. The circuit is quiescent when the generator output is grounded. When the base of the device under test is added to the circuit an error is introduced directly proportional to the impedance of the device. To keep the generator current at the programed level compensation must be added to the generator output to supply the additional voltage. This is done with a circuit that includes amplifier A2. As shown in figure 4-8, the input to A2 is taken from the generator output. In current tests, the additional resistance of the base forms a voltage divider effect with the voltage drop being the amount of error introduced. The input of A2 is the programed current plus the current drawn by the device. This input is applied to the non-inverting side of A2 which is clamped by the feedback to a gain of 1. The output of A2 is applied to the non-inverting input of A1 across 100 kΩ which attenuates the signal by a factor of 5. This drives A1 to increase its output voltage until the error is bucked out at which point the circuit stabilizes.

4-44. PULSER

4-45. When low duty cycle testing is required, the pulser circuit (see figure 4-10) is enabled with PULSED/NORMAL switch S4 on the front panel. This circuit is a two-transistor switch fired by a full wave rectifier whose inputs are taken from the

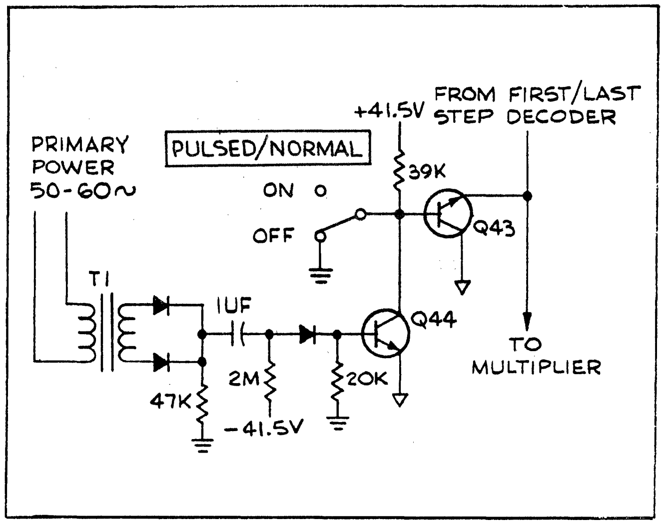


Figure 4-10 Pulser

center tapped secondary on T1. The switch is designed to permit a pulse at the peak of the primary power sine wave. With the base input stepped as the sine wave passes zero, the pulse is enabled at the center point of the base input. The bias at the base of Q44 controls the duty cycle of the pulse.

4-46. POWER SUPPLIES

4-47. The power supplies for the Model 6200 include: +41.5 and -41.5 volt, 0.5 amp supplies used for control, reference, and timing functions; +210 volt, 100 ma supply used as reference for the regulated CRT supply; 2500 volt regulated supply used as accelerating voltage source for the CRT; and three single function supplies used for filament power and pulse timing purposes.

4-48. +41.5 and -41.5 VOLT SUPPLIES

4-49. These supplies are mounted on the circuit board A1. (Refer to figure 5-6, sheet 1 of 3.) The -41.5 volt supply, used as a reference and bias source, is series regulated. Since more precise regulation is needed, differential amplifier Q8, controlled by potentiometer R17, is included in the circuit. Zener diode Q7 furnishes a highly stable reference for Q8. The +41.5 volt supply is a solid-state, series regulated power source whose input is taken from a full wave rectifier and a center tapped secondary of T1.

4-50. +210 VOLT SUPPLY

4-51. This supply is also located on the board A1. The input source is a 250 volt RMS secondary with a full wave bridge rectifier. Output regulation is done with V1 acting as a series regulator. At specified output value, the voltage drop across R25 is proportionally the same as the drop across R24 with respect to the resistance value. If the output changes, the voltage drop across R24 is no longer in the proper ratio. This causes Q9/Q10 to change state --- either on or off --- to change the voltage on the control grid of V1 correcting the gain and compensating for the output change.

4-52. HIGH VOLTAGE SUPPLY

4-53. The 2.5 kilovolt supply is mounted on printed circuit board A2 and supplies operating potentials for cathode ray tube V2. The circuit is a solid-state RF type high voltage supply with voltage regulation. The circuit for the supply and associated CRT electrodes, is shown in figure 4-11; figure 5-1, sheet 1, is a full schematic of board A2. Transistor Q1 and transformer T1 comprise a 50 kc oscillator and step-up circuit that has an output of approximately 2200 volts

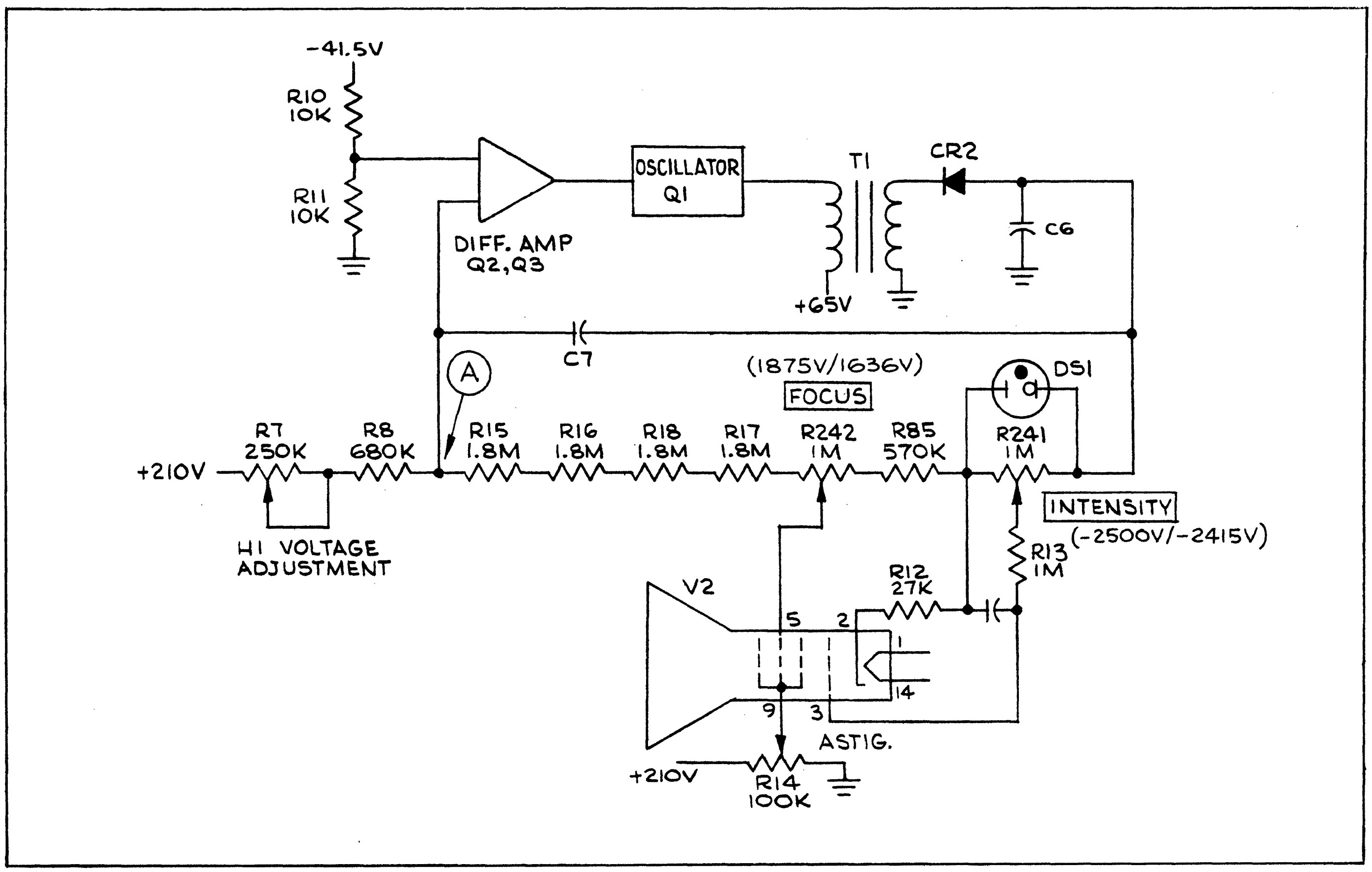


Figure 4-11 High Voltage Supply

RMS. Diode CR2 rectifies this signal and capacitor C6 filters the rectified output. The dc potential across C6 is approximately -2500 volts. The intensity and focus voltages for the CRT are obtained from a voltage divider network connected between C6 and the +210 volt supply. The range of voltage picked off by INTENSITY potentiometer R241 and FOCUS potentiometer R242 in the network is shown in figure 4-11. The high voltage output is regulated by a differential amplifier circuit (Q2, Q3) that controls the output of the RF oscillator Q1. The amplifier compares a portion of the output signal derived from the voltage divider (point A on figure 4-11)and a -20 volt reference obtained from R10 and R11, a voltage divider connected between the -41.5 volt supply and ground. In operation, when the output voltage drops, point A goes more positive and the differential amplifier increases the output of Q3 to return the output to its preset level; an increase in the output causes the amplifier to decrease the output of Q3. High Voltage Adjustment potentiometer R7 varies the level at point A, allowing the high voltage output to be varied from approximately 2.2 kv and 2.8 kv. The astigmatism potential for the CRT is derived from Astigmatism potentiometer R14 connected between +210 volts and ground.

4-54. FILAMENT SUPPLY

4-55. Two power outputs are derived directly from the secondary of T1. Terminals 13 and 14 supply 6.3 vac to the filament pins of the CRT and terminals 11 and 12 are connected to a) the filament of series regulator V1 in the +210 v supply and b) the display graticule illumination bulbs. Potentiometer R12 controls the intensity of the graticule illumination.

SECTION V
MAINTENANCE

5-1. SCOPE OF SECTION

5-2. This section contains performance check and adjustment procedures to be used for periodic inspection, trouble shooting, and repair of the Model 6200.

5-3. TEST EQUIPMENT

5-4. The test equipment required for the performance check and adjustments is listed in table 5-1. If the recommended equipment is not available, substitutes with same specifications can be used.

5-5. PERFORMANCE CHECK

5-6. The performance check outlined in the following paragraphs may be used as part of an incoming inspection, or to verify performance in preventive maintenance procedures.

5-7. PRELIMINARY CONTROL SETTINGS

5-8. Set front panel controls as detailed as follows before starting performance checks:

COLLECTOR SWEEP VOLTAGE	0
FULL RANGE VOLTAGE	+20

Table 5-1 Required Test Equipment

Equipment Type	Recommended	Required Specifications
Multimeter		Range: 0 to 3 kv Accuracy: ±3%
Digital Voltmeter	Fairchild Instrumentation Model 7100	Range: 0 to 1 kv Accuracy: ±0.1%
Oscilloscope	Dumont Model 766 with type 76-02A plug-in	Sensitivity: 5 mv/div Frequency Response: 25 mcs
Oscilloscope 10:1 Attenuator probe	Dumont Type 4290	
Fixed Resistors: 10 Ω, 20 w; 100 Ω, 1/2 w; 1 kΩ, 1/2 w; 10 kΩ, 1/2 w; 100 kΩ, 1/2 w		±1% of specified value

SERIES RESISTOR	100 k
BASE STEP MULTIPLIER	1
RANGE	1 μa
POLARITY	+
PULSED/NORMAL	NORMAL
FIRST SWEEP STEP NO.	0
LAST SWEEP STEP NO.	10
VERTICAL SENSITIVITY	20 MA
VERTICAL POSITION	mid-range
ZERO	OFF
HORIZ. SENSITIVITY	BASE .1 v
HORIZ. POSITION	mid-range
ZERO	OFF
FOCUS	mid-range
INTENSITY	CCW
SCALE LIGHT/POWER	fully ON

5-9. BASE STEP FUNCTION

5-10. To check operation of the base step generator, proceed as follows:

a. Connect 100 k ±1%, 1/2 w resistor between base and emitter terminals on front panel.

b. Adjust CRT FOCUS and INTENSITY controls and check that display consists of 11 dots in 10 divisions of graticule.

c. Repeat test for RANGE settings and resistor values listed in table 5-2. In each case readout should be 11 dots in 10 divisions.

Table 5-2 Base Step Function Check

RANGE Setting	Test Resistance (1/2 w, %1%)
10 μa	10 kΩ
100 μa	1 kΩ
1 ma	100 Ω
10 ma	10 Ω

d. Remove resistor and set front panel controls as detailed below:

RANGE	1 v
BASE STEP MULTIPLIER	3.3
FIRST SWEEP STEP NO.	10

e. Connect DVM between base and emitter terminals. Check that readout is +33.3 volts ±4%.

f. Set POLARITY switch to - (minus). Readout should now be -33.3 volts ±4%. Remove voltmeter.

5-11. VERTICAL AND HORIZONTAL FUNCTION CHECK

5-12. To check operation of the vertical and horizontal circuitry carry out following steps:

a. Connect a 10 Ω±1%, 20 w resistor between emitter and collector terminals.

b. Set front panel controls as follows:

VERTICAL SENSITIVITY	5 ma/div
HORIZ. SENSITIVITY	.05 v/div
FULL RANGE VOLTAGE	+20
SERIES RESISTOR	3 Ω

c. Rotate COLLECTOR SWEEP VOLTAGE control and check that trace appears as 45° line on CRT.

d. Repeat test for control settings listed in table 5-3. In each case trace should appear as 45° line.

Table 5-3 VERT. & HORIZ. Function Check, +20 V

VERTICAL SENSITIVITY	HORIZ. SENSITIVITY
10 ma/div	.1 v/div
20 ma/div	.2 v/div
50 ma/div	.5 v/div
100 ma/div	1. v/div
200 ma/div	2. v/div

e. Remove 10 Ω resistor and connect 10 kΩ ±1%, 1/2 w resistor between emitter and collector terminals.

f. Set controls as follows:

FULL RANGE VOLTAGE	+200 v
VERTICAL SENSITIVITY	2 ma/div
HORIZ. SENSITIVITY	20 v/div

g. Rotate COLLECTOR SWEEP VOLTAGE control and check that trace appears as 45° line on CRT.

h. Repeat test for control settings listed in table 5-4. In each case trace should be 45° line.

Table 5-4 VERT. & HORIZ. Function Check, +200 V

VERTICAL SENSITIVITY	HORIZ. SENSITIVITY
1 ma/div	10 v/div
500 μa/div	5 v/div
200 μa/div	2 v/div
100 μa/div	1 v/div
50 μa/div	.5 v/div
20 μa/div	.2 v/div
10 μa/div	.1 v/div
5 μa/div	.05 v/div
2 μa/div	.02 v/div
1 μa/div	.01 v/div

i. Return COLLECTOR SWEEP VOLTAGE control to zero. Remove 10 kΩ resistor.

5-13. SERIES RESISTOR CHECK

5-14. To check operation of the series resistor circuitry, carry out following steps:

a. Set front panel controls as detailed in paragraph 5-8, except:

VERTICAL SENSITIVITY	100 μa/div
HORIZ. SENSITIVITY	10 v/div
SERIES RESISTOR	1 kΩ
FULL RANGE VOLTAGE	+200

b. Rotate COLLECTOR SWEEP VOLTAGE control until horizontal trace is 10 divisions long.

c. Connect shorting link between collector and emitter test terminals. Set SERIES RESISTOR switch to 100 kΩ. Check that vertical trace is 10 divisions long. Repeat test for settings listed in table 5-5, and check that in each case length of vertical trace is within specifications given.

Table 5-5 SERIES RESISTOR Check, 100 kΩ through 1 kΩ

SERIES RESISTOR	VERTICAL SENSITIVITY	Vertical Trace
100 kΩ	100 μa/div	10 div ±10%
30 kΩ	500 μa/div	6.6 div ±10%
10 kΩ	1 ma/div	10 div ±10%
3 kΩ	5 ma/div	6.6 div ±10%
1 kΩ	10 ma/div	10 div ±10%

d. Remove shorting link. Set HORIZ. SENSITIVITY to 1 v/div; VERTICAL SENSITIVITY to

100 µa/div, and SERIES RESISTOR to 1 k. Rotate COLLECTOR SWEEP VOLTAGE control until horizontal trace is 10 divisions long.

e. Replace short between collector and emitter terminals. Select front panel settings given in table 5-6 and check that trace length is within specifications given. Remove short.

Table 5-6 SERIES RESISTOR Check, 300 and 100 Ω

SERIES RESISTOR	VERTICAL SENSITIVITY	Vertical Trace
300 Ω	5 ma/div	6.3 div ±10%
100 Ω	10 ma/div	9.5 div ±10%

f. Set HORIZ. SENSITIVITY to .5 v/div, SERIES RESISTOR to 30 Ω, and VERTICAL SENSITIVITY to 20 ma/div. Replace short between collector and emitter terminals. Check that vertical trace is 7.5 to 8.5 divisions. Remove short.

g. Set HORIZ. SENSITIVITY to .2 v/div and replace short between collector and emitter terminals. Check that vertical trace is 7.5 to 8.5 divisions. Remove short.

h. Set HORIZ. SENSITIVITY to .1 v/div, VERTICAL SENSITIVITY to 20 ma/div, and SERIES RESISTOR to 3. Replace short between collector and emitter terminals. Check that vertical trace is 5 or more divisions. Remove short.

5-15. PERIODIC MAINTENANCE

5-16. The Model 6200 requires little periodic maintenance. The procedure in the following paragraphs may be used when maintenance is performed on a regular basis.

5-17. INSPECTION

5-18. Remove the instrument covers. Inspect chassis-mounted components for damage, signs of overheating, etc. Inspect printed circuit boards and check for damage, component overheating, etc. Using low pressure, dry, compressed air, blow out any dust accumulation.

5-19. Rotate all front-panel controls through their full range, noting any binding or rough action.

5-20. Following inspection, replace all covers. Make the performance check detailed in paragraph 5-5.

5-21. TROUBLE SHOOTING

5-22. If improper performance is evident or suspected, use table 5-7 to locate the faulty circuit.

5-23. ADJUSTMENT PROCEDURE

5-24. The following paragraphs describe adjustments which should be made only after it is determined that adjustment is required.

NOTE

It is recommended that the procedure be completed in the order given as certain of the preliminary control settings listed at the start apply to the remainder of the adjustments.

Table 5-7 Trouble Shooting

Trouble	Check
No trace	HORIZ. and VERTICAL ZERO switch settings HORIZ. and VERTICAL POSITION potentiometer settings V_C of Q57 V_C of Q60 V_C of Q61 V_C of Q64
Excessive looping of trace at low vertical sensitivity settings and high voltages	C56 and C1 adjustment
Base steps pause intermittently	Trigger generator transistors Q11 and Q12
Zero step of base step generator jumps back and forth	Potentiometers R78, R106, and R128.
Base step generator fails in heavy current and/or voltage settings.	Diodes CR32 through CR40
Base step generator operates in one polarity only	Diodes CR35 through CR40
Some of first base steps missing during pulsed mode.	Front panel ZERO STEP screwdriver adjustment
Output of +41.5 v, - 41.5 v and +210 v power supplies are too high or too low.	-41.5 volt supply
In pulsed base mode, DC family of curves is present but lower in amplitude.	Transistor Q43

5-25. POWER SUPPLY ADJUSTMENTS

5-26. To adjust instrument power supplies, carry out following steps:

a. Set front panel controls as detailed below:

COLLECTOR SWEEP VOLTAGE	0
FULL RANGE VOLTAGE	+20
SERIES RESISTOR	100 k
BASE STEP MULTIPLIER	.33
RANGE	.01 v
POLARITY	+
PULSED/NORMAL	NORMAL
FIRST SWEEP STEP NO.	0
LAST SWEEP STEP NO.	0
VERTICAL SENSITIVITY	1 ma/div
VERTICAL POSITION	mid-range
ZERO	OFF
HORIZ. SENSITIVITY	.1 v/div
HORIZ. POSITION	mid-range
ZERO	OFF
FOCUS	mid-range
INTENSITY	fully CCW
SCALE LIGHT/POWER	fully CCW

b. Set SCALE LIGHT/POWER switch to ON and allow 5 minute warm-up period. Connect multimeter to points detailed in table 5-6. Check that each output is within tolerance. Make adjustment where necessary.

5-27. CRT ADJUSTMENTS

5-28. To adjust CRT circuitry, carry out following steps:

a. Set front panel controls as follows:

COLLECTOR SWEEP VOLTAGE	0
FULL RANGE VOLTAGE	+20

Table 5-8 Power Supply Adjustments

Voltmeter		Output	Tolerance	Adjustment
(+)	(-)			
Capacitor C5 Board A1	GND	+41.5 v	-0 +5%	R17, Board A1
GND	Collector Q4, Board A1	-41.5 v	-0 +5%	
Pin 8, V1, Board A1	GND	+210 v	-0 +5%	
GND	Transformer T1, Pin 13	-2400 v	±2%	R7, Board A2
NOTE: The -41.5 volt supply is reference for the +41.5 volt and +210 volt supplies. The +210 volt supply is reference for the -2500 volt supply.				

f. Set FIRST SWEEP STEP NO. and LAST SWEEP STEP NO. switches to 10. Adjust potentiometer R143 (A1) for readout of 1 volt. Remove DVM.

g. Set HORIZ. SENSITIVITY switch to .1 v BASE and FIRST SWEEP STEP NO. to 0. Adjust potentiometer R224 (A1) for a presentation of 1 dot per division on graticule.

h. Connect jumper between COLLECTOR and BASE terminals on front panel. Set HORIZ. SENSITIVITY switch to .01 v/div and RANGE switch to .01 v. Adjust potentiometer R209 (A1) for 1 dot per division on graticule.

i. Set HORIZ. SENSITIVITY to .02 v and BASE STEP MULTIPLIER to 2. Adjust potentiometer R208 (A1) until 11 dots cover 10 divisions. Remove jumper.

j. Set HORIZ. SENSITIVITY to .1 v COLLECTOR and VERTICAL SENSITIVITY to 10 ma/div.

k. Connect a 10 Ω ±1%, 20 w resistor between collector and emitter test terminals.

l. Rotate COLLECTOR SWEEP VOLTAGE control until presentation consists of a 45° line between lower left-hand to upper right-hand corners of graticule. Adjust potentiometer R217 (A1) until angle of trace is exactly 45°. Remove 10 Ω resistor.

m. Set VERTICAL SENSITIVITY switch to 1 μa/div, FULL RANGE VOLTAGE switch to +200, and HORIZ. SENSITIVITY to 20 v/div. Adjust variable capacitors C1 (A3) and C56 (A3) for as narrow a horizontal line as possible.

5-33. COMPONENT LOCATION AND SCHEMATIC DIAGRAMS

5-34. Figures 5-1 through 5-5 are photographs showing the location of components on printed circuit boards A1, A2, and A3. Figure 5-6 is a schematic diagram of the Model 6200.

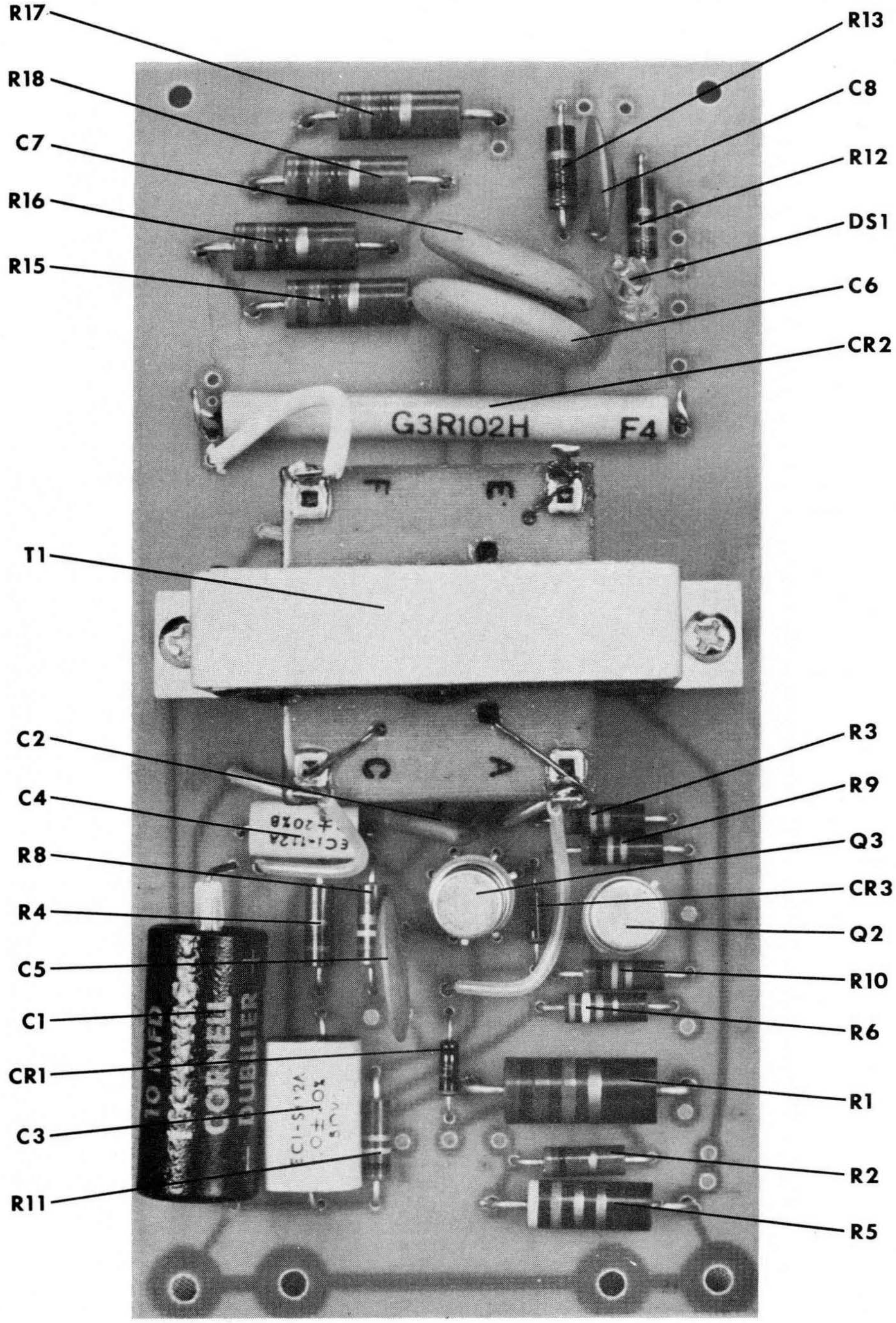


Figure 5-1 Printed Circuit Board A2 Parts Identification

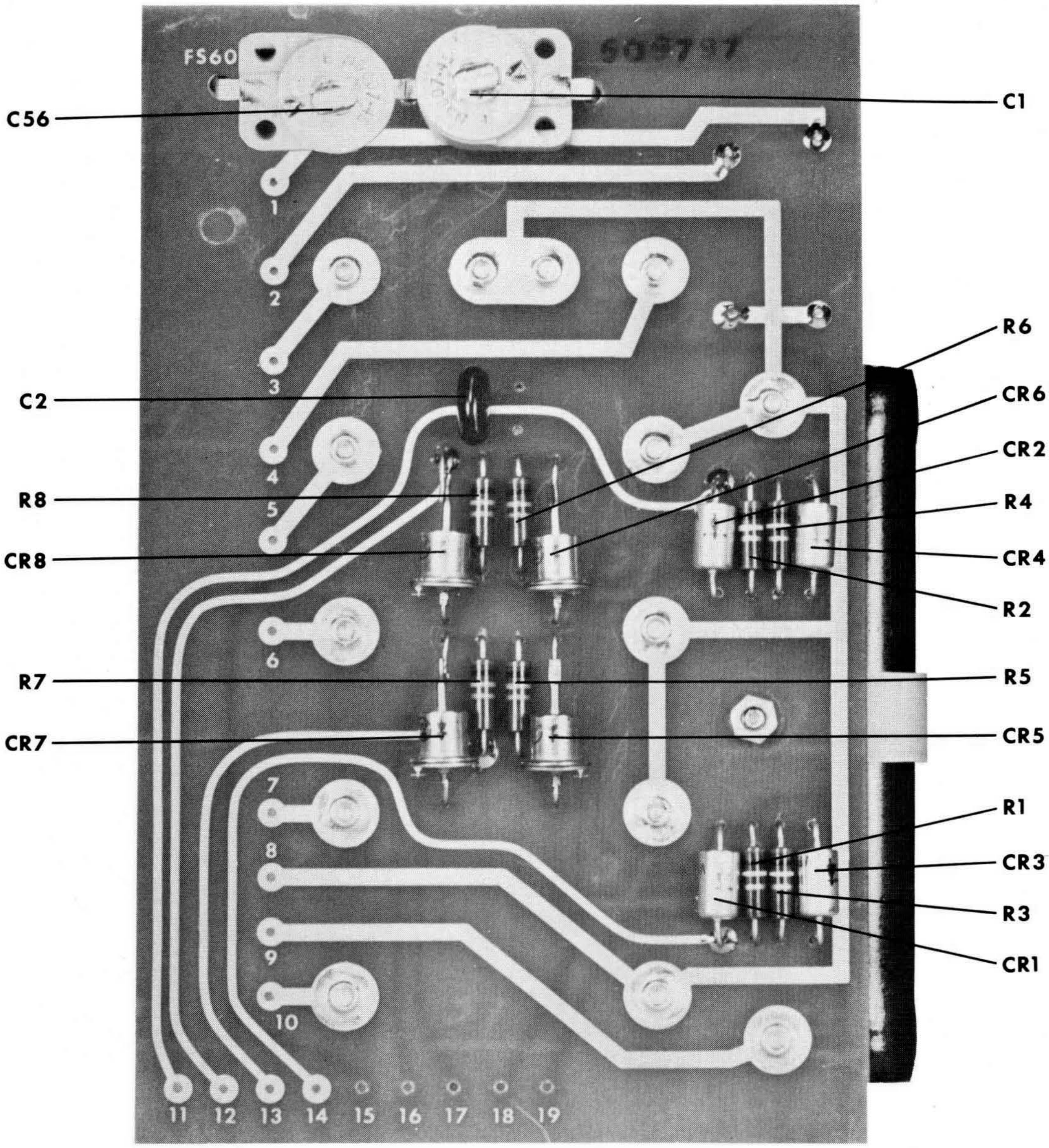


Figure 5-2 Printed Circuit Board A3 Parts Identification

Bottom View

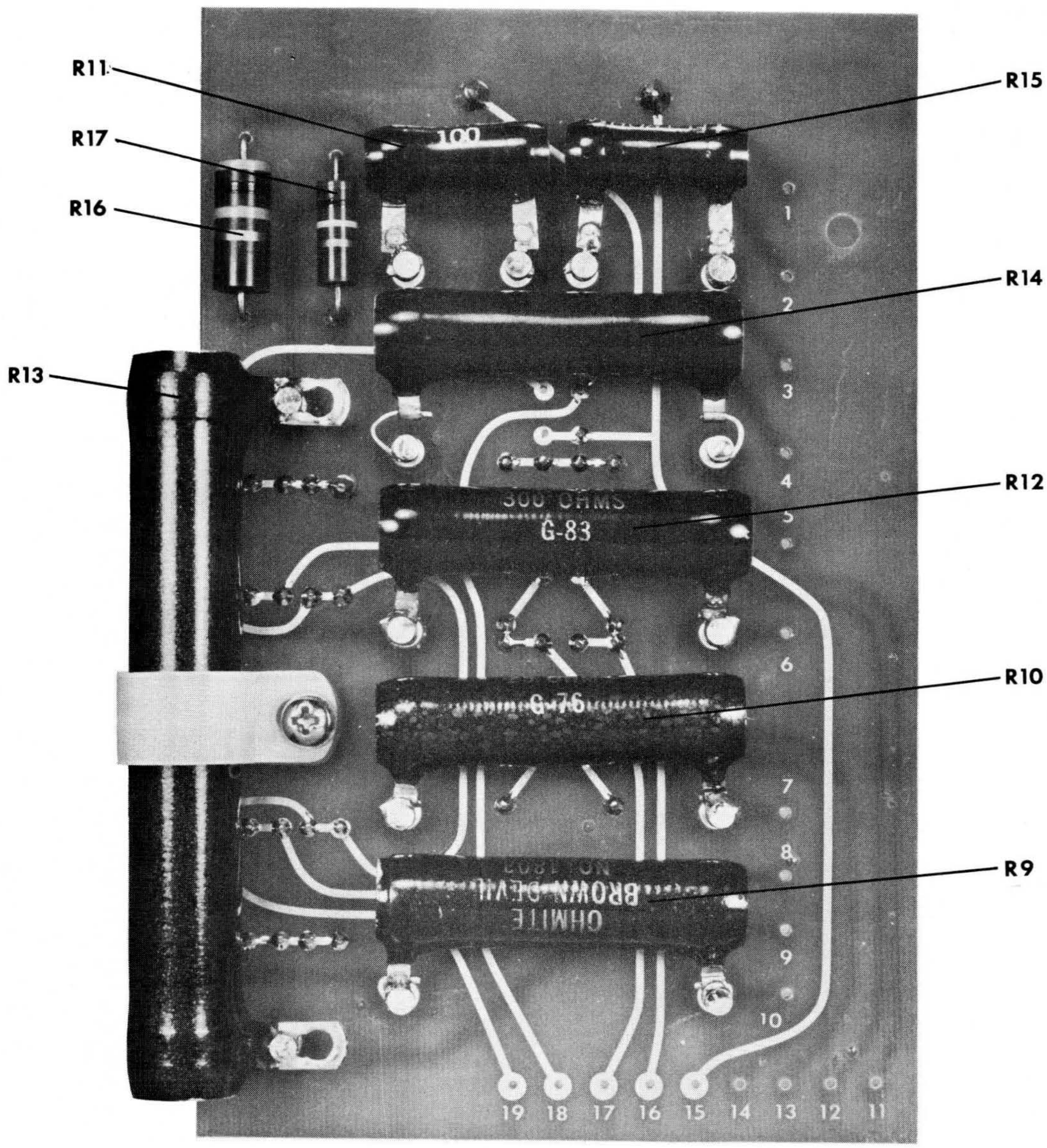


Figure 5-3 Printed Circuit Board A3 Parts Identification

Top View

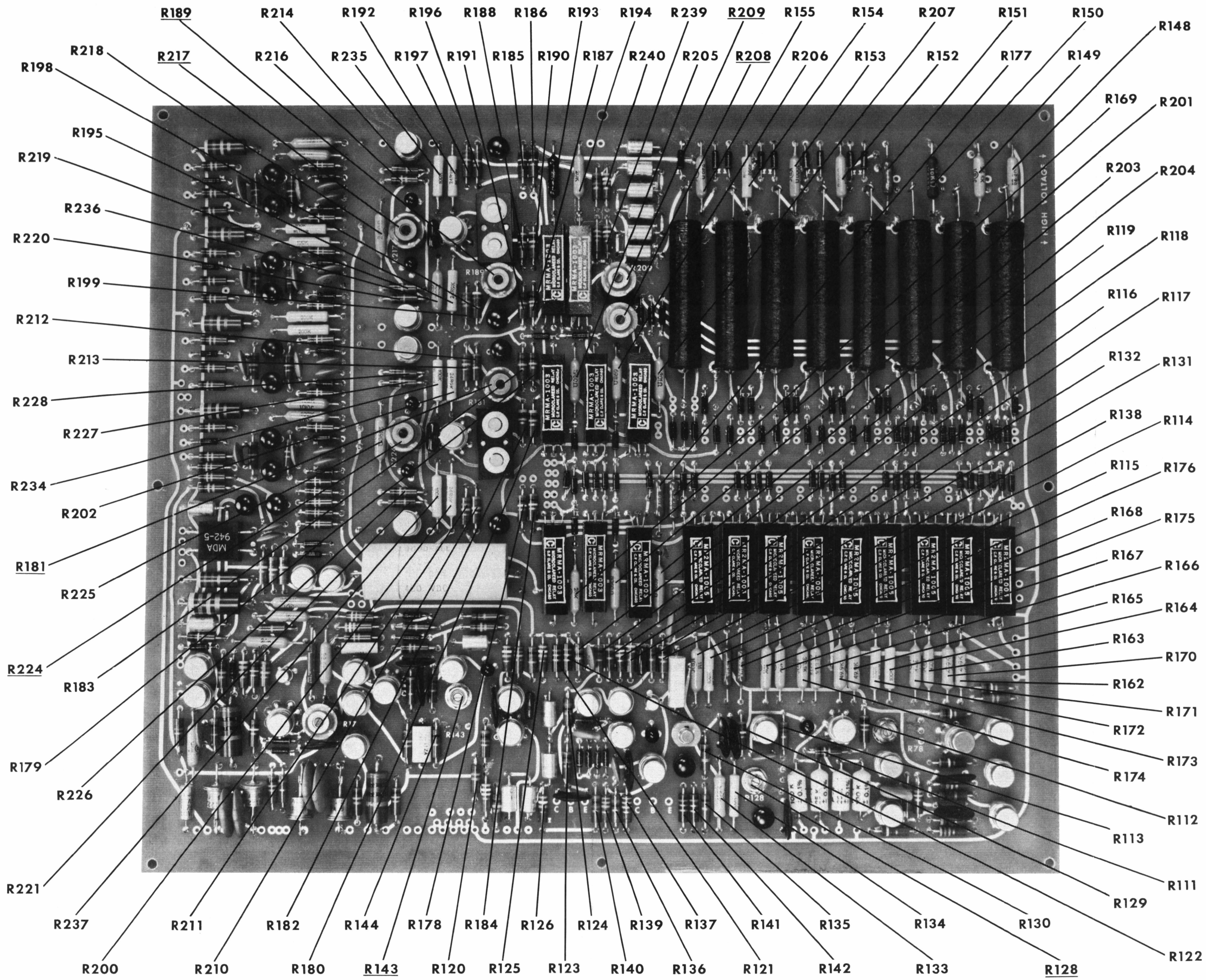


Figure 5-4 Printed Circuit Board A1 Parts Identification - Top View
(Sheet 1 of 4)

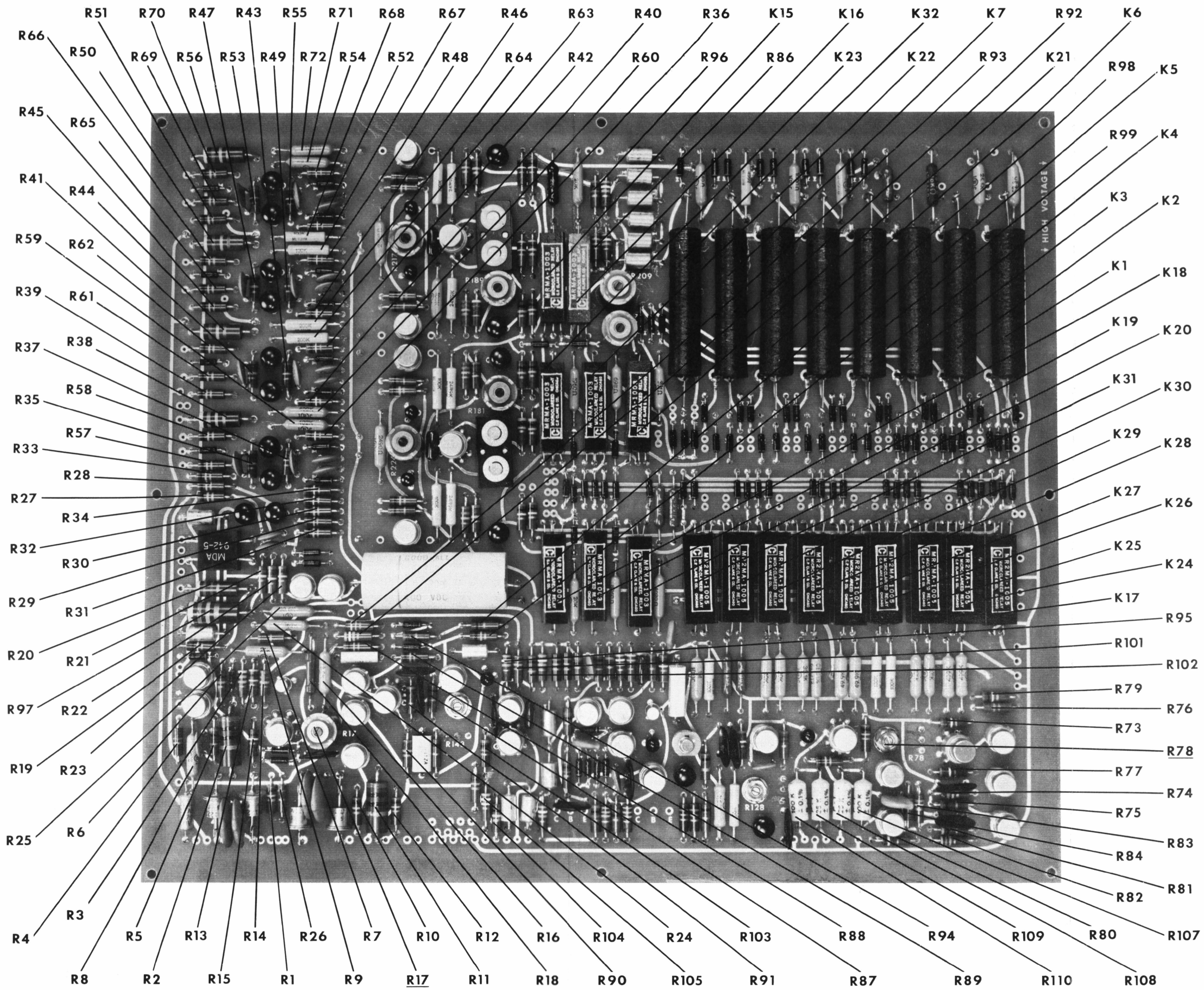


Figure 5-4 Printed Circuit Board A1 Parts Identification - Top View (Sheet 2 of 4)

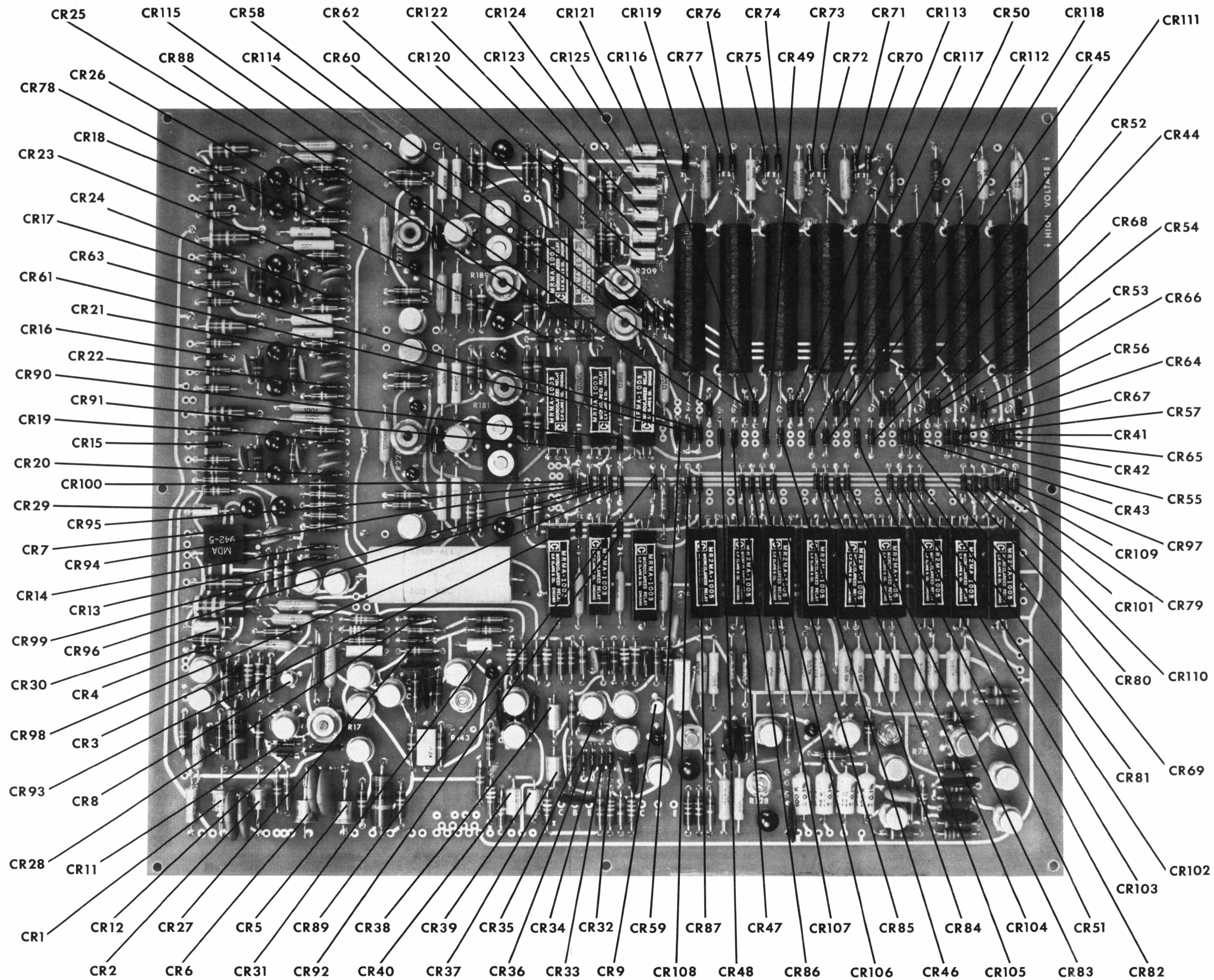


Figure 5-4 Printed Circuit Board A1 Parts Identification - Top View (Sheet 3 of 4)

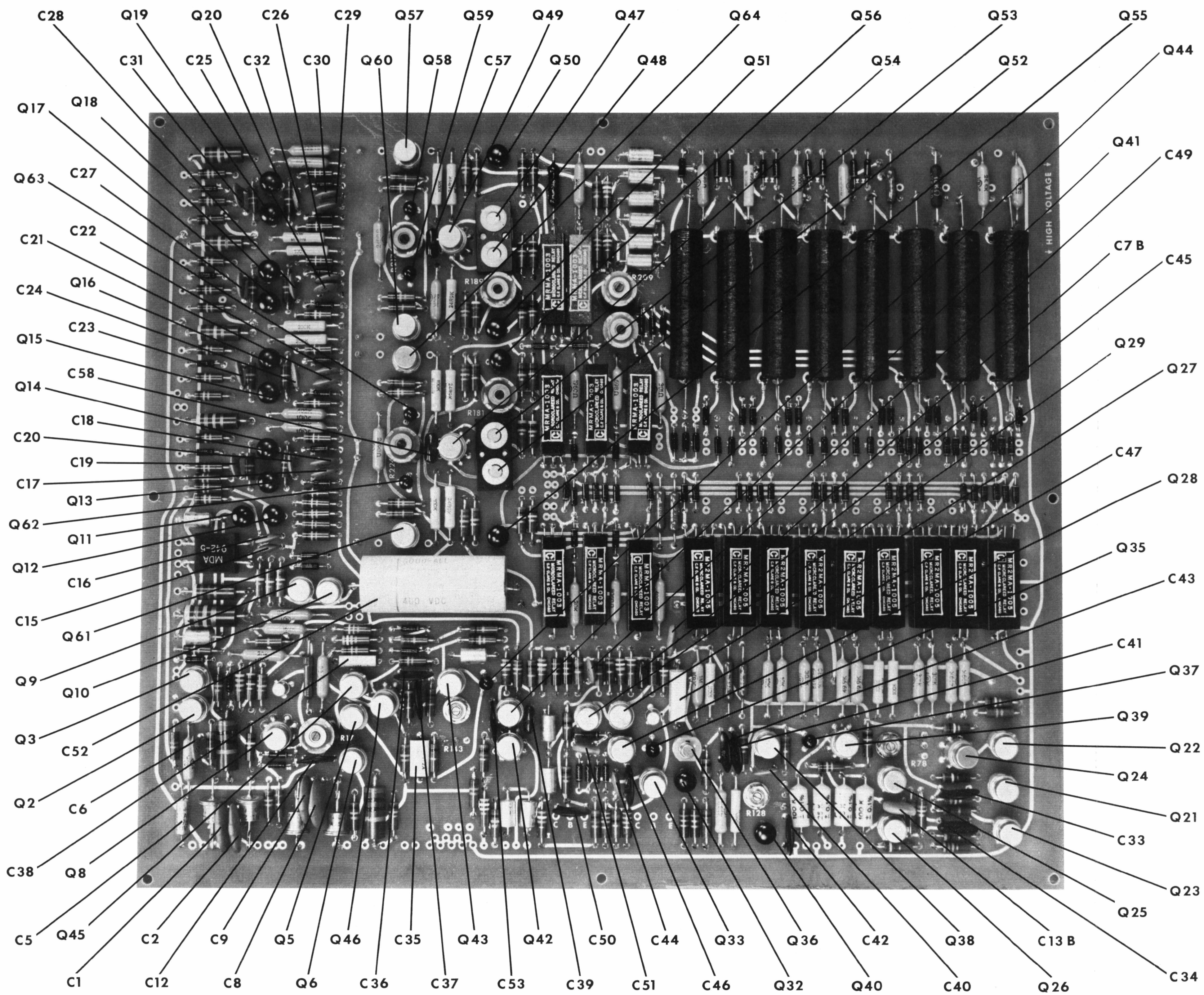
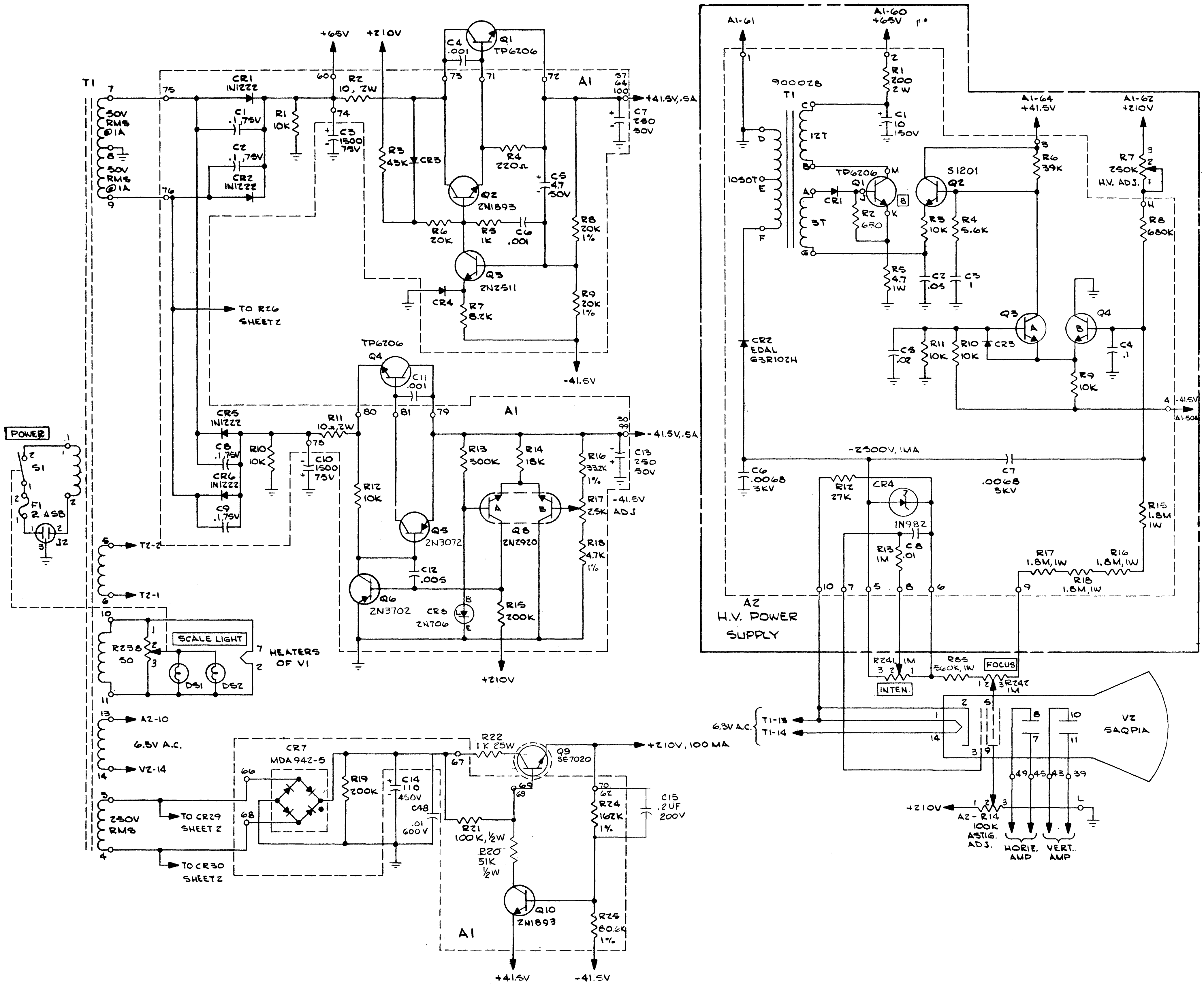


Figure 5-4 Printed Circuit Board A1 Parts Identification - Top View (Sheet 4 of 4)

This illustration will be provided
at a later date.

Figure 5-5 Printed Circuit Board A1 Parts
Identification - Bottom View



SYM	REF. DESIG NOT USED
C	54,55
CR	10
K	
R	
Q	7,34
V	
S	

LAST REF. DESIG. USED:

C59	R242	K32	S12	T3
CR125	Q64	V2	CB1	

[10] TO BE SELECTED DURING CHECKOUT.
[9] NOT ON BOARD A1 (Q30, Q31)
[8] NOT ON BOARD A2 (Q1)
[7] GND. AT FRONT PANEL ONLY.

4. ALL RESISTORS IN Ω.
3. ALL CAPACITORS IN UF.
2. ALL RESISTORS ½W, 5%.
1. ALL DIODES FD100.
NOTES: UNLESS OTHERWISE SPECIFIED.

Figure 5-6 Model 6200A Curve Tracer Schematic (Sheet 1 of 3)

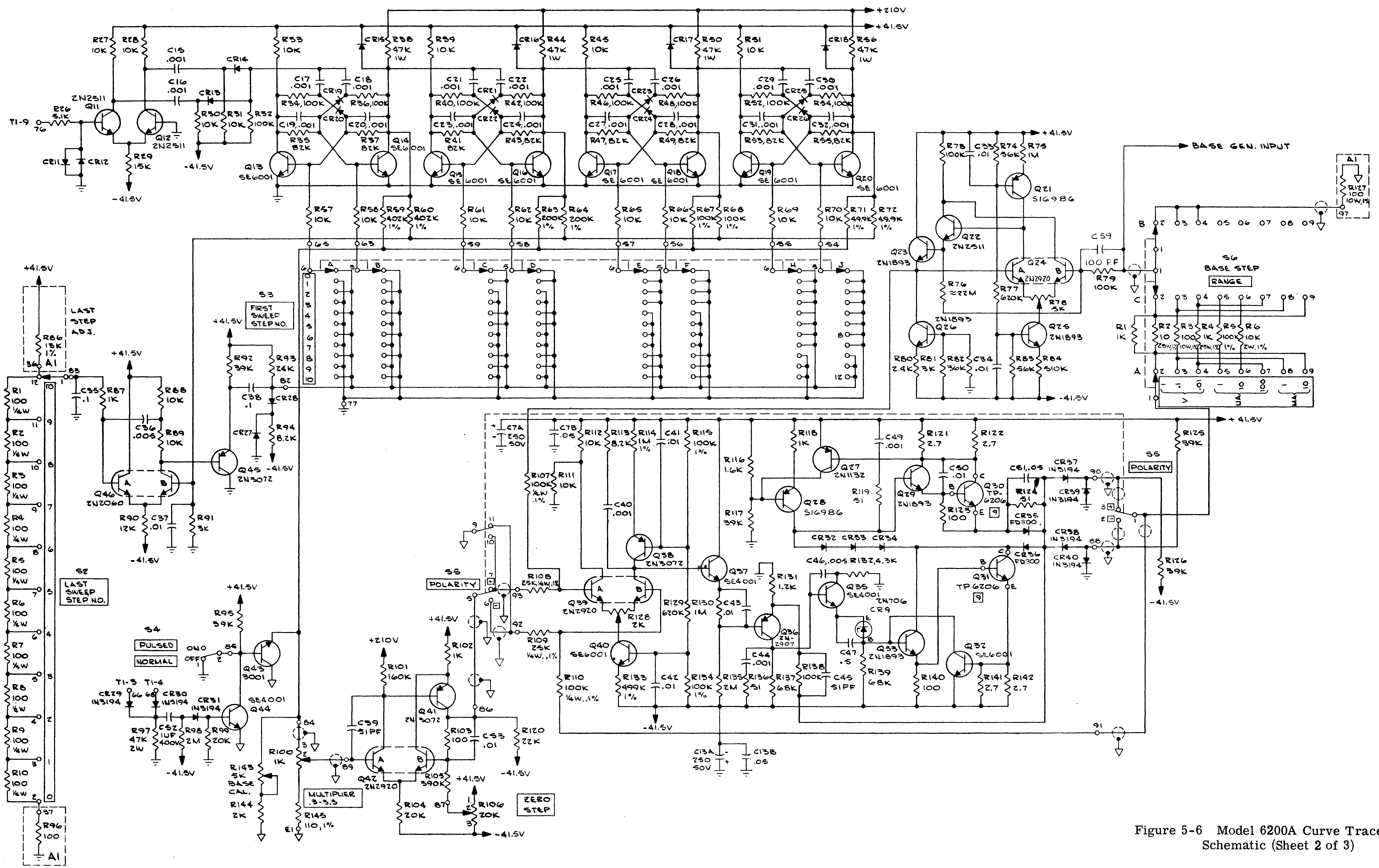


Figure 5-6 Model 6200A Curve Tracer
Schematic (Sheet 2 of 3)

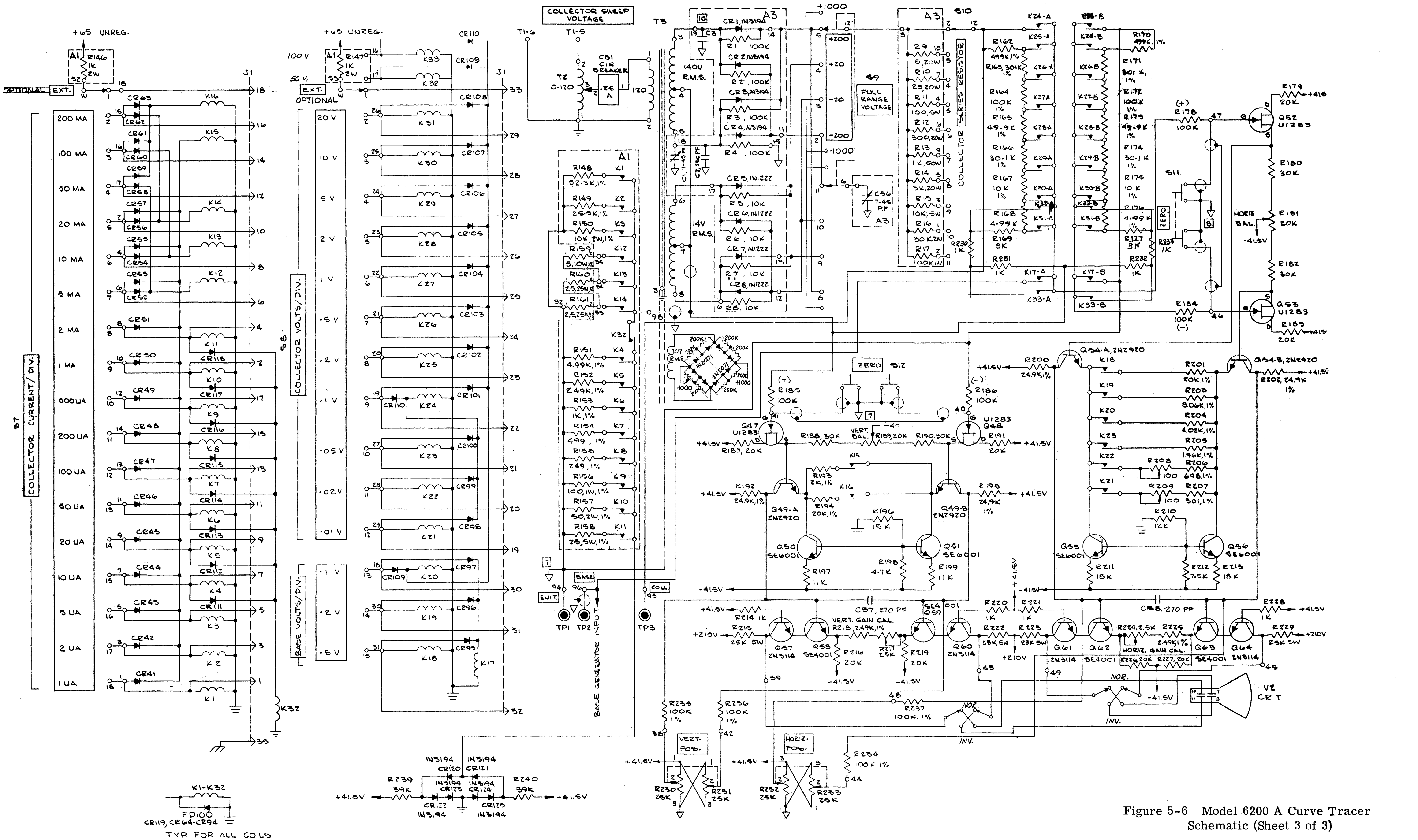


Figure 5-6 Model 6200 A Curve Tracer Schematic (Sheet 3 of 3)

SECTION VI
REPLACEABLE PARTS

6-1. GENERAL

6-2. Tables 6-1 through 6-4 contains information for ordering replacement parts, listing: circuit reference, description, manufacturer, and Fairchild Instrumentation part number.

6-3. ORDERING INFORMATION

6-4. To order a replacement part, address order to your authorized Fairchild Instrumentation sales representative or to: 844 Charleston Ave., Palo Alto, California.

6-5. Specify the following information for each part:

a. Model and serial number of instrument.
b. Fairchild Instrumentation stock number.
c. Circuit reference designation, assembly number, or complete description.

6-6. To order a part not listed in tables 6-1 through 6-4, provide a complete description of the part, including the function and location.

ABBREVIATIONS

A-B	Allen-Bradley Co.
Amphenol	Amphenol-Borg Electronics
Bechman	Helipot Div. Beckman Inst. Inc.
CD	Cornell-Dubilier Electronics
Clare	C. P. Clare and Co.
CRL	Centralab Div., Globe-Union Inc.
CTS	Chicago Telephone Supply
Dale	Dale Electronics
Dumont	Dumont Div. Fairchild Camera and Inst. Corp.
Edal	Edal Industries Inc.
Elmenco	The Electro Motive Mfg. Co.
Erie	Erie Resistor Corp.
Fansteel	Fansteel Metallurgical Corp.
FS	Fairchild Semiconductor
G. E.	General Electric Co., LampDiv.
Goodall	Good All Electric Mfg. Co.
Hopkins	Hopkins Engineering Co.
IRC	International Resistance Co.
Kidco	Kidco, Inc.
Littelfuse	Littelfuse Corp.
Mallory	P. R. Mallory and Co.
Motorola	Motorola Inc., Semiconductor Prod. Div.
MS	Miniature Switch
Ohmite	Ohmite Mfg. Co.
RCA	Radio Corp. of America
Rich	Rich Electronics Inc.
S-E	Standard Electrical Products Div., Staco, Inc.
Sprague	Sprague Electric Co.
Tranex	Tranex Inc.
Turbo-Jet	Turbo-Jet Prod. Co.
Welwyn	Welwyn International
West.	Westinghouse Electric Corp.
W-L	Ward Leonard Electric Co.

Table 6-1 Board A1 Parts Identification

C1	Capacitor, .1 µf 75 v	CRL	5303-91
C2	Same as C1		
C3	Not listed		
C4	Not listed		
C5	Capacitor, 4.7 µf 50 v	Fansteel	5303-92
C6	Capacitor, .001 µf 600 v	CRL	5301-15
C7	Capacitor, 250 µf 50 v	CD	5300-07
C7A	Same as C7		
C7B	Capacitor, .05 µf 50 v	Sprague	5301-24
C8	Same as C1		
C9	Same as C1		
C10	Not listed		
C11	Not listed		
C12	Capacitor, .005 µf 1 kv	CD	5301-19
C13	Same as C7		
C13A	Same as C7		
C13B	Same as C7B		
C14	Not listed		
C15	Same as C6		
C16	Same as C6		
C17	Same as C6		
C18	Same as C6		
C19	Same as C6		
C20	Same as C6		
C21	Same as C6		
C22	Same as C6		
C23	Same as C6		
C24	Same as C6		
C25	Same as C6		
C26	Same as C6		

Table 6-1 Board A1 Parts Identification (Cont)

Circuit Reference	Description	Manufacturer	FI Part Number
C27	Same as C6		
C28	Same as C6		
C29	Same as C6		
C30	Same as C6		
C31	Same as C6		
C32	Same as C6		
C33	Capacitor, .01 μf, 600 v	CD	5301-20
C34	Same as C33		
C35	Capacitor, .1 μf, 50 v	Hopkins	5302-67
C36	Same as C12		
C37	Same as C33		
C38	Same as C35		
C39	Capacitor, 51 pf, 300 v	Elmenco	5300-60
C40	Same as C6		
C41	Same as C33		
C42	Same as C33		
C43	Same as C33		
C44	Same as C6		
C45	Same as C12		
C46	Same as C12		
C47	Capacitor, .5 μf, 50 v	Hopkins	5302-69
C48	Not listed		
C49	Same as C6		
C50	Same as C33		
C51	Same as C7B		
C52	Capacitor, 1 μf, 400 v	Goodall	5303-49
C53	Same as C33		
C54	Not listed		
C55	Not listed		
C56	Not listed		

Table 6-1 Board A1 Parts Identification (Cont)

Circuit Reference	Description	Manufacturer	FI Part Number
C57	Capacitor, 270 pf	Elmenco	5300-78
C58	Same as C57		
CR1	Diode, 1N1222	Westinghouse	5150-60
CR2	Same as CR1		
CR3	Diode, FD100	FS	5151-37
CR4	Same as CR3		
CR5	Same as CR1		
CR6	Same as CR1		
CR7	Diode, bridge, MDA-924-5	Motorola	5152-49
CR8	Transistor, 2N706	FS	5152-21
CR9	Same as CR8		
CR10	Not listed		
CR11	Same as CR3		
CR12	Same as CR3		
CR13	Same as CR3		
CR14	Same as CR3		
CR15	Same as CR3		
CR16	Same as CR3		
CR17	Same as CR3		
CR18	Same as CR3		
CR19	Same as CR3		
CR20	Same as CR3		
CR21	Same as CR3		
CR22	Same as CR3		
CR23	Same as CR3		
CR24	Same as CR3		
CR25	Same as CR3		

Table 6-1 Board A1 Parts Identification (Cont)

Circuit Reference	Description	Manufacturer	FI Part Number
CR26	Same as CR3		
CR27	Same as CR3		
CR28	Same as CR3		
CR29	Diode, 1N3194	RCA	5161-02
CR30	Same as CR29		
CR31	Same as CR29		
CR32	Same as CR3		
CR33	Same as CR3		
CR34	Same as CR3		
CR35	Diode, FD2264	FS	5152-42
CR36	Same as CR35		
CR37	Same as CR29		
CR38	Same as CR29		
CR39	Same as CR29		
CR40	Same as CR29		
CR41	Same as CR3		
CR42	Same as CR3		
CR43	Same as CR3		
CR44	Same as CR3		
CR45	Same as CR3		
CR46	Same as CR3		
CR47	Same as CR3		
CR48	Same as CR3		
CR49	Same as CR3		
CR50	Same as CR3		
CR51	Same as CR3		
CR52	Same as CR3		
CR53	Same as CR3		
CR54	Same as CR3		
CR55	Same as CR3		

Table 6-1 Board A1 Parts Identification (Cont)

Circuit Reference	Description	Manufacturer	FI Part Number
CR56	Same as CR3		
CR57	Same as CR3		
CR58	Same as CR3		
CR59	Same as CR3		
CR60	Same as CR3		
CR61	Same as CR3		
CR62	Same as CR3		
CR63	Same as CR3		
CR64	Same as CR3		
CR65	Same as CR3		
CR66	Same as CR3		
CR67	Same as CR3		
CR68	Same as CR3		
CR69	Same as CR3		
CR70	Same as CR3		
CR71	Same as CR3		
CR72	Same as CR3		
CR73	Same as CR3		
CR74	Same as CR3		
CR75	Same as CR3		
CR76	Same as CR3		
CR77	Same as CR3		
CR78	Same as CR3		
CR79	Same as CR3		
CR80	Same as CR3		
CR81	Same as CR3		
CR82	Same as CR3		
CR83	Same as CR3		
CR84	Same as CR3		
CR85	Same as CR3		

Table 6-1 Board A1 Parts Identification (Cont)

Circuit Reference	Description	Manufacturer	FI Part Number
CR86	Same as CR3		
CR87	Same as CR3		
CR88	Same as CR3		
CR89	Same as CR3		
CR90	Same as CR3		
CR91	Same as CR3		
CR92	Same as CR3		
CR93	Same as CR3		
CR94	Same as CR3		
CR95	Same as CR3		
CR96	Same as CR3		
CR97	Same as CR3		
CR98	Same as CR3		
CR99	Same as CR3		
CR100	Same as CR3		
CR101	Same as CR3		
CR102	Same as CR3		
CR103	Same as CR3		
CR104	Same as CR3		
CR105	Same as CR3		
CR106	Same as CR3		
CR107	Same as CR3		
CR108	Same as CR3		
CR109	Same as CR3		
CR110	Same as CR3		
CR111	Same as CR3		
CR112	Same as CR3		
CR113	Same as CR3		
CR114	Same as CR3		
CR115	Same as CR3		

Table 6-1 Board A1 Parts Identification (Cont)

Circuit Reference	Description	Manufacturer	FI Part Number
CR116	Same as CR3		
CR117	Same as CR3		
CR118	Same as CR3		
CR119	Same as CR3		
CR120	Same as CR29		
CR121	Same as CR29		
CR122	Same as CR29		
CR123	Same as CR29		
CR124	Same as CR29		
CR125	Same as CR29		
K1	Relay, reed	Clare	5602-24
K2	Same as K1		
K3	Same as K1		
K4	Same as K1		
K5	Same as K1		
K6	Same as K1		
K7	Same as K1		
K8	Same as K1		
K9	Same as K1		
K10	Same as K1		
K11	Same as K1		
K12	Same as K1		
K13	Same as K1		
K14	Same as K1		
K15	Relay, single MRMA-1003	Clare	5605-03
K16	Same as K15		
K17	Relay, dual MR2MA-1005	Clare	5605-04
K18	Same as K15		
K19	Same as K15		
K20	Same as K15		

Table 6-1 Board A1 Parts Identification (Cont)

Circuit Reference	Description	Manufacturer	FI Part Number
K21	Same as K15		
K22	Same as K15		
K23	Same as K15		
K24	Same as K17		
K25	Same as K17		
K26	Same as K17		
K27	Same as K17		
K28	Same as K17		
K29	Same as K17		
K30	Same as K17		
K31	Same as K17		
K32	Same as K1		
LK1	Relay, coil	Turbo-Jet	5604-91
LK2	Same as LK1		
LK3	Same as LK1		
LK4	Same as LK1		
LK5	Same as LK1		
LK6	Same as LK1		
LK7	Same as LK1		
LK8	Same as LK1		
LK9	Same as LK1		
LK10	Same as LK1		
LK11	Same as LK1		
LK12	Same as LK1		
LK13	Same as LK1		
LK14	Same as LK1		
LK32	Same as LK1		

Table 6-1 Board A1 Parts Identification (Cont)

Circuit Reference	Description	Manufacturer	FI Part Number
Q1	Not listed		
Q2	Transistor, 2N1893	FS	5151-92
Q3	Transistor, 2N2511	FS	5152-98
Q4	Not listed		
Q5	Transistor, 2N1132	FS	5151-39
Q6	Same as Q5		
Q7	Not listed		
Q8	Transistor, 2N2920	FS	5154-06
Q9	Same as Q2		
Q10	Same as Q2		
Q11	Transistor, 2N2511	FS	5152-98
Q12	Same as Q11		
Q13	Transistor, SE6001	FS	5154-46
Q14	Same as Q13		
Q15	Same as Q 13		
Q16	Same as Q13		
Q17	Same as Q13		
Q18	Same as Q13		
Q19	Same as Q13		
Q20	Same as Q13		
Q21	Transistor, selected, B900022	FS	
Q22	Same as Q3		
Q23	Same as Q2		
Q24	Same as Q8		
Q25	Same as Q2		
Q26	Same as Q2		
Q27	Same as Q5		
Q28	Transistor, selected, B900024		
Q29	Same as Q2		
Q30	Not listed		

Table 6-1 Board A1 Parts Identification (Cont)

Circuit Reference	Description	Manufacturer	FI Part Number
Q31	Not listed		
Q32	Not listed		
Q33	Same as Q2		
Q34	Not listed		
Q35	Transistor, SE 4001	FS	5154-45
Q36	Transistor, 2N2907	FS	5154-15
Q37	Same as Q35		
Q38	Transistor, 2N3072	FS	5152-84
Q39	Same as Q8		
Q40	Same as Q11		
Q41	Same as Q38		
Q42	Transistor, selected, B900026	FS	
Q43	Transistor, 3001	FS	5152-39
Q44	Same as Q35		
Q45	Same as Q38		
Q46	Transistor, 2N2060	FS	5151-78
Q47	Transistor, 0033, B900011	FS	
Q48	Same as Q47		
Q49	Same as Q8		
Q50	Same as Q11		
Q51	Same as Q11		
Q52	Same as Q47		
Q53	Same as Q47		
Q54	Same as Q8		
Q55	Same as Q11		
Q56	Same as Q11		
Q57	Transistor, 2N3114		
Q58	Same as Q35		
Q59	Same as Q35		
Q60	Same as Q57		

Table 6-1 Board A1 Parts Identification (Cont)

Circuit Reference	Description	Manufacturer	FI Part Number
Q61	Same as Q57		
Q62	Same as Q35		
Q63	Same as Q35		
Q64	Same as Q57		
R1	Resistor, fixed, 10 k ±5%, 1/2 w	A-B	5215-76
R2	Resistor, fixed, 10 Ω ±5%, 2 w	A-B	5240-01
R3	Resistor, fixed, 43 k ±5%, 1/2 w	A-B	5215-92
R4	Resistor, fixed, 220 Ω ±5%, 1/2 w	A-B	5215-35
R5	Resistor, fixed, 1 k ±5%, 1/2 w	A-B	5215-51
R6	Resistor, fixed, 20 k ±5%, 1/2 w	A-B	5215-84
R7	Resistor, fixed, 8.2 k ±5%, 1/2 w	A-B	5215-74
R8	Resistor, fixed, 20 k ±1%, 1/2 w	IRC	5209-12
R9	Same as R8		
R10	Same as R1		
R11	Same as R2		
R12	Same as R1		
R13	Resistor, fixed, 300 k ±5%, 1/2 w	A-B	5216-14
R14	Resistor, fixed, 18 k ±5%, 1/2 w	A-B	5215-83
R15	Resistor, fixed, 200 k ±5%, 1/2 w	A-B	5216-10
R16	Resistor, fixed, 33.2 k ±1%, 1/2 w	IRC	5209-44
R17	Resistor, variable, 2.5 k	A-B	5291-46
R18	Resistor, fixed, 4.7 k ±1%, 1/2 w	Kidco	5210-77
R19	Same as R15		
R20	Resistor, fixed, 470 Ω ±5%, 1 w	A-B	5225-38
R21	Resistor, fixed, 270 k ±5%, 1/2 w	A-B	5216-13
R22	Resistor, fixed, 750 k ±5%, 1/2 w	A-B	5216-24
R23	Same as R22		
R24	Resistor, fixed, 162 k ±1%, 1/2 w	IRC	5209-26
R25	Resistor, fixed, 80.6 k ±1%, 1/2 w	IRC	5209-21

Table 6-1 Board A1 Parts Identification (Cont)

Circuit Reference	Description	Manufacturer	FI Part Number
R26	Resistor, fixed, 5.1 k ±5%, 1/2 w	A-B	5215-69
R27	Same as R1		
R28	Same as R1		
R29	Resistor, fixed, 15 k ±5%, 1/2 w	A-B	5215-81
R30	Same as R1		
R31	Same as R1		
R32	Resistor, fixed, 100 k ±5%, 1/2 w	A-B	5216-02
R33	Same as R1		
R34	Same as R32		
R35	Resistor, fixed, 82 k ±5%, 1/2 w	A-B	5215-99
R36	Same as R32		
R37	Same as R35		
R38	Resistor, fixed, 47 k ±5%, 1 w	A-B	5225-74
R39	Same as R1		
R40	Same as R32		
R41	Same as R35		
R42	Same as R32		
R43	Same as R35		
R44	Same as R38		
R45	Same as R1		
R46	Same as R32		
R47	Same as R35		
R48	Same as R32		
R49	Same as R35		
R50	Same as R38		
R51	Same as R1		
R52	Same as R32		
R53	Same as R35		
R54	Same as R32		
R55	Same as R35		

Table 6-1 Board A1 Parts Identification (Cont)

Circuit Reference	Description	Manufacturer	FI Part Number
R56	Same as R38		
R57	Same as R1		
R58	Same as R1		
R59	Resistor, fixed, 402 k ±1%, 1/2 w	IRC	5209-57
R60	Same as R59		
R61	Same as R1		
R62	Same as R1		
R63	Resistor, fixed, 200 k ±1%, 1/2 w	IRC	5209-27
R64	Same as R63		
R65	Same as R1		
R66	Same as R1		
R67	Resistor, fixed, 100 k ±1%, 1/2 w	IRC	5209-24
R68	Same as R67		
R69	Same as R1		
R70	Same as R1		
R71	Resistor, fixed, 49.9 k ±1%, 1/2 w	IRC	5209-18
R72	Same as R71		
R73	Same as R32		
R74	Resistor, fixed, 57 k ±5%, 1/2 w	A-B	5215-95
R75	Resistor, fixed, 1 M ±5%, 1/2 w	A-B	5216-27
R76	Resistor, fixed, 22 M, 1/2 w, B900027	FS	
R77	Resistor, fixed, 620 k ±5%, 1/2 w	A-B	5216-22
R78	Resistor, variable, 5 k	Bourns	5291-78
R79	Same as R32		
R80	Resistor, fixed, 2.4 k ±5%, 1/2 w	A-B	5215-61
R81	Resistor, fixed, 3 k ±5%, 1/2 w	A-B	5215-63
R82	Resistor, fixed, 36 k ±5%, 1/2 w	A-B	5215-90
R83	Same as R74		
R84	Resistor, fixed, 510 k ±5%, 1/2 w	A-B	5216-20
R85	Not listed		

Table 6-1 Board A1 Parts Identification (Cont)

Circuit Reference	Description	Manufacturer	FI Part Number
R86	Resistor, fixed, 13 k ±5%, 1/2 w	A-B	5215-79
R87	Not listed		
R88	Resistor, fixed, 10 k ±5%, 1/2 w	A-B	5215-76
R89	Same as R1		
R90	Resistor, fixed, 12 k ±5%, 1/2 w	A-B	5215-78
R91	Same as R81		
R92	Resistor, fixed, 39 k ±5%, 1/2 w	A-B	5215-91
R93	Resistor, fixed, 24 k ±5%, 1/2 w	A-B	5215-86
R94	Same as R7		
R95	Same as R92		
R96	Resistor, fixed, 100 Ω ±5%, 1/2 w	A-B	5215-26
R97	Resistor, fixed, 47 k ±5%, 2 w	A-B	5240-51
R98	Resistor, fixed, 2 M ±5%, 1/2 w	A-B	5216-35
R99	Same as R6		
R100	Not assigned		
R101	Resistor, fixed, 160 k ±5%, 1/2 w	A-B	5216-08
R102	Same as R5		
R103	Same as R96		
R104	Same as R6		
R105	Resistor, fixed, 390 k ±5%, 1/2 w	A-B	5216-17
R106	Not listed		
R107	Resistor, fixed, 100 k ±1%, 1/4 w	Rich	5217-33
R108	Resistor, fixed, 25 k ±1%, 1/4 w	Rich	5218-57
R109	Same as R108		
R110	Same as R107		
R111	Same as R1		
R112	Same as R1		
R113	Same as R7		
R114	Resistor, fixed, 1 M ±1%, 1/2 w	IRC	5209-33
R115	Same as R67		

Table 6-1 Board A1 Parts Identification (Cont)

Circuit Reference	Description	Manufacturer	FI Part Number
R116	Resistor, fixed, 1.6 k ±5%, 1/2 w	A-B	5215-57
R117	Same as R92		
R118	Same as R5		
R119	Resistor, fixed, 51 Ω±5%, 1/2 w	A-B	5215-19
R120	Resistor, fixed, 22 k ±5%, 1/2 w	A-B	5215-85
R121	Resistor, fixed, 2.7 Ω±5%, 1/2 w	A-B	
R122	Same as R121		
R123	Same as R96		
R124	Same as R119		
R125	Same as R92		
R126	Same as R92		
R127	Resistor, fixed, 100 Ω ±1%, 10 w	Dale	5219-37
R128	Resistor, variable, 2 k	Bourns	5291-57
R129	Same as R77		
R130	Same as R75		
R131	Resistor, fixed, 1.2 k ±5%, 1/2 w	A-B	5215-53
R132	Resistor, fixed, 4.3 k ±5%, 1/2 w	A-B	5215-67
R133	Resistor, fixed, 499 k ±1%, 1/2 w	IRC	5209-31
R134	Same as R67		
R135	Same as R98		
R136	Same as R119		
R137	Resistor, fixed, 68 k ±5%, 1/2 w	A-B	5215-97
R138	Same as R32		
R139	Same as R137		
R140	Same as R96		
R141	Same as R121		
R142	Same as R121		
R143	Same as R78		
R144	Resistor, fixed, 2 k ±5%, 1/2 w	A-B	5215-59
R145	Resistor, fixed, 110 Ω±1%, 1 w	Welwyn	5220-26

Table 6-1 Board A1 Parts Identification (Cont)

Circuit Reference	Description	Manufacturer	FI Part Number
R146	Resistor, fixed, 1 k ±5%, 2 w	A-B	5240-29
R147	Same as R146		
R148	Resistor, fixed, 52.3 k ±1%, 1/2 w	IRC	5209-45
R149	Resistor, fixed, 25.5 k ±1%, 1/2 w	IRC	5209-43
R150	Resistor, fixed, 10 k ±1%, 2 w	Dale	
R151	Resistor, fixed, 4.99 k ±1%, 1/2 w	IRC	5209-07
R152	Resistor, fixed, 2.49 k ±1%, 1/2 w	IRC	5209-05
R153	Resistor, fixed, 1 k ±1%, 1/2 w	IRC	5209-02
R154	Resistor, fixed, 499 Ω ±1%, 1/2 w	IRC	5209-51
R155	Resistor, fixed, 249 Ω ±1%, 1/2 w	IRC	5209-40
R156	Resistor, fixed, 100 Ω ±1%, 1 w	Dale	5219-36
R157	Resistor, fixed, 50 Ω ±1%, 2 w	Dale	5219-31
R158	Resistor, fixed, 25 Ω ±1%, 5 w	Dale	5219-32
R159	Resistor, fixed, 5 Ω ±1%, 10 w	Dale	5218-11
R160	Resistor, fixed, 2.5 Ω ±1%, 25 w	Dale	5219-14
R161	Same as R160		
R162	Same as R133		
R163	Resistor, fixed, 301 k %1±, 1/2 w	IRC	5209-47
R164	Same as R67		
R165	Same as R71		
R166	Resistor, fixed, 30.1 k ±1%, 1/2 w	IRC	5209-14
R167	Resistor, fixed, 10 k ±1%, 1/2 w	IRC	5209-09
R168	Same as R151		
R169	Same as R151		
R170	Same as R133		
R171	Same as R163		
R172	Same as R67		
R173	Same as R71		
R174	Same as R166		
R175	Same as R167		

Table 6-1 Board A1 Parts Identification (Cont)

Circuit Reference	Description	Manufacturer	FI Part Number
R176	Same as R151		
R177	Same as R151		
R178	Same as R32		
R179	Same as R6		
R180	Resistor, fixed, 30 k ±5%, 1/2 w	A-B	5215-88
R181	Resistor, variable, 20 k	A-B	5291-84
R182	Same as R180		
R183	Same as R6		
R184	Same as R32		
R185	Same as R32		
R186	Same as R32		
R187	Same as R6		
R188	Same as R180		
R189	Same as R181		
R190	Same as R180		
R191	Same as R6		
R192	Resistor, fixed, 24.9 k ±1%, 1/2 w	IRC	5209-13
R193	Resistor, fixed, 2 k ±1%, 1/2 w	IRC	5209-04
R194	Same as R8		
R195	Same as R192		
R196	Not listed		
R197	Resistor, fixed, 11 k ±5%, 1/2 w	A-B	5215-77
R198	Resistor, fixed, 4.7 k ±5%, 1/2 w	A-B	5215-68
R199	Same as R197		
R200	Same as R192		
R201	Same as R8		
R202	Same as R192		
R203	Resistor, fixed, 8.06 k ±1%, 1/2 w	IRC	5209-58
R204	Resistor, fixed, 4.02 k ±1%, 1/2 w	IRC	5209-06
R205	Resistor, fixed 1.96 k, ±1%, 1/2 w	IRC	5209-59

Table 6-1 Board A1 Parts Identification (Cont)

Circuit Reference	Description	Manufacturer	Fi Part Number
R206	Resistor, fixed, 698 Ω ±1%, 1/2 w	IRC	5209-60
R207	Resistor, fixed, 301 Ω, ±1%, 1/2 w	IRC	5209-61
R208	Resistor, variable, 100 Ω	A-B	5291-74
R209	Same as R208		
R210	Same as R90		
R211	Same as R14		
R212	Resistor, fixed, 7.5 k ±5%, 1/2 w	A-B	5215-73
R213	Same as R14		
R214	Same as R5		
R215	Resistor, fixed, 25 k ±5%, 5 w	W-L	
R216	Same as R6		
R217	Same as R17		
R218	Resistor, fixed, 2.49 k ±1%, 1/2 w	IRC	5209-05
R219	Same as R6		
R220	Same as R5		
R221	Same as R5		
R222	Same as R215		
R223	Same as R215		
R224	Same as R17		
R225	Same as R218		
R226	Same as R6		
R227	Same as R6		
R228	Same as R5		
R229	Same as R215		
R230	Not listed		
R231	Not listed		
R232	Not listed		
R233	Not listed		
R234	Same as R67		
R235	Same as R67		

Table 6-1 Board A1 Parts Identification (Cont)

Circuit Reference	Description	Manufacturer	FI Part Number
R236	Same as R67		
R237	Same as R67		
R238	Not listed		
R239	Same as R92		
R240	Same as R92		

Table 6-2 High Voltage Power Supply Board A2 Parts Identification

Circuit Reference	Description	Manufacturer	FI Part Number
C1	Capacitor, 10 μf, 150 v	CD	5300-03
C2	Capacitor, .05 μf	Sprague	5301-24
C3	Capacitor, 1 μf	Hopkins	5302-70
C4	Capacitor, .1 μf	Hopkins	5302-67
C5	Capacitor, .02 μf	CRL	5301-22
C6	Capacitor, .0068 μf, 3 kv	Sprague	5303-80
C7	Same as C6		
C8	Capacitor, .01 μf, 600 v	CD	5301-20
CR1	Diode, FD100	FS	5151-37
CR2	Diode, H. V., G3R102H	E dal	
CR3	Diode, FD100	FS	5151-37
DS1	Lamp, NE-96	G. E.	
Q1	Not listed		
Q2	Transistor, 2N1893	FS	5151-92
Q3	Transistor, 2N2920	FS	5154-06
R1	Resistor, fixed, 200 Ω ±5%, 2 w	A-B	
R2	Resistor, fixed, 1 k ±5%, 1/2 w	A-B	5215-51
R3	Resistor, fixed, 10 k ±5%, 1/2 w	A-B	5215-76
R4	Resistor, fixed, 5.6 k ±5%, 1/2 w	A-B	5215-70
R5	Resistor, fixed, 4.7 Ω ±5%, 1 w	A-B	5225-05
R6	Resistor, fixed, 39 k ±5%, 1/2 w	A-B	5215-91
R7	Not listed		
R8	Resistor, fixed, 680 ±5%, 1/2 w	A-B	5216-23
R9	Same as R3		
R10	Same as R3		
R11	Same as R3		
R12	Not listed		

Table 6-2 High Voltage Power Supply Board A2 Parts Identification (Cont)

Circuit Reference	Description	Manufacturer	FI Part Number
R13	Resistor, fixed, 1 M ±5%, 1/2 w	A-B	5226-20
R14	Not listed		
R15	Resistor, fixed, 1.8 M ±5%, 1 w	A-B	5226-02
R16	Same as R15		
R17	Same as R15		
R18	Same as R18		

Table 6-3 Collector Sweep Board A3 Parts Identification

Circuit Reference	Description	Manufacturer	FI Part Number
C1	Capacitor, 7 - 45 pf	Erie	5302-44
C2	Capacitor, 250 pf	Elmenco	5300-77
C3 - C55	Not listed		
C56	Same as C1		
CR1	Diode, 1N3194		5161-02
CR2	Same as CR1		
CR3	Same as CR1		
CR4	Same as CR1		
CR5	Diode, 1N1222	West.	5150-60
CR6	Same as CR5		
CR7	Same as CR5		
CR8	Same as CR5		
R1	Resistor, fixed, 100 k ±5%, 1/2 w	A-B	5216-02
R2	Same as R1		
R3	Same as R1		
R4	Same as R1		
R5	Resistor, fixed, 10 k ±5%, 1/2 w	A-B	5215-76
R6	Same as R5		
R7	Same as R5		
R8	Same as R5		
R9	Resistor, fixed, 5 Ω ±5%, 20 w	Ohmite	5251-01
R10	Resistor, fixed, 25 Ω ±5%, 20 w	Ohmite	5251-04
R11	Resistor, fixed, 100 Ω ±5%, 5 w	Ohmite	5240-93
R12	Resistor, fixed, 300 Ω ±5%, 20 w	Ohmite	5251-09
R13	Resistor, fixed, 1 k ±5%, 50 w	Ohmite	5251-25
R14	Resistor, fixed, 3 k ±5%, 20 w	Ohmite	5251-15
R15	Resistor, fixed, 10 k ±5%, 5 w	Ohmite	5240-92
R16	Resistor, fixed, 30 k ±5%, 2 w	A-B	5240-90
R17	Resistor, fixed, 100 k ±5%, 1 w	A-B	5225-80

Table 6-4 Assembly 6200 Replacement Parts

Circuit Reference	Description	Manufacturer	FI Part Number
C3	Capacitor, 1500 μf, 75 v	Mallory	5303-48
C4	Capacitor, .001 μf	CD	5301-15
C10	Same as C3		
C11	Same as C4		
C14	Capacitor, 110 μf, 450 v	Mallory	5303-47
CB1	Circuit breaker 1/4 A		
DS1	Lamp, no. 47	G. E.	5800-03
DS2	Same as DS1		
F1	Fuse, 2A SB	Littelfuse	5700-39
J1	Connector, 36 pin	Amphenol	6123-98
J2	Connector, A.C.	Tower	6124-47
Q1	Transistor, TP6206	FS	5152-38
Q4	Same as Q1		
Q30	Same as Q1		
Q31	Same as Q1		
R85	Resistor, fixed, 560 K ±5%, 1 w	A-B	5225-93
R100	Resistor, variable, 1 k (3 turn)	Beckman	5291-76
R106	Resistor, variable, 20 k, 1/2	A-B	5291-75
R145	Resistor, fixed, 110 Ω ±1%, 1/2 w	IRC	5209-65
R159	Resistor, fixed, 5Ω ±1%, 10 w	Dale	
R160	Resistor, fixed, 2.5 Ω ±1%, 25 w	Dale	
R161	Same as R160		

Table 6-4 Assembly 6200 Replacement Parts (Cont)

Circuit Reference	Description	Manufacturer	FI Part Number
R238	Resistor, variable, 50 Ω, 2 w	CTS	5290-03
R241	Resistor, variable, 1 M, 2 w	A-B	5291-82
R242	Same as R241		
S1	Switch	Ohmite	5604-78
S2	Switch, rotary	CRL	5604-75
S3	Switch, rotary B900015		5604-86
S4	Switch, toggle, SPDT	M S	5603-04
S5	Switch, rotary	CRL	5604-73
S6	Switch, consisting of		
	1 - Index	CRL	5600-23
	3 - Wafer	CRL	5600-26
S7	Switch, rotary B900013		5604-72
S8	Switch, rotary B900014		5604-71
S11	Switch, toggle, DPDT	M S	5601-63
S12	Same as S11		
S2R1 - S2R10	Resistor, fixed, 100 Ω ±5%, 1/4 w	A-B	5214-08
S6R1	Resistor, fixed, 1 k ±5%, 1/2 w	A-B	5215-51
S6R2	Resistor, fixed, 10 Ω ±1%, 25 w	Dale	
S6R3	Resistor, fixed, 100 Ω ±1%, 10 w	Dale	5291-37
S6R4	Resistor, fixed, 1 k ±1%, 25 w	Dale	
S6R5	Resistor, fixed, 100 k ±1%, 1/2 w	IRC	5209-24
S6R6	Resistor, fixed, 10 k ±1%, 2 w	Dale	
T1	Transformer	Tranex	5401-15
T2	Transformer	S-E	5401-16
T3	Transformer	Tranex	5401-14

Table 6-4 Assembly 6200 Replacement Parts (Cont)

Circuit Reference	Description	Manufacturer	FI Part Number
V1	Tube, 5881		5100-47
V2	Tube, 5AQP1A	Dumont	5100-04
XDS1	Socket, lamp	Dumont	6140-99
XDS2	Same as XDS1		
XV1	Socket, octal	Amphenol	6140-31
XV2	Socket, CRT	Dumont	6140-24
	Counter dial	Beckman	5291-80

SERIES RESISTOR	100 k
BASE STEP GENERATOR MULTIPLIER	1
RANGE	.1 volt
POLARITY	+
PULSED/NORMAL	NORMAL
FIRST SWEEP STEP NO.	0
LAST SWEEP STEP NO.	0
VERTICAL SENSITIVITY	20 ma
VERTICAL POSITION	mid-range
VERTICAL ZERO	ZERO
HORIZ. SENSITIVITY	.1 v COL.
HORIZ. POSITION	mid-range
HORIZ. ZERO	ZERO
FOCUS	mid-range
INTENSITY	CCW
SCALE LIGHT/POWER	CCW

b. Turn SCALE LIGHT/POWER control fully clockwise. Allow 5 minute warm-up period.

c. Rotate INTENSITY control until dot appears on CRT.

d. Adjust FOCUS control and Astigmatism potentiometer R15 (board A2) for smallest dot possible.

5-29. HORIZONTAL AND VERTICAL AMPLIFIER BALANCE ADJUSTMENT

5-30. To adjust horizontal and vertical amplifiers carry out following steps:

a. Perform CRT adjustment detailed in paragraph 5-20.

b. Switch HORIZ. SENSITIVITY VOLTS/DIV control between .01 v and .1 v COLLECTOR settings. Observe dot on CRT. Adjust Horiz. Balance potentiometer R181 (board A1) until there is no horizontal movement of dot when control is switched.

c. Switch VERTICAL SENSITIVITY control between 20 ma and 50 ma settings. Adjust Vertical Balance potentiometer R189 (A1) until there is no vertical movement of dot.

d. Set HORIZ. ZERO and VERTICAL ZERO toggle switches to OFF.

5-31. CALIBRATION ADJUSTMENTS

NOTE

This adjustment should be made immediately following any power supply adjustment.

5-32. Check calibration of the vertical and horizontal amplifier and base step generator as follows:

a. Connect digital voltmeter to COL. of Q26.

b. Connect a jumper between base and emitter test terminals.

c. Adjust potentiometer R78 (A1) until readout is zero volts.

d. Remove shorting link. Connect DVM between base and emitter test terminals.

e. Switch POLARITY control between (+) and (-) setting. Adjust ZERO STEP control until readout is the same value and sign in both polarities. Now adjust potentiometer R128 (1) until readout on DVM is zero volts.

FAIRCHILD
INSTRUMENTATION

INSTRUCTION MANUAL

CURVE TRACER

Model 6200

Manual 605128, June 1965, is changed as follows:

Delete all references to Model 6200. Substitute 6200A.

Page 1-1, paragraph 1-8. After paragraph 1-8, add a new paragraph: 1-8A. Toggle switches below both deflection amplifier controls allow the operator to invert the trace vertically, horizontally, or both.

Page 1-1, paragraph 1-9., line 3. Change ".01 to 20 v" to: .01 to 100 v.

Page 1-2, paragraph 1-10., line 3. Change "four-position switch" to: six-position switch.

Page 1-2, paragraph 1-10., line 7. Delete last two sentences and substitute: The variable control is roughly calibrated for the ±20 v range for the reference values in black on the inside of the circle. When using the ±200 v range, these calibration marks should be multiplied by 10. In the 1000 v range, the red reference values outside of the ring are used. These values are multiplied by 10.

Page 1-3, Table 1-1, "COLLECTOR SWEEP GENERATOR Range". Add a third range as follows: 0 to 1000 volts, 40 ma max.

Page 1-4, Table 1-1, "HORIZONTAL DISPLAY Collector Voltage". Change "10 mv to 20 v/div" to: 10 mv to 100 v/div.

Page 2-1. Insert before paragraph 2-1:

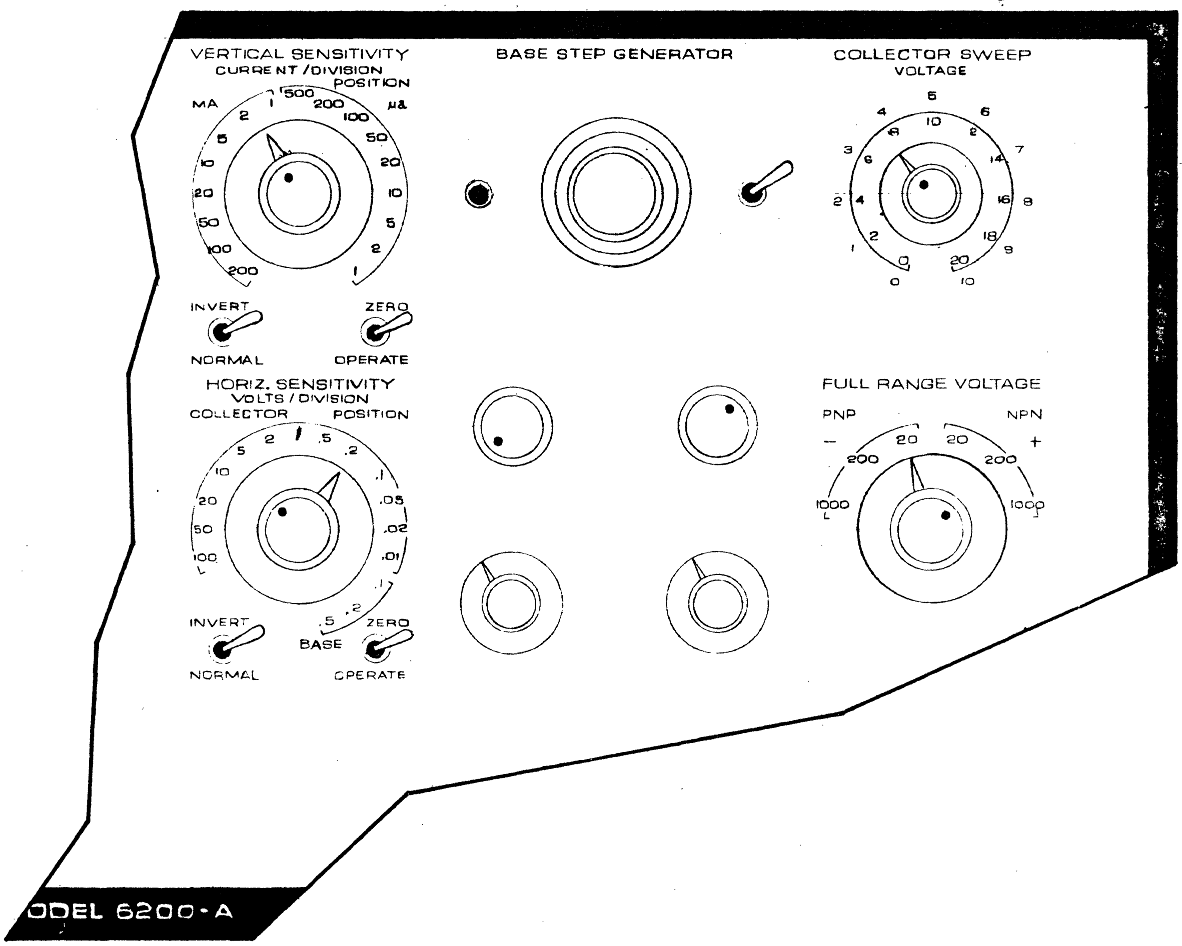
WARNING

WHEN USING THE INSTRUMENT, USE EXTREME CARE TO AVOID COMING IN CONTACT WITH THE TEST TERMINALS. DANGEROUS VOLTAGE MAY BE PRESENT. ALWAYS SET COLLECTOR SWEEP VOLTAGE CONTROL TO ZERO BEFORE ATTACHING OR REMOVING DEVICE UNDER TEST.

Page 3-1. Insert above WARNING before paragraph 3-1.

Page 3-1, paragraph 3-4., sub-paragraph 8., line 7. Change "and 20 v;" to: 20 v, 50 v, and and 100 v;

Page 3-2, figure 3-1. Change front panel controls as shown below:



Page 3-3, paragraph 3-4., sub-paragraph 18., line 6. Add: In ±1000 volt position of RANGE switch, the outside (red) markings multiplied by 10 give the amplitude.

Page 3-3, paragraph 3-4., sub-paragraph 19., line 1. Change "FULL RANGE VOLTAGE 4-position rotary switch" to: FULL RANGE VOLTAGE 6-position rotary switch.

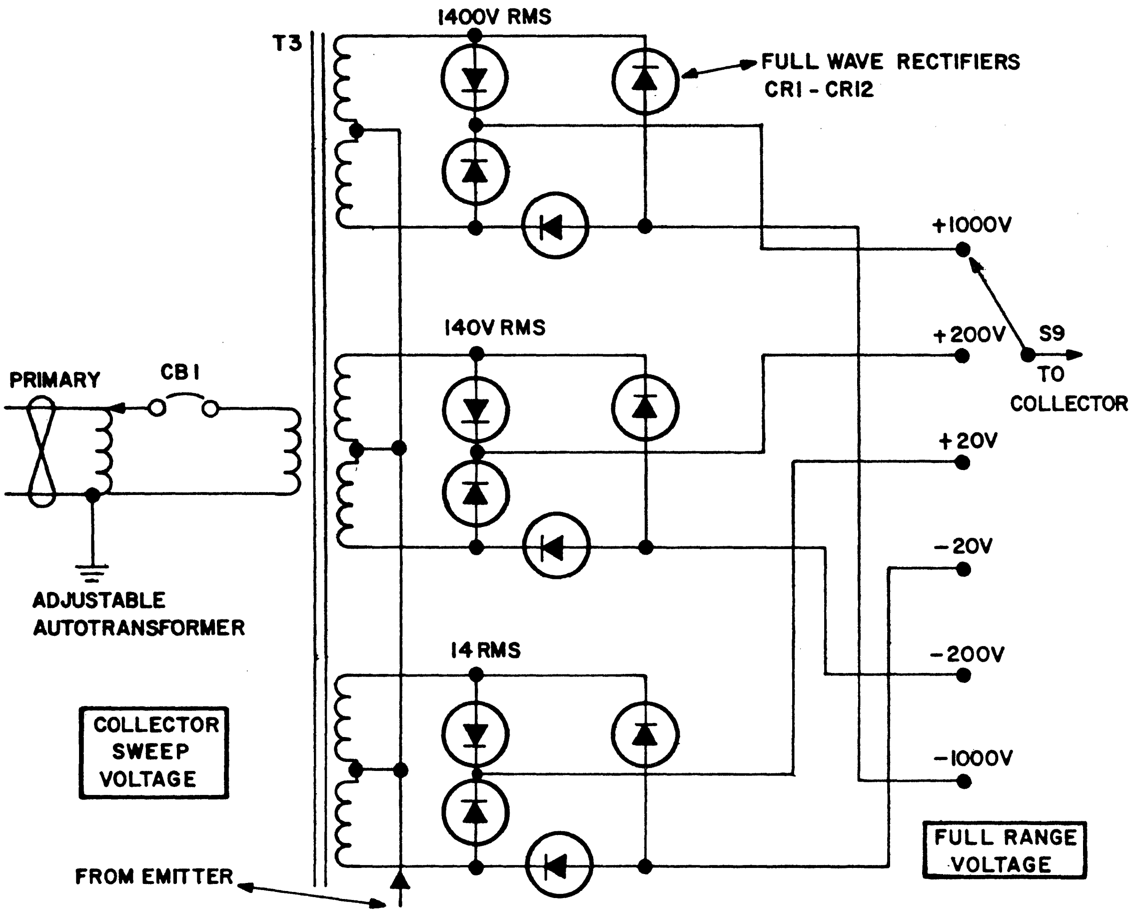
Page 3-3, paragraph 3-4., sub-paragraph 19., line 4. Change "+200 v, -20 v and -200 v." to: +200 v, +1000 v and -20 v, -200 v and -1000 v.

Page 3-4, table 3-1. Add following data:

J1 pin Designation	VERT. and HORIZ. SENSITIVITY Settings	
29	HORIZ SENS	20 v/div COLLECTOR
34	HORIZ SENS	50 v/div COLLECTOR
35	HORIZ SENS	100 v/div COLLECTOR

Page 4-2, paragraph 4-7., line 6. Change sentence beginning "The ranges are + or - 20 volts--" to: The ranges are + or - 20 volts, + or - 200 volts, and + or - 1000 volts.

Page 4-2, Figure 4-2. Delete and substitute figure shown below:



Page 4-3, paragraph 4-13., line 10. Change "CR8" to: CR12.

Page 4-3, paragraph 4-13., line 11. Change "dc outputs of ±20 volts and ±200 volts." to: dc outputs of ±20 volts, ±200 volts, and ±1000 volts.

Page 4-3, paragraph 4-13, line 18. Change "the scale indicates 1/10 of the voltage." to: the scale indicates 1/10 of the voltage; and in the ±1000 volt range, the red external markings indicate 1/10 the voltage.

Page 4-10, paragraph 4-51., line 4. Change "V1" to: Q9.

Page 4-10, paragraph 4-51, line 9. Change "Q9/Q10" to: Q9.

Page 4-10, paragraph 4-51, line 11. Change "the control grid of V1" to: the base of Q9.

Page 5-1. Insert before paragraph 5-1 WARNING given for page 2-1.

Page 5-3, paragraph 5-12., sub-paragraph i. Add the following sub-paragraphs and table:

j. Connect 100 kΩ ±1%, 2 w resistor between emitter and collector terminals.

k. Set controls as follows:

FULL RANGE VOLTAGE	+1000 v
VERTICAL SENSITIVITY	1 ma/div
HORIZ. SENSITIVITY	100 v/div

m. Rotate COLLECTOR SWEEP VOLTAGE CONTROL and check that trace appears as 45° line on CRT.

n. Repeat test for control settings listed in table 5-4A. Trace should be 45° line.

p. Return COLLECTOR SWEEP VOLTAGE to zero. Remove 100 kΩ resistor.

Table 5-4A VERT. and HORIZ. Function Check, +1000 V

VERTICAL SENSITIVITY	HORIZ. SENSITIVITY
1 ma/div	100 v/div
500 μa/div	50 v/div
200 μa/div	20 v/div
100 μa/div	10 v/div
50 μa/div	5 v/div
20 μa/div	2 v/div
10 μa/div	1 v/div

√ Page 5-23/5-24, Figure 5-6 (Sheet 1 of 3). Remove and insert new page.

√ Page 5-25/5-26, Figure 5-6 (Sheet 2 of 3). Remove and insert new page.

√ Page 5-27/5-28, Figure 5-6 (Sheet 3 of 3). Remove and insert new page.