

# INSTRUCTION MANUAL

Serial Number *B030407*

Copyright © 1967 by Tektronix, Inc.,  
Beaverton, Oregon. Printed in the United  
States of America. All rights reserved.  
Contents of this publication may not be  
reproduced in any form without permission  
of the copyright owner.

**TYPE  
81A  
PLUG-IN ADAPTER**

*Tektronix, Inc.*

S.W. Millikan Way ● P. O. Box 500 ● Beaverton, Oregon 97005 ● Phone 644-0161 ● Cables: Tektronix

070-0751-00

767

Type 81A

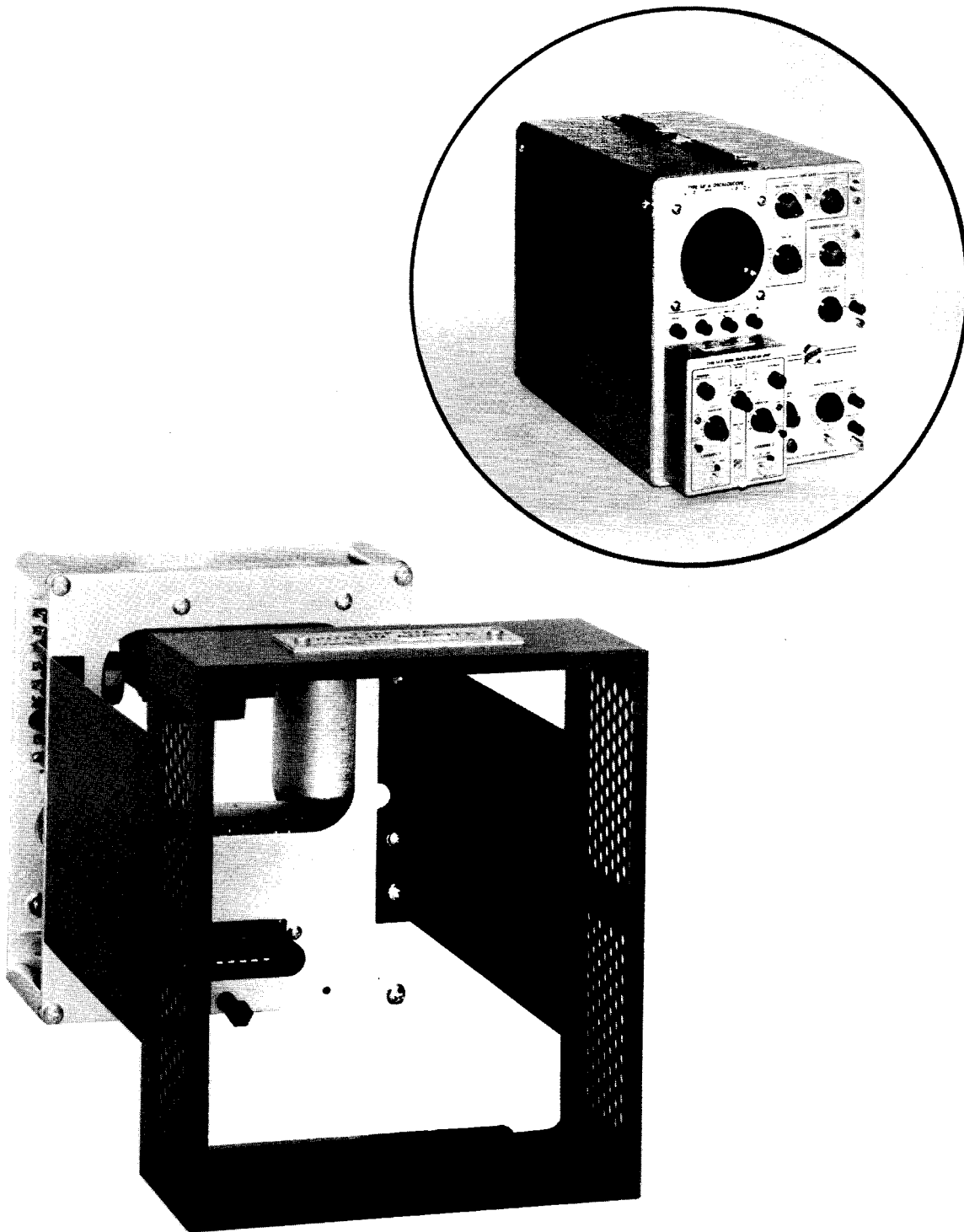


Fig. 1. Type 81A Plug-In Adapter.

# CHARACTERISTICS AND OPERATING INSTRUCTIONS

## Introduction

The Type 81A Plug-In Adapter makes the 580-series Oscilloscopes compatible with more than twenty Tektronix letter-series and 1-series plug-in units. The following categories of operation are thereby available:

Single Trace Amplifier	DC to 30 MHz
Dual Trace Amplifier	DC to 50 MHz
Four Trace Amplifier	DC to 50 MHz
Differential Amplifier	DC to 50 MHz
Differential Amplifier and Comparator	DC to 50 MHz
Operational Amplifier	DC to 25 MHz
Transducer and Strain Gage	DC to 6 kHz
Spectrum Analyzer	to 10.5 GHz
Sampling	to 3.9 GHz

Characteristics of individual plug-in units are listed in detail in the Tektronix catalog. Contact the Tektronix Representative or Field Office for additional information.

## Electrical Characteristics

Table 1 contains the electrical characteristics of the Type 81A Plug-In Adapter and the Tektronix 067-0521-00 Calibration Fixture combination except where noted otherwise. These characteristics permit operation up to the full capability limits of 1-series and letter-series plug-in units. Environmental characteristics are also included in Table 1.

## Physical Characteristics

The Type 81A Plug-In Adapter is made up of solid state circuitry mounted on a chassis whose approximate dimensions are 5½ inches × 6½ inches × 2½ inches. This chassis connects between applicable oscilloscopes and plug-in units. An attached plug-in shield extends beyond the oscilloscope by an amount equal to the thickness of the plug-in adapter chassis. The shield has a blue finish to match the equipment with which it is used. Overall dimensions of the chassis and shield are 12¼ inches long × 5⅞ inches wide × 7 inches high.

## Accessories

Standard accessories for the Type 81A Plug-In Adapter consist of two instruction manuals (070-0751-00).

## Operating Instructions

### WARNING

Voltages as high as 350 V are present in the plug-in compartment of an energized 580-series Oscilloscope.

To use the Type 81A Plug-In Adapter, insert it into the plug-in compartment of a de-energized 580-series Oscilloscope. Fasten it in place by turning the securing shaft clockwise. The adapter must be completely seated for proper operation. A plug-in unit can then be inserted and fastened to the adapter by tightening the plug-in securing knob. The plug-in sensing switch on the adapter is mechanically ac-

TABLE 1

Electrical and Environmental Characteristics

Characteristic	Performance Requirement	Supplemental Information
Bandwidth	50 MHz	Checked with 1A2 or other appropriate plug-in unit
Transient Response		Calibration Fixture set at +Pulse and Med Repetition Rate
Risetime	≤ 6 ns	
Aberration	≤ + or - 1.5%; ≤ 1.5% peak-to-peak	
Gain Accuracy	Within ±3%	
Alternate Trace Sync	Provide alternate traces when used with plug-in units operating in alternate mode	Checked with 1A2 or other appropriate plug-in unit
Warm-up time	None required for noncritical use	20 minutes required for rated accuracies at 25° C ±5° C
Temperature Range		
Operating	0° C to +50° C	
Nonoperating	-40° C to +65° C	
Altitude Range		
Operating	To 15,000 feet	
Nonoperating	To 50,000 feet	

## Type 81A

tivated by certain plug-in units when the securing knob is tightened.

Circuit design allows exchanging of plug-in units while the oscilloscope and Type 81A Plug-In Adapter are energized.

No Type 81A Plug-In Adapter controls are associated with routine operation, although internal adjustments are provided for calibration purposes.

The adapter can be removed from the oscilloscope by reversing the insertion procedure.

# CIRCUIT DESCRIPTION

## Block Diagram Discussion

The Type 81A Plug-In Adapter contains the following circuitry:

- Vertical Amplifier
- Grid Line Termination
- Alternate Trace Sync Pulse Amplifier
- +75-V Power Supply

In addition, the adapter contains decoupling circuits for all voltages which are routed through it. See Fig. 2.

## Vertical Amplifier

Refer to the schematic contained near the back of this manual. The vertical amplifier circuitry adapts the output impedance and voltage level of any 1-series or letter-series plug-in unit to the input impedance and voltage level of the oscilloscope. It is made up of a transient response compensation circuit (R8, C8 and SW8), a high input impedance Field Effect Transistor (FET) circuit (Q11, Q12), and a low output impedance amplifier circuit (Q20, Q28, Q30, Q38). The overall circuit gain is approximately one, and is adjustable for calibration purposes.

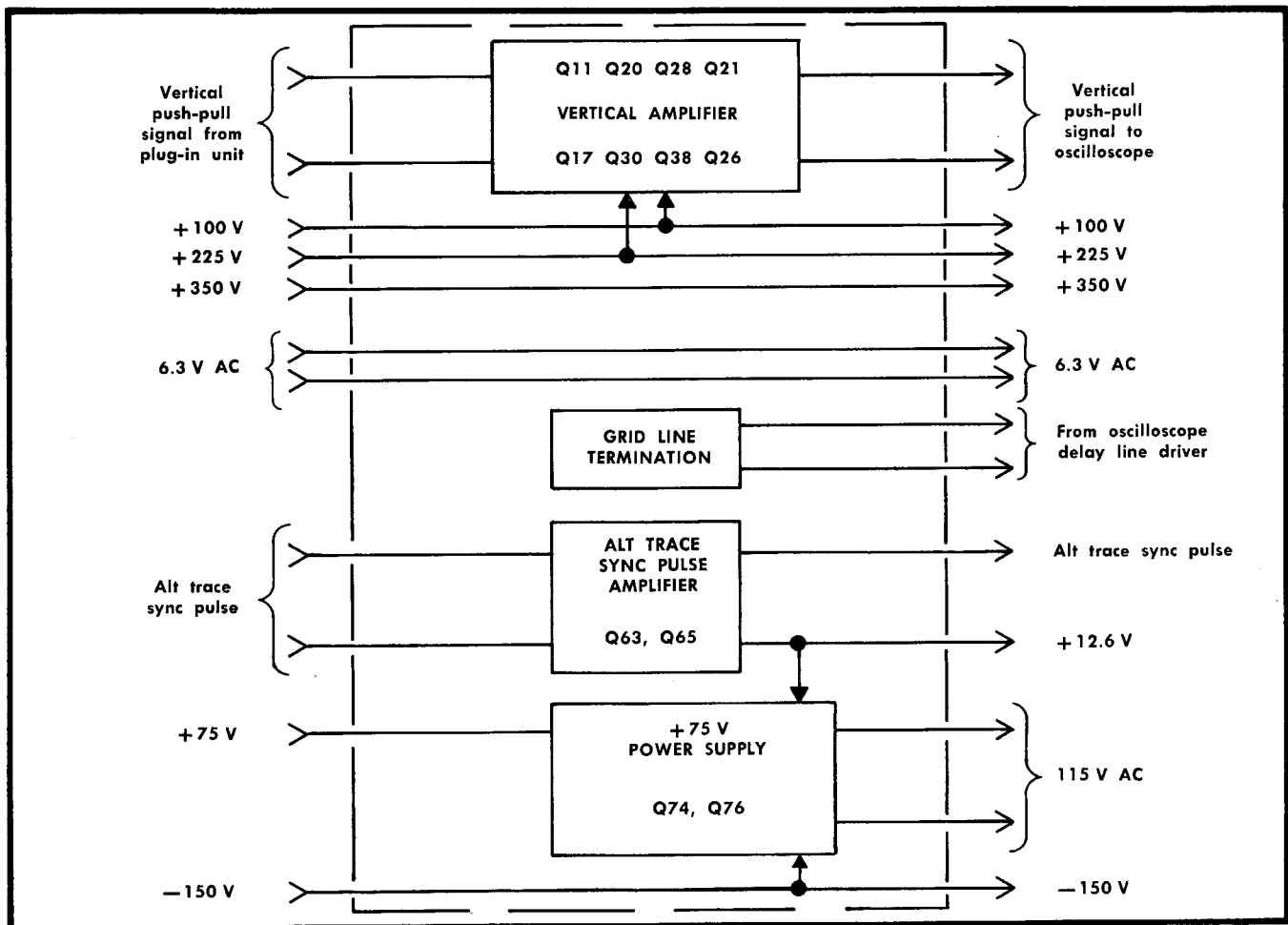


Fig. 2. Type 81A Plug-In Adapter simplified block diagram.

### Transient Response Compensation Components

R8, C8 and SW8 correct for the difference in transient response between certain plug-in units. The chassis of any plug-in unit which requires this circuit is designed to close SW8 when the plug-in unit is inserted into the Type 81A Adapter and the securing knob is tightened.

### Input Circuit

The plug-in output voltage and signals appear at terminals 1 and 3 of the plug-in interconnecting socket and are applied to the gates of Q11 and Q17. The operation of these N-channel Field Effect Transistors (FETs) is similar to that of triode vacuum tubes, with the gate, source, and drain comparing to grid, cathode, and plate respectively. As in vacuum tubes, the gate is negative with respect to the source for class A Amplifier applications. This results in extremely low gate current, providing a high impedance input. See Fig. 3.

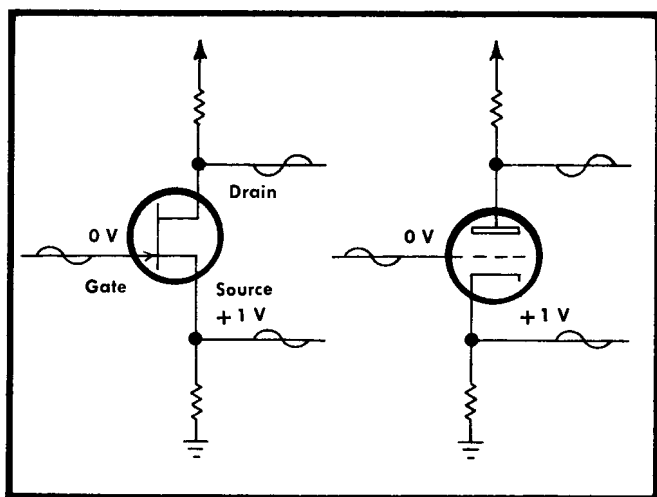


Fig. 3. Comparison between vacuum tube and N-channel field effect transistor circuitry.

Refer back to the schematic. The relatively high impedance between the FET source and ground causes the source voltage level to change in step with the gate voltage, maintaining proper bias conditions.

In typical cathode-follower fashion, signals are developed at the sources of Q11 and Q17, and applied to the bases of amplifiers Q20 and Q30. The FET drains are both returned to approximately +80 V, which is provided by dropping 20 V of the +100-V supply across Zener diode D13 and normally saturated transistor Q21. R15, DC BAL, is adjusted to balance the two halves of the amplifier unit.

Circuit protection is provided by D10, D11, D17, R10, R21 and Q21. The junction of D10 and R21 is clamped to approximately 100.4 V by the emitter-base junction of saturated transistor Q21. When no plug-in unit is inserted into the Type 81A Adapter, the gate leakage current of Q11 and Q17 passes through D11, D17, D10 and R21.

The Zener action of D10 clamps the gates of Q11 and Q17 to approximately +56 V, thus holding the voltage across circuit components within design limits.

At the instant a plug-in unit is inserted into the Type 81A Adapter, initial voltage difference causes current to surge between the plug-in unit and the adapter. This (conventional) current flows from the +225-V supply through R21, D10, D11 and D17 to the low potential which is initially present at pins 1 and 3 of the plug-in unit.

The current through R21 decreases the emitter-base current of Q21, taking it out of saturation. The resulting voltage drop across Q21 decreases the amplifier's +80-V supply. Since the circuit supply voltage decreases in step with the sudden decrease at the input, voltages across components remain within nondestructive limits.

When a plug-in unit is in use, R10 allows sufficient current to flow through D10 to hold the voltage at the D11-D17 junction at approximately 57 V, thus insuring that D11 and D17 remain off.

### Output Circuit

Refer to Fig. 4. Under quiescent conditions, the bases of Q20 and Q30 are at equal potentials, as determined by the source circuits of Q11 and Q17. This places the emitters of Q20 and Q30 at equal potentials, and the constant current supplied by the Q26, R25 and R26 circuit is divided evenly between the two halves of the output circuit. Equal currents therefore flow through R28 and R38, establishing balanced voltages of approximately +49 V at output pins 11 and 9.

During balanced conditions, no current flows through R46, R47 or the oscilloscope vertical amplifier input circuit. Under signal conditions, the voltages at the collectors of Q28 and Q38 change an equal amount, but in opposite directions. This unbalance causes current to flow through R46, R47 and the oscilloscope vertical amplifier input circuit, effectively placing those circuits in parallel with R28 and R38.

With one side increasing in voltage and the other decreasing, the point midway along the resistance separating the two collectors remains unchanged and can be referred to as a signal virtual ground.

The output DC signal-developing load for Q28 is therefore made up of R28 in parallel with one half the sum of R46 and R47, in parallel with R50. Since Q28 output signal current also flows through the emitter circuit of Q20, the DC voltage gain of the Q20-Q28 stage is approximately equal to the output signal DC load resistance divided by the Q20 emitter circuit DC resistance.

The same explanation applies to the Q30 side of the amplifier. The overall circuit gain is approximately 1, depending upon the effective resistance of the GAIN potentiometer, R46.

Q28, C27, R27, Q38, C37 and R37, in addition to lowering the operating voltage across Q20 and Q30, facilitate thermal compensation for those two transistors. The quiescent operating voltage of different types of plug-in units may differ by several volts. This causes the emitter DC levels of Q20 and Q30 to vary according. A large percentage of the Q20 and Q30 quiescent emitter voltage is coupled through R40, bootstrapping the bases of Q28 and Q38. The emitters of Q28 and Q38 follow their base voltages. This causes the voltage across R27-Q20 and that across R37-Q30 to remain fairly constant, despite changes in quiescent

## Type 81A

operating voltages. The circuit is designed to set the voltages across Q20 and Q30 approximately equal to that across R27 and R37 to complete the thermal compensation requirements.

As previously stated, different types of plug-in units may operate at different quiescent output DC voltage levels. If the differences are allowed to affect the current through R28 and R38 by an appreciable amount, the quiescent DC output voltage of the Type 81A Adapter will change. Although a certain amount of DC operating level shift can be tolerated by the 580-series Oscilloscopes, it should be kept to a minimum for optimum operation.

The constant current circuit (Q26, R25 and R26) makes the quiescent output voltage relatively independent of the quiescent value of DC input voltage.

The base voltage of Q26 is set at approximately +80 volts by Zener diode D13. The emitter of Q26 is therefore clamped at approximately 80.6 V. The 19.4 V across R25 and R26 dictates the current through them and the output amplifier circuit, regardless of the value of quiescent input voltage.

Refer back to the Type 81A Adapter schematic. Transient response of the output circuit is optimized by the action of R23, C23, R20, C20, R30, C30 and C31.

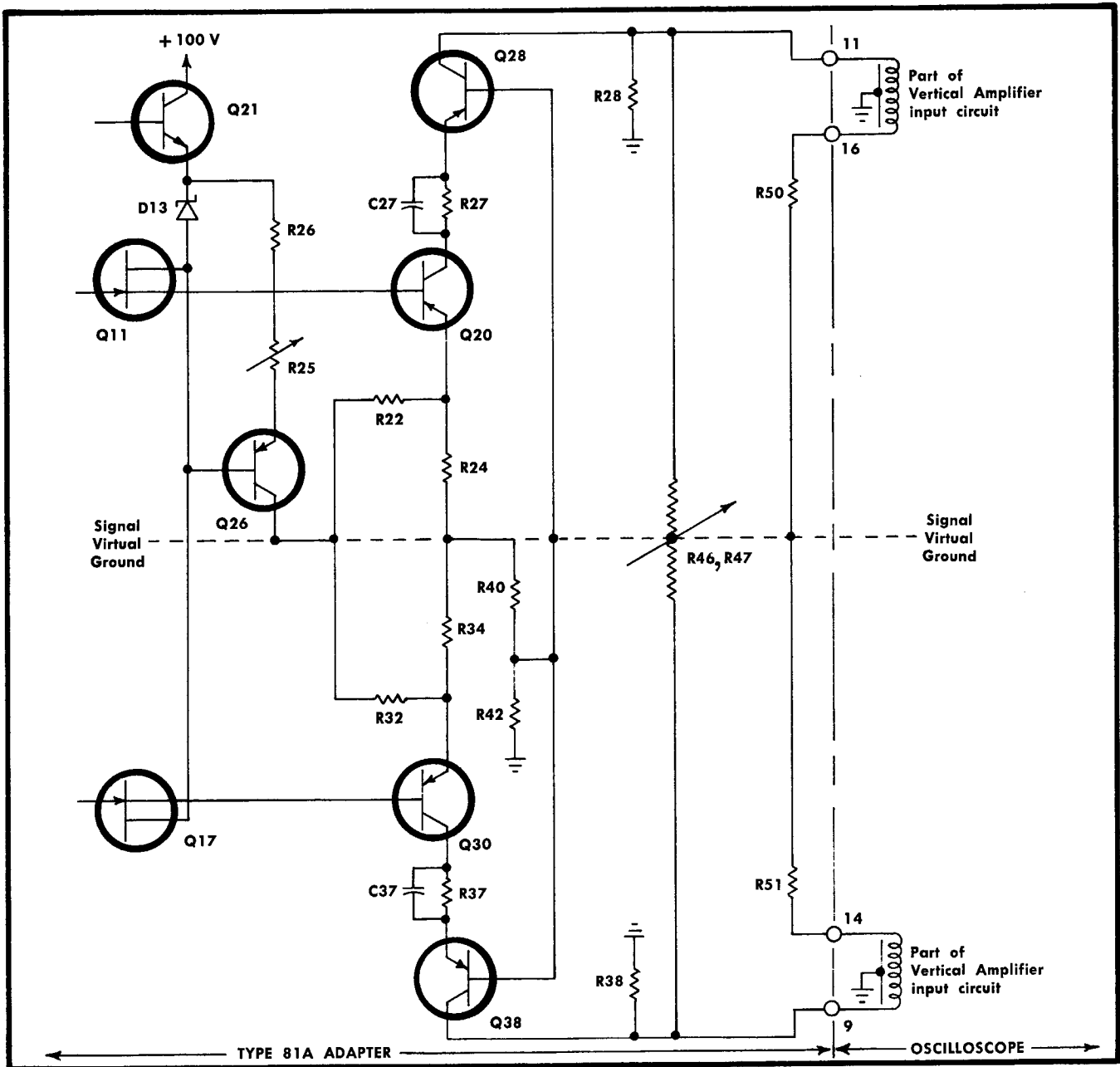


Fig. 4. Vertical Amplifier output circuit; simplified.

## Grid Line Termination

Termination for the oscilloscope's vertical amplifier delay line grid driver circuit is normally accomplished by components in an 80-series plug-in unit. When a letter-series or 1-series plug-in is used, the grid line termination is not available in the plug-in unit and must be provided by the Type 81A Adapter. R50, R51 and C50 perform this function.

## Alternate Trace Synchronization Circuit

A plug-in operating in alternate trace mode switches the CRT display from one vertical input to the other each time a horizontal sweep is completed. The pulse which triggers this switching is developed by the Q63-Q65 circuit. At the end of each horizontal sweep a positive pulse from the oscilloscope is applied through terminal 7 to the base of Q65. The Q63-Q65 circuit then develops a positive pulse voltage at the emitter of Q65 and a negative current pulse at the collector of Q63. The individual plug-in circuitry determines which pulse(s) is actually used.

The voltage at pin 16 of the plug-in connector may be as high as 350 volts in some applications. Connecting the base of Q63 to the +12.6-V supply insures that the voltage distribution across the two transistors remains within design limits.

## Power Supplies

The oscilloscope +100-V power supply capabilities are increased within the Type 81A Adapter by shunting current from the +225-V supply through R55 to the +100-V supply.

The 6.3-V AC supply is referenced to +100 volts through R57. Vacuum tube filament-to-cathode leakage within plug-in units is thereby kept to a minimum.

A +75-V supply is developed within the Type 81A Adapter by adding a regulated +62.4-V supply to the oscilloscope +12.6-V DC power supply. See Fig. 5.

The base voltage of Q76 is set by the R76, R78 and R79 voltage divider. The base voltage of Q74 is fixed primarily by the +12.6 V supply voltage connected to its emitter. Regulation of the +75-V supply is accomplished by controlling the base-emitter current of Q74. For example, if a change of plug-in units causes the +75-V load to decrease, the +75-V supply tends to increase. This increase causes a positive signal to be applied at the base of Q76, decreasing the current through Q76. At the same time, the increase in voltage across R74 demands more current. The combination of decreased current through Q76 and increased current demand through R74 requires a decrease in current through Q74 and therefore through the +75-V load. This regulation of current keeps the 75-V output within design limits.

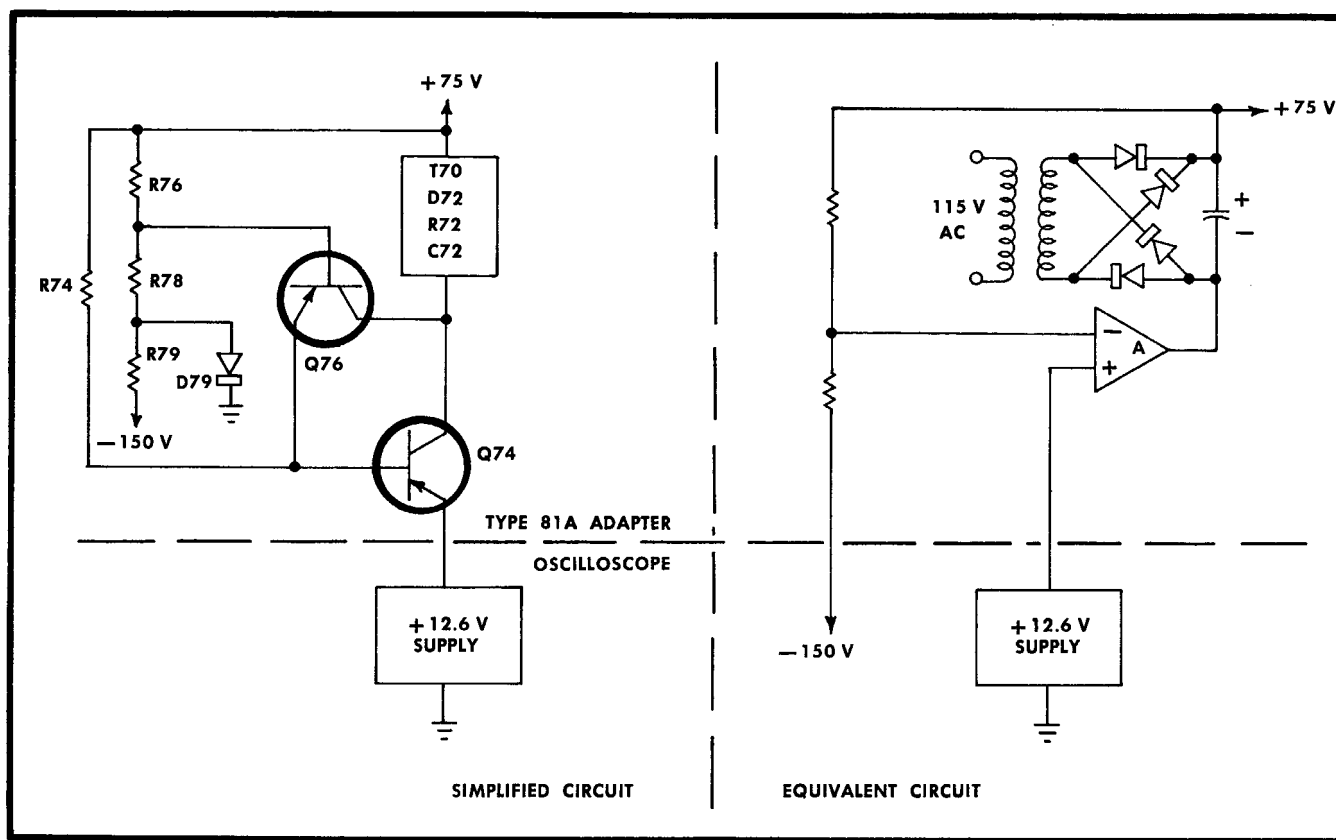


Fig. 5. +75-V Power Supply; simplified circuit and equivalent circuit.

## Type 81A

Protection against breakdown of Q76 and Q74 during oscilloscope warm up is provided by D79. The -150-V supply is not available until the oscilloscope time delay relay activates. Until then, the -150-V supply line is effectively 0V. Without D79, the voltage at the base of Q76 would rise to about +60V and the voltages across Q74 and Q76 would be excessively high. D79 bypasses

R79 during warm up and limits the base voltage of Q76 to about +20V, thus keeping the voltages across Q76 and Q74 within safe values.

C71 (in the secondary of T70) suppresses transient voltages which would otherwise be coupled in to the power supply through T70.

## MAINTENANCE

Maintenance of the Type 81A Plug-In Adapter consists of Routine Maintenance and Corrective Maintenance.

### Routine Maintenance

Routine maintenance should be performed every 500 operating hours or every six months, whichever occurs first. Routine maintenance includes cleaning, physical inspection and calibration.

**Cleaning.** Use a small soft-bristled brush to loosen and remove accumulated dirt. Stubborn dirt can be removed

with a soap and water solution applied with a small cotton-tipped swab. A vacuum cleaner or a stream of low pressure air is also effective in removing loose dirt. Solvents or high pressure air should not be used.

**Physical Inspection.** When inspecting the unit, look for improperly seated transistors, damaged components, poor connections and any other abnormal conditions. In event heat-damaged components are found, the cause of the damage should be determined and corrected. This may mean checking into the circuitry of plug-in units and oscilloscopes with which the Type 81A Adapter has been used.

Transistor Number	Installed View	Top View of Base	Bottom View of Transistor
Q21 Q63 Q76			
Q28 Q38 Q65			
Q20 Q26 Q30			
Q11 Q17			

Fig. 6. Transistor installation.



**Transistor Checks.** Checking of transistors as a routine maintenance function is not recommended. They are adequately checked by the calibration procedure. Any that are unsatisfactory will be detected at that time.

**Calibration.** After the adapter has been cleaned and checked, it should be recalibrated. Refer to the Calibration section of this manual for complete instructions.

## Corrective Maintenance

When sub-standard results are obtained from the Type 81A Plug-In Adapter, corrective maintenance must be performed. This consists of troubleshooting, repair and recalibration. (In addition, it is recommended that the unit be cleaned and inspected during the troubleshooting procedure.)

**Troubleshooting Hints.** The following troubleshooting hints are intended to aid in troubleshooting the Type 81A Plug-In Adapter.

A fast method of isolating a malfunction to a specific unit is to determine the operability of each unit when used with other equipment. This method determines the malfunctioning unit by process of elimination, but is not always possible because of the additional equipment required.

After isolating a casualty to the Type 81A Plug-In Adapter, troubleshooting it consists of taking voltage readings, checking sync pulse output waveforms and checking operation of the vertical amplifier circuit. Resistor values (in ohms unless otherwise noted) and typical waveforms (actual photographs) are included on the schematic diagram which is contained near the back of this manual. Transistor installation information is provided in Figure 6. Component locations and wire color codes are shown in Figures 7 and 8.

Troubleshooting the Type 81A Plug-In Adapter can be done most conveniently by connecting a flexible extension, Tektronix Part No. 012-0038-00, between the oscilloscope and the Plug-In Adapter.

### WARNING

1. Never connect a 1-series or letter-series plug-in unit to a flexible extension cable that is connected directly to a 580-series Oscilloscope. Never connect an 80-series plug-in unit to a flexible extension cable that is connected to the Type 81A Plug-In Adapter. Either combination will elevate the plug-in chassis to +100 volts, and will also cause immediate destruction to components in both the oscilloscope and plug-in unit.

2. Use extreme care when working around exposed live circuit.

The vertical amplifier circuit is a balanced, push-pull circuit. With a balanced input, voltages at corresponding points on the two sides of the amplifier should be approximately equal.

The ease of substitution makes transistor replacement a rapid means of troubleshooting once a casualty has been isolated to a specific circuit. However, if this method is used, the following precautions should be observed:

Use only known-good replacements.

Make certain that the circuit is safe for the replacement.

Return good transistors to their original sockets.

Multiple casualties may sometimes cause the substitution method to fail, even though a transistor is actually bad. Therefore, do not rely on transistors being good until a circuit check confirms that they are.

Normal N-channel FET gate voltage with respect to source voltage varies approximately from  $-0.1$  to  $-2$  V between different FETs.

The emitter-base junction of transistors used in the Type 81A Plug-In Adapter should be forward biased by approximately 0.7 V.

The types and accuracies of resistors found in this instrument vary in accordance with the circuit needs. Composition, metal film and wire-wound resistors are used. Replacement resistors should be of the same type and must be at least as accurate as those originally contained in the circuit. The size, location and lead length are often critical because of frequency considerations.

Disc and small electrolytic capacitors used in the Type 81A have the capacitive value marked in microfarads on the component body. White ceramic capacitors are color-coded in picofarads, using a modified IEEE code.

Glass diodes are color coded to identify their type and polarity. A blue band on the negative (cathode) end indicates that the next three bands translate to the last three digits of a Tektronix stock number.

Use discretion when using an ohmmeter for troubleshooting. Circuit or component resistance readings will vary considerably because of the presence of semiconductor devices. In addition, excessive ohmmeter voltage or current may damage diodes and transistors. Ohmmeter voltage and current should be kept at 1.5 V and below 2 mA respectively. Using the  $\times 1$  k scale on most ohmmeters will provide values within these limits. If doubt exists, measure the voltage and current before using the ohmmeter.

Good components which were removed for troubleshooting purposes should be returned to their original locations.

## Component Replacement

### Removal of Amplifier Board

Before removing the Amplifier Board, check the wire color code against Fig. 8. Using long, slender needle-nose pliers, disconnect the square pin connectors from the board. Remove the four securing screws from the board. Pull the board out the Q63 side of the chassis.

### Transistor Q74

Q74 has its collector connected to the case. The transistor is mounted on a mica insulator and the securing screws and nuts are insulated from chassis ground. Maximum heat transfer is accomplished by applying silicone grease to both sides of the mica insulator. When replacing Q74, insure that all insulators are in place and that silicone grease is used.

## Type 81A

### Parts Procurement

All parts used in this instrument can be purchased through Tektronix Field Offices or Representatives. However, replacements for standard electronic items can be obtained readily from local electronic parts stores. Before purchasing, consult the Electrical Parts List in this manual to determine the required specifications.

#### NOTE

When selecting replacement parts, it is important to remember that the physical size and shape of a component may affect its performance at high

frequencies. All replacement parts should be direct replacements unless it is known that a different component will not adversely affect instrument performance.

**Special Parts.** Some electrical parts are specially reworked, quality-checked, or manufactured by or for Tektronix to fulfill a specific requirement. Most mechanical parts used are common to Tektronix instruments only, or to a particular type of instrument. All electrical parts whose stock numbers are preceded by asterisks, and most mechanical parts, can therefore be obtained only through Tektronix Field Offices or Representatives.

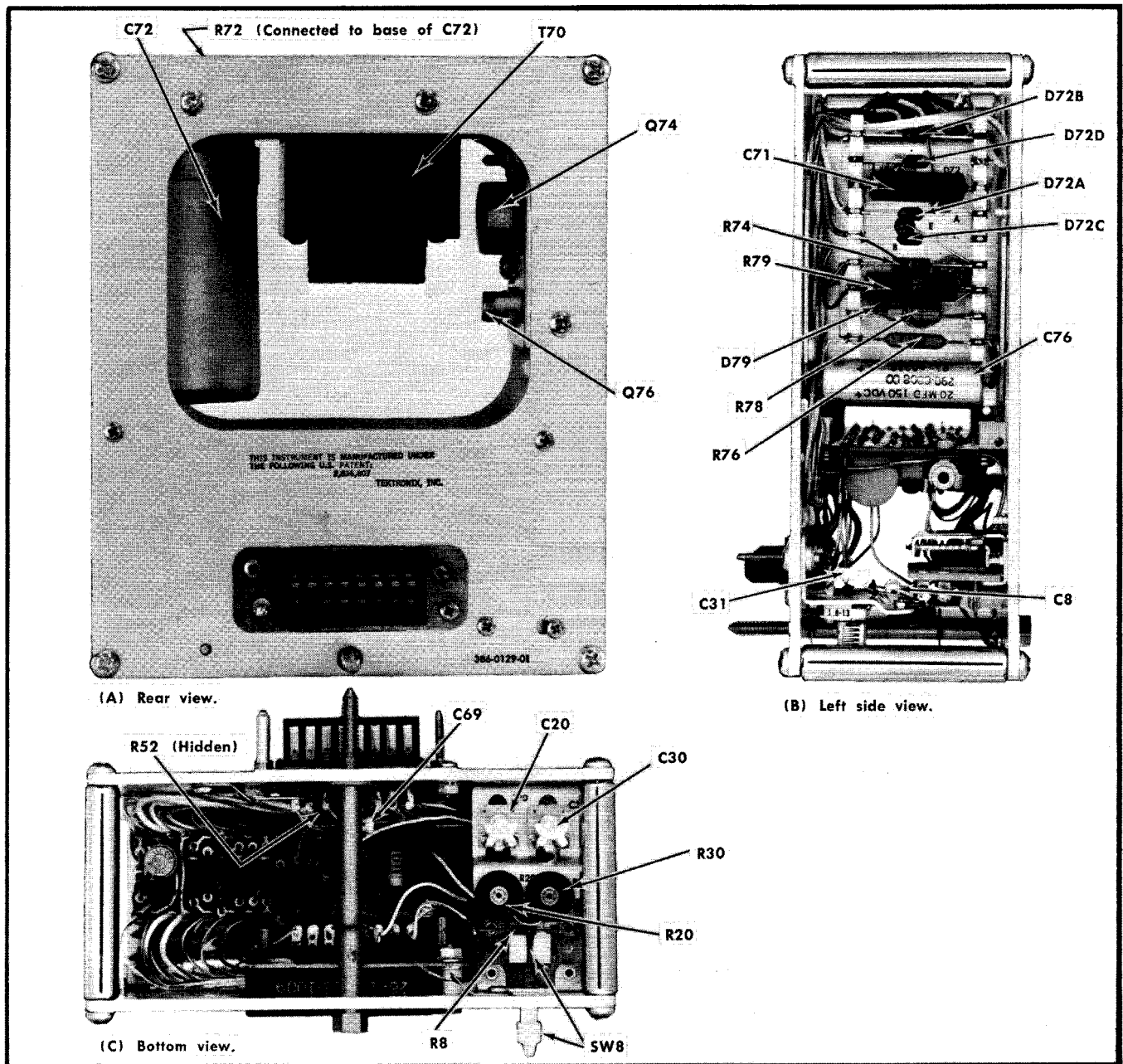


Fig. 7. Component locations on chassis.

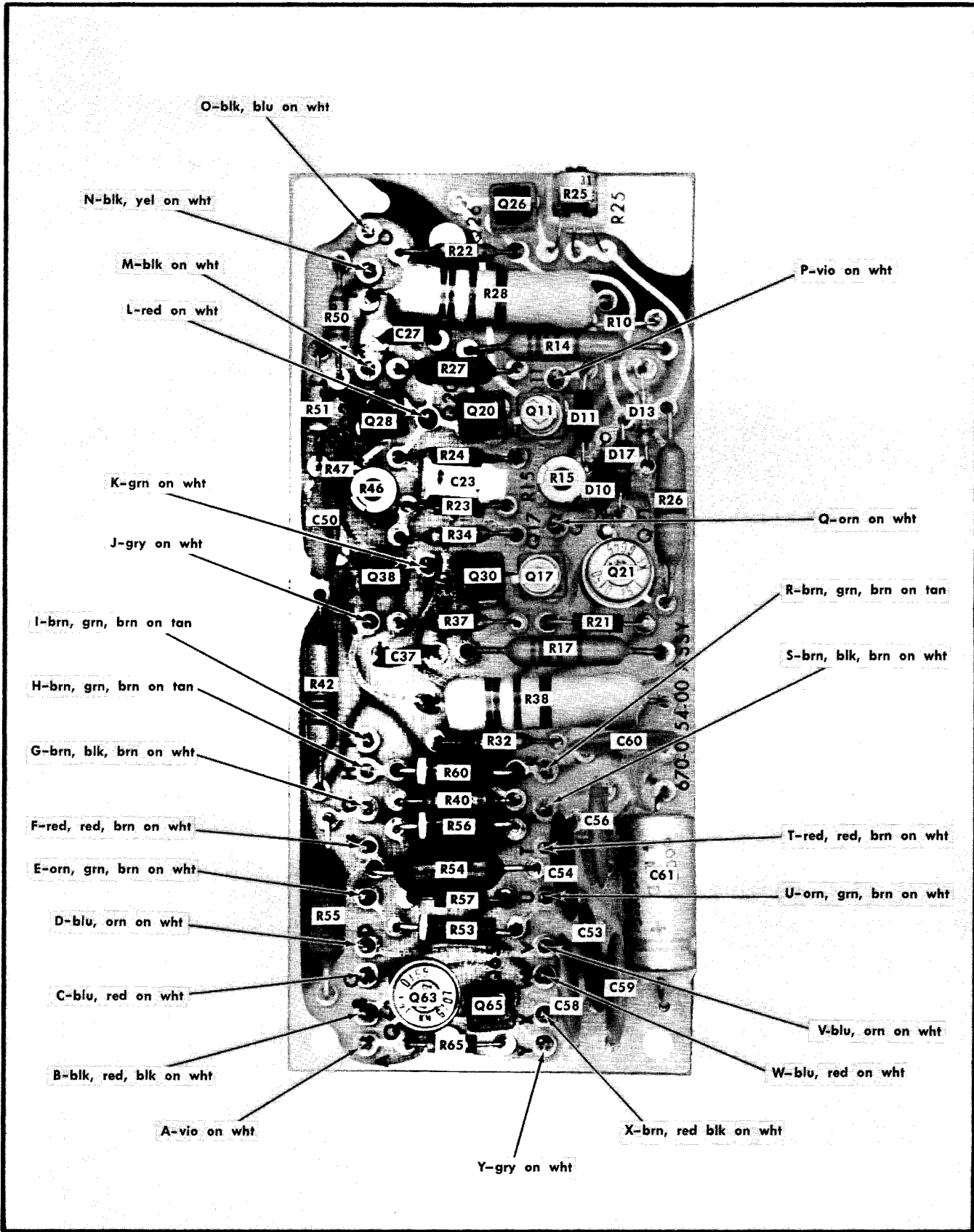


Fig. 8. Amplifier Board; component locations and wire color coding.

## Type 81A

**Ordering Information.** Include the following information when ordering parts:

- Tektronix Part Number
- Basic name of component ordered
- Quantity required

Including additional information (such as instrument type, instrument serial number, circuit number of electrical parts, item number of mechanical parts) will aid Tektronix in insuring that you receive the proper part.

### Soldering on Circuit Boards

Use a low-power (15 to 40 W) soldering iron and 3% silver-bearing solder when replacing components on the

circuit board. Use heat sinks as necessary to protect components, especially when short leads are involved. (Alligator clips make good light duty heat sinks, leaving both hands free.) Do not heat circuit boards excessively. Separation of the conductor from the board may result. Removal of multiple-lead devices can be aided by first removing the solder from the connections. A vacuum-type solder removing device is recommended for this purpose.

### Soldering on Ceramic Terminal Strips

Proper care must be exercised in both soldering and replacing ceramic terminal strips. Repairmen who are unfamiliar with ceramic strips should refer to the ceramic strip information which is contained in the 580-series Oscilloscope manuals before any soldering is done on them.

# CALIBRATION

## General

The Type 81A Plug-In Adapter should be calibrated every 500 operating hours or every six months, whichever occurs first. Calibration should be preceded by a thorough cleaning and inspection as explained in the Maintenance section.

Duplicating the calibration procedure will allow copies of it to be used as a check-off list and calibration record, leaving the original as an unmarked reference.

## Malfunctions

Correct all malfunctions at the time they are disclosed by the procedure. Failure to do so will probably affect other adjustments, requiring that they be re-accomplished after the trouble is finally corrected.

## Procedure Format

The equipment setup is given at the beginning of the calibration procedure. Principle control settings are again listed at the beginning of the one step that requires a substantial change. Pictures accompany the setups.

The step sequence is designed to allow rapid calibration with a minimum of setups. Each step continues from the equipment status that existed at the end of the preceding step.

Those steps containing adjustments are identified by the symbol **⓪** appearing on the right margin of the column. "ADJUST" indicates the point within the numbered steps at which the actual adjustment is performed. "CHECK" identifies either a pre-adjustment check or a performance check of a non-adjustable parameter.

The names of Type 81A internal adjustments are written in upper-case letters. Oscilloscope and test equipment controls have the first letter of their names capitalized. Pictures indicating adjustment locations and pictures of actual waveforms accompany the procedure.

## Complete Calibration Procedure

Do each step in sequence when performing a complete calibration procedure. For best results, refine all adjustments, even though the pre-adjustment check is within allowable limits.

## Partial Calibration Procedure

Any step in the calibration procedure can be done individually. Use the preliminary equipment setup in conjunction with steps 1 through 6. Step 7 has its own setup. If a pre-adjustment check is within allowable limits, it is suggested that the adjustment be bypassed to save time.

## Performance Check

The Type 81A Plug-In Adapter can be checked for proper operation without removing equipment covers by accomplishing the following calibration procedure steps:

3. a through e
- 4.
5. a through e
6. (step 7 can be substituted for 6)

## Equipment Required

Calibration of the Type 81A Plug-In Adapter requires use of the following equipment: (see Fig. 9)

1. A Tektronix 580-series Oscilloscope.
2. Calibration Fixture. Tektronix Part No. 067-0521-00.
3. Test Oscilloscope. Low bandwidth ( $\leq 10$  MHz); sensitivity at least 5 mV/division. Tektronix Type 503 used in this procedure, with Tektronix P6011 probe and UHF to BNC adapter.
4. Standard Amplitude Calibrator. 50 V-1 kHz square wave output; amplitude accuracy within 0.25%. Tektronix Standard Amplitude Calibrator, Part No. 067-0502-00 recommended.

5. Non-loading DC Voltmeter. 0 to 75 V; accuracy 1% or better. Fluke Model 825A used in this procedure.

6. Coaxial Cable. 42 inch-50  $\Omega$ ; equipped with BNC-male connectors. Tektronix Part No. 012-0057-00.

7. Aligning Tool. Plastic handle and shaft; metal screw-driver tip. Tektronix Part No. 003-0000-00.

8. Aligning Tool Handle, nylon. Tektronix Part No. 003-0307-00.

9. Aligning Tool Insert, recessed metal tip. Tektronix Part No. 003-0310-00.

The following additional equipment is required if step 7 is to be performed: (see Fig. 14)

1. Tektronix 1-series Vertical Amplifier Plug-In Unit; Bandwidth 50 MHz or greater. Type 1A2 used in this procedure.

2. Constant Amplitude Sine Wave Generator. 50 kHz and 50 MHz; Amplitude sufficient to provide 2 cm vertical deflection when used with the preceding plug-in unit. Tektronix Type 191 Constant Amplitude Signal Generator recommended.

3. Cable. Type RG8/213; GR connectors; 5 ns delay; (5 ns GR cable); Tektronix Part No. 017-0502-00. (Included with Type 191 Constant Amplitude Signal Generator.)

4. Termination, 50  $\Omega$ , GR-to-BNC male. Tektronix Part No. 017-0083-00.

## CALIBRATION PROCEDURE

### NOTE

The oscilloscope and all test equipment must be within calibration limits before an effective calibration can be performed.

### Preliminary Procedure

Place the de-energized Type 581A Oscilloscope on its right side. Remove the bottom cover and left side cover from the Oscilloscope. Seat the Type 81A Plug-In Adapter in the plug-in compartment and hand-tighten the securing shaft.

### WARNING

Voltages as high as 350 V are present in the plug-in compartment of an energized oscilloscope.

Install the 067-0521-00 Calibration Fixture and secure it in place.

Energize the Type 581A Oscilloscope and the test equipment. Allow 20 minutes warm-up time.

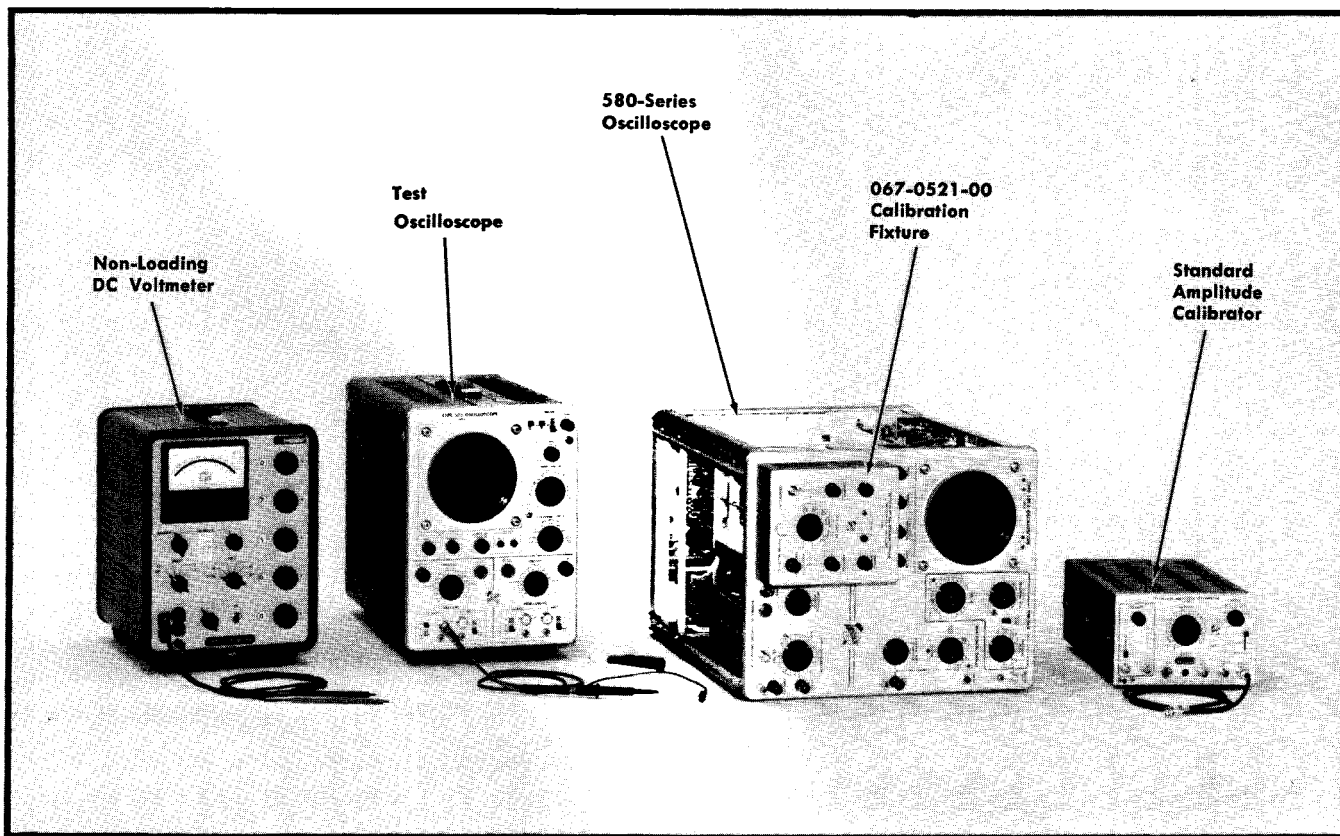


Fig. 9. Basic equipment setup for the calibration procedure.

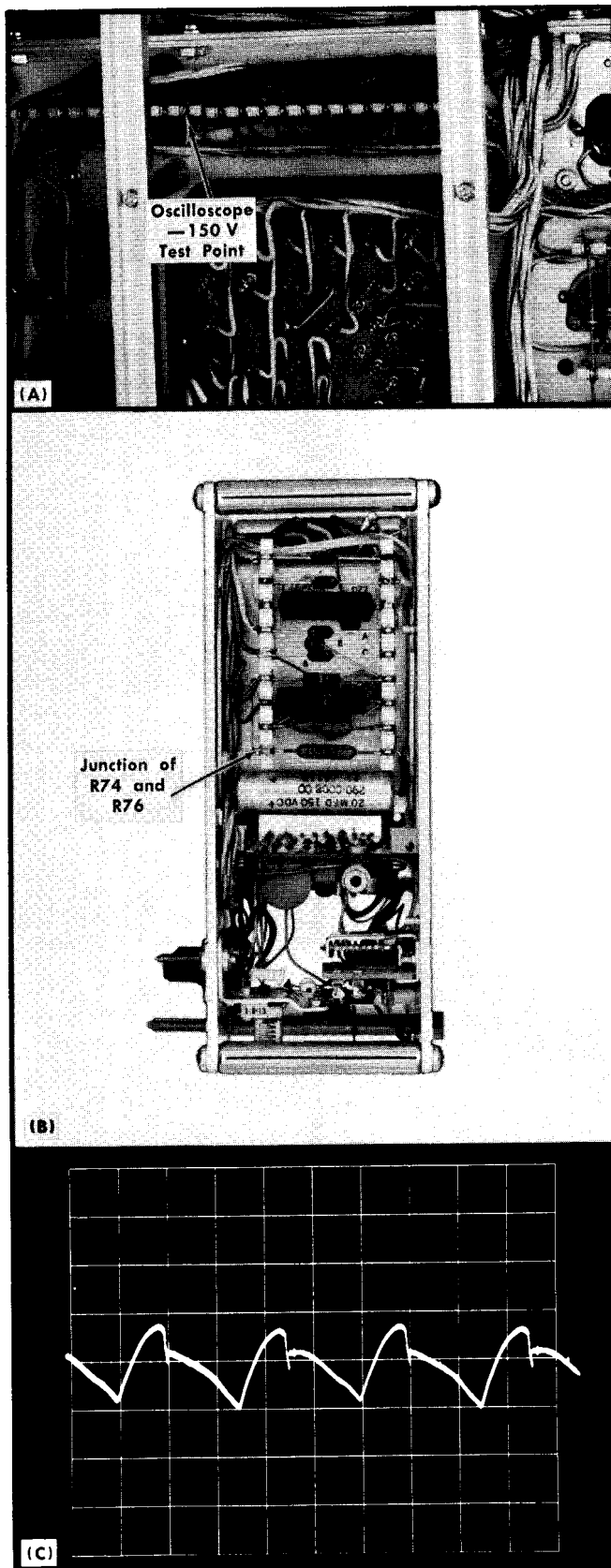


Fig. 10. (A) Oscilloscope -150-V supply test point location; (B) +75-V test point location; (C) typical ripple waveform with 60 Hz line frequency. Sweep rate approximately 3 ms/div; sensitivity 1 mV/div; line triggered.

Set the Oscilloscope controls to the following positions:

**Type 581A Oscilloscope Control Settings**

Triggering Level	0
Stability	Fully CW
Trigger Slope	+
Triggering Source	Int-AC LF Rej
Time/CM	.1 mSEC
Variable	Calibrated
Horizontal Display	Internal Sweep
5X Magnifier	Off
Horizontal Position	Midrange
Horizontal Position Vernier	Midrange
Amplitude Calibrator	Off
Focus	Optimum
Intensity	Optimum
Astigmatism	Optimum
Scale Illumination	Optimum

**1. Check +75-V Power Supply**

a. The preliminary procedure and oscilloscope control settings apply. Locations of the check points and a typical waveform are shown in Fig. 10.

b. Set the Calibration Fixture Test Function switch to High Load.

c. Measure the oscilloscope -150-V supply. The test point is shown in Fig. 10 (A). Determine the amount and polarity of deviation from -150 V.

d. CHECK—+75 V between the R74-R76 junction and ground, using a non-loading DC voltmeter. See Fig. 10 (B). Allowable range is +75 V ± (2.5 V minus one-half of oscilloscope -150-V deviation).

e. Disconnect the voltmeter.

f. CHECK—7 mV or less peak-to-peak ripple between the R74-R76 junction and ground, using the test oscilloscope. Ripple will occur at twice line frequency; adjacent peaks may be of different sizes, as determined by the characteristics of the two halves of the full wave rectifier. See Fig. 10 (C).

g. Disconnect the test oscilloscope. Use of it has been completed.

**2. Adjust DC BAL (R15) and OUTPUT DC LEVEL (R25)**

a. The preliminary procedure and Oscilloscope control settings apply. Locations of check points and adjustments are shown in Fig. 11.

b. Set the Calibration Fixture Test Function switch to Common Mode.

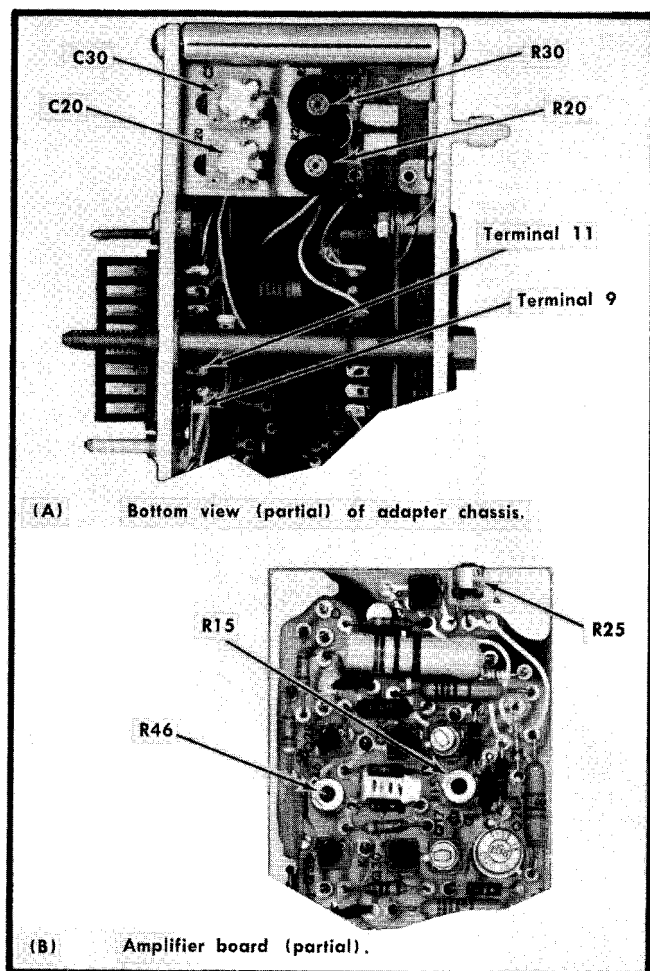


Fig. 11. Location of test points and adjustments for steps 2, 3 and 5.

c. Isolate both voltmeter leads from ground. If this cannot be done, omit steps d, e and f and perform steps d, e, f (alternate).

d. Connect the non-loading DC voltmeter across terminals 9 and 11 of the Adapter-to-Oscilloscope plug. See Fig. 11 (A).

e. CHECK—Voltmeter reads  $0\text{ V} \pm 50\text{ mV}$ .

f. ADJUST—DC BAL, R15, Fig. 11 (B), until the voltmeter reads  $0\text{ V} \pm 50\text{ mV}$ .

d, e, f (alternate). Using a shorting strap, connect the Adapter-to-Oscilloscope terminals 9 and 11 together. Obtain a trace on the Oscilloscope and note its vertical position. (Its position can be marked with a grease pencil for reference purposes.) Remove the shorting strap. Adjust DC BAL, R15, (Fig. 11) until the trace is positioned to the just-determined reference position.

#### CAUTION

Do not touch the shorting strap to ground or other components after one end has been connected.

g. Set the voltmeter to read approximately  $+49\text{ V DC}$ . Disconnect the negative (common) voltmeter lead from the connector plug and connect it to ground.

h. CHECK— $+49\text{ V} \pm 2.0\text{ V}$  output at terminal 9 (or 11).

i. ADJUST—DC LEVEL, R25, Fig. 11 (B), for  $+49\text{ V} \pm 2.0\text{ V}$  output.

j. Disconnect the voltmeter. Use of it has been completed.

### 3. Adjust GAIN (R46) ①

a. The preliminary procedure and Oscilloscope control settings apply. Location of the adjustment is shown in Fig. 11 (B).

b. Switch the Test Function switch to Gain Set.

c. Connect a 50-V square wave signal from the Standard Amplitude Calibrator Output connector to the Calibration Fixture Ext Input. The free running sweep should cause two traces to appear.

d. Adjust the Calibration Fixture Vertical Position control to center the display.

e. CHECK— $2\text{ cm} \pm 0.6\text{ mm}$  between the centers of the traces.

f. ADJUST—GAIN, R46, Fig. 11 (B), to provide  $2\text{ cm} \pm 0.6\text{ mm}$  between the center of the traces.

g. Turn off and disconnect the Standard Amplitude Calibrator. Use of it has been completed.

### 4. Check Alternate Trace Sync Pulse Operation and Chopped Operation

a. The preliminary procedure and Oscilloscope control settings apply.

b. Switch the Test Function switch to Alternate.

c. CHECK—Two separate traces appear with the Oscilloscope Time/CM control set to sweep rates of  $10\text{ mSec}$  through  $.05\text{ }\mu\text{Sec}$ , inclusive. Readjust the CRT Intensity, and the Calibration Fixture Vertical Position control if necessary. (Trace convergence occurs at slower sweep rates because of time constant values in the Calibration Fixture dual trace switching circuit.)

d. Switch the Oscilloscope Time/CM to  $2\text{ mSec}$  and the Test Function Switch to Chopped.

e. CHECK—Two separate traces appear. (The wide appearance of the traces is caused by the tilt of the Calibration Fixture's chopped waveform. The background glow occurs because chopping transients are not blanked by 580-series Oscilloscopes.)

#### NOTE

If desired, a check of Alternate and Chopped operation can be made using an appropriate plug-in unit such as the Type 1A2. Two nonconverging traces can thereby be observed at all sweep rates. Chopped operation will distinctly show chopped trace segments and switching transients at rates faster than  $.2\text{ mSec/CM}$ .

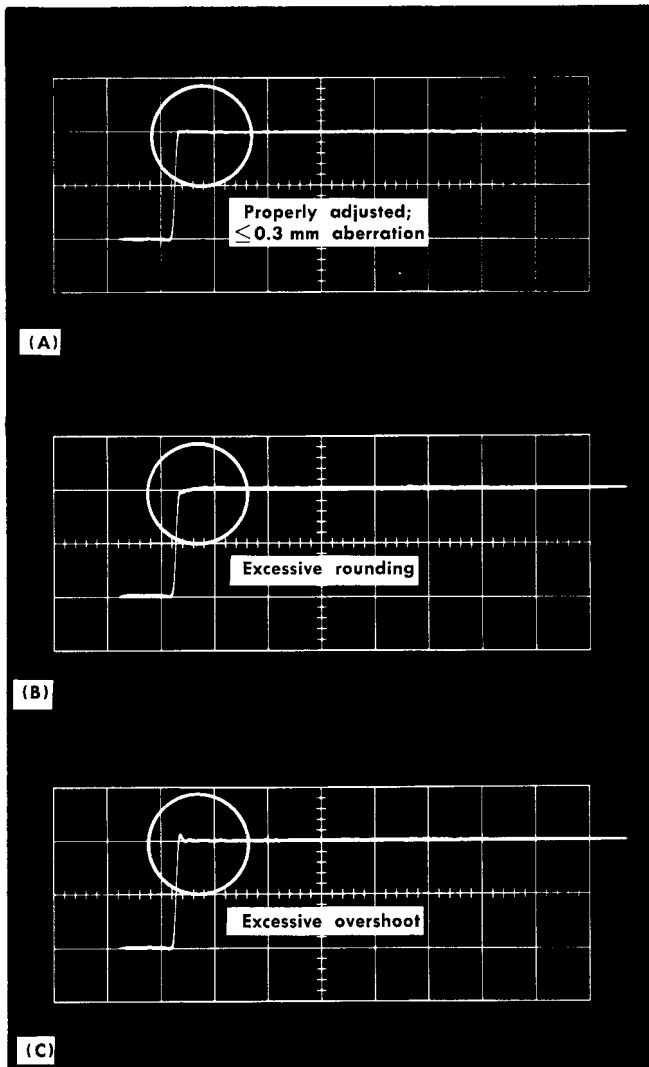


Fig. 12. High frequency compensation, step 5. (A) Waveform resulting from proper adjustment; (B) and (C) waveforms resulting from improper adjustment. Sweep rate .05 Sec/CM.

### 5. Adjust High Frequency Compensation (R20, C20, R30 C30)

- The preliminary procedure and Oscilloscope control settings apply. Locations of adjustments are shown in Fig. 11 (A). Typical waveforms are shown in Fig. 12.
- Switch the Test Function switch to + Pulse and the Repetition Rate switch to Med. Adjust the Amplitude control to provide 2 cm display amplitude between traces.
- Switch the Oscilloscope Time/CM control to .05  $\mu$ Sec and the 5 $\times$  Magnifier Off.
- Adjust the Oscilloscope Stability, Triggering Level, and Horizontal Position controls to provide a triggered waveform display as in Fig. 12 (A). Re-adjust the Intensity, Focus and Astigmatism controls as necessary for optimum viewing.
- CHECK—Squareness of the top left corner of the waveform. 0.3 mm or less rounding, overshoot or tilt. See Fig. 12 (A).

- ADJUST—R20, C20, R30 and C30, Fig. 11 (A), for optimum squareness and flatness at the top left corner of the waveform. 0.3 mm (approximately 1 graticule line width) or less rounding, overshoot or tilt. See Fig. 12 (A), (B) and (C). (Slower sweep rates may be used in addition to .05  $\mu$ Sec/CM to aid in observation of adjustment effects.)

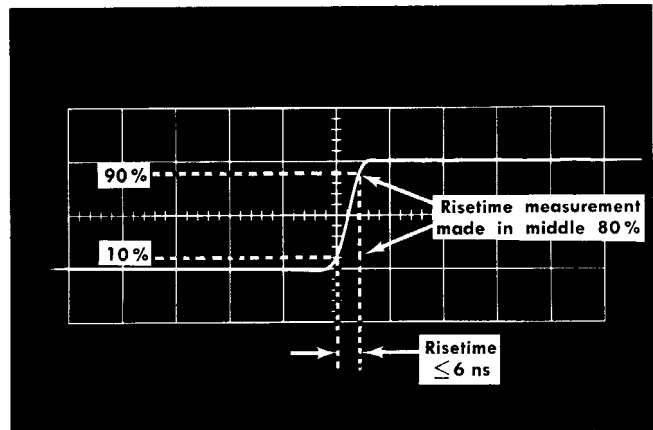


Fig. 13. Risetime waveform, step 6. Sweep rate 10 ns/cm.

### 6. Check Risetime

- The equipment setup is continued from step 5. A typical waveform appears in Fig. 13.
- Switch the Oscilloscope 5 $\times$  Magnifier On.
- CHECK—Risetime. Measure the risetime of the square wave between the 10 and 90% points as shown in Fig. 13. Use the Oscilloscope Focus, Intensity, Astigmatism and Horizontal Position controls and the Calibration Fixture Vertical Position control as necessary to set the trace for convenient measurement. Risetime should be 6 ns or less. Repeat step 5 if risetime requirement is not met.
- Reset the Oscilloscope controls as follows:
 

Time/CM	.1 mSec
5 $\times$ Magnifier	Off
Horizontal Position and Vernier	Midrange
- Remove the 067-0521-00 Calibration Fixture from the Oscilloscope. This concludes the Calibration Procedure unless optional step 7 is to be performed.

### 7. Check Bandwidth

#### NOTE

This step is optional. There is a direct relationship between risetime and bandwidth, expressed as approximately:

$$T_r (\mu s) \times B_w (\text{MHz}) = 0.35$$

A bandwidth in excess of 50 MHz is therefore indicated by the 6 ns risetime which was checked in step 6.

- Equipment setup appears in Fig. 14.



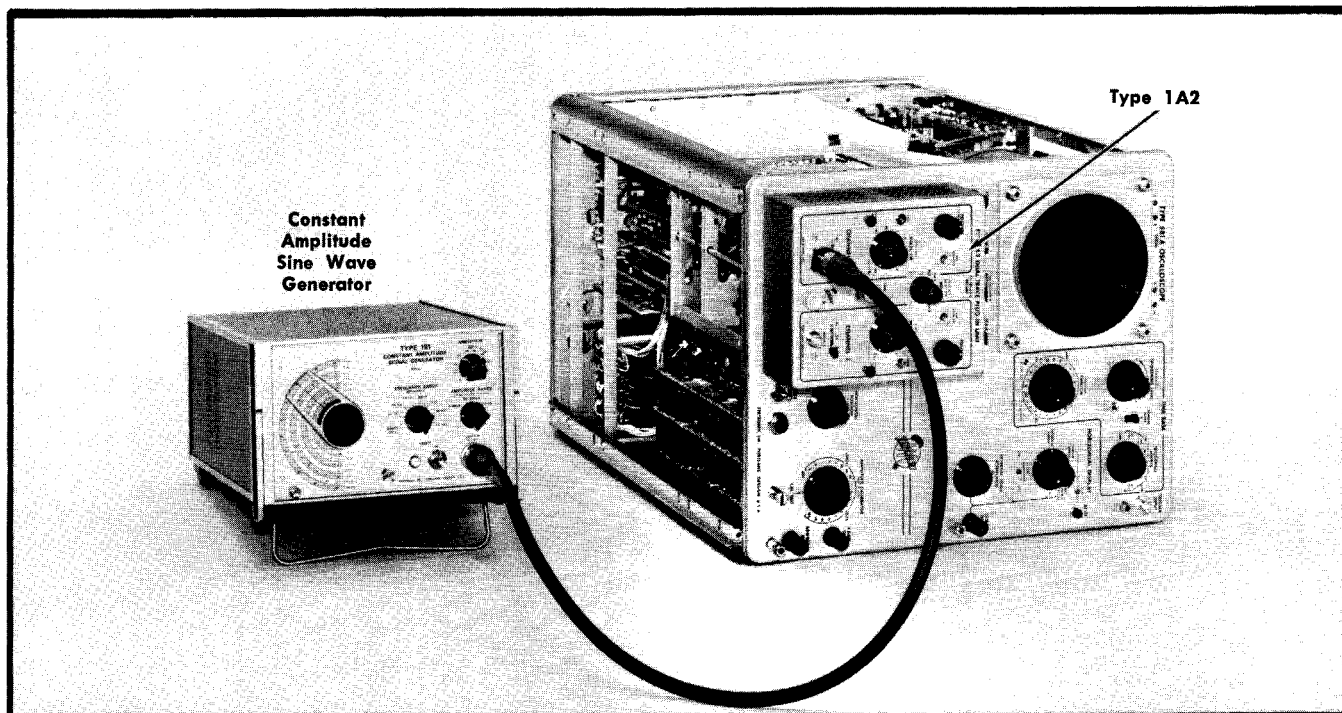


Fig. 14. Equipment setup for step 7.

#### Type 581A Oscilloscope Control Settings

Triggering Level	0
Stability	Fully CW
Triggering Source	Int-AC LF Rej
Time/CM	.1 mSec
Variable	Calibrated
5× Magnifier	Off
Horizontal Display	Internal Sweep
Horizontal Position	Midrange
Horizontal Position Vernier	Midrange

#### Type 1A2 Plug-In Unit Control Settings

Mode	CH 1
Trigger Selector	CH 1
Volts/CM	.05
Variable	Calibrated
AC-DC-GND	DC

b. Attach a Type 1A2 Plug-In Unit to the Oscilloscope-Type 81A Plug-In Adapter combination. Set the Type 1A2 controls as follows:

Mode	CH 1
Trigger Selector	CH 1
Volts/CM	.05
Variable	Calibrated
AC-DC-GND	DC

c. Connect the Type 191 Constant Amplitude Signal Generator to the Type 1A2 Input 1 connector, using a 5 ns-GR cable and a GR to BNC-male 50 Ω termination. Allow 5 minutes warm-up time.

d. Set the Constant Amplitude Signal Generator to provide a 50 kHz-2 cm presentation.

e. CHECK—Bandwidth. Set the Constant Amplitude Signal Generator Frequency to 50 MHz. Check for 1.4 cm or more display amplitude.

f. Disconnect the equipment. The calibration procedure has been completed.

# ELECTRICAL PARTS LIST

Values are fixed unless marked Variable.

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description		
<b>Capacitors</b>						
Tolerance $\pm 20\%$ unless otherwise indicated.						
C8	281-0601-00		7.5 pF	Cer	500 V	$\pm 0.5$ pF
C20	281-0103-00		1.8-13 pF, Var	Air		
C23	281-0602-00		68 pF	Cer	500 V	5%
C27	283-0114-00		0.0015 $\mu$ F	Cer	200 V	
C30	281-0103-00		1.8-13 pF, Var	Air		
C31	281-0501-00		4.7 pF	Cer	500 V	$\pm 1$ pF
C37	283-0114-00		0.0015 $\mu$ F	Cer	200 V	
C50	283-0079-00		0.01 $\mu$ F	Cer	250 V	
C53	283-0002-00		0.01 $\mu$ F	Cer	500 V	
C54	283-0002-00		0.01 $\mu$ F	Cer	500 V	
C56	283-0079-00		0.01 $\mu$ F	Cer	250 V	
C58	283-0079-00		0.01 $\mu$ F	Cer	250 V	
C59	283-0079-00		0.01 $\mu$ F	Cer	250 V	
C60	283-0079-00		0.01 $\mu$ F	Cer	250 V	
C61	290-0285-00		4 $\mu$ F	Elect.	200 V	+50%—10%
C69	281-0552-00		25 pF	Cer	500 V	
C71	285-0506-00		0.0047 $\mu$ F	MT	400 V	
C72A,B,C,D	290-0070-00		4 x 75 $\mu$ F	Elect.	150 V	
C76	290-0008-00		20 $\mu$ F	Elect.	150 V	

### Diodes

D10	152-0234-00		Zener	1N976A, 0.4 W, 43 V, 10%
D11	*152-0185-00		Silicon	Replaceable by 1N3605
D13	152-0304-00		Zener	1N968B, 0.4 W, 20 V, 5%
D17	*152-0185-00		Silicon	Replaceable by 1N3605
D72A,B,C,D (4)	152-0066-00		Silicon	1N3194
D79	152-0008-00		Germanium	

### Transistors

Q11	*153-0551-00		Silicon	FET (matched pair)
Q17				
Q20	151-0220-00		Silicon	2N4122
Q27	151-0150-00		Silicon	2N3440
Q28	151-0220-00		Silicon	2N4122

**Transistors (cont)**

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
Q28	151-0188-00		Silicon	2N3906
Q30	151-0220-00		Silicon	2N4122
Q38	151-0188-00		Silicon	2N3906
Q63	151-0169-00		Silicon	2N3439
Q65	151-0190-00		Silicon	2N3904
Q74	151-0170-00		Germanium	2N2147
Q76	151-0208-00		Silicon	2N4036

**Resistors**

Resistors are fixed, composition,  $\pm 10\%$  unless otherwise indicated.

R8	315-0820-00	82 $\Omega$	$\frac{1}{4}$ W		5%
R10	317-0105-00	1 M $\Omega$	$\frac{1}{8}$ W		5%
R14	323-0299-00	12.7 k $\Omega$	$\frac{1}{2}$ W	Prec	1%
R15	311-0609-00	2 k $\Omega$ , Var			1%
R17	323-0299-00	12.7 k $\Omega$	$\frac{1}{2}$ W	Prec	1%
R20	311-0303-00	200 $\Omega$ , Var			5%
R21	315-0224-00	220 k $\Omega$	$\frac{1}{4}$ W		5%
R22	321-0178-00	698 $\Omega$	$\frac{1}{8}$ W	Prec	1%
R23	315-0362-00	3.6 k $\Omega$	$\frac{1}{4}$ W		5%
R24	321-0064-00	45.3 $\Omega$	$\frac{1}{8}$ W	Prec	1%
R25	311-0634-00	500 $\Omega$ , Var			1%
R26	323-0186-00	845 $\Omega$	$\frac{1}{2}$ W	Prec	1%
R27	321-0181-00	750 $\Omega$	$\frac{1}{8}$ W	Prec	1%
R28	324-0269-00	6.19 k $\Omega$	1 W	Prec	1%
R30	311-0648-00	2 k $\Omega$ , Var			1%
R32	321-0178-00	698 $\Omega$	$\frac{1}{8}$ W	Prec	1%
R34	321-0064-00	45.3 $\Omega$	$\frac{1}{8}$ W	Prec	1%
R37	321-0181-00	750 $\Omega$	$\frac{1}{8}$ W	Prec	1%
R38	324-0269-00	6.19 k $\Omega$	1 W	Prec	1%
R40	321-0272-00	6.65 k $\Omega$	$\frac{1}{8}$ W	Prec	1%
R42	323-0332-00	28 k $\Omega$	$\frac{1}{2}$ W	Prec	1%
R46	311-0605-00	200 $\Omega$ , Var			1%
R47	321-0117-00	162 $\Omega$	$\frac{1}{8}$ W	Prec	1%
R50	321-0094-00	93.1 $\Omega$	$\frac{1}{8}$ W	Prec	1%
R51	321-0094-00	93.1 $\Omega$	$\frac{1}{8}$ W	Prec	1%
R52	315-0105-00	1 M $\Omega$	$\frac{1}{4}$ W		5%
R53	301-0910-00	91 $\Omega$	$\frac{1}{2}$ W		5%
R54	308-0451-00	91 $\Omega$	3 W	WW	5%
R55	308-0313-00	20 k $\Omega$	3 W	WW	1%
R56	301-0910-00	91 $\Omega$	$\frac{1}{2}$ W		5%

TYPE 81A

TENT SN 310

PARTS LIST CORRECTION

CHANGE TO:

D10      152-0283-00      Zener    1N976B    0.4 w, 43 v, 5%

M11,191/867

**Type 81A**

**Resistors (cont)**

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff Disc	Description	
R57	315-0104-00	100 kΩ	1/4 W	5%
R60	301-0910-00	91 Ω	1/2 W	5%
R65	315-0392-00	3.9 kΩ	1/4 W	5%
R72	301-0180-00	18 Ω	1/2 W	5%
R74	301-0223-00	22 kΩ	1/2 W	5%
R76	323-0302-00	13.7 kΩ	1/2 W	Prec 1%
R78	323-0253-00	4.22 kΩ	1/2 W	Prec 1%
R79	324-0335-00	30.1 kΩ	1 W	Prec 1%

**Switch**

Unwired

SW8	260-0601-00	Push-Button
-----	-------------	-------------

**Transformer**

T70	*120-0168-00	Power
-----	--------------	-------

## ABBREVIATIONS AND SYMBOLS

A or amp	amperes	L	inductance
AC or ac	alternating current	$\lambda$	lambda—wavelength
AF	audio frequency	$\gg$	large compared with
$\alpha$	alpha—common-base current amplification factor	$\ll$	less than
AM	amplitude modulation	LF	low frequency
$\approx$	approximately equal to	lg	length or long
$\beta$	beta—common-emitter current amplification factor	LV	low voltage
BHB	binding head brass	M	mega or $10^6$
BHS	binding head steel	m	milli or $10^{-3}$
BNC	baby series "N" connector	M $\Omega$ or meg	megohm
X	by or times	$\mu$	micro or $10^{-6}$
C	carbon	mc	megacycle
C	capacitance	met.	metal
cap.	capacitor	MHz	megahertz
cer	ceramic	mm	millimeter
cm	centimeter	ms	millisecond
comp	composition	—	minus
conn	connector	mtg hdw	mounting hardware
$\sim$	cycle	n	nano or $10^{-9}$
c/s or cps	cycles per second	no. or #	number
CRT	cathode-ray tube	ns	nanosecond
csk	countersunk	OD	outside diameter
$\Delta$	increment	OHB	oval head brass
dB	decibel	OHS	oval head steel
dBm	decibel referred to one milliwatt	$\Omega$	ohm
DC or dc	direct current	$\omega$	omega—angular frequency
DE	double end	p	pico or $10^{-12}$
$^{\circ}$	degrees	/	per
$^{\circ}$ C	degrees Celsius (degrees centigrade)	%	percent
$^{\circ}$ F	degrees Fahrenheit	PHB	pan head brass
$^{\circ}$ K	degrees Kelvin	$\phi$	phi—phase angle
dia	diameter	$\pi$	pi—3.1416
$\div$	divide by	PHS	pan head steel
div	division	+	plus
EHF	extremely high frequency	$\pm$	plus or minus
elect.	electrolytic	PIV	peak inverse voltage
EMC	electrolytic, metal cased	plstc	plastic
EMI	electromagnetic interference (see RFI)	PMC	paper, metal cased
EMT	electrolytic, metal tubular	poly	polystyrene
$\epsilon$	epsilon—2.71828 or % of error	prec	precision
$\geq$	equal to or greater than	PT	paper, tubular
$\leq$	equal to or less than	PTM	paper or plastic, tubular, molded
ext	external	pwr	power
F or f	farad	Q	figure of merit
F & I	focus and intensity	RC	resistance capacitance
FHB	flat head brass	RF	radio frequency
FHS	flat head steel	RFI	radio frequency interference (see EMI)
Fil HB	fillister head brass	RHB	round head brass
Fil HS	fillister head steel	$\rho$	rho—resistivity
FM	frequency modulation	RHS	round head steel
ft	feet or foot	r/min or rpm	revolutions per minute
G	giga or $10^9$	RMS	root mean square
g	acceleration due to gravity	s or sec.	second
Ge	germanium	SE	single end
GHz	gigahertz	Si	silicon
GMV	guaranteed minimum value	SN or S/N	serial number
GR	General Radio	$\ll$	small compared with
$>$	greater than	T	tera or $10^{12}$
H or h	henry	TC	temperature compensated
h	height or high	TD	tunnel diode
hex.	hexagonal	THB	truss head brass
HF	high frequency	$\theta$	theta—angular phase displacement
HHB	hex head brass	thk	thick
HHS	hex head steel	THS	truss head steel
HSB	hex socket brass	tub.	tubular
HSS	hex socket steel	UHF	ultra high frequency
HV	high voltage	V	volt
Hz	hertz (cycles per second)	VAC	volts, alternating current
ID	inside diameter	var	variable
IF	intermediate frequency	VDC	volts, direct current
in.	inch or inches	VHF	very high frequency
incd	incandescent	VSWR	voltage standing wave ratio
$\infty$	infinity	W	watt
int	internal	w	wide or width
$\int$	integral	w/	with
k	kilohms or kilo ( $10^3$ )	w/o	without
k $\Omega$	kilohm	WW	wire-wound
kc	kilocycle	xmfr	transformer
kHz	kilohertz		



## 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 or model 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.

## SPECIAL NOTES AND SYMBOLS

- ×000 Part first added at this serial number
- 00× Part removed after this serial number
- \*000-0000-00 Asterisk preceding Tektronix Part Number indicates manufactured by or for Tektronix, Inc., or reworked or checked components.
- Use 000-0000-00 Part number indicated is direct replacement.
-  Screwdriver adjustment.
-  Control, adjustment or connector.

# MECHANICAL PARTS LIST

## FIG. 1 TYPE 81A MECHANICAL PARTS

Fig. & Index No.	Tektronix Part No.	Serial/Model No.		Q † Y	Description
		Eff	Disc		
1-1	334-1134-00			1	PLATE, identification
	- - - - -			-	mounting hardware: (not included w/plate)
-2	211-0007-00			2	SCREW, 4-40 x $\frac{3}{16}$ inch, PHS
-3	210-0586-00			2	NUT, keps, 4-40 x $\frac{1}{4}$ inch
-4	426-0390-00			1	FRAME, housing
	- - - - -			-	mounting hardware: (not included w/frame)
-5	213-0146-00			4	SCREW, thread forming, 6-32 x $\frac{5}{16}$ inch, PHS
-6	384-0603-00			1	ROD, frame, securing
	354-0184-00			1	RING, retaining
-7	210-0894-00			1	WASHER, plastic, 0.190 ID x $\frac{7}{16}$ inch OD
-8	386-0129-01			2	PLATE, frame
-9	384-0561-00			4	ROD, frame
	- - - - -			-	mounting hardware for each: (not included w/rod)
-10	212-0044-00			2	SCREW, 8-32 x $\frac{1}{2}$ inch, RHS
-11	366-0271-00			1	KNOB, white, plastic
-12	260-0601-00			1	SWITCH, push button
	- - - - -			-	mounting hardware: (not included w/switch)
-13	211-0507-00			2	SCREW, 6-32 x $\frac{5}{16}$ inch, PHS
-14	131-0018-00			1	CONNECTOR, 16 contact, female
	- - - - -			-	mounting hardware: (not included w/connector)
-15	210-0586-00			2	NUT, keps, 4-40 x $\frac{1}{4}$ inch
	166-0031-00			2	TUBE, spacer, $\frac{1}{4}$ inch long
-16	211-0016-00			2	SCREW, 4-40 x $\frac{5}{8}$ inch, PHS
-17	210-0202-00			2	LUG, solder, SE #6
	- - - - -			-	mounting hardware for each: (not included w/lug)
	213-0044-00			1	SCREW, thread forming, 5-32 x $\frac{3}{16}$ inch, PHS
-18	210-0259-00			1	LUG, solder, SE #2
	- - - - -			-	mounting hardware: (not included w/lug)
	213-0055-00			1	SCREW, thread forming, 2-32 x $\frac{3}{16}$ inch, PHS
-19	136-0181-00			1	SOCKET, transistor, 3 pin
	- - - - -			-	mounting hardware: (not included w/socket)
	354-0234-00			1	RING, socket mounting



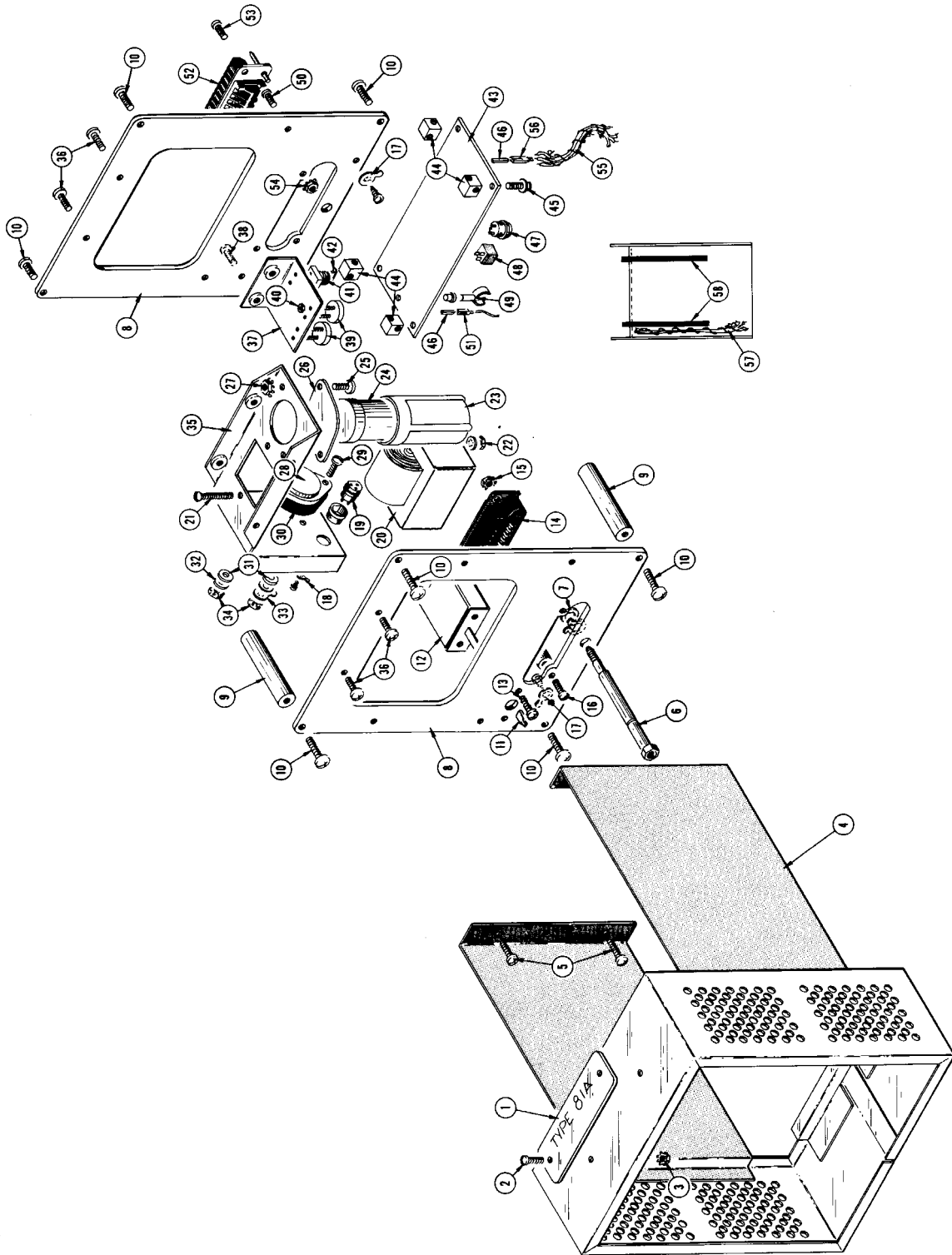
FIG. 1 TYPE 81A MECHANICAL PARTS (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model Eff	No. Disc	Q					Description	
				t	y	1	2	3		4
1-20	- - - - -			1						TRANSFORMER
				-						mounting hardware: (not included w/transformer)
-21	211-0021-00			2						SCREW, 4-40 x 1 1/4 inches, RHS
	210-0004-00			2						LOCKWASHER, internal, #4
-22	210-0406-00			2						NUT, hex., 4-40 x 3/16 inch
				1						COVER, capacitor, plastic, 1.365 ID x 2 3/16 inches long
-23	200-0293-00			1						CAPACITOR
-24	- - - - -			-						mounting hardware: (not included w/capacitor)
-25	211-0543-00			2						SCREW, 6-32 x 5/16 inch RHS
-26	386-0254-00			1						PLATE, fiber, large
-27	210-0457-00			2						NUT, keps, 6-32 x 5/16 inch
				1						TRANSISTOR
-28	- - - - -			-						mounting hardware: (not included w/transistor)
-29	211-0510-00			2						SCREW, 6-32 x 3/8 inch, PHS
-30	386-0978-00			1						PLATE, mica, insulating
-31	210-0935-00			2						WASHER, fiber, shouldered, 0.140 ID x 0.375 inch OD
-32	210-0803-00			2						WASHER, flat, 0.150 ID x 3/8 inch OD
-33	210-0202-00			1						LUG, solder, SE #6
	210-0006-00			2						LOCKWASHER, internal, #6
-34	210-0407-00			2						NUT, hex., 6-32 x 1/4 inch
				1						CHASSIS, power
-35	441-0747-00			-						mounting hardware: (not included w/chassis)
-36	211-0507-00			6						SCREW, 6-32 x 5/16 inch, PHS
				1						CHASSIS, plug-in unit adapter
-37	441-0746-00			-						mounting hardware: (not included w/chassis)
-38	211-0507-00			2						SCREW, 6-32 x 5/16 inch, PHS
				2						RESISTOR, variable
-39	- - - - -			-						mounting hardware for each: (not included w/resistor)
-40	210-0504-00			2						NUT, hex., 0-80 x 5/32 inch
				2						CAPACITOR
-41	- - - - -			-						mounting hardware for each: (not included w/capacitor)
-42	214-0456-00			1						FASTENER, plastic

FIG. 1 TYPE 81A MECHANICAL PARTS (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	No. Disc	Q	Description	
						t
1-43	670-0154-00			1	ASSEMBLY, circuit board—AMPLIFIER	
	-----			-	assembly includes:	
	388-0875-00			1	BOARD, circuit	
-44	220-0455-00			4	NUT, block	
	-----			-	mounting hardware for each: (not included w/nut)	
-45	211-0116-00			1	SCREW, sems, 4-40 x $\frac{5}{16}$ inch, PHB	
-46	214-0506-00			25	PIN, connector	
-47	136-0183-00			2	SOCKET, transistor, 3 pin	
-48	136-0220-00			8	SOCKET, transistor, 3 pin	
-49	352-0100-00			1	HOLDER, variable resistor	
	-----			-	mounting hardware: (not included w/holder)	
	361-0007-00			1	SPACER, plastic, 0.062 inch long	
	-----			-	mounting hardware: (not included w/assembly)	
-50	211-0097-00			4	SCREW, 4-40 x $\frac{5}{16}$ inch, PHS	
-51	131-0371-00			8	CONNECTOR, single contact	
-52	131-0017-00			1	CONNECTOR, 16 contact, male	
	-----			-	mounting hardware: (not included w/connector)	
-53	211-0097-00			2	SCREW, 4-40 x $\frac{5}{16}$ inch, PHS	
-54	210-0586-00			2	NUT, keps, 4-40 x $\frac{1}{4}$ inch	
-55	179-1200-00			1	CABLE HARNESS, connector	
	-----			-	cable harness includes:	
-56	131-0371-00			8	CONNECTOR, single contact	
-57	179-1199-00			1	CABLE HARNESS, main	
	-----			-	cable harness includes:	
	131-0371-00			9	CONNECTOR, single contact	
-58	124-0095-00			2	STRIP, ceramic, $\frac{7}{16}$ inch h, w/9 notches	
	-----			-	each strip includes:	
	355-0082-00			2	STUD, plastic	
	-----			-	mounting hardware for each: (not included w/strip)	
	361-0008-00			2	SPACER, plastic, 0.156 inch long	
					<b>STANDARD ACCESSORIES</b>	
	070-0751-00			2	MANUAL, instruction (not shown)	

Type 81A



# **SCHEMATIC DIAGRAM**

## **VOLTAGES and WAVEFORMS**

Typical operating voltages and waveforms appearing on the schematic are referenced to ground except where noted otherwise. Conditions equivalent to those stated here should be established before making comparisons. (The waveforms are reproductions of photographs taken with a Tektronix C12 Camera System and Projected Graticule.)

### **Conditions Pertaining to Both Voltages and Waveforms:**

Type 81A Adapter plugged into Type 581A Oscilloscope; Calibration Fixture 067-0521-00 installed in the Type 81A Adapter. Oscilloscope was connected to a 115 V - 60 Hz power source.

### **Additional Conditions for Voltages:**

DC voltage readings taken with a Differential or other non-loading DC Voltmeter.

AC voltage reading taken differentially with a 5000  $\Omega/V$  sensitivity AC Voltmeter.

Calibration Test Function Switch set to Common Mode (with 1 noted exception) and no external input applied.

### **Additional Conditions for Waveforms:**

Test Oscilloscope - Type 535A with Type 1A1 Dual Trace Plug-In Unit. AC coupling used for signal input.

Sweep rate and vertical sensitivity of 535A Oscilloscope and probe combination appear with each waveform.

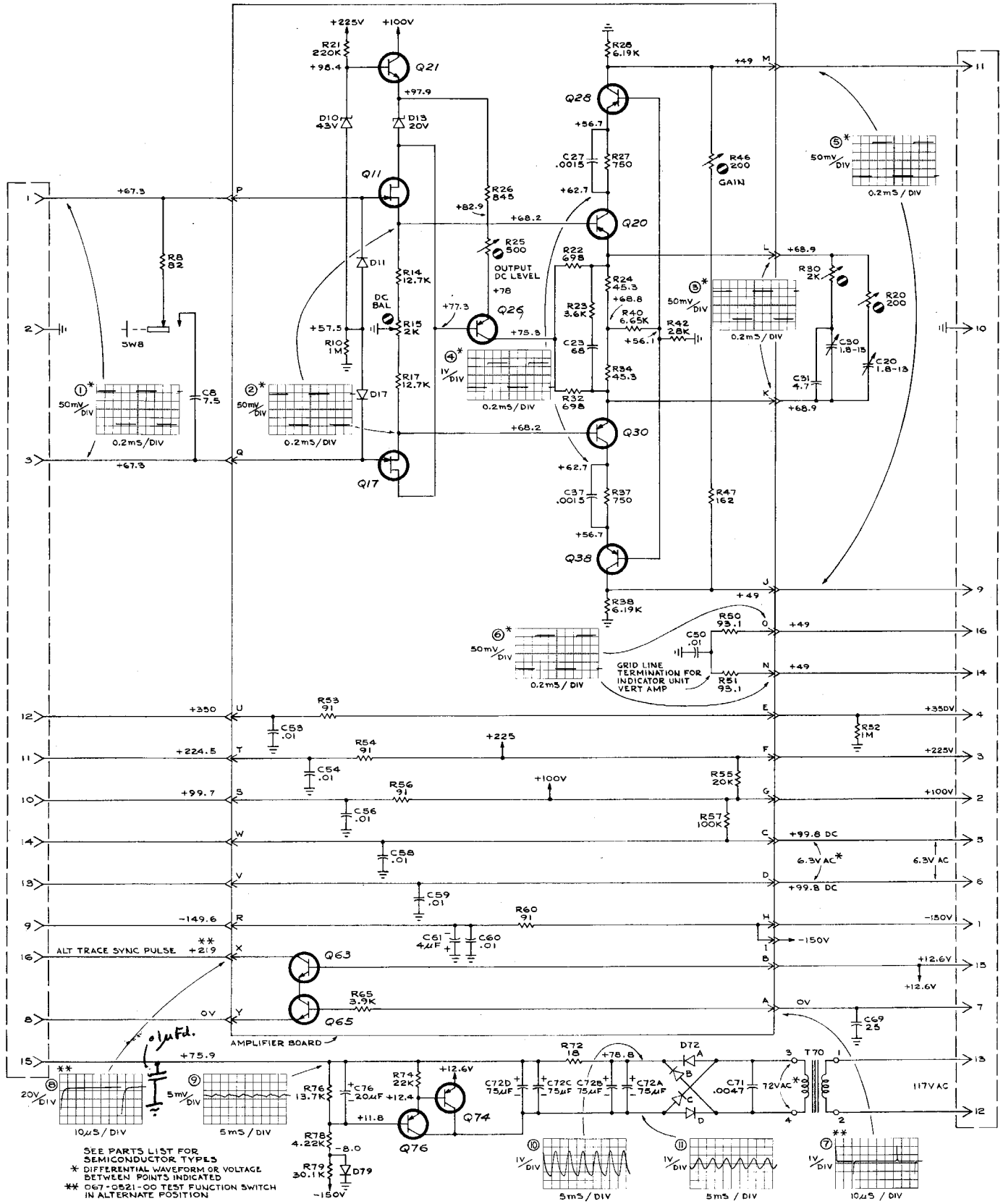
Waveforms 1 through 6: Calibration Fixture Test Function switch at Gain Set position; 581A Oscilloscope sweep not running; 50-V square wave from 581A Oscilloscope Amplitude Calibrator applied to Calibration Fixture. Oscilloscope set for external triggering; waveforms are time-related differential measurements observed between points indicated, using two 10 $\times$  probes; 1A1 in Add mode with one channel inverted.

## **NOTE**

Differential waveforms 1 through 6 are more meaningful than single-ended waveforms at points observed.

Waveforms 7 and 8: Calibration Fixture Test Function switch at Alternate position; no signal applied to Ext Input; 581A Oscilloscope sweep free-running at 5  $\mu s/cm$ ; 535A Oscilloscope set for Auto Triggering; 10 $\times$  probe used.

Waveforms 9, 10 and 11: 535A line triggered; 1 $\times$  probe used.



TYPE B1A PLUG-IN ADAPTER