Tektronix®
COMMITTED TO EXCELLENCE

PLEASE CHECK FOR CHANGE INFORMATION AT THE REAR OF THIS MANUAL.

576 CURVE-TRACER

INSTRUCTION MANUAL

Tektronix, Inc.
P.O. Box 500
Beaverton, Oregon 97077

070-0905-01
Product Group 48

Serial Number _____

First Printing NOV 1970
Revised APR 1988

INSTRUMENT SERIAL NUMBERS

Each instrument has a serial number on a panel insert, tag, or stamped on the chassis. The first number or letter designates the country of manufacture. The last five digits of the serial number are assigned sequentially and are unique to each instrument. Those manufactured in the United States have six unique digits. The country of manufacture is identified as follows:

B000000	Tektronix, Inc., Beaverton, Oregon, USA
100000	Tektronix Guernsey, Ltd., Channel Islands
200000	Tektronix United Kingdom, Ltd., London
300000	Sony/Tektronix, Japan
700000	Tektronix Holland, NV, Heerenveen, The Netherlands

TABLE OF CONTENTS

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.

Abbreviations and symbols used in this manual are based on or taken directly from IEEE Standard 260 "Standard Symbols for Units", MIL-STD-12B and other standards of the electronics industry.

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, but may 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.

As Marked on Equipment

CAUTION indicates a personal injury hazard not immediately accessible as one reads the marking, 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 indictes where applicable cautionary or other information is to be found.

As Marked on Equipment

DANGER — High voltage.

Protective ground (earth) terminal.

ATTENTION — refer to manual.

Power Source

This product is intended to operate from a power module connected to a power source that will 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 module power cord. To avoid electrical shock, plug the power cord into a properly wired receptacle before connecting to the product input or output terminals. A protective ground connection by way of the grounding conductor in the power module 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 Fuse

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

Refer fuse replacement to qualified service personnel.

Do Not Operate in Explosive Atmospheres

To avoid explosion, do not operate this product in an explosive atmosphere unless it has been specifically certified for such operation.

Do Not Operate Without Covers

To avoid personal injury, do not operate this product without covers or panels installed. Do not apply power to the plug-in via a plug-in extender.

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 conductor in the power cord is essential for safe operation.

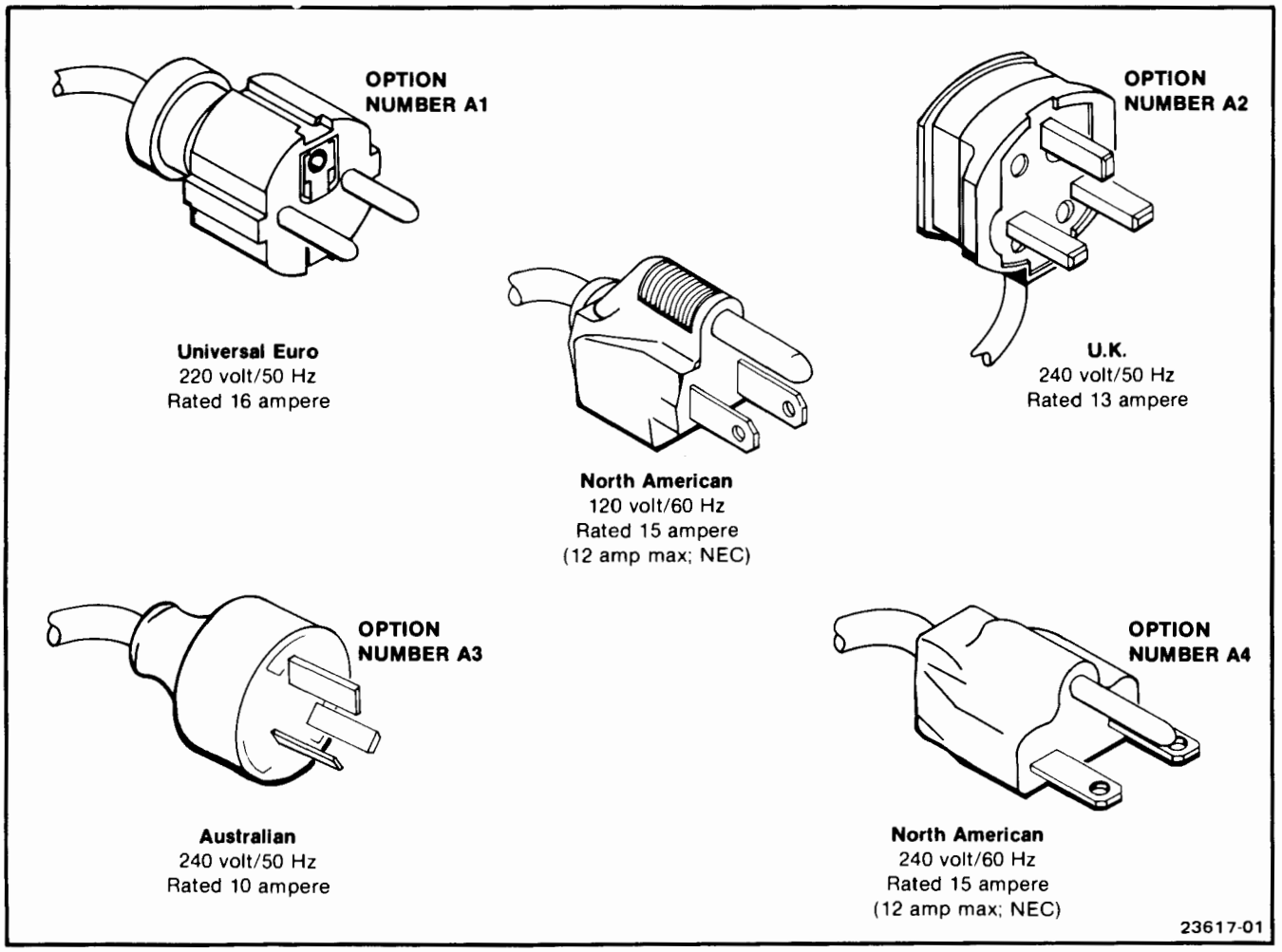


Fig. 1-1. Type 576 Curve Tracer.

WARNING NOTICE

Your 576 or 577/177 is designed to be a very versatile and flexible characteristic curve tracer capable of testing both high voltage and high current devices. The 576 collector supply can generate peak voltages up to 1500 volts, the 577/177 up to 1600 volts, and both are capable of generating up to 20 amps at lower voltages. This wide range of voltage and current makes it possible for you to test a very wide range of devices. However, these supplies are potentially very dangerous.

It has come to our attention that it is becoming increasingly common for our customers to connect 576's and 577/177's to devices or fixturing external to the instrument and thus external to or outside of the safety features that are designed into the instruments.

We have provided a wide range of adapters that are designed to allow you to test your devices while inside the plastic protective cover. However, if you feel it is necessary to connect the collector supply to devices or fixturing outside of this protective cover, in effect defeating the built-in safety features of the instrument, the following simple modification will at least allow you to do so with the plastic protective cover still installed. This will reduce the chances of the operator coming into contact with the collector supply voltage.

This simple modification will prevent exposed contacts at the instrument's test fixture. This prevents operators from exposure to dangerous voltages **only at the curve tracer end of the external wires.** Exposure to dangerous voltage is still possible at the external fixture connections and the DUT. If external wires/fixturing are used by your organization, then **it is your responsibility to ensure that the necessary safeguards (additional protective cover, interlocks, etc.) to protect the operators are provided.**

Modification

Drill a hole or otherwise remove just enough material from one of the sides of the plastic protective cover as shown on the attached drawing, to allow the necessary leads to be brought out through the side of the cover.

If you have misplaced or damaged the plastic protective cover, order a replacement through your local Tektronix Field Office, for the plastic protective cover is an integral part of the safety features for these instruments.

A plastic protective cover that has been modified (notched) is available from Tektronix by ordering part number 337-1194-02.

WARNING

DANGEROUS VOLTAGE MAY STILL BE EXPOSED AT THE DEVICE OR FIXTURE END OF THE CABLES WHICH YOU BRING OUT OF THE PLASTIC PROTECTIVE COVER. IT IS YOUR RESPONSIBLITY TO PROVIDE SAFEGUARDS TO PROTECT THE OPERATOR AT THE CABLES END.

COVER MODIFICATION

Drill a hole, notch or otherwise remove just enough material, from the left side of the plastic protective cover box (as shown in Fig. A) to allow test leads to be brought out through the cover. This will allow the cover to be kept in place while using outside test fixtures.

PROTECTIVE COVER "NOTCHED" TO ALLOW TEST LEADS TO BE BROUGHT OUT THROUGH THE COVER WHILE LEAVING THE COVER IN PLACE.

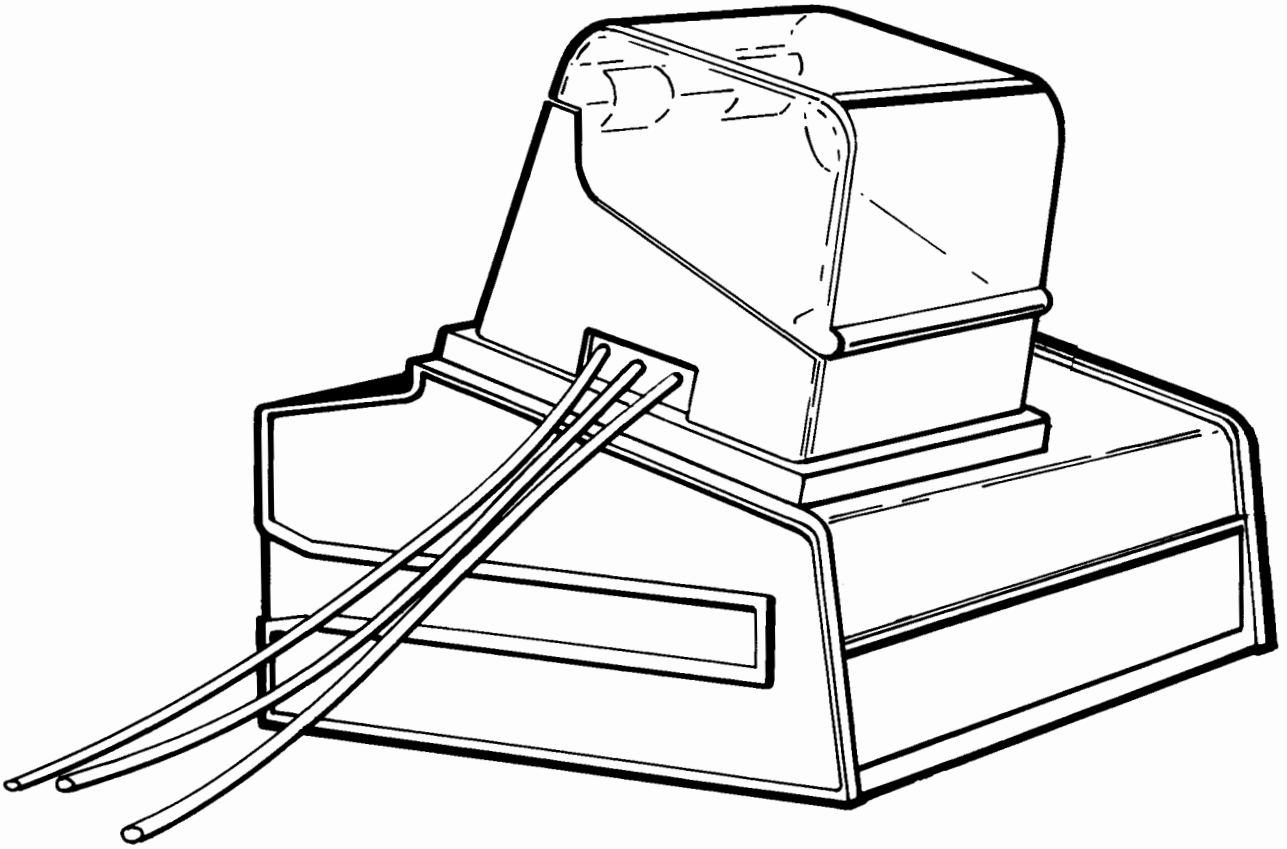


Figure A

NOTICE

To increase the operator safety of the 577/177 products, the RED button that was located on the front of the 177 has been removed. All references to the red button in either the Operators or Service manuals are no longer valid.

If your instrument still has the red interlock bypass button located on the front left side of the 177, it is strongly recommended that you contact your nearest Tektronix Field Office to schedule the installation of the Safety Interlock Modification.

SECTION 1
SPECIFICATION

The Type 576 Curve Tracer is a dynamic semiconductor tester which allows display and measurement of characteristic curves of a variety of two and three terminal devices including bipolar transistors, field effect transistors, MOSFETs, silicon controlled rectifiers and unijunction transistors. A variety of possible measurements is available using either grounded emitter or grounded base configurations. The instrument has available either an AC or a DC collector supply voltage ranging from 0 to ±1500 volts. The step generator produces either current or voltage steps, which may be applied to either the base terminal or the emitter terminal of the device under test. Step generator outputs range from 5 nA to 2 A in the current mode, and from 5 mV to 40 V in the voltage mode. The steps may also be produced as short duration pulses. Calibrated step offset allows offsetting the step generator output either positive or negative. The vertical display amplifier measures either collector current or leakage current with a maximum deflection factor of 1 nA/division when making a leakage measurement. The horizontal display amplifier allows measurement of both collector and base voltage.

The following electrical and environmental characteristics are valid for instruments operated at an ambient temperature of from +10°C to +40°C after an initial warmup period of 5 minutes, when previously calibrated at a temperature of +25°C ±5°C. Section 5, Performance Check and Calibration Procedure, gives a procedure for checking and adjusting the Type 576 with respect to the following specification.

The Type 576 MOD 301W is a standard Type 576 without the Readout Assembly. All the information contained in this manual pertaining to the Readout Assembly and its operation should be disregarded when used in conjunction with a modified instrument.

TABLE 1-1
ELECTRICAL CHARACTERISTICS

Collector Supply

Characteristic	Performance
Sweep Modes	Normal mode: AC (at line frequency); positive-or negative-going full wave rectified AC. DC mode: positive or negative DC.
DC Mode Ripple	No-load: 2% or less of voltage, or 0.1% or less of full range voltage.
Voltages Accuracy	Peak open circuit voltages on all ranges within +35% and −5%.
Ranges	15 V / 75 V / 350 V / 1500 V
Maximum Peak Current (Normal Mode)[1]	10 A / 2 A / 0.5 A / 0.1 A
Peak Current (Step Generator in Pulsed Steps Mode)	At least 20 A / At least 4 A / At least 1 A / At least 0.2 A
Minimum Series Resistance	0.3 Ω / 6.5 Ω / 140 Ω / 3 kΩ
Maximum Series Resistance	65 kΩ / 1.4 MΩ / 6.5 MΩ / 6.5 MΩ
Series Resistance Available	0.3 Ω, 1.4 Ω, 6.5 Ω, 30 Ω, 140 Ω, 650 Ω, 3 kΩ, 14 kΩ, 65 kΩ, 300 kΩ, 1.4 MΩ and 6.5 MΩ, all within 5% or 0.1 Ω.
Peak Power Watts Settings	0.1 W, 0.5 W, 2.2 W, 10 W, 50 W and 220 W. Derived from nominal peak open circuit collector voltages and nominal series resistance values at nominal line voltage.
Safety Interlock	When MAX PEAK VOLTS switch is set to either 75, 350 or 1500, a protective box must be in place over test terminals and its lid closed be-

[1]Collector Supply Maximum Continuous Peak Current Operating Time vs Duty Cycle and Ambient Temperature. With the PEAK POWER WATTS at 50 only, the following limitations apply: Maximum continuous operating time at rated current (100% duty cycle) into a short circuit is 20 minutes at 25°C ambient, or 10 minutes at 40°C ambient. Alternatively, duty cycle may be limited to 50% at 25°C ambient or 25% at 40°C ambient. (A normal family of curves for a transistor will produce a duty cycle effect to 50% or less even if operated continuously.) Over dissipation of the collector supply will temporarily shut it off and turn on the yellow COLLECTOR SUPPLY VOLTAGE DISABLED light. No damage will result.

	fore voltage can be applied. Amber light on indicates interlock is open Red light on indicates voltage is being applied to test terminals.
Looping Compensation	Cancels stray capacitance between collector test terminal and ground in Standard Test Fixture and all Standard Test Fixture Accessories.
	Step Generator
Accuracy (Current or Voltage Steps, Including Offset)	
Incremental Accuracy	Within 5% between any two steps, without .1X STEP MULT button pressed; within 10% with .1X STEP MULT button pressed.
Absolute Accuracy	Within 2% of total output, including any amount of offset, or 1% of AMPLITUDE switch setting, whichever is greater.
Step (Current or Voltage) Amplitudes	One times or 0.1 times (with .1X STEP MULT button pressed) the AMPLITUDE switch setting.
OFFSET MULT Control Range	Continuously variable from 0 to 10 times AMPLITUDE switch setting, either aiding or opposing the step generator polarity.
Current Mode	
AMPLITUDE Switch Range	200 mA to 50 nA, in 1-2-5 sequence.
Maximum Current (Steps and Aiding Offset)[2]	20 times AMPLITUDE switch setting, except 10 times switch setting when switch is set to 200 mA, and 15 times switch setting when the switch is set to 100 mA.
Maximum Voltage (Steps and Aiding Offset)	At least 10 V.
Maximum Opposing Offset Current	Whichever is less: 10 times AMPLITUDE switch setting, or between 10 mA and 20 mA.
Maximum Opposing Voltage	Between 1 V and 3 V.
Ripple Plus Noise	0.5% or less of AMPLITUDE switch setting or 1 nA, peak to peak.
Voltage Mode	
AMPLITUDE Switch Range	50 mV to 2 V, in 1-2-5 sequence.
Maximum Voltage (Steps and Aiding Offset)	20 times AMPLITUDE switch setting.
Maximum Current (Steps and Aiding Offset)	At least 2 A at 10 V or less, decreasing linearly to 10 mA at 40 V.
Short Circuit Current Limiting (Steps and Aiding Offset)	20 mA, 100 mA, 500 mA, +100%-0%; 2 A +50%-0%; as selected by CURRENT LIMIT switch.
Maximum Opposing Offset Voltage	10 times AMPLITUDE switch setting.
Maximum Opposing Current	Limited at between 5 mA and 20 mA
Ripple Plus Noise	0.5% or less of AMPLITUDE switch setting, or 2 mV, peak to peak.
Step Rates	(Front panel RATE button labels in parentheses.) 1 times (.5X), 2 times (NORM) and 4 times (2X) line frequency. Steps occur at zero collector voltage when .5X or NORM RATE buttons are pressed, and also at peak voltage when 2X RATE button is pressed. Steps occur at collector voltage peak and at normal rate when .5X and 2X RATE buttons are pressed together.
Pulsed Steps	Pulsed steps 80 μs wide within +20%, −5% or 300 μs wide within +5%, −15% produced whenever one of the PULSED STEPS buttons is pressed. Pulsed steps can be produced only at normal and .5 times normal rates. Collector Supply mode automatically becomes DC when either the 300 μs or 80 μs PULSED STEPS button is pressed unless POLARITY switch is set to AC. If the 300 μs and 80 μs PULSED STEPS buttons are pressed together, 300 μs pulsed steps are produced, but collector supply mode does not change.

[2]Continuous DC Output vs Time, Temperature and Duty Cycle. 2A continuous DC output can be achieved for an unlimited period up to 30°C ambient. Between 30°C and 40°C ambient, 2A continuous DC operation should be limited to 15 minutes or limited to a 50% duty cycle or less. A family of steps (such as 10 steps at 200 mA per step) will automatically reduce the duty cycle to 50% even if generated continuously. Exceeding the rating will temporarily shut off power to the entire instrument but no damage will result.

Steps and Offset Polarity	Corresponds with collector supply polarity (positive going when POLARITY switch is set to AC) when the POLARITY INVERT button is released. Is opposite collector supply polarity (negative-going in AC) when either the POLARITY INVERT button is pressed or the Lead Selector switch is set to BASE GROUNDED. If Lead Selector switch is set to BASE GROUNDED, POLARITY INVERT button has no effect on steps and offset polarity.
Step Families	Repetitive families of characteristic curves generated with REP STEP FAMILY button pressed. Single family of characteristic curves generated each time SINGLE STEP FAMILY button is pressed.
Number of Steps	Ranges from 1 to 10 as selected by the NUMBER OF STEPS switch. For zero steps, press SINGLE STEP FAMILY button.

Display Amplifiers

Display Accuracies (% of Highest On-Screen Value)	Display magnified (DISPLAY OFFSET Selector switch set to either VERT X10 or HORIZ X10) and offset between			Display Unmagnified
	100 and 40 divisions	35 and 15 divisions	10 and 0 divisions	
Normal and DC Collector Supply Modes				
Vertical Collector Current	2%	3%	4%	3%
External Vertical (Through Interface)	2%	3%	4%	3%
Horizontal Collector Volts	2%	3%	4%	3%
Horizontal Base Volts	2%	3%	4%	3%
External Horizontal (Through Interface)	2%	3%	4%	3%
Leakage Collector Supply Mode				
Vertical Emitter Current (VERTICAL Switch set between 10 nA and 2 mA)	2% ±1 nA	3% ±1 nA	4% ±1 nA	3% ±1 nA
Vertical Emitter Current (VERTICAL Switch set to 5 nA, 2 nA or 1 nA)	Not Applicable			5% ±1nA
Horizontal Collector or Base Volts VERTICAL switch set to:				
1 μA or more	2%	3%	4%	3%
100 nA, 10 nA or 1 nA	Not Applicable			3% plus 0.025 V for each vertical division of deflection on the CRT
500 nA, 50 nA or 5 nA	Not Applicable			3% plus 0.125 V for each vertical division of deflection on the CRT
200 nA, 20 nA or 2 nA	Not Applicable			3% plus 0.050 V for each vertical division of deflection of the CRT
Step Generator Display				

Vertical Step Generator	3%	4%	5%	4%
Horizontal Step Generator	3%	4%	5%	4%

Deflection Factors

Vertical Collector Current	1 μA/division to 2 A/division in 1-2-5 sequence.
Emitter Current	1 nA/division to 2 mA/division in 1-2-5 sequence.
Step Generator	1 step/division.
Horizontal Collector Volts	50 mV/division to 200 V/division in 1-2-5 sequence
Base Volts	50 mV/division to 2 V/division in 1-2-5 sequence.
Input Impedance	At least 100 MΩ with HORIZONTAL switch set to 50 mV, 100 mV and 200 mV BASE; 1 MΩ within 2% with switch set to .5 V, 1 V and 2 V.
Step Generator	1 step/division

Maximum Displayed Noise

1% or less, or the following depending on setting of MAX PEAK VOLTS switch:

	15	75	350	1500
Vertical				
COLLECTOR	1 μA	1 μA	2 μA	5 μA
EMITTER	1 nA	1 nA	2 nA	5 nA
Horizontal				
COLLECTOR	5 mV	5 mV	20 mV	200 mV
BASE	5 mV	5 mV	5 mV	5 mV

Calibration Check

With DISPLAY OFFSET Selector switch set to NORM (OFF), spot is deflected 10 divisions both vertically and horizontally within 1.5% whenever the CAL button is pressed.

With DISPLAY OFFSET Selector switch set to X10 MAGNIFIER (either axis) the calibration spot is within 0.5% of zero spot (previously set to CRT graticule center) when CAL button is pressed.

Vertical and Horizontal Position Controls	Coarse positioning in 5 division increments within 0.1 division; continuous fine positioning over at least 5 divisions for each coarse position.
Display Offset	Vertical or Horizontal offset of display centerline value up to 10 divisions in 21 half division steps.

Display Positioning Accuracy Using POLARITY Switch

Spot positioning with change in POLARITY switch setting (using AC position as reference), within 0.1 division of:

	Vertically	Horizontally
AC	Centered	Centered
+(NPN)	−5 divisions	−5 divisions
−(PNP)	+5 divisions	+5 divisions

CRT and Readout

CRT Type	Electrostatic deflection.
Screen Size	Calibrated area of 10 divisions by 10 divisions; 12 usable divisions horizontally (1 division equals 1 cm).
Typical Accelerating Potential	4000 V
Readouts	Automatic digitally lighted display. Readout is automatically blanked if readings would be outside the available ranges or would give erroneous display.
PER VERT DIV	1 nA to 20 A calculated from VERTICAL switch setting, DISPLAY OFFSET Selector switch setting and MODE switch setting (or X10 Vertical Interface Input).
PER HORIZ DIV	5 mV to 200 V calculated from HORIZONTAL switch setting and DISPLAY OFFSET Selector switch setting.
PER STEPS	5 nA to 2A and 5 mV to 20 V calculated from AMPLITUDE switch setting and .1X STEP MULT button position (or X10 Step Interface Input).

β or g_m PER DIV	1 μ to 500 k calculated from VERTICAL switch setting, DISPLAY OFFSET Selector switch setting, AMPLITUDE switch setting, .1X STEP MULT button position, X10 Vertical Interface Input and X10 Step Interface Input.

Power Requirements

Power Connection	This instrument is designed for operation from power source with its neutral at or near ground (earth) potential. It is not intended for operation from two phases of multi-phase system, or across legs of single-phase, three wire system. It is provided with a three-wire power cord with three-terminal polarized plug for connection to the power source. Third wire is directly connected to instrument frame, and is intended to ground the instrument to protect operating personnel, as recommended by national and international safety codes.	
Line Voltage Ranges	115 VAC	230 VAC
Low	90 V to 110 V	180 V to 220 V
Medium	104 V to 126 V	208 V to 252 V
High	112 V to 136 V	224 V to 272 V
Line Frequency Range	48 to 66 Hz	
Maximum Power Consumption at 115 VAC, 60 Hz	305 W, 3.2 A	

Table 1-2
ENVIRONMENTAL CHARACTERISTICS

Characteristic	Information
Temperature	
Nonoperating	−40°C to +65°C
Useful Operation	0°C to +50°C
Specified Operation	+10°C to +40°C
Altitude	
Nonoperating	To 50,000 feet
Operating	To 10,000 feet
Vibration	
Operating	15 minutes along each axis at 0.015 inch with frequency varied from 10-50-10 c/s in 1-minute cycles. Three minutes at any resonant point or at 50 c/s.
Shock	
Nonoperating	30 g's, 1/2 sine, 11 ms duration, 1 shock per axis. Total of 6 shocks
Transportation	12 inch package drop. Qualified under the National Safe Transit Committee test procedure 1A.

TABLE 1-3
MECHANICAL CHARACTERISTICS

Characteristic	Description
Dimensions	
Height	≈15 inches
Width	≈11 3/4 inches
Depth	≈23 1/4 inches
Weight	≈69 lbs.
Finish	
Front Panel (Type 576 and Standard Test Fixture)	Anodized Aluminum
Cabinet	Blue vinyl painted aluminum
Trim and Rear Panel	Satin finished chrome

NOTES

SECTION 2
OPERATING INSTRUCTIONS

Change information, if any, affecting this section will be found at the rear of the manual.

WARNING

The Type 576 is considered safe as shipped. Any modification of the interlock system in order to override its purpose of protecting operators from dangerous voltages, will make operation of the instrument potentially hazardous. Operators of the instrument should always be aware of the fact that when the red light is on dangerous voltages may appear at the Collector terminals.

General

This section of the instruction manual provides information necessary for operating the Type 576 and for using it to test various semiconductor devices. Included are setup procedures, a description of the Type 576 controls and connectors, a discussion of the theory of the instrument, a first time operation procedure, and general operating information. Also included is a section describing the use of the Type 576 for measuring the characteristics of various semi-conductor devices.

INITIAL CONSIDERATIONS

Cooling

The Type 576 maintains a safe operating temperature when operated in an ambient temperature between 0°C (32°F) and 50°C (122°F). Adequate clearance on all sides of the instrument should be provided to assure free air flow and dissipation of heat away from the instrument. A thermal cutout in the instrument provides thermal protection by disconnecting the power to the instrument if the internal temperature exceeds a safe operating level. Power is automatically restored when the temperature returns to a safe level. It should be noted that the instrument will turn off under certain conditions of high collector supply current output or high step generator current output even though the instrument is being operated in an ambient temperature which is within the specified range. See foot notes in the Specification section for further information.

Operating Voltage and Frequency

The Type 576 can be operated from either a 115-volt or a 230-volt line voltage source. The LINE VOLTAGE SELECTOR assembly, located on the rear panel, allows conversion of the instrument so that it may be operated from one line voltage or the other. In addition, this assembly changes the connections of the power transformer primary to allow selection of one of three regulating ranges (see Table 2-1). The assembly also includes the two line fuses. When the instrument is converted from 115-volt to 230-volt operation or vice versa, the assembly selects the proper fuse to provide the correct protection for the instrument.

The Type 576 may be operated from either a 50 Hz or a 60 Hz line frequency. In order to synchronize the step generator with the collector supply, the 60 Hz-50 Hz switch, located on the Type 576 rear panel below the LINE VOLTAGE SELECTOR assembly, must be set to the position which corresponds to the line frequency being used.

Use the following procedure to convert this instrument between line voltages, regulating ranges or line frequencies:

1. Disconnect the instrument from the power source.

TABLE 2-1
Regulating Ranges

Range Selector Switch Position	Regulating Range	
	115 Volts Nominal	230 Volts Nominal
LO (switch bar in left holes)	90 to 110 volts	180 to 220 volts
M (switch bar in middle holes)	104 to 126 volts	208 to 252 volts
HI (switch bar in right holes)	112 to 136 volts	224 to 272 volts

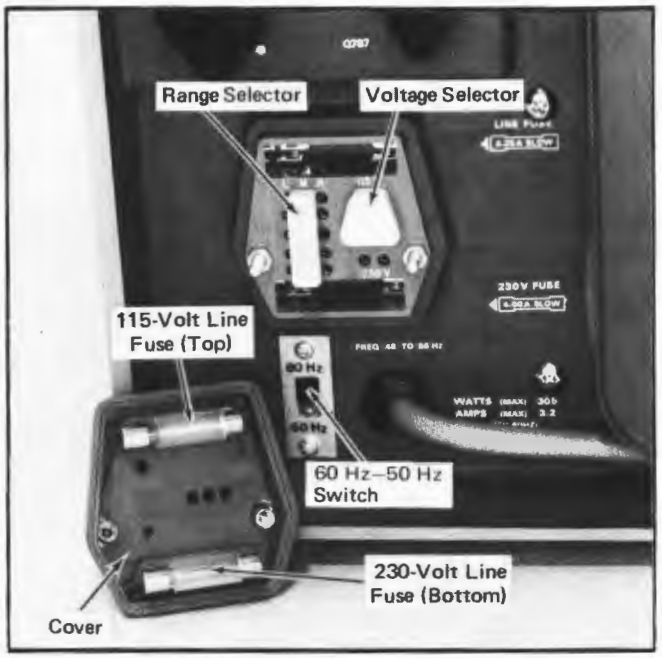


Fig. 2-1. Line Voltage Selector assembly and 60 Hz switch on the rear panel (shown with cover removed).

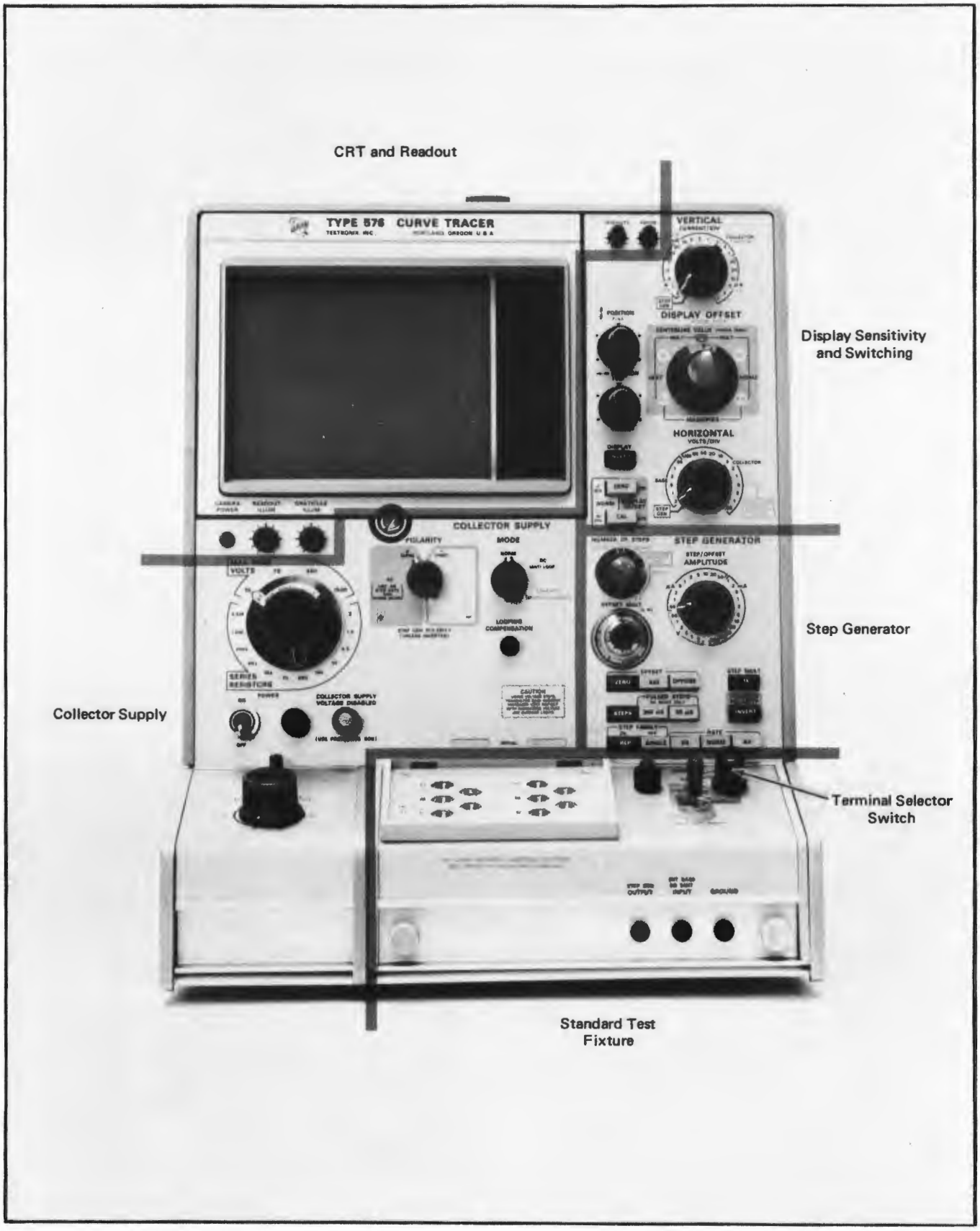


Fig. 2-2. Front-panel controls, connectors and readout.

2. Loosen the two captive screws which hold the cover onto the voltage selector assembly, then pull to remove the cover.

3. To convert from 115-volt to 230-volt line voltage or vice versa, pull out the Voltage Selector switch bar (see Fig. 2-1); turn it 180° and plug it back into the remaining holes. Change the line-cord power plug to match the power-source receptacle or use a 115-to-230-volt power plug adapter.

4. To change regulating ranges, pull out the Range Selector switch bar (see Fig. 2-1) slide it to the desired position and plug it back in. Select a range which is centered about the average line voltage to which the instrument is to be connected (see Table 2-1).

5. Re-install the cover and tighten the two captive screws.

6. To convert from operation with 60 Hz line frequency to operation with 50 Hz line frequency (or vice versa), slide the 60 Hz-50 Hz switch (see Fig. 2-1) to the position which coincides with the line frequency being used.

7. Before applying power to the instrument, check that the indicating tabs on the switch bars are protruding through the correct holes in the voltage selector assembly cover for the desired line voltage and regulating range.

CAUTION

The Type 576 should not be operated with the Voltage Selector switch or the Range Selector switch in the wrong position for the line voltage applied. Operation of the instrument with either of these switches in the wrong position will cause incorrect operation and may damage the instrument.

CONTROLS, CONNECTORS AND READOUT

All controls and connectors required for normal operation of the Type 576 are located on the front and rear panels of the instrument and on the front panel of the standard test fixture (see Figs. 2-2 and 2-3). In addition, readout of some of the instrument functions has been provided on the front panel. Familiarity with the function and use of each of these controls, connectors and the readout is necessary for effective operation of the instrument. The functions are described in the following table.

CRT and Readout

Controls

INTENSITY Control	Controls brightness of display.
FOCUS Control	Provides adjustment for optimum display definition.

Fig. 2-3. Rear-panel controls.

READOUT ILLUM CONTROL	Controls brightness of readout.
SCALE ILLUM Control	Controls graticule illumination.

Connector

CAMERA POWER Connector	Provides +15 volts for operation of camera.

Readouts

PER VERT DIV Readout	Readout indicates deflection factor of vertical display as viewed on CRT.
PER HORIZ DIV Readout	Readout indicates deflection factor of horizontal display as viewed on CRT.
PER STEP Readout	Readout indicates amplitude per step of Step Generator output.
β OR g_m PER DIV Readout	Readout indicates beta or transconductance per division of CRT display.

Display Sensitivity and Positioning

VERTICAL CURRENT/DIV Switch	Selects vertical deflection factor of display. COLLECTOR—Normal operation of instrument. Vertical display represents collector current. Use black units to determine vertical deflection factor.

EMITTER—Operation of instrument with MODE switch set to LEAKAGE (EMITTER CURRENT). Vertical display represents emitter current. Use orange units to determine vertical deflection factor.
STEP GEN—Steps indicating Step Generator output are displayed vertically. AMPLITUDE switch setting per division determines vertical deflection factor.

DISPLAY OFFSET Selector Switch — Allows selection of display offset or display offset and magnification.

NORM (OFF)—Display offset is not operable.
HORIZ X1—Allows horizontal display to be offset using calibrated CENTERLINE VALUE switch.
VERT X1—Allows vertical display to be offset using calibrated CENTERLINE VALUE switch.
HORIZ X10—Horizontal display magnified by 10 times. Allows horizontal display to be offset using calibrated CENTERLINE VALUE switch.
VERT X10—Vertical display magnified by 10 times. Allows vertical display to be offset using calibrated CENTERLINE VALUE switch.

CENTERLINE VALUE Switch — (Clear plastic flange with numbers on it) Provides calibrated offset of display.

X1 (VERT or HORIZ)—Number on CENTERLINE VALUE switch appearing in blue window represents number of divisions centerline of display is offset either vertically or horizontally from zero offset line.
X10 (VERT or HORIZ)—Number on CENTERLINE VALUE switch appearing in blue window multiplied by 10 represents number of divisions centerline of display is offset either vertically or horizontally from zero offset line.

HORIZONTAL VOLTS/DIV Switch — Selects the horizontal deflection factor of display.

COLLECTOR—Horizontal display represents collector voltage to ground.
BASE—Horizontal display represents base voltage to ground.
STEP GEN—Steps indicating Step Generator output are displayed horizontally. AMPLITUDE switch setting per division determines horizontal deflection factor.

ZERO Button — Provides a zero reference for the display.

NORM—When DISPLAY OFFSET selector switch is set to NORM (OFF), ZERO button provides point on CRT of zero vertical and horizontal deflection for adjusting position controls.
DISPLAY OFFSET—When DISPLAY OFFSET Selector switch is in one of four display offset positions, ZERO button provides reference point on CRT which must be positioned to vertical centerline (horizontal offset) or to horizontal centerline (vertical offset) to insure that the CENTERLINE VALUE switch setting applies to centerline. (Should always be checked with DISPLAY OFFSET Selector switch set to MAGNIFIER.)

CAL Button — Provides signal which should cause 10 divisions of vertical and horizontal deflection for checking calibration of vertical and horizontal amplifiers.

NORM—When DISPLAY OFFSET selector switch is set to NORM (OFF), CAL button provides point on CRT of 10 divisions of vertical and horizontal deflection.
DISPLAY OFFSET—When DISPLAY OFFSET Selector switch is in one of four display offset positions, CAL button provides signal which should cause reference point on CRT to appear on vertical centerline (horizontal offset) or on horizontal centerline (vertical offset), assuming zero reference point was properly adjusted. (Check should be performed with DISPLAY OFFSET Selector switch set to MAGNIFIER.)

DISPLAY INVERT Button — Inverts display vertically and horizontally about center of CRT.

POSITION Switch (Horizontal) — Provides coarse positioning of horizontal display.

FINE POSITION Control (Horizontal) — Provides fine positioning of horizontal display.

POSITION Switch (Vertical) — Provides fine positioning of vertical display.

FINE POSITION Control (Vertical) — Provides fine positioning of vertical display.

Collector Supply

Controls

MAX PEAK VOLTS Switch — Selects range of VARIABLE COLLECTOR SUPPLY control. Switch is located below PEAK POWER WATTS switch and range is indicated by white arrow. When switch is set to 75, 350 and 1500, protective box must be used with Standard Test Fixtures (see section on interlock system).

PEAK POWER WATTS Switch — Selects nominal peak power output of Collector Supply, by selecting resistance in series with Collector Supply output. PEAK POWER WATTS is indicated by number on transparent switch flange appearing above white MAX PEAK VOLTS indicator. SERIES RESISTORS are indicated by black indicator. PEAK POWER WATTS switch must be pulled out to set nominal peak power output. When PEAK POWER WATTS switch is set, series resistance is automatically changed to maintain desired nominal peak power output when MAX PEAK VOLTS switch setting is changed.

VARIABLE COLLECTOR SUPPLY Control — Allows varying of collector supply voltage within range set by MAX PEAK VOLTS switch.

POLARITY Switch — Selects polarity of Collector Supply voltage and Step Generator output.

−(PNP)—Collector Supply voltage and Step Generator output are negative-going.

+(NPN)—Collector Supply voltage and Step Generator output are positive-going.

AC—Collector Supply voltage is both positive- and negative-going (sine wave); Step Generator output is positive-going. When switch is set to AC position, use .5X step rate and normal mode of operation.

MODE Switch — Selects mode of operation of Collector Supply.

NORM—Normal Collector Supply output is obtained.

DC (ANTILOOP)—Collector Supply output is DC voltage equal to peak value set by VARIABLE COLLECTOR SUPPLY control.

LEAKAGE (EMITTER CURRENT)—Vertical sensitivity is increased 1000 times. Vertical amplifier measures emitter current. Collector Supply mode set for DC voltage output.

LOOPING COMPENSATION Control — Allows adjustment of looping compensation. Allows compensation of internal and adapter stray capacitance. Does not compensate for device capacitance.

COLLECTOR SUPPLY RESET Button — Resets Collector Supply if it has been disabled by internal circuit breaker. Collector Supply is turned off whenever maximum current rating of transformer primary of 1.2 Amperes is exceeded.

POWER ON-OFF Switch — Controls input power to instrument.

Lights

POWER Light — Lights when power is on.

COLLECTOR SUPPLY VOLTAGE DISABLED Light — Indicates Collector Supply voltage has been disabled. Lights when Collector Supply may present a potentially dangerous voltage at its output. In such a case, use of protective box is required to enable Collector Supply. Also lights when high current generated by Collector Supply or Step Generator causes instrument to overheat.

Step Generator

Controls

NUMBER OF STEPS Switch — Selects number of steps per family of Step Generator output.

CURRENT LIMIT Switch — Provides current limit of the Step Generator output when voltage steps are being produced.

STEP/OFFSET AMPLITUDE Switch — Selects amplitude per step of steps and offset of Step Generator output. Amplitudes within black arc represent current steps; within yellow arc, voltage steps. Note caution on front-panel when using voltage steps.

OFFSET Buttons — Allows offsetting of Step Generator output using OFFSET MULT control.

ZERO—No offset available.

AID—Allows zero step of Step Generator output to be offset as many as 10 steps above its zero offset level.

OPPOSE—Allows zero step of Step Generator output to be offset as many as 10 steps below its zero offset level.

OFFSET MULT Control — Provides calibrated offset of step Generator output to ±10 times AMPLITUDE setting when either OFFSET AID or OFFSET OPPOSE button is pressed.

STEPS Button — Provides steps of normal duration (step lasts for entire period of rate cycle).

PULSED STEPS Buttons — Allows Step Generator output to be applied to Device Under Test for only a portion of normal step duration. Pulsed steps occur at peak of Collector Supply output.

300 μs—Selects pulsed steps with duration of 300 μs. Collector Supply is automatically switched to DC mode.

80 μs—Selects pulsed steps with duration of 80 μs. Collector Supply is automatically switched to DC mode.

300 μs and 80 μs—When buttons are pressed together, selects pulsed steps with duration of 300 μs; however, Collector Supply is not automatically switched to DC mode.

STEP FAMILY Buttons — Allows steps to be generated in repetitive families or one family at a time.

ON REP—Provides repetitive Step Generator output.

OFF SINGLE—Provides one family of steps whenever button is pressed. Once button has been pressed, Step Generator is turned off until pressed again or until ON REP button is pressed.

RATE Buttons — Selects rate at which steps are generated.

NORM—Provides normal Step Generator rate of 1X normal Collector Supply rate (120 steps per second for 60 Hz line frequency).

2X—Provides rate of two times normal rate.

.5X—Provides rate of one half normal rate.

2X and .5X—When buttons are pressed together, provides normal rate but with step transistions occuring at peak of Collector Supply sweep.

STEP/OFFSET POLARITY INVERT Button — Allows change of polarity of Step Generator output (from polarity set by POLARITY switch).

STEP MULT .1X Button — Provides 0.1 times multiplication of step amplitude, but does not effect offset.

Standard Test Fixture

Controls

Terminal Selector Switch — Selects way in which Step Generator is applied to Device Under Test. In all positions Collector Supply output is connected to Collector terminal.

EMITTER GROUNDED—Emitter of Device Under Test is connected to ground.

STEP GEN—Step Generator is applied to base terminal of Device Under Test. Normal operating position.

OPEN (OR EXT)—Base terminal of Device Under Test open. External signal applied to EXT BASE OR EMIT INPUT connector, will be applied to base terminal.

SHORT—Base terminal of Device Under Test is shorted to emitter terminal.

BASE GROUNDED—Base terminal of Device Under Test is connected to ground. Step Generator polarity is inverted.

OPEN (OR EXT)—Emitter terminal of Device Under Test is open. External signal applied to EXT BASE OR EMIT INPUT connector, will be applied to emitter terminal.

STEP GEN—Inverted Step Generator output is applied to emitter of Device Under Test.

LEFT-OFF-RIGHT Switch — Selects which device (choice of 2) is to be tested, left or right.

Interlock Switch — Enables Collector Supply when Protective Box is in place and lid is closed.

Connectors

Adapter Connectors — Allows connection of various test adapters to Standard Test Fixture. Connectors will accept standard size

banana plugs if some other means of connecting Device Under Test to Standard Test Fixture is desired. C, B and E stand for collector, base and emitter, respectively. Unlabeled terminals allow Kelvin sensing of voltage for high current devices.

STEP GEN OUT Connector — Step Generator output signal appears at this connector.

EXT BASE OR EMIT INPUT Connector — Allows input of externally generated signal to either base terminal or emitter terminal of Device Under Test as determined by Terminal Selector Switch.

GROUND Connector — Provides external access to ground reference.

Light

Caution Light — Red light on, indicates Collector Supply is enabled and dangerous voltage may appear at collector terminals.

Rear Panel

Controls

Line Voltage Selector Switches — Switch assembly selects operating voltage and line voltage range. Also includes line fuses.

Voltage Selector—Selects operating voltage (115 V or 230 V).

Range Selector—Selects line voltage range (low, medium, high).

60 Hz-50 Hz Switch — Allows conversion of instrument for operation with either 60 Hz or 50 Hz line frequency.

FRONT PANEL COLORS

The various colors on the front-panel of the Type 576 and Standard Test Fixture indicate relationships between controls and control functions. Table 2-2 shows the relationship which each color indicates.

Table 2-2

Colors and Controls

Color	Relationship
Green	Indicates controls which affect the Step Generator polarity.
Blue	Indicates controls and statements associated with display offset.
Orange	Indicates relationship of LEAKAGE (EMITTER CURRENT) mode with the VERTICAL and HORIZONTAL switches.
Yellow	Indicates controls and statements associated with the voltage mode of operation of the Step Generator.
Black (Buttons)	Indicates function controlled by a single button, which is released for most common applications.
Dark Grey (Buttons)	Indicates function controlled by several buttons, and the dark grey button is pressed for most common applications.

PRECAUTIONS

A number of the Type 576 front-panel controls could, through improper use, cause damage to the device under test. Fig. 2-4 indicates the area of the Type 576 front panel where these controls are located. Care should be exercised when using controls located in this area.

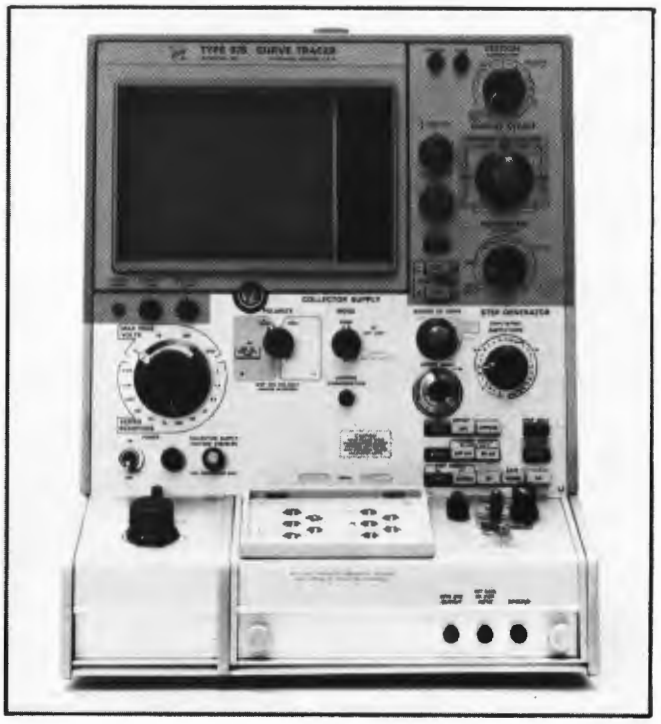


Fig. 2-4. Controls located in light area of Type 576 front-panel could cause damage to a device under test if used improperly.

GENERAL DESCRIPTION OF INSTRUMENT OPERATION

The Type 576 is a semiconductor tester which displays and allows measurement of both static and dynamic semiconductor characteristics obtained under simulated operating conditions. The Collector Supply and the Step Generator produces voltages and currents which are applied to the device under test. The display amplifiers measure the effects of these applied conditions on the device under test.

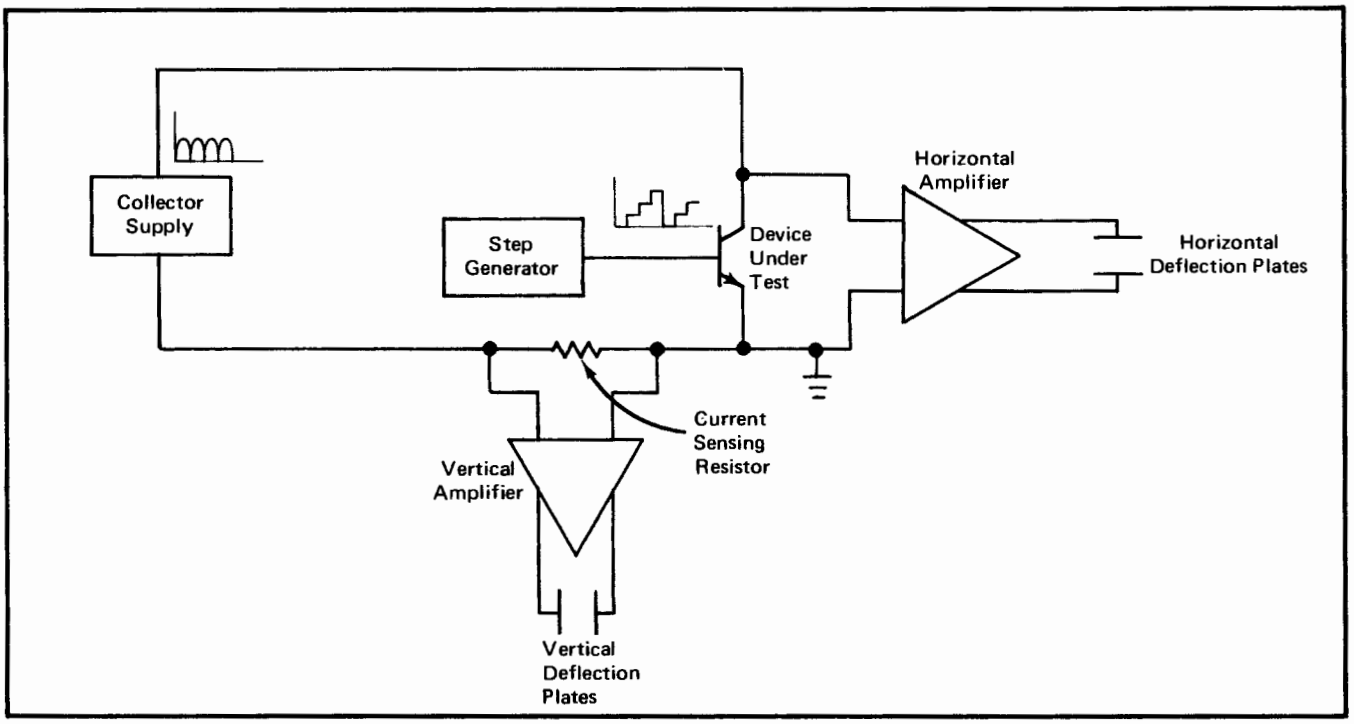


Fig. 2-5. Basic Block diagram showing typical connections of Collector Supply, Step Generator and Display Amplifiers to the device under test.

The result is families of characteristics curves traced on a CRT.

The Collector Supply circuit normally produces a full-wave rectified sine wave which may be either positive- or negative going. The amplitude of the signal can be varied from 0 to 1500 volts as determined by the MAX PEAK VOLTS switch and the VARIABLE COLLECTOR SUPPLY control. This Collector Supply output is applied to the collector (or equivalent) terminal of the device under test.

The Step Generator produces ascending steps of current or voltage at a normal rate of one step per cycle of the Collector Supply. The amount of current or voltage per step is controlled by the AMPLITUDE switch and the total number of steps is controlled by the NUMBER OF STEPS switch. This Step Generator output may be applied to either the base or the emitter (or equivalent) terminals of the device under test.

The display amplifiers are connected to the device under test. These amplifiers measure the effects of the Collector Supply and of the Step Generator on the device under test, amplify the measurements and apply the resulting voltages to the deflection plates of the CRT. The sensitivities of these amplifiers are controlled by the VERTICAL CURRENT/DIV switch and the HORIZONTAL VOLTS/DIV switch.

Fig. 2-5 is a block diagram showing the connection of these circuits to the device under test for a typical measurement.

FIRST TIME OPERATION

When the Type 576 is received, it is calibrated and should be performing within the specification shown in Section 1. The following procedure allows the operator to become familiar with the front panel controls and their functions as well as how they may be used to display transistor or diode characteristics. This procedure may also be used as a general check of the instrument's performance. For a check of the instrument's operation with respect to the specification given in Section 1, the Performance Check and Calibration Procedure in Section 5 must be used.

1. Apply power to the Type 576.

2. Allow the instrument to warm up for a few minutes. Instrument should operate within specified tolerances 5 minutes after it has been turned on.

3. Set the Type 576 and Standard Test Fixture front-panel controls as follows:

READOUT ILLUM	Fully counterclockwise
GRATICULE ILLUM	Fully counterclockwise
INTENSITY	Fully counterclockwise
FOCUS	Centered
VERTICAL	1 mA

DISPLAY OFFSET Selector	NORM (OFF)
CENTERLINE VALUE	0
HORIZONTAL	1 V COLLECTOR
Vertical POSITION	Centered
Vertical FINE POSITION	Centered
Horizontal POSITION	Centered
Horizontal FINE POSITION	Centered
ZERO	Released
CAL	Released
DISPLAY INVERT	Released
MAX PEAK VOLTS	15
PEAK POWER WATTS	0.1
VARIABLE COLLECTOR SUPPLY	Fully Counterclockwise
POLARITY	AC
MODE	NORM
LOOPING COMPENSATION	As is
NUMBER OF STEPS	1
CURRENT LIMIT	20 mA
AMPLITUDE	.05 μA
OFFSET	ZERO
STEPS	Pressed
PULSED STEPS	Released
STEP FAMILY	REP ON
RATE	NORM
POLARITY INVERT	Released
STEP MULT .1X	Released
Terminal Selector	BASE TERM STEP GEN
LEFT-OFF-RIGHT	OFF

CRT and Readout Controls

4. Turn the GRATICULE ILLUM control throughout its range. Note that the graticule lines become illuminated as the control is turned clockwise. Set the control for desired illumination.

5. Turn the READOUT ILLUM control throughout its range. Note that the fiber-optic readouts and the readout titles become illuminated as the control is turned clockwise. Set the control for the desired readout illumination. The readout should read for these initial control settings; 1 mA per vertical division, 1 V per horizontal division, 50 nA per step and 20 k β or g_m per division.

6. Turn the INTENSITY control clockwise until a spot appears at the center of the CRT graticule. To avoid burning the CRT phosphor, adjust the INTENSITY control until the spot is easily visible, but not overly bright.

7. Turn the FOCUS control throughout its range. Adjust the FOCUS control for a sharp, well-defined spot.

Positioning Controls

8. Turn the vertical FINE POSITION control throughout its range. Note that the control has a range of at least ±2.5 divisions about the center horizontal line. Set the control so that the spot is centered vertically on the CRT graticule.

9. Repeat step 8 using the horizontal FINE POSITION control.

10. Turn the vertical coarse POSITION switch. Note that the spot moves 5 divisions vertically each time the switch is moved one position. (The most extreme positions of the switch represent 10 divisions of deflection, which in this case causes the spot to be off the CRT graticule.) Set the POSITION switch to the center position.

11. Repeat step 10 using the horizontal coarse POSITION switch.

12. Set the POLARITY switch to –(PNP). Note that the spot moves to the upper right corner of the CRT graticule.

13. Set the POLARITY switch to +(NPN). Note that the spot moves to the lower left corner of the CRT graticule.

Vertical and Horizontal Sensitivity

14. Install the diode adapter (Tektronix Part No. 013-

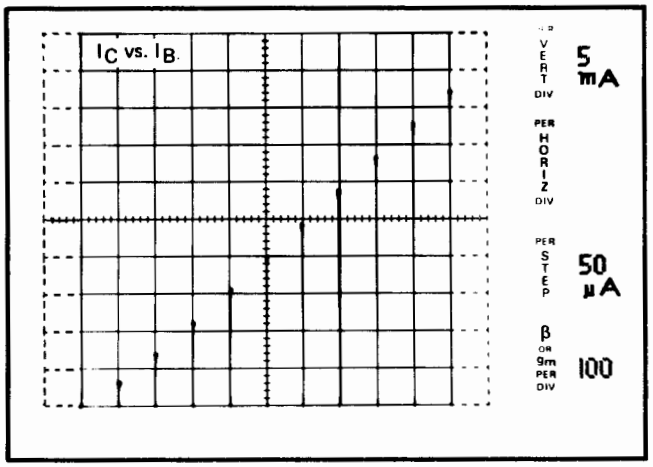


Fig. 2-6. Display of I vs. V for a 1 kΩ resistor using various settings of the VERTICAL and HORIZONTAL switches.

0111-00) into the right-hand set of accessory connectors located on the Standard Test Fixture.

15. Install a 1 kΩ, 1/2 watt resistor in the diode adapter.

16. Set the LEFT-OFF-RIGHT switch to RIGHT and turn the VARIABLE COLLECTOR SUPPLY control until a trace appears diagonally across the CRT.

17. Turn the VERTICAL switch clockwise and note that as the vertical deflection factor decreases the slope of the line increases (see Fig. 2-6). Turn the VERTICAL switch counterclockwise from the 1 mA position and note that the slope decreases. Also note that the PER VERT DIV readout changes in accordance with the position of the VERTICAL switch. Reset the VERTICAL switch to 1 mA.

18. Repeat step 17 using the HORIZONTAL switch within the COLLECTOR range of the switch. The change in slope of the trace will be the inverse of what it was for the VERTICAL switch. Reset the HORIZONTAL switch to 1 V COLLECTOR.

19. Press the ZERO button. Note that the diagonal trace reduces to a spot in the lower left corner of the CRT graticule. This spot denotes the point of zero deflection of the vertical and horizontal amplifiers. Release the ZERO button.

20. Press the CAL button. Note that the diagonal trace reduces to a spot in the upper right corner of the CRT graticule. The position of this spot indicates 10 divisions of deflection both vertically and horizontally. Release the CAL button.

21. Press the DISPLAY INVERT button and turn the VARIABLE COLLECTOR SUPPLY control counterclockwise. Note that the display has been inverted and is now originating from the upper right corner of the CRT graticule. Release the DISPLAY INVERT button.

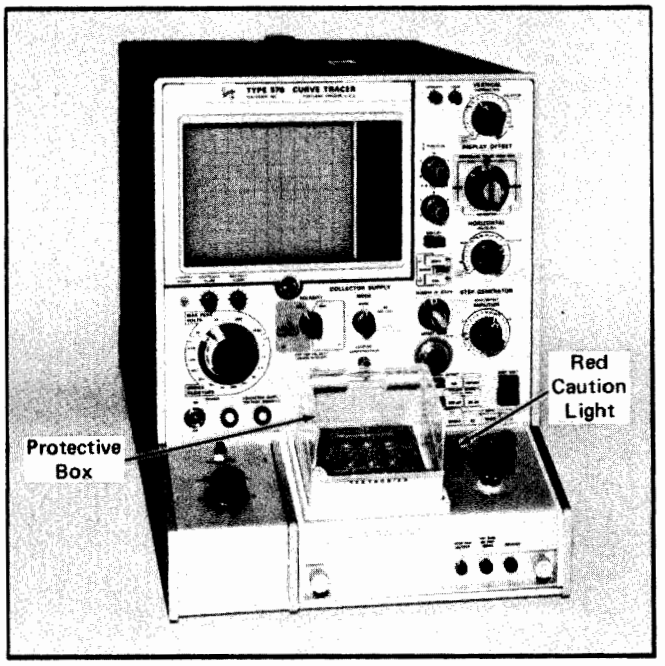


Fig. 2-7. Type 576 Standard Test Fixture with protective box installed for safe operation.

Collector Supply

22. Turn the MAX PEAK VOLTS switch throughout its range. Note that when the switch is in the 75, 350 and 1500 positions, the yellow light comes on.

23. While the yellow light is on, turn the VARIABLE COLLECTOR SUPPLY control fully clockwise. Note that the diagonal line obtained in step 16 does not appear. When the yellow light is on, the Collector Supply is disabled.

24. Set the following Type 576 controls:

MAX PEAK VOLTS	75
VARIABLE COLLECTOR SUPPLY	Fully counterclockwise
LEFT-OFF-RIGHT	OFF

25. Install the protective box on the Standard Test Fixture as shown in Fig. 2-7.

26. Close the lid of the protective box and note that the yellow light turns off and the red light turns on.

WARNING

The red light indicates that dangerous voltages may appear at the collector terminals of the Standard Test Fixture.

27. Set the LEFT-OFF-RIGHT switch to RIGHT and turn the VARIABLE COLLECTOR SUPPLY control clockwise. Note that the diagonal trace appears indicating that the Collector Supply has been enabled.

28. Set the following Type 576 controls to:

MAX PEAK VOLTS	15
VARIABLE COLLECTOR SUPPLY	Fully Counterclockwise

(The protective box may be removed if desired.)

29. Turn the VARIABLE COLLECTOR SUPPLY control until the diagonal trace reaches the center of the CRT graticule. Pull out on the PEAK POWER WATTS switch and set it to 220. Note that the diagonal trace lengthens as the switch is turned through its range. Also note that the SERIES RESISTORS decrease as the maximum peak power is increased.

30. Allow the MAX PEAK VOLTS switch and the PEAK POWER WATTS switch to become interlocked and switch to 75. Note that the maximum peak power value remains at 220 and that the SERIES RESISTORS values change.

31. Set the following Type 576 controls to:

HORIZONTAL	.1 V COLLECTOR
MAX PEAK VOLTS	15
VARIABLE COLLECTOR SUPPLY	Fully Counterclockwise
PEAK POWER WATTS	0.1
LEFT-OFF-RIGHT	OFF

32. Remove the resistor from the diode adapter and replace it with a silicon diode. Align the diode so that its cathode is connected to the emitter terminal.

33. Set the LEFT-OFF-RIGHT switch to RIGHT and turn the VARIABLE COLLECTOR SUPPLY control clockwise. Note the display of the forward voltage characteristic of the diode. (see Fig. 2-8).

34. Set the COLLECTOR SUPPLY POLARITY switch to −(PNP). Note the display of the reverse voltage characteristic of the diode (see Fig. 2-8).

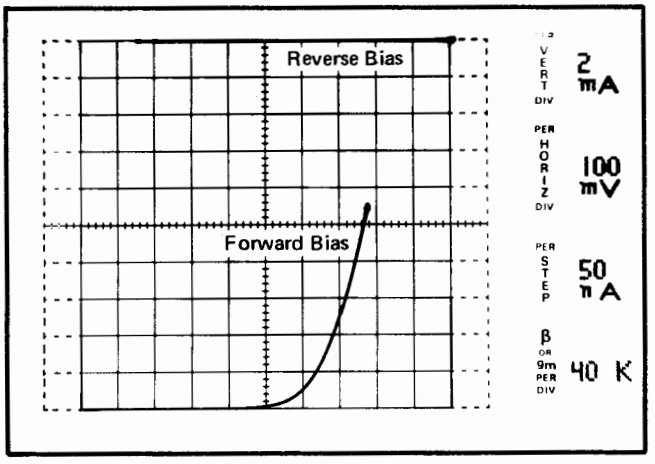


Fig. 2-8. Display of forward and reverse bias characteristics of a signal diode.

35. Set the following Type 576 controls to:

POLARITY	+ (NPN)
MODE	DC

Note that the display of the forward voltage diode characteristic has become a spot. The spot indicates the current conducted by the diode and the voltage across it.

36. Turn the VARIABLE COLLECTOR SUPPLY control counterclockwise. Note that the spot traces out the diode characteristic.

37. Set the following Type 576 controls to:

VERTICAL	1 μA
HORIZONTAL	2 V COLLECTOR
Vertical POSITION	Display Centered
VARIABLE COLLECTOR SUPPLY	Fully Clockwise
MODE	NORM
LEFT-OFF-RIGHT	LEFT

38. Adjust the LOOPING COMPENSATION control for minimum trace width (see Fig. 2-9).

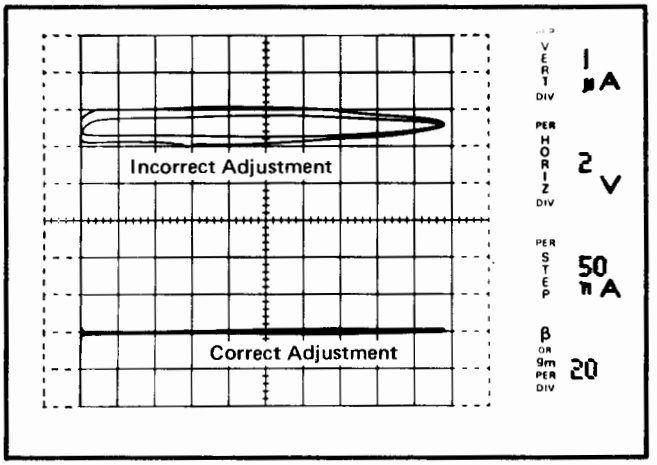


Fig. 2-9. Adjustment of LOOPING COMPENSATION control.

39. Set the following Type 576 controls to:

VERTICAL	5 mA
Vertical POSITION	Switch centered
VARIABLE COLLECTOR SUPPLY	Fully Counterclockwise
POLARITY	AC
LEFT-OFF-RIGHT	OFF

40. Remove the diode from the diode adapter and replace it with an 8 volt Zener diode. Align the diode so that its cathode is connected to the emitter terminal.

41. Set the LEFT-OFF-RIGHT switch to RIGHT and turn the VARIABLE COLLECTOR SUPPLY control clockwise. Note that the display shows both the forward and reverse characteristics of the Zener diode (see Fig. 2-10).

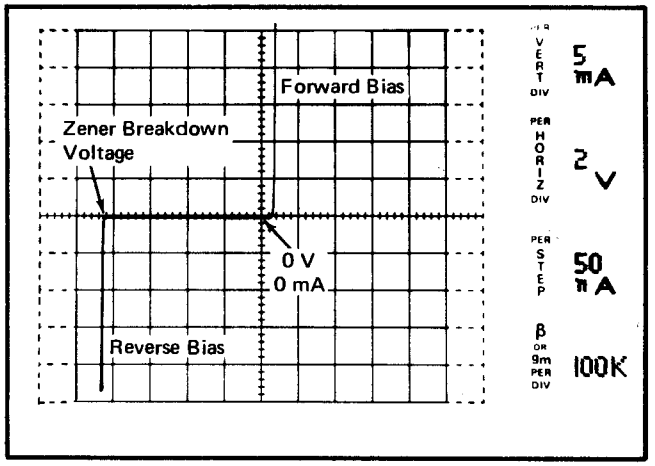


Fig. 2-10. Display of Zener diode I vs. V characteristic with POLARITY switch set to AC.

Display Offset and Magnifier

42. Set the Type 576 POLARITY switch to −(PNP). Note the display of the reverse voltage characteristic of the Zener diode.

Note the display of the reverse voltage characteristic of the Zener diode.

43. Position the display to the center of the CRT graticule with the vertical POSITION switch (see Fig. 2-11A).

44. Set the DISPLAY OFFSET Selector switch to HORIZ X10. Press the ZERO button and, using the horizontal FINE POSITION control, adjust the spot so that it is on the center vertical line of the CRT graticule. This spot position represents the zero offset position. Release the ZERO button and set the DISPLAY OFFSET Selector switch to HORIZ X1.

45. Turn the CENTERLINE VALUE switch from the 0 position counterclockwise, until the Zener breakdown portion of the display is within ±0.5 divisions of the center vertical line (see Fig. 2-11B). Note the number on the CENTERLINE VALUE switch which appears in the blue window below the word DIV. This number multiplied by the PER HORIZ DIV readout value gives the approximate value of the breakdown voltage of this Zener diode. For the diode in the example shown in Fig. 2-11, the approximate Zener breakdown voltage is 4 divisions times 2 V/division = 8 volts.

46. Set the DISPLAY OFFSET Selector switch to HORIZ X10. Note that PER HORIZ DIV readout value has changed to indicate the 10 times multiplication. By expanding the scale, a measurement can be made of that part of the characteristic which was not quite offset to the center vertical line of the CRT graticule (see Fig. 2-11C). This value when added to the approximate value (or subratcted

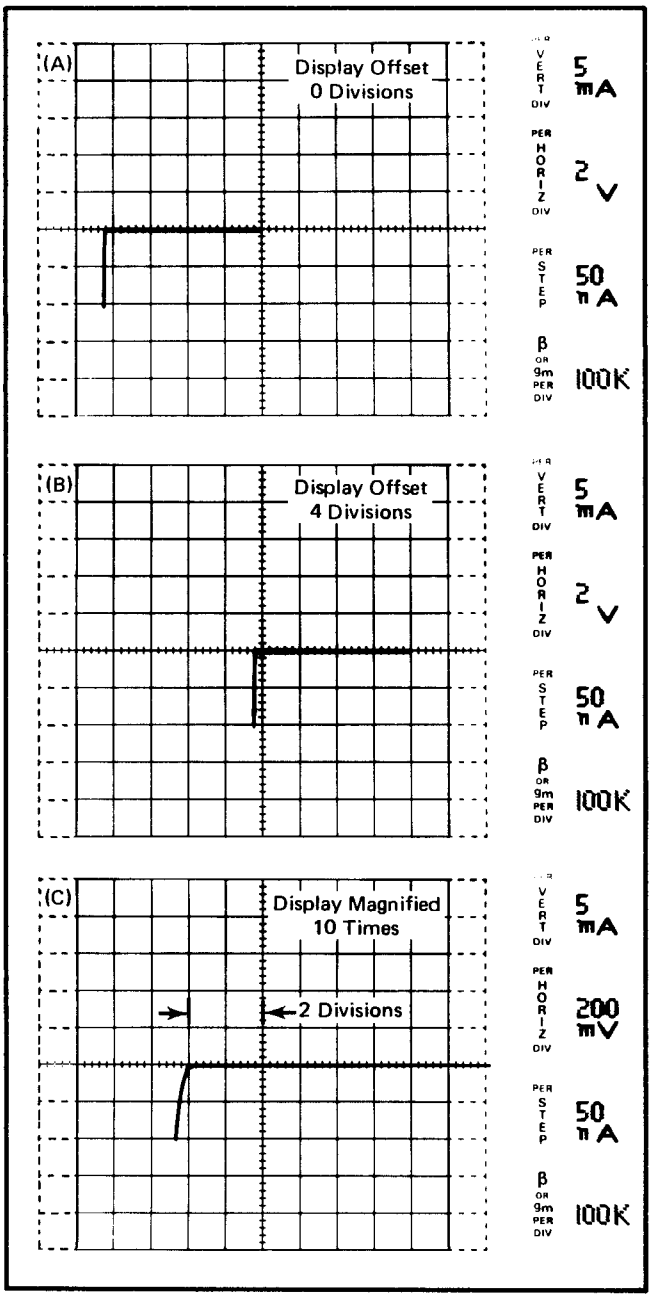


Fig. 2-11. Displays of measurement of Zener breakdown voltage using the DISPLAY OFFSET Selector and CENTERLINE VALUE switches, (A) DISPLAY OFFSET Selector switch set to HORIZ X1 and CENTERLINE VALUE switch set to 0; (B) CENTERLINE VALUE switch set to 4; (C) DISPLAY OFFSET Selector switch set to HORIZ X10.

if the approximate value was greater than the actual value) produces a more exact measurement of the breakdown voltage. In the example shown in Fig. 2-11, 400 mV should be

added to the approximate estimate, yielding a value of 8.4 for the Zener voltage of the diode. The same process can also be carried out using vertical display offset and magnification.

Step Generator

47. Set the following Type 576 controls to:

DISPLAY OFFSET Selector	NORM (OFF)
CENTERLINE VALUE HORIZONTAL	0 1 V COLLECTOR
Vertical POSITION	Switch centered
POLARITY	+(NPN)
VARIABLE COLLECTOR SUPPLY	Fully Counterclockwise
LEFT-OFF-RIGHT	OFF

48. Remove the diode adapter and replace it with a transistor adapter (Tektronix Part No. 013-0098-02).

49. Place an NPN silicon transistor into the right transistor test socket of the universal transistor adapter.

50. Set the LEFT-OFF-RIGHT switch to RIGHT and turn the VARIABLE COLLECTOR SUPPLY clockwise until the peak collector-emitter voltage is about 10 volts.

51. Turn the AMPLITUDE switch until a step appears on the CRT. Note that the greater the step amplitude, the greater the collector current (see Fig. 2-12). Set the AMPLITUDE for the minimum step amplitude which produces a noticeable step in the display.

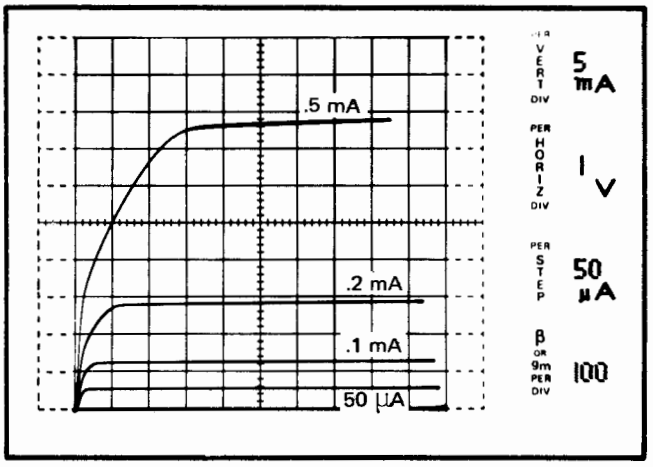


Fig. 2-12. Collector current vs. Collector-Emitter voltage for various settings of the AMPLITUDE switch.

52. Turn the NUMBER OF STEPS switch clockwise. Be sure the PEAK POWER WATTS switch is set within the power dissipation rating of the transistor being used. Note the display of collector current vs. collector-emitter voltage for ten different values of base current (see Fig. 2-13A).

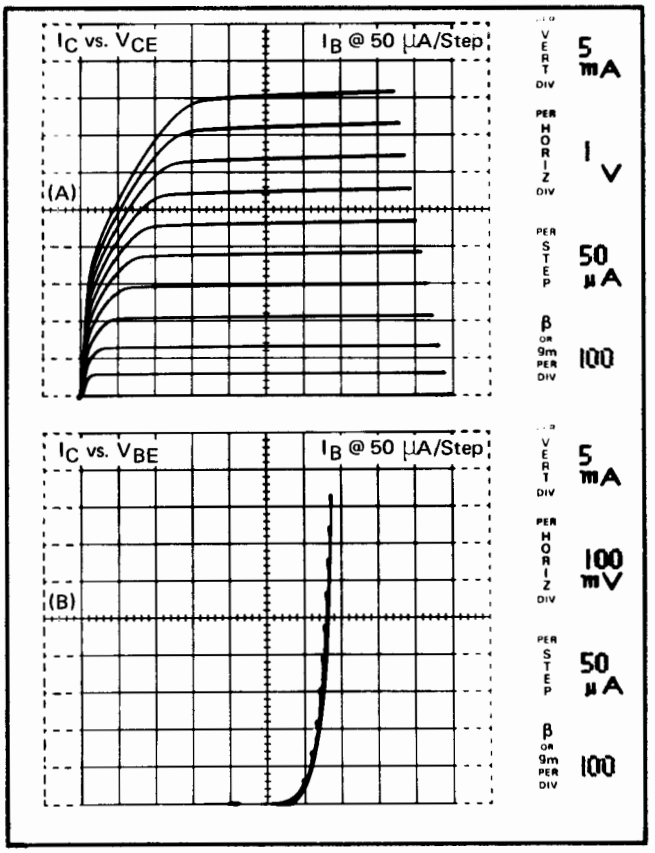


Fig. 2-13. (A) I_C vs. V_{CE} for 10 steps of base current at 50 µA per step; (B) I_C vs. V_{BE} for 10 steps of lease current at 50 µA per step.

53. Set the HORIZONTAL switch to .1 V BASE. Note the display of the collector current vs. base-emitter voltage for ten different values of base current (see Fig. 2-13B).

54. Set the VERTICAL switch to STEP GEN and the HORIZONTAL switch to 1 V COLLECTOR. Note the display of the base current, one step per vertical division, vs. the collector-emitter voltage (see Fig. 2-14A).

55. Set the HORIZONTAL switch to .1 V Base. Note the display of base current, one step per vertical division, vs. base-emitter voltage (see Fig. 2-14B)

56. Set the VERTICAL switch to 5 mA and the HORIZONTAL switch to STEP GEN. Note the display of collector current vs. base-current, one step per horizontal division (see Fig. 2-15).

57. Set the following Type 576 controls to:

HORIZONTAL	1 V COLLECTOR
RATE	.5X

Note that the step rate is slower than the normal rate.

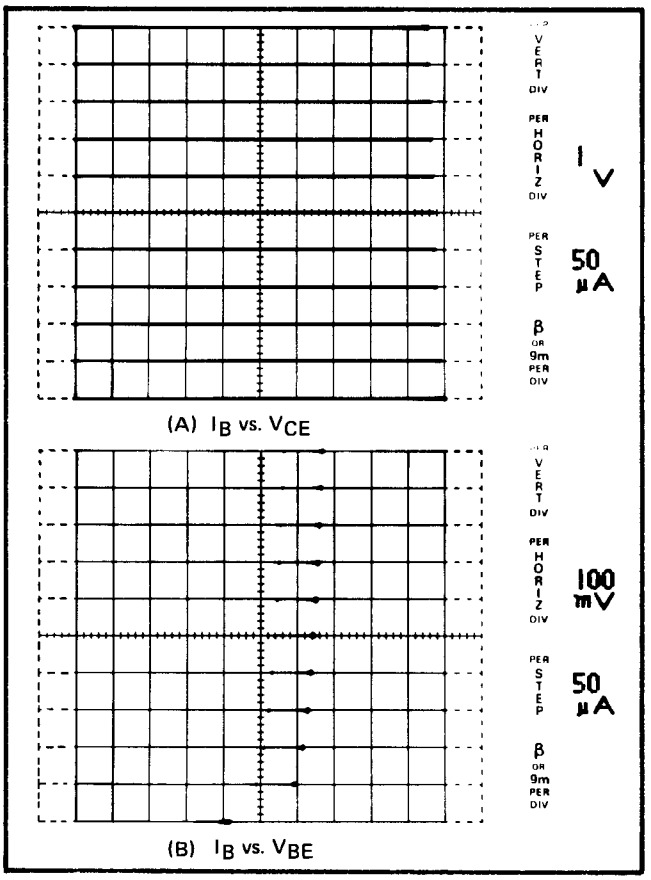


Fig. 2-14. (A) I_B vs. V_{CE}, I_b @ 50 µA per division; (B) I_B vs. V_{BE}, I_B @ 50 µA per division.

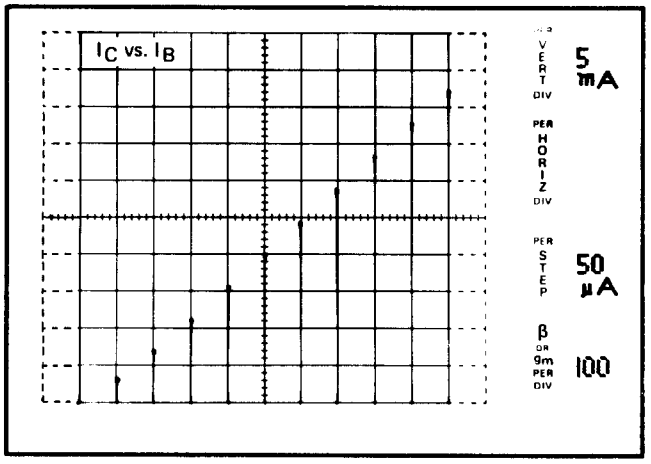


Fig. 2-15. I_C vs. I_B, I_B @ 50 µA per division.

58. Press the NORM RATE button and then the 2X RATE button. Note that the step rate is faster than the normal rate.

59. Press both the 2X RATE and .5X RATE buttons. Note that the step rate is normal, but that the steps occur at the peak of each collector sweep, rather than at the beginning of each collector sweep, as when the NORM RATE button is pushed.

60. Press the SINGLE STEP FAMILY button. Press it again. Note that each time the SINGLE button is pressed, a single family of characteristic curves is displayed and then the Step Generator turns off.

61. Set the following Type 576 controls to:

STEP FAMILY	REP ON
RATE	NORM
PULSED STEPS	300 µs

Note that the collector supply is in the DC mode and that each step is in the form of a pulse. (See Fig. 2-16A.) (Readjustment of the INTENSITY control may be necessary.)

62. Press the 80 µs button. Note that the duration of each pulsed step is reduced.

63. Press both the 300 µs and the 80 µs buttons. Note that the Collector Supply is in the normal mode and the steps are occurring at the peak of the collector sweep, with a duration as observed in step 61 (see Fig. 2-16B).

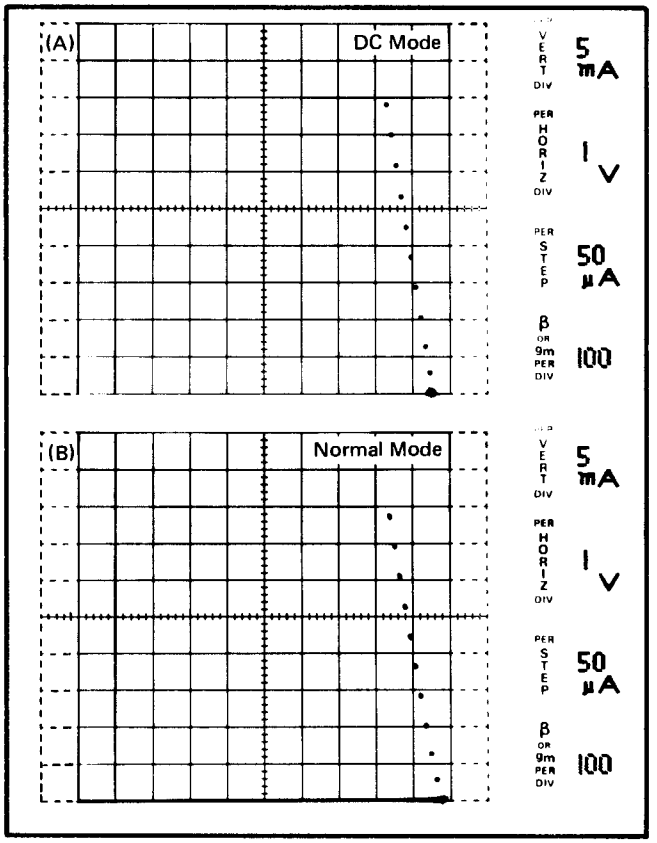


Fig. 2-16. 300 µs PULSED STEPS, (A) DC mode; (B) Normal mode.

64. Set the Type 576 LEFT-OFF-RIGHT switch to OFF and remove the universal transistor adapter from the Standard Test Fixture. (Leave the transistor in the adapter). Install the universal FET adapter (Tektronix Part No. 013-0099-02) on the Standard Test Fixture and place an N-channel junction FET into the right test socket of the adapter.

65. Set the following Type 576 controls to:

INTENSITY	Visible Display
VERTICAL	.5 mA
VARIABLE COLLECTOR SUPPLY	Fully Counterclockwise
AMPLITUDE	.1 V
STEPS	Pressed

66. Set the LEFT-OFF-RIGHT switch to RIGHT and turn the VARIABLE COLLECTOR SUPPLY control slowly clockwise. Note the display of drain current vs. drain-source voltage with voltage steps of 0.1 V/step

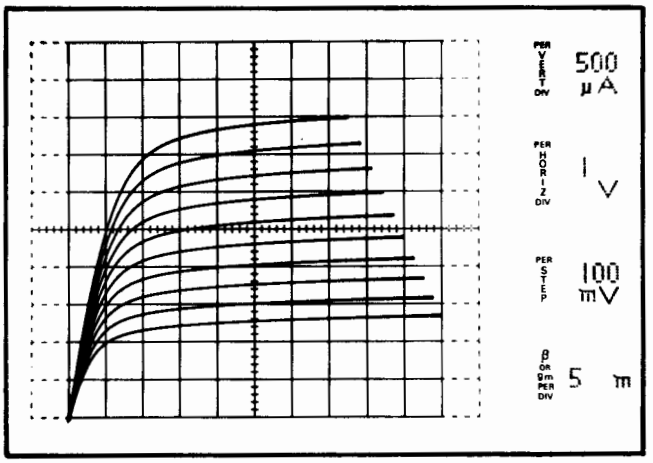


Fig. 2-17. Display of FET common-source characteristic curves: I_D vs. V_{DS} for 10 steps of gate voltage at 0.05 volts/step.

applied to the gate (see Fig. 2-17). Since the steps applied to the gate are positive-going, the curves displayed represent enhancement mode operation of the FET. (Press the SINGLE STEP FAMILY button to locate the curve obtained with zero volts on the gate.)

67. Press the POLARITY INVERT button and note the display of the depletion mode of operation of the FET (see Fig. 2-17). (Press SINGLE STEP FAMILY button for zero bias curve.)

68. Set the Type 576 LEFT-OFF-RIGHT switch to OFF. Remove the universal FET test adapter and replace it with the universal transistor test adapter (with the transistor still in it.)

69. Set the following Type 576 controls to:

VERTICAL	5 mA
AMPLITUDE	Current Steps
NUMBER OF STEPS	5
POLARITY INVERT	Released

Set the AMPLITUDE switch and the VARIABLE COLLECTOR SUPPLY control for a family of curves similar to Fig. 2-18A.

70. Note the β or g_m per division readout. By measuring the vertical divisions between two curves of the displayed family, the β of the device in that region can be determined. For example, there is approximately 0.9 division between the fourth and fifth steps shown in Fig. 2-18A. The β of the device when operated in this region is, therefore, approximately 0.9 (100) or (90). To make a more accurate measurement of β, the difference in both collector and base current between the fourth and fifth steps should be less.

71. Press the OFFSET AID button and set the OFFSET MULT control to 4. Note that the offset current has been added to the Step Generator output so that the zero step is now at the level of the fourth step displayed.

72. Press the STEP MULT .1X button. Note that the current per step is now 1/10 of the value set by the AMPLITUDE switch. Check the PER STEP readout for the new amplitude per step. (See Fig. 2-18B.)

73. Set the DISPLAY OFFSET Selector switch to VERT X1 and turn the CENTERLINE VALUE switch counterclockwise until the first step is within ±0.5 division of the center horizontal line.

74. Set the DISPLAY OFFSET Selector switch to VERT X10. Note that though the β per division is still 100 as it was in step 70, the change in collector and base current (ΔI_C and ΔI_B) is less between the fourth and the fifth step. This allows for a more accurate measurement of β at the level of the fourth step (see Fig. 2-18C). The β of the device at the fourth step now measures at about 0.8 (100) = 80

75. Set the following Type 576 controls to:

VERTICAL	1 mA
DISPLAY OFFSET Selector	NORM (OFF)
AMPLITUDE	.1 V
NUMBER OF STEPS	1
OFFSET MULT	0
STEP MULT	Released

76. Turn the OFFSET MULT control until a step just begins to appear on the CRT. Note the multiplier value on the OFFSET MULT control. This number times the AMPLITUDE switch setting is the base-to-emitter turn on voltage of the transistor.

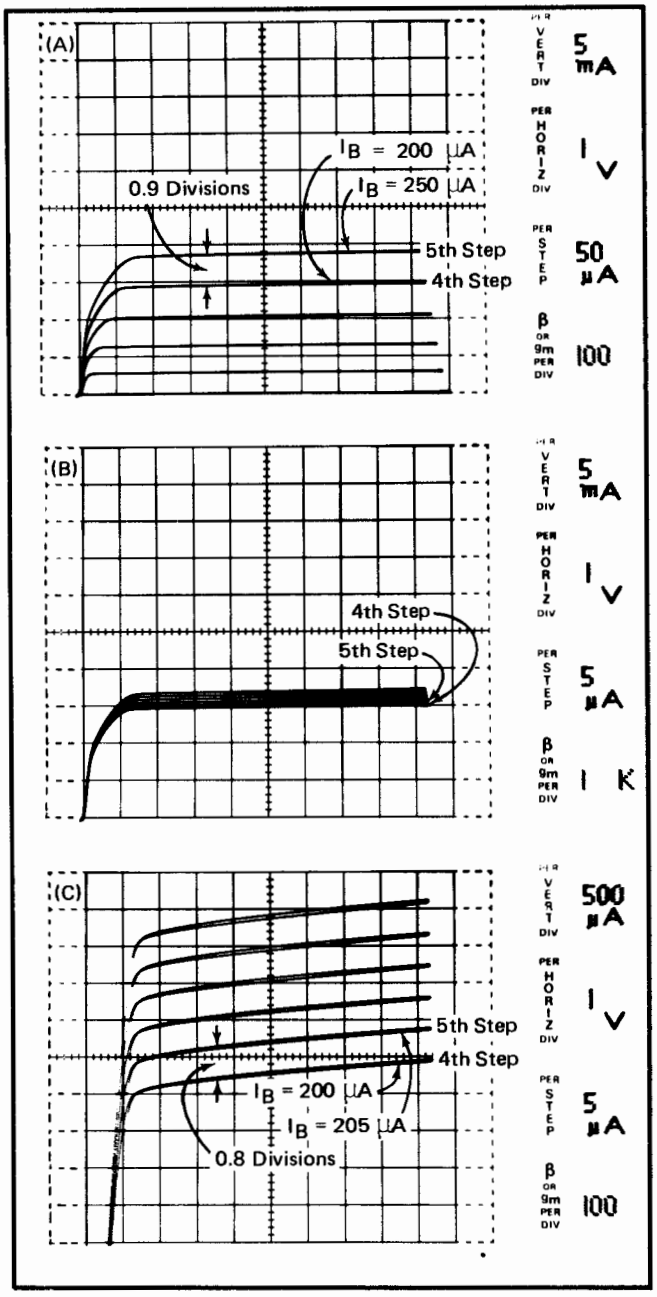


Fig. 2-18. Measurement of β of transistor, (A) Coarse measurement; (B) Offsetting of display and .1X multiplication of step amplitude; (C) 10X magnification of vertical display.

Standard Test Fixture

77. Set the following Type 576 controls to:

AMPLITUDE	1 µA
OFFSET	ZERO
NUMBER OF STEPS	10

78. Adjust the AMPLITUDE switch for a display of the characteristic curves with the emitter grounded and the current steps applied to the base (see Fig. 2-19A).

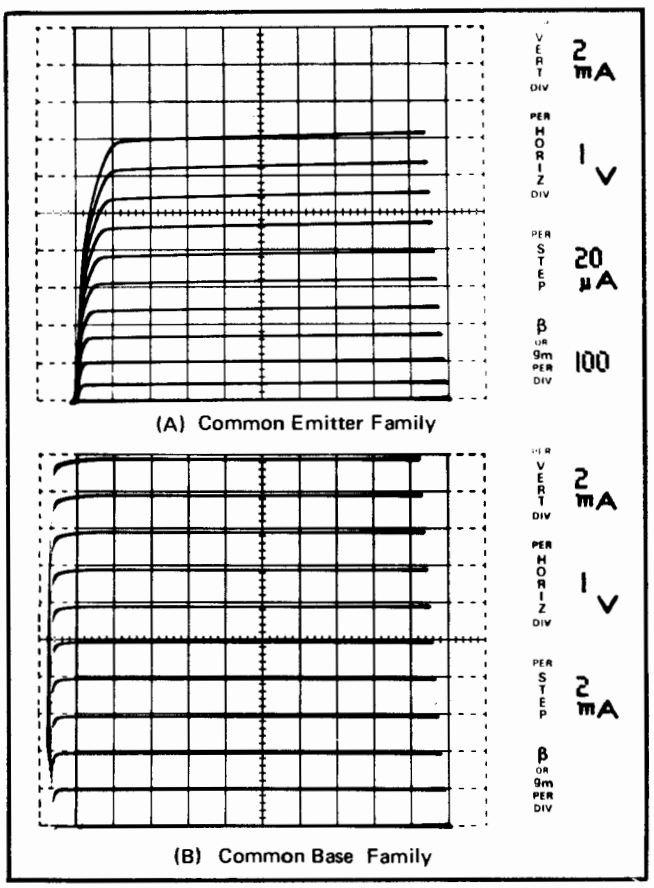


Fig. 2-19. (A) Terminal Selector switch set to BASE TERM STEP GEN (NORM); (B) Terminal Selector switch set to EMITTER TERM STEP GEN.

79. Set the LEFT-OFF-RIGHT switch to OFF and the STEP FAMILY button to OFF. Take a patch cord with banana plugs on each end and connect it between the STEP GEN OUTPUT connector and the EXT BASE OR EMIT INPUT connector.

80. Set the following Type 576 controls to:

STEP FAMILY	ON
LEFT-OFF-RIGHT	RIGHT
Terminal Selector	BASE TERM OPEN (OR EXT)

Note a display similar to that seen in step 78.

81. Set the following Type 576 controls to:

VERTICAL	1 nA EMITTER
MODE	LEAKAGE
VARIABLE COLLECTOR SUPPLY	Fully Counterclockwise
STEP FAMILY	OFF

Remove the patch cord.

82. Turn the VARIABLE COLLECTOR SUPPLY control clockwise and note the display of emitter leakage current with the base terminal open.

83. Set the Terminal Selector switch to SHORT and note the display of emitter leakage current with the base terminal shorted to ground.

84. Set the following Type 576 controls to:

VERTICAL	5 mA
AMPLITUDE	5 mA
MODE	NORM
Terminal Selector	EMITTER TERM STEP GEN
STEP FAMILY	ON

Turn the VARIABLE COLLECTOR SUPPLY control clockwise and note the display of collector current vs. collector-emitter voltage with current steps applied to the emitter of the transistor (see Fig. 2-19B).

85. Set the following Type 576 controls to:

STEP FAMILY	OFF
Terminal Selector	EMITTER TERM OPEN (OR EXT)

Reconnect the patch cord between the STEP GEN OUTPUT connector and the EXT BASE OR EMIT INPUT connector.

86. Set the STEP FAMILY button to ON and note a display similar to that seen in step 84.

This completes the first-time operation.

GENERAL OPERATING INFORMATION

CRT

The CRT in the Type 576 has a permanently etched internal graticule. The graticule is 10 divisions by 12 divisions, each division being 1 cm. Illumination of the graticule is controlled by the GRATICULE ILLUM control. Protective shields for the CRT and the fiber-optic readout display are fitted to the bezel. The bezel covers the CRT and the fiber-optic readout display. To remove, loosen the securing screw and pull out on the bottom of the bezel.

A blue filter has been provided to improve the contrast of the display when the ambient light is intense. This filter may be installed (or removed) by removing the bezel and sliding the filter from between the CRT protective shield and the bezel frame.

Readout

The readout located to the right of the CRT is made up of the fiber-optic displays and their titles. The fiber-optic displays show numbers and units (5 mA, 2 V, etc.) the values of which are a function of front-panel control settings. The titles are words printed on the fiber-optic display shield attached to the bezel. These words indicate the characteristics of the CRT display to which each fiber-optic display is related (PER VERT DIV, PER STEP, etc.). Illumination of the titles and the fiber-optic diplays is controlled by the READOUT ILLUM control. It should be noted that as the illumination of the readout is reduced, the fiber-optic display of β or g_m per division turns off before the other fiber-optic displays.

Intensity

The intensity of the display on the CRT is controlled by the INTENSITY control. This control should be adjusted so that the display is easily visible but not overly bright. It will probably require readjustment for different displays. Particular care should be exercised when a spot is being displayed. A high intensity spot may burn the CRT phosphor causing permanent damage to the CRT.

Focus

The focus of the CRT display is controlled by the FOCUS control. This control should be adjusted for optimum display definition.

Positioning

The position of the display on the CRT graticule, both vertically and horizontally, is controlled by four sets of controls: the vertical and horizontal POSITION controls, the POLARITY switch, the DISPLAY OFFSET controls and the DISPLAY INVERT, ZERO and CAL buttons.

The position controls provide coarse and fine positioning of the display both vertically and horizontally. Each coarse POSITION switch provides 5-division increments of display positioning. Each FINE POSITION control has a continuous range of greater than 5 divisions. The position controls should not be used to position the zero reference off the CRT. The DISPLAY OFFSET controls may be used for this purpose. If the display is magnified either vertically or horizontally using the DISPLAY OFFSET Selector switch, the ranges of the position controls are increased 10 times.

The POLARITY switch positions the zero signal point of a display (located by pressing the ZERO button) to a position convenient for making measurements on an NPN device, a PNP device or when making an AC measurement.

The DISPLAY OFFSET controls provide calibrated offset (or positioning) of the display either vertically or horizontally. These controls may be used either to make a measurement or to position particular portions of a display, which has been magnified, on the CRT graticule. The DISPLAY OFFSET Selector switch determines whether the display will be offset vertically or horizontally and the CENTERLINE VALUE switch provides the offset. Under unmagnified conditions, 10 divisions of offset are available. When the DISPLAY OFFSET Selector switch is set to one of its MAGNIFIER positions, 100 divisions of offset are available.

When making a measurement using the DISPLAY OFFSET controls, the CRT graticule becomes a window. When the CENTERLINE VALUE switch is set to 0, the vertical centerline (horizontal offset) or the horizontal centerline (vertical offset) of the window is at the zero signal portion of the display. As the CENTERLINE VALUE switch is turned counterclockwise, the window moves either vertically or horizontally along the display. For each position of the CENTERLINE VALUE switch, the number on the switch appearing in the blue window represents the number of divisions the vertical centerline or the horizontal centerline has been offset from the zero offset line. If the display has been magnified, the number in the blue window must be multiplied by 10.

The ZERO button provides a convenient means of positioning the zero reference point on the CRT graticule. Under normal operating conditions (DISPLAY OFFSET Selector switch set to NORM) when the ZERO button is pressed, a zero reference spot appears on the CRT graticule. This spot indicates the point on the CRT where zero signal is being measured by the vertical and horizontal display amplifiers. With the button pressed, the positioning controls may be used to position the spot to a point on the CRT graticule which makes measurements convenient. If the DISPLAY OFFSET Selector switch is set to VERT or HORIZ, the zero reference point indicates the horizontal or vertical graticule line, respectively, to which the CENTERLINE VALUE switch setting applies. To assure the accuracy of the CENTERLINE VALUE switch settings, the zero reference spot should be adjusted (using the positioning controls) to the appropriate centerline for the offset being used. For maximum accuracy of measurement, the position of this zero reference point should be adjusted with the DISPLAY OFFSET Selector switch in one of its MAGNIFIER positions.

The CAL button provides a means of checking the calibration of the display amplifiers. Under normal operating conditions (DISPLAY OFFSET Selector switch set to NORM) when the CAL button is pressed, a calibration reference spot appears on the CRT. This spot represents a signal applied to both the vertical and the horizontal display amplifiers which should cause 10 divisions deflection on the CRT graticule both vertically and horizontally. If the position of this spot is compared with the position of the spot obtained when the ZERO button is pressed, the accuracy of calibration of the display amplifiers can be determined. When the DISPLAY OFFSET Selector switch is set to either VERT or HORIZ, the calibration reference spot should appear on the vertical centerline (horizontal offset) or the horizontal centerline (vertical offset), assuming the zero reference point is properly adjusted. This calibration check should be made with the DISPLAY OFFSET Selector switch in either HORIZ X10 or VERT X10. Any departure of the calibration reference spot from the centerline, when this check is made, represents an error of 1% per division in the display offset.

The DISPLAY INVERT button provides a means of inverting the display on the CRT. When the DISPLAY INVERT button is pushed, the inputs to the display amplifiers are reversed, causing the display on the CRT to be inverted both vertically and horizontally about the center of the graticule.

If the position controls are centered, the zero and calibration references spots should appear in particular positions on the graticule depending on the positions of the POLARITY switch and the DISPLAY OFFSET Selector switch. Fig. 2-20 shows these positions of the spot for the various settings of the two switches. To determine the spot positions when the INVERT button is pressed, assume the graticule shown is inverted both vertically and horizontally.

Vertical Measurement and Deflection Factor

In the vertical dimension, the display on the CRT measures either collector current (I_C), emitter current (I_E) or the output of the Step Generator. The MODE switch and the VERTICAL switch determine which of these measurements are made.

The Vertical deflection factor of the display on the CRT is controlled by the VERTICAL switch, the DISPLAY OFFSET Selector switch and the MODE switch. The PER VERT DIV readout to the right of the CRT indicates the vertical deflection factor due to the combined effects of these three controls.

Under normal operating conditions, with the MODE switch set to NORM and the DISPLAY OFFSET Selector switch set to NORM (OFF), collector current is measured vertically and the VERTICAL switch determines the vertical sensitivity of the display.

When measuring collector current, the VERTICAL switch provides deflection factors (unmagnified) ranging from 1 μA/division to 2 A/division. The vertical deflection factor is indicated either by the PER VERT DIV readout or by the position of the VERTICAL switch, using the letters printed in black to determine units. The readout and the switch position should coincide.

When the MODE switch is set to LEAKAGE (EMITTER CURRENT) the CRT display measures emitter current vertically. In this case the vertical sensitivity of the display is increased by 1000 times for each position of the VERTICAL switch. The vertical deflection factor is indicated either by the PER VERT DIV readout or by the position of the VERTICAL switch, using the letters printed in orange to determine units. When the MODE switch is set to LEAKAGE the output of the Collector Supply is DC voltage, like that obtained when the MODE switch is set to DC (ANTI LOOP), rather than a voltage sweep. Also in the leakage mode a slight error (up to 1.25 V) is added to the horizontal display. The following Horizontal Measurement and Deflection Factor section shows how to determine the degree of this error.

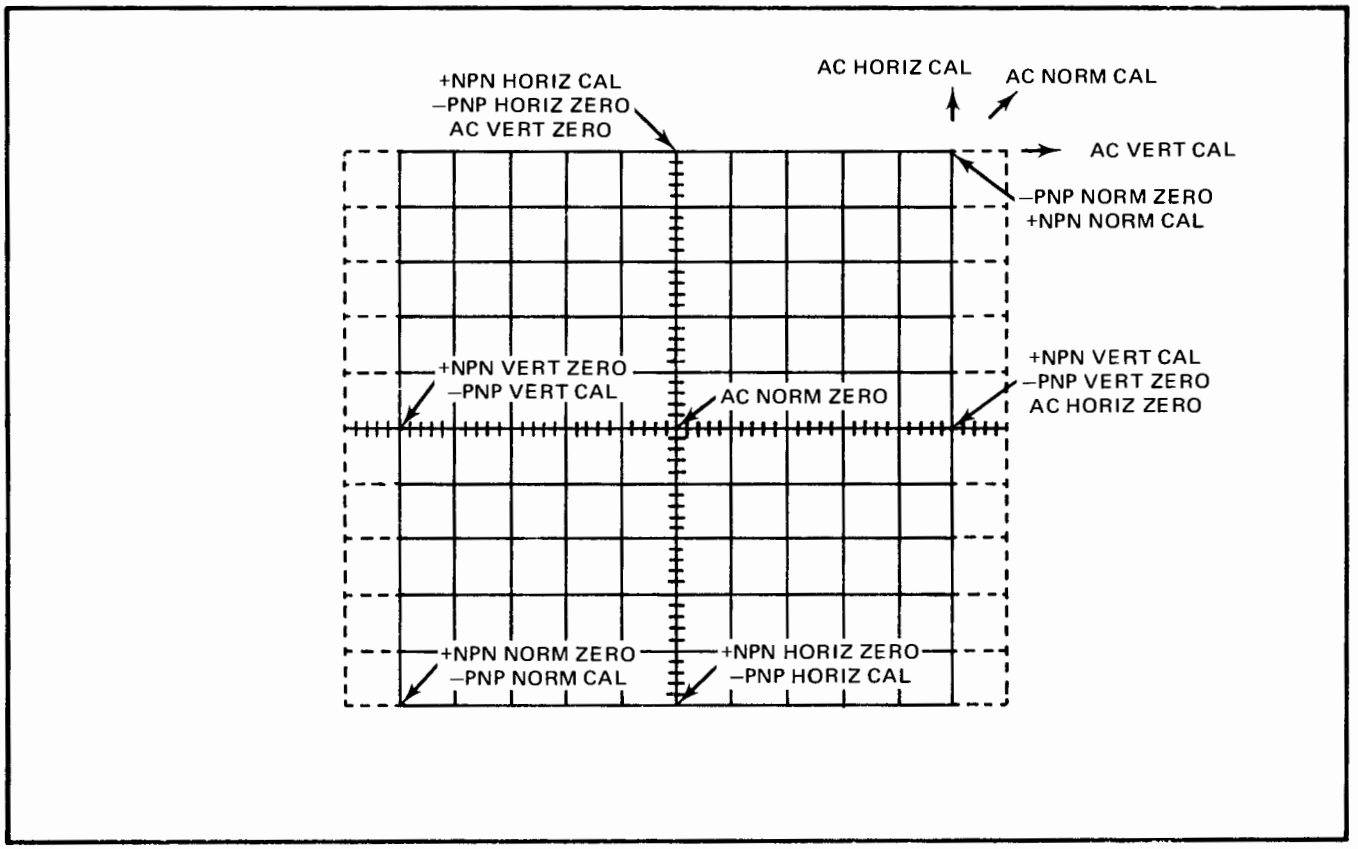


Fig. 2-20. Positions of spot on CRT graticule when ZERO or CAL buttons are pressed, for various positions of the POLARITY switch and the DISPLAY OFFSET Selection switch, assuming the position controls are centered.

In the leakage mode of operation, the current sensing resistor is between the emitter and ground. Assuming a constant collector supply output voltage, therefore, emitter current will change whenever the current sensing resistor is changed. The current sensing resistor is changed every decade on the VERTICAL switch. The resulting change in emitter is most evident when the VERTICAL switch is switched between its 5 nA and 10 nA positions or its 50 nA and 100 nA positions.

When the VERTICAL switch is set to STEP GEN, steps indicating the Step Generator output are displayed vertically. The vertical display shows one step per division and the amplitude of each step, as shown by the PER STEP readout, determines the vertical deflection factor. It should be noted that if the HORIZONTAL switch is set to STEP GEN, the Step Generator output signal is not available for display vertically. In this case, setting the VERTICAL switch to STEP GEN causes zero vertical signal to be displayed.

The vertical sensitivity can be increased by 10 times for any of the previously mentioned measurements by setting the DISPLAY OFFSET Selector switch to VERT X10. The magnified vertical deflection factor can be determined either from the PER VERT DIV readout[1] or by dividing the setting of the VERTICAL switch by 10.

[1]**The PER VERT DIV readout does not indicate deflection factors less than I nA/division.**

Horizontal Measurement and Deflection Factor

In the horizontal dimension, the display on the CRT measures either collector to emitter voltage (V_{CE}), collector to base voltage (V_{CB}), base to emitter voltage (V_{BE}), emitter to base voltage (V_{EB}) or the Step Generator output. The HORIZONTAL switch, the Terminal Selector switch and the parameter being measured vertically determine what is measured horizontally.

The horizontal deflection factor of the display on the CRT is controlled by the HORIZONTAL switch and the DISPLAY OFFSET Selector switch. The PER HORIZ DIV readout to the right of the CRT indicates the horizontal deflection factor due to the combined effects of these two controls.

Under normal operating conditions with collector current being measured vertically, the Terminal Selector switch set to EMITTER GROUNDED and the DISPLAY OFFSET Selector switch set to NORM (OFF), the display will measure V_{CE} or V_{BE} horizontally. To measure V_{CE}, the HORIZONTAL switch must be set within the COLLECTOR range which has deflection factors between 50 mV/division and 200 V/division. To measure V_{BE}, the HORIZONTAL switch must be set within BASE range which has deflection factors between 50 mV/division and 2 V/division. In both cases, the horizontal deflection factors are indicated by both the PER HORIZ DIV readout and the position of the HORIZONTAL switch. The two values should coincide.

When the Terminal Selector switch is set to BASE GROUNDED the horizontal display measures collector to base voltage (V_{CB}) with the HORIZONTAL switch in the COLLECTOR range, or emitter to base voltage (V_{EB}) with the HORIZONTAL switch in the BASE range. It should be noted that V_{EB} in this case does not indicate a measurement of the emitter-base voltage under a reverse biased condition. It is a measurement of the forward biased base-emitter voltage with the horizontal sensing leads reversed.

When emitter current is being measured by the vertical display, the only significant measurements made by the horizontal display are V_{CE} and V_{CB}. To make these measurements, the HORIZONTAL switch is set within the COLLECTOR range and the Terminal Selector switch is set to EMITTER GROUNDED or BASE GROUNDED.

With the VERTICAL switch set between 500 nA/division and 1 nA/division, an error occurs in the horizontal measurement. Table 2-3 indicates the degree of this error in voltage per division of vertical deflection for all the settings of the VERTICAL switch within this given range. Using this table and the following procedure, the actual V_{CE} or V_{CB} can be caluclated.

TABLE 2-3

Error in Horizontal Voltage Measurement Per Division of Vertical Deflection

VERTICAL Switch Setting[1]	Voltage Error Per Vertical Division
500 nA, 50 nA, 5 nA	125 mV
200 nA, 20 nA, 2 nA	50 mV
100 nA, 10 nA, 1 nA	25 mV

[1]EMITTER current, DISPLAY OFFSET Selector switch set to NORM (OFF).

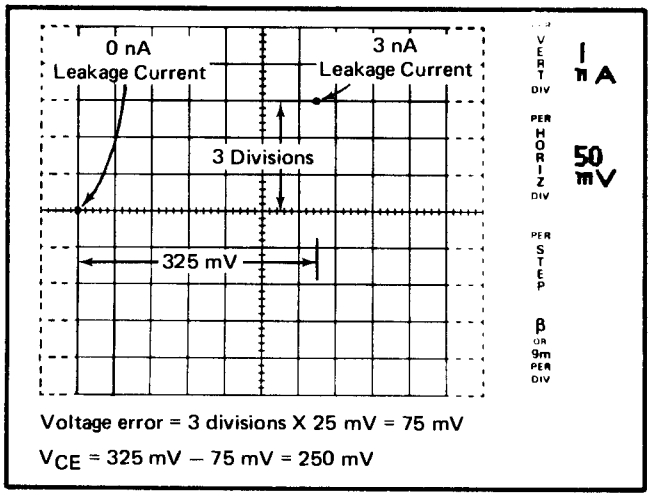


Fig. 2-21. Sample calculation of error in collector to emitter voltage incurred when measuring leakage of a transistor.

1. Measure the vertical deflection of the display in divisions (see Fig. 2-21).

2. Measure the horizontal deflection of the display in volts.

3. Using Table 2-3, find the error factor for the setting of the VERTICAL switch and multiply it by the value determined in step 1.

4. Subtract the voltage determined in step 3 from the voltage determined in step 2 to give the actual V_{CE} or V_{CB}.

When the HORIZONTAL switch is set to STEP GEN, steps indicating the Step Generator output are displayed horizontally. The horizontal display shows one step per division and the amplitude of each step, as shown by the PER STEP readout determines the horizontal deflection factor.

The horizontal deflection factor can be increased by 10 times for any of the previously mentioned measurements by setting the DISPLAY OFFSET Selector switch to HORIZ X10[2]. The magnified horizontal deflection can be determined either from the PER HORIZ DIV readout or by dividing the setting of the HORIZONTAL switch by 10.

Measurements

Table 2-4 shows the measurements which are being made vertically and horizontally by the display for the various positions of the VERTICAL switch, the HORIZONTAL switch and the Terminal Selector switch. Those switch position combinations not covered by the table are not considered useful.

Display Offset and Magnifier

The DISPLAY OFFSET Selector switch and the CENTERLINE VALUE switch provides a calibrated display offset of from 0 to 10 divisions (0 to 100 divisions when the display is magnified) and a 10 times display magnifier. The display offset and the display magnifier, when in operation, effect the display either vertically or horizontally, but never the whole display. Use of the calibrate display offset is discussed in the Positioning section. Use of the magnifier is discussed in both the Vertical and Horizontal Measurement and Deflection Factor sections.

Collector Supply

The Collector Supply provides operating voltage for the device under test. It is a variable voltage in the form of either a sine wave, or a full-wave rectified sine wave (see Fig. 2-22). This voltage is applied to the collector terminals of the Standard Test Fixture.

The MAX PEAK VOLTS switch and the VARIABLE COLLECTOR SUPPLY control determine the peak voltage output of the Collector Supply, which may be varied from 0 volts to 1500 volts. The MAX PEAK VOLTS switch provides four peak voltage ranges: 15 volts, 75 volts, 350 volts and 1500 volts. The VARIABLE COLLECTOR SUPPLY

[2]The Horizontal display is not calibrated when the VERTICAL switch is set between 500 nA and 1 nA EMITTER.

TABLE 2-4

Measurements Made by the Type 576 Display

Switch Settings			Measured by Display	
VERTICAL	HORIZONTAL	Terminal Selector	Vertically	Horizontally
COLLECTOR	COLLECTOR	EMITTER GROUNDED	I_C	V_{CE}
COLLECTOR	BASE	EMITTER GROUNDED	I_C	V_{BE}
COLLECTOR	STEP GEN	EMITTER GROUNDED	I_C	I_B or V_{BE}
COLLECTOR	COLLECTOR	BASE GROUNDED	I_C	V_{CB}
COLLECTOR	BASE	BASE GROUNDED	I_C	V_{EB}[2]
COLLECTOR	STEP GEN	BASE GROUNDED	I_C	I_B or V_{EB}[2]
EMITTER	COLLECTOR	EMITTER GROUNDED	I_E	V_{CE}[1]
EMITTER	COLLECTOR	BASE GROUNDED	I_B	V_{CB}[1]
STEP GEN	COLLECTOR	EMITTER GROUNDED	I_B or V_{BE}	V_{CE}
STEP GEN	BASE	EMITTER GROUNDED	I_B or V_{BE}	V_{BE}
STEP GEN	COLLECTOR	BASE GROUNDED	I_B or V_{BE}	V_{CB}
STEP GEN	BASE	BASE GROUNDED	I_B or V_{EB}[2]	V_{EB}[2]

[1] **Error in voltage must be calculated. See Horizontal Measurements in Deflection Factor section.**
[2] **V_{EB} indicates a measurement of forward voltage base-emitter, with the horizontal voltage sensing leads reversed.**

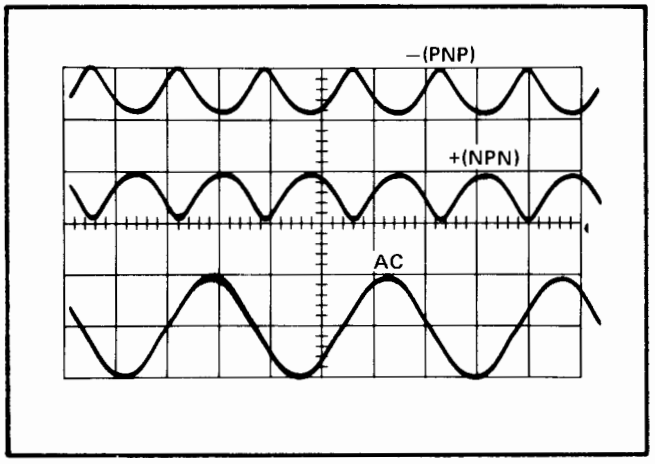


Fig. 2-22. Output of Collector Supply for three settings of POLARITY switch.

allows continuous voltage variation of the peak voltage within each peak voltage range.

The PEAK POWER WATTS switch, which interlocks with the MAX PEAK VOLTS switch, determines the maximum power output of the Collector Supply. Power output is controlled by placing a resistor, selected from the SERIES RESISTORS, in series with the Collector Supply output. The series resistance limits the amount of current which can be conducted by the Collector Supply. In setting the peak power output using the PEAK POWER WATTS switch, the proper series resistor is automatically selected. If the peak voltage range is changed while the MAX PEAK VOLTS and the PEAK POWER WATTS switches are interlocked, a new series resistor is chosen which will provide the same peak power output.

The Collector Supply POLARITY switch determines the polarity of the Collector Supply output and the Step Generator output. It also provides an initial display position on the CRT graticule as discussed in the section on positioning. When the POLARITY switch is set to +(NPN) the Collector Supply output is a positive-going full wave rectified sine wave and the Step Generator output is positive-going. When the switch is set to –(PNP) the Collector Supply output is a negative-going full wave rectified sine wave and the Step Generator output is also negative-going. The AC position of the POLARITY switch provides a Collector Supply output which is an unrectified sine wave, and the Step Generator output is positive-going. A negative-going Step Generator output can be obtained in this case by pressing the STEP/OFFSET POLARITY INVERT button. As noted on the front panel, when the AC position is being used, the MODE switch should be set to NORM and the Step Generator rate to .5X.

The MODE switch determines whether the Collector Supply output voltage will be a voltage sweep or a DC voltage. When the MODE switch is set to NORM the output is a repetitive voltage sweep varying from 0 volts to the peak voltage set by the MAX PEAK VOLTS switch and the VARIABLE COLLECTOR SUPPLY control. When the MODE switch is set to DC (ANTILOOP) or LEAKAGE (EMITTER CURRENT) the Collector Supply output is a DC voltage equal to the peak voltage set by the MAX PEAK VOLTS switch and the VARIABLE COLLECTOR SUPPLY control. This DC voltage may be either positive or negative. The DC mode is very useful when the normal display is exhibiting excessive looping.

Occasionally some of the characteristic curves displayed on the CRT consist of loops rather than well defined lines (see Fig. 2-23). This effect is known as looping and is most noticeable at very low or very high values or current. Looping is generally caused by stray capacitance within the Type 576, and device capacitance. It may also be caused by heating of the device under test. The LOOPING COMPENSATION control provides complete compensation for non heat-related looping due to the Type 576 and any standard device adapter which may be used. In general it does not compensate for any added capacitance introduced by the device under test. (Control has some effect in reducing stray capacitance in small diodes, and voltage-driven three terminal devices.) If uncompensated looping is hindering measurements, the MODE switch should be set to DC (ANTILOOP). If the collector sweep mode of operation (MODE switch set to NORM) is desired, an imaginary line lying inside the loop and equidistant from each side of the loop is the best approximation of the actual characteristic curve (see Fig. 2-23). Looping due to heating may be reduced by using the pulsed steps operation of the Type 576.

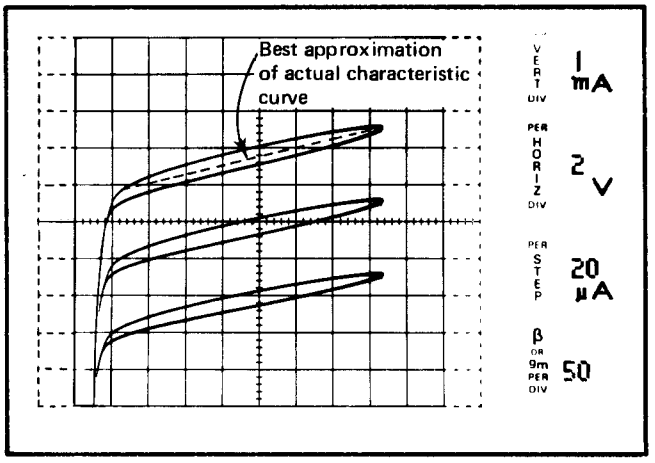


Fig. 2-23. Example of a display exhibiting looping.

Interlock System

Whenever the MAX PEAK VOLTS switch is in the 75, 350 or 1500 positions, the yellow COLLECTOR SUPPLY VOLTAGE DISABLED light comes on. This light indicates that the Collector Supply is disabled. In order to enable the Collector Supply under these circumstances, the Type 576 uses an interlock system. When the yellow light is on, the protective box must be installed over the accessories connectors (see Fig. 2-7). When the protective box is in place and the lid closed, the yellow light turns off and the red light turns on. The red light indicates that the Collector Supply is enabled and that a dangerous voltage may appear at the Collector terminals. For further information about the interlock system, see the Circuit Description.

Step Generator

The Step Generator provides current or voltage which may be applied to the base or the emitter of the device under test. The output of the Step Generator is families of ascending steps of current or voltage (see Fig. 2-24). When these steps together with the Collector Supply output are applied to the device under test, families of characteristic curves of the device are displayed on the CRT.

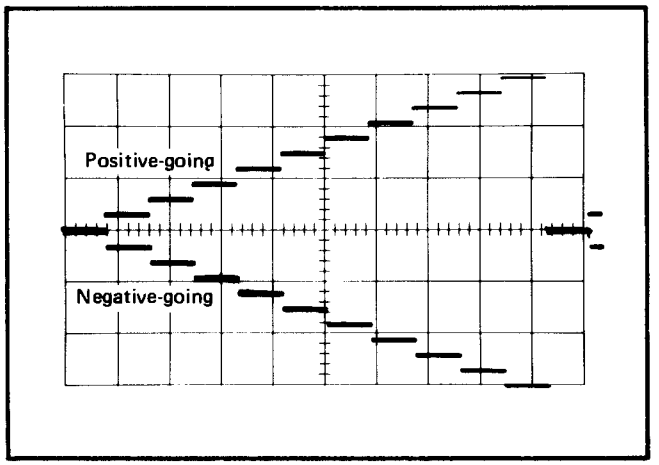


Fig. 2-24. Step Generator output in both polarities

The NUMBER OF STEPS switch determines the number of steps per family and has a range of from 1 step to 10 steps. The AMPLITUDE switch determines the amplitude of each step and provides both current steps and voltage steps. The range of step amplitudes available are from 50 nA/step to 200 mA/step for current steps and from 5 mV/step to 2 V/step for voltage steps. The STEP MULT .1X button, when pressed, divides the step amplitude by 10. When voltage steps are being applied to the base of a transistor, the base current increases very rapidly with increasing base voltage (note Caution on front-panel). To avoid damage to the transistor when using voltage steps, current limiting is provided through the CURRENT LIMIT switch.

The rate of generation of steps by the Step Generator is determined by the RATE buttons. When the NORM RATE button is pressed, steps are generated at a rate of 120 steps/second (assuming a 60 Hz line frequency), or one step per cycle of the Collector Supply, POLARITY switch set to +(NPN) or −(PNP). In this case each step occurs at the beginning of a Collector Supply cycle. When the .5X RATE button is pressed, the Step Generator rate is 60 steps/

second, or one step per 2 cycles of the Collector supply. Again, each step occurs at the beginning of a Collector Supply cycle. (This rate should be used when the POLARITY switch is set to AC.) Pressing the 2X RATE button produces a Step Generator rate of 240 steps/second, 2 steps per cycle of the Collector Supply. In this case steps occur at both the beginning and the peak of a Collector Supply cycle. If the 2X RATE and .5X RATE buttons are pressed together, the Step Generator rate is the normal rate of 120 steps/second except that the steps occur at the peak of each Collector Supply cycle rather than at the beginning as in normal rate operation.

The STEP FAMILY buttons determine whether step families are generated repetitively or one family at a time. Pressing the REP STEP FAMILY button turns the Step Generator on and provides repetitive families of steps. When the SINGLE STEP FAMILY button is pushed, one step family is generated and the Step Generator turns off. To get another step family, the SINGLE button must be pressed again.

The OFFSET buttons and the OFFSET MULT control allow current or voltage to be either added or subtracted from the Step Generator output. This causes the level at which the steps begin, to be shifted either in the direction of the ascending steps (aiding) offset, or in the opposite direction of the steps (opposing) offset. When the ZERO OFFSET button is pushed, the step family is generated at its nomal level where the zero step level is either 0 mA or 0 V and the OFFSET MULT control is inhibited. When the AID OFFSET button is pressed, current or voltage may be added to the Step Generator output using the OFFSET MULT control. The amount of current or voltage added to the Step Generator output when the AID button is pressed is equal to the setting of the OFFSET MULT control times the setting of the AMPLITUDE switch. The OFFSET MULT control has a continuous range of 0 to 10 times the setting of the AMPLITUDE switch. Pressing the OPPOSE OFFSET button allows either current or voltage to be subtracted from the Step Generator output, the amount subtracted determined by the OFFSET MULT control. Table 2-5 shows the polarity of the offset current or voltage for the two polarities of the Step Generator output.

Opposing offset is most useful when generating voltage steps to test field effect transistors. When current steps are being generated, the maximum opposing voltage is limited to approximately 2 volts. This voltage limiting protects the base-emitter junction of a bi-polar transistor from reverse breakdown.

The STEP/OFFSET POLARITY INVERT button allows the Step Generator output (both steps and offset) to be inverted from the polarity at which it was set by the POLARITY switch. It has no effect when the Terminal Selector switch is set to BASE GROUNDED. Caution should be exercised when using this button to cause reverse current to flow between the base and emitter terminals. Voltage limiting occurs, when current steps are being generated, only when the OPPOSE OFFSET button is pressed.

TABLE 2-5

Polarity of Offset for Polarity of Step Generator Output

Step Generator Polarity	OFFSET Buttons	Offset	
		Current	Voltage
Positive going	AID	Positive	Positive
Positive going	OPPOSE	Negative	Negative
Negative going	AID	Negative	Negative
Negative going	OPPOSE	Positive	Positive

When one of the PULSED STEPS buttons is pressed, steps are generated in pulses having durations of either 300 µs or 80 µs (offset is unaffected). Pulsed operation is useful when testing a device at power levels which might damage the device if applied for a sustained length of time. Pulsed steps of a 300 µs duration occur when the 300µs PULSED STEPS button is pressed. When the 80 µs PULSED STEPS button is pressed, the duration of the pulsed steps is 80 µs. When either the 300 µs button or the 80 µs button is pressed, the Collector Supply mode is automatically set to DC. If the 300 µs and 80 µs buttons are pressed together, the Collector Supply remains in the normal mode and 300 µs pulsed steps are produced. In all the previously mentioned cases, the pulses occur at the peak of the Collector Supply sweep and therefore only the normal and .5 times normal Step Generator rates are available for use.

Standard Test Fixture

The Standard Test Fixture, which slides into the front of the Type 576, provides a means of connecting the Collector Supply output, the Step Generator output and the display amplifiers to the device to be tested.

The Terminal Selector switch, located on the Standard Test Fixture, determines the state of the base and the emitter terminals of the device under test. The switch has two ranges: EMITTER GROUNDED and BASE GROUNDED. In the EMITTER GROUNDED range, the emitter terminal is connected to ground and the Terminal Selector switch determines the state of the base terminal. With the switch set to STEP GEN, the Step Generator output is applied to the base terminal. In the OPEN (OR EXT) position, the base terminal is left open. In this case measurements may be made with the base terminal left open or with an externally generated signal applied to it through the EXT BASE

TEST SET-UP CHART TYPE 576

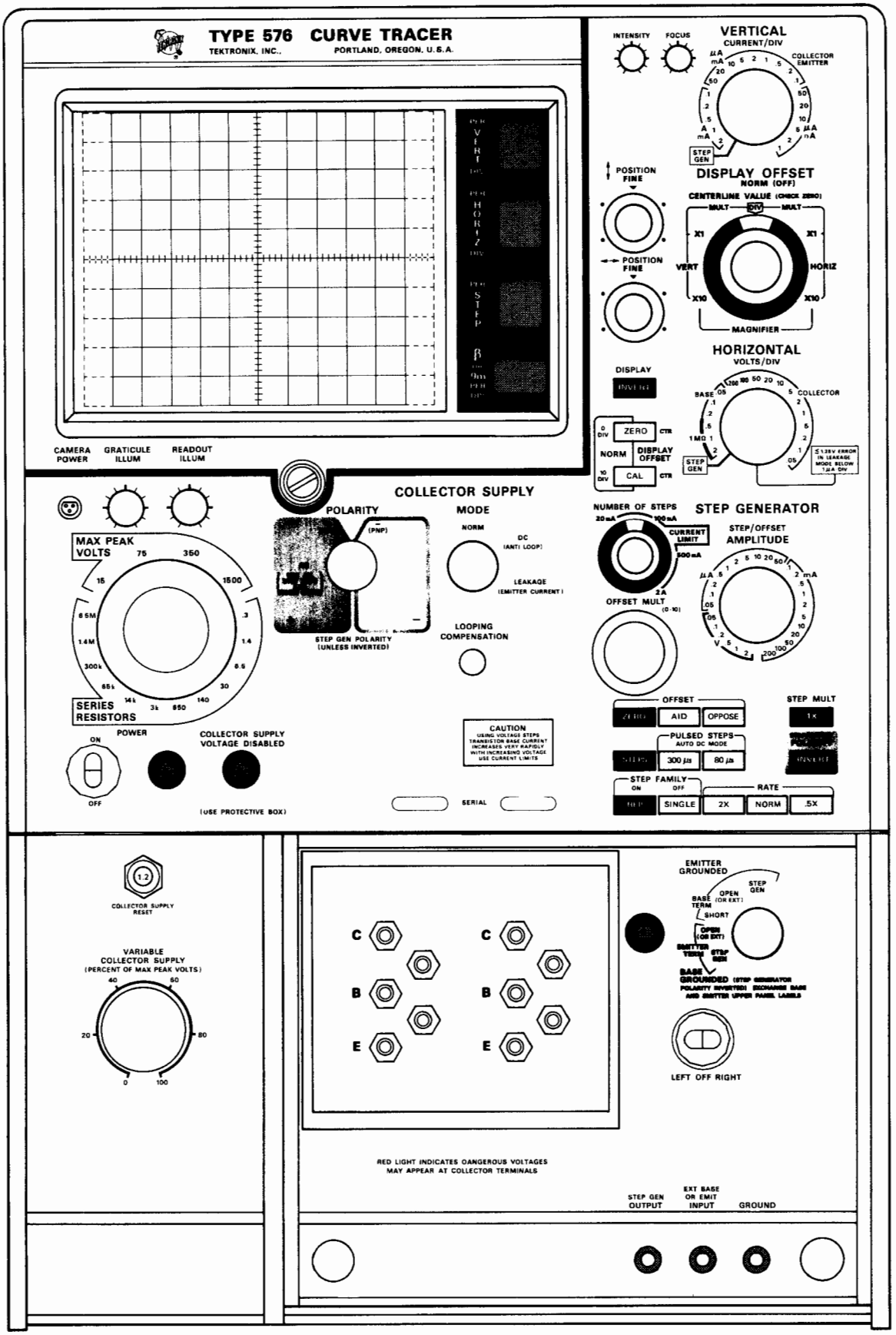


Fig. 2-25. Control setup chart for the Type 576 front panel.

OR EMIT INPUT connector. When the Terminal Selector switch is set to BASE TERM SHORT, the base terminal is shorted to the emitter.

In the BASE GROUNDED range, the base terminal is connected to ground and the Terminal Selector switch determines the state of the emitter terminal. With the switch set to STEP GEN, the Step Generator output is inverted and applied to the emitter terminal. When the switch is set to OPEN (OR EXT) the emitter terminal is left open. In this case, measurements may be made with the emitter terminal left open or with an externally generated signal applied to it through the EXT BASE OR EMIT INPUT connector.

Devices to be tested are connected to the Type 576 through 10 accessories connectors provided on the Standard Test Fixture. These connectors allow two devices to be set up at a time for comparison testing. The LEFT-OFF-RIGHT switch determines which device is under test. Tektronix Type 576 test fixture adapters may be plugged into the 10 accessories connectors. These adapters provide sockets into which devices with various lead arrangements may be placed for testing. Table 2-7 lists the test fixture adapters available and their uses. The 10 accessories connectors also accept standard banana plugs so that a device may be connected to the Type 576 without using a specific device testing accessory.

The unlabeled accessories connectors allow Kelvin sensing of voltages measured under high current conditions. Kelvin sensing means that current is supplied to a device under test through one set of contacts and the voltage is measured through another set of contacts. This method of sensing voltage eliminates errors in voltage measurements due to contact resistance. The upper unlabeled accessories connectors on the Standard Test Fixture are used for sensing collector voltage and the lower connectors are for sensing emitter voltage.

CAUTION

Conduction of high current through a voltage sensing connector will damage the instrument. When using Kelvin sensing without a special test fixture adapter, separate leads are required for current carrying and for voltage sensing.

The STEP GEN OUTPUT connector allows the Step Generator output to be used externally. The EXT BASE OR EMIT INPUT connector allows application of an externally generated signal to either the base or the emitter of the device under test by selection with the Terminal Selector switch. The GROUND connector provides a Type 576 ground reference for signals generated or externally applied to the Type 576.

Polarities of the Collector Supply and Step Generator Output

Table 2-8 shows the polarities of the Collector Supply and the Step Gnerator output for various settings of the Collector Supply POLARITY switch and the Terminal Selector switch.

TABLE 2-7

Test Fixture Adapters[1]

Tektronix Part Number	Devices Tested	Case Types
013-0072-00[2]	Diodes	Axial lead
013-0098-02	Transistors and P-Channel FET's	TO-18, TO-5 and related sizes
013-0099-02	N-Channel FET's	TO-18, TO-5 and related sizes
013-0100-01	Transistors and SCR's	TO-3; provides Kelvin sensing
013-0101-00	Transistors and SCR's	TO-66; provides Kelvin sensing
013-0102-00[2]	Transistors and P-Channel FET's	long lead devices
013-0103-00[2]	N-Channel FET's	long lead devices
013-0110-00	Diodes	Stud leads; DO-4/DO-5; Kelvin sensing
013-0111-00	Diodes	Axial leads; Kelvin sensing
013-0112-00[2]	Transistors and SCR's	TO-36; Kelvin sensing
013-0124-03[2]	Integrated circuits	multipin device packages; sockets available for 8, 10, 14, 16 pins
013-0127-01[2]	Transistors	Can be rewired for different configurations
013-0138-01	In-line transistors and voltage regulators	B-C-E configuration; can be rewired for other configurations; Kelvin sensing
013-0163-00[2]	Power Transistors	Kelvin sensing

[1]Some of these accessories are made of plastic and are susceptible to damage from excessive heat. If a device is likely to heat excessively, a heat sink for the device or the pulsed steps mode of operation should be used.

[2]Optional accessory.

TABLE 2-8

Polarities of the Collector Supply and Step Generator Output

Switches		Polarities	
Collector Supply POLARITY	Terminal Selector	Collector Supply	Step Generator
—(PNP)	EMITTER GROUNDED	Negative going	Negative going[1]
—(PNP)	BASE GROUNDED	Negative going	Positive going
+(NPN)	EMITTER GROUNDED	Positive going	Positive going[1]
+(NPN)	BASE GROUNDED	Positive going	Negative going
AC	EMITTER GROUNDED	Positive and Negative going	Positive going[1]
AC	BASE GROUNDED	Positive and Negative going	Negative going

[1] May be inverted by pressing the **POLARITY INVERT** button.

APPLICATIONS

This part of the Operating Instructions describes the use of the Type 576 to measure some basic parameters of bipolar transistors, field effect transistors, unijunction transistors, silicon controlled rectifiers, signal and rectifier diodes, Zener diodes, and tunnel and back diodes. For each of the devices discussed, this section includes tables of Type 576 control settings required to make an accurate measurement without damaging the device under test. Below each table is a block diagram showing the connections of the collector supply, the step generator and the display amplifiers to the device under test, and a picture of a typical characteristic for the semiconductor type being discussed. Also included is a list of common measurements which may be made on the given devices with the Type 576 and a brief set of instructions on how to make each of these measurements.

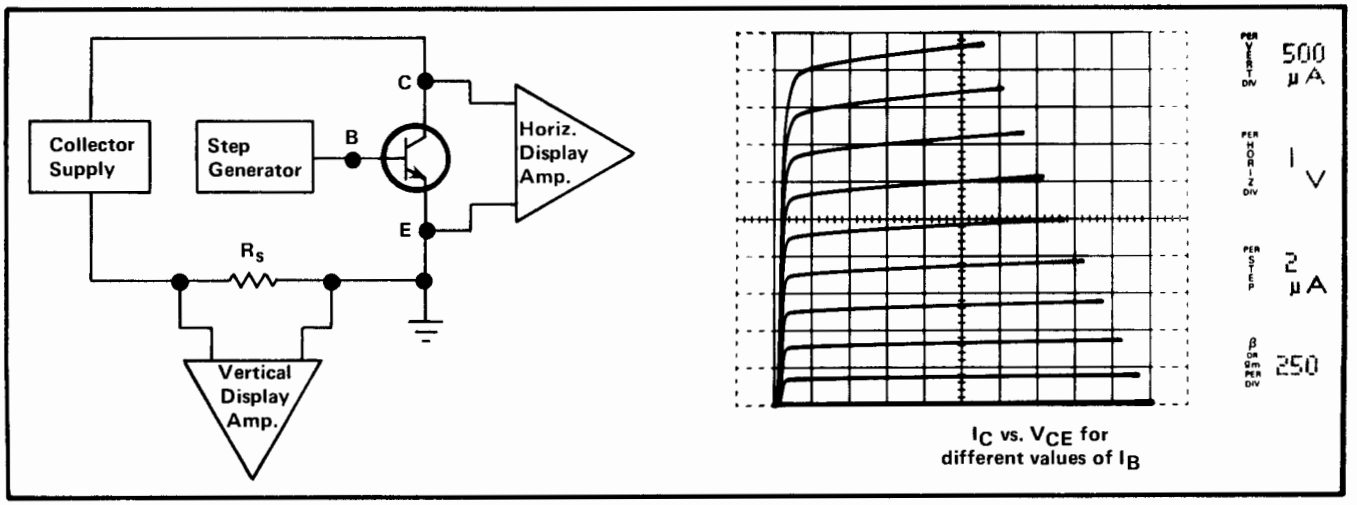
This section has been written with the assumption that the reader is familiar with the operation of the Type 576 as described at the beginning of the Operating Instructions. It is also assumed that the reader is familiar with the parameters being discussed.

BIPOLAR TRANSISTORS

Required Type 576 Control Settings

Control	Required Setting
HORIZONTAL	COLLECTOR
POLARITY	+(NPN) or −(PNP) depending on the transistor type
PEAK POWER WATTS	Less than maximum power rating of device
AMPLITUDE	Current steps
STEPS	Pressed when using low base current
PULSED STEPS	Pressed when using high base current
Terminal Selector	EMITTER GROUNDED BASE TERM STEP GEN for common-emitter family
	BASE GROUNDED EMITTER TERM STEP GEN for common-base family
OFFSET	AID pressed if more than 10 steps are desired

Common-Emitter Family



I_C vs. V_{CE} for different values of I_B

Some Common Measurements

β (Static)

The static forward current transfer ratio (emitter grounded), h_{FE}, is I_C/I_B.

β (Small Signal)

The small-signal short-circuit forward current transfer ratio (emitter grounded), h_{fe}, is $\Delta I_C/\Delta I_B$. To determine h_{fe} at various points in a family of curves, multiply the vertical separation of two adjacent curves by the β OR g_m PER DIV readout. To make a more accurate measurement, see steps 69 through 74 of the First Time Operation instructions.

V_{CE} (Sat)

Saturation current and voltage is measured by expanding the display of the saturation region of the device by decreasing the horizontal deflection factor with the HORIZONTAL switch or the DISPLAY OFFSET MAGNIFIER. Saturation current can be adjusted to the desired operating point with the AMPLITUDE switch.

I_C vs. V_{BE}

Base-emitter voltage can be measured by setting the HORIZONTAL switch to the BASE range.

I_{CEO} and BV_{CEO}

Collector-emitter leakage current and collector-emitter breakdown voltage (base open) are measured by setting the Terminal Selector switch to BASE TERM OPEN (OR EXT). For small leakage currents set the MODE switch to LEAKAGE (EMITTER CURRENT). To measure breakdown voltage, increase both the horizontal deflection factor and the collector supply voltage.

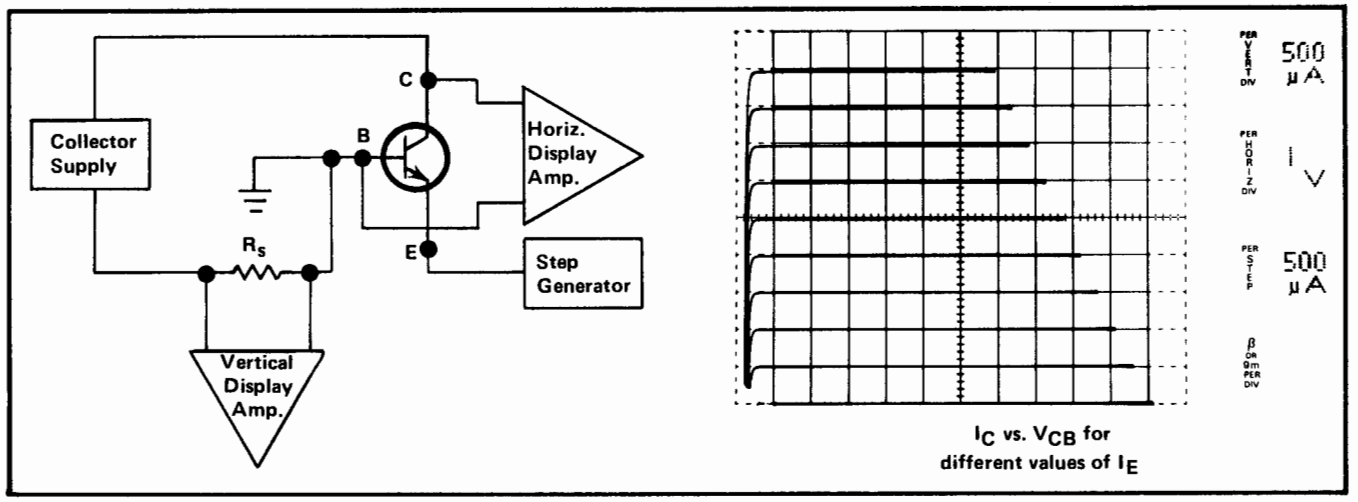
I_{CES} and BV_{CES}

Collector-emitter leakage current and collector-emitter breakdown voltage (base shorted to emitter) are measured the same as I_{CEO} and BV_{CEO} except that the Terminal Selector switch is set to BASE TERM SHORT.

I_{CER} and BV_{CER}

Collector-emitter leakage current and collector-emitter breakdown voltage (with a specified resistance between the base terminal and the emitter terminal) are measured the same as I_{CEO} and BV_{CEO} except that a specified resistance is connected between the base terminal and the emitter terminal.

Common-Base Family



I_C vs. V_{CB} for different values of I_E

Some Common Measurements

α (Small Signal)

The small-signal short-circuit forward current transfer ratio (base grounded), h_{fb}, can be measured from the common-base family display but is determined most easily by calculating it from the equation $\alpha = \beta/1 + \beta$.

I_{CBO} and BV_{CBO}

Collector-base leakage current and collector-base breakdown voltage (emitter open) is measured the same as I_{CEO} and BV_{CEO} except that the Terminal Selector switch is set to EMITTER TERM OPEN (OR EXT).

I_{EBO} and BV_{EBO}

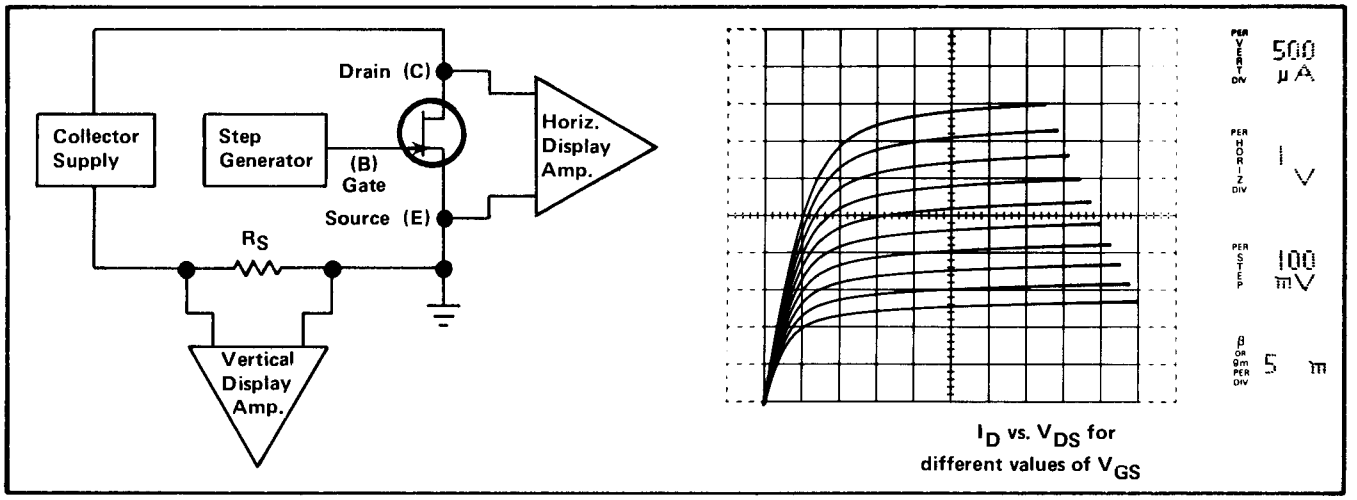
Emitter-base leakage current and emitter-base breakdown voltage (collector open) is measured the same as I_{CBO} and BV_{CBO} except that the device terminals are inverted in the device testing socket (collector lead in the emitter terminal of the socket and the emitter lead in the collector terminal).

FIELD EFFECT TRANSISTORS

Required Type 576 Control Settings

Control	Required Setting	
HORIZONTAL	COLLECTOR	
POLARITY	+(NPN) for N-channel device; −(PNP) for P-channel device	
PEAK POWER WATTS	Less than maximum power rating of device	
AMPLITUDE	Voltage Steps	
STEPS	Pressed	
Terminal Selector	EMITTER GROUNDED BASE TERM STEP GEN	
	Enhancement	Depletion
POLARITY INVERT	Released	Pressed
OFFSET with POLARITY INVERT button pressed	OPPOSE	ZERO or AID

Common-Source Family



I_D vs. V_{DS} for different values of V_{GS}

Some Common Measurements

g_m (Static)

The static transconductance (source grounded) is I_D/V_{GS}.

g_m (Small Signal)

The small-signal transconductance (source grounded) is $\Delta I_D/\Delta V_{GS}$. To determine g_m at various points in a family of curves, multiply the vertical separation of two adjacent curves by the β OR g_m PER DIV readout. To make a more accurate measurement, see steps 69 through 74 of the First Time Operation instructions.

I_{DSS}

Drain-source current with zero V_{GS} is measured from the common-source family, with the Terminal Selector switch set to BASE TERM SHORT. It should be measured above the knee of the curve.

Pinch-Off Voltage (V_P)

Pinch-off voltage (V_P) can be measured by increasing the depletion voltage with the OFFSET MULT control and the AMPLITUDE switch until the specified pinch-off current is reached by the zero step (zero step only is obtained by pressing SINGLE button). Thus the pinch-off voltage is the setting of the OFFSET MULT control times the setting of the AMPLITUDE switch, to which, for greatest accuracy in the LEAKAGE mode, must be added the error voltage developed between ground and source as per Table 2-3.

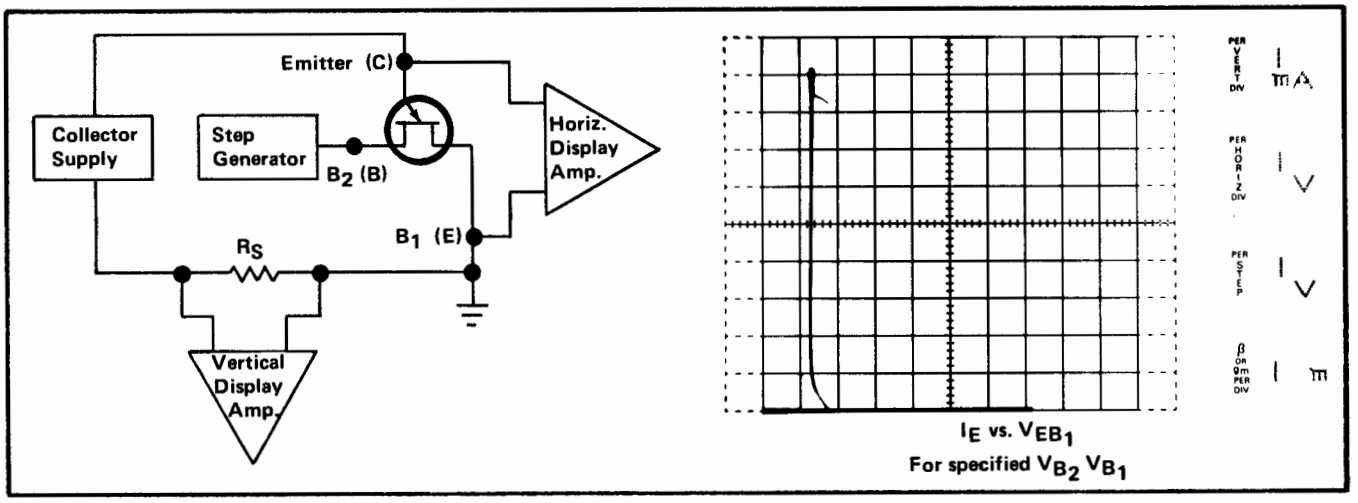
BV_{GSS}

Gate-source breakdown voltage with the drain shorted to the source can be measured by putting the gate lead of the device in the drain terminal of the test socket, the source lead in the gate terminal and the drain lead in the source terminal. Set the Terminal Selector switch to BASE TERM SHORT and reverse the collector supply polarity. This measurement should not be made on an insulated-gate device.

UNIJUNCTION TRANSISTORS

Required Type 576 Control Settings

Control	Required Setting
HORIZONTAL	COLLECTOR
POLARITY	+(NPN)
PEAK POWER WATTS	Less than maximum power rating of device
AMPLITUDE	Voltage
OFFSET	AID
STEP FAMILY	OFF (SINGLE)
Terminal Selector	BASE TERM STEP GEN



Some Common Measurements

η

The intrinsic standoff ratio is $V_P - V_{EB_1}/V_{B_2}V_{B_1}$. In measuring η, $V_{B_2B_1}$ is determined by the OFFSET MULT control and the AMPLITUDE switch. $V_{B_2B_1}$ may be measured by setting the HORIZONTAL switch to the BASE range. V_P is determined by applying voltage between the emitter and the base$_1$ terminals using the VARIABLE COLLECTOR SUPPLY control. V_P is the voltage at which the emitter-base$_1$ junction becomes forward biased. V_{EB_1}, the turn on voltage of the emitter-base$_1$ junction is determined by setting the Terminal Selector switch to BASE TERM OPEN.

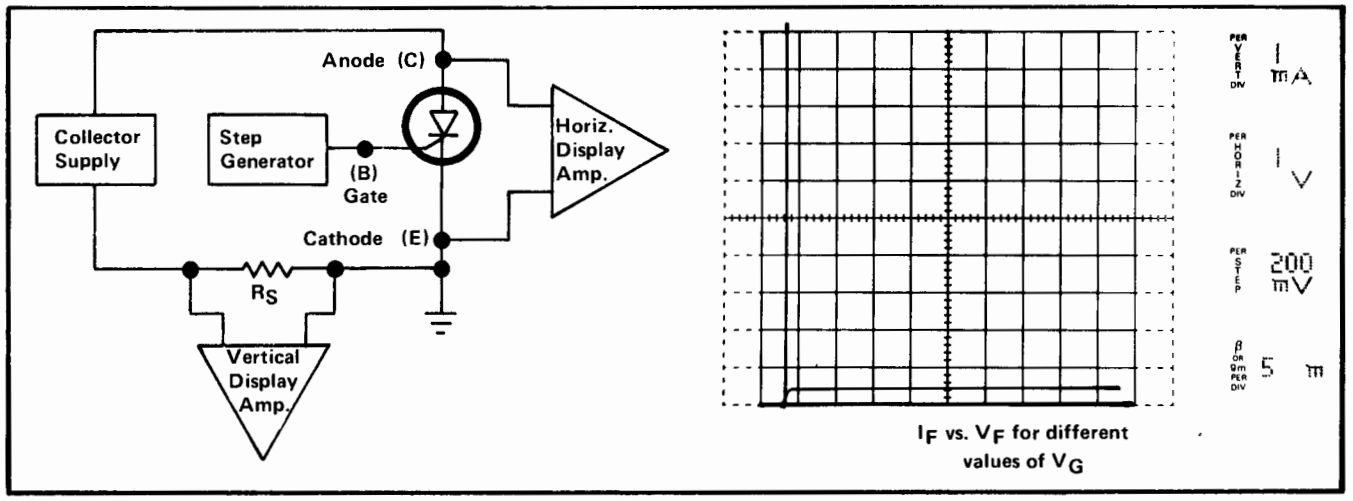
$R_{B_2B_1}$

The interbase resistance can be measured by placing the $base_2$ lead in the collector terminal of the test socket and the $base_1$ lead in the emitter terminal. Leave the emitter lead at the device open and apply voltage across the two bases with the VARIABLE COLLECTOR SUPPLY control.

SILICON CONTROLLED RECTIFIERS (SCRs)

Required Type 576 Control Settings

Control	Required Setting
HORIZONTAL	COLLECTOR
PEAK POWER WATTS	Less than maximum power rating of device
POLARITY	+(NPN)
STEPS	Pressed when using low gate voltage or current
PULSED STEPS	Pressed when using high gate voltage or current
Terminal Selector	EMITTER GROUNDED BASE TERM STEP GEN



I_F vs. V_F for different values of V_G

Some Common Measurements

Turn-on

The gate voltage or current at which the device turns on can be measured by applying a specified voltage between the anode and cathode terminals using the VARIABLE COLLECTOR SUPPLY control and applying current or voltage steps in small increments to the gate with the AMPLITUDE switch.

Forward Blocking Voltage

To measure the forward blocking voltage, set the Terminal Selector switch to BASE TERM OPEN (or SHORT depending on the specification) and turn the VARIABLE COLLECTOR SUPPLY control clockwise until the device switches to its low impedance state. The voltage at which switching occurs is the forward blocking voltage.

Holding Current

Holding current is measured in the same manner as forward blocking voltage. Holding current is the minimum current conducted by the device, while operating in its low impedance state, without turning off.

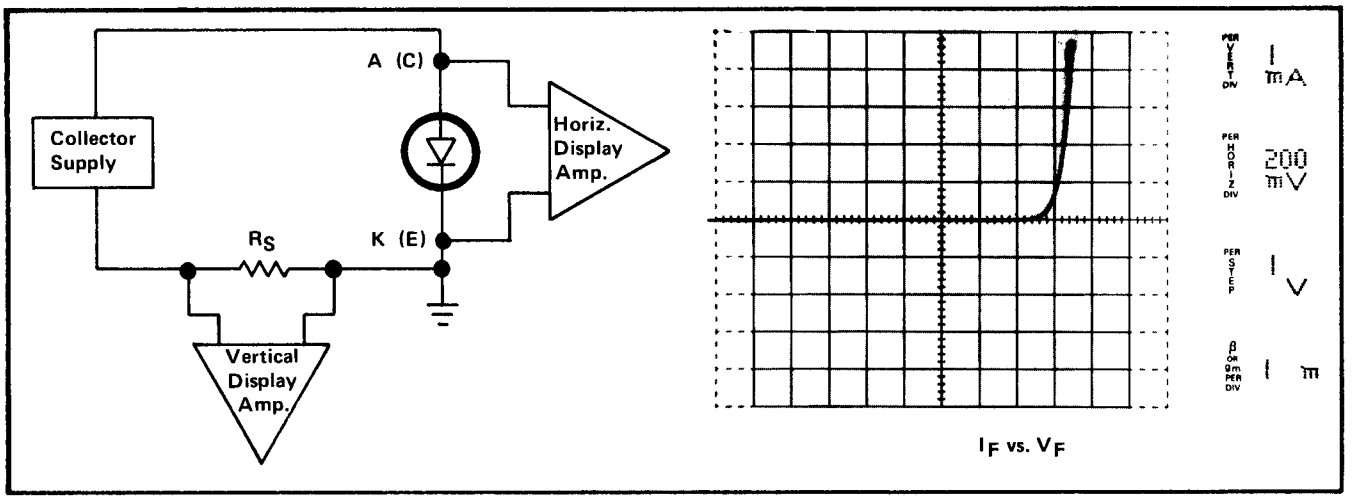
Reverse Blocking Voltage

The reverse blocking voltage is measured the same way as the forward blocking voltage except that the POLARITY switch is set to −(PNP).

SIGNAL DIODES AND RECTIFYING DIODES

Required Type 576 Control Settings

Control	Required Setting
HORIZONTAL	COLLECTOR
PEAK POWER WATTS	Less than maximum power rating of device
POLARITY	+(NPN)
Terminal Selector	EMITTER GROUNDED



Some Common Measurements

I_F and V_F

To measure forward current and voltage, put the cathode of the diode in the emitter terminal of the test socket and the anode of the diode in the collector terminal. Apply voltage to the device with the VARIABLE COLLECTOR SUPPLY control.

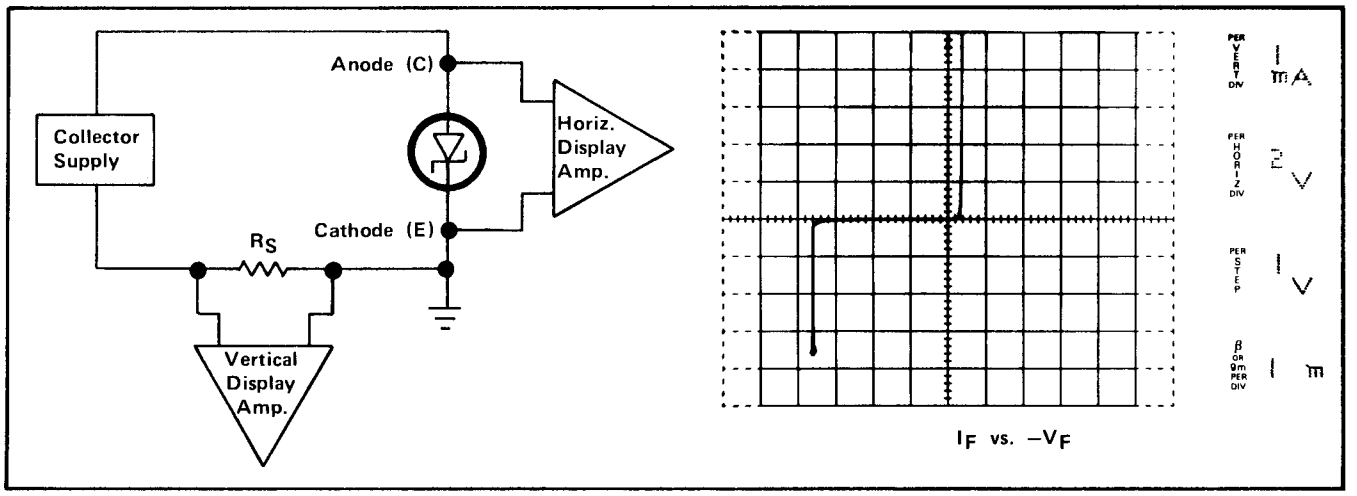
I_R and V_R

Current and voltage in the reverse direction are measured in the same manner as in the forward direction except that the POLARITY switch is set to –(PNP). For measurements of small amounts of reverse current, set the MODE switch to LEAKAGE (EMITTER CURRENT).

ZENER DIODES

Required Type 576 Control Settings

Control	Required Setting
HORIZONTAL	COLLECTOR
PEAK POWER WATTS	Less than maximum power rating of device
POLARITY	–(PNP)
Terminal Selector	EMITTER GROUNDED



Some Common Measurements

V_Z and I_R

To measure Zener voltage or reverse current, put the cathode of the diode in the emitter terminal of the test socket and the anode of the diode in the collector terminal. Apply voltage to the device with the VARIABLE COLLECTOR SUPPLY control. For a more accurate measurement of Zener voltage, see steps 42 through 46 of the First Time Operation instructions. For measurements of small amounts of reverse current, set the MODE switch to LEAKAGE (EMITTER CURRENT).

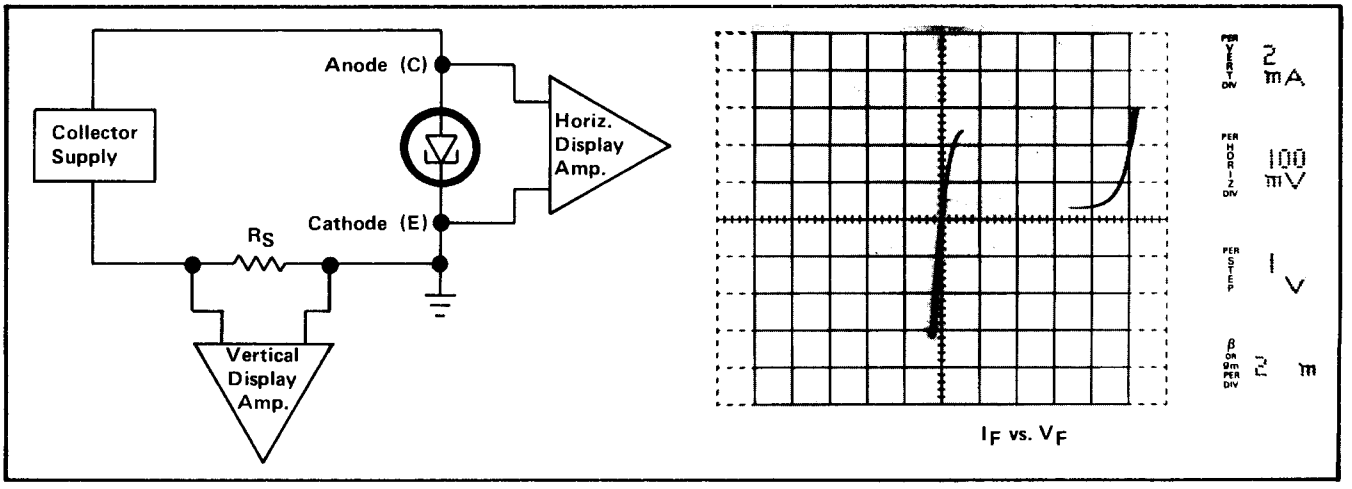
I_F and V_F

Current and voltage in the forward direction are measured in the same manner as in the reverse direction except that the POLARITY switch is set to +(NPN). For a display of currents and voltages in both directions, set the POLARITY switch to AC.

TUNNEL DIODES AND BACK DIODES

Required Type 576 Control Settings

Control	Required Setting
HORIZONTAL	COLLECTOR
PEAK POWER WATTS	Less than maximum power rating of device
POLARITY	+(NPN)
Terminal Selector	EMITTER GROUNDED



Some Common Measurements

I_F and V_F

To measure the forward current and voltage characteristics of a tunnel diode or a back diode, such as the peak point and valley point currents and voltages, put the cathode of the diode in the emitter terminal of the test socket and the anode of the diode in the collector terminal. Apply voltage to the device with the VARIABLE COLLECTOR SUPPLY control. For most accurate measurements of peak and valley points, use the magnified display offset as described in steps 42 through 46 of the First Time Operation instructions.

I_R and V_R

Current and voltage in the reverse direction are measured in the same manner as in the forward direction except that the POLARITY switch is set to —(PNP). For a display of currents and voltages in both directions, set the POLARITY switch to AC.

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.

SECTION 3
CIRCUIT DESCRIPTION

General

This discussion of the Type 576 internal operation is divided into two parts: Block diagram description and circuit description. The block diagram description discusses the functions of the major circuits within the instrument, using the overall block diagram. The circuit description provides a detailed description of all the major circuits and the signal switching within the instrument.

It is suggested that the block diagrams and schematics which have been included in this manual be referred to while reading this circuit description. Individual block diagrams and simplified schematics of most of the major circuits and signal switching accompany the text of this section. An overall block diagram of the instrument, showing all the major circuits and a simplified version of the signal switching, is provided in the diagrams section at the back of the manual. Also in the diagram sections are complete schematics of all the circuitry within the Type 576 which include component part numbers and values.

BLOCK DIAGRAM DESCRIPTION

The Type 576 is a static and dynamic semiconductor tester which displays and allows measurement of static and dynamic semiconductor characteristics obtained under simulated operating conditions. The collector supply circuit and the step generator produce operating voltages and currents which are applied to the device under test. The display amplifiers measure the effects of these applied conditions. The tests result in curves of transistor, diode, and other semiconductor device characteristics traced on the face of a CRT.

The collector supply circuit produce full-wave rectified sine waves which may be either positive-going or negative-going or unrectified sine waves, depending on the position of the POLARITY switch. The amplitude of the signal can be varied from 0 to 1500 volts as determined by the MAX PEAK VOLTS switch and the VARIABLE COLLECTOR SUPPLY control. The Collector Supply output is applied to the collector (or equivalent) terminal of the device under test.

The step generator produces ascending steps of current or voltage at a normal rate of one step for each half-sine wave of the collector supply. The amount of current or voltage per step is controlled by the AMPLITUDE switch and the total number of steps is controlled by the NUMBER OF STEPS switch. The Step Generator output may be applied to either the base or the emitter (or equivalent) terminals of the device under test.

The display amplifiers are connected to the device under test. These amplifiers measure the effects of the collector supply and the step generator on the device under test, amplify the measurements, and apply the resulting voltages to the deflection plates of the CRT. The sensitivities of these amplifers are controlled by the VERTICAL CURRENT/DIV switch and the HORIZONTAL VOLTS/DIV switch.

CIRCUIT DESCRIPTION

The following discussion provides a detailed circuit description of all the major circuits within the Type 576 and the Standard Test Fixture. This description explains the operation of the various circuits within the instrument, and the voltages and waveforms which can be expected from them. Discussion of basic electronics and simple electronic circuits will be kept at a minimum.

Collector Supply

The collector supply circuit produces an unrectified sine wave or a full-wave rectified sine wave with a peak amplitude which may be varied from 0 to 1500 volts peak in four ranges. The initial voltage for the collector supply comes from variable auto-transformer T300 (see Fig. 3-1) which has a source voltage of 115 volts AC. The output of T300 is connected to the primary of sweep transformer T301 and is controlled by the VARIABLE COLLECTOR SUPPLY VOLTS control and varies from 0 to 115 volts. The MAX PEAK VOLTS switch allows the choice of four collector sweep voltage ranges by choosing pairs of transformer taps from the secondary of T301. The voltage from these taps is rectified by one of two diode bridge rectifier assemblies: the 500 volt assembly for the 15, 75 and 350 volt ranges and the 2 kilovolt assembly for the 1500 volt range.

The 500 volt rectifier assembly is used either as a center tapped full-wave rectifier or a bridge rectifier depending on the connection of the current return input to the collector supply. The current return comes from the non-grounded side of the current sensing resistor. Since the voltage level of the current return input is dependent on the current flowing through the current sensing resistor, the collector supply can be considered to be floating. For the 15 volt or 75 volt ranges, the current return is connected to the center tap of the sweep transformer secondary. In this case only two diodes of the 500 volt rectifier assembly are used as a full-wave rectifier. For the 350 volt range, the current return goes to the bridge rather than the center tap of the transformer. In this case, the whole 500 volt

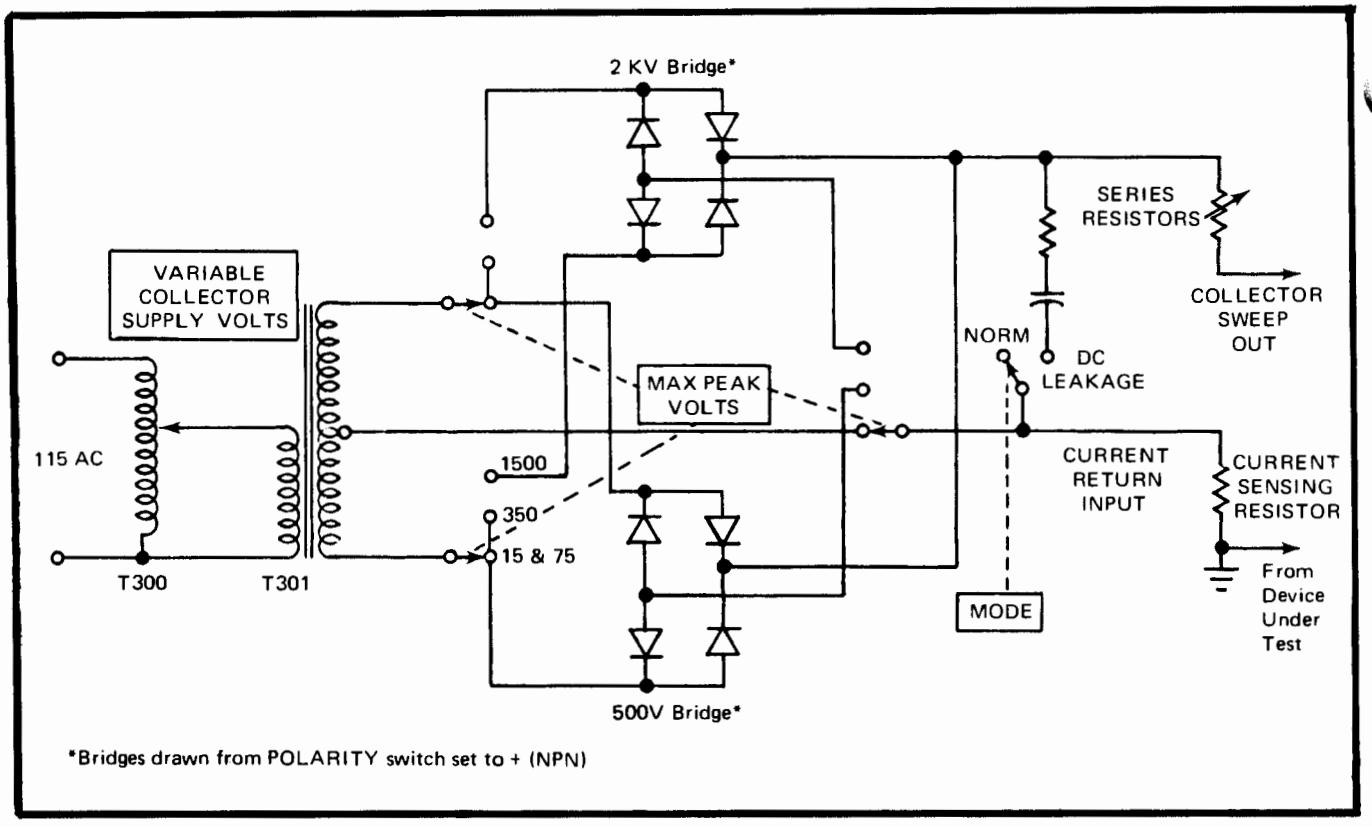


Fig. 3-1. Simplified schematic of collector supply circuit.

rectifier assembly is used for rectification. Operation in the 1500 volt range is similar to operation in the 350 volt range except that the 2 kilovolt bridge is used for rectification.

The POLARITY switch (see the Collector Supply schematic) allows the choice of three different sweep outputs from the collector supply by changing the output connections on the rectifier bridges. The possible outputs are positive-going +(NPN) or negative-going −(PNP) full-wave rectifed sine waves or unrectified sine-waves (AC). In all cases the peak amplitude of the collector sweep is controlled by the VARIABLE COLLECTOR SUPPLY control and the MAX PEAK VOLTS switch.

The MODE switch allows the choice of two different Collector Supply outputs: the normal collector sweep as has been previously mentioned and a DC collector voltage output. When the MODE switch is set to DC (ANTILOOP) or LEAKAGE (EMITTER CURRENT) the MAX PEAK VOLTS switch picks one of four resistor-capacitor combinations which is connected between the collector sweep output and the current return input. The purpose of these capacitors is to hold the collector sweep voltage at a constant DC level set by the VARIABLE COLLECTOR SUPPLY control. This holding is done by charging the capacitor up to maximum peak voltage as set by the VARIABLE COLLECTOR SUPPLY control and keeping them charged with the repetitive collector sweep. The result of charging these holding capacitors is a dot on the CRT rather than the normal sweep.

In series with the collector sweep are series resitors R345 through R355. The interconnected MAX PEAK VOLTS and PEAK POWER WATTS switches add these resistors in series according to the amount of peak collector current desired. The amount of this current is determined by the maximum power dissipation rating of the device under test.

Looping

There is a certain amount of non-discrete capacitance associated with the collector supply which causes an effect known as looping. Part of this undesired capacitance is stray capacitance, which provides an AC current path between the collector supply and chassis ground. The transformer and the guard box also exhibit some undesired capacitance between the guard box potential (common return point connected to guard

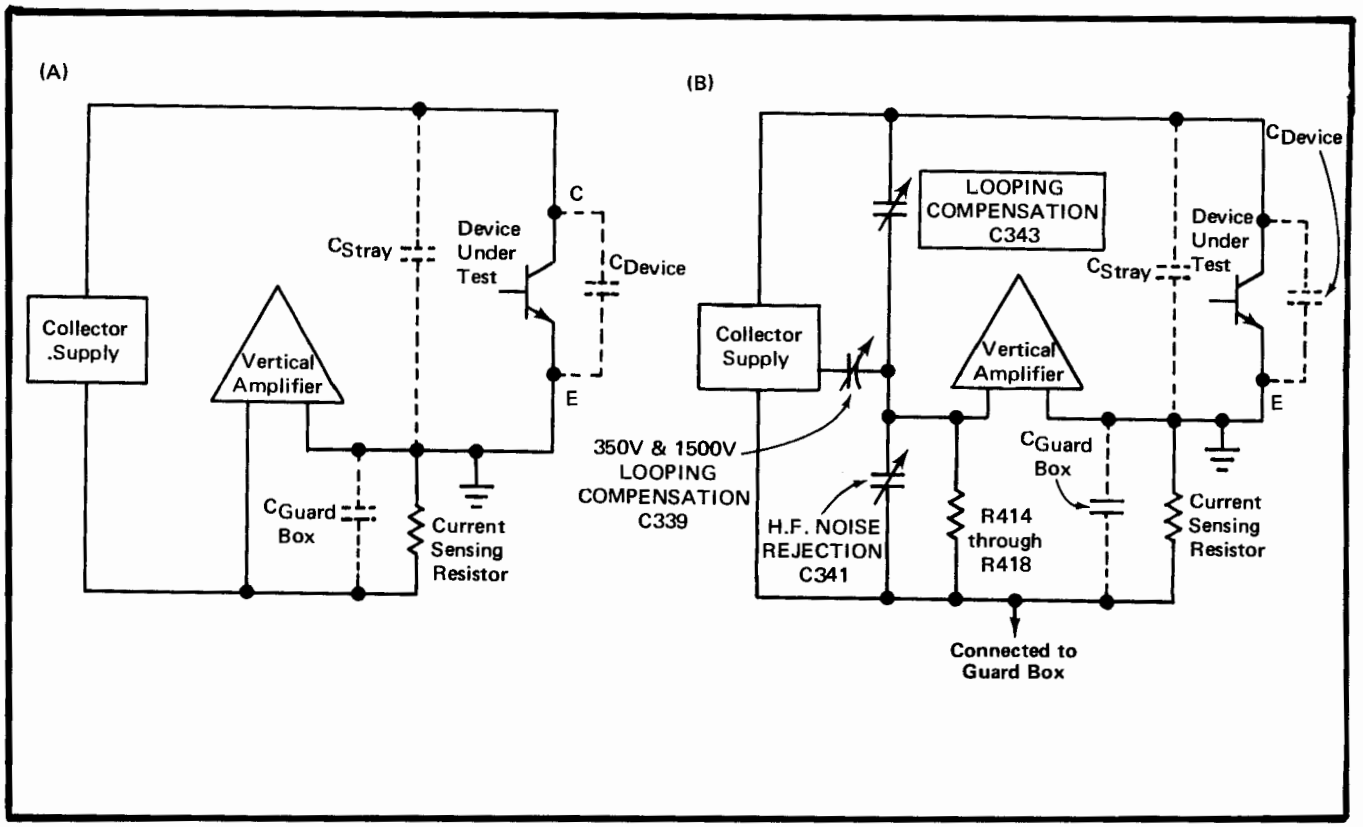


Fig. 3-2. (A) Undesired capacitance causing looping; (B) Looping compensation.

box) and chassis ground. Fig. 3-2A shows that these two capacitances form a divider from AC current, the center of the divider being connected to the vertical amplifier.

During transitions of the collector sweep, some current will be transmitted by this undesired capacitance, bypassing the device under test. This current, however, is sensed by the vertical amplifier along with the collector current and causes the reading of collector current on the CRT to be incorrect. When the collector sweep rises, the undesired current will start positive and decrease to zero as the collector sweep reaches its peak. As the sweep falls, the stray current will go negative. The result on the CRT is a loop instead of a single line to represent the curve of I_C vs V_{CE}.

Looping Compensation

The LOOPING COMPENSATION adjustment, C343 (see Fig. 3-2B and the Collector Supply schematic), H.F. NOISE REJECTION adjustment C341 and R414 through R418 (see the Display Sensitivity Switching schematic) have been added to the circuitry as compensation for the stray and guard box capacitance previously discussed. In general, these adjustments will not compensate for device capacitance. This added capacitance forms a new capacitive divider which transmits AC current to the vertical amplifier in opposition to the current transmitted by the undesired capacitance. This opposing current, therefore, nulls the effect of the undesired capacitance which causes looping. In adjusting these added capacitors, C343 is adjusted to compensate for looping current transmitted from the collector sweep to ground, and C341 is adjusted to compensate for high frequency noise coming in on the line.

Another source of looping current is unbalance in the sweep transformer. As has been discussed in the collector supply circuit description, the sweep transformer is sometimes used in a full-wave rectifier arrangement. This method of transformer operation requires that the transformer be balanced about the center tap. LOOPING BALANCE adjustment C301 is adjusted to equalize the capacitance on both sides of the transformer center tap.

When the transformer is used in bridge operation, the voltage at one end is held essentially constant, and the transformer operates unbalanced. In this case, the transformer capacitance is added to the stray capacitance found between

the Collector Supply and ground. 350 V and 1500 V LOOPING COMP adjustment C339 has been added between the transformer center tap and the junction of C343 and C341, for bridge operation of the Collector Supply to compensate for unbalanced operation of the transformer.

Interlock

The Type 576 has an interlock system designed to protect the user of the instrument from potentially dangerous voltages which may appear at the Collector terminals of the Standard Test Fixture. The interlock system is shown on the Collector Supply schematic in Section 8.

Coil K323 enables or disables the Collector Supply output through K323-B, enabling it when the coil is energized. The coil is always energized when the MAX PEAK VOLTS switch is set to 15. When this switch is set to the 75, 350 or 1500 positions, one side of the coil is opened and the Collector Supply is diabled. The yellow COLLECTOR SUPPLY VOLTAGE DISABLED light is turned on through K323-A. In order to enable the Collector Supply under these conditions, the Protective Box must be put in place on the Standard Text Fixture and the lid closed. With the lid closed, High Voltage Interlock switch SW360 is closed and +12.5 volts is applied through the red DANGEROUS VOLTAGE light, B360, to coil K323, thus enabling the Collector Supply. With the coil now activated, the COLLECTOR SUPPLY VOLTAGE DISABLED light is turned off.

The COLLECTOR SUPPLY VOLTAGE DISABLED light may also be turned on if thermal cutout TK346 becomes open. TK346 opens whenever the internal heat in the instrument becomes hot enough to damage the collector supply or the readout.

Step Generator

The purpose of the step generator is to present a discrete level of current or voltage to the base or emitter (or equivalent terminals) of the device under test for each sweep, or change of direction of sweep, of the collector supply. These discrete levels are generated in the form of ascending steps which have a calibrated current or voltage separation.

The step generator circuit consists of four major sections: the clock, the counter, the digital-to-analog converter, and the pulsed steps operation section. The clock circuit produces negative-going clock pulses which determine the rate and phase, with respect to the collector supply, of the Step Generator output. The counter circuit counts these clock pulses and transforms each count into a digital code which controls the digital-to-analog converter. The digital-to-analog converter transforms the digital code into analog current which is summed at a current summing node and transmitted to the step amplifier. The pulsed steps operation circuit provides a variation of the Step Generator output where short duration pulsed steps rather than normal steps are generated.

Logic. The clock circuit, the counter circuit and a portion of the digital-to-analog circuit are digital circuits which make use of transistors and integrated circuits in digital configurations. The most convenient method of describing and understanding digital circuitry is through a logic description rather than a detailed circuit description. In order to make this description understandable by a wider range of readers, a simplified logic description, using high and low rather than true and false, has been utilized. A knowledge of basic logic symbols and truth tables will help in understanding this description.

Simplified schematics of each of these circuits are shown in Figs. 3-5, 3-6 and 3-7. Pertinent information such as internal logic diagrams, truth tables, timing charts and descriptions of operation are given in Fig. 8-1 at the beginning of the Diagrams section, for all the logic devices used in the Step Generator circuit. Logic level information for these logic devices is shown in blue on the Step Generator schematic. Familiarity with the logic symbols and related truth tables of these logic devices will greatly aid in understanding the following description.

Clock. Sine waves produced at line frequency by transformer T701 provide the timing source for the clock (see the Step Generator schematic). Transformer T701, steering diodes D1-D2 and D10-D11, and trigger generators U3A-U3B and U3C-U3D operate together to produce low level pulses at the inputs of U22A. Using U3A-U3B as an example, each time the transformer voltage at the anode of D1 crosses zero going negative, D1 will turn off and D2 will turn on. When D2 is conducting, the voltage at the pin 1 input of U3A is held at a low voltage level. Since the other input to U3A, pin 2, is held at a high voltage level by voltage divider R4-R5, this low causes a high to appear at the output of U3A (see Fig. 8-1 at the beginning of the Diagrams section for truth table of inverted input OR gate). This high is inverted by U3B and the resulting low is applied to the pin 1 input of U22A. This low output produced by the trigger generator continues until C5 charges to a high voltage level as determined by divider R4-R5. When the voltage at D1 crosses through zero going positive, D1 turns on and D2 turns off. With D2 off, both inputs to U3A are high, the output goes low and the output of U3B goes high. This is the quiescent state of the trigger generator. Trigger generator U3D-U3C operates the same as U3B-U3A except that the additional input at pin 9 of U3C allows the trigger generator to be inhibited when a low is applied to it.

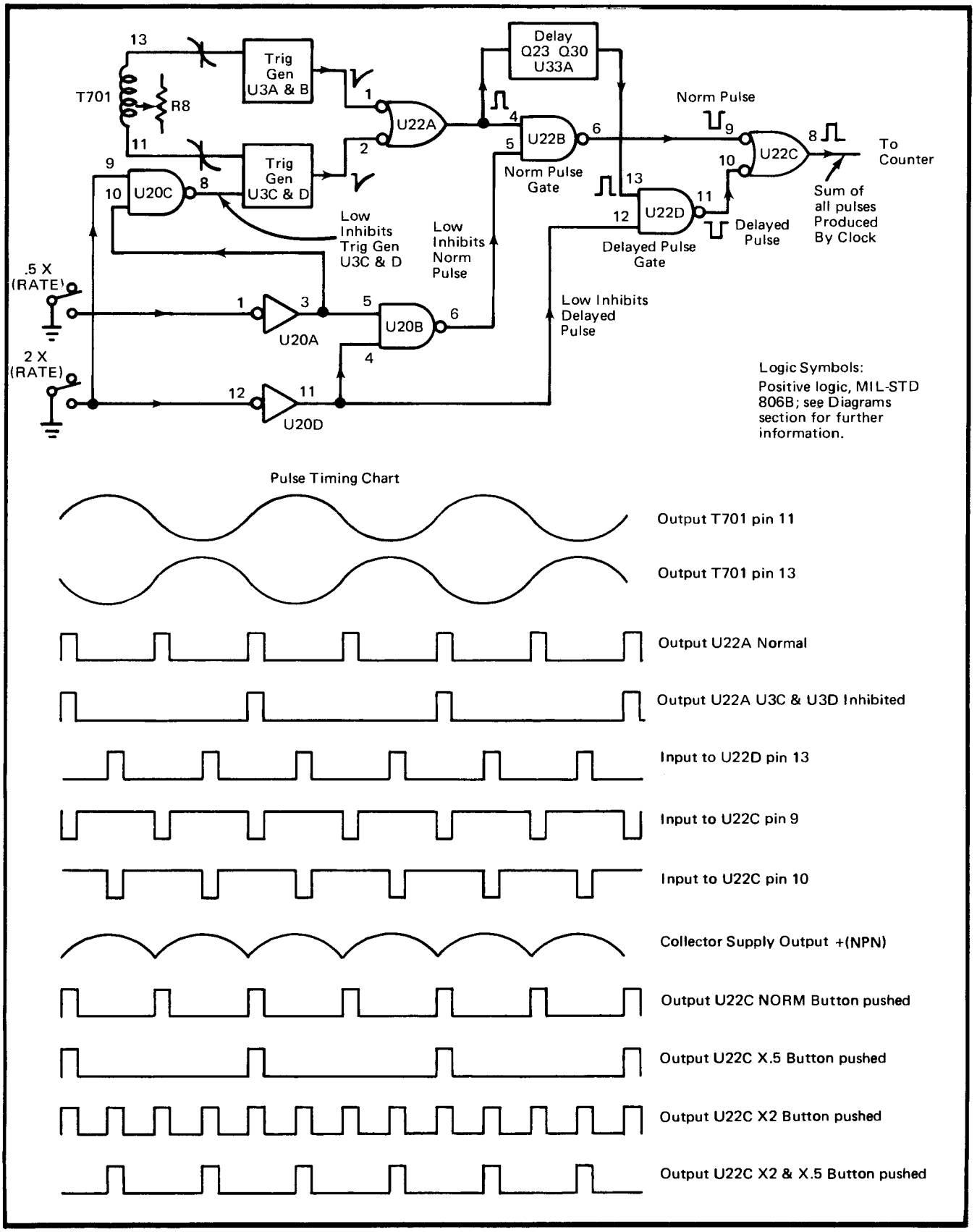


Fig. 3-4. Logic diagram, Pulse Timing chart for Step Generator Clock circuit.

Transformer T701 (see Fig. 3-4) is center tapped, causing the voltages at its outputs to be equal and opposite. The two trigger generators are triggered by T701, therefore, operate in opposite phase, producing alternate low level pulses at their outputs. Since T701 is in phase with the Collector Supply output, a pulse is generated by one of the trigger generators at the start of each collector sweep (assuming +NPN or −PNP polarity). ZERO CROSS adjustment R8 allows adjustment of the trigger level of the trigger generators.

With the NORM RATE button pressed, low pulses from the trigger generator are inverted to U22A and transmitted to norm pulse gate U22B. The pin 5 input to U22B is normally held high. A high at its other input, therefore, produces a low at its output. This low is applied to U22C, which produces a high level clock pulse to be applied to the counter circuit. With the NORM RATE button pressed, the rate of production of clock pulses (and therefore the step generator rate) is 120 pulses/second (assuming a 60 Hz line frequency) which is the normal collector supply rate.

High level output pulses from U22A are also applied to the base of Q23 (shown on the Step Generator schematic), the input to the delay circuit. This circuit generates clock pulses at the normal rate, but delayed (with respect to the start of each normal clock pulse) by a delay time equal to half the time duration between normal clock pulses. This delay circuit is triggered each time a high is produced at the output of U22A. This high turns on Q23, which pulls down on the base of Q30, turning it off. Since Q23 is pulling down on one side of C26, the other side begins charging. It continues to charge until a high enough voltage is reached to again turn on Q30. When Q30 turns on, a low level is produced at its collector, which is differentiated by C33 and R33 into a negative-going spike and applied to the input of inverter U33A. The result of this low at the input of U33A is a high at its output, and thus a high-level delayed pulse at the pin 13 input of U22D. The delay time of the half-step delay circuit is controlled by DELAY adjustment R24, which controls the charge time of C26. R24 is adjusted for a delay time equal to half the duration of a normal step (about 4167 μs). Delayed clock pulses, therefore, occur coincident with the peak of the Collector Supply output. SW27 lengthens the delay time of this circuit to 5000 μs when T701 is operated with a 50 Hz line frequency.

The clock circuit has two sources of clock pulses, the output of U22A and the output of the delay circuit. The various step generator rates are produced by inhibiting some of the clock pulses from these two sources from being summed by U22C. Three devices control the transmission of clock pulses through the circuit: Trig Gen Gate U20C, Norm Pulse Gate U22B and Delayed Pulse Gate U22D.

When the NORM RATE button is pressed, pin 9 of U3C is held high, enabling trigger generator U3D-U3C. A high is also applied to pin 5 of U22B, allowing the clock pulses from U22A to be transmitted to pin 9 of U22C. A low is applied to pin 12 of U22D, inhibiting the delayed clock pulse. When the .5X RATE button is pressed, the circuit operates as described for normal operation except that both inputs of U20C are held high, which holds pin 9 of U3C low and inhibits trigger generator U3C-U3D. The result is a step generator rate of half the normal rate, 60 steps/second (assuming a 60 Hz line frequency). Pressing the 2X RATE button causes normal operation of the circuit, except that a high is applied to pin 12 of U22D, allowing the delayed clock pulses to be applied to pin 10 of U22C. The step generator rate in this case is 240 steps/second. When both the 2X RATE and the .5X RATE buttons are pressed, the normal clock pulses are inhibited by a low at pin 5 of U22B and the delayed clock pulses are transmitted to U22C. In this case the Step Generator rate is normal, but the steps occur out of phase with the normal steps by the delay time of the delay circuit.

Counter. When the clock circuit generates a clock pulse, it is counted by the counter (see Fig. 3-5). The counter counts clock pulses until it reaches a preset number, then resets and begins counting again. Each time the counter counts, it changes a four-bit binary code which is applied to the digital-to-analog converter.

U70 is a divide-by-16 counter with the outputs of all four of its internal flip-flops utilized (see Fig. 3-5). A negative pulse at the pin 14 input of U70 causes a count to be recorded by the flip-flops. In recording a count, the flip-flops assume high or low states according to a 1-2-4-8 binary code. A high state represents the presence of either a 1, 2, 4 or 8. A low state represents a 0. Output terminals 12, 9, 8 and 11 of U70 represent 1, 2, 4 and 8 respectively. By connecting pin 8 and pin 11 of U70 to U72D through inverters, the 1-2-4-8 code of the U70 outputs is modified to a 1-2-4-4 code. The truth table in Table 3-1 shows the state of each modified counter output for successive counts counted by U70 up to 11. Whenever U70 is reset, it returns to the zero count state with lows on all the outputs.

The counter may be reset after from 1 to 10 steps have been produced. The NUMBER OF STEPS switch determines on which clock pulse the counter is reset. This switch presets the inputs to U75, so that when the counter has counted the desired number of clock pulses, a high is generated at pins 2 and 3 of U70, resetting the counter. This high is generated when a high appears at the output of reset trigger generator U75. U75 consists of four inverted input OR gates whose outputs are connected to a 4-input AND gate. One input of each inverted input OR gate is connected through an inverter to an output of the modified counter. The other input is connected to a section of the NUMBER OF STEPS switch. When a low appears on one input of each inverted input OR gate of U75, all four inputs to the U75 AND gate will be low and a high reset pulse is produced at the output. This condition of having at least one low on each inverted input OR gate of U75 is typically obtained by first setting lows on some of the inverted input OR gates through the NUMBER OF STEPS switch. The counter then counts until lows are produced by the modified counter output at the inverted input OR gates without preset lows. When no preset lows are applied to U75, the counter is reset when it

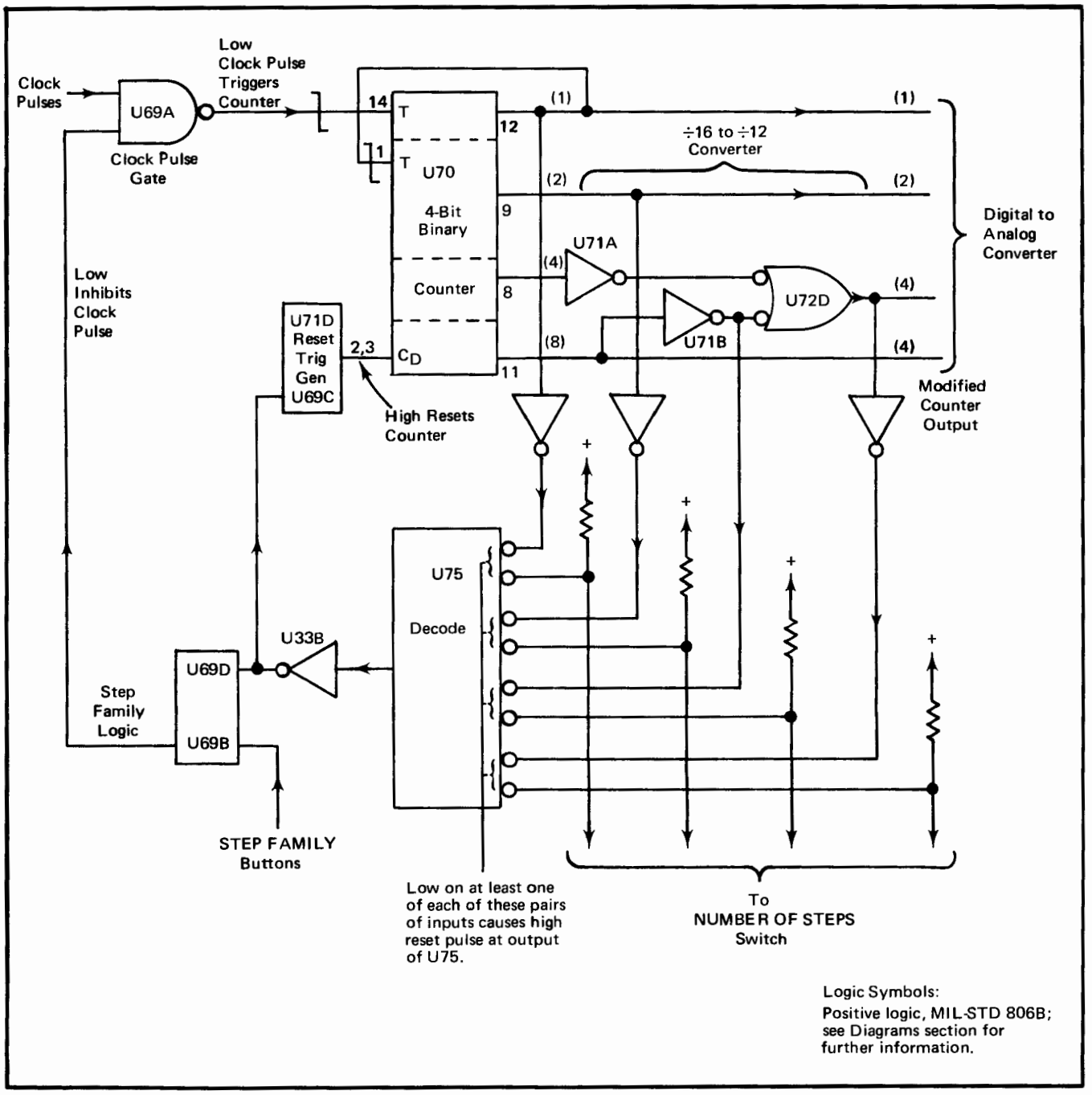


Fig. 3-5. Block diagram of counter and reset logic.

reaches the eleventh step (1 + 2 + 4 + 4 = 11) when all modified counter outputs are low. It should be noted that the clock pulse which causes the counter to be reset is always one clock pulse more than the number selected by the NUMBER OF STEPS switch. The time duration from the point at which this extra clock pulse is counted by the counter to the point when the counter is reset is so short that the extra step never appears at the Step Generator output.

The high at the output of U75 is inverted by U33B (see the Step Generator Schematic) and again by U69C, producing a reset high at pin 2 and 3 of U70. U71D and C81 stretch the reset high to a long-enough duration to assure that the counter is reset.

The state of pin 2 of clock pulse enable U69A determines whether clock pulses are applied to the pin 14 input of U70. When the STEP FAMILY REP button is pressed, a low is applied to pin 5 of U69B, causing pin 2 of U69A to be held permanently high. In this state of U69A, all clock pulses applied to its pin 1 input are inverted, and become counter triggers. When the STEP FAMILY SINGLE button is pressed, a momentary low is applied to pin 5 of U69B which goes high as C78 charges. This momentary low enables U69A until one step family has been generated. When the reset high causes pin 4 of U69B to go high, a low is produced at the pin 2 input of U69A. This low inhibits clock pulses from being transmitted past U69A.

Digital-to-Analog Converter. The outputs of them modified counter are connected to the digital-to-analog converter. The purpose of this circuit is to convert the modified counter output code into analog current which is applied to the step ampiifier input. The digital-to-analog converter consists of a set of current setting resistor pairs and four sets of current steering diodes.

TABLE 3-1

Normal and Modified Counter Output Codes

Count	Normal Code				Modified Code			
	Pins on U70				Pins on U70			U72D
	12	9	8	11	12	9	11	11
0	L	L	L	L	L	L	L	L
1	H	L	L	L	H	L	L	L
2	L	H	L	L	L	H	L	L
3	H	H	L	L	H	H	L	L
4	L	L	H	L	L	L	L	H
5	H	L	H	L	H	L	L	H
6	L	H	H	L	L	H	L	H
7	H	H	H	L	H	H	L	H
8	L	L	L	H	L	L	H	H
9	H	L	L	H	H	L	H	H
10	L	H	L	H	L	H	H	H
11	H	H	L	H	H	H	H	H

The digital-to-analog converter conducts a constant amount of current, the amount of which is set by current setting resistor pairs R54-R55, R57-R58, R60-R61 and R63-R64 (see Fig. 3-6). Each resistor pair conducts a discrete amount of current which is a multiple of the modified counter code: one increment of current conducted by R54-R55, two increments by R57-R58, four by R60-R61 and four by R63-R64. Each increment of current causes one step to be generated at the Step Generator output.

Another set of current paths is provided by diodes D54, D57, D60 and D63. These diodes provide current paths between the current summing node (at the cathode of D83)

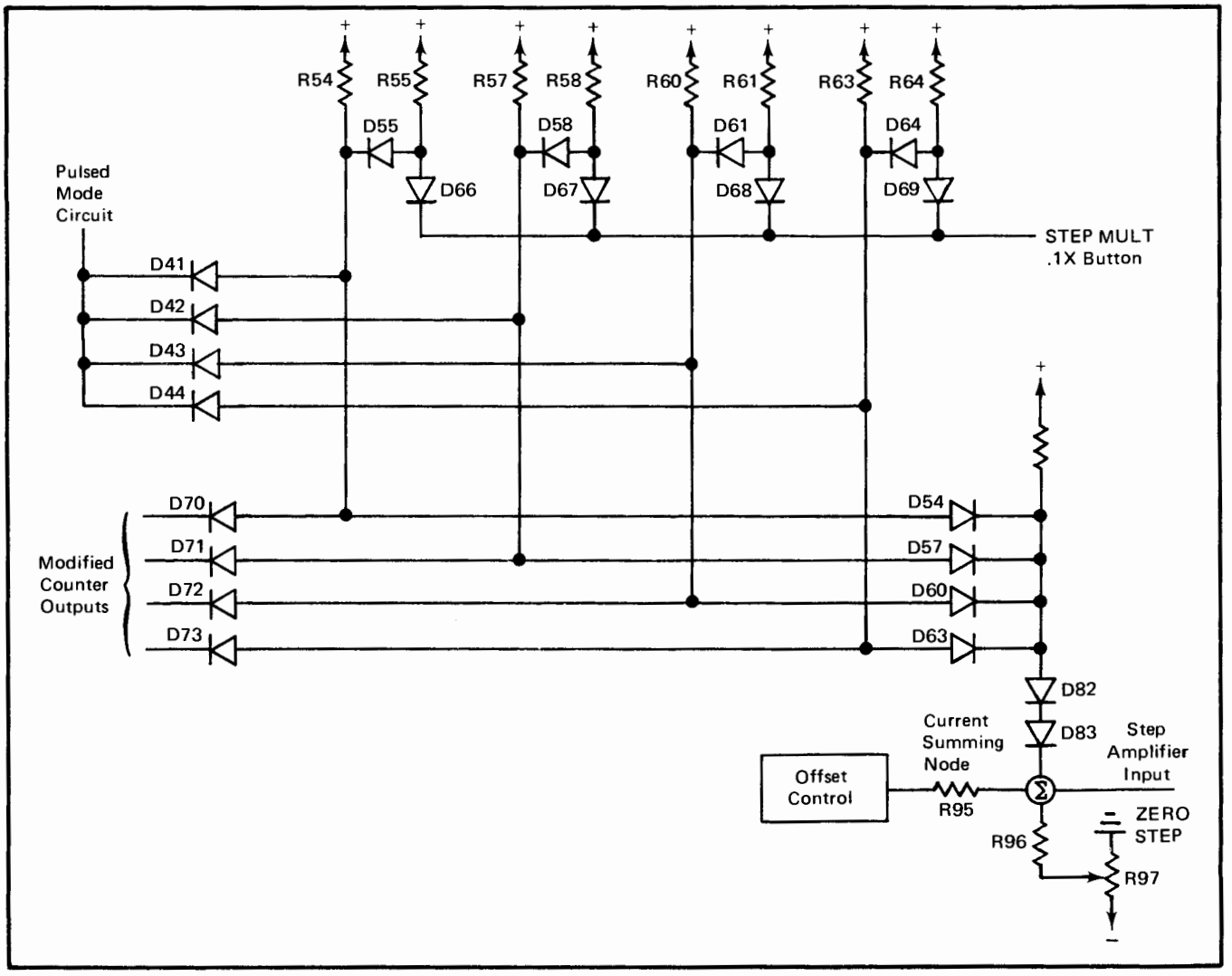


Fig. 3-6. Simplified schematic of Digital-To-Analog Converter.

and the current setting resistor pairs. It is these current paths which cause step current to be conducted by the step amplifier input. Whenever a high appears at one of the modified counter outputs, its associated steering diode off and the current conducted by its associated resistor pair is conducted by the step amplifier input.

The amount of current conducted by the step amplifier input is a function of the modified counter output and may be determined by adding the currents conducted by each resistor pair associated with a modified counter output which is high. For example, if five counts have been recorded by the counter, highs appear at the cathodes of D70 and D72. The current applied to the step amplifier input is, therefore, one increment by R54-R55 plus four increments by R60-R61, totalling 5 increments. Thus five counts recorded by the counter results in five increments of analog current conducted by the step amplifier input. The 1-2-4-4 modified counter code is designed so that the step current conducted by the step amplifier input increases by one increment for each clock pulse counted by the counter (until the counter resets). ZERO STEP adjustment R97 controls the level of the zero step (with zero offset) by adjusting the quiescent current through D82 and D83.

Steering diodes D66, D67, D68 and D69 provide current paths for the currents conducted by R55, R58, R61 and R64, respectively, whenever the STEP MULT .1X button is pressed. (With the STEP MULT .1X button pressed D55, D58, D61 and D64 are reverse biased.) These new current paths reduce the amount of current per increment which may be conducted by the step amplifier input by a factor of 10. The result is that the step amplitude is reduced to one-tenth its normal value.

The fourth set of steering diodes, D41, D42, D43 and D44 is used only when the step generator is operating in the pulsed mode. In all other cases, their cathodes are held high and they have no effect on the current applied to the step amplifier input.

The current summing node sums current from R95 as well as the digital-to-analog converter. The zero step level may be offset either in the direction which steps are ascending or in the opposite direction of ascent as determined by the DC current conducted by R95. If offset in the direction of the steps is desired, the AID OFFSET button is pressed. This allows positive voltage to be applied to the base of Q90 using the OFFSET MULT control, which raises the emitter voltage of Q93 and causes additional current to be conducted through R95. When the OPPOSE OFFSET button is pressed, negative voltage is applied to the base of Q90 using the OFFSET MULT control, which causes current to be conducted through R95 in the opposite direction. OPPOSE OFFSET adjustment R85 and AID OFFSET adjustment R86 adjusts the offset level of the steps when the OPPOSE OFFSET and AID OFFSET buttons are pressed, respectively.

Pulsed Step Mode. When one of the PULSED STEPS buttons is pressed, the Step Generator output steps are reduced to short pulses. These pulsed steps are obtained by inhibiting the digital-to-analog converter for all but 300 μs or 80 μs of each step.

The digital-to-analog converter is inhibited by pressing either the 300μs or the 80 μs PULSED STEPS button (see the Step Generator schematic). Pressing one of these buttons turns Q41 on and provides current paths for the resistor pairs through D41, D42, D43 and D44. The digital-to-analog converter is inhibited in this state because no step current is available to be conducted by the step amplifier input, regardless of the condition of the modified counter output. The digital-to-analog converter remains inhibited until a negative-going trigger from the collector of Q30 reverse biases D39 and turns off Q41. With Q41 off, its collector goes high, turning on Q36 and reverse biasing steering diodes D41, D42, D43 and D44. The digital-to-analog converter is now enabled and free to produce a step in the manner described previously. The duration of the step is controlled by the charge time of C35. With Q36 on, its collector holds one side of C35 at about ground, allowing the other side to be charged through R39 (and R37 when the 300 μs button is pressed). C35 charges until D39 is forward biased and Q41 again turns on. With Q41 on, Q36 is turned off and the digital-to-analog converter is again inhibited by the steering diodes D41, D42, D43 and D44.

Since each pulsed step is triggered by a negative-going trigger from the delay circuit, the pulsed steps always appear at the peak of the Collector Supply output. When the step generator is operating in the pulsed step mode, the 2X RATE button is inhibited.

When Q41 is turned on, Q46 is turned off, which also turns off Q52. The collector of Q52 is connected to the grid of the CRT, V897 (see the CRT Circuit schematic). When Q52 turns off, its collector voltage goes negative, causing the intensity of the CRT display to be reduced. The display intensity remains reduced until Q41 turns off, allowing Q46 and Q52 to turn on. The CRT display in the pulsed step mode is, therefore, intensified only when a pulsed step occurs.

The Collector Supply schematic shows that when either the 300 μs or the 80 μs PULSED STEPS button is pressed, K320 is energized and the Collector Supply operates in its DC mode. It also shows, that if the 300 μs and 80 μs PULSED STEPS buttons are pressed together, 300 μs pulsed steps are generated and the collector supply operates in its normal mode (K320 is not energized).

Step Amplifier

The step amplifier transforms the output of the step generator into current or voltage steps of various amplitudes to be applied to the device under test. The AMPLITUDE switch, which is part of this circuit, determines the amplitude of the steps. The circuit consists of a current to voltage converter, an inverter and a differential output

amplifier. The output amplifier has two modes of operation, one producing current steps and the other producing voltage steps.

The output of the Step Generator, which may be from one to ten current steps of 350 μA per step plus from one to ten steps of offset, is applied to the base of Q105A (see the Step Amplifier schematic). Q105A together with Q105B form a differential amplifier. As the base current of Q105A is decreased, the collector current of Q105B increases, raising the voltage at the base of Q110. Each current step at the base of Q105A, therefore, causes a positive voltage step at the base of Q110 which is amplified and inverted by Q110. Part of the output of Q110 is transmitted through R113, R112 and C112 creating negative feedback at the base of Q105A. R113 adjusts the feedback gain of current to voltage amplifier Q105 and Q110 for an output at the collector of Q110 of negative-going steps with amplitudes of 1/2 volt/step.

Q117 and Q122 have been added to the current to voltage amplifier circuit to slow down the voltage transition from the level of the last step generated to the zero step level, in cases where this transition may cause damage to the device under test. When the preset number of steps has been produced at the Q110 output, a rapid transition occurs as the step returns to its starting point. This transition, when applied to the base of a transistor, rapidly turns it off. If a transistor is turned off in this manner when its collector is at a high level, a high inductive voltage kick will be produced in the collector supply transformer. Such an inductive voltage kick may be large enough to damage the transistor.

This circuit operates either when the 2X RATE button is pressed or when the 300 μs and 80 μs PULSED STEPS buttons are pressed together. In this case the emitter circuit of Q122 is opened, turning the transistor off. The source of FET Q117 is held at −11.3 volts by divider R116-D115-R108. When Q122 turns off, divider R119-R120-R121 sets the voltage at the gate of Q117 at −10.3 volts, turning the FET on. With Q117 on, its drain is held at about −11.3 volts, providing a constant voltage on the side of C114 connected to Q117. By holding one side of C114 at constant voltage and transmitting the output of Q110 across the other side, C114 becomes an integrator. The voltage transition of the Q110 output from the level of its last step to the starting level is, therefore, slowed down by integrator C114. When Q122 is turned on (normal or 0.5 times rate or DC mode), Q117 is held off by having about −34 volts at its gate. In this case, the current through R117 controls the voltage on Q117 side of C114, which moves up and down with changes in the output of Q110. C114, therefore, has little effect on the output of Q110 and causes no slowing of the voltage transition.

When relay K101A is in the − position, the output of Q110 is transmitted through inverter circuit Q130A and B and Q133 and inverted before it is applied to the output amplifier. The inverter is identical in operation to the current to voltage amplifier described previously. Since the input resistance (R125) and the feedback resistance (R137) are equal, the gain of the inverter is 1. INVERT ZERO adjustment R127 sets the voltage at the base of Q130A so that the initial level is the same for the non-inverted steps and the inverted steps.

The position of relay K101A is controlled by the COLLECTOR SUPPLY POLARITY switch, the STEP-OFFSET POLARITY INVERT button and the Terminal Selector switch in conjunction with the step generator polarity logic (see the Step Amplifier schematic). U33C and D, U72A, B and C form a coincidence gate. See Table 3-2 for a truth table of this gate. The output at pin 6 of U72B causes Q101 to turn on and off, thus switching relay K101A between + and −. If a high appears at the output of U72B, K101A switches to the − position and if a low appears, it remains in the + state. The inputs to U33C and D and to U72A and C are controlled by the voltage levels on connectors T and S as shown in Table 3-2. Setting the Terminal Selector switch to EMITTER TERM STEP GEN has the same effect on the voltage level of connector T as pressing the POLARITY INVERT button. If the POLARITY INVERT button is pressed, however, the Terminal Selector switch has no effect on the voltage level at connector T and vice versa.

TABLE 3-2

Step Generator Polarity Logic

COLLECTOR SUPPLY POLARITY	POLARITY INVERT	Connectors		Pin 6 U72B
		T	S	
AC	Pressed	H	L	H
AC	Not Pressed	H	H	L
+(NPN)	Pressed	H	L	H
+(NPN)	Not Pressed	H	H	L
−(PNP)	Pressed	L	L	L
−(PNP)	Not Pressed	L	H	H

Output Amplifier. The step output amplifier transforms the output steps of the current to voltage amplifier (or inverter) into current or voltage steps of various amplitudes as determined by the AMPLITUDE switch. It is basically a differential amplifier with separate feedback to each input. The negative input side of the amplifier controls the amplitude of the output steps. The positive input side of the amplifier provides either current regulation or a constant operating level. To obtain current steps (see Fig. 3-7A), the gain of the negative side of the differential amplifier is set for an output of 1 volt per step. This output is then transmitted through a variable resistance in series, the current setting resistors. With the constant voltage per step relationship across the current setting resistors, the current per step output can be varied by changing this resistance in series. To obtain voltage steps, the input resistance to the nega-

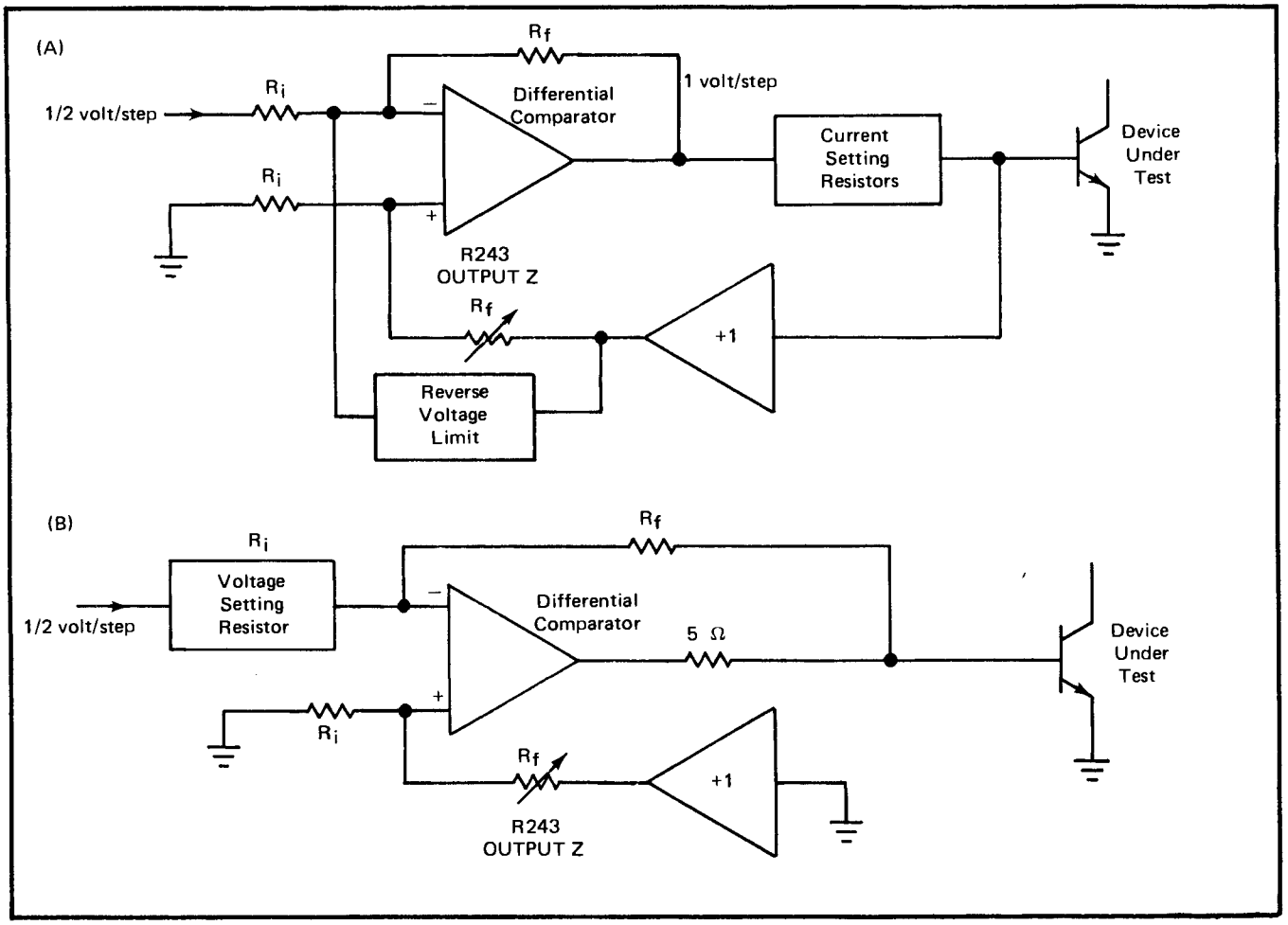


Fig. 3-7. Block diagram of Step Output Amplifier: (A) Current Mode; (B) Voltage Mode.

tive input, the voltage setting resistors, is changed, thus varying the feedback gain of that side of the differential amplifier. In this manner voltage steps of various amplitudes are obtained.

Current Mode. Input to the negative side of the differential comparator, at the base of Q150A, is always through VOLTAGE SETTING RESISTORS R141 through R145. In the current mode, this input resistance is set at 3.01 kΩ (R141) for all current positions of the AMPLITUDE switch. When 1/2 volt steps are applied to the base of Q150A through R141, they are inverted, applied to the base of Q164 and inverted again. The steps are then transmitted through emitter follower Q169 to the bases of Q172 and Q176. Depending on the position of relay contacts K102B and K102C, either Q172 and Q180 or Q176 and Q184 are turned on. If, for example, K102B and K102C are in the + positions, signifying positive-going steps out, Q176 and Q184 are on the Q172 and Q180 are off. In this case the input to Q176 is negative-going steps. They are inverted by Q176 and the resulting positive-going steps are transmitted through emitter follower Q184 to the negative side of the floating 50-volt supply. Each time a positive step occurs at the negative side of the 50-volt supply, the supply is pushed up by the amount of the step. The positive side of the 50-volt supply is connected to both the feedback resistors and the input to the current setting resistors, so that each time the 50-volt supply is raised by a step, the voltage at this connecting point is also raised by the amount of the step. Due to the presence of the 50-volt supply, the voltage at the input to the current setting resistors is offset by 50 volts. To compensate for this offset, 50 volts of opposing offset is added to the input of the current setting resistors through relay K102A. If K102B and K102C are in their – positions, Q172 and Q180 are on and Q176 and Q184 are off. In this case negative-going steps are applied to the positive side of the 50-volt supply and negative-going steps appear at the input to the current setting resistors.

The output of the negative side of the differential amplifier at either K102B or K102C is fed back to the base of Q150A through feedback resistor R194. Since R194 is 6.04 kΩ and the input resistance, R141, is 3.01 kΩ the feedback gain of this circuit is 2. For a half volt per step input, the resulting output of the negative side of the differential amplifier (as seen by the input to CURRENT SETTING RESISTORS R197 through R216) is steps of one volt per step, the zero level being at ground. (If offset has been

added in the step generator circuit, the zero step level may range from 0 to 10 volts.)

The output end of the current setting resistors is connected through the device under test to ground. When voltage steps of 1 volt per step are applied between the input end of the current setting resistors and ground, current steps of variable amplitude flow through the device under test. The current amplitude of the steps is determined by AMPLITUDE switch SW195 (see Step Generator Switching schematic), which chooses various combinations of resistors R197 through R216.

In order to obtain calibrated current steps, the voltage across the current setting resistors must be held at 1 volt per step. The voltage at the output, however, may vary by the amount of the turn-on voltage of the device under test thus altering the current per step output of the step generator. To compensate for this turn-on voltage, any variation from ground of voltage at the input to the device under test is transmitted through the +1 amplifier to the positive side of the differential amplifier. This starts a regulating process which causes the voltage at the input to the current setting resistors to move in the same direction as the turn-on voltage at the output, thus nullifying its effect.

The +1 amplifier is made up of paraphase amplifier Q229A and B, constant current sources Q233 and Q226, and emitter followers Q235 and Q241. In the current mode, any voltage at the input of the device under test is transmitted through R220 to the high impedance gate input to Q229B. If, for example, this variation is a rise in voltage at the gate input, it will be accompanied by a rise in voltage at the drain of Q229A, due to the paraphase operation of Q229A and B. Raising the voltage at the Q229A drain raises the base of emitter follower Q235, and thus the base of emitter follower Q241. As the emitter of Q241 follows its base up, it pulls the voltage at the gate of Q229A up so that it is equal to the voltage at the gate of Q229B. This rise in voltage at the gate of Q229A is then transmitted to the base of Q150B (positive side of the differential amplifier) through feedback resistors R243 and R244. The +1 amplifier, therefore, transmits any voltage variation from the input to the device under test to the input to the base of Q150B with no change in amplitude or polarity. In performing this task, the +1 amplifier provides the voltage variation with a high impedance input and a low impedance output. When the rise in voltage at the base of Q150B has been transmitted to the input to the current setting resistors, it compensates for voltage variations at the input to the device under test holding the voltage across the current setting resistors at 1 volt per step. AMP BAL adjustment R224 adjusts the DC balance of paraphase amplifier Q229, and also compensates for unbalance in Q150. OUTPUT Z adjustment R243 adjusts the output impedance of the step amplifier.

Relay K101B and Q248 or Q250 are used to limit the voltage which may be applied to a device under test in the reverse direction using opposing offset. If, for example, positive going steps are to be applied to the device under test, K101B is in the + position. If negative offset is applied to the device under test by pushing the OPPOSE button and turning the OFFSET MULT control clockwise, the step generator will attempt to conduct negative current at the input to the device under test. In doing this, the voltage at the input to the device under test and thus the voltage at the Q229B gate input is driven down. When the voltage goes approximately 2 volts below ground, Q248 turns on. With Q248 on, the negative-going voltage steps at the base of Q150A are limited, thus limiting the output of the output amplifier (the input to the device under test) to about 2 volts. This amount of voltage should not damage a device under test.

Voltage Mode. Voltage steps are obtained from the output amplifier in a manner similar to that used to obtain current steps. For voltage steps, however, the VOLTAGE SETTING RESISTORS are changed to obtain the various voltage amplitudes, rather than the CURRENT SETTING RESISTORS (which are held constant in the voltage mode). Also since it is not desirable to regulate the voltage at the input to the CURRENT SETTING RESISTORS in the voltage mode, the feedback to the positive side of the differential amplifier through the +1 amplifier is disconnected and the input to the +1 amplifier is connected to ground. The base of Q150B is, therefore, held at essentially ground. Since the output of the +1 amplifier is at ground, reverse voltage limiting transistors Q248 and Q250 are disabled in the voltage mode.

In the voltage mode when steps of 1/2 volt per step are applied to the step output amplifier, they are transmitted through VOLTAGE SETTING RESISTORS R141 through R145, the input resistance. By varying this input resistance with respect to constant feedback resistor R194, the feedback gain of the negative side of the differential amplifier is changed, thus varying the amplitude of the voltage steps. After being conducted through the voltage setting resistors, the steps are amplified and transmitted through the negative side of the differential amplifier in the same manner as described in the current mode section. When the voltage steps reach the CURRENT SETTING RESISTORS, they are transmitted through a nominal resistance (R215 and R216) of 5 Ω, for all voltage positions of the AMPLITUDE switch, before being applied to the device under test. Voltage steps of varying amplitudes, as determined by the AMPLITUDE switch, are then applied across the input impedance of the device under test. Feedback to the input to the differential amplifier occurs at the output of the current setting resistors, therefore, minimizing the effect of R215 and R216.

When using voltage steps, the current conducted at the step generator input to the device under test may increase quite rapidly and possibly damage the device under test (especially when testing transistors). As a means of limiting this current in the voltage mode, current limiting resistors R185, R186 and R187 are added to the output amplifier circuit by the CURRENT LIMIT switch. These resistors limit current at the Step Generator Output by limiting

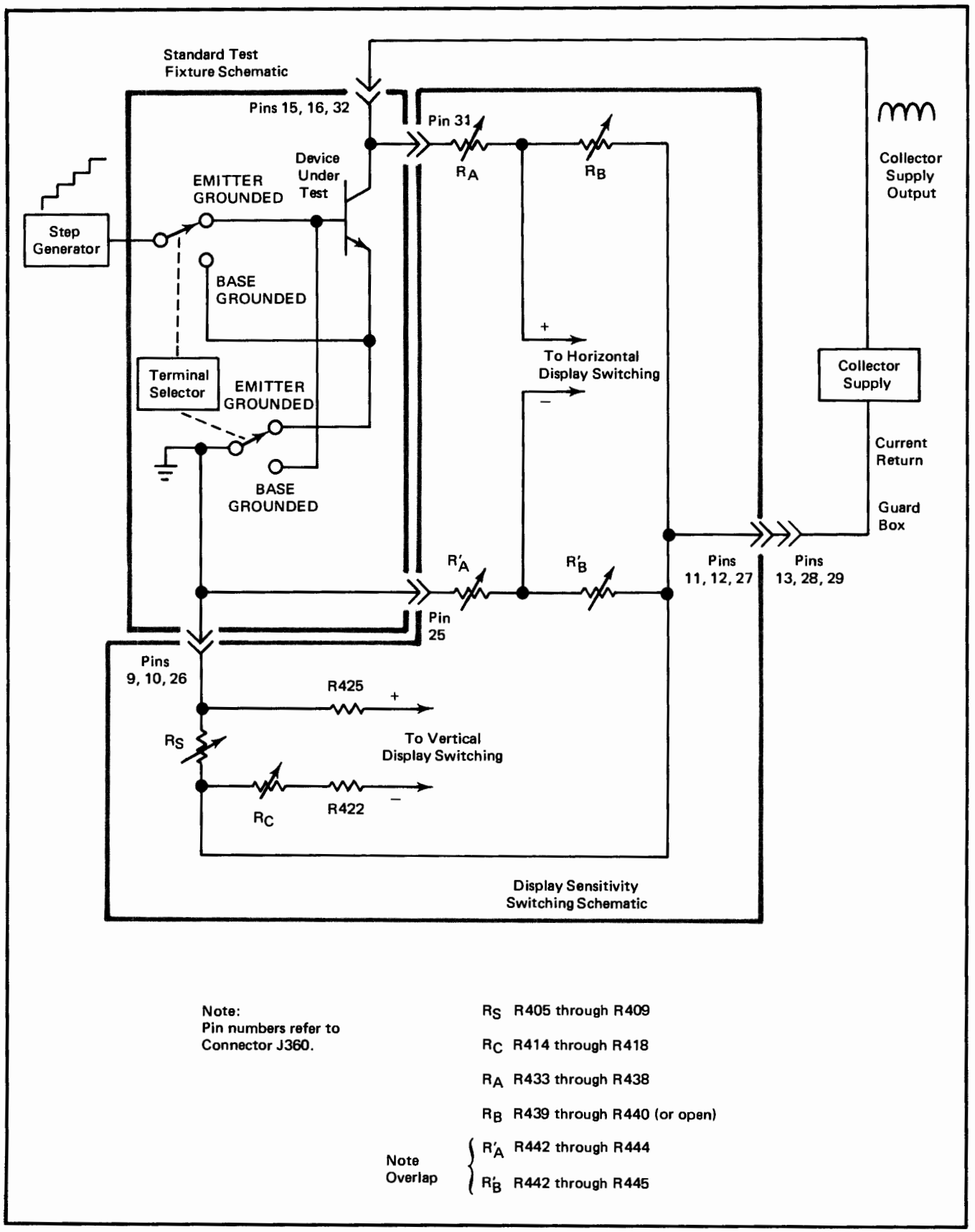


Fig. 3-8. Simplified schematic of Display Sensitivity Switching and Standard Test Fixture schematics for measurement of collector current (I_C) and collector-emitter voltage (V_{CE}) or collector-base voltage (V_{CB}).

current through R165, R166 and R167. As the voltage steps increase through Q176 and Q184 or through Q172 and Q180, the current increases through the current limiting resistors. This current increase causes the voltage drop across the resistors to increase. If positive-going steps are being produced, this increase in voltage drop is transmitted through Q176 and Q169 to the junction of R166 and R167. As the voltage drop increases, the voltage at this junction point goes down. When the voltage reaches about −2.3 volts, D165 forward biases, clamping the voltage at the base of Q169. This prevents generation of further steps. When negative-going steps are being produced, the drop across the current limiting resistors is transmitted through three base-emitter junctions, Q180, Q172 and Q169, to the junction of R166 and R167. As voltage drop increases, the voltage at the collector of Q164 goes up. When this voltage reaches +12.5 volts, Q164 is saturated, and again no further steps can be generated. The CURRENT LIMIT switch determines the number of resistors to be included in the current limiting resistance, therefore determining the amount of current necessary to either turn on D165 or saturate Q169.

VERTICAL AND HORIZONTAL DISPLAY

Signal Sensing and Display Sensitivity

Once the Collector Supply and the Step Generator Output have been applied to the device under test, measurements of the voltages and currents seen at the terminals of the device under test may be displayed on the vertical and horizontal axes of the CRT. These measurements are made by first sensing the current or voltage through current sensing resistors or voltage dividers, then amplifying the resulting voltage with the display amplifiers and applying them to the deflection plates of the CRT. The positions of the HORIZONTAL, the MODE and the Terminal Selector switches determine which measurements are made.

Collector Current Sensing. If the MODE switch is set to either NORM or DC, collector current (I_C) is measured on the vertical axis of the CRT. Collector current is measured by placing a resistor (R_S) between ground and the current return to the collector supply and measuring the voltage developed across this resistor (see Fig. 3-8 and Fig. 3-9). By

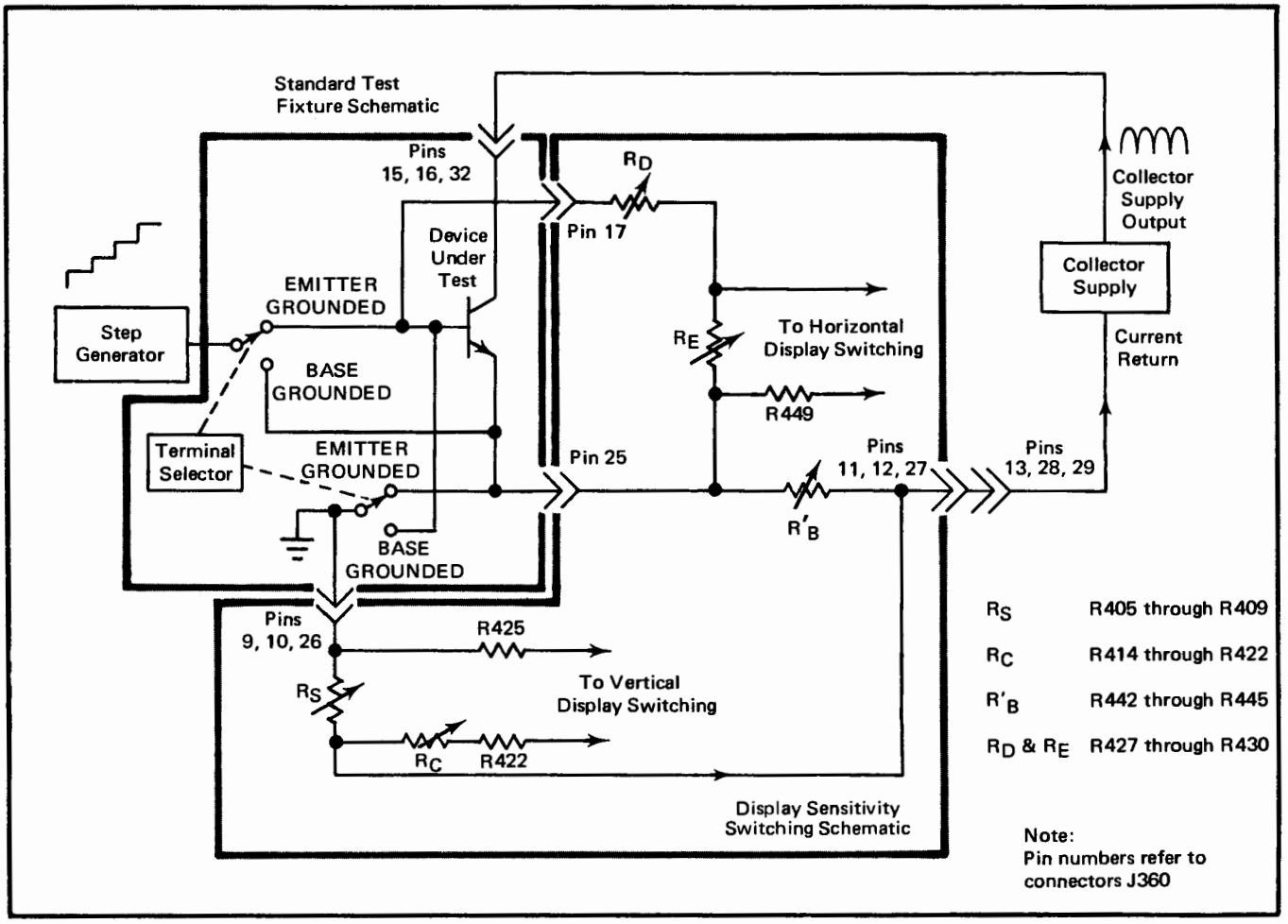


Fig. 3-9. Simplified schematic of Display Sensitivity Switching and Standard Test Fixture schematics for measurement of collector current (I_C) and base-emitter voltage (V_{BE}) or emitter-base voltage (V_{EB}).

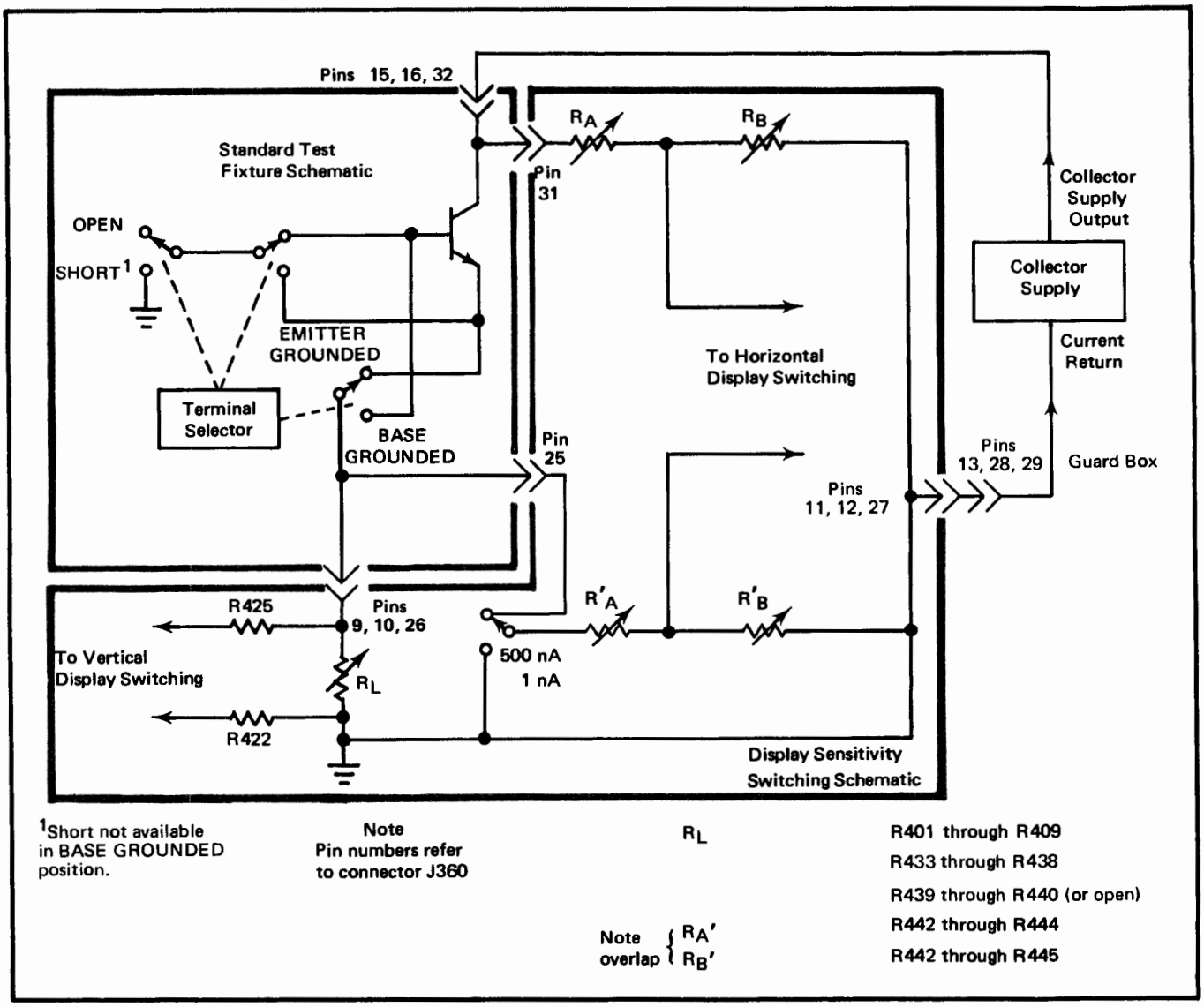


Fig. 3-10. Simplified schematic of Display Sensitivity switching and Standard Test Fixture schematics for measurement of emitter current (I_E) collector-base current (I_{CBO}) collector-emitter voltage (V_{CE}) or collector-base voltage (V_{CB}).

varying the value of this current sensing resistor (R_S), the deflection factor of the display on the CRT may be varied.

Leakage Current Sensing. If the MODE switch is set to LEAKAGE, emitter current (I_E) or collector-base current (I_{CBO}) is measured on the vertical axis of the CRT. Emitter current is measured by placing a leakage current sensing resistance (R_L) between the emitter terminal of the device under test and ground, and measuring the voltage developed across it (see Fig. 3-10). If emitter current is to be measured, the Terminal Selector switch must be set to GROUNDED EMITTER BASE TERM OPEN or BASE TERM SHORT. When the Terminal Selector switch is set to BASE GROUNDED EMITTER TERM OPEN, collector-base current is measured on the vertical axis. In this case the current sensing resistor is connected between the base terminal and ground. As when measuring collector current, the deflection factor of the display, when measuring emitter current and collector-base current, can be varied by varying the current sensing resistance. It should be noted that the deflection factor of the vertical display is always decreased 1000 times when the MODE switch is set to LEAKAGE and the collector supply operates in its DC mode.

Voltage Sensing Normal Mode. Either collector or base voltage may be measured on the horizontal axis of the CRT, depending on the position of the HORIZONTAL switch. When the HORIZONTAL switch is in its COLLECTOR range, voltage is measured between the collector and emitter terminals of the device under test, V_{CE} (Terminal Selector switch set to EMITTER GROUNDED), or between the collector and base terminals, V_{CB}, (Terminal Selector switch set to BASE GROUNDED). When the HORIZONTAL switch is in its BASE range, voltage is measured between the base and emitter terminals, V_{BE} (EMITTER GROUNDED), or between the emitter and base terminals,

V_{BE} (BASE GROUNDED). It should be noted, that the measurement of voltage from the emitter terminal to the base terminal appears as a negative measurement on the CRT graticule. It is not, however, a reverse voltage measurement. By use of a variable voltage divider across these terminals, the deflection factor of the horizontal display can be varied.

Voltage Sensing Leakage Mode. When the MODE switch is set to LEAKAGE, only the measurement of V_{CE} and V_{CB} are useful. In this situation a slight error in voltage measurement occurs whenever the VERTICAL switch is set within the 500 nA to 1 nA EMITTER range. In this range (see Fig. 3-10) the horizontal display is a measurement of collector voltage to ground, rather than collector to emitter or collector to base voltage. As discussed previously, when current measurements are made in the leakage mode, the current sensing resistor is between ground and the emitter or ground and the base terminal. Any measurement of voltage between the collector and ground, therefore, measures the voltage drop across the current sensing resistor and adds it to the desired measurement of V_{CE} or V_{CB}. The correct values of V_{CE} or V_{CB} can be determined by subtracting the voltage drop across the current sensing resistor from the total measurement shown on the horizontal axis of the CRT. See the Horizontal Measurement and Deflection Factor section of the Operating Instructions for instructions on how to determine this error voltage.

Display of Step Generator. If either the VERTICAL or the HORIZONTAL switch is set to STEP GEN, the 1/2 volt steps at the input to the output amplifier section of the step amplifier (see Fig. 3-7) are applied to the inputs to the vertical display amplifier or the horizontal display amplifier (see Fig. 3-11). If both switches are set to STEP GEN, the 1/2 volt steps are applied to the Horizontal Display Amplifier only.

Vertical and Horizontal Positioning

The positioning of the display on the CRT is determined by current applied to the low impedance inputs of the Display Amplifiers at the emitters of Q533A and B in the vertical display amplifier, and Q633A and B in the horizontal display amplifier (see discussion of Display Amplifiers). This current comes from many individual current sources which are controlled by the POSITION switches, the FINE POSITION controls, the POLARITY switch and the DISPLAY OFFSET controls (see the Display Positioning schematic).

The POSITION switches and the FINE POSITION controls allow both coarse and fine positioning of the display. The current for the coarse control comes from resistors R480 through R483 (vertical) and R490 through R493 (horizontal). These resistors are all connected to the −75 volt supply, making them current sources. Each of these current sources is connected between a pair of contacts. When one contact of a pair is closed, this current flows into one side of the display amplifier. If the other contact of the pair is closed, the current flows into the other side of the amplifier. The matrixes for the POSITION cam switches show that at all times one contact of each pair must be

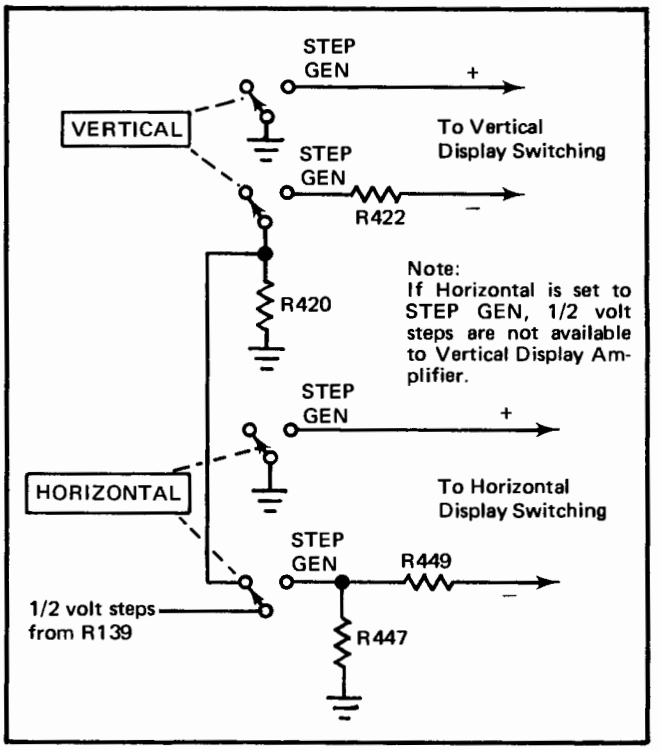


Fig. 3-11. Simplified schematic of Display Sensitivity Switching when VERTICAL and/or HORIZONTAL switches are set to STEP GEN.

closed, but never both closed at once. This assures that the sum of the positioning current flowing into the amplifiers is always a constant. Each POSITION switch provides 20 divisions of positioning in five division steps. The FINE POSITION controls, R488 (vertical) and R498 (horizontal) operate in a similar manner to the coarse controls except that the adjustment is continuously variable.

The POLARITY switch provides automatic positioning of the display when switching between the AC, +(NPN) or −(PNP) positions of the switch. This positioning current is obtained in the same manner as the coarse positioning current. Current sources R474 and R475 (vertical) and R477 and R478 (horizontal) provide this positioning current.

The display may also be positioned by the calibrated CENTERLINE VALUE switch. This control affects the circuit only when the DISPLAY OFFSET Selector switch is switched to one of its VERT or HORIZ positions and affects only one display amplifier at a time. When the DISPLAY OFFSET Selector switch is set to NORM (OFF), current sources R468 and R469 (vertical) and R471 and R472 (horizontal) supply current to the display amplifiers. When, for example, the switch is set to VERT, R468 and R469 are disconnected from the circuit and an equal amount of current is supplied to the vertical display amplifier by current sources R450 through R464. These resistor-contact combinations are controlled by the CENTERLINE VALUE switch and operate identical to the POSITION switches. The CENTERLINE VALUE switch provides 10 divisions of calibrated positioning in half-division steps.

Display Switching

Once the desired voltages and currents have been sensed by the display sensitivity switching circuit, and once the desired positioning currents have been obtained from the display positioning circuit, the resulting voltage signals and positioning currents must be applied to the display amplifiers. Before being applied to the display amplifiers, however, these signals pass through the display switching circuit (see the Display Amplifiers and Display Positioning Switches schematics).

Under normal operating conditions with neither the DISPLAY INVERT, the ZERO nor the CAL buttons pressed, these signals and currents pass directly to the display amplifers. If the DISPLAY INVERT button is pressed, however, the signal and current (CENTERLINE VALUE Switch and POLARITY switch positioning current) input lines to both amplifiers are reversed. This causes the display on the CRT to be inverted, both vertically and horizontally.

The ZERO button, when pressed, disconnects the signal input lines from both pairs of high impedance inputs and shorts the input pairs together. This provides a zero reference for both display amplifiers. If the DISPLAY OFFSET controls are being used when the ZERO button is pressed, offset positioning current is caused to flow as if the CENTERLINE VALUE switch were set to 0 (see Display Positioning schematic and discussion of positioning).

The CAL button, when pressed, disconnects the signal input lines from both pairs of high impedance inputs and applies a substitute voltage across each input pair which should cause full graticule deflection (10 divisions by 10 divisions). This provides a means of checking the accuracy of calibration of the display amplifiers. The substitute voltage is determined by R501 through R513 and by D507. Since each display amplifier has three gains to check, three substitute voltages must be available. Relays K537C, K541C, K637C and K641C determine which voltages are applied to the high impedance input pairs for various settings of the VERTICAL and HORIZONTAL switches. If the DISPLAY OFFSET current controls are being used when the CAL button is pressed, offset current is caused to flow as if the CENTERLINE VALUE switch were set to 10.

Display Amplifiers

The vertical and horizontal display amplifiers are identical with a few minor exceptions. They are both differential amplifiers, each with two sets of differential inputs and one set of differential outputs. One set of differential inputs is high impedance and receives its inputs from the display sensitivity switching circuit. The other set of differential inputs is low impedance and their inputs are the differential positioning currents from the display positioning circuit. The differential outputs are connected to the deflection plates of the CRT and control the potential on the deflection plates.

The simplified schematic in Fig. 3-12 will help in understanding the operation of the display amplifiers. The display amplifiers control the voltage between the deflection plates of the CRT by controlling the currents through load resistors R_{L1} and R_{L2}. The currents I_{L1} and I_{L2} conducted by the load resistors are controlled by two means: differential current I_S and positioning currents I_{P1} and I_{P2}. The differential current flows through source coupling resistor R_S whenever there is a differential voltage signal applied to the high impedance gate inputs of FETS Q1A and Q1B. Positioning currents I_{P1} and I_{P2} are determined by the resistance between the emitter of Q2A and −75 volts and between Q2B and −75 volts, respectively.

The relationship between the load resistor currents and the other currents in the amplifier is as follows:

$$I_L = I_P - (I_D + I_S) \quad \text{(Equation 3-1)}$$

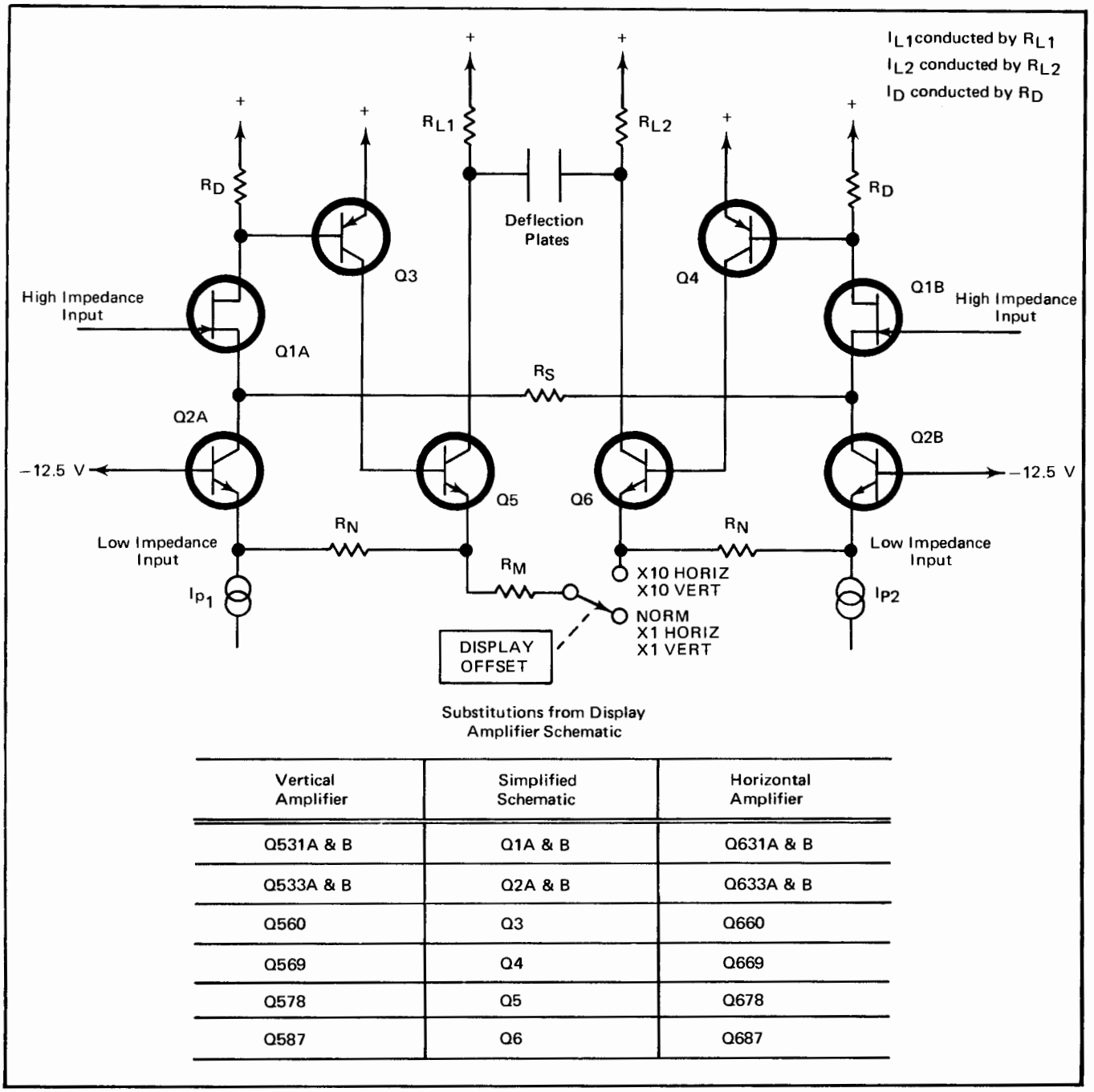
Equation 3-1 pertains to the currents which flow in one side of the amplifier. I_S is either positive or negative, depending on whether it adds to or subtracts from I_D. I_D represents the FET drain current. It originates from a constant current source and is the same in each side of the amplifier. This equation also shows that the load current is dependent on the interaction between the differential current (I_S) and the positioning current (I_P).

To understand the operation of this circuit, first assume that the amplifier is operating in a balanced condition where the two positioning currents are equal ($I_{P1} = I_{P2}$) and there is no voltage difference between the two high impedance inputs ($I_S = 0$). In this case, the load currents on each side of the amplifier are equal to I_{LO}. Equation 3-1, then, becomes:

$$I_{LO} = I_{L1} = I_{L2} = I_{P1} - I_D = I_{P2} - I_D \quad \text{(Equation 3-2)}$$

To illustrate the effect the high impedance inputs have on the load current, assume that a difference in voltage is applied across the gates of Q1A and Q1B, making the gate of Q1A more positive. This voltage differential causes differential current I_S to flow through source coupling resistance R_S. With this additional current (I_S) flowing through Q1A, less current is needed from Q2A to keep drain current I_D constant. The current conducted by Q2A is thus reduced to $I_D - I_S$. Since the positioning current I_{P1}, which supplies the current conducted by Q2A, is also constant, there is a surplus of positioning current created equal to I_S which must be conducted by Q5, and therefore R_{L1}. The load current is increased to $I_{L1} = I_{LO} + I_S$. On the other side of the amplifier, the current through Q2B is increased to $I_D + I_S$, which decreases the load current through Q6 and R_{L2} to $I_{L2} = I_{LO} - I_S$. For this example, it can be seen that whenever a differential voltage occurs between the two high impedance inputs, the load currents change, thus changing the voltage potential between the deflection plates of the CRT.

To illustrate the effect the positioning currents have on the load currents, assume that the voltages at the high



Substitutions from Display Amplifier Schematic

Vertical Amplifier	Simplified Schematic	Horizontal Amplifier
Q531A & B	Q1A & B	Q631A & B
Q533A & B	Q2A & B	Q633A & B
Q560	Q3	Q660
Q569	Q4	Q669
Q578	Q5	Q678
Q587	Q6	Q687

Fig. 3-12. Simplified schematic of display amplifier.

impedance inputs are equal ($I_S = 0$) and that the positioning currents are unequal ($I_{P1} \neq I_{P2}$). From Equation 3-1 the load currents are found to be:

$$I_{L1} = I_{P1} - I_D \quad \text{(Equation 3-3)}$$

$$I_{L2} = I_{P2} - I_D \quad \text{(Equation 3-4)}$$

By subtracting Equation 3-4 from Equation 3-3, it is shown that the difference in the two load currents exactly equal the difference in the two positioning currents.

$$I_{L1} - I_{L2} = I_{P1} - I_{P2} \quad \text{(Equation 3-5)}$$

Since the positioning currents are now unequal, the load currents (I_{L1} and I_{L2}) are unequal, which again changes the voltage potential between the deflection plates of the CRT.

These two examples have shown that the voltage between the deflection plates (and thus the position of the electron beam as it strikes the face of the CRT) is controlled by two means, the voltage applied to the high impedance inputs and the positioning currents applied to

the low impedance inputs. Equation 3-1 shows this relationship.

It should be noted that it is transistors Q3 and Q4 which cause Q5 and Q6 to conduct more or less load current. As in previous examples, assume the normally constant drain current I_D conducted by Q1A is caused to increase either by increasing I_S or I_{P1}. This increase in I_D causes the drain voltage of Q1A to go negative, causing Q3 to conduct more current. This in turn causes Q5 to conduct more current. The additional current conducted by Q5 reduces the current through Q2A and causes the drain current I_D to be reduced back to its normal constant value.

The gain of the display amplifiers is adjusted in two ways. The overall gain is controlled by varying the load resistance (R_{L1} and R_{L2}). Adjusting the load resistance affects the gain of the high impedance inputs, as well as that of the positioning current. R_{L1} and R_{L2} are adjusted so that the positioning inputs provide the proper deflection. Varying the source coupling resistance (R_S) sets the gain of the high impedance inputs only. R_S is adjusted to match the high impedance gain to the positioning inputs.

By switching R_M into the circuit, the overall display amplifier gain is increased by a factor of 10. Load currents I_{L1} and I_{L2} flow through resistors R_{N1} and R_{N2}. When R_M is in the circuit, any change in the current through R_{N1} and R_{N2} causes a voltage across R_M. This voltage across RM causes additional load current to be conducted by Q5 and Q6, load current which is not felt by the emitters of Q2A and Q2B. For a given change in current at the emitters of Q2A and Q2B, therefore, a greater change in load current through Q5 and Q6 occurs, causing additional gain of the display amplifier. The gain of the circuit under magnified conditions is controlled by adjusting R_M.

Vertical Display Amplifier

The Display Amplifiers schematic shows the complete schematic of the vertical display amplifier. The table in Fig. 3-12 relates the transistors and FETs in the simplified schematic with those in the actual schematic of this circuit.

The complete schematic shows that the high impedance inputs of the amplifier have three separate gains (R_S has three different values). As has been mentioned previously in the discussion of the signal sensing and display sensitivity, the deflection factor of the vertical display is partially determined before the measurement is applied to the high impedance inputs. The three gains of the vertical display amplifier allow the vertical display to have three different deflection factors for each voltage signal applied to the high impedance inputs in a 1-2-5 relationship. 1'S GAIN adjustment R541, 2'S GAIN adjustment R538 and 5'S GAIN adjustment R536 determine the three gains of the high impedance inputs. Relays K537A and K541A determine which resistors will control the gain for the various positions of the VERTICAL switch. VERT OUTPUT GAIN adjustment R592A and B determines the overall gain of the vertical display amplifier by allowing adjustment of the load resistors R_{L1} and R_{L2}.

The overall balance of the positioning currents of the vertical display amplifier is controlled by VERT CENT adjustment R581. In addition, 1'S BAL adjustment R550 and 2'S BAL adjustment R545 provide positioning current balance when the VERTICAL switch is set to a position with a one times or a two times multiplier, respectively. Relays K537B and K541B determine which resistors control the positioning current balance for various positions of the VERTICAL switch.

When the DISPLAY OFFSET Selector switch is set to VERT X10, R574 and VERT MAG GAIN adjustment R573 are added to the vertical display amplifier circuit. These resistors constitute R_M and increase the sensitivity of the vertical display 10 times. R580 is always in the circuit and gives the output stage an unmagnified current gain of about 1.8.

Horizontal Display Amplifier

The Display Amplifiers schematic shows the complete schematic of the horizontal display amplifier. The table in Fig. 3-12 relates the transistors and FETs in the simplified schematic with those in the actual schematic of this circuit.

The horizontal display amplifier operates basically the same as the vertical display amplifier. 1'S GAIN adjustment R638, 2'S GAIN adjustment R636 and 5'S GAIN adjustment R641 control the three gains of the horizontal high impedance inputs. Relays K637A and K641A determine which resistors will control the gain for the various positions of the HORIZONTAL switch. HORIZ OUTPUT GAIN adjustment R692A and B controls the load resistance. ORTHOG adjustment R685 interacts with the vertical display amplifier and allows adjustment of the orthogonality of the display on the CRT. When the DISPLAY OFFSET Selector switch is set to HORIZ X10, R674 and HORIZ MAG GAIN adjustment R673 are added to the circuit and form R_M. R680, like R580, is always in the circuit and gives the output stage an unmagnified current gain of about 1.8.

The overall balance of the position currents of the horizontal display amplifier is controlled by HORIZ CENT adjustment R681. In addition, 1'S BAL adjustment R650 and 5'S BAL adjustment R645 provide positioning current balance when the HORIZONTAL switch is set to a position with a one times or a five times multiplier, respectively. Relays K637B and K641B determine which resistors control the positioning current balance for various positions of the HORIZONTAL switch.

READOUT

A display of the vertical and horizontal deflection factors, the step amplitude and the β or g_m per division (vertical deflection factor divided by step amplitude) is given to the right of the CRT. This display of numbers and units is

obtained through the use of fiber-optic readout. Fiber-optic readout involves the use of plastic fibers of very small diameter, called light tubes, for transferring light from one place to another. The light tubes are designed so that the light incident at one end of the tube is transmitted through the tube to the other end. If the output end of the tube is viewed directly, the output light looks like a small dot. This transmission of light occurs even if the light tubes are bent at slight angles. In order to form a character, many light tubes are arranged so that their output ends, the dots of light, are in the configuration of the character to be formed. The input ends are then arranged so that they receive their incident light from the same light source. In some cases it may take two or more light sources to form one character. Whenever the proper light source (or sources) is illuminated, the desired character appears. It is the purpose of the readout circuitry, therefore, to light the readout lamps so the deflection factors they indicate correspond with the CRT display deflection factors determined by the positions of the VERTICAL and HORIZONTAL switches, the MODE switch, the DISPLAY OFFSET Selector switch, the AMPLITUDE switch and the .1X STEP MULT button.

The inputs for the readout logic come from logic lines whose logic levels are controlled by the switches shown on the Readout Switching and Interconnections schematic, or by externally provided logic levels. The form of the inputs is a high-low code. Normally all inputs are high and the code is determined by switching some of the logic lines to ground. Ground reference is generally provided directly as part of the switch. However, in the case of the vertical and horizontal switches, ground is provided through saturated transistors Q900 and Q943 respectively. If lows are applied to pins 7 and 20 of J363, these transistors are turned off. In this case ground reference for the affected logic lines must then be provided externally.

The readout logic (see Readout Logic schematic) primarily consists of integrated circuit decoders. These decoders receive inputs from the incoming logic lines in terms of the above-mentioned switch code. This input code is then translated into a high-low lamp code which appears on the output logic lines. Each of the output logic lines is connected to a readout lamp (see Readout Lamps schematics) and each lamp illuminates one character or part of a character. A low on a readout lamp causes the lamp to light. The intensity of the readout is determined by the 0 to 4.5 volt supply.

The readout logic circuitry also generates a lamp code which produces a readout of beta or transconductance (g_m) per division. This β or g_m readout lamp code is obtained by dividing the vertical lamp code by the steps lamp code.

The decoders which control the horizontal deflection factor readout are U951 and U953. Inputs to these decoders are controlled by the HORIZONTAL switch, the DISPLAY OFFSET Selector switch or by externally applied inputs to J363. Outputs from these decoders go to the horizontal readout lamps. As an example of how a lamp code is generated, assume that the HORIZONTAL switch is set to .5 V COLLECTOR and the DISPLAY OFFSET Selector switch is set to NORM (OFF). Due to the closing of contacts by the HORIZONTAL cam switch (see the Readout Switching and Interconnections schematic), lows are applied to the inputs to U951 and U953 at connectors 13, T, and S of P950 (see Fig. 3-13). The other inputs to the horizontal decoders are held high. The output lamp code resulting from this input code is lows at lamp input connectors F, I, J, L, A, C, D and E. The resulting PER HORIZ DIV readout is 500 mV, which corresponds with the .5 V COLLECTOR position of the HORIZONTAL switch.

Decoders U956 and U960 control the vertical deflection factor readout. Inputs to these decoders are controlled by the VERTICAL switch, the DISPLAY OFFSET Selector switch, the MODE switch and externally applied inputs to J363. Outputs from these decoders go to the vertical readout lamps. The horizontal and vertical decoders are also affected by the logic inputs, at pin U, pin Y and pin 12 of J950, whose logic levels may only be determined externally.

Decoders U965 and U970 control the step amplitude readout. Inputs to U965 and U970 are controlled by the AMPLITUDE switch, the STEP MULT .1X button and externally applied inputs to J361. Outputs from U965 and U970 go to the steps readout lamps.

The beta or g_m generator consists of U974, U975 and U976. The input code received by these decoders is a combination of logic levels coming in part from the vertical lamp code, and in part from the steps lamp code. The outputs from these decoders go to the beta readout lamps. Q960 and Q974 decode the logic levels appearing at pins 13 and 15 of U960 and pins 13 and 15 of U970. Q977 and Q979 provide a means of lighting the 1,4 lamp (connector BI) whenever the 2,5 lamp (connector AR) is off.

POWER SUPPLY

Low Voltage Power Supply

The Type 576 can be operated either from a 115-volt or a 230-volt line voltage source. The low voltage power supply (see Fig. 3-14) consists of a single transformer, T701, which has nine secondaries. This supply provides six regulated voltages: −75 volts, −12.5 volts, +5 volts, +12.5 volts, +15 volts and +100 volts. It also produces a regulated variable voltage of 0 to 4.5 volts, one unregulated voltage of +50 volts and an AC voltage to drive the POWER ON light and the GRATICULE ILLUM lights. In addition the windings providing a source of clock pulses for the step generator and the CRT heater are among the nine secondaries of T701. All the regulated power supplies are completely short proof.

Input Circuit. When the POWER switch is switched tc ON, line current flows from the input, P701 (see Power Supply schematic), through power switch SW701, fuse F701, Thermal Cutout TK701 and into the primary wind-

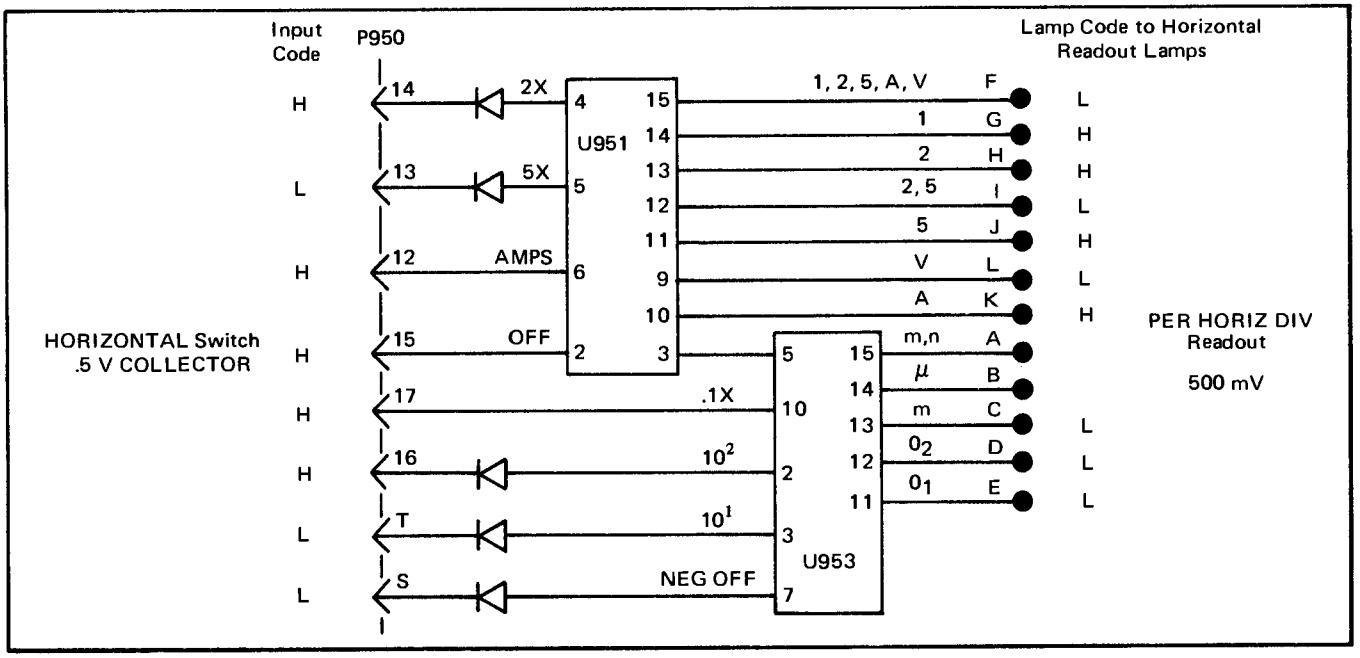


Fig. 3-13. Example of operation of Horizontal Readout decoders.

ings. For 115-volt operation the LINE SELECTOR switch connects the two primaries in parallel and for 230-volt operation connects them in series. For 230-volt operation, F703 is connected into the circuit. The RANGE SELECTOR plug determines how many turns of each primary winding are utilized to compensate for variations in line voltage.

—75-volt Supply. The —75-volt supply consists of diode bridge D706 A, B, C and D, filter capacitors C706 and C707, comparator Q716A and B, emitter follower Q729, short protection Q725 and Q727, and series regulator Q734.

9-volt Zener diode D708 sets the base voltage of comparator transistor Q716A while the quiescent voltage at the base of Q716B is set by —75 V adjustment R721. Any variation in the —75-volt supply voltage is compared by Q716A and B. The resulting rise or fall in voltage across R715 is transmitted by Q729 to the base of series regulator Q734. Any change in voltage of the —75-volt supply will be opposed by a change in current through the series regulator.

The output current of the —75 volt supply is limited to a value less than normal whenever the supply is shorted to a voltage between —75 V and chassis ground. The supply current of the —75 volt supply is controlled by the voltage across R735, which is dependent on the base voltage of Q734. This voltage is in turn dependent on the voltage across R730 and R731. As the —75 volt supply becomes more positive (due to shorting it to a more positive supply), the voltage at the base of Q734 is raised, causing more supply current to be conducted through R735. As the supply voltage becomes more positive, the voltage at the junction of R730 and R731 rises high enough to turn on Q727. When Q727 turns on, it begins pulling down on the base voltage of Q729 and down on the base voltage of Q734, thus limiting the supply current. The output current of the —75-volt supply comes less, the closer the supply voltage is to ground.

D732 prevents the supply from going more than 0.6 volt above chassis ground if the —75 volt supply is shorted to a positive voltage. D722 protects the —12.5 volt supply if it is shorted to the —75 volt supply. If the —12.5 volt supply is pulled negative, D722 turns on when the supply is about at —15 volts which disables comparator Q716A and B. The —75 volt supply then limits current until both supplies are at about —2.5 volts. If the +12.5 volt supply is shorted to the +100 volt supply, Q725 turns on. When Q725 is on, it limits current through R735 in the same manner as discussed previously for Q727. The result of shorting the +12.5 volt supply to a more positive voltage is to turn off the —75 volts supply. Since the —75 volt supply is the reference for the —12.5 volt, +12.5 volt, +100 volt, and CRT voltage supplies, when the —75 volt supply is turned off, the other power supplies are turned off.

—12.5-volt Supply. The —12.5 volt supply consists of diode bridge D737A, B, C and D, filter capacitor C738, comparator Q744A and B, emitter follower Q750, short protection Q748 and series regulator Q756. This circuit regulates the —12.5-volt supply in essentially the same manner as the —75-volt supply operates.

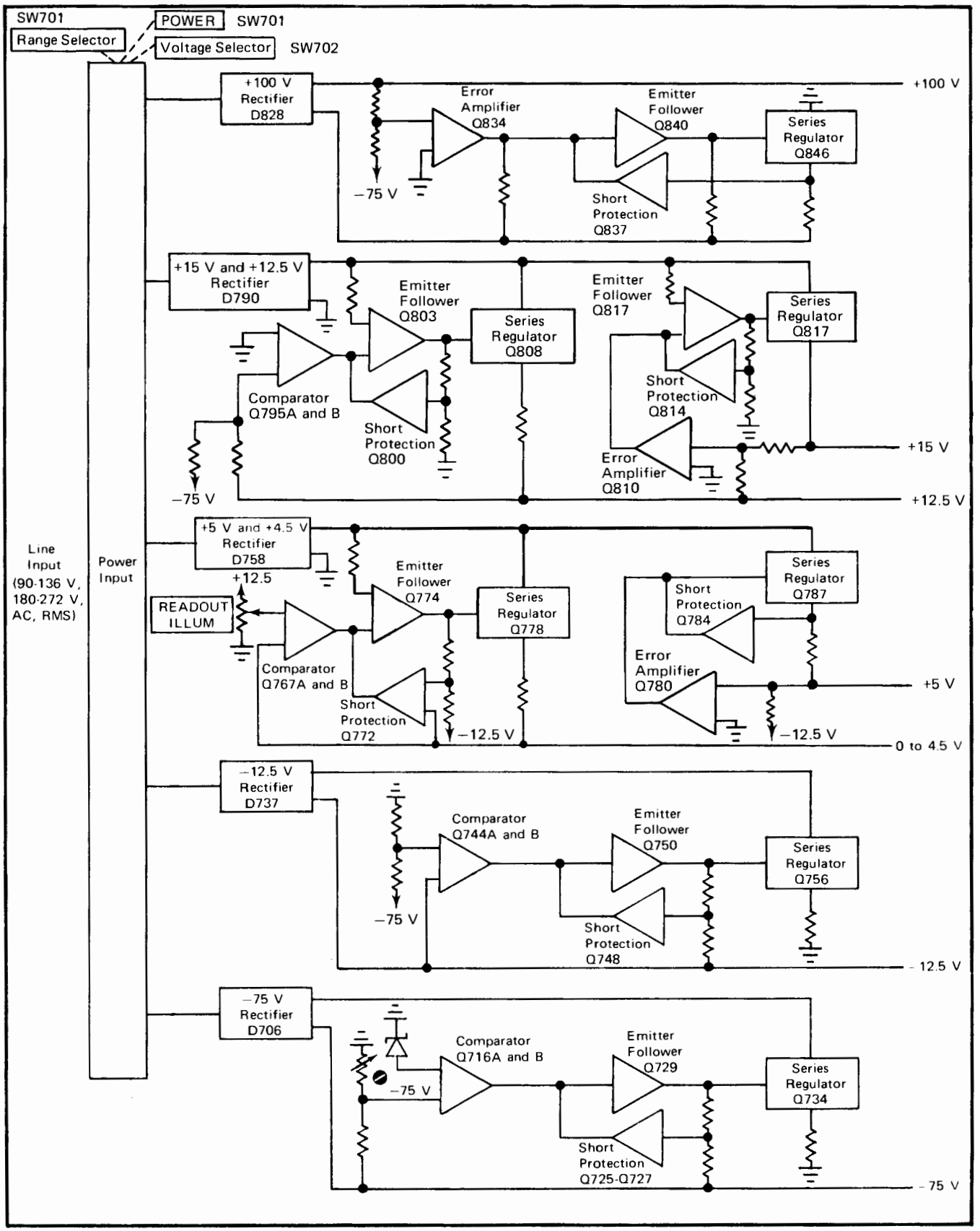


Fig. 3-14. Block diagram of L. V. Power Supply.

0 to +4.5-volt Variable Supply. The 0 to +4.5-volt variable supply consists of diode bridge D758A, B, C and D, filter capacitor C759, comparator Q767A and B, emitter follower Q774, short protection Q772 and series regulator Q778. This circuit operates in essentially the same manner as the −75-volt supply circuit. In this circuit, however, the reference voltage at the base of Q767A is variable from 0 volts to +4.5 volts by the READOUT ILLUM control, R760, and divider R762 and R763. The output current of the supply is limited by Q772.

+5-volt Supply. The +5-volt supply consists of error amplifier Q780, short protection Q784 and series regulator Q787. The supply shares diode bridge D758A, B, C and D and filter capacitors C758 and C759 with the +4.5-volt supply. Any variation in the +5-volt supply voltage is amplified by Q780, causing the base voltage of Q787 to vary in opposition to the variation of the supply. The current conducted through R788 by the supply is thus regulated, which in turn regulates the +5-volt supply. Q784 provides short protection by turning on whenever the current through R788 becomes excessive. When Q784 turns on, the base voltage of Q787 is pulled down, limiting the current through R788.

+12.5-volt Supply. The +12.5-volt supply consists of diode bridge D790A, B, C and D, filter capacitor C791, comparator Q795A and B, emitter follower Q803, short protection Q800, and series regulator Q808. This circuit operates in essentially the same manner as the −75-volt supply. Short protection of the +12.5-volt supply when it is shorted to a more positive voltage is provided by Q725 of the −75-volt supply. If the +12.5-volt supply voltage is pulled up, the base of Q725 is also pulled up, turning on Q725. With Q725 turned on, the base of Q729 is pulled down turning off the −75-volt supply, which will turn off the +12.5-volt supply.

+15-volt Supply, Camera Power. The +15-volt supply consists of error amplifier Q810, emitter follower Q817, short protection Q814 and series regulator Q819. The supply shares diode bridge D790 and filter capacitors C790 and C791 with the +12.5-volt supply. Any variation in the +15-volt supply voltage is amplified by Q810, causing an opposing variation in the voltage at the base of Q817. This opposing voltage variation is transmitted through the emitter of Q817 to the base of series regulator Q819 where it controls the current conducted by R819 and thus regulates the supply. When enough current is conducted by Q819 to turn on Q814, the voltage at the base of Q817 is pulled down, thus limiting the current through Q819.

+50-volt Supply. The +50-volt supply consists of diode bridge D821A, B, C and D, and filter capacitors C822 and C823. It is a floating unregulated supply used to power the step amplifier output.

+100-volt Supply. The +100-volt supply consists of diode bridge D828A, B, C and D, filter capacitor C829, error amplifier Q834, emitter follower Q840, short protection Q837 and series regulator Q846. Any variation in voltage by the +100-volt supply is amplified by Q834 and transmitted through Q840 to the base of Q846. Since any variation in the supply is inverted by Q834, the base voltage of Q846 will always move in opposition to a variation of the supply. The current conducted by R846, therefore, also is conducted so as to oppose any change in supply voltage. When enough current is conducted by Q846 to turn on Q837, the voltage at the base of Q840 is pulled down, thus limiting the current conducted by Q819.

CRT Voltage Power Supply

The CRT power supply produces two high voltages, −4 kV and +225 volts, for operation of the CRT and its related controls. In addition, the +225-volt supply is used by the display amplifiers. The source of power for the two supplies is a high frequency (about 28 kHz) Hartley oscillator which consists of Q851 and the two primaries of transformer T850. The collector of Q851 is connected through the collector primary, R850 and L850 to the +100-volt supply. When current flows through the collector primary, a magnetic field is built up in the transformer core. Due to this field, a reverse base current is caused to be conducted through Q851 by the base primary and Q851 is eventually turned off. With Q851 off, no current flows through the collector primary. The residual field in the transformer core now causes forward base current to be conducted through Q851, turning it on. As Q851 turns on, current again flows through the collector primary, thus beginning a new cycle. The frequency of the oscillator and thus the output current of the secondaries is controlled by the voltage on pin 2 of the base primary.

−4 kilovolt Supply. The −4 kV supply consists of half-wave rectifier D870, filter capacitors C870 and C871, and divider resistors R875 through R883. This supply is a half-wave rectified supply with D870 forward biasing on negative transistions of the voltage on the −4 kV secondary. The −4 kV supply voltage after being filtered by C870 and C871 is reduced by Zener diode D882 to provide the −3890 volt cathode voltage. The grid voltage is controlled by the divider made up of R882 and INTENSITY control R883. The voltage on the focus screen of the CRT is controlled by FOCUS control R880.

The −4 kV supply is regulated from a reference supply which is generated by the winding between terminals 6 and 5 of T850. This reference supply consists of half-wave rectifier D866 and D869, and filter capacitor C866. The regulator circuit consists of error amplifier Q859 and emitter follower Q855. Any variation in the reference supply voltage is transmitted to the base of Q859 through divider R860-R864. The variation is then amplified and inverted by Q859 and transmitted through Q855 to the base of Q851, where it regulates the drive of the oscillator. Any variation in current conducted by the −4 kV supply is conducted by R899, which causes the decoupled supply voltage at the emitter of Q859 to vary, thus compensating for current variation in the −4 kV supply.

The voltage on the display geometry screen is controlled by GEOMETRY adjustment R893. The voltage on the display astigmatism screen is controlled by ASTIGMATISM adjustment R891. Current for the trace rotation controlling coil is controlled by TRACE ROTATION adjustment R897.

+225-volt Supply. The +225-volt supply is generated from the same transformer winding as the −4 kV reference supply. It consists of half-wave rectifier D868 and D865, filter capacitors C869, C868 and Q868. Regulation of the +225-volt supply is supplied by the reference supply through divider R860 through R864, and through emitter followers Q866 and Q868.

NOTES

SECTION 4
MAINTENANCE

Introduction

This section of the manual provides information for use in preventive maintenance, troubleshooting and corrective maintenance of the Type 576.

PREVENTIVE MAINTENANCE

General

Preventive maintenance consists of cleaning, visual inspection, lubrication, etc. Preventive maintenance performed on a regular basis will improve the reliability of this instrument. The severity of the environment to which the Type 576 is subjected determines the frequency of maintenance.

Cleaning

The Type 576 should be cleaned as often as operating conditions require. Accumulation of dirt in the instrument can cause overheating and component breakdown. Dirt on components acts as an insulating blanket and prevents efficient heat dissipation. It can also provide an electrical conduction path.

Exterior. Loose dust accumulated on the outside of the Type 576 can be removed with a soft cloth or small paint brush. The paint brush is particularly useful for dislodging dirt on and around the front-panel controls. Dirt which remains can be removed with a soft cloth dampened in a mild detergent and water solution. Abrasive cleaners should not be used.

Interior. Dust in the interior of the instrument should be removed occasionally to prevent electrical conductivity under high-humidity conditions. The best way to clean the interior is to blow out the accumulated dust with dry, low-velocity air. Remove any dirt which remains with a soft paint brush or a cloth dampened with a mild detergent and water solution. A cotton-tipped applicator is useful for cleaning in narrow spaces or for cleaning ceramic terminal strips and circuit boards.

CAUTION

Avoid the use of chemical cleaning agents which might damage the plastics used in this instrument. Avoid chemicals which contain benzene, toluene, xylene, acetone or similar solvents.

Lubrication

The reliability of potentiometers, rotary switches, and other moving parts can be maintained if they are kept properly lubricated. Use a cleaning-type lubricant on switch contacts. Lubricate switch detents with a heavier grease (such as Tektronix Part No. 006-0219-00). Shaft bushings and potentiometers that are not sealed should be lubricated with a lubricant which will not affect electrical characteristics (such as Tektronix Part No. 006-2574-00). Do not use excessive lubrication. A lubrication kit containing the necessary lubricants and instructions is available from Tektronix, Inc. (order Tektronix Part No. 003-0342-02).

Visual Inspection

The Type 576 should be inspected occasionally for such defects as broken connections, loose pin connections, broken or damaged ceramic strips, improperly seated transistors, damaged circuit boards and heat damaged parts.

The corrective procedure for most visible defects is obvious; however, particular care must be taken if heat-damaged components are found. Overheating usually indicates other trouble in the instrument; therefore, it is important that the cause of overheating be corrected to prevent recurrence of the damage.

Transistors and Integrated Circuits

Periodic checks of individual transistors and integrated circuits are not recommended. The best check of them is their operation in the equipment, as reflected by a performance check or calibration procedure. Sub-standard performance will normally be detected at that time.

Recalibration

To ensure accurate measurements, check the calibration of this instrument after each 1000 hours of operation or, if used infrequently, every 6 months. In addition, replacement of components may necessitate recalibration of the affected circuits. Complete calibration instructions are given in the Performance Check and Calibration section. This procedure may also be helpful in localizing certain troubles in the instrument. In some cases, minor troubles may be revealed and/or corrected by recalibration.

TROUBLESHOOTING

Troubleshooting Aids

Diagrams. A complete set of diagrams is given on fold-out pages in Section 8, Diagrams. Each component in this instrument is shown on the appropriate diagram, along with its circuit number and electrical value. Also included on the circuit

circuit diagrams are voltages and waveforms which can be expected at various points in the circuitry. A block diagram and other information concerning the major circuits in the instrument are included at the beginning of the diagram foldouts.

Electrical Parts List. The electrical parts list contains a complete list of all the electrical components within the instrument in the order of their circuit numbers. A component description is also included for each part which provides: The Tektronix part number and electrical value (or substitute part number); and tolerance. Instructions for ordering replacement parts is provided at the beginning of the Electrical Parts List section.

Calibration Procedure. The Performance Check/Calibration section also provides an adjustment procedure which covers all the internal adjustments in the instrument. See the Performance Check/Calibration Record and Index in Table 5-2 for a list of the internal adjustments. The Performance Check/Calibration section provides a performance check procedure which will help determine whether a malfunction is due to improper calibration or to a circuit or component malfunction.

Circuit Description. A circuit description of each circuit in the instrument with accompanying block diagrams is provided in the Circuit Description section. This section is helpful when the source of a malfunction cannot be determined from the diagrams or the performance check/calibration procedure. Also included is a block diagram description that gives the theory of operation of the instrument.

Circuit Boards. Fig. 4-6 through Fig. 4-28, at the rear of this section, show all the circuit boards in the Type 576. The electrical components on each of these pictures are identified by their circuit numbers.

Wiring Color Code. All insulated wire and cable used in the Type 576 is color-coded to facilitate circuit tracing. Signal carrying leads have white backgrounds with one or two colored stripes. The signal carrying wire color-codes are given in Fig. 4-6 through 4-28 with the appropriate pin connection. Power supply leads have either a red background (positive supply) or a purple background (negative supply). Each power supply lead also has one colored stripe which represents its ordinal relationship to the other supplies having the same polarity, using the EIA resistor color code. Table 4-1 gives the wiring color-code for the power supply voltages used in the Type 576.

Power Cord Conductor Identification

Conductor	Color	Alternate Color
Ungrounded (Line)	Brown	Black
Grounded (Neutral)	Blue	White
Grounding (Earthing)	Green-Yellow	Green-Yellow

TABLE 4-1

Power Supply Wiring Color

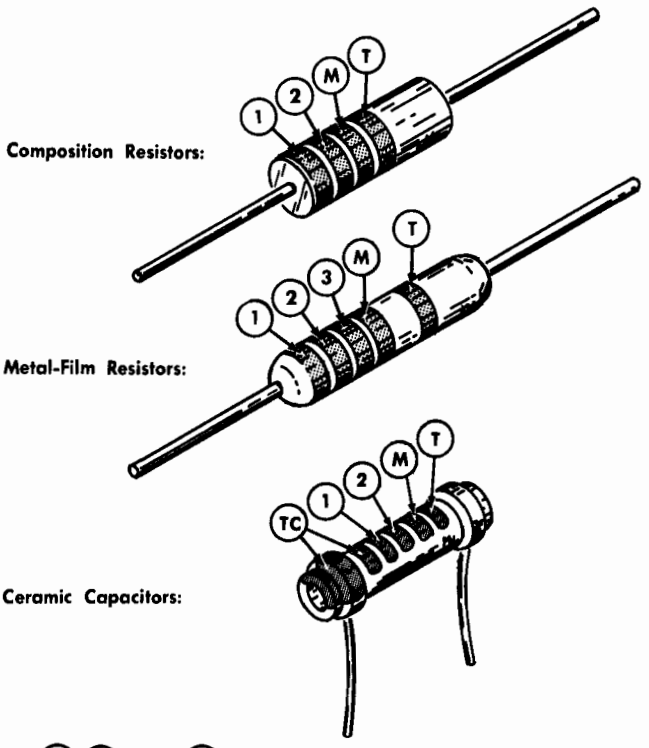
Supply	Background Color	Stripe Color
−75 volt	Purple	Red
−12.5 volt	Purple	Black
Var +4.5 volt	Brown	(none)
+5 volt	Red	Black
+12.5 volt	Red	Brown
+50 volt	Red	Yellow
+15 volt	Red	Orange
+100 volt	Red	Green
+225 volt	Red	Blue
−4 kV	White	Purple
Ground	Black	(none)

Switch Wafer Identification. Switch wafers shown on the diagrams are coded to indicate the position of each wafer in the complete switch assembly. The numbered portion of the code refers to the wafer number counting from the front, or mounting end of the switch, toward the rear. The letters F and R indicate whether the front or rear of the wafer performs the particular switching function. For example, a wafer designated by 2R indicates that the rear of the second wafer (from the front) is used for this particular switching function.

Resistor Color Code. In addition to the brown composition resistors, some metal-film resistors (identifiable by their gray body color) and some wire-wound resistors (usually light blue or dark gray) are used in the Type 576. The resistance value of a wire-wound resistor is printed on the body of the component. The resistance value of a composition resistor or metal-film resistor is color-coded on the component with EIA color-code (some metal-film resistors may have the value printed on the body). The color-code is read starting with the stripe nearest the end of the resistor. Composition resistors have four stripes which consist of two significant figures, a multiplier and a tolerance value (see Fig. 4-1). Metal-film resistors have five stripes consisting of three significant figures, a multiplier and a tolerance value.

Capacitor Marking. The capacitance value of a common disc capacitor or small electrolytic is marked in microfarads on the side of the component body. The white ceramic capacitors used in the Type 576 are color-coded in picofarads using a modified EIA code (see Fig. 4-1).

Diode Color Code. The cathode end of each glass encased diode is indicated by a stripe, a series of stripes or a dot. For most silicon or germanium diodes with a series of stripes, the color-code identifies the Tektronix Part Number using the resistor color-code system (e.g., a diode color-coded blue or pink-brown-grey-green indicates Tektronix Part Number 152-0185-00). The cathode and anode ends of



Resistor and Capacitor Color Code

Color	Significant Figures	Multiplier		Tolerance	
		Resistors	Capacitors	Resistors	Capacitors
Silver	---	10^{-2}	---	±10%	---
Gold	---	10^{-1}	---	±5%	---
Black	0	1	1	---	±20% or 2 pF*
Brown	1	10	10	±1%	±1% or 0.1 pF*
Red	2	10^{2}	10^{2}	±2%	±2%
Orange	3	10^{3}	10^{3}	±3%	±3%
Yellow	4	10^{4}	10^{4}	±4%	+100% −0%
Green	5	10^{5}	10^{5}	±0.5%	±5% or 0.5 pF*
Blue	6	10^{6}	10^{6}	---	---
Violet	7	---	---	---	---
Gray	8	---	10^{-2}	---	+80% −20% or 0.25 pF*
White	9	---	10^{-1}	---	±10% or 1 pF*
(none)	---	---	---	±20%	±10% or 1 pF*

*For capacitance of 10 pF or less.

NOTE: T and/or TC color code for capacitors depends upon manufacturer and capacitor type. May not be present in some cases.

Fig. 4-1. Color-code for resistors and ceramic capacitors.

metal-encased diodes can be identified by the diode symbol marked on the body.

Transistor and Integrated Circuit Lead Configuration. Fig. 4-2 shows the lead configurations of the transistors and integrated circuits used in this instrument. The view is as seen from the bottom of the device.

Troubleshooting Equipment

The following equipment is useful for troubleshooting the Type 576:

1. Semiconductor Tester—Some means of testing the transistors, diodes and FET's used in this instrument is helpful. A transistor-curve tracer such as the Tektronix Type 576 or 575 will give the most complete information.

2. DC Voltmeter and Ohmmeter—A voltmeter for checking voltages within the circuit and an ohmmeter for checking resistors and diodes are required. For most applications a 20,000 ohm/volt VOM can be used to check voltages and resistances, if allowances are made for the circuit loading of a VOM when making voltage measurements at high-impedance points.

3. Test Oscilloscope—A test oscilloscope is required to view waveforms at different points in the circuit. An oscilloscope with DC to 10 MHz frequency response and 10 mV to 10 V/division vertical deflection factor is suggested. A 10X probe should be used to reduce circuit loading.

Troubleshooting Techniques

CAUTION

High voltage may appear in many areas of this instrument. Read the entire maintenance section before removing the cabinet covers.

This troubleshooting procedure is arranged in an order which checks the simple trouble possibilities before proceeding with extensive troubleshooting. The first few checks ensure proper connection, operation and calibration. If the trouble is not located by these checks, the remaining steps aid in locating the defective component. When the defective component is located, it should be replaced following the replacement procedure given under Corrective Maintenance.

1. Check Control Settings. Incorrect control settings can indicate a trouble that does not exist. If there is any question about the correct function or operation of any control, see the Operating Instructions section of this manual.

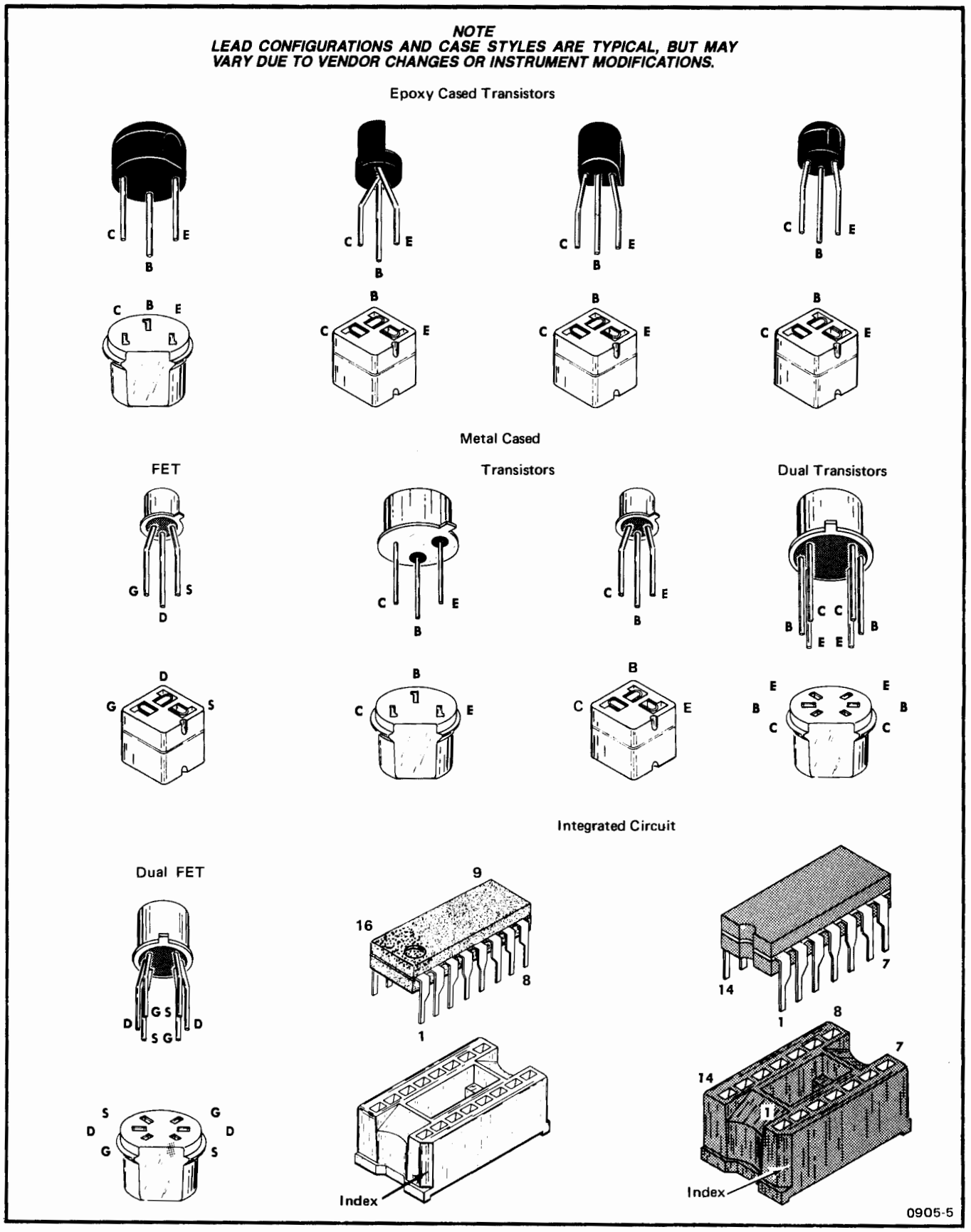


Fig. 4-2. Electrode configurations for socket-mounted semiconductor devices.

2. Check Instrument Calibration. Check the calibration of this instrument or of the affected circuit if the trouble is known to exist in one particular circuit. The apparent trouble may be only a result of misadjustment and may be corrected by calibration. Complete calibration instructions are given in the Performance Check/Calibration section of this manual.

3. Locating Malfunctioning Circuits. To locate the source of a malfunction in instrument operation, the trouble symptom will often indicate the identity of the faulty circuit(s). For example, if a display of the Collector Supply output can be obtained on the test oscilloscope CRT but a display of the Step Generator output cannot be obtained, the Step Generator is probably malfunctioning.

If the trouble symptom does not indicate which circuit(s) is causing problems (for example, if there were no Collector Supply or Step Generator outputs), a more systematic troubleshooting procedure is necessary. Fig. 4-3 provides a general guide for locating the circuits which are most likely causing the instrument to malfunction.

The following preliminary procedure ensures that the instrument malfunction is not caused by improper control settings and helps determine where to begin on the troubleshooting chart:

A. Set the following Type 576 controls to:

GRATICULE ILLUM	Fully Clockwise
READOUT ILLUM	Fully Clockwise
INTENSITY	Trace Visible
FOCUS	Centered
VERTICAL	STEP GEN
DISPLAY OFFSET Selector	NORM(OFF)
CENTERLINE VALUE	0
HORIZONTAL	2 V COLLECTOR
POSITION (Vert and Horiz)	Centered
FINE POSITION (Vert and Horiz)	Centered
ZERO	Released
CAL	Released
DISPLAY INVERT	Released
MAX PEAK VOLTS	15
PEAK POWER WATTS	0.5
VARIABLE COLLECTOR SUPPLY	Fully Clockwise
POLARITY	+(NPN)
MODE	NORM
LOOPING COMPENSATION	As Is
NUMBER OF STEPS	10
CURRENT LIMIT	20 mA
AMPLITUDE	2 V
OFFSET	ZERO
OFFSET MULT	0
STEPS	Pressed
PULSED STEPS	Released
STEP FAMILY	REP
RATE	NORM
POLARITY INVERT	Released
STEP MULT .1X	Released
Terminal Selector	BASE TERM STEP GEN
LEFT-OFF-RIGHT	RIGHT

B. Turn on the Type 576 and allow a few minutes to warm up.

C. CHECK FOR—Display of the Collector Supply sweep of about 15 volts peak horizontally on the Type 576 CRT graticule and of the Step Generator signal of one step per division vertically.

D. If no display can be obtained or the display is incorrect, connect the 10X probe between the test oscilloscope and the collector terminal on the right hand side of the Standard Test Fixture (connect ground lead to emitter terminal).

E. CHECK FOR—Display of Collector Supply output—a positive-going full-wave rectified sine wave of about 15 volts peak on test oscilloscope CRT.

F. Connect the probe to the right base terminal of the Standard Test Fixture.

G. CHECK FOR—Display of Step Generator output of positive-going steps of 2 volts/step on test oscilloscope CRT.

H. Start with the following step on Fig. 4-3 according to the results of the previous checks:

1. Step (A)—No Collector Supply output; Step Generator output or display on the Type 576 CRT.

2. Step (B)—No Collector Supply output or incorrect output, but Step Generator is displayed on the Type 576 CRT.

3. Step (C)—No Step Generator output (or incorrect output), but Collector Supply is displayed on the Type 576 CRT.

4. Step (D)—No display on type 576 CRT (or incorrect display), but Collector Supply output and Step Generator output are displayed properly on the test oscilloscope CRT.

After the defective circuit has been located using Fig. 4-3, proceed with steps 4 through 9 to locate and repair the faulty components.

4. Visual Check. Visually check the portion of the instrument in which the trouble is located. Many troubles can be located by visual indications such as unsoldered connections, broken wires, damaged circuit boards, damaged components, etc.

5. Check Circuit Board Interconnections. After the trouble has been isolated to a particular circuit, check the pin connectors on the circuit board for correct connection. Figs. 4-6 through 4-28 show the correct connections for each board.

The pin connectors used in this instrument also provide a convenient means of circuit isolation. For example, if the

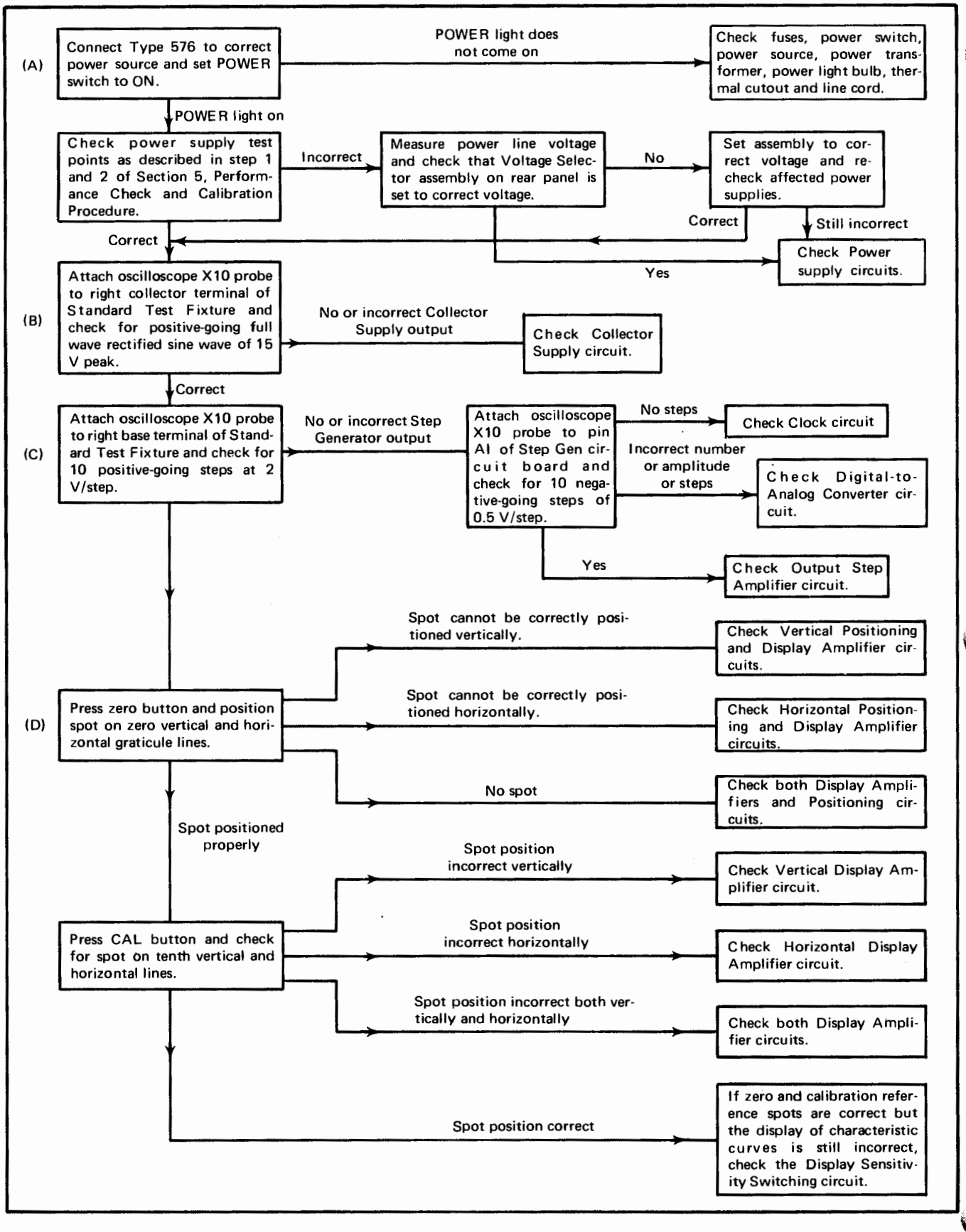


Fig. 4-3. Troubleshooting chart.

power supply is shorted, the defective circuit can be isolated by disconnecting the pin connectors at the boards until the shorting condition is removed.

6. Check Voltages and Waveforms. Often the defective component can be located by checking for the correct voltages and waveforms as given on the circuit diagrams on foldout pages in the back of this manual.

NOTE

Voltages and waveforms given on the diagrams are not absolute and may vary slightly between instruments. To obtain operating conditions similar to those used to take these readings, see the beginning of the Diagrams section.

7. Check Semiconductors. Most circuit failures result from the failure of a transistor, FET, diode, or integrated circuit due to normal aging and use. The following explains various methods of checking semiconductor devices. Insertion information is provided in Fig. 4-2.

TRANSISTORS. Transistor defects usually take the form of the transistor opening, shorting, or developing excessive leakage. The best method of checking transistors is by direct substitution. Be sure the voltage conditions of the circuit are not such that a replacement transistor might also be damaged. If substitute transistors are not available, use a dynamic tester (such as a Tektronix Type 576).

Static-type testers are not recommended since they do not check the device under operating conditions. However, if no other tester is immediately available, an ohmmeter will usually indicate when a transistor is totally bad. As a general rule, use the R X 1 k range where the current is usually limited to less than 2 mA and the internal voltage is usually 1 1/2 volts. Check the current and voltage of the ohmmeter by inserting a multimeter between the ohmmeter leads and measuring the current and voltage of the various ranges. After it has been determined which ohmmeter ranges will not harm the transistor, use those ranges to measure the transistor's resistance. Check the resistance in both directions through the junctions as listed in Table 4-3.

TABLE 4-2

Transistor and FET Resistance Checks

Ohmmeter Connections	Resistance Readings That Can Be Expected Using the R X 1 k Range
Emitter-Collector	High readings both ways (about 60 kΩ to around 500 kΩ).
Emitter-Base	High reading one way (about 200 kΩ or more). Low reading the other way (about 400 Ω to 2.5 kΩ.
Base-Collector	High reading one way (about 500 kΩ or more). Low reading the other way (about 400 Ω to 2.5 kΩ).
Drain-to-Source	Less than 500 Ω
Gate-to-Source and Gate-to-Drain	400 Ω to 10 Ω (approximately) in one direction; more than 200 kΩ with leads reversed.

FIELD EFFECT TRANSISTORS. The voltage and resistance of field effect transistors can be checked in the same manner as transistors, 1 1/2 V and less than 2 mA should be used for ohmmeter checks. See Table 4-2 for proper resistance readings.

INTEGRATED CIRCUITS. Integrated circuits are best checked in the circuit with a voltmeter, test oscilloscope, or by direct substitution. A good understanding of the circuit description is essential when troubleshooting a circuit using integrated circuits. In addition, operating voltages and waveforms, logic levels and other operating information for the integrated circuits, which are provided in the Diagrams section, are also helpful, Use care when checking voltages and waveforms around the integrated circuits so that adjacent leads are not shorted together. A convenient means of clipping a test probe to the 14- and 16-pin integrated circuits is with an integrated-circuit test clip. This device also doubles as an integrated-circuit extraction tool.

DIODES. Diodes (except for tunnel diodes) can be checked for an open or short-circuited condition by measuring the resistance between the terminals after unsoldering one end of the component. Use a resistance scale with an internal voltage between 800 mV and 3 volts. The resistance should measure very high (in megohm range) in one direction and low in the other.

8. Circuit Description. If the malfunction has not been located after checking the voltages, waveforms and semiconductors, the circuit description should be consulted. The circuit description describes the purpose of the circuit and its components with emphasis on the semiconductors. It will help in determining voltages and waveforms not shown in the diagrams and thus help in further pin-pointing the source of the malfunction.

9. Check Other Components. If the semiconductors in the circuit have been found to be good, the rest of the components should be checked. Components which are soldered in place are best checked by disconnecting one end. This isolates the measurement from the effects of surrounding circuitry.

10. Repair and Readjust the Circuit. If any defective parts are located, follow the replacement procedures given in this section. Be sure to check the performance of any circuit that has been repaired or that has had any electrical components replaced. If a component has been replaced, recalibration is usually necessary.

TABLE 4-3

Input and Output Lines to
Horizontal Decoders U951 and U953

Inputs		Outputs	
Pins on J950	Title	Solder Point on Readout Logic Circuit Board	Title (Lamp)
14	2X	F	1, 2, 4, A, V
13	5X	G	1
12	AMPS	H	2
15	OFF	I	2, 5
17	.1X	J	5
16	10^2	L	V
T	10^1	K	A
S	NEG EXP	A	m, n
		B	μ
		C	m
		D	0_2
		E	0_1

TABLE 4-4

Input and Output Lines to
Vertical Decoders U956 and U960

Inputs		Outputs	
Pins on J950	Title	Solder Point on Readout Logic Circuit Board	Title (Lamp)
19	2X	V	1, 2, 5, A, V
18	5X	W	1
U	Volts	X	2
V	OFF	Y	2, 5
W	.1X	Z	5
Y	10X	AA	V
20	10^{-1}	AB	A
21	10^{-2}	U	0_1
22	10^{-4}	T	0_2
X	10^{-3}	S	m
		R	μ
		O	m, n

TABLE 4-5

Input and Output Lines
to Steps Decoders U965 and U970

Inputs		Outputs	
Pins on J950	Titles	Solder Point on Readout Logic Circuit Board	Title (Lamp)
F	2X	AH	1,2,5,A,V
5	5X	AI	1
4	VOLTS	AJ	2
H	OFF	AK	2,5
J	.1X	AL	5
K	10X	AM	V
8	10^{-1}	AN	A
9	10^{-2}	AG	0_1
10	10^{-4}	AF	0_2
6	10^{-8}	AE	M
		AD	μ
		AC	m,n

TABLE 4-6

Input and Output Lines
To Beta Decoders U974, U975 and U976

Inputs		Outputs	
Solder Points on Readout Logic Circuit Board	Titles (Lamps)	Solder Points on Readout Logic Circuit Board	Titles (Lamps)
R	μ (vert)	AW	K
S	m (vert)	AX	K,M
Collector Q960)	n (vert)	AY	m
AE	m (steps)	AZ	K,μ
Collector Q974	n (steps)	BA	μ
AD	μ (steps)	BD	5_2
AG	0_1 (steps)	BE	DEC PT
AF	0_2 (steps)	BF	$0, 5_2$
U	0_1 (vert)	BG	0_1
T	0_2 (vert)	BH	0_2
X	2 (vert)	AQ	4,5
Z	5 (vert)	AV	1,2,4
AL	5 (steps)	AS	2
AJ	2,5 (steps)	AT	2,4,5
Collector Q984	BETA OFF	AV	1,4,5
		AR	2,5
		BI	1,4

Additional Troubleshooting Information

Troubleshooting the Readout. Malfunction of the readout display can be caused by three things: a burned out readout lamp, improper operation of the readout logic or improper operation of a cam switch. The best method of locating the malfunction is by checking the inputs and the outputs of the decoders for various positions of the front panel switches. Tables 4-3 through 4-6 show to which decoders the pins on the J950 are inputs. The state of these pins (high or low) for various front-panel control settings can be obtained from the Readout Switching and Interconnections schematic in the Diagrams section. The outputs of the decoders are checked by first determining what the readout ought to be for the given settings of the front-panel

TABLE 4-7
Supply Voltages When One Supply is Shorted to Ground

Shorted Supply	Supply Voltages (Approximate)								
	−75	−12.5	+12.5	+100	+225	−4 kV	+4.5	+5	+15
−75	0	0	1	3	0	0	0	0.5	1
−12.5	−35	0	1.5	3	0	0	1	1	1
+12.5	−75	0	0	+100	0	0	0	0	1.5
+100	−75	−1	1.5	0	0	0	0	0	0
+225	−75	−12.5	5	8	0	0	2	3	6
−4 kV	−75	−12.5	5	8	0	0	2	3	6
4.5	−75	−12.5	+12.5	+100	+225	−4 kV	0	+5	+15
+5	−75	−12.5	+12.5	+100	+225	−4 kV	+4.5	0	+15
+15	−75	−12.5	+12.5	+100	+225	−4 kV	+4.5	+5	0

controls (be sure to note the effects of the MODE switch, DISPLAY OFFSET Selector switch and STEP MULT .1X button). When the proper readout has been determined, locate the pins on the Readout Logic circuit board which must be low to cause that readout (see Tables 4-3 through 4-6). When the proper states of the inputs and outputs of the decoders have been determined, check these levels with a voltmeter. A Type 576 READOUT EXTENDER (Tektronix Part No. 067-0603-00) is available to aid in troubleshooting the readout.

1. If the inputs to the decoders are incorrect, something is wrong with one of the cam switches.

2. If the inputs to the decoders are correct, but the outputs are incorrect, the decoders are malfunctioning.

TABLE 4-8
Power Supply Resistance Check[1]

Supply	VOM Scale	Resistance	
		Leads +	Leads −
−75	1 kΩ	1.5 k	1.9 k
+100	1 kΩ	5 k	1.8 k
+15	1 kΩ	23 k	2 k
+225	1 kΩ	36 k	12 k
−12.5	10 Ω	25 Ω	35 Ω
+12.5	10 Ω	16 Ω	31 Ω
+5	10 Ω	28 Ω	90 Ω
+4.5[2]	10 Ω	35 Ω	100 Ω

[1] Type 576 turned off.

[2] READOUT ILLUM control fully clockwise.

3. If the outputs of the decoders are correct, something is wrong with a fiber-optic and lamp assembly (probably a burned out lamp).

See the section of the Circuit Description on readout for further information and an example of the operation of the readout system.

Power Supply. A malfunction in the power supply is often caused by one or more supplies being shorted to ground. Table 4-7 indicates the states of all the power supplies in the instrument when one of them is shorted to ground. This table does not give values in cases when more than one supply is shorted to ground or when one supply is shorted to another supply. In these cases, the table only indicates interrelationships between supplies. Table 4-8 gives resistance values of the supplies to ground as measured by a VOM. Be sure the instrument is turned off when making these measurements.

CORRECTIVE MAINTENANCE

General

Corrective maintenance consists of component replacement and instrument repair. Special techniques required to replace components in this instrument are given here.

Obtaining Replacement Parts

Standard Parts. All electrical and mechanical part replacements for the Type 576 can be obtained through your local Tektronix Field Office or representative. However, many of the standard electronic components can be obtained locally in less time than is required to order them from Tektronix, Inc. Before purchasing or ordering replacement parts, check the parts list for value, tolerance, rating and description.

NOTE

When selecting replacement parts, it is important to remember that the physical size and shape of a component may affect its performance, particularly at the upper frequency limits of the instrument. All replacement parts should be direct replacements unless it is known that a different component will not adversely affect instrument performance.

Special Parts. In addition to the standard electronic components, some special parts are used in the Type 576. These parts are manufactured or selected by Tektronix, Inc. to meet specific performance requirements, or are manufac-

tured for Tektronix, Inc. in accordance with our specifications. Each special part is indicated in the electrical parts list by an asterisk preceding the part number. Most of the mechanical parts used in this instrument have been manufactured by Tektronix, Inc. Order all special parts directly from your local Tektronix Field Office or representative.

Ordering Parts. When ordering replacement parts from Tektronix, Inc., include the following information.

1. Instrument Type.

2. Instrument Serial Number.

3. A description of the part (if electrical, include circuit number).

4. Tektronix Part Number.

Soldering Techniques

WARNING

Disconnect the instrument from the power source before soldering.

Circuit Boards. Use ordinary 60/40 solder and a 35- to 40-watt pencil type soldering iron on the circuit boards. The tip of the iron should be clean and properly tinned for best heat transfer to the solder joint. A higher wattage soldering iron may separate the wiring from the base material.

The following techniques should be used to replace a component on a circuit board. Most components can be replaced without removing the boards from the instrument.

1. Grip the component lead with long-nose pliers. Touch the soldering iron to the lead at the solder connection. Do not lay the iron directly on the board, as it may damage the board.

2. When the solder begins to melt, pull the lead out gently. This should leave a clean hole in the board. If not, the hole can be cleaned by reheating the solder and placing a sharp object such as a toothpick into the hole to clean it out. A vacuum-type desoldering tool can also be used for this purpose.

3. Bend the leads of the new component to fit the holes in the board. If the component is replaced while the board is mounted in the instrument, cut the leads so they will just protrude through the board. Insert the leads into the holes in the board so the component is firmly seated against the board (or as positioned originally). If it does not seat properly, heat the solder and gently press the component into place.

4. Touch the iron to the connection and apply a small amount of solder to make a firm solder joint. To protect heat-sensitive components, hold the lead between the component body and the solder joint with a pair of long-nose pliers or other heat sink.

5. Clip off the excess lead that protrudes through the board (if not clipped in step 3).

6. Clean the area around the solder connection with a flux-remover solvent. Be careful not to remove information printed on the board.

Ceramic Terminal Strips. Solder used on the ceramic terminal strips should contain about 3% silver. Use a 40- to 75-watt soldering iron with a 1/8-inch wide wedge-shaped tip. Ordinary solder can be used occasionally without damage to the ceramic terminal strips. However, if ordinary solder is used repeatedly or if excessive heat is applied, the solder-to-ceramic bond may be broken.

A sample roll of solder containing about 3% silver is mounted on the right side of the instrument below the bracket holding the VERT OUTPUT GAIN and HORIZ OUTPUT GAIN adjustments. Additional solder of the same type should be available locally, or it can be purchased from Tektronix, Inc. in one-pound rolls order by Tektronix Part No. 251-0514-00.

Observe the following precautions when soldering to a ceramic terminal strip:

1. Use a hot iron for a short time. Apply only enough heat to make the solder flow freely.

2. Maintain a clean, properly tinned tip.

3. Avoid putting pressure on the ceramic terminal strip.

4. Do not attempt to fill the terminal-strip notch with solder; use only enough solder to cover the wires adequately.

5. Clean the flux from the terminal strip with a flux-remover solvent.

Metal Terminals. When soldering to metal termianls (e.g., switch terminals, potentiometers, etc.), ordinary 60/40 solder can be used. Use a soldering iron with a 40- to 75-watt rating and a 1/8-inch wide wedge-shaped tip.

Observe the following precautions when soldering to a metal terminal:

1. Apply only enough heat to make the solder flow freely.

2. Apply only enough solder to form a solid connection. Excess solder may impair the function of the part.

3. If a wire extends beyond the solder joint, clip off the excess.

4. Clean the flux from the solder joint with a flux-remover solvent.

Component Removal and Replacement

WARNING

Disconnect the instrument from the power source before replacing components.

Not all the components in this instrument are accessible without first removing some obstructions, such as circuit boards, CRT and shield or the guard box. None of these obstructions, however, are difficult to remove or replace.

CRT and Shield. To adjust the CRT, to remove the CRT, or to remove the CRT and shield, follow these procedures:

Removal of CRT

1. Remove the bezel from the Type 576 front panel.
2. Remove the power cord retainer from the rear panel.
3. Disconnect the connector on the rear of the CRT by pulling on the white handle.
4. Loosen the CRT clamp from the neck of the CRT by loosening the Allen head screw (from the rear) on the right side of the clamp.
5. Disconnect the pin connectors from the side of the CRT.
6. Push the CRT from the rear, while pulling it from the front.

Removal of CRT Shield

1. Remove the CRT.
2. Disconnect the shield from the rear by loosening the clamps which secure the shield to the rear panel.
3. Disconnect the red and white wires from the READOUT INTERCONN circuit board. Disconnect the pin connectors from the graticule light circuit board.
4. Remove the readout.
5. Remove the screw which connects the readout illumination light circuit board to the chassis.
6. Remove the screw which is under the center frame section (the section the handle is connected to) on the instrument's right, in front.
7. Remove the four screws securing the shield to the front panel.
8. Pull the shield out from the front of the instrument.

To replace the CRT and shield reverse these procedures. Use the following procedure to adjust the CRT once it has been replaced.

Adjustment of CRT

1. With the bezel in place on the Type 576 front-panel, note in which direction the CRT is out of alignment (all graticule lines should be visible).
2. Remove the bezel.
3. Loosen the four hexagonal head screws which secure the CRT support blocks. (Screws are located about 3 inches back from the front of the CRT shield.)
4. Loosen the CRT and pull it forward until the CRT support blocks are accessible.
5. Push the upper CRT support blocks back as far as possible.
6. Adjust the lower CRT support blocks so that the CRT will be properly aligned when put back in place.
7. Replace the CRT (do not secure).
8. Replace the bezel (do not secure).
9. Check that the CRT is now properly aligned.
10. If the CRT is still not properly aligned, remove the bezel and CRT and readjust the bottom CRT support blocks.
11. Repeat steps 7 through 10 until the CRT is properly aligned.
12. Tighten the hexagonal head screws which secure the bottom CRT support blocks.
13. Push the upper CRT support blocks forward (by pushing on the hexagonal head screws) until they are firmly against the CRT and tighten the upper hexagonal head screws.
14. Secure the CRT.
15. Remove the bezel.
16. Check that the graticule lamp reflector fits tightly against the top of the CRT.
17. If the reflector is not properly aligned, realign it.
18. Replace and secure the bezel.

Guard Box.

WARNING

Power switch must be turned off before removing or replacing the phenolic shield on the guard box. Lethal voltages may appear on the components in the guard box and on the metal portions of the guard box.

Guard Box. The suggested method of gaining access to components located in the guard box is to remove the CRT and shield or remove the bottom panel of the instrument. All components in the guard box except for D310 can then

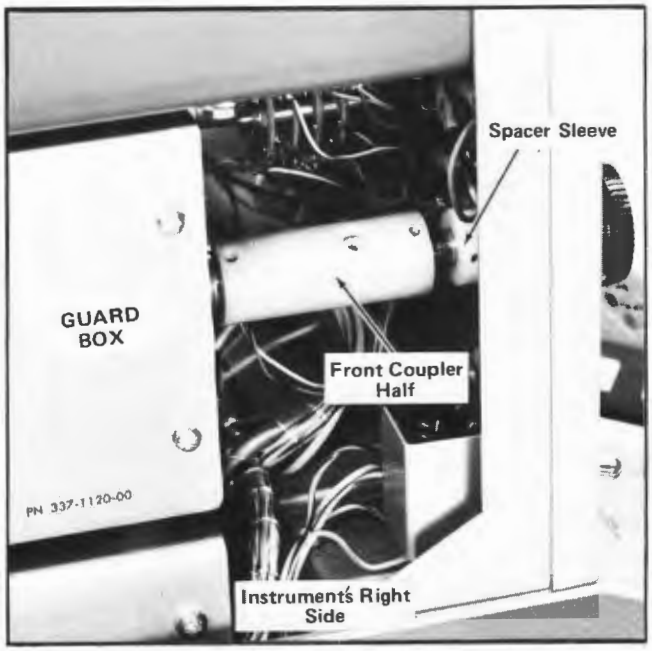


Fig. 4-4. MAX PEAK VOLTS- PEAK POWER WATTS switch assembly.

be removed either by removing the guard box cover or through the bottom of the instrument. If for some reason it is necessary to remove the guard box, use the following procedure:

1. Remove the right side panel from the Type 576.

2. Disconnect the MAX PEAK VOLTS–MAX PEAK POWER WATTS switch assembly as follows:

a. Set the MAX PEAK VOLTS indicator to 15 and the SERIES RESISTORS indicator to .3.

b. Looking behind the front panel, loosen the Allen screw which can be seen through the hole in the front of the front coupler half (see Fig. 4-4).

c. Set the SERIES RESISTORS indicator to 650 and loosen another Allen screw which now appears through the hole in the coupler half.

d. Pull the top portion of the switch assembly out through the front panel.

e. Loosen the two Allen screws in the spacer sleeve.

f. Loosen the Allen screw in the end of the front coupler half.

g. Pull the bottom portion of the switch assembly through the front panel.

3. Disconnect the LOOPING COMPENSATION shaft from the coupler to the guard box by loosening the two Allen screws in the coupler.

4. Disconnect P300 from the guard box.

5. Turn the Type 576 on its side and remove its bottom cover.

6. Remove the screws from the chassis which hold the guard box in place.

7. Carefully pull the guard box out of the instrument (it is very heavy). The MODE switch coupling should disconnect as the guard box is removed.

To replace the guard box, reverse the preceding procedure.

Circuit Board Replacement. Most of the components mounted on the circuit boards can be replaced without removing the boards from the instrument. Observe the soldering precautions given under Soldering Techniques in this section. If a circuit board is damaged beyond repair, either the entire assembly (including all soldered-on-components) or the board only can be replaced. Part numbers are given in the Mechanical Parts List for either the completely wired board assembly or the unwired board.

Use the following procedure to remove a circuit board.

1a. To lift the board for maintenance or access to areas beneath the board, disconnect the pin connectors which might impair lifting.

1b. To completely remove the board disconnect all the remaining pin connectors.

2. Remove all screws holding the board to the chassis.

3. Lift the circuit board partially or all the way out of the instrument. Do not force or bend the board.

4. To replace the board, reverse the order of removal. The correct connections of the pin connectors is shown in Figs. 4-6 through 4-28. Reconnect the pin connectors carefully so they mate correctly with the pins. If forced into place incorrectly, the pin connectors may be damaged.

Cam Switches. A complete cam switch is actually a cam switch assembly. Each assembly consists of a nylon cam which is rotated by a front panel knob, and a set of contacts mounted on an adjacent circuit board which are actuated by the lobes on the cam. A cam switch repair kit including the proper repair tools, instructions and replacement contacts is available from Tektronix, Inc. (Tektronix Part No. 040-0541-00).

CAUTION

Repair of cam switches should be undertaken only by experienced maintenance personnel. The switch alignment and spring tension of the contacts must be carefully maintained for proper operation of the switch. For assistance in the maintenance of cam switches, contact your local Tektronix Field Office or representative.

Removal of a Cam Switch Assembly.

1a. To remove the cam switch assembly for maintenance or access to areas beneath, disconnect only those pin connectors which might impair lifting.

1b. To completely remove the assembly disconnect all the pin connectors.

2. Disconnect the switch from the front panel.

3. Disconnect the circuit board from the rear mounting bracket.

NOTE

The thin film resistors on some of the cam switch assemblies are brittle. Do not bend them when handling.

4. Remove the switch assembly from the instrument.

NOTE

The rear mounting bracket will bend outward allowing enough clearance to remove assembly.

Disassembling the Cam Switch Assembly.

1. Remove the cam switch assembly as described previously.

2. Remove the two screws from the top of the metal cover and remove the cover.

3. Separate the cam from the circuit board by removing the four connecting screws from the circuit board.

4. The cam may be disconnected from its support blocks by removing the retaining ring from the shaft on the front of the switch and sliding the cam out of the support block. Be careful not to lose the small detent roller.

5. Defective switch contacts may be replaced by first unsoldering the damaged contacts and cleaning the solder from the holes in the circuit board. Next, position the new contacts in the holes so they are properly aligned in relation to the other switch contacts and the mating area on the circuit board (an alignment tool is provided in the cam switch repair kit). Solder the new contacts into place. Be sure that the spring ends of the contacts have adequate clearance from the circuit board.

6. Reassemble the cam switch assembly by reversing the previous process.

Replacement of a Cam Switch Assembly.

1. Connect the switch to the front panel.

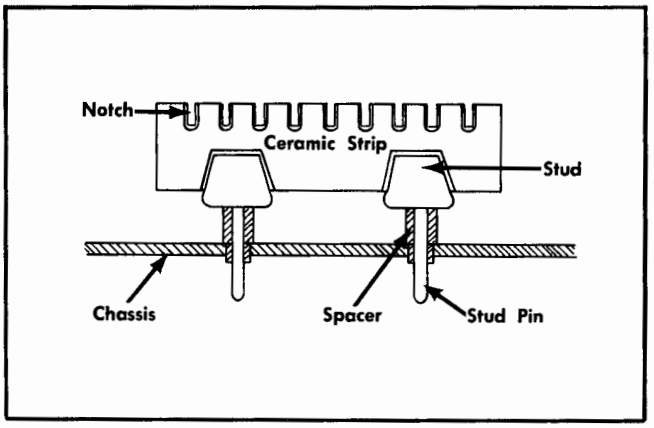


Fig. 4-5. Ceramic terminal strip assembly.

2. Connect the circuit board to the rear mounting bracket.

NOTE

Do not bend the circuit board while securing it to the rear mounting bracket. If the circuit board must be bent to secure the board to the rear mounting bracket, re-adjust the rear mounting bracket.

3. Reconnect the pin connections to the proper pins (see Figs. 4-6 through 4-28).

Rotary Switches. Individual wafers or mechanical parts of rotary switches are normally not replaceable. If a switch is defective, replace the entire assembly. Replacement switches can be ordered either wired or unwired; refer to the Electrical Parts List for the applicable part number.

When replacing a switch, tag the leads and switch terminals with corresponding identification tags as the leads are disconnected. Then, use the old switch as a guide for installing the new one. An alternative method is to draw a sketch of the switch layout and record the wire color at each terminal. When soldering to the new switch, be careful that the solder does not flow beyond the rivets of the switch terminals. Spring tension of the switch contact can be destroyed by excessive solder.

Semiconductor Replacement. Semiconductors should not be replaced unless they are actually defective. If removed from their sockets during routine maintenance, return them to their original sockets. Unnecessary replacement or exchange of semiconductors may affect the calibration of this instrument. When semiconductors are replaced, check the operation of that part of the instrument which may be affected.

CAUTION

POWER switch must be turned off before removing or replacing transistors.

Replacement semiconductors should be of the original type or a direct replacement. Fig. 4-2 shows the lead configuration of the semiconductors used in this instrument. Some plastic case transistors have lead configurations which

do not agree with those shown here. If a semiconductor is replaced by one which is made by a different manufacturer than the original, check the manufacturer's basing diagram for correct basing. All transistor sockets in this instrument are wired for the basing used for metal-case transistors. Use silicone grease when replacing transistors which have heat radiators or are mounted on the chassis.

WARNING

Handle silicone grease with care. Avoid getting silicone grease in the eyes. Wash hands thoroughly after use.

To prevent damage to the pins of the integrated circuits while they are being removed from their sockets, an extracting tool should be used. Such a tool is available from Tektronix, Inc. (Tektronix Part No. 003-0619-00.) If an integrated circuit is being removed without the use of an extracting tool, pull slowly and evenly on both ends of the device. If one end of the device disengages from the socket before the other, the pins can easily be damaged.

Relay Replacement. Relays like the one on the Step Generator circuit board (Tektronix Part No. 148-0044-00) may be turned either direction when connected to the circuit board.

Fuse Replacement. The power-line fuses are located on the rear panel in the Voltage Selector Assembly. See the electrical parts list for the values of the fuses.

Graticule Lamp Replacement. The graticule and readout title lamps may be removed from the rear of the graticule lamp circuit board by lifting the retainers from the contact of the lamp and pulling the lamp out from the rear.

Readout Lamp Replacement. Use the following procedure to replace a readout lamp:

1. Remove the bezel from the Type 576 front-panel.

2. Pull the readout assembly from the instrument.

3. Remove the metal cover from the readout assembly which has a burned out lamp.

CAUTION

Do not loosen or remove heat sinks or readout shelves when replacing readout lamps.

4. If the lamp to be replaced is connected to one of the rear readout lamp circuit boards, disconnect the readout logic circuit board from the readout assembly.

5. Unsolder the lamp leads of the burned out lamp from the back of the readout lamp circuit board. To determine which leads to unsolder, locate the pin on the readout logic circuit board which pertains to the burned out lamp, and follow the color-coded wire from that pin to the readout lamp circuit board.

6. Pull the readout lamp circuit board (and black plastic mounting) far enough away from its holder to replace the damaged lamp and replace the circuit board.

7. Solder the new lamp leads to the readout lamp circuit board.

8. Replace the readout lamp assembly cover (and readout logic circuit board if removed).

CeramicTerminal Strip Replacement. A complete ceramic terminal strip assembly is shown in Fig. 4-5. Replacement strips (including studs) and spacers are supplied under separate part numbers. However, the old spacers may be re-used if they are not damaged. The applicable Tektronix Part Numbers for the ceramic strips and spacers used in this instrument are given in the Mechanical Part List.

To replace a ceramic terminal strips, use the following procedure.

Removal.

1. Unsolder all components and connections on the strip. To aid in replacing the strip, it may be advisable to mark each lead or draw a sketch showing the location of the components and connections.

2. Pry or pull the damaged strip from the chassis.

3. If the spacers come out with the strip, remove them from the stud pins for use on the new strip (spacers should be replaced if they are damaged).

Replacement.

1. Place the spacers in the chassis holes.

2. Carefully press the studs of the strip into the spacers until they are completely seated. If necessary, use a soft mallet and tap lightly, directly over the stud, to seat the strip completely.

3. If the studs on the new ceramic strip are longer than those on the old one, cut off the excess length before the new strip is put in place.

4. Replace all components and connections. Observe the soldering precautions given under Soldering Techniques in this section.

Transformer Replacement. Be sure to replace only with a direct replacement Tektronix transformer.

Recalibration After Repair

After any electrical component has been replaced, the calibration of the associated circuit should be checked, as well as the calibration of other closely related circuits. Since the Power Supply affects all circuits, calibration of the entire instrument should be checked if work has been done in the Power Supply or if the power transformer has been replaced. The Performance Check and Calibration Procedure in Section 5 provides a means of checking instrument operation and making necessary adjustments.

TEST FIXTURE INTERFACE

The following two tables show pertinent information about the Test Fixture Interface located on the Type 576 front panel. This interface consists of four connectors: J360, J361, J362, J363 (see the Test Fixture Connectors schematic in the Diagrams section). The terminals on these connectors may be in one of two states: true or false. True and false are defined in terms of positive logic; the true state is the more positive of two voltage levels. Table 4-10 defines the true and false states of each usable terminal on these connectors in terms of voltage and current ranges. References to current are in terms of conventional current flow; that is, current flowing from a positive potential to a negative potential.

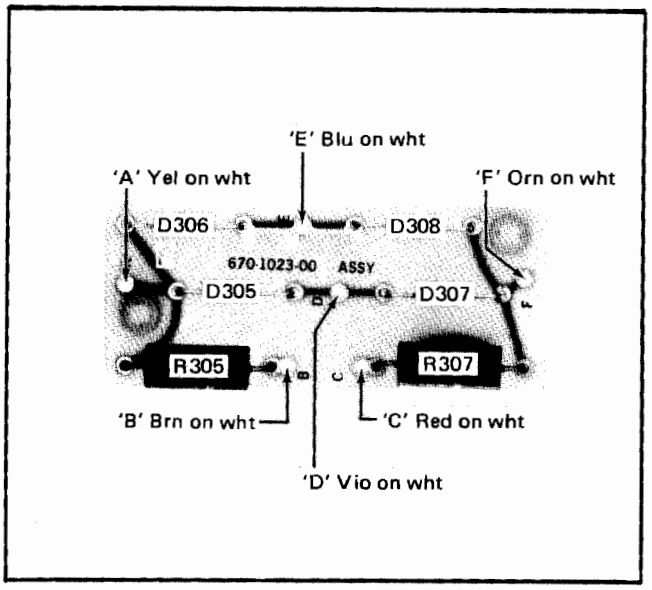


Fig. 4-6. Component locations and wiring color codes on 2 kV Bridge circuit board.

TABLE 4-9

Explanation of the terms Sink and Source

INPUTS	OUTPUTS
Current Sinking When terminal accepts current from external circuit.	Current Sinking When terminal accepts current from external load.
Current Sourcing When terminal supplies current into external circuit.	Current Sourcing When terminal supplies current into external load.

TABLE 4-10

Test Fixture Interface

J360 Pin	J361 Pin	J362 Pin	J363 Pin	Description	Performance	
				Input Signal Logic Levels	Input controls indicated function. 25 V maximum safe input.	
					False	True
2				Step Generator Polarity Invert	Drive terminal to between 0 V (ground) and +0.8 V. Terminal sources 5 mA or less into external circuit.	Provide effective open circuit. Terminal must source 1 μA or less. Terminal open circuit voltage is +4 V to +5 V.
3				Step Generator Readout Off	Drive terminal to between 0 V (ground) and +1.5 V. Terminal sources 5 mA or less into external circuit.	
4				Beta Readout Off		
	15			Step Generator Readout 10X Multiplier		
			6	External Vertical Display Enable	Drive terminal to between 0 V (ground) and +1.5 V. Terminal sources 50 mA or less into external circuit.	Provide effective open circuit. Terminal must source 100 μA or less. Terminal open circuit voltage is the +12.5 V supply.
		1		Collector Supply DC Mode		
			7	Vertical Readout Remote Control	Drive terminal to between 0 V (ground) and +1.5 V. Terminal sources 5 mA or less into external circuit. Changes convertible vertical outputs to inputs.	Provide effective open circuit. Terminal must source 1 μA or less. Terminal open circuit voltage is +4 V to +10 V.
			8	Vertical Readout Off	Drive terminal to between 0 V (ground) and +1.5 V. Terminal sources 5 mA or less into external circuit.	Provide effective open circuit. Terminal must source 1 μA or less. Terminal open circuit voltage is +4 V to +5 V.
			9	Vertical Readout in Volts		
			10	Vertical Readout 10X Multiplier		
			19	External Horizontal Display Enable	Drive terminal to between 0 V (ground) and +1.5 V. Terminal sources 50 mA or less into external circuit.	Provide effective open circuit. Terminal must source 100 μA or less. Terminal open circuit voltage is the +12.5 V supply
			20	Horizontal Readout Remote Control	Drive terminal to between 0 V (ground) and +1.5 V. Terminal sources 5 mA or less into external circuit. Changes convertible horizontal outputs into inputs.	Provide effective open circuit. Terminal must source 1 μA or less. Terminal open circuit voltage is +4 V to +10 V.

To replace a ceramic terminal strips, use the following procedure.

Removal.

1. Unsolder all components and connections on the strip. To aid in replacing the strip, it may be advisable to mark each lead or draw a sketch showing the location of the components and connections.

2. Pry or pull the damaged strip from the chassis.

3. If the spacers come out with the strip, remove them from the stud pins for use on the new strip (spacers should be replaced if they are damaged).

Replacement.

1. Place the spacers in the chassis holes.

2. Carefully press the studs of the strip into the spacers until they are completely seated. If necessary, use a soft mallet and tap lightly, directly over the stud, to seat the strip completely.

3. If the studs on the new ceramic strip are longer than those on the old one, cut off the excess length before the new strip is put in place.

4. Replace all components and connections. Observe the soldering precautions given under Soldering Techniques in this section.

Transformer Replacement. Be sure to replace only with a direct replacement Tektronix transformer.

Recalibration After Repair

After any electrical component has been replaced, the calibration of the associated circuit should be checked, as well as the calibration of other closely related circuits. Since the Power Supply affects all circuits, calibration of the entire instrument should be checked if work has been done in the Power Supply or if the power transformer has been replaced. The Performance Check and Calibration Procedure in Section 5 provides a means of checking instrument operation and making necessary adjustments.

TEST FIXTURE INTERFACE

The following two tables show pertinent information about the Test Fixture Interface located on the Type 576 front panel. This interface consists of four connectors: J360, J361, J362, J363 (see the Test Fixture Connectors schematic in the Diagrams section). The terminals on these connectors may be in one of two states: true or false. True and false are defined in terms of positive logic; the true state is the more positive of two voltage levels. Table 4-10 defines the true and false states of each usable terminal on these connectors in terms of voltage and current ranges. References to current are in terms of conventional current flow; that is, current flowing from a positive potential to a negative potential.

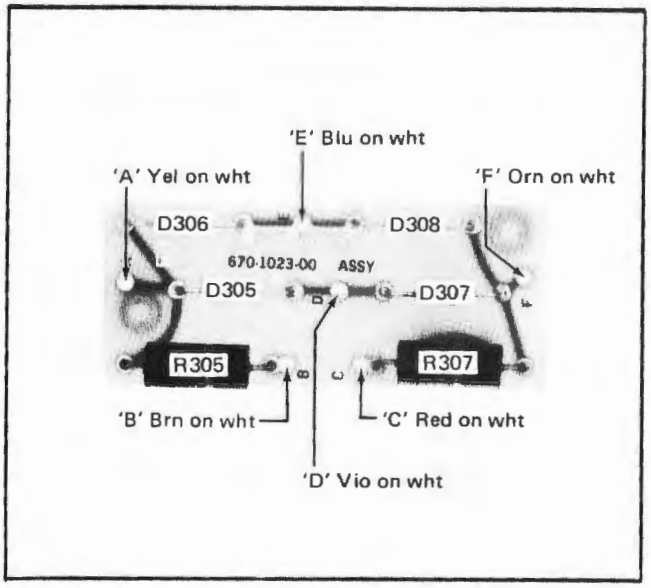


Fig. 4-6. Component locations and wiring color codes on 2 kV Bridge circuit board.

TABLE 4-9

Explanation of the terms Sink and Source

INPUTS	OUTPUTS
Current Sinking When terminal accepts current from external circuit.	Current Sinking When terminal accepts current from external load.
Current Sourcing When terminal supplies current into external circuit.	Current Sourcing When terminal supplies current into external load.

TABLE 4-10

Test Fixture Interface

J360 Pin	J361 Pin	J362 Pin	J363 Pin	Description	Performance	
				Input Signal Logic Levels	**Input controls indicated function. 25 V maximum safe input.**	
					False	True
2				Step Generator Polarity Invert	Drive terminal to between 0 V (ground) and +0.8 V. Terminal sources 5 mA or less into external circuit.	Provide effective open circuit. Terminal must source 1 μA or less. Terminal open circuit voltage is +4 V to +5 V.
3				Step Generator Readout Off	Drive terminal to between 0 V (ground) and +1.5 V. Terminal sources 5 mA or less into external circuit.	
4				Beta Readout Off		
	15			Step Generator Readout 10X Multiplier		
			6	External Vertical Display Enable	Drive terminal to between 0 V (ground) and +1.5 V. Terminal sources 50 mA or less into external circuit.	Provide effective open circuit. Terminal must source 100 μA or less. Terminal open circuit voltage is the +12.5 V supply.
		1		Collector Supply DC Mode		
			7	Vertical Readout Remote Control	Drive terminal to between 0 V (ground) and +1.5 V. Terminal sources 5 mA or less into external circuit. Changes convertible vertical outputs to inputs.	Provide effective open circuit. Terminal must source 1 μA or less. Terminal open circuit voltage is +4 V to +10 V.
			8	Vertical Readout Off	Drive terminal to between 0 V (ground) and +1.5 V. Terminal sources 5 mA or less into external circuit.	Provide effective open circuit. Terminal must source 1 μA or less. Terminal open circuit voltage is +4 V to +5 V.
			9	Vertical Readout in Volts		
			10	Vertical Readout 10X Multiplier		
			19	External Horizontal Display Enable	Drive terminal to between 0 V (ground) and +1.5 V. Terminal sources 50 mA or less into external circuit.	Provide effective open circuit. Terminal must source 100 μA or less. Terminal open circuit voltage is the +12.5 V supply
			20	Horizontal Readout Remote Control	Drive terminal to between 0 V (ground) and +1.5 V. Terminal sources 5 mA or less into external circuit. Changes convertible horizontal outputs into inputs.	Provide effective open circuit. Terminal must source 1 μA or less. Terminal open circuit voltage is +4 V to +10 V.

J360 Pin	J361 Pin	J362 Pin	J363 Pin	Description	Performance	
				Input Signal Logic Levels (cont)		
					False	True
			21	Horizontal Readout Off	Drive terminal to between 0 V (ground) and +1.5 V. Terminal sources 5 mA or less into external circuit.	Provide effective open circuit. Terminal must source 1 μA or less. Terminal open circuit voltage is +4 V to +5 V.
			22	Horizontal Readout in Amps		
				Output Signal Logic	**Indicates state of instrument operation. Either True or False, depending on setting of instrument controls.**	
					False	True
	6			Negative Step Polarity	Drive terminal to between 0 V (ground) and +1.5 V. Terminal can sink 50 mA or less from external load.	Provide effective open circuit. Terminal must sink or source 100 μA or less. Terminal open circuit voltage is the +12.5 V supply.
	11			Step Generator Amplitude, 10^{-1} Decade		Provide effective open circuit. Open circuit voltage is +4 V to +5 V. Terminal must source 1 μA or less. With external load returned to voltage between +5 V and +25 V, terminal sinks 0.1 μA or less.
	12			Step Generator Amplitude, 10^{-2} Decade		
	13			Step Generator Amplitude 2X Switch Position		
	14			Step Generator Amplitude 5X Switch Position		
	16			Step Generator, 10^{-4} or 10^{-8} Decade or Volts		
		2		Negative Collector Sweep Polarity		Provide effective open circuit. With external load returned to voltage of +25 V or less, terminal sinks 0.1 μA or less.
		3		15 V Range		
		4		75 V Range		
		5		350 V Range		

J360 Pin	J361 Pin	J362 Pin	J363 Pin	Description	Performance			
				Convertible Outputs	**Outputs indicate state of instrument operation. When converted to inputs, they control the indicated readout and the 2X and 5X display amplifiers gains, but none of the other instrument functions.**			
				Vertical Logic Levels	Vertical outputs converted to inputs by False state at J363 pin 7 25 V maximum input voltage.			
					Outputs		Inputs	
					False	True	False	True
			1	Vertical 10^{1} Decade Information	Drive terminal to between 0 V and +1.5 V. Terminal can sink 50 mA or less from external load.	Provide effective open circuit voltage. Terminal open circuit voltage is +4 V to +5 V. Terminal must source 1 μA or less. If external circuit load is returned to a voltage between +5 V and +25 V, terminal sinks 0.1 μA or less.	Drive terminal to between 0 V and +1.5 V. Terminal sources 5 mA or less into external circuit.	Provide effective open circuit. Terminal must source 1 μA or less. Terminal open circuit voltage is +4 V to +5 V.
			2	Vertical 10^{2} Decade Information				
			3	Vertical 10^{4} Decade Information				
			4	Vertical 2X Switch Position or 50 mV/DIV Deflection Factor		Provide effective open circuit voltage. Open circuit voltage Open circuit voltage of the +12.5 V supply. Terminal must sink or source 100 μA or less.	Drive terminal to between 0 V and +1.5 V. Terminal sources 50 mA or less into external circuit.	Provide effective open circuit. Open circuit voltage is the +12.5 V supply. Terminal must source 100 μA or less.
			5	Vertical 5X Switch Position or 125 mV/DIV DIV Deflection Factor.				

J360 Pin	J361 Pin	J362 Pin	J363 Pin	Description	Performance			
				Convertibles (Cont)				
				Vertical Logic Levels				
					Outputs		Inputs	
					False	True	False	True
			13	Vertical 10^{-3} Leakage		Provide effective open circuit. Terminal open circuit voltage of +4 V to +5 V. Terminal must source 1 μA or less. If external circuit is returned to a voltage between +5 V and +25 V, terminal sinks 0.1 μA or less.	Drive terminal to between 0 V and +1.5 V. Terminal sources 5 mA or less into external circuit.	Provide effective open circuit. Terminal must source 1 μA or less. Terminal open circuit voltage is +4 V to +5 V.
				Horizontal Logic Levels	Horizontal outputs converted to inputs by False state at J363, Pin 20.			
					Outputs		Inputs	
					False	True	False	True
			14	Horizontal 10^{-1} Decade Information	Drive terminal to between 0 V and +1.5 V. Terminal can sink 50 mA or less from external load.	Provide effective open circuit voltage. Terminal open circuit voltage is +4 V to +5 V. Terminal must source 1 μA or less. If external circuit load is returned to a voltage between +5 V and +25 V, terminal sinks 0.1 μA or less.	Drive terminal to between 0 V and +1.5 V. Terminal sources 5 mA or less into external circuit.	Provide effective open circuit. Terminal must source 1 μA or less. Terminal open circuit voltage is +4 V to +5 V.
			15	Horizontal 10^{-2} Decade Information				
			16	Horizontal Decade Negative Exponent Control				

J360 Pin	J361 Pin	J362 Pin	J363 Pin	Description	Performance			
				Convertibles (Cont)				
				Horizontal Logic Levels				
					Outputs		Inputs	
					False	True	False	True
			17	Horizontal 2X Switch Position or 200 mV/DIV Deflection Factor		Provide effective open circuit voltage. Open circuit voltage is the +12.5 V. Terminal must sink or source 100 μA or less.	Drive terminal to between 0 V and +1.5 V. Terminal sources 50 mA or less into external circuit.	Provide effective open circuit voltage. Open circuit voltage is the +12.5 V supply. Terminal must source 100 μA or less.
			18	Horizontal 5X Switch Position or 50 mV/DIV Deflection Factor				

				Power Supply Outputs	**Recommended maximum rate of load current changes: 1 mA/μs**
18				+5 V	Maximum load 100 mA
19				−75 V	Maximum load 15 mA
20				+100 V	Maximum load 25 mA
21				−12.5 V	Maximum load 100 mA
22				+12.5 V	Maximum load 500 mA
23				Ground	
	1, 9			AC Power	Pin 1, line terminal; Pin 9, neutral terminal.
				Collector Supplies	
6				Safety Interlock Bypass	Normally open-ended. Can be wired for bypass on 75 V and 350 V ranges. +12.5 V present when bypassed range is selected.
7				Safety Interlock	Open circuit on 15 V range. −12.5 V on all other ranges. If grounded, activates collector power supply.
24				Looping Compensation	Capacitive coupled to Collector Supply output.
15, 16 32				Collector Supply Out	15 V Range: 10 A continuous peak current. 75 V Range: 2 A continuous peak current. 350 V Range: 0.5 A continuous peak current. 1500 V Range: 100 mA continuous peak current.
13, 28, 29				Collector Current Return	Returns for all collector currents as well as 15 V AC and 75 V AC Power.

J360 Pin	J361 Pin	J362 Pin	J363 Pin	Description	Performance
				Collector Supplies (Cont)	
7				Return for 350 V AC Power	
18, 15, 16				15 V, 75 V, 350 V AC Power Out	Selected by front panel switch. Same current limits as Collector Supply output on J1, Pins 15, 16, 32.
				Step Generator	
1				Step Generator Output	
	7			Plus or Minus 1/2 V/ Step Output	Plus or minus half volt per step regardless of AMPLITUDE switch setting. Series resistance of 470 Ω.
	8			Pulse Output	300 μs or 80 μs pulses, +12 V amplitude, in pulsed mode only. Series resistance of 470 Ω.
				Sensing	
5				Switched Ground	Ground in NORM and DC Modes; open in LEAKAGE.
8				Looping Compensation	Sensing into Vertical Amplifier.
9, 10, 26					Current in
11, 12 27					Current out
17				Base Volts	
25				Emitter Volts	
31				Collector Volts	
				Display Amplifier External Inputs	
			11		Differential: Negative vertical input. Activated by False state at J363, Pin 6.
			12		Positive vertical input. Activated by False state at J363, Pin 6.
			23		Negative horizontal input. Activated by False state at J363, Pin 19.
			24		Positive horizontal input. Activated by False state at J363, Pin 19.

J360 Pin	J361 Pin	J362 Pin	J363 Pin	Description	Performance
				Input Requirements (Cont)	
				Maximum Safe Overload	Equivalent of plus or minus 12 divisions of deflection, depending on which amplifier sensitivity is selected by logic switching.
				Input Offset Current	1 nA or less
				Noise	300 μV or less or 100 pA or less.
				Response Time	20 μs or less to settle within 2% of final value with step input.
				Common Mode Rejection	At least 100:1 at 1 kHz or less.
				Maximum Common Mode Input	5 times the deflection factor.
				Input Impedance	At least 100 MΩ paralleled by approximately 70 pF.
				Deflection Factors	
				Vertical	25 mV/division normal; 50 mV/division with False Input at J363, Pin 4; 125 mV/division with False Input at J363, Pin 5.
				Horizontal	100 mV/division normal; 200 mV/division with False Input at J363, Pin 17; 50 mV/division with False Input at J363, Pin 18.

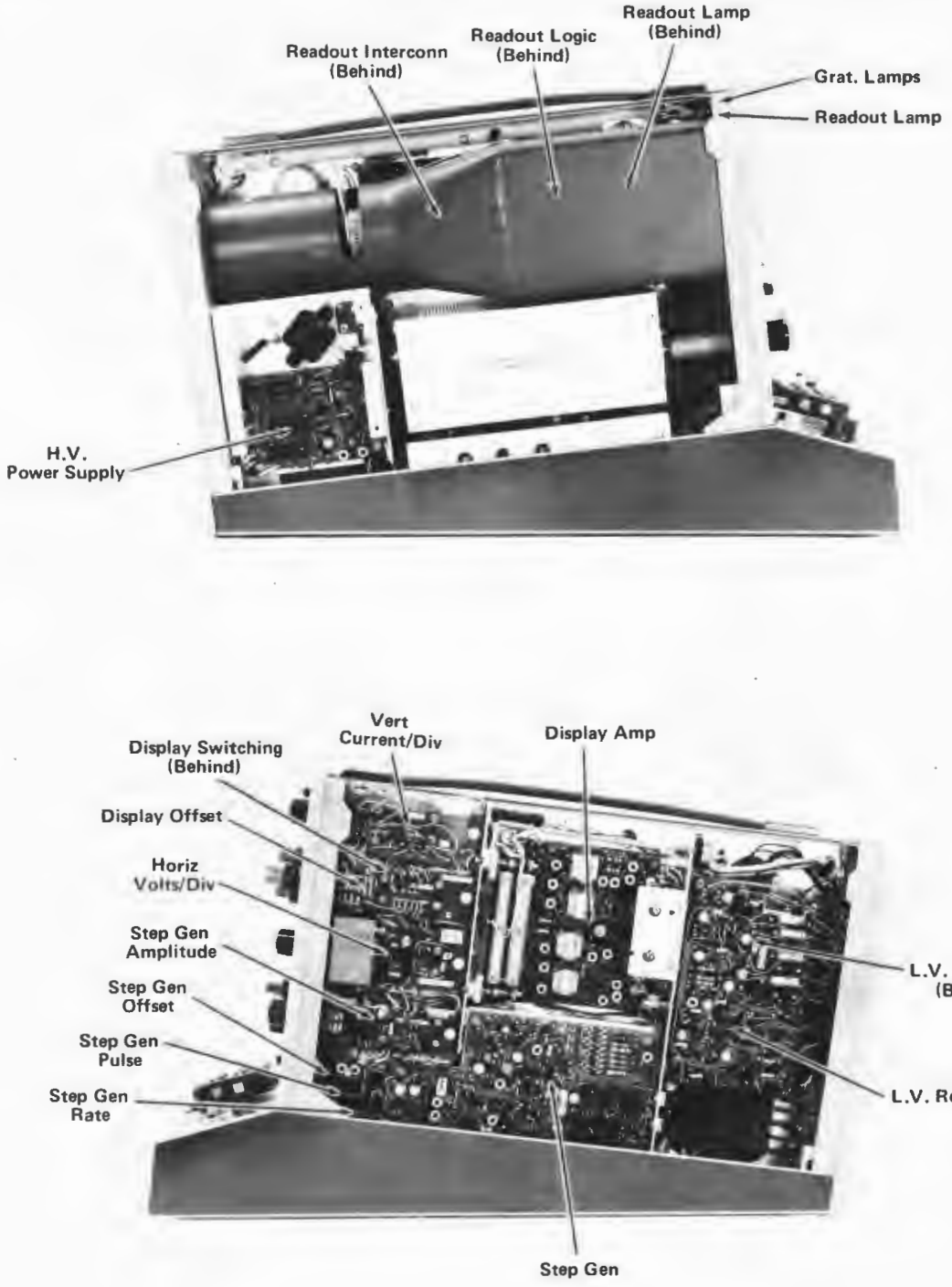


Fig. 4-7. Locations of circuit boards in Type 576.

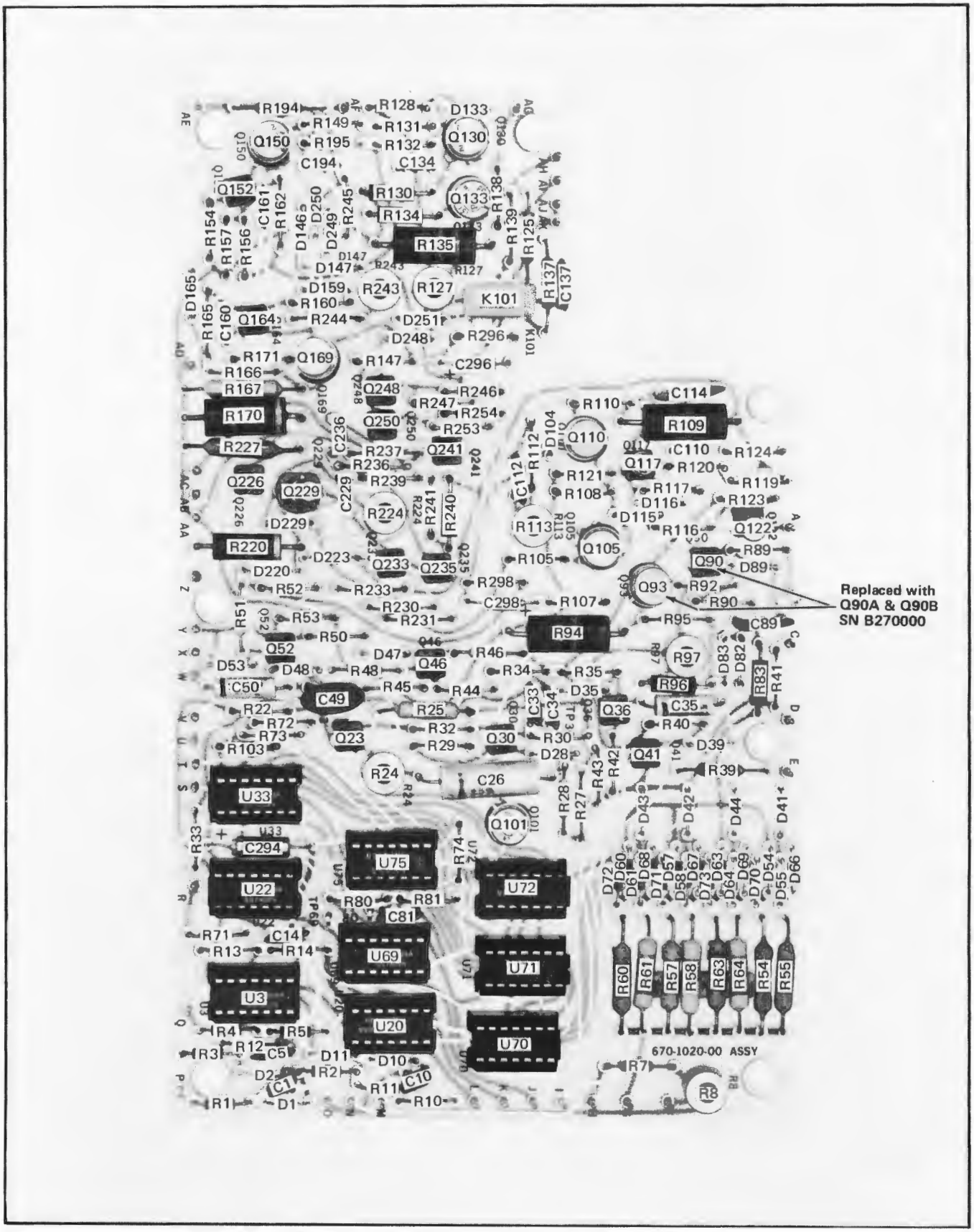


Fig. 4-8. Component locations of Step Gen circuit board.

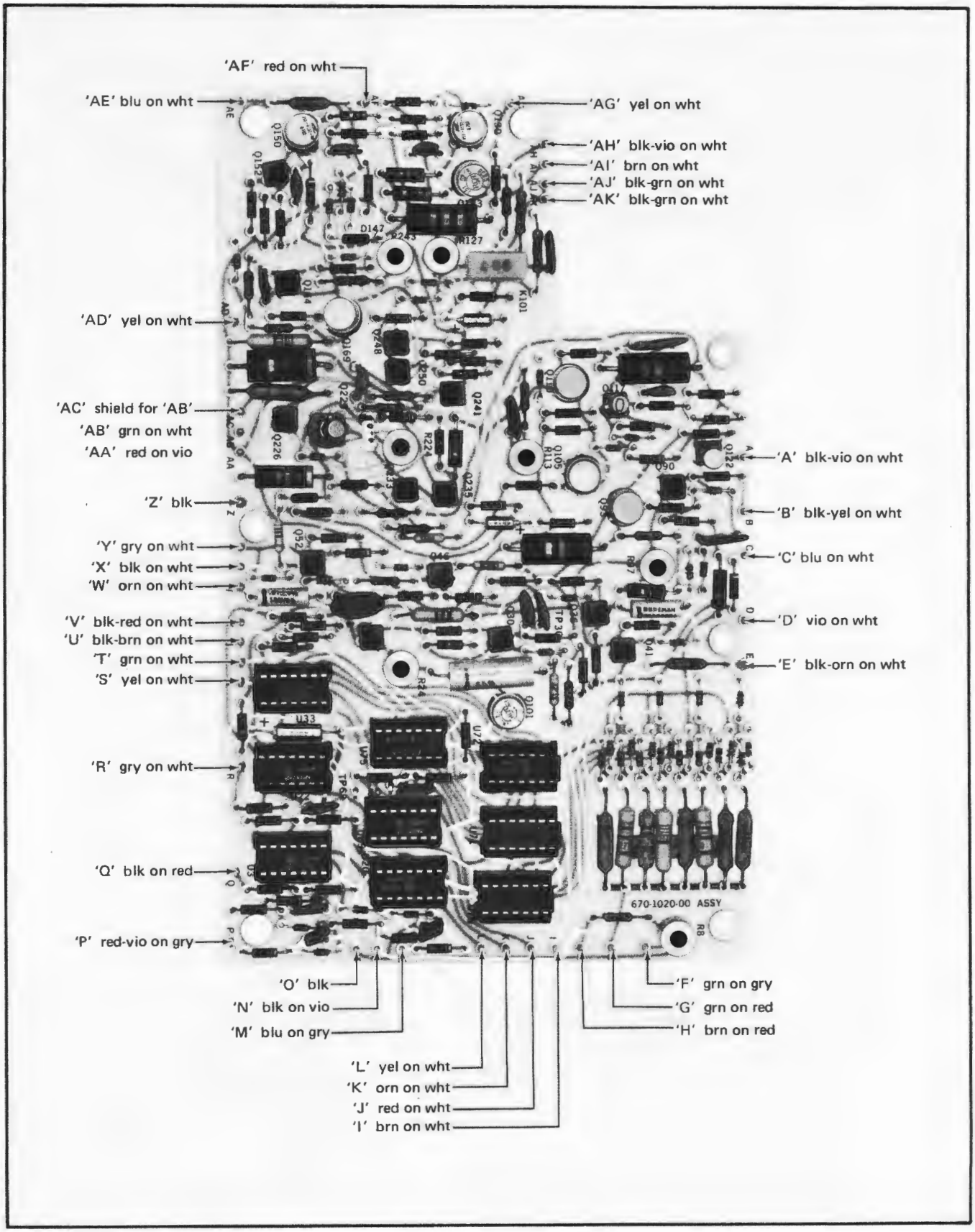


Fig. 4-9. Wiring color codes on Step Gen circuit board.

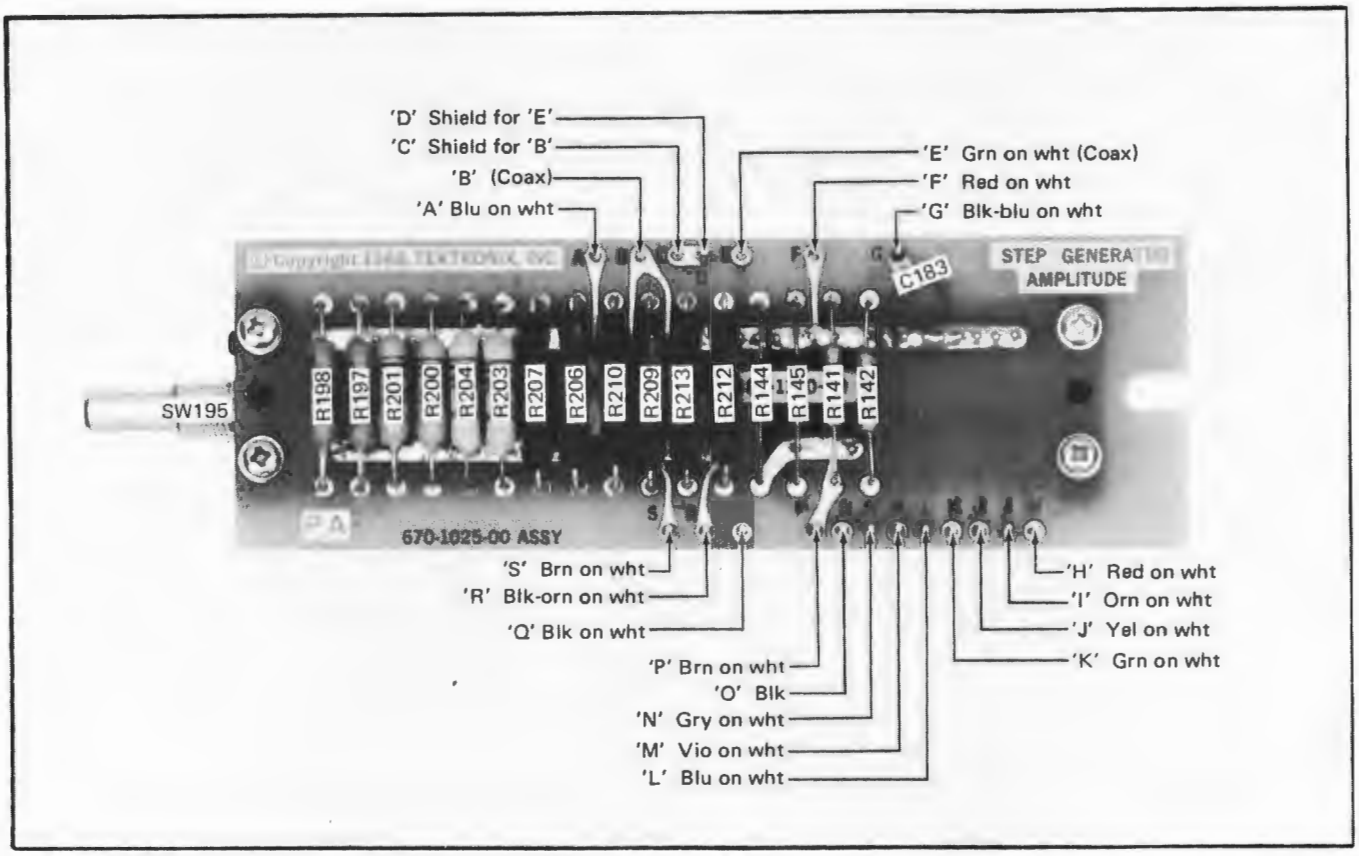


Fig. 4-10A. Component locations and wiring color codes on Step Generator Amplitude circuit board, serial numbers through B091299.

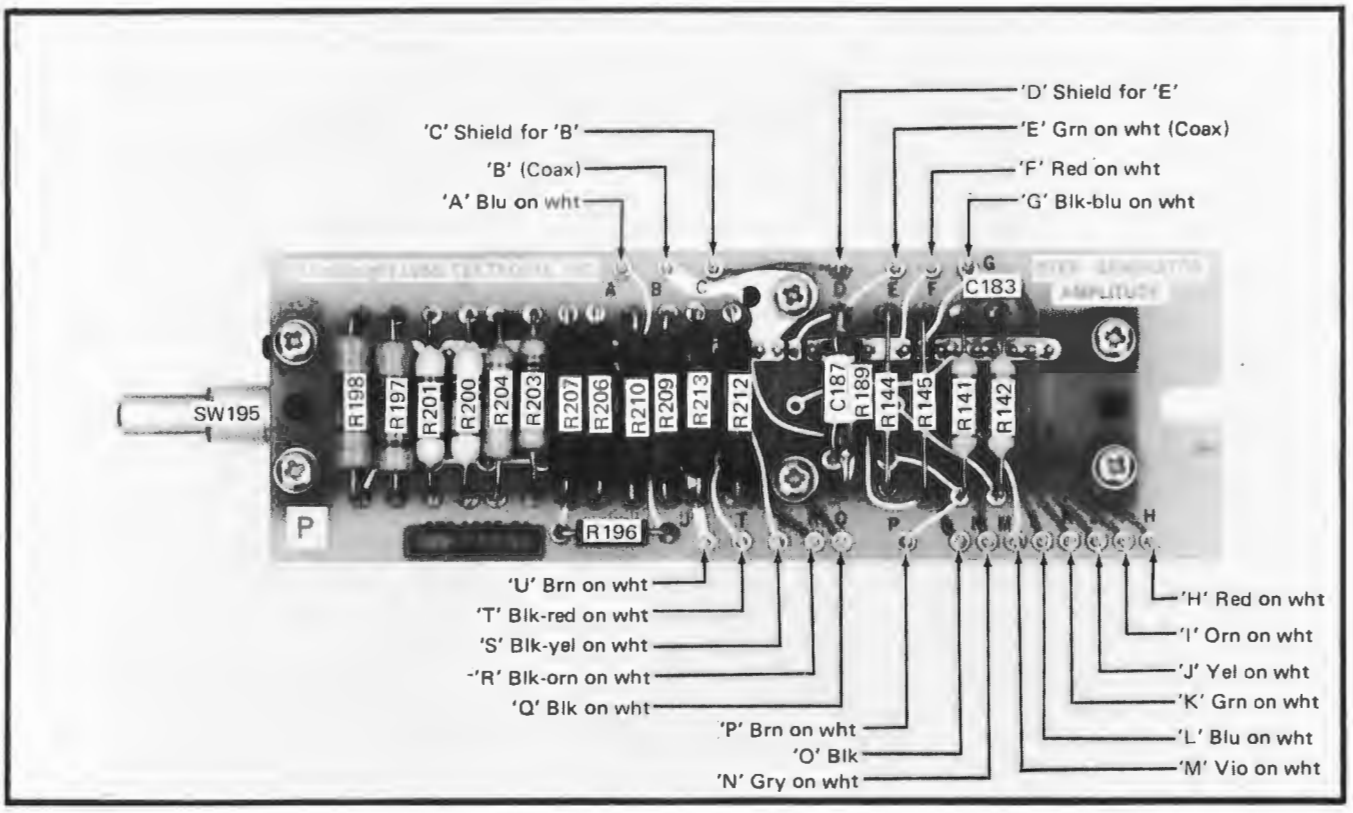


Fig. 4-10B. Component locations and wiring color codes on Step Generator Amplitude circuit board, serial numbers B101300-up.

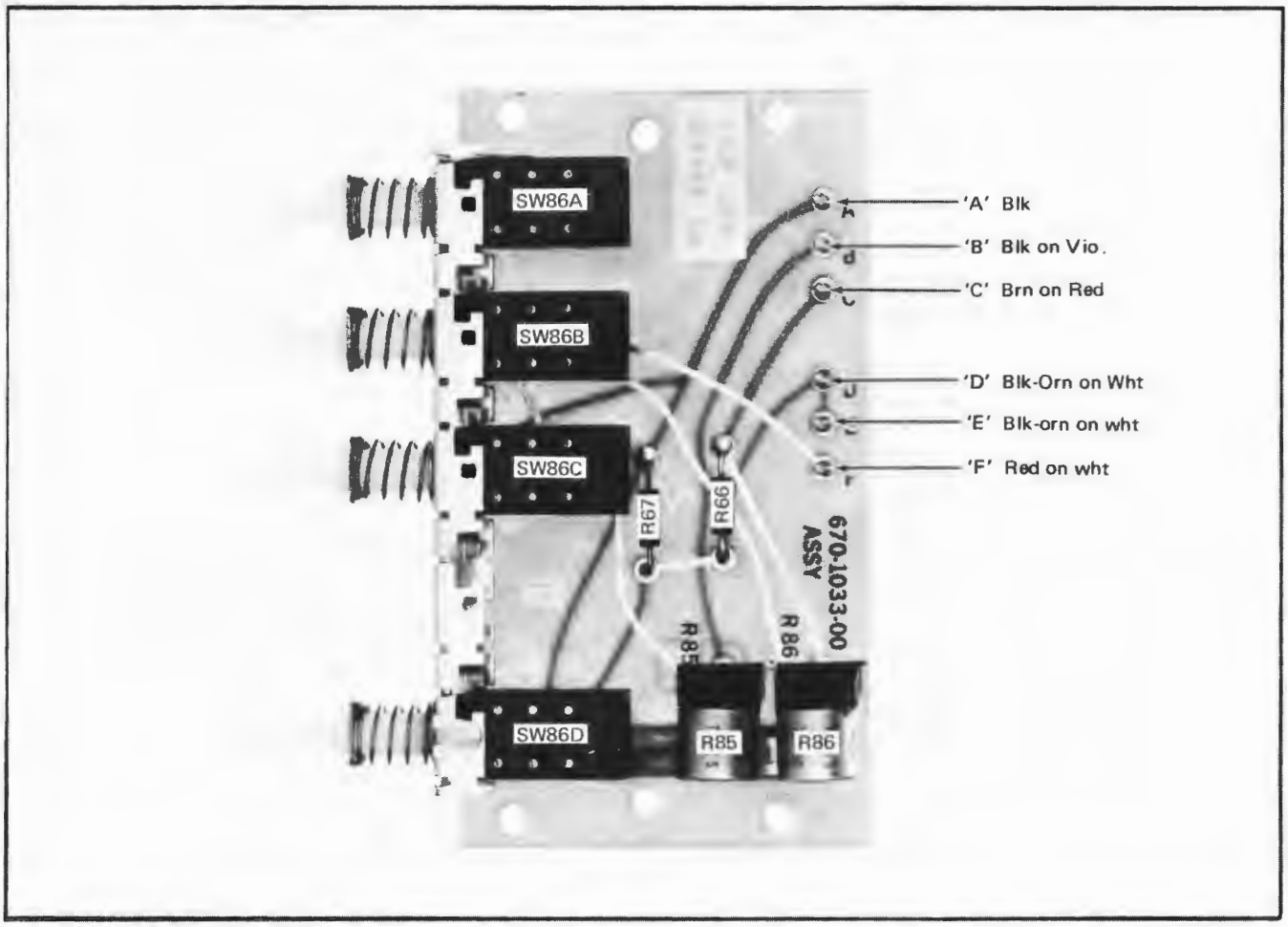


Fig. 4-11. Component locations and wiring color codes on Step Gen Offset circuit board.

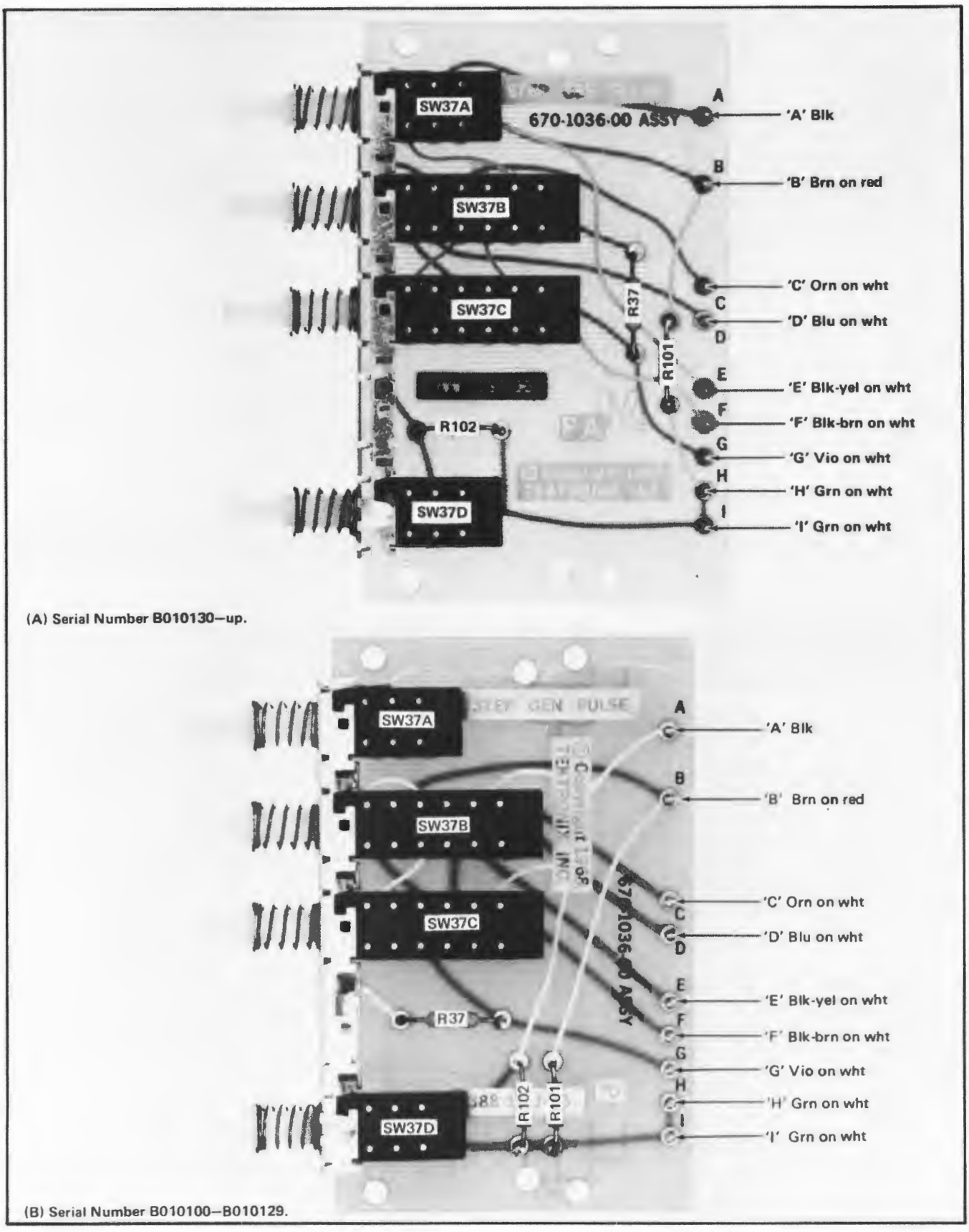


Fig. 4-12. Component locations and wiring color codes on Step Gen Pulse circuit board.

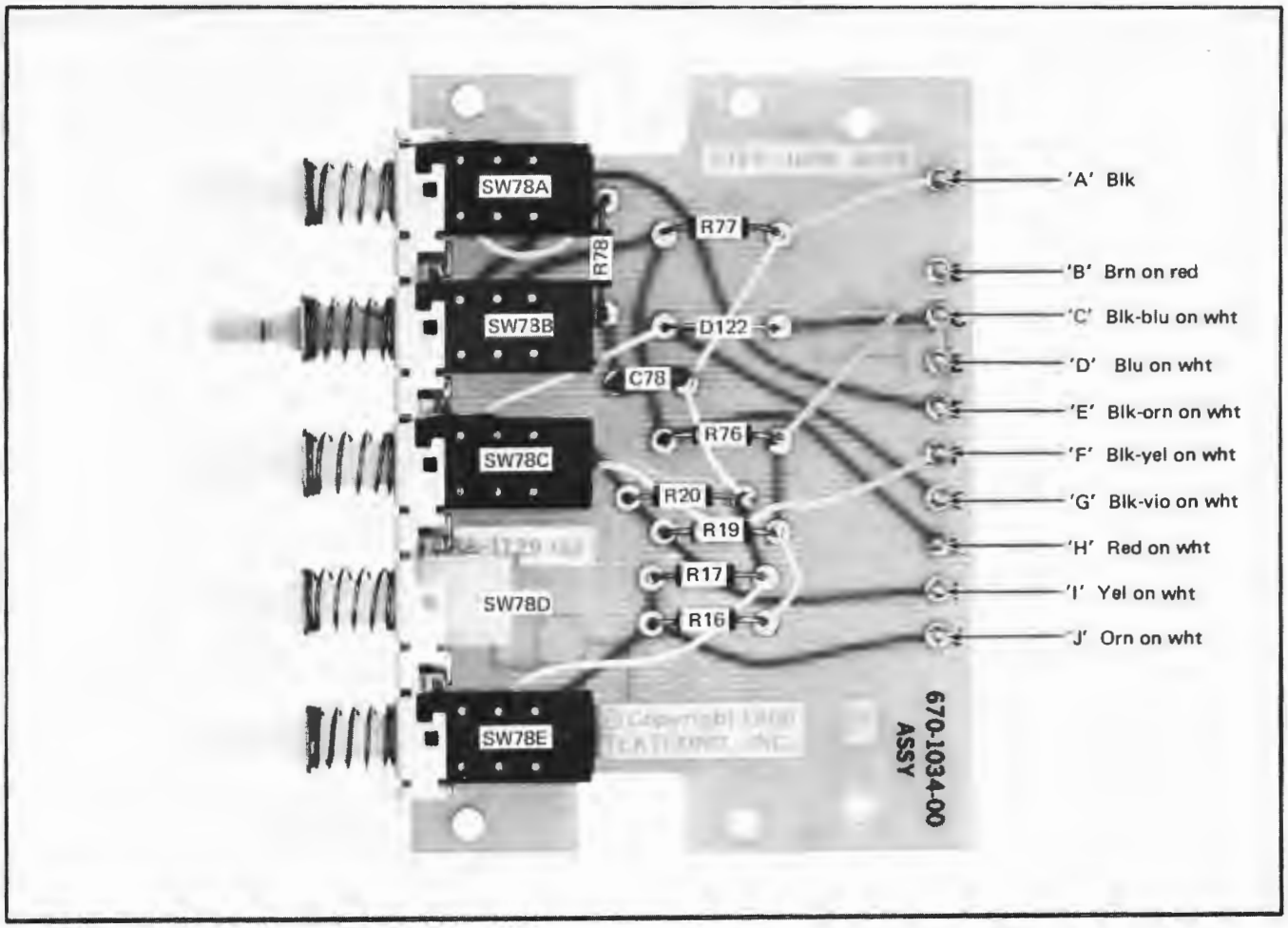
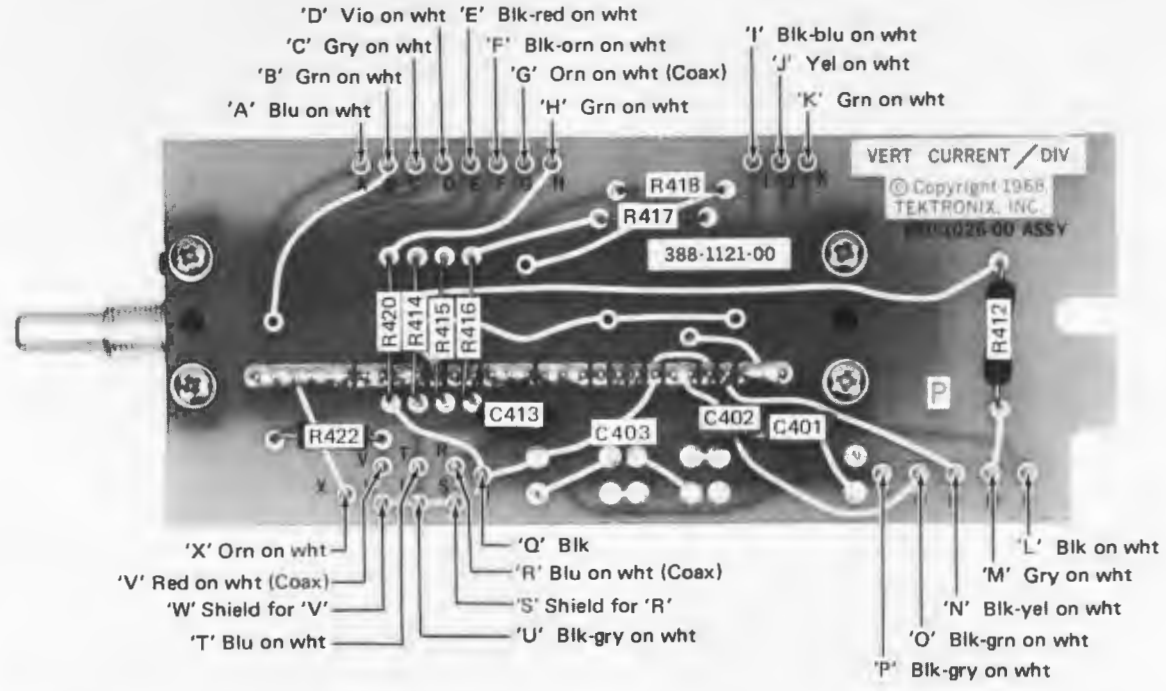


Fig. 4-13. Component locations and wiring color codes on Step Gen Rate circuit board.



R412 and Pin M
Removed B010129-up

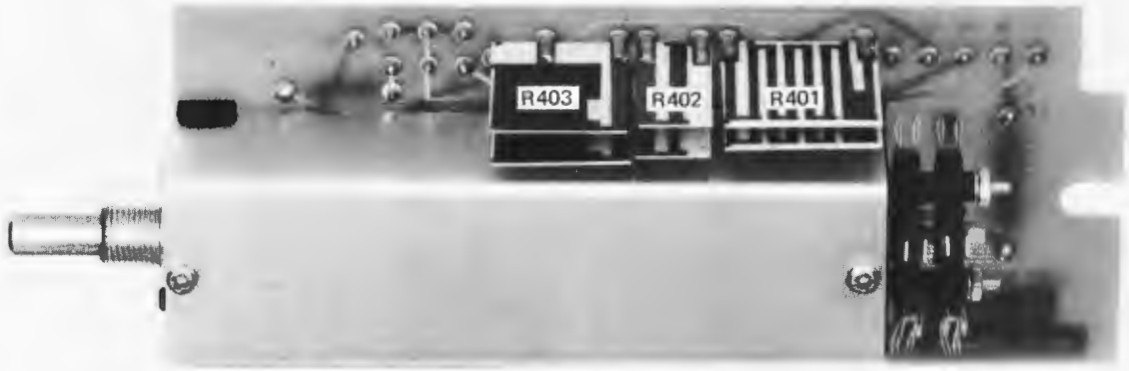


Fig. 4-14A. Component locations and wiring color codes on Vert Current/Div circuit board, serial numbers through B091299.

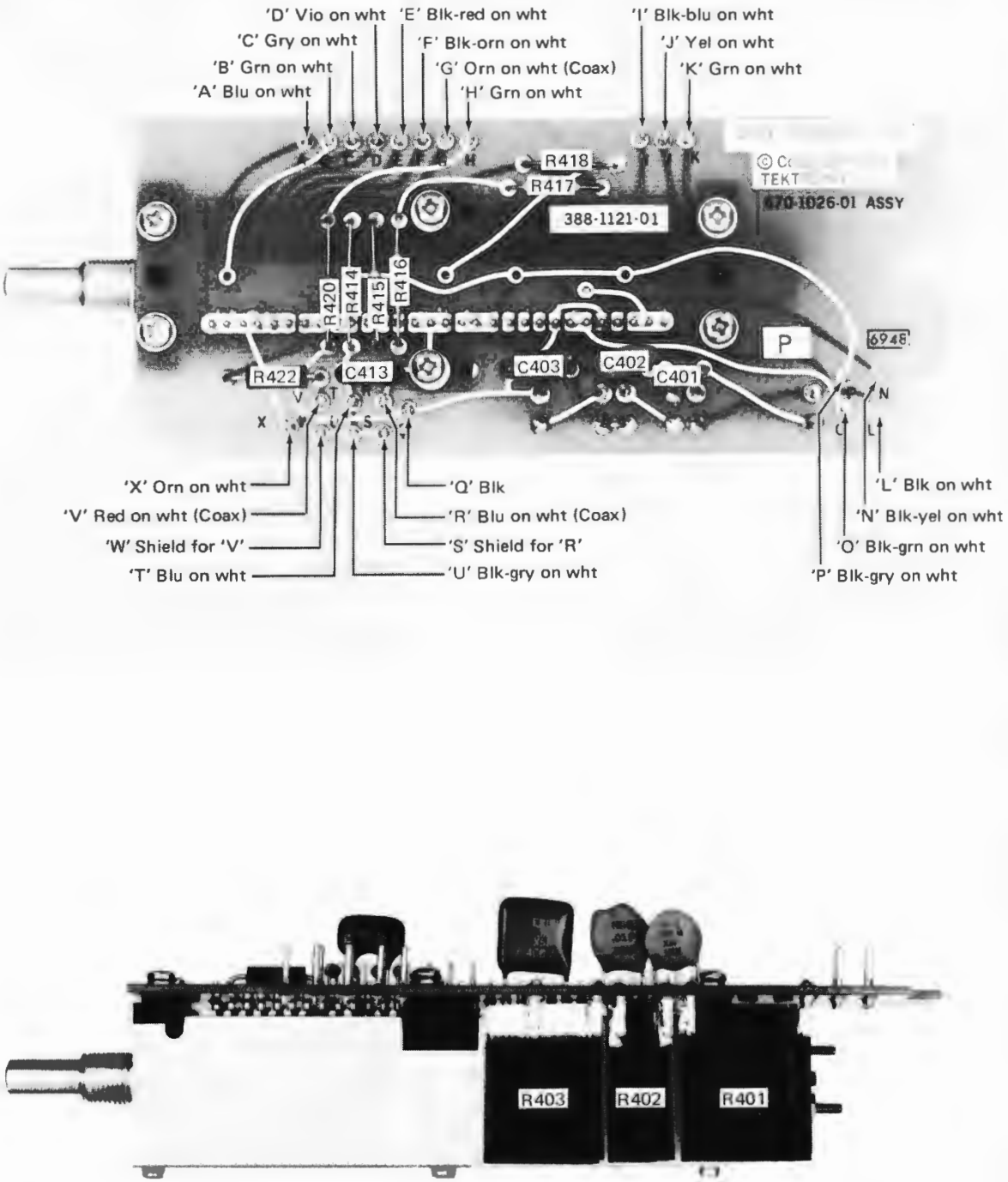


Fig. 4-14B. Component locations and wiring color codes on Vert Current/Div circuit board, serial numbers B101300-up.

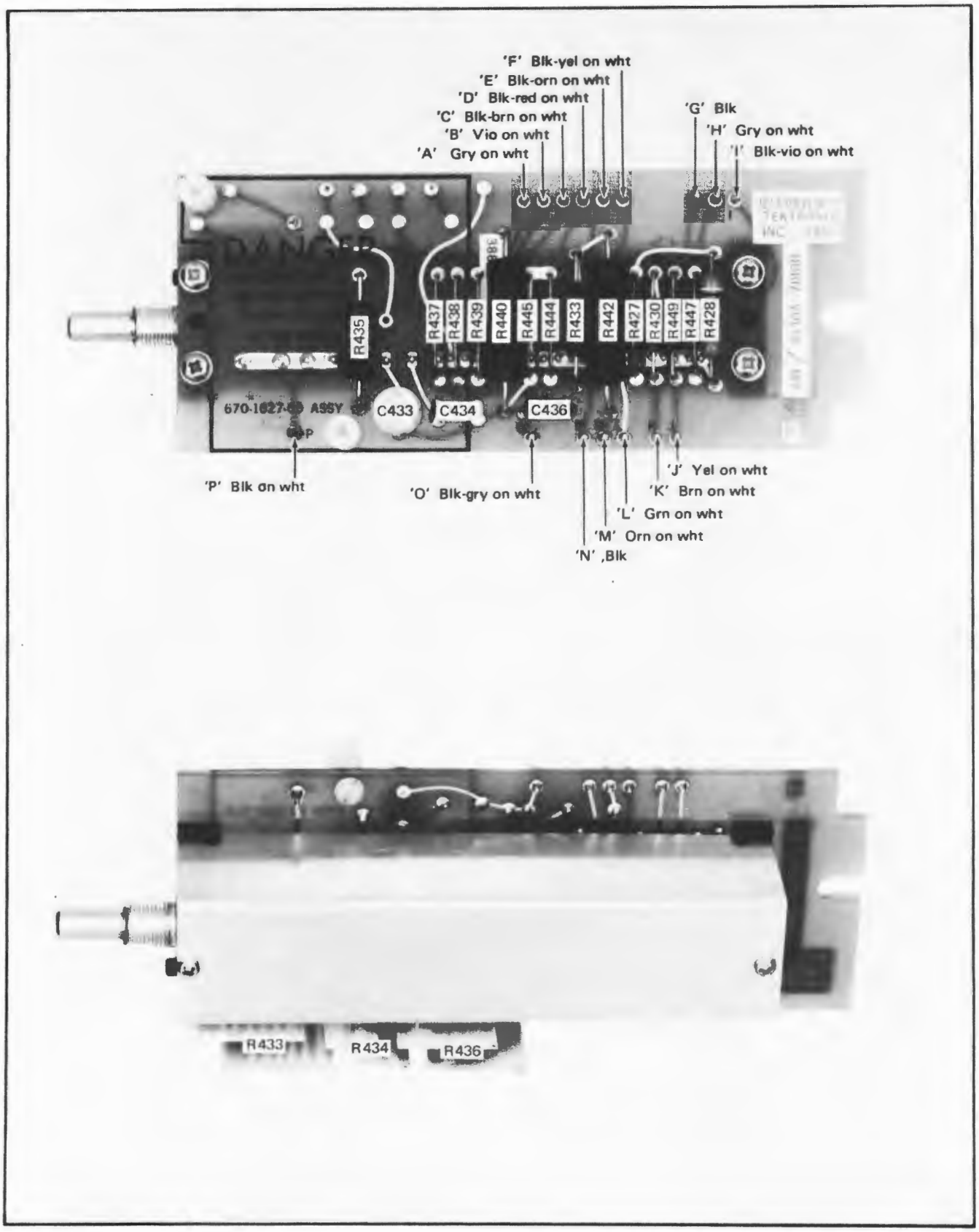


Fig. 4-15A. Component locations and wiring color codes on Horiz Volts/Div circuit board, serial numbers through B091299.

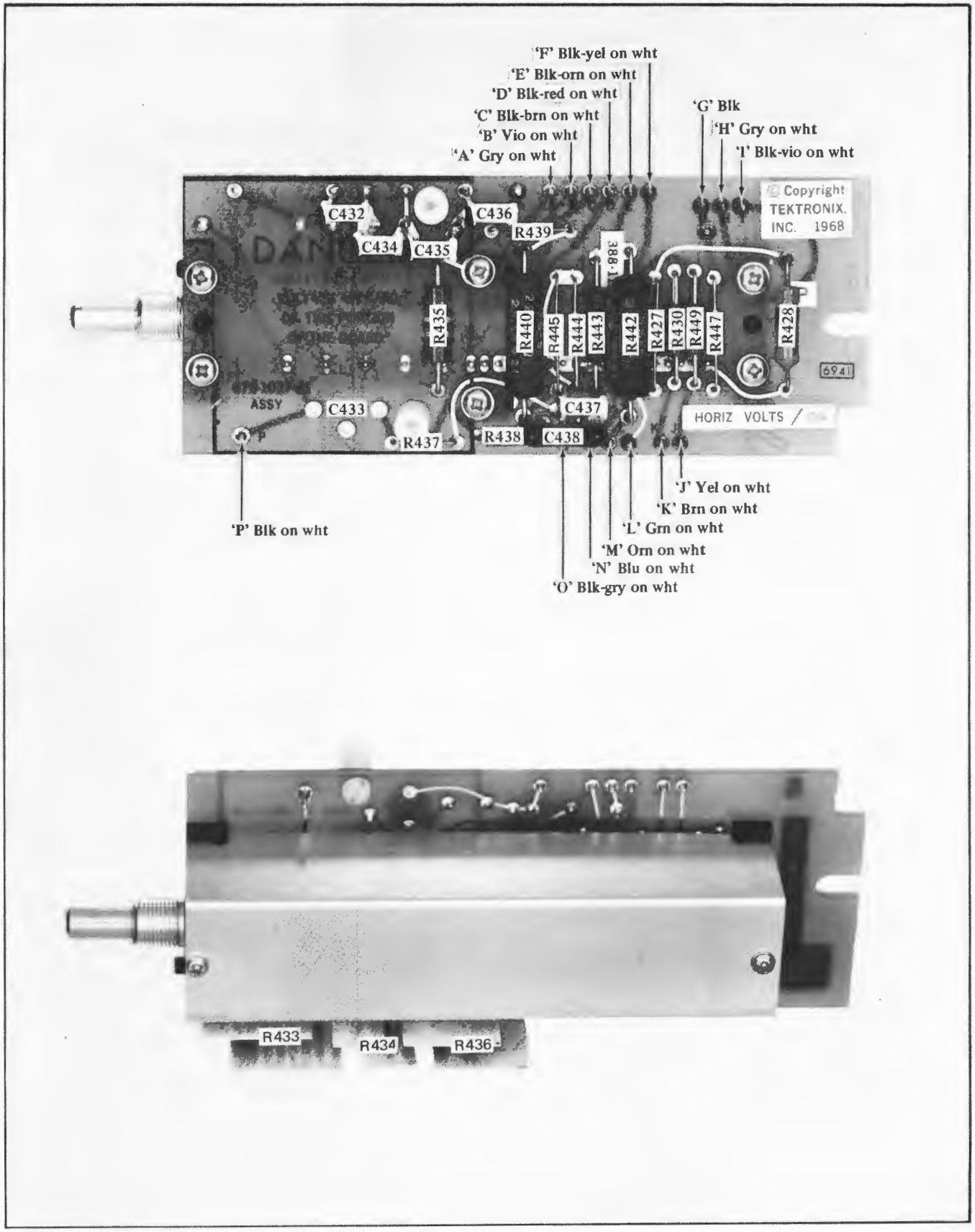


Fig. 4-15B. Component locations and wiring color codes on Horiz Volts/Div circuit board, serial numbers B101300-up.

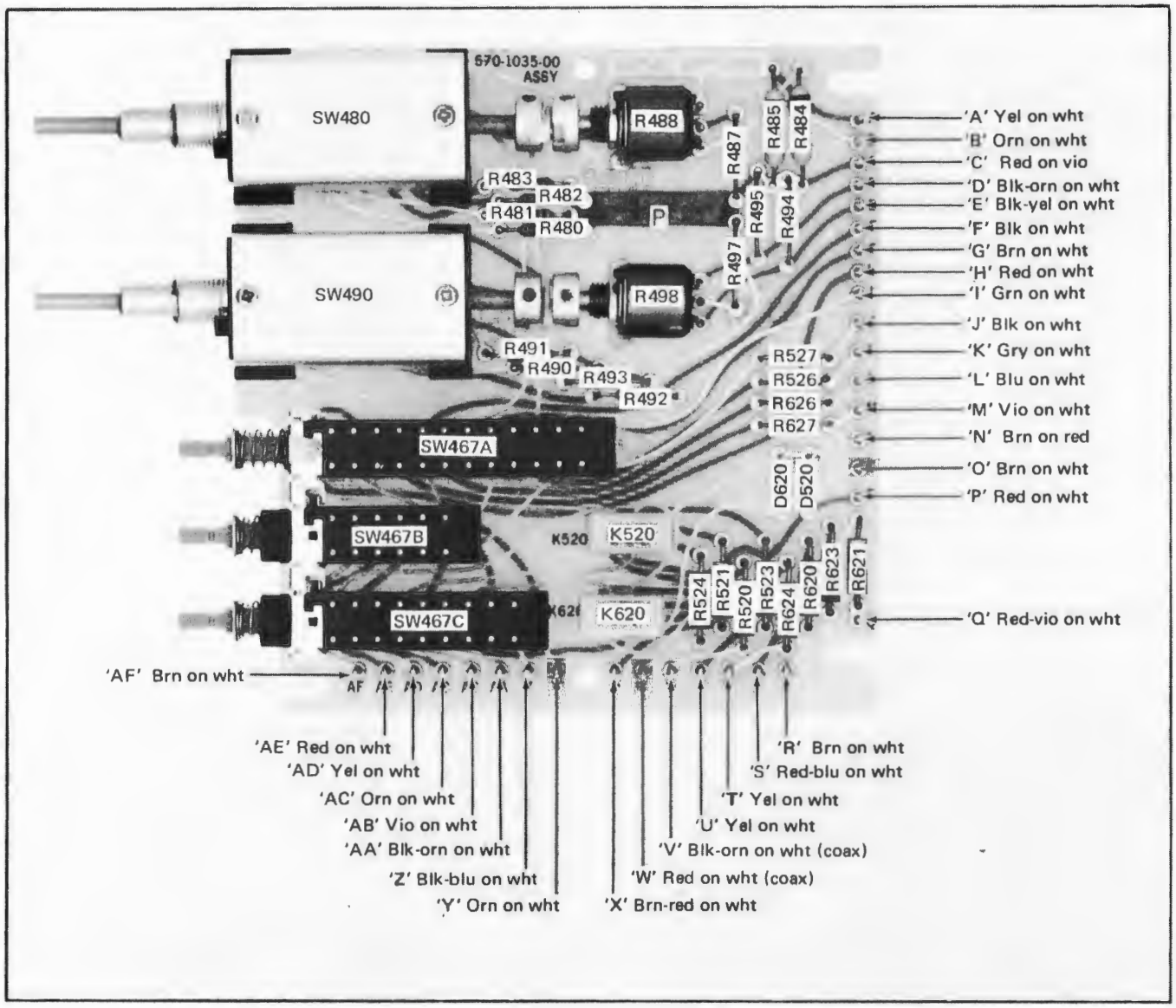


Fig. 4-16. Component location and wiring color codes on Display Switching circuit board.

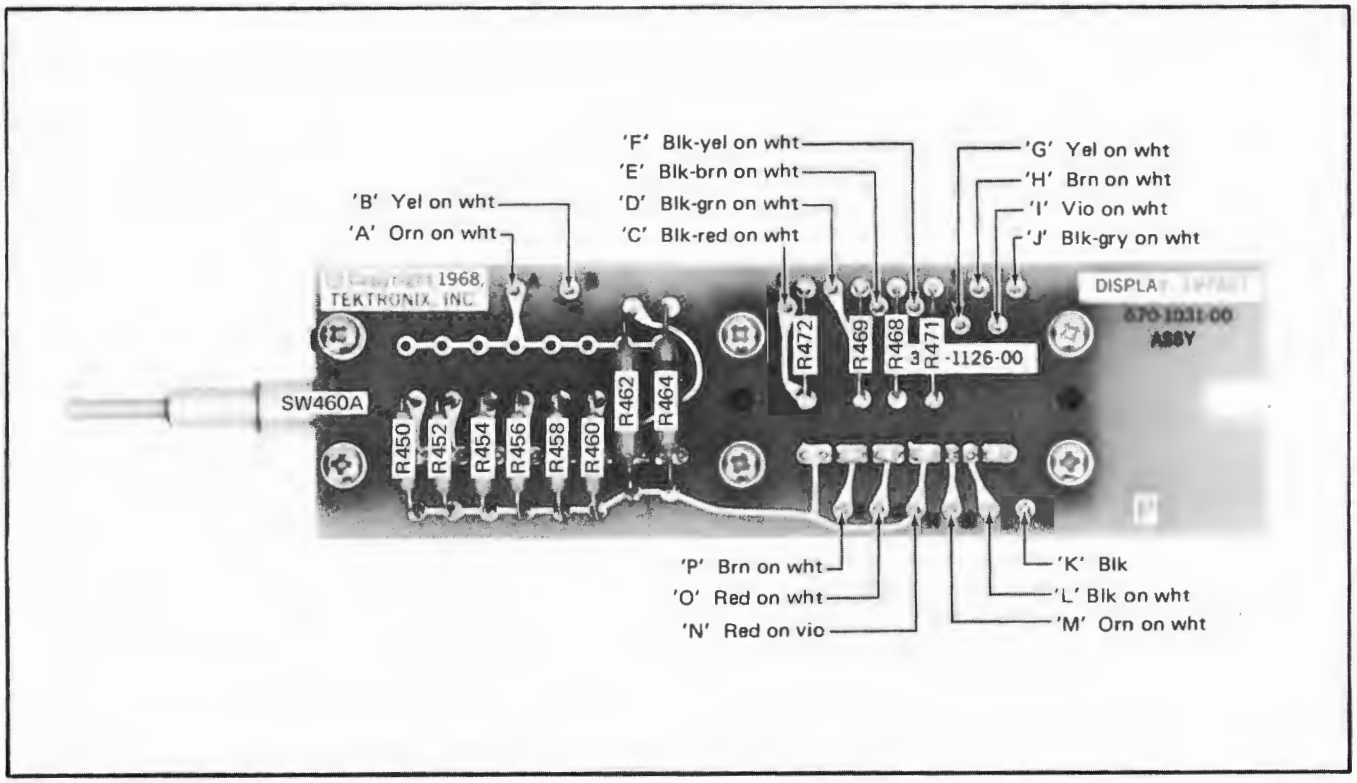


Fig. 4-17. Component locations and wiring color codes on Display Offset circuit board.

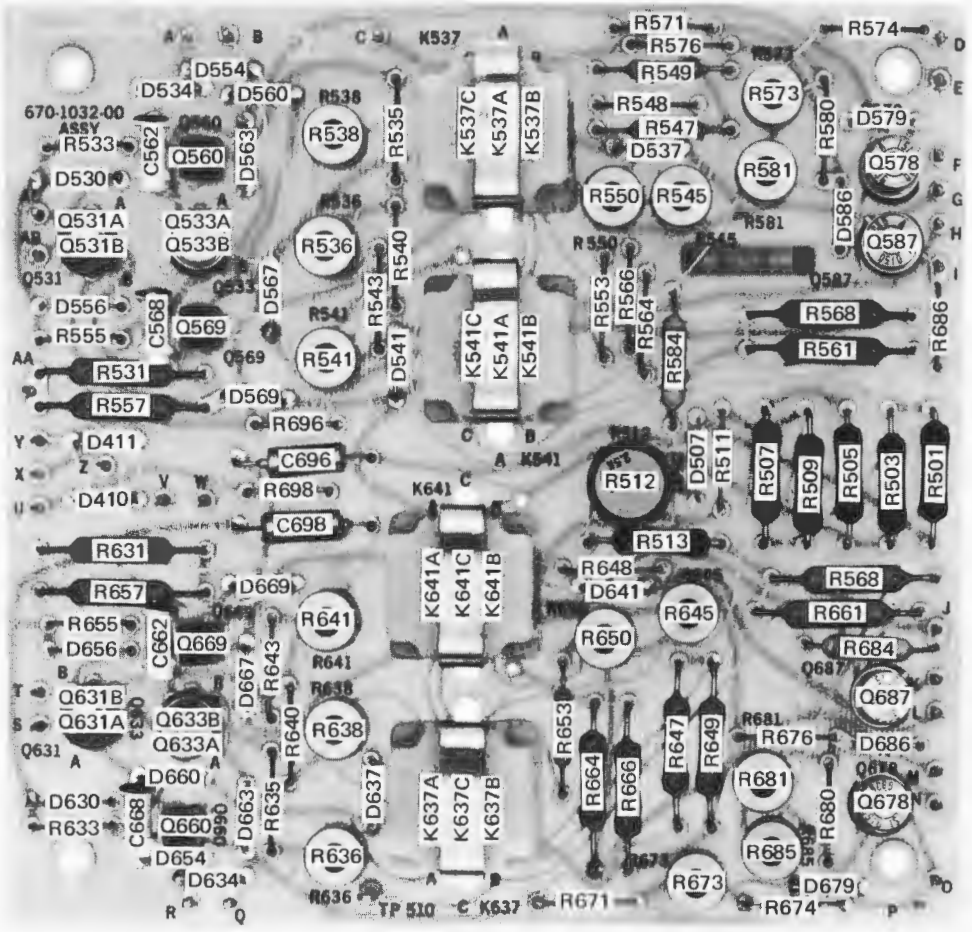


Fig. 4-18. Component locations on Display Amp circuit board.

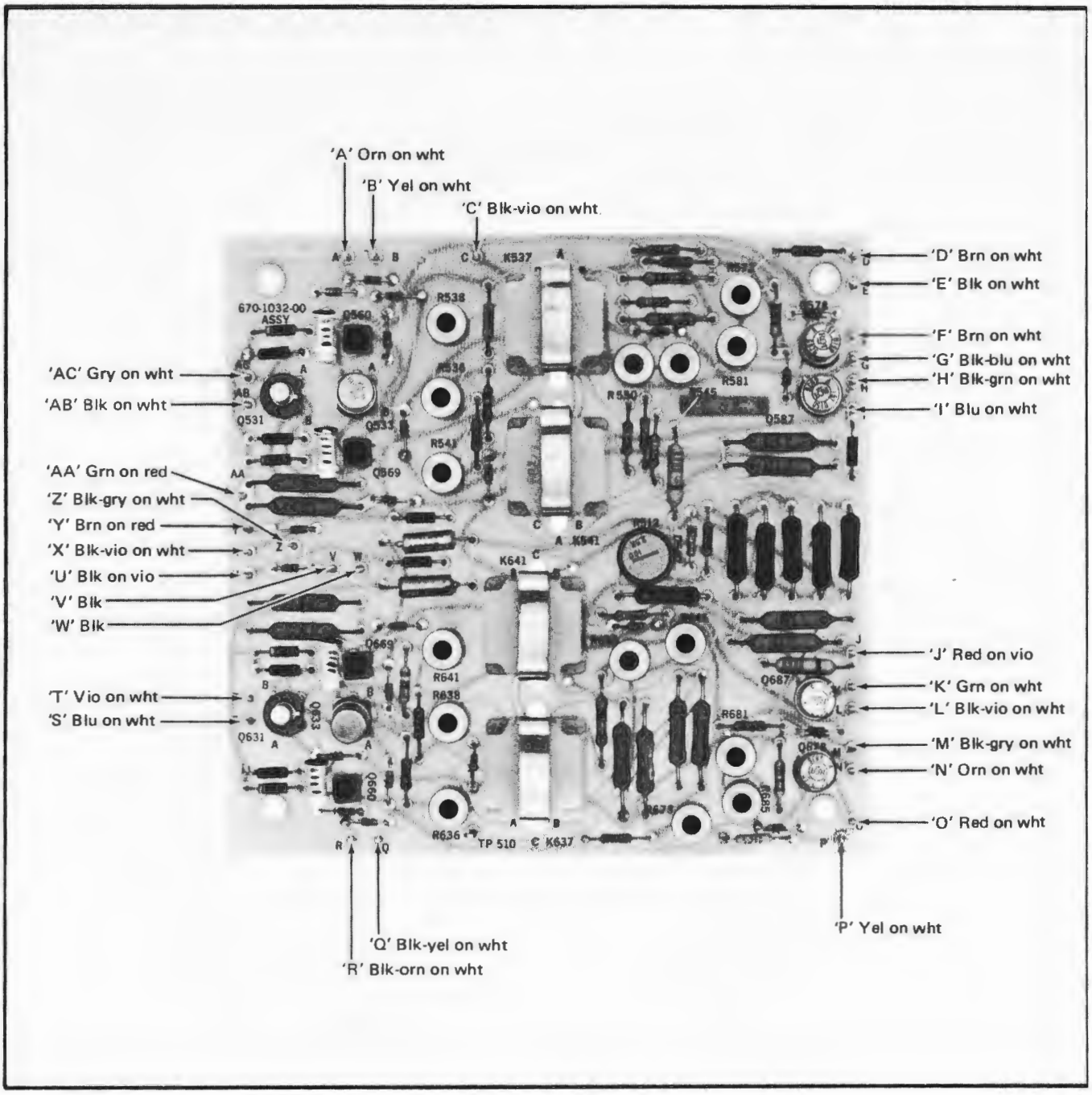


Fig. 4-19. Wiring color codes on Display Amp circuit board.

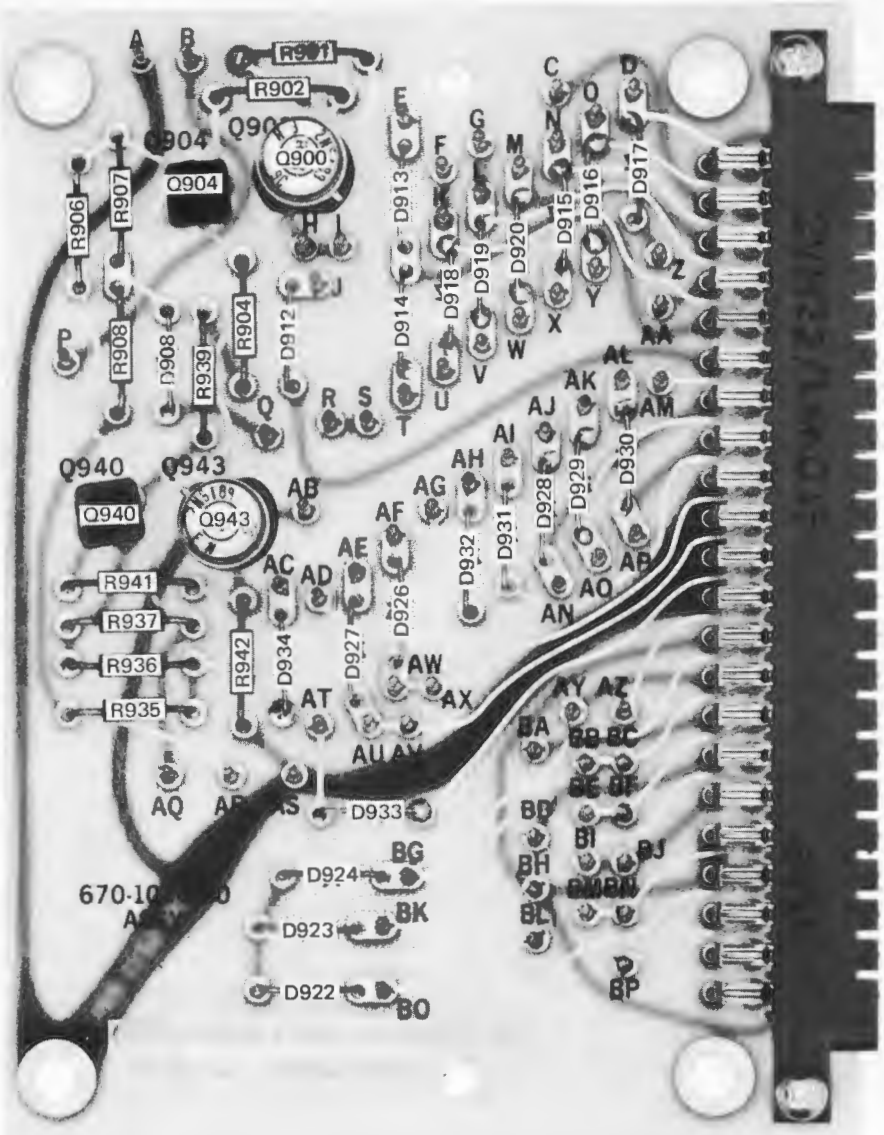


Fig. 4-20. Component locations on Readout Interconn circuit board.

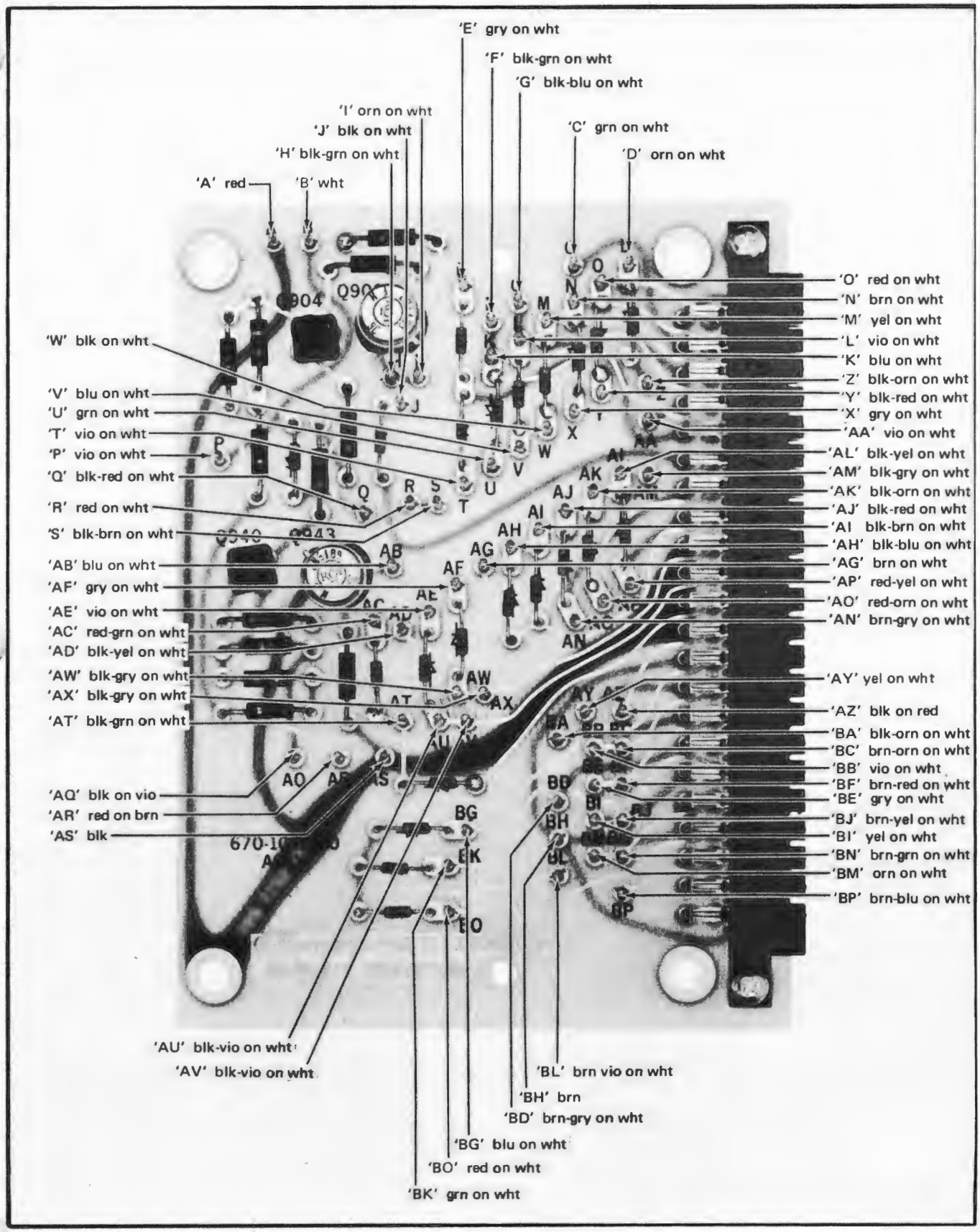


Fig. 4-21. Wiring color codes on Readout Interconn circuit board.

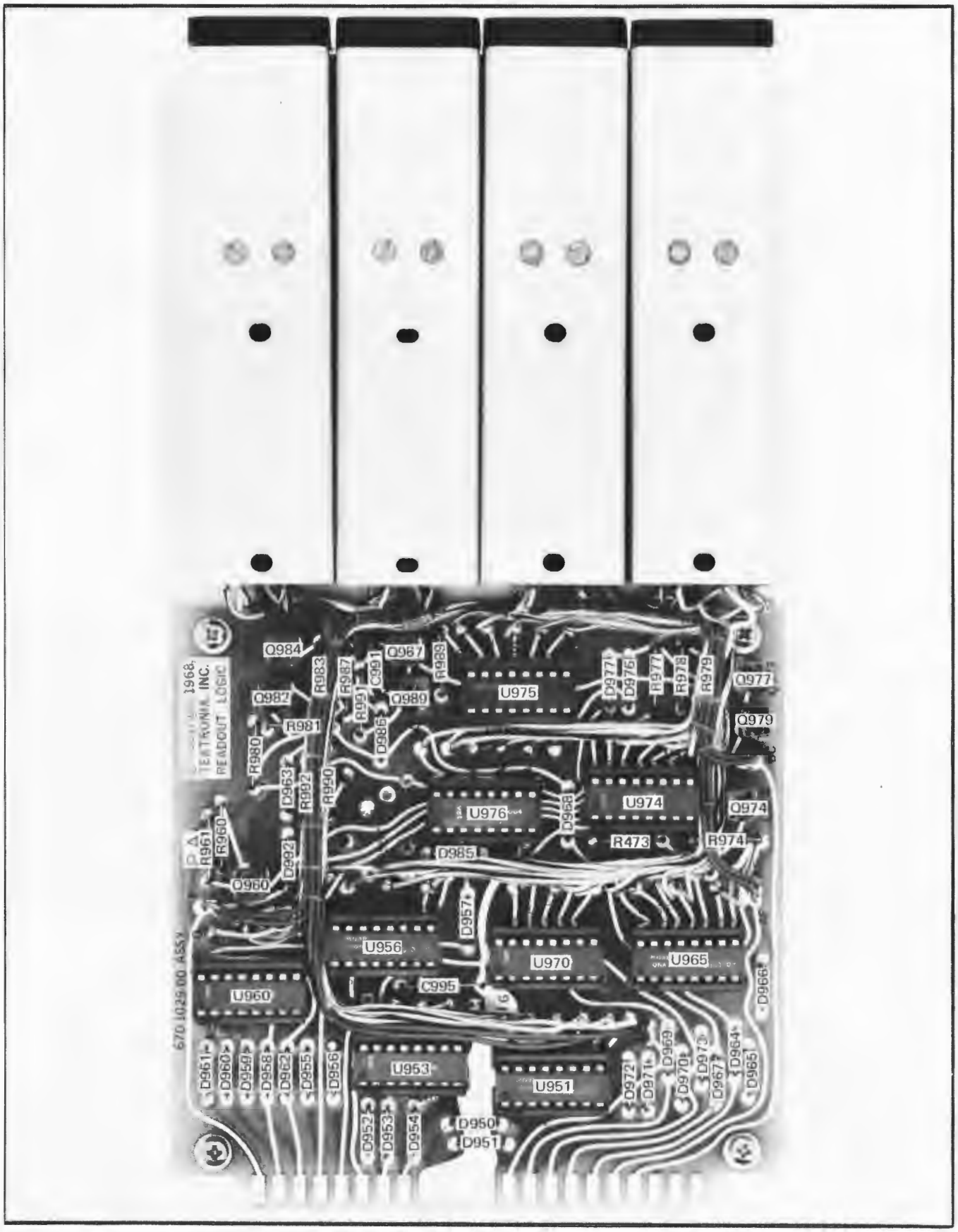


Fig. 4-22. Component locations on Readout Logic circuit board.

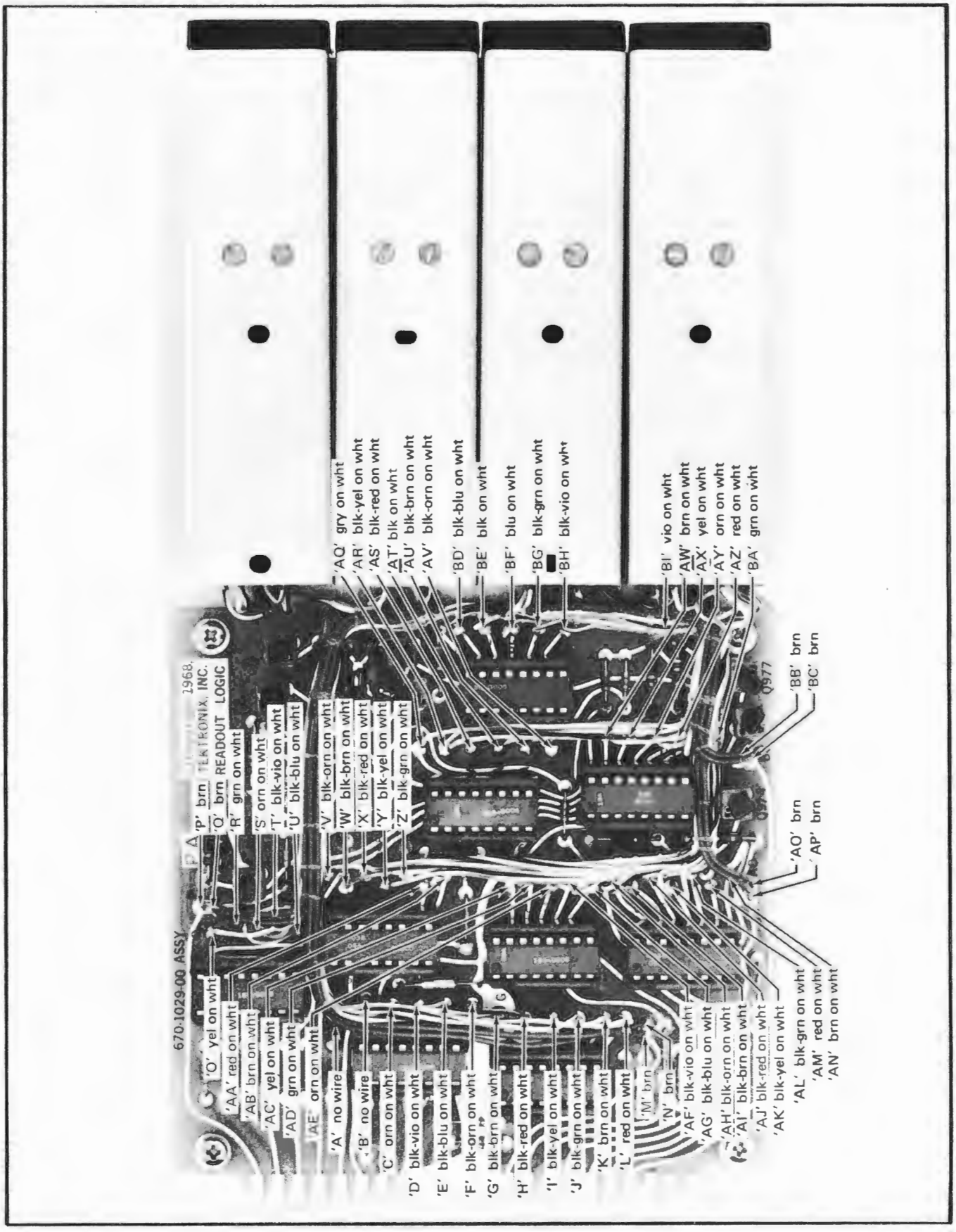


Fig. 4-23. Wiring color codes on Readout Logic circuit board.

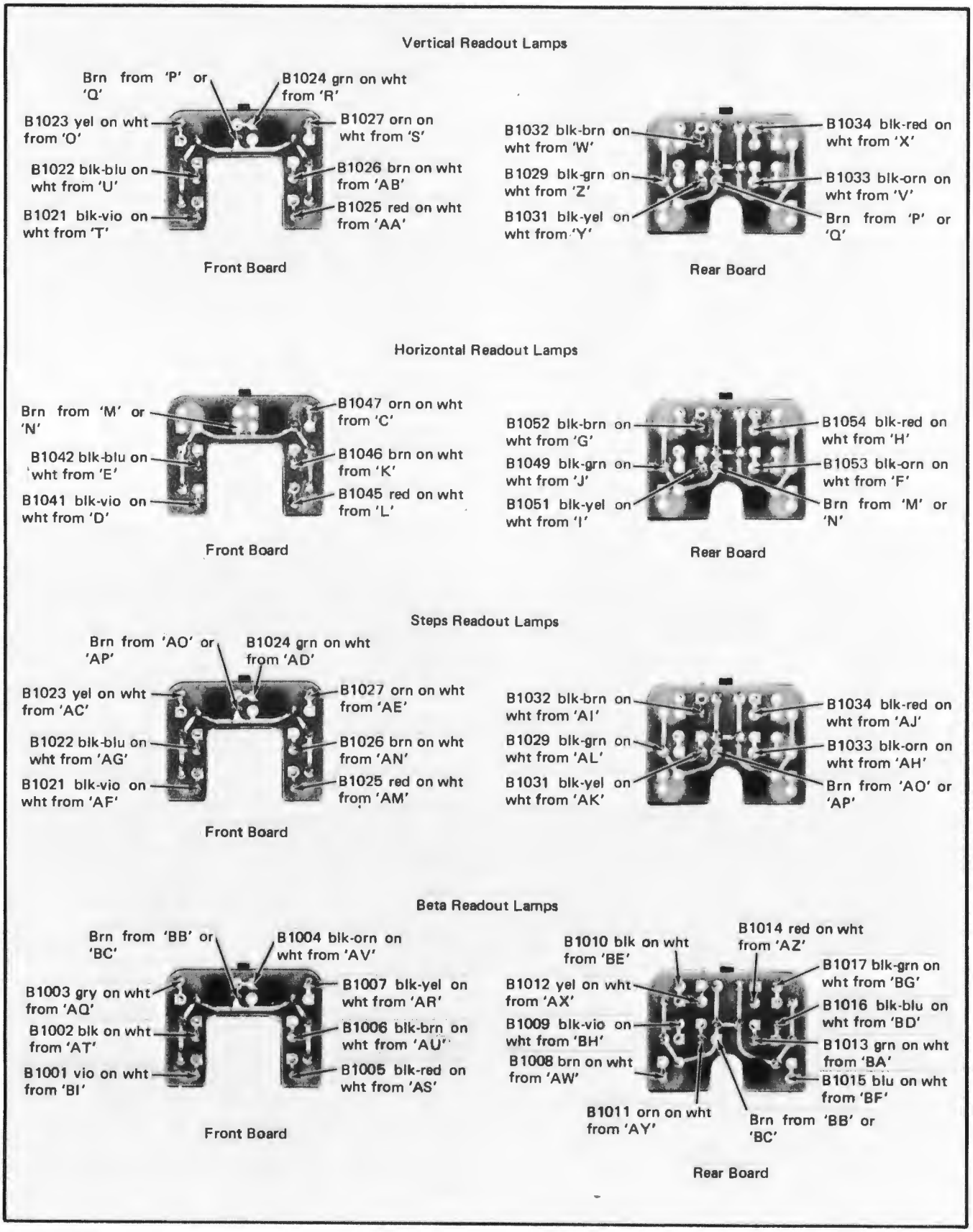


Fig. 4-24. Component locations and wiring color codes on Readout Lamp circuit boards.

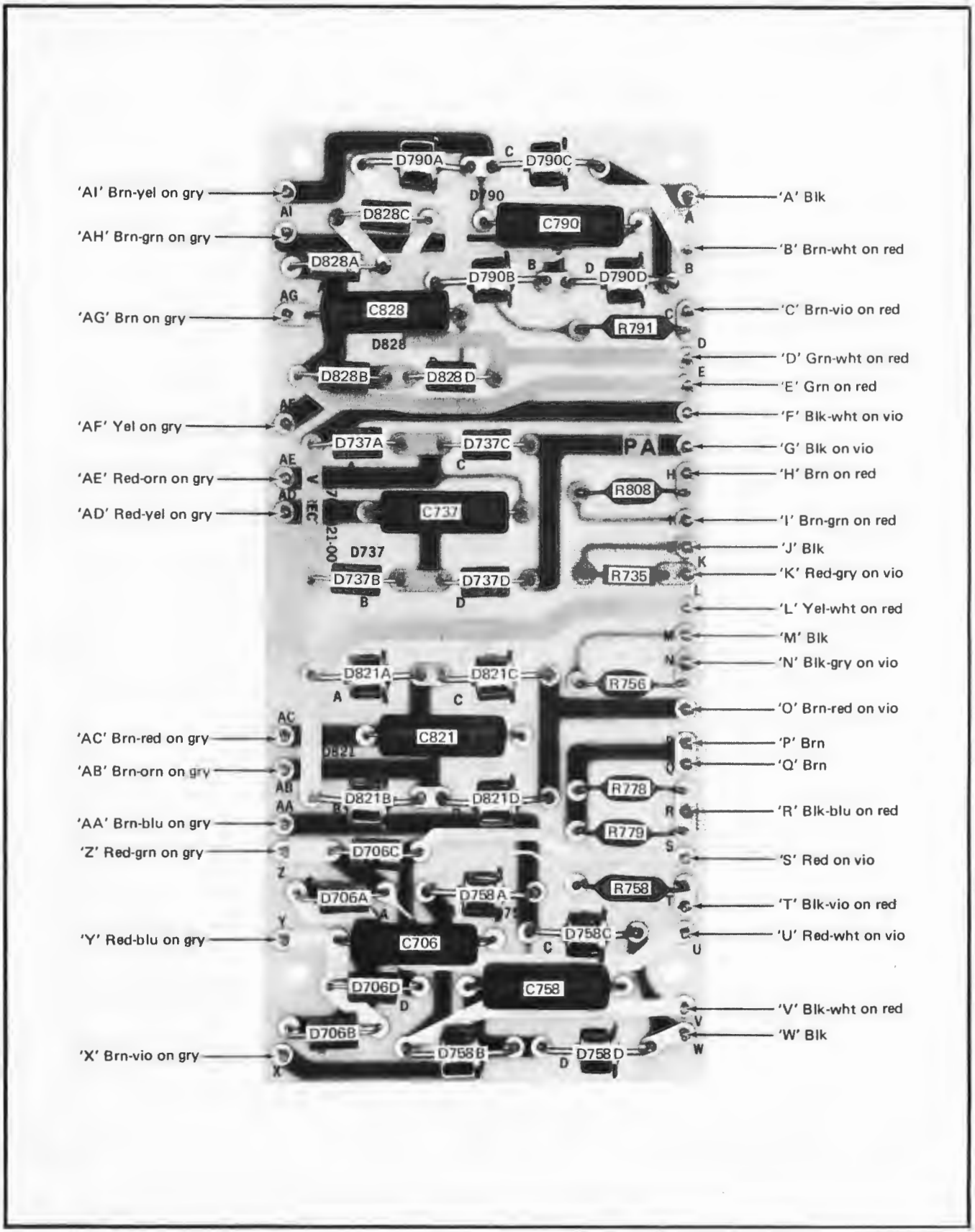


Fig. 4-25. Component locations and wiring color codes on L.V. Rectifiers circuit board.

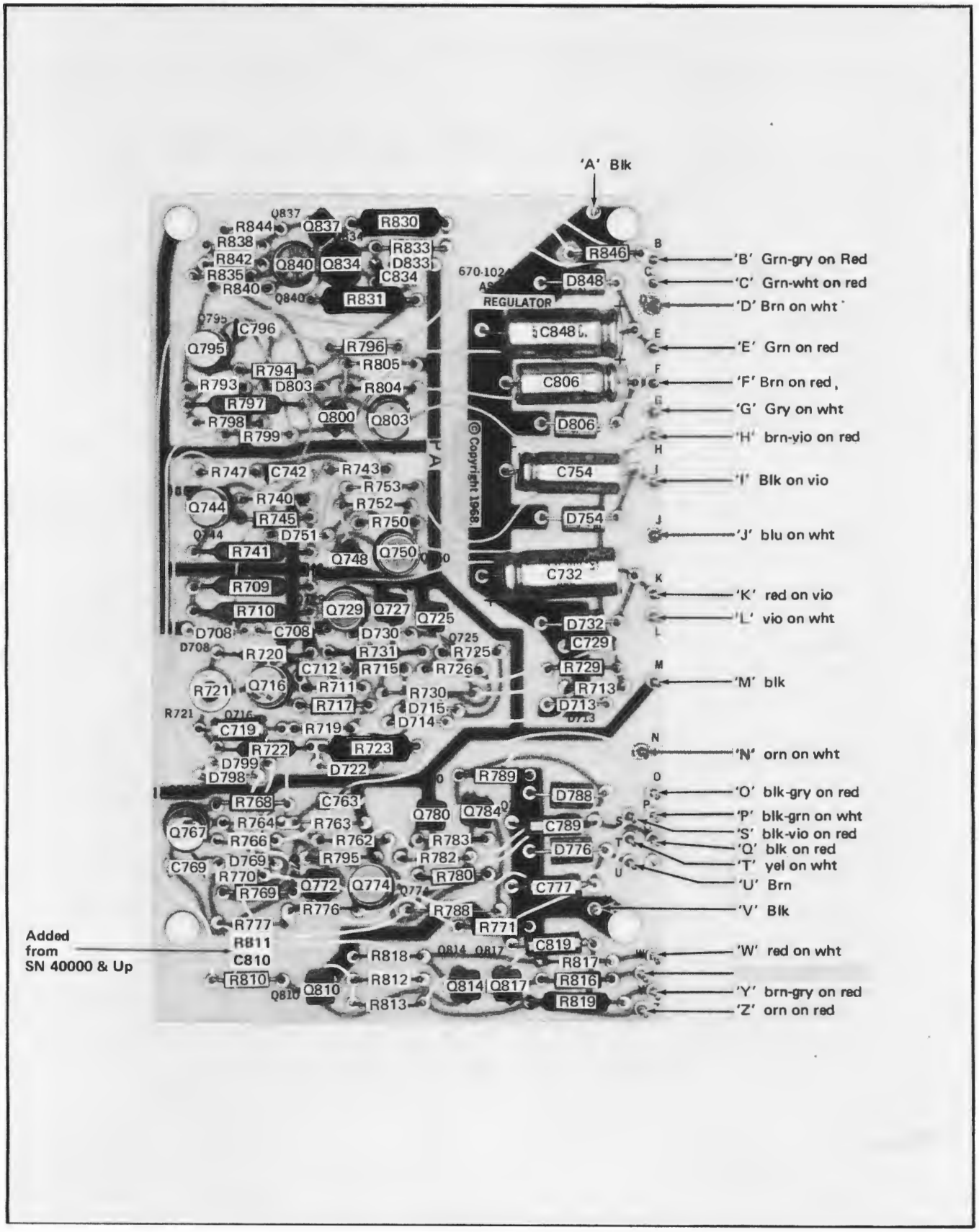


Fig. 4-26. Component locations and wiring color codes on L.V. Regulator circuit board.

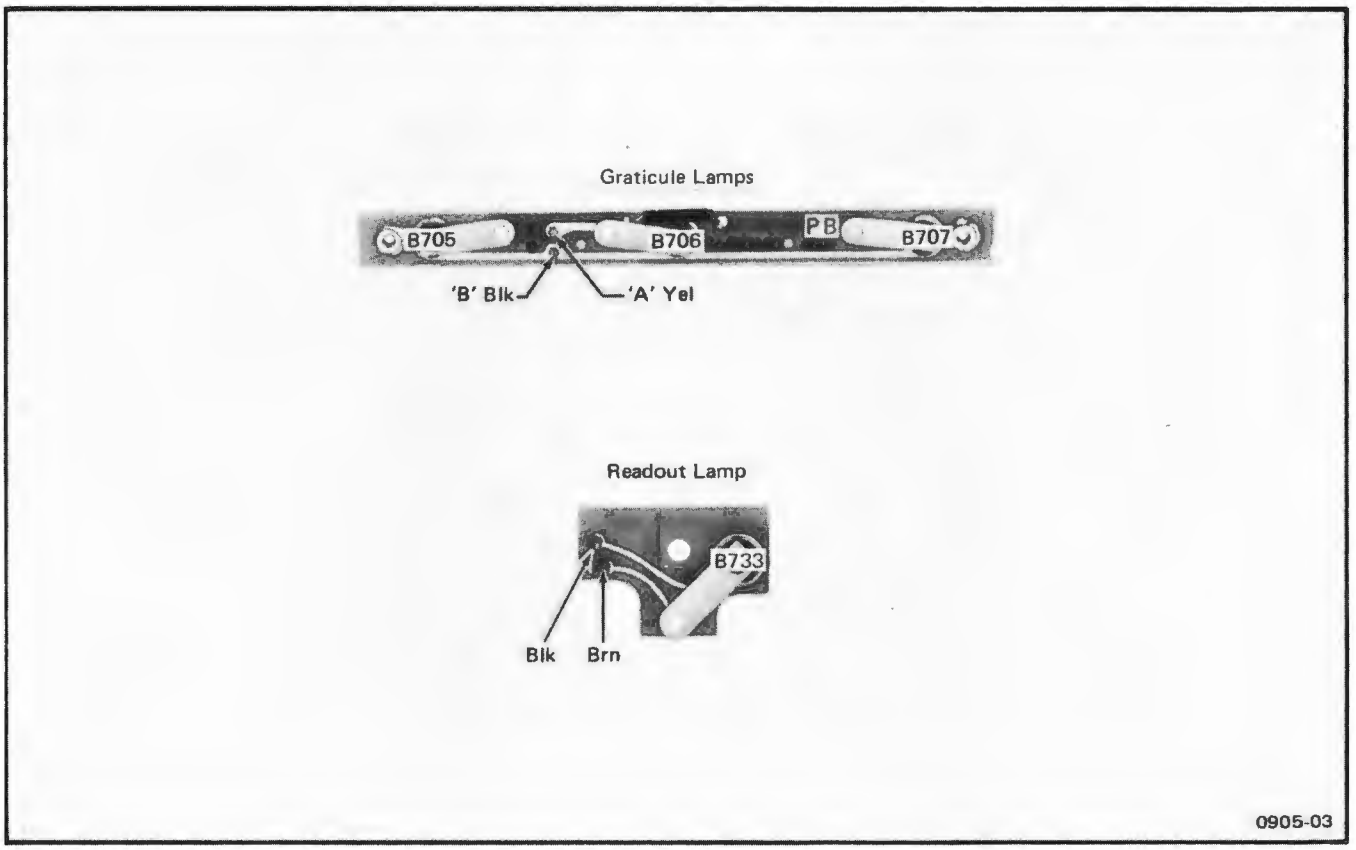


Fig. 4-27. Component locations and wiring color codes on Grat. Lamps and Readout Lamp circuit boards.

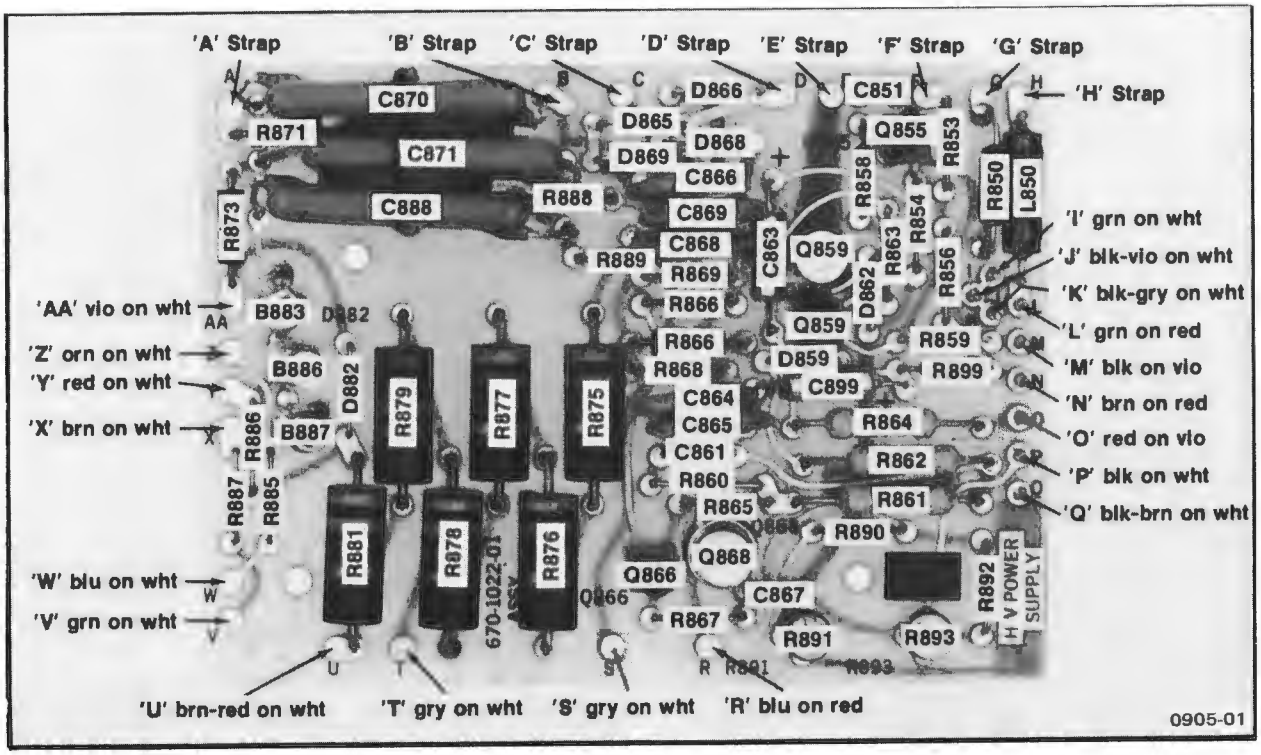


Fig. 4-28A. Component locations and wiring color codes on H.V. Power Supply circuit board; Serial B020000 and up.

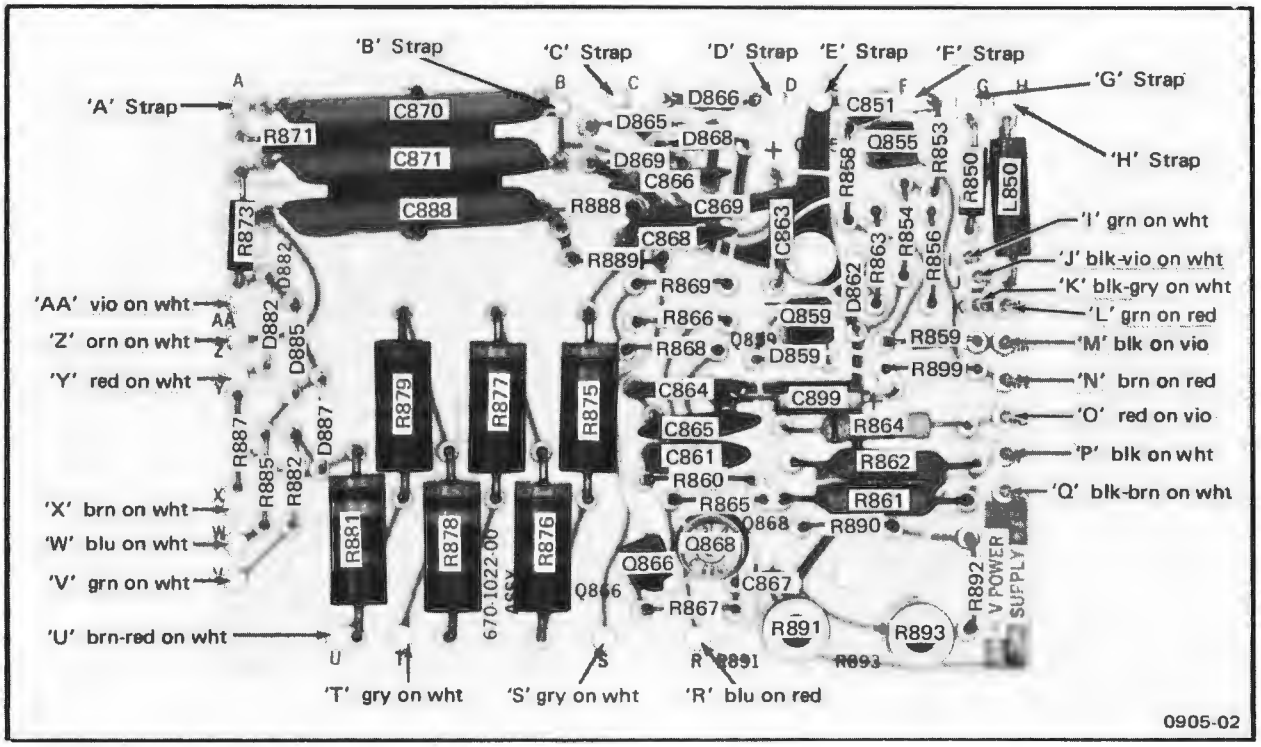


Fig. 4-28B. Component locations and wiring color codes on H.V. Power Supply circuit board; Serial B-19999 and below.

SECTION 5
PERFORMANCE CHECK/CALIBRATION

Change information, if any, affecting this section will be found at the rear of the manual.

GENERAL

Introduction

The Type 576 should be checked and, if necessary, recalibrated after each 1000 hours of operation or at least once every six months, to ensure that it is operating properly. In addition, portions of the instrument may require recalibration if components are replaced or other electrical repairs are made. This procedure provides instructions for adjusting the Type 576 internal adjustments and checking the performance of the Type 576 against the electrical characteristics listed in Section 1.

NOTE

An alternate method of calibrating the Type 576 is available which uses a special Type 576 Calibration Fixture (Tektronix Part No. 067-0599-00). This fixture provides a more efficient method of calibrating the Type 576. The fixture is particularly useful when several Type 576's are to be calibrated. A performance check/calibration procedure using this fixture is included at the end of this section as appendix A.

Maintenance

Any maintenance required on the Type 576 should be completed before starting this procedure. If instrument troubles occur while using this procedure, they should be corrected before proceeding. Repair and servicing information is given in the Maintenance section.

Equipment List

The following equipment list shows the required test equipment ranges and tolerances and suggests particular test instruments. For accurate measurement, the tolerances required for each piece of test equipment must exceed the measured tolerance by at least 4 times. For measured tolerances of less than 1%, the accuracy of the test equipment must exceed that tolerance by at least 10 times.

1. DC Voltmeter—Requirements: range of 0 to ±1000 V, basic accuracy of ±0.5%, accuracy of 0.05% ±1 mV between 0 and ±75 volts, input impedance of at least 500 MΩ. Fluke Model 801B differential voltmeter suggested. A digital voltmeter can be used if its input impedance is accurately known. If the meter chosen has an input impedance of less than 500 MΩ, the voltages measured in steps 19 and 24 will not coincide with those shown in Tables 5-9 and 5-11. Instructions for calculating the proper voltages are given in those steps.

2. DC Voltmeter (High Voltage)—Requirements: Measure −4000 volts, accuracy within 3% (Triplett Model 630 NA suggested).

3. Test Oscilloscope—Requirements: 200 kHz bandwidth sweep rates from 5 ms/cm to 5 μs/cm, vertical deflection factors from 10 mV/div to 2 V/div, accuracy of voltage measurement within 3%, AC and DC coupling, internal triggering, 1X probe included. A Tektronix Type 422, Type 453, or Type 561B/2A63/2B67 is suggested.

4. Variable Autotransformer (e.g., General Radio, Variac Type W10MT3W for 115-volt operation, or Type W20HMT3A for 230-volt operation). Minimum Requirements: Output voltage variable from 90 V to 136 VAC RMS for 115-volt operation or from 180 V to 272 VAC RMS for 230-volt operation; power output of at least 305 watts. If a monitor voltmeter is not included, a separate AC voltmeter is required.

5. DC Ammeter or Shunt Resistors—The DC voltmeter (Item 1) and a group of shunt resistors (see Table 5-1) are used to measure the accuracy of the collector current portion of the VERTICAL switch and the current portion of the AMPLITUDE switch. The more convenient but more expensive method of checking these switches is to use a DC ammeter with the following range and accuracy: range from 50 μA to 10 A, accuracy within 0.5%. If such an ammeter is available the first 7 resistors in Table 5-1 are not needed.

6. 10 Amp Supply—To measure the 1 A and 2 A positions of the VERTICAL switch. Requirements: 10 Amps ±0.5%. A DC ammeter is required to check the accuracy of the supply.

7. Shunt Resistors—The DC voltmeter (Item 1) and a group of shunt resistors ranging from 25 kΩ to 25 MΩ (see Table 5-1) are used to measure the accuracy of the emitter current portion of the VERTICAL switch.

8. Miscellaneous Resistors and Capacitor—Some other resistors and a capacitor not mentioned in items 5 or 7 or this list are also required. See Table 5-1.

9. NPN transistor with BV_{CEO} of 50 volts or more.

10. Twelve inch patch cord with standard banana plugs.

11. Two very short patch cords with banana plug to alligator clip connectors.

12. BNC male to dual binding post adapter. Tektronix Part No. 103-0035-00.

13. Nonconducting screwdriver-type adjustment tool.

14. Small screwdriver.

TABLE 5-1

Resistors[1]

Value	Watts	Accuracy
1 Ω	3	1/4%
10 Ω	3	
100 Ω	1/2	
1 kΩ	1/4	
10 kΩ	1/4	
100 kΩ	1/8	
1 MΩ	1/8	
25 kΩ	1/8	1/4%
250 kΩ		
2.5 MΩ		
25 MΩ		
1 kΩ[2]	1/4	5%
18 kΩ		
10 MΩ	1/4	5%
0.01 μF	1000 V	20%

[1]These resistors are available from Tektronix, Inc. in a kit (Tektronix Part No. 067-0652-00).

[2]Not needed if 1/4% 1 kΩ resistor is used in procedure.

Use of the Procedure

The following procedure is arranged to allow either:

a. Adjustment (complete or partial) of the Type 576 without a performance check.

b. A performance check of the Type 576 with respect to the electrical characteristics given in Section 1.

c. A complete calibration of the Type 576, which includes both internal adjustment and a complete performance check.

To perform any of these operations, use one of the following methods.

Adjustment Only. Start with the Preliminary Calibration Procedure and perform only those steps with titles starting with the word Adjust, throughout the main procedure and the Performance Check/Calibration Record and Index. The text of all adjust steps is printed in a bolder type than the rest of the procedure. (Steps 3 and 4 should also be performed as part of the adjustment procedure.)

Performance Check Only. Start with the Preliminary Performance Check Procedure and perform only those steps with titles starting with the word Check, throughout the main procedure and the Performance Check/Calibration Record and Index. (Steps 3 and 4 should not be performed when doing only a performance check.)

Calibration. Start with the Preliminary Calibration Procedure and perform all the steps throughout the main procedure and the Performance Check/Calibration Record and Index.

Record and Index

Table 5-2 at the beginning of the procedure provides a record and index of the procedure. The table may be used as a checklist to verify adjustments or correct performance, an abridged guide for an experienced calibrator, or an index of individual adjustments or checks. Note that each listing of an adjustment also includes a list of related adjustments or checks.

Control Settings

A complete list of initial control settings for the Type 576 and significant control settings for the test instruments precedes Step 1 of this procedure. In addition, partial lists of control settings are provided in various places throughout the procedures. Any control setting not listed in a partial list should be set as designated in the initial list of control settings for the respective procedure. If adjustments and/or checks are made without following one of the three procedures, start with the list of control settings preceding the desired adjustment or check and follow the sequence up to the desired step, making changes in control settings as indicated.

Making Adjustments

When doing a complete calibration or a complete adjustment of the instrument, each internal control should be adjusted as near the specified setting as possible, even if the observed performance is within tolerance. When doing only a partial adjustment, do not readjust any controls unless the observed performance is outside the given tolerance. In either case, do not preset any adjustments unless they are known to be significantly out of adjustment or repairs have been made in the circuit. In these instances, set the particular controls to midrange.

Preliminary Calibration Procedure

1. Remove the side panels from the Type 576. See Warning in the Maintenance Section of this manual, page 4-11.

2. Set the Line Voltage Selector assembly and the 60 Hz-50 Hz switch on the Type 576 rear panel in accordance with the line voltage source to be used.

3. Connect the autotransformer and other test instruments to a suitable power source. Connect the Type 576 to the autotransformer output.

4. Set the autotransformer for the line voltage and range chosen on the Type 576 Line Voltage Selector assembly.

5. Turn on the autotransformer, Type 576, DC voltmeter and test oscilloscope. Allow at least 5 minutes warmup at an ambient temperature of +25°C ±5°C (+77°F ±9°F) before making any checks or adjustments.

6. Connect the 1X probe to the vertical input of the test oscilloscope.

7. Set the instrument controls as shown in the list of Initial Control Settings prceding step 1 and start the adjustment and calibration procedure with step 1.

Preliminary Performance Check Procedure

1. Set the Line Voltage Selector assembly switches and the 60 Hz-50 Hz switch on the Type 576 rear panel in accordance with the line voltage source to be used.

2. Connect the Type 576 to the line voltage source.

3. Turn on the Type 576. Allow at least 5 minutes warmup at an ambient temperature between 0°C and +50°C (+32°F and +122°F) before making any checks.

4. Set the controls as shown in the list of Initial Control Settings preceding step 1 and start the performance check procedure with step 6.

TABLE 5-2

Performance Check/Calibration Record and Index

Step No.	Title	Adjust	Req'd Previous Steps	Page
1	Adjust −75 Volt Supply	R721		5-4
2	Adjust Calibrator Voltage	R512	1	5-5
3	Check Other Power Supply Voltages		1	5-6
4	Check Power Supply Regulation		1	5-7
5	Adjust CRT Controls	R891, R897, R685, R893	1, 3	5-7
6	Check CRT Controls			5-9
7	Check Readout			5-9
8	Adjust Balance of Horizontal Display Amplifier	R681, R650, R645	1, 3	5-10
9	Adjust Balance of Vertical Display Amplifier	R581, R550, R545	1, 3	5-11
10	Adjust Horizontal and Vertical CRT Gain	R692, R592	1, 3, 8, 9	5-11
11	Adjust Horizontal and Vertical Magnifier Gains	R673, R573	1, 3, 8, 9, 10	5-12
12	Adjust Horizontal Display Amplifier Gains	R636, R638, R641	1, 2, 3, 8, 9, 10, 11	5-12
13	Adjust Vertical Display Amplifier Gains	R536, R538, R541	1, 2, 3, 8, 9, 10, 11	5-12
14	Adjust Horizontal Compensation	C433	1, 3	5-13
15	Check Horizontal and Vertical Positioning and INVERT Button			5-14
16	Check Horizontal and Vertical Displayed Noise			5-15
17	Check Display Offset and CAL Button			5-16
18	Check Horizontal Display Accuracy			5-16

TABLE 5-2 (cont.)

Step No.	Title	Adjust	Req'd Previous Steps	Page
19	Check Vertical Display Accuracy			5-18
20	Adjust Zero Crossing and Step Delay	R8, R24	1, 3	5-20
21	Adjust Zero Step Level	R224, R97, R127	1, 3	5-20
22	Adjust Step Amplifier Gain	R113, R86, R85	1, 3, 8, 9, 10, 11	5-21
23	Adjust Current Balance	R243	1, 3	5-21
24	Check Step Generator and Offset Multiplier Accuracy		15, 17, 18, 19	5-22
25	Check Maximum Current Output		15, 17, 18, 19	5-23
26	Check Short Circuit Current and Reverse Current Limits		15, 17, 18, 19	5-24
27	Check Maximum Voltage Output and Reverse Voltage Limit			5-24
28	Check Miscellaneous Step Generator Buttons			5-25
29	Check Step Generator Ripple			5-26
30	Check Collector Supply Polarity, Peak Voltage, Ripple and Interlock		15, 17, 18, 19	5-26
31	Check Collector Supply Peak Currents		15, 17, 18, 19	5-27
32	Adjust Looping Compensation	C301, C339 C341, LOOPING COMPENSATION	1, 3	5-27
33	Check and Adjust LOOPING COMPENSATION Control	LOOPING COMPENSATION		5-28
34	Check Series Resistors			5-28

Initial Control Settings

FOCUS	Centered
VERTICAL	5 mA COLLECTOR
DISPLAY OFFSET Selector	NORM (OFF)
CENTERLINE VALUE	5
HORIZONTAL	2 V COLLECTOR
Vertical POSITION	Control Centered
Vertical FINE POSITION	Control Centered
Horizontal POSITION	Control Centered
Horizontal FINE POSITION	Control Centered
DISPLAY INVERT	Not Pressed
ZERO	Not Pressed
CAL	Not Pressed
MAX PEAK VOLTS	15
PEAK POWER WATTS	0.1
VARIABLE COLLECTOR SUPPLY	Fully Counterclockwise
POLARITY	AC
MODE	NORM
LOOPING COMPENSATION	As is
NUMBER OF STEPS	10
CURRENT LIMIT	2 A
AMPLITUDE	2 V
OFFSET	ZERO
OFFSET MULT	0.00 (fully counterclockwise
STEPS	Pressed
PULSED STEPS	Released
STEP FAMILY	SINGLE
RATE	NORM
POLARITY INVERT	Released
STEP MULT .1X	Released
LEFT-OFF-RIGHT	OFF
Terminal Selector	BASE TERM STEP GEN

Test Oscilloscope

Time/Cm	5 ms
Triggering	Trig, +, AC, Line
Volts/Cm	.01
Input Coupling	AC (Both Channels)
Position	Display Centered

POWER SUPPLY

1. Adjust −75 Volt Supply

a. Set the Type 576 controls as shown in the list of Initial Control Settings preceding this step.

b. Position the instrument so that the L.V. REGULATOR circuit board (operator's right side) is visible.

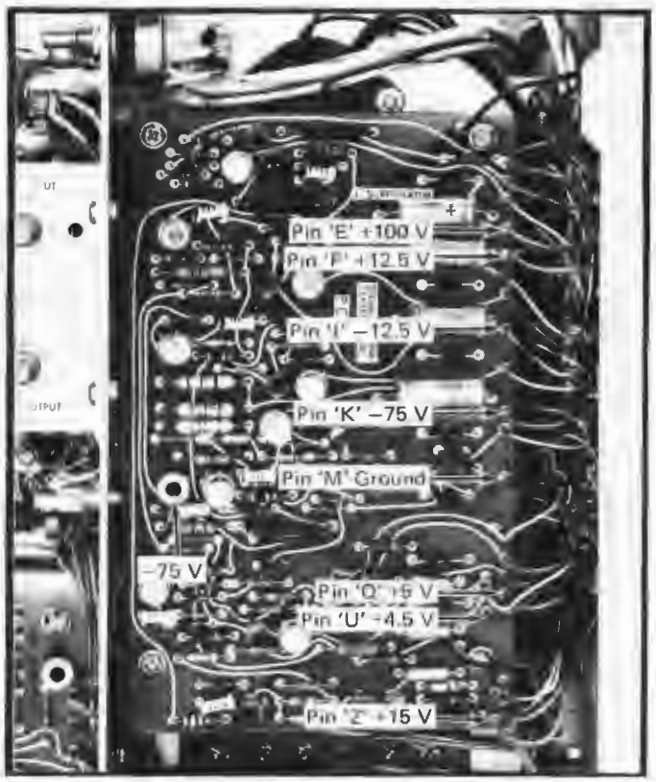


Fig. 5-1. L.V. REGULATOR circuit board: Location of test points and adjustments in steps 1 and 3.

c. Connect the negative lead of the DC voltmeter to ground, pin M on the L.V. REGULATOR board, (see Fig. 5-1). Connect the positive lead to the −75 volt supply, pin K. Be sure the polarity of the DC voltmeter is set for measuring a negative voltage.

d. Check for DC voltmeter reading of −75 volts ±0.375 volts (−75 V ±0.5%).

e. ADJUST—R721, −75-V adjustment, (see Fig. 5-1) if the voltage is not correct.

NOTE

The voltage level of the −75-volt supply affects the calibration of the entire instrument. Do not adjust R721 unless the voltage measured in part d is out of tolerance or unless a complete calibration is being performed.

2. Adjust Calibrator Voltage

a. Connect the positive lead of the DC voltmeter to TP510 on the DISPLAY AMPLIFIER circuit board (see Fig. 5-2).

b. Check for DC voltmeter reading of −2 volts ±0.01 volt (−2 V ±0.5%).

c. ADJUST—R512, CAL adjustment (see Fig. 5-2), if the voltage is not correct.

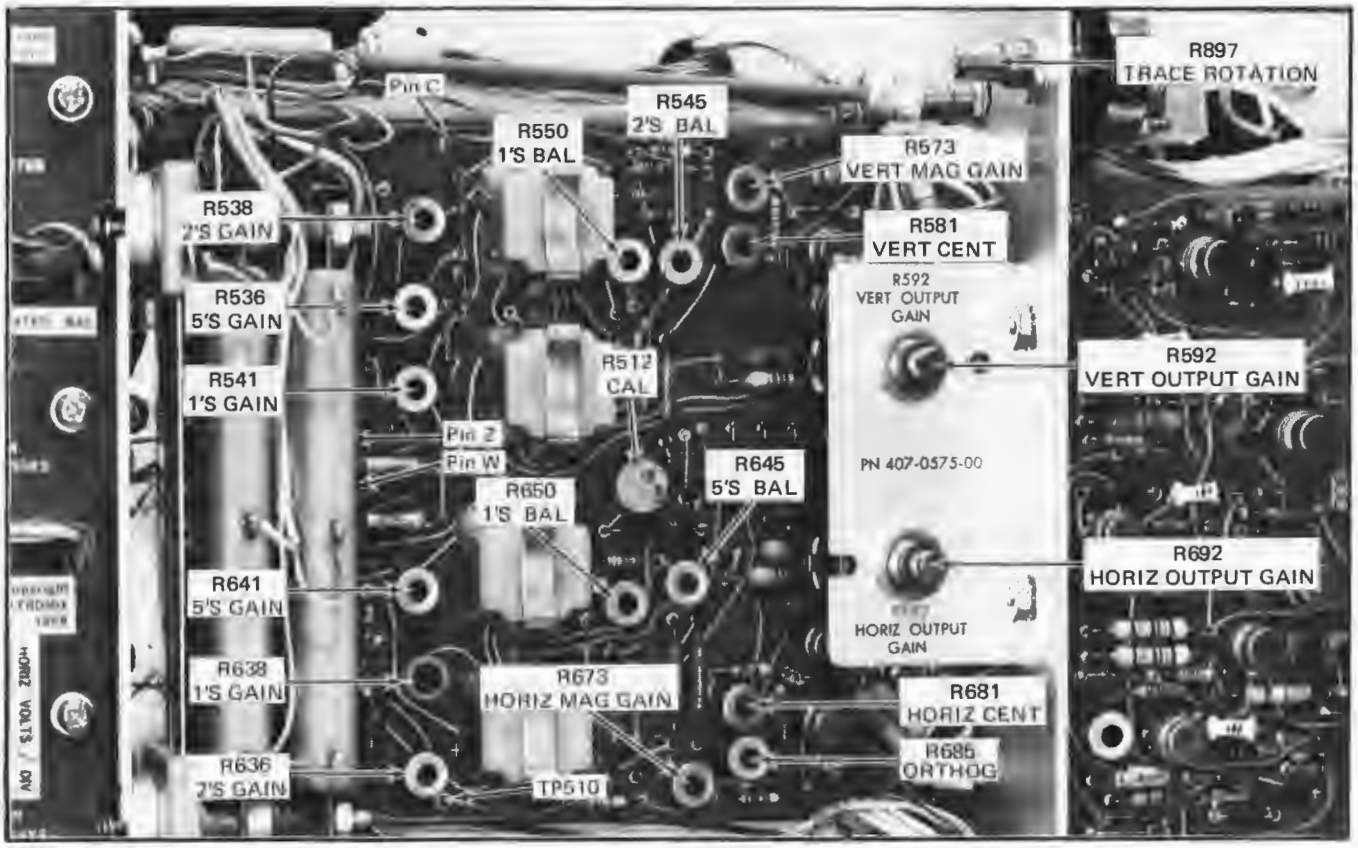


Fig. 5-2. DISPLAY AMP circuit board: Location of voltage checks and adjustments in steps 2, 3 and 8 through 14.

TABLE 5-3

Check Power Supply Voltage and Regulation

Voltage	Accuracy	Total Output Noise and Line Frequency Ripple, Peak To Peak	Location of Test Point on L.V. Regulator Circuit Board
−75		5 mV	Pin K
−12.5	±0.31 volt	5 mV	Pin I
Variable +4.0	−0.1 volts, +0.2 volt (with READOUT ILLUM control fully clockwise)	20 mV	Pin U
+5	±0.25 volt	10 mV	Pin Q
+12.5	±0.31 volt	5 mV	Pin F
+15	±0.75 volt	20 mV	Pin Z
+100	±2.5 volts	20 mV of 28 kHz high voltage oscillator ripple and line frequency ripple	Pin E
+225	±9 volts	80 mV of 28 kHz high voltage oscillator ripple and line frequency ripple	Left arm of R592 VERT OUTPUT GAIN (see Fig. 5-3)

3. Check Other Power Supply Voltages

a. Move the positive lead of the DC voltmeter to the power supply test points (other than −75 volts) listed in Table 5-3. See Fig. 5-1 for pin locations. (Change polarity of voltmeter for positive voltages.)

b. CHECK FOR—Meter reading of the power supply voltage within the tolerance given in the accuracy column of Table 5-3.

c. Disconnect the DC voltmeter leads from the Type 576.

d. Connect the negative lead of the High Voltage DC Voltmeter to ground (pin M of the L.V. REGULATOR circuit board). Be sure the polarity of the meter is set for measuring a negative voltage.

e. Set the meter for measuring −4 kV.

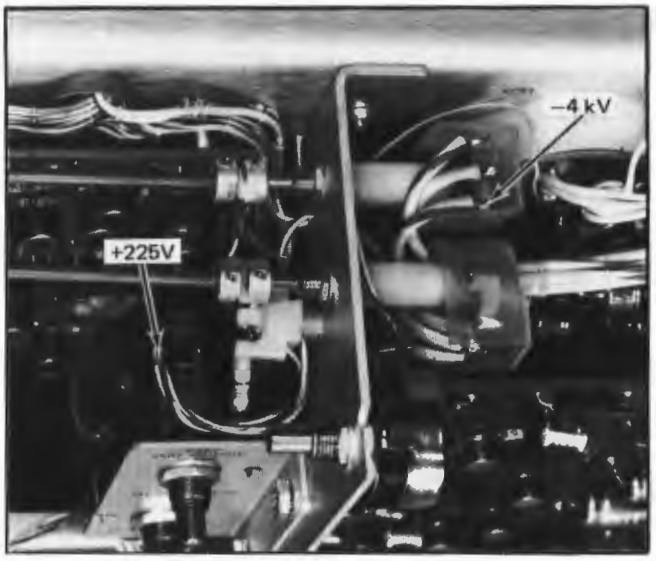


Fig. 5-3. Location of high voltage test points on right side of instrument.

f. Connect the positive lead of the meter to the arm of the INTENSITY control, R883 (see Fig. 5-3), connected to the white and purple wire.

g. CHECK FOR—High Voltage DC voltmeter reading of −4000 volts ±160 V ±error of meter (4 kV ±4% ±% error of meter).

h. Disconnect the High Voltage DC Voltmeter leads from the Type 576.

i. Connect the negative lead of the DC voltmeter to pin W and the positive lead to pin Z of the DISPLAY AMP circuit board (see Fig. 5-2). (Set the DC voltmeter for measuring a negative voltage.)

j. Turn the HORIZONTAL switch through the three positions given in Table 5-4.

k. CHECK FOR—Voltages given in Table 5-4 for each setting of the HORIZONTAL switch ±0.5%.

l. Connect the positive lead of the DC voltmeter to pin C of the DISPLAY AMP circuit board.

m. Turn the VERTICAL switch through the three positions given in Table 5-4.

TABLE 5-4

CAL Button Voltage Checks

HORIZONTAL Switch (COLLECTOR)	Voltage at Pin Z	Accuracy	VERTICAL Switch (COLLECTOR)	Voltage at Pin C	Accuracy
2 V	2 V	±0.01 V	5 mA	1.25 V	±0.00625 V
1 V	1 V	±0.005 V	2 mA	0.5 V	±0.0025 V
.5 V	.5 V	±0.0025 V	1 mA	0.25 V	±0.00125 V

n. CHECK FOR–Voltages given in Table 5-4 for each setting of the VERTICAL switch ±0.5%.

o. Disconnect the DC voltmeter from the Type 576.

p. Set the HORIZONTAL switch to 1 V COLLECTOR.

4. Check Power Supply Regulation

a. Trigger the test oscilloscope on the internal line signal.

b. Connect the 1X test probe ground clip to pin M on the L.V. REGULATOR circuit board.

c. Set the autotransformer for the highest voltage within the voltage range selected by the Line Voltage Selector assembly on the rear panel.

d. Connect the 1X test probe tip to the test points of each of the power supplies given in Table 5-3.

e. CHECK FOR–Test oscilloscope display of power supply ripple with the line frequency ripple peak-to-peak amplitude not exceeding the maximum value given in Table 5-3. On the +100-volt and the +225-volt supplies, set the test oscilloscope time/cm to 50 µs and check the 20 kHz ripple.

f. Set the autotransformer for the lowest voltage within the voltage range selected by the Line Voltage Selector assembly on the rear panel.

g. Repeat parts d and e.

h. Disconnect the probe from the Type 576 and the test oscilloscope vertical input.

i. Disconnect the Type 576 from the autotransformer and connect it directly to the power source, or set the autotransformer output voltage to the center of the regulated range selected by the Line Voltage selector assembly.

CRT AND READOUT

5. Adjust CRT Controls

a. Turn the Type 576 FOCUS control fully counterclockwise and adjust INTENSITY control for a large spot on the CRT.

b. Check for spot having a circular shape.

c. ADJUST–R891, ASTIGMATISM adjustment on the operator's left side of the instrument (see Fig. 5-4), if the spot is not circular.

d. Turn the Type 576 FOCUS control clockwise until the spot is the smallest possible.

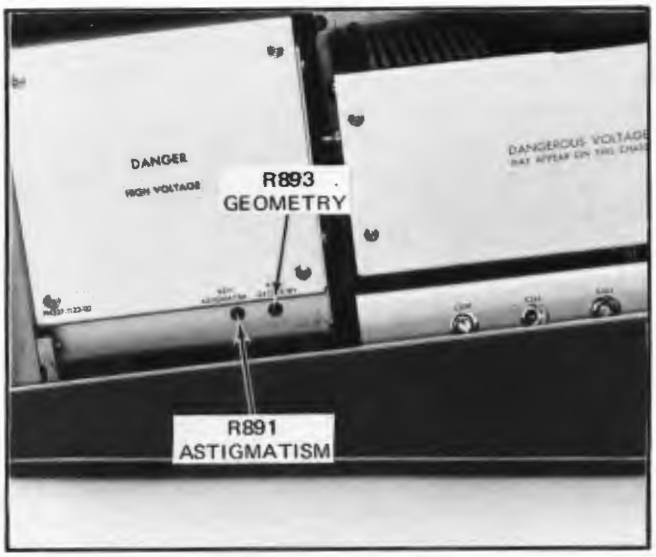


Fig. 5-4. Location of adjustments in step 5.

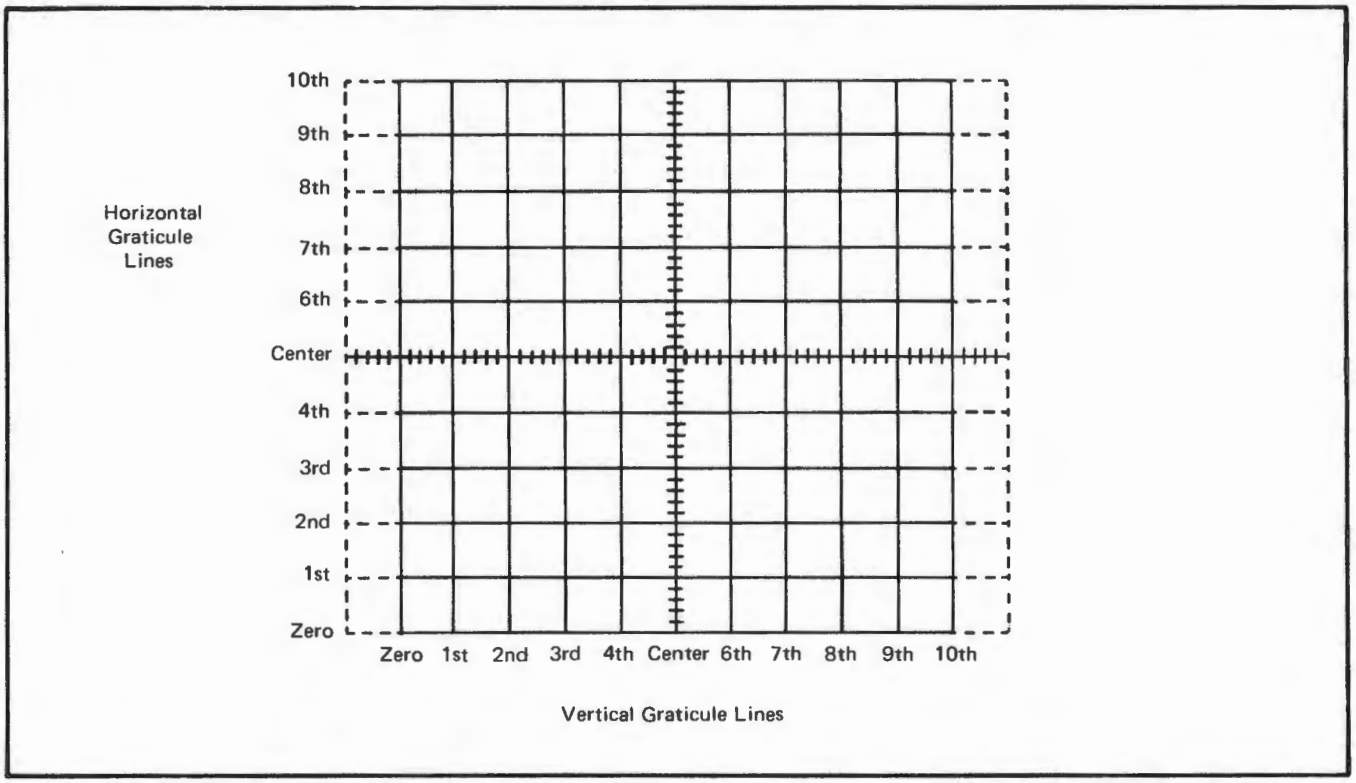


Fig. 5-5. Graticule line labels.

CAUTION

At various times throughout this procedure, a single spot will be displayed on the CRT. When displaying a single spot, reduce the intensity as much as possible, while still maintaining easy visibility, to avoid burning of the CRT phospor.

e. Position the spot to the center of the CRT graticule using the Type 576 FINE POSITION controls.

f. Set the Type 576 VARIABLE COLLECTOR SUPPLY control for a trace 10 divisions long.

g. Check for the trace parallel with the horizontal centerline (see Fig. 5-5).

h. ADJUST—R897, TRACE ROTATION adjustment on a chassis bracket on the operator's right of the instrument (see Fig. 5-2) if the trace is not parallel.

i. Connect a patch cord between the collector jack C and the emitter jack E (right hand set of jacks) on the Standard Test Fixture. Set the LEFT-OFF-RIGHT switch to RIGHT.

j. Check for trace parallel with the vertical centerline (see Fig. 5-5).

k. ADJUST—R685, ORTHOGONALITY adjustment, on the DISPLAY AMP circuit board (see Fig. 5-2) if the trace is not parallel.

l. Using the Type 576 horizontal POSITION switch, position the trace on the zero vertical graticule line of the CRT (see Fig. 5-5).

m. Check the geometry of the trace for minimum bowing.

n. Position the trace to the tenth vertical graticule line (see Fig. 5-5).

o. Repeat part m.

p. Set the horizontal POSITION switch to its center position.

q. Remove the patch cord from the collector and emitter jacks of the Standard Test Fixture.

r. Using the Type 576 vertical POSITION switch, position the trace to the zero horizontal graticule line (see Fig. 5-5).

s. Repeat part m.

t. Position the trace to the tenth horizontal graticule line.

u. Repeat part m.

v. ADJUST—R893, GEOMETRY adjustment on the operator's left side of the instrument (see Fig. 5-4), for minimum bowing of trace.

w. Position the trace to the center horizontal graticule line.

x. Turn the Type 576 FOCUS control and the VARIABLE COLLECTOR SUPPLY control fully counterclockwise and recheck adjustment of astigmatism and focus as in parts b through d.

y. (If doing Adjust steps only, go to step 8.)

6. Check CRT Controls

a. Set the Type 576 controls as shown in the list of initial control settings at the beginning of this procedure. (If continuing from step 5, no changes in control settings are required.)

b. Turn the Type 576 GRATICULE ILLUM control throughout its range.

c. CHECK FOR—Continuous increase in graticule illumination when the control is turned from fully counterclockwise to fully clockwise.

d. Set the GRATICULE ILLUM control for visible graticule lines and the VARIABLE COLLECTOR SUPPLY control for a 10 cm trace.

e. Turn the Type 576 INTENSITY control throughout its range. Maintain overly-bright trace only momentarily.

f. CHECK FOR—Continuous increase in the brightness of the trace when the control is turned from fully counterclockwise to fully clockwise.

g. Set the INTENSITY control for a barely visible trace and turn the VARIABLE COLLECTOR SUPPLY control fully counterclockwise.

h. Set the INTENSITY control for a visible spot.

CAUTION

At various times throughout this procedure, a single spot will be displayed on the CRT. When displaying a single spot, reduce the intensity as much as possible, while still maintaining visibility, to avoid burning of the CRT phosphor.

i. Turn the Type 576 FOCUS control throughout its range.

j. CHECK FOR—Spot in focus in the center range of the control.

k. Set the FOCUS control for the smallest possible spot.

7. Check Readout

a. Turn the Type 576 READOUT ILLUM control throughout its range.

b. CHECK FOR—Continuous increase in the readout illumination when the control is turned from fully counterclockwise to fully clockwise.

c. Set the READOUT ILLUM control for a visible readout.

d. Turn the Type 576 VERTICAL switch throughout its range.

e. CHECK FOR—PER VERT DIV readout coinciding with the settings of the VERTICAL switch, using COLLECTOR current units. (The readout should always be blank for the STEP GEN position of the switch.)

f. Set the Type 576 DISPLAY OFFSET Selector switch to VERT X10 and turn the VERTICAL switch throughout its range.

g. CHECK FOR—PER VERT DIV readout of 10 times less than the settings of the VERTICAL switch, using COLLECTOR current units.

h. Set the Type 576 MODE switch to LEAKAGE and the DISPLAY OFFSET Selector switch to NORM (OFF).

i. Turn the VERTICAL switch throughout its range.

j. CHECK FOR—PER VERT DIV readout coinciding with settings of the VERTICAL switch, using EMITTER current units.

k. Set the DISPLAY OFFSET Selector switch to VERT X10 and turn the VERTICAL switch throughout its range.

l. CHECK FOR—PER VERT DIV readout of 10 times less than the settings of the VERTICAL switch using EMITTER current units. (Readout should be blank for 1 nA, 2 nA and 5 nA settings of VERTICAL switch.)

m. Set the DISPLAY OFFSET Selector switch to NORM (OFF) and turn the HORIZONTAL switch throughout its range.

n. CHECK FOR—PER HORIZ DIV readout coinciding with the settings of the HORIZONTAL switch. (The readout should always be blank for the STEP GEN position of the switch.)

o. Set the DISPLAY OFFSET Selector switch to HORIZ X10 and turn the HORIZONTAL switch throughout its range.

p. CHECK FOR—PER HORIZ DIV readout of 10 times less than the settings of the HORIZONTAL switch.

q. Turn the Type 576 AMPLITUDE switch throughout its range.

r. CHECK FOR—PER STEP readout coinciding with the settings of the AMPLITUDE switch.

s. Press the Type 576 STEP MULT .1X button and turn the AMPLITUDE switch throughout its range.

t. CHECK FOR—PER STEP readout 10 times less than the settings of the AMPLITUDE switch.

u. Set the MODE switch to NORM and release the STEP MULT .1X button.

NOTE

It is a complex and lengthy process to check all the possible positions of the VERTICAL and AMPLITUDE switches which will provide a β OR g_m PER DIV readout. The following procedure checks only that all the β OR g_m PER DIV fiber-optics will light up.

v. Set the VERTICAL and AMPLITUDE switches for displayed readout as shown in Table 5-5.

w. CHECK FOR—β OR g_m PER DIV readout coinciding with the third column of Table 5-5.

x. (If doing check steps only, go to step 15.)

TABLE 5-5

Check β OR g_m PER DIV Readout

PER VERT DIV	PER STEP	β OR g_m PER DIV
200 µA	2 V	100 µ
200 µA	100 mV	2 m
200 µA	50 nA	4 k
500 µA	100 nA	5 k
500 µA	200 nA	2.5 k
500 µA	1 µA	500

Control Settings (Partial List)

Type 576

VERTICAL	.5 A
DISPLAY OFFSET Selector	HORIZ X10

DISPLAY AMPLIFIERS

8. Adjust Balance of Horizontal Display Amplifier

a. Set the Type 576 controls as shown in the initial list of control settings except as noted above.

b. Position the spot to the center of the CRT graticule using the FINE POSITION controls.

c. Set the DISPLAY OFFSET Selector switch to HORIZ X1.

d. Check for the spot on the vertical centerline of the CRT graticule.

e. ADJUST–R681, HORIZ CENT adjustment, on the DISPLAY AMP circuit board (see Fig. 5-2) if the spot is not centered.

f. Repeat parts b through e until no movement of the spot occurs between the two settings of the DISPLAY OFFSET Selector switch.

g. Set the following Type 576 controls to:

DISPLAY OFFSET Selector	HORIZ X10
HORIZONTAL	1 V COLLECTOR

h. Check for the spot horizontally centered on the CRT graticule.

i. ADJUST–R650, 1'S BAL adjustment, on the DISPLAY AMP circuit board (see Fig. 5-2) if the spot is not centered.

j. Set the HORIZONTAL switch to .5 V COLLECTOR.

k. Check for the spot horizontally centered on the CRT graticule.

l. ADJUST–R645, 5'S BAL adjustment, on the DISPLAY AMP circuit board (see Fig. 5-2) if the spot is not centered.

m. Set the HORIZONTAL switch to 2 V COLLECTOR and recheck the adjustments made in parts b through l.

9. Adjust Balance of Vertical Display Amplifier ❶

a. Set the DISPLAY OFFSET Selector switch to VERT X10 and position the spot to the center of the graticule using the FINE POSITION controls.

b. Set the DISPLAY OFFSET Selector switch to VERT X1.

c. Check for the spot on the horizontal centerline of the CRT graticule.

d. ADJUST–R581, VERT CENT adjustment, on the DISPLAY AMP circuit board (see Fig. 5-2) if the spot is not centered.

e. Repeat parts a through d until no movement of the spot occurs between the two settings of the DISPLAY OFFSET Selector switch.

f. Set the following Type 576 controls to:

DISPLAY OFFSET Selector	VERT X10
VERTICAL	1 A

g. Check for the spot vertically centered on the CRT graticule.

h. ADJUST–R550, 1'S BAL adjustment, on the DISPLAY AMP circuit board (see Fig. 5-2) if the spot is not centered.

i. Set the VERTICAL switch to 2 A.

j. Check for the spot vertically centered on the CRT graticule.

k. ADJUST–R545, 2'S BAL adjustment, on the DISPLAY AMP circuit board (see Fig. 5-2) if the spot is not centered.

l. Set the VERTICAL switch to .5 A and recheck the adjustments made in parts a through k.

10. Adjust Horizontal and Vertical CRT Gain ❶

a. Set the DISPLAY OFFSET Selector switch to NORM (OFF) and the POLARITY switch to +(NPN).

b. Position the spot to the zero horizontal and vertical CRT graticule lines (see Fig. 5-5) using the FINE POSITION controls.

c. Set the POLARITY switch to –(PNP).

d. Check for the spot on tenth horizontal and vertical CRT graticule lines ±0.1 division both horizontally and vertically.

e. ADJUST–R692, HORIZ OUTPUT GAIN adjustment, and R592, VERT OUTPUT GAIN adjustment, on a chassis bracket on the operator's right of the instrument (see Fig. 5-2) to remove one half the error noted in part d.

f. Set the POLARITY switch to +(NPN) and repeat steps b through e until 10 divisions of horizontal and vertical deflection are obtained between the +(NPN) and −(PNP) positions of the POLARITY switch.

g. Set the POLARITY switch to AC.

11. Adjust Horizontal and Vertical Magnifier Gains

a. Set DISPLAY OFFSET Selector switch to HORIZ X10 and position the spot on the center vertical graticule line with the horizontal FINE POSITION control.

b. Switch the CENTERLINE VALUE switch between the 4.5 and the 5.5 positions.

c. Check for the spot deflected 10 divisions horizontally, when the CENTERLINE VALUE switch is switched for 4.5 to 5.5.

d. ADJUST—R673, HORIZ MAG GAIN adjustment, on the DISPLAY AMP circuit board (see Fig. 5-2) if the spot deflection is not correct.

e. Set the DISPLAY OFFSET Selector switch to VERT X10 and the CENTERLINE VALUE switch to 5.

f. Position the spot on the center horizontal graticule line with the vertical FINE POSITION control.

g. Switch the CENTERLINE VALUE switch between the 4.5 and 5.5 positions.

h. Check for the spot deflected 10 divisions vertically when the CENTERLINE VALUE switch is switched from 4.5 to 5.5.

i. ADJUST—R573, VERT MAG GAIN adjustment, on the DISPLAY AMP circuit board (see Fig. 5-2) if the spot deflection is not correct.

12. Adjust Horizontal Display Amplifier Gain

a. Set the following Type 576 controls to:

HORIZONTAL	2 V COLLECTOR
DISPLAY OFFSET Selector	HORIZ X10
CENTERLINE VALUE	10
POLARITY	+(NPN)

b. Press the ZERO button and position the spot vertically to the zero horizontal graticule line and horizontally to the center vertical graticule line using the FINE POSITION controls. Release the ZERO button.

c. Press the Type 576 CAL button.

NOTE

Be sure that R512 has been properly adjusted in step 2 and the CAL button accuracy has been checked in step 3, before making the adjustments in this step and step 13.

d. Check for the spot centered horizontally on the CRT graticule.

e. ADJUST—R636, 2'S GAIN adjustment, on the DISPLAY AMP circuit board (see Fig. 5-2) if the spot is not centered.

f. Release the CAL button and set the Type 576 HORIZONTAL switch to 1 V COLLECTOR.

g. Repeat parts b, c and d.

h. ADJUST—R638, 1'S GAIN adjustment, on the DISPLAY AMP circuit board (see Fig. 5-2) if the spot is not centered.

i. Release the CAL button and set the Type 576 HORIZONTAL switch to .5 V COLLECTOR.

j. Repeat parts b, c and d.

k. ADJUST—R641, 5'S GAIN adjustment, on the DISPLAY AMP circuit board (see Fig. 5-2) if the spot is not centered.

l. Release the CAL button.

13. Adjust Vertical Display Amplifier Gain

a. Set the following Type 576 controls to:

VERTICAL	.5 A
DISPLAY OFFSET Selector	VERT X10

b. Press the ZERO button and position the spot vertically onto the center horizontal graticule line and hori-

zontally onto the zero vertical graticule line using the FINE POSITION controls. Release the ZERO button.

c. Press the CAL button.

d. Check for the spot vertically centered on the CRT graticule.

e. ADJUST—R536, 5'S GAIN adjustment, on the DISPLAY AMP circuit board (see Fig. 5-2) if the spot is not centered.

f. Release the CAL button and set the Type 576 VERTICAL switch to .2 A.

g. Repeat parts b, c and d.

h. ADJUST—R538, 2'S GAIN adjustment, on the DISPLAY AMP circuit board (see Fig. 5-2) if the spot is not centered.

i. Release the CAL button and set the Type 576 VERTICAL switch to .1 A.

j. Repeat parts b, c and d.

k. ADJUST—R541, 1'S GAIN adjustment, on the DISPLAY AMP circuit board (see Fig. 5-2) if the spot is not centered.

l. Release the CAL button.

14. Adjust Horizontal Compensation ◑

NOTE

This is a factory adjustment and does not require adjustment when doing a normal maintenance calibration.

a. Install the transistor adapter (Tektronix Part No. 013-0098-00) on the Standard Test Fixture.

b. Install a NPN transistor, with a BV_{CEO} of at least 50 volts, in one of the transistor sockets on the right side of the adapter. Install the high voltage protective box on the Standard Test Fixture.

c. Set the following Type 576 controls as listed:

VERTICAL	1 mA
DISPLAY OFFSET Selector	HORIZ X10
CENTERLINE VALUE	.5
HORIZONTAL	50 V COLLECTOR
MAX PEAK VOLTS	75
MAX PEAK POWER WATTS	0.5
AMPLITUDE	.05 µA
PULSED STEPS	300 µs
STEP FAMILY	REP
LEFT-OFF-RIGHT	RIGHT

d. Turn the VARIABLE COLLECTOR SUPPLY control and the AMPLITUDE switch clockwise until a display similar to Fig. 5-6A or B is obtained. Note that the horizontal deflection factor for this setup is 5 V/division.

e. Remove the bottom screw from the high voltage protection shield on the HORIZ VOLTS/DIV circuit board. Carefully swing the shield to the right, exposing C433.

WARNING

High voltage may appear on this capacitor. Use a nonconducting tool to make this adjustment.

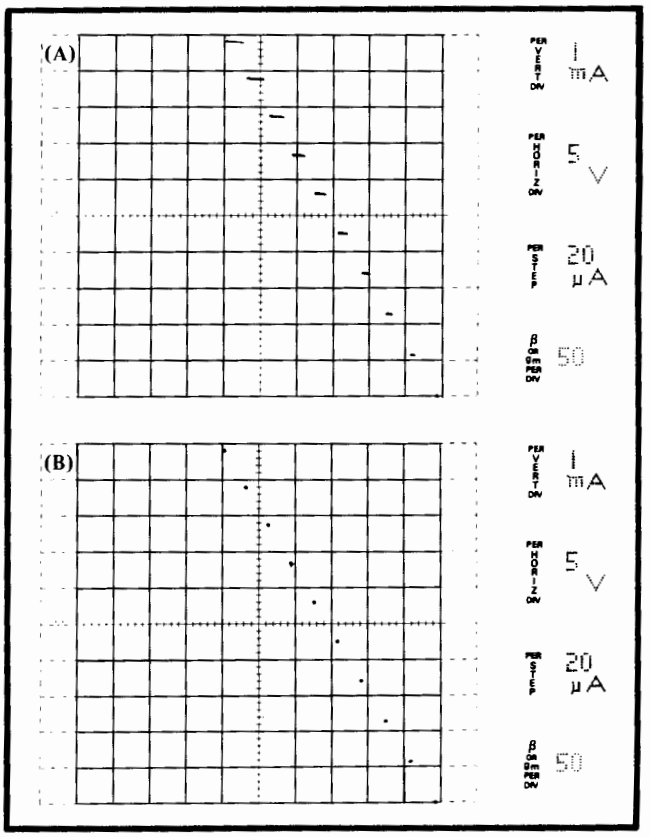


Fig. 5-6. Display for adjusting HORIZ COMP adjustment: (A) Incorrect display; (B) Correct display.

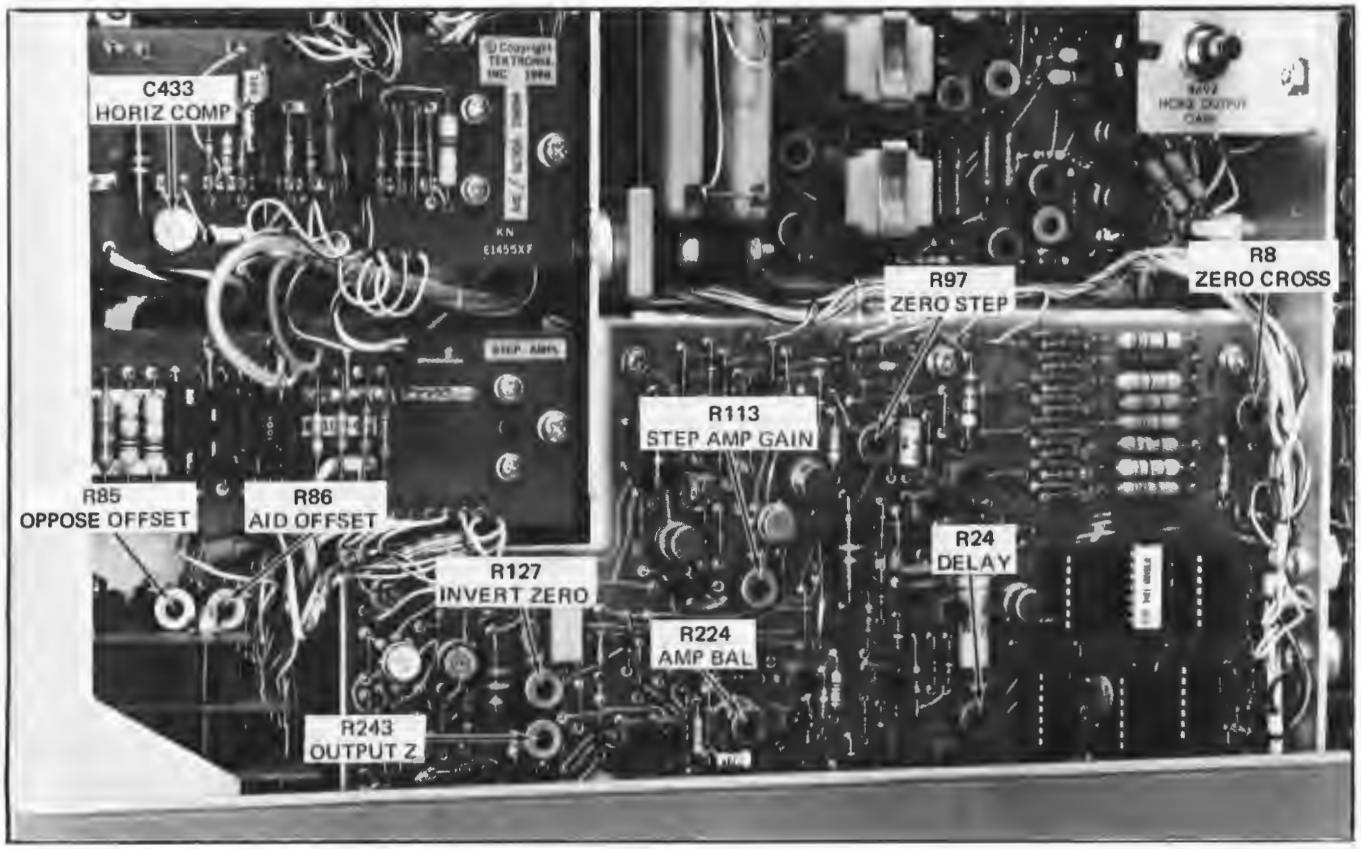


Fig. 5-7. STEP GEN, STEP GEN OFFSET and HORIZ VOLTS/DIV circuit boards: Location of adjustments in step 14 and steps 20 through 23.

f. Turn C433, HORIZ COMP adjustment, on the HORIZ VOLTS/DIV circuit board (see Fig. 5-7) throughout its range.

g. Note the tails on the spots in the display for certain positions of the control (see Fig. 5-6A).

h. ADJUST—C433 for no tails or minimum tail length on the spots (see Fig. 5-6B).

i. Set the LEFT-OFF-RIGHT switch to OFF and remove the transistor adapter from the Standard Test Fixture. (Leave the protective box installed on the Standard Test Fixture.)

j. Swing the shield back over C433 and replace the screw removed in part e.

k. (If doing Adjust steps only, go to step 20).

Control Settings (Partial List)

Type 576

VERTICAL	1 μA COLLECTOR
HORIZONTAL	.05 V COLLECTOR
MAX PEAK POWER WATTS	220

15. Check Horizontal and Vertical Positioning and INVERT Button

a. Set the Type 576 controls as shown in the list of initial control settings at the beginning of the procedure except as noted above.

b. Turn the horizontal FINE POSITION control throughout its range.

c. CHECK FOR—Spot movement at least 2.5 divisions to the right and 2.5 divisions to the left of the center vertical graticule line (see Fig. 5-5).

d. Turn the vertical FINE POSITION control throughout its range.

e. CHECK FOR—Spot movement at least 2.5 divisions above and 2.5 divisions below the center horizontal graticule line.

f. Press the ZERO button and center the spot on the graticule using the FINE POSITION controls. Release the ZERO button.

g. Set the POLARITY switch to +(NPN).

h. CHECK FOR—Spot located at the intersection of the zero horizontal and vertical graticule lines ±0.1 division (see Fig. 5-5).

i. Set the POLARITY switch to −(PNP).

j. CHECK FOR—Spot located at the intersection of the tenth horizontal and vertical graticule lines ±0.1 division (see Fig. 5-5).

k. Press the Type 576 DISPLAY INVERT button.

l. CHECK FOR—Spot located at the intersection of the zero horizontal and vertical graticule lines.

m. Release the DISPLAY INVERT button and switch the horizontal POSITION switch counterclockwise two positions.

n. CHECK FOR—Spot movement 5 divisions to the left ±0.1 division each time the switch is moved one position.

o. Switch the vertical POSITION switch to both counterclockwise positions.

p. CHECK FOR—Spot movement 5 divisions down ±0.1 division each time the switch is moved one position.

q. Set the following Type 576 controls as listed:

POSITION (Horizontal and Vertical	Centered
POLARITY	+(NPN)

r. Switch the horizontal POSITION switch to both clockwise positions.

s. CHECK FOR—Spot movement 5 divisions to the right ±0.1 division each time the switch is moved one position.

t. Switch the vertical POSITION switch to both clockwise positions.

u. CHECK FOR—Spot movement 5 divisions up ±0.1 division each time the switch is moved one position.

16. Check Horizontal and Vertical Displayed Noise

a. Set the following Type 576 controls to:

POSITION (Horizontal and Vertical)	Centered
DISPLAY OFFSET Selector	HORIZ X10
POLARITY	AC
SERIES RESISTORS	140 Ω

b. Install the protective box on the Standard Test Fixture and close the lid.

c. Turn the Type 576 MAX PEAK VOLTS switch throughout its range. (Be sure the CENTERLINE VALUE switch is set to 5.)

d. CHECK FOR—Horizontal width of spot no greater than indicated in Table 5-6 for Horizontal Collector Volts, for each position of the MAX PEAK VOLTS switch.

e. Set the HORIZONTAL switch to .05 BASE. Connect a 1 MΩ resistor between the base (B) and emitter (E) jacks on the Standard Test Fixture (right hand set of jacks) and set the LEFT-OFF-RIGHT switch to RIGHT.

f. Repeat parts c and d, using Horizontal Base Volts values from Table 5-6.

g. Set the following Type 576 controls to:

HORIZONTAL	200 COLLECTOR
DISPLAY OFFSET Selector	NORM (OFF)
POSITION (Vertical)	1 position clockwise
POLARITY	+ (NPN)
VARIABLE COLLECTOR SUPPLY	Fully clockwise

Set the LEFT-OFF-RIGHT switch to OFF and remove the 1 MΩ resistor.

h. Turn the Type 576 MAX PEAK VOLTS switch throughout its range.

i. CHECK FOR—Vertical width of display no greater than indicated in Table 5-6 for Vertical Collector Current, for each position of the MAX PEAK VOLTS switch.

NOTE

The LOOPING COMPENSATION control may have some effect on this check. It may be necessary to make this check after the looping compensation adjustments have been made in step 32.

j. Set the MODE, switch to LEAKAGE (EMITTER CURRENT).

k. Repeat parts g and h using Vertical Emitter values from Table 5-6.

l. Remove the protective box.

TABLE 5-6

Check Horizontal and Vertical Displayed Noise

Horizontal or Vertical Range	MAX PEAK VOLTS Switch			
	15	75	350	1500
Horizontal				
Collector Volts	1 div	1 div	4 div	40 div
Base Volts	1 div	1 div	1 div	1 div
Vertical				
Collector Current	1 div	1 div	2 div	5 div
Emitter Current	1 div	1 div	2 div	5 div

17. Check Display Offset and CAL Button

a. Set the following Type 576 controls to:

VERTICAL	2 A COLLECTOR
DISPLAY OFFSET Selector	HORIZ X10
CENTERLINE VALUE	10
HORIZONTAL	1 V COLLECTOR
POSITION (Vertical)	Centered
OFFSET	AID
MAX PEAK VOLTS	15
MODE	DC
VARIABLE COLLECTOR SUPPLY	Fully counterclockwise
LEFT-OFF-RIGHT	RIGHT
AMPLITUDE	2 V

b. Connect a patch cord between the base (B) and collector (C) jacks on the Standard Test Fixture (right hand set of jacks). Connect a DC voltmeter (0 to 1000 V) between the collector and emitter jacks, (The meter could be connected across the Kelvin Sensing jacks.)

c. Press the ZERO button and center the spot horizontally on the CRT graticule. Release the ZERO button and turn the OFFSET MULT control to bring the spot back to centerline.

d. Note the reading of the DC Voltmeter and record this reading in the second column, bottom row of Table 5-7.

e. Turn the CENTERLINE VALUE switch throughout its range, one position at a time. For each position of the CENTERLINE VALUE switch listed in the left column of Table 5-7, use the OFFSET MULT control to set the voltmeter reading to the indicated percentage (given in the right column to Table 5-7) of the voltage reading in Step 17.d.

f. CHECK FOR—Spot on center vertical graticule line ±.25 division for each position of the CENTERLINE VALUE switch.

g. When the CENTERLINE VALUE switch has been checked, press the ZERO button and center the spot on the CRT graticule with the horizontal FINE POSITION control. Release the ZERO button and press the CAL button.

h. CHECK FOR—Spot centered horizontally on the CRT graticule ±0.5 division.

TABLE 5-7

Check Accuracy of CENTERLINE VALUE Switch

CENTERLINE VALUE	Percentage of Voltmeter Reading Obtained in Step 17.d.
.5	5%
1	10%
1.5	15%
2	20%
2.5	25%
3	30%
3.5	35%
4	40%
4.5	45%
5	50%
5.5	55%
6	60%
6.5	65%
7	70%
7.5	75%
8	80%
8.5	85%
9	90%
9.5	95%
10	100%

18. Check Horizontal Display Accuracy

a. Set the following Type 576 controls to:

HORIZONTAL	.05 COLLECTOR
AMPLITUDE	.05 V

b. Press the ZERO button and horizontally center the spot on the CRT graticule. Release the ZERO button.

c. Set the OFFSET MULT control for a DC voltmeter reading as shown in Table 5-8 for the corresponding setting of the HORIZONTAL switch.[3]

d. CHECK FOR—Spot on the center vertical graticule line ±2 divisions.

e. Turn the HORIZONTAL switch and the AMPLITUDE switch together counterclockwise, through 2 V COLLECTOR for the HORIZONTAL switch and through 2 V for the AMPLITUDE switch. For each position of the HORIZONTAL switch, repeat parts c and d.

f. Set the HORIZONTAL switch to .05 BASE and the AMPLITUDE switch to .05 V.

g. Turn the HORIZONTAL switch and the AMPLITUDE switch together counterclockwise, through 2 V BASE for the HORIZONTAL switch and through 2 V for the AMPLITUDE switch. For each position of the HORIZONTAL switch, repeat parts c and d.

h. Set the LEFT-OFF-RIGHT switch to OFF and disconnect the DC voltmeter and patch cord from the Type 576 Standard Test Fixture. Switch the collector mode switch to DC (DC ANTI LOOP). Connect the DC voltmeter between the collector and emitter jacks.

i. Set the following Type 576 controls to:

CENTERLINE VALUE	10
HORIZONTAL	5 V COLLECTOR
OFFSET	ZERO
VARIABLE COLLECTOR SUPPLY	Fully counterclockwise
MAX PEAK VOLTS	1500
SERIES RESISTORS	6.5 M
LEFT-OFF-RIGHT	RIGHT

[3]**Since adjustment of the step generator occurs further in this procedure, the OFFSET MULT control may not have enough range to produce the voltages listed in Table 5-8. In such a case, set the CENTERLINE VALUE switch to 9.5 and set the OFFSET MULT control for a DC voltmeter reading 0.95 times the value given in Table 5-8.**

j. With a non-metallic object press down on the interlock switch on the left of the Standard Test Fixture. With the interlock switch held down, adjust the VARIABLE COLLECTOR SUPPLY control for a DC voltmeter reading as shown in Table 5-8 for the corresponding setting of the HORIZONTAL switch.

TABLE 5-8

Check Accuracy of HORIZONTAL Switch

HORIZONTAL	DC Voltmeter
.05 COLLECTOR	0.5 V
.1	1 V
.2	2 V
.5	5 V
1	10 V
2	20 V
5	50 V
10	100 V
20	200 V
50	500 V
100	1000 V
200	1000 V
.05 BASE	0.5 V
.1	1 V
.2	2 V
.5	5 V
1	10 V
2	20 V

WARNING

Enabling the Collector Supply without the use of the protective box, as described in part j, presents a potential hazard to the person checking the instrument. Operators of the instrument should always be aware of the fact that when the red light is on, dangerous voltages may appear at the Collector terminals.

k. CHECK FOR—Spot on the center vertical graticule line ±2 divisions.

l. Turn the HORIZONTAL switch counterclockwise through its COLLECTOR range to 100. For each position of the switch repeat parts j and k. For the 200 COLLECTOR position, set the CENTERLINE VALUE switch to 5. Repeat parts j and k checking that the spot is centered ±1 division. (The PEAK POWER WATTS switch may have to be set to a higher value to get a 1000 V collector supply output.)

m. Release the Interlock switch and set the LEFT-OFF-RIGHT switch to OFF.

n. Disconnect dc voltmeter leads.

19. Check Vertical Display Accuracy

a. Set the following Type 576 controls to:

VARIABLE COLLECTOR SUPPLY	Fully counterclockwise
MAX PEAK VOLTS	15
SERIES RESISTORS	.3
MODE	NORM
VERTICAL	1 μA
DISPLAY OFFSET Selector	VERT X10
CENTERLINE VALUE	10
AMPLITUDE	1 μA
OFFSET	AID
POLARITY INVERT	PRESSED
HORIZONTAL	200 V COLLECTOR

b. Connect the DC voltmeter between the collector and base terminals (right side) of the Standard Test Fixture.

c.[4] Connect a 100 kΩ resistor between the collector and the base connectors. (Very short banana plug-to-alligator-clip leads are suggested.)

d. Set the LEFT-OFF-RIGHT switch to RIGHT.

e. Press the ZERO button and position the spot on the center horizontal graticule line. Release the ZERO button.

f. Set the OFFSET MULT control for a DC voltmeter reading as shown in Table 5-9 for the corresponding setting of the VERTICAL switch.[3]

g. CHECK FOR—Spot on the center horizontal graticule line ±2 divisions. (If the position of the spot cannot be determined due to noise, disconnect the DC voltmeter from the resistor.)

h. Turn the VERTICAL switch (counterclockwise) and the AMPLITUDE switch (clockwise) throughout the range of the AMPLITUDE switch. Repeat parts f and g for each position of the VERTICAL switch. For each three positions of the VERTICAL switch, set the LEFT-OFF-RIGHT switch to OFF, replace the resistor between the base-collector jacks with a new value as shown in Table 5-9 and set the LEFT-OFF-RIGHT switch to RIGHT. For the .5 A position of the VERTICAL switch, leave the AMPLITUDE switch set to .2 A and set the CENTERLINE VALUE switch to 4. In this case check for spot centered ±0.8 division.

TABLE 5-9

Check Accuracy of VERTICAL Switch (Collector Range)

VERTICAL Switch	Resistor (R_s)	DC Voltmeter[5] (R_m)	DC Ammeter
1 μA	100 kΩ	1 V	10 μA ±0.2 μA
2 μA		2 V	20 μA ±0.4 μA
5 μA		5 V	50 μA ±1 μA
10 μA	10 kΩ	1 V	100 μA ±2 μA
20 μA		2 V	200 μA ±4 μA
50 μA		5 V	500 μA ±10 μA
.1 mA	1 kΩ	1 V	1 mA ±0.02 mA
.2 mA		2 V	2 mA ±0.04 mA
.5 mA		5 V	5 mA ±0.1 mA
1 mA	100 Ω	1 V	10 mA ±0.2 mA
2 mA		2 V	20 mA ±0.4 mA
5 mA		5 V	50 mA ±1 mA
10 mA	10 Ω	1 V	100 mA ±2 mA
20 mA		2 V	200 mA ±4 mA
50 mA		5 V	500 mA ±10 mA
.1 A	1 Ω	1 V	1 A ±0.02 A
.2 A		2 V	2 A ±0.04 A
.5 A		2 V	2 A ±0.04 A

[5] **If a DC voltmeter with an input impedance of less than 500 MΩ is used to measure the voltage across the 100 kΩ and 10 kΩ resistors, an error in the voltage reading may be noticed. To calculate the correct voltage under these conditions (V_2), multiply the voltage in the DC voltmeter column of Table 5-9 (V_1) by the input impedance of the DC voltmeter (R_m) divided by the current sensing resistor (R_s) plus R_m:**

$$V_2 = V_1 \left(\frac{R_m}{R_m + R_s} \right)$$

i. Set the LEFT-OFF-RIGHT switch to OFF and disconnect the DC voltmeter and resistor from the Standard Test Fixture.

j. Connect the 10 A supply and DC ammeter between the collector (C) and emitter (E), jacks (right side) of the Standard Test Fixture. Current should flow from the emitter to the collector.

[4] **A DC ammeter can be substituted for the resistor and DC Voltmeter.**

k. Set the following Type 576 controls to:

VERTICAL	1 A
CENTERLINE VALUE	10
LEFT-OFF-RIGHT	RIGHT

l. CHECK FOR—Spot vertically centered on the graticule ±2 divisions.

m. Set the VERTICAL switch to 2 A and the CENTERLINE VALUE switch to 5.

n. CHECK FOR—Spot vertically centered on the graticule ±1 division.

o. Set the LEFT-OFF-RIGHT switch to OFF and disconnect the 10 A supply and meter from the Type 576.

p. Connect the DC voltmeter between the base jack (right side) and the GROUND jack on the Standard Test Fixture.

q. Connect the 25 MΩ resistor between the base jack and the emitter jack.

r. Set the following Type 576 controls to:

VERTICAL	1 nA EMITTER
DISPLAY OFFSET Selector	NORM (OFF)
CENTERLINE VALUE	10
AMPLITUDE	.5 V
OFFSET MULT	0.00
POLARITY INVERT	Released
MODE	LEAKAGE (EMITTER CURRENT)
LEFT-OFF-RIGHT	RIGHT

s. Turn the OFFSET MULT control clockwise until the spot is on the tenth horizontal graticule line. (If the spot has noise, adjust the center of the elongated spot to the tenth horizontal graticule line.)

t. CHECK FOR—DC voltmeter reading as shown in Table 5-10 for the setting of the VERTICAL switch.

u. Repeat parts s and t for the 2 nA and 5 nA positions of the VERTICAL switch.

v. Exchange the 25 MΩ resistor for a 2.5 MΩ resistor.

TABLE 5-10

Check Accuracy of VERTICAL Switch (Emitter Range)

VERTICAL Switch	Resistor	DC Voltmeter
1 nA	25 MΩ	0.5 V ±0.075 V
2 nA		1 V ±0.1 V
5 nA		2.5 V ±0.175 V
10 nA	2.5 MΩ	0.5 V ±0.015 V
20 nA		1 V ±0.025 V
50 nA		2.5 V ±0.055 V
.1 μA	250 kΩ	0.5 V ±0.01 V
.2 μA		1 V ±0.02 V
.5 μA		2.5 V ±0.05 V
1 μA	25 kΩ	0.5 V ±0.01 V
2 μA		1 V ±0.02 V
5 μA		2.5 V ±0.05 V

w. Set the following Type 576 controls to:

VERTICAL	10 nA
DISPLAY OFFSET Selector	VERTICAL X10

x. Press the ZERO button and position the spot vertically onto the center horizontal graticule line. Release the ZERO button.

y. Adjust the spot to the center horizontal graticule line with the OFFSET MULT control.

z. CHECK FOR—DC voltmeter reading as shown in Table 5-10 for the setting of the VERTICAL switch.

aa. Repeat parts y and z for all the remaining emitter current positions of the VERTICAL switch through 5 μA. The resistor must be changed each three positions of the vertical switch.

ab. Disconnect the DC voltmeter and resistor from the Type 576.

ac. (If doing check steps only go to step 24.)

Control Settings (Partial List)

Type 576

INTENSITY	Trace Visible
VERTICAL	STEP GEN
DISPLAY OFFSET Selector	HORIZ X10
HORIZONTAL	5 V COLLECTOR

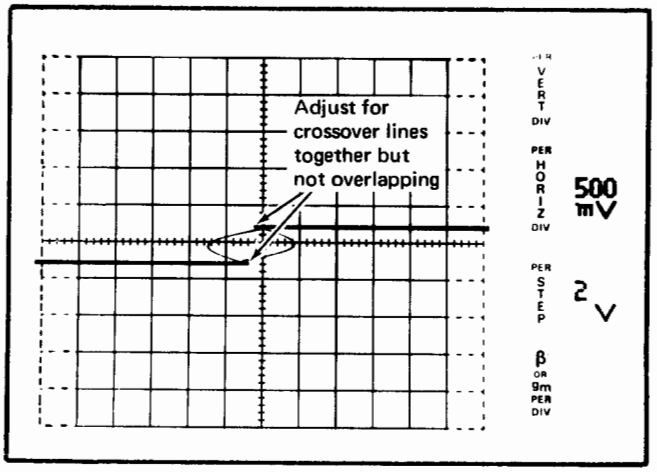


Fig. 5-8. Type 576 display of crossover lines for adjusting ZERO CROSS adjustment R8.

VARIABLE COLLECTOR SUPPLY	Fully clockwise
AMPLITUDE	.05 V
NUMBER OF STEPS	1
OFFSET MULT	10.00 (fully clockwise)
STEP FAMILY	REP

STEP GENERATOR

20. Adjust Zero Crossing and Step Delay

a. Set the Type 576 controls as shown in the list of Initial Control Settings except as shown above.

b. Position the crossover point of the two traces to the center of the CRT graticule using the horizontal FINE POSITION controls.

c. Check that the crossover lines are together at center (see Fig. 5-8). (Display may be inverted from that shown in Fig. 5-8.)

d. ADJUST—R8, ZERO CROSS adjustment, on the STEP GEN circuit board (see Fig. 5-7) if the display is not correct.

e. Set the following Type 576 controls to:

POLARITY	+(NPN)
NUMBER OF STEPS	3
RATE	2X

f. Turn the CENTERLINE VALUE switch clockwise until the peaks of the Collector Supply output are displayed on the CRT (see Fig. 5-9A).

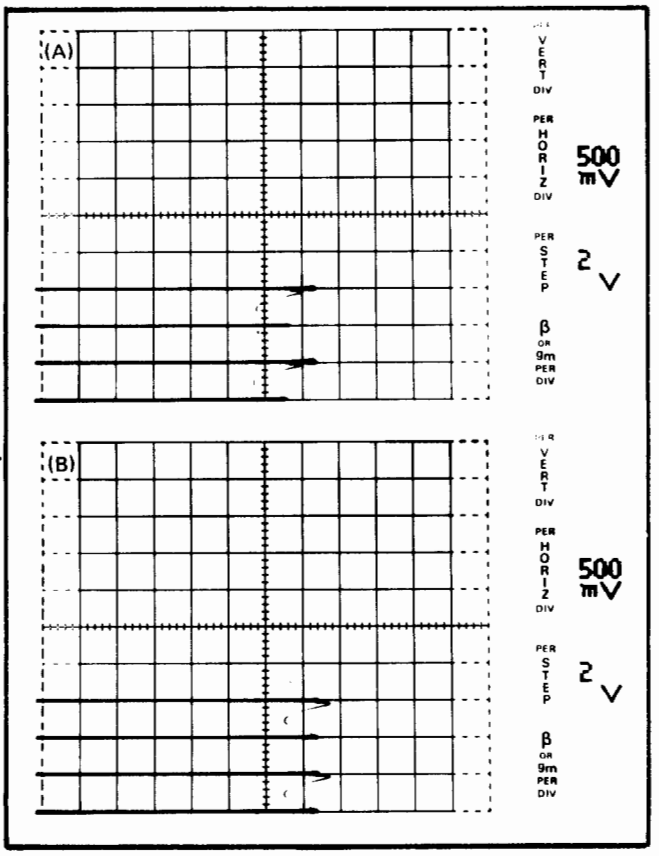


Fig. 5-9. Type 576 display of Collector Supply peaks for adjusting DELAY adjustment R24: (A) incorrect adjustment; (B) correct adjustment.

g. Check that the steps occur exactly at the peak of the Collector Supply output (see Fig. 5-9B).

h. ADJUST—R24, DELAY adjustment, on the STEP GEN circuit board (see Fig. 5-7) if the steps do not occur at the peak of the collector supply output.

21. Adjust Zero Step Level

a. Set the following Type 576 controls to:

CENTERLINE VALUE	0
HORIZONTAL	.05 V BASE
VARIABLE COLLECTOR SUPPLY	Fully Counterclockwise
STEP FAMILY	SINGLE

b. Press the ZERO button and center the spot horizontally on the graticule using the horizontal FINE POSITION control.

c. Release the ZERO button.

d. Check for the spot horizontally centered on the CRT graticule.

e. ADJUST—R224, AMP BAL adjustment, on the STEP GEN circuit board (see Fig. 5-7) if the spot is not centered.

f. Set the Type 576 AMPLITUDE switch to 2 V.

g. Check for the spot horizontally centered on the CRT graticule.

h. ADJUST—R97, ZERO STEP adjustment, on the STEP GEN circuit board (see Fig. 5-7) if the display is not centered.

i. Reset the AMPLITUDE switch to .05 V.

j. Repeat parts b through i until the spot remains centered when the AMPLITUDE switch is switched between the .05 V and the 2 V positions.

k. Set the AMPLITUDE switch to 2 V and press the POLARITY INVERT button.

l. Check for the spot centered horizontally on the CRT graticule.

m. ADJUST—R127, INVERT ZERO adjustment, on the STEP GEN circuit board (see Fig. 5-7) if the spot is not centered.

22. Adjust Step Amplifier Gain

a. Set the following Type 576 controls to:

VERTICAL	2 A
CENTERLINE VALUE	10
HORIZONTAL	1 V BASE
NUMBER OF STEPS	10
AMPLITUDE	1 V
STEP FAMILY	REP
POLARITY INVERT	Released

b. Press the Type 576 ZERO button and position the spot to the center vertical graticule line with the FINE POSITION controls.

c. Release the ZERO button.

d. Check for the spot on the center vertical graticule line ±2 divisions (±2%).

e. ADJUST—R113, STEP AMP GAIN adjustment on the STEP GEN circuit board, (see Fig. 5-7) if the spot is not centered.

f. Press the AID OFFSET button.

g. Check for the spot on the center vertical graticule line ±2 divisions (±2%).

h. ADJUST—R86, AID OFFSET adjustment on the STEP GEN OFFSET circuit board, (see Fig. 5-7) if the spot is not centered.

i. Set the CENTERLINE VALUE switch to 0 and press the OPPOSE OFFSET button.

j. Check for the spot on the center vertical graticule line ±2 divisions (±2%).

k. ADJUST—R85, OPPOSE OFFSET adjustment on the STEP GEN circuit board (see Fig. 5-7), if the spot is not centered.

23. Adjust Current Balance

a. Set the following Type 576 controls to:

VERTICAL	STEP GEN
HORIZONTAL	.1 V BASE
DISPLAY OFFSET Selector	HORIZ X1
CENTERLINE VALUE	5
AMPLITUDE	50 μA
OFFSET	ZERO
Terminal Selector	EMITTER GROUNDED BASE TERM OPEN (OR EXT)

b. Connect a 1 kΩ resistor between the base (B) and the emitter (E) jacks (right side) of the Standard Test Fixture.

c. Connect a shorting strap between the STEP GEN OUTPUT connector on the Standard Test Fixture and the base connector.

d. Set the LEFT-OFF-RIGHT switch to RIGHT and position the tenth spot to the intersection of the tenth horizontal and center vertical graticule lines.

e. Set the DISPLAY OFFSET Selector switch to HORIZ X10.

f. Reposition the spot to the intersection of the tenth horizontal and center vertical graticule line.

g. Set the LEFT-OFF-RIGHT switch to OFF and replace the shorting strap with a 18 kΩ resistor. Set the LEFT-OFF-RIGHT switch to RIGHT.

h. Check for the spot centered horizontally.

i. ADJUST—R243, OUTPUT Z adjustment on the STEP GEN circuit board, (see Fig. 5-7) if the spot is not centered.

j. Exchange the 18 kΩ resistor for the shorting strap and check for no movement of the spot between the two step generator loads.

k. Disconnect the resistors and shorting strap from the Standard Test Fixture.

l. (If doing Adjust steps only go to step 32.)

Control Settings (Partial List)

Type 576

VERTICAL	2 A
DISPLAY OFFSET Selector	HORIZ X10
CENTERLINE VALUE	0
HORIZONTAL	1 V BASE
AMPLITUDE	1 V
OFFSET MULT	10.00
STEP FAMILY	REP
MAX PEAK POWER WATTS	220
POLARITY	+(NPN)

Test Oscilloscope

Time/Cm	2 ms
Triggering	Trig, —, DC, Int
Volts/Cm	2
Input Coupling	DC

24. Check Step Generator and Offset Multiplier Accuracy

a. Set the Type 576 and test oscilloscope controls as shown in the list of Initial Control Settings except as shown above.

b. Press the ZERO button and position the spot onto the center horizontal graticule line.

c. Release the ZERO button.

d. CHECK FOR—Spot on the center horizontal graticule line ±0.1 division (1% of 1 volt).

NOTE

The Type 576 vertical, horizontal, and display offset must be calibrated to perform the following checks.

e. Turn the CENTERLINE VALUE switch throughout its range, two positions at a time.

f. CHECK FOR—A spot in the same position horizontally on the CRT each time the CENTERLINE VALUE switch is switched two positions ±0.5 division (5% of 1 volt).

g. Set the CENTERLINE VALUE switch to 10.

h. CHECK FOR—Spot on the center vertical line ±2 divisions (±2% of total output).

i. Press the AID OFFSET button.

j. CHECK FOR—Spot on the center vertical line ±2 divisions (±2%).

k. Turn the OFFSET MULT control counterclockwise throughout its range. For each complete revolution of the OFFSET MULT control, turn the CENTERLINE VALUE switch clockwise two positions.

l. CHECK FOR—Continuous decrease in zero step voltage level.

m. Set the Type 576 OFFSET MULT control to 10.00 and press the OFFSET OPPOSE button.

n. CHECK FOR—Spot on center vertical graticule line ±2 divisions (±2%).

o. Set the following Type 576 controls to:

HORIZONTAL	.1 V BASE
OFFSET	ZERO
STEP MULT .1X	Pressed

p. Repeat parts b, c, and e.

q. CHECK FOR—A spot in the same position horizontally on the CRT each time the CENTERLINE VALUE switch is switched two positions ±1 division (10% of 0.1 volt).

r. Set the CENTERLINE VALUE switch to 10.

s. CHECK FOR—Spot on the center vertical line ±2 divisions (2% of total output).

t. Set the following Type 576 controls to:

HORIZONTAL	200 COLLECTOR
AMPLITUDE	2 V
OFFSET	AID
STEP MULT .1X	Released
STEP FAMILY	SINGLE

u. Connect a DC voltmeter between the base and emitter jacks (right side) of the Standard Test Fixture. Set the LEFT-OFF-RIGHT switch to RIGHT.

v. Turn the AMPLITUDE switch throughout its voltage range.

w. CHECK FOR—DC voltage reading as shown in Table 5-11 for each voltage setting of the AMPLITUDE switch.

x.[7] Set the LEFT-OFF-RIGHT switch to OFF and connect a 1 MΩ resistor between the base and the emitter terminals of the Standard Test Fixture (right side). Leave the DC voltmeter connected to the base and emitter terminals. Set the LEFT-OFF-RIGHT switch to RIGHT.

y. Turn the AMPLITUDE switch throughout its current range. Change the shunting resistor each three positions of the AMPLITUDE switch as described in part x.

z. CHECK FOR—DC voltmeter reading as shown in Table 5-11 for each current setting of the AMPLITUDE switch. For the higher current settings, be sure that the resistor leads are as short as possible.

aa. Set the LEFT-OFF-RIGHT switch to OFF and disconnect the DC voltmeter and resistor from the Standard Test Fixture.

TABLE 5-11

Check Accuracy of Step Generator

AMPLITUDE Switch	Resistor	DC Voltmeter[8]	DC Ammeter
2 V		20 V ±0.4 V	
1 V		10 V ±0.2 V	
.5 V		5 V ±0.1 V	
.2 V		2 V ±0.04 V	
.1 V		1 V ±0.02 V	
.05 V		0.5 V ±0.01 V	
.05 μA		0.5 V ±0.01 V	0.5 μA ±0.01 μA
.1 μA	1 MΩ	1 V ±0.02 V	1 μA ±0.02 μA
.2 μA		2 V ±0.04 V	2 μA ±0.04 μA
.5 μA		0.5 V ±0.01 V	5 μA ±0.1 μA
1 μA	100 kΩ	1 V ±0.02 V	10 μA ±0.2 μA
2 μA		2 V ±0.04 V	20 μA ±0.4 μA
5 μA		0.5 V ±0.01 V	50 μA ±1 μA
10 μA	10 kΩ	1 V ±0.02 V	100 μA ±2 μA
20 μA		2 V ±0.04 V	200 μA ±4 μA
50 μA		0.5 V ±0.01 V	500 μA ±10 μA
.1 mA	1 kΩ	1 V ±0.02 V	1 mA ±0.02 mA
.2 mA		2 V ±0.04 V	2 mA ±0.04 mA
.5 mA		0.5 V ±0.01 V	5 mA ±0.1 mA
1 mA	100	1 V ±0.02 V	10 mA ±0.2 mA
2 mA		2 V ±0.04 V	20 mA ±0.4 mA
5 mA		0.5 V ±0.01 V	50 mA ±1 mA
10 mA	10	1 V ±0.02 V	100 mA ±2 mA
20 mA		2 V ±0.04 V	200 mA ±4 mA
50 mA		0.5 V ±0.01 V	500 mA ±10 mA
100 mA	1 Ω	1 V ±0.02 V	1 A ±0.02 A
200 mA		2 V ±0.04 V	2 A ±0.04 A

[8]See footnote to Table 5-9 for instructions for calculating current DC Voltmeter readings when input impedance of DC Voltmeter is less than 500 MΩ.

25. Check Maximum Current Output

a. Set the following Type 576 controls to:

VERTICAL	1 μA COLLECTOR
DISPLAY OFFSET Selector	NORM (OFF)
HORIZONTAL	10 V COLLECTOR
AMPLITUDE	.05 μA
POLARITY INVERT	Pressed
STEP FAMILY	REP
POLARITY	AC

[7]A DC ammeter may be substituted for the DC voltmeter and shunt resistors.

b. Connect a patch cord with banana plugs between the base (B) and collector (C) jacks on the right side of the Standard Test Fixture.

c. Set the LEFT-OFF-RIGHT switch to RIGHT.

d. Press the STEP OFFSET ZERO button and position the bottom spot to the center of the CRT graticule. Press the AID button.

e. CHECK FOR—Upper spot on sixth horizontal graticule line.

f. Set the AMPLITUDE switch to .1 μA.

g. CHECK FOR—Upper spot on seventh horizontal graticule line.

h. Turn the AMPLITUDE switch (clockwise) and the VERTICAL switch (counterclockwise) together throughout their ranges.

i. CHECK FOR—Upper spot on seventh horizontal graticule line for each current position of the AMPLITUDE switch except for the 100 mA and 200 mA positions. For the 100 mA position, the tenth spot should be at least 0.5 division above the sixth horizontal graticule line and for the 200 mA position the upper spot should be at least above the sixth line.

j. Set the following Type 576 controls to:

AMPLITUDE	1 V
SERIES RESISTORS	6.5

k. CHECK FOR—A spot above the sixth horizontal graticule line and to the left of the fourth vertical graticule line (at least 2 A at 10 V).

l. Set the following Type 576 controls to:

VERTICAL	10 mA
AMPLITUDE	2 V
SERIES RESISTORS	3 k

m. CHECK FOR—A spot on the first vertical graticule line and above the sixth horizontal graticule line (at least 10 mA at 40 V).

26. Check Short Circuit Current and Reverse Current Limits

a. Set the SERIES RESISTORS switch to .3 and the VERTICAL switch and CURRENT LIMIT switch as shown in Table 5-12.

TABLE 5-12

Check Short Circuit Current Limit

CURRENT LIMIT	VERTICAL
2 A	2 A
500 mA	.5 A
100 mA	.1 A
20 mA	20 mA

b. CHECK FOR—Spot between sixth and seventh horizontal graticule lines (sixth and 0.5 division above sixth for the 2 A settings).

c. Press the OFFSET OPPOSE button and release the POLARITY INVERT button.

d. Turn the AMPLITUDE switch throughout its range.

e. CHECK FOR—Spot between 0.5 and 1 division above the center horizontal graticule line when the AMPLITUDE switch is in its voltage range or above 1 mA of the current region. Below 1 mA of the current region, the spot should approach the center horizontal graticule line.

27. Check Maximum Voltage Output and Reverse Voltage Limit[9]

a. Set the AMPLITUDE switch to 2 V and press the OFFSET AID button.

b. Remove the patch cord from between the collector and base terminals of the Standard Test Fixture and connect the DC voltmeter to the base and emitter terminals (right).

c. Turn the AMPLITUDE switch throughout its voltage range.

[9]**This step cannot be performed using a digital voltmeter. A DC voltmeter with a meter movement and having an input impedance of at least 100 MΩ is required to get the specified display.**

d. CHECK FOR—DC voltmeter readings as shown in Table 5-13.

TABLE 5-13

Maximum Voltage Readings

AMPLITUDE	DC Voltmeter
2 V	30 V
1 V	15 V
.5 V	7.5 V
.2 V	3 V
.1 V	1.5 V
.05 V	0.75 V

e. Turn the AMPLITUDE switch throughout its current range.

f. CHECK FOR—DC voltmeter reading of least 10 V.

g. Press the OFFSET OPPOSE button and turn the AMPLITUDE switch throughout its current range.

h. CHECK FOR—DC voltmeter reading of between 1 V and 3 V.

i. Set the LEFT-OFF-RIGHT switch to OFF and disconnect the DC voltmeter from the Standard Test Fixture.

28. Check Miscellaneous Step Generator Buttons

a. Set the following Type 576 controls to:

HORIZONTAL	1 BASE
AMPLITUDE	1 V
OFFSET	ZERO
RATE	.5X
POLARITY	+(NPN)

b. Turn the Type 576 NUMBER OF STEPS switch throughout its range.

c. CHECK FOR—Number of steps per family reduced by one each time the switch is turned one position counterclockwise.

d. Set the NUMBER OF STEPS switch to 10 and press the SINGLE STEP FAMILY button. Press the SINGLE button again.

e. CHECK FOR—Single step family generated each time the SINGLE button is pressed.

f. Connect the BNC male to dual binding post adapter to the Channel 1 input to the test oscilloscope. Connect patch cords from the STEP GEN OUTPUT connector and the GROUND connector on the Standard Test Fixture to the dual binding posts. (Be sure the STEP GEN OUTPUT connector is connected to the red binding post.)

g. Press the STEP FAMILY REP buttons and trigger the test oscilloscope. Check for a display of the step generator output with 10 steps.

h. CHECK FOR—Step width of 8.33 cm (10 cm if the Type 576 is being operated from 50 Hz line frequency).

i. (If operating from 60 Hz line frequency), adjust the test oscilloscope variable sweep rate for a step width of 8 cm.

j. Press the NORM RATE button.

k. CHECK FOR—Step width of 4 cm (5 cm for 50 Hz operation).

l. Press the 2X RATE button.

m. CHECK FOR—Step width of 2 cm (2.5 for 50 Hz operation).

n. Set the Type 576 NUMBER OF STEPS switch to 1 and press the 300 μs PULSED STEPS button.

o. Set the test oscilloscope sweep rate to 50 μs/cm (calibrated) and trigger the display on the +trigger slope.

p. CHECK FOR—Pulsed step with a width of 6 cm +1.2 cm, −0.3 cm (300 μs/cm (calibrated) and trigger and display on the +trigger slope. For instruments having SN 172570 and up or those which have been modified to change R37 to 26.1 kΩ, change the 300 μs pulse width to 6 cm +0.3 cm, −0.9 cm (300 μs, +5%, −15%).

q. Press the 80 μs PULSED STEPS button.

r. CHECK FOR—Pulsed step with a width of 1.6 cm +0.3 cm, −0.1 cm (80 μs +20%, −5%).

29. Check Step Generator Ripple

a. Set the following Type 576 controls to:

DISPLAY OFFSET Selector	HORIZ X10
CENTERLINE VALUE	10
HORIZONTAL	.05 BASE
AMPLITUDE	.05 μA
OFFSET	AID
OFFSET MULT	0.00
STEPS	Pressed
STEP FAMILY	SINGLE
POLARITY	+(NPN)

b. Disconnect the Type 576 from the test oscilloscope.

c. Connect a 10 MΩ, 1 watt, ¼% resistor between the base and emitter jacks (right) of the Standard Test Fixture. Set the LEFT-OFF-RIGHT switch to RIGHT.

d. Press the ZERO button and position the spot to the horizontal center of the CRT graticule.

e. Turn the OFFSET MULT control clockwise until a spot appears on the CRT.

f. CHECK FOR—Spot with a horizontal width of less than 4.0 divisions (8.0 divisions for 230 V operation).

g. Set the following Type 576 controls to:

AMPLITUDE	.05 V
OFFSET MULT	10.00
LEFT-OFF-RIGHT	OFF

h. CHECK FOR—Spot with a horizontal width of less than 0.4 division (less than 2 mV peak to peak).

COLLECTOR SUPPLY

30. Check Collector Supply Polarity, Peak Voltage, Ripple and Interlock

a. Set the Type 576 controls as shown in the list of Initial Control Settings at the beginning of the procedure. Set the MAX PEAK POWER WATTS switch to 220.

b. Install the protective box on the Standard Test Fixture and close its lid.

c. Press the ZERO button and position the spot to the center of the CRT graticule.

d. Turn the VARIABLE COLLECTOR SUPPLY control clockwise to obtain a 10 division trace.

e. CHECK FOR—Horizontal trace extending out from both sides of the center vertical graticule line.

f. Set the POLARITY switch to −(PNP) and turn the VARIABLE COLLECTOR SUPPLY fully clockwise.

g. CHECK FOR—Horizontal trace extending to the left from the tenth vertical graticule line (along top of the graticule).

h. Set the POLARITY switch to +(NPN).

i. CHECK FOR—Horizontal trace extending to the right from the zero vertical graticule line (along bottom of the graticule).

j. Set the HORIZONTAL switch and MAX PEAK VOLTS as shown in Table 5-14. For each setting of these switches, perform the following procedure:

1. CHECK FOR—Peak of trace displaced from zero vertical graticule line as shown in Table 5-14 under peak volts.

2. Lift the lid on the protective box, then close it.

3. CHECK FOR—Yellow light going on, trace disappearing and red light turning off when lid is lifted, and yellow light turning off, trace reappearing and red light turning on when lid is closed, for all collector supply ranges except the 15 V range. In the 15 V range, neither light is on and the trace is not affected when the lid of the protective box is opened.

4. Set the following Type 576 controls to:

DISPLAY OFFSET Selector	HORIZ X10
MODE	DC

5. Position the spot onto the CRT with the CENTERLINE VALUE switch.

6. CHECK FOR—Width of spot no greater than shown in Table 5-14 under DC ripple.

TABLE 5-14

Check Collector Supply Peak Voltage and DC Ripple

Switch Settings		Peak Volts		DC Ripple (Peak-to-Peak)	
HORIZONTAL	MAX PEAK VOLTS	Voltage	Divisions	Voltage	Divisions
2 V	15 V	15 V +35%, –5%	7.5 div +2.6 div, –0.37 div	2% of 15 V	1.5 div
10 V	75 V	75 V +35%, –5%	7.5 div +2.6 div, –0.37 div	2% of 75 V	1.5 div
50 V	350 V	350 V +35%, –5%	7 div +2.4 div, –0.35 div	2% of 350 V	1.4 div
200 V	1500 V	1500 V +35%, –5%	7.5 div +2.6 div, –0.35 div	2% of 1500 V	1.5 div

7. Set DISPLAY OFFSET Selector switch to NORM (OFF), and MODE switch to NORM and the HORIZONTAL and the MAX PEAK VOLTS switches to the next positions shown in Table 5-14. (Always set HORIZONTAL switch first to avoid damage to horizontal amplifier.)

8. Repeat parts 1 through 7.

k. Set the following Type 576 controls to:

DISPLAY OFFSET Selector	NORM (OFF)
MODE	NORM
VARIABLE COLLECTOR SUPPLY	Fully counterclockwise

31. Check Collector Supply Minimum Peak Currents

a. Lift the lid of the protective box and connect a patch cord between the collector and emitter jacks (right) of the Standard Test Fixture. Set the LEFT-OFF-RIGHT switch to RIGHT.

b. Press the ZERO button and position the spot on the zero horizontal graticule line. Release the ZERO button.

c. Set the Type 576 VERTICAL and MAX PEAK VOLTS switches as shown in Table 5-15. (Always set the VERTICAL switch first to avoid damage to the vertical amplifier.)

TABLE 5-15

Check Collector Supply Peak Current

VERTICAL	MAX PEAK VOLTS	Minimum Peak Currents
20 mA	1500	10 divisions (20 mA)
.1 A	350	10 divisions (1 A)
.5 A	75	8 divisions (4 A)
2 A	15	10 divisions (20 A)

d. For each setting of the MAX PEAK VOLTS switch, turn the VARIABLE COLLECTOR SUPPLY control clockwise until the minimum peak current shown in Table 5-15 is reached, then return the VARIABLE COLLECTOR SUPPLY control to its fully counterclockwise position.

CAUTION

Do not exceed the rating of the collector supply as shown in Table 5-15. Return the VARIABLE COLLECTOR SUPPLY control to its fully counterclockwise position as soon as the given current has been obtained.

e. CHECK FOR–Minimum peak current values as shown in Table 5-15 under Minimum Peak Current.

32. Adjust Looping Compensation ◐

a. Set the LEFT-OFF-RIGHT switch to OFF, lift the lid of the protective box and remove the patch cord from the Standard Test Fixture terminals. Close the lid of the protective box.

b. Set the following Type 576 controls to:

VERTICAL	1 µA
DISPLAY OFFSET Selector	VERT X10
HORIZONTAL	2 COLLECTOR
CENTERLINE VALUE	0
MAX PEAK VOLTS	15
VARIABLE COLLECTOR SUPPLY	Fully clockwise
MODE	DC

c. Check that the spot has minimum vertical width.

d. ADJUST–C301, LOOPING BALANCE ADJUSTMENT (see Fig. 5-10), and front panel LOOPING COMPENSATION control for minimum vertical width.

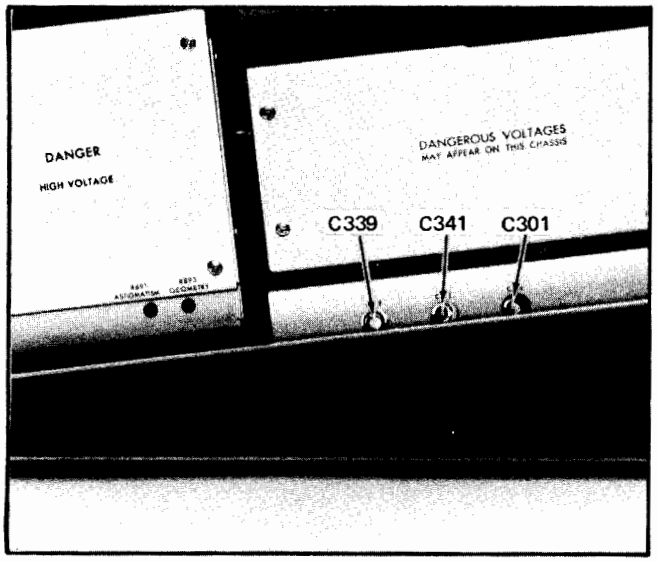


Fig. 5-10. Location of adjustments in steps 32 and 33.

e. Set the DISPLAY OFFSET Selector switch to VERT X1 and the MAX PEAK VOLTS switch to 1500. Set the HORIZONTAL switch to 200 COLLECTOR.

f. Check that the spot has minimum vertical width.

g. ADJUST—C339, 350 V and 1500 V LOOPING COMPENSATION adjustment (see Fig. 5-10) for minimum vertical width.

h. Set MAX PEAK VOLTS switch to 350 and repeat parts f and g. Set C339 for minimum vertical width between the two settings of the MAX PEAK VOLTS switch.

i. Set the MAX PEAK VOLTS switch to 1500 and the MODE switch to NORM.

j. Check for trace with minimum deviation from horizontal line at start of sweep.

k. ADJUST—C341, H.F. NOISE REJECTION adjustment (see Fig. 5-10), for minimum deviation of line. Typical setting of C341 is almost fully counterclockwise. Adjust front panel LOOPING COMPENSATION control if necessary to get a display. High voltage will appear on this capacitor. Use a non-conducting tool to make the adjustment.

33. Check and Adjust LOOPING COMPENSATION Control ❶

a. Set the MAX PEAK VOLTS switch and HORIZONTAL switch as shown in Table 5-16. (Always set MAX PEAK VOLTS switch first to avoid damage to horizontal amplifier.)

TABLE 5-16

Check LOOPING COMPENSATION Control

MAX PEAK VOLTS	HORIZONTAL
1500	200 V COLLECTOR
350	50 V COLLECTOR
75	10 V COLLECTOR
15	2 V COLLECTOR

b. For each setting of the MAX PEAK VOLTS switch, turn the LOOPING COMPENSATION control throughout its range.

c. CHECK FOR—Looping passing through zero for each setting of the MAX PEAK VOLTS switch.

d. Set the MODE switch to DC.

e. ADJUST—LOOPING COMPENSATION control for minimum vertical width.

If the side panels have been removed, replace them.

34. Check Series Resistors

a. Set the Type 576 controls as shown in the list of initial control settings at the beginning of the procedure except as noted below:

SERIES RESISTORS	.3 Ω
VERTICAL CURRENT/DIV	2 A
HORIZONTAL VOLTS/ DIV	.5 V COLLECTOR

b. Connect shorting strap from COLLECTOR to EMITTER terminals on front porch (right side).

c. Position crt dot display to center of graticule area.

d. Adjust VARIABLE COLLECTOR SUPPLY control for 10 divisions of horizontal deflection.

e. Set LEFT-OFF-RIGHT switch to RIGHT.

f. CHECK FOR—6 divisions or more of vertical deflection.

g. Set VARIABLE COLLECTOR SUPPLY to zero.

h. Turn power off and remove front porch.

i. Remove the guard box protective cover by loosening the four screws shown in Fig. 5-10 immediately above C339, C341, and C301.

j. Connect an ohmmeter between white-black and white-green wires on the rear wafer of the MAX PEAK VOLTS switch (outside switch in the guard box).

NOTE

Meter lead resistance may cause an error on the LOW SERIES R positions. It may be necessary to use SENSE leads.

k. CHECK—Series resistors to be within tolerances as listed in Table 5-17. Change MAX PEAK VOLTS and SERIES R settings as required.

TABLE 5-17

Check Series Resistors

MAX PEAK VOLTS	SERIES RESISTORS	TOLERANCE
15 V	1.4 Ω	1.0 — 1.2
15 V	6.5 Ω	5.89 — 6.51
15 V	30.0 Ω	28.50 — 31.5
15 V	140.0 Ω	133.0 — 147.0
15 V	650.0 Ω	617.0 — 683.0
15 V	3 kΩ	2.85 — 3.15
15 V	14 kΩ	13.3 — 14.7
15 V	65 kΩ	61.7 — 68.3
350 V	300 kΩ	285 — 315
350 V	1.4 MΩ	1.33 — 1.47
350 V	6.5 MΩ	6.17 — 6.83

APPENDIX A
ALTERNATE CALIBRATION PROCEDURE

INTRODUCTION

The following procedures are for use in adjusting and checking the Type 576 using the special Type 576 Calibration Fixture (Tektronix part no. 067-0599-00). If this fixture is being used to adjust or check a Type 576, this procedure replaces section 5 of the Type 576 Instruction Manual.

This procedure is made up of 2 sections. Section 1 contain an adjustment procedure which allows all the adjustments in the Type 576 to be made using the calibration fixture. Section 2 contains two procedures: a performance check procedure and a supplementary performance check procedure. The performance check procedure checks the accuracies of the display amplifiers, the step generator and the collector supply with respect to the characteristics given in section 1 of the Type 576 Instruction Manual using the calibration fixture. In addition, this procedure checks each control for proper operation. The supplementary performance check procedure does not use the calibration fixture. This procedure checks characteristics which do not affect the basic accurcy of the instrument, or which can not be checked using the calibration fixture. The performance check procedure provides a good check of the performance of the Type 576 and should be sufficient for most requirements. The addition of the supplementary procedure allows a complete performance check to be made of the instrument.

The Type 576 Calibration Fixture is particularly useful when making adjustments and checks in on-line situations, that is adjusting or checking a Type 576 in the same location in which it is being used.

The Type 576 should be checked and, if necessary, readjusted after each 1000 hours of operation or at least once every six months. To ensure maximum accuracy, it may be desirable to perform the performance check procedure on a shorter cycle.

TABLE OF CONTENTS

SECTION 1
ADJUSTMENT PROCEDURE

General

The following procedure is arranged to allow a complete or partial adjustment of all the internal controls in the Type 576. Most of the steps require the use of only the calibration fixture and a precision DC voltmeter. After becoming familiar with the procedure, a calibrator can easily adjust the Type 576 in an on-line situation by leaving out some steps such as checking power supply regulation (step 3) and adjusting the horizontal compensation (step 11).

Maintenance

Any maintenance required on the Type 576 should be completed before starting this procedure. If troubles occur in the middle of the procedure, they should be corrected before proceeding. Repair and servicing information is given in the Maintenance section.

Equipment List

The following equipment list gives the equipment required to use the following procedure. The required ranges and tolerances of this equipment along with some suggested instrument types are also provided. To allow accurate measurement, the required tolerances given for each piece of equipment have been chosen to exceed the tolerance to be measured by at least 4 times. For tolerances to be measured to less than 1%, the accuracy of the equipment has been chosen to exceed the tolerance by at least 10 times.

1. Type 576 Calibration Fixture (Tektronix Part No. 067-0599-00).

2. DC Voltmeter (e.g., Fluke Model 801B differential voltmeter or suitable digital voltmeter). Requirements: Voltage range from 0 volts to ±250 volts, basic accuracy within 0.5%, accuracy within 0.05% between 0 and ±75 volts.[1]

3. DC Voltmeter—High Voltage (e.g., Triplett Model 630 NA). Requirements: Measure −4000 volts, accuracy within 3%.

4. Test oscilloscope examples are: Tektronix 2200 series or 5100 series. Requirements: Bandwidth from DC to 200 kHz, sweep rates from 0.2 ms/cm to 5 μs/cm, vertical deflection factors from 10 mV/div to 2 V/div, accuracy of voltage measurement within 3%, AC vertical input coupling, internal triggering, X1 test probe.

5. Variable autotransformer (e.g., General Radio, Variac Type W10MT3W for 115-volt operation, or Type W20HMT3A for 230-volt operation). Requirements: Output voltage variable from 90 V to 136 V AC RMS for 115-volt operation or from 180 V to 272 V AC RMS for 230-volt operation; maximum power output at least 305 watts. If a monitor voltmeter is not included, a separate AC voltmeter is required.

6. NPN transistor with BV_{CEO} of 50 volts or more.

Record and Index

Table 1-1 at the beginning of this procedure provides a record and index of the procedure. The table may be used as a check list to verify adjustments, an abridged guide for an experienced calibrator, or an index of individual adjustments. Note that each listing of an adjustment also includes a list of related adjustments or checks.

Control Settings

A complete list of initial control settings for the Type 576 and significant control settings for the test instruments precedes step 1 of this procedure. In addition, partial lists of control settings are provided in various places throughout the procedure. Any control setting not listed in a partial list should be set as designated in the initial list of control settings. If adjustments are made without following the procedure, start with the list of control settings preceding the desired adjustment and follow the sequence up to the desired step, making changes in control settings as indicated.

Making Adjustments

When doing a complete adjustment of the instrument, each internal control should be adjusted as near to the specified setting as possible, even if the observed performance is within tolerance. When doing only a partial adjustment, do not readjust any controls unless the observed performance is outside the given tolerance. In either case, do not preset any adjustments unless they are known to be significantly out of adjustment or repairs have been made in the circuit. In these instances, set the particular controls to midrange.

[1] A similar DC voltmeter, but with very high input impedance (500 MΩ) is required for the performance check. Although this high an input impedance is not required for the adjustment procedure, it may be desirable to use the same instrument for both procedures.

TABLE 1-1

ADJUSTMENT PROCEDURE RECORD AND INDEX

Step No.	Title	Adjust	Required Previous Steps	Page
1	Adjust –75 Volt Supply	R721		1-3
2	Check Other Power Supply Voltages			1-4
3	Check Power Supply Regulation			1-4
4	Adjust CRT Controls	R891, R897, R685, R893	1	1-5
5	Adjust Balance of Horizontal Display Amplifier	R681, R650, R645	1, 4	1-7
6	Adjust Balance of Vertical Display Amplifier	R581, R550, R545	1, 4	1-8
7	Adjust Horizontal and Vertical CRT Gain	R692, R592	1, 4, 5, 6	1-8
8	Adjust Horizontal and Vertical Magnifier Gains	R673, R573	1, 4, 5, 6, 7	1-8
9	Adjust Horizontal Display Amplifier Gains	R636, R638, R641	1, 4, 5, 6, 7, 8	1-9
10	Adjust Vertical Display Amplifier Gains	R536, R538, R541	1, 4, 5, 5, 7, 8	1-9
11	Adjust Horizontal Compensation	C433	1	1-10
12	Adjust Zero Crossing and Step Delay	R8, R24	1	1-12
13	Adjust Zero Step Level	R224, R97, R127	1, 12	1-12
14	Adjust Step Amplifier Gain	R113, R86, R85	1, 12, 13	1-13
15	Adjust Current Balance	R243	1, 12, 13, 14	1-13
16	Adjust Looping Compensation	C301, C339, C341, LOOPING COMPENSATION	1	1-14

Preliminary Adjustment Procedure

1. Remove the side panels and the Standard Test Fixture from the Type 576.

2. Set the Line Voltage Selector assembly and the 60 Hz-50 Hz switch on the Type 576 rear panel in accordance with the line voltage source to be used.

3. Connect the autotransformer and other test instruments to a suitable power source. Connect the Type 576 to the autotransformer output.

4. Set the autotransformer for the line voltage and range chosen on the Type 576 Line Voltage Selector assembly.

5. Turn on the autotransformer, Type 576, DC voltmeter and test oscilloscope. Allow at least 5 minutes warmup at an ambient temperature of +25°C ±5°C (+77°F ±9°F) before making any checks or adjustments.

6. Set the instrument controls as shown in the list of Initial Control Settings at the beginning of the procedure and start the procedure with step 1.

Initial Control Settings

Type 576

GRATICULE ILLUM	Graticule Lines Visible
READOUT ILLUM	Readout Visible
INTENSITY	Fully Counterclockwise
FOCUS	Centered
VERTICAL	.5 mA
DISPLAY OFFSET Selector	NORM (OFF)
CENTERLINE VALUE	5

HORIZONTAL	2 V COLLECTOR
POSITION (Vertical and Horizontal)	Control Centered
FINE POSITION (Vertical and Horizontal)	Control Centered
ZERO	Released
CAL	Released
DISPLAY INVERT	Released
MAX PEAK VOLTS	15
PEAK POWER WATTS	220
VARIABLE COLLECTOR SUPPLY	Fully Counterclockwise
POLARITY	AC
MODE	NORM
LOOPING COMPENSATION	As is
NUMBER OF STEPS	1
CURRENT LIMIT	2 A
STEP GENERATOR AMPLITUDE	2 V
OFFSET	ZERO
OFFSET MULT	10.00 (fully clockwise)
STEPS	Pressed
PULSED STEPS	Released
STEP FAMILY	SINGLE
RATE	.5X
POLARITY INVERT	Released
STEP MULT .1X	Released
LEFT-OFF-RIGHT	OFF
Terminal Selector	BASE TERM STEP GEN

Type 576 Calibration Fixture (067-0599-00)

Function	Step Gen
Calibrator Range	200 mV Cal
Vertical	10 A (fully counterclockwise)
Display Offset Multiplier	0
Horizontal	.5 Collector
Step Generator	.05 μA
Step Generator Loads	Off

Test Oscilloscope

Time/Cm	5 ms
Triggering	Trig, +, AC, Line
Volts/cm	.01
Input Coupling	AC
Position	Display Centered

POWER SUPPLY

1. Adjust –75 Volt Supply

a. Set the Type 576 controls as shown in the list of Initial Control Settings preceding this step.

b. Position the instrument so that the L. V. REGULATOR circuit board (left side of instrument) is visible.

c. Connect the negative lead of the DC voltmeter to ground, pin M on the L. V. REGULATOR board, (See Fig. 1-1). Connect the positive lead to the –75 volt supply, pin K. Be sure the polarity of the DC voltmeter is set for measuring a negative voltage.

d. Check for DC voltmeter reading of –75 volts ±0.375 volt (–75 V ±0.5%).

e. ADJUST–R721, –75-V adjustment (see Fig. 1-1) if the voltage is not correct.

NOTE

The voltage level of the –75-volt supply affects the calibration of the entire instrument. Do not adjust R721 unless the voltage measured in part d is out of tolerance or unless a complete adjustment of the instrument is being performed.

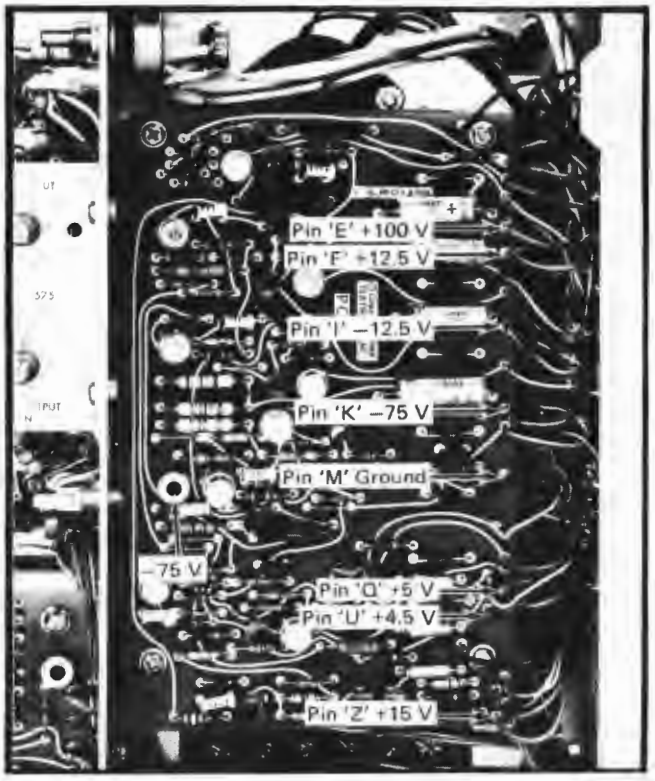


Fig. 1-1. L.V. REGULATOR circuit board: Location of test points and adjustment in steps 1 through 3.

2. Check Other Power Supply Voltages

a. Move the positive lead of the DC voltmeter to the power supply test points (other than –75 volts) listed in Table 1-2. (Change polarity of voltmeter for positive voltages.)

b. CHECK FOR–Meter reading of the power supply voltage within the tolerance given in the accuracy column of Table 1-2.

c. Disconnect the DC voltmeter leads from the Type 576.

d. Connect the negative lead of the High Voltage DC Voltemter to ground (pin M of the L. V. REGULATOR circuit board). Be sure the polarity of the meter is set for measuring a negative voltage.

e. Set the meter for measuring –4 kV. Connect the positive lead of the meter to the arm of the INTENSITY control, R883 (see Fig. 1-2) connected to the white and purple wire.

f. CHECK FOR–High Voltage DC Voltmeter reading of –4000 volts ±160 V ± error of meter (4 kV ±4% ±% error of meter).

g. Disconnect the High Voltage DC Voltmeter leads from the Type 576.

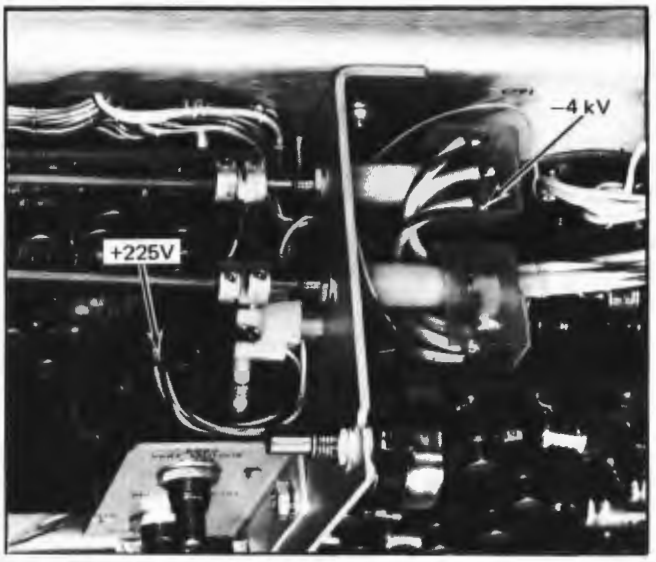


Fig. 1-2. Location of high voltage test points on right side of instrument.

3. Check Power Supply Regulation

a. Trigger the test oscilloscope on the internal line signal.

b. Connect the 1X test probe ground clip to pin M on the L. V. REGULATOR circuit board.

c. Set the autotransformer for the highest voltage within the voltage range selected by the Line Voltage Selector assembly on the rear panel.

TABLE 1-2

POWER SUPPLY VOLTAGE AND REGULATION CHECKS

Voltage	Accuracy	Total Output Noise and Line Frequency Ripple, Peak to Peak	Location of Test Point
–75		5 mV	Pin K
–12.5	±0.31 volt	5 mV	Pin I
Variable +4.5	–0 volts, +0.3 volt (with READOUT ILLUM control fully clockwise)	20 mV	Pin U
+5	±0.25 volt	10 mV	Pin Q
+12.5	±0.31 volt	5 mV	Pin F
+15	±0.75 volt	20 mV	Pin Z
+100	±2.5 volts	20 mV of 28 kHz high voltage oscillator ripple and line frequency ripple	Pin E
+225	±9 volts	80 mV of 28 kHz high voltage oscillator ripple and line frequency ripple	Left arm of R592 VERT OUTPUT GAIN (see Fig. 1-5)

d. Connect the 1X test probe tip to the test points of each of the power supplies given in Table 1-2.

e. CHECK FOR—Test oscilloscope display of power supply ripple with the line frequency ripple peak to peak amplitude not exceeding the maximum value given in Table 1-2. On the +100-volt and the +225-volt supplies, set the test oscilloscope time/cm to 50 μs and check the 20 kHz ripple.

f. Turn off the Type 576. Install the Calibration Fixture. Turn on the Type 576. (Be sure to connect small cable to the CAMERA POWER connector.)

g. Set the autotransformer for the lowest voltage within the voltage range selected by the Line Voltage Selector assembly on the rear panel.

h. Repeat parts d and e.

i. Disconnect the probe from the Type 576.

j. Disconnect the Type 576 from the autotransformer and connect it directly to the power source, or set the autotransformer output votlage to the center of the regulated range selected by the Line Voltage selector assembly. (The camera power cable may also be disconnected from the Type 576.)

CRT AND READOUT

4. Adjust CRT Controls

a. Set the Type 576 and Calibrator Fixture controls as shown in the list of Initial Control Settings at the beginning of the procedure.

b. Turn the Type 576 FOCUS control fully counterclockwise and the INTENSITY control clockwise until a large spot is visible on the CRT.

c. Check for spot having a circular shape.

d. ADJUST—R891, ASTIGMATISM adjustment on the left side of the instrument (see Fig. 1-3), if spot is not circular.

e. Turn the Type 576 FOCUS control clockwise until the spot is the smallest possible.

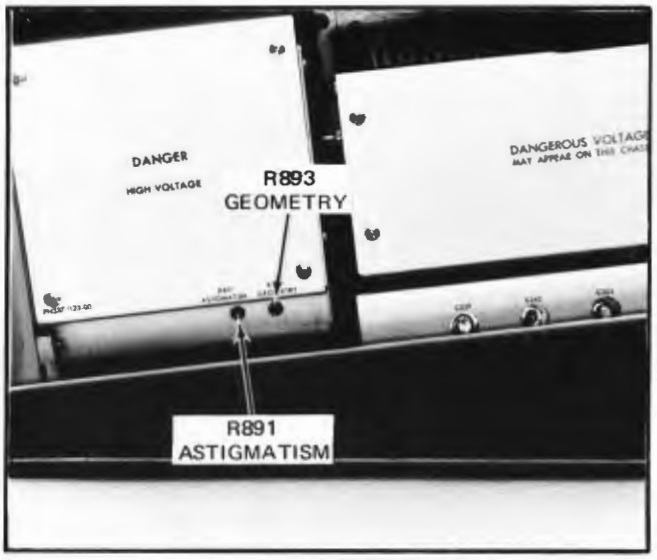


Fig. 1-3. Location of adjustments in step 4.

CAUTION

At various times throughout this procedure, a single spot will be displayed on the CRT. When displaying a single spot reduce the intensity as much as possible, while still maintaining visibility, to prevent burning of the CRT phosphor.

f. Position the spot to the center of the CRT graticule using the Type 576 FINE POSITION controls.

g. Set the Type 576 VARIABLE COLLECTOR SUPPLY control for a trace 10 divisions long.

h. Check for the trace parallel with the horizontal centerline (see Fig. 1-4).

i. ADJUST—R897, TRACE ROTATION adjustment on a chassis bracket on the right of the instrument (see Fig. 1-5) if the trace is not parallel.

j. Set the Calibration Fixture Step Generator Loads switch to 1 K Collector Short.

k. Check for trace parallel with the vertical centerline (see Fig. 1-5).

l. ADJUST—R685, ORTHOGONALITY adjustment, on the DISPLAY AMP circuit board (See Fig. 1-5) if the trace is not parallel.

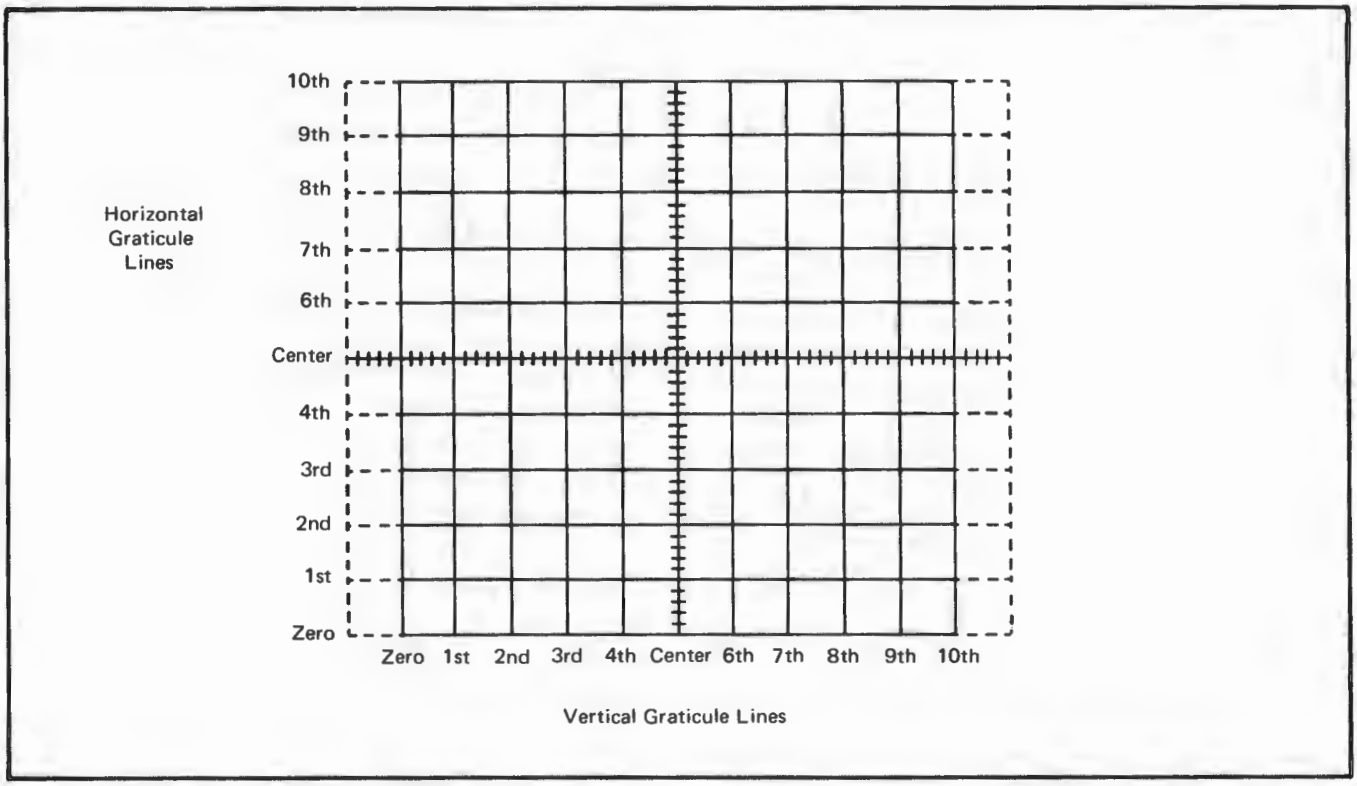


Fig. 1-4. Graticule line labels.

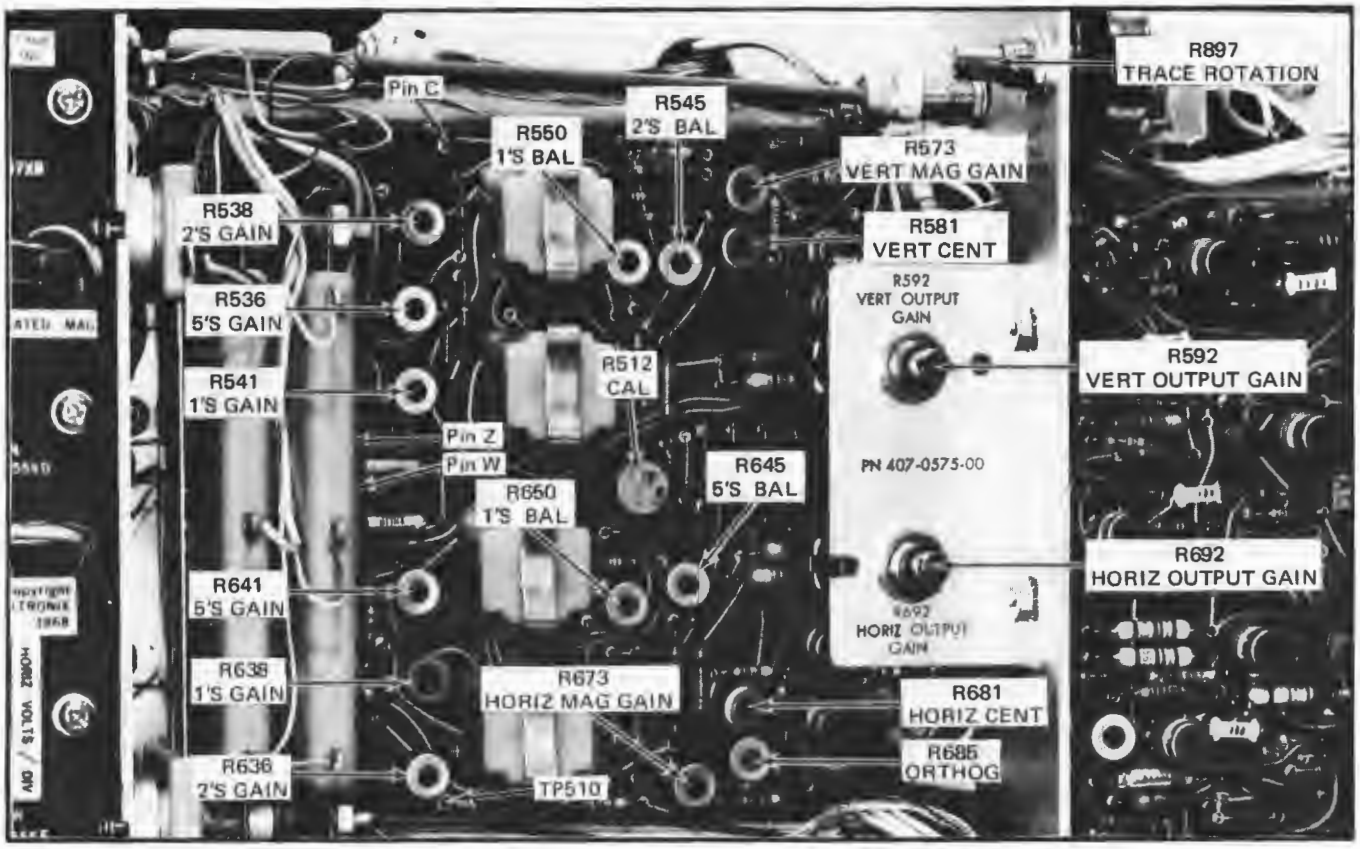


Fig. 1-5. DISPLAY AMP circuit board: Location of voltage checks and adjustments in steps 5 through 10.

m. Using the Type 576 horizontal POSITION switch, position the trace on the zero vertical graticule line of the CRT (see Fig. 1-4).

n. Check the geometry of the trace for minimum bowing.

o. Position the trace to the tenth vertical graticule line (see Fig. 1-4).

p. Repeat part n.

q. Set the horizontal POSITION switch to its center position.

r. Set the Calibration Fixture Step Gen Loads switch to OFF.

s. Using the Type 576 vertical POSITION switch, position the trace to the zero horizontal graticule line (see Fig. 1-4).

t. Repeat part n.

u. Position the trace to the tenth horizontal graticule line.

v. Repeat part n.

w. ADJUST–R893, GEOMETRY adjustment on the left of the instrument (see Fig. 1-3), for minimum bowing of trace.

x. Position the trace to the center horizontal graticule line.

y. Turn the Type 576 FOCUS control and the VARIABLE COLLECTOR SUPPLY control fully counterclockwise and recheck the adjustment of astigmatism and focus as in parts b through f.

Control Settings (Partial List)

INTENSITY	Spot Visible
VERTICAL	.5 A
DISPLAY OFFSET Selector	HORIZ X10

5. Adjust Balance of Horizontal Display Amplifier

a. Set the Type 576 and Calibration Fixture controls as shown in the list of Initial Control Settings at the beginning of the procedure with changes as shown in the preceding partial list.

b. Position the spot to the center of the graticule using the FINE POSITION controls.

c. Set the DISPLAY OFFSET Selector switch to HORIZ X1.

d. Check for the spot on vertical centerline of the CRT graticule.

e. ADJUST–R681, HORIZ CENT adjustment, on the DISPLAY AMP circuit board (see Fig. 1-5) if the spot is not centered.

f. Set the DISPLAY OFFSET selector switch to HORIZ X10 and repeat parts b through e until no movement of the spot occurs between the two settings of the DISPLAY OFFSET Selector switch.

g. Set the following Type 576 controls to:

DISPLAY OFFSET Selector	HORIZ X10
HORIZONTAL	1 V COLLECTOR

h. Check for the spot horizontally centered on the CRT graticule.

i. ADJUST–R650, 1'S BAL adjustment, on the DISPLAY AMP circuit board (see Fig. 1-5) if the spot is not centered.

j. Set the HORIZONTAL switch to .5 V COLLECTOR.

k. Check for the spot horizontally centered on the CRT graticule.

l. ADJUST–R645, 5'S BAL adjustment, on the DISPLAY AMP circuit board (see Fig. 1-5) if the spot is not centered.

m. Set the HORIZONTAL switch to 2 V COLLECTOR and re-check the adjustments made in parts a through l.

6. Adjust Balance of Vertical Display Amplifier

a. Set the DISPLAY OFFSET Selector switch to VERT X10 and position the spot to the center of the graticule using the FINE POSITION controls.

b. Set the DISPLAY OFFSET Selector switch to VERT X1.

c. Check for the spot on the horizontal centerline of the CRT graticule.

d. ADJUST–R581, VERT CENT adjustment, on the DISPLAY AMP circuit board (see Fig. 1-5) if the spot is not centered.

e. Repeat parts a through d until no movement of the spot occurs between the two settings of the DISPLAY OFFSET Selector switch.

f. Set the following Type 576 controls to:

DISPLAY OFFSET Selector	VERT X10
VERTICAL	1 A

g. Check for the spot vertically centered on the CRT graticule.

h. ADJUST–R550, 1'S BAL adjustment, on the DISPLAY AMP circuit board (see Fig. 1-5) if the spot is not centered.

i. Set the VERTICAL switch to 2 A.

j. Check for the spot vertically centered on the CRT graticule.

k. ADJUST–R545, 2'S BAL adjustment, on the DISPLAY AMP circuit board (see Fig. 1-5) if the spot is not centered.

l. Set the VERTICAL switch to .5 A and recheck the adjustments made in parts a through k.

7. Adjust Horizontal and Vertical CRT Gain

a. Set the DISPLAY OFFSET Selector switch to NORM (OFF) and the POLARITY switch to +(NPN).

b. Position the spot to the zero horizontal and vertical CRT graticule lines (see Fig. 1-4) using the FINE POSITION controls.

c. Set the POLARITY switch to –(PNP).

d. Check for the spot on the tenth horizontal and vertical CRT graticule lines ±0.1 division both horizontally and vertically.

e. ADJUST–R692, HORIZ OUTPUT GAIN adjustment, and R592, VERT OUTPUT GAIN adjustment, on a chassis bracket on the right of the instrument (see Fig. 1-5) to remove one half the error noted in part d.

f. Set the POLARITY switch to + (NPN) and repeat steps b through e until 10 divisions of horizontal and vertical deflection are obtained between the +(NPN) and –(PNP) positions of the POLARITY switch.

g. Set the POLARITY switch to AC.

8. Adjust Horizontal and Vertical Magnifier Gains

a. Set the DISPLAY OFFSET Selector switch to HORIZ X10 and position the spot on the center vertical graticule line with the horizontal FINE POSITION control.

b. Switch the CENTERLINE VALUE switch between the 4.5 and the 5.5 positions.

c. Check for the spot deflected 10 divisions horizontally, when the CENTERLINE VALUE switch is switched from 4.5 to 5.5.

d. ADJUST–R673, HORIZ MAG GAIN adjustment, on the DISPLAY AMP circuit board (see Fig. 1-5) if the spot deflection is not correct.

e. Set the DISPLAY OFFSET Selector switch to VERT X10 and the CENTERLINE VALUE switch to 5.

f. Position the spot on the center horizontal graticule line with the vertical FINE POSITION control.

g. Switch the CENTERLINE VALUE switch between the 4.5 and 5.5 positions.

h. Check for the spot deflected 10 divisions vertically when the CENTERLINE VALUE switch is switched from 4.5 to 5.5.

i. ADJUST—R573, VERT MAG GAIN adjustment, on the DISPLAY AMP circuit board (see Fig. 1-5) if the spot deflection is not correct.

9. Adjust Horizontal Display Amplifier Gains

a. Set the following Type 576 controls to:

HORIZONTAL	2 V COLLECTOR
DISPLAY OFFSET Selector	HORIZ X10
CENTERLINE VALUE	10
POLARITY	+(NPN)

b. Set the Calibration Fixture FUNCTION switch to HORIZ AMPL CAL and the Display Offset Multiplier switch to 10.

c. Press the ZERO button and center the spot horizontally on the CRT graticule using the horizontal FINE POSITION control. Release the ZERO button.

NOTE

Before making an adjustment in this step and the following one, always press the ZERO button and be sure the spot is horizontally centered (step 9) or vertically centered (step 10) on the CRT as illustrated in part c of this step.

d. Check for spot centered horizontally on the CRT graticule.

e. ADJUST—R636, 2'S GAIN adjustment, on the DISPLAY AMP circuit board (see Fig. 1-5) if the spot is not centered.

f. Press the Type 576 CAL button and check for the spot centered horizontally (on the tenth horizontal graticule line).

g. ADJUST—R512, CAL adjustment, (see Fig. 1-5) if the spot is not centered.

h. Release the Type 576 CAL button and set the HORIZONTAL switch to 1 V COLLECTOR.

i. Set the Calibration Fixture Calibrator Range switch to 100 mV.

j. Check for spot horizontally centered on the graticule.

k. ADJUST—R638, 1'S GAIN adjustment, on the DISPLAY AMP circuit board (see Fig. 1-5) if the spot is not centered.

l. Press the CAL button and check that the spot is still horizontally centered.[2]

m. Release the CAL button and set the HORIZONTAL switch to .5 V COLLECTOR.

n. Set the Calibration Fixture Calibrator Range to 50 mV.

o. Check for spot horizontally centered on the graticule.

p. ADJUST—R641, 5'S GAIN adjustment, on the DISPLAY AMP circuit board (see Fig. 1-5) if the spot is not centered.

q. Press the CAL button and check that the spot is still horizontally centered.[2]

10. Adjust Vertical Display Amplifier Gains

a. Set the following Type 576 controls to:

VERTICAL	.5 A
DISPLAY OFFSET Selector	VERT X10

b. Set the following Calibration Fixture controls to:

Function	Vert Ampl Cal
Calibration Range	125 mV

c. Press the ZERO button and position the spot vertically onto the center horizontal graticule line using the vertical FINE POSITION control. Release the ZERO button.

d. Check for spot vertically centered on the CRT graticule.

[2] If the spot is not horizontally centered on the CRT graticule, R512 is out of adjustment or the calibrator divider is out of tolerance.

e. ADJUST–R536, 5'S GAIN adjustment, on the DISPLAY AMP circuit board (see Fig. 1-5) if the spot is not centered.

f. Press the CAL button and check that the spot is still vertically centered on the graticule.[3]

g. Release the CAL button and set the VERTICAL switch to .2 A.

h. Set the Calibration Fixture Calibrator Range switch to 50 mV.

i. Check for spot vertically centered on the CRT graticule.

j. ADJUST–R538, 2'S GAIN adjustment, on the DISPLAY AMP circuit board (see Fig. 1-5) if the spot is not centered.

k. Press the CAL button and check that the spot is still vertically centered on the graticule.[3]

l. Release the CAL button and set the VERTICAL switch to .1 A.

m. Set the Calibration Fixture Calibration Range switch to 25 mV.

n. Check for spot vertically centered on the graticule.

o. ADJUST–R541, 1'S GAIN adjustment, on the DISPLAY AMP circuit board (see Fig. 1-5) if the spot is not centered.

p. Press the CAL button and check that the spot is still vertically centered on the graticule.

11. Adjust Horizontal Compensation

NOTE

This is a factory adjustment and does not require readjustment when doing a normal maintenance calibration.

[3] **If the spot is not vertically centered on the CRT graticule, R512 is out of adjustment or the calibrator divider is out of tolerance.**

a. Turn off the Type 576, remove the calibration fixture and install the Standard Test Fixture. Turn on the Type 576.

b. Install the transistor adapter (Tektronix Part No. 013-0098-00) on the Standard Test Fixture.

c. Install a NPN transistor, with a BV_{CEO} of at least 50 volts, in one of the transistor sockets on the right side of the adapter. Install the high voltage protective box on the Standard Test Fixture.

d. Set the following Type 576 controls as listed:

VERTICAL	1 mA
DISPLAY OFFSET Selector	HORIZ X10
CENTERLINE VALUE	.5
HORIZONTAL	50 V COLLECTOR
MAX PEAK VOLTS	75
MAX PEAK POWER WATTS	0.5
STEP GENERATOR AMPLITUDE	.05 μA
PULSED STEPS	300 μs
STEP FAMILY	REP
LEFT-OFF-RIGHT	RIGHT

e. Turn the VARIABLE COLLECTOR SUPPLY control and the AMPLITUDE switch clockwise until a display similar to Fig. 1-6A or B is obtained. Note that the horizontal deflection factor for this setup is 5 V/division.

f. Remove the bottom screw from the high voltage protection shield on the HORIZ VOLTS/DIV circuit board. Carefully swing the shield to the right, exposing C433.

WARNING

High voltage may appear on this capacitor. Use a nonconducting tool to make this adjustment.

g. Turn C433, HORIZ COMP adjustment, on the HORIZ VOLTS/DIV circuit board (see Fig. 1-7) throughout its range.

h. Note the tails on the spots in the display for certain positions of the control (see Fig. 1-6A).

i. ADJUST–C433 for no tails or minimum tail length on the spots (see Fig. 1-6B).

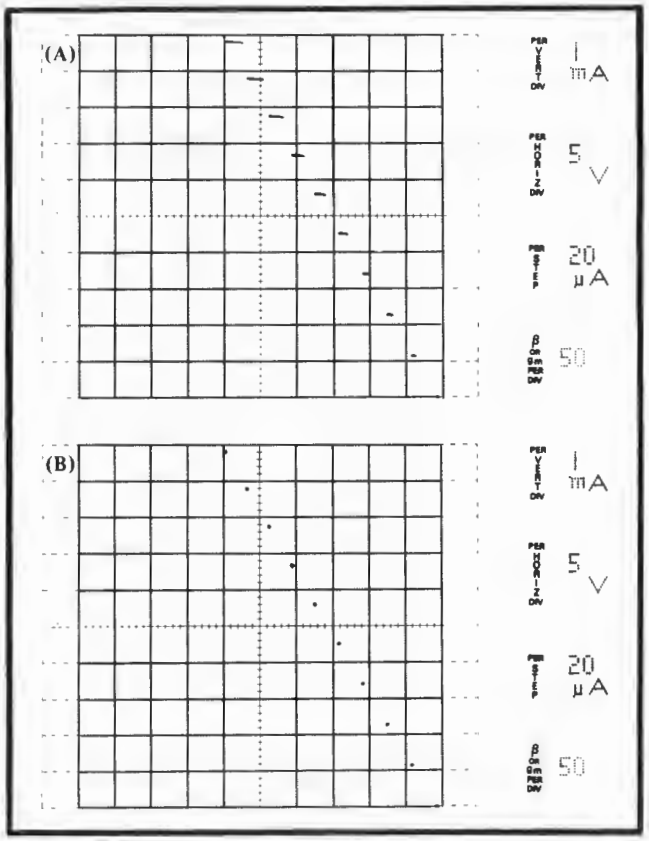


Fig. 1-6. Display for adjusting HORIZ COMP adjustment: (A) Incorrect display; (B) Correct display.

j. Turn off the Type 576 and remove the Standard Test Fixture. Install the Calibration Fixture.

k. Swing the shield back over C433 and replace the screw removed in part f. Turn on the Type 576.

Control Settings (Partial List)

Type 576

INTENSITY	Trace Visible
FOCUS	Well Defined Display
VERTICAL	STEP GEN
HORIZONTAL	.5 V COLLECTOR
VARIABLE COLLECTOR SUPPLY	80
STEP FAMILY	REP

Type 576 Calibration Fixture (067-0599-00)

Step Generator Loads	Step Gen

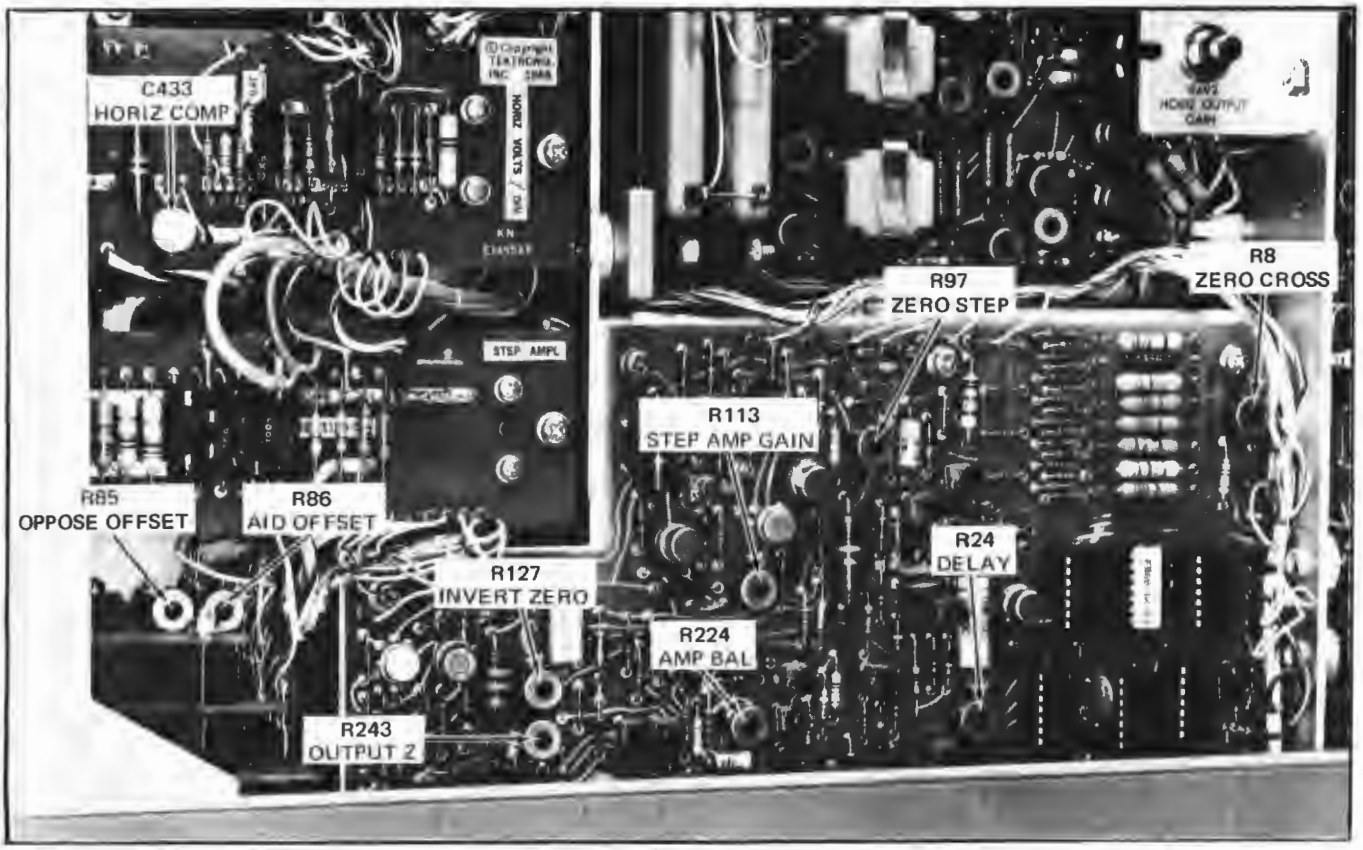


Fig. 1-7. STEP GEN, STEP GEN OFFSET and HORIZ VOLTS/DIV circuit boards: Location of adjustments in steps 11 through 15.

STEP GENERATOR

12. Adjust Zero Crossing and Step Delay

a. Set the Type 576 and Calibration Fixture controls as shown in the list of Initial Control Setting with changes as shown in the preceding partial list.

b. Press the ZERO button and center the spot horizontally using the FINE POSITION controls.

c. Check that the lines crossover at the center vertical graticule line.

d. ADJUST–R8, ZERO CROSS adjustment, on the STEP GEN circuit board (see Fig. 1-7) if the display is not correct.

e. Set the following Type 576 controls to:

DISPLAY OFFSET Selector	HORIZ X10
HORIZONTAL	2 V
POLARITY	+(NPN)
NUMBER OF STEPS	3
RATE	2X

f. Turn the CENTERLINE VALUE switch counterclockwise until the peaks of the Collector Supply output are displayed on the CRT (see Fig. 1-8A).

g. Check that the steps occur exactly at the peak of the Collector Supply output (see Fig. 1-8B).

h. ADJUST–R24, DELAY adjustment, on the STEP GEN circuit board (see Fig. 1-7) if the steps do not occur at the peak of the collector supply output.

13. Adjust Zero Step Level

a. Set the following Type 576 controls to:

CENTERLINE VALUE	0
HORIZONTAL	.05 V BASE
VARIABLE COLLECTOR SUPPLY	Fully Counterclockwise
STEP GENERATOR AMPLITUDE	.05 V
STEP FAMILY	SINGLE

b. Press the ZERO button and center the spot horizontally on the graticule using the horizontal FINE POSITION control. Release the ZERO button.

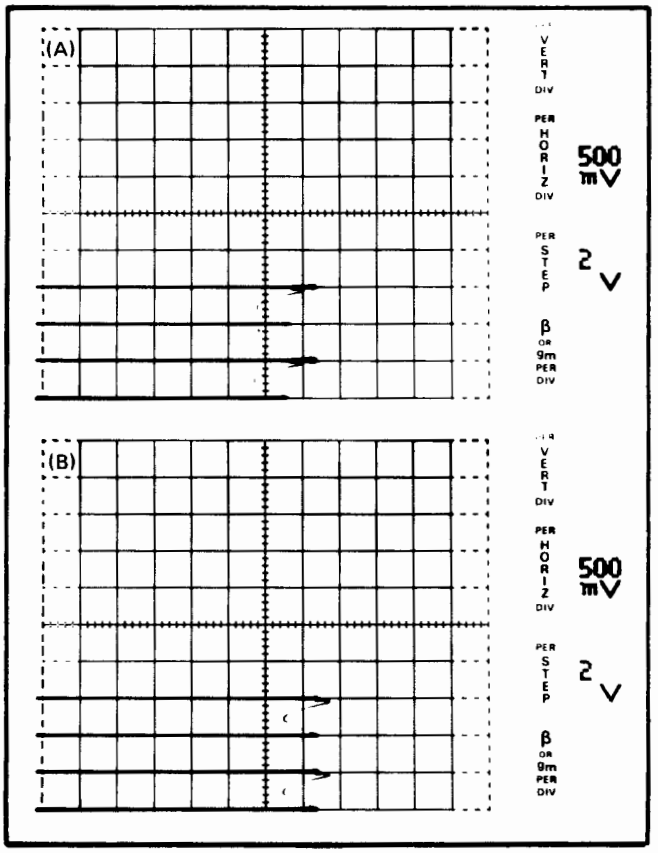


Fig. 1-8. Type 576 display of Collector Supply peaks for adjusting DELAY adjustment R24: (A) incorrect adjustment; (B) correct adjustment.

c. Check for spot horizontally centered on the CRT graticule.

d. ADJUST–R224, AMP BAL adjustment, on the STEP GEN circuit board (see Fig. 1-7) if the spot is not centered.

e. Set the Type 576 AMPLITUDE switch to 2 V.

f. Check for spot horizontally centered on the CRT graticule.

g. ADJUST–R97, ZERO STEP adjustment, on the STEP GEN circuit board (see Fig. 1-7) if the display is not centered.

h. Reset the AMPLITUDE switch to .05 V.

i. Repeat parts b through i until the spot remains centered when the AMPLITUDE switch is switched between the .05 V and the 2 V positions.

j. Set the AMPLITUDE switch to 2 V and press the POLARITY INVERT button.

k. Check for spot centered horizontally on the CRT graticule.

l. ADJUST–R127, INVERT ZERO adjustment, on the STEP GEN circuit board (see Fig. 1-7) if the spot is not centered.

14. Adjust Step Amplifier Gain

a. Set the following Type 576 controls to:

VERTICAL	2 A
CENTERLINE VALUE	10
HORIZONTAL	1 V BASE
NUMBER OF STEPS	10
AMPLITUDE	1 V
STEP FAMILY	REP
POLARITY INVERT	Released

b. Set the Calibration Fixture Step Generator switch to 1 V.

c. Press the Type 576 ZERO button and position the spot to the center vertical graticule line with the FINE POSITION controls. Release the ZERO button.

d. Check for spot on the center vertical graticule line ±2 divisions (±2%).

e. ADJUST–R113, STEP AMP GAIN adjustment, on the STEP GEN circuit board (see Fig. 1-7) if the spot is not centered.

f. Press the AID OFFSET button.

g. Check for spot on the center vertical graticule line ±2 divisions (±2%).

h. ADJUST–R86, AID OFFSET adjustment, on the STEP GEN OFFSET circuit board (see Fig. 1-7) if the spot is not centered.

i. Set the CENTERLINE VALUE switch to 0 and press the OPPOSE OFFSET button.

j. Check for spot on the center vertical graticule line ±2 divisions (±2%).

k. ADJUST–R85, OPPOSE OFFSET adjustment on the STEP GEN circuit board (see Fig. 1-7) if the spot is not centered.

15. Adjust Current Balance

a. Set the following Type 576 controls to:

VERTICAL	STEP GEN
HORIZONTAL	.1 V BASE
DISPLAY OFFSET Selector	HORIZ X1
CENTERLINE VALUE	5
AMPLITUDE	50 μA
OFFSET	ZERO

b. Set the following Calibration Fixture controls to:

Step Generator	50 μA
Step Generator Loads	1 K Collector Short

c. Position the tenth spot to the intersection of the tenth horizontal and center vertical graticule lines.

d. Set the DISPLAY OFFSET Selector switch to HORIZ X10.

e. Reposition the spot to the intersection of the tenth horizontal and center vertical graticule line.

f. Set the Calibration Fixture Step Generator Loads switch to 1 K + 18 K.

g. Check for spot centered horizontally.

h. ADJUST–R243, OUTPUT Z adjustment, on the STEP GEN circuit board (see Fig. 1-7) if the spot is not centered.

i. Turn the Step Generator Loads switch back and forth between the 1 K Collector Short and the 1 K + 18 K positions and check for no movement of the spot between the two positions.

Control Settings (Partial List)

VERTICAL	1 μA
DISPLAY OFFSET Selector	VERT X10
CENTERLINE VALUE	0.0
VARIABLE COLLECTOR SUPPLY	Fully Clockwise
POLARITY	+(NPN)
MODE	DC (ANTI LOOP)

16. Adjust Looping Compensation

a. Turn off the Type 576, remove the Type 576 Calibration Fixture and install the Standard Test Fixture. (Remove the transistor adapter from the Standard Test Fixture.) Turn on the Type 576.

b. Install the protective box on the Standard Test Fixture and close the lid.

c. Set the Type 576 controls as shown in the list of Initial Control Settings with changes as shown in the preceding partial list.

d. Check that the spot has minimum vertical width.

e. ADJUST–C301, LOOPING BALANCE ADJUSTMENT (See Fig. 1-9), and the front panel LOOPING COMPENSATION control for minimum vertical width.

f. Set the following Type 576 controls to:

HORIZONTAL	200 COLLECTOR
DISPLAY OFFSET	VERT X1
Selector	
MAX PEAK VOLTS	1500

g. Check that the spot has minimum vertical width.

h. ADJUST–C339, 350 V and 1500 V LOOPING COMPENSATION adjustment (see Fig. 1-9) for minimum vertical width.

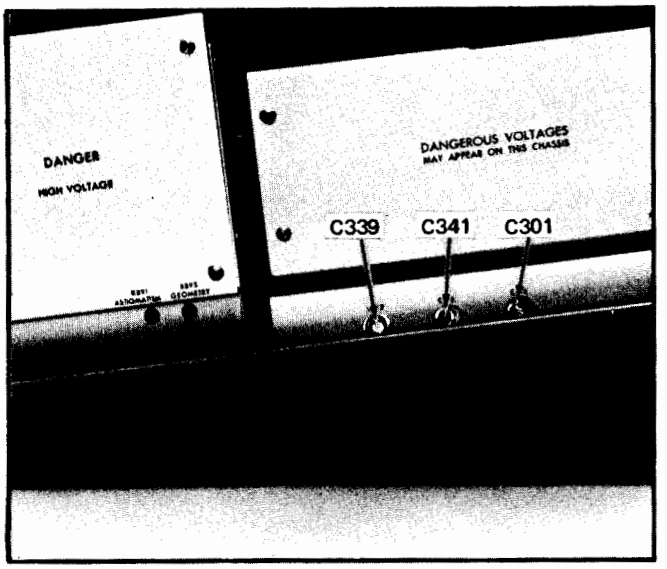


Fig. 1-9. Location of adjustments in step 16.

i. Set MAX PEAK VOLTS switch to 350 and repeat parts g and h. Set C339 for minimum vertical width between the two settings of the MAX PEAK VOLTS switch.

j. Set the MAX PEAK VOLTS switch to 1500 and the MODE switch to NORM.

k. Check for trace with minimum deviation from horizontal line at start of sweep.

l. ADJUST–C341, H. F. NOISE REJECTION adjustment (see Fig. 1-9), for minimum deviation of line. Typical setting of C341 is almost fully counterclockwise. Adjust front-panel LOOPING COMPENSATION control if necessary to get a display.

This concludes the Adjustment procedure.

PERFORMANCE CHECK PROCEDURE

General

The following procedures are arranged to allow on-line and incoming inspection performance checks of the Type 576. Using the performance check procedure and the calibration fixture, the accuracies of the display amplifiers, step generator and collector supply are checked with respect to the characteristics given in Section 1 of the Type 576 Instruction Manual. In addition, each control on the Type 576 is checked for proper operation. This performance check does not constitute a complete performance check of the Type 576 since all of the Type 576 performance characteristics are not checked. Those characteristics which do not affect the basic accuracy of the instrument and which are not conveniently checked on an on-line basis are not included in the performance check procedure. These characteristics are checked in the supplementary performance check procedure which follows the performance check procedure.

The performance check procedure provides a high level of confidence in the performance of the Type 576 and should be sufficient for most performance check requirements. The addition of the supplementary performance check procedure allows a complete performance check to be performed.

Record and Index

Table 2-1 and 2-6 at the beginning of these procedures provides a record and index of the procedures. Each table may be used as a check list to verify checks, an abridged guide for an experienced calibrator, or an index of individual checks.

Control Settings

A complete list of initial control settings for the Type 576 and significant control settings for the test instruments precedes step 1 of each procedure. In addition, partial lists of control settings are provided in various places throughout the procedures. Any control setting not listed in a partial list should be set as designated in the initial list of control settings.

PERFORMANCE CHECK PROCEDURE

Equipment List

The following equipment list gives the equipment required to use the following procedure. The required ranges and tolerances of this equipment along with some suggested instrument types are also provided. To allow accurate measurement, the required tolerances given for each piece of equipment have been chosen to exceed the tolerance to be measured by at least 4 times. For tolerances to be measured to less than 1%, the accuracy of the equipment has been chosen to exceed the tolerance by at least 10 times.

TABLE 2-1

Performance Check Record and Index

Step No.	Title	Req'd Previous Steps	Page
1	Check CRT and Readout Controls		2-2
2	Check Horizontal and Vertical Positioning and INVERT Button		2-3
3	Check Display Offset and CAL Button		2-3
4	Check Horizontal Display Accuracy	3	2-4
5	Check Vertical Display Accuracy	3	2-4
6	Check Miscellaneous Step Generator Controls		2-5
7	Check Step Generator and Offset Multiplier Accuracy	3, 4, 5	2-6
8	Check Collector Supply Polarity, Peak Voltage and Ripple	3, 4, 5	2-7
9	Check Collector Supply Minimum Peak Currents	3, 4, 5	2-8
10	Check and Adjust LOOPING COMPENSATION Control		2-8

1. Type 576 Calibration Fixture (Tektronix Part No. 067-0599-00).

2. DC Voltmeter (e.g., Fluke Model 801B differential voltmeter or suitable digital voltmeter). Requirements: Voltage range from 0 volts to ±15 volts, accuracy within 0.5%, input impedance at least 500 MΩ.

3. Two 12 inch patch cords with standard banana plugs.

4. BNC male to dual binding post adapter. Tektronix Part No. 103-0035-00.

Preliminary Performance Check Procedure

1. Set the Line Voltage Selector assembly switches and the 60 Hz-50 Hz switch on the Type 576 rear panel in accordance with the line voltage source to be used.

2. Remove the Standard Test Fixture from the Type 576 and install the Calibration Fixture.

3. Connect the Type 576 to the line voltage source.

4. Turn on the Type 576. Allow at least 5 minutes warm-up at an ambient temperature between 0°C and +50°C (+32°F and +122°F) before making any checks.

5. Set the controls as shown at the beginning of the procedure and start the performance check procedure with step 1.

Initial Control Settings

Type 576

GRATICULE ILLUM	Graticule Lines Visible
READOUT ILLUM	Readout Visible
INTENSITY	Fully Counterclockwise
FOCUS	Centered
VERTICAL	.5 A
DISPLAY OFFSET Selector	NORM (OFF)
CENTERLINE VALUE	0
HORIZONTAL	2 V COLLECTOR
POSITION (Vertical and Horizontal)	Control Centered
FINE POSITION (Vertical and Horizontal)	Control Centered
ZERO	Released
CAL	Released
DISPLAY INVERT	Released
MAX PEAK VOLTS	15
PEAK POWER WATTS	220
VARIABLE COLLECTOR SUPPLY	Fully Counterclockwise
POLARITY	AC
MODE	NORM
LOOPING COMPENSATION	As is
NUMBER OF STEPS	10
CURRENT LIMIT	2 A
STEP GENERATOR AMPLITUDE	2 V
OFFSET	ZERO
STEPS	Pressed
PULSED STEPS	Released
STEP FAMILY	SINGLE
RATE	NORM
POLARITY INVERT	Released
STEP MULT .1X	Released
LEFT-OFF-RIGHT	OFF
Terminal Selector	BASE TERM STEP GEN

Type 576 Calibration Fixture (067-0599-00)

Function	Step Gen
Calibration Range	200 mV Cal
Vertical	10 A (fully counter-clockwise)
Display Offset Multiplier	0
Horizontal	.5 Collector
Step Generator	.05 μA
Step Generator Loads	Off

CRT AND READOUT

1. Check CRT and Readout Controls

a. Turn the Type 576 GRATICULE ILLUM control throughout its range.

b. CHECK FOR—Continuous increase in graticule illumination when the control is turned from fully counter-clockwise to fully clockwise.

c. Set the GRATICULE ILLUM control for visible graticule lines.

d. Turn the READOUT ILLUM control throughout its range.

e. CHECK FOR—Continuous increase in the readout illumination when the control is turned from fully counter-clockwise to fully clockwise.

f. Set the READOUT ILLUM control for a visible readout.

g. Turn the INTENSITY control throughout its range. Maintain an overly bright spot only momentarily.

h. CHECK FOR—Continuous increase in the brightness of the spot when the control is turned from fully counterclockwise to fully clockwise.

i. Set the INTENSITY control for a visible spot.

CAUTION

At various times throughout this procedure, a single spot will be displayed on the CRT. When displaying a single spot, reduce the intensity as much as possible while still maintaining visibility, to prevent burning of the CRT phosphor.

j. Turn the FOCUS control throughout its range.

k. CHECK FOR—Spot in focus in the center range of the control.

l. Set the FOCUS control for the smallest possible spot.

DISPLAY AMPLIFIERS

2. Check Horizontal and Vertical Positioning and INVERT Button

a. Turn the horizontal FINE POSITION control throughout its range.

b. CHECK FOR—Spot moving at least ±2.5 divisions horizontally about the center vertical graticule line (see Fig. 1-4 in Section 1 of this booklet).

c. Turn the vertical FINE POSITION control throughout its range.

d. CHECK FOR—Spot moving at least ±2.5 divisions vertically about the center horizontal graticule line.

e. Press ZERO button and center the spot on the graticule using the FINE POSITION controls.

f. Set the POLARITY switch to +(NPN).

g. CHECK FOR—Spot located at the intersection of the zero horizontal and vertical graticule lines ±0.1 division.

h. Set the POLARITY switch to −(PNP).

i. CHECK FOR—Spot located at the intersection of the tenth horizontal and vertical graticule lines ±0.1 division.

j. Press the Type 576 DISPLAY INVERT button.

k. CHECK FOR—Spot located at the intersection of the zero horizontal and vertical graticule lines.

l. Release the DISPLAY INVERT button and switch the horizontal POSITION switch to both counterclockwise positions.

m. CHECK FOR—Spot moving 5 divisions to the left ±0.1 division each time the switch is switched one position.

n. Switch the vertical POSITION switch to both counterclockwise positions.

o. CHECK FOR—Spot moving 5 divisions down ±0.1 division each time the switch is switched one position.

p. Set the following Type 576 controls as listed:

POSITION (Horizontal and Vertical)	Centered
POLARITY	+(NPN)

q. Switch the horizontal POSITION switch to both clockwise positions.

r. CHECK FOR—Spot moving 5 divisions to the right ±0.1 division each time the switch is switched one position.

s. Switch the vertical POSITION switch to both clockwise positions.

t. CHECK FOR—Spot moving 5 divisions up ±0.1 division each time the switch is switched one position.

3. Check Display Offset and Cal Button

a. Set the following Type 576 controls as listed:

DISPLAY OFFSET Selector	HORIZ X10
POSITION (Horiz. and Vert.)	Centered

b. Set the Calibration Fixture Function switch to Horiz Ampl Cal.

c. Press the ZERO button and center the spot horizontally on the CRT graticule. Release the ZERO button.

d. Turn the Type 576 CENTERLINE VALUE switch and the Calibration Fixture Display Offset Multiplier switch, together, throughout their ranges.

e. CHECK FOR—Spot centered horizontally for each position of the CENTERLINE VALUE switch ±0.25 division.

f. When the CENTERLINE VALUE switch is set to 10, press the ZERO button and be sure the spot is centered horizontally.

TABLE 2-2

Check CAL Button Accuracy

Type 576		Calibration Fixture
Horizontal	VERTICAL	Calibrator Range
2 V		200 mV
1 V		100 mV
.5 V		50 mV
	.5 A	125 mV
	.2 A	50 mV
	.1 A	25 mV

g. Set the Type 576 HORIZONTAL switch and the Calibration Fixture Calibration Range switch as shown in Table 2-2. For each setting of the HORIZONTAL switch note the position of the spot horizontally, then press the CAL button.

h. CHECK FOR—Spot within ±0.5 division, horizontally, of the position noted in part g.

i. Set the Type 576 DISPLAY OFFSET Selector switch to VERT X10.

j. Set the Calibration Fixture Function switch to Vert Ampl Cal.

k. Press the ZERO button and center the spot vertically.

l. Set the Type 576 VERTICAL switch and the Calibration Fixture Calibrator Range switch as shown in Table 2-2. For each setting of the VERTICAL switch note the position of the spot vertically, then press the CAL button.

m. CHECK FOR—Spot within ±0.5 division, vertically, of the position noted in part l.

4. Check Horizontal Display Accuracy

a. Set the following Type 576 controls to:

HORIZONTAL	.05 COLLECTOR
DISPLAY OFFSET Selector	HORIZ X10
MAX PEAK VOLTS	1500
MODE	DC
STEP FAMILY	REP

b. Set the Calibration Fixture Function switch to Horiz Atten Check.

c. Press the ZERO button and position the spot to the vertical centerline of the CRT graticule. Release the ZERO button.

d. Turn the VARIABLE COLLECTOR SUPPLY control fully clockwise.

e. CHECK FOR—Spot on center vertical graticule line ±2 divisions (±2%).

f. Turn the Type 576 HORIZONTAL switch and the Calibration Fixture Horizontal switch together throughout their ranges.

g. CHECK FOR—Spot on the center vertical graticule line ±2 divisions (±2%) for each position of the HORIZONTAL switch except the STEP GEN position and the 200 COLLECTOR position. In the 200 COLLECTOR position, set the Type 576 CENTERLINE VALUE switch to 5. In the STEP GEN position, set the Type 576 DISPLAY OFFSET Selector switch to NORM (OFF). In this case 11 spots should be displayed horizontally, with the first spot on the zero vertical line and the eleventh spot on the tenth vertical graticule line ±0.4 division (±4%). Note: the horizontal base input impedance is automatically checked by this procedure.

5. Check Vertical Display Accuracy

a. Set the following Type 576 controls as listed:

VERTICAL	2 A
DISPLAY OFFSET Selector	VERT X10
CENTERLINE VALUE	5
HORIZONTAL	200 COLLECTOR
VARIABLE COLLECTOR SUPPLY	Fully Counterclockwise
MAX PEAK VOLTS	15
PULSED STEPS	300 μs
STEP FAMILY	SINGLE

b. Set the Calibration Fixture Function switch to Vertical Current Check.

c. Press the ZERO button and position the spot on the center horizontal line. Release the ZERO button.

d. Turn the VARIABLE COLLECTOR SUPPLY control fully clockwise.

e. CHECK FOR—Spot on the center horizontal graticule line ±2 divisions (±2%).

f. Set the Type 576 CENTERLINE VALUE switch to 10.

g. Turn the Type 576 VERTICAL switch and the Calibration Fixture Vertical switch, together, throughout their ranges.

h. CHECK FOR—Spot on center horizontal graticule line ±2 divisions (±2%) for all positions of the VERTICAL switch. On high sensitivity positions, adjust the intensity until 2 spots appear. Then, momentarily turn the VARIABLE COLLECTOR SUPPLY control counterclockwise to obtain a single spot.

i. Set the following Type 576 controls as listed:

VERTICAL	5 μA EMITTER LEAKAGE (EMITTER CURRENT)
MODE	
STEPS	Pressed

j. Set the Calibration Fixture Vertical control to 50 μA.

k. Turn the Type 576 VERTICAL switch and the Calibration Fixture Vertical switch, together clockwise throughout their ranges.

l. CHECK FOR—Spot on center horizontal graticule line ±2 divisions ±1 nA (±2% ±1 nA) for all positions of the Type 576 VERTICAL switch except the 1 nA, 2 nA and 5 nA positions. In these positions set the DISPLAY OFFSET Selector switch to NORM (OFF) and check that the spot is on the tenth horizontal graticule line ±0.5 division ±1 nA (±5% ±1 nA).

m. Set the following Type 576 controls to:

VERTICAL	STEP GEN
VARIABLE COLLECTOR SUPPLY	Fully Counterclockwise
MODE	NORM
STEP FAMILY	REP

n. CHECK FOR—11 spots displayed vertically with the first spot on the zero horizontal graticule line and the eleventh on the tenth horizontal graticule line ±0.4 division (±4%).

Control Settings (Partial List)

Type 576

INTENSITY	Visible Spot
FOCUS	Smallest Spot Possible
VERTICAL	STEP GEN
POLARITY	+(NPN)
OFFSET MULT	10.0
STEP FAMILY	REP

6. Check Miscellaneous Step Generator Buttons

a. Set the Type 576 and Calibration Fixture controls as shown in the list of Initial Control Settings with changes as shown in the preceding partial list.

b. Turn the NUMBER OF STEPS switch counterclockwise throughout its range.

c. CHECK FOR—Number of spots decreasing by one for each position of the switch. At one step there should be 2 spots.

d. Turn the vertical POSITION switch two positions clockwise and press the POLARITY INVERT button. Turn the NUMBER OF STEPS switch clockwise throughout its range.

e. CHECK FOR—Inverted step generator output with zero step on tenth horizontal graticule line.

f. Set the following Type 576 controls as listed:

Vertical POSITION	Centered
POLARITY INVERT	Released
RATE	.5X

g. Note the rate at which steps are being generated then press the NORM RATE and 2X RATE buttons.

h. CHECK FOR—rate of step generation increasing when the NORM RATE button is pressed then increasing again when the 2X RATE button is pressed.

i. Press the SINGLE STEP FAMILY button. Press it again.

j. CHECK FOR—One Step family generated each time the SINGLE STEP FAMILY button is pressed.

7. Check Step Generator and Offset Multiplier Accuracy

a. Set the following Type 576 controls to:

VERTICAL	2 A
DISPLAY OFFSET Selector	HORIZ X10
HORIZONTAL	1 V BASE
STEP GENERATOR	1 V
STEP FAMILY	REP
RATE	NORM

b. Set the Calibration Fixture Step Generator Loads switch to Step Gen and the Step Generator switch to 1 V.

c. Press the ZERO button and position the spot onto the center horizontal graticule line.

d. Release the ZERO button.

e. CHECK FOR—Spot on the center horizontal graticule line ±0.1 division (1% of 1 volt).

NOTE

The Type 576 vertical, horizontal and display offset must be calibrated to perform the following checks.

f. Turn the CENTERLINE VALUE switch throughout its range, two positions at a time.

g. CHECK FOR—A spot in same position horizontally on the CRT each time the CENTERLINE VALUE switch is switched two positions ±0.5 division (5% of 1 volt).

h. Set the CENTERLINE VALUE switch to 10.

i. CHECK FOR—Spot on the center vertical line ±2 divisions (±2% of total output).

j. Press the AID OFFSET button.

k. CHECK FOR—Spot on the center vertical line ±2 divisions (±2%).

l. Turn the OFFSET MULT control counterclockwise throughout its range. For each complete revolution of the OFFSET MULT control, turn the CENTERLINE VALUE switch clockwise two positions.

m. CHECK FOR—Spot on the center vertical line for each revolution of the OFFSET MULT control.

n. Set the Type 576 OFFSET MULT control to 10.00 and press the OPPOSE OFFSET button.

o. CHECK FOR—Spot on center vertical graticule line ±2 divisions (±2%).

p. Set the following Type 576 controls to:

HORIZONTAL	.1 V BASE
OFFSET	ZERO
STEP MULT .1X	Pressed

q. Repeat parts c through f.

r. CHECK FOR—A spot in the same position horizontally on the CRT each time the CENTERLINE VALUE switch is switched two positions ±1 division (10% of 0.1 volt).

s. Set the CENTERLINE VALUE switch to 10.

t. CHECK FOR—Spot on the center vertical line ±2 divisions (2% of total output).

u. Set the following Type 576 controls to:

HORIZONTAL	200 COLLECTOR
AMPLITUDE	2 V
OFFSET	AID
STEP MULT .1X	Released
STEP FAMILY	SINGLE

v. Set the Calibration Fixture Step Generator switch to 2 V.

w. Set the DC voltmeter to measure 10 volts ±0.2 volt.

x. Connect the male BNC to dual binding post adapter to the Calibration Fixture External Monitor connector.

y. Connect the patch cords between the dual binding posts and the DC voltmeter.

z. CHECK FOR—DC voltmeter reading of 10 volts ±0.2 volts (10 V ±2%).

aa. Turn the Type 576 AMPLITUDE switch and the Calibration Fixture Step Generator switch together throughout their ranges.

bb. CHECK FOR—DC voltmeter reading of 10 volts ±0.2 volts (10 V ±2%) for each setting of the Type 576 AMPLITUDE switch.

cc. Disconnect the DC voltmeter from the calibration fixture.

Control Settings (Partial List)

Type 576

INTENSITY	Visible Spot
FOCUS	Smallest Spot Possible
VERTICAL	20 mA

8. Check Collector Supply Polarity, Peak Voltage and Ripple

a. Set the Type 576 and Calibration Fixture controls as shown in the list of Initial Control Settings at the beginning of the procedure, with changes as shown in the preceding partial list.

b. Press the ZERO button and position the spot to the center of the CRT graticule.

c. Turn the VARIABLE COLLECTOR SUPPLY control clockwise to obtain a 10 division trace.

d. CHECK FOR—Horizontal trace extending out from both sides of the center vertical graticule line.

e. Set the POLARITY switch to −(PNP) and turn the VARIABLE COLLECTOR SUPPLY fully clockwise.

f. CHECK FOR—Horizontal trace extending to the left from the tenth vertical graticule line (along top of the graticule).

g. Set the POLARITY switch to +(NPN).

h. CHECK FOR—Horizontal trace extending to the right from the zero vertical graticule line (along bottom of the graticule).

i. Set the MODE switch to DC.

j. Set the HORIZONTAL switch and MAX PEAK VOLTS as shown in Table 2-3. For each setting of these switches, perform the following procedure:

1. CHECK FOR—Spot displaced from zero vertical graticule line as shown in Table 2-3 under peak volts.

2. Set the DISPLAY OFFSET Selector switch to HORIZ X10.

3. Position the spot onto the CRT with the CENTERLINE VALUE switch.

4. CHECK FOR—Width of spot no greater than shown in Table 2-3 under DC ripple.

TABLE 2-3

Check Collector Supply Peak Voltage and DC Ripple

Switch Settings		Peak Voltages		DC Ripple (Peak-to-Peak)	
HORIZONTAL	MAX PEAK VOLTS	Voltage	Divisions	Voltage	Divisions
2 V	15 V	15 V +35%, −5%	7.5 div +2.6 div, −0.37 div	2% of 15 V	1.5 div
10 V	75 V	75 V +35%, −5%	7.5 div +2.6 div, −0.37 div	2% of 75 V	1.5 div
50 V	350 V	350 V +35%, −5%	7 div +2.4 div, −0.35 div	2% of 350 V	1.4 div
200 V	1500 V	1500 V +35%, −5%	7.5 div +2.6 div, −0.35 div	2% of 1500 V	1.5 div

5. Set DISPLAY OFFSET Selector switch to NORM (OFF) and the HORIZONTAL and the MAX PEAK VOLTS switches to the next positions shown in Table 2-3. (Always set HORIZONTAL switch first to avoid damage to horizontal amplifier.)

6. Repeat parts 1 through 5.

k. Set the following Type 576 controls to:

DISPLAY OFFSET Selector	NORM (OFF)
MODE	NORM
VARIABLE COLLECTOR SUPPLY	Fully counterclockwise

9. Check Collector Supply Minimum Peak Currents

a. Set the Calibration Fixture Step Generator Loads switch to 1 k Collector Short.

b. Press the ZERO button and position the spot on the zero horizontal graticule line. Release the ZERO button.

c. Set the Type 576 VERTICAL and MAX PEAK VOLTS switches as shown in Table 2-4. (Always set the VERTICAL switch first to avoid damage to the vertical amplifer.)

TABLE 2-4

Check Collector Supply Peak Current

VERTICAL	MAX PEAK VOLTS	Minimum Peak Currents
20 mA	1500	10 divisions (200 mA)
.1 A	350	10 divisions (1 A)
.5 A	75	8 divisions (4 A)
2 A	15	10 divisions (20 A)

d. For each setting of the MAX PEAK VOLTS switch, turn the VARIABLE COLLECTOR SUPPLY control clockwise until the minimum peak current shown in Table 2-4 is reached, then return the VARIABLE COLLECTOR SUPPLY control to its fully counterclockwise position.

CAUTION

Do not exceed the rating of the collector supply as shown in Table 2-4. Return the VARIABLE COLLECTOR SUPPLY control to its fully counterclockwise position as soon as the given current has been obtained.

e. CHECK FOR—Minimum peak current values as shown in Table 2-4 under Minimum Peak Current.

10. Check and Adjust LOOPING COMPENSATION Control

a. Turn off the Type 576, remove the Calibration Fixture and install the Standard Test Fixture. Turn on the Type 576. Install the protective box on the Standard Test Fixture and close the lid.

b. Set the VERTICAL switch to 1 μA and the vertical POSITION switch one position clockwise.

c. Set the MAX PEAK VOLTS switch and HORIZONTAL switch as shown in Table 2-5. (Always set MAX PEAK VOLTS switch first to avoid damage to horizontal amplifier.) Turn the VARIABLE COLLECTOR SUPPLY fully clockwise.

TABLE 2-5

Check LOOPING COMPENSATION Control

MAX PEAK VOLTS	HORIZONTAL
1500	200 V COLLECTOR
350	50 V COLLECTOR
75	10 V COLLECTOR
15	2 V COLLECTOR

d. For each setting of the MAX PEAK VOLTS switch, turn the LOOPING COMPENSATION control throughout its range.

e. CHECK FOR—Looping passing through zero for each setting of the MAX PEAK VOLTS switch.

f. Set the MODE switch to DC.

g. ADJUST—LOOPING COMPENSATION control for minimum vertical width.

This concludes the performance check procedure.

SUPPLEMENTARY PERFORMANCE CHECK PROCEDURE

General

This procedure provides a method of checking those electrical characteristics not checked in the Performance Check procedure. It is expected that this procedure will be used when it is desired to perform a complete performance check of the instrument. The procedure may be used as a continuation of the performance check procedure, or as a separate procedure.

Instructions for using the Record and Index, Table 2-6, and for setting controls, are given at the beginning of this section.

Equipment Required

The following equipment and electrical components are required to perform this procedure.

1. Test Oscilloscope—See the description in item 4 of the Equipment Required list for the adjustment procedure (X1 probe not required).

2. 10 MΩ resistor, 1/4 watt, 5%; 1 MΩ resistor, 1/4 watt, 5%.

3. Two 12 inch patch cords with standard banana plugs.

4. BNC male to dual binding post adapter. See item 5 of the Equipment Required list for the performance check procedure.

TABLE 2-6

Supplememtary Performance Check Record and Index

Step No.	Title	Page
1	Check Readout	2-10
2	Check Horizontal and Vertical Displayed Noise	
3	Check Step Generator Limits—Current Mode	2-11
4	Check Step Generator Limits—Voltage Mode	2-11
5	Check Pulsed Steps Width	2-12
6	Check Step Generator Ripple	2-13

Preliminary Supplementary Performance Check Procedure

1. If this procedure is being performed following the performance check procedure, go to step 5.

2. Set the Line Voltage Selector assembly switches and the 60 Hz-50 Hz switch on the Type 576 rear panel in accordance with the line voltage source to be used.

3. Connect the Type 576 to the line voltage source.

4. Turn on the Type 576 and allow at least 5 minutes warmup at an ambient temperature between 0°C and +50°C (+32°F and +122°F) before making any checks.

5. Set the controls as shown at the beginning of the procedure and start the supplementary performance check procedure with step 1.

Initial Control Settings

	Type 576
GRATICULE ILLUM	Graticule Lines Visible
READOUT ILLUM	Readout Visible
INTENSITY	Spot Visible
FOCUS	Well Defined Spot
VERTICAL	1 μA COLLECTOR
DISPLAY OFFSET Selector	NORM (OFF)
CENTERLINE VALUE	5
HORIZONTAL	.05 V COLLECTOR
POSITION (Vertical and Horizontal	Control Centered
FINE POSITION (Vertical and Horizontal	Control Centered
ZERO	Released
CAL	Released
DISPLAY INVERT	Released
MAX PEAK VOLTS	15
PEAK POWER WATTS	50
VARIABLE COLLECTOR SUPPLY	Fully Counterclockwise
POLARITY	AC
MODE	NORM
LOOPING COMPENSATION	As is
NUMBER OF STEPS	10
CURRENT LIMIT	2 A
STEP GENERATOR AMPLITUDE	2 V
OFFSET	ZERO
OFFSET MULT	10.00 (fully counter-clockwise)
STEPS	Pressed
PULSED STEPS	Released
STEP FAMILY	SINGLE

RATE	NORM
POLARITY INVERT	Released
STEP MULT .1X	Released
LEFT-OFF-RIGHT	OFF
Terminal Selector	BASE TERM STEP GEN

Test Oscilloscope

Time/Div	50 μA/DIV
Triggering	Internally Triggered on + slope
Volts/Div	.5 V/div
Input Coupling	DC
Position	Display Centered

1. Check Readout

a. Turn the Type 576 VERTICAL switch throughout its range.

b. CHECK FOR–PER VERT DIV readout coinciding with the settings of the VERTICAL switch, using COLLECTOR current units. (The readout should always be blank for the STEP GEN position of the switch.)

c. Set the Type 576 DISPLAY OFFSET Selector switch to VERT X10 and turn the VERTICAL switch throughout its range.

d. CHECK FOR–PER VERT DIV readout of 10 times less than the settings of the VERTICAL switch, using COLLECTOR current units.

e. Set the Type 576 MODE switch to LEAKAGE and the DISPLAY OFFSET Selector switch to NORM (OFF).

f. Turn the VERTICAL switch throughout its range.

g. CHECK FOR–PER VERT DIV readout coinciding with settings of the VERTICAL switch, using EMITTER current units.

h. Set the DISPLAY OFFSET Selector switch to VERT X10 and turn the VERTICAL switch throughout its range.

i. CHECK FOR–PER VERT DIV readout of 10 times less than the settings of the VERTICAL switch using EMITTER current units. (Readout should be blank for 1 nA, 2 nA and 5 nA settings of VERTICAL switch.)

j. Set the DISPLAY OFFSET Selector switch to NORM (OFF) and turn the HORIZONTAL switch throughout its range.

k. CHECK FOR–PER HORIZ DIV readout coinciding with the settings of the HORIZONTAL switch. (The readout should be blank for the STEP GEN position of the switch.)

l. Set the DISPLAY OFFSET Selector switch to HORIZ X10 and turn the HORIZONTAL switch throughout its range.

m. CHECK FOR–PER HORIZ DIV readout of 10 times less than the settings of the HORIZONTAL switch.

n. Turn the Type 576 AMPLITUDE switch throughout its range.

o. CHECK FOR–PER STEP readout coinciding with the settings of the AMPLITUDE switch.

p. Press the Type 576 STEP MULT .1X button and turn the AMPLITUDE switch throughout its range.

q. CHECK FOR–PER STEP readout 10 times less than the settings of the AMPLITUDE switch.

r. Set the MODE switch to NORM and release the STEP MULT .1X button.

NOTE

Checking all the positions of the VERTICAL and AMPLITUDE switches which provide a β OR g_m PER DIV readout is a complicated, time-consuming job. The following procedure checks only that all the β OR g_m PER DIV fiber-optics will light up.

s. Set the VERTICAL and AMPLITUDE switches for displayed readout as shown in Table 2-7.

TABLE 2-7

Check β OR g_m PER DIV Readout

PER VERT DIV	PER STEP	β OR g_m PER DIV
200 μA	2 V	100 μ
200 μA	100 mV	2 m
200 μA	50 nA	4 k
500 μA	100 nA	5 k
500 μA	200 nA	2.5 k
500 μA	1 μA	500

t. CHECK FOR—β OR g_m PER DIV readout coinciding with the third column of Table 2-7.

2. Check Horizontal and Vertical Displayed Noise

a. Set the following Type 576 controls as listed:

VERTICAL	1 μA COLLECTOR
HORIZONTAL	.05 V COLLECTOR

b. Install the protective box on the Standard Test Fixture and close the lid.

c. Turn the Type 576 MAX PEAK VOLTS switch throughout its range. (Be sure the CENTERLINE VALUE switch is set to 5.)

d. CHECK FOR—Horizontal width of spot no greater than indicated in Table 2-8 for Horizontal Collector Volts, for each position of the MAX PEAK VOLTS switch.

e. Set the HORIZONTAL switch to .05 BASE. Lift the lid of the protective box and install a 1 MΩ resistor between the base and emitter jacks (right side). Close the lid of the protective box and set the LEFT-OFF-RIGHT switch to RIGHT.

f. Repeat parts c and d, using the Horizontal Base Volts values from Table 2-8.

g. Set the LEFT-OFF-RIGHT switch to off and remove the 1 MΩ resistor.

h. Set the following Type 576 controls to:

HORIZONTAL	200 COLLECTOR
DISPLAY OFFSET Selector	NORM (OFF)
POSITION (Vertical)	1 position clockwise
POLARITY	+(NPN)
VARIABLE COLLECTOR SUPPLY	Fully clockwise

i. Turn the Type 576 MAX PEAK VOLTS switch throughout its range.

NOTE

The LOOPING COMPENSATION control will affect this check. Adjust it for minimum looping.

j. CHECK FOR—Vertical width of display no greater than indicated in Table 2-8 for Vertical Collector Current, for each position of the MAX PEAK VOLTS switch.

k. Set the MODE switch to LEAKAGE (EMITTER CURRENT).

l. Repeat parts i and j using Vertical Emitter Current values from Table 2-8.

m. Remove the protective box.

TABLE 2-8

Check Horizontal and Vertical Displayed Noise

Horizontal or Vertical Range	MAX PEAK VOLTS Switch			
	15	75	350	1500
Horizontal				
Collector Volts	1 div	1 div	4 div	40 div
Base Volts	1 div	1 div	1 div	1 div
Vertical				
Collector Current	1 div	1 div	2 div	5 div
Emitter Current	1 div	1 div	2 div	5 div

3. Step Generator Limits—Current Mode

a. Set the following Type 576 controls as listed:

VERTICAL	1 A COLLECTOR
HORIZONTAL	10 V COLLECTOR
POSITION (Vertical)	Centered
MAX PEAK VOLTS	15
VARIABLE COLLECTOR SUPPLY	Fully Counterclockwise
POLARITY	AC
MODE	NORM
STEP GENERATOR AMPLITUDE	100 mA
OFFSET	AID
STEP FAMILY	REP

b. Connect a patch cord with banana plugs between the base and collector jacks (right side) of the Standard Test Fixture. Set the LEFT-OFF-RIGHT switch to RIGHT.

c. Press the ZERO button and position the spot to the center of the CRT graticule. Release the ZERO button.

d. CHECK FOR—Lowest spot in the display at least 1.5 divisions below the center horizontal graticule line (at least 1.5 A).

e. Press the POLARITY INVERT button.

f. CHECK FOR—Highest spot in the display at least 1 division above the center horizontal graticule line (at least 1.5 A).

g. Release the POLARITY INVERT button.

NOTE

For the remainder of this step and for step 4, make each check with the POLARITY INVERT button both pressed and released. The display with the button pressed in each case will be inverted about the center of the CRT as is illustrated in parts d through g preceding this note.

h. Set the STEP GENERATOR AMPLITUDE switch to 200 mA.

i. CHECK FOR—Lowest spot in the display at least 2 divisions below the center horizontal graticule line (at least 2 A).

j. Set the VERTICAL switch to 10 mA and press the OPPOSE OFFSET button.

k. CHECK FOR—Highest spot in the display between 1 and 2 divisions above the center horizontal graticule line (between 10 mA and 20 mA).

l. Set the following Type 576 controls as listed:

VERTICAL	2 A
SERIES RESISTORS	65 k
STEP GENERATOR AMPLITUDE	50 μA
OFFSET	AID

m. ,CHECK FOR—Spot farthest to the right at least 1 division to the right of the center vertical graticule line (at least 10 V).

n. Set the HORIZONTAL switch to 1 V and press the OPPOSE OFFSET button.

o. CHECK FOR—Spot farthest to the left between 1 and 3 divisions to the left of the center vertical graticule line (between 1 V and 3 V).

4. Check Step Generator Limits—Voltage Mode

a. Set the following Type 576 controls as listed:

HORIZONTAL	10 V COLLECTOR
OFFSET	AID
STEP GENERATOR AMPLITUDE	2 V

b. CHECK FOR—Spot farthest to the right on the fourth vertical graticule line to the right of center (40 V).

c. Set the HORIZONTAL switch to 20 V and press the OPPOSE OFFSET button. Turn the HORIZONTAL switch clockwise and the STEP GENERATOR AMPLITUDE switch clockwise, together, throughout the voltage range of the STEP GENERATOR AMPLITUDE switch.

d. CHECK FOR—Spot farthest to left on the first vertical graticule line to the left of center (10 times AMPLITUDE switch setting).

e. Set the following Type 576 controls as listed:

VERTICAL	10 mA COLLECTOR
HORIZONTAL	10 V COLLECTOR
SERIES RESISTORS	3 k
STEP GENERATOR AMPLITUDE	2 V
OFFSET	AID

f. CHECK FOR—Spot farthest to the right at least 1 division below the center horizontal graticule line (at least 10 mA at 40 V).

g. Set the following Type 576 controls as listed:

VERTICAL	2 A COLLECTOR
SERIES RESISTORS	6.5

h. CHECK FOR—Spot at least 1 division below the center horizontal graticule line (at least 2 A at 10 V).

i. Set the Type 576 controls as shown in Table 2-9.

j. CHECK FOR—Spot is between 1 and 2 divisions below the center horizontal graticule line for each setting of the CURRENT LIMIT switch (between 1 and 1.5 divisions for the 2A setting).

k. Set the following Type 576 controls as listed:

VERTICAL	10 mA COLLECTOR
CURRENT LIMIT	2 A
OFFSET	OPPOSE

l. CHECK FOR—Highest spot of the display between 0.5 and 2 divisions above the center horizontal graticule line (between 5 mA and 20 mA).

TABLE 2-9

Check Short Circuit Current Limit

CURRENT LIMIT	VERTICAL
2 A	2 A
500 mA	.5 A
100 mA	.1 A
20 mA	20 mA

5. Check Pulsed Step Width

a. Set the following Type 576 controls as listed:

NUMBER OF STEPS	1
OFFSET	ZERO
PULSED STEPS	300 μs
LEFT-OFF-RIGHT	OFF

b. Disconnect the patch cord from the Standard Test Fixture. Connect the BNC-to-dual binding post adapter to channel 1 of the test oscilloscope. Connect the + input (red binding post) through a patch cord to the base jack (right side) of the Standard Test Fixture and the ground input to the emitter jack.

NOTE

If the display exhibits noise, shorter patch cords and a shielded cable between the BNC-to-dual binding post adapter and the test oscilloscope may be required.

c. Set the test oscilloscope controls as shown in the list of Initial Control Settings at the beginning of the procedure.

d. Set the LEFT-OFF-RIGHT switch to RIGHT and trigger the test oscilloscope on the positive edge of the pulsed step.

e. CHECK FOR—Pulse width of 300 μs +5%, −15%.

f. Press the 80 μs PULSED STEPS button and set the test oscilloscope Time/div switch to 20 μs.

g. CHECK FOR—Pulse width of 80 μs +20%, −5%.

6. Check Step Generator Ripple

a. Set the following Type 576 controls to:

DISPLAY OFFSET Selector	HORIZ X10
CENTERLINE VALUE	10
HORIZONTAL	.05 BASE
AMPLITUDE	.05 μA
OFFSET	AID
OFFSET MULT	0.00
STEPS	Pressed
STEP FAMILY	SINGLE
POLARITY	+(NPN)
LEFT-OFF-RIGHT	OFF

b. Disconnect the Type 576 from the test oscilloscope.

c. Connect a 10 MΩ, 1/4 watt, 5% resistor between the base and emitter jacks (right) of the Standard Test Fixture. Set the LEFT-OFF-RIGHT switch to RIGHT.

d. Press the ZERO button and position the spot to the horizontal center of the CRT graticule.

e. Turn the OFFSET MULT control clockwise until a spot appears on the CRT.

f. CHECK FOR—Spot with a horizontal width of less than 2 divisions (less than 1 nA peak to peak).

g. Set the following Type 576 controls to:

AMPLITUDE	.05 V
OFFSET MULT	10.00
LEFT-OFF-RIGHT	OFF

h. CHECK FOR—Spot with horizontal width of less than 0.2 division (less than 2 mV peak to peak).

This concludes the Supplementary Performance Check Procedure.

REPLACEABLE ELECTRICAL 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.

SPECIAL NOTES AND SYMBOLS

X000	Part first added at this serial number
00X	Part removed after this serial number

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.

ABBREVIATIONS

ACTR	ACTUATOR	PLSTC	PLASTIC
ASSY	ASSEMBLY	QTZ	QUARTZ
CAP	CAPACITOR	RECP	RECEPTACLE
CER	CERAMIC	RES	RESISTOR
CKT	CIRCUIT	RF	RADIO FREQUENCY
COMP	COMPOSITION	SEL	SELECTED
CONN	CONNECTOR	SEMICOND	SEMICONDUCTOR
ELCTLT	ELECTROLYTIC	SENS	SENSITIVE
ELEC	ELECTRICAL	VAR	VARIABLE
INCAND	INCANDESCENT	WW	WIREWOUND
LED	LIGHT EMITTING DIODE	XFMR	TRANSFORMER
NONWIR	NON WIREWOUND	XTAL	CRYSTAL

CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
00213	NYTRONICS COMPONENTS GROUP INC SUBSIDIARY OF NYTRONICS INC	ORANGE ST	DARLINGTON SC 29532
00656	AEROVOX INC	740 BELLEVILLE AVE	NEW BEDFORD MA 02745-6010
00853	SANGAMO WESTON INC COMPONENTS DIV	SANGAMO RD PO BOX 128	PICKENS SC 29671-9716
01121	ALLEN-BRADLEY CO	1201 S 2ND ST	MILWAUKEE WI 53204-2410
01295	TEXAS INSTRUMENTS INC SEMICONDUCTOR GROUP	13500 N CENTRAL EXP PO BOX 655012	DALLAS TX 75265
01686	RCL ELECTRONICS/SHALLCROSS INC SUB OF HIRSCH AND ASSOCIATES INC	195 MCGREGOR ST	MANCHESTER NH 03102-3731
02111	HAMILTON STANDARD CONTROLS INC SPECTROL DIV	17070 E GALE AVE P O BOX 1220	CITY OF INDUSTRY CA 91749
02288	TELEMECANIQUE INC	100 RELAY RD	PLANTSVILLE CT 06479-1415
02660	AMPHENOL CORP SUB OF ALLIED CORP COMMERCIAL AND INDUSTRIAL OPNS	4300 COMMERCE CT	LISLE IL 60532
02735	RCA CORP SOLID STATE DIVISION	ROUTE 202	SOMERVILLE NJ 08876
03508	GENERAL ELECTRIC CO SEMI-CONDUCTOR PRODUCTS DEPT	W GENESEE ST	AUBURN NY 13021
03797	GENISCO TECHNOLOGY CORP ELDEMA DIV	18435 SUSANA RD	COMPTON CA 90221
03888	PYROFILM DIV DIV OF KDI ELECTRONICS INC	60 S JEFFERSON RD	WHIPPANY NJ 07981-1001
04099	CAPCO INC	1328 WINTERS AVE PO BOX 1028	GRAND JUNCTION CO 81502
04222	AVX CERAMICS DIV OF AVX CORP	19TH AVE SOUTH P O BOX 867	MYRTLE BEACH SC 29577
04713	MOTOROLA INC SEMICONDUCTOR PRODUCTS SECTOR	5005 E MCDOWELL RD	PHOENIX AZ 85008-4229
05397	UNION CARBIDE CORP MATERIALS SYSTEMS DIV	11901 MADISON AVE	CLEVELAND OH 44101
05574	VIKING CONNECTORS INC SUB OF CRITON CORP	21001 NORDHOFF ST	CHATSWORTH CA 91311-5911
05828	GENERAL INSTRUMENT CORP GOVERNMENT SYSTEMS DIV	600 W JOHN ST	HICKSVILLE NY 11802
06402	E-T-A CIRCUIT BREAKERS	7400 N CRONAME RD	CHICAGO IL 60648-3902
07263	FAIRCHILD SEMICONDUCTOR CORP NORTH AMERICAN SALES SUB OF SCHLUMBERGER LTD MS 118	10400 RIDGEVIEW CT	CUPERTINO CA 95014
07716	TRW INC TRW IRC FIXED RESISTORS/BURLINGTON	2850 MT PLEASANT AVE	BURLINGTON IA 52601
09353	C AND K COMPONENTS INC	15 RIVERDALE AVE	NEWTON MA 02158-1057
10582	CTS OF ASHEVILLE INC	MILLS GAP ROAD	SKYLAND NC 28776
12697	CLAROSTAT MFG CO INC	LOWER WASHINGTON ST	DOVER NH 03820
12969	UNITRODE CORP	5 FORBES RD	LEXINGTON MA 02173-7305
14099	SEMTECH CORP	652 MITCHELL ROAD	NEWBURY PARK CA 91320-2211
14193	CAL-R INC	1601 OLYMPIC BLVD PO BOX 1397	SANTA MONICA CA 90406
14552	MICROSEMI CORP	2830 S FAIRVIEW ST	SANTA ANA CA 92704-5948
14859	TEXAS INSTRUMENTS INC CONTROL PRODUCTS DIV	300 NORTH MAIN	VERSAILLES KY 40383-1245
15605	EATON CORP OPERATIONS AND TECHNICAL CTR	4201 N 27TH ST	MILWAUKEE WI 53216-1807
18324	SIGNETICS CORP MILITARY PRODUCTS DIV	4130 S MARKET COURT	SACRAMENTO CA 95834-1222
19396	ILLINOIS TOOL WORKS INC PAKTRON DIV	1205 MCCONVILLE RD PO BOX 4539	LYNCHBURG VA 24502-4535
19701	MEPCO/CENTRALAB A NORTH AMERICAN PHILIPS CO MINERAL WELLS AIRPORT	PO BOX 760	MINERAL WELLS TX 76067-0760
21226	CONTEL BUSINESS SYSTEMS INC	5550 TRIANGLE PKY	NORCROSS GA 30092
24546	CORNING GLASS WORKS	550 HIGH ST	BRADFORD PA 16701-3737
26769	MEPCO/CENTRALAB A NORTH AMERICAN PHILIPS CO	5900 AUSTRALIAN AVE	WEST PALM BEACH FL 33407-2330

CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
31433	UNION CARBIDE CORP ELECTRONICS DIV	HWY 276 SE PO BOX 5928	GREENVILLE SC 29606
31918	ITT SCHADOW INC	8081 WALLACE RD	EDEN PRAIRIE MN 55344-2224
32997	BOURNS INC TRIMPOT DIV	1200 COLUMBIA AVE	RIVERSIDE CA 92507-2114
33095	SPECTRUM CONTROL INC	2185 WEIGHT ST	ERIE PA 16505
44655	OHMITE MFG CO	3601 W HOWARD ST	SKOKIE IL 60076-4014
51406	MURATA ERIE NORTH AMERICA INC HEADQUARTERS AND GEORGIA OPERATIONS	2200 LAKE PARK DR	SMYRNA GA 30080
51642	CENTRE ENGINEERING INC	2820 E COLLEGE AVE	STATE COLLEGE PA 16801-7515
52763	STETTNER ELECTRONICS INC	6135 AIRWAYS BLVD PO BOX 21947	CHATTANOOGA TN 37421-2970
52769	SPRAGUE-GOODMAN ELECTRONICS INC	134 FULTON AVE	GARDEN CITY PARK NY 11040-5352
54583	TDK ELECTRONICS CORP	12 HARBOR PARK DR	PORT WASHINGTON NY 11550
56289	SPRAGUE ELECTRIC CO WORLD HEADQUARTERS	92 HAYDEN AVE	LEXINGTON MA 02173-7929
57668	ROHM CORP	16931 MILLIKEN AVE	IRVINE CA 92713
58224	XENELL CORP	11 DUNBARTON RD PO BOX 4401	CHERRY HILL NJ 08003-2107
58474	SUPERIOR ELECTRIC CO THE	383 MIDDLE ST	BRISTOL CT 06010-7438
58854	GTE PRODUCTS CORP LIGHTING PRODUCTS GROUP	60 BOSTON ST	SALEM MA 01970-2147
59660	TUSONIX INC	7741 N BUSINESS PARK DR PO BOX 37144	TUCSON AZ 85740-7144
59821	MEPCO/CENTRALAB A NORTH AMERICAN PHILIPS CO	7158 MERCHANT AVE	EL PASO TX 79915-1207
71313	CARDWELL CONDENSER CORP	80 E MONTAUK HWY	LINDENHURST LI NY 11757-5835
71400	BUSSMANN DIV OF COOPER INDUSTRIES INC	114 OLD STATE RD PO BOX 14460	ST LOUIS MO 63178
71590	MEPCO/CENTRALAB INC A NORTH AMERICAN PHILIPS CO	HWY 20 W PO BOX 858	FORT DODGE IA 50501
73138	BECKMAN INDUSTRIAL CORP BECKMAN ELECTRONIC TECHNOLOGIES SUB OF EMERSON ELECTRIC	4141 PALM ST	FULLERTON CA 92635
73803	TEXAS INSTRUMENTS INC METALLURGICAL MATERIALS DIVISION	34 FOREST ST	ATTLEBORO MA 02703-2454
74868	AMPHENOL CORP SUB OF ALLIED CORP R F CONNECTOR (OPNS)	1 KENNEDY AVE	DANBURY CT 06810-5803
74970	JOHNSON E F CO	299 10TH AVE S W	WASECA MN 56093-2539
75042	IRC ELECTRONIC COMPONENTS PHILADELPHIA DIV TRW FIXED RESISTORS	401 N BROAD ST	PHILADELPHIA PA 19108-1001
75498	MULTICOMP INC	3005 SW 154TH TERRACE #3	BEAVERTON OR 97006
76854	OAK SWITCH SYSTEMS INC SUB OF OAK TECHNOLOGY INC	100 S MAIN ST PO BOX 517	CRYSTAL LAKE IL 60014-6201
77342	AMF INC POTTER AND BRUMFIELD DIV	200 RICHLAND CREEK DR	PRINCETON IN 47670-4771
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500 MS 53-111	BEAVERTON OR 97707-0001
80294	BOURNS INSTRUMENTS INC	6135 MAGNOLIA AVE	RIVERSIDE CA 92506-2521
81312	WINCHESTER ELECTRONICS DIVISION LITTON SYSTEMS INC	400 PARK RD	WATERTOWN CT 06795-1612
82389	SWITCHCRAFT INC SUB OF RAYTHEON CO	5555 N ELSTRON AVE	CHICAGO IL 60630-1314
83003	VARO INC	538 SHEPHERD DR	GARLAND TX 75042
83008	STACO ENERGY PRODUCTS CO	301 GADDIS BLVD	DAYTON OH 45403-1314
91637	DALE ELECTRONICS INC	2064 12TH AVE PO BOX 609	COLUMBUS NE 68601-3632
TK1055	DUTCH BOY INC GLOWLITE DIV	P O BOX 698	PAULS VALLEY OK 73075
TK1319	MORELLIS Q & D PLASTICS	1812 16-TH AVE	FOREST GROVE OR 97116
TK1345	ZMAN AND ASSOCIATES	7633 S 180TH	KENT WA 98032
TK2038	MULTICOMP INC	3005 SW 154TH TERRACE #3	BEAVERTON OR 97006
TK2042	ZMAN & ASSOCIATES	7633 S 180TH	KENT WA 98032

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A	670-0614-00			CIRCUIT BD ASSY:READOUT,FIBER OPTIC	80009	670-0614-00
A	670-0615-00			CIRCUIT BD ASSY:READOUT,FIBER OPTIC	80009	670-0615-00
A	670-0616-00			CIRCUIT BD ASSY:READOUT,FIBER OPTIC	80009	670-0616-00
A	670-0617-00			CIRCUIT BD ASSY:READOUT,FIBER OPTIC	80009	670-0617-00
A	670-0778-00			CIRCUIT BD ASSY:READOUT ILLUMINATION	80009	670-0778-00
A	670-1020-00	B010100	B269999	CIRCUIT BD ASSY:STEP GENERATOR	80009	670-1020-00
A	670-1020-01	B270000		CIRCUIT BD ASSY:STEP GENERATOR	80009	670-1020-01
A	670-1021-00			CIRCUIT BD ASSY:LV RECTIFIERS	80009	670-1021-00
A	670-1022-00	B010100	B089999	CIRCUIT BD ASSY:HV POWER SUPPLY	80009	670-1022-00
A	670-1022-01	B090000		CIRCUIT BD ASSY:HV POWER SUPPLY	80009	670-1022-01
A	670-1023-00			CIRCUIT BD ASSY:2KV BRIDGE	80009	670-1023-00
A	----- -----			CKT BOARD ASSY:STEP GENERATOR AMP (PART OF 672-0931-XX)		
A	670-1024-00			CIRCUIT BD ASSY:LV REGULATOR	80009	670-1024-00
A	670-1026-00			CIRCUIT BD ASSY:VERTICAL CURRENT,DIV SW	80009	670-1026-00
A	670-1026-01			CIRCUIT BD ASSY:VERTICAL CURRENT,DIV SW	80009	670-1026-01
A	670-1026-02			CIRCUIT BD ASSY:VERTICAL CURRENT,DIV SW	80009	670-1026-02
				CKT BOARD ASSY:HORIZONTAL VOLTS/DIV SW (PART OF 672-0931-XX)		
A	670-1028-00			CIRCUIT BD ASSY:GRATICULE LAMPS	80009	670-1028-00
A	670-1029-00			CIRCUIT BD ASSY:READOUT LOGIC	80009	670-1029-00
A	670-1030-00			CIRCUIT BD ASSY:READOUT INTERCONNECTIONS	80009	670-1030-00
A	670-1031-00			CIRCUIT BD ASSY:DISPLAY OFFSET	80009	670-1031-00
A	670-1032-00			CIRCUIT BD ASSY:DISPLAY AMPLIFIER	80009	670-1032-00
A	670-1033-00			CIRCUIT BD ASSY:STEP GENERATOR OFFSET SW	80009	670-1033-00
A	670-1034-00			CIRCUIT BD ASSY:STEP GENERATOR RATE SW	80009	670-1034-00
A	670-1035-00			CIRCUIT BD ASSY:DISPLAY SWITCHING	80009	670-1035-00
A	670-1036-00			CIRCUIT BD ASSY:STEP GENERATOR PULSE	80009	670-1036-00
	670-1021-00			CIRCUIT BD ASSY:LV RECTIFIERS	80009	670-1021-00
B323	150-0089-00			LAMP,CARTRIDGE:14V,0.08A,YELLOW LENS	03797	CF03-YTS2182
B360	150-0090-00			LAMP,CARTRIDGE:14V,0.08A,RED LENS	03797	CF03-RTS-2182
B704	150-0087-00			LAMP,CARTRIDGE:6.3V,0.2A,GREEN LENS	03797	CF03-GTS-2181
B705	150-0029-00			LAMP,INCAND:6.3V,0.2A,#349,MIDGET FLG	58854	349
B706	150-0029-00			LAMP,INCAND:6.3V,0.2A,#349,MIDGET FLG	58854	349
B707	150-0029-00			LAMP,INCAND:6.3V,0.2A,#349,MIDGET FLG	58854	349
B773	150-0029-00			LAMP,INCAND:6.3V,0.2A,#349,MIDGET FLG	58854	349
B885	150-0067-00	B020000		LAMP,GLOW:64-80V,0.3MA,NE81,WIRE LEADS	TK1055	NE-81
B886	150-0067-00	B020000		LAMP,GLOW:64-80V,0.3MA,NE81,WIRE LEADS	TK1055	NE-81
B887	150-0030-00	B020000		LAMP,GLOW:60-90V MAX,0.7MA,A28-T,WIRE LEADS	58224	A2B-T
C1	283-0177-00	B010100	B089999	CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR302E105ZAATR
C1	283-0203-00	B090000		CAP,FXD,CER DI:0.47UF,20%,50V	04222	SR305SC474MAA
C5	283-0003-00	B010100	B019999	CAP,FXD,CER DI:0.01UF,+80-20%,150V	59821	D103Z40Z5UJDCEX
C5	283-0051-00	B020000		CAP,FXD,CER DI:0.0033UF,5%,100V	04222	SR301A332JAA
C10	283-0177-00	B010100	B089999	CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR302E105ZAATR
C10	283-0203-00	B090000		CAP,FXD,CER DI:0.47UF,20%,50V	04222	SR305SC474MAA
C14	283-0003-00	B010100	B019999	CAP,FXD,CER DI:0.01UF,+80-20%,150V	59821	D103Z40Z5UJDCEX
C14	283-0051-00	B020000		CAP,FXD,CER DI:0.0033UF,5%,100V	04222	SR301A332JAA
C22	283-0119-00	B180000		CAP,FXD,CER DI:2200PF,5%,200V	59660	855-XXXY5E0222J
C26	285-0703-00			CAP,FXD,PLASTIC:0.1UF,5%,100V	19396	104J01PT605
C33	283-0078-00	B010100	B179999	CAP,FXD,CER DI:0.001UF,20%,500V	59660	0801 547X5F0102M
C33	283-0119-00	B180000		CAP,FXD,CER DI:2200PF,5%,200V	59660	855-XXXY5E0222J
C34	283-0003-00			CAP,FXD,CER DI:0.01UF,+80-20%,150V	59821	D103Z40Z5UJDCEX
C35	285-0598-00			CAP,FXD,PLASTIC:0.01UF,5%,100V	19396	DU490B103J
C49	283-0104-00	B010100	B349169	CAP,FXD,CER DI:2000PF,5%,500V	59660	811-565-B202J
C49	283-0083-00	B349170		CAP,FXD,CER DI:0.0047UF,20%,500V	59660	811-565C471J
C50	285-0598-00			CAP,FXD,PLASTIC:0.01UF,5%,100V	19396	DU490B103J
C70	283-0110-00	B327878		CAP,FXD,CER DI:0.005UF,+80-20%,150V	59660	855-547-E-502Z
C78	283-0080-00			CAP,FXD,CER DI:0.022UF,+80-20%,25V	59821	2DDU60E223Z
C81	283-0003-00			CAP,FXD,CER DI:0.01UF,+80-20%,150V	59821	D103Z40Z5UJDCEX
C89	283-0026-00			CAP,FXD,CER DI:0.2UF,+80-20%,25V	31433	C330C332JIG5CA

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
C110	283-0032-00			CAP,FXD,CER DI:470PF,5%,500V	59660	831-000-Z5E0471J
C112	283-0128-00			CAP,FXD,CER DI:100PF,5%,500V	59660	871-536T2H101J
C114	283-0092-00			CAP,FXD,CER DI:0.03UF,+80-20%,200V	59660	845-534Z5U0303Z
C134	283-0032-00			CAP,FXD,CER DI:470PF,5%,500V	59660	831-000-Z5E0471J
C137	283-0128-00			CAP,FXD,CER DI:100PF,5%,500V	59660	871-536T2H101J
C160	283-0144-00			CAP,FXD,CER DI:33PF,2%,500V	59660	801-547P2G330G
C161	283-0032-00			CAP,FXD,CER DI:470PF,5%,500V	59660	831-000-Z5E0471J
C172	283-0000-00	B010100	B199999	CAP,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-610-Y5U0102P
C172	283-0104-00	B200000	B349169	CAP,FXD,CER DI:2000PF,5%,500V	59660	811-565-B202J
C172	283-0083-00	B349170		CAP,FXD,CER DI:0.0047UF,20%,500V	59660	811-565C471J
C177	283-0000-00	B010100	B199999	CAP,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-610-Y5U0102P
C177	283-0104-00	B200000		CAP,FXD,CER DI:2000PF,5%,500V	59660	811-565-B202J
C182	283-0079-00			CAP,FXD,CER DI:0.01UF,20%,250V	04222	SR503C103MAA
C183	283-0177-00			CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR302E105ZAATR
C187	281-0550-00	B120000		CAP,FXD,CER DI:120PF,10%,500V	52763	2RDPLZ007 120PMO
C188	290-0410-00			CAP,FXD,ELCTLT:15UF,+50-10%,100V	00853	556DD150T100B
C189	290-0410-00			CAP,FXD,ELCTLT:15UF,+50-10%,100V	00853	556DD150T100B
C194	283-0032-00			CAP,FXD,CER DI:470PF,5%,500V	59660	831-000-Z5E0471J
C229	281-0504-00			CAP,FXD,CER DI:10PF,+/-1PF,500V	54583	TCC20CH2H100FYA
C236	283-0032-00			CAP,FXD,CER DI:470PF,5%,500V	59660	831-000-Z5E0471J
C294	290-0297-00			CAP,FXD,ELCTLT:39UF,10%,10V	05397	T110B396K010AS
C296	290-0136-00			CAP,FXD,ELCTLT:2.2UF,20%,20V	05397	T322B225M020AS
C298	290-0136-00			CAP,FXD,ELCTLT:2.2UF,20%,20V	05397	T322B225M020AS
C300	285-0718-00	B010100	B309999	CAP,FXD,PPR DI:3.75UF,10%,236V	56289	200P1883
C300	285-0718-01	B310000		CAP,FXD,PLASTIC:3.75UF,10%,236V	00656	P50G2403Y
C301	281-0143-00			CAP,VAR,AIR DI:3.5-27PF,1500V	71313	167-0032-001
C323	283-0177-00			CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR302E105ZAATR
C326	290-0409-00			CAP,FXD,ELCTLT:1000UF,+75-10%,25V	00853	066GL102U025B
C329	290-0403-00			CAP,FXD,ELCTLT:5200UF,+75-10%,12V	56289	39D314
C332	290-0213-00			CAP,FXD,ELCTLT:10UF,+50-10%,450V	56289	34D106F450GJ4
C335	285-0787-00			CAP,FXD,PLASTIC:0.47UF,20%,1000V	04099	TEK-40
C336	285-0787-00			CAP,FXD,PLASTIC:0.47UF,20%,1000V	04099	TEK-40
C339	281-0144-00			CAP,VAR,AIR DI:4-50PF,1500V	71313	167-0003-002
C341	281-0141-00			CAP,VAR,MICA DI:65-340PF	52769	GME 10301
C343	281-0142-00			CAP,VAR,AIR DI:9-75PF,10%	71313	167-0431-001
C401	283-0078-00			CAP,FXD,CER DI:0.001UF,20%,500V	59660	0801 547X5F0102M
C402	283-0068-00			CAP,FXD,CER DI:0.01UF,+100-0%,500V	59660	871-533E103P
C403	283-0008-00	B010100	B019999	CAP,FXD,CER DI:0.1UF,20%,500V	51642	500-500-X7R-104M
C403	283-0189-00	B020000		CAP,FXD,CER DI:0.1UF,20%,400V	51642	500400X5R 104M
C413	283-0605-00			CAP,FXD,MICA DI:678PF,1%,300V	00853	D153F6780F0
C432	281-0601-00	B090000		CAP,FXD,CER DI:7.5PF,+/-0.5PF,500V	52763	2RDPLZ007 7P50DC
C433	281-0091-00	B010100	B089999	CAP,VAR,CER DI:2-8PF,350V	33095	53-717-001 A2-8
C433	281-0159-00	B090000		CAP,VAR,AIR DI:1.8-5.1PF,1200V	74970	189-0277-075
C434	281-0572-00	B010100	B089999	CAP,FXD,CER DI:6.8PF,0.5%,500V	52763	2RDPLZ007 6P80DC
C434	281-0601-00	B090000		CAP,FXD,CER DI:7.5PF,+/-0.5PF,500V	52763	2RDPLZ007 7P50DC
C435	281-0637-00	B090000		CAP,FXD,CER DI:91PF,5%,500V	52763	2RDPLZ007 91POJU
C436	283-0616-00	B010100	B089999	CAP,FXD,MICA DI:75PF,5%,500V	00853	D155E750J0
C436	281-0637-00	B090000		CAP,FXD,CER DI:91PF,5%,500V	52763	2RDPLZ007 91POJU
C437	281-0546-00	B090000		CAP,FXD,CER DI:330PF,10%,500V	52763	2RDPLZ007 330PMO
C438	283-0626-00	B090000		CAP,FXD,MICA DI:1800PF,5%,500V	00853	D195F182J0
C562	281-0625-00			CAP,FXD,CER DI:35PF,5%,500V	52763	2RDPLZ007 35POJC
C568	281-0625-00			CAP,FXD,CER DI:35PF,5%,500V	52763	2RDPLZ007 35POJC
C662	281-0625-00			CAP,FXD,CER DI:35PF,5%,500V	52763	2RDPLZ007 35POJC
C668	281-0625-00			CAP,FXD,CER DI:35PF,5%,500V	52763	2RDPLZ007 35POJC
C696	290-0135-00			CAP,FXD,ELCTLT:15UF,20%,20V	05397	T110B156M020AS
C698	290-0135-00			CAP,FXD,ELCTLT:15UF,20%,20V	05397	T110B156M020AS
C706	285-0515-00			CAP,FXD,PLASTIC:0.022UF,20%,400V	56289	192P22304M434
C707	290-0173-00			CAP,FXD,ELCTLT:200UF,+75-10%,250V	56289	D38790-DFP

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
C708	290-0136-00			CAP,FXD,ELCTLT:2.2UF,20%,20V	05397	T322B225M020AS
C712	281-0536-00			CAP,FXD,CER DI:1000PF,10%,500V	52763	2RDPLZ007 1N00MO
C719	290-0305-01			CAP,FXD,ELCTLT:3UF,10%,150V	26769	40LW305A150K1C
C729	283-0004-00			CAP,FXD,CER DI:0.02UF,+80-20%,150V	59660	855-558Z5V0203Z
C732	290-0410-00			CAP,FXD,ELCTLT:15UF,+50-10%,100V	00853	556DD150T100B
C737	285-0515-00			CAP,FXD,PLASTIC:0.022UF,20%,400V	56289	192P22304M434
C738	290-0411-00			CAP,FXD,ELCTLT:4200UF,+100-10%,30V	56289	60D10040-DFP
C742	281-0504-00			CAP,FXD,CER DI:10PF,+/-1PF,500V	54583	TCC20CH2H100FYA
C754	290-0287-00			CAP,FXD,ELCTLT:47UF,20%,25V	56289	30D476X0025CC4
C758	285-0515-00			CAP,FXD,PLASTIC:0.022UF,20%,400V	56289	192P22304M434
C759	290-0321-00			CAP,FXD,ELCTLT:11000UF,+100-10%,15V	56289	D45069
C763	283-0004-00			CAP,FXD,CER DI:0.02UF,+80-20%,150V	59660	855-558Z5V0203Z
C769	281-0630-00			CAP,FXD,CER DI:390PF,5%,500V	52763	2RDPLZ007 390PMO
C777	290-0297-00			CAP,FXD,ELCTLT:39UF,10%,10V	05397	T110B396K010AS
C789	290-0297-00			CAP,FXD,ELCTLT:39UF,10%,10V	05397	T110B396K010AS
C790	285-0515-00			CAP,FXD,PLASTIC:0.022UF,20%,400V	56289	192P22304M434
C791	290-0411-00			CAP,FXD,ELCTLT:4200UF,+100-10%,30V	56289	60D10040-DFP
C796	281-0504-00			CAP,FXD,CER DI:10PF,+/-1PF,500V	54583	TCC20CH2H100FYA
C806	290-0287-00			CAP,FXD,ELCTLT:47UF,20%,25V	56289	30D476X0025CC4
C810	281-0523-00			CAP,FXD,CER DI:100PF,20%,350V	52763	2RDPLZ007 100PMU
C819	290-0135-00			CAP,FXD,ELCTLT:15UF,20%,20V	05397	T110B156M020AS
C821	285-0515-00			CAP,FXD,PLASTIC:0.022UF,20%,400V	56289	192P22304M434
C822	290-0310-00			CAP,FXD,ELCTLT:2000UF,+75-10%,75V	56289	D44886-DFP
C823	290-0310-00			CAP,FXD,ELCTLT:2000UF,+75-10%,75V	56289	D44886-DFP
C828	285-0515-00			CAP,FXD,PLASTIC:0.022UF,20%,400V	56289	192P22304M434
C829	290-0173-00			CAP,FXD,ELCTLT:200UF,+75-10%,250V	56289	D38790-DFP
C834	281-0510-00			CAP,FXD,CER DI:22PF,+/-4.4PF,500V	52763	2RDPLZ007 22POMC
C848	290-0149-00			CAP,FXD,ELCTLT:5UF,+75-10%,150V	00853	556DD050U150B
C850	290-0412-00			CAP,FXD,ELCTLT:100UF,+75-10%,150V	56289	60D1423-DFP
C851	283-0177-00			CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR302E105ZAATR
C861	283-0079-00			CAP,FXD,CER DI:0.01UF,20%,250V	04222	SR503C103MAA
C863	290-0134-00			CAP,FXD,ELCTLT:22UF,20%,15V	05397	T110B226M015AS
C864	283-0006-00			CAP,FXD,CER DI:0.02UF,+80-20%,500V	59660	0841545Z5V00203Z
C865	283-0006-00			CAP,FXD,CER DI:0.02UF,+80-20%,500V	59660	0841545Z5V00203Z
C866	283-0006-00			CAP,FXD,CER DI:0.02UF,+80-20%,500V	59660	0841545Z5V00203Z
C867	283-0000-00			CAP,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-610-Y5U0102P
C868	283-0006-00			CAP,FXD,CER DI:0.02UF,+80-20%,500V	59660	0841545Z5V00203Z
C869	283-0006-00			CAP,FXD,CER DI:0.02UF,+80-20%,500V	59660	0841545Z5V00203Z
C870	283-0071-00			CAP,FXD,CER DI:0.0068UF,+80-20%,5KV	51406	DHA 34Y5S682Z5KV
C871	283-0071-00			CAP,FXD,CER DI:0.0068UF,+80-20%,5KV	51406	DHA 34Y5S682Z5KV
C888	283-0071-00			CAP,FXD,CER DI:0.0068UF,+80-20%,5KV	51406	DHA 34Y5S682Z5KV
C899	290-0134-00			CAP,FXD,ELCTLT:22UF,20%,15V	05397	T110B226M015AS
D1	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D2	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D10	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D11	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D28	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D35	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D39	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D41	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D42	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D43	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D44	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D47	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D48	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D53	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D54	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D55	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
D57	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D58	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D60	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D61	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D63	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D64	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D66	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D67	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D68	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D69	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D70	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D71	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D72	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D73	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D82	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D83	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D89	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D102	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D104	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D115	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D116	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D122	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D133	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D146	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D147	152-0217-00			SEMICOND DVC,DI:ZEN,SI,8.2V,5%,0.4W,DO-7	04713	SZG20
D159	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D165	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D179	152-0198-00			SEMICOND DVC,DI:RECT,SI,200V,3A,A249	03508	1N5624
D185	152-0198-00			SEMICOND DVC,DI:RECT,SI,200V,3A,A249	03508	1N5624
D188	152-0040-00			SEMICOND DVC,DI:RECT,SI,600V,1A,DO-41	80009	152-0040-00
D189	152-0040-00			SEMICOND DVC,DI:RECT,SI,600V,1A,DO-41	80009	152-0040-00
D220	152-0324-00			SEMICOND DVC,DI:SW,SI,35V,0.1A,DO-7	14552	MT5128
D223	152-0324-00			SEMICOND DVC,DI:SW,SI,35V,0.1A,DO-7	14552	MT5128
D229	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D248	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D249	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D250	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D251	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D305	152-0385-00			SEMICOND DVC,DI:RECT,SI,2000V,0.1A,	14099	M20
D306	152-0385-00			SEMICOND DVC,DI:RECT,SI,2000V,0.1A,	14099	M20
D307	152-0385-00			SEMICOND DVC,DI:RECT,SI,2000V,0.1A,	14099	M20
D308	152-0385-00			SEMICOND DVC,DI:RECT,SI,2000V,0.1A,	14099	M20
D310	152-0404-00	B010100	B299999	SEMICOND DVC,DI:RECT,SI,500V,25A W/HEAT SK	80009	152-0404-00
D310	152-0404-01	B300000		SEMICOND DVC,DI:RECT,SI,500V,25A W/HEAT SK	80009	152-0404-01
D320	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D410	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D411	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D507	152-0212-00			SEMICOND DVC,DI:ZEN,SI,9V,5%,0.5W,DO-7	04713	SZ50646RL
D520	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D530	152-0324-00			SEMICOND DVC,DI:SW,SI,35V,0.1A,DO-7	14552	MT5128
D534	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D537	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D541	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D554	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D556	152-0324-00			SEMICOND DVC,DI:SW,SI,35V,0.1A,DO-7	14552	MT5128
D560	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D563	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D567	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
D569	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D579	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,3DV,DO-35	03508	DA2527 (1N4152)
D586	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D620	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D630	152-0324-00			SEMICOND DVC,DI:SW,SI,35V,0.1A,DO-7	14552	MT5128
D634	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D637	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D641	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D654	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D656	152-0324-00			SEMICOND DVC,DI:SW,SI,35V,0.1A,DO-7	14552	MT5128
D660	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D663	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D667	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D669	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D679	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D686	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D706	152-0066-00			SEMICOND DVC,DI:RECT,SI,400V,1A,DO-41	05828	GP10G-020
D708	152-0212-00			SEMICOND DVC,DI:ZEN,SI,9V,5%,0.5W,DO-7	04713	SZ50646RL
D713	152-0280-00			SEMICOND DVC,DI:ZEN,S1,6.2V,5%,0.4W,DO-7	04713	1N753A
D714	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D715	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D722	152-0233-00			SEMICOND DVC,DI:SW,SI,80V,75MA,DO-7	03508	DA2737
D730	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D732	152-0066-00			SEMICOND DVC,DI:RECT,SI,400V,1A,DO-41	05828	GP10G-020
D737	152-0066-00			SEMICOND DVC,DI:RECT,SI,400V,1A,DO-41	05828	GP10G-020
D751	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D754	152-0066-00			SEMICOND DVC,DI:RECT,SI,400V,1A,DO-41	05828	GP10G-020
D758	152-0198-00			SEMICOND DVC,DI:RECT,SI,200V,3A,A249	03508	1N5624
D769	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D776	152-0066-00			SEMICOND DVC,DI:RECT,SI,400V,1A,DO-41	05828	GP10G-020
D788	152-0066-00			SEMICOND DVC,DI:RECT,SI,400V,1A,DO-41	05828	GP10G-020
D790	152-0198-00			SEMICOND DVC,DI:RECT,SI,200V,3A,A249	03508	1N5624
D798	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D799	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D803	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D806	152-0066-00			SEMICOND DVC,DI:RECT,SI,400V,1A,DO-41	05828	GP10G-020
D821	152-0198-00			SEMICOND DVC,DI:RECT,SI,200V,3A,A249	03508	1N5624
D828	152-0066-00			SEMICOND DVC,DI:RECT,SI,400V,1A,DO-41	05828	GP10G-020
D833	152-0233-00			SEMICOND DVC,DI:SW,SI,80V,75MA,DO-7	03508	DA2737
D848	152-0066-00			SEMICOND DVC,DI:RECT,SI,400V,1A,DO-41	05828	GP10G-020
D859	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D862	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D865	152-0107-00			SEMICOND DVC,DI:RECT,SI,400 V,400MA,A1	12969	"G727"
D866	152-0107-00			SEMICOND DVC,DI:RECT,SI,400 V,400MA,A1	12969	"G727"
D868	152-0107-00	B010100	B319999	SEMICOND DVC,DI:RECT,SI,400 V,400MA,A1	12969	"G727"
D868	152-0107-03	B320000		SEMICOND DVC,DI:RECT,SI,400V,400MA,A1	04713	1N4004
D869	152-0107-00			SEMICOND DVC,DI:RECT,SI,400 V,400MA,A1	12969	"G727"
D870	152-0408-00			SEMICOND DVC,DI:RECT,SI,10K,5MA,A-LUG	83003	H-345
D882	152-0288-00			SEMICOND DVC,DI:ZEN,SI,140V,5%,400MW	80009	152-0288-00
D885	152-0242-00	B010100	B019999	SEMICOND DVC,DI:SIG,SI,225V,0.2A,DO-7	07263	FDH5004
D887	152-0242-00	B010100	B019999	SEMICOND DVC,DI:SIG,SI,225V,0.2A,DO-7	07263	FDH5004
D908	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D912	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D913	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D914	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D915	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D916	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D917	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
D918	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D919	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D920	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D922	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D923	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D924	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D926	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D927	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D928	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D929	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D930	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D931	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D932	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D933	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D934	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
F701	159-0011-00	B010100	B259999	FUSE,CARTRIDGE:3AG,6.25A,125V,5 SEC	71400	MDX 6 25/100
F701	159-0005-00	B260000		FUSE,CARTRIDGE:3AG,3A,250V,30SEC,CER	71400	MSL-3
F702	159-0027-00	B010100	B259999	FUSE,CARTRIDGE:3AG,4A,125V,23SEC	71400	MDX4
F702	159-0034-00	B260000	B361396	FUSE,CARTRIDGE:3AG,1.6A,125V,22SEC	71400	MDL 1 6/10
F702	159-0003-00	B361397		FUSE,CARTRIDGE:3AG,1.6A,250V,25SEC	71400	MDX 1 6/10
J300	131-0689-00			CONN,RCPT,ELEC:15 CONTACT,FEMALE	74868	126-150
J360	131-0097-00			CONN,RCPT,ELEC:32 CONTACT,FEMALE	02660	26-190-32
J361	131-0018-00			CONN,RCPT,ELEC:FEMALE 16 CONTACT	02660	26-190-16
J362	131-0018-00			CONN,RCPT,ELEC:FEMALE 16 CONTACT	02660	26-190-16
J363	131-0148-00			CONN,RCPT,ELEC:FEMALE,24 CONTACT	02660	26-190-24-1004
J372	136-0140-00			JACK,TIP:BANANA,CHARCOAL GRAY	TK1319	ORDER BY DESCR
J373	136-0140-00			JACK,TIP:BANANA,CHARCOAL GRAY	TK1319	ORDER BY DESCR
J374	136-0140-00			JACK,TIP:BANANA,CHARCOAL GRAY	TK1319	ORDER BY DESCR
J819	131-0717-00			CONN,RCPT,ELEC:PWR,FEMALE,125VAC,3A	81312	SM3SN
J950	131-0697-00			CONN,RCPT,ELEC:CKT BD,22/44 CONT	05574	000201-3154
K101	148-0044-00			RELAY,ARMATURE:DPDT,12VDC	80009	148-0044-00
K102	148-0045-00			RELAY,ARMATURE:4 FORM C,5A,28VDC,COIL 12VDC 185 OHM	80009	148-0045-00
K320	148-0047-00			RELAY,ARMATURE:2 FORM C,5A,28VDC,COIL 12VDC 185 OHM	77342	R10-E0697-3
K323	148-0022-00	B010100	B129999	RELAY,ARMATURE:2 FORM C,2A,26.5VDC,COIL 12VDC 185 OHM	02288	T154CC12VDC
K323	148-0047-00	B130000		RELAY,ARMATURE:2 FORM C,5A,28VDC,COIL 12VDC 185 OHM	77342	R10-E0697-3
K520	148-0044-00			RELAY,ARMATURE:DPDT,12VDC	80009	148-0044-00
K537	148-0027-00			RELAY,ARMATURE:3 FORM W/6 FORM C,25A,24VDC, COIL 12VDC 300 OHM	21226	12-BW3-G15
K541	148-0027-00			RELAY,ARMATURE:3 FORM W/6 FORM C,25A,24VDC, COIL 12VDC 300 OHM	21226	12-BW3-G15
K620	148-0044-00			RELAY,ARMATURE:DPDT,12VDC	80009	148-0044-00
K637	148-0027-00			RELAY,ARMATURE:3 FORM W/6 FORM C,25A,24VDC, COIL 12VDC 300 OHM	21226	12-BW3-G15
K641	148-0027-00			RELAY,ARMATURE:3 FORM W/6 FORM C,25A,24VDC, COIL 12VDC 300 OHM	21226	12-BW3-G15
L300	108-0521-00			COIL,RF:FIXED,10MH	TK1345	108-0521-00
L370	276-0549-00	B010100	B279999	CORE,EM:TOROID,FERRITE	80009	276-0549-00
L370	276-0525-00	B280000		CORE,EM:TOROID,FERRITE	01121	T037C351A
L371	276-0549-00	B010100	B279999	CORE,EM:TOROID,FERRITE	80009	276-0549-00
L371	276-0525-00	B280000		CORE,EM:TOROID,FERRITE	01121	T037C351A
L375	276-0549-00	B010100	B279999	CORE,EM:TOROID,FERRITE	80009	276-0549-00
L375	276-0525-00	B280000		CORE,EM:TOROID,FERRITE	01121	T037C351A
L850	108-0237-00			COIL,RF:FIXED,80UH	TK2042	ORDER BY DESCR
L897	108-0518-00			COIL,TUBE DEFL:TRACE ROTATOR	80009	108-0518-00

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
P300	131-0690-00			CONN,RCPT,ELEC:15 CONTACT,MALE	80009	131-0690-00
P360	131-0096-00			CONN,RCPT,ELEC:32 CONTACT,MALE	02660	26-159-32
Q23	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
Q30	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
Q36	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
Q41	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
Q46	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
Q52	151-0219-00			TRANSISTOR:PNP,SI,R-124	07263	S022650
Q90	151-0219-00	B010100	B269999	TRANSISTOR:PNP,SI,R-124	07263	S022650
Q90	151-0361-00	B270000		TRANSISTOR:NPN,SI,R-138	56289	TD702
Q93	151-0136-00	B010100	B269999	TRANSISTOR:NPN,SI,TO-39	02735	35495
Q101	151-0260-00			TRANSISTOR:NPN,SI,TO-39	04713	ST1083
Q105	151-0261-00			TRANSISTOR:PNP,SI,TO-77	80009	151-0261-00
Q110	151-0136-00			TRANSISTOR:NPN,SI,TO-39	02735	35495
Q117	151-1021-00			TRANSISTOR:FET,N-CHAN,SI,TO-18	80009	151-1021-00
Q122	151-0250-00			TRANSISTOR:NPN,SI,TO-104	07263	S036744
Q130	151-0232-00			TRANSISTOR:NPN,SI,TO-78	07263	SP12141
Q133	151-0208-00			TRANSISTOR:PNP,SI,TO-39	80009	151-0208-00
Q150	151-0232-00			TRANSISTOR:NPN,SI,TO-78	07263	SP12141
Q152	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
Q164	151-0219-00			TRANSISTOR:PNP,SI,R-124	07263	S022650
Q169	151-0136-00			TRANSISTOR:NPN,SI,TO-39	02735	35495
Q172	151-0226-00			TRANSISTOR:NPN,SI,TO-66	80009	151-0226-00
Q176	151-0227-00			TRANSISTOR:PNP,SI,TO-66	80009	151-0227-00
Q180	151-0140-00	B010100	B219999	TRANSISTOR:NPN,SI,TO-3	80009	151-0140-00
Q180	151-0337-00	B220000	B229999	TRANSISTOR:NPN,SI,TO-3	02735	61443
Q180	151-0140-00	B230000		TRANSISTOR:NPN,SI,TO-3	80009	151-0140-00
Q184	151-0140-00	B010100	B219999	TRANSISTOR:NPN,SI,TO-3	80009	151-0140-00
Q184	151-0337-00	B220000	B229999	TRANSISTOR:NPN,SI,TO-3	02735	61443
Q184	151-0140-00	B230000		TRANSISTOR:NPN,SI,TO-3	80009	151-0140-00
Q226	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
Q229	151-1029-00			TRANSISTOR:FET,N-CHAN,SI,TO-71	80009	151-1029-00
Q233	151-0219-00			TRANSISTOR:PNP,SI,R-124	07263	S022650
Q235	151-0273-00			TRANSISTOR:SELECTED	03508	X16E3616
Q241	151-0219-00			TRANSISTOR:PNP,SI,R-124	07263	S022650
Q248	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
Q250	151-0219-00			TRANSISTOR:PNP,SI,R-124	07263	S022650
Q531	151-1029-00			TRANSISTOR:FET,N-CHAN,SI,TO-71	80009	151-1029-00
Q533	151-0232-00			TRANSISTOR:NPN,SI,TO-78	07263	SP12141
Q560	151-0219-00			TRANSISTOR:PNP,SI,R-124	07263	S022650
Q569	151-0219-00			TRANSISTOR:PNP,SI,R-124	07263	S022650
Q578	151-0150-00			TRANSISTOR:SELECTED	80009	151-0150-00
Q587	151-0150-00			TRANSISTOR:SELECTED	80009	151-0150-00
Q631	151-1029-00			TRANSISTOR:FET,N-CHAN,SI,TO-71	80009	151-1029-00
Q633	151-0232-00			TRANSISTOR:NPN,SI,TO-78	07263	SP12141
Q660	151-0219-00			TRANSISTOR:PNP,SI,R-124	07263	S022650
Q669	151-0219-00			TRANSISTOR:PNP,SI,R-124	07263	S022650
Q678	151-0150-00			TRANSISTOR:SELECTED	80009	151-0150-00
Q687	151-0150-00			TRANSISTOR:SELECTED	80009	151-0150-00
Q716	151-0232-00			TRANSISTOR:NPN,SI,TO-78	07263	SP12141
Q725	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
Q727	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
Q729	151-0136-00			TRANSISTOR:NPN,SI,TO-39	02735	35495
Q734	151-0256-00			TRANSISTOR:NPN,SI,TO-3	80009	151-0256-00
Q744	151-0232-00			TRANSISTOR:NPN,SI,TO-78	07263	SP12141
Q748	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
Q750	151-0136-00			TRANSISTOR:NPN,SI,TO-39	02735	35495
Q756	151-0140-00	B010100	B219999	TRANSISTOR:NPN,SI,TO-3	80009	151-0140-00

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
Q756	151-0337-00	B220000	B229999	TRANSISTOR:NPN,SI,TO-3	02735	61443
Q756	151-0140-00	B230000		TRANSISTOR:NPN,SI,TO-3	80009	151-0140-00
Q767	151-0232-00			TRANSISTOR:NPN,SI,TO-78	07263	SP12141
Q772	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
Q774	151-0136-00			TRANSISTOR:NPN,SI,TO-39	02735	35495
Q778	151-0140-00	B010100	B219999	TRANSISTOR:NPN,SI,TO-3	80009	151-0140-00
Q778	151-0337-00	B220000	B229999	TRANSISTOR:NPN,SI,TO-3	02735	61443
Q778	151-0140-00	B230000		TRANSISTOR:NPN,SI,TO-3	80009	151-0140-00
Q780	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
Q784	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
Q787	151-0148-00			TRANSISTOR:NPN,SI,TO-66	02735	2N4231A
Q795	151-0232-00			TRANSISTOR:NPN,SI,TO-78	07263	SP12141
Q800	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
Q803	151-0136-00			TRANSISTOR:NPN,SI,TO-39	02735	35495
Q808	151-0140-00	B010100	B219999	TRANSISTOR:NPN,SI,TO-3	80009	151-0140-00
Q808	151-0337-00	B220000	B229999	TRANSISTOR:NPN,SI,TO-3	02735	61443
Q808	151-0140-00	B230000		TRANSISTOR:NPN,SI,TO-3	80009	151-0140-00
Q810	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
Q814	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
Q817	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
Q819	151-0148-00			TRANSISTOR:NPN,SI,TO-66	02735	2N4231A
Q834	151-0228-00			TRANSISTOR:PNP,SI,TO-105	07263	S21862
Q837	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
Q840	151-0150-00			TRANSISTOR:SELECTED	80009	151-0150-00
Q846	151-0256-00			TRANSISTOR:NPN,SI,TO-3	80009	151-0256-00
Q851	151-0251-00	B010100	B219999	TRANSISTOR:NPN,SI,TO-66	80009	151-0251-00
Q851	151-0210-00	B220000		TRANSISTOR:NPN,SI,TO-66	80009	151-0210-00
Q855	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
Q859	151-0219-00			TRANSISTOR:PNP,SI,R-124	07263	S022650
Q866	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
Q868	151-0150-00			TRANSISTOR:SELECTED	80009	151-0150-00
Q900	151-0260-00			TRANSISTOR:NPN,SI,TO-39	04713	ST1083
Q904	151-0207-00			TRANSISTOR:NPN,SI,X-55,SEL	57668	XD11BCP0207
Q940	151-0207-00			TRANSISTOR:NPN,SI,X-55,SEL	57668	XD11BCP0207
Q943	151-0260-00			TRANSISTOR:NPN,SI,TO-39	04713	ST1083
R1	315-0470-00			RES,FXD,FILM:47 OHM,5%,0.25W	57668	NTR25J-E47E0
R2	315-0752-00			RES,FXD,FILM:7.5K OHM,5%,0.25W	57668	NTR25J-E07K5
R3	315-0683-00			RES,FXD,FILM:68K OHM,5%,0.25W	57668	NTR25J-E68K0
R4	315-0622-00			RES,FXD,FILM:6.2K OHM,5%,0.25W	19701	5043CX6K200J
R5	315-0223-00	B010100	B019999	RES,FXD,FILM:22K OHM,5%,0.25W	19701	5043CX22K00J92U
R5	315-0103-00	B020000		RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
R7	321-0204-00			RES,FXD,FILM:1.30K OHM,1%,0.125W,TC=T0	19701	5033ED1K300F
R8	311-0704-00	B010100	B269999	RES,VAR,NONWW:TRMR,500 OHM,0.5W	73138	91-101-0
R8	311-1261-00	B270000		RES,VAR,NONWW:TRMR,500 OHM,0.5W	32997	3329P-L58-501
R10	315-0470-00			RES,FXD,FILM:47 OHM,5%,0.25W	57668	NTR25J-E47E0
R11	315-0752-00			RES,FXD,FILM:7.5K OHM,5%,0.25W	57668	NTR25J-E07K5
R12	315-0683-00			RES,FXD,FILM:68K OHM,5%,0.25W	57668	NTR25J-E68K0
R13	315-0622-00			RES,FXD,FILM:6.2K OHM,5%,0.25W	19701	5043CX6K200J
R14	315-0223-00	B010100	B019999	RES,FXD,FILM:22K OHM,5%,0.25W	19701	5043CX22K00J92U
R14	315-0103-00	B020000		RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
R16	315-0473-00			RES,FXD,FILM:47K OHM,5%,0.25W	57668	NTR25J-E47K0
R17	315-0223-00			RES,FXD,FILM:22K OHM,5%,0.25W	19701	5043CX22K00J92U
R19	315-0473-00			RES,FXD,FILM:47K OHM,5%,0.25W	57668	NTR25J-E47K0
R20	315-0223-00			RES,FXD,FILM:22K OHM,5%,0.25W	19701	5043CX22K00J92U
R22	315-0223-00			RES,FXD,FILM:22K OHM,5%,0.25W	19701	5043CX22K00J92U
R24	311-0732-00	B010100	B269999	RES,VAR,NONWW:TRMR,1K OHM,0.5W	01121	SV1021
R24	311-1263-00	B270000		RES,VAR,NONWW:1K OHM,10%,0.50W	32997	3329P-L58-102
R25	322-0251-00			RES,FXD,FILM:4.02K OHM,1%,0.25W,TC=T0	19701	5043RD4K020F

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
R27	321-0298-00			RES,FXD,FILM:12.4K OHM,1%,0.125W,TC=T0	07716	CEAD12401F
R28	321-0365-00			RES,FXD,FILM:61.9K OHM,1%,0.125W,TC=T0	07716	CEAD61901F
R29	315-0104-00			RES,FXD,FILM:100K OHM,5%,0.25W	57668	NTR25J-E100K
R30	315-0472-00			RES,FXD,FILM:4.7K OHM,5%,0.25W	57668	NTR25J-E04K7
R32	315-0223-00			RES,FXD,FILM:22K OHM,5%,0.25W	19701	5043CX22K00J92U
R33	315-0622-00			RES,FXD,FILM:6.2K OHM,5%,0.25W	19701	5043CX6K200J
R34	315-0223-00			RES,FXD,FILM:22K OHM,5%,0.25W	19701	5043CX22K00J92U
R35	315-0472-00			RES,FXD,FILM:4.7K OHM,5%,0.25W	57668	NTR25J-E04K7
R37	321-0335-00	B010100	B169999	RES,FXD,FILM:30.1K OHM,1%,0.125W,TC=T0	57668	RB14FXE30K1
R37	321-0329-00	B170000		RES,FXD,FILM:26.1K OHM,1%,0.125W,TC=T0	19701	5043ED26K10F
R39	322-0298-00			RES,FXD,FILM:12.4K OHM,1%,0.25W,TC=T0	19701	5043RD12K40F
R40	315-0104-00			RES,FXD,FILM:100K OHM,5%,0.25W	57668	NTR25J-E100K
R41	315-0471-00			RES,FXD,FILM:470 OHM,5%,0.25W	57668	NTR25J-E470E
R42	315-0223-00			RES,FXD,FILM:22K OHM,5%,0.25W	19701	5043CX22K00J92U
R43	315-0472-00			RES,FXD,FILM:4.7K OHM,5%,0.25W	57668	NTR25J-E04K7
R44	315-0393-00			RES,FXD,FILM:39K OHM,5%,0.25W	57668	NTR25J-E39K0
R45	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
R46	321-0280-00			RES,FXD,FILM:8.06K OHM,1%,0.125W,TC=T0	19701	5033ED8K060F
R48	321-0258-00			RES,FXD,FILM:4.75K OHM,1%,0.125W,TC=T0	19701	5033ED4K750F
R50	315-0471-00			RES,FXD,FILM:470 OHM,5%,0.25W	57668	NTR25J-E470E
R51	321-0348-00			RES,FXD,FILM:41.2K OHM,1%,0.125W,TC=T0	19701	5043ED41K20F
R52	315-0153-00			RES,FXD,FILM:15K OHM,5%,0.25W	19701	5043CX15K00J
R53	315-0563-00			RES,FXD,FILM:56K OHM,5%,0.25W	19701	5043CX56K00J
R54	309-0329-00	B010100	B019999	RES,FXD,FILM:2.87 MEG OHM,1%,0.5W	91637	DCS123128703F
R54	323-0525-00	B020000		RES,FXD,FILM:2.87 MEG OHM,1%,0.5W,TC=T0	19701	5053RD2M870F
R55	323-0433-00			RES,FXD,FILM:316K OHM,1%,0.5W,TC=T0	19701	5053RRD316K0F
R57	323-0712-00			RES,FXD,FILM:1.43MEG OHM,0.5%,0.5W,TC=T0	19701	5053RD1M430D
R58	323-0404-00			RES,FXD,FILM:158K OHM,1%,0.5W,TC=T0	19701	5053RD158K0F
R60	323-0467-00			RES,FXD,FILM:715K OHM,1%,0.5W,TC=T0	19701	5053RD715K0F
R61	323-0375-01			RES,FXD,FILM:78.7K OHM,0.5%,0.5W,TC=T0	75042	CECT0-7872D
R63	323-0467-00			RES,FXD,FILM:715K OHM,1%,0.5W,TC=T0	19701	5053RD715K0F
R64	323-0375-01			RES,FXD,FILM:78.7K OHM,0.5%,0.5W,TC=T0	75042	CECT0-7872D
R66	315-0473-00			RES,FXD,FILM:47K OHM,5%,0.25W	57668	NTR25J-E47K0
R67	315-0223-00			RES,FXD,FILM:22K OHM,5%,0.25W	19701	5043CX22K00J92U
R71	315-0622-00			RES,FXD,FILM:6.2K OHM,5%,0.25W	19701	5043CX6K200J
R72	315-0622-00			RES,FXD,FILM:6.2K OHM,5%,0.25W	19701	5043CX6K200J
R73	315-0622-00			RES,FXD,FILM:6.2K OHM,5%,0.25W	19701	5043CX6K200J
R74	315-0622-00			RES,FXD,FILM:6.2K OHM,5%,0.25W	19701	5043CX6K200J
R76	315-0473-00			RES,FXD,FILM:47K OHM,5%,0.25W	57668	NTR25J-E47K0
R77	315-0223-00			RES,FXD,FILM:22K OHM,5%,0.25W	19701	5043CX22K00J92U
R78	315-0105-00			RES,FXD,FILM:1M OHM,5%,0.25W	19701	5043CX1M000J
R80	315-0622-00			RES,FXD,FILM:6.2K OHM,5%,0.25W	19701	5043CX6K200J
R81	315-0223-00			RES,FXD,FILM:22K OHM,5%,0.25W	19701	5043CX22K00J92U
R83	301-0275-00			RES,FXD,FILM:2.7M OHM,5%,0.5W	01121	EB2755
R85	311-0863-00	B010100	B269999	RES,VAR,NONWW:TRMR,500 OHM,0.5W	01121	SH5011
R85	311-1279-00	B270000		RES,VAR,NONWW:TRMR,500 OHM,0.5W	32997	3329S-L58-501
R86	311-0863-00	B010100	B269999	RES,VAR,NONWW:TRMR,500 OHM,0.5W	01121	SH5011
R86	311-1279-00	B270000		RES,VAR,NONWW:TRMR,500 OHM,0.5W	32997	3329S-L58-501
R88	311-0386-00			RES,VAR,WW:PNL,2K OHM,2W	02111	534-9778
R89	315-0221-00			RES,FXD,FILM:220 OHM,5%,0.25W	57668	NTR25J-E220E
R90	315-0104-00			RES,FXD,FILM:100K OHM,5%,0.25W	57668	NTR25J-E100K
R92	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
R94	305-0103-00			RES,FXD,CMPSN:10K OHM,5%,2W	01121	HB1035
R95	321-0242-00			RES,FXD,FILM:3.24K OHM,1%,0.125W,TC=T0	19701	5043ED3K240F
R96	301-0204-00			RES,FXD,FILM:200K OHM,5%,0.5W	19701	5053CX200K0J
R97	311-0836-00	B010100	B269999	RES,VAR,NONWW:TRMR,5K OHM,0.5W	01121	SV5021
R97	311-1267-00	B270000		RES,VAR,NONWW:TRMR,5K OHM,0.5W	32997	3329P-L58-502
R101	315-0473-00			RES,FXD,FILM:47K OHM,5%,0.25W	57668	NTR25J-E47K0

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
R102	315-0223-00			RES,FXD,FILM:22K OHM,5%,0.25W	19701	5043CX22K00J92U
R103	315-0622-00			RES,FXD,FILM:6.2K OHM,5%,0.25W	19701	5043CX6K200J
R105	315-0512-00			RES,FXD,FILM:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
R107	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
R108	315-0563-00			RES,FXD,FILM:56K OHM,5%,0.25W	19701	5043CX56K00J
R109	305-0113-00	B010100	B019999	RES,FXD,CMPSN:11K OHM,5%,2W	01121	HB1135
R109	308-0286-00	B020000		RES,FXD,WW:8.2K OHM,5%,3W	00213	1240S-8200-5
R110	315-0330-00			RES,FXD,FILM:33 OHM,5%,0.25W	19701	5043CX33R00J
R112	321-0204-00			RES,FXD,FILM:1.30K OHM,1%,0.125W,TC=T0	19701	5033ED1K300F
R113	311-0827-00	B010100	B269999	RES,VAR,NONWW:TRMR,250 OHM,0.5W	01121	SV2511
R113	311-1260-00	B270000		RES,VAR,NONWW:TRMR,250 OHM,0.5W	32997	3329P-L58-251
R116	315-0474-00			RES,FXD,FILM:470K OHM,5%,0.25W	19701	5043CX470K0J92U
R117	315-0105-00			RES,FXD,FILM:1M OHM,5%,0.25W	19701	5043CX1M000J
R119	315-0104-00			RES,FXD,FILM:100K OHM,5%,0.25W	57668	NTR25J-E100K
R120	315-0205-00			RES,FXD,FILM:2M OHM,5%,0.25W	01121	CB2055
R121	315-0205-00			RES,FXD,FILM:2M OHM,5%,0.25W	01121	CB2055
R123	315-0202-00			RES,FXD,FILM:2K OHM,5%,0.25W	57668	NTR25J-E 2K
R124	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
R125	322-0239-01	B010100	B189999	RES,FXD,FILM:3.01K OHM,1%,0.25W,TC=T0	75042	CEBT0-3011D
R125	321-0239-07	B190000		RES,FXD,FILM:3.01K OHM,0.1%,0.125W,TC=T9MI	07716	CEAE30100B
R127	311-0840-00	B010100	B269999	RES,VAR,NONWW:TRMR,20K OHM,0.5W	73138	91-103-0
R127	311-1269-00	B270000		RES,VAR,NONWW:TRMR,20K OHM,0.5W	32997	3329P-L58-203
R128	315-0564-00			RES,FXD,FILM:560K OHM,5%,0.25W	19701	5043CX560K0J
R130	301-0363-00			RES,FXD,FILM:36K OHM,5%,0.5W	19701	5053CX36K00J
R131	315-0823-00			RES,FXD,FILM:82K OHM,5%,0.25W	57668	NTR25J-E82K
R132	315-0152-00			RES,FXD,FILM:1.5K OHM,5%,0.25W	57668	NTR25J-E01K5
R134	302-0330-00			RES,FXD,CMPSN:33 OHM,10%,0.5W	01121	EB 3301
R135	305-0133-00	B010100	B019999	RES,FXD,CMPSN:13K OHM,5%,2W	01121	HB1335
R135	305-0113-00	B020000		RES,FXD,CMPSN:11K OHM,5%,2W	01121	HB1135
R137	322-0239-01	B010100	B189999	RES,FXD,FILM:3.01K OHM,1%,0.25W,TC=T0	75042	CEBT0-3011D
R137	321-0239-07	B190000		RES,FXD,FILM:3.01K OHM,0.1%,0.125W,TC=T9MI	07716	CEAE30100B
R138	315-0471-00			RES,FXD,FILM:470 OHM,5%,0.25W	57668	NTR25J-E470E
R139	321-0289-00			RES,FXD,FILM:10.0K OHM,1%,0.125W,TC=T0	19701	5033ED10K0F
R141	322-0239-01	B010100	B189999	RES,FXD,FILM:3.01K OHM,1%,0.25W,TC=T0	75042	CEBT0-3011D
R141	321-0239-07	B190000		RES,FXD,FILM:3.01K OHM,0.1%,0.125W,TC=T9MI	07716	CEAE30100B
R142	322-0239-01	B010100	B189999	RES,FXD,FILM:3.01K OHM,1%,0.25W,TC=T0	75042	CEBT0-3011D
R142	321-0239-07	B190000		RES,FXD,FILM:3.01K OHM,0.1%,0.125W,TC=T9MI	07716	CEAE30100B
R144	321-0685-00			RES,FXD,FILM:30K OHM,0.5%,0.125W,TC=T2	19701	5033RC30K00D
R145	321-0685-00			RES,FXD,FILM:30K OHM,0.5%,0.125W,TC=T2	19701	5033RC30K00D
R147	315-0472-00			RES,FXD,FILM:4.7K OHM,5%,0.25W	57668	NTR25J-E04K7
R149	315-0334-00			RES,FXD,FILM:330K OHM,5%,0.25W	57668	NTR25J-E 330K
R154	315-0104-00			RES,FXD,FILM:100K OHM,5%,0.25W	57668	NTR25J-E100K
R156	315-0163-00			RES,FXD,FILM:16K OHM,5%,0.25W	57668	NTR25J-E 16K
R157	315-0683-00			RES,FXD,FILM:68K OHM,5%,0.25W	57668	NTR25J-E68K0
R160	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
R162	321-0285-00			RES,FXD,FILM:9.09K OHM,1%,0.125W,TC=T0	07716	CEAD90900F
R165	321-0234-00	B010100	B019999	RES,FXD,FILM:2.67K OHM,1%,0.125W,TC=T0	19701	5033ED2K67F
R165	321-0232-00	B020000		RES,FXD,FILM:2.55K OHM,1%,0.125W,TC=T0	19701	5043ED2K550F
R166	321-0193-00			RES,FXD,FILM:1K OHM,1%,0.125W,TC=T0	19701	5033ED1K00F
R167	323-0345-00			RES,FXD,FILM:38.3K OHM,1%,0.5W,TC=T0	75042	CECT0-3832F
R170	305-0752-00			RES,FXD,CMPSN:7.5K OHM,5%,2W	01121	HB7525
R171	315-0470-00			RES,FXD,FILM:47 OHM,5%,0.25W	57668	NTR25J-E47E0
R174	301-0470-00			RES,FXD,FILM:47 OHM,5%,0.5W	19701	5053CX47R00J
R177	301-0470-00			RES,FXD,FILM:47 OHM,5%,0.5W	19701	5053CX47R00J
R182	308-0204-00			RES,FXD,WW:1 OHM,5%,10W CHASSIS MT	91637	HL1202Z71R000J
R185	301-0470-00	B010100	B019999	RES,FXD,FILM:47 OHM,5%,0.5W	19701	5053CX47R00J
R185	323-0065-00	B020000		RES,FXD,FILM:46.4 OHM,1%,0.5W,TC=T0	91637	CMF65116G46R40F
R186	301-0150-00			RES,FXD,FILM:15 OHM,5%,0.5W	19701	5053CX15R00J

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
R187	308-0441-00			RES,FXD,WW:3 OHM,5%,3W	14193	SA31-3R00J
R189	304-0223-00	B100000		RES,FXD,CMPSN:22K OHM,10%,1W	01121	GB2231
R190	303-0162-00			RES,FXD,CMPSN:1.6K OHM,5%,1W	01121	GB1625
R192	308-0135-00			RES,FXD,WW:5K OHM,5%,5W	00213	1550S-5000-5
R194	322-0268-00	B010100	B189999	RES,FXD,FILM:6.04K OHM,1%,0.25W,TC=T0	19701	5043RD6K040F
R194	322-0268-03	B190000		RES,FXD,FILM:6.04K OHM,0.25%,0.25W,TC=T2	19701	5043RC6K040C
R195	315-0153-00			RES,FXD,FILM:15K OHM,5%,0.25W	19701	5043CX15K00J
R196	301-0102-00	B100000		RES,FXD,CMPSN:1K OHM,5%,0.50W	19701	5053CX1K000J
R197	309-0095-00	B010100	B049999	RES,FXD,FILM:10 MEG OHM,1%,0.5W	75042	CECT0-1005F
R197	323-0577-01	B050000	B109999	RES,FXD,FILM:10M OHM,0.5%,0.5W,TC=T0	91637	PME70T0-1005D
R197	325-0071-00	B110000		RES,FXD,FILM:10M OHM,0.5%,0.5W,TC=T0	03888	PME70 10M 0.5%
R198	309-0095-00	B010100	B049999	RES,FXD,FILM:10 MEG OHM,1%,0.5W	75042	CECT0-1005F
R198	323-0577-01	B050000	B109999	RES,FXD,FILM:10M OHM,0.5%,0.5W,TC=T0	91637	PME70T0-1005D
R198	325-0071-00	B110000		RES,FXD,FILM:10M OHM,0.5%,0.5W,TC=T0	03888	PME70 10M 0.5%
R200	323-0481-01			RES,FXD,FILM:1 MEG OHM,0.5%,0.5W,TC=T0	19701	5053RD1M000D
R201	323-0481-01			RES,FXD,FILM:1 MEG OHM,0.5%,0.5W,TC=T0	19701	5053RD1M000D
R203	323-0385-01			RES,FXD,FILM:100K OHM,0.5%,0.5W,TC=T0	19701	5053RD100K0D
R204	323-0385-01			RES,FXD,FILM:100K OHM,0.5%,0.5W,TC=T0	19701	5053RD100K0D
R206	308-0538-00			RES,FXD,WW:10K OHM,0.5%,5W,TC=30PPM	00213	1250SA-10000-0.5
R207	308-0538-00			RES,FXD,WW:10K OHM,0.5%,5W,TC=30PPM	00213	1250SA-10000-0.5
R209	308-0537-00			RES,FXD,WW:1K OHM,0.5%,5W,TC=30PPM	00213	1250SA-1000-0.5
R210	308-0537-00			RES,FXD,WW:1K OHM,0.5%,5W,TC=30PPM	00213	1250SA-1000-0.5
R212	308-0545-00			RES,FXD,WW:100 OHM,0.5%,5W,TC=30PPM	00213	1250SA-100-0.5
R213	308-0545-00			RES,FXD,WW:100 OHM,0.5%,5W,TC=30PPM	00213	1250SA-100-0.5
R214	308-0545-00	B100000		RES,FXD,WW:100 OHM,0.5%,5W,TC=30PPM	00213	1250SA-100-0.5
R215	308-0512-00	B010100	B099999	RES,FXD,WW:10 OHM,5%,55W,TC=50PPM	91637	HL5508Z810R00D
R215	308-0591-00	B100000		RES,FXD,WW:40 OHM,0.5%,55W,TC=50PPM	91637	HLT5509Z-11
R216	308-0512-00	B010100	B099999	RES,FXD,WW:10 OHM,5%,55W,TC=50PPM	91637	HL5508ZB10R00D
R216	308-0591-00	B100000		RES,FXD,WW:40 OHM,0.5%,55W,TC=50PPM	91637	HLT5509Z-11
R220	303-0473-00			RES,FXD,CMPSN:47K OHM,5%,1W	01121	GB4735
R224	311-0884-00	B010100	B269999	RES,VAR,NONWW:TRMR,100 OHM,0.5W	01121	SV 1011
R224	311-1259-00	B270000		RES,VAR,NONWW:TRMR,100 OHM,0.5W	32997	3329P-L58-101
R227	323-0337-00			RES,FXD,FILM:31.6K OHM,1%,0.5W,TC=T0	19701	5053RD31K60F
R230	321-0370-00			RES,FXD,FILM:69.8K OHM,1%,0.125W,TC=T0	07716	CEAD69801F
R231	321-0335-00			RES,FXD,FILM:30.1K OHM,1%,0.125W,TC=T0	57668	RB14FXE30K1
R233	321-0370-00			RES,FXD,FILM:69.8K OHM,1%,0.125W,TC=T0	07716	CEAD69801F
R236	321-0326-00			RES,FXD,FILM:24.3K OHM,1%,0.125W,TC=T0	19701	5043ED24K30F
R237	321-0397-00			RES,FXD,FILM:133K OHM,1%,0.125W,TC=T0	19701	5043ED133K0F
R239	315-0473-00			RES,FXD,FILM:47K OHM,5%,0.25W	57668	NTR25J-E47K0
R240	301-0163-00			RES,FXD,FILM:16K OHM,5%,0.5W	19701	5053CX16K00J
R241	315-0153-00			RES,FXD,FILM:15K OHM,5%,0.25W	19701	5043CX15K00J
R243	311-0732-00	B010100	B269999	RES,VAR,NONWW:TRMR,1K OHM,0.5W	01121	SV1021
R243	311-1263-00	B270000		RES,VAR,NONWW:1K OHM,10%,0.50W	32997	3329P-L58-102
R244	321-0312-00	B010100	B019999	RES,FXD,FILM:17.4K OHM,1%,0.125W,TC=T0	19701	5033ED17K40F
R244	321-0313-00	B020000		RES,FXD,FILM:17.8K OHM,1%,0.125W,TC=T0	07716	CEAD17801F
R245	315-0331-00			RES,FXD,FILM:330 OHM,5%,0.25W	57668	NTR25J-E330E
R246	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
R247	315-0183-00			RES,FXD,FILM:18K OHM,5%,0.25W	19701	5043CX18K00J
R253	315-0183-00			RES,FXD,FILM:18K OHM,5%,0.25W	19701	5043CX18K00J
R254	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
R296	307-0106-00			RES,FXD,CMPSN:4.7 OHM,5%,0.25W	01121	CB 47G5
R298	307-0106-00			RES,FXD,CMPSN:4.7 OHM,5%,0.25W	01121	CB 47G5
R300	308-0568-00			RES,FXD,WW:35 OHM,5%,5W	00213	1550S-35-5
R305	306-0101-00			RES,FXD,CMPSN:100 OHM,10%,2W	01121	HB1011
R307	306-0101-00			RES,FXD,CMPSN:100 OHM,10%,2W	01121	HB1011
R317	305-0334-00			RES,FXD,CMPSN:330K OHM,5%,2W	01121	HB3345
R318	305-0334-00			RES,FXD,CMPSN:330K OHM,5%,2W	01121	HB3345
R319	305-0104-00			RES,FXD,CMPSN:100K OHM,5%,2W	01121	HB1045

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
R323	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
R325	308-0244-00			RES,FXD,WW:0.3 OHM,10%,2W	00213	310S 0.3-10
R326	301-0152-02			RES,FXD,CMPSN:1.5K OHM,5%,0.50W	01121	EB1525 (CD PACK)
R328	308-0179-00			RES,FXD,WW:5 OHM,5%,5W	00213	1550S 5-5
R329	303-0153-00			RES,FXD,CMPSN:15K OHM,5%,1W	01121	GB1535
R331	308-0075-00			RES,FXD,WW:100 OHM,5%,3W	00213	1240S-100-5
R332	306-0224-00			RES,FXD,CMPSN:220K OHM,10%,2W	01121	HB2241
R334	308-0230-00			RES,FXD,WW:2.7K OHM,5%,3W	14193	SA31-2701J
R335	305-0475-00			RES,FXD,CMPSN:4.7M OHM,5%,2W	01121	HB4755
R336	305-0475-00			RES,FXD,CMPSN:4.7M OHM,5%,2W	01121	HB4755
R346	308-0533-00			RES,FXD,WW:6.2 OHM,5%,65W,TAPPED AT	91637	HLT-70-09Z-AR0
R348	308-0534-00			RES,FXD,WW:133.5 OHM,5%,65W,TAPPED AT 23.5 OHM,2%	91637	HLT70-09Z-AR0
R350	308-0535-00			RES,FXD,WW:2.35K OHM,5%,65W,TAPPED AT 510 OHM,2%	91637	HLT70-09Z-AR0
R352	308-0536-00			RES,FXD,WW:11K OHM,5%,65W	91637	HL-70-09Z
R354	307-0204-01			RES,FXD,FILM:6.486M OHM,2%,5W,W/TAPS	80009	307-0204-01
R370	301-0220-00			RES,FXD,FILM:22 OHM,5%,0.5W	19701	5053CX22R00J
R376	301-0220-00			RES,FXD,FILM:22 OHM,5%,0.5W	19701	5053CX22R00J
R401	312-0653-00	B010100	B209999	RES SET,MATCHED:(2) RESISTORS SELECTED	80009	312-0653-00
R401	312-0653-01	B210000		RES SET,MATCHED:(2) RESISTORS SELECTED	80009	312-0653-01
R402	312-0654-00	B010100	B209999	RES SET,MATCHED:(2) RESISTORS SELECTED	80009	312-0654-00
R402	312-0654-01	B210000		RES SET,MATCHED:(2) RESISTORS SELECTED	80009	312-0654-01
R403	312-0655-00	B010100	B209999	RES SET,MATCHED:(2)RESISTORS SELECTED	80009	312-0655-00
R403	312-0655-01	B210000		RES SET,MATCHED:(2) RESISTORS,+/-1% TOTAL	80009	312-0655-01
R405	308-0509-00			RESISTOR ASSY:	80009	308-0509-00
R407	----- -----			(PART OF R405)		
R409	----- -----			(PART OF R405)		
R411	308-0018-00			RES,FXD,WW:2.5K OHM,5%,10W	91637	HL1202Z7 2.5K 5%
R412	308-0499-00	B010100	B010129	RES,FXD,WW:0.5 OHM,10%,2.5W,AXIAL	14193	SA31 R500K
R414	307-0103-00			RES,FXD,CMPSN:2.7 OHM,5%,0.25W	01121	CB27G5
R415	321-0039-00			RES,FXD,FILM:24.9 OHM,1%,0.125W,TC=T0	91637	CMF55116G24R90F
R416	321-0135-00			RES,FXD,FILM:249 OHM,1%,0.125W,TC=T0	07716	CEAD249R0F
R417	321-0231-00			RES,FXD,FILM:2.49K OHM,1%,0.125W,TC=T0	19701	5033ED2K49F
R418	321-0327-00			RES,FXD,FILM:24.9K OHM,1%,0.125W,TC=T0	07716	CEAD24901F
R420	321-0243-00			RES,FXD,FILM:3.32K OHM,1%,0.125W,TC=T0	19701	5033ED3K32F
R422	301-0273-00			RES,FXD,FILM:27K OHM,5%,0.5W	19701	5053CX27K00J
R425	303-0273-00			RES,FXD,CMPSN:27K OHM,5%,1W	01121	GB2735
R427	321-0645-00			RES,FXD,FILM:100K OHM,0.5%,0.125W,TC=T2	19701	5033RC1003D
R428	323-0611-03			RES,FXD,FILM:900K OHM,0.25%,0.5W,TC=T2	19701	5053RC900K0C
R430	302-0273-00			RES,FXD,CMPSN:27K OHM,10%,0.5W	01121	EB 2731
R433	312-0653-00	B010100	B209999	RES SET,MATCHED:(2) RESISTORS SELECTED	80009	312-0653-00
R433	312-0653-01	B210000		RES SET,MATCHED:(2) RESISTORS SELECTED	80009	312-0653-01
R434	312-0654-00	B010100	B209999	RES SET,MATCHED:(2) RESISTORS SELECTED	80009	312-0654-00
R434	312-0654-01	B210000		RES SET,MATCHED:(2) RESISTORS SELECTED	80009	312-0654-01
R435	304-0273-00			RES,FXD,CMPSN:27K OHM,10%,1W	01121	CB2731
R436	312-0655-00	B010100	B089999	RES SET,MATCHED:(2)RESISTORS SELECTED	80009	312-0655-00
R436	312-0661-00	B090000	B209999	RES SET,MATCHED:(2)RESISTORS,+/-1% TOTAL	80009	312-0661-00
R436	312-0661-01	B210000		RES SET,MATCHED:(2) RESISTORS,+/-1% TOTAL	80009	312-0661-01
R437	321-0231-00	B010100	B089999	RES,FXD,FILM:2.49K OHM,1%,0.125W,TC=T0	19701	5033ED2K49F
R437	301-0105-00	B090000		RES,FXD,FILM:1M OHM,5%,0.50W	19701	5053CX1M000J
R438	321-0135-00	B010100	B089999	RES,FXD,FILM:249 OHM,1%,0.125W,TC=T0	07716	CEAD249R0F
R438	301-0362-00	B090000		RES,FXD,FILM:3.6K OHM,5%,0.5W	19701	5053CX3K600J
R439	321-1231-01			RES,FXD,FILM:2.52K OHM,0.5%,0.125W,TC=T0	07716	CEAD252000
R440	308-0544-00			RES,FXD,WW:22.5K OHM,0.25%,5W,TC=30PPM	00213	1500S-22500-0.25
R442	308-0544-00			RES,FXD,WW:22.5K OHM,0.25%,5W,TC=30PPM	00213	1500S-22500-0.25
R443	308-0539-00			RES,FXD,WW:2.25K OHM,0.5%,3W,TX=20PPM	00213	1240S22500D
R444	321-0131-00			RES,FXD,FILM:226 OHM,1%,0.125W,TC=T0	19701	5043ED226R0F

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
R445	321-0039-00			RES,FXD,FILM:24.9 OHM,1%,0.125W,TC=T0	91637	CMF55116G24R90F
R447	321-0198-00			RES,FXD,FILM:1.13K OHM,1%,0.125W,TC=T0	07716	CEAD11300F
R449	302-0273-00			RES,FXD,CMPSN:27K OHM,10%,0.5W	01121	EB 2731
R450	322-0673-03			RES,FXD,FILM:500K OHM,0.25%,0.25W,TC=T2	75042	CCAT2-5003C
R452	322-0673-03			RES,FXD,FILM:500K OHM,0.25%,0.25W,TC=T2	75042	CCAT2-5003C
R454	322-0673-03			RES,FXD,FILM:500K OHM,0.25%,0.25W,TC=T2	75042	CCAT2-5003C
R456	322-0673-03			RES,FXD,FILM:500K OHM,0.25%,0.25W,TC=T2	75042	CCAT2-5003C
R458	322-0673-03			RES,FXD,FILM:500K OHM,0.25%,0.25W,TC=T2	75042	CCAT2-5003C
R460	322-0673-03			RES,FXD,FILM:500K OHM,0.25%,0.25W,TC=T2	75042	CCAT2-5003C
R462	323-0498-00			RES,FXD,FILM:1.50 MEG OHM,1%,0.5W,TC=T0	19701	5053RD1M50F
R464	323-0498-00			RES,FXD,FILM:1.50 MEG OHM,1%,0.5W,TC=T0	19701	5053RD1M50F
R468	321-0402-01			RES,FXD,FILM:150K OHM,0.5%,0.125W,TC=T0	24546	NA55D1503D
R469	321-0402-01			RES,FXD,FILM:150K OHM,0.5%,0.125W,TC=T0	24546	NA55D1503D
R471	321-0402-01			RES,FXD,FILM:150K OHM,0.5%,0.125W,TC=T0	24546	NA55D1503D
R472	321-0402-01			RES,FXD,FILM:150K OHM,0.5%,0.125W,TC=T0	24546	NA55D1503D
R474	321-0402-01			RES,FXD,FILM:150K OHM,0.5%,0.125W,TC=T0	24546	NA55D1503D
R475	321-0402-01			RES,FXD,FILM:150K OHM,0.5%,0.125W,TC=T0	24546	NA55D1503D
R477	321-0402-01			RES,FXD,FILM:150K OHM,0.5%,0.125W,TC=T0	24546	NA55D1503D
R478	321-0402-01			RES,FXD,FILM:150K OHM,0.5%,0.125W,TC=T0	24546	NA55D1503D
R480	321-0402-01			RES,FXD,FILM:150K OHM,0.5%,0.125W,TC=T0	24546	NA55D1503D
R481	321-0402-01			RES,FXD,FILM:150K OHM,0.5%,0.125W,TC=T0	24546	NA55D1503D
R482	321-0402-01			RES,FXD,FILM:150K OHM,0.5%,0.125W,TC=T0	24546	NA55D1503D
R483	321-0402-01			RES,FXD,FILM:150K OHM,0.5%,0.125W,TC=T0	24546	NA55D1503D
R484	322-0402-00			RES,FXD,FILM:150K OHM,1%,0.25W,TC=T0	19701	5043RD150K0F
R485	322-0402-00			RES,FXD,FILM:150K OHM,1%,0.25W,TC=T0	19701	5043RD150K0F
R487	321-0385-00			RES,FXD,FILM:100K OHM,1%,0.125W,TC=T0	19701	5033ED100K0F
R488	311-0881-00			RES,VAR,NONWW:PNL,20K OHM,0.5W	01121	W-7674
R490	321-0402-01			RES,FXD,FILM:150K OHM,0.5%,0.125W,TC=T0	24546	NA55D1503D
R491	321-0402-01			RES,FXD,FILM:150K OHM,0.5%,0.125W,TC=T0	24546	NA55D1503D
R492	321-0402-01			RES,FXD,FILM:150K OHM,0.5%,0.125W,TC=T0	24546	NA55D1503D
R493	321-0402-01			RES,FXD,FILM:150K OHM,0.5%,0.125W,TC=T0	24546	NA55D1503D
R494	321-0397-00			RES,FXD,FILM:133K OHM,1%,0.125W,TC=T0	19701	5043ED133K0F
R495	321-0397-00			RES,FXD,FILM:133K OHM,1%,0.125W,TC=T0	19701	5043ED133K0F
R497	321-0385-00			RES,FXD,FILM:100K OHM,1%,0.125W,TC=T0	19701	5033ED100K0F
R498	311-0381-00			RES,VAR,NONWW:PNL,2X100K OHM,20%,2W	01121	JJ-89117C
R501	308-0542-00			RES,FXD,WW:500 OHM,0.1%,3W,TC=20PPM	00213	1240S 500-0.1
R503	308-0542-00			RES,FXD,WW:500 OHM,0.1%,3W,TC=20PPM	00213	1240S 500-0.1
R505	308-0541-00			RES,FXD,WW:1K OHM,0.1%,3W,TC=20PPM	00213	1240S-10000B
R507	308-0542-00			RES,FXD,WW:500 OHM,0.1%,3W,TC=20PPM	00213	1240S 500-0.1
R509	308-0540-00			RES,FXD,WW:1.5K OHM,0.1%,TC=20PPM	00213	1240S-1500-0.1
R511	321-0300-00			RES,FXD,FILM:13.0K OHM,1%,0.125W,TC=T0	07716	CEAD13001F
R512	311-0540-00	B010100	B219999	RES,VAR,WW:TRMR,2.5K OHM,1W	80294	3345P-1-252
R512	311-1226-00	B220000		RES,VAR,NONWW:TRMR,2.5K OHM,0.5W	32997	3386F-T04-252
R513	308-0543-00			RES,FXD,WW:8.25K OHM,1%,3W,TC=30PPM	00213	1240S-8250-1
R520	302-0473-00			RES,FXD,CMPSN:47K OHM,10%,0.5W	01121	EB 4731
R521	302-0473-00			RES,FXD,CMPSN:47K OHM,10%,0.5W	01121	EB 4731
R523	302-0183-00			RES,FXD,CMPSN:18K OHM,10%,0.5W	01121	EB 1831
R524	302-0183-00			RES,FXD,CMPSN:18K OHM,10%,0.5W	01121	EB 1831
R526	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
R527	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
R531	323-0366-00			RES,FXD,FILM:63.4K OHM,1%,0.5W,TC=T0	19701	5053RD63K40F
R533	315-0470-00			RES,FXD,FILM:47 OHM,5%,0.25W	57668	NTR25J-E47E0
R535	321-0187-00			RES,FXD,FILM:866 OHM,1%,0.125W,TC=T0	07716	CEAD866R0F
R536	311-0827-00	B010100	B269999	RES,VAR,NONWW:TRMR,250 OHM,0.5W	01121	SV2511
R536	311-1260-00	B270000		RES,VAR,NONWW:TRMR,250 OHM,0.5W	32997	3329P-L58-251
R538	311-0886-00	B010100	B269999	RES,VAR,NONWW:TRMR,50 OHM,0.5W	01121	SV5001
R538	311-1258-00	B270000		RES,VAR,NONWW:TRMR,50 OHM,0.5W	32997	3329P-L58-500
R540	321-0144-00			RES,FXD,FILM:309 OHM,1%,0.125W,TC=T0	07716	CEAD309R0F

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
R541	311-0886-00	B010100	B269999	RES,VAR,NONWW:TRMR,50 OHM,0.5W	01121	SV5001
R541	311-1258-00	B270000		RES,VAR,NONWW:TRMR,50 OHM,0.5W	32997	3329P-L58-500
R543	321-0140-00			RES,FXD,FILM:280 OHM,1%,0.125W,TC=T0	07716	CEAD280R0F
R545	311-0831-00	B010100	B269999	RES,VAR,NONWW:TRMR,100K OHM,0.5W	73138	91-104-0
R545	311-1272-00	B270000		RES,VAR,NONWW:TRMR,100K OHM,0.5W	32997	3329P-L58-104
R547	322-0481-00			RES,FXD,FILM:1M OHM,1%,0.25W,TC=T0	75042	CEBT0-1004F
R548	321-0452-00			RES,FXD,FILM:499K OHM,1%,0.125W,TC=T0	19701	5043ED499K0F
R549	322-0481-00			RES,FXD,FILM:1M OHM,1%,0.25W,TC=T0	75042	CEBT0-1004F
R550	311-0883-00	B010100	B269999	RES,VAR,NONWW:TRMR, 50K OHM,0.5W	01121	SV5031
R550	311-1271-00	B270000		RES,VAR,NONWW:TRMR,50K OHM,0.5W	32997	3329P-L58-503
R553	321-0423-00			RES,FXD,FILM:249K OHM,1%,0.125W,TC=T0	19701	5043ED249K0F
R555	315-0470-00			RES,FXD,FILM:47 OHM,5%,0.25W	57668	NTR25J-E47E0
R557	323-0366-00			RES,FXD,FILM:63.4K OHM,1%,0.5W,TC=T0	19701	5053RD63K40F
R561	323-0349-00			RES,FXD,FILM:42.2K OHM,1%,0.5W,TC=T0	19701	5053RD42K20F
R564	321-0452-00			RES,FXD,FILM:499K OHM,1%,0.125W,TC=T0	19701	5043ED499K0F
R566	321-0452-00			RES,FXD,FILM:499K OHM,1%,0.125W,TC=T0	19701	5043ED499K0F
R568	323-0349-00			RES,FXD,FILM:42.2K OHM,1%,0.5W,TC=T0	19701	5053RD42K20F
R571	321-0281-00			RES,FXD,FILM:8.25K OHM,1%,0.125W,TC=T0	19701	5043ED8K250F
R573	311-0827-00	B010100	B269999	RES,VAR,NONWW:TRMR,250 OHM,0.5W	01121	SV2511
R573	311-1260-00	B270000		RES,VAR,NONWW:TRMR,250 OHM,0.5W	32997	3329P-L58-251
R574	321-0186-00			RES,FXD,FILM:845 OHM,1%,0.125W,TC=T0	19701	5043ED845R0F
R576	321-0281-00			RES,FXD,FILM:8.25K OHM,1%,0.125W,TC=T0	19701	5043ED8K250F
R580	321-0318-00			RES,FXD,FILM:20.0K OHM,1%,0.125W,TC=T0	19701	5033ED20K0F
R581	311-0885-00	B010100	B269999	RES,VAR,NONWW:TRMR,200K OHM,0.5W	73138	91-106-0
R581	311-1273-00	B270000		RES,VAR,NONWW:TRMR,200K OHM,0.5W	32997	3329P-L58-204
R584	322-0609-00			RES,FXD,FILM:333K OHM,1%,0.25W,TC=T0	19701	5043RD333K0F
R590	323-0374-00			RES,FXD,FILM:76.8K OHM,1%,0.5W,TC=T0	19701	5053RD76K80F
R592	311-0090-00			RES,VAR,NONWW:PNL,2.20K OHM,1.25W	01121	JJ62881-E
R594	323-0374-00			RES,FXD,FILM:76.8K OHM,1%,0.5W,TC=T0	19701	5053RD76K80F
R620	302-0473-00			RES,FXD,CMPSN:47K OHM,10%,0.5W	01121	EB 4731
R621	302-0473-00			RES,FXD,CMPSN:47K OHM,10%,0.5W	01121	EB 4731
R623	302-0183-00			RES,FXD,CMPSN:18K OHM,10%,0.5W	01121	EB 1831
R624	302-0183-00			RES,FXD,CMPSN:18K OHM,10%,0.5W	01121	EB 1831
R626	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
R627	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
R631	323-0366-00			RES,FXD,FILM:63.4K OHM,1%,0.5W,TC=T0	19701	5053RD63K40F
R633	315-0470-00			RES,FXD,FILM:47 OHM,5%,0.25W	57668	NTR25J-E47E0
R635	321-0198-00			RES,FXD,FILM:1.13K OHM,1%,0.125W,TC=T0	07716	CEAD11300F
R636	311-0827-00	B010100	B269999	RES,VAR,NONWW:TRMR,250 OHM,0.5W	01121	SV2511
R636	311-1260-00	B270000		RES,VAR,NONWW:TRMR,250 OHM,0.5W	32997	3329P-L58-251
R638	311-0884-00	B010100	B269999	RES,VAR,NONWW:TRMR,100 OHM,0.5W	01121	SV 1011
R638	311-1259-00	B270000		RES,VAR,NONWW:TRMR,100 OHM,0.5W	32997	3329P-L58-101
R640	321-0170-00			RES,FXD,FILM:576 OHM,1%,0.125W,TC=T0	07716	CEAD576R0F
R641	311-0886-00	B010100	B269999	RES,VAR,NONWW:TRMR,50 OHM,0.5W	01121	SV5001
R641	311-1258-00	B270000		RES,VAR,NONWW:TRMR,50 OHM,0.5W	32997	3329P-L58-500
R643	321-0171-00			RES,FXD,FILM:590 OHM,1%,0.125W,TC=T0	19701	5033ED590R0F
R645	311-0831-00	B010100	B269999	RES,VAR,NONWW:TRMR,100K OHM,0.5W	73138	91-104-0
R645	311-1272-00	B270000		RES,VAR,NONWW:TRMR,100K OHM,0.5W	32997	3329P-L58-104
R647	309-0023-00	B010100	B019999	RES,FXD,FILM:2 MEG OHM,1%,0.5W	07716	DCC20003F
R647	323-0510-00	B020000		RES,FXD,FILM:2.00 MEG OHM,1%,0.5W,TC=T0	75042	CECT0-2004F
R648	321-0452-00			RES,FXD,FILM:499K OHM,1%,0.125W,TC=T0	19701	5043ED499K0F
R649	309-0023-00	B010100	B019999	RES,FXD,FILM:2 MEG OHM,1%,0.5W	07716	DCC20003F
R649	323-0510-00	B020000		RES,FXD,FILM:2.00 MEG OHM,1%,0.5W,TC=T0	75042	CECT0-2004F
R650	311-0831-00	B010100	B269999	RES,VAR,NONWW:TRMR,100K OHM,0.5W	73138	91-104-0
R650	311-1272-00	B270000		RES,VAR,NONWW:TRMR,100K OHM,0.5W	32997	3329P-L58-104
R653	322-0481-00			RES,FXD,FILM:1M OHM,1%,0.25W,TC=T0	75042	CEBT0-1004F
R655	315-0470-00			RES,FXD,FILM:47 OHM,5%,0.25W	57668	NTR25J-E47E0
R657	323-0366-00			RES,FXD,FILM:63.4K OHM,1%,0.5W,TC=T0	19701	5053RD63K40F

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
R661	323-0349-00			RES,FXD,FILM:42.2K OHM,1%,0.5W,TC=T0	19701	5053RD42K20F
R664	309-0023-00	B010100	B019999	RES,FXD,FILM:2 MEG OHM,1%,0.5W	07716	DCC20003F
R665	323-0510-00	B020000		RES,FXD,FILM:2.00 MEG OHM,1%,0.5W,TC=T0	75042	CECT0-2004F
R666	309-0023-00	B010100	B019999	RES,FXD,FILM:2 MEG OHM,1%,0.5W	07716	DCC20003F
R666	323-0510-00	B020000		RES,FXD,FILM:2.00 MEG OHM,1%,0.5W,TC=T0	75042	CECT0-2004F
R668	323-0349-00			RES,FXD,FILM:42.2K OHM,1%,0.5W,TC=T0	19701	5053RD42K20F
R671	321-0281-00			RES,FXD,FILM:8.25K OHM,1%,0.125W,TC=T0	19701	5043ED8K250F
R673	311-0827-00	B010100	B269999	RES,VAR,NONWW:TRMR,250 OHM,0.5W	01121	SV2511
R673	311-1260-00	B270000		RES,VAR,NONWW:TRMR,250 OHM,0.5W	32997	3329P-L58-251
R674	321-0194-00			RES,FXD,FILM:1.02K OHM,1%,0.125W,TC=T0	07716	CEAD10200F
R676	321-0281-00			RES,FXD,FILM:8.25K OHM,1%,0.125W,TC=T0	19701	5043ED8K250F
R680	321-0337-00			RES,FXD,FILM:31.6K OHM,1%,0.125W,TC=T0	07716	CEAD31601F
R681	311-0885-00	B010100	B269999	RES,VAR,NONWW:TRMR,200K OHM,0.5W	73138	91-106-0
R681	311-1273-00	B270000		RES,VAR,NONWW:TRMR,200K OHM,0.5W	32997	3329P-L58-204
R684	322-0609-00			RES,FXD,FILM:333K OHM,1%,0.25W,TC=T0	19701	5043RD333K0F
R685	311-0695-00	B010100	B269999	RES,VAR,NONWW:TRMR,1MEG OHM,0.5W	01121	SV1051
R685	311-1275-00	B270000		RES,VAR,NONWW:TRMR,1M OHM,0.5W	32997	3329P-L58-105
R686	315-0106-00			RES,FXD,FILM:10M OHM,5%,0.25W	01121	CB1065
R690	323-0374-00			RES,FXD,FILM:76.8K OHM,1%,0.5W,TC=T0	19701	5053RD76K80F
R692	311-0090-00			RES,VAR,NONWW:PNL,2.20K OHM,1.25W	01121	JJ62881-E
R694	323-0374-00			RES,FXD,FILM:76.8K OHM,1%,0.5W,TC=T0	19701	5053RD76K80F
R696	315-0220-00			RES,FXD,FILM:22 OHM,5%,0.25W	19701	5043CX22R00J
R698	315-0220-00			RES,FXD,FILM:22 OHM,5%,0.25W	19701	5043CX22R00J
R704	311-0939-00			RES,VAR,WW:PNL,25 OHM,12.5W	44655	57208
R705	308-0269-00			RES,FXD,WW:22 OHM,5%,3W	00213	1240S-22R00J
R709	323-0313-00			RES,FXD,FILM:17.8K OHM,1%,0.5W,TC=T0	19701	5053RD17K80F
R710	323-0313-00			RES,FXD,FILM:17.8K OHM,1%,0.5W,TC=T0	19701	5053RD17K80F
R711	315-0471-00			RES,FXD,FILM:470 OHM,5%,0.25W	57668	NTR25J-E470E
R713	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
R715	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
R717	301-0303-00			RES,FXD,FILM:30K OHM,5%,0.5W	57668	TR50J-E30K
R719	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
R720	322-0210-00			RES,FXD,FILM:1.50K OHM,1%,0.25W,TC=T0	75042	CEBT0-1501F
R721	311-0704-00	B010100	B269999	RES,VAR,NONWW:TRMR,500 OHM,0.5W	73138	91-101-0
R721	311-1261-00	B270000		RES,VAR,NONWW:TRMR,500 OHM,0.5W	32997	3329P-L58-501
R722	322-0205-00			RES,FXD,FILM:1.33K OHM,1%,0.25W,TC=T0	24546	NA6001331F
R723	308-0566-00			RES,FXD,WW:12.5K OHM,1%,4W	00213	1300S-12500-1
R725	315-0163-00			RES,FXD,FILM:16K OHM,5%,0.25W	57668	NTR25J-E 16K
R726	315-0133-00			RES,FXD,FILM:13K OHM,5%,0.25W	19701	5043CX13K00J
R729	301-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.50W	19701	5053CX1K000J
R730	321-0150-00			RES,FXD,FILM:357 OHM,1%,0.125W,TC=T0	07716	CEAD357R0F
R731	322-0344-00			RES,FXD,FILM:37.4K OHM,1%,0.25W,TC=T0	75042	CEBT0-3742F
R735	307-0051-00			RES,FXD,CMPSN:2.7 OHM,5%,0.5W	01121	EB27G5
R740	321-0260-00			RES,FXD,FILM:4.99K OHM,1%,0.125W,TC=T0	19701	5033ED4K990F
R741	323-0327-00			RES,FXD,FILM:24.9K OHM,1%,0.5W,TC=T0	91637	MFF1226G24901F
R743	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
R745	301-0303-00			RES,FXD,FILM:30K OHM,5%,0.5W	57668	TR50J-E30K
R747	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
R750	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
R752	321-0150-00			RES,FXD,FILM:357 OHM,1%,0.125W,TC=T0	07716	CEAD357R0F
R753	321-0277-00			RES,FXD,FILM:7.50K OHM,1%,0.125W,TC=T0	24546	NA55D7501F
R756	308-0245-00			RES,FXD,WW:0.6 OHM,5%,2W	00213	310S .6-5
R758	308-0269-00			RES,FXD,WW:22 OHM,5%,3W	00213	1240S-22R00J
R760	311-0310-00			RES,VAR,NONWW:PNL,5K OHM,0.5W	01121	W7350A
R762	321-0277-00	B010100	B279999	RES,FXD,FILM:7.50K OHM,1%,0.125W,TC=T0	24546	NA55D7501F
R762	321-0280-00	B280000		RES,FXD,FILM:8.06K OHM,1%,0.125W,TC=T0	19701	5033ED8K060F
R763	321-0254-00	B010100	B279999	RES,FXD,FILM:4.32K OHM,1%,0.125W,TC=T0	07716	CEAD43200F
R763	321-0249-00	B280000		RES,FXD,FILM:3.83K OHM,1%,0.125W,TC=T0	19701	5033ED3K83F

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
R764	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
R766	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
R768	301-0152-00			RES,FXD,FILM:1.5K OHM,5%,0.5W	19701	5053CX1K500J
R769	301-0202-00			RES,FXD,FILM:2K OHM,5%,0.5W	19701	5053CX2K000J
R770	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
R771	301-0111-00			RES,FXD,FILM:110 OHM,5%,0.50W	19701	5053CX110R0J
R775	321-0237-00			RES,FXD,FILM:2.87K OHM,1%,0.125W,TC=T0	07716	CEAD 28700F
R776	321-0148-00			RES,FXD,FILM:340 OHM,1%,0.125W,TC=T0	07716	CEAD340R0F
R777	321-0339-00			RES,FXD,FILM:33.2K OHM,1%,0.125W,TC=T0	07716	CEAD33201F
R778	308-0244-00			RES,FXD,WW:0.3 OHM,10%,2W	00213	310S 0.3-10
R779	308-0244-00			RES,FXD,WW:0.3 OHM,10%,2W	00213	310S 0.3-10
R780	301-0471-00			RES,FXD,FILM:470 OHM,5%,0.5W	19701	5053CX 470R0J
R782	321-0254-00			RES,FXD,FILM:4.32K OHM,1%,0.125W,TC=T0	07716	CEAD43200F
R783	321-0302-00			RES,FXD,FILM:13.7K OHM,1%,0.125W,TC=T0	07716	CEAD 13701F
R788	308-0420-00	B010100	B119999	RES,FXD,WW:1.8 OHM,3%,1.5W	91637	RS-1A-91
R788	308-0365-00	B120000		RES,FXD,WW:1.5 OHM,5%,3W	00213	1240S-1.5-5
R789	301-0111-00			RES,FXD,FILM:110 OHM,5%,0.50W	19701	5053CX110R0J
R791	308-0269-00			RES,FXD,WW:22 OHM,5%,3W	00213	1240S-22R00J
R793	315-0471-00			RES,FXD,FILM:470 OHM,5%,0.25W	57668	NTR25J-E470E
R794	301-0363-00			RES,FXD,FILM:36K OHM,5%,0.5W	19701	5053CX36K00J
R796	301-0823-00			RES,FXD,FILM:82K OHM,5%,0.5W	19701	5053CX82K00J
R797	323-0335-00			RES,FXD,FILM:30.1K OHM,1%,0.5W,TC=T0	75042	CECT0-3012F
R798	321-0231-00			RES,FXD,FILM:2.49K OHM,1%,0.125W,TC=T0	19701	5033ED2K49F
R799	321-0232-00			RES,FXD,FILM:2.55K OHM,1%,0.125W,TC=T0	19701	5043ED2K550F
R804	321-0150-00			RES,FXD,FILM:357 OHM,1%,0.125W,TC=T0	07716	CEAD357R0F
R805	321-0277-00			RES,FXD,FILM:7.50K OHM,1%,0.125W,TC=T0	24546	NA55D7501F
R808	308-0244-00			RES,FXD,WW:0.3 OHM,10%,2W	00213	310S 0.3-10
R810	301-0393-00			RES,FXD,FILM:39K OHM,5%,0.5W	19701	5053CX39K00J
R811	315-0101-00	B040000		RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
R812	321-0300-00			RES,FXD,FILM:13.0K OHM,1%,0.125W,TC=T0	07716	CEAD13001F
R813	321-0302-00			RES,FXD,FILM:13.7K OHM,1%,0.125W,TC=T0	07716	CEAD 13701F
R816	301-0220-00			RES,FXD,FILM:22 OHM,5%,0.5W	19701	5053CX22R00J
R817	321-0152-00			RES,FXD,FILM:374 OHM,1%,0.125W,TC=T0	07716	CEAD374R0F
R818	321-0283-00			RES,FXD,FILM:8.66K OHM,1%,0.125W,TC=T0	19701	5043ED8K660F
R819	308-0459-00			RES,FXD,WW:1.1 OHM,5%,3W	01686	T2B-791.1-5
R822	308-0188-00			RES,FXD,WW:3 OHM,5%,25W	91637	HL-25-02Z-6
R823	301-0223-00			RES,FXD,FILM:22K OHM,5%,0.5W	19701	5053CX22K00J
R825	308-0188-00			RES,FXD,WW:3 OHM,5%,25W	91637	HL-25-02Z-6
R830	308-0564-00			RES,FXD,WW:20K OHM,1%,4W	00213	1300S-20000-1
R831	308-0565-00			RES,FXD,WW:15K OHM,1%,4W AXIAL LEAD	00213	1300S-15000-1
R833	301-0563-00			RES,FXD,FILM:56K OHM,5%,0.5W	19701	5053CX56K00J
R835	315-0273-00			RES,FXD,FILM:27K OHM,5%,0.25W	57668	NTR25J-E27K0
R838	315-0104-00			RES,FXD,FILM:100K OHM,5%,0.25W	57668	NTR25J-E100K
R840	315-0471-00			RES,FXD,FILM:470 OHM,5%,0.25W	57668	NTR25J-E470E
R842	315-0271-00			RES,FXD,FILM:270 OHM,5%,0.25W	57668	NTR25J-E270E
R844	315-0471-00			RES,FXD,FILM:470 OHM,5%,0.25W	57668	NTR25J-E470E
R846	307-0051-00			RES,FXD,CMPSN:2.7 OHM,5%,0.5W	01121	EB27G5
R850	308-0532-00			RES,FXD,WW:10 OHM,3%,2W,TC=+4000PPM	14193	PTB15-10R0H
R851	308-0503-00			RES,FXD,WW:6.8 OHM,5%,2.5W	14193	SA31-6R80J
R853	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
R854	315-0472-00			RES,FXD,FILM:4.7K OHM,5%,0.25W	57668	NTR25J-E04K7
R856	315-0472-00			RES,FXD,FILM:4.7K OHM,5%,0.25W	57668	NTR25J-E04K7
R858	315-0152-00			RES,FXD,FILM:1.5K OHM,5%,0.25W	57668	NTR25J-E01K5
R859	315-0154-00			RES,FXD,FILM:150K OHM,5%,0.25W	57668	NTR25J-E150K
R860	321-0321-00	B010100	B089999	RES,FXD,FILM:21.5K OHM,1%,0.125W,TC=T0	07716	CEAD21501F
R860	321-0337-00	B090000		RES,FXD,FILM:31.6K OHM,1%,0.125W,TC=T0	07716	CEAD31601F
R861	323-0388-00			RES,FXD,FILM:107K OHM,1%,0.5W,TC=T0	19701	5053RD107K0F
R862	323-0386-00	B010100	B089999	RES,FXD,FILM:102K OHM,1%,0.5W,TC=T0	75042	CECT0-1023F

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
R862	323-0385-00	B090000		RES,FXD,FILM:100K OHM,1%,0.5W,TC=T0	75042	CECT0-1003F
R863	315-0471-00			RES,FXD,FILM:470 OHM,5%,0.25W	57668	NTR25J-E470E
R864	323-0378-00			RES,FXD,FILM:84.5K OHM,1%,0.5W,TC=T0	19701	5053RD84K50F
R865	315-0471-00			RES,FXD,FILM:470 OHM,5%,0.25W	57668	NTR25J-E470E
R866	315-0562-00			RES,FXD,FILM:5.6K OHM,5%,0.25W	57668	NTR25J-E05K6
R867	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
R868	315-0471-00			RES,FXD,FILM:470 OHM,5%,0.25W	57668	NTR25J-E470E
R869	315-0221-00			RES,FXD,FILM:220 OHM,5%,0.25W	57668	NTR25J-E220E
R870	303-0223-00	B010100	B019999	RES,FXD,CMPSN:22K OHM,5%,1W	01121	GB2235
R870	301-0223-00	B020000		RES,FXD,FILM:22K OHM,5%,0.5W	19701	5053CX22K00J
R871	301-0103-00			RES,FXD,FILM:10K OHM,5%,0.50W	19701	5053CX10K00J
R873	301-0103-00			RES,FXD,FILM:10K OHM,5%,0.50W	19701	5053CX10K00J
R875	305-0365-00			RES,FXD,CMPSN:3.6M OHM,5%,2W	01121	HB3655
R876	305-0365-00			RES,FXD,CMPSN:3.6M OHM,5%,2W	01121	HB3655
R877	305-0365-00			RES,FXD,CMPSN:3.6M OHM,5%,2W	01121	HB3655
R878	305-0335-00			RES,FXD,CMPSN:3.3M OHM,5%,2W	01121	HB3355
R879	305-0156-00			RES,FXD,CMPSN:15M OHM,5%,2W	01121	HB1565
R880	311-0254-00			RES,VAR,NONWW:PNL,5MEG OHM,20%,0.5W	12697	CM29709
R881	305-0335-00			RES,FXD,CMPSN:3.3M OHM,5%,2W	01121	HB3355
R883	311-0397-01			RES,VAR,NONWW:PNL,2M OHM,20%,0.5W	71590	BA147-044UV3
R885	315-0104-00			RES,FXD,FILM:100K OHM,5%,0.25W	57668	NTR25J-E100K
R886	315-0273-00			RES,FXD,FILM:27K OHM,5%,0.25W	57668	NTR25J-E27K0
R887	315-0474-00			RES,FXD,FILM:470K OHM,5%,0.25W	19701	5043CX470K0J92U
R888	315-0473-00			RES,FXD,FILM:47K OHM,5%,0.25W	57668	NTR25J-E47K0
R889	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
R890	315-0333-00			RES,FXD,FILM:33K OHM,5%,0.25W	57668	NTR25J-E33K0
R891	311-0885-00	B010100	B269999	RES,VAR,NONWW:TRMR,200K OHM,0.5W	73138	91-106-0
R891	311-1273-00	B270000		RES,VAR,NONWW:TRMR,200K OHM,0.5W	32997	3329P-L58-204
R892	315-0333-00			RES,FXD,FILM:33K OHM,5%,0.25W	57668	NTR25J-E33K0
R893	311-0885-00	B010100	B269999	RES,VAR,NONWW:TRMR,200K OHM,0.5W	73138	91-106-0
R893	311-1273-00	B270000		RES,VAR,NONWW:TRMR,200K OHM,0.5W	32997	3329P-L58-204
R897	311-0141-00			RES,VAR,WW:PNL,2K OHM,2W	10582	AW-3748
R898	308-0499-00			RES,FXD,WW:0.5 OHM,10%,2.5W,AXIAL	14193	SA31 R500K
R899	315-0152-00			RES,FXD,FILM:1.5K OHM,5%,0.25W	57668	NTR25J-E01K5
R901	315-0681-00			RES,FXD,FILM:680 OHM,5%,0.25W	57668	NTR25J-E680E
R902	315-0151-00			RES,FXD,FILM:150 OHM,5%,0.25W	57668	NTR25J-E150E
R904	315-0161-00			RES,FXD,FILM:160 OHM,5%,0.25W	57668	NTR25J-E 160E
R906	315-0203-00			RES,FXD,FILM:20K OHM,5%,0.25W	57668	NTR25J-E 20K
R907	315-0242-00			RES,FXD,FILM:2.4K OHM,5%,0.25W	57668	NTR25J-E02K4
R908	315-0302-00			RES,FXD,FILM:3K OHM,5%,0.25W	57668	NTR25J-E03K0
R935	315-0302-00			RES,FXD,FILM:3K OHM,5%,0.25W	57668	NTR25J-E03K0
R936	315-0242-00			RES,FXD,FILM:2.4K OHM,5%,0.25W	57668	NTR25J-E02K4
R937	315-0203-00			RES,FXD,FILM:20K OHM,5%,0.25W	57668	NTR25J-E 20K
R939	315-0161-00			RES,FXD,FILM:160 OHM,5%,0.25W	57668	NTR25J-E 160E
R941	315-0151-00			RES,FXD,FILM:150 OHM,5%,0.25W	57668	NTR25J-E150E
R942	315-0681-00			RES,FXD,FILM:680 OHM,5%,0.25W	57668	NTR25J-E680E
SW27	260-0675-00			SWITCH,SLIDE:DPDT,W/O DETENTS	82389	11A1024
SW37	260-1039-00			SWITCH,PUSH:DT,1A,25VDC,3 BUTTON	31918	ORDER BY DESCR
SW73	260-1028-00			SWITCH,ROTARY:STEPS/FAM	80009	260-1028-00
SW78	260-1040-00			SWITCH,PUSH:DT,1A,25VDC,3 BUTTON	59821	2KCM140000244
SW86	260-1041-00			SWITCH,PUSH:DT,1A,25VDC,3 BUTTON	59821	2KCM040000242
SW195	----- -----	B010100	B099999	(670-1025-00 ONLY)		
SW195	----- -----	B100000		(BEGAN USAGE 670-1025-01)		
SW300	260-1042-00			CIRCUIT BREAKER:SPST,1.2A,240VAC	06402	45700IG1P104183
SW310	260-1037-00			SWITCH,ROTARY:VOLT RANGE & SER RES	76854	5-44384-837
SW315	260-1032-00			SWITCH,ROTARY:POLARITY	59821	2APA06000975
SW315	260-1031-00			SWITCH,ROTARY:POLARITY (REAR)	80009	260-1031-00
SW320	260-1030-00			SWITCH,ROTARY:MODE	59821	2APA06020690

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
SW360	----- -----			(USED WITH 670-1027-XX CKT BOARD)		
SW371	260-1048-00			SWITCH,LEVER:3 POSN LKG,CTR OFF	82389	22S-1046A
SW375	260-1029-00			SWITCH,ROTARY:TERMINAL SELECTOR	59821	PA06000976
SW400	----- -----			SWITCH,CAM:VERTICAL CURRENT/DIV (PART OF 670-1026-XX)		
SW430	----- -----	B010100	B089999	SWITCH,CAM:HORIZONTAL VOLTS/DIV (PART OF 670-1027-XX)		
SW460	----- -----			SWITCH,CAM:DISPLAY OFFSET (PART OF 670-1031-00)		
SW467	260-1038-00			SWITCH,PUSH:DT,1A,25VDC,3 BUTTON	59821	2KCM00111241
SW480	----- -----			SWITCH,CAM:VERTICAL POSITION (PART OF 670-1035-00)		
SW490	----- -----			SWITCH,CAM:HORIZONTAL POSITION (PART OF 670-1035-00)		
SW701	260-0276-00	B010100	B329999	SWITCH,TOGGLE:DPST,15A,125VAC,OFF-ON	15605	8906K-1694
SW701	260-1921-00	B330000		SWITCH,TOGGLE:DPDT,10A,125VAC	09353	9221TZ4Q
SW702	260-0675-00			SWITCH,SLIDE:DPDT,W/O DETENTS	82389	11A1024
SW703	260-0675-01			SWITCH,SLIDE:DPDT,W/SHIELD	80009	260-0675-01
T300	120-0476-00	B010100	B326319	XFMR,VAR,POWER:	58474	10B1218
T300	120-0808-00	B326320		XFMR,VAR,POWER:0-132V,1.75A	83008	033-0152
T301	120-0611-00			XFMR,PWR,SDN&SU:COLLECTOR SWEEP	TK2038	120-0611-00
T701	120-0610-00			XFMR,PWR,STPDN:	75498	120-0610-00
T850	120-0612-00	B010100	B019999	XFMR,PWR,STU:HV	80009	120-0612-00
T850	120-0612-01	B020000	B089999	XFMR,PWR,STU:HV	80009	120-0612-01
T850	120-0612-02	B090000	B249999	XFMR,PWR,STU:HV	80009	120-0612-02
T850	120-0612-03	B250000		XFMR,PWR,STU:HV	80009	120-0612-03
TK346	260-0638-00			SWITCH,THRMSTC:NC,OPEN 75,CL 55,10A,240V	14859	20700 LA506-2042
TK701	260-0227-00			SW,THRMSTC:NC,OPEN 73.9,CL 51.7,10A,240V	73803	20700L63-330
TP30	214-0579-00			TERM,TEST POINT:BRS CD PL	80009	214-0579-00
TP69	214-0579-00			TERM,TEST POINT:BRS CD PL	80009	214-0579-00
TP80	214-0579-00			TERM,TEST POINT:BRS CD PL	80009	214-0579-00
TP510	214-0579-00			TERM,TEST POINT:BRS CD PL	80009	214-0579-00
U3	156-0030-03			MICROCKT,DGTL:QUAD 2 INPUT NAND GATE,SCRN	18324	N7400(NB OR FB)
U20	156-0030-03			MICROCKT,DGTL:QUAD 2 INPUT NAND GATE,SCRN	18324	N7400(NB OR FB)
U22	156-0030-03			MICROCKT,DGTL:QUAD 2 INPUT NAND GATE,SCRN	18324	N7400(NB OR FB)
U33	156-0030-03			MICROCKT,DGTL:QUAD 2 INPUT NAND GATE,SCRN	18324	N7400(NB OR FB)
U69	156-0030-03			MICROCKT,DGTL:QUAD 2 INPUT NAND GATE,SCRN	18324	N7400(NB OR FB)
U70	156-0032-03			MICROCKT,DGTL:4 BIT BINARY COUNTER	01295	SN7493NP3
U71	156-0029-00	B010100	B360819	MICROCKT,DGTL:TTL,HEX INVERTER	07263	9016DC
U71	156-0058-02	B360820		MICROCKT,DGTL:HEX INV,SCRN	18324	N7404(NB OR FB)
U72	156-0030-03			MICROCKT,DGTL:QUAD 2 INPUT NAND GATE,SCRN	18324	N7400(NB OR FB)
U75	156-0031-00	B010100	B327029	MICROCKT,DGTL:4-W 2-INP AND-OR-INVT GATES	01295	SN7454N
U75	156-0031-01	B327030		MICROCKT,DGTL:4-W 2-INP AND-OR INVT GATE	80009	156-0031-01
V897	154-0563-00	B010100	B059999	ELECTRON TUBE:CRT,P2,INT SCALE	80009	154-0563-00
V897	154-0563-01	B060000	B279999	ELECTRON TUBE:CRT,P31,INT SCALE	80009	154-0563-01
V897	154-0563-05	B280000		ELECTRON TUBE:CRT,P31,INT SC	80009	154-0563-05

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A	----- -----			(NOT INCLUDED IN TYPE 576 MOD 301W)		
A	672-0405-00			CIRCUIT BD ASSY:READOUT	80009	672-0405-00
B1001	150-0048-00	MODEL.1	MODEL.4	LAMP,INCAND:5V,0.06A,#683,WIRE LEAD	08806	683
B1001	150-0048-01	MODEL.5		LAMP,INCAND:5V,0.06A,#683,AGED & SEL	58854	683AS15
B1002	150-0048-00	MODEL.1	MODEL.4	LAMP,INCAND:5V,0.06A,#683,WIRE LEAD	08806	683
B1002	150-0048-01	MODEL.5		LAMP,INCAND:5V,0.06A,#683,AGED & SEL	58854	683AS15
B1003	150-0048-00	MODEL.1	MODEL.4	LAMP,INCAND:5V,0.06A,#683,WIRE LEAD	08806	683
B1003	150-0048-01	MODEL.5		LAMP,INCAND:5V,0.06A,#683,AGED & SEL	58854	683AS15
B1004	150-0048-00	MODEL.1	MODEL.4	LAMP,INCAND:5V,0.06A,#683,WIRE LEAD	08806	683
B1004	150-0048-01	MODEL.5		LAMP,INCAND:5V,0.06A,#683,AGED & SEL	58854	683AS15
B1005	150-0048-00	MODEL.1	MODEL.4	LAMP,INCAND:5V,0.06A,#683,WIRE LEAD	08806	683
B1005	150-0048-01	MODEL.5		LAMP,INCAND:5V,0.06A,#683,AGED & SEL	58854	683AS15
B1006	150-0048-00	MODEL.1	MODEL.4	LAMP,INCAND:5V,0.06A,#683,WIRE LEAD	08806	683
B1006	150-0048-01	MODEL.5		LAMP,INCAND:5V,0.06A,#683,AGED & SEL	58854	683AS15
B1007	150-0048-00	MODEL.1	MODEL.4	LAMP,INCAND:5V,0.06A,#683,WIRE LEAD	08806	683
B1007	150-0048-01	MODEL.5		LAMP,INCAND:5V,0.06A,#683,AGED & SEL	58854	683AS15
B1008	150-0048-00	MODEL.1	MODEL.4	LAMP,INCAND:5V,0.06A,#683,WIRE LEAD	08806	683
B1008	150-0048-01	MODEL.5		LAMP,INCAND:5V,0.06A,#683,AGED & SEL	58854	683AS15
B1009	150-0048-00	MODEL.1	MODEL.4	LAMP,INCAND:5V,0.06A,#683,WIRE LEAD	08806	683
B1009	150-0048-01	MODEL.5		LAMP,INCAND:5V,0.06A,#683,AGED & SEL	58854	683AS15
B1010	150-0048-00	MODEL.1	MODEL.4	LAMP,INCAND:5V,0.06A,#683,WIRE LEAD	08806	683
B1010	150-0048-01	MODEL.5		LAMP,INCAND:5V,0.06A,#683,AGED & SEL	58854	683AS15
B1011	150-0048-00	MODEL.1	MODEL.4	LAMP,INCAND:5V,0.06A,#683,WIRE LEAD	08806	683
B1011	150-0048-01	MODEL.5		LAMP,INCAND:5V,0.06A,#683,AGED & SEL	58854	683AS15
B1012	150-0048-00	MODEL.1	MODEL.4	LAMP,INCAND:5V,0.06A,#683,WIRE LEAD	08806	683
B1012	150-0048-01	MODEL.5		LAMP,INCAND:5V,0.06A,#683,AGED & SEL	58854	683AS15
B1013	150-0048-00	MODEL.1	MODEL.4	LAMP,INCAND:5V,0.06A,#683,WIRE LEAD	08806	683
B1013	150-0048-01	MODEL.5		LAMP,INCAND:5V,0.06A,#683,AGED & SEL	58854	683AS15
B1014	150-0048-00	MODEL.1	MODEL.4	LAMP,INCAND:5V,0.06A,#683,WIRE LEAD	08806	683
B1014	150-0048-01	MODEL.5		LAMP,INCAND:5V,0.06A,#683,AGED & SEL	58854	683AS15
B1015	150-0048-00	MODEL.1	MODEL.4	LAMP,INCAND:5V,0.06A,#683,WIRE LEAD	08806	683
B1015	150-0048-01	MODEL.5		LAMP,INCAND:5V,0.06A,#683,AGED & SEL	58854	683AS15
B1016	150-0048-00	MODEL.1	MODEL.4	LAMP,INCAND:5V,0.06A,#683,WIRE LEAD	08806	683
B1016	150-0048-01	MODEL.5		LAMP,INCAND:5V,0.06A,#683,AGED & SEL	58854	683AS15
B1017	150-0048-00	MODEL.1	MODEL.4	LAMP,INCAND:5V,0.06A,#683,WIRE LEAD	08806	683
B1017	150-0048-01	MODEL.5		LAMP,INCAND:5V,0.06A,#683,AGED & SEL	58854	683AS15
B1021	150-0048-00	MODEL.1	MODEL.4	LAMP,INCAND:5V,0.06A,#683,WIRE LEAD	08806	683
B1021	150-0048-01	MODEL.5		LAMP,INCAND:5V,0.06A,#683,AGED & SEL	58854	683AS15
B1022	150-0048-00	MODEL.1	MODEL.4	LAMP,INCAND:5V,0.06A,#683,WIRE LEAD	08806	683
B1022	150-0048-01	MODEL.5		LAMP,INCAND:5V,0.06A,#683,AGED & SEL	58854	683AS15
B1023	150-0048-00	MODEL.1	MODEL.4	LAMP,INCAND:5V,0.06A,#683,WIRE LEAD	08806	683
B1023	150-0048-01	MODEL.5		LAMP,INCAND:5V,0.06A,#683,AGED & SEL	58854	683AS15
B1024	150-0048-00	MODEL.1	MODEL.4	LAMP,INCAND:5V,0.06A,#683,WIRE LEAD	08806	683
B1024	150-0048-01	MODEL.5		LAMP,INCAND:5V,0.06A,#683,AGED & SEL	58854	683AS15
B1025	150-0048-00	MODEL.1	MODEL.4	LAMP,INCAND:5V,0.06A,#683,WIRE LEAD	08806	683
B1025	150-0048-01	MODEL.5		LAMP,INCAND:5V,0.06A,#683,AGED & SEL	58854	683AS15
B1026	150-0048-00	MODEL.1	MODEL.4	LAMP,INCAND:5V,0.06A,#683,WIRE LEAD	08806	683
B1026	150-0048-01	MODEL.5		LAMP,INCAND:5V,0.06A,#683,AGED & SEL	58854	683AS15
B1027	150-0048-00	MODEL.1	MODEL.4	LAMP,INCAND:5V,0.06A,#683,WIRE LEAD	08806	683
B1027	150-0048-01	MODEL.5		LAMP,INCAND:5V,0.06A,#683,AGED & SEL	58854	683AS15
B1029	150-0048-00	MODEL.1	MODEL.4	LAMP,INCAND:5V,0.06A,#683,WIRE LEAD	08806	683
B1029	150-0048-01	MODEL.5		LAMP,INCAND:5V,0.06A,#683,AGED & SEL	58854	683AS15
B1031	150-0048-00	MODEL.1	MODEL.4	LAMP,INCAND:5V,0.06A,#683,WIRE LEAD	08806	683
B1031	150-0048-01	MODEL.5		LAMP,INCAND:5V,0.06A,#683,AGED & SEL	58854	683AS15
B1032	150-0048-00	MODEL.1	MODEL.4	LAMP,INCAND:5V,0.06A,#683,WIRE LEAD	08806	683
B1032	150-0048-01	MODEL.5		LAMP,INCAND:5V,0.06A,#683,AGED & SEL	58854	683AS15

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
B1033	150-0048-00	MODEL.1	MODEL.4	LAMP,INCAND:5V,0.06A,#683,WIRE LEAD	08806	683
B1033	150-0048-01	MODEL.5		LAMP,INCAND:5V,0.06A,#683,AGED & SEL	58854	683AS15
B1034	150-0048-00	MODEL.1	MODEL.4	LAMP,INCAND:5V,0.06A,#683,WIRE LEAD	08806	683
B1034	150-0048-01	MODEL.5		LAMP,INCAND:5V,0.06A,#683,AGED & SEL	58854	683AS15
B1041	150-0048-00	MODEL.1	MODEL.4	LAMP,INCAND:5V,0.06A,#683,WIRE LEAD	08806	683
B1041	150-0048-01	MODEL.5		LAMP,INCAND:5V,0.06A,#683,AGED & SEL	58854	683AS15
B1042	150-0048-00	MODEL.1	MODEL.4	LAMP,INCAND:5V,0.06A,#683,WIRE LEAD	08806	683
B1042	150-0048-01	MODEL.5		LAMP,INCAND:5V,0.06A,#683,AGED & SEL	58854	683AS15
B1045	150-0048-00	MODEL.1	MODEL.4	LAMP,INCAND:5V,0.06A,#683,WIRE LEAD	08806	683
B1045	150-0048-01	MODEL.5		LAMP,INCAND:5V,0.06A,#683,AGED & SEL	58854	683AS15
B1046	150-0048-00	MODEL.1	MODEL.4	LAMP,INCAND:5V,0.06A,#683,WIRE LEAD	08806	683
B1046	150-0048-01	MODEL.5		LAMP,INCAND:5V,0.06A,#683,AGED & SEL	58854	683AS15
B1047	150-0048-00	MODEL.1	MODEL.4	LAMP,INCAND:5V,0.06A,#683,WIRE LEAD	08806	683
B1047	150-0048-01	MODEL.5		LAMP,INCAND:5V,0.06A,#683,AGED & SEL	58854	683AS15
B1049	150-0048-00	MODEL.1	MODEL.4	LAMP,INCAND:5V,0.06A,#683,WIRE LEAD	08806	683
B1049	150-0048-01	MODEL.5		LAMP,INCAND:5V,0.06A,#683,AGED & SEL	58854	683AS15
B1051	150-0048-00	MODEL.1	MODEL.4	LAMP,INCAND:5V,0.06A,#683,WIRE LEAD	08806	683
B1051	150-0048-01	MODEL.5		LAMP,INCAND:5V,0.06A,#683,AGED & SEL	58854	683AS15
B1052	150-0048-00	MODEL.1	MODEL.4	LAMP,INCAND:5V,0.06A,#683,WIRE LEAD	08806	683
B1052	150-0048-01	MODEL.5		LAMP,INCAND:5V,0.06A,#683,AGED & SEL	58854	683AS15
B1053	150-0048-00	MODEL.1	MODEL.4	LAMP,INCAND:5V,0.06A,#683,WIRE LEAD	08806	683
B1053	150-0048-01	MODEL.5		LAMP,INCAND:5V,0.06A,#683,AGED & SEL	58854	683AS15
B1054	150-0048-00	MODEL.1	MODEL.4	LAMP,INCAND:5V,0.06A,#683,WIRE LEAD	08806	683
B1054	150-0048-01	MODEL.5		LAMP,INCAND:5V,0.06A,#683,AGED & SEL	58854	683AS15
C991	283-0003-00			CAP,FXD,CER DI:0.01UF,+80-20%,150V	59821	D103Z40Z5UJDCEX
C995	290-0246-00			CAP,FXD,ELCTLT:3.3UF,10%,15V	12954	D3R3EA15K1
D950	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D951	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D952	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D953	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D954	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D955	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D956	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D957	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D958	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D959	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D960	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D961	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D962	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D963	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D964	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D965	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D966	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D967	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D968	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D969	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D970	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D971	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D972	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D973	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D976	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D977	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D985	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D986	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
D992	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
Q960	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
Q974	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
Q977	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
Q979	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
Q982	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
Q984	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
Q987	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
Q989	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
R950	316-0104-00	MODEL.2	MODEL.3	RES,FXD,CMPSN:100K OHM,10%,0.25W	01121	CB1041
R951	316-0104-00	MODEL.2	MODEL.3	RES,FXD,CMPSN:100K OHM,10%,0.25W	01121	CB1041
R952	316-0104-00	MODEL.2	MODEL.3	RES,FXD,CMPSN:100K OHM,10%,0.25W	01121	CB1041
R953	316-0104-00	MODEL.2	MODEL.3	RES,FXD,CMPSN:100K OHM,10%,0.25W	01121	CB1041
R954	316-0104-00	MODEL.2	MODEL.3	RES,FXD,CMPSN:100K OHM,10%,0.25W	01121	CB1041
R955	316-0104-00	MODEL.2	MODEL.3	RES,FXD,CMPSN:100K OHM,10%,0.25W	01121	CB1041
R956	316-0104-00	MODEL.2	MODEL.3	RES,FXD,CMPSN:100K OHM,10%,0.25W	01121	CB1041
R958	316-0104-00	MODEL.2	MODEL.3	RES,FXD,CMPSN:100K OHM,10%,0.25W	01121	CB1041
R959	316-0104-00	MODEL.2	MODEL.3	RES,FXD,CMPSN:100K OHM,10%,0.25W	01121	CB1041
R960	315-0102-00	MODEL.2	MODEL.3	RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
R961	315-0472-00	MODEL.2	MODEL.3	RES,FXD,FILM:4.7K OHM,5%,0.25W	57668	NTR25J-E04K7
R962	316-0104-00	MODEL.2	MODEL.3	RES,FXD,CMPSN:100K OHM,10%,0.25W	01121	CB1041
R963	316-0104-00	MODEL.2	MODEL.3	RES,FXD,CMPSN:100K OHM,10%,0.25W	01121	CB1041
R964	316-0104-00	MODEL.2	MODEL.3	RES,FXD,CMPSN:100K OHM,10%,0.25W	01121	CB1041
R966	316-0104-00	MODEL.2	MODEL.3	RES,FXD,CMPSN:100K OHM,10%,0.25W	01121	CB1041
R967	316-0104-00	MODEL.2	MODEL.3	RES,FXD,CMPSN:100K OHM,10%,0.25W	01121	CB1041
R968	316-0104-00	MODEL.2	MODEL.3	RES,FXD,CMPSN:100K OHM,10%,0.25W	01121	CB1041
R969	316-0104-00	MODEL.2	MODEL.3	RES,FXD,CMPSN:100K OHM,10%,0.25W	01121	CB1041
R970	316-0104-00	MODEL.2	MODEL.3	RES,FXD,CMPSN:100K OHM,10%,0.25W	01121	CB1041
R971	316-0104-00	MODEL.2	MODEL.3	RES,FXD,CMPSN:100K OHM,10%,0.25W	01121	CB1041
R973	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
R974	315-0472-00			RES,FXD,FILM:4.7K OHM,5%,0.25W	57668	NTR25J-E04K7
R977	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
R978	315-0431-00			RES,FXD,FILM:430 OHM,5%,0.25W	19701	5043CX430R0J
R979	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
R980	315-0223-00			RES,FXD,FILM:22K OHM,5%,0.25W	19701	5043CX22K00J92U
R981	315-0223-00			RES,FXD,FILM:22K OHM,5%,0.25W	19701	5043CX22K00J92U
R983	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
R987	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
R989	315-0472-00			RES,FXD,FILM:4.7K OHM,5%,0.25W	57668	NTR25J-E04K7
R990	315-0431-00			RES,FXD,FILM:430 OHM,5%,0.25W	19701	5043CX430R0J
R991	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
R992	315-0431-00			RES,FXD,FILM:430 OHM,5%,0.25W	19701	5043CX430R0J
U951	155-0007-00	MODEL.1	MODEL.3	MICROCKT,DGTL:READOUT LGC 1,2,5	80009	155-0007-00
U951	155-0007-01	MODEL.4		MICROCKT,DGTL:READOUT LGC 1,2,5	80009	155-0007-01
U953	155-0008-00	MODEL.1	MODEL.3	MICROCKT,DGTL:DIP	80009	155-0008-00
U953	155-0008-01	MODEL.4		MICROCKT,DGTL:READOUT LOGIC	80009	155-0008-01
U956	155-0007-00	MODEL.1	MODEL.3	MICROCKT,DGTL:READOUT LGC 1,2,5	80009	155-0007-00
U956	155-0007-01	MODEL.4		MICROCKT,DGTL:READOUT LGC 1,2,5	80009	155-0007-01
U960	155-0008-00	MODEL.1	MODEL.3	MICROCKT,DGTL:DIP	80009	155-0008-00
U960	155-0008-01	MODEL.4		MICROCKT,DGTL:READOUT LOGIC	80009	155-0008-01
U965	155-0007-00	MODEL.1	MODEL.3	MICROCKT,DGTL:READOUT LGC 1,2,5	80009	155-0007-00
U965	155-0007-01	MODEL.4		MICROCKT,DGTL:READOUT LGC 1,2,5	80009	155-0007-01
U970	155-0008-00	MODEL.1	MODEL.3	MICROCKT,DGTL:DIP	80009	155-0008-00
U970	155-0008-01	MODEL.4		MICROCKT,DGTL:READOUT LOGIC	80009	155-0008-01
U974	155-0006-00	MODEL.1	MODEL.2	MICROCKT,DGTL:BETA CMPTR LGC MU	80009	155-0006-00
U974	155-0006-01	MODEL.3		MICROCKT,DGTL:BETA CMPTR LGC MU	80009	155-0006-01
U975	155-0005-00			MICROCKT,DGTL:BETA COMPUTER	80009	155-0005-00
U976	155-0004-00	MODEL.1	MODEL.2	MICROCKT,DGTL:BETA CMPTR LGC 1,2,5	80009	155-0004-00
U976	155-0004-01	MODEL.3		MICROCKT,DGTL:BETA COMPUTER	80009	155-0004-01

REPLACEABLE MECHANICAL 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.

SPECIAL NOTES AND SYMBOLS

X000	Part first added at this serial number
00X	Part removed after this serial number

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
- - - * - - -
  Detail Part of Assembly and/or Component
  Attaching parts for Detail Part
  - - - * - - -
    Parts of Detail Part
    Attaching parts for Parts of Detail Part
    - - - * - - -
```

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.

Attaching parts must be purchased separately, unless otherwise specified.

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.

ABBREVIATIONS

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

CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
00779	AMP INC	2800 FULLING MILL PO BOX 3608	HARRISBURG PA 17105
01002	GENERAL ELECTRIC CO CAPACITOR PRODUCTS DEPT	JOHN ST	HUDSON FALLS NY 12839
01536	TEXTRON INC CAMCAR DIV SEMS PRODUCTS UNIT	1818 CHRISTINA ST	ROCKFORD IL 61108
02288	TELEMECANIQUE INC	100 RELAY RD	PLANTSVILLE CT 06479-1415
02660	AMPHENOL CORP SUB OF ALLIED CORP COMMERCIAL AND INDUSTRIAL OPNS	4300 COMMERCE CT	LISLE IL 60532
04348	LAWRENCE ENGINEERING AND SUPPLY INC	500 S FLOWER ST P O BOX 30	BURBANK CA 91503
05129	KILO ENGINEERING CO	2118 D ST	LA VERNE CA 91750-5422
05574	VIKING CONNECTORS INC SUB OF CRITON CORP	21001 NORDHOFF ST	CHATSWORTH CA 91311-5911
06915	RICHCO PLASTIC CO	5825 N TRIPP AVE	CHICAGO IL 60646-6013
06950	SCREWCORP VSI AEROSPACE PRODUCTS DIV SUB OF FAIRCHILD INDUSTRIES INC	13001 E TEMPLE AVE PO BOX 730	CITY OF INDUSTRY CA 91746-1417
07111	PNEUMO CORP	4800 PRUDENTIAL TOWER	BOSTON MA 02199
09422	PLASTIC STAMPING CORP	2216 W ARMITAGE AVE	CHICAGO IL 60647-4461
09772	WEST COAST LOCKWASHER CO INC	16730 E JOHNSON DRIVE P O BOX 3588	CITY OF INDUSTRY CA 91744
09922	BURNDY CORP	RICHARDS AVE	NORWALK CT 06852
11897	PLASTIGLIDE MFG CORP	2701 W EL SEGUNDO BLVD	HAWTHORNE CA 90250-3318
12136	P H C INDUSTRIES INC	1643 HADDON AVE	CAMDEN NJ 08103-3109
12327	FREEWAY CORP	9301 ALLEN DR	CLEVELAND OH 44125-4632
12697	CLAROSTAT MFG CO INC	LOWER WASHINGTON ST	DOVER NH 03820
14438	NYLOK FASTENER CORP	6465 PRODESEL AVE	LINCOLNWOOD IL 60645-3916
16037	SPRUCE PINE MICA CO INC	PO BOX 219	SPRUCE PINE NC 28777-0219
16428	COOPER BELDEN ELECTRONIC WIRE AND CA SUB OF COOPER INDUSTRIES INC	NW N ST	RICHMOND IN 47374
17605	INSULFAB PLASTICS INC	69 GROVE	WATERTOWN MA 02172-2826
18680	HIGHLAND MFG CO THE DIV OF BUELL INDUSTRIES INC	1240 WOLCOTT ST	WATERBURY CT 06720
22526	DU PONT E I DE NEMOURS AND CO INC DU PONT CONNECTOR SYSTEMS DIV MILITARY PRODUCTS GROUP	515 FISHING CREEK RD	NEW CUMBERLAND PA 17070-3007
22670	G M NAMEPLATE INC	2040 15TH AVE WEST	SEATTLE WA 98119-2728
22753	UID SWITCHES INC DIV OF ILLINOIS TOOL WORKS INC	6615 W IRVING PARK RD	CHICAGO IL 60634
24796	AMF INC POTTER AND BRUMFIELD DIV	26181 AVENIDA AEROPUERTO P O BOX 116	SAN JUAN CAPISTRANO CA 92675
26365	GRIES DYNACAST CO DIV OF COATS AND CLARK INC	125 BEECHWOOD AVE	NEW ROCHELLE NY 10802
28520	HEYCO MOLDED PRODUCTS	750 BOULEVARD P O BOX 160	KENILWORTH NJ 07033-1721
50293	GENERAL ELECTRIC CO ENGINEERING DEPT		SCHENECTADY NY
63743	WARD LEONARD ELECTRIC CO INC	31 SOUTH ST	MOUNT VERNON NY 10550-1714
70318	ALLMETAL SCREW PRODUCTS CO INC	821 STEWART AVE	GARDEN CITY NY 11530-4810
70903	COOPER BELDEN ELECTRONICS WIRE AND C SUB OF COOPER INDUSTRIES INC	2000 S BATAVIA AVE	GENEVA IL 60134-3325
71590	MEPCO/CENTRALAB INC A NORTH AMERICAN PHILIPS CO	HWY 20 W PO BOX 858	FORT DODGE IA 50501
71744	GENERAL INSTRUMENT CORP LAMP DIV/WORLD WIDE/	4433 N RAVENSWOOD AVE	CHICAGO IL 60640-5802
71785	TRW INC TRW CINCH CONNECTORS DIV	1501 MORSE AVE	ELK GROVE VILLAGE IL 60007-5723
73743	FISCHER SPECIAL MFG CO	111 INDUSTRIAL RD	COLD SPRING KY 41076-9749
74445	HOLO-KROME CO	31 BROOK ST	ELMWOOD CT 06110-2350
74868	AMPHENOL CORP SUB OF ALLIED CORP R F CONNECTOR (OPNS)	1 KENNEDY AVE	DANBURY CT 06810-5803
74921	ITEN INDUSTRIES	4001 BENEFIT AVE PO BOX 9	ASHTABULA OH 44004-5453

CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
74970	JOHNSON E F CO	299 10TH AVE S W	WASECA MN 56093-2539
77250	ALLIED PRODUCTS CORP PHEOLL MFG CO DIV	5700 W ROOSEVELT RD	CHICAGO IL 60650-1156
77900	SHAKEPROOF DIV OF ILLINOIS TOOL WORKS	SAINT CHARLES RD	ELGIN IL 60120
78189	ILLINOIS TOOL WORKS INC SHAKEPROOF DIV	ST CHARLES ROAD	ELGIN IL 60120
79136	WALDES KOHINOR IN	47-16 AUSTEL PLACE	LONG ISLAND CITY NY 11101-4402
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500 MS 53-111	BEAVERTON OR 97707-0001
81312	WINCHESTER ELECTRONICS DIVISION LITTON SYSTEMS INC	400 PARK RD	WATERTOWN CT 06795-1612
82389	SWITCHCRAFT INC SUB OF RAYTHEON CO	5555 N ELSTRON AVE	CHICAGO IL 60630-1314
83309	ELECTRICAL SPECIALITY CO SUB OF BELDEN CORP	345 SWIFT AVE	SOUTH SAN FRANCISCO CA 94080-6206
83385	MICRODOT MFG INC GREER-CENTRAL DIV	3221 W BIG BEAVER RD	TROY MI 48098
83903	ACCURATE DIE AND STAMPING DIV., ALLI ED PRODUCTS CORP.	1947 N. MAUD AVE.	CHICAGO, IL 60614
86928	SEASTROM MFG CO INC	701 SONORA AVE	GLENDALE CA 91201-2431
87930	TOWER MFG CORP	25 RESERVOIR AVE	PROVIDENCE RI 02907-3348
89265	POTTER AND BRUMFIELD SALES CO		CHICAGO IL
91506	AUGAT INC	33 PERRY AVE P O BOX 779	ATTLEBORO MA 02703-2417
93907	TEXTRON INC CAMCAR DIV	600 18TH AVE	ROCKFORD IL 61108-5181
95987	BRADY/WECKESSER MFG CO	4444 WEST IRVING PARK RD	CHICAGO IL 60641
96904	HIGH VOLTAGE ENGINEERING CORP NARVAR CO DIV	ROUTE 70 EAST PO BOX 658	CLAYTON NC 27520
98159	RUBBER TECK INC	19115 HAMILTON AVE PO BOX 389	GARDENA CA 90247
98278	MALCO A MICRODOT CO	306 PASADENA AVE	SOUTH PASADENA CA 91030-2905
98291	SEALECTRO CORP BICC ELECTRONICS	40 LINDEMAN DR	TURNBULL CT 06611-4739
S3109	FELLER	ASA ADOLF AG STOTZWEID CH8810	HORGEN SWITZERLAND
TK0392	NORTHWEST FASTENER SALES INC	7923 SW CIRRUS DRIVE	BEAVERTON OR 97005-6448
TK0431	THE H M HARPER CO		
TK0433	PORTLAND SCREW CO	6520 N BASIN	PORTLAND OR 97217-3920
TK0435	LEWIS SCREW CO	4300 S RACINE AVE	CHICAGO IL 60609-3320
TK0484	EL COM INC	13854 BENTLEY PL	CERRITOS CA 90701-2434
TK0858	STAUFFER SUPPLY CO (DIST)	810 SE SHERMAN	PORTLAND OR 97214
TK1319	MORELLIS Q & D PLASTICS	1812 16-TH AVE	FOREST GROVE OR 97116
TK1373	PATELEC-CEM (ITALY)	10156 TORINO	VAICENTALLO 62/45S ITALY
TK1498	VEMALINE PRODUCTS CO INC	487 JEFFERSON BLVD	WARWICK RI 02886
TK1568	CONSOLIDATED METCO INC CLACKAMAS PLANT	3625 MISSISSIPPI AVE PO BOX 03201	PORTLAND OR 97203
TK1809	PRINTACT TELECOMMUNICATIONS	2 JERICHO PLAZA	JERICHO NY 11753

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-1	333-1155-01			1	PANEL,FRONT:	80009	333-1155-01
					(ATTACHING PARTS)		
	211-0001-00			2	SCREW,MACHINE:2-56 X 0.25,PNH,STL	TK0435	ORDER BY DESCR
					(END ATTACHING PARTS)		
-2	124-0219-00			1	STRIP,TRIM:FRONT PANEL VERT & HORIZ	80009	124-0219-00
-3	366-0494-00			1	KNOB:GRAY WITH SETSCREW	80009	366-0494-00
	213-0153-00			1	.SETSCREW:5-40 X 0.125,STL	TK0392	ORDER BY DESCR
-4	----- -----			1	RESISTOR,VAR:		
					(ATTACHING PARTS)		
	210-0940-00			1	WASHER,FLAT:0.25 ID X 0.375 OD X 0.02,STL	12327	ORDER BY DESCR
-5	210-0583-00			1	NUT,PLAIN,HEX:0.25-32 X 0.312,BRS CD PL	73743	2X-20319-402
					(END ATTACHING PARTS)		
-6	366-0494-00			1	KNOB:GRAY WITH SETSCREW	80009	366-0494-00
	213-0153-00			1	.SETSCREW:5-40 X 0.125,STL	TK0392	ORDER BY DESCR
-7	----- -----			1	RESISTOR,VAR:		
					(ATTACHING PARTS)		
-8	210-0223-00			1	TERMINAL,LUG:0.26 ID,LOCKING,BRZ TIN PL	86928	5441-37
	210-0940-00			1	WASHER,FLAT:0.25 ID X 0.375 OD X 0.02,STL	12327	ORDER BY DESCR
-9	210-0583-00			1	NUT,PLAIN,HEX:0.25-32 X 0.312,BRS CD PL	73743	2X-20319-402
					(END ATTACHING PARTS)		
-10	366-1028-00			1	KNOB:GY,0.252 ID X 0.796 OD X 0.65 H	80009	366-1028-00
	213-0153-00			1	.SETSCREW:5-40 X 0.125,STL	TK0392	ORDER BY DESCR
-11	----- -----			1	SWITCH,ROTARY:(SEE SW315 REPL)		
					(ATTACHING PARTS)		
	210-0978-00			1	WASHER,FLAT:0.375 ID X 0.5 OD X 0.024,STL	12327	ORDER BY DESCR
	210-0590-00			1	NUT,PLAIN,HEX:0.375-32 X 0.438 BRS CD PL	73743	28269-402
					(END ATTACHING PARTS)		
-12	366-1028-00			1	KNOB:GY,0.252 ID X 0.796 OD X 0.65 H	80009	366-1028-00
	213-0153-00			2	.SETSCREW:5-40 X 0.125,STL	TK0392	ORDER BY DESCR
-13	----- -----			1	SWITCH,ROTARY:(SEE SW320 REPL)		
					(ATTACHING PARTS)		
	210-0978-00			1	WASHER,FLAT:0.375 ID X 0.5 OD X 0.024,STL	12327	ORDER BY DESCR
	210-0590-00			1	NUT,PLAIN,HEX:0.375-32 X 0.438 BRS CD PL	73743	28269-402
					(END ATTACHING PARTS)		
-14	366-0494-00			1	KNOB:GRAY WITH SETSCREW	80009	366-0494-00
	213-0153-00			1	.SETSCREW:5-40 X 0.125,STL	TK0392	ORDER BY DESCR
-15	366-1124-00			1	KNOB:GY,0.252 ID X 1.095 OD X 0.79 H	80009	366-1124-00
	213-0153-00			2	.SETSCREW:5-40 X 0.125,STL	TK0392	ORDER BY DESCR
-16	366-0491-01			1	KNOB:GRAY,0.127 ID X 0.706 OD X 0.65 H	80009	366-0491-01
	213-0153-00			1	.SETSCREW:5-40 X 0.125,STL	TK0392	ORDER BY DESCR
-17	366-1090-00			1	KNOB:GY,0-10,0.252 ID X 1.4 OD	80009	366-1090-00
	213-0153-00			1	.SETSCREW:5-40 X 0.125,STL	TK0392	ORDER BY DESCR
-18	366-1124-00			1	KNOB:GY,0.252 ID X 1.095 OD X 0.79 H	80009	366-1124-00
	213-0153-00			2	.SETSCREW:5-40 X 0.125,STL	TK0392	ORDER BY DESCR
-19	366-1124-00			1	KNOB:GY,0.252 ID X 1.095 OD X 0.79 H	80009	366-1124-00
	213-0153-00			2	.SETSCREW:5-40 X 0.125,STL	TK0392	ORDER BY DESCR
-20	----- -----			1	SWITCH,TOGGLE:(SEE SW701 REPL)		
					(ATTACHING PARTS)		
	354-0055-00			1	WASHER,KEY:0.468 ID X 0.718 OD,STL CD PL	80009	354-0055-00
-21	337-0398-00			1	SHIELD,ELEC:POWER SWITCH	80009	337-0398-00
	210-0902-00			1	WASHER,FLAT:0.47 ID X 0.656 OD X 0.03,STL	12327	ORDER BY DESCR
	210-0473-00			1	NUT,PLAIN,DODEC:0.469-32 X 0.638,BRS NP	73743	ORDER BY DESCR
					(END ATTACHING PARTS)		
-22	366-0379-01			1	KNOB:GRAY,0.127 ID X 0.5 OD X 0.93 H	80009	366-0379-01
	213-0153-00			1	.SETSCREW:5-40 X 0.125,STL	TK0392	ORDER BY DESCR
-23	366-1092-00			1	KNOB:0.252 ID X 0.7 OD X 0.57 H	80009	366-1092-00
	213-0153-00			1	.SETSCREW:5-40 X 0.125,STL	TK0392	ORDER BY DESCR
-24	----- -----			1	SWITCH,ROTARY:(SEE SW73 REPL)		
					(ATTACHING PARTS)		
	210-0978-00			1	WASHER,FLAT:0.375 ID X 0.5 OD X 0.024,STL	12327	ORDER BY DESCR
	210-0590-00			1	NUT,PLAIN,HEX:0.375-32 X 0.438 BRS CD PL	73743	28269-402
					(END ATTACHING PARTS)		
-25	366-0392-00			1	KNOB:GY,0.125 ID X 0.375 H X 0.812 H	80009	366-0392-00
-26	366-0392-00			1	KNOB:GY,0.125 ID X 0.375 H X 0.812 H	80009	366-0392-00
-27	366-1125-00			1	KNOB:GY,0.127 ID X 0.5 OD X 0.531 H	80009	366-1125-00
	213-0153-00			1	.SETSCREW:5-40 X 0.125,STL	TK0392	ORDER BY DESCR
-28	366-1027-00			1	KNOB:GY,0.127 ID X 0.825 OD X 0.67 H	80009	366-1027-00
	213-0153-00			1	.SETSCREW:5-40 X 0.125,STL	TK0392	ORDER BY DESCR

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-29	366-1125-00			1	KNOB:GY,0.127 ID X 0.5 OD X 0.53I H	80009	366-1125-00
	213-0153-00			1	.SETSCREW:5-40 X 0.125,STL	TK0392	ORDER BY DESCR
-30	366-1027-00			1	KNOB:GY,0.127 ID X 0.825 OD X 0.67 H	80009	366-1027-00
	213-0153-00			1	.SETSCREW:5-40 X 0.125,STL	TK0392	ORDER BY DESCR
-31	366-1048-08	B010100	B079999	1	PUSH BUTTON:CHARCOAL,INVERT	80009	366-1048-08
	366-1160-22	B080000		1	PUSH BUTTON:CHARCOAL,INVERT	80009	366-1160-22
-32	366-1048-11	B010100	B079999	1	PUSH BUTTON:SIL GRAY,ZERO	80009	366-1048-11
	366-1161-03	B080000		1	PUSH BUTTON:SIL GY,ZERO	80009	366-1161-03
-33	366-1048-09	B010100	B079999	1	PUSH BUTTON:SIL GRAY,CAL	80009	366-1048-09
	366-1161-02	B080000		1	PUSH BUTTON:SIL GY,CAL	80009	366-1161-02
	672-0933-00			1	CIRCUIT BD ASSY:DISPLAY SWITCHING	80009	672-0933-00
-34	----- -----			1	.CKT BOARD ASSY:DSPL SW(SEE REPL)		
-35	131-0633-00			31	..TERMINAL,PIN:0.385 L X 0.048 OD BRS TIN	80009	131-0633-00
-36	136-0252-01			16	..SOCKET,PIN TERM:U/W 0.0.19 DIA PINS	00779	1-332095-2
-37	----- -----			1	..SWITCH,PUSH:(SEE SW467 REPL)		
-38	131-0604-00			16	..CONTACT,ELEC:CKT BD SW,SPR,CU BE	80009	131-0604-00
	263-1196-00			2	.SW CAM ACTR AS:DISPLAY SWITCHING	80009	263-1196-00
-39	401-0053-00			2	..BEARING,CAM SW:FRONT,W/0.375-32 EXT THD	80009	401-0053-00
					..(ATTACHING PARTS)		
-40	211-0116-00			4	..SCR,ASSEM WSHR:4-40 X 0.312,PNH,BRS,NP,POZ	77900	ORDER BY DESCR
	210-0406-00			4	..NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL	73743	12161-50
					..(END ATTACHING PARTS)		
-41	354-0219-00			2	..RING,RETAINING:EXT,CRESCENT,U/O 0.25 DIA	79136	5103-25-S-ZD-R
-42	214-1127-00			2	..ROLLER,DETENT:0.125 DIA X 0.125,SST	80009	214-1127-00
-43	214-1126-01	B010100	B029999	2	..SPRING,FLAT:0.7 X 0.125,CU BE GRN CLR	80009	214-1126-01
	214-1126-00	B030000		2	..SPRING,FLAT:0.7 X 0.125,CU BE GOLD CLR	80009	214-1126-00
-44	105-0089-00	B010100	B029999	2	..ACTUATOR,CAM SW:HORIZ/VERT POS	80009	105-0089-00
	105-0089-01	B030000		2	..ACTUATOR,CAM SW:HORIZ/VERT POS	80009	105-0089-01
-45	401-0060-00	B010100	B029999	2	..BEARING,CAM SW:REAR,0.454 DIA CAM	80009	401-0060-00
	401-0061-00	B030000		2	..BEARING,CAM SW:REAR OR CENTER,0.454 DIA	80009	401-0061-00
					..(ATTACHING PARTS)		
-46	211-0116-00			4	..SCR,ASSEM WSHR:4-40 X 0.312,PNH,BRS,NP,POZ	77900	ORDER BY DESCR
-47	210-0406-00			4	..NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL	73743	12161-50
					..(END ATTACHING PARTS)		
-48	200-0994-00			2	..COVER,CAM SW:8 ELEMENTS	80009	200-0994-00
					..(ATTACHING PARTS)		
-49	211-0079-00			4	..SCREW,MACHINE:2-56 X 0.188,PNH,STL	TK0435	5549-418
	210-0046-00			4	..WASHER,LOCK:0.261 ID,INTL,0.018 THK,STL	77900	1214-05-00-0541C
	210-0583-00			4	..NUT,PLAIN,HEX:0.25-32 X 0.312,BRS CD PL	73743	2X-20319-402
					..(END ATTACHING PARTS)		
-50	384-0313-00			2	.EXTENSION SHAFT:3.375 L X 0.125 OD,AL	80009	384-0313-00
	376-0051-00			2	.CPLG,SHAFT,FLEX:0.127 ID X 0.375 OD,DELRIN	80009	376-0051-00
-51	376-0049-00			1	..CPLG,SHAFT,FLEX:0.127 ID X 0.375 OD	80009	376-0049-00
-52	354-0251-00			2	..RING,CPLG:0.251 X 0.375 X 0.187,AL	80009	354-0251-00
	213-0022-00			4	..SETSCREW:4-40 X 0.188,STL	74445	ORDER BY DESCR
-53	----- -----			2	.RESISTOR,VAR:		
					.(ATTACHING PARTS)		
	210-0046-00			2	.WASHER,LOCK:0.261 ID,INTL,0.018 THK,STL	77900	1214-05-00-0541C
-55	210-0583-00			2	.NUT,PLAIN,HEX:0.25-32 X 0.312,BRS CD PL	73743	2X-20319-402
					.(END ATTACHING PARTS)		
					.(ATTACHING PARTS)		
-56	211-0601-00			3	SCR,ASSEM WSHR:6-32 X 0.312,PNH,BRS NP,POZ	TK0435	ORDER BY DESCR
	210-0978-00			2	WASHER,FLAT:0.375 ID X 0.5 OD X 0.024,STL	12327	ORDER BY DESCR
	210-0012-00			2	WASHER,LOCK:0.384 ID,INTL,0.022 THK,STL	09772	ORDER BY DESCR
-57	210-0590-00			2	NUT,PLAIN,HEX:0.375-32 X 0.438 BRS CD PL	73743	28269-402
					(END ATTACHING PARTS)		
-58	366-1048-05	B010100	B079999	1	PUSH BUTTON:GRAY,ZERO	80009	366-1048-05
	366-1162-02	B080000		1	PUSH BUTTON:GRAY,ZERO	80009	366-1162-02
-59	366-1048-12	B010100	B079999	1	PUSH BUTTON:SIL GRAY,AID	80009	366-1048-12
	366-1161-04	B080000		1	PUSH BUTTON:SIL GY,AID	80009	366-1161-04
-60	366-1048-15	B010100	B079999	1	PUSH BUTTON:SIL GRAY,OPPOSE	80009	366-1048-15
	366-1161-07	B080000		1	PUSH BUTTON:SIL GY,OPPOSE	80009	366-1161-07
-61	366-1048-07	B010100	B079999	1	PUSH BUTTON:CHARCOAL,1X	80009	366-1048-07
	366-1160-21	B080000		1	PUSH BUTTON:CHARCOAL,.1X	80009	366-1160-21
-62	366-1048-04	B010100	B079999	1	PUSH BUTTON:SIL GRAY,STEPS	80009	366-1048-04
	366-1162-01	B080000		1	PUSH BUTTON:GRAY,STEPS	80009	366-1162-01
-63	366-1048-13	B010100	B079999	1	PUSH BUTTON:SIL GRAY,300US	80009	366-1048-13
	366-1161-05	B080000		1	PUSH BUTTON:SIL GY,300US	80009	366-1161-05

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-64	366-1048-16	B010100	B079999	1	PUSH BUTTON:SIL GRAY,80US	80009	366-1048-16
	366-1161-08	B080000		1	PUSH BUTTON:SIL GY,80US	80009	366-1161-08
-65	366-1048-08	B010100	B079999	1	PUSH BUTTON:CHARCOAL,INVERT	80009	366-1048-08
	366-1160-22	B080000		1	PUSH BUTTON:CHARCOAL,INVERT	80009	366-1160-22
-66	366-1048-06	B010100	B079999	1	PUSH BUTTON:GRAY,REP	80009	366-1048-06
	366-1162-03	B080000		1	PUSH BUTTON:GRAY,REP	80009	366-1162-03
-67	366-1048-14	B010100	B079999	1	PUSH BUTTON:SIL GRAY,SINGLE	80009	366-1048-14
	366-1161-06	B080000		1	PUSH BUTTON:SIL GY,SINGLE	80009	366-1161-06
-68	366-1048-03	B010100	B079999	1	PUSH BUTTON:SIL GRAY,2X	80009	366-1048-03
	366-1161-01	B080000		1	PUSH BUTTON:SIL GY,2X	80009	366-1161-01
-69	366-1048-17	B010100	B079999	1	PUSH BUTTON:SIL GRAY,NORM	80009	366-1048-17
	366-1161-09	B080000		1	PUSH BUTTON:SIL GY,NORM	80009	366-1161-09
-70	366-1048-18	B010100	B079999	1	PUSH BUTTON:SIL GRAY,.5 X	80009	366-1048-18
	366-1161-10	B080000		1	PUSH BUTTON:SIL GY,.5X	80009	366-1161-10
	672-0407-00			1	CIRCUIT BD ASSY:PB SWITCH	80009	672-0407-00
-71	----- -----			1	.CKT BOARD ASSY:STEP GEN OFFSET SW .(SEE REPL)		
-72	131-0633-00			6	..TERMINAL,PIN:0.385 L X 0.048 OD BRS TIN	80009	131-0633-00
-73	----- -----			1	..SWITCH,PUSH:(SEE SW86 REPL)		
-74	----- -----			1	.CKT BOARD ASSY:STEP GENERATOR PULSE .(SEE REPL)		
-75	131-0633-00			9	..TERMINAL,PIN:0.385 L X 0.048 OD BRS TIN	80009	131-0633-00
-76	----- -----			1	..SWITCH,PUSH:(SEE SW37 REPL)		
-77	----- -----			1	.CKT BOARD ASSY:STEP GENERATOR RATE SW .(SEE REPL)		
-78	131-0633-00			11	..TERMINAL,PIN:0.385 L X 0.048 OD BRS TIN	80009	131-0633-00
-79	----- -----			1	..SWITCH,PUSH:(SEE SW78 REPL) ..(ATTACHING PARTS)		
-80	211-0027-00			4	.SCREW,MACHINE:4-40 X 1.5,PNH,STL .(END ATTACHING PARTS)	83385	ORDER BY DESCR
-81	361-0229-00	B010100	B079999	2	.SPACER,CKT BD:BLACK,ABS	80009	361-0229-00
	361-0229-01	B080000		2	.SPACER,CKT BD:BLACK,ABS	80009	361-0229-01
-82	361-0231-00	B010100	B079999	2	.SPACER,CKT BD:BLACK ABS	80009	361-0231-00
	361-0231-01	B080000		2	.SPACER,CKT BD:BLACK ABS	80009	361-0231-01
	210-0994-00			4	.WASHER,FLAT:0.125 ID X 0.25 OD X 0.022,STL	86928	A371-283-20
-83	210-0586-00			4	.NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL .(ATTACHING PARTS)	78189	211-041800-00
-84	211-0012-00			4	SCREW,MACHINE:4-40 X 0.375,PNH,STL .(END ATTACHING PARTS)	TK0435	ORDER BY DESCR
-85	366-1095-00	B010100	B326049	1	KNOB:GY,0.252 ID X 1.85 OD X 0.8 H	80009	366-1095-00
	366-1095-01	B326050		1	KNOB:GY,0.252 ID X 1.85 OD X 0.8 H	80009	366-1095-01
	213-0153-00			2	.SETSCREW:5-40 X 0.125,STL	TK0392	ORDER BY DESCR
-86	354-0337-00			1	RING,KNOB SKIRT:NEW GEN GRAY,1.85 OD	80009	354-0337-00
	213-0153-00			1	.SETSCREW:5-40 X 0.125,STL	TK0392	ORDER BY DESCR
-87	358-0254-00			1	BSHG,MACH THD:0.625-24 X 0.377 ID,BRS	80009	358-0254-00
	210-0049-00			1	WASHER,LOCK:0.65 ID INTL,0.022 THK,STL	77900	128-02-00-0541C
-88	210-0579-00			1	NUT,PLAIN,HEX:0.625-24 X 0.75,BRS CD PL	73743	48046-402
-89	136-0164-00			2	LAMP,CARTRIDGE:CLEAR LENS (ATTACHING PARTS)	71744	CML10203-1
-90	220-0480-02	B010100	B359699	2	NUT,PLAIN,DODEC:0.375-32 X 0.438,BRS	80009	220-0480-02
	220-0495-00	B359700		2	NUT,PLAIN,HEX:0.375-32 X 0.438 HEX,BRS	73743	ORDER BY DESCR
-91	210-0978-00			2	WASHER,FLAT:0.375 ID X 0.5 OD X 0.024,STL (END ATTACHING PARTS)	12327	ORDER BY DESCR
-92	331-0231-00	B010100	B326239	1	DIAL,CONTROL:10 TURN COUNTING W/BRAKE	05129	462-S29
	331-0231-01	B326240		1	DIAL,CONTROL:10 TURN COUNTING W/BRAKE	05129	462-S-29
-93	----- -----			1	RESISTOR,VAR: (ATTACHING PARTS)		
-94	201-0013-00			1	CUP,CMPNT MTG:	80009	201-0013-00
-95	131-0672-00			1	CONTACT,ELEC:GROUNDING,PH BRZ (END ATTACHING PARTS)	80009	131-0672-00
-96	200-0915-01			1	RTNR,CRT SCALE:7.477 X 6.025 X 0.435 (ATTACHING PARTS)	80009	200-0915-01
-97	213-0201-00			1	SCREW,EXT RLV:10-24 X 0.595,0.48 OD HD,SST (END ATTACHING PARTS)	80009	213-0201-00
-98	378-0616-00			1	FILTER,LT,CRT:LT BLUE,5.65 X 4.33 X 0.03	80009	378-0616-00
-99	337-1118-00			1	SHLD,IMPLOSION:5.552 X 4.915 X .125 PLEX (ATTACHING PARTS)	80009	337-1118-00
-100	211-0079-00			3	SCREW,MACHINE:2-56 X 0.188,PNH,STL	TK0435	5549-418

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-					(END ATTACHING PARTS)		
-101	386-1598-00			1	DIFFUSER,LIGHT:READOUT ILLUM,PLEXIGLAS	80009	386-1598-00
-102	331-0230-00	B010100	B149999	1	MASK,READOUT:	80009	331-0230-00
	331-0230-01	B150000		1	MASK,READOUT:	80009	331-0230-01
					(ATTACHING PARTS)		
	211-0073-00			2	SCREW,MACHINE:2-56 X 0.218,FLH,SST	TK0431	ORDER BY DESCR
					(END ATTACHING PARTS)		
-103	366-1007-00			1	KNOB:GY,0.252 ID X 1.17 OD X 0.7 H	80009	366-1007-00
	213-0153-00			1	.SETSCREW:5-40 X 0.125,STL	TK0392	ORDER BY DESCR
-104	----- -----			1	TRANSFORMER,VAR:		
					(ATTACHING PARTS)		
-105	210-0012-00			1	WASHER,LOCK:0.384 ID,INTL,0.022 THK,STL	09772	ORDER BY DESCR
	210-0978-00			1	WASHER,FLAT:0.375 ID X 0.5 OD X 0.024,STL	12327	ORDER BY DESCR
-106	210-0590-00			1	NUT,PLAIN,HEX:0.375-32 X 0.438 BRS CD PL	73743	28269-402
					(END ATTACHING PARTS)		
-107	----- -----			1	CIRCUIT BREAKER:(SEE SW300 REPL)		
					(ATTACHING PARTS)		
-108	210-0505-00			2	NUT,PLAIN,HEX:0.375-27 X 0.5 HEX,BRS CD PL	73743	2X32032-402
	210-0978-00			1	WASHER,FLAT:0.375 ID X 0.5 OD X 0.024,STL	12327	ORDER BY DESCR
	210-0012-00			1	WASHER,LOCK:0.384 ID,INTL,0.022 THK,STL	09772	ORDER BY DESCR
					(END ATTACHING PARTS)		
-109	333-1200-01			1	PANEL,FRONT:	80009	333-1200-01
-110	200-0937-00			1	COV,VAR PWR TRA:5.8 X 3.319 X 3.18,AL ANDZ	80009	200-0937-00
					(ATTACHING PARTS)		
-111	212-0023-00			2	SCREW,MACHINE:8-32 X 0.375,PNH,STL	TK0435	ORDER BY DESCR
					(END ATTACHING PARTS)		
-112	426-0483-01			1	FRAME SECT,CAB.:BOTTOM CENTER	80009	426-0483-01
					(ATTACHING PARTS)		
-113	212-0023-00			2	SCREW,MACHINE:8-32 X 0.375,PNH,STL	TK0435	ORDER BY DESCR
-114	212-0043-00			1	SCREW,MACHINE:8-32 X 0.5,FLH,100 DEG,STL	TK0435	ORDER BY DESCR
-115	220-0533-00			1	NUT STRIP:8-32 2.5 X 0.375 X 0.125,AL	80009	220-0533-00
					(END ATTACHING PARTS)		
-116	426-0470-01			1	FRAME PNL,CAB.:FRONT	80009	426-0470-01
	220-0534-00			2	.NUT,PLAIN,SPLN:10-24 X 0.29,BRASS	80009	220-0534-00
-117	131-0018-00			2	CONN,RCPT,ELEC:FEMALE 16 CONTACT	02660	26-190-16
					(ATTACHING PARTS)		
-118	211-0012-00			4	SCREW,MACHINE:4-40 X 0.375,PNH,STL	TK0435	ORDER BY DESCR
-119	210-0586-00			4	NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL	78189	211-041800-00
					(END ATTACHING PARTS)		
-120	131-0097-00			1	CONN,RCPT,ELEC:32 CONTACT,FEMALE	02660	26-190-32
					(ATTACHING PARTS)		
	211-0012-00			2	SCREW,MACHINE:4-40 X 0.375,PNH,STL	TK0435	ORDER BY DESCR
	210-0586-00			2	NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL	78189	211-041800-00
					(END ATTACHING PARTS)		
-121	131-0148-00			1	CONN,RCPT,ELEC:FEMALE,24 CONTACT	02660	26-190-24-1004
					(ATTACHING PARTS)		
-122	211-0012-00			2	SCREW,MACHINE:4-40 X 0.375,PNH,STL	TK0435	ORDER BY DESCR
-123	210-0586-00			2	NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL	78189	211-041800-00
					(END ATTACHING PARTS)		
	650-0459-01			1	TEST FIXTURE:	80009	650-0459-01
-123.1	337-1194-00	B010100	B360671	1	.SHIELD,ELEC:TRANSISTOR	80009	337-1194-00
	337-1194-01	B360672	B361319	1	.SHIELD,ELEC:TRANSISTOR	80009	337-1194-01
	337-1194-02	B361320		1	.SHIELD,ELEC:TRANSISTOR	80009	337-1194-02
-124	----- -----			1	..SHIELD,ELEC:TEST LID		
					..(NOT AVAILABLE)		
-125	----- -----			2	..HINGE,SPRING:HV HOUSING,CU BE NP		
					..(NOT AVAILABLE)		
-126	337-1148-00	B010100	B360671	1	..SHIELD,ELEC:WRAPAROUND	80009	337-1148-00
	337-1148-01	B360672	B361319	1	..SHIELD,ELEC:WRAPAROUND	80009	337-1148-01
	337-1148-02	B361320		1	..SHIELD,ELEC:WRAPAROUND	80009	337-1148-02
-127	----- -----			1	..ADAPTER,SW ACTR:PUSH		
					..(NOT AVAILABLE)		
-128	----- -----			1	..SPRING,HLCPS:0.19 OD X 0.6 L,CLOSED		
					..(NOT AVAILABLE)		
-129	----- -----			1	..RETAINER,SPRING:ALUMINUM		
					..(NOT AVAILABLE)		
-130	386-1544-00			1	.PL,MTG,TEST ADA:10 HOLE	80009	386-1544-00
					.(ATTACHING PARTS)		

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-131	211-0025-00			3	.SCREW,MACHINE:4-40 X 0.375,FLH,100 DEG,STL .(END ATTACHING PARTS)	TK0435	ORDER BY DESCR
-132	131-0031-00			10	.JACK,TIP:BANANA,NON-INSULATED .(ATTACHING PARTS)	74970	108-0740-023
-133	210-0455-00			20	.NUT,PLAIN,HEX:0.25-28 X 0.375,BRS NP	73743	3089-402
	210-0223-00			10	.TERMINAL,LUG:0.26 ID,LOCKING,BRZ TIN PL .(END ATTACHING PARTS)	86928	5441-37
-134	131-0749-00			1	.CONTACT,ELEC:UPPER,SWITCH,CU BE	80009	131-0749-00
-135	131-0748-00			1	.CONTACT,ELEC:LOWER SWITCH,CU BE	80009	131-0748-00
-136	361-0259-00			1	.INSULATOR,PLATE:CONNECTOR,ABS	80009	361-0259-00
-137	337-1152-00			1	.SHIELD,ELEC:PUSH SWITCH	80009	337-1152-00
-138	211-0112-00			2	.SCREW,MACHINE:2-56 X 0.375,FLH,100 DEG,STL	TK0435	ORDER BY DESCR
-139	333-1190-01			1	.PANEL,FRONT:	80009	333-1190-01
-140	386-1546-00			1	.SUBPANEL,FRONT:	80009	386-1546-00
-141	366-1126-00			1	.KNOB:GY,6-32 X 0.28 OD X 0.75	80009	366-1126-00
-142	----- -----			1	.SWITCH,LEVER:(SEE SW371 REPL) .(ATTACHING PARTS)		
	354-0055-00			1	.WASHER,KEY:0.468 ID X 0.718 OD,STL CD PL	80009	354-0055-00
	361-0262-00			1	.SP,RING:0.125 L X 0.468 ID,ABS SIL GRAY	80009	361-0262-00
	210-0902-00	B010100	B079999	1	.WASHER,FLAT:0.47 ID X 0.656 OD X 0.03,STL	12327	ORDER BY DESCR
	210-0021-00	B080000		1	.WASHER,LOCK:0.476 ID,INTL,0.018 THK,STL	78189	1222-01
-143	210-0473-00			1	.NUT,PLAIN,DODEC:0.469-32 X 0.638,BRS NP .(END ATTACHING PARTS)	73743	ORDER BY DESCR
-144	366-1028-00			1	.KNOB:GY,0.252 ID X 0.796 OD X 0.65 H	80009	366-1028-00
	213-0153-00			1	..SETSCREW:5-40 X 0.125,STL	TK0392	ORDER BY DESCR
-145	----- -----			1	.SWITCH,ROTARY:(SEE SW375 REPL) .(ATTACHING PARTS)		
	210-0840-00			1	.WASHER,FLAT:0.39 ID X 0.562 OD X 0.02,STL	86928	ORDER BY DESCR
-146	210-0413-00			1	.NUT,PLAIN,HEX:0.375-32 X 0.5,BRS CD PL .(END ATTACHING PARTS)	73743	3145-402
-147	136-0140-00			3	.JACK,TIP:BANANA,CHARCOAL GRAY .(ATTACHING PARTS)	TK1319	ORDER BY DESCR
	210-0904-00			3	.WASHER,SHLDR:0.255 ID X 0.5 OD X 0.1 THK	74921	ORDER BY DESCR
-148	210-0465-00			6	.NUT,PLAIN,HEX:0.25-32 X 0.375,BRS CD PL	73743	3095-402
	210-0223-00			3	.TERMINAL,LUG:0.26 ID,LOCKING,BRZ TIN PL .(END ATTACHING PARTS)	86928	5441-37
-149	136-0164-00			1	.LAMP,CARTRIDGE:CLEAR LENS .(ATTACHING PARTS)	71744	CML10203-1
-150	220-0480-02			1	.NUT,PLAIN,DODEC:0.375-32 X 0.438,BRS	80009	220-0480-02
-151	210-0255-00			1	.TERMINAL,LUG:0.391 ID,LOCKING,BRS CD PL .(END ATTACHING PARTS)	12327	ORDER BY DESCR
-152	131-0096-00			1	.CONN,RCPT,ELEC:32 CONTACT,MALE .(ATTACHING PARTS)	02660	26-159-32
-153	211-0008-00			1	.SCREW,MACHINE:4-40 X 0.25,PNH,STL	93907	ORDER BY DESCR
-154	210-0586-00			2	.NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL .(END ATTACHING PARTS)	78189	211-041800-00
-155	390-0098-00			1	.CAB.BOT,PLUG-IN:BOTTOM .(ATTACHING PARTS)	80009	390-0098-00
-156	211-0504-00			6	.SCREW,MACHINE:6-32 X 0.250,PNH,STL .(END ATTACHING PARTS)	TK0435	ORDER BY DESCR
-157	390-0083-00			1	.CAB.SIDE,PL-IN:LEFT .(ATTACHING PARTS)	80009	390-0083-00
-158	213-0146-00	B010100	B101469	3	.SCREW,TPG,TF:6-20 X 0.312,TYPE B,PNH,STL	83385	ORDER BY DESCR
	213-0146-00	B101470		1	.SCREW,TPG,TF:6-20 X 0.312,TYPE B,PNH,STL	83385	ORDER BY DESCR
	213-0166-00	B101470		2	.SCREW,TPG,TF:6-20 X 0.75,TYPE B,PNH,STL .(END ATTACHING PARTS)	93907	ORDER BY DESCR
-159	390-0082-00			1	.CAB.SIDE,PL-IN:RIGHT .(ATTACHING PARTS)	80009	390-0082-00
-160	213-0146-00			3	.SCREW,TPG,TF:6-20 X 0.312,TYPE B,PNH,STL .(END ATTACHING PARTS)	83385	ORDER BY DESCR
-161	366-0125-00			2	.KNOB:AL,0.189 ID X 0.563 OD X 0.625 H	80009	366-0125-00
	213-0004-00			1	..SETSCREW:6-32 X 0.188,STL	74445	ORDER BY DESCR
-162	384-0715-00			2	.PIN,STR,THD:0.188 OD X 6.185 L,SST	80009	384-0715-00
-163	354-0025-00			1	..RING,RETAINING:EXTERNAL,U/O 0.187 DIA SFT	79136	5555-18
-164	210-0894-00			2	.WASHER,FLAT:0.19 ID X 0.438 OD X 0.031	09422	ORDER BY DESCR
-165	179-1377-00			1	.WIRING HARNESS:MAIN	80009	179-1377-00
-166	179-1378-00			1	.WIRING HARNESS:HIGH VOLTAGE	80009	179-1378-00
-167	179-1371-00			1	WIRING HARNESS:CONNECTOR	80009	179-1371-00

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-168	131-0371-00			36	.CONNECTOR,TERM:U/W 26 AWG WIRE	98278	122-0182-019
-169	131-0717-00			1	CONN,RCPT,ELEC:PWR,FEMALE,125VAC,3A	81312	SM3SN
-170	----- -----			1	CKT BOARD ASSY:READOUT ILLUM (SEE REPL)		
-171	131-0633-00			2	.TERMINAL,PIN:0.385 L X 0.048 OD BRS TIN	80009	131-0633-00
	131-0704-00			1	.CONTACT,ELEC:SCALE LIGHTS,CU BE	80009	131-0704-00
	210-0759-00			1	.EYELET,METALLIC:0.061 OD X 0.192 L,	71590	30818-11
	210-0957-00			1	.WASHER,FLAT:0.062 ID X 0.25 OD X 0.033,STL .(ATTACHING PARTS)	83903	ORDER BY DESCR
-172	211-0116-00			1	SCR,ASSEM WSHR:4-40 X 0.312,PNH,BRS,NP,POZ (END ATTACHING PARTS)	77900	ORDER BY DESCR
-173	407-0634-00			1	BRACKET,CKT BD:ALUMINUM (ATTACHING PARTS)	80009	407-0634-00
-174	211-0007-00			2	SCREW,MACHINE:4-40 X 0.188,PNH,STL (END ATTACHING PARTS)	TK0435	ORDER BY DESCR
-175	426-0568-00	B080000		16	FRAME,PUSH BTN:	80009	426-0568-00

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
2-	672-0932-00	B010100	B359650	1	CIRCUIT BD ASSY:CURRENT/DIV	80009	672-0932-00
	672-0932-01	B359651		1	CIRCUIT BD ASSY:VERT CURRENT/DIV	80009	672-0932-01
-1	----- -----			1	.CKT BOARD ASSY:VERTICAL CURRENT,DIV SW .(PART OF 672-0932-XX)		
-2 -	131-0633-00			30	..TERMINAL,PIN:0.385 L X 0.048 OD BRS TIN	80009	131-0633-00
-3	131-0639-00			12	..CONTACT,ELEC:SPR CLIP TYPE	22526	44642
-4	131-0604-00			30	..CONTACT,ELEC:CKT BD SW,SPR,CU BE	80009	131-0604-00
	263-1195-00	B010100	B359650	1	.SW CAM ACTR AS:CURRENT/DIV	80009	263-1195-00
	263-1195-01	B359651		1	.SW CAM ACTR AS:VERT CURRENT/DIV	80009	263-1195-01
	407-0653-00	B100000	B359650	1	..BRACKET,COVER:CAM SWITCH,DELRIN	80009	407-0653-00
	407-1199-04	B359651		1	..BRACKET,COVER:PLASTIC ..(ATTACHING PARTS)	80009	407-1199-04
	211-0116-00	B100000	B359650	2	..SCR,ASSEM WSHR:4-40 X 0.312,PNH,BRS,NP,POZ	77900	ORDER BY DESCR
	211-0292-00	B359651		2	..SCR,ASSEM WSHR:4-40 X 0.29,PNH,BRS NI PL	78189	51-040445-01
	210-0406-00	B100000		2	..NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL ..(END ATTACHING PARTS)	73743	12161-50
-5	401-0054-00	B010100	B359650	1	..BEARING,CAM SW:FRONT,	80009	401-0054-00
	401-0178-08	B359651		1	..BEARING,CAM SW:REAR ..(ATTACHING PARTS)	80009	401-0178-08
-6	211-0116-00			2	..SCR,ASSEM WSHR:4-40 X 0.312,PNH,BRS,NP,POZ	77900	ORDER BY DESCR
-7	210-0406-00			2	..NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL ..(END ATTACHING PARTS)	73743	12161-50
-8	354-0219-00	B010100	B359650	1	..RING,RETAINING:EXT,CRESCENT,U/O 0.25 DIA	79136	5103-25-S-ZD-R
	354-0390-00	B359651		1	..RING,RETAINING:BASIC EXT,U/O 0.375 DIA SFT	79136	5100-37-ZD
-9	214-1127-00	B010100	B359650	1	..ROLLER,DETENT:0.125 DIA X 0.125,SST	80009	214-1127-00
	214-1752-00	B359651		2	..ROLLER,DETENT:0.125 OD X 0.16,SST	80009	214-1752-00
-10	214-1139-02	B010100	B359650	1	..SPRING,FLAT:0.885 X 0.156 CU BE GRN CLR	80009	214-1139-02
	214-1139-03	B010100	B359650	1	..SPRING,FLAT:0.885 X 0.156 CU BE RED CLR	80009	214-1139-03
	214-1139-03	B359651		2	..SPRING,FLAT:0.885 X 0.156 CU BE RED CLR	80009	214-1139-03
-11	105-0085-00	B010100	B359650	1	..ACTUATOR,CAM SW:VERT CUR/DIV	80009	105-0085-00
	105-0085-04	B359651		1	..ACTUATOR,CAM SW:VERT CUR/DIV	80009	105-0085-04
	384-1642-00	B359651		1	..SHAFT,CAM SW:W/EXTENTION AND DRIVER	80009	384-1642-00
-12	401-0056-00	B010100	B359650	1	..BEARING,CAM SW:REAR,0.83 DIA CAM	80009	401-0056-00
	401-0180-04	B359651		1	..BEARING,CAM SW:FRONT,W/INSERTS ..(ATTACHING PARTS)	80009	401-0180-04
-13	211-0116-00	B010100	B359650	2	..SCR,ASSEM WSHR:4-40 X 0.312,PNH,BRS,NP,POZ	77900	ORDER BY DESCR
	211-0292-00	B359651		2	..SCR,ASSEM WSHR:4-40 X 0.29,PNH,BRS NI PL	78189	51-040445-01
-14	210-0406-00			2	..NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL ..(END ATTACHING PARTS)	73743	12161-50
-15	263-0511-00			1	..SW SECTION,RTRY:15 DEG,VERT CURRENT/DIV ..(ATTACHING PARTS)	80009	263-0511-00
-16	211-0100-00	B010100	B359650	2	..SCREW,MACHINE:2-56 X 0.750,PNH,STL	83385	ORDER BY DESCR
	211-0022-00	B359651		2	..SCREW,MACHINE:2-56 X 0.188,PNH,STL	TK0435	ORDER BY DESCR
	210-0001-00	B359651		2	..WASHER,LOCK:#2 INTL,0.013 THK,STL	77900	1202-00-00-0541C
	210-0053-00	B010100	B359650	2	..WASHER,LOCK:#2 SPLIT,0.02 THK STL	78189	ORDER BY DESCR
-17	210-0405-00	B010100	B359650	2	..NUT,PLAIN,HEX:2-56 X 0.188,BRS CD PL	73743	12157-50
	210-0406-00	B359651		2	..NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL ..(END ATTACHING PARTS)	73743	12161-50
	361-0219-00	B359651		2	..SPACER,SLEEVE:0.06 L X 0.093 ID,BRS	80009	361-0219-00
	386-3069-00	B359651		1	..PLATE,SW MTG:BAND	80009	386-3069-00
-18	200-0940-00	B010100	B099999	1	..COVER,CAM SW:30 ELEMENTS	80009	200-0940-00
	200-0940-01	B100000	B359650	1	..COVER,CAM SW:30 ELEMENTS	80009	200-0940-01
	200-2717-00	B359651		1	..COVER,CAM SW:40 ELEMENT ..(ATTACHING PARTS)	80009	200-2717-00
-19	211-0079-00	B010100	B099999	2	..SCREW,MACHINE:2-56 X 0.188,PNH,STL	TK0435	5549-418
	211-0079-00	B100000	B359650	4	..SCREW,MACHINE:2-56 X 0.188,PNH,STL	TK0435	5549-418
	211-0292-00	B359651		2	..SCR,ASSEM WSHR:4-40 X 0.29,PNH,BRS NI PL	78189	51-040445-01
	210-0001-00	B010100	B099999	2	..WASHER,LOCK:#2 INTL,0.013 THK,STL	77900	1202-00-00-0541C
	210-0001-00	B100000		4	..WASHER,LOCK:#2 INTL,0.013 THK,STL	77900	1202-00-00-0541C
-20	210-0405-00	B010100	B099999	2	..NUT,PLAIN,HEX:2-56 X 0.188,BRS CD PL	73743	12157-50
	210-0405-00	B100000	B359650	4	..NUT,PLAIN,HEX:2-56 X 0.188,BRS CD PL	73743	12157-50
	210-0406-00	B359651		4	..NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL ..(END ATTACHING PARTS) ..(ATTACHING PARTS FOR CKT BD ASSY)	73743	12161-50
-21	211-0601-00			1	SCR,ASSEM WSHR:6-32 X 0.312,PNH,BRS NP,POZ	TK0435	ORDER BY DESCR
	210-0012-00			1	WASHER,LOCK:0.384 ID,INTL,0.022 THK,STL	09772	ORDER BY DESCR
	210-0978-00			1	WASHER,FLAT:0.375 ID X 0.5 OD X 0.024,STL	12327	ORDER BY DESCR
	210-0590-00			1	NUT,PLAIN,HEX:0.375-32 X 0.438 BRS CD PL	73743	28269-402

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
2-					(END ATTACHING PARTS)		
	672-0930-00	B010100	B359650	1	CIRCUIT BD ASSY:DISPLAY OFFSET	80009	672-0930-00
	672-0930-00	B359651		1	CIRCUIT BD ASSY:DISPLAY OFFSET	80009	672-0930-00
-22	----- -----			1	.CKT BOARD ASSY:DSPL OFFSET (SEE REPL)		
-23	131-0633-00			16	..TERMINAL,PIN:0.385 L X 0.048 OD BRS TIN	80009	131-0633-00
-24	131-0604-00			28	..CONTACT,ELEC:CKT BD SW,SPR,CU BE	80009	131-0604-00
	263-1193-00	B010100	B359650	1	.SW CAM ACTR AS:DISPLAY OFFSET	80009	263-1193-00
	263-1193-01	B359651		1	.SW CAM ACTR AS:DISPLAY OFFSET	80009	263-1193-01
-25	401-0054-00	B010100	B359650	1	..BEARING,CAM SW:FRONT,	80009	401-0054-00
	401-0180-05	B359651		1	..BEARING,CAM SW:FRONT	80009	401-0180-05
					..(ATTACHING PARTS)		
-26	211-0116-00	B010100	B359650	2	..SCR,ASSEM WSHR:4-40 X 0.312,PNH,BRS,NP,POZ	77900	ORDER BY DESCR
	211-0292-00	B359651		2	..SCR,ASSEM WSHR:4-40 X 0.29,PNH,BRS NI PL	78189	51-040445-01
-27	210-0406-00			2	..NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL	73743	12161-50
					..(END ATTACHING PARTS)		
-28	354-0219-00	B010100	B359650	2	..RING,RETAINING:EXT,CRESCENT,U/O 0.25 DIA	79136	5103-25-S-ZD-R
	354-0219-00	B359651		1	..RING,RETAINING:EXT,CRESCENT,U/O 0.25 DIA	79136	5103-25-S-ZD-R
	354-0390-00	B359651		1	..RING,RETAINING:BASIC EXT,U/O 0.375 DIA SFT	79136	5100-37-ZD
-29	214-1127-00	B010100	B359650	2	..ROLLER,DETENT:0.125 DIA X 0.125,SST	80009	214-1127-00
	214-1752-00	B359651		4	..ROLLER,DETENT:0.125 OD X 0.16,SST	80009	214-1752-00
-30	214-1139-02	B010100	B359650	1	..SPRING,FLAT:0.885 X 0.156 CU BE GRN CLR	80009	214-1139-02
	214-1139-02	B359651		2	..SPRING,FLAT:0.885 X 0.156 CU BE GRN CLR	80009	214-1139-02
-31	214-1139-03			1	..SPRING,FLAT:0.885 X 0.156 CU BE RED CLR	80009	214-1139-03
	214-1139-00	B010100	B359650	1	..SPRING,FLAT:0.885 X 0.156 CU BE GLD CLR	80009	214-1139-00
-32	105-0095-00	B010100	B359650	1	..ACTUATOR,CAM SW:DIS CTR	80009	105-0095-00
	105-0095-01	B359651		1	..ACTUATOR,CAM SW:DIS CTR	80009	105-0095-01
	384-0878-58	B359651		1	..SHFT,CAM SW:1.699 X 0.248,OUTER CONCENTRIC	80009	384-0878-58
-33	401-0055-00	B010100	B359650	1	..BEARING,CAM SW:CENTER,0.83 DIA CAM	80009	401-0055-00
	401-0178-03	B359651		1	..BEARING,CAM SW:CENTER/REAR	80009	401-0178-03
					..(ATTACHING PARTS)		
-34	211-0116-00	B010100	B359650	2	..SCR,ASSEM WSHR:4-40 X 0.312,PNH,BRS,NP,POZ	77900	ORDER BY DESCR
	211-0292-00	B359651		2	..SCR,ASSEM WSHR:4-40 X 0.29,PNH,BRS NI PL	78189	51-040445-01
-35	210-0406-00			2	..NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL	73743	12161-50
					..(END ATTACHING PARTS)		
-36	105-0093-00	B010100	B359650	1	..ACTUATOR,CAM SW:OFFSET/MAG	80009	105-0093-00
	105-0093-01	B359651		1	..ACTUATOR,CAM SW:OFFSET & MAG	80009	105-0093-01
	384-1476-04	B359651		1	..SHAFT,CAM SW:5.788 L X 0.125 OD,INTMD	80009	384-1476-04
					..CONCENTRIC W/DRIVER		
-37	401-0057-00	B010100	B359650	1	..BEARING,CAM SW:FRONT W/0.83 DIA BSHG	80009	401-0057-00
	401-0180-00	B359651		1	..BEARING,CAM SW:FR & REAR,0.80 & 0.83 DIA	80009	401-0180-00
					..(ATTACHING PARTS)		
-38	211-0116-00	B010100	B359650	2	..SCR,ASSEM WSHR:4-40 X 0.312,PNH,BRS,NP,POZ	77900	ORDER BY DESCR
	211-0292-00	B359651		2	..SCR,ASSEM WSHR:4-40 X 0.29,PNH,BRS NI PL	78189	51-040445-01
-39	210-0406-00			2	..NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL	73743	12161-50
					..(END ATTACHING PARTS)		
-40	200-0944-00	B010100	B359650	1	..COVER,CAM SW:12 & 16 ELEMENTS	80009	200-0944-00
	200-2714-00	B359651		1	..COVER,CAM SW:16 & 12 ELEMENT,ALUMINUM	80009	200-2714-00
					..(ATTACHING PARTS)		
-41	211-0079-00	B010100	B359650	3	..SCREW,MACHINE:2-56 X 0.188,PNH,STL	TK0435	5549-418
	211-0292-00	B359651		6	..SCR,ASSEM WSHR:4-40 X 0.29,PNH,BRS NI PL	78189	51-040445-01
	210-0001-00	B010100	B359650	3	..WASHER,LOCK:#2 INTL,0.013 THK,STL	77900	1202-00-00-0541C
-42	210-0405-00	B010100	B359650	3	..NUT,PLAIN,HEX:2-56 X 0.188,BRS CD PL	73743	12157-50
	210-0406-00	B359651		6	..NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL	73743	12161-50
					..(END ATTACHING PARTS)		
					..(ATTACHING PARTS FOR CKT BD ASSY)		
-43	211-0601-00			1	SCR,ASSEM WSHR:6-32 X 0.312,PNH,BRS NP,POZ	TK0435	ORDER BY DESCR
	210-0012-00			1	WASHER,LOCK:0.384 ID,INTL,0.022 THK,STL	09772	ORDER BY DESCR
	210-0978-00			1	WASHER,FLAT:0.375 ID X 0.5 OD X 0.024,STL	12327	ORDER BY DESCR
	210-0590-00			1	NUT,PLAIN,HEX:0.375-32 X 0.438 BRS CD PL	73743	28269-402
					(END ATTACHING PARTS)		
	672-0931-00	B010100	B359650	1	CIRCUIT BD ASSY:HORIZ V/DIV	80009	672-0931-00
	672-0931-01	B359651		1	CIRCUIT BD ASSY:HORIZ V/DIV	80009	672-0931-01
-44	----- -----			1	.CKT BOARD ASSY:HORIZONTAL VOLTS/DIV SW		
					.(PART OF 672-0931-XX)		
-45	131-0633-00			16	..TERMINAL,PIN:0.385 L X 0.048 OD BRS TIN	80009	131-0633-00
-46	131-0639-00	B010100	B209999	12	..CONTACT,ELEC:SPR CLIP TYPE	22526	44642
-47	131-0604-00			27	..CONTACT,ELEC:CKT BD SW,SPR,CU BE	80009	131-0604-00
-48	337-1137-00	B010100	B089999	1	..SHIELD,INSUL:HORIZ CAM SW	80009	337-1137-00

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
2-	337-1137-01	B090000		1	..SHIELD,ELEC:HORIZ CAM SW	80009	337-1137-01
					..(ATTACHING PARTS)		
-49	211-0040-00			4	..SCREW,MACHINE:4-40 X 0.25,BDGH,NYL	26365	ORDER BY DESCR
	210-0003-00	B090000		1	..WASHER,LOCK:#4 EXT,0.015 THK,STL	78189	1104-00-00-0541C
-50	384-0536-00	B010100	B089999	2	..SP,POST:0.531 L,4-40 THRU NYLON,0.25 OD	80009	384-0536-00
	385-0107-00	B090000		2	..SPACER,POST:0.75 L W/4-40 THD THRU,NYL	80009	385-0107-00
					..(END ATTACHING PARTS)		
	263-1194-00	B010100	B359650	1	.SW CAM ACTR AS:HORIZ V/DIV	80009	263-1194-00
	263-1194-01	B359651		1	.SW CAM ACTR AS:HORIZ V/DIV	80009	263-1194-01
-51	401-0054-00	B010100	B359650	1	..BEARING,CAM SW:FRONT,	80009	401-0054-00
	401-0178-08	B359651		1	..BEARING,CAM SW:REAR	80009	401-0178-08
					..(ATTACHING PARTS)		
	211-0116-00	B010100	B359650	2	..SCR,ASSEM WSHR:4-40 X 0.312,PNH,BRS,NP,POZ	77900	ORDER BY DESCR
	211-0292-00	B359651		2	..SCR,ASSEM WSHR:4-40 X 0.29,PNH,BRS NI PL	78189	51-040445-01
-52	210-0406-00			2	..NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL	73743	12161-50
					..(END ATTACHING PARTS)		
-53	354-0219-00	B010100	B359650	1	..RING,RETAINING:EXT,CRESCENT,U/O 0.25 DIA	79136	5103-25-S-ZD-R
	354-0390-00	B359651		1	..RING,RETAINING:BASIC EXT,U/O 0.375 DIA SFT	79136	5100-37-ZD
-54	214-1127-00	B010100	B359650	1	..ROLLER,DETENT:0.125 DIA X 0.125,SST	80009	214-1127-00
	214-1752-00	B359651		2	..ROLLER,DETENT:0.125 OD X 0.16,SST	80009	214-1752-00
	214-1139-00			1	..SPRING,FLAT:0.885 X 0.156 CU BE GLD CLR	80009	214-1139-00
-55	214-1139-02	B010100	B359650	1	..SPRING,FLAT:0.885 X 0.156 CU BE GRN CLR	80009	214-1139-02
-56	214-1139-03			1	..SPRING,FLAT:0.885 X 0.156 CU BE RED CLR	80009	214-1139-03
-57	----- -----			1	..ACTUATOR,CAM SW:HORIZ V/DIV		
					..(PART OF 672-0931-XX)		
-58	401-0056-00	B010100	B359650	1	..BEARING,CAM SW:REAR,0.83 DIA CAM	80009	401-0056-00
	401-0180-00	B359651		1	..BEARING,CAM SW:FR & REAR,0.80 & 0.83 DIA	80009	401-0180-00
	384-1480-03	B359651		1	..SHAFT,CAM SW:5.43 L X 0.248 OD,W DRIVER	80009	384-1480-03
					..(ATTACHING PARTS)		
-59	211-0116-00	B010100	B359650	2	..SCR,ASSEM WSHR:4-40 X 0.312,PNH,BRS,NP,POZ	77900	ORDER BY DESCR
	211-0292-00	B359651		2	..SCR,ASSEM WSHR:4-40 X 0.29,PNH,BRS NI PL	78189	51-040445-01
-60	210-0406-00			2	..NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL	73743	12161-50
					..(END ATTACHING PARTS)		
-61	200-0943-00	B010100	B089999	1	..COVER,CAM SW:36 ELEMENTS	80009	200-0943-00
	200-0943-01	B090000	B359650	1	..COVER,CAM SW:36 ELEMENTS	80009	200-0943-01
	200-2715-00	B359651		1	..COVER,CAM SW:36 ELEMENT	80009	200-2715-00
					..(ATTACHING PARTS)		
-62	211-0079-00	B010100	B359650	2	..SCREW,MACHINE:2-56 X 0.188,PNH,STL	TK0435	5549-418
	211-0292-00	B359651		6	..SCR,ASSEM WSHR:4-40 X 0.29,PNH,BRS NI PL	78189	51-040445-01
	210-0001-00	B010100	B359650	2	..WASHER,LOCK:#2 INTL,0.013 THK,STL	77900	1202-00-00-0541C
	210-0259-00	B090000	B359650	1	..TERMINAL,LUG:0.099 ID,LOCKING,BRS CD PL	80009	210-0259-00
	210-0201-00	B359651		1	..TERMINAL,LUG:0.12 ID,LOCKING,BRZ TIN PL	86928	A373-157-2
-63	210-0405-00	B010100	B359650	4	..NUT,PLAIN,HEX:2-56 X 0.188,BRS CD PL	73743	12157-50
	210-0406-00	B359651		4	..NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL	73743	12161-50
					..(END ATTACHING PARTS)		
	407-0653-00	B090000		1	..BRACKET,COVER:CAM SWITCH,DELRIN	80009	407-0653-00
					..(ATTACHING PARTS)		
	211-0116-00	B010100	B359650	2	..SCR,ASSEM WSHR:4-40 X 0.312,PNH,BRS,NP,POZ	77900	ORDER BY DESCR
	211-0292-00	B359651		2	..SCR,ASSEM WSHR:4-40 X 0.29,PNH,BRS NI PL	78189	51-040445-01
	210-0406-00			2	..NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL	73743	12161-50
					..(END ATTACHING PARTS)		
					(ATTACHING PARTS FOR CKT BD ASSY)		
-64	211-0601-00			1	SCR,ASSEM WSHR:6-32 X 0.312,PNH,BRS NP,POZ	TK0435	ORDER BY DESCR
	210-0012-00			1	WASHER,LOCK:0.384 ID,INTL,0.022 THK,STL	09772	ORDER BY DESCR
	210-0978-00			1	WASHER,FLAT:0.375 ID X 0.5 OD X 0.024,STL	12327	ORDER BY DESCR
	210-0590-00			1	NUT,PLAIN,HEX:0.375-32 X 0.438 BRS CD PL	73743	28269-402
					(END ATTACHING PARTS)		
	672-0929-00	B010100	B359650	1	CIRCUIT BD ASSY:STEP GEN AMPL	80009	672-0929-00
	672-0929-01	B359651		1	CIRCUIT BD ASSY:W/CAM SWITCH	80009	672-0929-01
-65	----- -----			1	.CKT BOARD ASSY:STEP GENERATOR AMPLITUDE		
					.(PART OF 672-0929-XX)		
-66	131-0633-00	B010100	B099999	17	..TERMINAL,PIN:0.385 L X 0.048 OD BRS TIN	80009	131-0633-00
	131-0633-00	B100000		21	..TERMINAL,PIN:0.385 L X 0.048 OD BRS TIN	80009	131-0633-00
-67	131-0604-00			39	..CONTACT,ELEC:CKT BD SW,SPR,CU BE	80009	131-0604-00
	263-1192-00	B010100	B359650	1	.SW CAM ACTR AS:STEP GEN AMPL	80009	263-1192-00
	263-1192-01	B359651		1	.SW CAM ACTR AS:STEP GEN AMPL	80009	263-1192-01
-68	401-0054-00	B010100	B359650	1	..BEARING,CAM SW:FRONT,	80009	401-0054-00
	401-0178-08	B359651		1	..BEARING,CAM SW:REAR	80009	401-0178-08

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
2-					..(ATTACHING PARTS)		
-69	211-0116-00	B010100	B359650	2	..SCR,ASSEM WSHR:4-40 X 0.312,PNH,BRS,NP,POZ	77900	ORDER BY DESCR
	211-0292-00	B359651		2	..SCR,ASSEM WSHR:4-40 X 0.29,PNH,BRS NI PL	78189	51-040445-01
-70	210-0406-00			2	..NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL	73743	12161-50
					..(END ATTACHING PARTS)		
-71	354-0219-00	B010100	B359650	1	..RING,RETAINING:EXT,CRESCENT,U/O 0.25 DIA	79136	5103-25-S-ZD-R
	354-0390-00	B359651		1	..RING,RETAINING:BASIC EXT,U/O 0.375 DIA SFT	79136	5100-37-ZD
-72	214-1127-00	B010100	B359650	1	..ROLLER,DETENT:0.125 DIA X 0.125,SST	80009	214-1127-00
	214-1752-00	B359651		1	..ROLLER,DETENT:0.125 OD X 0.16,SST	80009	214-1752-00
-73	214-1139-02			1	..SPRING,FLAT:0.885 X 0.156 CU BE GRN CLR	80009	214-1139-02
-74	214-1139-03			1	..SPRING,FLAT:0.885 X 0.156 CU BE RED CLR	80009	214-1139-03
-75	105-0087-00	B010100	B099999	1	..ACTUATOR,CAM SW:STEP GEN	80009	105-0087-00
	105-0087-01	B100000	B359650	1	..ACTUATOR,CAM SW:STEP GEN	80009	105-0087-01
	105-0087-02	B359651		1	..ACTUATOR,CAM SW:STEP GEN	80009	105-0087-02
	384-1480-05	B359651		1	..SHAFT,CAM SW:5,733 L X 0.248 OD,W/DRIVER	80009	384-1480-05
-76	401-0056-00	B010100	B359650	1	..BEARING,CAM SW:REAR,0.83 DIA CAM	80009	401-0056-00
	401-0180-00	B359651		1	..BEARING,CAM SW:FR & REAR,0.80 & 0.83 DIA	80009	401-0180-00
					..(ATTACHING PARTS)		
-77	211-0116-00	B010100	B359650	2	..SCR,ASSEM WSHR:4-40 X 0.312,PNH,BRS,NP,POZ	77900	ORDER BY DESCR
	211-0292-00	B359651		2	..SCR,ASSEM WSHR:4-40 X 0.29,PNH,BRS NI PL	78189	51-040445-01
-78	210-0406-00			2	..NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL	73743	12161-50
					..(END ATTACHING PARTS)		
-79	200-0941-00	B010100	B099999	1	..COVER,CAM SW:39 ELEMENTS	80009	200-0941-00
	200-0941-01	B100000	B359650	1	..COVER,CAM SW:39 ELEMENTS	80009	200-0941-01
	200-2716-00	B359651		1	..COVER,CAM SW:40 ELEMENT	80009	200-2716-00
					..(ATTACHING PARTS)		
-80	211-0079-00	B010100	B359650	2	..SCREW,MACHINE:2-56 X 0.188,PNH,STL	TK0435	5549-418
	211-0292-00	B359651		2	..SCR,ASSEM WSHR:4-40 X 0.29,PNH,BRS NI PL	78189	51-040445-01
	210-0001-00	B010100	B359650	2	..WASHER,LOCK:#2 INTL,0.013 THK,STL	77900	1202-00-00-0541C
-81	210-0405-00	B010100	B359650	2	..NUT,PLAIN,HEX:2-56 X 0.188,BRS CD PL	73743	12157-50
	210-0406-00	B359651		6	..NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL	73743	12161-50
					..(END ATTACHING PARTS)		
	407-0653-00	B100000	B359650	1	..BRACKET,COVER:CAM SWITCH,DELRIN	80009	407-0653-00
	407-1199-04	B359651		1	..BRACKET,COVER:PLASTIC	80009	407-1199-04
					..(ATTACHING PARTS)		
	211-0116-00	B010100	B359650	2	..SCR,ASSEM WSHR:4-40 X 0.312,PNH,BRS,NP,POZ	77900	ORDER BY DESCR
	211-0292-00	B359651		2	..SCR,ASSEM WSHR:4-40 X 0.29,PNH,BRS NI PL	78189	51-040445-01
	210-0406-00			2	..NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL	73743	12161-50
					..(END ATTACHING PARTS)		
					..(ATTACHING PARTS FOR CKT BD ASSY)		
-82	211-0601-00			1	SCR,ASSEM WSHR:6-32 X 0.312,PNH,BRS NP,POZ	TK0435	ORDER BY DESCR
	210-0012-00			1	WASHER,LOCK:0.384 ID,INTL,0.022 THK,STL	09772	ORDER BY DESCR
	210-0978-00			1	WASHER,FLAT:0.375 ID X 0.5 OD X 0.024,STL	12327	ORDER BY DESCR
	210-0590-00			1	NUT,PLAIN,HEX:0.375-32 X 0.438 BRS CD PL	73743	28269-402
					(END ATTACHING PARTS)		
-83	441-0851-00			1	CHASSIS,SCOPE:CIRCUIT BOARD	80009	441-0851-00
					(ATTACHING PARTS)		
-84	129-0208-00			7	SPACER,POST:0.312 L,W/6-32 THD 1 END	80009	129-0208-00
					(END ATTACHING PARTS)		
-85	----- -----			1	CKT BOARD ASSY:STEP GENERATOR (SEE REPL)		
-86	131-0633-00			37	.TERMINAL,PIN:0.385 L X 0.048 OD BRS TIN	80009	131-0633-00
-87	214-0579-00			3	.TERM,TEST POINT:BRS CD PL	80009	214-0579-00
-88	136-0183-00	B010100	B269999	5	.SKT,PL-IN ELEK:TRANSISTOR,3 CONTACT	80009	136-0183-00
	136-0183-00	B270000		4	.SKT,PL-IN ELEK:TRANSISTOR,3 CONTACT	80009	136-0183-00
-89	136-0220-00	B010100	B269999	17	.SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT	71785	133-23-11-034
	136-0220-00	B270000		16	.SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT	71785	133-23-11-034
-90	136-0235-00	B010100	B269999	4	.SKT,PL-IN ELEK:TRANSISTOR,6 CONTACT	71785	133-96-12-062
	136-0235-00	B270000	B361206	5	.SKT,PL-IN ELEK:TRANSISTOR,6 CONTACT	71785	133-96-12-062
	136-0252-07	B361207		30	.SOCKET,PIN CONN:W/O DIMPLE	22526	75060-012
-91	136-0252-01			8	.SOCKET,PIN TERM:U/W 0.0.19 DIA PINS	00779	1-332095-2
-92	136-0269-02	B010100	B327029	9	.SKT,PL-IN ELEK:MICROCIRCUIT,14 DIP	09922	DILB14P-108T
					.(ATTACHING PARTS)		
-93	211-0601-00			7	SCR,ASSEM WSHR:6-32 X 0.312,PNH,BRS NP,POZ	TK0435	ORDER BY DESCR
					.(END ATTACHING PARTS)		
-94	343-0088-00			2	CLAMP,CABLE:0.062 DIA,PLASTIC	80009	343-0088-00
-95	358-0215-00			2	GROMMET,PLASTIC:BLACK,U-SHAPED,0.524ID	80009	358-0215-00
-96	220-0532-00			4	NUT BLOCK:3,4-40 THD HOLES,PLASTIC	TK1319	ORDER BY DESCR
					(ATTACHING PARTS)		

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
2-97	211-0157-00			8	SCREW,MACHINE:4-40 X 0.312,HEX HD,STL	TK0435	6111-3000
					(END ATTACHING PARTS)		
-98	407-0576-00			1	BRACKET,ELEC SW:ALUMINUM	80009	407-0576-00
					(ATTACHING PARTS)		
	210-0804-00			2	WASHER,FLAT:0.17 ID X 0.375 OD X 0.032	86928	76430-000
	212-0004-00			2	SCREW,MACHINE:8-32 X 0.312,PNH,STL	TK0435	ORDER BY DESCR
					(END ATTACHING PARTS)		
-99	----- -----			1	RESISTOR:		
					(ATTACHING PARTS)		
-100	211-0553-00			1	SCREW,MACHINE:6-32 X 1.5,PNH,STL	TK0435	ORDER BY DESCR
	210-0808-00			1	WASHER,RECESSED:0.173 X 0.156,BRS	63743	25151.13-3
	210-0478-00			1	SPACER,POST:0.66 L W/6-32 THD THRU,AL	80009	210-0478-00
-101	211-0507-00			1	SCREW,MACHINE:6-32 X 0.312,PNH,STL	83385	ORDER BY DESCR
					(END ATTACHING PARTS)		
-102	----- -----			1	RESISTOR ASSY:W/HARDWARE		
-103	407-0516-00			1	BRACKET,CMPNT:ALUMINUM	80009	407-0516-00
					(ATTACHING PARTS)		
	212-0023-00			4	SCREW,MACHINE:8-32 X 0.375,PNH,STL	TK0435	ORDER BY DESCR
	210-0458-00			2	NUT,PL,ASSEM WA:8-32 X 0.344,STL CD PL	78189	511-081800-00
					(END ATTACHING PARTS)		
-104	----- -----			2	RESISTOR:		
					(ATTACHING PARTS)		
-105	212-0037-00			2	SCREW,MACHINE:8-32 X 1.75,FILH,STL	83385	ORDER BY DESCR
	210-0008-00			2	WASHER,LOCK:#8 INTL,0.02 THK,STL	77900	1208-00-00-0541C
	210-0601-00			2	EYELET,METALLIC:0.183 OD X 0.192 L,BRASS	18680	77362
	210-0462-00			2	NUT,SLEEVE:0.719 L W/8-32 THD THRU,AL,HEX O	80009	210-0462-00
					NE END,ROUND OTHER		
-106	212-0004-00			2	SCREW,MACHINE:8-32 X 0.312,PNH,STL	TK0435	ORDER BY DESCR
					(END ATTACHING PARTS)		
-107	136-0270-00			1	SKT,PL-IN ELEK:TRANSISTOR,2 CONTACT	22753	03-100-0003
					(ATTACHING PARTS)		
-108	211-0062-00			2	SCREW,MACHINE:2-56 X 0.312,PNH,STL	06950	ORDER BY DESCR
	210-0001-00			2	WASHER,LOCK:#2 INTL,0.013 THK,STL	77900	1202-00-00-0541C
-109	210-0405-00			2	NUT,PLAIN,HEX:2-56 X 0.188,BRS CD PL	73743	12157-50
					(END ATTACHING PARTS)		
-110	----- -----			1	TRANSISTOR:		
					(ATTACHING PARTS)		
-111	213-0104-00			2	SCREW,TPG,TF:6-20 X 0.375,TYBE 8,TRH,STL	TK0435	1491-302
	386-0143-00			1	INSULATOR,PLATE:TRANSISTOR MICA	80009	386-0143-00
					(END ATTACHING PARTS)		
-112	136-0193-00			1	SKT,PL-IN ELEK:RELAY,2 POLE,CHAS MT	24796	27E701 W/20C249
					(ATTACHING PARTS)		
-113	211-0008-00			1	SCREW,MACHINE:4-40 X 0.25,PNH,STL	93907	ORDER BY DESCR
	214-0536-00			1	SPRING,HLCPS:0.826 OD X 0.531 L,MUSIC	14438	ORDER BY DESCR
-114	210-0586-00			1	NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL	78189	211-041800-00
					(END ATTACHING PARTS)		
-115	214-0210-00			1	SLDR SPOOL ASSY:W/36.0 SILVER SOLDER	80009	214-0210-00
	214-0209-00			1	.SPOOL,SOLDER:1.0 DIA X 0.562,PLASTIC	80009	214-0209-00
					(ATTACHING PARTS FOR SPOOL ASSY)		
	361-0007-00			1	SPACER,SLEEVE:0.188 L X 0.111 ID,POLTHN	80009	361-0007-00
					(END ATTACHING PARTS)		
-116	----- -----			1	SWITCH,THERMOSTATIC:		
					(ATTACHING PARTS)		
-117	211-0504-00			2	SCREW,MACHINE:6-32 X 0.250,PNH,STL	TK0435	ORDER BY DESCR
					(END ATTACHING PARTS)		
-118	407-0575-00			1	BRACKET,ANGLE:RESISTOR MTG,ALUMINUM	80009	407-0575-00
					(ATTACHING PARTS)		
-119	211-0507-00			2	SCREW,MACHINE:6-32 X 0.312,PNH,STL	83385	ORDER BY DESCR
					(END ATTACHING PARTS)		
-120	----- -----			3	RESISTOR,VAR:		
					(ATTACHING PARTS)		
-121	210-0840-00			3	WASHER,FLAT:0.39 ID X 0.562 OD X 0.02,STL	86928	ORDER BY DESCR
-122	210-0413-00			3	NUT,PLAIN,HEX:0.375-32 X 0.5,BRS CD PL	73743	3145-402
					(END ATTACHING PARTS)		
-123	384-0466-00			2	EXTENSION SHAFT:11.75 L X 0.125 OD,AL	80009	384-0466-00
	376-0051-00			2	CPLG,SHAFT,FLEX:0.127 ID X 0.375 OD,DELRIN	80009	376-0051-00
-124	354-0251-00			2	.RING,CPLG:0.251 X 0.375 X 0.187,AL	80009	354-0251-00
-125	376-0049-00			1	.CPLG,SHAFT,FLEX:0.127 ID X 0.375 OD	80009	376-0049-00

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
2-	213-0022-00			4	SETSCREW:4-40 X 0.188,STL	74445	ORDER BY DESCR
-126	----- -----			2	RESISTOR,VAR: (ATTACHING PARTS)		
-127	210-0046-00			2	WASHER,LOCK:0.261 ID,INTL,0.018 THK,STL	77900	1214-05-00-0541C
	210-0940-00			2	WASHER,FLAT:0.25 ID X 0.375 OD X 0.02,STL	12327	ORDER BY DESCR
-128	210-0583-00			2	NUT,PLAIN,HEX:0.25-32 X 0.312,BRS CD PL (END ATTACHING PARTS)	73743	2X-20319-402
-129	348-0067-00			1	GROMMET,PLASTIC:GRAY,ROUND,0.252 ID	80009	348-0067-00
-130	348-0055-00			1	GROMMET,PLASTIC:GRAY,ROUND,0.207 ID	80009	348-0055-00
-131	124-0119-00			1	TERMINAL BOARD:2 NOTCH,CERAMIC,CLIP MTD	80009	124-0119-00
	355-0046-00			1	.MOUNT,TERM BD:0.577 H,DELRIN .(ATTACHING PARTS)	80009	355-0046-00
	361-0009-00			1	SPACER,SLEEVE:0.406 L X 0.111 ID,PP (END ATTACHING PARTS)	80009	361-0009-00
-132	124-0092-00			1	TERMINAL BOARD:3 NOTCH,CERAMIC,CLIP MTD	80009	124-0092-00
	355-0046-00			1	.MOUNT,TERM BD:0.577 H,DELRIN .(ATTACHING PARTS)	80009	355-0046-00
	361-0009-00			1	SPACER,SLEEVE:0.406 L X 0.111 ID,PP (END ATTACHING PARTS)	80009	361-0009-00
-133	200-0608-00			2	SHIELD,RESISTOR:0.7 X 1.0 X 0.75,VAR	80009	200-0608-00

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
3-	672-0405-00			1	CIRCUIT BD ASSY:READOUT	80009	672-0405-00
-1	----- -----			1	.CKT BOARD ASSY:READOUT,FIBER OPTIC .(SEE REPL)		
-2	----- -----			1	.CKT BOARD ASSY:READOUT,FIBER OPTIC .(SEE REPL)		
-3	----- -----			1	.CKT BOARD ASSY:READOUT,FIBER OPTIC .(SEE REPL)		
-4	----- -----			3	.CKT BOARD ASSY:READOUT,FIBER OPTIC .(SEE REPL)		
-5	331-0227-00			1	.READOUT ASSY:	80009	331-0227-00
	211-0087-00			24	..SCREW,MACHINE:2-56 X 0.188,FLH,82 DEG	TK0435	ORDER BY DESCR
	220-0529-00			4	..NUT,PLAIN,PLATE:2-56 SST,PSVT	80009	220-0529-00
	441-0848-00			1	..CHASSIS,SCOPE:READOUT ASSEMBLY	80009	441-0848-00
	205-0109-00			1	..SHELL,READOUT:FRONT,HORIZ	80009	205-0109-00
	205-0110-00			1	..SHELL,READOUT:FRONT,BETA	80009	205-0110-00
	205-0111-00			2	..SHELL,READOUT:FRONT,VERT-STEPS	80009	205-0111-00
	166-0474-00			4	..INSUL SLVG,ELEC:0.33 ID X 1.1 L,VINYL	80009	166-0474-00
	351-0175-00			1	..GUIDE,OPTIC FBR:READOUT,REAR,10 HOLE,PP	80009	351-0175-00
	351-0176-00			1	..GUIDE,OPTIC FBR:READOUT,REAR,7 HOLE,PP	80009	351-0176-00
	351-0177-00			3	..GUIDE,OPTIC FBR:READOUT,FRONT,7 HOLE,PP	80009	351-0177-00
	351-0178-00			3	..GUIDE,OPTIC FBR:READOUT,REAR,5 HOLE,PP	80009	351-0178-00
	214-1116-00			4	..HEAT SINK,ELEC:READOUT,RIGHT,AL	80009	214-1116-00
	214-1117-00			1	..HEAT SINK,ELEC:READOUT,LEFT,AL	80009	214-1117-00
	214-1228-00			3	..HEAT SINK,ELEC:READOUT,AL	80009	214-1228-00
-6	200-0921-00			4	..COV,RDOUT ASSY:3.968 X 1.065 X 0.767,AL ..(ATTACHING PARTS)	80009	200-0921-00
-7	211-0087-00			8	..SCREW,MACHINE:2-56 X 0.188,FLH,82 DEG ..(END ATTACHING PARTS)	TK0435	ORDER BY DESCR
-8	179-1337-00			1	.WIRING.HARNESS:VERT & HORIZONTAL	80009	179-1337-00
-9	----- -----			1	.CKT BOARD ASSY:READOUT LOGIC(SEE REPL)		
-10	136-0220-00			8	..SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT	71785	133-23-11-034
-11	136-0260-00	B010100	B079999	9	..SKT,PL-IN ELEK:MICROCIRCUIT,16 DIP,PCB MT	71785	133-51-92-008
	136-0260-02	B080000	B327029	9	..SKT,PL-IN ELEK:MICROCIRCUIT,16 DIP .(ATTACHING PARTS FOR ASSEMBLY)	09922	DILB16P-108T
-12	211-0116-00			4	.SCR,ASSEM WSHR:4-40 X 0.312,PNH,BRS,NP,POZ .(END ATTACHING PARTS)	77900	ORDER BY DESCR
-13	407-0572-00			1	BRKT,RDOUT CHAS:ALUMINUM (ATTACHING PARTS)	80009	407-0572-00
-14	211-0504-00			4	SCREW,MACHINE:6-32 X 0.250,PNH,STL (END ATTACHING PARTS)	TK0435	ORDER BY DESCR
-15	351-0179-00			2	GUIDE,RDOUT CHA:6.75 X 0.495 X 0.18,DELRIN SAFETY CONTROLLED (ATTACHING PARTS)	80009	351-0179-00
-16	211-0008-00			6	SCREW,MACHINE:4-40 X 0.25,PNH,STL (END ATTACHING PARTS)	93907	ORDER BY DESCR
-17	----- -----			1	CKT BOARD ASSY:READOUT INTCON (SEE REPL)		
-18	131-0633-00			67	.TERMINAL,PIN:0.385 L X 0.048 OD BRS TIN	80009	131-0633-00
-19	131-0697-00			1	.CONN,RCPT,ELEC:CKT BD,22/44 CONT .(ATTACHING PARTS)	05574	000201-3154
-20	211-0015-00			2	.SCREW,MACHINE:4-40 X 0.5,RDH,STL	83385	ORDER BY DESCR
-21	210-0994-00			2	.WASHER,FLAT:0.125 ID X 0.25 OD X 0.022,STL	86928	A371-283-20
-22	210-0406-00			2	.NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL .(END ATTACHING PARTS)	73743	12161-50
-23	136-0183-00			2	.SKT,PL-IN ELEK:TRANSISTOR,3 CONTACT	80009	136-0183-00
-24	136-0220-00			2	.SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT .(ATTACHING PARTS FOR ASSEMBLY)	71785	133-23-11-034
-25	211-0116-00			4	SCR,ASSEM WSHR:4-40 X 0.312,PNH,BRS,NP,POZ (END ATTACHING PARTS)	77900	ORDER BY DESCR
-26	441-0845-00			1	CHASSIS,SCOPE:MAIN	80009	441-0845-00
-27	210-0201-00			2	TERMINAL,LUG:0.12 ID,LOCKING,BRZ TIN PL (ATTACHING PARTS)	86928	A373-157-2
-28	213-0044-00			1	SCREW,TPG,TF:5-32 X 0.188,TYPE C,PNH,STL (END ATTACHING PARTS)	83385	ORDER BY DESCR
-29	210-0201-00			1	TERMINAL,LUG:0.12 ID,LOCKING,BRZ TIN PL (ATTACHING PARTS)	86928	A373-157-2
-30	213-0044-00			1	SCREW,TPG,TF:5-32 X 0.188,TYPE C,PNH,STL (END ATTACHING PARTS)	83385	ORDER BY DESCR
-31	348-0031-00			4	GROMMET,PLASTIC:0.127 ID,GRAY ACETAL	80009	348-0031-00

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
3-32	348-0055-00			1	GROMMET,PLASTIC:GRAY,ROUND,0.207 ID	80009	348-0055-00
-33	348-0063-00			1	GROMMET,PLASTIC:GRAY,ROUND,0.0457 ID	80009	348-0063-00
-34	348-0064-00			2	GROMMET,PLASTIC:GRAY,ROUND,0.582 ID	80009	348-0064-00
-35	358-0166-00	B010100	B109999	1	GROMMET,PLASTIC:BLACK,U-SHAPE,0.656 ID	80009	358-0166-00
	255-0334-00	B110000		AR	PLASTIC CHANNEL:12.75 X 0.175 X 0.155,NYLON	11897	122-37-2500
-36	407-0573-00			1	BRACKET,CMPNT:RELAY & CKT BD,ALUMINUM	80009	407-0573-00
					(ATTACHING PARTS)		
-37	210-0457-00			2	NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL	78189	511-061800-00
					(END ATTACHING PARTS)		
-38	407-0578-00			1	BRACKET,ANGLE:ALUMINUM	80009	407-0578-00
					(ATTACHING PARTS)		
-39	211-0504-00			2	SCREW,MACHINE:6-32 X 0.250,PNH,STL	TK0435	ORDER BY DESCR
					(END ATTACHING PARTS)		
-40	136-0215-00			1	SKT,PL-IN ELEK:RELAY,4 POLE,CHASSIS MOUNT	89265	27E702
					(ATTACHING PARTS)		
-41	211-0008-00			1	SCREW,MACHINE:4-40 X 0.25,PNH,STL	93907	ORDER BY DESCR
	214-0538-00			1	SPRING,FLAT:SPRING STEEL	02288	30052-1
-42	210-0586-00			1	NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL	78189	211-041800-00
					(END ATTACHING PARTS)		
-43	----- -----			1	RESISTOR:		
					(ATTACHING PARTS)		
-44	211-0553-00			1	SCREW,MACHINE:6-32 X 1.5,PNH,STL	TK0435	ORDER BY DESCR
-45	210-0601-00			1	EYELET,METALLIC:0.183 OD X 0.192 L,BRASS	18680	77362
	210-0478-00			1	SPACER,POST:0.66 L W/6-32 THD THRU,AL	80009	210-0478-00
-46	210-0202-00			1	TERMINAL,LUG:0.146 ID,LOCKING,BRZ TIN PL	86928	A-373-158-2
					(END ATTACHING PARTS)		
-47	----- -----			2	RESISTOR:		
					(ATTACHING PARTS)		
-48	211-0517-00			2	SCREW,MACHINE:6-32 X 1.0,PNH,STL	83385	ORDER BY DESCR
	210-0803-00			2	WASHER,FLAT:0.15 ID X 0.375 OD X 0.032,STL	12327	ORDER BY DESCR
-49	220-0410-00			2	NUT,PL,ASSEM WA:10-32 X 0.375 HEX,STL CD PL	78189	511-101800-50
					(END ATTACHING PARTS)		
-50	214-1130-00			1	HEAT SINK,XSTR:2 EA TO-3 & TO-66,AL BK ANDZ	80009	214-1130-00
					(ATTACHING PARTS)		
-51	210-0457-00			4	NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL	78189	511-061800-00
					(END ATTACHING PARTS)		
-52	----- -----			2	TRANSISTOR:		
					(ATTACHING PARTS)		
-53	211-0511-00			4	SCREW,MACHINE:6-32 X 0.5,PNH,STL	TK0435	ORDER BY DESCR
-54	210-0978-00			2	WASHER,FLAT:0.375 ID X 0.5 OD X 0.024,STL	12327	ORDER BY DESCR
-55	210-0975-00			4	WASHER,SHLDR:0.14 ID X 0.375 OD X 0.1 THK	80009	210-0975-00
	210-0803-00			4	WASHER,FLAT:0.15 ID X 0.375 OD X 0.032,STL	12327	ORDER BY DESCR
	210-0202-00			2	TERMINAL,LUG:0.146 ID,LOCKING,BRZ TIN PL	86928	A-373-158-2
-56	210-0457-00			4	NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL	78189	511-061800-00
					(END ATTACHING PARTS)		
-57	----- -----			2	TRANSISTOR:		
					(ATTACHING PARTS)		
-58	211-0511-00			4	SCREW,MACHINE:6-32 X 0.5,PNH,STL	TK0435	ORDER BY DESCR
-59	386-0143-00			2	INSULATOR,PLATE:TRANSISTOR MICA	80009	386-0143-00
-60	210-0935-00			4	WASHER,SHLDR:0.141 X 0.375 X 0.078,FBR	74921	ORDER BY DESCR
	210-0803-00			4	WASHER,FLAT:0.15 ID X 0.375 OD X 0.032,STL	12327	ORDER BY DESCR
	210-0202-00			2	TERMINAL,LUG:0.146 ID,LOCKING,BRZ TIN PL	86928	A-373-158-2
-61	210-0457-00			4	NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL	78189	511-061800-00
					(END ATTACHING PARTS)		
-62	----- -----			1	CKT BOARD ASSY:DISPLAY AMP (SEE REPL)		
-63	131-0633-00			29	.TERMINAL,PIN:0.385 L X 0.048 OD BRS TIN	80009	131-0633-00
-64	136-0183-00			4	.SKT,PL-IN ELEK:TRANSISTOR,3 CONTACT	80009	136-0183-00
-65	136-0220-00			4	.SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT	71785	133-23-11-034
-66	136-0235-00			4	.SKT,PL-IN ELEK:TRANSISTOR,6 CONTACT	71785	133-96-12-062
-67	214-0579-00			1	.TERM,TEST POINT:BRS CD PL	80009	214-0579-00
	343-0297-00	B150000		4	.RTN,ELEC RELAY:CKT BD MTD	TK1809	A306388
					.(ATTACHING PARTS)		
-68	211-0601-00			4	SCR,ASSEM WSHR:6-32 X 0.312,PNH,BRS NP,POZ	TK0435	ORDER BY DESCR
					(END ATTACHING PARTS)		
-69	----- -----			1	CKT BOARD ASSY:LV REGULATOR (SEE REPL)		
-70	131-0633-00			25	.TERMINAL,PIN:0.385 L X 0.048 OD BRS TIN	80009	131-0633-00
-71	136-0183-00			6	.SKT,PL-IN ELEK:TRANSISTOR,3 CONTACT	80009	136-0183-00
-72	136-0220-00			11	.SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT	71785	133-23-11-034

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
3-73	136-0235-00			4	.SKT,PL-IN ELEK:TRANSISTOR,6 CONTACT (ATTACHING PARTS)	71785	133-96-12-062
-74	211-0602-00			4	SCR,ASSEM WSHR:6-32 X 0.438,PNH,BRS NP,POZ (END ATTACHING PARTS)	01536	ORDER BY DESCR
-75	----- -----			1	CKT BOARD ASSY:LV RECTIFIERS (SEE REPL)		
-76	131-0633-00			36	.TERMINAL,PIN:0.385 L X 0.048 OD BRS TIN (ATTACHING PARTS)	80009	131-0633-00
-77	211-0602-00			4	SCR,ASSEM WSHR:6-32 X 0.438,PNH,BRS NP,POZ (END ATTACHING PARTS)	01536	ORDER BY DESCR
-78	129-0197-00			4	SPACER,POST:DUAL,1.125 & 2.25 L,NYLON (ATTACHING PARTS)	80009	129-0197-00
-79	211-0507-00			4	SCREW,MACHINE:6-32 X 0.312,PNH,STL (END ATTACHING PARTS)	83385	ORDER BY DESCR
-80	----- -----			1	TRANSFORMER:		
-81	212-0516-00			4	.SCREW,MACHINE:10-32 X 2.0,HEX HD,STL	77250	ORDER BY DESCR
	210-0813-00			4	.WASHER,SHLDR:0.196 X 0.438 X 0.062 THK,FBR	83309	ORDER BY DESCR
	210-0010-00	B114800		4	.WASHER,LOCK:#10 INTL,0.02 THK,STL	77900	1210-00-00-0541C
-82	407-0571-00			1	.BRACKET,ANGLE:TRANSFORMER,ALUMINUM (ATTACHING PARTS FOR XFMR)	80009	407-0571-00
	212-0023-00			2	SCREW,MACHINE:8-32 X 0.375,PNH,STL	TK0435	ORDER BY DESCR
-83	220-0533-00			1	NUT STRIP:8-32 2.5 X 0.375 X 0.125,AL	80009	220-0533-00
-84	220-0410-00			4	NUT,PL,ASSEM WA:10-32 X 0.375 HEX,STL CD PL (END ATTACHING PARTS)	78189	511-101800-50
-85	200-0538-00			4	SHIELD,CAP.:1.365 DIA X 1.644 L,POLTHN	80009	200-0538-00
-86	200-0293-00			3	SHIELD,CAP.:1.365 DIA X 2.562 L,POLTHN	80009	200-0293-00
-87	----- -----			7	CAPACITOR: (ATTACHING PARTS)		
-88	211-0516-00			14	SCREW,MACHINE:6-32 X 0.875,PNH,STL	TK0435	ORDER BY DESCR
-89	432-0048-00			7	BASE,CAP.MTG:	80009	432-0048-00
-90	386-0254-00			7	RETAINER,CAP.:LARGE FIBER	17605	ORDER BY DESCR
-91	210-0457-00			14	NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL (END ATTACHING PARTS)	78189	511-061800-00
-92	343-0089-00			2	CLAMP,CABLE:0.3 DIA,PLASTIC	80009	343-0089-00
-93	179-1370-00			1	WIRING HARNESS:POWER	80009	179-1370-00
-94	131-0371-00			60	.CONNECTOR,TERM:U/W 26 AWG WIRE	98278	122-0182-019
-95	131-0677-00			8	.CONNECTOR,TERM:20-24 AWG	98278	122-0192-019
-96	179-1369-00	B010100	B099999	1	WIRING HARNESS:CHASSIS	80009	179-1369-00
	179-1369-01	B100000		1	WIRING HARNESS:CHASSIS	80009	179-1369-01
-97	131-0371-00			213	.CONNECTOR,TERM:U/W 26 AWG WIRE	98278	122-0182-019
-98	179-1373-00			1	WIRING HARNESS:RELAY	80009	179-1373-00
-99	124-0086-00			1	TERMINAL BOARD:2 NOTCH,CERAMIC,CLIP MTD	80009	124-0086-00
	355-0082-00			1	.MOUNT,TERM BD:0.616 L,DELRIN .(ATTACHING PARTS)	80009	355-0082-00
	361-0009-00			1	SPACER,SLEEVE:0.406 L X 0.111 ID,PP (END ATTACHING PARTS)	80009	361-0009-00
-100	124-0088-00			4	TERMINAL BOARD:4 NOTCH,CERAMIC,CLIP MTD	80009	124-0088-00
	355-0082-00			2	.MOUNT,TERM BD:0.616 L,DELRIN	80009	355-0082-00
	361-0009-00			8	SPACER,SLEEVE:0.406 L X 0.111 ID,PP	80009	361-0009-00
-101	124-0119-00			1	TERMINAL BOARD:2 NOTCH,CERAMIC,CLIP MTD	80009	124-0119-00
	355-0046-00			1	.MOUNT,TERM BD:0.577 H,DELRIN	80009	355-0046-00
	361-0009-00			1	SPACER,SLEEVE:0.406 L X 0.111 ID,PP	80009	361-0009-00

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
4-1	----- -----			1	SWITCH,ROTARY:(SEE SW310 REPL)		
					(ATTACHING PARTS)		
-2	210-0449-00			2	NUT,PLAIN,HEX:5-40 X 0.25,BRS CD PL	73743	3030-402
	210-0801-00			4	WASHER,FLAT:0.14 ID X 0.281 OD X 0.25,BRS	12327	31724-000
-3	386-1550-00			1	PL,MTG,SW ALIGN:	80009	386-1550-00
-4	210-0949-00			3	WASHER,FLAT:0.141 ID X 0.5 OD X 0.062,BRS	12327	ORDER BY DESCR
-5	211-0603-00			3	SCREW,MACHINE:6-32 X 0.312,HEX HD,STL	83385	ORDER BY DESCR
-6	210-0049-00			1	WASHER,LOCK:0.65 ID INTL,0.022 THK,STL	77900	128-02-00-0541C
-7	210-0579-00			1	NUT,PLAIN,HEX:0.625-24 X 0.75,BRS CD PL	73743	48046-402
					(END ATTACHING PARTS)		
-8	376-0083-00			1	CPLG HALF,SHAFT:0.625 ID,DELRIN	80009	376-0083-00
	213-0178-00			1	.SETSCREW:4-40 X 0.125,STL	74445	ORDER BY DESCR
-9	376-0084-01			1	CPLG,SHAFT,FLEX:0.251 ID X 0.5 OD,PC	80009	376-0084-01
	213-0153-00			4	.SETSCREW:5-40 X 0.125,STL	TK0392	ORDER BY DESCR
-10	384-0451-00			1	EXTENSION SHAFT:2.6 L X 0.249 OD,SST	80009	384-0451-00
-11	376-0082-00			1	CPLG HALF,SHAFT:0.625 ID,DELRIN	80009	376-0082-00
	213-0178-00			1	.SETSCREW:4-40 X 0.125,STL	74445	ORDER BY DESCR
-12	384-0453-00			1	EXTENSION SHAFT:1.62 L X 0.375 OD BRS	80009	384-0453-00
-13	361-0220-00			1	SPACER,SLEEVE:0.25 L X 0.277 ID,DELRIN	80009	361-0220-00
	213-0153-00			2	.SETSCREW:5-40 X 0.125,STL	TK0392	ORDER BY DESCR
-14	----- -----			1	SWITCH,ROTARY:(SEE SW315 REPL)		
					(ATTACHING PARTS)		
-15	210-0012-00			1	WASHER,LOCK:0.384 ID,INTL,0.022 THK,STL	09772	ORDER BY DESCR
	210-0207-00			1	TERMINAL,LUG:0.385 OD,PLAIN,BRS CD PL	12697	01136902
	210-0013-00			1	WASHER,LOCK:0.391 ID INTL,0.035 THK,STL	77900	1220-00-00-0541C
	210-1085-00			1	WASHER,FLAT:0.375 ID X 0.75 OD X 0.032,STL	12327	ORDER BY DESCR
-16	210-0413-00			1	NUT,PLAIN,HEX:0.375-32 X 0.5,BRS CD PL	73743	3145-402
					(END ATTACHING PARTS)		
-17	376-0086-00			1	CPLG,SHAFT,FLEX:0.25 ID X 0.5 OD,AL	TK1498	4011
-18	----- -----			1	CAPACITOR:		
					(ATTACHING PARTS)		
-19	211-0507-00			2	SCREW,MACHINE:6-32 X 0.312,PNH,STL	83385	ORDER BY DESCR
					(END ATTACHING PARTS)		
-20	384-0250-00			1	EXTENSION SHAFT:3.001 L X 0.125 OD,AL	80009	384-0250-00
	376-0052-00			1	CPLG,SHAFT,FLEX:0.127 & 0.25 ID,DELRIN	80009	376-0052-00
-21	354-0251-00			1	.RING,CPLG:0.251 X 0.375 X 0.187,AL	80009	354-0251-00
-22	376-0049-00			1	.CPLG,SHAFT,FLEX:0.127 ID X 0.375 OD	80009	376-0049-00
-23	354-0261-00			1	.RING,COUPLING:0.375 DIA X 0.437,AL	80009	354-0261-00
	213-0022-00			2	.SETSCREW:4-40 X 0.188,STL	74445	ORDER BY DESCR
	213-0075-00			2	.SETSCREW:4-40 X 0.094,STL	74445	ORDER BY DESCR
	213-0115-00			1	.SETSCREW:4-40 X 0.312,STL	50293	ORDER BY DESCR
-24	131-0689-00			1	CONN,RCPT,ELEC:15 CONTACT,FEMALE	74868	126-150
					(ATTACHING PARTS)		
-25	211-0016-00			2	SCREW,MACHINE:4-40 X 0.625,PNH,STL	TK0435	ORDER BY DESCR
-26	210-0586-00			2	NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL	78189	211-041800-00
					(END ATTACHING PARTS)		
-27	407-0519-00			1	BRACKET,ANGLE:ALUMINUM	80009	407-0519-00
					(ATTACHING PARTS)		
-28	211-0507-00			2	SCREW,MACHINE:6-32 X 0.312,PNH,STL	83385	ORDER BY DESCR
	210-0803-00			2	WASHER,FLAT:0.15 ID X 0.375 OD X 0.032,STL	12327	ORDER BY DESCR
					(END ATTACHING PARTS)		
-29	129-0207-00			1	SPACER,ROD:8.5 L,6-32 BOTH ENDS,AL,0.25 OD	80009	129-0207-00
					(ATTACHING PARTS)		
-30	211-0507-00			2	SCREW,MACHINE:6-32 X 0.312,PNH,STL	83385	ORDER BY DESCR
					(END ATTACHING PARTS)		
-31	337-1120-00	B010100	B269999	1	SHIELD,ELEC:GUARD BOX	80009	337-1120-00
	337-1120-02	B270000		1	SHIELD,ELEC:GUARD BOX	80009	337-1120-02
					(ATTACHING PARTS)		
-32	211-0504-00	B010100	B269999	4	SCREW,MACHINE:6-32 X 0.250,PNH,STL	TK0435	ORDER BY DESCR
	211-0558-00	B270000		4	SCREW,MACHINE:6-32 X 0.25,BDGH,NYL	26365	ORDER BY DESCR
					(END ATTACHING PARTS)		
-33	----- -----			1	DIODE:		
					(ATTACHING PARTS)		
-34	211-0507-00			4	SCREW,MACHINE:6-32 X 0.312,PNH,STL	83385	ORDER BY DESCR
					(END ATTACHING PARTS)		
-35	----- -----			1	CKT BOARD ASSY:2KV BRIDGE (SEE REPL)		
					(ATTACHING PARTS)		
-36	211-0028-00			2	SCREW,MACHINE:4-40 X 0.188,BDGH,NYL	95987	ORDER BY DESCR

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
4-37	385-0109-00			2	SPACER,POST:0.312 L W/4-40 THD THRU,NYL	80009	385-0109-00
-38	211-0008-00	B010100	B091499	2	SCREW,MACHINE:4-40 X 0.25,PNH,STL	93907	ORDER BY DESCR
	211-0007-00	B091500		2	SCREW,MACHINE:4-40 X 0.188,PNH,STL	TK0435	ORDER BY DESCR
					(END ATTACHING PARTS)		
-39	----- -----			5	RESISTOR:		
					(ATTACHING PARTS)		
-40	212-0029-00			2	SCREW,MACHINE:8-32 X 3.0 HEX HD,STL	TK0858	ORDER BY DESCR
-41	386-1645-00			1	PLATE,CMPNT MTG:THERMO SWITCH,AL	80009	386-1645-00
	166-0032-00			2	SPACER,SLEEVE:0.313 L X 0.18 ID,AL	80009	166-0032-00
	210-0804-00			2	WASHER,FLAT:0.17 ID X 0.375 OD X 0.032	86928	76430-000
-42	210-0940-00			2	WASHER,FLAT:0.25 ID X 0.375 OD X 0.02,STL	12327	ORDER BY DESCR
-43	210-0839-00			2	WASHER,SPR TNSN:0.258 X 0.438 X 0.005.STL	78189	3539-14-01-0541C
-44	361-0257-00			2	SPACER,SLEEVE:0.37 L X 0.188 ID,AL	80009	361-0257-00
	210-0812-00	B010100	B101500	4	WASHER,FLAT:0.188 ID X 0.375 OD X 0.31	83309	ORDER BY DESCR
-45	210-0458-00			4	NUT,PL,ASSEM WA:8-32 X 0.344,STL CD PL	78189	511-081800-00
					(END ATTACHING PARTS)		
-46	337-1096-00	B010100	B299999	1	SHIELD,ELEC:WRAPAROUND COIL SPRT	80009	337-1096-00
	337-1096-02	B030000		1	SHIELD,ELEC:WRAPAROUND COIL SPRT	80009	337-1096-02
-47	337-1095-00			1	PLATE,ELEC SHLD:COIL SUPPORT	80009	337-1095-00
					(ATTACHING PARTS)		
-48	211-0504-00			7	SCREW,MACHINE:6-32 X 0.250,PNH,STL	TK0435	ORDER BY DESCR
					(END ATTACHING PARTS)		
-49	348-0056-00			1	GROMMET,PLASTIC:GRAY,ROUND,0.332 ID	80009	348-0056-00
-50	407-0574-00	B010100	B299999	1	BRKT,XFMR-GD BX:ALUMINUM	80009	407-0574-00
	407-0574-02	B300000		1	BRACKET,XFMR:ALUMINUM	80009	407-0574-02
					(ATTACHING PARTS)		
-51	211-0531-00			4	SCREW,MACHINE:6-32 X .375,FILH,STL	TK0435	ORDER BY DESCR
					(END ATTACHING PARTS)		
-52	386-1525-00			1	SUPPORT,BOX:XFMR-GUARD	80009	386-1525-00
					(ATTACHING PARTS)		
-53	212-0070-00			2	SCREW,MACHINE:8-32 X 0.312,FLH,100 DEG,STL	TK0435	ORDER BY DESCR
-54	212-0004-00			4	SCREW,MACHINE:8-32 X 0.312,PNH,STL	TK0435	ORDER BY DESCR
					(END ATTACHING PARTS)		
-55	358-0215-00			1	GROMMET,PLASTIC:BLACK,U-SHAPED,0.524ID	80009	358-0215-00
-56	343-0088-00			1	CLAMP,CABLE:0.062 DIA,PLASTIC	80009	343-0088-00
-57	210-0201-00			1	TERMINAL,LUG:0.12 ID,LOCKING,BRZ TIN PL	86928	A373-157-2
					(ATTACHING PARTS)		
-58	213-0044-00			1	SCREW,TPG,TF:5-32 X 0.188,TYPE C,PNH,STL	83385	ORDER BY DESCR
					(END ATTACHING PARTS)		
-59	214-0539-00			1	RTNR,ELEC RELAY:	TK0484	30040-2
-60	136-0193-00			1	SKT,PL-IN ELEK:RELAY,2 POLE,CHAS MT	24796	27E701 W/20C249
					(ATTACHING PARTS)		
	210-0586-00			1	NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL	78189	211-041800-00
-61	211-0038-00			1	SCREW,MACHINE:4-40 X 0.312,FLH,100 DEG,STL	TK0435	ORDER BY DESCR
					(END ATTACHING PARTS)		
-62	407-0582-00	B010100	B299999	1	BRACKET,CAP.:ALUMINUM	80009	407-0582-00
	407-0582-02	B300000		1	BRACKET,CAP.:ALUMINUM	80009	407-0582-02
					(ATTACHING PARTS)		
-63	211-0507-00			4	SCREW,MACHINE:6-32 X 0.312,PNH,STL	83385	ORDER BY DESCR
					(END ATTACHING PARTS)		
-64	----- -----			1	CAPACITOR:		
					(ATTACHING PARTS)		
-65	210-0865-00			2	WASHER,SHLDR:0.377 X 0.625 X 0.063,FBR	86928	5604-31
	210-0840-00			1	WASHER,FLAT:0.39 ID X 0.562 OD X 0.02,STL	86928	ORDER BY DESCR
-66	210-0413-00			1	NUT,PLAIN,HEX:0.375-32 X 0.5,BRS CD PL	73743	3145-402
					(END ATTACHING PARTS)		
-67	----- -----			1	CAPACITOR:		
					(ATTACHING PARTS)		
-68	210-0020-00			1	WASHER,LOCK:#12 INTL,0.025 THK,STL	78189	ORDER BY DESCR
	210-0971-00			1	WASHER,FLAT:0.219 ID X 0.35 OD X 0.033,STL	98291	ORDER BY DESCR
-69	----- -----			1	(HARDWARE INCLUDED WITH CAPACITOR)		
					(END ATTACHING PARTS)		
-70	----- -----			1	CAPACITOR:		
					(ATTACHING PARTS)		
-71	210-0012-00			1	WASHER,LOCK:0.384 ID,INTL,0.022 THK,STL	09772	ORDER BY DESCR
	210-0840-00			1	WASHER,FLAT:0.39 ID X 0.562 OD X 0.02,STL	86928	ORDER BY DESCR
-72	210-0413-00			1	NUT,PLAIN,HEX:0.375-32 X 0.5,BRS CD PL	73743	3145-402
-73	----- -----			1	CAPACITOR:		

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
4-					(ATTACHING PARTS)		
-74	407-0270-00	B010100	B309999	2	BRACKET,CAP.:STEEL CD PL	80009	407-0270-00
	407-1548-00	B310000		2	BRACKET,CAP.:	01002	302-C920-P112
	210-0006-00			2	WASHER,LOCK:#6 INTL,0.018 THK,STL	77900	1206-00-00-0541C
-75	210-0407-00			2	NUT,PLAIN,HEX:6-32 X 0.25,BRS CD PL	73743	3038-402
					(END ATTACHING PARTS)		
-76	----- -----			1	TOROID:		
					(ATTACHING PARTS)		
-77	212-0094-00	B010100	B020409	1	SCREW,MACHINE:8-32 X 1.125,PNH,STL,CD PL,	07111	ORDER BY DESCR
	212-0020-00	B020410		1	SCREW,MACHINE:8-32 X 1.0,PNH,STL	83385	ORDER BY DESCR
-78	348-0079-00	B010100	B020409	1	FOOT,CAP:BLACK POLYCARBONATE	80009	348-0079-00
	348-0054-00	B020410		1	FOOT,CAP:BLACK POLYCARBONATE	80009	348-0054-00
					(END ATTACHING PARTS)		
-79	----- -----			1	TRANSFORMER:		
					(ATTACHING PARTS)		
-80	212-0516-00			4	SCREW,MACHINE:10-32 X 2.0,HEX HD,STL	77250	ORDER BY DESCR
-81	210-0812-00			4	WASHER,FLAT:0.188 ID X 0.375 OD X 0.31	83309	ORDER BY DESCR
	210-0805-00			4	WASHER,FLAT:0.204 ID X 0.438 OD X 0.032,STL	12327	ORDER BY DESCR
-82	220-0410-00			4	NUT,PL,ASSEM WA:10-32 X 0.375 HEX,STL CD PL	78189	511-101800-50
					(END ATTACHING PARTS)		
-83	179-1375-00			1	WIRING HARNESS:GUARD BOX NO 1	80009	179-1375-00
-84	179-1376-00			1	WIRING HARNESS:GUARD BOX NO 2	80009	179-1376-00
-85	179-1374-00	B010100	B060989	1	WIRING HARNESS:L V SWITCH	80009	179-1374-00
	179-1374-01	B060990		1	WIRING HARNESS:L V SWITCH	80009	179-1374-01
-86	124-0089-00			4	TERMINAL BOARD:7 NOTCH,CERAMIC,CLIP MTD	80009	124-0089-00
	355-0046-00			2	.MOUNT,TERM BD:0.577 H,DELRIN	80009	355-0046-00
	361-0007-00			4	SPACER,SLEEVE:0.188 L X 0.111 ID,POLTHN	80009	361-0007-00
-87	124-0092-00			1	TERMINAL BOARD:3 NOTCH,CERAMIC,CLIP MTD	80009	124-0092-00
	355-0046-00			1	.MOUNT,TERM BD:0.577 H,DELRIN	80009	355-0046-00
	361-0007-00			1	SPACER,SLEEVE:0.188 L X 0.111 ID,POLTHN	80009	361-0007-00
-88	----- -----			1	SWITCH,THERMAL CUTOUT:		
					(ATTACHING PARTS)		
-89	211-0008-00			2	SCREW,MACHINE:4-40 X 0.25,PNH,STL	93907	ORDER BY DESCR
	210-0586-00			2	NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL	78189	211-041800-00
					(END ATTACHING PARTS)		
-90	131-0690-00			1	CONN,RCPT,ELEC:15 CONTACT,MALE	80009	131-0690-00
-91	337-1174-01			1	SHIELD,ELEC:	80009	337-1174-01
					(ATTACHING PARTS)		
	212-0023-00			2	SCREW,MACHINE:8-32 X 0.375,PNH,STL	TK0435	ORDER BY DESCR
					(END ATTACHING PARTS)		

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
5-1	386-1510-00			2	SUPPORT,CRT:TOP RIGHT,BOTTOM LEFT	80009	386-1510-00
					(ATTACHING PARTS)		
-2	212-0084-00			2	SCREW,MACHINE:8-32 X 0.312,LGE HEX HD,STL	83385	ORDER BY DESCR
	210-0858-00			2	WASHER,FLAT:0.172 ID X 0.5 OD X 0.062,BRS	12327	ORDER BY DESCR
					(END ATTACHING PARTS)		
-3	386-1509-00			2	SUPPORT,CRT:TOP LEFT,BOTTOM RIGHT	80009	386-1509-00
					(ATTACHING PARTS)		
-4	212-0084-00			2	SCREW,MACHINE:8-32 X 0.312,LGE HEX HD,STL	83385	ORDER BY DESCR
	210-0858-00			2	WASHER,FLAT:0.172 ID X 0.5 OD X 0.062,BRS	12327	ORDER BY DESCR
					(END ATTACHING PARTS)		
-5	378-0601-00			1	DIFFUSER,LIGHT:SCALE ILLUMINATION	80009	378-0601-00
-6	----- -----			1	CKT BOARD ASSY:GRATICULE LAMPS (SEE REPL)		
-7	129-0205-00			2	.SPACER,POST:0.165 L,2-56 THRU,BRS,0.188 OD	80009	129-0205-00
-8	131-0633-00			2	.TERMINAL,PIN:0.385 L X 0.048 OD BRS TIN	80009	131-0633-00
	131-0704-00			3	.CONTACT,ELEC:SCALE LIGHTS,CU BE	80009	131-0704-00
	210-0957-00			3	.WASHER,FLAT:0.062 ID X 0.25 OD X 0.033,STL	83903	ORDER BY DESCR
	210-0759-00			3	.EYELET,METALLIC:0.061 OD X 0.192 L,	71590	30818-11
	361-0279-00			2	.SPACER,CKT BD:0.158 L X 0.0125 OD,DELRIN	80009	361-0279-00
					(ATTACHING PARTS FOR CKT BD ASSY)		
-9	213-0202-00			2	SCREW,MACHINE:2-56 X 0.625,FLH 100 DEG	83385	ORDER BY DESCR
					(END ATTACHING PARTS)		
-10	337-1119-01			1	SHIELD,CRT:	80009	337-1119-01
					(ATTACHING PARTS)		
-11	211-0504-00			2	SCREW,MACHINE:6-32 X 0.250,PNH,STL	TK0435	ORDER BY DESCR
	210-0802-00			2	WASHER,FLAT:0.15 ID X 0.312 OD X 0.032,STL	12327	ORDER BY DESCR
					(END ATTACHING PARTS)		
-12	348-0055-00			1	GROMMET,PLASTIC:GRAY,ROUND,0.207 ID	80009	348-0055-00
-13	175-0586-00			1	LEAD,ELECTRICAL:STRD,22 AWG,WHITE W/BROWN	80009	175-0586-00
	175-0592-00			1	LEAD,ELEC:STRD,22 AWG,9-5,PVC,11.52L	80009	175-0592-00
	175-0594-00			1	LEAD,ELECTRICAL:STRD,22 AWG,WHITE W/BLUE,	80009	175-0594-00
	175-0595-00			1	LEAD,ELECTRICAL:STRD,22 AWG,WHITE W/RED,PVC	80009	175-0595-00
					11.52L		
-14	131-0049-00			1	.TERM,QIK DISC.:22-24 AWG,TIN PL BRS	00779	42765-1
-15	348-0085-00			2	.GROMMET,PLASTIC:GRAY,U-SHAPE,0.48 ID	80009	348-0085-00
-16	352-0123-01			1	HOLDER,CRT RTNR:AL CD PLATED	TK1568	ORDER BY DESCR
					(ATTACHING PARTS)		
-17	211-0590-00			4	SCREW,MACHINE:6-32 X 0.25,PNH,BRS	TK0435	ORDER BY DESCR
					(END ATTACHING PARTS)		
-18	343-0138-00			1	CLAMP,LOOP:2.0 ID,NYLON	80009	343-0138-00
					(ATTACHING PARTS)		
-19	211-0599-00			2	SCREW,MACHINE:6-32 X 0.750,FILH,SST	TK0435	ORDER BY DESCR
-20	211-0146-00	B010100	B139999	1	SCREW,CAP:4-40 X 1.312,SCH,SST,PVST,HEX REC	TK0392	ORDER BY DESCR
	211-0600-00	B140000		1	SCREW,MACHINE:6-32 X 2.000,FILH,SST	80009	211-0600-00
-21	343-0123-01	B010100	B139999	1	CLP,ELCTRN TUBE:AL,CD PL	80009	343-0123-01
-22	343-0171-01	B010100	B139999	1	CLAMP,CRT:ALUMINUM CD PL	80009	343-0171-01
	343-0123-01	B140000		2	CLP,ELCTRN TUBE:AL,CD PL	80009	343-0123-01
-23	220-0444-00	B010100	B139999	2	NUT,PLAIN,SQ:6-32 X 0.25 SQ,SST	70318	ORDER BY DESCR
	220-0444-00	B140000		3	NUT,PLAIN,SQ:6-32 X 0.25 SQ,SST	70318	ORDER BY DESCR
					(END ATTACHING PARTS)		
	136-0334-00	B010100	B079999	1	SKT,PL-IN ELEK:ELCTRN TUBE,9 CONT W/LEADS	80009	136-0334-00
	136-0334-01	B080000	B139999	1	SKT,PL-IN ELEK:ELCTRN TUBE,9 CONT W/LEADS	80009	136-0334-01
	136-0334-02	B140000	B239999	1	SKT,PL-IN ELEK:ELCTRN TUBE,9 CONT W/LEADS	80009	136-0334-02
	136-0334-03	B240000		1	SKT,PL-IN ELEK:ELCTRN TUBE,9 CONT W/LEADS	80009	136-0334-03
-24	136-0304-00	B010100	B239999	1	.SKT,PL-IN ELEK:ELECTRN TUBE,14 CONTACT	80009	136-0304-00
	136-0202-01	B240000	B327189	1	.SKT,PL-IN ELEK:ELECTRON TUBE,14 CONTACT	80009	136-0202-01
	136-0202-04	B327190		1	.SKT,PL-IN ELEK:ELECTRON TUBE,14 CONTACT	80009	136-0202-04
	131-0371-00			5	.CONNECTOR,TERM:U/W 26 AWG WIRE	98278	122-0182-019
-25	200-0917-00	B010100	B079999	1	COVER,CRT SKT:2.462 OD X 0.291 H,PLASTIC	80009	200-0917-00
	200-0917-01	B080000	B239999	1	COVER,CRT SKT:2.052 OD X 0.291 H,PLASTIC	80009	200-0917-01
	200-0616-00	B240000		1	COVER,CRT SKT:1.78 DIA X 0.2 D,WHITE	80009	200-0616-00
-26	337-1046-01	B010100	B079999	1	SHLD,ELCTRN TU:CRT SOCKET	80009	337-1046-01
	337-1199-01	B080000	B239999	1	SHLD,ELEC CONN:CRT SOCKET	80009	337-1199-01
-27	367-0095-00	B010100	B079999	1	HANDLE,BOW:2.68 L,ACETAL	80009	367-0095-00
	367-0117-00	B080000	B239999	1	PULL,SOCKET:CRT,PLASTIC	80009	367-0117-00
	343-0235-00	B080000	B239999	1	CLAMP,CRT SKT:DELRIN	80009	343-0235-00
-28	386-1524-00			1	SUPPORT,CHASSIS:POWER SUPPLY	80009	386-1524-00
					(ATTACHING PARTS)		
-29	211-0507-00			4	SCREW,MACHINE:6-32 X 0.312,PNH,STL	83385	ORDER BY DESCR

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
5-					(END ATTACHING PARTS)		
-30	343-0089-00			2	CLAMP,CABLE:0.3 DIA,PLASTIC	80009	343-0089-00
-31	348-0055-00			1	GROMMET,PLASTIC:GRAY,ROUND,0.207 ID	80009	348-0055-00
-32	358-0215-00			2	GROMMET,PLASTIC:BLACK,U-SHAPED,0.524ID	80009	358-0215-00
-33	343-0013-00	B010100	B131979	1	CLAMP,LOOP:0.375 ID,PLASTIC	06915	ORDER BY DESCR
	343-0005-00	B131980		1	CLAMP,LOOP:0.437 ID,PLASTIC	06915	E7 CLEAR ROUND
					(ATTACHING PARTS)		
-34	211-0510-00	B010100	B131979	1	SCREW,MACHINE:6-32 X 0.375,PNH,STL	83385	ORDER BY DESCR
	211-0578-00	B131980		1	SCREW,MACHINE:6-32 X 0.438,PNH,STL	TK0435	ORDER BY DESCR
	210-0863-00			1	WSHR,LOOP CLAMP:0.187 ID U/W 0.5 W CLP	95987	C191
-35	210-0457-00			1	NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL	78189	511-061800-00
					(END ATTACHING PARTS)		
-36	441-0856-00			1	CHASSIS,SCOPE:POWER SUPPLY	80009	441-0856-00
					(ATTACHING PARTS)		
-37	212-0039-00			2	SCREW,MACHINE:8-32 X 0.375,TRH,STL	83385	ORDER BY DESCR
					(END ATTACHING PARTS)		
-38	----- -----			1	CAPACITOR:		
					(ATTACHING PARTS)		
-39	211-0534-00			2	SCR,ASSEM WSHR:6-32 X 0.312,PNH,STL,CD PL	01536	ORDER BY DESCR
-40	386-0253-00			1	RETAINER,CAP.:SMALL METAL CD PL	80009	386-0253-00
-41	210-0457-00			2	NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL	78189	511-061800-00
					(END ATTACHING PARTS)		
-42	136-0270-00			1	SKT,PL-IN ELEK:TRANSISTOR,2 CONTACT	22753	03-100-0003
					(ATTACHING PARTS)		
-43	213-0088-00			2	SCREW,TPG,TF:4-24 X 0.25,TYPE B,PNH,STL	83385	ORDER BY DESCR
					(END ATTACHING PARTS)		
-44	----- -----			1	TRANSISTOR:		
					(ATTACHING PARTS)		
-45	213-0104-00			2	SCREW,TPG,TF:6-20 X 0.375,TYBE 8,TRH,STL	TK0435	1491-302
-46	386-0143-00			1	INSULATOR,PLATE:TRANSISTOR MICA	80009	386-0143-00
					(END ATTACHING PARTS)		
-47	----- -----			1	TRANSFORMER:		
					(ATTACHING PARTS)		
-48	346-0001-00			1	BAND,RETAINING:XFMR,0.312 X 4.25,AL	80009	346-0001-00
	162-0004-00			AR	INSUL SLVG,ELEC:0.263 ID,VINYL,BLK	96904	TYPE400SIZE2BLK
-49	210-0586-00			2	NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL	78189	211-041800-00
					(END ATTACHING PARTS)		
-50	----- -----			1	CKT BOARD ASSY:HV POWER SUPPLY (SEE REPL)		
-51	131-0633-00			9	.TERMINAL,PIN:0.385 L X 0.048 OD BRS TIN	80009	131-0633-00
-52	136-0183-00	B010100	B361206	1	.SKT,PL-IN ELEK:TRANSISTOR,3 CONTACT	80009	136-0183-00
	136-0252-07	B361207		1	.SOCKET,PIN CONN:W/O DIMPLE	22526	75060-012
-53	136-0220-00	B010100	B361206	3	.SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT	71785	133-23-11-034
	136-0252-07	B361207		6	.SOCKET,PIN CONN:W/O DIMPLE	22526	75060-012
-54	343-0043-00	B020000		3	.RETAINER,LAMP:NEON BULB	80009	343-0043-00
-55	----- -----			3	.CAPACITOR		
					.(ATTACHING PARTS)		
	210-0966-00			2	.WASHER,FLAT:0.312 ID X 0.875 OD X 0.09	TK0858	210-0966-00
-56	346-0032-00			1	.STRAP,RETAINING:0.075 DIA X 4.0 L,MLD RBR	98159	2829-75-4
					.(END ATTACHING PARTS)		
					(ATTACHING PARTS FOR CKT BD ASSY)		
-57	211-0116-00			4	SCR,ASSEM WSHR:4-40 X 0.312,PNH,BRS,NP,POZ	77900	ORDER BY DESCR
-58	129-0212-00			3	SP,POST:0.435 L,4-40 THRU,NYLON,0.312 OD	80009	129-0212-00
-59	211-0008-00			3	SCREW,MACHINE:4-40 X 0.25,PNH,STL	93907	ORDER BY DESCR
					(END ATTACHING PARTS)		
	131-1084-00	B330000		1	CONN,RCPT,ELEC:PWR,MALE,250VAC,15A	87930	0367
-60	337-1123-00			1	SHIELD,ELEC:POWER SUPPLY	80009	337-1123-00
					(ATTACHING PARTS)		
-61	211-0504-00			4	SCREW,MACHINE:6-32 X 0.250,PNH,STL	TK0435	ORDER BY DESCR
					(END ATTACHING PARTS)		
-62	129-0224-00			1	TERM,STUD:0.47 L,6-32 1 END,TEFLON INS CTR	80009	129-0224-00
-63	211-0504-00	B010100	B329999	1	SCREW,MACHINE:6-32 X 0.250,PNH,STL	TK0435	ORDER BY DESCR
	211-0501-00	B330000		1	SCREW,MACHINE:6-32 X 0.125,PNH,STL	TK0435	ORDER BY DESCR
	210-0202-00			2	TERMINAL,LUG:0.146 ID,LOCKING,BRZ TIN PL	86928	A-373-158-2
					(ATTACHING PARTS)		
	210-0407-00			3	NUT,PLAIN,HEX:6-32 X 0.25,BRS CD PL	73743	3038-402
					(END ATTACHING PARTS)		
	334-3379-02	B326610		1	MARKER,IDENT:MARKED GROUND SYMBOL	22670	ORDER BY DESCR
-64	426-0471-01	B010100	B249999	1	FRAME PNL,CAB.:REAR	80009	426-0471-01

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
5-	426-0471-04	B250000	B329999	1	FRAME PNL,CAB.:REAR	80009	426-0471-04
	426-0471-09	B330000		1	FRAME PNL,CAB.:REAR	80009	426-0471-09
					(ATTACHING PARTS)		
-65	212-0039-00			4	SCREW,MACHINE:8-32 X 0.375,TRH,STL	83385	ORDER 8Y DESCR
					(END ATTACHING PARTS)		
-66	220-0536-00			2	NUT BLOCK:6-32 X 1.0 X 0.5,PLASTIC	80009	220-0536-00
					(ATTACHING PARTS)		
	210-0802-00			2	WASHER,FLAT:0.15 ID X 0.312 OD X 0.032,STL	12327	ORDER BY DESCR
-67	211-0575-00			2	SCREW,MACHINE:6-32 X 0.5,HEX HD,STL	TK0433	ORDER BY DESCR
					(END ATTACHING PARTS)		
-68	136-0270-00			1	SKT,PL-IN ELEK:TRANSISTOR,2 CONTACT	22753	03-100-0003
					(ATTACHING PARTS)		
	211-0062-00			2	SCREW,MACHINE:2-56 X 0.312,PNH,STL	06950	ORDER BY DESCR
	210-0001-00	B010100	B327069	2	WASHER,LOCK:#2 INTL,0.013 THK,STL	77900	1202-00-00-0541C
-69	210-0405-00	B010100	B327069	2	NUT,PLAIN,HEX:2-56 X 0.188,BRS CD PL	73743	12157-50
					(END ATTACHING PARTS)		
-70	136-0135-00	B010100	B327069	5	SKT,PL-IN ELEK:PWR TRANSISTOR,2 CONTACT	91506	8038-1G8
	136-0135-01	B327070		5	SKT,PL-IN ELEK:TRANSISTOR,2 CONT	91506	8080-1G7 W/MICA
					(ATTACHING PARTS)		
-71	211-0034-00	B010100	B327069	10	SCREW,MACHINE:2-56 X 0.5,PNH,STL	06950	ORDER BY DESCR
	210-0001-00	B010100	B327069	10	WASHER,LOCK:#2 INTL,0.013 THK,STL	77900	1202-00-00-0541C
-72	210-0405-00	B010100	B327069	10	NUT,PLAIN,HEX:2-56 X 0.188,BRS CD PL	73743	12157-50
					(END ATTACHING PARTS)		
-73	----- -----			1	TRANSISTOR:		
					(ATTACHING PARTS)		
	213-0183-00			1	SCREW,TPG,TF:6-20 X 0.5,TYPE B,PNH,STL	83385	ORDER BY DESCR
	213-0185-00			1	SCREW,TPG,TF:6-20 X 0.625,TYPE B,PNH,STL	TK0435	3012
-74	200-0669-00			1	COVER,XSTR:TO-66,MALAMINE	80009	200-0669-00
-75	386-0143-00			1	INSULATOR,PLATE:TRANSISTOR MICA	80009	386-0143-00
					(END ATTACHING PARTS)		
-76	----- -----			5	TRANSISTOR:		
					(ATTACHING PARTS)		
-77	211-0514-00	B010100	B327069	5	SCREW,MACHINE:6-32 X 0.750,PNH,STL	TK0435	1541-300
	211-0516-00	B327070		5	SCREW,MACHINE:6-32 X 0.875,PNH,STL	TK0435	ORDER BY DESCR
-78	200-0692-00			5	COVER,XSTR:TO-3,POLYPHENYLENE SOLFIDE	80009	200-0692-00
-79	211-0513-00			5	SCREW,MACHINE:6-32 X 0.625,PNH,STL	93907	B80-00032-003
-80	386-0978-00			5	INSULATOR,PLATE:TRANSISTOR,MICA	16037	#130
					(END ATTACHING PARTS)		
-81	----- -----			1	SWITCH,SLIDE:(SEE SW703 REPL)		
	----- -----			AR	.SWITCH,SLIDE:(SEE SW702 REPL)		
-82	337-1036-00			1	.SHIELD,SOLDER:SIX TERM SLIDE SWITCH	82389	P2238
					(ATTACHING PARTS FOR SLIDE SW)		
-83	211-0008-00			2	SCREW,MACHINE:4-40 X 0.25,PNH,STL	93907	ORDER BY DESCR
-84	210-0406-00			2	NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL	73743	12161-50
					(END ATTACHING PARTS)		
-85	204-0279-00			1	BODY ASSY,LINE:W/CONTACTS & SHORTING BARS	80009	204-0279-00
					(ATTACHING PARTS)		
	210-0006-00			2	WASHER,LOCK:#6 INTL,0.018 THK,STL	77900	1206-00-00-0541C
-86	210-0407-00			2	NUT,PLAIN,HEX:6-32 X 0.25,BRS CD PL	73743	3038-402
					(END ATTACHING PARTS)		
-87	200-0762-00			1	COV ASSY,LINE V:	80009	200-0762-00
-88	352-0102-00			2	.FUSEHOLDER:(1)3AG	80009	352-0102-00
					.(ATTACHING PARTS)		
-89	213-0088-00			4	.SCREW,TPG,TF:4-24 X 0.25,TYPE B,PNH,STL	83385	ORDER BY DESCR
					.(END ATTACHING PARTS)		
-90	358-0025-00	B010100	B329999	1	BSHG,STRAIN RLF:U/W 0.325 OD CABLE,STRAIGHT	28520	1210 (SR 6P-4)BL
-91	161-0017-00	B010100	B329999	1	CABLE ASSY,PWR,:3,18 AWG,96.0 L	16428	FH-8385, CH-8385
	161-0066-00	B330000		1	CABLE ASSY,PWR,:3,18AWG,115V,98.0 L	16428	CH8481, FH8481
-92	161-0066-09	B330000		1	CABLE ASSY,PWR,:3,0.75MM SQ,220V,99.0 L	S3109	86511000
					(OPTION A1 UNIVERSAL EUROPE)		
-93	161-0066-10	B330000		1	CABLE ASSY,PWR,:3,0.75MM SQ,240V,96.0 L	TK1373	24230
					(OPTION A2 UNITED KINGDOM)		
-94	161-0066-11	B330000		1	CABLE ASSY,PWR,:3,0.75MM,240V,96.0 L	S3109	ORDER BY DESCR
					(OPTION A3 AUSTRALIAN)		
-95	161-0066-12	B330000		1	CABLE ASSY,PWR,:3,18 AWG,250V,99.0 L	70903	CH-77893
					(OPTION A4 NORTH AMERICAN)		
	386-4612-00	B330000		1	PLATE,CONN MTG:ALUMINUM	80009	386-4612-00
					(ATTACHING PARTS)		

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
5-	211-0097-00	B330000		2	SCREW,MACHINE:4-40 X 0.312,PNH,STL	TK0435	ORDER BY DESCR
	210-0586-00	B330000		2	NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL (END ATTACHING PARTS)	78189	211-041800-00
-96	386-1512-00			1	PL,RTNG,PWR CA:ALUMINUM (ATTACHING PARTS)	80009	386-1512-00
-97	211-0565-00			4	SCREW,MACHINE:6-32 X 0.250,TRH,STL (END ATTACHING PARTS)	TK0435	ORDER BY DESCR
-98	124-0100-00			1	TERMINAL BOARD:1 NOTCH,CERAMIC,CLIP MTD	80009	124-0100-00
	355-0046-00			1	.MOUNT,TERM BD:0.577 H,DELRIN (ATTACHING PARTS FOR STRIP)	80009	355-0046-00
	361-0008-00			1	SPACER,SLEEVE:0.28 L X 0.111 ID,PP (END ATTACHING PARTS)	80009	361-0008-00
-99	179-1372-00			1	WIRING HARNESS:AC	80009	179-1372-00
-100	214-0768-00			8	.SOCKET,PIN TERM:U/W 0.062 DIA PIN	81312	100-0967S204
-101	348-0197-00	B010100	B069999	1	GASKET:LIGHT SEAL,4.55 X 0.55,PU	80009	348-0197-00
	348-0197-01	B070000		1	GASKET:LIGHT SEAL,2.65 X 0.375,PU	80009	348-0197-01

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
6-	367-0073-03	B010100	B059999	1	HANDLE,CARRYING:16.02 L,BLUE PVC	80009	367-0073-03
	367-0073-04	B060000		1	HANDLE,CARRYING:16.02 L,BLUE PVC	80009	367-0073-04
-1	124-0218-00			1	.STRIP,TRIM:ALUMINUM	80009	124-0218-00
-2	386-1283-01			2	.PLATE,HDL MTG:FRONT	80009	386-1283-01
-3	367-0073-01	B010100	B059999	1	.HANDLE,CARRYING:16.02 L,BLUE PVC	80009	367-0073-01
	367-0073-02	B060000		1	.HANDLE,CARRYING:16.02 L,BLUE PVC .(ATTACHING PARTS)	12136	ORDER BY DESCR
-4	212-0559-00			4	.SCREW,MACHINE:10-32 X 0.625,FLH,100 DEG,STL	04348	ORDER BY DESCR
-5	386-1601-00			2	.PLATE,HDL RTNG:STAINLESS STEEL	80009	386-1601-00
-6	358-0369-00			4	.BSHG,SLEEVE:0.203 ID X 0.287 OD X 0.175 L .(END ATTACHING PARTS)	80009	358-0369-00
-7	200-0728-00			2	.COVER,HDL END:1.91 X 0.91 X 0.36 BLUE	80009	200-0728-00
-8	426-0481-00			1	.FRAME SECT,CAB.:TOP CENTER (ATTACHING PARTS)	80009	426-0481-00
-9	212-0002-00			4	SCREW,MACHINE:8-32 X 0.25,FLH,100 DEG,STL (END ATTACHING PARTS)	83385	ORDER BY DESCR
-10	390-0088-00			2	CAB.SIDE,SCOPE:LEFT & RIGHT SIDE	80009	390-0088-00
	214-0812-00			2	.FASTENER,PAWL:	80009	214-0812-00
-11	214-0603-01			1	..PIN,SECURING:0.45 DIA X 0.27,ZAMAK CD PL	80009	214-0603-01
	214-0604-00			1	..WASHER,SPR TNSN:0.26 ID X 0.47 OD,SST	80009	214-0604-00
	386-0227-00			1	..STOP,CLP,RIM CL:	80009	386-0227-00
-12	386-0226-00			1	..CLAMP,RIM CLENC:	80009	386-0226-00
-13	390-0087-00			1	CAB.BOT,SCOPE:BOTTOM	80009	390-0087-00
-14	348-0177-00			4	.PAD,CAB.FOOT:BLACK,POLYURETHANE	80009	348-0177-00
-15	348-0178-00			4	.FOOT,CABINET:BLACK DELRIN .(ATTACHING PARTS)	80009	348-0178-00
	210-0803-00			8	.WASHER,FLAT:0.15 ID X 0.375 OD X 0.032,STL	12327	ORDER BY DESCR
-16	213-0054-00			8	.SCREW,TPG,TF:6-32 X 0.312,TYPE T,PNH,STL .(END ATTACHING PARTS) (ATTACHING PARTS FOR CABINET)	93907	ORDER BY DESCR
-17	211-0504-00			14	SCREW,MACHINE:6-32 X 0.250,PNH,STL	TK0435	ORDER BY DESCR
-18	212-0004-00			2	SCREW,MACHINE:8-32 X 0.312,PNH,STL	TK0435	ORDER BY DESCR
	210-0802-00			4	WASHER,FLAT:0.15 ID X 0.312 OD X 0.032,STL	12327	ORDER BY DESCR
	210-0804-00			2	WASHER,FLAT:0.17 ID X 0.375 OD X 0.032 (END ATTACHING PARTS)	86928	76430-000
-19	426-0472-01			1	FRAME SECT,CAB.:BOTTOM LEFT	80009	426-0472-01
-20	426-0473-01			1	FRAME SECT,CAB.:RIGHT BOTTOM	80009	426-0473-01

Voltage and Waveform Test Conditions

Voltages and waveforms on the diagrams are not absolute and may vary between instruments because of differing component tolerances, internal calibration or front-panel control settings.

Typical voltage measurements and waveform photographs were obtained under the following conditions unless noted otherwise on the individual diagrams:

Test Oscilloscope (with 10X Probe)

Frequency Response	DC to 50 MHz
Deflection factor (with probe)	100 millivolts to 5 volts/division
Input impedance	10 Megohms, 7.5 picofarads
Probe ground	Type 576 chassis ground
Recommended type (as used for waveforms on diagrams)	Tektronix Type 547 with Type 1A1 plug-in unit

Voltmeter

Type	DVM (20,000 ohm/volt)
Range	0 to ±500 volts
Reference voltage	Type 576 chassis ground

Type 576

GRATICULE ILLUM	Graticule Lines Visible
READOUT ILLUM	Readout Visible
INTENSITY	Display Visible
FOCUS	Maximum Display Definition
VERTICAL	1 mA
DISPLAY OFFSET Selector	NORM (OFF)
CENTERLINE VALUE	0
HORIZONTAL	2 V
POSITION (Vertical and Horizontal)	Controls Centered
FINE POSITION (Vertical and Horizontal)	Controls Centered
ZERO	Released
CAL	Released
DISPLAY INVERT	Released
MAX PEAK VOLTS	15
PEAK POWER WATTS	220
VARIABLE COLLECTOR SUPPLY	Fully Clockwise
POLARITY	+(NPN)
MODE	NORM
LOOPING COMPENSATION	As Is
NUMBER OF STEPS	10
CURRENT LIMIT	20 mA
AMPLITUDE	1 V
OFFSET ZERO	ZERO
OFFSET MULT	0.00
STEPS	Pressed
PULSED STEPS	Released
STEP FAMILY	REP
RATE	NORM
POLARITY INVERT	Released
STEP MULT .1X	Released

TABLE 8-1

Components Numbers

Component Numbers On Diagrams	Diagram Number	Circuit
1-99	2, 4	Step Generator
100-199	3, 4	Step Amplifier
200-299	3, 4	Step Amplifier
300-399	1, 6	Collector Supply, Standard Test Fixture
400-499	5, 8	Display Sensitivity Switching, Display Positioning
500-599	9	Vertical Display Amplifier
600-699	9	Horizontal Display Amplifier
700-799	13	Power Supply
800-899	14	CRT Circuit
900-999	10, 11	Readout Switching and Interconnections, Readout Logic
1000-1199	12	Readout Lamps

Circuit Diagrams and the Circuit Board Pictures. To locate a component (physically) in the instrument from a circuit number on a circuit diagram, refer to the circuit board pictures at the end of Section 5. Each component in a circuit board picture is identified by its circuit number. **The black lines on the circuit diagrams enclose components located on circuit boards, and can** thus be used to determine on which circuit board a component is located. Fig. 4-7 shows where in the instrument each circuit board is located. Table 8-1 helps determine where a component on a circuit board (or in a circuit board picture) is located in the circuit diagrams.

Logic

The schematics and block diagrams in this manual which involve digital logic are drawn in terms of positive logic. In positive logic, the true state is the more positive of the two logic levels and the false state is the more negative. The small circles on some of the input or output terminals of the logic symbols indicate a logic negation. Any terminal having a logic negation symbol on it will be at a false level (or low) when the related device is in its activated state. For further information on the logic used in this manual see MIL-STD 806B.

Pertinent information about the integrated circuits used in the Step Generator circuits is given in Figs. 8-1 and 8-2. The symbols used conform to MIL-STD 806B. The truth tables are constructed in terms of highs and lows: a high representing a true state and a low representing a false state.

DIAGRAMS AND CIRCUIT BOARD ILLUSTRATIONS

Symbols and Reference Designators

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).

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

Logic symbology is based on ANSI Y32.14-1973 in terms of positive logic. 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 goes to the low state.

Abbreviations are based on ANSI Y1:1-1972.

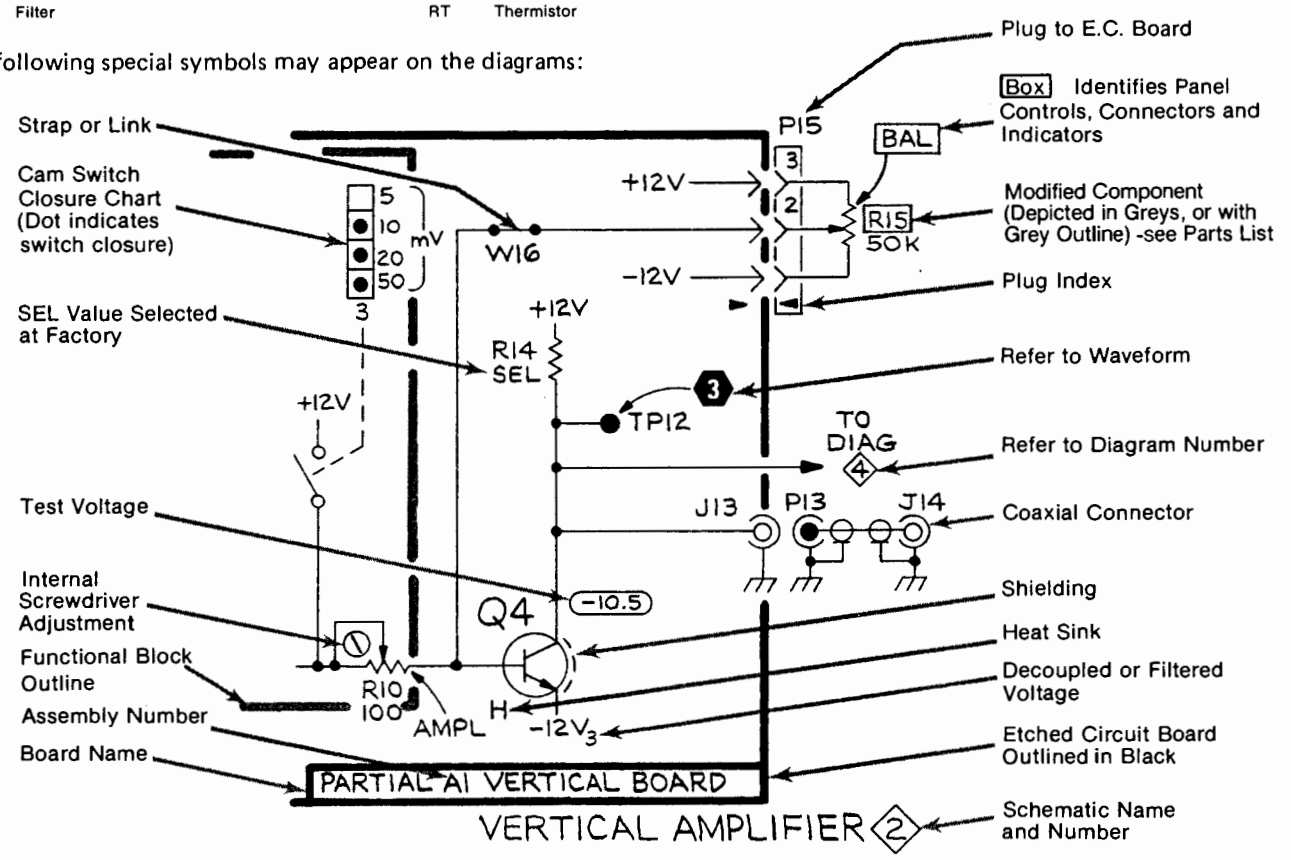
Other ANSI standards that are used in the preparation of diagrams by Tektronix, Inc. are:

Y14.15, 1966	Drafting Practices.
Y14.2, 1973	Line Conventions and Lettering.
Y10.5, 1968	Letter Symbols for Quantities Used in Electrical Science and Electrical Engineering.

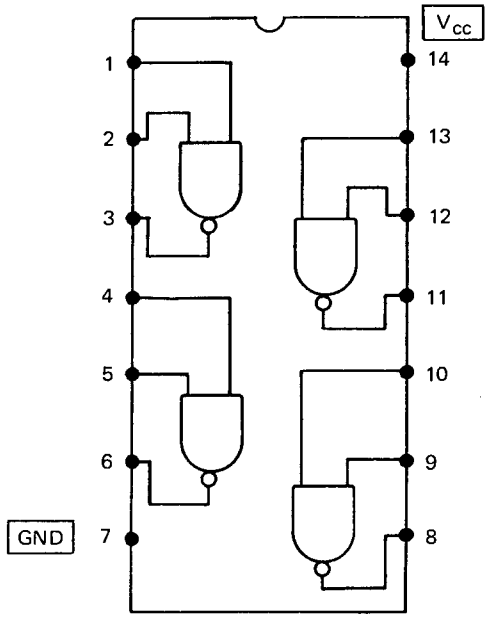
The following prefix letters are used as reference designators to identify components or assemblies on the diagrams.

A	Assembly, separable or repairable (circuit board, etc)	H	Heat dissipating device (heat sink, heat radiator, etc)	S	Switch or contactor
AT	Attenuator, fixed or variable	HR	Heater	T	Transformer
B	Motor	HY	Hybrid circuit	TC	Thermocouple
BT	Battery	J	Connector, stationary portion	TP	Test point
C	Capacitor, fixed or variable	K	Relay	U	Assembly, inseparable or non-repairable (integrated circuit, etc.)
CB	Circuit breaker	L	Inductor, fixed or variable	V	Electron tube
CR	Diode, signal or rectifier	M	Meter	VR	Voltage regulator (zener diode, etc.)
DL	Delay line	P	Connector, movable portion	W	Wirestrap or cable
DS	Indicating device (lamp)	Q	Transistor or silicon-controlled rectifier	Y	Crystal
E	Spark Gap, Ferrite bead	R	Resistor, fixed or variable	Z	Phase shifter
F	Fuse	RT	Thermistor		
FL	Filter				

The following special symbols may appear on the diagrams:



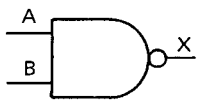
SECTION 8–TYPE 576



SN7400N
Quadruple 2-Input NAND Gate

Each gate may be used as a:

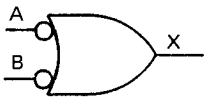
NAND Gate



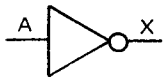
Truth Table

A	B	X
H	H	L
H	L	H
L	H	H
L	L	H

Inverted Input OR Gate

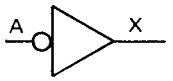


Inverter

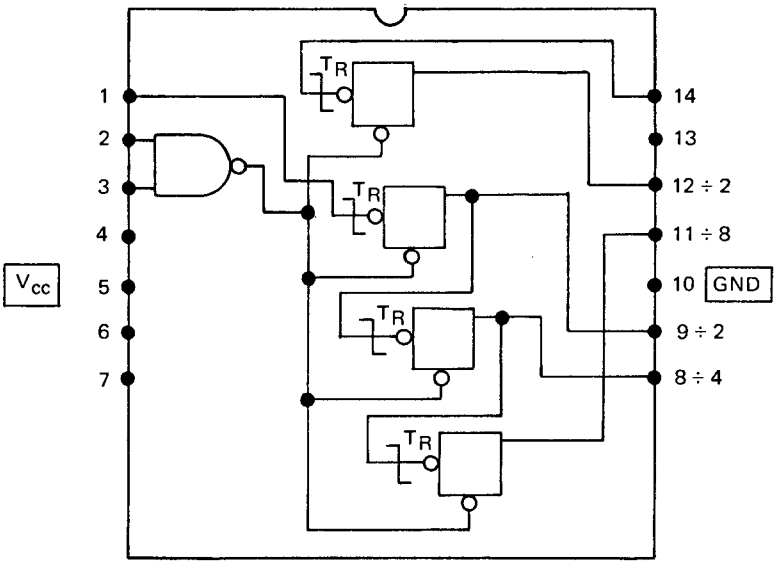


Truth Table

A	X
H	L
L	H



SN7493 N
4-Bit Binary Counter



Device becomes a ÷ 16 counter when pin 12 is externally connected to pin 1. Pin 14 is sensitive to only negative going transitions. A high at pin 2 and pin 3 resets all the outputs to lows.

Timing Chart for ÷ 16 Operation

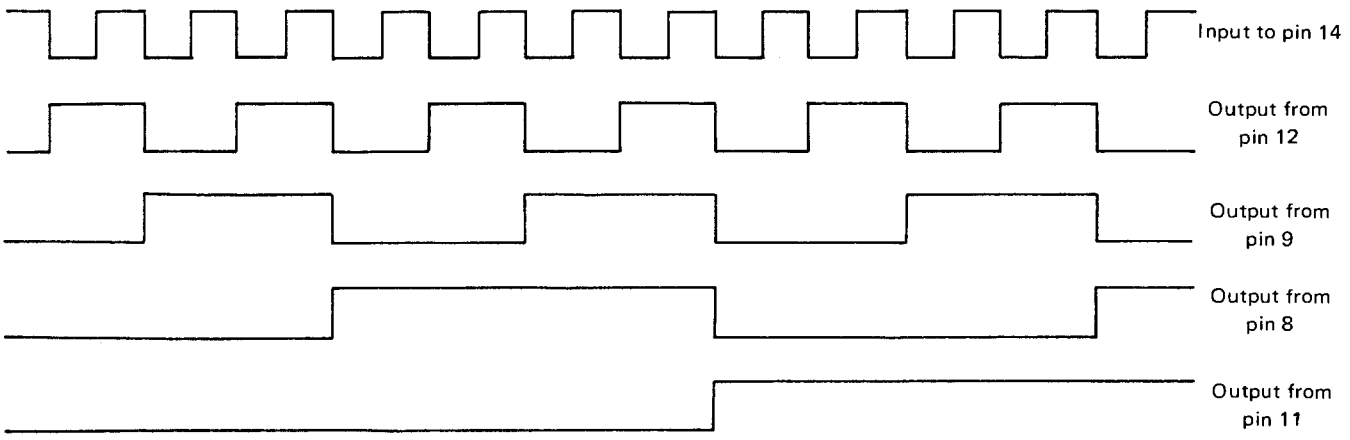


Fig. 8-1. Integrated circuits used in step generator circuit: SN7400N and SN7493N.

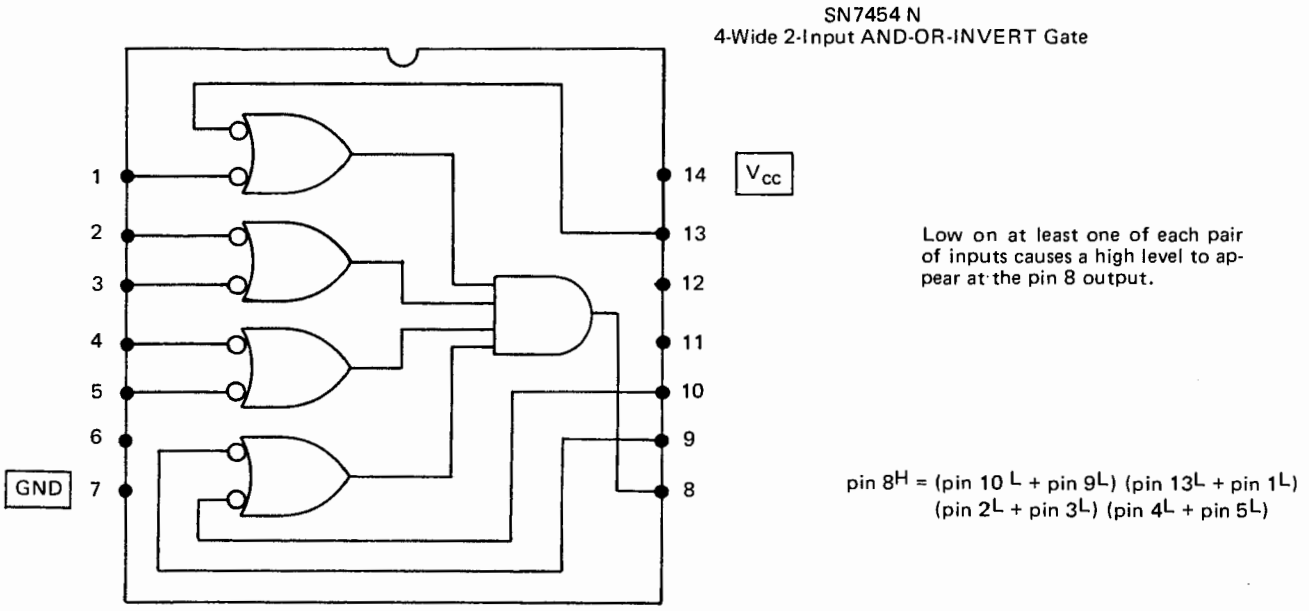
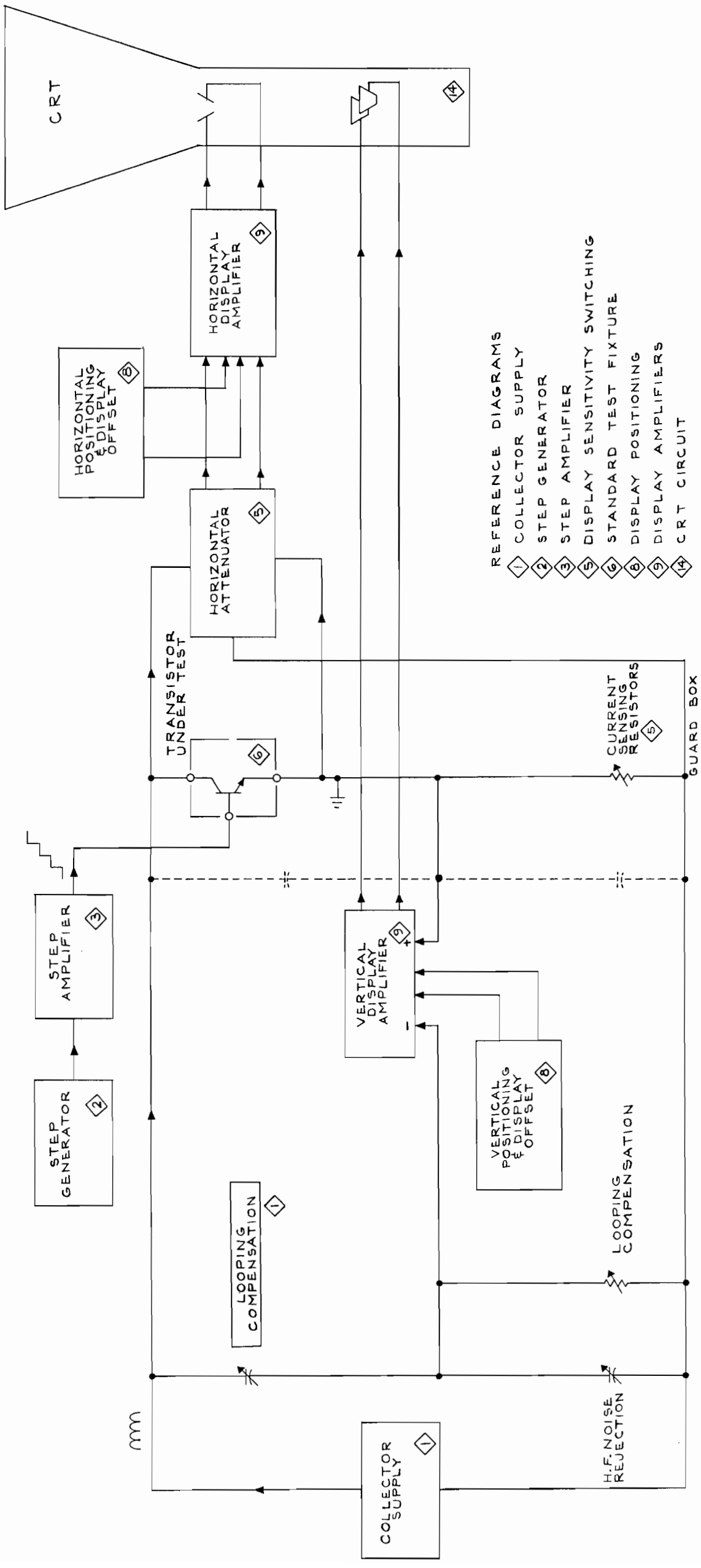


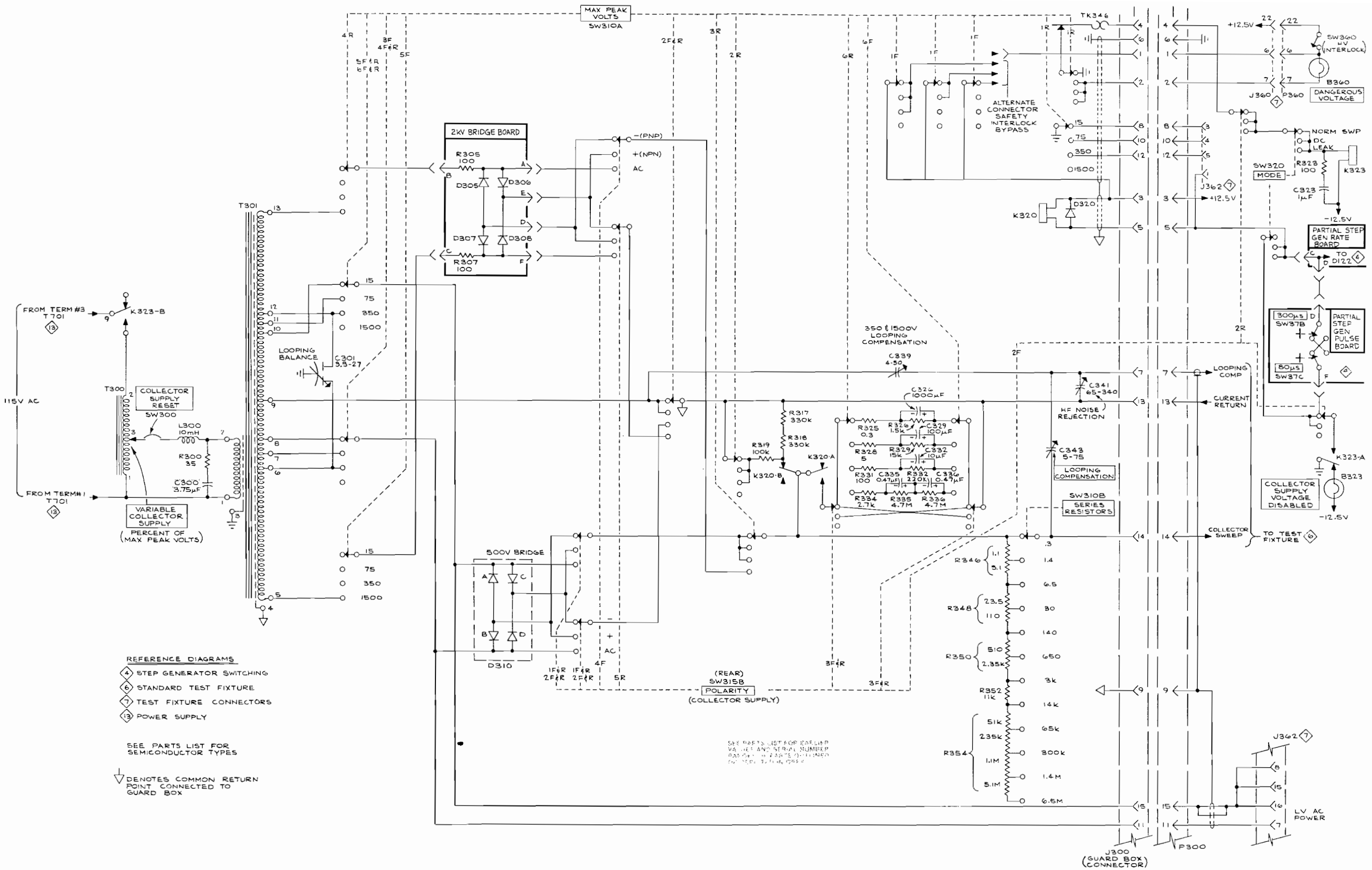
Fig. 8-2. Integrated circuit used in step generator circuit: SN7454N.



169

BLOCK DIAGRAM

TYPE 576



REFERENCE DIAGRAMS

- (4) STEP GENERATOR SWITCHING
- (6) STANDARD TEST FIXTURE
- (7) TEST FIXTURE CONNECTORS
- (13) POWER SUPPLY

SEE PARTS LIST FOR SEMICONDUCTOR TYPES

▽ DENOTES COMMON RETURN POINT CONNECTED TO GUARD BOX

SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES. CHANGES ARE LISTED IN CHRONOLOGICAL ORDER.

TYPE 576

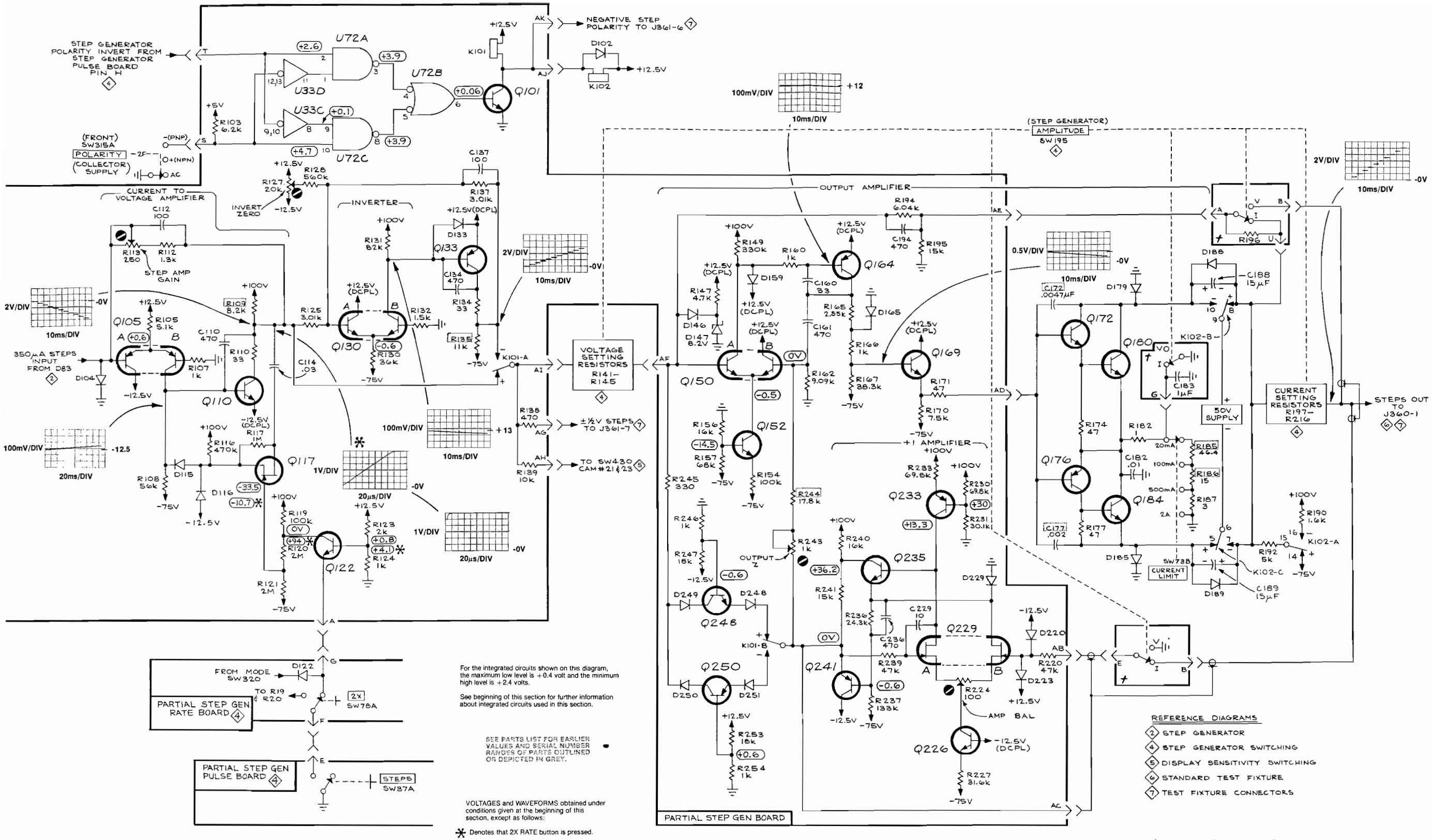
REV AUG 1982.

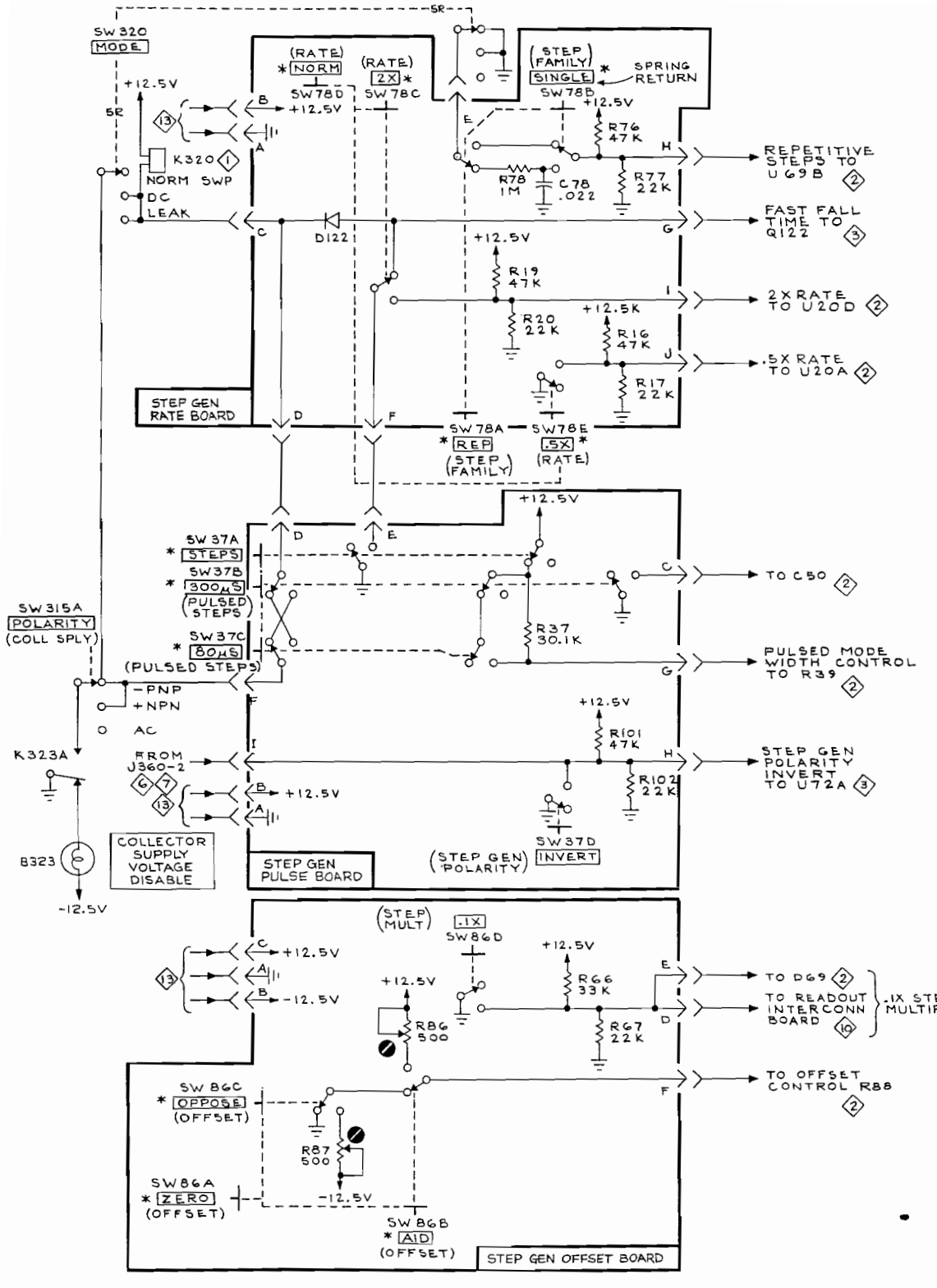
COLLECTOR SUPPLY (1)

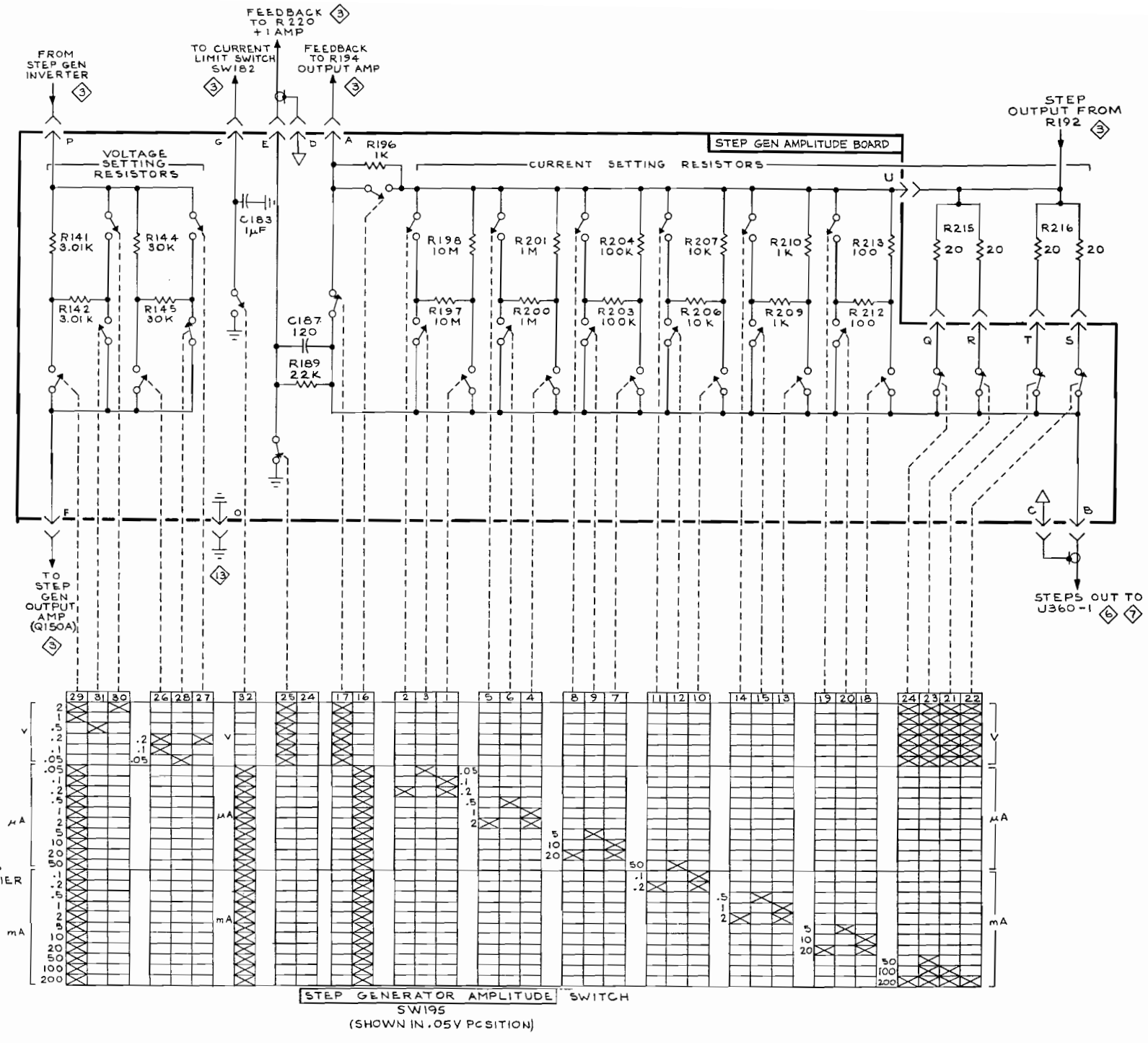
SW37A STEPS / SW37B 300µs / SW37C 80µs
+12.5V
R37 26.1k
80µs OR 300µs PULSE TO J3611-B ◇7
SW37B 300µs
SW27 +12.5V 60Hz 50Hz
R27 12.4k
R28 61.9k
2V/DIV -0V 5ms/DIV
10V/DIV -0V 5ms/DIV
5V/DIV -0V 2ms/DIV
T701
R1 47
D1 D2
C1 .47µF
R2 7.5k -12.5V
R3 68k +5V
R4 6.2k +5V
R5 10k
U3A
R25 4.02k
R24 1k DELAY
C26 .01
Q23
Q30
D28
R29 100k
R30 4.7k +12.5V
R34 2.2k +12.5V
R35 4.7k +12.5V
D35
C34 .01
1V/DIV -0V TP30
2ms/DIV
R32 22k
C33 .0022
R33 6.2k +5V
1V/DIV -0V 2µs/DIV
C35 .01
D39
R40 100k
Q41 0V
5V/DIV -0V 1ms/DIV
2V/DIV -0V 1ms/DIV
R39 12.4k
R41 470
C49 .0047µF
R50 470 (-0.7)
Q52
R46 8.06k (+0.06)
D47 (-0.2) D48
R48 4.75k
R51 41.2k (-0.05)
R52 15k -12.5V
R43 4.7k +12.5V
R44 39k
R45 10k (+0.6)
Q46
R53 56k -75V
D53
INTENSIFYING PULSE TO R889 ◇14
R54 2.87M +100V
R55 316k
R57 1.43M
R58 158k
R60 715k
R61 78.7k
R63 715k
R64 78.7k
D41 D55 D66 D58 D67 D61 D68 D64 D69
D42 D43 D44
.1X STEP MULT FROM SW86D ◇4
R83 2.7M +100V
D54 D57 D60 D63 D82 D83
TO Q105A ◇3
T701 +12.5V R7 1.3k 0.2V/DIV R8 500 ZERO CROSS
2ms/DIV -0V
C5 .0033
U3B
R22 22k
U33A
C22 .0022
1V/DIV -0V 1ms/DIV
5µs/DIV
TP69
Q36 (+0.7)
R42 2.2k
U3D
R10 47 D10 D11
C10 .47µF
R11 7.5k -12.5V
R12 68k +5V
R13 6.2k +5V
R14 10k
C14 .0033
U22A (+3.9)
U22B
U22C (+3.9)
U22D (+3.9)
C30 .005 +5V
U69A
R80 6.2k
TP80
C81 .01
R81 2.2k
U71D
U69C
U69D
U69B
U33B
U70
U75
U71A
U71B
U72D
U71E
U71F
U71C
R71 6.2k
R72 6.2k
R73 6.2k
R74 6.2k
+5V
.5X RATE FROM SW78E ◇4
2X RATE FROM SW78C ◇4
U20A (+3.9)
U20C
U3C
U20B (+3.9)
U20D (+0.1)
C13 .0033
+100V +12.5V +12.5V (DCPL) +5V -12.5V -12.5V (DCPL) -75V
R296 4.7 C296 2.2µF
C294 39µF
C295 2.2µF
For the integrated circuits shown on this diagram, the maximum low level is +0.4 volt and the minimum high level is +2.4 volts.
See beginning of this section for further information about integrated circuits used in this section.
PARTIAL STEP GENERATOR BOARD
SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS OUTLINED OR DEPICTED IN GREY.
SINGLE SW78B
C75 .022
R78 1M
REP SW78A
R76 47k
R77 22k
MODE ◇4
PARTIAL STEP GEN RATE BOARD
VOLTAGES and WAVEFORMS obtained under conditions given at the beginning of this section, except as follows:
* Denotes that 300µS PULSED STEPS button is pushed.
SW73A NUMBER OF STEPS
1R 1F 1R 1F
† PARTIAL STEP GEN PULSE BOARD ◇4
SW86C OPPOSE
R86 500 AID OFFSET
R85 500 -12.5V OPPOSE OFFSET
PARTIAL STEP GEN OFFSET BOARD
SW86B AID
R88 2k
OFFSET MULTIPLIER
R89 220
C89 0.2
D89
R90 100k +100V
R92 100 +12.5V
Q90
R94 10K -75V
R95 3.24K
(+0.8)
R96 200K
R97 5k ZERO STEP -12.5V

REFERENCE DIAGRAMS
◇3 STEP AMPLIFIER
◇4 STEP GENERATOR SWITCHING
◇7 TEST FIXTURE CONNECTIONS
◇13 POWER SUPPLY
◇14 CRT CIRCUIT

TYPE 576
REV MAR 1983
0371
STEP GENERATOR ◇2


STEP GENERATOR POLARITY INVERT FROM STEP GENERATOR PULSE BOARD PIN H
4
U72A
U33D
U33C
U72B
U72C
+2.6
+3.9
+0.06
+0.1
+4.7
K101
Q101
AK
AJ
NEGATIVE STEP POLARITY TO J361-6
7
D102
K102
+12.5V
+5V
R103 6.2k
(FRONT) SW315A POLARITY (COLLECTOR SUPPLY)
-(PNP)
+(NPN)
AC
-2F-
S
R127 20k
INVERT ZERO
-12.5V
R128 560k
CURRENT TO VOLTAGE AMPLIFIER
C112 100
R113 250
R112 1.3k
STEP AMP GAIN
INVERTER
+100V
R131 82k
C137 100
R137 3.01k
+12.5V(DCPL)
D133
Q133
C134 470
R134 33
R135 11k
-75V
2V/DIV
-0V
10ms/DIV
Q105
R105 5.1k
R109 5.2k
C110 470
R110 33
R107 1k
D104
350μA STEPS INPUT FROM D83
2
-12.5V
Q110
R125 3.01k
Q130
R132 1.5k
R130 36k
C114 .03
K101-A
AI
VOLTAGE SETTING RESISTORS R141-R145
4
AF
100mV/DIV
+13
10ms/DIV
R138 470
AG
±½V STEPS TO J361-7
7
AH
TO SW430 CAM #21 & 23
5
R139 10K
-12.5
20ms/DIV
R116 470k
R117 1M
-12.5V (DCPL)
Q117
1V/DIV
R108 56k
D115
D116
(-33.5)
(-10.7)
R119 100k
(+94)
R120 2M
Q122
R121 2M
20μs/DIV
R123 2k
(+0.8)
(+4.1)
R124 1k
A
FROM MODE SW320
D122
G
TO R19 & R20
2X
SW78A
F
PARTIAL STEP GEN RATE BOARD 4
PARTIAL STEP GEN PULSE BOARD 4
E
STEPS
SW87A
For the integrated circuits shown on this diagram, the maximum low level is +0.4 volt and the minimum high level is +2.4 volts.
See beginning of this section for further information about integrated circuits used in this section.
SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS OUTLINED OR DEPICTED IN GREY.
VOLTAGES and WAVEFORMS obtained under conditions given at the beginning of this section, except as follows:
✳ Denotes that 2X RATE button is pressed.
100mV/DIV
+12
10ms/DIV
(STEP GENERATOR) AMPLITUDE SW195
4
OUTPUT AMPLIFIER
+100V
R149 330k
R160 1k
+12.5V (DCPL)
Q164
R194 6.04k
C194 470
R195 15k
AE
R147 4.7K
D146
D147 8.2V
D159
C160 33
C161 470
D165
R165 2.55k
R166 1k
R167 88.3k
R162 9.09k
Q150
Q169
R171 47
R170 7.5k
AD
-0.5
R156 16k
Q152
-14.5
R157 68k
R154 100k
-75V
+1 AMPLIFIER
+100V
R233 69.8k
Q233
+13.3
R230 69.8k
+30
R231 30.1k
R245 330
R244 17.8k
R246 1k
R247 16k
R243 1k
OUTPUT Z
-0.6
-12.5V
+100V
R240 16k
Q235
+36.2
R241 15k
D249
D248
Q248
K101-B
D229
C229 10
C236 470
R236 24.3k
Q229
-12.5V
D220
AB
R220 4.7k
D223
+12.5V
Q250
D250
D251
Q241
R239 47k
R237 133k
R224 100
AMP BAL
Q226
-12.5V (DCPL)
R227 31.6k
R253 15k
R254 1k
AC
PARTIAL STEP GEN BOARD
0.5V/DIV
-0V
10ms/DIV
D179
C172 .0047μF
Q172
Q180
K102-B
C183 1μF
50V SUPPLY
R174 47
R182
20mA
100mA
500mA
2A
R185 46.4
R186 15
R187 3
C182 .01
Q176
Q184
C177 .002
R177 47
D185
SW738 CURRENT LIMIT
D189
C189 15μF
K102-C
R192 5k
K102-A
R190 1.6k
D188
C188 15μF
R196
2V/DIV
-0V
10ms/DIV
CURRENT SETTING RESISTORS R197-R216
4
STEPS OUT TO J360-1
6 7
REFERENCE DIAGRAMS
2 STEP GENERATOR
4 STEP GENERATOR SWITCHING
5 DISPLAY SENSITIVITY SWITCHING
6 STANDARD TEST FIXTURE
7 TEST FIXTURE CONNECTORS
† DENOTES PARTIAL STEP GEN AMPLITUDE BOARD 4





⊠ INDICATES SWITCH CLOSED

* DENOTES SELF CANCELLING SWITCH

⏚ COMMON RETURN POINT CONNECTED TO GUARD BOX

REFERENCE DIAGRAMS
- ⟨1⟩ COLLECTOR SUPPLY
- ⟨2⟩ STEP GENERATOR
- ⟨3⟩ STEP AMPLIFIER
- ⟨6⟩ STANDARD TEST FIXTURE
- ⟨7⟩ TEST FIXTURE CONNECTIONS
- ⟨10⟩ READOUT SWITCHING & INTERCONNECTIONS
- ⟨13⟩ POWER SUPPLY

DISPLAY SENS SWITCHING ⑤

⑤ DISPLAY SENSITIVITY SWITCHING

REV AUG 1982

(SHOWN IN STEP GEN POSITION)

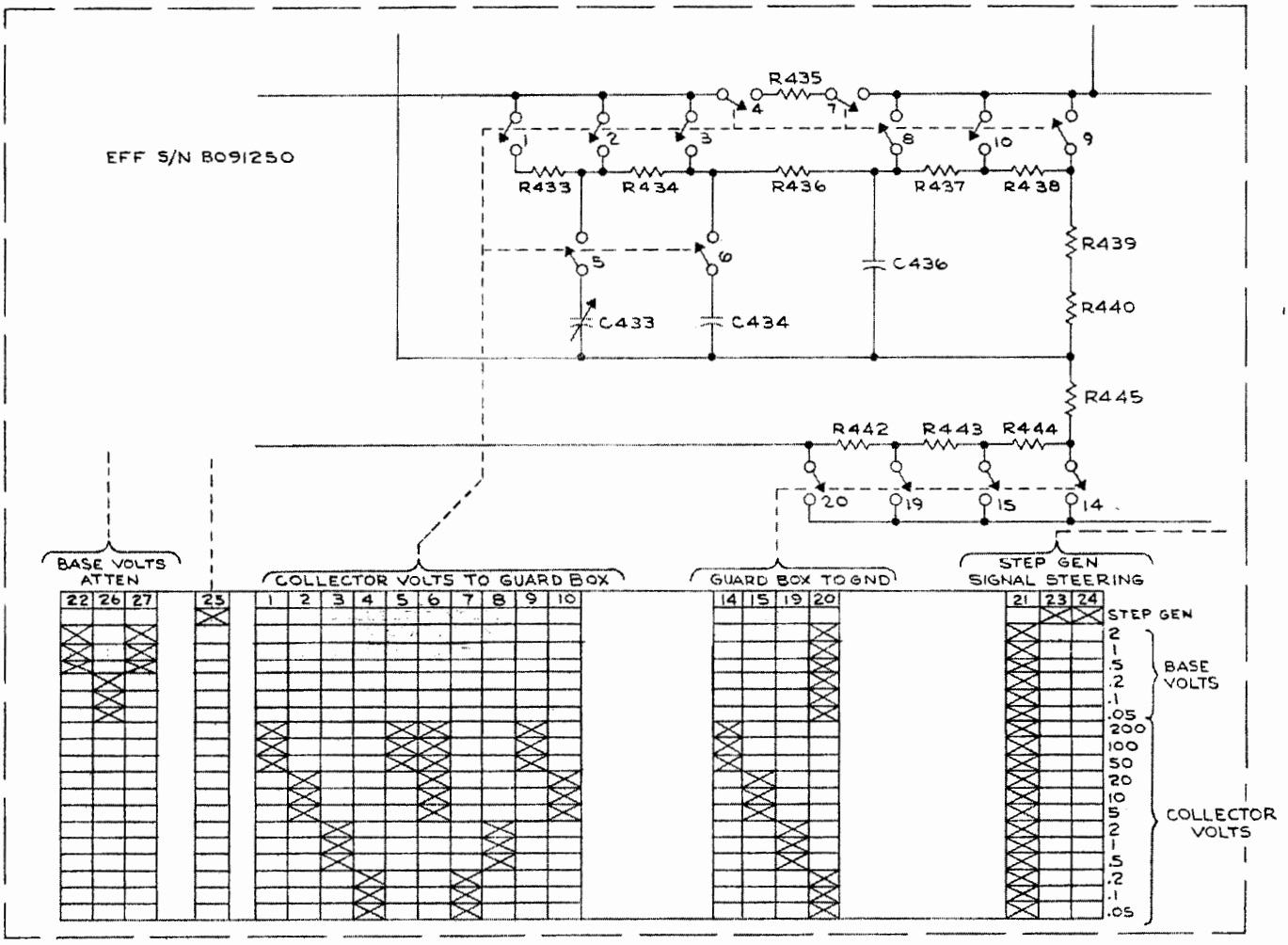
(SHOWN IN STEP GEN POSITION)

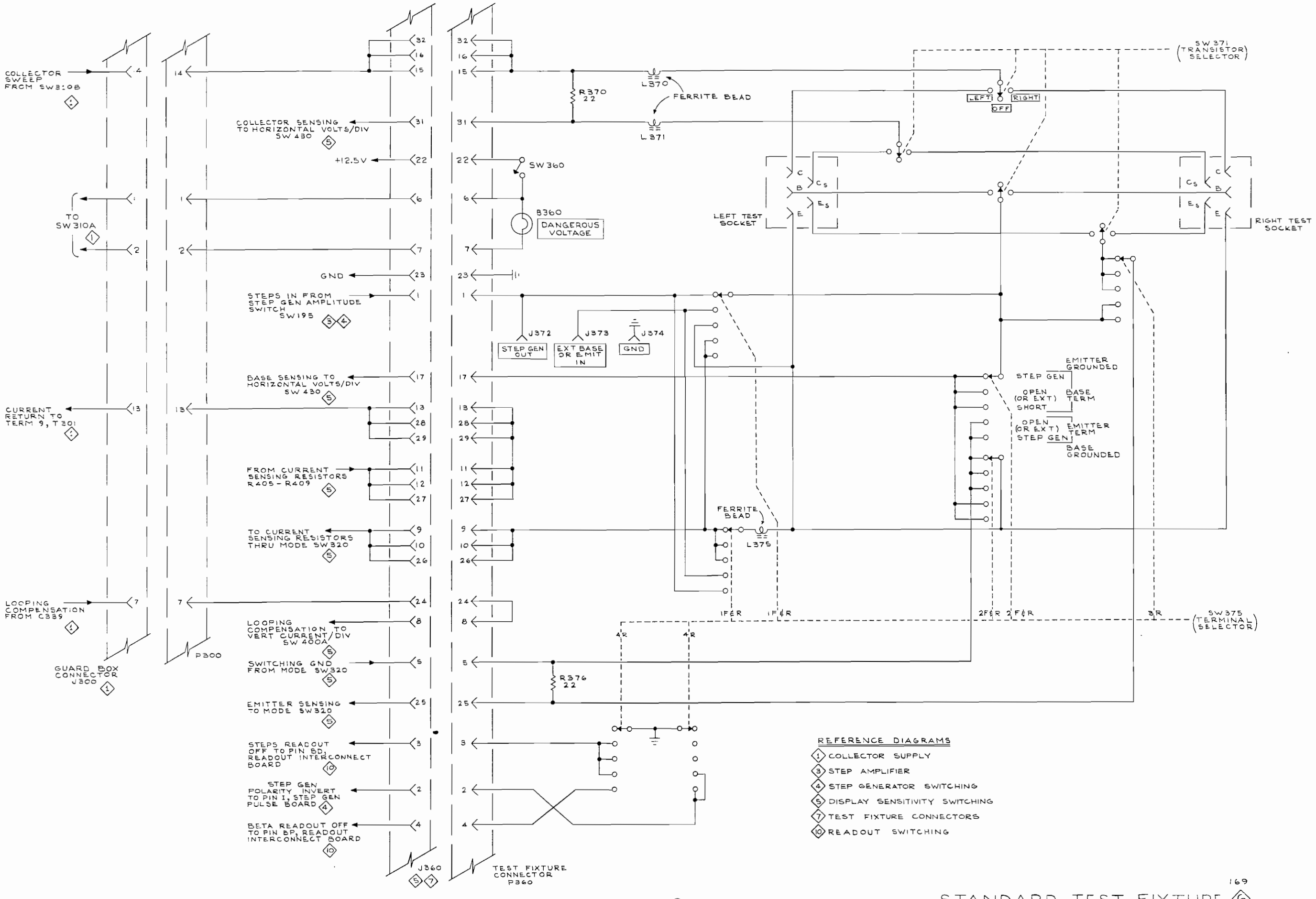
SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS OUTLINED OR DEPICTED IN GREY

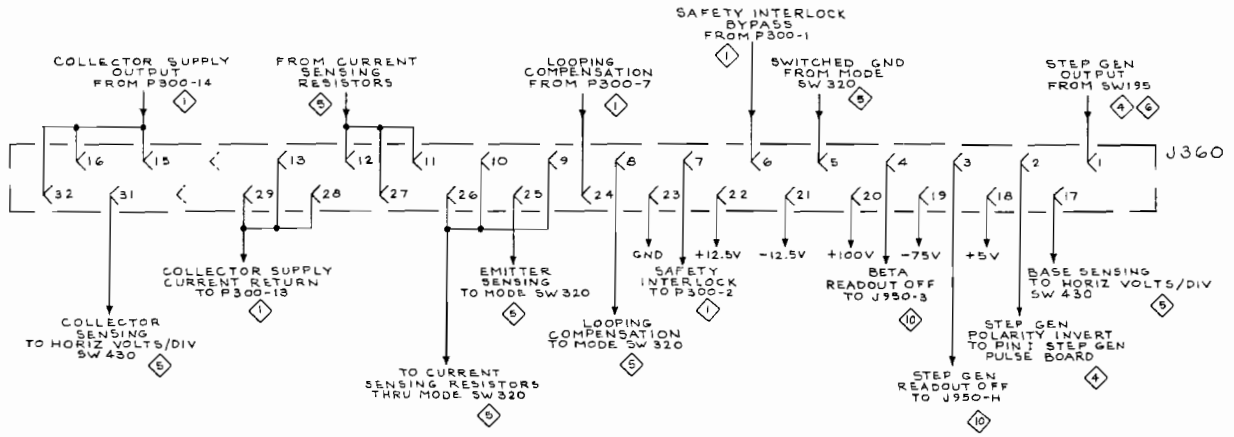
☒ INDICATES SWITCH CLOSED

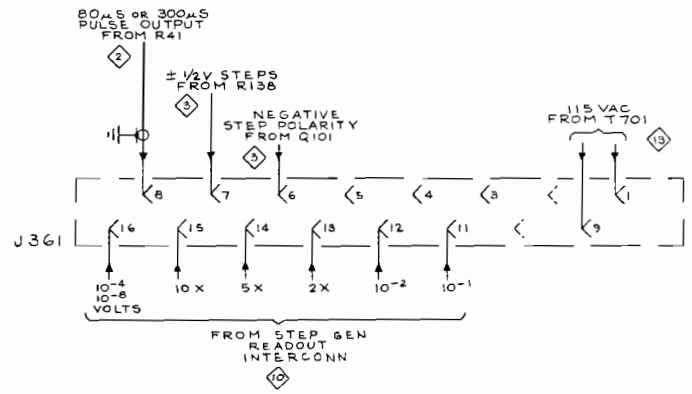
REFERENCE DIAGRAMS

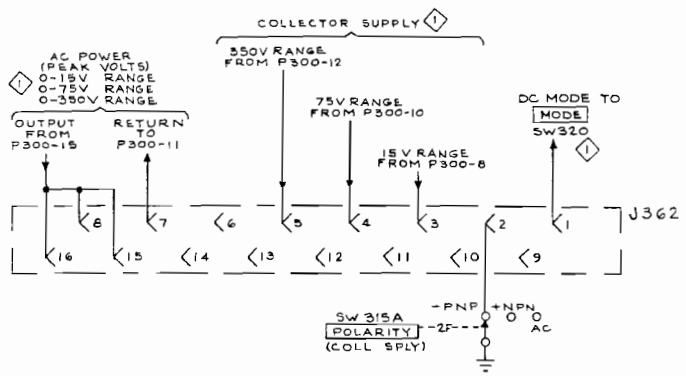
③ STEP AMPLIFIER
⑥ STANDARD TEST FIXTURE
⑦ TEST FIXTURE CONNECTORS
⑨ DISPLAY AMPLIFIERS
⑩ READOUT SWITCHING
⑱ POWER SUPPLY

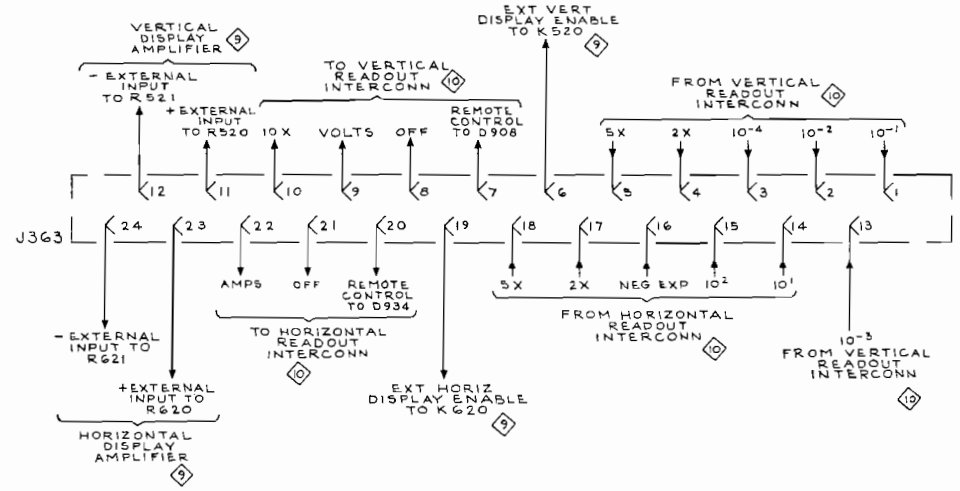

EFF S/N B091250
R435
R433
R434
R436
R437
R438
R439
R440
R445
R442
R443
R444
C433
C434
C436
BASE VOLTS ATTEN
COLLECTOR VOLTS TO GUARD BOX
GUARD BOX TO GND
STEP GEN SIGNAL STEERING
STEP GEN
BASE VOLTS
COLLECTOR VOLTS


COLLECTOR SWEEP FROM SW310B
TO SW310A
CURRENT RETURN TO TERM 9, T301
LOOPING COMPENSATION FROM C339
GUARD BOX CONNECTOR J300
P300
COLLECTOR SENSING TO HORIZONTAL VOLTS/DIV SW430
+12.5V
GND
STEPS IN FROM STEP GEN AMPLITUDE SWITCH SW195
BASE SENSING TO HORIZONTAL VOLTS/DIV SW430
FROM CURRENT SENSING RESISTORS R405-R409
TO CURRENT SENSING RESISTORS THRU MODE SW320
LOOPING COMPENSATION TO VERT CURRENT/DIV SW400A
SWITCHING GND FROM MODE SW320
EMITTER SENSING TO MODE SW320
STEPS READOUT OFF TO PIN BD, READOUT INTERCONNECT BOARD
STEP GEN POLARITY INVERT TO PIN 1, STEP GEN PULSE BOARD
BETA READOUT OFF TO PIN BP, READOUT INTERCONNECT BOARD
J360
TEST FIXTURE CONNECTOR P360
R370 22
L370
FERRITE BEAD
L371
SW360
B360
DANGEROUS VOLTAGE
J372
STEP GEN OUT
J373
EXT BASE OR E-MIT IN
J374
GND
R376 22
FERRITE BEAD
L375
1FER
2FER
3R
4R
SW371 (TRANSISTOR SELECTOR)
LEFT
OFF
RIGHT
LEFT TEST SOCKET
RIGHT TEST SOCKET
EMITTER GROUNDED
STEP GEN
OPEN (OR EXT) BASE TERM
SHORT
OPEN (OR EXT) EMITTER TERM
STEP GEN
BASE GROUNDED
SW375 (TERMINAL SELECTOR)
REFERENCE DIAGRAMS
1 COLLECTOR SUPPLY
3 STEP AMPLIFIER
4 STEP GENERATOR SWITCHING
5 DISPLAY SENSITIVITY SWITCHING
7 TEST FIXTURE CONNECTORS
10 READOUT SWITCHING



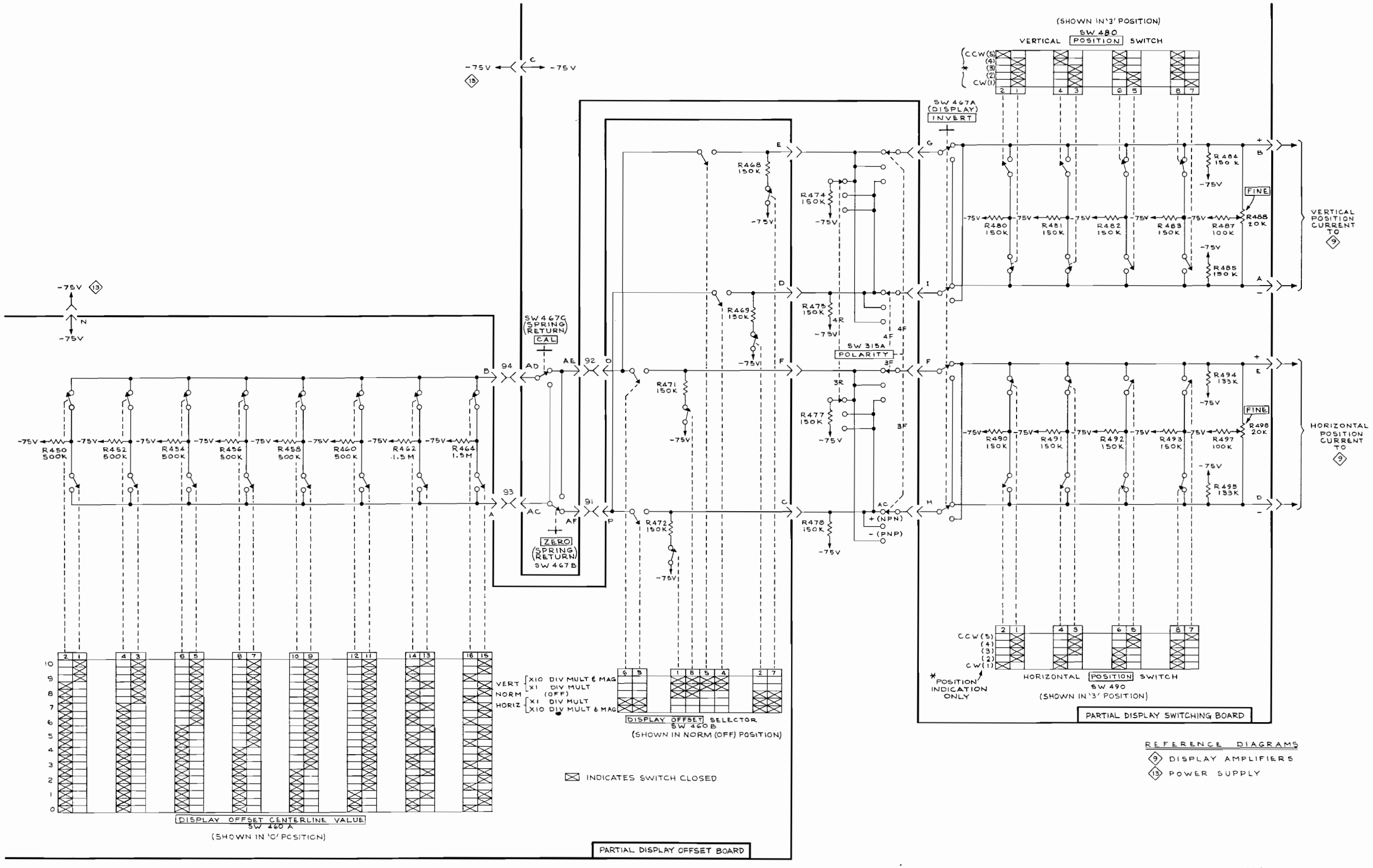






REFERENCE DIAGRAMS

1. COLLECTOR SUPPLY
2. STEP GENERATOR
3. STEP AMPLIFIER
4. STEP GENERATOR SWITCHING
5. DISPLAY SENSITIVITY SWITCHING
6. STANDARD TEST FIXTURE
9. DISPLAY AMPLIFIERS
10. READOUT SWITCHING INTERCONNECTIONS
13. POWER SUPPLY



REFERENCE DIAGRAMS

9 DISPLAY AMPLIFIERS

13 POWER SUPPLY

PARTIAL DISPLAY AMP BOARD

SW315A (COLLECTOR SUPPLY) POLARITY

EXTERNAL ENABLE FROM VERTICAL READOUT SWITCHING

EXTERNAL SIGNAL 7 — FROM J363-11, FROM J363-12

INTERNAL SIGNAL FROM SW 400 6

SW467C CAL · SW467B ZERO · SW467A DISPLAY INVERT

VERTICAL POSITIONING CURRENT 8

GAIN SWITCHING

EXTERNAL ENABLE FROM HORIZONTAL READOUT SWITCHING

INTERNAL SIGNAL FROM SW 430 5

HORIZONTAL POSITIONING CURRENT 8

FROM VERTICAL READOUT SWITCHING 10 — 2X 5X

FROM HORIZONTAL READOUT SWITCHING 10 — 2X 5X

PARTIAL DISPLAY SWITCHING BOARD

TO LOWER VERTICAL DEFLECTION PLATE

TO UPPER VERTICAL DEFLECTION PLATE

TO LEFT HORIZONTAL DEFLECTION PLATE

TO RIGHT HORIZONTAL DEFLECTION PLATE

VERT MAG GAIN · VERT CENT · VERT OUTPUT GAIN · +225V

HORIZ MAG GAIN · HORIZ CENT · ORTHAGONALITY · HORIZ OUTPUT GAIN · +225V

SW460B DISPLAY OFFSET SELECTOR

REFERENCE DIAGRAMS

- 5 DISPLAY SENSITIVITY SWITCHING
- 7 TEST FIXTURE CONNECTIONS
- 8 DISPLAY POSITIONING SWITCHES
- 10 READOUT SWITCHING
- 13 POWER SUPPLY

* DENOTES PARTIAL DISPLAY OFFSET BOARD

VOLTAGES and WAVEFORMS obtained under conditions given at the beginning of this section.

REV AUG 1982

READOUT SW. & INTERCON. ⟨10⟩

READOUT SWITCHING & INTERCONNECTIONS ⟨10⟩

REFERENCE DIAGRAMS
4 STEP GENERATOR SWITCHING
5 DISPLAY SENSITIVITY SWITCHING
6 STANDARD TEST FIXTURE
7 TEST FIXTURE CONNECTIONS
8 DISPLAY POSITIONING SWITCHES
9 DISPLAY AMPLIFIERS
19 POWER SUPPLY

INDICATES SWITCH CLOSED

(SHOWN IN STEP GEN)

(SHOWN IN .05V POSITION)

READOUT INTERCONNECT BD

PARTIAL VERT CURRENT BD

PARTIAL DISPLAY OFFSET BD

PARTIAL STEP GEN AMPLITUDE BOARD

PARTIAL HORIZ VOLTS/DIV BD

HORIZONTAL DISPLAY RELAYS ⟨9⟩

VERTICAL DISPLAY RELAYS ⟨9⟩

HORIZONTAL READOUT

STEPS READOUT

VERTICAL READOUT

TYPE 576

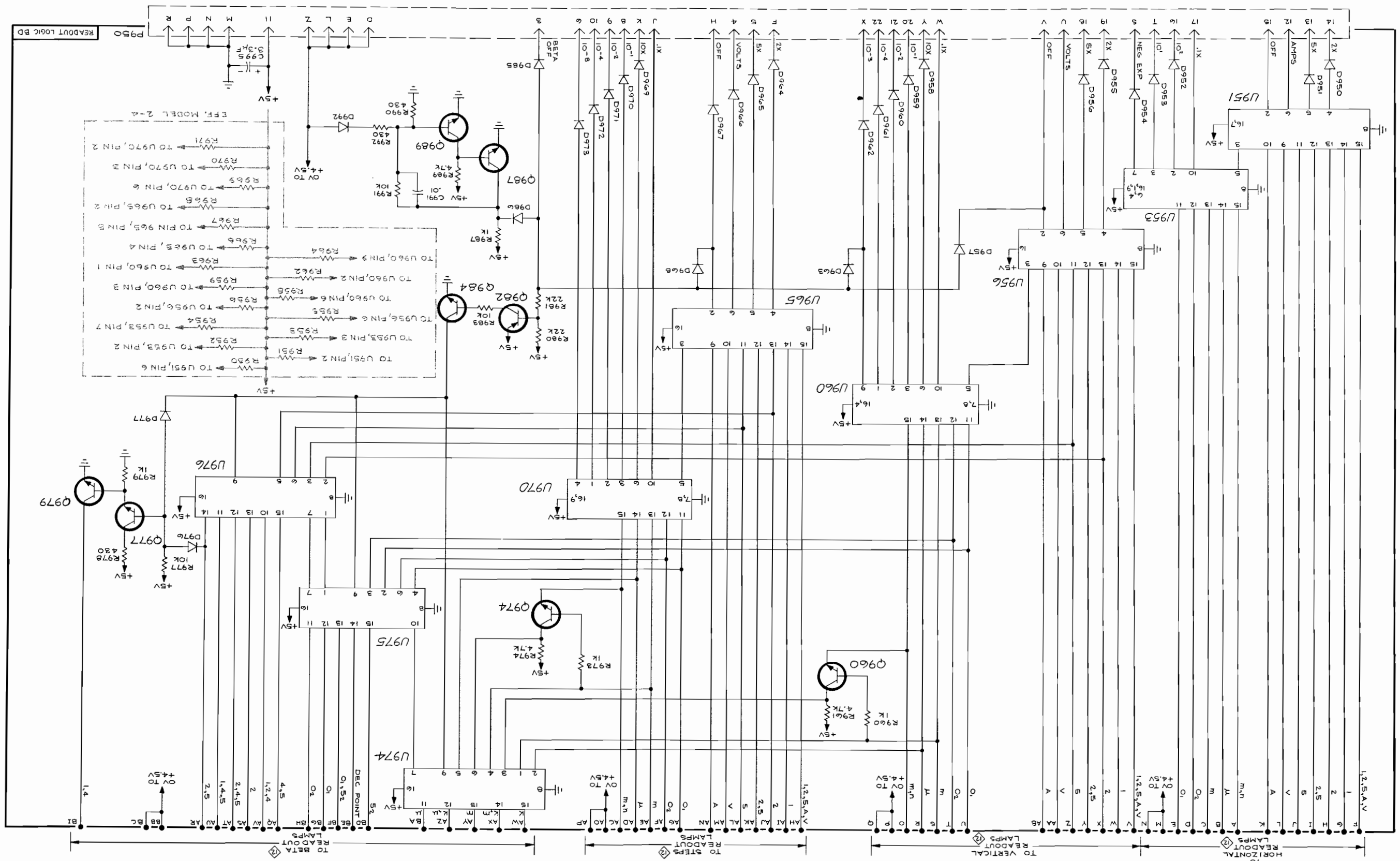
REV AUG 1982

READOUT LOGIC (11)

0270

SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS OUTLINED OR DEPICTED IN GREY.

REFERENCE DIAGRAM (12) READOUT LAMPS



REV AUG 1982

POWER SUPPLY

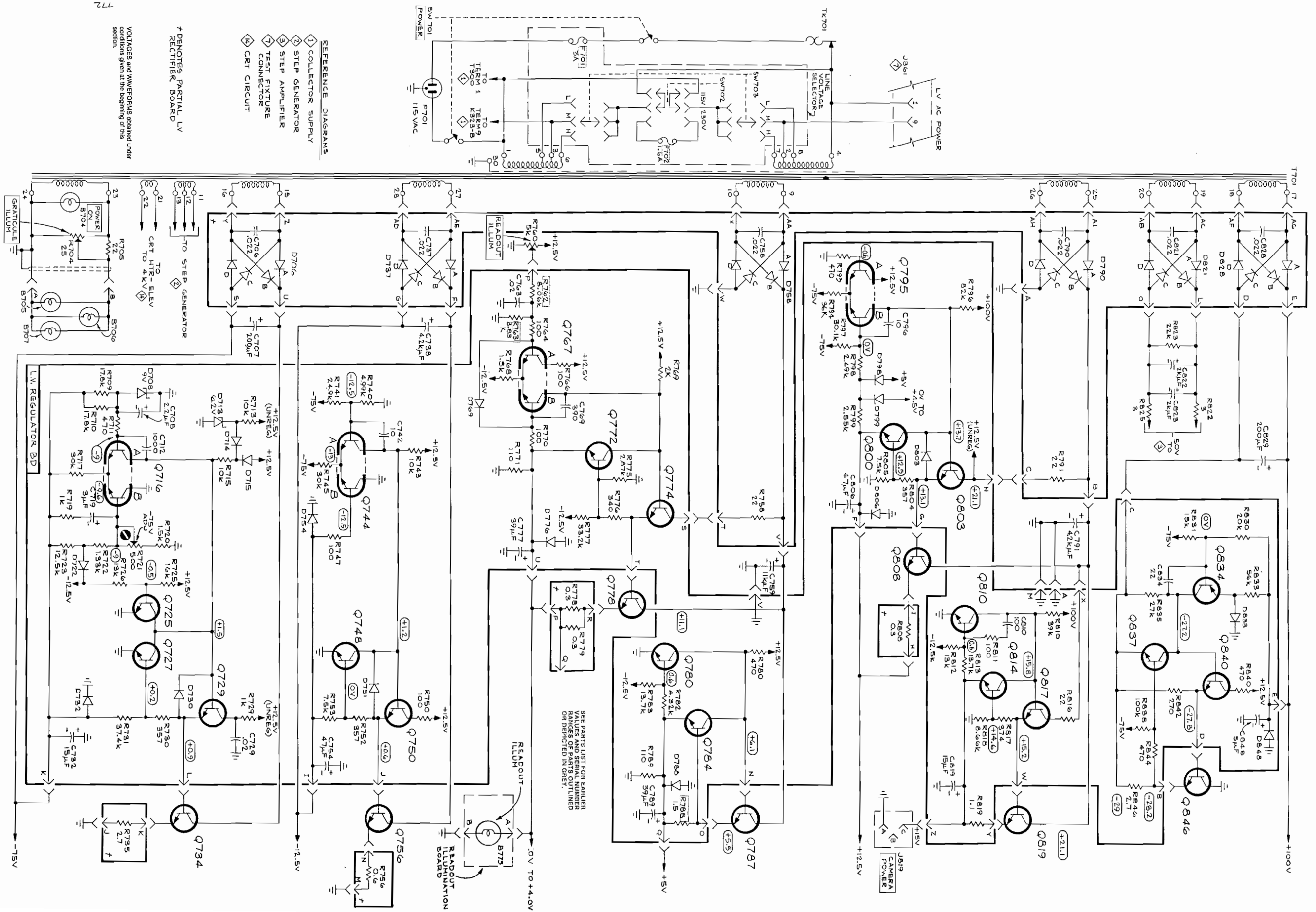
POWER SUPPLY

REFERENCE DIAGRAMS

1. COLLECTOR SUPPLY
2. STEP GENERATOR
3. STEP AMPLIFIER
4. TEST FIXTURE CONNECTOR
5. CRT CIRCUIT

* DENOTES PARTIAL LV RECTIFIER BOARD

VOLTAGES and WAVEFORMS obtained under conditions given at the beginning of this section.



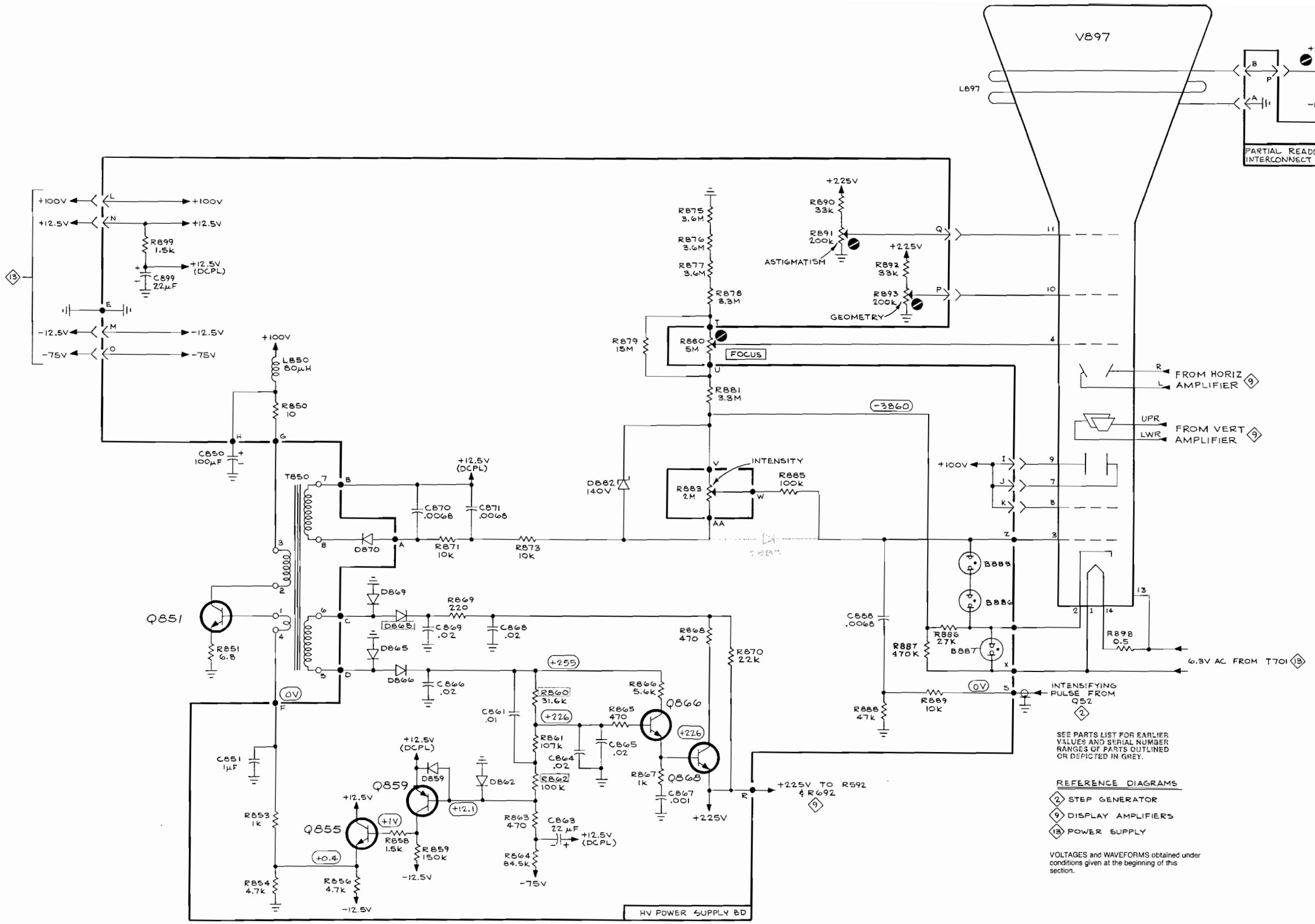

V897
L897
+12.5V
R897 2k
-12.5V
TRACE ROTATION
PARTIAL READOUT INTERCONNECT BD
+100V
+12.5V
-12.5V
-75V
R899 1.5k
C899 22µF
+12.5V (DCPL)
L850 80µH
R850 10
C850 100µF
T850
C870 .0068
C871 .0068
D870
R871 10k
R873 10k
D869
D868
D865
D866
C869 .02
C868 .02
C866 .02
R869 220
Q851
R851 6.8
R875 3.6M
R876 3.6M
R877 3.6M
R878 8.3M
R879 15M
+225V
R890 33k
R891 200k
ASTIGMATISM
R892 33k
R893 200k
GEOMETRY
R860 5M
FOCUS
R881 3.3M
-3860
D882 140V
R883 2M
INTENSITY
R885 100k
FROM HORIZ AMPLIFIER
FROM VERT AMPLIFIER
UPR
LWR
B885
B886
B887
R886 2.7k
R887 470k
R888 47k
R889 10k
C888 .0068
R898 0.5
6.3V AC FROM T701
INTENSIFYING PULSE FROM Q52
R860 31.6k
R861 107k
R862 100k
C861 .01
C864 .02
C865 .02
R865 470
R866 5.6k
Q866
R867 1k
Q868
C867 .001
R868 470
R870 2.2k
+225V TO R592 & R692
C851 1µF
Q859
D859
D862
+12.1
R853 1k
Q855
R858 1.5k
R859 150k
R863 470
C863 22µF
R864 84.5k
R854 4.7k
R856 4.7k
HV POWER SUPPLY BD
SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS OUTLINED OR DEPICTED IN GREY.
REFERENCE DIAGRAMS
2 STEP GENERATOR
9 DISPLAY AMPLIFIERS
13 POWER SUPPLY
VOLTAGES and WAVEFORMS obtained under conditions given at the beginning of this section.

FIG. 1 FRONT

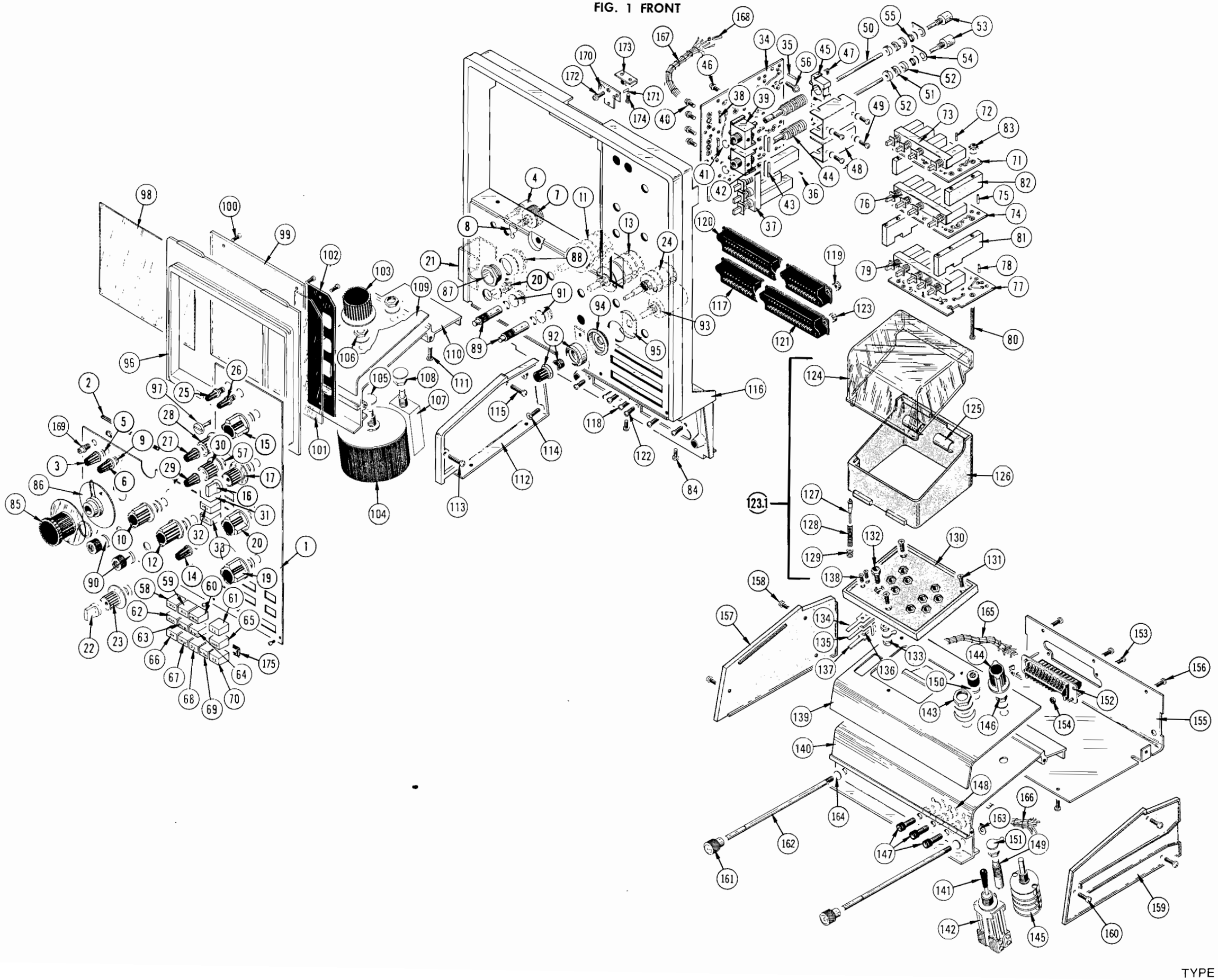


FIG. 1 FRONT

FIG. 2 SWITCHES

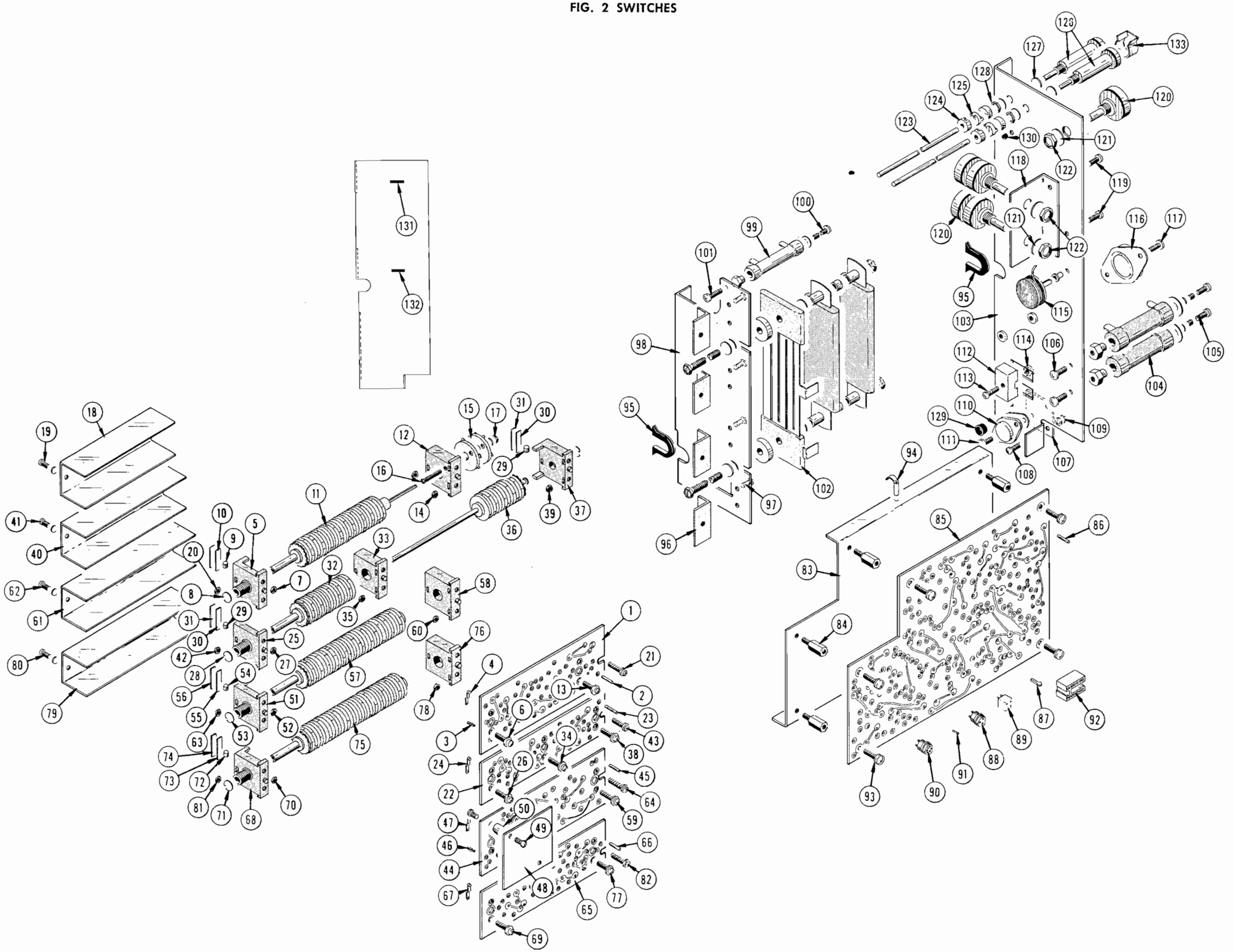


FIG. 3 CHASSIS

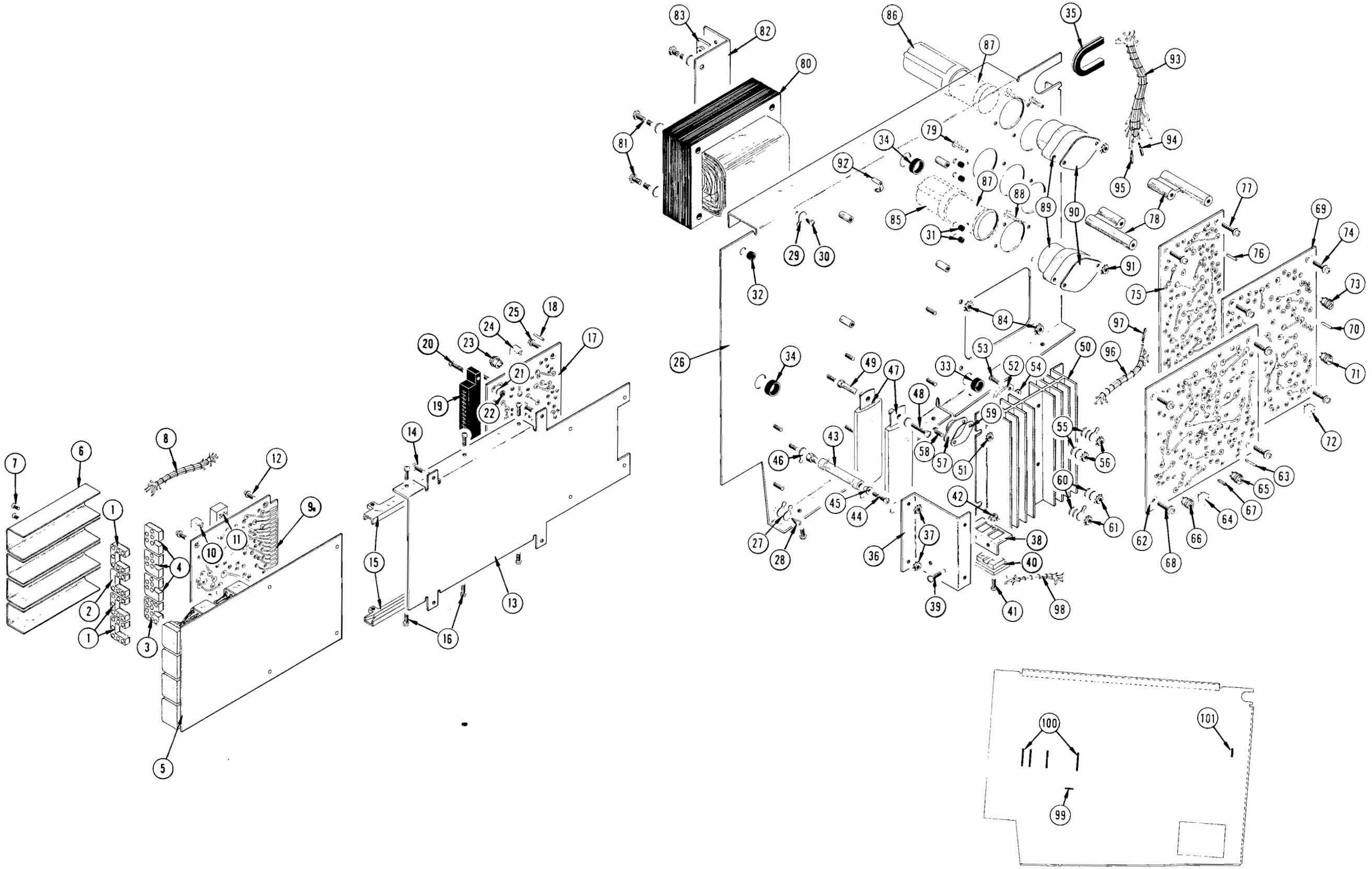


FIG. 3 CHASSIS

FIG. 4 COLLECTOR SUPPLY

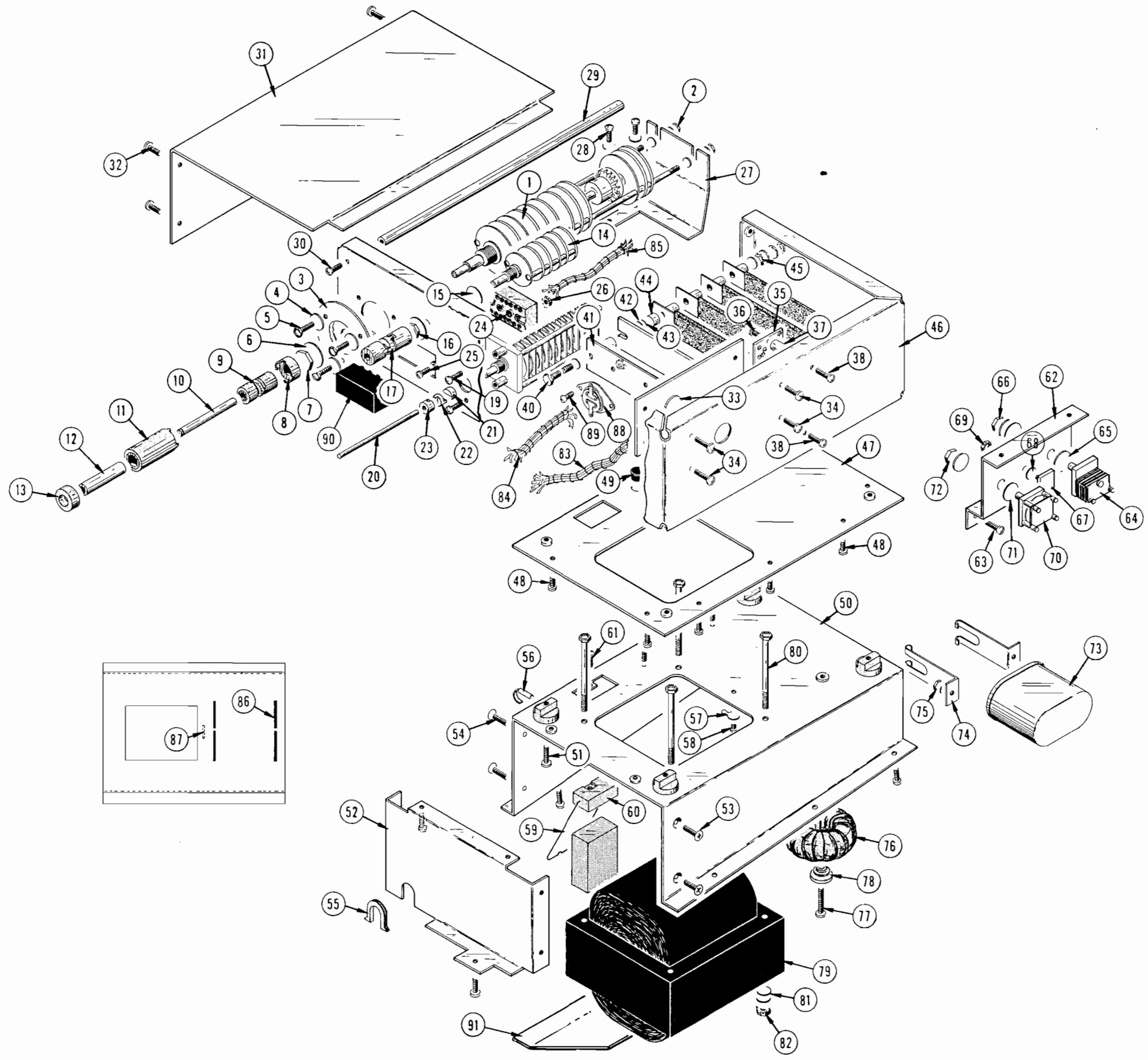


FIG. 5 CRT & REAR

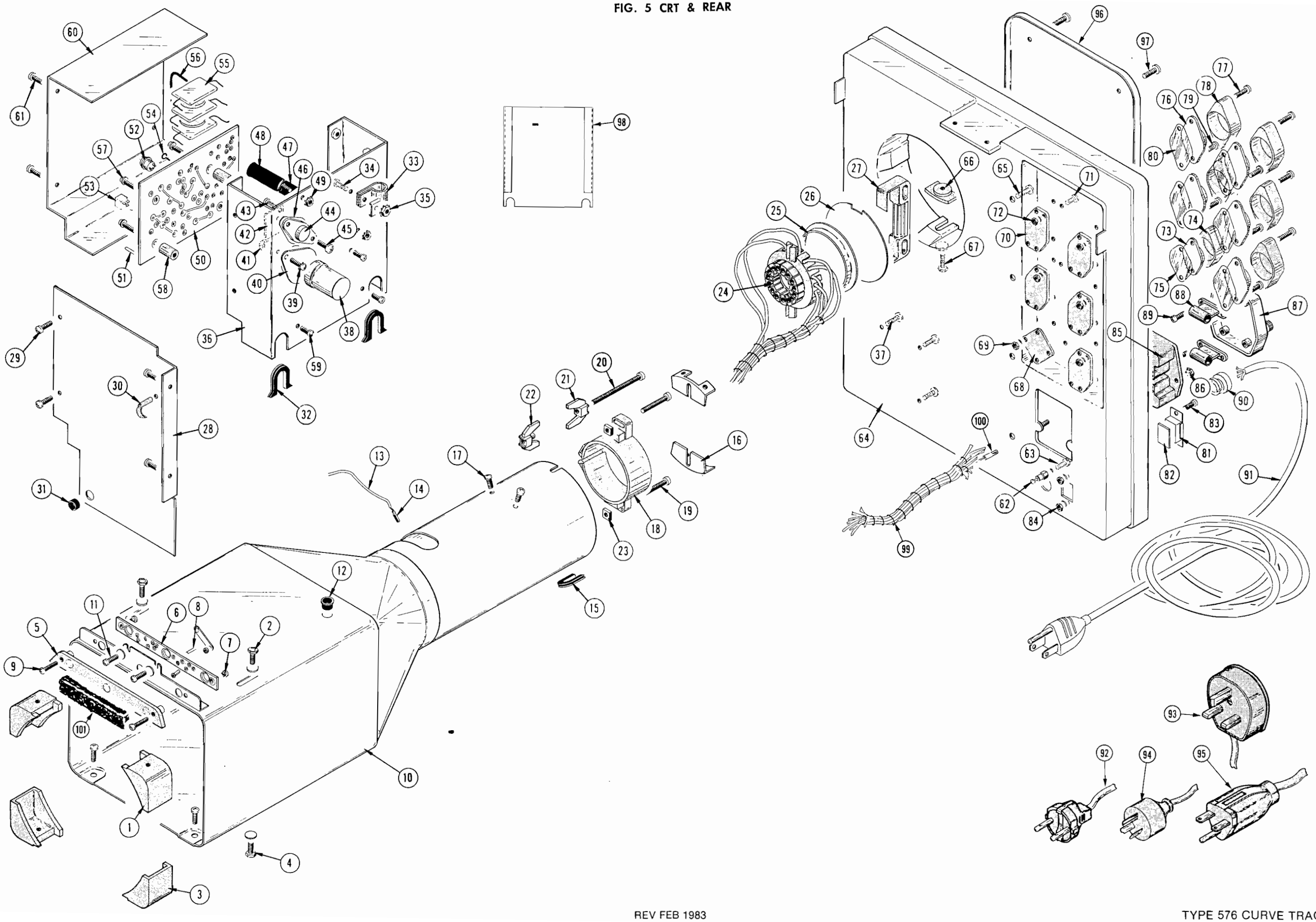


FIG. 6 CABINET

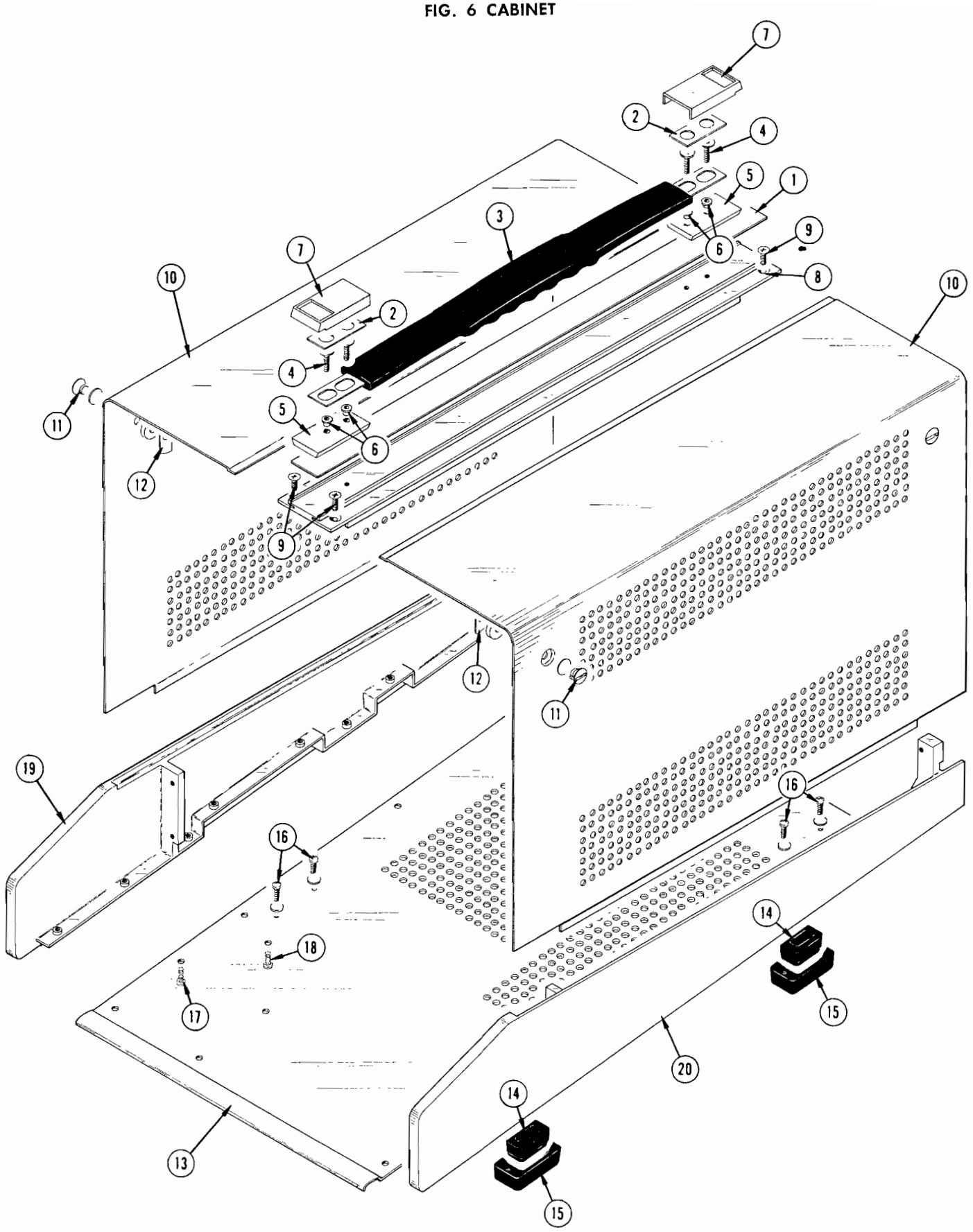


FIG. 6 CABINET

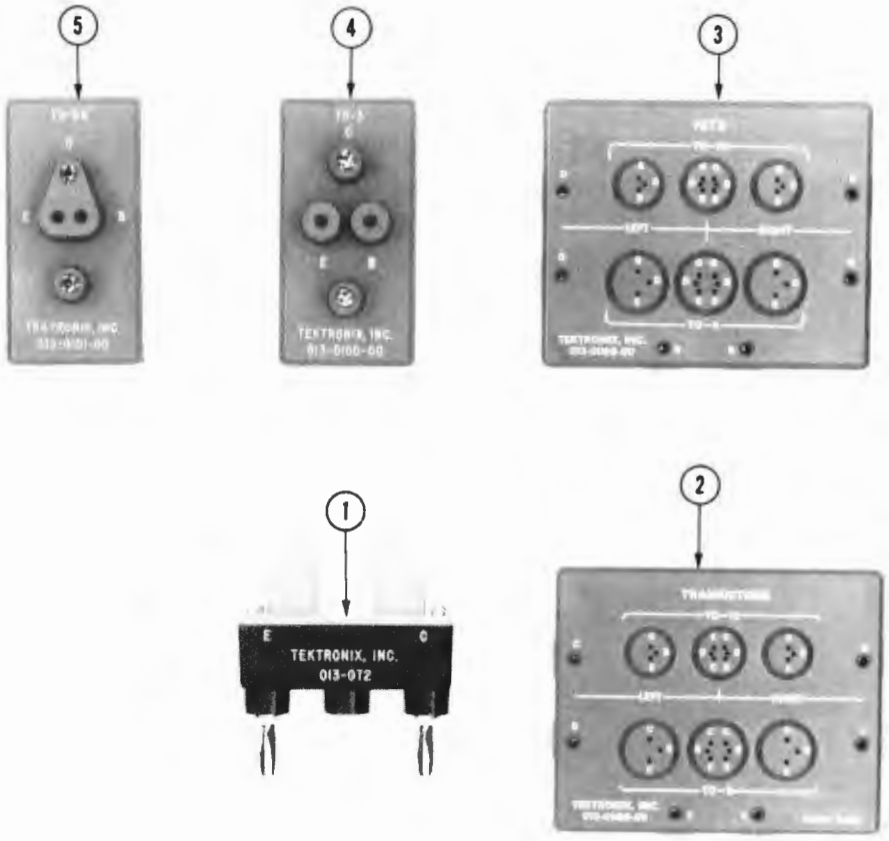


Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
7-1	013-0072-00	B010100	B139999	2		ADAPTER,TEST:DIODE	80009	013-0072-00
	013-0111-00	B140000	B289999	2		ADAPTER,TEST:DIODE	80009	013-0111-00
	013-0111-00	B290000		1		ADAPTER,TEST:DIODE	80009	013-0111-00
-2	013-0098-00	B010100	B149999	1		ADAPTER,TEST:BIPOLAR TRANSISTOR	80009	013-0098-00
	013-0098-01	B150000	B315099	1		ADAPTER,TEST:TRANSISTOR	80009	013-0098-01
	013-0098-02	B315100		1		ADAPTER,TEST:TRANSISTOR	80009	013-0098-02
-3	013-0099-00	B010100	B149999	1		ADAPTER,TEST:FET TRANSISTORS	80009	013-0099-00
	013-0099-01	B150000	B315099	1		ADAPTER,TEST:JUNCTION FET TRANSISTORS	80009	013-0099-01
	013-0099-02	B315100		1		ADAPTER,TEST:JUNCTION FET TRANSISTORS	80009	013-0099-02
-4	013-0100-00	B010100	B289999	2		ADAPTER,TEST:TO-3 TRANSISTOR	80009	013-0100-00
	013-0100-01	B290000		1		ADAPTER,TEST:TO-3 TRANSISTOR	80009	013-0100-01
-5	013-0101-00			1		ADAPTER,TEST:TO-66 TRANSISTOR	80009	013-0101-00
	013-0110-00	XB290000		1		ADAPTER,TEST:DO-4,DO-5 DIODES	80009	013-0110-00
	013-0138-00	XB290000	B325839X	1		ADAPTER,TEST:IN-LINE,LARGE	80009	013-0138-00
	013-0138-01	B325840		1		ADAPTER,TEST:W/KELVIN SENSING	80009	013-0138-01
	013-0139-00	XB290000	B325839X	1		ADAPTER,TEST:IN-LINE,SMALL	80009	013-0139-00
	436-0089-00	B010100	B139999	1		TRAY,TEST ADPT:TOP	80009	436-0089-00
	436-0089-01	B140000	B326370X	1		TRAY,TEST ADPT:TOP	80009	436-0089-01
	436-0090-00	B010100	B139999	1		TRAY,TEST ADPT:BOTTOM	80009	436-0090-00
	436-0090-01	B140000	B326370X	1		TRAY,TEST ADPT:BOTTOM	80009	436-0090-01
	070-0905-01			1		MANUAL,TECH:INSTRUCTION	80009	070-0905-01

MANUAL CHANGE INFORMATION

At Tektronix, we continually strive to keep up with latest electronic developments by adding circuit and component improvements to our instruments as soon as they are developed and tested.

Sometimes, due to printing and shipping requirements, we can't get these changes immediately into printed manuals. Hence, your manual may contain new change information on following pages.

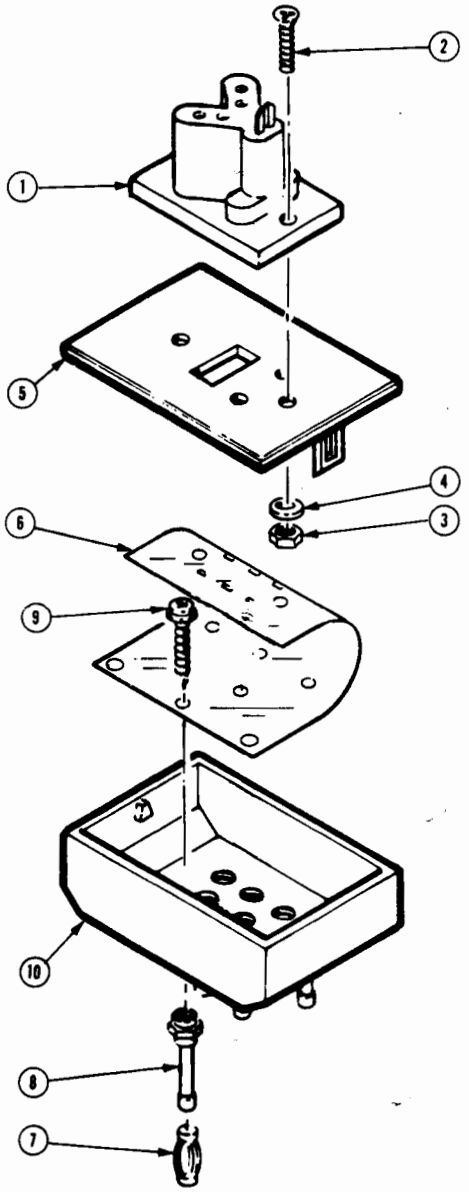
A single change may affect several sections. Since the change information sheets are carried in the manual until all changes are permanently entered, some duplication may occur. If no such change pages appear following this page, your manual is correct as printed.

Tektronix®
COMMITTED TO EXCELLENCE

data sheet

CUSTOMER SERVICES SUPPORT

A1003 for 370
A1003 OPTION 01 for 576 and 577
TO-3/TO-66 ADAPTER



The A1003 and A1003 Option 01 TO-3/TO-66 Adapters differ in that the A1003 is equipped with six interconnect pins which provide Kelvin Sensing for emitter, base, and collector terminals. The A1003 Option 01 is equipped with five interconnect pins which provide Kelvin Sensing for emitter and collector terminals only.

The A1003 may be modified to a five-pin configuration by removal of the extra pin.

Since the A1003 Option 01 is slightly wider than the adapter previously supplied, use of the A1003 Option 01 with a 576 or 577 Curve Tracer may require replacement of the existing protective shield assembly. This is only required when the adapter is installed in the right hand socket. If use of the A1003 Option 01 is kept to the left hand socket, the protective shield need not be replaced. See the Optional Accessories listing for the new protective shield part number.

NO. 062-8512-01
DATE OCT 1986(R)

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-1	136-0853-00			1	SKT,PL-IN ELEK:TO-3 & TO-66	53036	203-0103-00-0605
					(ATTACHING PARTS)		
-2	211-0036-00			2	SCREW,MACHINE:4-40 X 0.5,BDGH,NYL	26365	ORDER BY DESCR
-3	220-0665-00			2	NUT,SLFLKG,HEX:4-40 X 0.25 HEX,NYLON	23050	ORDER BY DESCR
-4	210-1011-00			2	WASHER,FLAT:0.13 ID X 0.375 OD X 0.01,NYL	83309	ORDER BY DESCR
					(END ATTACHING PARTS)		
-5	200-3190-00	8537	8638	1	COVER,ADAPTER:TO-3/TO-66	80009	200-3190-00
	200-3190-01	8639		1	COVER,ADAPTER:TO-3/TO-66	80009	200-3190-01
-6	259-0032-00	8537	8638	1	FLEX CIRCUIT:INTERCONNECT,T03/T066 ADPTR	80009	259-0032-00
	259-0032-01	8639		1	FLEX CIRCUIT:INTERCONNECT,T03/T066 ADPTR	80009	259-0032-01
-7	214-3790-00			6	SPRING,CONTACT:0.470 L,CU BE	80009	214-3790-00
-8	131-3576-00			6	CONTACT,ELEC:0.25 DIA,BRASS	80009	131-3576-00
					(ATTACHING PARTS)		
-9	211-0324-00			6	SCR,ASSEM WSHR:4-40 X 0.188,PNH,T9 TORX DR	01536	829-06780-024
					(END ATTACHING PARTS)		
-10	202-0201-00	8537	8638	1	BOX,TEST ADPTR:2.205 X 1.60 X 0.640	80009	202-0201-00
	202-0201-01	8639		1	BOX,TEST ADPTR:2.205 X 1.6 X 0.64	80009	202-0201-01
					STANDARD ACCESSORIES		
	003-1369-00	8537	8638	1	RLSE TOOL,COVER:POLYCARBONATE	80009	003-1369-00
	062-8512-01			1	DATA SHEET:A1003,TO-31/TO-66 ADAPTER	80009	062-8512-01
					OPTIONAL ACCESSORIES		
	337-1194-02			1	SHIELD,ELEC:TRANSISTOR	80009	337-1194-02

CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

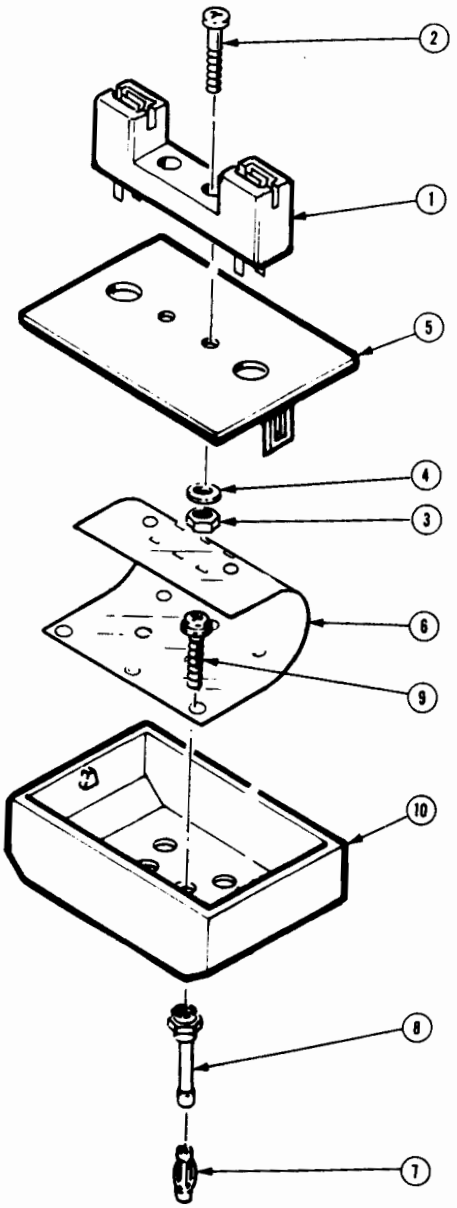
Mfr. Code	Manufacturer	Address	City, State, Zip Code
01536	TEXTRON INC CAMCAR DIV SEMS PRODUCTS UNIT	1818 CHRISTINA ST	ROCKFORD IL 61108
23050	PRODUCT COMPONENTS CORP	30 LORRAINE AVE	MT VERNON NY 10553
26365	GRIES REPRODUCER CO DIV OF COATS AND CLARK INC	125 BEECHWOOD AVE	NEW ROCHELLE NY 10802
80009	TEKTRONIX INC	4900 S W GRIFFITH DR P O BOX 500	BEAVERTON OR 97077
83309	ELECTRICAL SPECIALITY CO SUBSIDIARY OF BELDEN CORP	213 E HARRIS AVE	SOUTH SAN FRANCISCO CA 94080

Tektronix®
COMMITTED TO EXCELLENCE

data sheet

CUSTOMER SERVICES SUPPORT

A1005 DIODE ADAPTER



NO. 062-8514-01
DATE APR 1987 (R)

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-1	136-0852-00			1	SKT,PL-IN ELEK:AXIAL LEAD	53036	202-2483-00-1125
					(ATTACHING PARTS)		
-2	211-0741-00			2	SCREW,MACHINE:6-32 X 0.5,NYLON	83486	ORDER BY DESCR
-3	220-0030-00			2	NUT,PLAIN,HEX:6-32 X 0.305,WHITE NYLON	TK1281	ORDER BY DESCR
-4	210-3057-00			2	WASHER,FLAT:0.17 ID X 0.35 OD X 0.03,NYL	TK1452	ORDER BY DESCR
					(END ATTACHING PARTS)		
-5	200-3188-00	8537	8638	1	COVER,ADAPTER:OFF-SET LEAD	80009	200-3188-00
	200-3188-01	8639		1	COVER,ADAPTER:OFF-SET LEAD	80009	200-3188-01
-6	259-0034-00	8537	8638	1	FLEX CIRCUIT:FLEX INTERCONNECT DIODE ADAPTE R	80009	259-0034-00
	259-0034-01	8639		1	FLEX CIRCUIT:INTERCONNECT DIODE ADAPTER	80009	259-0034-01
-7	214-3790-00			4	SPRING,CONTACT:0.470 L,CU BE	80009	214-3790-00
-8	131-3576-00			4	CONTACT,ELEC:0.25 DIA,BRASS	80009	131-3576-00
					(ATTACHING PARTS)		
-9	211-0324-00	8537	8707	4	SCR,ASSEM WSHR:4-40 X 0.188,PNH,T9 TORX DR	01536	829-06780-024
	211-0292-00	8708		4	SCR,ASSEM WSHR:4-40 X 0.29,PNH,BRS NI PL	78189	51-040445-01
					(END ATTACHING PARTS)		
-10	202-0201-00	8537	8638	1	BOX,TEST ADPTR:2.205 X 1.60 X 0.640	80009	202-0201-00
	202-0201-01	8639		1	BOX,TEST ADPTR:2.205 X 1.6 X 0.64	80009	202-0201-01
					STANDARD ACCESSORIES		
	003-1369-00	8537	8638	1	RLSE TOOL,COVER:POLYCARBONATE	80009	003-1369-00
	062-8514-00	8537	8638	1	DATA SHEET:A1005 DIODE ADAPTER	80009	062-8514-00
	062-8514-01	8639		1	DATA SHEET:A1005 DIODE ADAPTER	80009	062-8514-01

CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

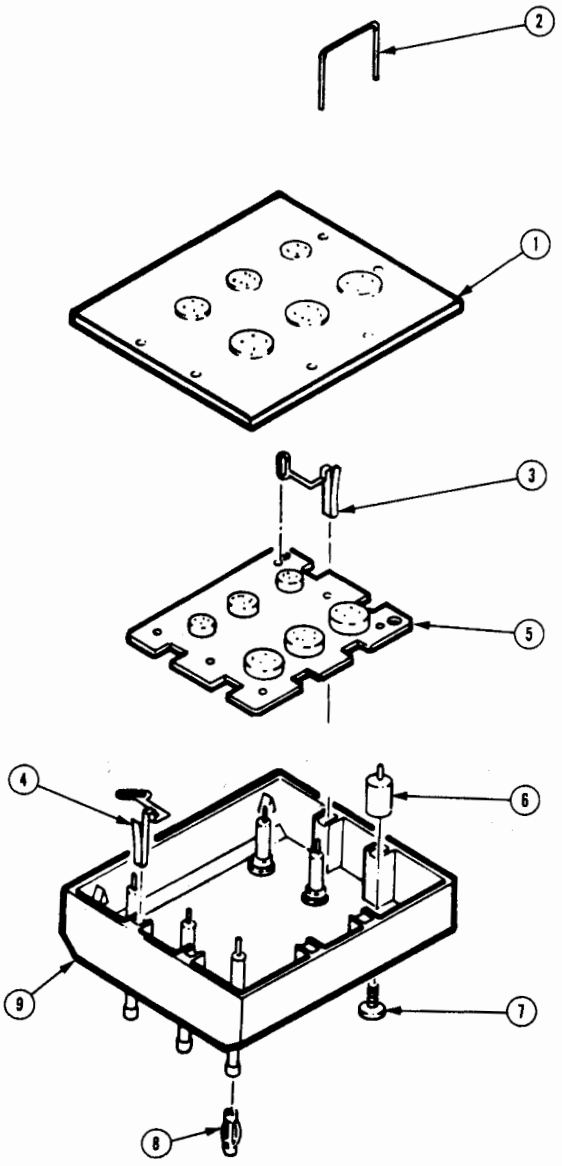
Mfr. Code	Manufacturer	Address	City, State, Zip Code
01536	TEXTRON INC CAMCAR DIV SEMS PRODUCTS UNIT	1818 CHRISTINA ST	ROCKFORD IL 61108
78189	ILLINOIS TOOL WORKS INC SHAKEPROOF DIVISION	ST CHARLES ROAD	ELGIN IL 60120
80009	TEKTRONIX INC	4900 S W GRIFFITH DR P O BOX 500	BEAVERTON OR 97077
83486	ELCO INDUSTRIES INC	1101 SAMUELSON RD	ROCKFORD IL 61101
TK1281	MICRO PLASTICS INC	HWY 178 NORTH	FLIPPIN AR 72634
TK1452	SHELLY-RAGON INC	8219 SW CIRRUS	BEAVERTON OR 97005

Tektronix®
COMMITTED TO EXCELLENCE

data sheet

CUSTOMER SERVICES SUPPORT

A1009 FET 4,6 LEAD ADAPTER



NO. 062-8518-01
DATE OCT 1986 (R)

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-1	200-3176-00	8537	8638	1	COV;TEST ADPTR:DUAL,4 & 6 LEAD FETS	80009	200-3176-00
	200-3176-01	8639		1	COV,TEST ADPTR:DUAL,4 X 6 LEAD FETS	80009	200-3176-01
-2	131-1046-00			1	CONTACT,ELEC:TEST ADPTR,BRS CU-SN-ZN	80009	131-1046-00
-3	131-3442-01			1	CONTACT,ELEC:CU-BE,NI PL,RIGHT,PKG OF 3	80009	131-3442-01
-4	131-3441-01			1	CONTACT,ELEC:BE-CU,NI PL,LEFT,PKG OF 3	80009	131-3441-01
-5	670-9171-00			1	CIRCUIT BD ASSY:DUAL 4 & 6 LEAD FET	80009	670-9171-00
-6	----- -----			1	MOUNT,CKT BOARD: (AVAILABLE ONLY AS PACKAGE OF 5)		
	426-2108-01			1	MOUNT,CKT BOARD:PKG OF 5 (ATTACHING PARTS)	80009	426-2108-01
-7	134-0186-00			1	PLUG,TIP:DUMMY (END ATTACHING PARTS)	80009	134-0186-00
-8	214-3790-00			5	SPRING,CONTACT:0.470 L,CU BE	80009	214-3790-00
-9	202-0199-00	8537	8638	1	BOX,TEST ADPTR:3.006 X 2.50 X 0.640	80009	202-0199-00
	202-0199-01	8639		1	BOX,TEST ADPTR:3.006 X 2.5 X 0.64	80009	202-0199-01
					STANDARD ACCESSORIES		
	003-1369-00	8537	8638	1	RLSE TOOL,COVER:POLYCARBONATE	80009	003-1369-00
	196-3063-00			1	LEAD,ELECTRICAL:20 AWG,8.0 L,2-D	80009	196-3063-00
	062-8518-01			1	DATA SHEET:A1009 4 & 6 LEAD ADAPTER	80009	062-8518-01

CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

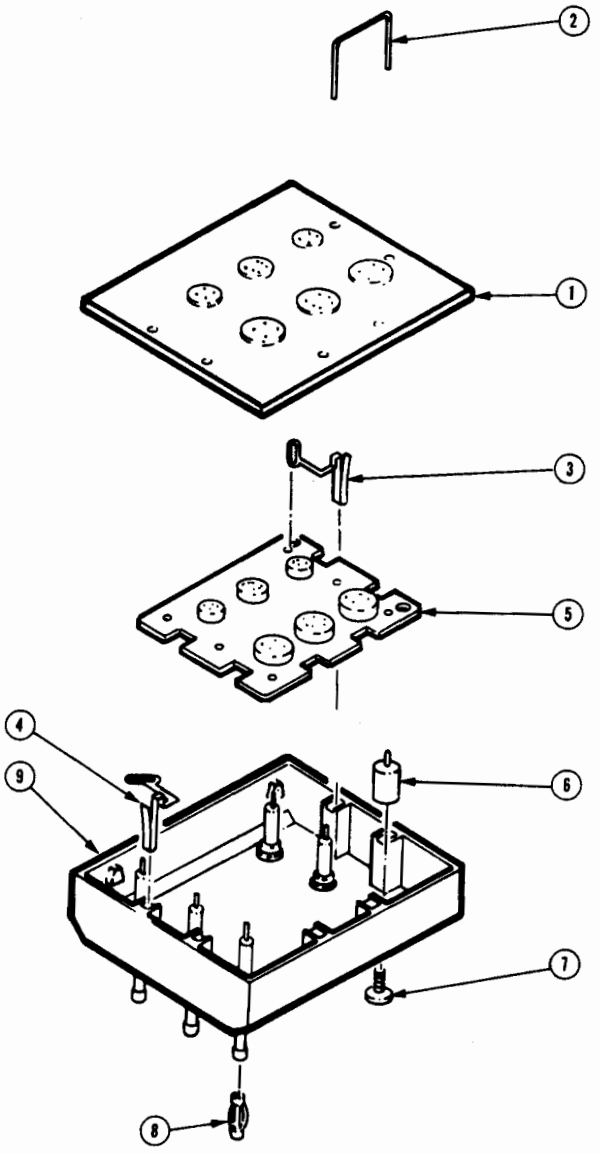
Mfr. Code	Manufacturer	Address	City, State, Zip Code
80009	TEKTRONIX INC	4900 S W GRIFFITH DR P O BOX 500	BEAVERTON OR 97077

Tektronix®
COMMITTED TO EXCELLENCE

data sheet

CUSTOMER SERVICES SUPPORT

A1007 TRANSISTOR 4,6 LEAD ADAPTER



NO. 062-8516-01
DATE APR 1987 (R)

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-1	200-3165-00	8537	8638	1	COV,TEST ADPTR:DUAL,4 & 6 LEAD TRANSISTOR	80009	200-3165-00
	200-3165-01	8639		1	COV,TEST ADPTR:DUAL,4 X 6 LEAD TESTER	80009	200-3165-01
-2	131-1046-00			1	CONTACT,ELEC:TEST ADPTR,BRS CU-SN-ZN	80009	131-1046-00
-3	131-3442-01			1	CONTACT,ELEC:CU-BE,NI PL,RIGHT,PKG OF 3	80009	131-3442-01
-4	131-3441-01			1	CONTACT,ELEC:BE-CU,NI PL,LEFT,PKG OF 3	80009	131-3441-01
-5	670-9170-00			1	CIRCUIT BD ASSY:DUAL 4 & 6 LEAD TRANS	80009	670-9170-00
-6	----- -----			1	MOUNT,CKT BOARD:		
	426-2108-01			1	MOUNT,CKT BOARD:PKG OF 5 (ATTACHING PARTS)	80009	426-2108-01
-7	134-0186-00			1	PLUG,TIP:DUMMY (END ATTACHING PARTS)	80009	134-0186-00
-8	214-3790-00			5	SPRING,CONTACT:0.470 L,CU BE	80009	214-3790-00
-9	202-0199-00	8537	8638	1	BOX,TEST ADPTR:3.006 X 2.50 X 0.640	80009	202-0199-00
	202-0199-01	8639		1	BOX,TEST ADPTR:3.006 X 2.5 X 0.64	80009	202-0199-01
					STANDARD ACCESSORIES		
	003-1369-00	8537	8638	1	RLSE TOOL,COVER:POLYCARBONATE	80009	003-1369-00
	196-3063-00			1	LEAD,ELECTRICAL:20 AWG,8.0 L,2-0	05276	1126-4
	062-8516-00	8537	8638	1	DATA SHEET:A1007 4 & 6 LEAD ADAPTER	80009	062-8516-00
	062-8516-01	8639		1	DATA SHEET:A1007 4 & 6 LEAD ADAPTER	80009	062-8516-01

CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

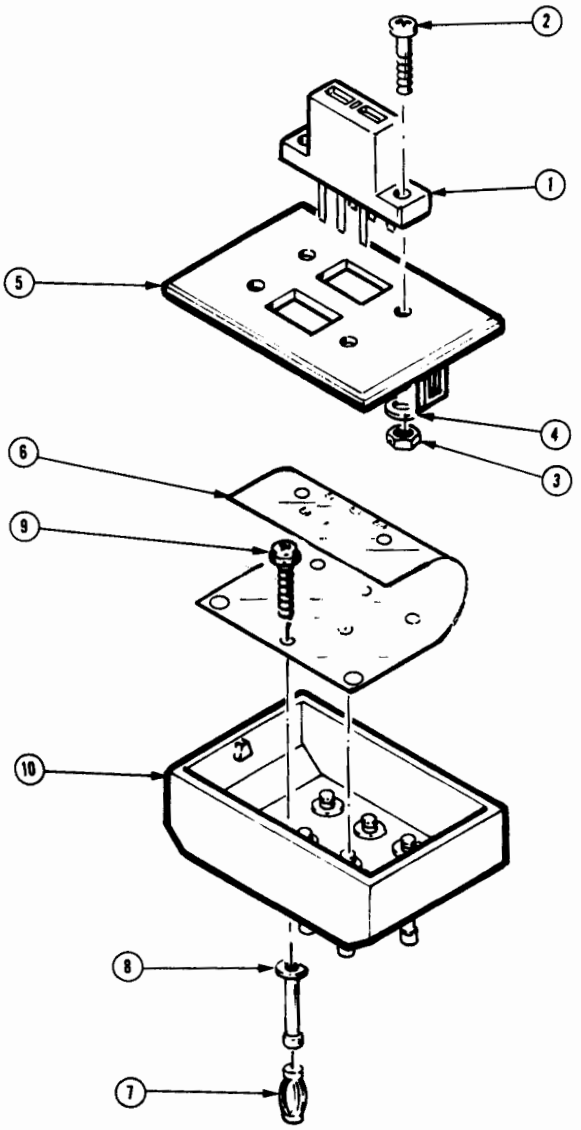
Mfr. Code	Manufacturer	Address	City, State, Zip Code
05276	ITT POMONA ELECTRONICS DIV	1500 E 9TH ST P O BOX 2767	POMONA CA 91766
80009	TEKTRONIX INC	4900 S W GRIFFITH DR P O BOX 500	BEAVERTON OR 97077

Tektronix®
COMMITTED TO EXCELLENCE

data sheet

CUSTOMER SERVICES SUPPORT

A1002 for 370
A1002 OPTION 01 for 576 and 577
KELVIN SENSING IN-LINE ADAPTER



The A1002 and A1002 Option 01 Kelvin Sensing In-line Adapters differ in that the A1002 is equipped with six interconnect pins which provide Kelvin Sensing for emitter, base and collector terminals. The A1002 Option 01 is equipped with five interconnect pins which provide Kelvin Sensing for emitter and collector terminals only.

The A1002 may be modified to a five-pin configuration by removal of the extra pin.

Since the A1002 Option 01 is slightly wider than the adapter previously supplied, use of the A1002 Option 01 with a 576 or 577 Curve Tracer may require replacement of the existing protective shield assembly. This is only required when the adapter is installed in the right hand socket. If use of the A1002 Option 01 is kept to the left hand socket, the protective shield need not be replaced. See the Optional Accessories listing for the new protective shield part number.

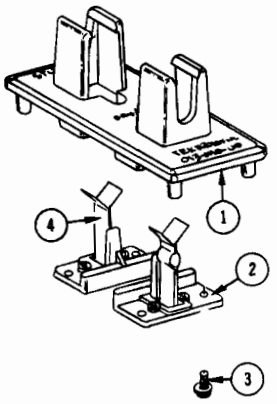
NO. 062-8511-01
DATE APRIL 1987(R)

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-1	136-0677-00			2	SKT,PL-IN ELEK:TRANSISTOR,3 CONTACT	19613	203-2737-00-1225
					(ATTACHING PARTS)		
-2	211-0741-00			4	SCREW,MACHINE:6-32 X 0.5,NYLON	83486	ORDER BY DESCR
-3	220-0030-00			4	NUT,PLAIN,HEX:6-32 X 0.305,WHITE NYLON	TK1281	ORDER BY DESCR
-4	210-3057-00			4	WASHER,FLAT:0.17 ID X 0.35 OD X 0.03,NYL	TK1452	ORDER BY DESCR
					(END ATTACHING PARTS)		
-5	200-3187-00	8537	8638	1	COVER,ADAPTER:IN-LINE LEAD	80009	200-3187-00
	200-3187-01	8639		1	COVER,ADAPTER:IN-LINE LEAD	80009	200-3187-01
-6	259-0031-00	8537	8638	1	FLEX CIRCUIT:INTERCONNECT,IN-LINE ADPTR	80009	259-0031-00
	259-0031-01	8639		1	FLEX CIRCUIT:INTERCONNECT,IN-LINE ADPTR	80009	259-0031-01
-7	214-3790-00			6	SPRING,CONTACT:0.470 L,CU BE	80009	214-3790-00
-8	131-3576-00			6	CONTACT,ELEC:0.25 DIA,BRASS	80009	131-3576-00
					(ATTACHING PARTS)		
-9	211-0324-00	8537	8707	6	SCR,ASSEM WSHR:4-40 X 0.188,PNH,T9 TORX DR	01536	829-06780-024
	211-0292-00	8708		6	SCR,ASSEM WSHR:4-40 X 0.29,PNH,BRS NI PL	78189	51-040445-01
					(END ATTACHING PARTS)		
-10	202-0201-00	8537	8638	1	BOX,TEST ADPTR:2.205 X 1.60 X 0.640	80009	202-0201-00
	202-0201-01	8639		1	BOX,TEST ADPTR:2.205 X 1.6 X 0.64	80009	202-0201-01
					STANDARD ACCESSORIES		
	003-1369-00	8537	8638	1	RLSE TOOL,COVER:POLYCARBONATE	80009	003-1369-00
	062-8511-00	8537	8638	1	DATA SHEET:A1002 IN-LINE ADAPTER	80009	062-8511-00
	062-8511-01	8639		1	DATA SHEET:A1002 IN-LINE ADAPTER	80009	062-8511-01
					OPTIONAL ACCESSORIES		
	337-1194-02			1	SHIELD,ELEC:TRANSISTOR	80009	337-1194-02

CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
01536	TEXTRON INC CAMCAR DIV SEMS PRODUCTS UNIT	1818 CHRISTINA ST	ROCKFORD IL 61108
19613	MINNESOTA MINING AND MFG CO TEXTOOL PRODUCTS DEPT ELECTRONIC PRODUCT DIV	1410 E PIONEER DR	IRVING TX 75061
78189	ILLINOIS TOOL WORKS INC SHAKEPROOF DIVISION	ST CHARLES ROAD	ELGIN IL 60120
80009	TEKTRONIX INC	4900 S W GRIFFITH DR P O BOX 500	BEAVERTON OR 97077
83486	ELCO INDUSTRIES INC	1101 SAMUELSON RD	ROCKFORD IL 61101
TK1281	MICRO PLASTICS INC	HWY 178 NORTH	FLIPPIN AR 72634
TK1452	SHELLY-RAGON INC	8219 SW CIRRUS	BEAVERTON OR 97005

TEST ADAPTER
(Part No. 013-0110-00)



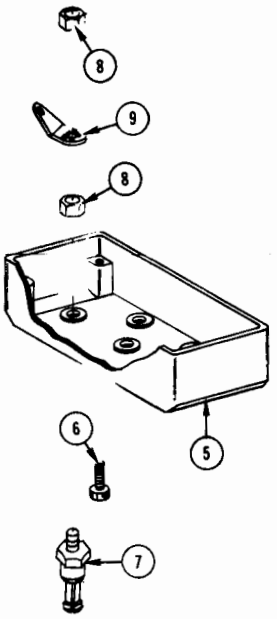


Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty 1 2 3 4 5	Description
	013-0110-00			1	TEST ADAPTER, DO-4, DO-5 diodes
	- - - - - -			-	test adapter includes:
1	200-1100-02			1	COVER, test adapter
2	352-0245-02			1	HOLDER, contact
	- - - - - -			-	mounting hardware: (not included w/holder)
3	211-0180-00			2	SCREW, sems, 2-56 x 0.25 inch, PHS
4	352-0245-01			1	HOLDER, contact
	- - - - - -			-	mounting hardware:
	- - - - - -			-	(not included w/holder)
	211-0180-00			2	SCREW, sems, 2-56 x
	- - - - - -			-	0.25 inch, PHS

DATA SHEET

NO. 062-1209-00

DATE MAR. 1973(R)

TEST ADAPTER
(Part No. 013-0110-00)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	Description
5	202-0176-00			1	BOX, test adapter
	- - - - - -			-	mounting hardware: (not included w/box)
6	213-0214-00			4	SCREW, 2-56 x 0.375 inch, CHS
7	134-0128-00			4	PLUG, tip
	- - - - - -			-	mounting hardware for each: (not included w/plug)
8	210-0407-00			2	NUT, hex., 6-32 x 0.25 inch
9	210-0202-00			1	LUG, solder, SE #6