TEK SERVICE MANUAL

070-6739-00
Product Group 46

CPS250
TRIPLE OUTPUT POWER SUPPLY
SERVICE

Tektronix
COMMITTED TO EXCELLENCE

TEK SERVICE MANUAL

070-6739-00
Product Group 46

CPS250
TRIPLE OUTPUT POWER SUPPLY
SERVICE

WARNING

THE FOLLOWING SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID PERSONAL INJURY, DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO. REFER TO OPERATORS SAFETY SUMMARY AND SERVICE SAFETY SUMMARY PRIOR TO PERFORMING ANY SERVICE.

Please Check for CHANGE INFORMATION at the Rear of This Manual

First Printing OCT 1988

Tektronix
COMMITTED TO EXCELLENCE

Scan by Zenith

INSTRUMENT SERIAL NUMBERS

Each instrument has a serial number on a panel insert, tag, or stamped on the chassis. The first two digits designate the country of manufacture. The last five digits of the serial number are unique to each instrument. The country of manufacture is identified as follows:

B000000 Tektronix, Inc., Beaverton, Oregon, U.S.A.

E200000 Tektronix United Kingdom, Ltd., London

G100000 Tektronix Guernsey, Ltd., Channel Islands

HK00000 Hong Kong

H700000 Tektronix Holland, NV, Heerenveen, The Netherlands

J300000 Sony/Tektronix, Japan

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

OPERATORS SAFETY SUMMARY

The general safety information in this part of the summary is for both operating and servicing personnel. Specific warnings and cautions will be found throughout the manual where they apply and do not appear in this summary.

Terms in This Manual

CAUTION statements identify conditions or practices that could result in damage to the equipment or other property.

WARNING statements identify conditions or practices that could result in personal injury or loss of life.

Terms as Marked on Equipment

CAUTION indicates a personal injury hazard not immediately accessible as one reads the markings, or a hazard to property, including the equipment itself.

DANGER indicates a personal injury hazard immediately accessible as one reads the marking.

Symbols in This Manual

This symbol indicates where applicable cautionary or other information is to be found. For maximum input voltage see Table 1-1.

Symbols as Marked on Equipment

DANGER – High voltage.

Protective ground (earth) terminal.

ATTENTION – Refer to manual.

Replace fuse as specified – Refer to manual.

Power Source

This product is intended to operate from a power source that does not apply more than 250 volts rms between the supply conductors or between either supply conductor and ground. A protective ground connection, by way of the grounding conductor in the power cord, is essential for safe operation.

Grounding the Product

This product is grounded through the grounding conductor of the power cord. To avoid electrical shock, plug the power cord into a properly wired receptacle before making any connections to the product input or output terminals. A protective ground connection, by way of the grounding conductor in the power cord, is essential for safe operation.

Danger Arising From Loss of Ground

Upon loss of the protective-ground connection, all accessible conductive parts (including knobs and controls that may appear to be insulating) can render an electric shock.

Use the Proper Power Cord

Use only the power cord and connector specified for your product.

Use only a power cord that is in good condition.

For detailed information on power cords and connectors, see Figure 2-2.

Use the Proper Fuse

To avoid fire hazard, use only a fuse of the correct type, voltage rating, and current rating as specified in the parts list for your product.

Do Not Operate in an Explosive Atmosphere

To avoid explosion, do not operate this instrument in an explosive atmosphere.

Do Not Remove Covers or Panels

To avoid personal injury, do not remove the product covers or panels. Do not operate the instrument without the covers and panels properly installed.

SERVICING SAFETY SUMMARY

FOR QUALIFIED SERVICE PERSONNEL ONLY

Refer also to the preceding Operators Safety Summary

Do Not Service Alone

Do not perform internal service or adjustment of this product unless another person capable of rendering first aid and resuscitation is present.

Use Care When Servicing With Power On

Dangerous voltages exist at several points in this product. To avoid personal injury, do not touch exposed connections or components while power is on.

Disconnect power before removing protective panels, soldering, or replacing components.

Power Source

This product is intended to operate from a power source that does not apply more than 250 volts rms between the supply conductors or between either supply conductor and ground. A protective ground connection by way of the grounding connector in the power cord is essential for safe operation.

6739-02

The CPS250 TRIPLE OUTPUT POWER SUPPLY.

GENERAL INFORMATION

INTRODUCTION

The TEKTRONIX CPS250 TRIPLE OUTPUT POWER SUPPLY is a multifunction portable instrument that provides two 0 to 20 V power supplies and a single 5 V supply. The 0 to 20 volt, 500 mA, variable outputs meet the needs of most semiconductor test or experimental applications. The fixed 5 volt output is available for use in transistor-transistor-logic (TTL) applications.

The output voltages can be operated as floating supplies or referenced to ground. In parallel and series mode of operation, the two 0 to 10 V power supplies are internally connected. Two or three of the output voltages may be externally wired to produce voltages different than the front panel settings as described in Section 2 of the Operators Manual.

The CPS250 has a locking, multiposition handle that folds under the instrument to allow stacking with other instruments of the same series.

Standard accessories provided with the CPS250 include: a power cord, three pairs of test leads (one red and one black), and an operators manual. For part numbers and further information about standard and optional accessories, refer to Replaceable Parts (section 8) in this manual. For additional information, contact your Tektronix Sales Office or Distributor and the Tektronix products catalog.

SPECIFICATION

The operational characteristics given in Table 1-1 are valid when the instrument as been adjusted at an ambient temperature between +21 °C and +25 °C, has had a warm-up period of at least ten minutes (with the cabinet in place), and is operating at an ambient temperature between +10 °C and +40 °C, with 75% maximum relative humidity.

Table 1-1

General Characteristics

Characteristics	Performance Requirements
OPERATIONAL	
Voltages	
5 V Output	5.0 ±0.1 Vdc.
A and B Outputs	0.015 Vdc ±0.015 Vdc 20.25 Vdc ±0.25 Vdc
Currents	
5 V Output	2.0 A maximum.
A and B Outputs	0.5 A maximum.
Load Regulation	
5 V Output	0.1% +5 mV.
A and B Outputs	0.01% +3 mV.
Line Regulation	
5 V Output	0.1% +5 mV.
A and B Outputs	0.01% +3 mV.
Ripple/Noise (All Outputs)	2 mV rms, 5 Hz to 1 MHz.
Tracking Error (Between A and B Outputs)	±0.2% ±20 mV.
Meters	
Voltage	0 to 25 Vdc ±2.5% of full scale.[a]
Current	0 to 600 mA ±2.5% of full scale.[a]
ELECTRICAL	
Line Voltage Range	90 to 110, 108 to 132, 198 to 242, and 216 to 250 Vac at 50-60 Hz.[a]
Power Consumption	175 VA, 160 W maximum.[a]
ENVIRONMENTAL	
Temperature	
Operating	+10°C to +40°C (+50°F to +104°F), 75% relative humidity.
Nonoperating	-10°C to +60°C (-14°F to +140°F), 80% relative humidity.

[a] **Performance Requirement not checked in manual.**

Table 1-1 (cont)

Characteristics	Performance Requirements
Physical	
Width	240 mm (9.5 in).
Height	100 mm (3.9 in).
Depth	190 mm (7.5 in).
Weight	4.8 kg (10.56 lb).

PREPARATION FOR USE

SAFETY

This section of the manual tells how to proceed with the initial start-up of the instrument.

Refer to the Safety Summaries at the front of this manual for power source, grounding, and other safety considerations pertaining to the use of the instrument. Before connecting the CPS250 to a power source, read both this section and the Safety Summaries.

LINE VOLTAGE

CAUTION

This instrument may be damaged if operated with the LINE VOLTAGE SELECT switches set for the wrong line voltage.

This product is intended to operate from a power source that does not supply more than 250 Vrms between the ac input conductors or between either ac input conductor and ground. Before connecting the power cord to a power-input source, verify that the LINE VOLTAGE SELECT switches on the Rear Panel are set to the correct line voltage setting. Figure 2-1 shows the location of the LINE VOLTAGE SELECT switches, power cord receptacle, and power fuse.

POWER CORD

A protective ground connection, the third wire in the power cord, is necessary for safe operation. To avoid electrical shock, plug the power cord into a properly wired receptacle before making any connections to the equipment input terminals. Do not remove the ground lug from the power cord for any reason. Use only the power cord and connector specified for this equipment.

Instruments are shipped with the required power cord as ordered by the customer (see Figure 2-2). Contact your Tektronix representative or Tektronix Field Office for additional power-cord information.

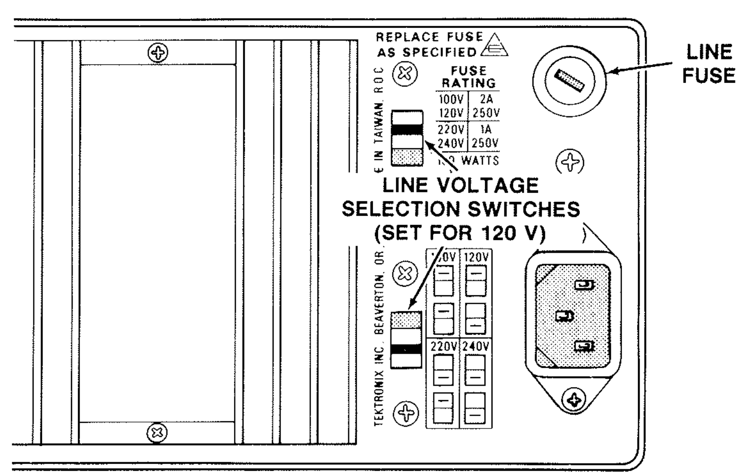
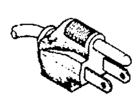
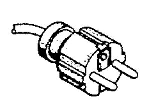
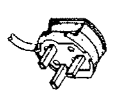
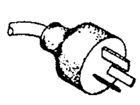
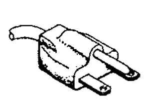
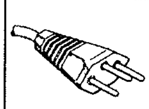


Figure 2-1. Rear Panel.

Plug Configuration	Option	Power Cord/ Plug Type	Line Voltage	Reference Standards [b]
	U.S. Std.	U.S. 120V	120V	ANSI C73.11 NEMA 5-15-P IEC 83 UL 198.6
	A1	EURO 220V	220V	CEE(7), II, IV, VII IEC 83 IEC 127
	A2	UK[a] 240V	240V	BS 1363 IEC 83 IEC 127
	A3	Australian 240V	240V	AS C112 IEC 127
	A4	North American 240V	240V	ANSI C73.20 NEMA 6-15-P IEC 83 UL 198.6
	A5	Switzerland 220V	220V	SEV IEC 127

[a] A 6A, type C fuse is also installed inside the plug of the Option A2 power cord.

[b] Reference Standards Abbreviations:

ANSI—American National Standards Institute
AS—Standards Association of Australia
BS—British Standards Institution
CEE—International Commission on Rules for the Approval of Electrical Equipment
IEC—International Electrotechnical Commission
NEMA—National Electrical Manufacturer's Association
SEV—Schweizervischer Elektrotechnischer Verein
UL—Underwriters Laboratories Inc.

Figure 2-2. Optional power cords.

FUSES

CAUTION

The instrument may be damaged if operated with the wrong type and rating line fuses installed.

WARNING

Unplug the power cord and disconnect the test leads from any voltage source before checking or changing the fuses.

Verify the proper value of the fuses with the following procedure. Figure 2-1, Rear Panel, shows the location of the fuse:

1. Disconnect the power cord from the power-input source.
2. Press in the fuse-holder cap and release it with a slight counterclockwise rotation.
3. Pull the cap (with the attached fuse inside) out of the fuse holder.
4. Verify proper fuse value.
5. Install the proper fuse and reinstall the fuse-holder cap.

DETAILED OPERATING INFORMATION

For detail operating information about the instrument, refer to the Operators Manual.

THEORY OF OPERATION

INTRODUCTION

This section contains a general and detailed description of the CPS250 TRIPLE OUTPUT POWER SUPPLY circuitry. General operation of the instrument is described in the Block Diagram Description. Each functional circuit is described in more detail in the Detailed Circuit Description.

The schematic diagram and the circuit board illustrations are located in the Diagrams section near the rear of this manual. To understand the circuit descriptions in this section, refer to both the Block Diagram, Figure 3-1 in this section, and to the schematic diagram.

LINEAR DEVICES

The operation of individual linear devices is described in this section using graphic techniques when needed to illustrate their circuit action. For specific device characteristics of common parts, refer to the manufacturer's data book.

BLOCK DIAGRAM DESCRIPTION

The CPS250 provides two 0-to-20-volt dc power supplies and a single 5-volt dc power supply. The ac input voltage is applied to the primary side of the power transformer through the power switch, fuse and Line Voltage Selector switch. The secondary windings of the power transformer provide the stepped-down ac voltages for the power supplies.

A and B Power Supplies

The A and B 0-to-20 V Power Supplies use three secondary windings of the power transformer. Two of the windings provide ac voltages for the positive and negative reference voltages of the A and B Power Supplies. The third secondary winding is each supply used to provide ac voltage to the output power rectifiers.

The secondary ac voltage for the positive reference voltage is rectified by a bridge rectifier and regulated by a pair of zener diodes. The secondary ac voltage winding for the negative reference voltage is half-wave rectified, filtered, and regulated by a zener.

Secondary ac voltage for the A or B power supply output is applied to a bridge rectifier through the HI/LO Relay circuit. The HI/LO Relay circuit senses the setting of the output voltage and selects the amplitude of the secondary ac voltage for rectification.

The output of the bridge rectifier is filtered and regulated. The regulator circuit senses the output voltage and current requirements and develops a correction signal that is applied to the series-pass transistors. The correction signal regulates the current through the series-pass transistor maintaining a constant output voltage level.

The A and B Power Supplies operate independently when the A/B OUTPUTS switch is in the INDEPENDENT position. When the A/B OUTPUTS switch is in PARALLEL or SERIES TRACKING positions, the outputs of the A and B Power Supplies are connected together to operate as a single power supply. In Parallel and Series Tracking mode, the A VOLTAGE and A CURRENT controls set the output voltage and current levels. In Parallel Tracking mode, the A and B Power Supply currents are added together to produce a variable output current from 0 to 1 A at 0 to 20 V at either the A or the B Output. In Series Tracking mode, the A and B output voltage are added together to produce an output voltage that is variable from 0 to 40 V.

The A/B switch selects either the A or the B Power Supply outputs to be monitored by the front-panel voltmeter and ammeter. The voltmeter is placed across the selected + and - outputs, and the ammeter is placed in series with the selected + output.

5-V Power Supply

The secondary voltage from the power transformer for the 5-V Power Supply is rectified by a bridge rectifier. A zener diode across the output of the bridge provides a stable voltage for the regulator. Reference voltage for the 5-V Power Supply is set by internal circuitry of the regulator. The regulator circuit senses the output load and develops a correction signal that is applied to the series-pass transistors. The correction signal controls the current through the series-pass transistor to maintain a constant output voltage level.

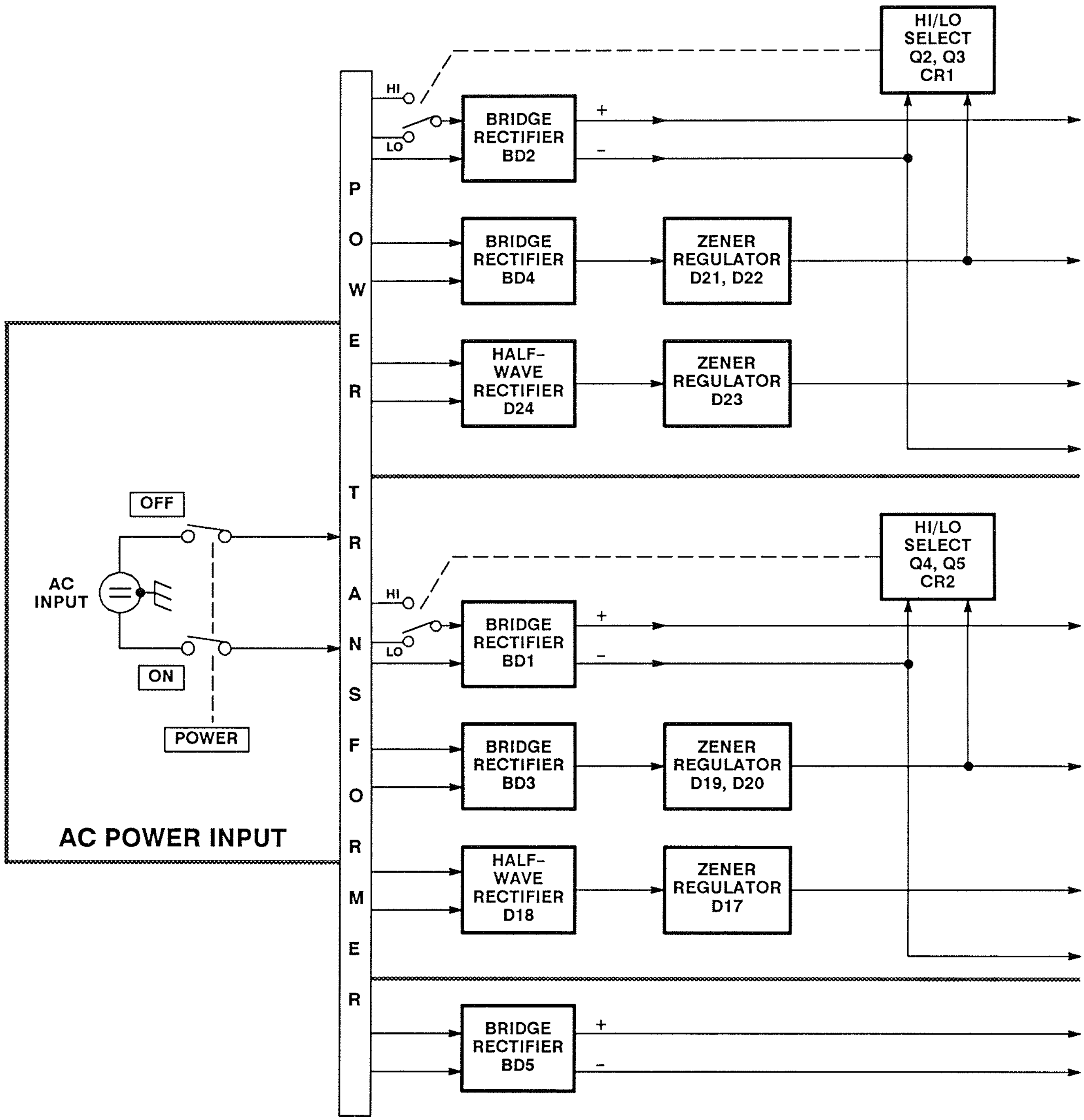


Figure 3-1. CPS250 Block Diagram.

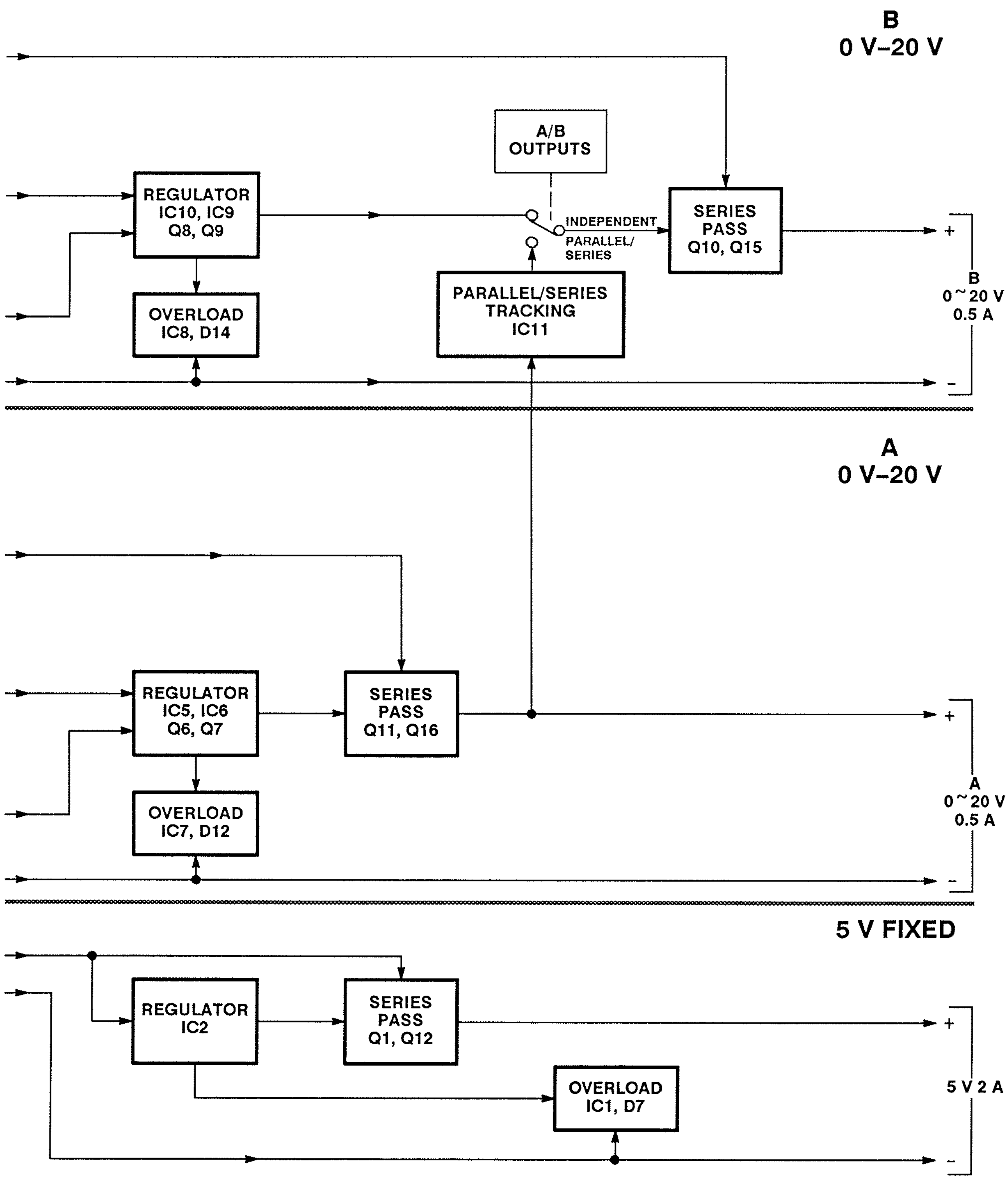


Figure 3-1. CPS250 Block Diagram (cont).

DETAILED CIRCUIT DESCRIPTION

Ac Power Input

The power supply will operate from nominal line voltages of 100 V, 120, V 220 V, and 240 V. Set the LINE VOLTAGE SELECT switch (located on the rear panel) to the voltage level supplied by the local ac power source. The POWER switch applies the ac source voltage to the primary side of the power transformer. The POWER indicator across the outputs of the 5V rectifier BD5 lights to show when the power supply is on or off.

A and B Power Supplies

The A and B Power Supplies shown in the Diagram Section of this manual are identical when the TRACKING switch is in INDEPENDENT position. Therefore, only the A Power Supply is described. Similar components in the B Power Supply perform the identical circuit functions. The Series and Parallel tracking circuitry that ties the two supplies together is discussed later.

Reference Voltages

Bridge rectifier BD3 along with Zener diodes D19 and D20 provide a positive reference voltage of about 20 V above the + A output voltage. Half-wave rectifier D18 and Zener D17 provide a negative reference voltage of about 5.6 V below the + A output voltage.

Output Voltage Rectifier

The ac voltage for the A Supply outputs is rectified by bridge rectifier BD1 and filter by C11. The ac voltage to one input of BD1 is fused by FS3. The amplitude of the ac voltage to the other input of BD1 is selected by HI/LO Relay circuit.

When the A Supply output voltage exceeds 12 volts, Q5 becomes reverse biased, turning Q4 on. With Q4 turned on, current relay CR2 becomes energized, switching the relay contacts from the LO to the HI position. In HI position, the secondary voltage to the rectifier BD1, is about doubled. The increased supply voltage allows the A Power Supply to operate at full output voltage under various loads.

Regulator

The regulator circuitry consists of Regulator Control IC6, Voltage Control IC5, Current Control Q6 and Q7, and associated components.

Regulator Control IC6 monitors the signals from the Voltage Control and Current Control circuits and develops a control signal that regulates the A Power Supply output. It contains an error amplifier for voltage settings and the series- pass control circuitry that provides correction signal to the Series-Pass circuit.

VOLTAGE CONTROL. The voltage control circuit, IC5, provides a control signal to Regulator Control IC6 pin 5 that sets the voltage difference between the + and - outputs.

Potentiometers SVR4, SVR6, and the A VOLTAGE control VR3 sets the reference voltage on pin 3 of IC5. Potentiometer SVR4 and SVR6 sets the maximum and minimum control limits of VR3 (and therefore the output voltage range). The voltage divider formed by R39 and R35 between Vref of IC6 and the + A output, sets the input comparison voltage for pin 2 of IC5 and pin 4 of IC6 error amplifier. The voltage control signal from IC5 pin 6 is applied to pin 5 of IC6 second error amplifier input. The voltage difference between pins 4 and 5 of IC6 sets the voltage level on pin 9 of IC6.

CURRENT CONTROL. The current-control circuit consists of Q6 and Q7 connected as a differential amplifier. The switching action of Q6 and Q7 sets the bias supply to Q16 to increase or decrease the current through Q11.

The reference voltage at the base of Q6 is set by A CURRENT control VR4 with potentiometer SVR5 setting the maximum control limits. The comparison voltage at Q7 is developed across R31 in the current path. When the comparison voltage at the base of Q7 exceeds the reference voltage at the base of Q6, Q6 turns off and Q7 conducts. The current control signal of Q7 is applied to pin 13 of IC6 the series-pass control circuit input. The correction signal from pin 9 of IC6 is applied to the Series-Pass circuit to control the output current path.

Series Pass

The series-pass circuit consists of Q11 and Q16 connected in a Darlington configuration. Transistor Q11 is in series with the positive voltage from rectifier DB1 to the + output of the A Supply. Output current through Q11 is controlled by the correction signal from IC6 pin 9 through driver transistor Q16.

Overload Indicator

The Overload circuit monitors the voltage control error signal to the Regulator circuit and indicates when load demands exceed the limits of the A Power Supply. The circuit is made up of comparator IC7, A OVERLOAD LED, and associated components.

The comparator IC7 senses the output of IC5 the voltage control comparator, and compares it to the reference voltage on pin 3. The reference voltage is set by the voltage divider formed by R38 and R45 between the V ref input of IC6 and the + A output. When an overload conditions exists, the voltage level on pin 2 IC7 becomes more positive than pin 3. The output of IC7 goes negative, and D28, the A OVERLOAD LED turns on.

Shutdown

Protection from damage to the power supply due to excessive output voltage is supplied by silicon-controlled rectifier Q14. Should the output voltage exceed 24 V, zener diode D27 conducts causing Q14 to also conduct. The conduction of Q14 shorts the outputs of bridge rectifier BD1 to open fuse FS3.

Parallel Tracking

In Parallel Tracking Mode, the B Power Supply output is internally connected in parallel to the A Power Supply output. The combination of the A and B outputs into a single output doubles the current available for the 0 to 20 V range. The B Power Supply tracks the A Power Supply to maintain an output voltage equal to the A Power Supply output.

In Parallel Tracking mode, the B Power Supply control signal from IC10 to series pass transistors Q10 and Q15 is disabled by the A/B OUTPUTS switch. The control signal for Q10 and Q15 is then provided by operational amplifier IC11A that monitors the + output of the A and B Power Supplies. The control to Q10 and Q15 forces the B Power Supply to maintain the same output voltage level as the A Power Supply output.

Series Tracking

In Series Tracking mode, the outputs of the A and B Power Supplies are added together in series. The A Power Supply - output and B Power Supply + output are internally connected through A/B OUTPUTS switch S3. This gives a 0 to 40 V range between the - B Power Supply and + A Power Supply binding posts The Series Tracking circuit is composed of operational amplifier IC11B and associated components.

The output of B Power Supply control regulator IC10 to series pass transistors Q10 and Q15 is disabled by A/B OUTPUTS switch S3. The tracking signal for the B Power Supply Series Pass transistors Q15 and Q10 is provided by operational amplifier IC11B through switch S3. The circuit is adjusted by potentiometers SVR10 and SVR11 to set the correct output tracking signal level to Q15 and Q10. The series tracking signal to Q15 and Q10 forces the B Power Supply to maintained the same voltage level as the A Power Supply.

5-V Power Supply

The 5-V Power Supply provides a stable low-ripple output voltage. The secondary voltage of transformer T1 for the 5 V output is rectified by full wave bridge rectifier BD5 and filtered by capacitor C1.

REGULATOR. The Regulator circuitry is composed of Regulator Control IC2, Series-Pass transistors Q1 and Q12, and associated components.

Regulator Contrl IC2 maintains the 5-V level by regulating the output current through the Series Pass circuit.

The output voltage level is adjusted to 5 volts by potentiometer SVR3. This sets the voltage level on pin 4 of the internal error amplifier of IC2. Resistors R12 and R13 form a voltage divider that sets the reference input to pin 5 of IC2.

The output current through R14 develops a sense voltage proportional to the load current. That sense voltage is applied to pin 2 of IC2 of its internal current limiter circuit through potentiometer SVR1. Potentiometer SVR1 sets a balance condition between pin 2 and pin 3 that is tied directly to the 5-V output. The balance condition between pins 2 and pin 3 of IC2 sets the current level for the 5-V Power Supply.

When load current exceeds the rated output, the voltage level at pin 2 of IC2 increases until the internal current limiter is turned on. With the current limiter turned on, the control voltage level at pin 10 of IC2 decreases to lower the output current through the series-pass transistors. The output current will continue to decrease until the voltage drop across R14 is low enough to just turn off the internal current limiter of IC2. An short across the output would drop the control voltage level on pin 10 of IC2 far enough to limit the current flow through Q12 to about 2.1 amps.

SERIES PASS. The series-pass circuit consists of Q12 and Q1 connected in a Darlington configuration. Transistor Q12 is in series with the positive voltage from rectifier DB5 to the + output of the 5-V Power Supply. Output current through Q12 is controlled by the correction signal from IC2 pin 10 through driver transistor Q1.

Overload Indicator

The overload circuit monitors the output voltage for excessive output loading. When the demands on the load current exceeds the current limit of the 5 V Power Supply, the OVERLOAD LED (D6) turns on.

Potentiometer SVR2, sets a comparison voltage on pin 3 of IC1, as the load current increase, the voltage at the emitter of Q12 will rise above 5 V due to the drop across R14. That causes the voltage on pin 3 to rise. When the comparison voltage on pin 3 exceeds that on pin 2, the output of IC1 goes towards the positive supply voltage and LED D6, the 5V OVERLOAD indicator, turns on.

PERFORMANCE CHECK PROCEDURE

INTRODUCTION

This procedure checks the electrical characteristics listed in the Specification part of Section 1 of this manual. If the instrument fails to meet the requirements given in this performance check, the Calibration Procedure in Section 5 should be done. This performance check may also be used as an acceptance test or as a troubleshooting aid.

You do not have to remove the instrument case to do this procedure. All checks can be made with controls and binding posts accessible from the outside.

To ensure instrument accuracy, check its performance after every 2000 hours of operation, or once each year if used infrequently. If these checks indicate a need for readjustment or repair, refer the instrument to a qualified service person.

TEST EQUIPMENT NEEDED

The test equipment listed in Table 4-1 is a complete list of the equipment needed for this performance check and the adjustment procedure in Section 5. All test equipment is assumed to be operating within tolerance. Detailed operating instructions for test equipment are not given in this procedure. If operating information is needed, refer to the appropriate test equipment instruction manual.

Table 4-1

Test Equipment Required

Item and Description	Minimum Specification	Purpose	Example of Applicable Test Equipment
1. Digital Multimeter	Dc voltage range, 0 to 200 Volts within 0.5%. Dc current range, 0 to 10 Amps within 0.5%.	Voltage checks, adjustments, load regulation.	Tektronix CDM250.
2. Variable Transformer	108 Vac to 132 Vac. Power 250 W or more.	Line regulation.	Technipower W10MT3W Auto Varic.
3. Load Resistors	5% or less, 25 Watts.	Voltage checks, adjustments, load regulation, and ripple.	Power Resistor Decade Box Model 240C
4. Test Oscilloscope with 1X probes	Bandwidth: dc to 20 MHz. Minimum deflection factor: 5 mV/div Accuracy: ±3%.	Ripple checks.	Tektronix 2205 Oscilloscope.
5. Alignment Tool	Length: 1-in shaft. Bit size: 3/32 in. Low Capacitance: insulated.	Adjust variable resistors.	Tektronix Part Number 003-0675-00.

PREPARATION

Connect the test equipment to an appropriate ac-power-input source and connect the CPS250 to a variable autotransformer that is set to 120 Vac. Apply power and allow 20 minutes for the instrument to warm up and stabilize.

Set the following controls for the instrument under test during warm-up time:

VOLTAGE (both)	MIN
CURRENT (both)	MIN
A/B OUTPUTS	INDEPENDENT
A/B	A

PROCEDURE

1. Check 5 V Power Supply

a. Connect the power resistor decade box between the 5 V - and 5 V + binding posts. Set the resistance value to 3 Ω.

b. Connect the digital multimeter common lead to the 5 V - binding post and the positive lead from the V-Ω jack to the 5 V + binding post. Set the digital multimeter to 20 dc voltage range.

c. CHECK—The digital multimeter reads between 4.9 V and 5.1 V.

d. CHECK—The voltage varies less than 10 mV as the line voltage is changed from 120 V to 108 V and from 120 V to 132 V. Return the line voltage to 120 V.

e. Remove the digital multimeter leads from the instrument. Do not remove the power resistor decade box from the instrument.

f. Connect the test oscilloscope and its 1X probe tip to the 5 V + binding post and the probe ground lead to the 5 V - binding post.

g. CHECK—For 6 mV or less of ripple (peak-to-peak).

h. Disconnect the power resistor decade box from the instrument.

i. Move the positive lead from the V-Ω jack to the 10 A jack of the digital multimeter. Set the digital multimeter to 10 A dc current range.

j. CHECK—The digital multimeter reads between 2.0 A and 2.2 A.

k. Disconnect the test equipment from the instrument.

2. Check A and B Power Supplies In Independent Mode

a. Connect the power resistor decade box between the A - and A + binding posts. Set the resistance value to 40 Ω.

b. Connect the digital multimeter common lead to A - binding post and the positive lead from the V-Ω jack to the A + binding post. Set the digital multimeter to dc 200 volt range.

c. Rotate the A CURRENT control from MIN to MAX position.

d. CHECK—The A Power Supply varies from 0 V to 20 V as the A VOLTAGE control rotates from MIN to MAX positions.

e. CHECK—The digital multimeter reads between 20.0 V and 23.0 V at MAX position.

f. CHECK—The A Power Supply voltage varies less than 10 mV as the line voltage is changed from 120 V to 108 V and from 120 V to 132 V. Return the line voltage to 120 V.

g. Disconnect the digital multimeter leads from the instrument. Do not remove the power resistor decade box from the instrument.

h. Connect the test oscilloscope and its 1X probe tip to the A + binding post and the probe ground to A - binding post.

i. CHECK—For 6 mV or less of ripple (peak-to-peak).

j. Disconnect the test equipment from the instrument.

k. Connect the digital multimeter common lead to A - binding post and the positive lead from the A jack to the A + binding post. Set the digital multimeter to 2 A dc current range.

l. CHECK—The digital multimeter reads between 500 mA and 600 mA..

m. Set A/B switch to B position and repeat parts a through l for B Power Supply.

n. Disconnect the test equipment from the instrument.

3. Check Parallel Tracking

a. Set:

A/B OUTPUTS	PARALLEL TRACKING
VOLTAGE (both)	MIN
CURRENT (both)	MAX
A/B	A

b. Connect the power resistor decade box between the − A and + binding posts. Set the resistance value to 20 Ω.

c. Connect the digital multimeter common lead to A − binding post and the positive lead to the A + binding post. Set the digital multimeter to 20 dc voltage range.

d. Rotate the A VOLTAGE control clockwise until the digital multimeter reads 20.00 V.

e. Move the digital multimeter from the A − and A + binding posts to the B − and B + binding posts, observe the polarity of the test leads.

f. CHECK—The digital multimeter reads between 19.94 V and 20.06 V.

g. Disconnect the test equipment from the instrument.

4. Check Series Tracking

a. Set:

A/B OUTPUTS	SERIES
A VOLTAGE	MIN

b. Connect the power resistor decade box between the B − binding post and A + binding post. Set the resistance value to 80 Ω.

c. Connect the digital multimeter common lead to A − binding post and the positive post lead from V-Ω jack to the A + binding post. Set the digital multimeter to 200 dc voltage range.

d. Rotate the A VOLTAGE control clockwise until the digital multimeter reads 20.00 V.

e. Move the digital multimeter leads from the A − and A + binding posts to the B − and B + binding posts, observe the polarity of the test leads.

f. CHECK—The digital multimeter reads between 19.94 V and 20.06 V.

g. Rotate the A VOLTAGE control to MIN position.

h. Disconnect the test equipment from the instrument.

CPS250: Correction for 5 Volt Power Supply Fuse Opening *(Pullout A)*

CPS250 POWER SUPPLY MANUAL CHANGE

In the performance check procedure, change part j of step 1 to read:

j. CHECK—The digital multimeter reads less than 0.8A.

For the 5V power supply adjustment, use the following procedure:

Equipment Needed:

CDM250 DMM or equivalent
Power Resistor Box (shown in Figure A)

1. Adjust 5V Power Supply (SVR3, SVR1, and SVR2)

a. Connect the power resistor box between the 5V– and 5V+ binding posts. Set the resistance to 3 Ω (1.67A) as shown in Figure A.

b. Connect the digital multimeter common lead to the 5V– binding post and the positive leads from the V-Ω jack to the 5V+ binding post. Set the digital multimeter to the 20 Vdc range.

c. ADJUST—The 5V Adj (SVR3) for a digital multimeter reading between 5.01V and 5.02V.

d. Change the power resistor box resistance value from 3 Ω (1.67A) to 2 Ω (2.5A).

e. ADJUST—The 2A Adj (SVR1) until the voltage drops sharply, then adjust slowly until the digital multimeter indicates between 4.90V and 4.99V.

f. ADJUST—The 5V Overload Adj (SVR2) until the 5V OVERLOAD LED just turns on.

g. Change the power resistor box resistance value from 2 Ω (2.5A) to 3 Ω (1.67A).

h. CHECK—The digital multimeter reads between 5.01V and 5.02V, and that the 5V OVERLOAD goes turns off.

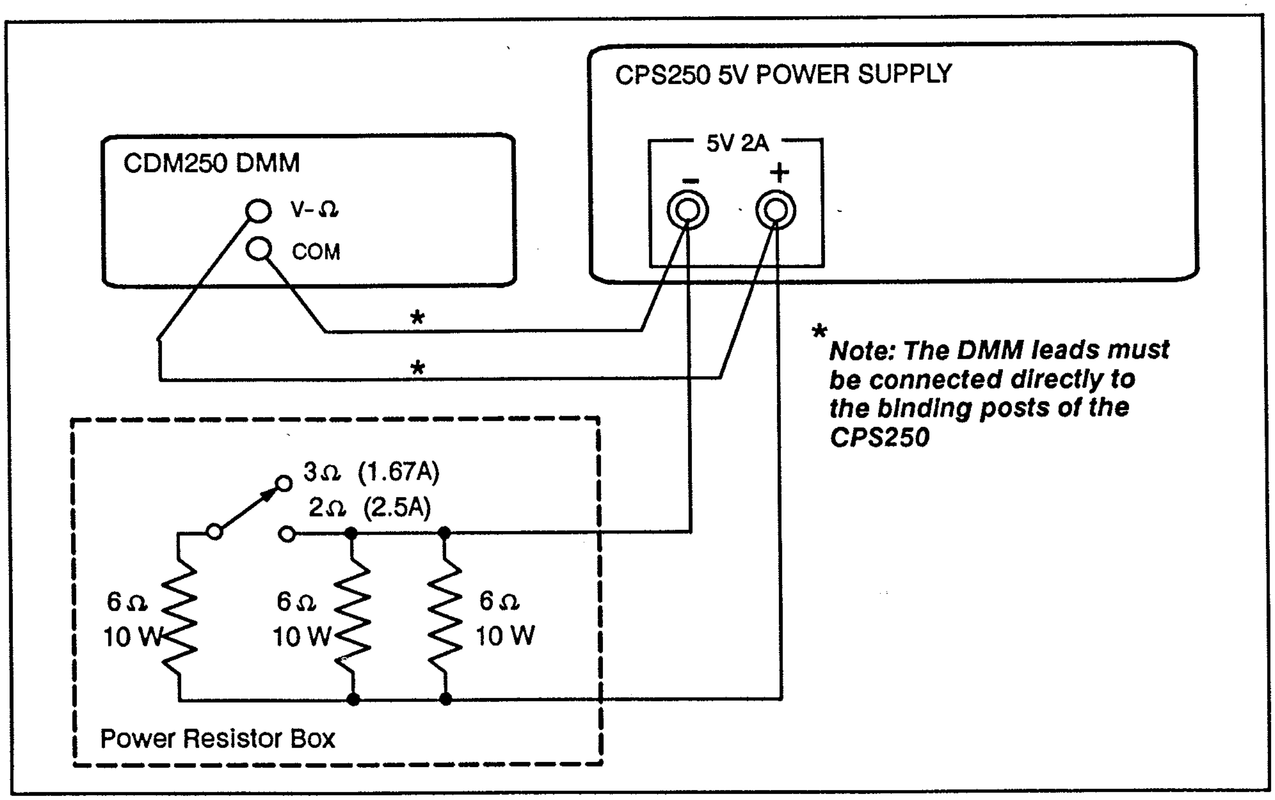


Figure A. Setup for adjusting the 5V power supply.

ADJUSTMENT PROCEDURE

To ensure instrument accuracy, this Adjustment Procedure should be done every 2000 hours of operation or at least once each year if used infrequently.

PREPARATION FOR ADJUSTMENT

Make the adjustments in this procedure at an ambient temperature of +21 °C to +25 °C (+69.8 °F to +77 °F) and a relative humidity of 75% or less.

It is necessary to remove the top cover from the instrument to gain access to the adjustments located on the component side of the Main circuit board. Disconnect the power cord from the CPS250 and follow the top case and side panels removal instructions in the Maintenance section of this manual.

Test equipment needed for these adjustments is described in Table 4-1 at the beginning of the Performance Check Procedure. Refer to the appropriate test equipment instruction manuals for test equipment operating information.

Connect the test equipment to an appropriate ac-power-input source and connect the CPS250 to a variable autotransformer that is set to 120 Vac. Apply power and allow 20 minutes for the instrument to warm up and stabilize.

Set the following controls for the instrument under test during warm-up time:

VOLTAGE (both)	MIN
CURRENT (both)	MIN
A/B OUTPUTS	INDEPENDENT
A/B	A

PROCEDURE STEPS

1. Adjust 5 V Power Supply (SVR3, SVR1, and SVR2)

a. Connect the power resistor decade box between the 5 V - and 5 V + binding posts. Set the resistance value to 3 Ω.

b. Connect the digital multimeter common lead to the 5 V - binding post and the positive lead from the V-Ω jack to the + 5 V binding post. Set the digital multimeter to 20 dc voltage range.

c. ADJUST — The 5V Adj (SVR3) for a digital multimeter reading between 4.9 V and 5.1 V. Record the voltage reading for part g.

d. Change the power resistor decade box resistance value from 3 Ω to 2 Ω.

e. ADJUST — The 2A Adj (SVR1) until the digital multimeter indicates a voltage drop of about 0.05 V from reading in part d.

f. ADJUST — The 5 V Overload Adj (SVR2) until the 5 V OVERLOAD LED just turns On.

g. Change the power resistor decade box resistance value from 2 Ω to 3 Ω.

h. CHECK — The digital multimeter reads between 4.9 V and 5.1 V and the 5 V OVERLOAD LED goes Out.

2. Check 5 V Power Supply Load Regulation and Ripple

a. CHECK — The output voltage varies less than 10 mV as the line voltage is changed from 120 V to 108 V and from 120 V to 132 V. Return the line voltage to 120 V.

b. Remove the digital multimeter leads from the instrument. Do not remove the power resistor decade box from the instrument.

c. Connect the test oscilloscope and its 1X probe tip to the 5 V + binding post and the probe ground lead to the 5 V - binding post.

d. CHECK — For 6 mV or less of ripple (peak-to-peak) with the 3 Ω load.

e. Disconnect the test equipment from the instrument.

3. Adjust A Power Supply Voltage Output (SVR6 and SVR4)

a. Connect the power resistor decade box between the A – and A + binding posts. Set the resistance value to 40 Ω.

b. Connect the digital multimeter common lead to A – binding post and the positive lead from the V-Ω jack to the A + binding post.

c. Rotate the A CURRENT control from MIN to MAX position.

d. Set the digital multimeter to the 2 dc voltage range and ensure that the A VOLTAGE control is set to MIN position.

e. ADJUST—The A Volt Min (SVR6) for a digital multimeter reading between 0.00 V and 0.03 V.

f. Set the digital multimeter to 200 dc voltage range.

g. Rotate the A VOLTAGE control from MIN to MAX position.

h. ADJUST—The A Volt Max (SVR4) for a digital multimeter reading between 20.0 V and 20.50 V.

i. Repeat steps d through h until the voltage reading for minimum and maximum adjustments are obtained.

4. Check A Power Supply Load Regulation and Ripple

a. Rotate the A CONTROL until the digital multimeter reads 20.0 V.

b. CHECK—The output voltage varies less than 10 mV as the line voltage is changed from 120 V to 108 V and from 120 V to 132 V. Return the line voltage to 120 V.

c. Remove the digital multimeter leads from the instrument. Do not remove the power resistor decade box from the instrument.

d. Connect the test oscilloscope and its 1X probe tip to the A + binding post and the probe ground lead to the A – binding post.

e. CHECK—For 6 mV or less of ripple (peak-to-peak).

f. Disconnect the test equipment from the instrument.

5. Adjust A Power Supply Current Output (SVR5)

a. Connect the digital multimeter common lead to A – binding post and the positive lead from the A jack to the A + binding post. Set the digital multimeter to the 2 A dc current range.

b. ADJUST—The A Current Max (SVR5) for a digital multimeter reading between 510 mA and 540 mA.

c. Disconnect the test equipment from the instrument.

6. Check A Power Supply Output Overload

a. Set:

A VOLTAGE	MIN
A CURRENT	MIN

b. Connect the power resistor decade box between the A – and A + binding posts. Set the resistance value to 40 Ω.

c. Rotate the A VOLTAGE control to MAX position.

d. CHECK—The A OVERLOAD LED is turned on.

e. Rotate the A CURRENT control to MAX position.

f. CHECK—The A OVERLOAD LED is turned off as the A CURRENT control is rotated towards the MAX position.

g. Disconnect the test equipment from the instrument.

7. Adjust B Power Supply Voltage Output (SVR9 and SVR8)

a. Set the A/B switch to B position.

b. Connect the power resistor decade box between the B – and B + binding posts. Set the resistance value to 40 Ω.

c. Connect the digital multimeter common lead to B – binding post and the positive lead from the V-Ω jack to the B + binding post.

d. Rotate the B CURRENT control from MIN to MAX position.

e. Set the digital multimeter to the 2 dc voltage range and ensure that the B VOLTAGE control is set to MIN position.

f. ADJUST—The B Volt Min (SVR9) for a voltage reading between 0.00 V and 0.03 V.

g. Set the digital multimeter to 200 dc voltage range.

h. Rotate the B VOLTAGE control from MIN to MAX position.

i. ADJUST—The B Volt Max (SVR8) for a voltage reading between 20.00 V and 20.50 V.

j. Repeat steps e through i until the voltage reading for minimum and maximum adjustments are obtained.

8. Check B Power Supply Load Regulation and Ripple

a. Rotate the B CONTROL until the digital multimeter reads 20.0 V.

b. CHECK—The output voltage varies less than 10 mV as the line voltage is changed from 120 V to 108 V and from 120 V to 132 V. Return the line voltage to 120 V.

c. Remove the digital multimeter leads from the instrument. Do not remove the power resistor decade box from the instrument.

d. Connect the test oscilloscope and its 1X probe tip to the B + binding post and the probe ground lead to the B - binding post.

e. CHECK—For 6 mV or less of ripple (peak-to-peak).

f. Disconnect the test equipment from the instrument.

9. Adjust B Power Supply Current Output (SVR7)

a. Connect the digital multimeter common lead to B - binding post and the positive lead from the A jack to the B + binding post. Set the digital multimeter to the 2 A dc current range.

b. Rotate the B CURRENT control to MAX position.

c. ADJUST—The B Current Max (SVR7) for a current reading between 510 mA and 540 mA.

d. Disconnect the test equipment from the instrument.

10. Check B Power Supply Overload

a. Set:

B VOLTAGE	MIN
B CURRENT	MIN

b. Connect the power resistor decade box between the B - and B + binding posts. Set the resistance value to 40 Ω.

c. Rotate the B VOLTAGE control to MAX position.

d. CHECK—The B OVERLOAD LED is turned on.

e. Rotate the B CURRENT control to MAX position.

f. CHECK—The B OVERLOAD LED turns off as the B CURRENT control is rotated towards the MAX position.

g. Disconnect the test equipment from the instrument.

11. Check Parallel Tracking

a. Set:

A/B OUTPUTS	PARALLEL
VOLTAGE (both)	MIN
CURRENT (both)	MAX
A/B	A

b. Connect the power resistor decade box between the B - and A + binding posts. Set the resistance value to 20 Ω.

c. Connect the digital multimeter common lead to A - binding post and the positive lead from the V-Ω jack to the A + binding post. Set the digital multimeter to 200 dc voltage range.

d. Rotate the A VOLTAGE control clockwise until the digital multimeter reads 20.00 V.

e. Move the digital multimeter from the A - and A + binding posts to the B - and B + binding posts, observe the polarity of the test leads.

f. CHECK—The digital multimeter reads between 19.94 V and 20.06 V.

g. CHECK—The B VOLTAGE control has no effect on the output voltage.

h. Disconnect the test equipment from the instrument.

12. Adjust/Check Series Tracking Voltage (SVR10)

a. Set:

A/B OUTPUTS	SERIES TRACKING
VOLTAGE (both)	MIN
A/B	A

b. Connect the power resistor decade box between the B - binding post and A + binding post. Set the resistance value to 80 Ω.

c. Connect the digital multimeter common lead to A - binding post and the positive lead from the V-Ω jack to the A + binding post. Set the digital multimeter to 200 dc voltage range.

d. Rotate the A VOLTAGE control for digital multimeter reading of 20.0 V.

e. Move the digital multimeter leads from the A - and A + binding posts to the B - and B + binding posts, observe the polarity of the test leads.

f. ADJUST—Series Track Voltage (SVR10) for a digital multimeter reading of 20.00 V.

g. Rotate the A VOLTAGE control to MIN position.

h. Connect the digital multimeter positive lead to the A + binding post. Return the A VOLTAGE control to MIN position.

i. CHECK—The output voltage varies from 0 V to 40.00 V as the A VOLTAGE control rotates from MIN to MAX positions.

j. CHECK—The B VOLTAGE control has no effect on the output voltage.

NOTE

The B OVERLOAD LED turns on when B VOLTAGE control setting is higher than the A VOLTAGE control setting.

k. Rotate the A VOLTAGE control and B VOLTAGE control to MIN positions.

l. Disconnect the test equipment from the instrument.

13. Adjust Series Tracking Current (SVR11)

a. Connect the digital multimeter common lead to A - binding post and the positive lead from the A jack to the A + binding post. Set the digital multimeter to the 2 A dc current range.

b. Rotate the A VOLTAGE control towards MAX position.

c. Set the A CURRENT control for a digital multimeter reading of 500 mA.

d. Move the digital multimeter leads from the A - and A + binding posts to the B - and B + binding posts, observe the polarity of the test leads.

e. ADJUST—The SERIES TRACK CURRENT (SVR11) for a digital multimeter reading of 500 mA.

f. Rotate the A VOLTAGE control to MIN position.

g. Disconnect the test equipment from the instrument.

MAINTENANCE

This section of the manual contains information on static-sensitive components, preventive maintenance, trouble-shooting, and corrective maintenance.

STATIC-SENSITIVE COMPONENTS

The following precautions apply when performing any maintenance involving internal access to the instrument.

CAUTION

Static discharge can damage any semiconductor component in this instrument.

This instrument contains electrical components that are susceptible to damage from static discharge. Table 6-1 lists the relative susceptibility of various classes of semiconductors. Static voltages of 1 kV to 30 kV are common in unprotected environments.

When performing maintenance, observe the following precautions to avoid component damage:

1. Minimize handing of static-sensitive components.
2. Transport and store static-sensitive components or assemblies in their original containers or on a metal rail. Label any package that contains static-sensitive components or assemblies.
3. Discharge the static voltage from your body by wearing a grounded antistatic wrist strap while handling these components. Servicing static-sensitive components or assemblies should be performed only at a static-free work station by qualified service personnel.
4. Keep anything capable of generating or holding a static charge off the work station surface.
5. Keep the component leads shorted together whenever possible.
6. Pick up components by their bodies, never by their leads.
7. Do not slide the components over any surface.

Table 6-1

Relative Susceptibility to Static-Discharge Damage

Semiconductor Classes	Relative Susceptibility Levels [a]
MOS or CMOS microcircuits or discretes, or linear microcircuits with MOS inputs (Most Sensitive)	1
ECL	2
Schottky signal diodes	3
Schottky TTL	4
High-frequency bipolar transistors	5
JFET	6
Linear microcircuits	7
Low-power Schottky TTL	8
TTL (Least Sensitive)	9

[a]Voltage equivalent for levels (voltage discharged from a 100-pF capacitor through a resistance of 100 Ω):

1 = 100 to 500 V
2 = 200 to 500 V
3 = 250 V
4 = 500 V
5 = 400 to 600 V
6 = 600 to 800 V
7 = 400 to 1000 V (est)
8 = 900 V
9 = 1200 V

8. Avoid handling components in areas that have a floor or work-surface covering capable of generating a static charge.
9. Use a soldering iron that is connected to earth ground.
10. Use only approved antistatic, vacuum-type desoldering tools for component removal.

PREVENTIVE MAINTENANCE

Preventive maintenance consists of cleaning, inspecting, and checking instrument performance. Preventive maintenance done on a regular basis may prevent some instrument problems and improve reliability. The required frequency of regular maintenance depends on the environment in which the instrument is used. A good time to do preventive maintenance is just before instrument adjustment.

INSPECTION AND CLEANING

Inspect and clean the CPS250 as often as operating conditions require. Dirt inside the instrument can cause overheating and component breakdown because dirt insulates and prevents heat dissipation. It also provides an electrical conduction path that could result in instrument failure, especially under high-humidity conditions.

CAUTION

Do not use chemical cleaning agents which might damage the plastics used in this instrument. Use a nonresidue-type cleaner, preferably isopropyl alcohol or a solution of 1% mild detergent and 99% water. Before using any other type of cleaner, consult your Tektronix Service Center or representative.

Exterior

INSPECTION. Inspect the external parts of the instrument for damage, wear, and missing parts; use Table 6-2 as a guide. Instruments that appear to have been dropped or abused should be checked for correct operation. Defects that could cause personal injury or could further damage the instrument should be repaired at once.

CAUTION

Do not allow moisture to get inside the instrument during external cleaning. Use only enough liquid to dampen the cloth or applicator.

CLEANING. Dust on the outside of the instrument can be removed with a soft cloth or small soft-bristle brush. The brush is useful on and around controls and connectors. Remove remaining dirt with a soft cloth dampened in a mild detergent-and-water solution. Do not use abrasive cleaners.

Interior

WARNING

To avoid electrical shock, disconnect the instrument from the ac power source before inspecting or cleaning the internal circuitry.

To clean or inspect the inside of the instrument, first refer to the removal and replacement instructions in the Corrective Maintenance part of this section.

INSPECTION. Inspect the internal parts of the CPS250 for damage and wear, using Table 6-3 as a guide. Repair any problems immediately. The repair method for most visible defects is obvious, but take particular care if heat-damaged components are found. Since overheating usually indicates other trouble in the instrument, the cause of overheating must be found and corrected to prevent further damage.

CAUTION

To prevent damage from electrical arcing, ensure that circuit boards and components are dry before applying power to the instrument.

CLEANING. To clean the interior, blow off dust with dry, low-pressure air (approximately 9 psi). Remove any remaining dust with a soft brush or a cloth dampened with a solution of mild detergent and water. A cotton-tipped applicator is useful for cleaning in narrow spaces and on circuit boards.

Semiconductor Checks

Periodic checks of the transistors and other semiconductors in this instrument are not recommended. The best check of semiconductor performance is actual operation in the instrument.

Table 6-2
External Inspection Checklist

Item	Inspect For	Repair Action
Cabinet and Front Panel	Cracks, scratches, deformations, and damaged hardware or gaskets.	Touch up paint and replace defective components.
Front-panel controls	Missing, damaged, or loose knobs, buttons, and controls.	Repair or replace missing or defective items.
Connectors	Broken shells, cracked insulation, and deformed contacts. Dirt in connectors.	Replace defective parts. Clean or wash out dirt.
Carrying Handle	Correct operation.	Replace defective parts.
Accessories	Missing items or parts of items, bent pins, broken or frayed cables, and damaged connectors.	Replace damaged or missing items, frayed cables, and defective parts.

Table 6-3
Internal Inspection Checklist

Item	Inspect For	Repair Action
Circuit Boards	Loose, broken, or corroded solder connections. Burned circuit boards. Burned, broken, or cracked circuit-run plating.	Clean solder corrosion with an eraser and flush with isopropyl alcohol. Resolder defective connections. Determine cause of burned items and repair. Repair defective circuit runs.
Resistors	Burned, cracked, broken, or blistered.	Replace defective resistors. Check for cause of burned component and repair as necessary.
Solder Connections	Cold solder or rosin joints.	Resolder joint and clean with isopropyl alcohol.
Capacitors	Damaged or leaking cases. Corroded solder on leads or terminals.	Replace defective capacitors. Clean solder connections and flush with isopropyl alcohol.
Semiconductors	Loosely inserted in sockets. Distorted pins.	Firmly seat loose semiconductors. Remove devices having distorted pins. Carefully straighten pins (as required to fit the socket), using long-nose pliers, and reinsert firmly. Ensure that straightening action does not crack the pins, causing them to break.
Wiring and Cables	Loose plugs or connectors. Burned, broken, or frayed wiring.	Firmly seat connectors. Repair or replace defective wires or cables.
Chassis	Dents, deformations, and damaged hardware.	Straighten, repair, or replace defective hardware.

TROUBLESHOOTING

Preventive maintenance done on a regular basis should reveal most potential problems before an instrument fails. However, should troubleshooting be needed, the following information will help to locate the problem. Also, the Theory of Operation and the Diagrams sections of this manual may help with troubleshooting.

TROUBLESHOOTING AIDS

Schematic Diagram

A schematic diagram is located on a tabbed foldout page in the Diagrams section. Portions of circuitry mounted on each circuit board are enclosed by heavy black lines. The assembly number and name(s) of the circuit(s) are shown near the top or the bottom edge of the diagram.

Functional blocks on the schematic diagram are outlined with a wide gray line. Components within the outlined area perform the function named by the block label. The Theory of Operation uses these functional block names when describing circuit operation.

Component numbers and electrical values of components in this instrument are shown on the schematic diagram. Refer to the first page of the Diagrams section for the reference designators and symbols used to identify components. Important voltages are also shown on the diagram.

Circuit Board Illustrations

Circuit board illustrations in the Diagrams section show the physical location of each component.

Grid Coordinate System

The schematic diagram and circuit board illustrations have grid borders along their left and top edges. The grid coordinates for the components are given in an accompanying table.

Component Color Coding

An illustration at the beginning of the Diagrams section gives information about color codes and markings on resistors and capacitors.

RESISTORS. Resistors used in this instrument are carbon-film, composition, or precision metal-film types. They are usually color coded with the EIA color code; however, some metal-film type resistors may have the value printed on the body. The color code is interpreted starting with the stripe nearest to one end of the resistor. Composition resistors have four stripes; these represent two significant digits, a multiplier, and a tolerance value. Metal-film resistors have five stripes representing three significant digits, a multiplier, and a tolerance value.

CAPACITORS. Common disc capacitors and small electrolytics have capacitance values marked on the side of the capacitor body. White ceramic capacitors are color coded in picofarads, using a modified EIA code. Dipped tantalum capacitors are color coded in microfarads. The color dot indicates both the positive lead and the voltage rating. Since these capacitors are easily destroyed by reversed or excessive voltage, be careful to observe the polarity and voltage rating when replacing them.

DIODES. The cathode end of each glass-encased diode is indicated by either a stripe, a series of stripes, or a dot. The cathode and anode ends of a metal-encased diode may be identified by the diode symbol marked on its body.

Semiconductor Lead Configurations

The second figure in the Diagrams section shows some typical lead configurations for semiconductor devices that may be used in this instrument. If a semiconductor does not seem to match the configurations shown, consult a manufacturer's data sheet.

TROUBLESHOOTING TECHNIQUES

When troubleshooting the CPS250, be sure to read the troubleshooting techniques given here before going on to CPS250 Troubleshooting Tips. The troubleshooting methods described in this procedure are general techniques that should be used together with the more specific CPS250 Troubleshooting Tips.

This procedure is arranged to check simple trouble possibilities before doing more extensive troubleshooting.

When the defective component is located, either replace the assembly containing the defective part or replace the component by using the appropriate replacement procedure given under Corrective Maintenance. Replacement assemblies available through Tektronix are shown in an exploded-view drawing in Replaceable Parts (section 8) and are described in the parts list in that section.

CAUTION

Before using any test equipment to make measurements on static-sensitive, current-sensitive, or voltage-sensitive components or assemblies, ensure that any voltage or current supplied by the test equipment does not exceed the limits of the component to be tested.

1. Check Control Settings

Incorrect control settings can give a false indication of instrument malfunction. If there is any question about the correct function or operation of any control, refer to the CPS250 Operators Manual.

2. Check Associated Equipment

Before proceeding, ensure that any equipment used with the CPS250 is operating correctly. Verify that input signals are properly connected and that the interconnecting cables are not defective. Check that the ac-power-source voltage to all equipment is correct.

3. Visual Check

WARNING

To avoid electrical shock, disconnect the instrument from the ac power source before making a visual inspection of the internal circuitry.

Look for broken connections or wires, damaged components, semiconductors not firmly mounted, damaged circuit boards, or other clues to the cause of a malfunction.

4. Check Instrument Performance and Adjustment

Check the performance of either those circuits where you suspect trouble or the entire instrument. An apparent trouble may be the result of misadjustment. The Performance Check is in section 4 of this manual, and the Adjustment Procedure in section 5.

5. Isolate Trouble to a Circuit

To isolate problems, use any symptoms noticed when checking the instrument's operation to help localize the trouble to a particular circuit. The CPS250 Troubleshooting Tips, following this procedure, may help in locating a problem.

6. Check Individual Components

WARNING

To avoid electrical shock, always disconnect the instrument from the ac power source before removing or replacing components.

The following procedures describe methods of checking individual components. Two-lead components that are soldered in place are most accurately checked by first disconnecting one end from the circuit board. This isolates the measurement from the effects of the surrounding circuitry. See Figure 9-1 for component value identification and Figure 9-2 for semiconductor lead configurations.

CAUTION

When checking semiconductors, observe the static-sensitivity precautions given at the beginning of this section.

TRANSISTORS. A good check of a transistor is actual performance under operating conditions. A transistor can most effectively be checked by substituting a known-good component. However, be sure that circuit conditions are not such that a replacement transistor will also be damaged. If substitute transistors are not available, use a dynamic-type transistor checker for testing. Static-type transistor checks are not recommended, since they do not check operation under simulated operating conditions.

When troubleshooting transistors in the circuit with a voltmeter, measure both the emitter-to-base and emitter-to-collector voltages to find out if they are consistent with normal circuit voltages. Voltages across a transistor may vary with the type of device and its circuit function.

Some of these voltages are predictable. The emitter-to-base voltage for a conducting silicon transistor will normally range from 0.6 V to 0.8 V. The emitter-to-collector voltage for a saturated transistor is about 0.2 V. Because these values are small, the best way to check them is by connecting a sensitive voltmeter across the junction rather than comparing two voltages taken with respect to ground. If the former method is used, both leads of the voltmeter must be isolated from ground.

If voltage values measured are less than those just given, either the device is shorted or no current is flowing in the external circuit. If values exceed the emitter-to-base values given, either the junction is reverse biased or the device is defective. Voltages exceeding those given for typical emitter-to-collector values could indicate either a nonsaturated device operating normally or a defective (open-circuited) transistor. If the device is conducting, voltage will be developed across the resistors in series with it; if open, no voltage will be developed across the resistors unless current is being supplied by a parallel path.

CAUTION

When checking emitter-to-base junctions, do not use an ohmmeter range that has a high internal current. High current may damage the transistor. Reverse biasing the emitter-to-base junction with a high current may degrade the current-transfer ratio (Beta) of the transistor.

A transistor emitter-to-base junction also can be checked for an open or shorted condition by measuring the resistance between terminals with an ohmmeter set to a range having a low internal source current, such as the R X 1 kΩ range. The junction resistance should be very high in one direction and much lower when the meter leads are reversed.

When troubleshooting a field-effect transistor (FET), the voltage across its elements can be checked in the same manner as previously described for other transistors. However, remember that in the normal depletion mode of operation, the gate-to-source junction is reverse biased; in the enhanced mode, the junction is forward biased.

INTEGRATED CIRCUITS. An integrated circuit (IC) can be checked with a voltmeter, test oscilloscope, or by direct substitution. A good understanding of circuit operation is essential when troubleshooting a circuit having IC components. Use care when checking voltages and waveforms around the IC so that adjacent leads are not shorted together. An IC test clip provides a convenient means of clipping a test probe to an IC.

CAUTION

When checking a diode, do not use an ohmmeter scale that has a high internal current. High current may damage a diode. Checks on diodes can be performed in much the same manner as those on transistor emitter-to-base junctions.

DIODES. A diode can be checked for either an open or a shorted condition by measuring the resistance between terminals with an ohmmeter set to a range having a low internal source current, such as the R X 1 kΩ range. The diode resistance should be very high in one direction and much lower when the meter leads are reversed.

Silicon diodes should have 0.6 V to 0.8 V across their junctions when conducting; Schottky diodes about 0.2 V to 0.4 V. Higher readings indicate that they are either reverse biased or defective, depending on polarity.

RESISTORS. Check resistors with an ohmmeter. Refer to the Replaceable Parts list for the tolerances of resistors used in this instrument. A resistor normally does not require replacement unless its measured value varies widely from its specified value and tolerance.

INDUCTORS. Check for open inductors by checking continuity with an ohmmeter. Shorted or partially shorted inductors can usually be found by checking the waveform response when high-frequency signals are passed through the circuit.

CAPACITORS. A leaky or shorted capacitor can be detected by checking resistance with an ohmmeter set to one of the highest ranges. Do not exceed the voltage rating of the capacitor. The resistance reading should be high after the capacitor is charged to the output voltage of the ohmmeter. An open capacitor can be detected with a capacitance meter or by checking whether the capacitor passes ac signals.

7. Repair and Adjust the Circuit

If any defective parts are located, follow the replacement procedures given under Corrective Maintenance in this section. After any electrical component has been replaced, the performance of that circuit and any other closely related circuit should be checked. Refer to the Performance Check Procedure and the Adjustment Procedure, sections 4 and 5 in this manual.

TROUBLESHOOTING TIPS

NOTE

Check resistors with an ohmmeter. Refer to the Replaceable Parts list for the tolerances of resistors used in this instrument. Refer to the parts list or schematic for component values. Also refer to Troubleshooting Aids and Troubleshooting Techniques in this section for locating components and for more detailed troubleshooting methods.

5 V Supply

No Output Voltage

1. Check fuse FS1 for open.
2. Check resistor R3 for correct value.
3. Check Zener D4 for short.
4. Check diode D29 for short.
5. Check for defective transistors Q1 and Q12.

Incorrect Output Voltage

1. Adjust 5 V Adj potentiometer SVR3.
2. Check resistors R10, R11, R12, and R13 for correct values.

Incorrect Output Current

1. Adjust 2 A Adj potentiometer SVR1.
2. Check resistor R9 for correct value.
3. Check Regulator control IC2.

Overload LED Performing Incorrectly

1. Adjust 5 V Overload Adj potentiometer SVR2.
2. Check resistors R5 and R6 for correct values.
3. Check OVERLOAD LED D7.
4. Check Overload Regulator IC1.

Power Indicator LED Performing Incorrectly

1. Check resistor R7 and Zener D3 for open.
2. Check Power Indicator LED D7.

A Output in Independent Mode

No Output Voltage

1. Check fuses FS3, FS4, and FS5 for open.
2. Check transistor Q11 for open.
3. Check capacitors C11 and C24 for shorts.
4. Check Zeners D19 and D20 for shorts.
5. Check diode D8 for a short.

Incorrect Output Voltage

1. Adjust A Volts Max potentiometer SVR4 and A Volts Min potentiometer SVR6.
2. Check resistors R35, R36, R37 and R39 for correct values.
3. Check A VOLTAGE control VR3.
4. Check Voltage Comparator IC5.
5. Check Regulator Control IC6.

Incorrect Output Current

1. Adjust A Current Max potentiometer SVR5.
2. Check resistors R41, R42, R43, and R65 for correct values.
3. Check for defective transistors Q6 and Q7.
4. Check Regulator control IC6.

Overload LED Performing Incorrectly

1. Check for defective A OVERLOAD LED D28.
2. Check resistors R38 and R45 for correct values.
3. Check Overload Comparator IC7.

B Output in Independent Mode

No Output Voltage

1. Check fuse FS2, FS6, and FS7 are open.
2. Check transistor Q10 for open.
3. Check capacitors C10 and C26 for shorts.
4. Check Zeners D21 and D22 for shorts.
5. Check diode D25 for a short.

Incorrect Output Voltage

1. Adjust B Volts Max potentiometer SVR8 and B Volts Min potentiometer SVR9.
2. Check resistors R48, R51, R54, and R63 for correct values.
3. Check B VOLTAGE control (VR1).
4. Check Voltage Comparator IC9.
5. Check Regulator Control IC10.

Incorrect Output Current

1. Adjust B Current Max potentiometer SVR7.
2. Check resistors R24, R47, R57, and R58 for correct values.
3. Check for defective transistors Q8 and Q9.
4. Check Regulator Control IC10.

Overload LED Performing Incorrectly

1. Check B OVERLOAD LED D9.
2. Check resistors R49 and R53 for correct values.
3. Check Overload Comparator IC8.

Tracking Parallel/Series Mode

Parallel Tracking Incorrect

1. Check resistor R62 for correct values.
2. Check resistors R23 and R31 for correct values.
3. Check Parallel/Series Comparator IC11.

Series Tracking Voltage Incorrect

1. Adjust Series Tracking Voltage potentiometer SVR10.
2. Check resistors R46, R52, and R63 for correct values.
3. Check diode D16.
4. Check Parallel/Series Comparator IC11.

Series Tracking Current Incorrect

1. Readjust Series Tracking Current potentiometer SVR11.
2. Check resistor R63 for correct value.
3. Check Parallel/Series Comparator IC11.

CORRECTIVE MAINTENANCE

The Corrective Maintenance part of this section describes methods and procedures for disassembly, parts replacement, and repair. If it is necessary to ship your instrument to a Tektronix Service Center for repair or service, refer to the repackaging information in this section.

MAINTENANCE PRECAUTIONS

To avoid personal injury or damage to equipment, observe the following precautions:

- Disconnect the instrument from the ac–power source before removing or installing components.
- Verify that any line–rectifier filter capacitors are discharged before doing any servicing.
- Use care not to interconnect instrument grounds which may be at different potentials (cross grounding).
- When soldering on circuit boards or small insulated wires, use only a 15–watt, pencil–type soldering iron.

OBTAINING REPLACEMENT PARTS

Replacement assemblies for this instrument (Cabinet, Front Panel Assembly, and Rear Panel Assembly) can be obtained through your local Tektronix Field Office or representative. The CPS250 assemblies and their Tektronix part numbers are shown in the exploded–view drawing in section 8 of this manual.

The Replaceable Parts list in section 8 gives Tektronix part number, name and description of the instrument assemblies and lists mechanical and electrical parts in each assembly. The Replaceable Parts list gives a generic description (value, rating, and tolerance) of the individual parts for each assembly. The Replacement Parts list is useful if a component is obtained form a local commercial source.

NOTE

Physical size and shape of a component may affect instrument performance, particularly at high frequencies. Always use direct replacement components, unless you know that a substitute will not degrade performance.

Ordering Parts

When ordering parts from Tektronix, Inc., be sure to include the following information:

- Instrument type (include all modification and option numbers).
- Instrument serial number.
- A description of the part).
- Tektronix part number.

REPACKAGING FOR SHIPMENT

Save the original carton and packing material for reuse if the instrument should have to be reshipped on a commercial transport carrier. If the original materials are unfit or not available, repackage the instrument as follows:

1. Use a corrugated cardboard shipping carton with a test strength of at least 200 pounds and with an inside dimension at least six inches greater than the instrument dimensions.
2. If the instrument is being shipped to a Tektronix Service Center, enclose the following: the owner's address, name and phone number of a contact person, type and serial number of the instrument, reason for returning, and a complete description of the service needed.
3. Completely wrap the instrument with polyethylene sheeting or equivalent to protect the outside finish and prevent entry of foreign material into the instrument.
4. Cushion the instrument on all sides, using three inches of padding material or urethane foam tightly packed between the carton and the instrument.

Table 6-4
Maintenance Aids

Description	Specification	Usage	Example
Soldering Iron	15 to 25 W.	General soldering and unsoldering.	Antex Precision Model C.
Nutdrivers	5/16.	Assembly and disassembly.	Xcelite #10.
Phillips Screwdriver		Assembly and disassembly.	
Open-end Wrench	1/4 inch, 7/16 inch	Assembly and disassembly.	
Long-nose Pliers		Component removal and replacement.	Diamalloy Model LN55-3.
Diagonal Cutters		Component removal and replacement.	Diamalloy Model M554-3.
Vacuum Solder Extractor	No Static Charge Retention.	Unsoldering static sensitive devices and components on multi-layer boards.	Pace Model PC-10.
Contact Cleaner	No-Noise.®	Switch and pot cleaning.	Tektronix Part Number 006-0442-02.
IC-removal Tool		Removing DIP IC packages.	Augat T114-1.
Isopropyl Alcohol	Reagent grade.	Cleaning.	2-Isopropanol.

5. Seal the shipping carton with an industrial stapler or strapping tape.

6. Mark the address of the Tektronix Service Center and also your own return address on the shipping carton.

MAINTENANCE AIDS

The maintenance aids recommended in Table 6-4 include items that may be needed for instrument maintenance and repair. Equivalent products may be substituted if their characteristics are similar.

INTERCONNECTIONS

Pin connectors used to connect the wires to the interconnect pins are factory assembled. They consist of machine-inserted pin connectors mounted in plastic holders. If the connectors are faulty, the entire wire assembly should be replaced.

TRANSISTORS AND INTEGRATED CIRCUITS

Transistors and integrated circuits should not be replaced unless they are actually defective. If one is removed from its socket or unsoldered from the circuit board during routine maintenance, return it to its original board location. Unnecessary replacement or transposing of semiconductor devices may affect the adjustment of the instrument. When a semiconductor is replaced, check the performance of any circuit that may be affected.

Any replacement component should be of the original type or a direct replacement. Bend component leads to fit their circuit board holes, and cut the leads to the same length as the original component. See Figure 9-2 in the Diagrams section for the semiconductor lead configurations.

CAUTION

After replacing a power transistor, check that the collector is not shorted to the chassis before applying power to the instrument.

To remove socketed dual-in-line packaged (DIP) integrated circuits, pull slowly and evenly on both ends of the device. Avoid disengaging one end of the integrated circuit from the socket before the other, since this may damage the pins.

To remove a soldered DIP IC when it is going to be replaced, clip all the leads of the device and remove the leads from the circuit board one at a time. If the device must be removed intact for possible reinstallation, do not heat adjacent conductors consecutively. Apply heat to pins at alternate sides and ends of the IC as solder is removed. Allow a moment for the circuit board to cool before proceeding to the next pin.

SOLDERING TECHNIQUES

The reliability and accuracy of this instrument can be maintained only if proper soldering techniques are used to remove or replace parts. General soldering techniques that apply to maintenance of any precision electronic equipment should be used when working on this instrument.

WARNING

To avoid an electrical shock hazard, observe the following precautions before attempting any soldering: turn the instrument off, disconnect it from the ac power source, and wait at least three minutes for line-rectifier filter capacitors to discharge.

Use rosin-core wire solder containing 63% tin and 37% lead. Contact your local Tektronix Field Office or representative to obtain the names of approved solder types.

When soldering on circuit boards or small insulated wires, use only a 15-watt, pencil-type soldering iron. A higher wattage soldering iron may cause etched circuit conductors to separate from the board base material and melt the insulation on small wires. Always keep the soldering iron tip properly tinned to ensure the best heat transfer from the tip to the solder joint. Apply only enough solder to make a firm joint. After soldering, clean the area around the solder connection with an approved flux-removing solvent (such as isopropyl alcohol) and allow it to air dry.

CAUTION

Only a maintenance person experienced in the use of vacuum-type desoldering equipment should attempt repair of any circuit board in this instrument. Many integrated circuits are static sensitive and may be damaged by solder extractors that generate static charges. Perform work involving static-sensitive devices only at a static-free work station while wearing a grounded antistatic wrist strap. Use only an antistatic vacuum-type solder extractor approved by a Tektronix Service Center.

CAUTION

Attempts to unsolder, remove, and resolder leads from the component side of a circuit board may cause damage to the reverse side of the circuit board. The following techniques should be used to replace a component on a circuit board:

1. Touch the vacuum desoldering tool tip to the lead at the solder connection. Never place the tip directly on the board; doing so may damage the board.

NOTE

Some components are difficult to remove from the circuit board due to a bend placed in the component leads during machine insertion. To make removal of machine-inserted components easier, straighten the component leads on the reverse side of the circuit board.

2. When removing a multipin component, especially an IC, do not heat adjacent pins consecutively. Apply heat to the pins at alternate sides and ends of the IC as solder is removed. Allow a moment for the circuit board to cool before proceeding to the next pin.

CAUTION

Excessive heat can cause the etched circuit conductors to separate from the circuit board. Never allow the solder extractor tip to remain at one place on the board for more than three seconds. Solder wick, spring-actuated or squeeze-bulb solder suckers, and heat blocks (for desoldering multipin components) must not be used. Damage caused by poor soldering techniques can void the instrument warranty.

3. Bend the leads of the replacement component to fit the holes in the circuit board. If the component is replaced while the board is installed in the instrument, cut the leads so they protrude only a small amount through the reverse side of the circuit board. Excess lead length may cause shorting to other conductive parts.

4. Insert the leads into the holes of the board so that the replacement component is positioned the same as the original component. Most components should be firmly seated against the circuit board.

5. Touch the soldering iron tip to the connection and apply enough solder to make a firm solder joint. Do not move the component while the solder hardens.

6. Cut off any excess lead protruding through the circuit board (if not clipped to the correct length in step 3).

7. Clean the area around the solder connection with an approved flux-removing solvent. Be careful not to remove any of the printed information from the circuit board.

REMOVAL AND REPLACEMENT INSTRUCTIONS

WARNING

To avoid electrical shock, disconnect the instrument from the power input source before removing or replacing any component or assembly.

The exploded-view drawings in the Replaceable Parts list may be helpful during removal and replacement procedures. Component locations are shown in the Diagrams section.

Read these instructions before attempting to remove or install any assemblies or components.

Cabinet

The removal procedure for the cabinet assembly is divided into two parts. The first part removes the top cabinet and side panels for servicing the top portion of the instrument. The second part describe how to remove the bottom cabinet from the instrument.

To remove the Cabinet Assembly from the instrument perform the following procedure:

1. Unplug the power cord from its rear-panel connector.

2. Place the instrument upside down on a clean, flat surface.

NOTE

Do not remove the two middle-rear screws and washers from the bottom cabinet. The two screws and washers secure the power transformer to the bottom cabinet.

3. Remove the four cabinet-securing screws from the bottom of the instrument. The two rear screws also hold the rear rubber pads (feet) in place. Remove the pads that are loose and save for reinstallation.

4. Carefully turn the instrument right side up, while holding together the top and bottom cabinets.

WARNING

Potentially dangerous voltages exist at several points throughout this instrument. If it is operated with the covers removed, do not touch exposed connections or components. Before replacing parts, disconnect the ac-power source from the instrument.

5. Remove the top cabinet from the instrument.
6. Remove the two side panels and handle from the instrument.

NOTE

Removal of the top cabinet, side panels, and handle will access the component side of the Main board and allow access to the internal adjustment (see the Adjustment Procedure in section 5).

6. Remove two screws securing the Main board to the bottom cabinet. Screws are located at the rear corners of the Main board.
7. Remove two nuts, flat washers, lock washers, and ground lug that secures the power transformer to the bottom cabinet.
8. Pull one at a time the Front-Panel and Rear-Panel Assemblies from the bottom cabinet.

To replace the Cabinet Assembly, perform the reverse of the preceding steps.

Front-Panel Assembly

The Front-Panel Assembly can be removed and reinstalled a follows:

1. Perform the Cabinet Assembly removal procedure steps 1 through 6.
2. Disconnect the following connectors from the Main board, noting their locations for reinstallation reference:
   a. W1, a six-wire connector located at the left rear of the Main board.
   b. W2, a two-wire connector located at the left rear of the Main board.
   c. W3, a six wire connector located at the left rear of the Main board.
   d. W4, a six-wire connector located at the middle rear of the Main board.
   e. W7, a eight-wire connector located at the right rear of the Main board.
3. Disconnect and remove the two ground lugs from the GND connector and front-panel post.
4. Remove two screws securing the Main board to the bottom cabinet. Screws are located at the rear corners of the Main board.

NOTE

Perform step 5 only if the original instrument Front-Panel Assembly is to be replaced with a new Front-Panel Assembly.

5. Cut the POWER switch red and blue leads just behind the black insulating sleeves.

NOTE

The new Front-Panel Assembly will include insulating sleeves for the switch wires from the Rear-Panel Assembly.

6. Remove the Front-Panel Assembly out of the slot in the bottom cabinet.

To reinstall the Main board, perform the reverse of the procedure.

Rear-Panel Assembly

The Rear-Panel Assembly can be removed and reinstalled as follows:

1. Perform the Cabinet Assembly removal procedure steps 1 through 6.
2. Disconnect the following connectors from the Main board, noting their locations for reinstallation reference:
   a. W1, a six-wire connector located at the left rear of the Main board.
   b. W2, a two-wire connector located at the left rear of the Main board.
   c. W3, a six wire connector located at the left rear of the Main board.

d. W4, a six-wire connector located at the middle rear of the Main board.

e. W7, a eight-wire connector located at the right rear of the Main board.

3. Disconnect and remove the two ground lugs from the GND connector and front-panel post.
4. Remove two nuts, flat washers, lock washers, and ground lug that secures the power transformer to the bottom cabinet.

NOTE

Perform step 5 only if the original instrument Front-Panel Assembly is to be replaced with a new Front-Panel Assembly.

5. Cut the POWER switch red and blue leads just behind the black insulating sleeves.

NOTE

Insulating sleeves for the POWER switch leads are shipped with the replacement Rear-Panel Assembly.

6. Remove the Rear-Panel Assembly out of the slot in the bottom cabinet.

To reinstall the Rear-Panel Assembly, perform the reverse of the procedure.

NOTE

Removal of the top case, side panels, and handles will access the component side of the Main board and allow access to the internal adjustment (see the Adjustment Procedure in section 5).

To gain access to the bottom of the Main board for servicing, perform steps 7 and 8.

7. Remove two screws securing the Main board to the bottom case. Screws are located at the rear corners of the Main board.
8. Remove the Main board with attached Control board and Front-Panel Assembly out of the slot in the bottom case.

NOTE

The bottom of the Main board is accessible for servicing by tilting the Main board and Front-Panel Assembly in a upward position.

To reinstall the Main board, Control board and Front-Panel Assembly, Top Case, and Side Panels, perform the reverse of the preceding steps.

OPTIONS

INTERNATIONAL POWER CORDS

Instruments are shipped with the detachable power cord option ordered by the customer. Descriptive information about international power cord options is given in Section 2. The following list describes the power cords available for this instrument.

Standard	North American, 120 V
Option A1	Universal Euro, 220 V
Option A2	UK, 240 V
Option A3	Australian, 240 V
Option A4	North American, 240 V
Option A5	Switzerland, 220 V

REPLACEABLE PARTS

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

ITEM NAME

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

FIGURE AND INDEX NUMBERS

Items in this section are referenced by figure and index numbers to the illustrations.

INDENTATION SYSTEM

This mechanical parts list is indented to indicate item relationships. Following is an example of the indentation system used in the description column.

1 2 3 4 5 *Name & Description*

Assembly and/or Component
Attaching parts for Assembly and/or Component
**** END ATTACHING PARTS ****
Detail Part of Assembly and/or Component
Attaching parts for Detail Part
**** END ATTACHING PARTS ****
Parts of Detail Part
Attaching parts for Parts of Detail Part
**** END ATTACHING PARTS ****

Attaching Parts always appear in the same indentation as the item it mounts, while the detail parts are indented to the right. Indented items are part of, and included with, the next higher indentation. The separation symbol - - - * - - - indicates the end of attaching parts.

ABBREVIATIONS

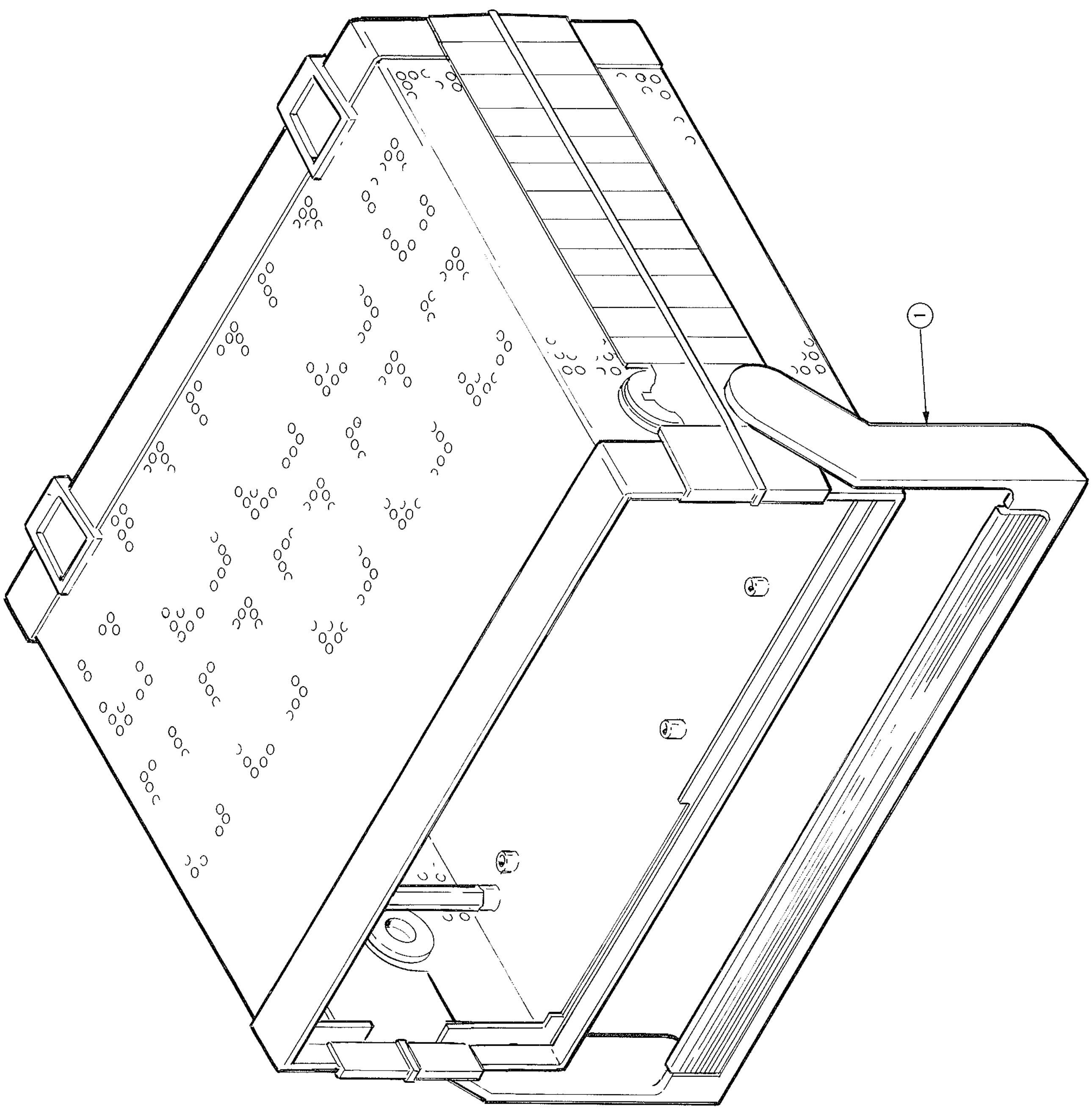
"	INCH	ELCTRN	ELECTRON	IN	INCH	SE	SINGLE END
#	NUMBER SIZE	ELEC	ELECTRICAL	INCAND	INCANDESCENT	SECT	SECTION
ACTR	ACTUATOR	ELCTLT	ELECTROLYTIC	INSUL	INSULATOR	SEMICOND	SEMICONDUCTOR
ADPTR	ADAPTER	ELEM	ELEMENT	INTL	INTERNAL	SHLD	SHIELD
ALIGN	ALIGNMENT	EPL	ELECTRICAL PARTS LIST	LPHLDR	LAMPHOLDER	SHLDR	SHOULDERED
AL	ALUMINUM	EQPT	EQUIPMENT	MACH	MACHINE	SKT	SOCKET
ASSEM	ASSEMBLED	EXT	EXTERNAL	MECH	MECHANICAL	SL	SLIDE
ASSY	ASSEMBLY	FIL	FILLISTER HEAD	MTG	MOUNTING	SLFLKG	SELF-LOCKING
ATTEN	ATTENUATOR	FLEX	FLEXIBLE	NIP	NIPPLE	SLVG	SLEEVING
AWG	AMERICAN WIRE GAGE	FLH	FLAT HEAD	NON WIRE	NOT WIRE WOUND	SPR	SPRING
BD	BOARD	FLTR	FILTER	OBD	ORDER BY DESCRIPTION	SQ	SQUARE
BRKT	BRACKET	FR	FRAME or FRONT	OD	OUTSIDE DIAMETER	SST	STAINLESS STEEL
BRS	BRASS	FSTNR	FASTENER	OVH	OVAL HEAD	STL	STEEL
BRZ	BRONZE	FT	FOOT	PH BRZ	PHOSPHOR BRONZE	SW	SWITCH
BSHG	BUSHING	FXD	FIXED	PL	PLAIN or PLATE	T	TUBE
CAB	CABINET	GSKT	GASKET	PLSTC	PLASTIC	TERM	TERMINAL
CAP	CAPACITOR	HDL	HANDLE	PN	PART NUMBER	THD	THREAD
CER	CERAMIC	HEX	HEXAGON	PNH	PAN HEAD	THK	THICK
CHAS	CHASSIS	HEX HD	HEXAGONAL HEAD	PWR	POWER	TNSN	TENSION
CKT	CIRCUIT	HEX SOC	HEXAGONAL SOCKET	RCPT	RECEPTACLE	TPG	TAPPING
COMP	COMPOSITION	HLCPS	HELICAL COMPRESSION	RES	RESISTOR	TRH	TRUSS HEAD
CONN	CONNECTOR	HLEXT	HELICAL EXTENSION	RGD	RIGID	V	VOLTAGE
COV	COVER	HV	HIGH VOLTAGE	RLF	RELIEF	VAR	VARIABLE
CPLG	COUPLING	IC	INTEGRATED CIRCUIT	RTNR	RETAINER	W/	WITH
CRT	CATHODE RAY TUBE	ID	INSIDE DIAMETER	SCH	SOCKET HEAD	WSHR	WASHER
DEG	DEGREE	IDENT	IDENTIFICATION	SCOPE	OSCILLOSCOPE	XFMR	TRANSFORMER
DWR	DRAWER	IMPLR	IMPELLER	SCR	SCREW	XSTR	TRANSISTOR

CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
	ESCORT	2ND FLOOR NO. 37 POA HSIN RD SHIN TIEN	TAI PEI, TAIWAN
70903	COOPER BELDEN ELECTRONICS WIRE AND C SUB OF COOPER INDUSTRIES INC	2000 S BATAVIA AVE	GENEVA IL 60134-3325
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON OR 97707-0001
S3109	FELLER	ASA ADOLF AG STOTZWEID CH8810	HORGEN SWITZERLAND
TK1373	PATELEC-CEM (ITALY)	10156 TORINO	VAICENTALLO 62/45S ITALY

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-1	118-7933-00			1	CABINET ASSY:	80009	118-7933-00
					.CASE,TOP: (QTY. 1)		15-25585-4
					.CASE,BOTTOM: (QTY. 1)		15-25585-4A
					.GRILLE:INSTALLED ON BOTTOM CASE (QTY. 1)		1-25062-1
					.PANEL,SIDE:LEFT (QTY. 1)		15-25827-2
					.PANEL,SIDE:RIGHT (QTY. 1)		15-25828-2
					.HANDLE: (QTY. 1)		15-25598-4
					.FEET,FRONT: (QTY. 2)		16-25593-5
					.SCREW,PLASTIC: (QTY. 2)		15-25047-1
					.FEET,REAR: (348-1105-00)(QTY. 2)		16-25593-6

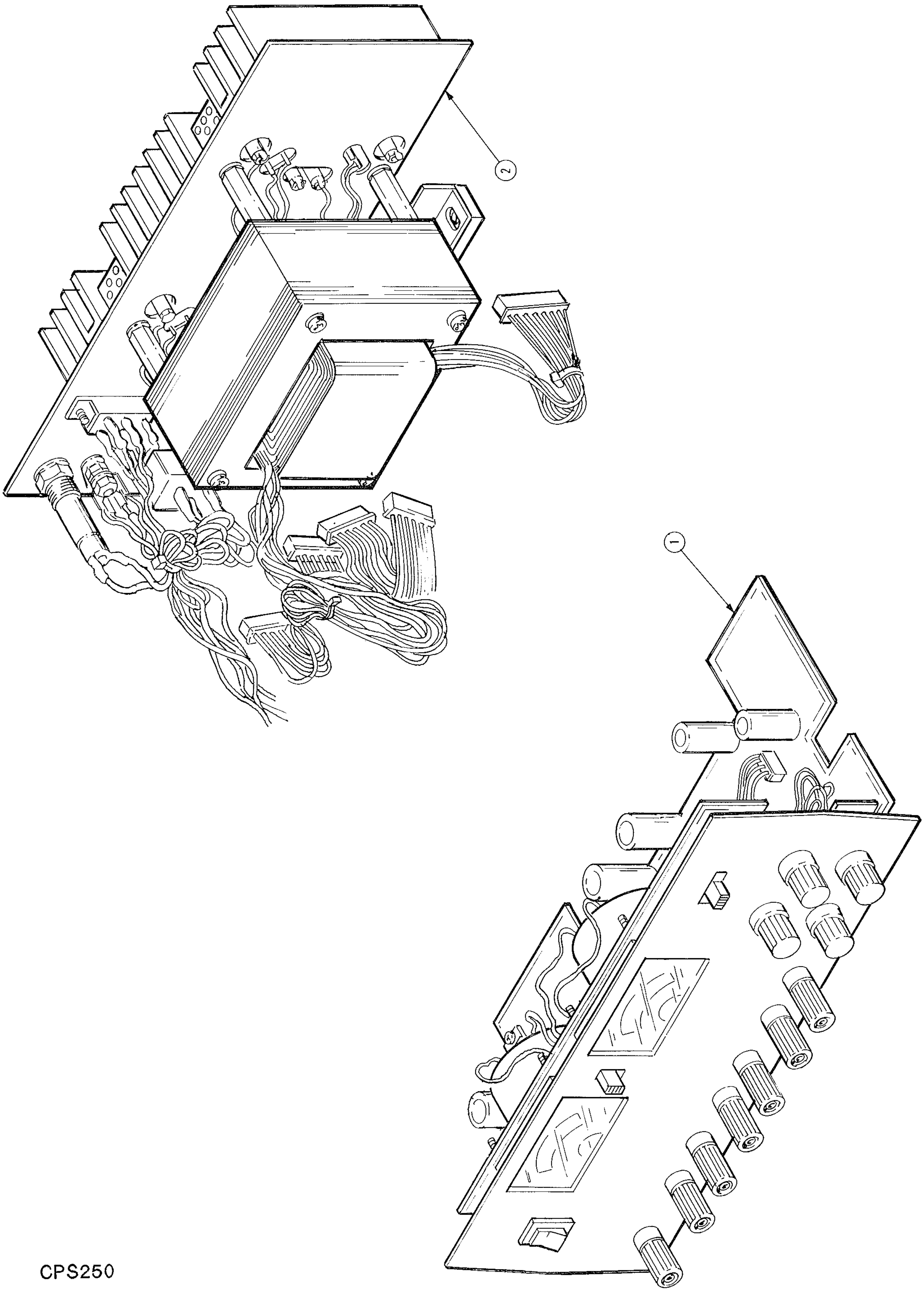
Scan by Zenith



CPS250

Scan by Zenith

FIG. 2 ASSEMBLIES



CPS250

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
2-1	118-7934-00			1	FRONT PNL ASSY:	80009	118-7934-00
					.PANEL,FRONT: (QTY. 1)		1-25670-1
					.OVERLAY,CPS250: (QTY. 1)		24-25097-1
					.CIRCUIT BD ASSY:CONTROL (QTY. 1)		25-25903-2B
					..WAFER:3 PIN,90 DEG (W1,3,5,7)		30-25625-5
					..WAFER:4 PIN,90 DEG (W2,4,6)		30-25626-6
					..RESISTOR:0 OHM (J1 THRU J7)		33-000J8T-7
					..RESISTOR:0.1 OHM 5%,1/2W (R15,25)		33-R10J8T-X1D7
					..DIODE:1N4002 (D8,25,29)		35-25112-2
					..LT EMITTING DIODE:ORANGE (D6,7,9,28)		64-25232-10
					..SWITCH,SLIDE:5P2C,9MM (S2)		80-25590-3
					..SWITCH,SLIDE:6P3C,9MM (S3)		80-25597-1
					.CIRCUIT BD ASSY:MAIN		25-25902-2B
					..WAFER:4P W/LOCK (W5,6)		30-25663-4
					..WAFER:6P W/LOCK (W1,3,4)		30-25663-6
					..WAFER:8P W/LOCK (W7)		30-25663-8
					..POST,BINDING:RED (QTY. 3)		30-25596-2
					..POST,BINDING:BLK (QTY. 3)		30-25596-1
					..POST,BINDING:YELLOW (QTY. 1)		30-25596-3
					..WAFER:2P W/LOCK (W2)		30-25663-2
					..WIRE:22AWG,GRAY (QTY. 1)		30-26185-2B
					..CAPACITOR:1UF,+80/-20%,50V (C23,31)		31-105Z50-2
					..CAPACITOR:47UF,+80/-20%,25V (C18,28)		31-476Z25-2
					..CAPACITOR:100UF,+80/-20%,16V (C19)		31-107Z16-2
					..CAPACITOR:100UF,+80/-20%,25V (C6,14,17)		31-107Z25-2
					..CAPACITOR:330UF,+80/-20%,16V (C7,27)		31-337Z16-2
					..CAPACITOR:470UF,+80/-20%,35V (C24,26)		31-477Z35-2
					..CAPACITOR:1000UF,+80/-20%,50V (C10,11)		31-108Z50-2
					..CAPACITOR:4700UF,+80/-20%,16V (C1)		31-478Z16-2
					..CAPACITOR:0.001UF,25V (C4,5,20,21,29,30)		31-102Z25-3
					..CAPACITOR:0.1UF,50V (C2,3,8,9,13,16,22,25)		31-104Z50-3
					..CAPACITOR:0.01UF,50V (C12,15,33,34)		31-103K50-4
					..RESISTOR:0.22 OHM,5%,5W (R14)		33-R22J5-1
					..RESISTOR:1 OHM,5%,3W (R23,31)		33-1RJ03-1
					..RESISTOR:0 OHM (J1 THRU J32)		33-000J8T-7
					..RESISTOR:100 OHM,5%,1/8W (R7)		33-101J8T-7
					..RESISTOR:82 OHM,5%,1W (R3)		33-082J1-7
					..RESISTOR:120 OHM,5%,1/8W (R24,43)		33-131J8T-7
					..RESISTOR:150 OHM,5%,1/8W (R41,57)		33-151J8T-7
					..RESISTOR:220 OHM,5%,1/8W (R55,56)		33-221J1-7
					..RESISTOR:470 OHM,5%,1/8W (R40,59)		33-471J8T-7
					..RESISTOR:510 OHM,5%,1/8W (R2)		33-511J2T-7
					..RESISTOR:680 OHM,5%,1/8W (R8,44,61)		33-681J8T-7
					..RESISTOR:1K,5% (R9,32,33,37,50,63,71,73)		33-102J8T-7
					..RESISTOR:1.5K,5%,1/8W (R12,36,48)		33-152J8T-7
					..RESISTOR:1.5K,5%,1/2W (R1)		33-152J8T-7
					..RESISTOR:1.8K,5%,1/8W (R13)		33-182J8T-7
					..RESISTOR:2.4K,5%,1/8W (R38,53)		33-242J8T-7
					..RES:2.7K,5% (R11,35,39,45,49,51,54,62)		33-272J8T-7
					..RES:3.3K,5% (R42,47,58,65,72,74)		33-332J8T-7
					..RES:10K,5% (R4,5,6,21,30,34,60)		33-103J8T-7
					..RESISTOR:22.1K,1%,1/8W (R52)		33-2212F8T-7
					..RESISTOR:22K,5%,1/8W (R17,18,27,29)		33-223J8T-7
					..RESISTOR:1.2K,5%,1/8W (R10)		33-122J8T-7
					..RESISTOR:22.6K,1%,1/8W (R46)		33-2262F8T-7
					..RES,VAR:1KB,20% (VR2,4)		34-1022-05D
					..RES,VAR:20KB,20% (VR1,3)		34-2032-05D
					..RES,VAR:SEMI,470 OHM,20% (SVR3)		34-4711-08E
					..RES,VAR:SEMI,2K,20% (SVR1)		34-2021-08E
					..RES,VAR:SEMI,5K,20% (SVR4,6,8,9,11)		34-5021-08E
					..RES,VAR:SEMI,10K,20% (SVR2,5,7)		34-1031-08E
					..RES,VAR:SEMI,1K,20% (SVR10)		34-1021-08E
					..DIODE:1N4002 (D12,15,18,24)		34-25112-2
					..DIODE:1N4148 (D1,2,5,10,11,13,14,16)		34-25111-1
					..DIODE:UZP-5.6B,1/2W (D3,17,23)		34-25113-5R6
					..DIODE:UZP-10,12 (D4,19,20,21,22)		34-25389-10
					..DIODE:1N4116,24V,1/2W (D26,27)		35-25601-1
					..DIODE,BRIDGE:1.5A,100V (BD3,4)		35-25393-7

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
2-					..DIODE,BRIDGE:2A,100V (BD1,2)		35-25393-4
					..DIODE,BRIDGE:6A,200V (BD5)		35-25393-8
					..TRANSISTOR:2SC1384 (Q15,16)		36-25349-1
					..TRANSISTOR:2SC1815GR (Q2 THRU Q9)		36-25238-3
					..TRANSISTOR:2SD313 (Q1)		36-25351-1
					..TRANSISTOR:2N3055 (Q10,11,12)		36-25350-1
					..SCR:C122A,100V (Q13,14)		36-25603-1
					..MICROCKT:HA17741 (IC1,5,7,8,9)		38-25411-1
					..MICROCKT:HA17358 (IC11)		38-25410-1
					..MICROCKT:CA723CE (IC2,6,10)		41-25413-1
					..METER,VOLTAGE PANEL:FS25V		42-25530-1
					..METER,CURRENT PANEL:FS600MA		42-25531-1
					..RELAY:1P2C,24V (CR1,2)		45-26002-1
					..FUSE:1.5A,250V (159-0311-00)(FS2,3)		62-25608-1U
					..FUSE:250MA,250V (159-0312-00)(FS4,7)		62-25026-4U
					..FUSE:5A,125V (159-0310-00)(FS1)		62-25609-1U
					..FUSE:500MA,250V (159-0314-00)(FS5,6)		62-25603-1U
					.KNOB:(366-0701-00)(QTY. 4)		15-25713-4
					.SOCKET,LED:94HB (QTY. 4)		15-25489-1
					.LEAD,TEST:RED (QTY. 3)		30A-25641-1
					.LEAD,TEST:BLACK (QTY. 3)		30A-25641-2
-2	118-7935-00			1	REAR PNL ASSY:	80009	118-7935-00
					.PANEL,REAR: (QTY. 1)		1-25671-1
					.FUSEHOLDER:CARRIER (QTY. 1)		62-25604-1
					.FUSEHOLDER:BASE (QTY. 1)		62-25604-3
					.FUSE:2A OR 1A,250V (F8)		62-25607-1U
					.SWITCH,VOLTAGE CONVERSION (QTY. 2)		80-25605-1
					.AC POWER JACK (QTY. 1)		30-25625-1
					.TRANSFORMER: (QTY. 1)		63-1915-815
					.SAFETY GROUND CONNECTION:		
					..LUG,FOUR LEG: (QTY. 1)		1-25071-1
					..LUG,GROUND: (QTY. 1)		6-13103-02A
					..SCREW,GROUND (QTY. 1)		4-1113R5-1002
					..NUT,GROUND (QTY. 3)		5-1423R5-02
					..WASHER,FLAT:GROUND (QTY. 1)		6-1113R5-02
					.HEATSINK:W/ALL ATTACHING PARTS (QTY. 1)		1-25647-1
					.COVER,HEATSINK: (QTY. 2)		1-25675-1
					.TRANSISTOR:2N3055 (QTY. 3)		36-25350-1
					.DIODE,BRIDGE: (QTY. 1)		35-25393-8

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
3-					ACCESSORIES		
	070-6739-00			1	MANUAL,TECH:SERVICE,CPS250	80009	070-6739-00
	070-6740-00			1	MANUAL,TECH:OPERATORS,CPS250	80009	070-6740-00
	161-0104-05			1	CABLE ASSY,PWR,:3,18 AWG,240V,98.0 L (OPTION A3 - AUSTRALIAN)	S3109	ORDER BY DESCR
	161-0104-06			1	CABLE ASSY,PWR,:3 X 0.75MM SQ,220V,98.0 L (OPTION A1 - EUROPEAN)	S3109	ORDER BY DESCR
	161-0104-07			1	CABLE ASSY,PWR,:3 X 0.75MM SQ,240V,98.0 L (OPTION A2 - UNITED KINGDOM)	TK1373	A25UK-RA
	161-0104-08			1	CABLE ASSY,PWR,:3,18 AWG,240V,98.0 L (OPTION A4 - NORTH AMERICAN)	70903	ORDER BY DESCR
	161-0167-00			1	CABLE ASSY,PWR,:3.0 X 0.75,6A,240V,2.5M L (OPTION A5 - SWITZERLAND)	S3109	ORDER BY DESCR
	161-0248-00			1	CABLE ASSY,PWR,:	80009	161-0248-00
	214-4206-00			1	HARDWARE KIT:CPS250	80009	214-4206-00

Scan by Zenith

DIAGRAMS AND CIRCUIT BOARD ILLUSTRATIONS

Symbols

Graphic symbols and class designation letters are based on ANSI Standard Y32.2-1975.

Logic symbology is based on ANSI/IEEE 91-1984. Logic symbols depict the logic function performed and may differ from the manufacturer's data.

The overline on a signal name indicates that the signal performs its intended function when it is in the LO state.

Abbreviations are based on ANSI Y1.1-1972.

Other ANSI standards that are used in the preparation of diagrams by Tektronix, Inc., are:

Y14.15-1966	Drafting Practices.
Y14.2M-1979	Line Conventions and Lettering.
ANSI/IEEE 280-1985	Letter Symbols for Quantities Used in Electrical Science and Electrical Engineering.

American National Standards Institute
1430 Broadway
New York, New York 10018

Component Values

Electrical components shown on the diagrams are in the following units unless noted otherwise:

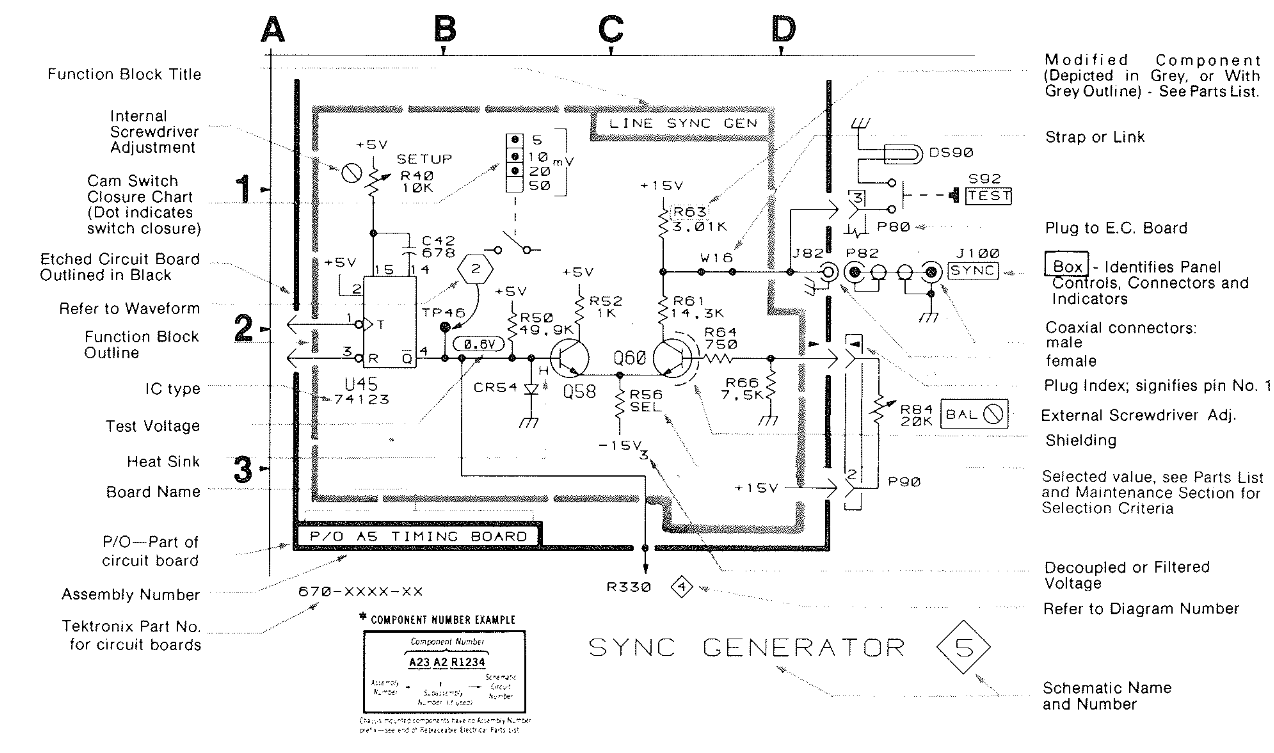
Capacitors	Values one or greater are in picofarads (pF). Values less than one are in microfarads (μF).
Resistors	Ohms (Ω).

The information and special symbols below may appear in this manual.

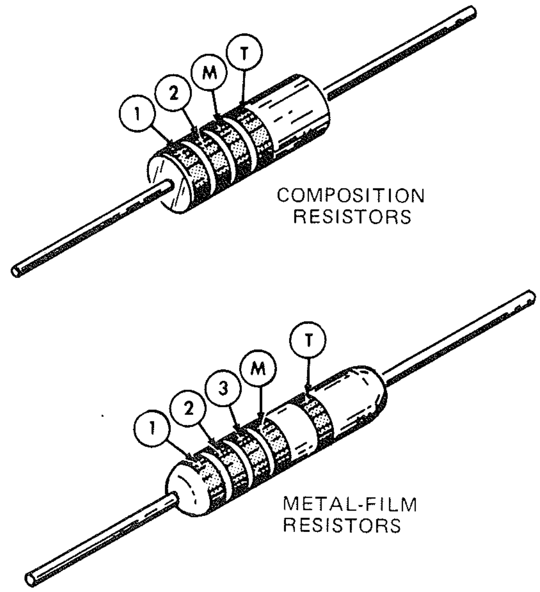
Assembly Numbers and Grid Coordinates

Each assembly in the instrument is assigned an assembly number (e.g., A20). The assembly number appears on the circuit board outline on the diagram, in the title for the circuit board component location illustration, and in the lookup table for the schematic diagram and corresponding component locator illustration. The Replaceable Electrical Parts list is arranged by assemblies in numerical sequence; the components are listed by component number *(see following illustration for constructing a component number).

The schematic diagram and circuit board component location illustration have grids. A lookup table with the grid coordinates is provided for ease of locating the component. Only the components illustrated on the facing diagram are listed in the lookup table. When more than one schematic diagram is used to illustrate the circuitry on a circuit board, the circuit board illustration may only appear opposite the first diagram on which it was illustrated; the lookup table will list the diagram number of other diagrams that the circuitry of the circuit board appears on.



Scan by Zenith

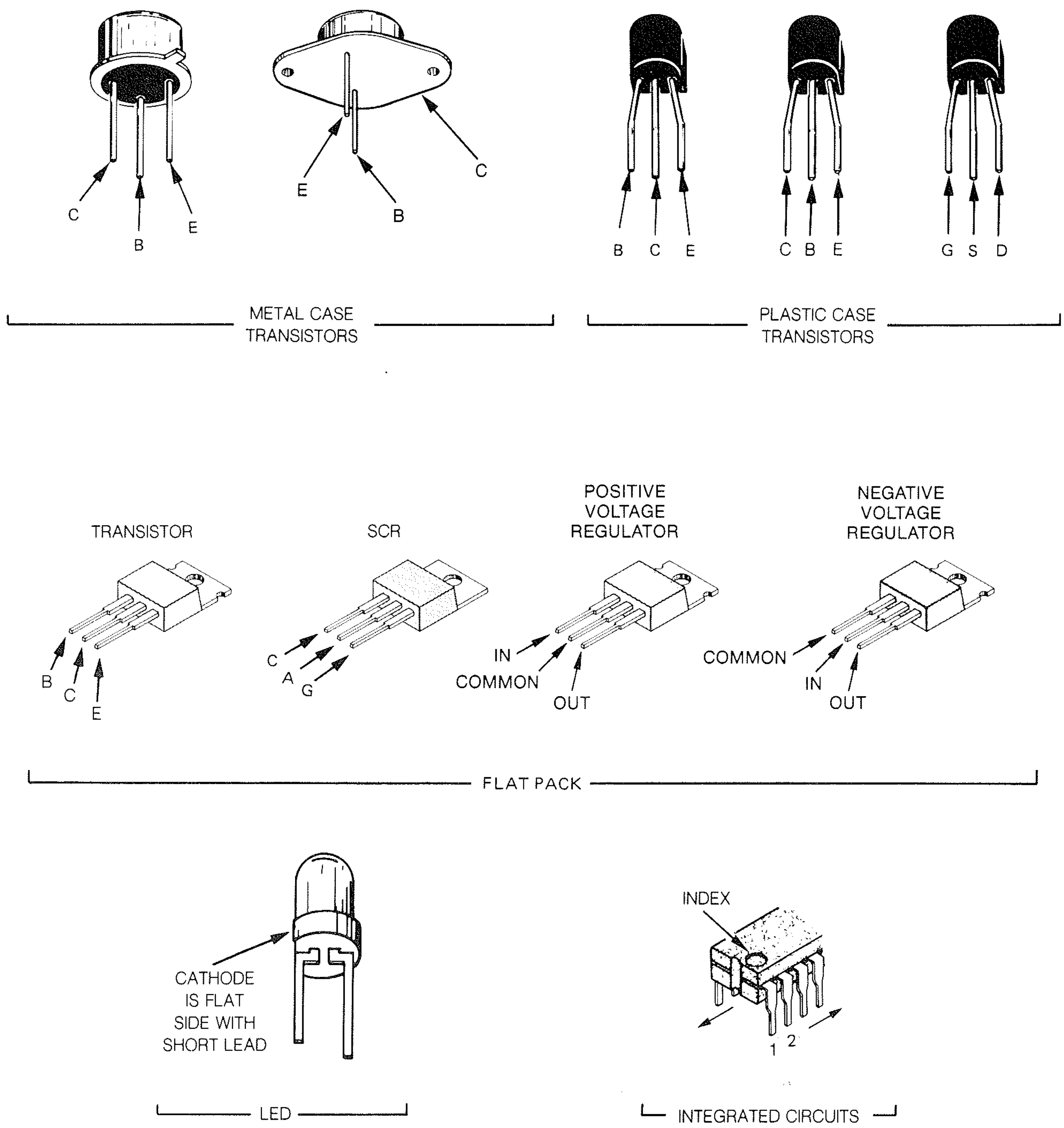


(1)(2) and (3) — 1st, 2nd, and 3rd significant figures
(M) —multiplier (T) —tolerance

COLOR	SIGNIFICANT FIGURES	RESISTORS	
		MULTIPLIER	TOLERANCE
BLACK	0	1	–––
BROWN	1	10	±1%
RED	2	10^2 or 100	±2%
ORANGE	3	10^3 or 1 K	±3%
YELLOW	4	10^4 or 10 K	±4%
GREEN	5	10^5 or 100 K	±½%
BLUE	6	10^6 or 1 M	±¼%
VIOLET	7	–––	±1/10%
GRAY	8	–––	–––
WHITE	9	–––	–––
GOLD	–	10^{-1} or 0.1	±5%
SILVER	–	10^{-2} or 0.01	±10%
NONE	–	–––	±20%

(1861-20A)6557-87

Figure 9-1. Color codes for resistors.



LEAD CONFIGURATIONS AND CASE STYLES ARE TYPICAL, BUT MAY VARY DUE TO VENDOR CHANGES OR INSTRUMENT MODIFICATIONS.

(6081-20)6735-05

Figure 9-2. Semiconductor lead configurations.

Scan by Zenith

CPS250 DIAGRAM

A-1 MAIN BOARD

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
BD1	4C	2C	D21	1C	3G	J4	9H	4B	R5	9J	4A
BD2	1C	2D	D22	1C	2H	J5	8J	4B	R50	2E	3G
BD3	5D	2H	D23	3D	2H	J6	8J	4B	R51	3F	4G
BD4	2D	2H	D24	4C	2H	J7	4C	3C	R52	3K	4F
			D26	2J	4D	J8	4C	3C	R53	2H	4G
C1	8D	2A	D27	6K	4D	J9	1H	3C	R54	2F	4G
C10	1C	2D	D3	7K	4A				R55	5D	2G
C11	5C	2E	D4	8E	4A	Q1	8H	2A	R56	1D	3G
C12	2E	3D	D5	9K	4B	Q13	2J	4D	R57	2H	3H
C13	4J	4D				Q14	7H	4D	R58	2H	3H
C14	4K	4D	FS1	8C	2A	Q15	1K	3C	R59	4C	2H
C15	5E	3E	FS2	1C	2B	Q16	4J	3D	R6	9J	4A
C16	7K	4E	FS3	5C	2B	Q2	1E	3D	R60	2D	4H
C17	7K	4E	FS4	6C	2F	Q3	2E	3D	R61	1J	4H
C18	7C	2E	FS5	6C	1G	Q4	5E	3D	R62	2K	4H
C19	7D	2E	FS6	2C	1H	Q5	5E	3D	R63	3K	4H
C2	8D	2B	FS7	3C	1H	Q6	6G	3F	R65	5G	3E
C20	5H	3F				Q7	5H	3F	R7	7K	4A
C21	5F	3F	IC1	9K	4A	Q8	2G	3H	R71	2J	4D
C22	5D	4F	IC10	1G	4H	Q9	2H	3H	R72	4J	4D
C23	3E	3G	IC11A	2K	4H				R73	6K	4E
C24	6D	2G	IC11B	3H	4H	R1	8D	2B	R74	7J	4E
C25	1D	3H	IC2	8F	3C	R10	9J	4B	R8	9K	4A
C26	2D	2H	IC5	6F	4E	R11	9J	4B	R9	9G	3B
C27	3D	2H	IC6	4G	3F	R12	9G	4B			
C28	3C	2H	IC7	6H	4F	R13	9G	3C	SVR1	8H	3B
C29	2F	3H	IC8	2H	3G	R14	8J	3C	SVR10	3K	4F
C3	8E	4A	IC9	3F	4G	R17	1E	3D	SVR11	3K	4H
C30	1H	3H				R18	3E	4D	SVR2	9H	3B
C31	7E	4F	J1	8H	2A	R2	8H	3A	SVR3	9J	4B
C33	4J	4D	J10	2C	3D	R21	2D	4C	SVR4	5E	3E
C34	7K	4D	J11	2E	3D	R23	2J	3D	SVR5	5G	2F
C4	8G	3C	J119	4J	2D	R24	2G	3G	SVR6	6E	2F
C5	8G	3C	J12	1E	4D	R27	4E	3D	SVR7	2G	3G
C6	9K	4B	J13	5C	3D	R29	6E	4D	SVR8	2E	3F
C7	8F	4C	J14	6D	3E	R3	8E	3A	SVR9	3E	4F
C8	8E	4C	J15	4G	4F	R30	6D	4E			
C9	9K	4C	J16	6E	3E	R31	5J	3E	W1	7C	1A
			J17	4D	4E	R32	6K	4E	W1	7J	1A
CR1	1C	3B	J18	7E	4E	R33	2K	4D	W1	8C	1A
CR1	1E	3B	J19	5J	3D	R34	5D	4E	W1	8H	1A
CR2	4C	3C	J2	9E	3B	R35	6F	3E	W1	8J	1A
CR2	4E	3C	J21	5F	3F	R36	6E	3E	W2	7C	1B
			J22	2F	4G	R37	6E	3E	W3	1B	1B
D1	1E	3D	J24	4E	4F	R38	6H	3E	W3	4B	1B
D10	5D	3E	J26	5C	2H	R39	6F	3E	W4	1J	2D
D11	6D	4E	J27	2J	3F	R4	9H	4A	W4	1K	2D
D12	6F	4E	J29	3D	3G	R40	7C	2F	W4	2J	2D
D13	2D	4G	J3	9H	3B	R41	5H	2F	W4	4J	2D
D14	3D	4G	J30	3J	4G	R42	6H	2F	W4	5J	2D
D15	3F	4G	J31	2J	3H	R43	6G	3F	W5	6G	3F
D16	3H	4H	J32	2K	4H	R44	4H	3E	W5	7F	3F
D17	7D	2F	J33	1K	4H	R45	6H	4F	W6	3F	3G
D18	7C	2F	J34	3H	4H	R46	3H	4F	W6	3G	3G
D19	5D	3G	J35	5K	4G	R47	2G	3G	W7	1B	1G
D2	4E	3E	J36	2E	4D	R48	3E	3G	W7	5B	1G
D20	5D	2G	J37	1K	4G	R49	3H	4G			

A-2 CONTROL BOARD

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
D25	3M	3E	D8	7L	3D	S2-1	6N	1E	S3-1	2N	1B
D28	4L	3D	D9	1L	3E	S2-2	6M	1E	S3-2	3M	1B
D29	9N	3G				S2-3	6M	1E	S3-3	2M	1B
D6	9L	3G	R15	6L	2E	S2-4	6L	1E	S3-4	3L	1B
D7	9M	1G	R25	3M	3F						

OTHER PARTS

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
BD5	7C	CHASSIS	Q11	5J	CHASSIS	S4A	1B	CHASSIS	VR1	3F	CHASSIS
			Q12	8J	CHASSIS	S4B	2B	CHASSIS	VR2	3G	CHASSIS
FS8	1B	CHASSIS				S5	2B	CHASSIS	VR3	7F	CHASSIS
			S1A	1A	CHASSIS				VR4	6G	CHASSIS
Q10	1J	CHASSIS	S1B	2A	CHASSIS	T1	1B	CHASSIS			

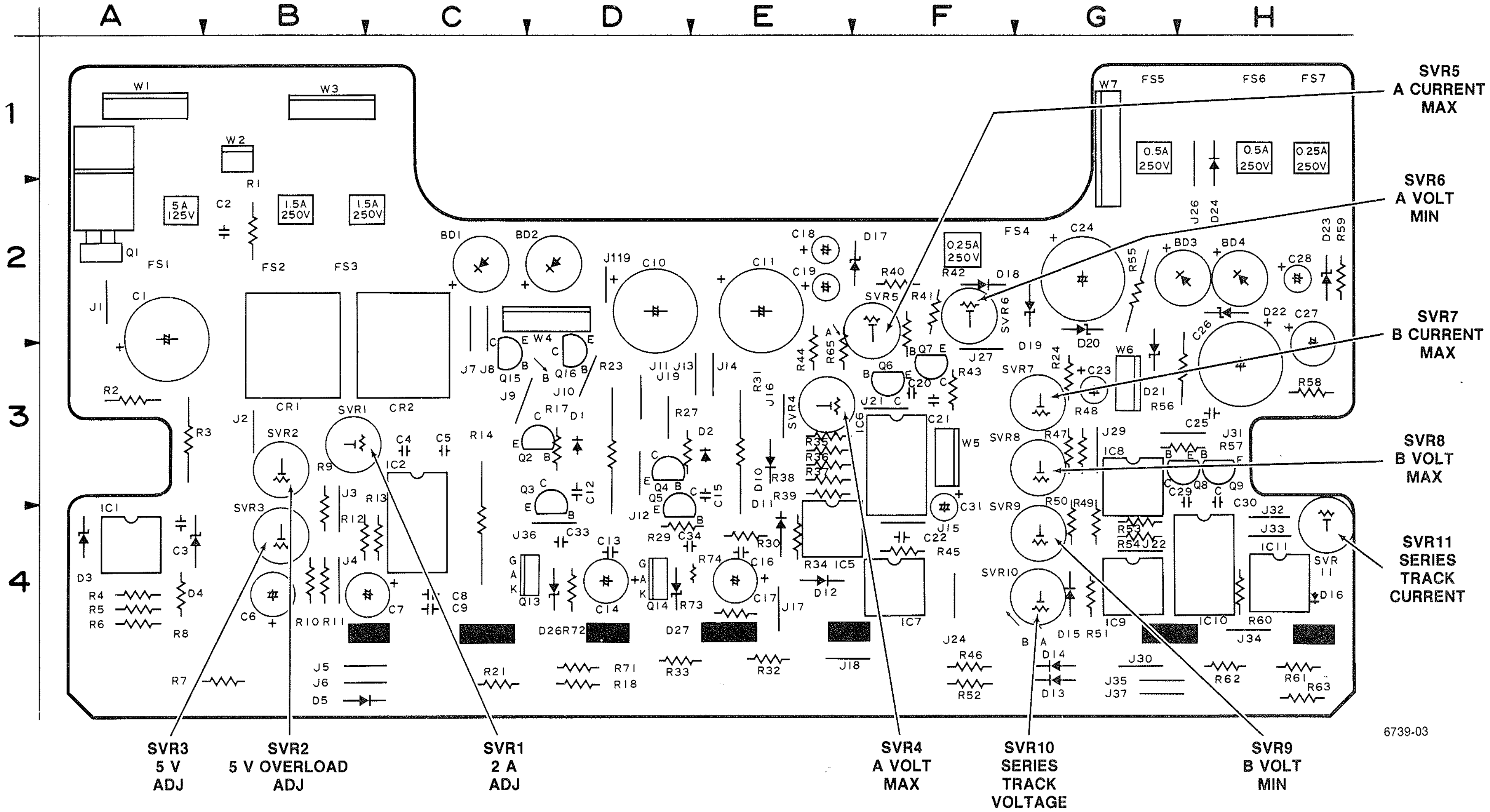
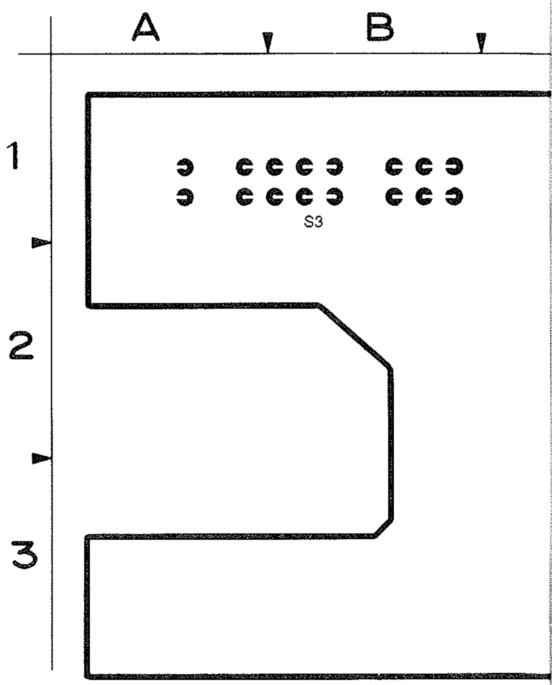
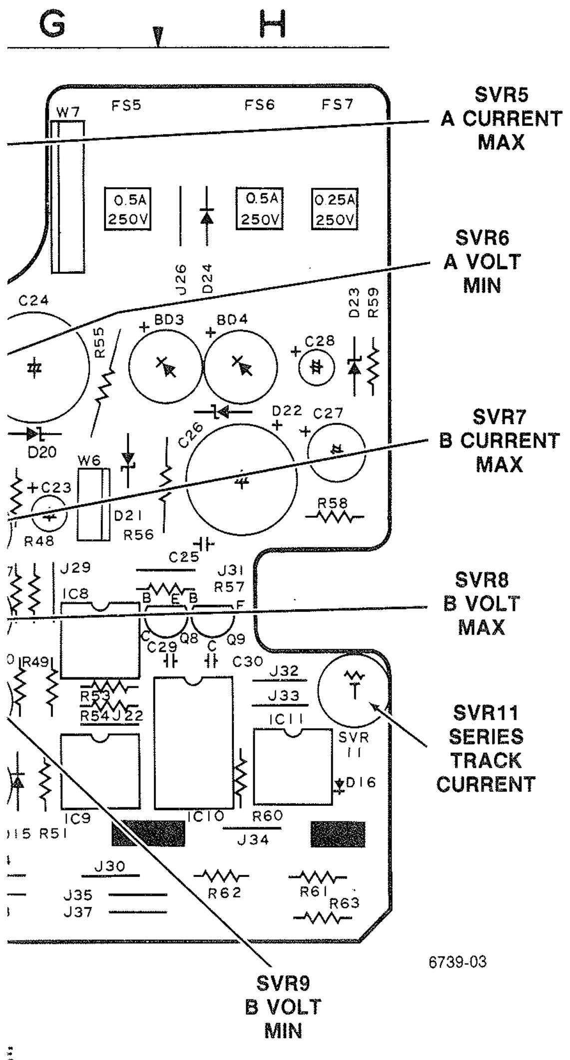


Figure 9-3. Main board and adjustment locations.





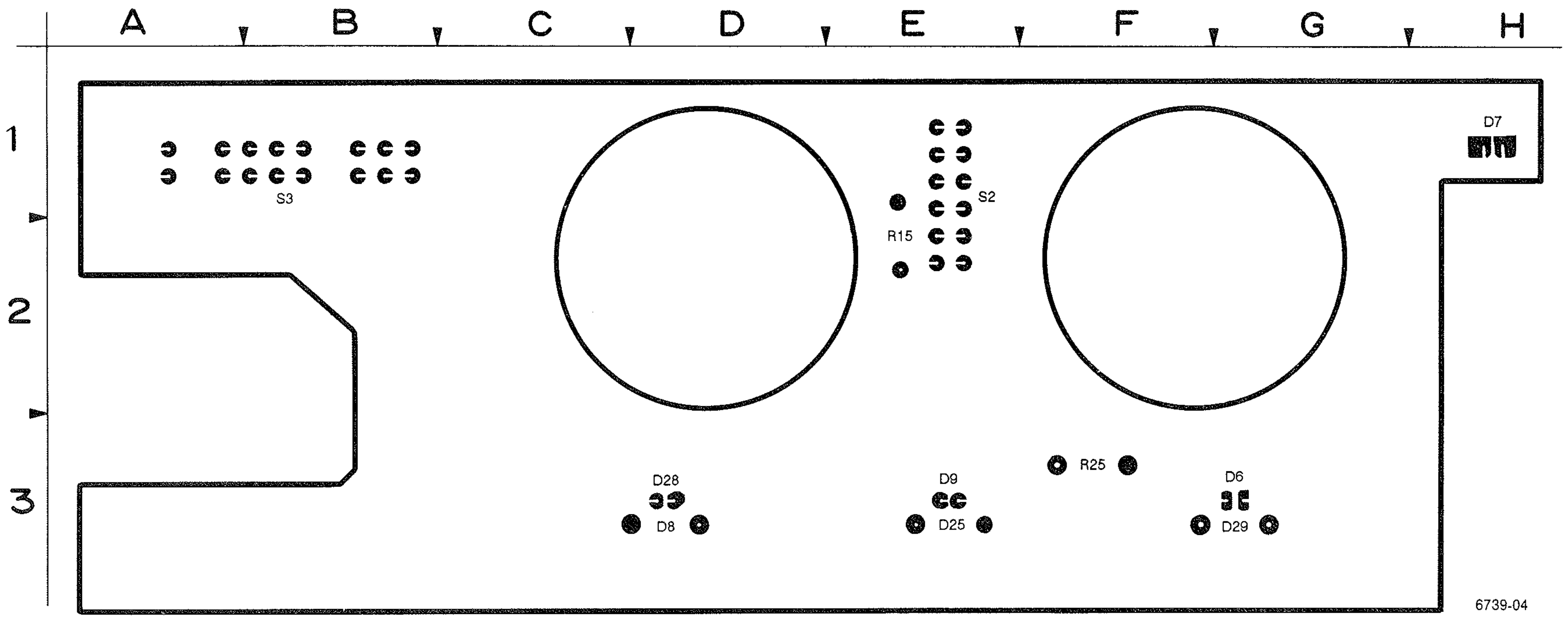
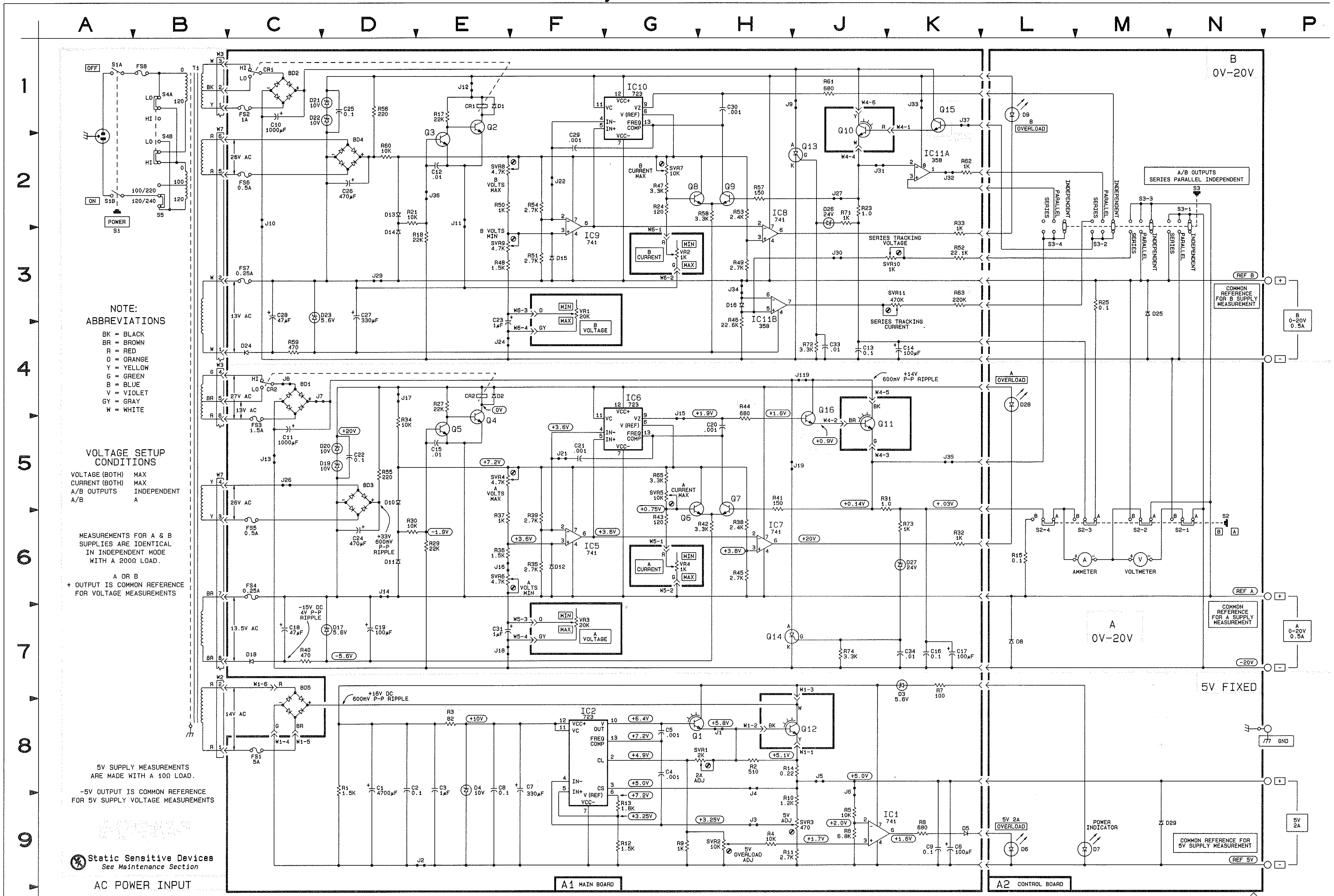


Figure 9-4. Control board.



CPS250 TRIPLE OUTPUT POWER SUPPLY

6739 - 01