INSTRUCTION MANUAL

Serial Number 2684

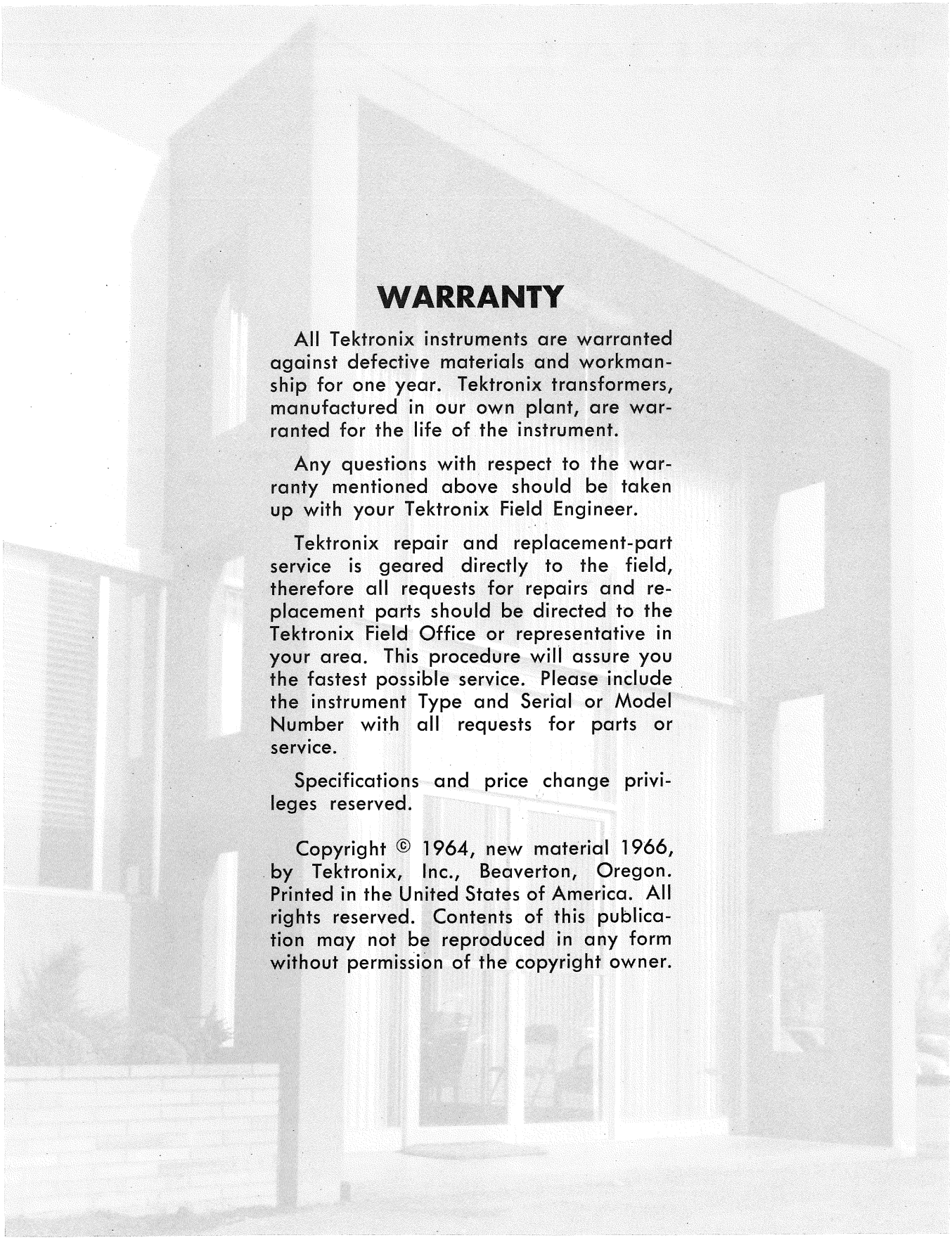
The Type TU-7, Type 1M1 and 067-0521-00 are electrically similar instruments. The Type designation was changed from TU-7 to Type 1M1 at S/N 500 and changed to 067-0521-00 at S/N 1387.

067-0521-00

CALIBRATION FIXTURE

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

070-0407-01



WARRANTY

All Tektronix instruments are warranted against defective materials and workmanship for one year. Tektronix transformers, manufactured in our own plant, are warranted for the life of the instrument.

Any questions with respect to the warranty mentioned above should be taken up with your Tektronix Field Engineer.

Tektronix repair and replacement-part service is geared directly to the field, therefore all requests for repairs and replacement parts should be directed to the Tektronix Field Office or representative in your area. This procedure will assure you the fastest possible service. Please include the instrument Type and Serial or Model Number with all requests for parts or service.

Specifications and price change privileges reserved.

CONTENTS

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

Fig. 1-1. 067-0521-00 Plug-In Test Unit

SECTION 1

CHARACTERISTICS

General Description

The 067-0521-00 Plug-In Test Unit is a versatile single-unit calibration aid for use with all Tektronix 530-, 540-, or 550-Series Oscilloscopes using 1-series or letter-series vertical plug-in units. The 067-0521-00 is the only plug-in unit required for calibrating the oscilloscope.* An input connector on the front panel permits application of various external signals for use in the calibration procedure. The self-contained unit also generates fast-rise pulses for checking risetime and adjusting transient response of the oscilloscope vertical amplifier.

The 067-0521-00 permits checking the regulation limits of the power supplies. In addition, the unit provides a quick check of the oscilloscope alternate sync pulse and chopped blanking circuitry. For oscilloscopes capable of displaying two time-base signals alternately, the 067-0521-00 checks the ability of the alternate-sweep switching circuitry to lock the channels of a dual-trace plug-in unit to the time bases of the oscilloscope.

ELECTRICAL

TEST FUNCTION SWITCH POSITIONS

LOW LOAD, HIGH LOAD

These two switch positions permit the oscilloscope low-voltage power supplies to be loaded from minimum to maximum. External signals applied through the EXT INPUT connector on the front panel of the unit will be ac-coupled to the oscilloscope vertical amplifier to produce a normal display. Maximum vertical sensitivity of the 067-0521-00 oscilloscope combination is about 0.5 volt/cm when the VARIABLE control is set fully clockwise.

GAIN SET

Permits setting the gain of the oscilloscope vertical amplifier with a 100-volt calibrator signal applied to the EXT INPUT connector. The 250-to-1 fixed ratio of this position attenuates the 100-volt signal to 0.4 volt which produces 4 cm of vertical deflection on the crt when the oscilloscope vertical amplifier gain adjustment has been accurately set.

COMMON MODE

Checks common-mode rejection ratio and dc balance of the oscilloscope vertical amplifier.

ALTERNATE

Checks operation of the alternate-mode synchronizing circuits in the oscilloscope. Also permits checking for proper sweep slaving in oscilloscopes having two time bases that can be displayed alternately. Any external signal applied to the EXT INPUT connector is attenuated approximately 1000 times by an internal attenuation network.

CHOPPED

Checks oscilloscope for proper operation in the chopped mode. Free-running rate of the dual-trace switching multivibrator is approximately 100 kc. Any external signal applied to the EXT INPUT connector is attenuated approximately 1000 times by the internal attenuation network.

+PULSE, —PULSE

In these two switch positions, a fast-rise square wave with a risetime considerably less than the vertical deflection system risetime of a Type 546 or Type 547 Oscilloscope is applied to the vertical-deflection system of the oscilloscope being adjusted. The amplitude of either a + or — pulse display can be varied between approximately 2 cm and 6 cm.

Other Controls and Connectors

REPETITION RATE

Three-position switch to select the approximate pulse repetition rate of the Pulse Generator circuit: LOW — 5 kc, MED — 100 kc, HIGH — 600 kc.

AMPLITUDE

Adjusts amplitude of the pulse applied to the oscilloscope vertical amplifier when the TEST FUNCTION switch is set to + PULSE or — PULSE.

VARIABLE

Controls amplitude of the signal applied through the EXT INPUT connector when the TEST FUNCTION switch is set to LOW LOAD or HIGH LOAD. The minimum deflection factor is 0.5 volt/cm with the VARIABLE control set fully clockwise.

VERTICAL POSITION

Controls vertical positioning of the trace or display on the crt in all TEST FUNCTION positions except COMMON MODE.

+225V Pushbutton

Provides +225 volts at the front-panel output banana jack when the pushbutton is pressed.

+225V Banana Jack

Convenient source of +225 volts for checking dc balance of each stage of a distributed vertical amplifier. With the voltage output connected to the cathodes, the stage is effectively cut off when the +225 V pushbutton is pressed.

* A sine-wave bandpass check of the system cannot be made by applying an external high-frequency sine wave through the plug-in test unit.

FUSE

Front-panel 1/16-amp fast-blow fuse protects the oscilloscope +225-volt supply if a low-resistance path occurs from the banana jack connector to ground.

EXT INPUT

Connector for applying external signals to the oscilloscope vertical system through the 067-0521-00. Useful for applying the calibrator signal when setting the gain of the oscilloscope vertical amplifier and for inserting signals for calibrating the time-base generator(s), trigger circuit(s), and trace geometry.

MECHANICAL

Construction

Aluminum-alloy chassis with anodized front panel. Circuit board sub-chassis.

SECTION 2

OPERATING INSTRUCTIONS

Introduction

This information should be used in conjunction with the calibration procedure section of the oscilloscope instruction manual. If desired, any of the following adjustments or checks may be performed without regard to sequence.

NOTE

If the —150 Volts control in the oscilloscope is adjusted, the oscilloscope should be completely recalibrated.

The 067-0521-00 is calibrated and ready for use as shipped from the factory.

Power-Supply Output Voltages

To check the oscilloscope power-supply voltages, proceed as follows:

1. Apply design-center line voltage to the oscilloscope and turn on the oscilloscope Power switch.
2. Set the 067-0521-00 TEST FUNCTION switch to LOW LOAD.
3. Measure the voltages at the power-supply test points as described in the oscilloscope instruction manual.

Power Supply Regulations and Ripple

To check the oscilloscope low-voltage power supply regulation and ripple, proceed as follows:

1. Set the oscilloscope Amplitude Calibrator switch to Off and set the oscilloscope triggering so the time-base circuit(s) does not free run.
2. With the TEST FUNCTION switch set to LOW LOAD, measure the ripple (with a test oscilloscope) of the various supplies with the line voltage at 126.5 volts (or 253 volts if the oscilloscope is wired for 230-volt operation).
3. Set the line voltage at 103.5 volts (or 207 volts) and set the TEST FUNCTION switch to HIGH LOAD. Measure the ripple of the various supplies. Refer to the oscilloscope instruction manual for ripple voltage limits.

Oscilloscope Vertical Gain

To check or set the oscilloscope vertical gain, proceed as follows:

1. Set the TEST FUNCTION switch to the GAIN SET position.
2. Apply a 100-volt peak-to-peak Calibrator signal to the 067-0521-00 EXT INPUT connector.
3. Free-run the oscilloscope time base at about 1 msec/cm. Two traces should be visible on the crt. Use the VERTICAL POSITION control to center the display.
4. Adjust the oscilloscope Vertical Gain control for exactly 4 cm vertical distance between the two traces. Keep the display centered vertically on the crt while making this adjustment.
5. Turn off the Calibrator and disconnect the signal lead.

Oscilloscope Vertical Amplifier Balance

The amount of vertical amplifier dc unbalance must be small for optimum common-mode rejection ratio and for linear amplifier operation. To check the amount of dc unbalance, a suggested procedure is as follows:

1. Set the TEST FUNCTION switch to COMMON MODE.
2. With a small screwdriver, short the crt vertical deflection-plate pins together.

CAUTION

Do not short the crt deflection-plate pins to ground. Excessive current will damage the power supply.

3. Note the position of the trace. This is the electrical center of the crt vertical deflection plates.
4. Remove the screwdriver from the crt pins.
5. Note the amount of vertical distance that the trace shifts between the shorted condition and the non-shorted condition. Refer to the oscilloscope instruction manual for the vertical unbalance limit.

If your oscilloscope vertical amplifier has a distributed amplifier section, the +225V front-panel connector on the 067-0521-00 supplies +225 volts when the pushbutton switch is pressed. A lead connected from this connector can be used to apply +225 volts to the cathodes of the tubes in the vertical amplifier. This voltage effectively cuts the tubes off for checking the dc balance of each stage.

Oscilloscope Alternate-Trace Sync Pulse Check

Set the TEST FUNCTION switch to ALTERNATE. If two traces appear on the crt, the oscilloscope time-base generator is producing proper alternate-trace sync pulses for the plug-in unit. Check each sweep rate to be sure the sync pulse is present with sufficient amplitude. If the oscilloscope has two time bases, make the same check for the other time base.

Alternate-Sweep Slaving Check

If your oscilloscope is capable of alternating between two time bases, check this mode of operation as follows:

1. Set the oscilloscope Horizontal Display switch to Alternate.

2. Set both Time/Cm switches to .5 mSec.

3. Set both Triggering Mode switches to Auto, and both Triggering Source switches to Plug-In.

4. Set the TEST FUNCTION switch to ALTERNATE.

5. Apply a 100-volt peak-to-peak Calibrator signal to the INPUT connector.

6. Adjust the Triggering Level controls of both time bases to trigger the displays. (For a Type 547 Oscilloscope, the Trace Separation control should be set to zero.)

7. Check that 0.5 cm of the Calibrator waveform is displayed when Time Base A is generating its sweep (lower trace), and that 1 trace width of the Calibrator waveform is displayed when Time Base B generates its sweep (upper trace). Fig. 2-1 shows the oscilloscope display.

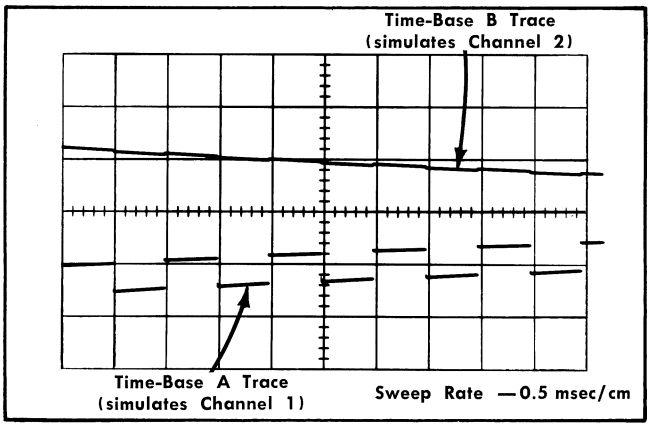


Fig. 2-1. Alternate-sweep slaving check.

8. Check that Time Base A is locked to the lower trace by turning the Time Base A Time/Cm switch. The waveform in the upper trace should not change.

In this check, the lower trace simulates the Channel 1 operation of a dual-trace plug-in preamplifier and the upper trace simulates Channel 2.

Oscilloscope Chopped-Mode Operation

To check the oscilloscope for chopped-mode operation (with no input signal applied), proceed as follows:

1. Set the TEST FUNCTION switch to CHOPPED.

2. Set the oscilloscope Time/Cm switch to 5 μSec/Cm.

3. Adjust the oscilloscope triggering controls for a stable chopped waveform display (Fig. 2-2).

4. Set the oscilloscope Crt Cathode Selector switch to the Chopped Blanking position and check that the fast rising and falling portions (switching portions) of the display are blanked so that only the "on" segments of each trace are visible (Fig. 2-3).

5. If your oscilloscope has two time bases, make the same check using the other time base.

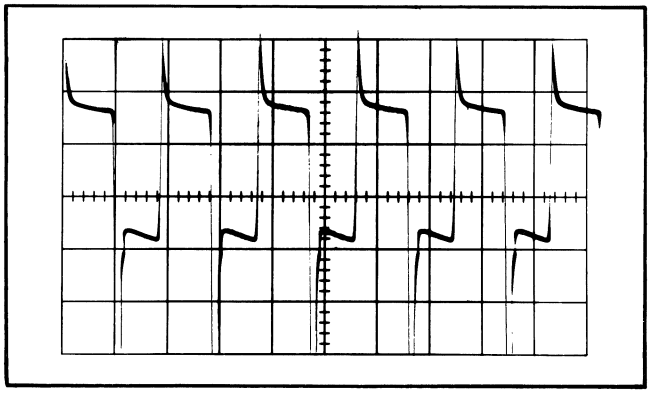


Fig. 2-2. Chopped waveform display.

6. After checking the chopped mode of operation, return the oscilloscope Crt Cathode Selector switch to the Crt Cathode position.

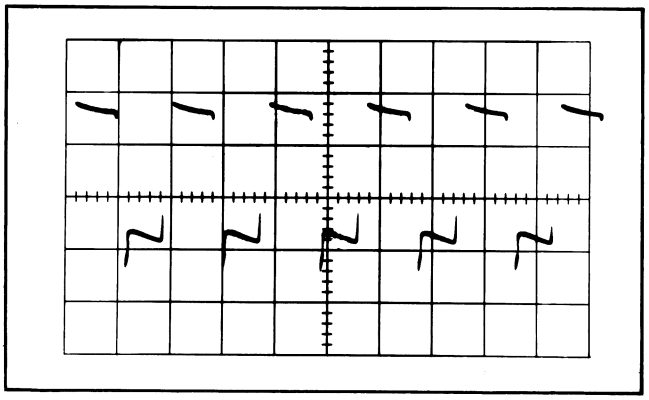


Fig. 2-3. Chopped blanking check with Crt Cathode Selector switch at Chopped. Vertical switching lines are blanked.

Oscilloscope Vertical Amplifier Transient Response

After completing the oscilloscope calibration procedure for vertical amplifier unbalance and after checking the vertical gain, check the transient response as follows:

1. Set the TEST FUNCTION switch to + PULSE.

2. Set the REPETITION RATE switch to HIGH. (For the Type 547 Oscilloscope, set switch to MED.)

3. Set the oscilloscope Time/Cm switch to .1 μSec/Cm.

4. Set the VARIABLE AMPLITUDE control to produce a display 4 cm in amplitude for 6-cm scan oscilloscopes or 3 cm in amplitude for 4-cm scan oscilloscopes.

NOTE

Do not use the 067-0521-00 with a plug-in extension for the high-frequency checks. The extension may cause considerable ringing to appear on the display of fast-rising pulses such as the Pulse Generator signal.

5. Carefully focus and check the display. If the waveshape does not show good transient response because of overshoot, rolloff or bumpiness, proceed with the adjustments described in the oscilloscope instruction manual.

Other Checks

The 067-0521-00 can be used as a limited bandpass plug-in unit. It is useful for inserting calibrated time marks into the vertical system when adjusting the oscilloscope geometry, trigger, and time-base circuits for proper operation. For making a sine-wave bandpass check of an oscilloscope preamplifier system, use a 1-series or letter-series plug-in unit rather than the plug-in test unit.

When using the 067-0521-00 to couple an input signal to the oscilloscope vertical amplifier, the deflection factor of the unit is about 0.5 volt/cm with the TEST FUNCTION switch set to LOW LOAD or HIGH LOAD and the VARIABLE control turned fully clockwise. LOW LOAD is the normal position of the TEST FUNCTION switch for displaying signals applied through the EXT INPUT connector.

Resistance Measurements

Blank columns are provided in Table 4-1 for recording resistance readings and the meter used. Resistance measurements recorded when the 067-0521-00 operates correctly may be useful if trouble should occur.

NOTES

SECTION 3
CIRCUIT DESCRIPTION

General Information

Fig. 3-1 is a block diagram of the 067-0521-00 Plug-In Test Unit. The circuitry of the unit may be separated into three major divisions: the Power Supply Loading Circuit, the Dual-Trace Switching Circuit, and the Pulse Generator Circuit. All three of these circuits are controlled by TEST FUNCTION switch SW10.

POWER SUPPLY LOADING CIRCUIT

General Operation

The purpose of this circuit is to operate the regulated power supplies of the oscilloscope under extreme load conditions to determine if they regulate properly. Fixed-resistor dummy loads are used to simulate the loading effect of plug-in preamplifiers. The LOW LOAD and HIGH LOAD positions of the TEST FUNCTION switch are used to connect the correct loads to the low-voltage power supplies. The GAIN SET position provides a check of the gain of the oscilloscope vertical amplifier. The COMMON MODE position of the switch provides a check of the oscilloscope vertical amplifier rejection ratio. The last four positions of the TEST FUNCTION switch operate the dual-trace switching circuit or the pulse generator circuit and will be discussed under those headings.

Detailed Description

When TEST FUNCTION SW10 is set to the LOW LOAD position, the main load on the —150-volt supply is provided through R125, with slight additional loading through the dual-trace switching multivibrator circuit. The +100-volt supply is loaded primarily by R121, R124, R18, and R19, with additional loading through R85 and R86. Minimum loading for the +225-volt supply is provided by R122, as well as the resistors in the vertical position network, R80A,B,C,D, R81 and R82. The +350-volt supply receives no load in the LOW LOAD position. All of the minimum load resistances remain in the circuit at all times.

When the TEST FUNCTION switch is set to the HIGH LOAD position, additional dummy load resistors are connected to all four low-voltage power supplies. R116 loads the —150-volt supply; R111 and R112 in parallel load the +100-volt supply; R109 and R110 in parallel load the +225-volt supply; and R106 and R107 in parallel load the +350-volt supply.

Pins 1 and 3 of the interconnecting plug are the input signal and vertical positioning connections for the oscillo-

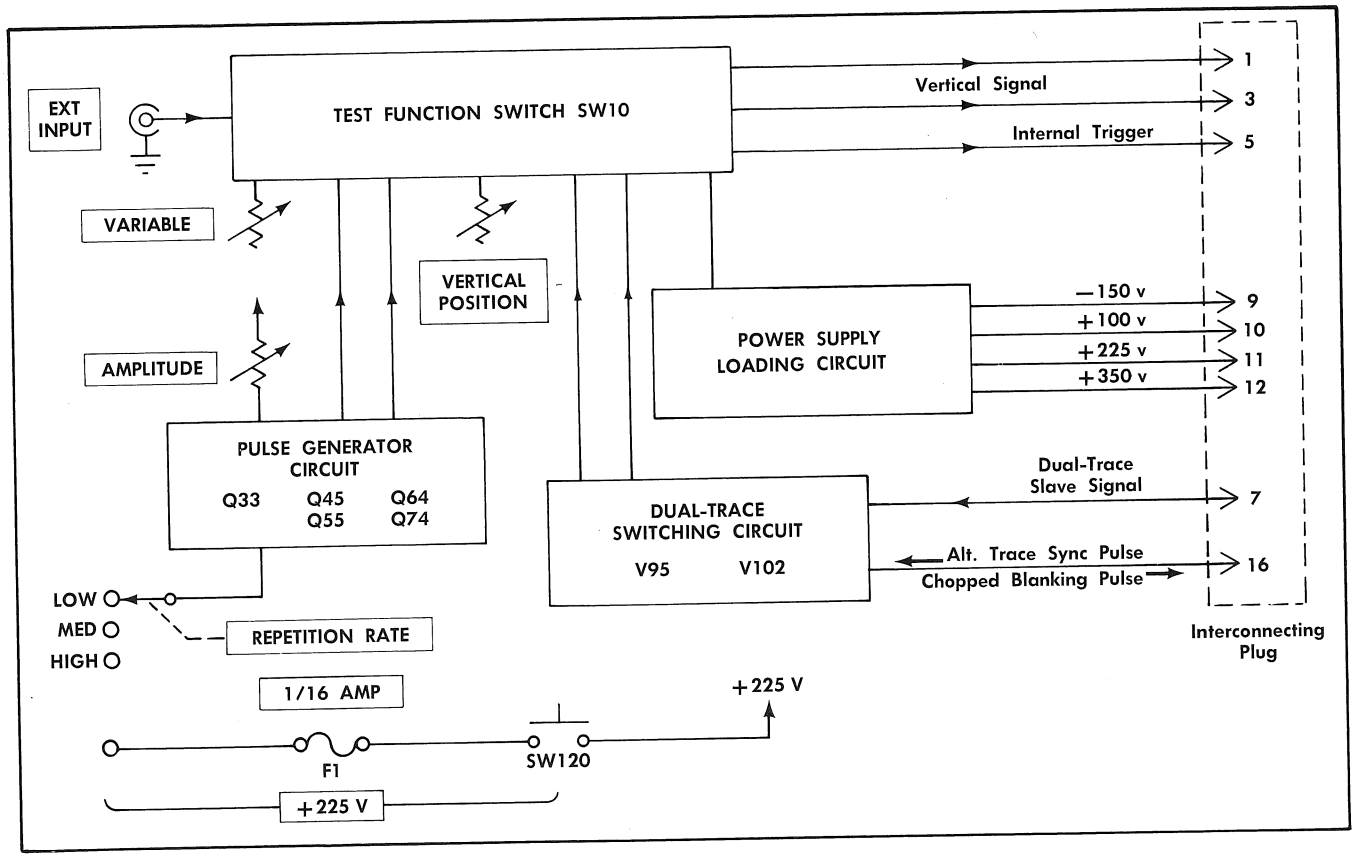


Fig. 3-1. 067-0521-00 Block diagram.

scope vertical amplifier. When using the LOW LOAD or HIGH LOAD positions, an external signal applied to the INPUT connector is ac coupled through C22 to pin 1 of the interconnecting plug. Since the signal is applied to pin 1 only, it provides signle-ended drive to the vertical amplifier. Front-panel VARIABLE control R11, connected between the junction of R10/C10 and ground, controls the amount of input signal applied to pin 1. R10 and C10 provide some input signal frequency compensation. Vertical positioning of the trace is provided by the voltage applied to pin 3 of the interconnecting plug through the vertical position network.

An internal trigger signal is applied from the junction of R12 and R14 to pin 5 of the interconnecting plug. For oscilloscopes that can trigger directly from the plug-in unit, this signal simulates the internal trigger signal from a dual-trace plug-in preamplifier, such as the Tektronix Type 1A1.

In all positions of the TEST FUNCTION switch except COMMON MODE, +PULSE, and —PULSE, two separate voltage dividers set the dc voltages at pins 1 and 3 of the interconnecting plug at +67.5 volts with the trace centered and no signal applied. This voltage, which simulates the nominal output voltage of a plug-in preamplifier, is essential at the input of the oscilloscope for linear operation of the vertical amplifier. The voltage at pin 1 is set by voltage divider R16, R17, R18 and R19. The voltage at pin 3 is set by voltage divider R84, R85, R86, vertical positioning network R80A, B, C, D, R81, and VERTICAL POSITION control R82. The VERTICAL POSITION control varies the divider voltage applied to pin 3 of the interconnecting plug and thus controls the vertical position of the display in all positions of the TEST FUNCTION switch except COMMON MODE.

In the GAIN SET position of the TEST FUNCTION switch, a precision 250-to-1 divider consisting of R17 in series with parallel resistors R18 and R19 sets the amount of input calibrator signal applied to the oscilloscope vertical amplifier. Thus, if a 100-volt peak-to-peak calibrator signal is used, the divider dc couples a 0.4-volt signal to pin 1 of the interconnecting plug. This signal results in a 4-cm deflection on the crt if the gain of the oscilloscope vertical amplifier is set correctly.

In the COMMON MODE position of the TEST FUNCTION switch, a signal applied to the INPUT connector is ac coupled through C22 and applied equally through R25 and R26 to pins 1 and 3 of the interconnecting plug. The TEST FUNCTION switch disconnects the AMPLITUDE and VERTICAL POSITION controls. In this position, voltage divider R16, R17, R18 and R19, sets the dc voltage at both pin 1 and pin 3. Since the same signal is applied in phase to both sides of the oscilloscope vertical amplifier, the signals will cancel if the rejection ratio of the amplifier is high. The position of the trace on the crt is the dc balance point of the oscilloscope vertical amplifier, whether or not a signal is applied to the input.

DUAL-TRACE SWITCHING CIRCUIT

General Operation

The Dual-Trace Switching Circuit consists of plate-coupled switching multivibrator V95A/V95B and steering diodes V102A/V102B. Under normal conditions, the circuit performs five general functions:

1. When the TEST FUNCTION switch is set to ALTERNATE, the switching multivibrator operates in a bistable configuration. An alternate-trace sync pulse from the oscilloscope at the end of each sweep is applied via pin 16 on the interconnecting plug, switching the multivibrator from one state to the other by turning on the steering diode that was cut off. The output of the multivibrator is a sequence of two dc levels for each complete cycle of operation. The two levels produce two alternate traces on the crt. A signal applied to the EXT INPUT connector also appears at pin 1 of the interconnecting plug, and is displayed by the lower trace, simulating the Channel 1 operation of a dual-trace preamplifier plug-in unit. The upper trace, which simulates Channel 2, displays essentially no signal.

2. In the alternate mode of operation, a portion of the applied signal is picked off and used as an internal trigger signal at pin 5 of the interconnecting plug. If the oscilloscope is capable of internally triggering on the signal at pin 5, a stable display of the applied signal can be obtained.

3. In the alternate mode of operation, if the oscilloscope has two time bases that can be operated alternately, a "slave pulse" signal is applied from the oscilloscope via pin 7 of the interconnecting plug through the steering diode stage to the switching multivibrator. The slave pulse sets the state of the multivibrator so the upper trace will be displayed when Time Base B generates its sweep. At the end of the Time Base B sweep, a sync pulse applied through pin 16 and the steering diode causes the multivibrator to switch states so the lower trace will be displayed while Time Base A generates its sweep.

4. When the TEST FUNCTION switch is set to the CHOPPED position, the switching multivibrator is in an astable configuration. The free-running rate of the circuit is approximately 100 kc. The output of the circuit is a sequence of two dc levels which produces a display of two traces chopped into off-on segments at the 100 kc rate. A signal applied to the INPUT of the 067-0521-00 is ac coupled to pin 1 of the interconnecting plug and is displayed by the "on" segments of the lower trace. The upper and lower traces simulate the operation of Channels 2 and 1 respectively of a dual-trace preamplifier operated in the chopped mode.

5. With the 067-0521-00 set for chopped mode, the switching multivibrator produces blanking pulses that are applied through pin 16 of the interconnecting plug to the oscilloscope blanking circuit. The blanking pulses cause the crt beam to be blanked during the time the beam is being switched from one trace to the other.

Detailed Operation

When the TEST FUNCTION switch is set to the ALTERNATE position, the voltage in the grid circuit of the switching multivibrator is set at a level that causes the circuit to operate as a bistable multivibrator. Basic operation of the circuit is illustrated in Fig. 3-2. To show the operation of the circuit, assume that V95A is initially conducting and V95B is cut off. With current through V95A, V102A is reverse biased and non-conducting due to the voltage drop across R94. D89 and D90 are forward biased by current through V95A.

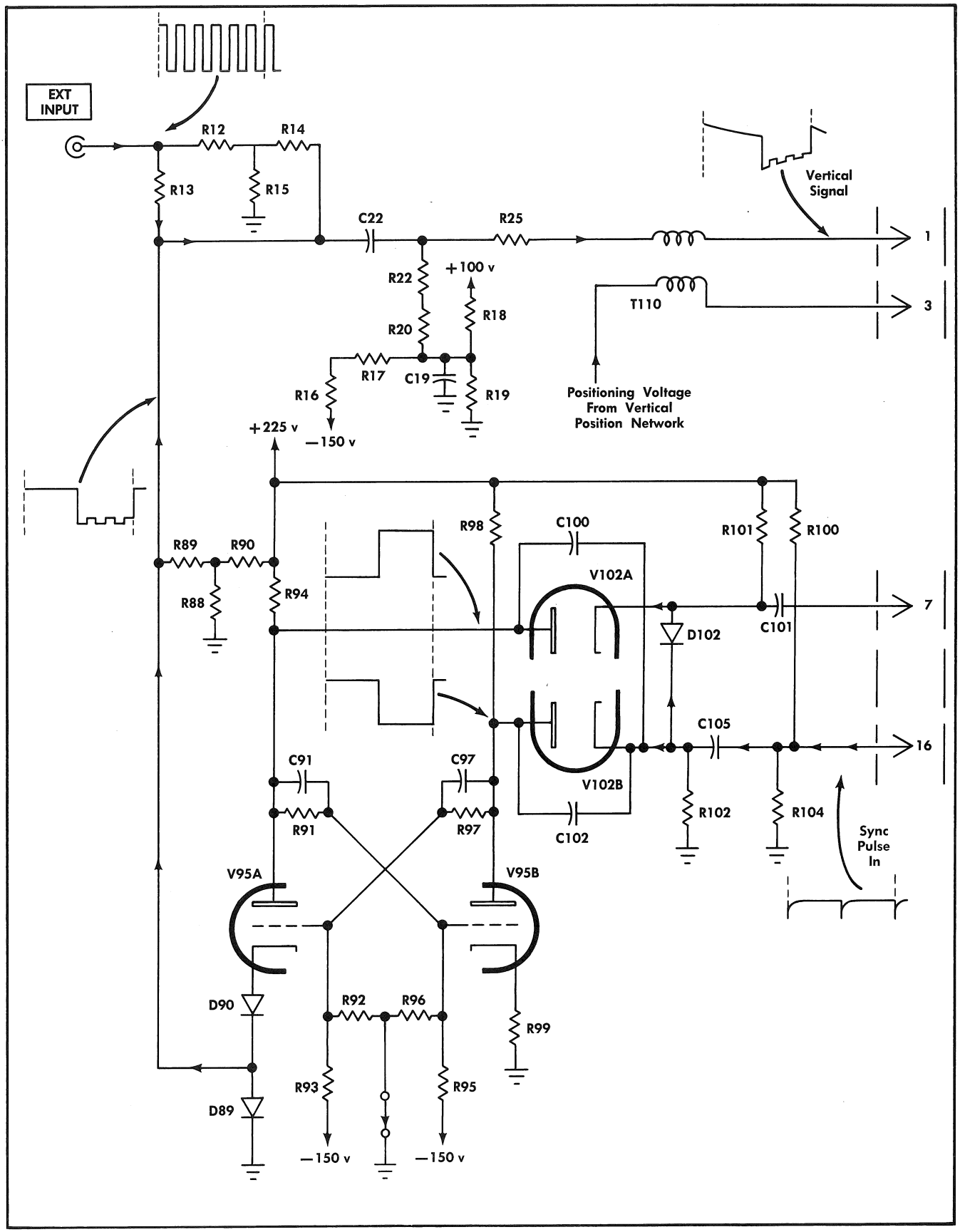


Fig. 3-2. Simplified schematic of Dual-Trace Switching circuit showing basic operation with TEST FUNCTION switch at ALTERNATE.

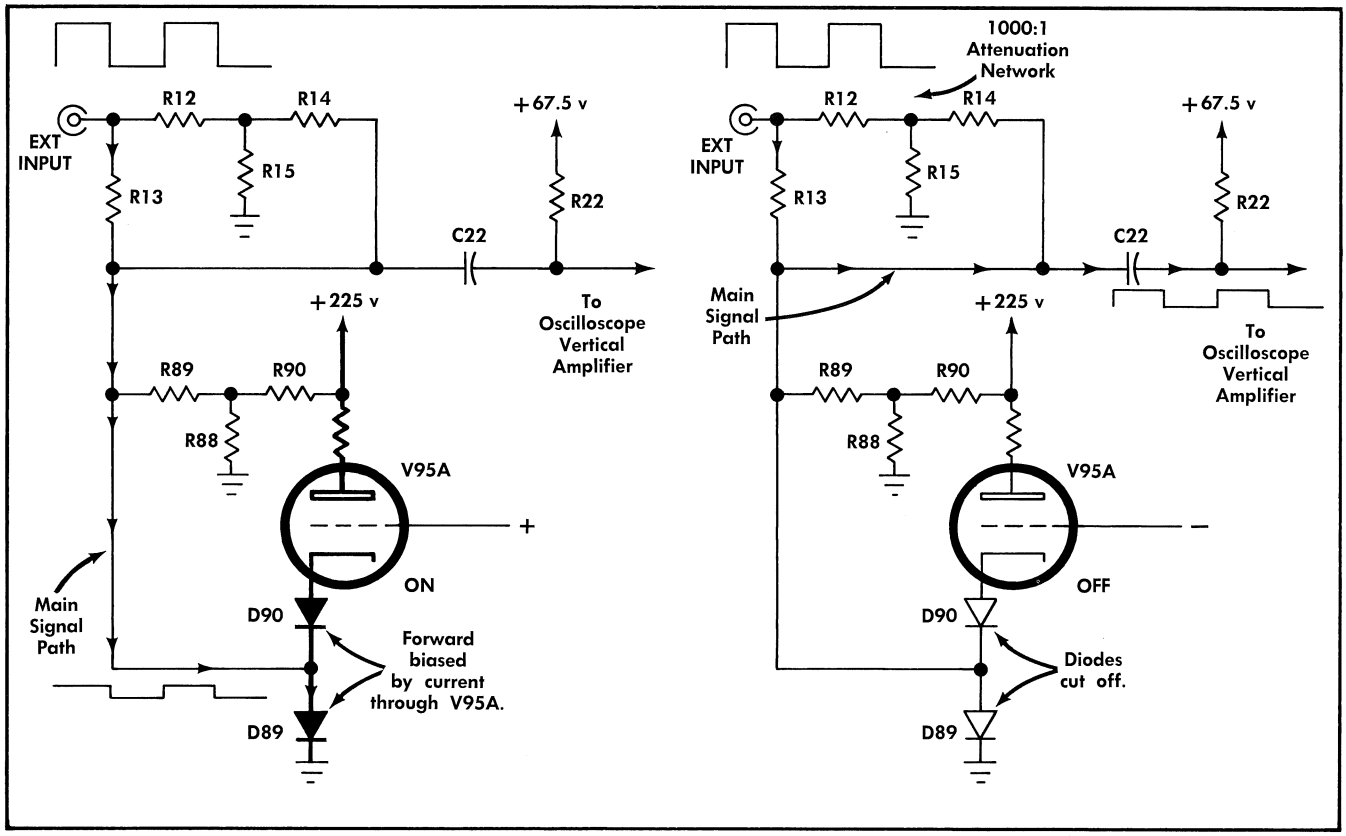


Fig. 3-3. Simplified schematic diagram showing input signal path during the two states of the dual-trace switching multivibrator, with TEST FUNCTION switch set to ALTERNATE or CHOPPED.

The voltage drop across D89 sets the dc level of the output applied to C22 at approximately 0.2 volt, causing the displayed trace to start about 2 cm above zero signal dc level. The major portion of any signal applied to the EXT INPUT connector is shunted to ground through D89 (see Fig. 3-3), so essentially no waveform is displayed. The initial +0.2 volt signal dc level rapidly drops toward the dc voltage applied through R22 due to the ac-coupling through C22. At sweep rates slower than about 50 msec/cm, the trace reashes the dc voltage very near the beginning of the sweep.

A negative-going sync pulse produced by the oscilloscope at the end of each sweep is received by the Dual-Trace Switching circuit through pin 16 of the inter-connecting plug and is applied through C105 to the cathode of V102B and through D102 to the cathode of V102A. The pulse causes V102A to conduct monentarily, and the pulse appears at the grid of V95A through C91 and R91. V95B, however, is already cut off and the pulse has no effect on V95B. The same pulse applied to the cathode of V102B, which is conducting, appears at the grid of V95A through C97 and R97 and cuts it off, switching the multivibrator to its other bistable state. After switching, V95A and V102B are cut off, and V95B and 102A are conducting. With no current through V95A, bias current is removed from D89 and D90, cutting them off. The dc output level applied to C22 drops from 0.2 volt to approximately ground, set by R88/R89. Any signal now applied to the EXT INPUT connector is attenuated by the 1000:1 attenuator at the input, and applied through C22 to the vertical amplifier of the oscilloscope. The lower trace with the waveform is then displayed on the crt.

At the end of the sweep, another sync pulse arrives through pin 16 and C105 and is directed to the cathode of V102B and through D102 to the cathode of V102A. The pulse causes V102B to conduct momentarily, and since V102A is already conducting, the pulse appears at both multivibrator grids. V95B then reverts to its original state (cut off), and V95A again conducts. With V95A conducting, current through D89 and D90 shunts any input signal to ground and sets the dc output level at 0.2 volt, starting another cycle of operation.

When using an oscilloscope capable of alternating between time-base circuits, an alternate-trace slave pulse is applied through pin 7 of the inter-connecting plug and C101 to the cathode of V102A (see Fig. 3-4). The slave pulse is a negative gate from the sweep switching circuit of the oscilloscope, time-related to the sync pulses in such a way as to lock the upper trace of the Alternate display to the Time Base B sweep of the oscilloscope. (The Trace Separation control on a Type 547 should be set to zero). This operation simulates the locking of channel 2 on a dual-trace plug-in preamplifier to the Time Base B sweep, and Channel 1 to the Time Base A sweep.

The negative slave pulse starts at the end of Time Base A sweep as a voltage at pin 7 drops from about +45 volts to zero, and ends at the end of Time Base B sweep as the voltage returns to +45 volts. The pulse appears as a differentiated signal at the cathode of V102A. The positive portion of the differentiated signal does not appear at the cathode of

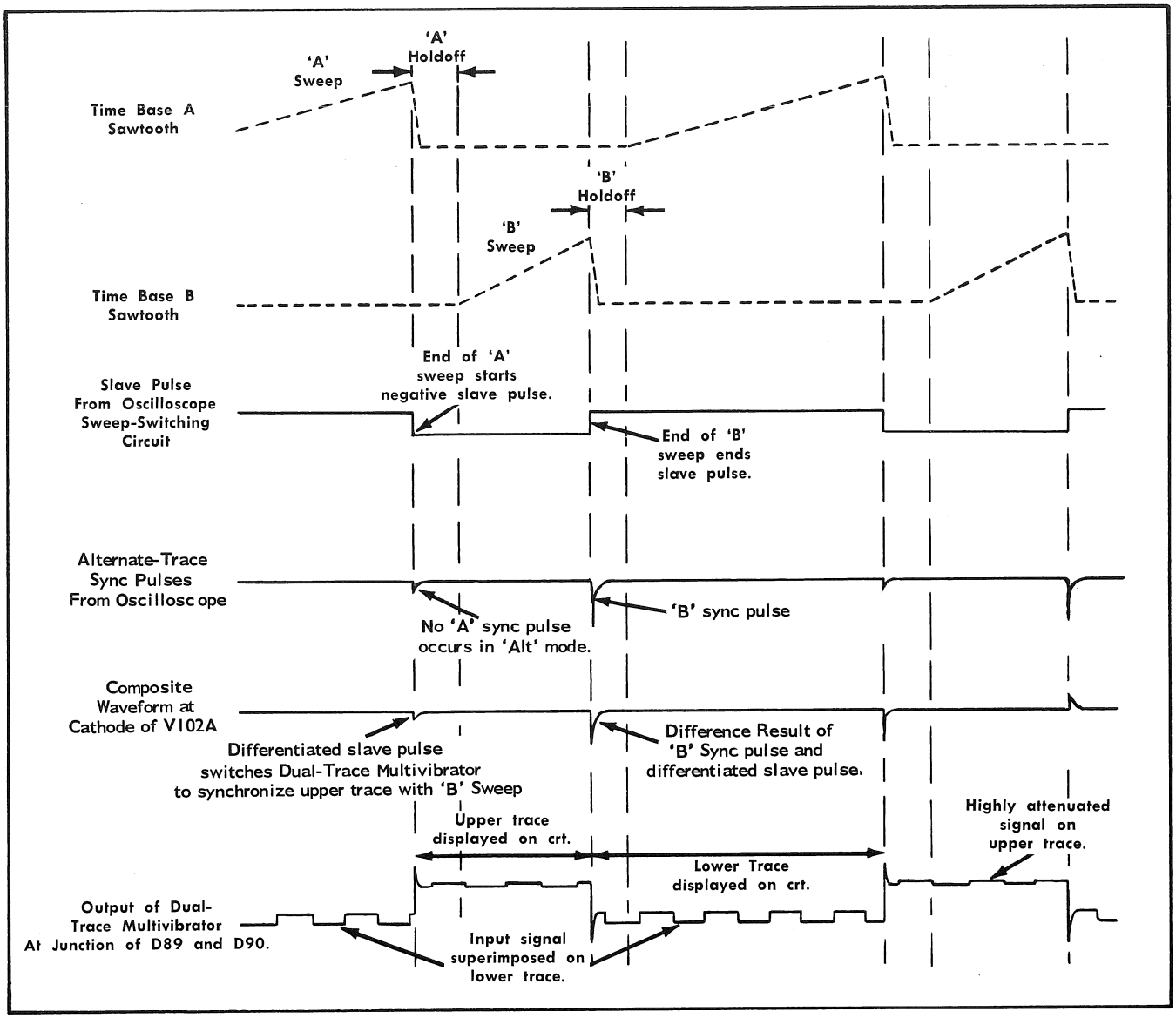


Fig. 3-4. Timing relationship of waveforms during alternate-sweep slaving operation of oscilloscopes capable of alternate-sweep switching. Sweep rate of Time Base B is set twice as fast as Time Base A.

V102A, since it arrives at the same time as the large negative Time Base B sync pulse through D102. No sync pulse is received from the oscilloscope at the end of "A" sweep, thus the composite signal at the cathode of V102A consists of negative spikes which are alternately the sync pulse at the end of + "B" sweep, then the slave pulse at the end of "A" sweep.

When V102B and B95A are conducting, the switching multivibrator is set to display the upper trace (Time Base B sweep). In this state, the negative slave pulse has no effect on the multivibrator; since the pulse cannot pass through D102, it is applied through V102A to the grid of V95B, which is already cut off. However, when V102B and V95A are cut off, the multivibrator is not set to display the upper trace. In this case, if a slave pulse arrives, it will cut off V95B, turning on V95A and resetting the multivibrator to be ready to display the upper trace. Thus the upper trace always occurs immediately following the negative slave pulse and is locked to the Time Base B sweep.

When the TEST FUNCTION switch is set to the CHOPPED position, the voltage in the grid circuit of the switching multivibrator sets the circuit for astable operation. See Fig. 3-5. The switching action begins as soon as supply voltages are connected, due to slight characteristic differences between the A and B sections of the tube. The repetition rate of the multivibrator in the Chopped mode is approximately 100 kc, set by the supply voltages and the resistor-capacitor combinations in the grid and plate circuits.

As the multivibrator switches from one state to the other, one output signal is generated in the same manner as the vertical switching signal in the Alternate mode as D89 turns on and off. Each time V95A conducts, D89 and D90 are forward biased and D89 shunts to ground any signal applied to the EXT INPUT connector during the time that the upper trace

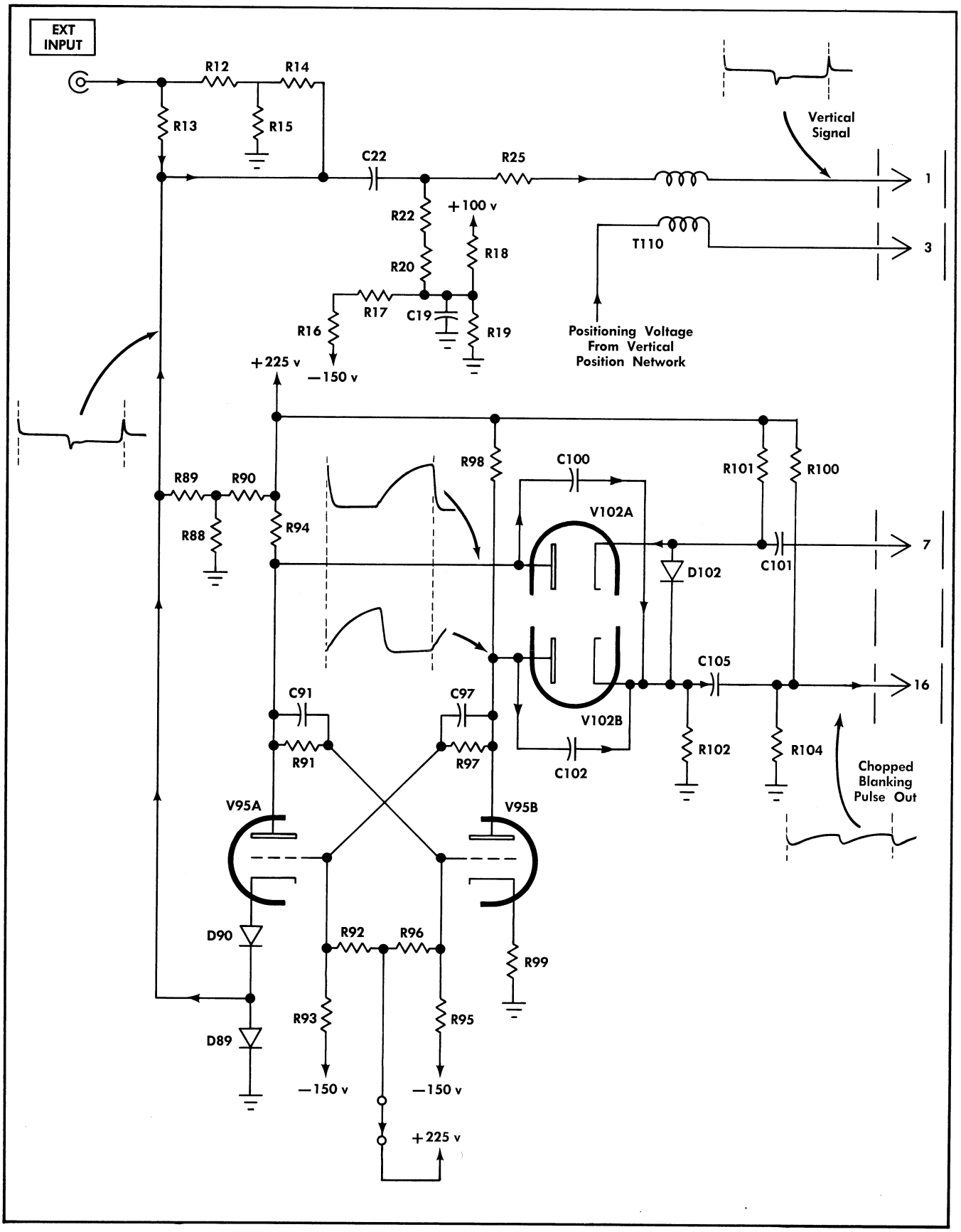


Fig. 3-5. Dual-Trace Switching circuit showing operation with TEST FUNCTION switch at CHOPPED.

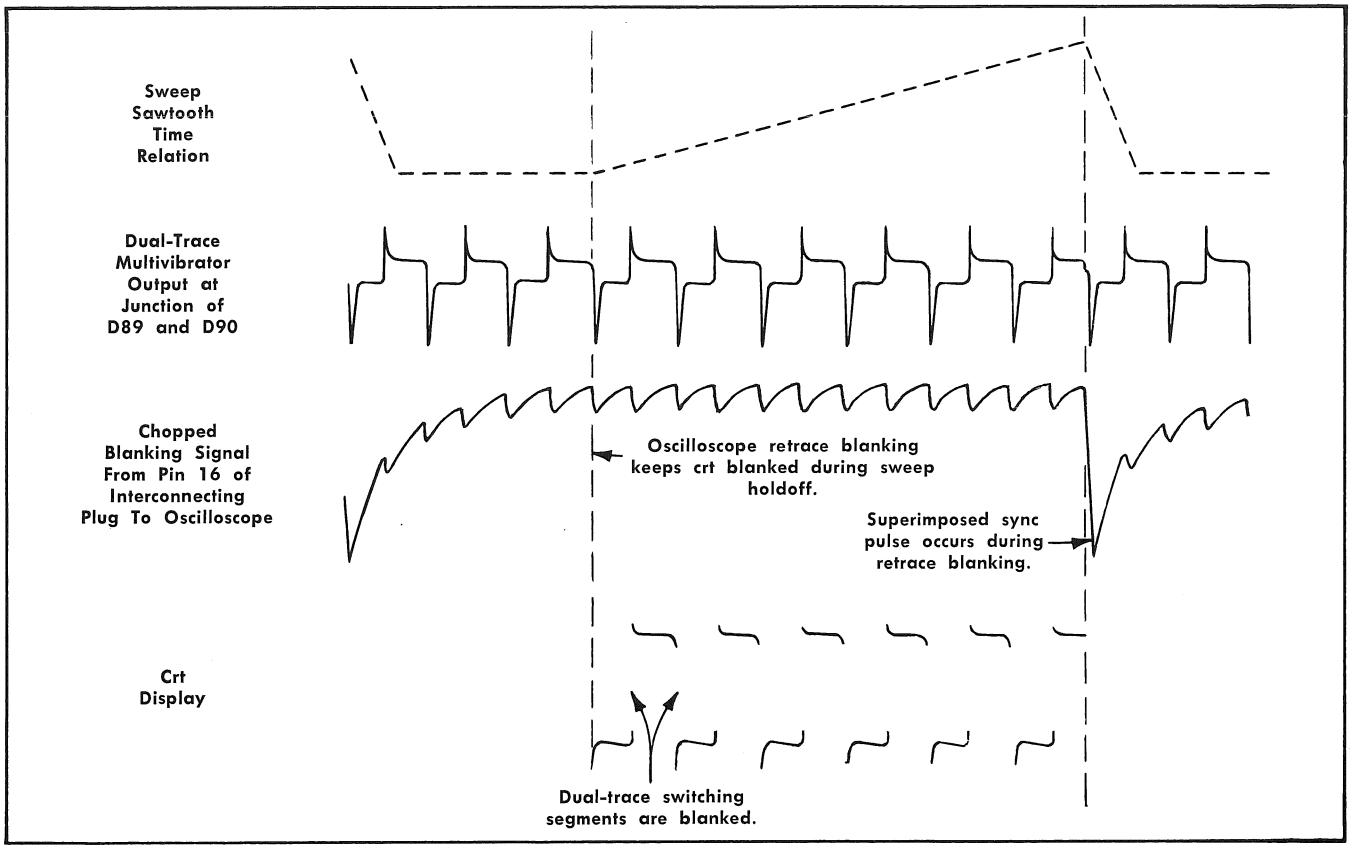


Fig. 3-6. Timing of chopped blanking pulses from 067-0521-00 to oscilloscope crt cathode with TEST FUNCTION switch at CHOPPED.

segment apears on the crt. Then when V95A cuts off, D89 stops conducting and the lower trace appears on the crt. If a signal is applied to the input at this time, it will be displayed by the lower trace for the duration of the trace segment. Refer to the discussion of Alternate operation for a more detailed description of this switching signal.

A second output is produced in the plate circuits of the multivibrator and coupled out through C100 and C102. Each time the multivibrator switches states, the voltage in the plate circuit of one tube drops fast as the tube turns on, stays at the lower voltage level until the other tube turns on, then rises slowly to its maximum value as the capacitance charges through a relatively high impedance path. The waveforms produced in both plate circuits of the switching multivibrator are coupled through C100 and C102 to the cathode circuit of V102B where they are combined and applied through C105 and pin 16 of the interconnecting plug to the oscilloscope blanking circuit. The frequency of the composite output chopped blanking signal is twice the repetition rate of the switching multivibrator. See Fig. 3-6. This output signal is inverted and amplified in the oscilloscope and applied to the crt cathode to blank the crt beam during the switching portions of the signal sent to the vertical amplifier through pin 1 of the interconnecting plug.

PULSE GENERATOR CIRCUIT

General Operation

The Pulse Generator circuit consists of rate generator multivibrator Q45/Q55, constant-voltage transistor Q33, current-switching transistors, Q64/Q74, and disconnect diodes D64, D65, D74 and D75. Fig. 3-7 is a simplified schematic of the circuit. When the TEST FUNCTION switch is set to the + PULSE or — PULSE position, the rate generator operates as an astable circuit. One complete multivibrator cycle turns the current-switching transistors on and off. As these transistors are turned on, they shunt across the disconnect diodes which then cut off very fast, producing the fast-rise step-function output (see Fig. 3-8). As the current-switching transistors are turned off again, the disconnect diodes conduct again and the output pulse ends (see Fig. 3-9).

Detailed Operation

For the following discussion, assume that the TEST FUNCTION switch is set to the + PULSE position and the AMPLITUDE control is turned fully clockwise to the maximum amplitude position. The TEST FUNCTION switch connects the +100-volt supply to the collector circuit of Q33, and applies about +75 volts to the base of the transistor through D30 and R30. The transistor is thus turned on with emitter current provided through D35 and R39 from ground. When the circuit is correctly adjusted, the voltage at the emitter of Q33 is approximately +75 volts, providing all positive supply voltages for the Pulse Generator circuit. The +60 volts existing at the anode of D35 provides the supply voltage for the base circuits of the rate generator multivibrator and for one end of the amplitude control network. DRIVE BAL R40 is adjusted so the push-pull output voltages are equal.

As soon as supply voltages are applied to the circuit, the rate generator begins its astable multivibrator operation.

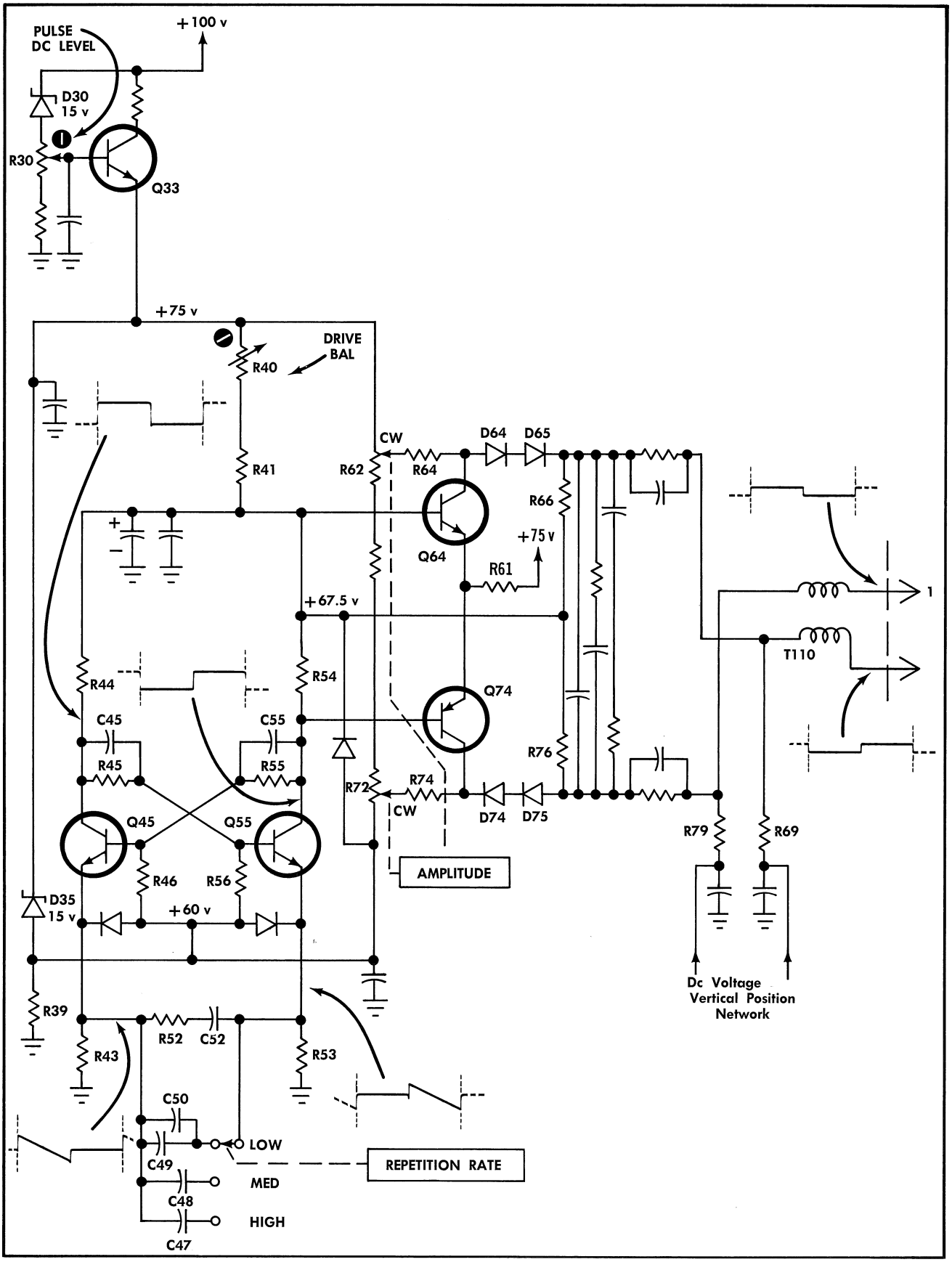


Fig. 3-7. Simplified schematic of the Pulse Generator circuit with TEST FUNCTION switch at +PULSE and AMPLITUDE control fully clockwise.

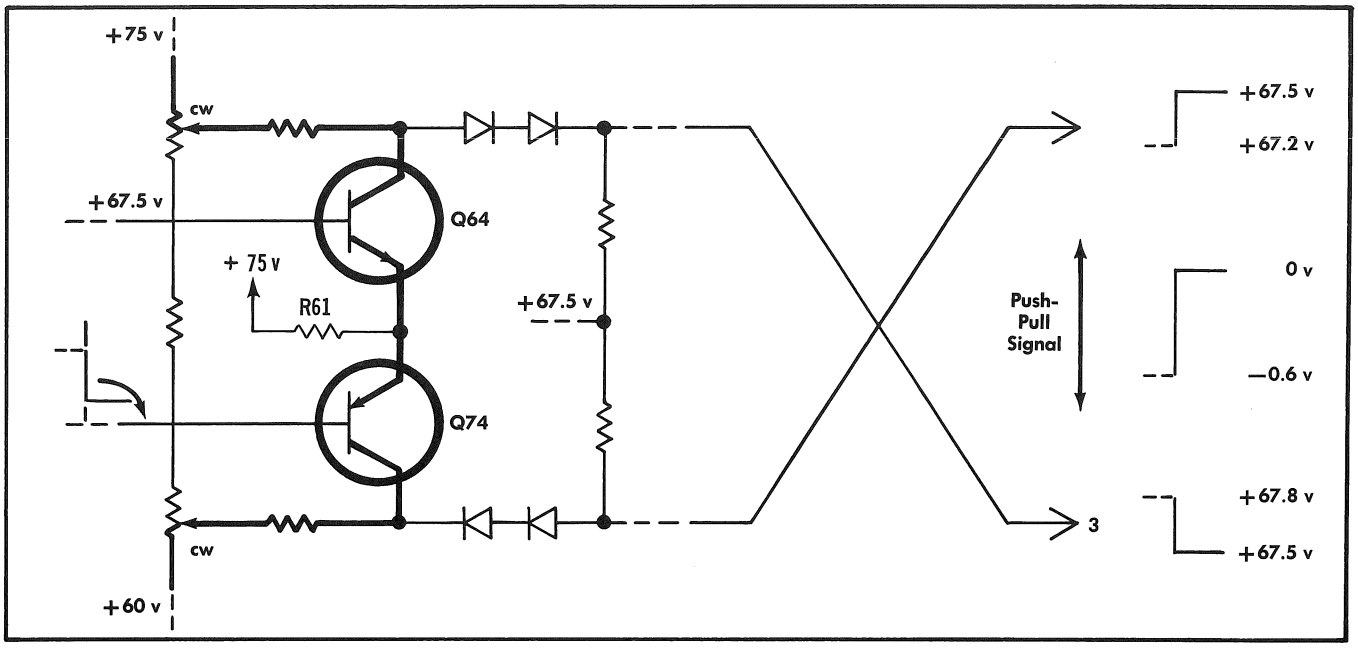


Fig. 3-8. Major current path during rise and top of pulse with TEST FUNCTION switch at +PULSE and AMPLITUDE control fully clockwise.

During the multivibrator cycle, when Q45 is conducting and Q55 is cut off, the positive voltage at the collector of Q55 causes the current through Q74 to be limited to approximately 10 μA or less through R61. Since the current through Q74 is limited to a few microamperes the voltage across the base-emitter junction of Q74 is not enough to forward bias Q64 and it is held in cutoff. With no current through Q64 and a limited amount of current through Q74, the disconnect diodes are forward biased and are conducting current from the supply voltages through R62/R64/R66 and R72/R74/R76. Current through the disconnect diode circuit and thus through the output resistors (R66/R76) is adjusted by ganged AMPLITUDE controls R62/R72. The output voltages are applied to pins 1 and 3 of the interconnecting plug and produce the baseline voltage on the crt display of the +pulse. With the AMPLITUDE control turned fully clockwise and the disconnect diodes conducting, this output is approximately +67.2 volts at the junction of D75 and R76, and approximately +67.8 volts at the junction of D65 and R66.

During the time that Q55 is cut off, C52 and the capacitor selected by REPETITION RATE SW50 charge to ground

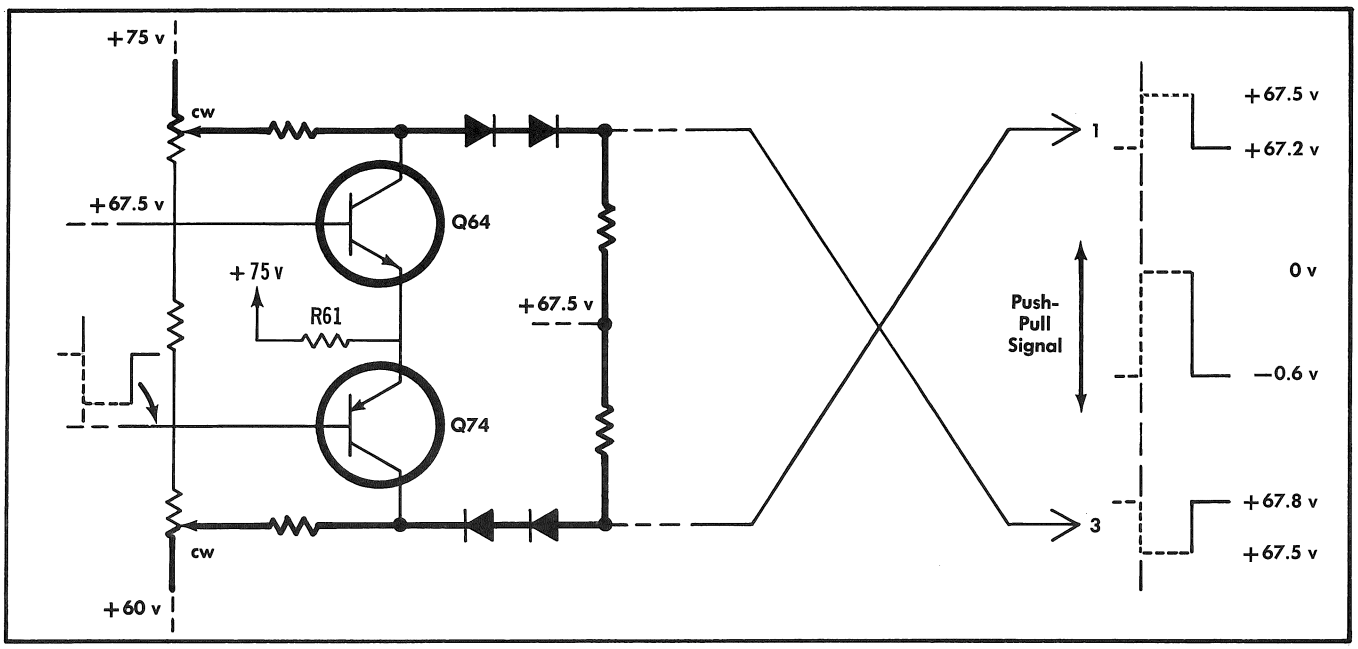


Fig. 3-9. Major current path during fall and bottom of pulse with TEST FUNCTION at +PULSE and AMPLITUDE control fully clockwise.

through R53, and the voltage in the emitter circuit becomes more negative. As the base-emitter junction of Q55 becomes forward biased, this transistor turns on and causes the multivibrator to switch states. As Q55 turns on and Q45 turns off, the base-emitter junctions of Q64 and Q74 become forward biased, turning on these transistors and shunting current away from the disconnect diodes. The fast switching characteristics of the disconnect diodes enable them to cut off very fast when the current source is removed, producing the fast-rise (3 nsec) output step as both output voltages go to +67.5 volts. As the differential voltage between pins 1 and 3 changes to zero volts, the fast rise of the pulse is displayed on the crt.

As soon as current through Q55 has reached a maximum and Q45 is cut off, the capacitors in the emitter circuit of Q45 begin to charge, allowing the emitter voltage to go negative. When the base-emitter junction of Q45 becomes forward biased, the multivibrator switches states again. The positive-going voltage at the collector of Q55 decreases the conducting of Q74 and turns off Q64, restoring the current source to the disconnect diodes. As current rises through the output resistors, the output voltages to the oscilloscope return to +67.2 and +67.8 volts, and the displayed +pulse returns to its baseline. The next pulse is started when Q55 turns on again.

The switching rate of the rate generator multivibrator is determined by the supply voltages and the resistor-capacitor combinations in the base and emitter circuits. The front-panel REPETITION RATE switch allows the capacitance in the emitter circuits to be changed, controlling the charging rate in the emitter circuits and thus the switching rate of the multivibrator. With C49 and C50 connected in the circuit (LOW), the repetition rate of the output pulse is approximately 5 kc; with C48 in the circuit (MED), the rate is 120 kc and with C47 in the circuit (HIGH), the repetition rate is 600 kc.

The output of the Pulse Generator circuit simulates a fast-rise input pulse from a 50-ohm system. The impedance presented to the oscilloscope vertical amplifier is determined primarily by the values of R66 and R76. The center voltage at the output (+67.5 volts) is adjusted by PULSE DC LEVEL control R30 during calibration. Vertical positioning of the pulse display on the crt is controlled by dc voltages added to the output through R69 and R79.

Operation of the Pulse Generator circuit is exactly the same in —PULSE as in +PULSE, but the polarity of the output is reversed by the TEST FUNCTION switch.

SECTION 4

MAINTENANCE

PREVENTIVE MAINTENANCE

Cleaning the Interior

Internal cleaning should precede calibration since the cleaning process could alter the setting of certain calibration controls.

One way to clean the interior is by vacuum and/or low-pressure compressed air (high-velocity air could damage certain components). Hardened dirt may be removed with a soft paint brush, cotton-tipped swab, or cloth dampened with a water and mild detergent solution. Pay special attention to high-voltage circuits where conductive dust can cause arcing.

The contacts on the plug-in interconnecting jacks and plugs should be lightly lubricated with an oil of the type used on rotary-switch contacts. To extend the life of the contacts clean and relubricate if the oil becomes contaminated with abrasive dust.

Visual Inspection

The instrument should be inspected occasionally for such defects as poor connections, broken or damaged ceramic terminal strips, improperly seated tubes or transistors, and heat-damaged parts. The remedy for most visible defects is obvious. However, overheating is usually a symptom of other unseen defects and unless the cause is determined before parts are replaced, the damage may be repeated.

Tube and Transistor Checks

Periodic preventive maintenance checks on the tubes and transistors used in the instrument are not recommended. The circuits within the instrument generally provide the most satisfactory means of checking tube or transistor performance. Performance of the circuits is thoroughly checked during recalibration so that substandard tubes and transistors will usually be detected at that time.

Recalibration

To insure accurate measurements, the instrument calibration should be checked after each 500 hours of operation or every six months if used intermittently. Complete calibration instructions are contained in Section 6 of this manual.

The calibration procedure can be helpful in isolating major troubles in the instrument. Moreover, minor troubles not apparent during regular operation may be revealed and corrected during calibration.

CORRECTIVE MAINTENANCE

General Information

Removal or replacement procedures for most parts in the 067-0521-00 are obvious. However, some parts require special procedures. Removal and replacement of these parts are discussed in the following paragraphs.

Many components in the 067-0521-00 are mounted in a particular way to reduce stray inductance and capacitance. Therefore, carefully install replacement components to duplicate lead length, lead dress, and location of the original component.

After replacing any electrical components, be sure to check the calibration of the instrument. Components of the same type usually exhibit slightly different characteristics and will often affect calibration.

Standard Parts

Many components in the instrument are standard electronic parts available locally. However, all parts can be obtained through your Tektronix Field Engineer or Field Office. Before purchasing or ordering, consult the parts list (Section 7) to determine the value, tolerance, and rating required.

Special Parts

Some parts are manufactured or selected by Tektronix to satisfy particular requirements, or are manufactured for Tektronix to our specifications. These and most mechanical parts should be ordered directly from your Tektronix Field Engineer or Field Office. See "Parts Ordering Information" and "Special Notes and Symbols" on the first page of Section 7.

Soldering

Special silver-bearing solder is used to establish a bond to the ceramic terminal strips in Tektronix instruments. This bond may be broken by repeated use of ordinary tin-lead solder or by execessive heating. Solder containing about 3% silver is recommended. Silver-bearing solder is usually available locally or may be purchased in one-pound rolls through your Tektronix Field Engineer or Field Office. Order by part number 251-0514-00.

Soldering to Ceramic Strips:

1. Use a wedge-shaped soldering-iron tip about 1/8-inch wide. This will allow you to apply heat directly to the solder in the terminal without touching the ceramic, thereby reducing the amount of heat required.
2. Maintain a clean, properly tinned tip.

3. Use a hot iron for a short time. A 50- to 75-watt iron with good heat storage and transfer properties is adequate.
4. Avoid putting pressure on the strip with the soldering iron or other tools. Excessive pressure may cause the strip to crack or chip.

Soldering to Etched-Wiring Boards:

1. To remove a component, cut the leads near the body. This frees the leads for individual unsoldering.
2. Grip the lead with needle-nose pliers. Apply the tinned tip of a 40-watt pencil soldering iron to the lead between the pliers and the board; then pull gently.
3. When the solder first begins to melt, the lead will come out, leaving a clean hole. If the hole is not clean, use a scribe or pointed tool and the soldering iron to open the terminal hole.
4. Bend the leads on the new component to the correct shape and carefully insert the leads into the holes.
5. Apply the iron for a short time at each connection on the side of the board opposite the component to properly seat the component.
6. Apply the iron and a little solder to the connections to finish the solder joint.
7. Clip any excess lead that extends through the board.

Ceramic Terminal Strips

Fig. 4-1 shows an assembled ceramic terminal strip. Replacement strips with studs attached are supplied under a single part number and spacers under another number. The original spacers may be reused if undamaged.

Usually, a strip can be pried out of the chassis or pulled out with a pair of pliers. In some cases, you may choose to use a hammer and punch to drive out the studs from the opposite side of the chassis.

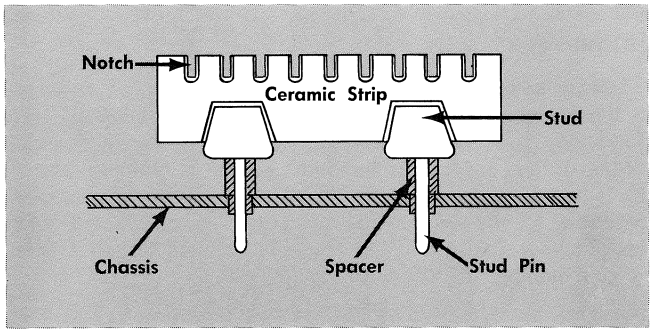


Fig. 4-1. Ceramic Terminal Strip Assembly.

When the damaged strip has been removed, place new or used (but undamaged) spacers in the chassis holes. Then carefully force the studs of the new strip into the spacers until they are completely seated. If necessary, use a soft-faced mallet and tap lightly over the stud area of the strip.

Switch Replacement

Individual wafers normally are not replaced in switch assemblies. Replacement switiches may be ordered from Tektronix either unwired or with the associated wires and components attached. See Section 7.

When soldering leads to a switch, do not let solder flow around and beyond the terminal rivet as this may destroy the contact spring tension.

Tubes and Transistors

Tubes and transistors should not be replaced unless actually defective. When a defect is suspected, it is suggested that circuit conditions be checked first to be certain that a replacement tube or transistor will not be immediately destroyed. In some cases, these checks will also show whether or not the tube or transistor is at fault.

When circuit conditions are known to be safe, install a tube or transistor that is known to be good and check for proper operation. If the original tube or transistor proves acceptable, return it to its original socket to avoid unnecessary recalibration.

TROUBLESHOOTING

Operational Checks

If trouble is encountered in the 067-0521-00, first perform a visual inspection of the entire unit. If a visual inspection does not reveal the cause of trouble, change tubes or transistors, depending on the area of the trouble.

As a troubleshooting aid, Table 4-1 provides resistance values to ground at the terminals of the 16-pin interconnecting plug at the rear of the unit. The resistance measurements were taken with the unit disconnected from the oscilloscope. The measurements are not absolute since semiconductors are used in the circuitry. Therefore, for future reference, blank columns are provided in the table for recording measurements and type of meter used.

NOTE

To make the unit more accessible for servicing, use either a Tektronix 6½-inch extension (Part No. 013-0055-00" or a 30-inch flexible extension (Part No. 012-0038-00". Remember, however, that if the TEST FUNCTION switch is set to + PULSE or —PULSE, the oscilloscope display will contain some overshoot and ringing due to the lead lengths in the extension.

TABLE 4-1

Resistance Measurement

Pin	TEST FUNCTION Switch	Type of Meter: VOM*		Type of Meter: Manufactured By: Model No.: Type TU-7 Serial No.:	
		Approximate Resistance Readings	Ohms Range	Resistance Readings	Ohms Range
1	LOW LOAD, HIGH LOAD, COMMON MODE, ALTERNATE, CHOPPED	110 k	100,000		
1	GAIN SET	9.6 k	1000		
1	+PULSE, —PULSE	18 k	1000		
2	All Positions	0	1		
3	LOW LOAD, HIGH LOAD, GAIN SET ALTERNATE, CHOPPED	45 k	1000		
3	COMMON MODE	110 k	100,000		
3	+PULSE, —PULSE	17 k	1000		
4	All Positions	0	1		
5	LOW LOAD, HIGH LOAD, ALTERNATE, CHOPPED	17 k	1000		
5	GAIN SET, COMMON MODE, +PULSE, —PULSE	20 k	1000		
6	All Positions	Infinite	100,000		
7	All Positions	Infinite	100,000		
8	All Positions	0	1		
9	LOW LOAD, GAIN SET, COMMON MODE, +PULSE, —PULSE	39 k	1000		
9	HIGH LOAD	2.4 k	1000		
9	ALTERNATE, CHOPPED	35 k	1000		
10	LOW LOAD, GAIN SET, COMMON MODE, ALTERNATE, CHOPPED	12.1 k	1000		
10	HIGH LOAD	1.5 k	1000		
10	+PULSE, —PULSE	4.4 k, 12 k**	1000	**	
11	LOW LOAD, GAIN SET, COMMON MODE, +PULSE —PULSE	15.5 k	1000		
11	HIGH LOAD	2.35 k	1000		
11	ALTERNATE, CHOPPED	10.3 k	1000		
12	All Positions except HIGH LOAD	Infinite	100,000		
12	HIGH LOAD	14 k	1000		
13	All Positions	Infinite	100,000		
14	All Positions	Infinite	100,000		
15	All Positions	500 Ω	10		
16	LOW LOAD, HIGH LOAD, COMMON MODE, GAIN SET, +PULSE, —PULSE	110 k	100,000		
16	ALTERNATE, CHOPPED	42 k	1000		

*VOM used to obtain these measurements was a 20,000 Ω/volt dc meter with a center-scale reading of 4.5 k on the 1,000 Ω scale. For the 1,000 Ω scale, center-scale deflection current is 160 μa and 320 μa at full scale.

**Ohmmeter leads are connected first in one direction, then the other, to obtain the two readings.

NOTES

SECTION 5

PERFORMANCE CHECK PROCEDURE

Introduction

This performance check procedure is provided as a functional check of the 067-0521-00 and may be used for incoming inspection, quality assurance, etc. Failure to meet the characteristics outlined will require internal checks and/or adjustment.

Recommended Equipment

The following equipment is recommended for a complete performance check. Specifications given are the minimum necessary to perform this procedure. All equipment is assumed to be calibrated and operating within the original specifications. If equipment is substituted, it must meet or exceed the specifications of the recommended equipment.

For the most accurate and convenient performance check, special calibration fixtures are used in this procedure. These calibration fixtures are available from Tektronix, Inc. Order by part number through your local Tektronix Field Office or representative.

1. Real-time test oscilloscope. Must be capable of switching alternately between two time bases. Tektronix Type 547 recommended.

2. Sampling test oscilloscope. Must be capable of presenting two inputs differentially. Minimum deflection factor 50 mv/division; bandpass to 0.825 gigacycle. Tektronix Type 561A, with 3S76 dual trace plug-in and 3T77 sampling sweep plug-in recommended.

3. Sine-wave generator frequency, 50 Mc; output amplitude 4 volts peak to peak; amplitude accuracy ±3%. Tektronix Type 191 recommended.

4. Precision DC voltmeter. Accuracy within ±0.05%; meter resolution 50 μV; range 0 to 500 volts. For example, Fluke Model 801B.

5. DC voltmeter. Minimum sensitivity, 20,000 ohms/volt; accuracy, check to within 1% at 225 volts. For example, Simpson Model 262.

6. Ohmmeter. Range, 400 ohms to infinite; accuracy, ±3%; range voltage, 1 volt or more. For example, Simpson Model 262.

7. Standard amplitude calibrator. Amplitude accuracy 0.025%; signal amplitude 0.5 volt to 100 volts; output signal frequency, 1 kc. Tektronix calibration fixture 067-0502-00 recommended.

8. Flexible plug-in extension. Length 30 inches. Tektronix Part No. 012-0038-00.

9. Cable. Impedance, 50 ohms; Type RG58A/U; length 42 inches, connectors BNC. Tektronix Part No. 012-0057-00.

10. Coupling capacitor, (two). Impedance 50 ohm; connectors GR. For example, GR Type 874X, Tektronix Part No. 017-0028-00.

11. Cable (two) Impedance, 50 ohms; delay time, 2 ns; connectors GR. Tektronix Part No. 017-0505-00.

12. Modified rigid plug-in extension, see Fig. 6-1. Required parts.

a. Rigid plug-in extension (two). Tektronix Part No. 013-0055-00.

b. Cable (two). Impedance, 50 ohms; delay time, 1 ns; connector (one end only), GR. Tektronix Part No. 017-0503-00.

c. Grommet (two). Size, 5/16 inch; material, rubber. Tektronix Part No. 348-0003-00.

PERFORMANCE CHECK PROCEDURE

General

In the following procedure, test equipment connections or control settings should not be changed except as noted. Equipment used is listed under Recommended Equipment. If substitute equipment is used, control settings or setup must be altered to meet the requirements of the substitute equipment.

NOTE

Since this is a performance check of the 067-0521-00, the test oscilloscope with which it is used is assumed to have been adjusted to perform within its specifications.

Preliminary Procedure

1. Connect the test oscilloscope to a line voltage within the regulating range of its power supplies.

2. Set the 067-0521-00 and test oscilloscope controls as follows:

3. Check—That the ohmmeter reading for each pin lies between the values listed in Table 5-1 for that pin.

TABLE 5-1

067-0521-00

VERTICAL POSITION	Centered
TEST FUNCTION	LOW LOAD
VARIABLE	Counterclockwise
AMPLITUDE	Counterclockwise
REPETITION RATE	LOW

Test Oscilloscope

Horizontal Display	A
Single Sweep	Norm

Sweep Magnifier	Off
Horizontal Position	Centered
Intensity, Focus, Astigmatism	Trace focused, normal brilliance
Scale Illum	As desired
Trace Separation	0
Crt Cathode Selector (at rear of scope)	External Crt Cathode
Triggering Level	Push in and rotate fully clockwise
Mode	Auto
Slope	+
Source	Norm
Time/Cm	0.5 ms
Time/Cm Variable	Calibrated

1. Check LOW LOAD Resistances

a. Requirement—Resistance must be within ranges indicated in Table 5-1.

b. Connect the ohmmeter between the chassis of the 067-0521-00 and the interconnecting plug pins indicated in Table 5-1.

c. Check—That the ohmmeter reading for each pin lies between the values listed in Table 5-1 for that pin.

TABLE 5-1

Pin No.	Meter Range	Resistance Reading
9	X10 kΩ	35 kΩ to 43 kΩ
12	X100 kΩ	infinite
10[1]	X1 kΩ	9.5 kΩ to 11.7 kΩ
11[1]	X1 kΩ	13 kΩ to 16 kΩ
15	X100 Ω	450 Ω to 550 Ω

2. Check HIGH LOAD Resistances

a. Requirement—Resistance must be within ranges indicated in Table 5-2.

b. Set the Type 1M1 TEST FUNCTION switch to HIGH LOAD.

c. Check—That the ohmmeter reading for each pin lies between the values listed in Table 5-2 for that pin.

TABLE 5-2

Pin No.	Meter Range	Resistance Reading
15	X100 Ω	450 Ω to 550 Ω
12	X1 kΩ	12.5 kΩ to 15.5 kΩ
11[1]	X1 kΩ	1.3 kΩ to 1.6 kΩ
10[1]	X1 kΩ	2 kΩ to 2.5 kΩ
9	X1 kΩ	2.2 kΩ to 2.6 kΩ

d. Install the 067-0521-00 test oscilloscope and tighten the securing rod. Turn the test oscilloscope power switch to on. Allow at least 20 minutes warm up at 25° C, ±5°, before checking the instrument to the given accuracies.

[1]When measuring pins 10 and 11, connect a shorting strap across D80 to remove non-linear device from resistance measurements.

3. Check +225 V

a. Requirement—Positive 225 volts must appear at the +225 V output jack on the front panel of the 067-0521-00.

b. Connect the DC voltmeter between ground and the +225 V output jack.

c. Push the button adjacent to the +225 V output jack. Read the voltage on the meter and release the button.

d. Check—Positive 225 V at the output jack, which returns to zero when the button is released.

NOTE

The voltage reading at the +225 V jack should be the same as the test oscilloscope power supply reading.

4. Check VARIABLE

a. Requirement—Control must be able to vary a 0.5 V peak to peak signal amplitude from zero to a display amplitude of 0.6 cm or more.

b. With all controls set as previously indicated, apply a 0.5 V square wave from the standard amplitude calibrator to the EXT INPUT.

c. Rotate the VARIABLE control from fully counterclockwise to fully clockwise.

d. Check—At the fully counterclockwise position, no signal should be visible on the free-running trace; fully clockwise, the signal amplitude should be 0.6 Mc or more.

5. Check Plug-in Trigger

a. Requirement—Sufficient signal to provide a stable display.

b. Set the standrad amplitude calibrator to 5 V and adjust the VARIABLE control for a 5.5 cm display.

c. Set the test oscilloscope Time Base A Triggering Source switch to Plug-In and adjust the Triggering Level control for a stable square wave display (index mark on Triggering knob should be near the center (0) Position).

d. Check—A stable display indicates that the 067-0521-00 internal trigger network is delivering a signal to pin 5 of the connecting plug. (This signal simulates the internal trigger from a dual-trace plug-in unit with single channel pickoff.)

6. Check VERTICAL POSITION

a. Requirement—Ability of the VERTICAL POSITION control to move the display up (clockwise) and down (counterclockwise) over a full positioning range.

b. Set the standard amplitude calibrator to 10 V and adjust Variable for 6 cm of display.

c. Check—Rotating the VERTICAL POSITION control fully clockwise should move the display completely off the graticule in an upward direction; fully counterclockwise should move the display completely off the graticule in a downward direction.

7. Check COMMON MODE

a. Requirement—No vertical movement of trace from test oscilloscope electrical center.

b. Remove the 10 V signal from the EXT INPUT and set TEST FUNCTION switch to COMMON MODE.

c. Check—Trace should be at electrical center of the test oscilloscope. Rotation of the VERTICAL POSITION control should have no effect on the position of the trace.

NOTE

Normally the trace will be within 0.5 cm of the graticule centerline. The exact position with respect to this centerline will depend on the DC balance of the Vertical Amplifier in the test oscilloscope. This centerline of the trace indicates that equal in-phase dc voltage are being applied to interconnecting plug pins 1 and 3.

8. Check ALTERNATE Operation

a. Requirement—Two traces at all sweep rates of the test oscilloscope.

b. Set the TEST FUNCTION switch to ALTERNATE, the test oscilloscope Time Base A Triggering Source to Plug-in, Triggering Level clockwise.

c. Apply a 100 V square wave from the standard amplitude calibrator to EXT INPUT.

d. Rotate the test oscilloscope Time Base A Time/Cm control through all positions from 5s/Cm through .1 μs/Cm.

e. Check—Two traces should appear at all switch positions, only one of which will show the standard amplitude calibrator signal. See Fig. 5-1.

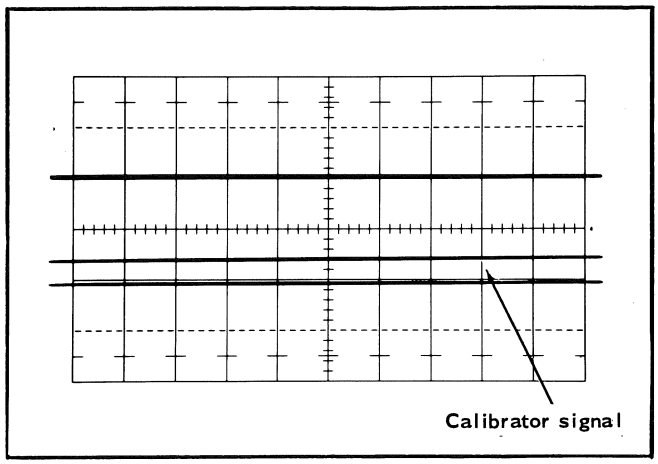


Fig. 5-1. Alternate-trace display with signal applied to EXT INPUT.

9. Check Slave Operation

a. Requirement—Control of vertical position of the trace which displays the standard amplitude calibrator signal.

b. Set the test oscilloscope Horizontal Display to A Alt B, Main Time Base (B) Triggering Source to Plug-in, Time Base A Time/Cm to .5 ms.

c. Check—That rotation of the test oscilloscope Trace Separation control changes the vertical position of the trace with the calibrator signal on it. (Two traces only should appear; four traces indicate malfunction of the slave circuitry.)

10. Check CHOPPED Rate:

a. Requirement—Chopping rate 100 kc ±25%.

b. Remove the standard amplitude calibrator signal.

c. Set test oscilloscope Time Base A Time/Cm to 10 μs, Horizontal Display to A, Time Base A Triggering Source to Norm. Set the 067-0521-00 TEST FUNCTION switch to CHOPPED.

d. Adjust test oscilloscope Triggering Level for a stable display.

e. Check—7.5 to 12.5 cycles displayed within 10 cm. See Fig. 5-2.

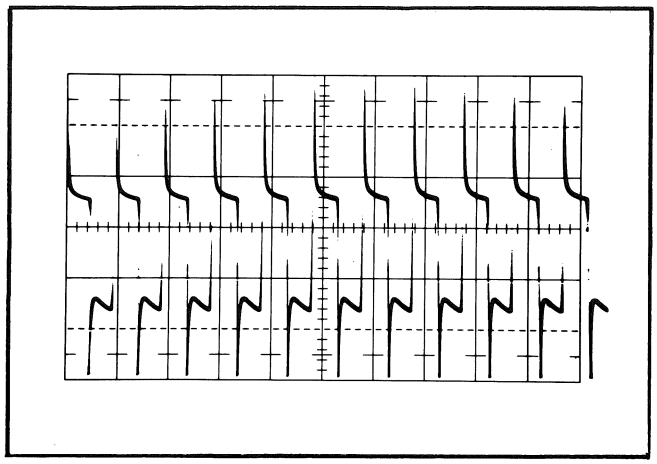


Fig. 5-2. Typical chopping waveform, transients unblanked. Note that the display shows 10 cycles of the waveform within the 10-cm horizontal dimension of the graticule.

11. Check CHOPPED blanking:

a. Requirement—Chopping transients must be blanked.

b. Set CRT Cathode Selector switch (on rear of test oscilloscope) to Chopped Blanking.

c. Check—Rising and falling portions of waveform are blanked. See Fig. 5-3.

12. Check +PULSE and —PULSE minimum amplitude:

a. Requirement—Not more than 3 cm display of positive and negative pulses with AMPLITUDE control fully counterclockwise.

b. Return test oscilloscope CRT Cathode Selector switch to EXT CRT Cathode.

c. Set test oscilloscope Time Base A Time/Cm to 0.2 ms and TEST FUNCTION switch to +PULSE.

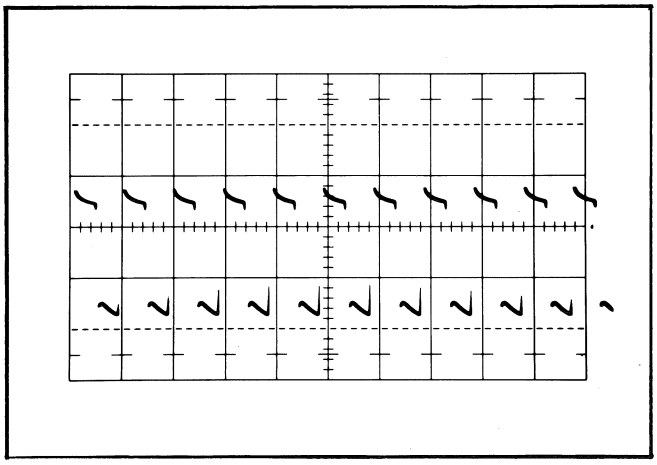


Fig. 5-3. Chopping waveform with transients blanked.

d. Turn AMPLITUDE control fully counterclockwise.

e. Check—Display amplitude should not exceed 3 cm.

f. Set TEST FUNCTION switch to —PULSE and repeat check (part e).

13. Check +PULSE and —PULSE maximum amplitude:

a. Requirement—At least 5.5 cm display of positive and negative pulses with AMPLITUDE control fully clockwise.

b. Turn AMPLITUDE control full clockwise. Adjust VERTICAL POSITION to display both traces.

c. Check—Amplitude of display must be at least 5.5 cm.

d. Set TEST FUNCTION switch to +PULSE and repeat check (part c).

14. Check REPETITION RATE:

a. Requirement—Pulse repetition rates within the following limits: LOW, 5 kc ±25%; MED, 100 kc ±25%; HIGH, 600 kc ±20%.

b. Set AMPLITUDE control for a 4 cm display. Set test oscilloscope Time Base A Time/Cm to 0.2 ms and Triggering Level for stable display. Set 067-0521-00 REPETITION RATE switch to LOW.

c. Check—7.5 to12.5 cycles per 10 cm must be displayed. See Fig. 5-4.

d. Set REPETITION RATE switch to MED and Time/Cm to 10 μs.

e. Check—9 to 15 cycles per 10 cm. See Fig. 5-5.

f. Set REPETITION RATE switch to HIGH and Time/Cm to 1 μs.

g. Check—4.5 to 7.5 cycles per 10 cm. See Fig. 5-6.

15. Check Overshoot or Ringing:

a. Requirement—Overshoot or ringing must not exceed 2% of total height of square wave.

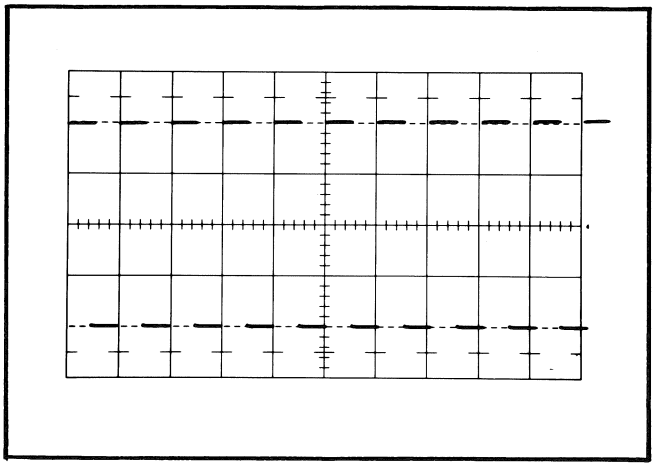


Fig. 5-4. Pulse repetition rate, LOW. Note that 10 cycles of the waveform are displayed.

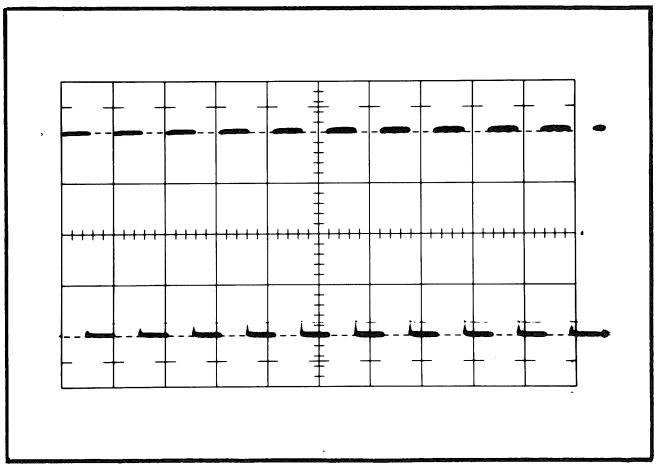


Fig. 5-5. Pulse repetition rate, MED. As in Fig. 5-4, 10 cycles of the waveform appear.

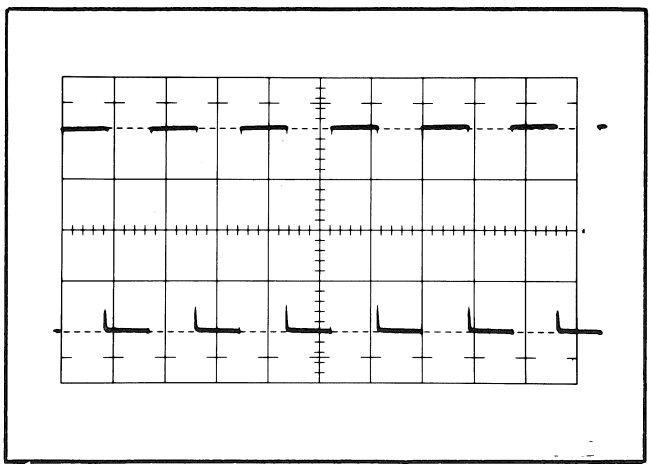


Fig. 5-6. Pulse repetition rate, HIGH. Note 6 cycles of display.

b. Set REPETITION RATE switch to MED and position the top of trace to graticule center and slightly to the right to observe leading edge of pulse.

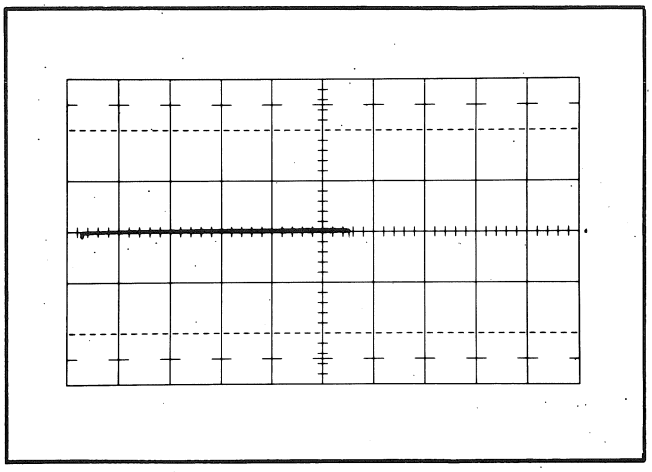


Fig. 5-7. Typical pulse waveform showing check of overshoot or ringing.

c. Check—Overshoot or ringing maximum 0.8 mm (0.4 minor graticule division) on a 4 cm signal. See Fig. 5-7.

16. Check 50 Mc Response:

a. Requirement—Sufficient control of amplitude of a 50 MHz signal should be available to the test oscilloscope vertical amplifier input, for High Frequency Sync checks, etc.

b. Set the Type 191 Frequency Range selector to 42-100, the Frequency dial to 50, and the output amplitude controls for a 4 volt output.

c. Properly terminate the Type 191 and apply its output to the 067-0521-00 EXT INPUT.

d. Change the TEST FUNCTION switch to HIGH LOAD and turn the VARIABLE control fully clockwise.

e. Check—The signal amplitude should be 2.5 cm or more. See Fig. 5-8.

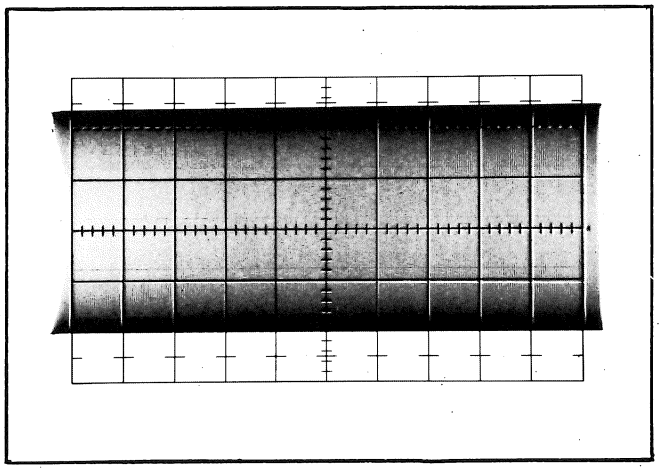


Fig. 5-8. Typical 50 Mc response, VARIABLE control maximum.

f. Turn the VARIABLE control fully counterclockwise.

g. Check—The signal amplitude should be no more than 1 cm. See Fig. 5-9.

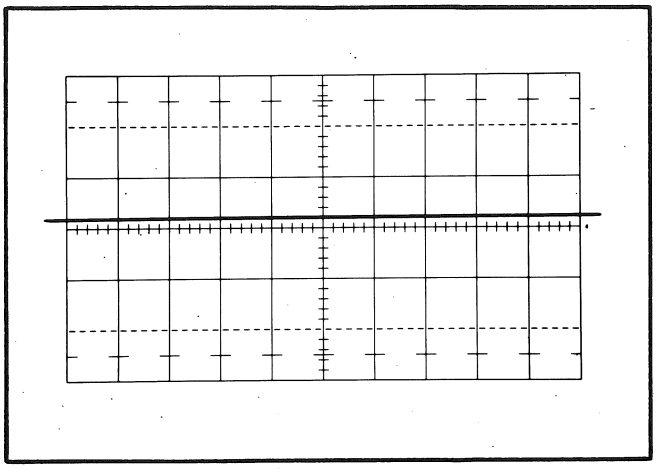


Fig. 5-9. Typical 50 Mc response, VARIABLE control minimum.

17. Check GAIN SET:

a. Requirement—Input signal division ratio of 250:1, accuracy 1%.

b. Turn off the test oscilloscope and remove the 067-0521-00.

c. Change the TEST FUNCTION switch to GAIN SET and connect pin 10 of the interconnecting plug to chassis ground with a short jumper. See Fig. 5-10.

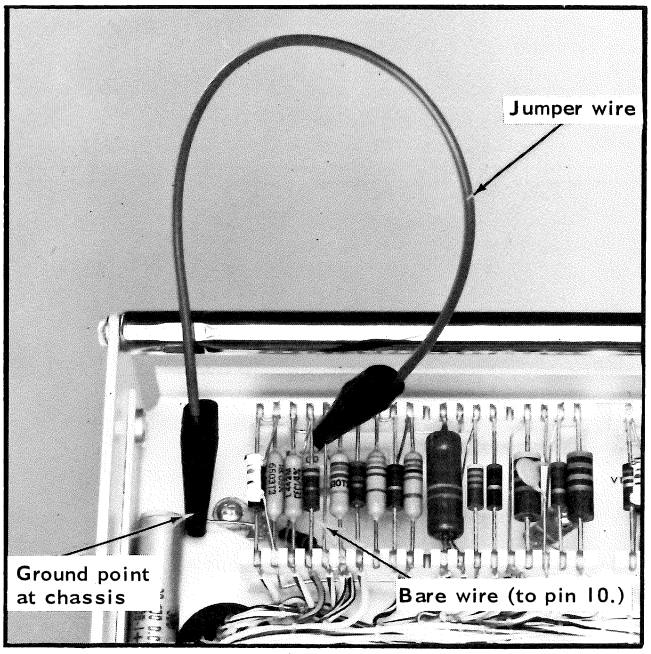


Fig. 5-10. Illustrating a convenient method of grounding connecting pulg pin 10.

d. With the 067-0521-00 disconnected from the test oscilloscope, apply 100 volt dc signal from the standard amplitude calibrator to EXT INPUT.

e. Connect the precision dc voltmeter between pin 1 of the interconnecting plug and ground. See Fig. 5-11.

f. Check—For a voltmeter reading of 0.4 V ±4 mV.

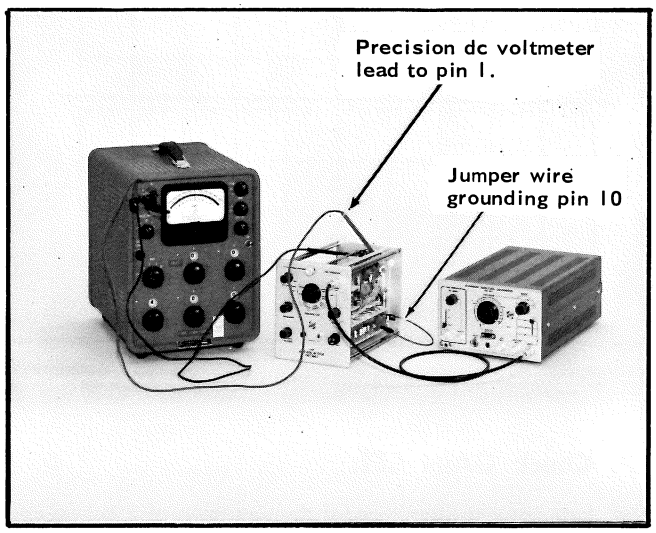


Fig. 5-11. Test equipment setup for step 18.

18. Check ±PULSE Risetime:

a. Requirement—Risetime no more than 3 ns.

b. Disconnect the 100 volt dc calibrator signal from the EXT INPUT. Connect a flexable plug-in extension to the test oscilloscope interconnecting socket. Connect the modified rigid plug-in extension between the flexable plug-in extension and the 067-0521-00. See Fig. 5-12.

c. Turn on the realtime and sampling test oscilloscope, allowing approximately 10 minutes for warm-up.

NOTE

When operating the plug-in unit from a plug-in extension, the plug-in sensing switch located near the top rear of the plug-in compartment must be manually operated. To operate the switch manually, pull the plastic plunger froward to the stop position.

d. Connect the GR pigtail from pin 1 of the modified rigid plug-in extension through a 2 ns cable and a coupling capacitor to Input A of the dual trace sampling amplifier.

e. Connect the GR pigtail from pin 3 of the modibied rigid plug-in extension to Input B of the dual trace sampling amplifier in the same manner. See Fig. 5-12.

f. Set the dual trace sampling amplifier controls as follows:

Mode Switch	A+B
Internal Trigger	A
Mv/Div (both)	50
2-200 Var (both)	Calib.
Channel A Polarity	Norm.
Channel B Polarity	Inv.

g. Set the sampling sweep controls as follows:

Time/Div	1 μs
Variable	Calib.
Horiz Mag	×1
Dots Per Div	100
Sweep Mode	Normal
Trigger	+Int
Trigger Sensitivity	Clockwise (until stable waveform appears)

h. Change the sampling sweep Time/Div switch to 1 ns. Move the rising portion of the display to the center area of the graticule with the Delay control and the sampling amplifier position control. Adjust the Type 067-0521-00 Amplitude control for a display 4 cm in amplitude.

i. Check—Risetime should be 3 ns (3 cm) or less. See Fig. 5-13.

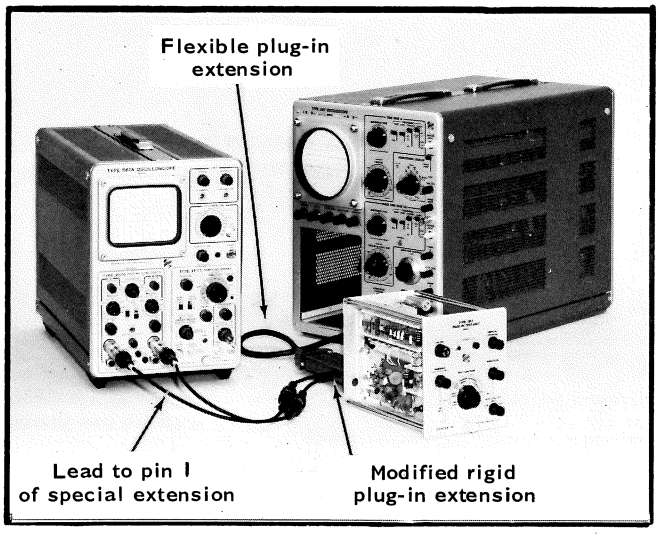


Fig. 5-12. Test equipment setup for risetime check (step 19).

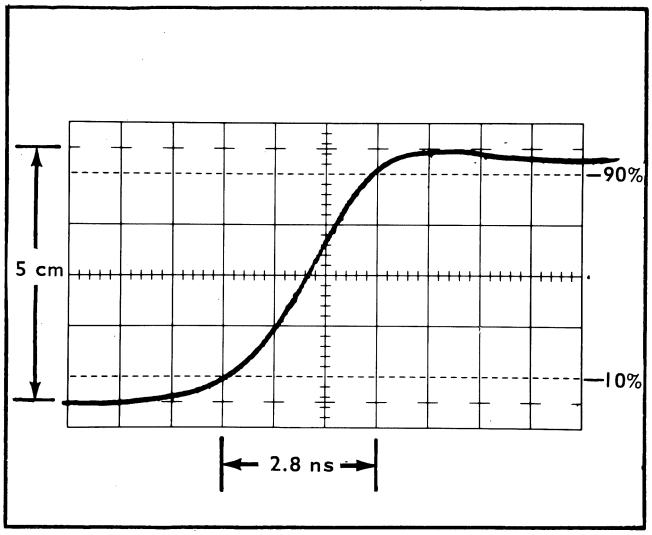


Fig. 5-13. Typical display showing pulse risetime.

SECTION 6

CALIBRATION

General Information

The 067-0521-00 does not require frequent recalibration, however, the calibration should be checked at regular intervals to insure that it is operating properly and accurately. In addition, calibration should be checked after tubes or transistors have been replaced or repairs have been made. A complete procedure is provided in this section for checking and adjusting the 067-0521-00.

In the instructions that follow, the steps are arranged in convenient sequence to avoid unnecessary repetition. Individual steps can be performed out of sequence, but the equipment connections and control settings in previous steps will need to be noted. If the DRIVE BAL control (step 12) is adjusted, the PULSE DC LEVEL adjustment (step 13) must be checked.

Equipment Required

The following items of equipment or equivalent are required for a complete calibration.

1. Indicator oscilloscope, Tektronix 530-, 540-, or 550-Series. Must operate properly and be calibrated for vertical gain and sweep timing.
2. Test oscilloscope, laboratory-type. Dc to at least 1 mc bandpass, ac and dc input coupling, 0.02 to 20 volts/cm input deflection factor.
3. 10×probe, for test oscilloscope. High impedance input.
4. 42-inch 50-ohm coaxial cable with BNC connectors (Tektronix part no. 012-0057-00).
5. Amplitude calibrator. 1 kc square-wave output, amplitudes from at least 0.5 volt to 100 volts peak-to-peak, accuracy within 3%. The oscilloscope Calibrator may be used.
6. Dc voltmeter. 20,000 ohms/volt impedance, 0.5% accuracy at 67.5-volt reading.
7. Ohmmeter or multimeter. Resistance scale of 1 ohm, 10 ohms, 1,000 ohms, and 100,000 ohms, 3% accuracy. Minimum ohmmeter voltage on each resistance range must be 1 volt.
8. Oscilloscope, sampling-type, dual-trace. 50-ohm inputs with GR connectors, at least 10 to 100 mv/cm input deflection factor, bandpass to 0.825 gc (gigacycle $= 10^9$ cps), capable of operating in differential mode. This instrument and the following two items are required only for checking the risetime of the Pulse Generator output.
9. Two 50-ohm coupling capacitors (874-K), with GR connectors, for sampling oscilloscope. (Tektronix part no. 017-0028-00.
10. 16-pin plug-in extension, specially modified for checking Pulse Generator output. Construction of the extension is illustrated in Fig.6-1.

PRELIMINARY INSTRUCTIONS

1. Lay the indicator oscilloscope (item 1 under "Equipment Required") on its right side. If rackmounted, leave oscilloscope upright.
2. Remove the oscilloscope bottom panel and left side panel.
3. Connect the test instruments to the power line.
4. Turn on all test instruments except the indicator oscilloscope.
5. Set the indicator oscilloscope front-panel controls as follows:

Horizontal Display	Time Base A
Time/Cm	1 mSEC
Triggering	+Internal, Ac

6. Set the sampling oscilloscope controls as follows:

Time/Cm	1 nSEC
Triggering	+Internal

7. Set the 067-0521-00 controls as follows:

NOTE

Do not insert the 067-0521-00 into the indicator oscilloscope until instructed later in the procedure.

TEST FUNCTION	LOW LOAD
VARIABLE	Centered
VERTICAL POSTION	Centered
AMPLITUDE	Centered
REPETITION RATE	MED

PROCEDURE

1. Check Resistances

NOTE

This step is required only if the instrument has been repaired or has been malfunctioning.

a. With the aid of Table 4-1, measure resistance from chassis ground to the interconnecting plug pins.

2. Check Protection Diode—Pulse Generator

a. Set the ohmmeter to the 1-ohm scale and check the in-circuit resistance across D54 for approximately 5 ohms in one direction; infinite in the other direction. See Fig. 6-2 for location of D54.

3. Check +225 V Output

a. Insert the 067-0521-00 into the indicator oscilloscope.

1. Remove signal leads from pins 1 and 3.
2. Drill two 5/16-inch holes in side of casing
3. Place rubber grommets (348-0003-00) around "pigtails."
4. Insert "pigtails" through holes in casing.
5. Solder both outer conductors to short piece of bus wire.
6. Solder Bus Wire to pin 2.
7. Solder center conductors to Pins 1 and 3.

*Flexible 16-pin plug-in Extension(012-0038-00) may be substituted.

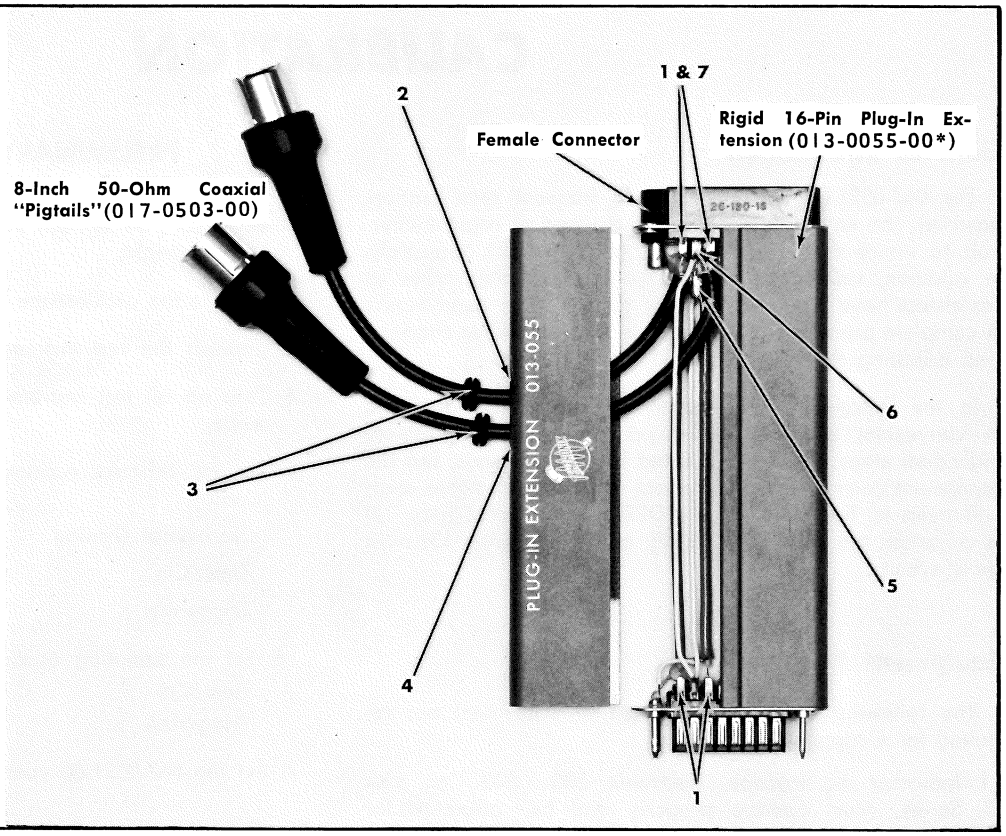


Fig. 6-1. Construction of special extender for checking pulse risetime. Tektronix part numbers are given in parentheses.

b. Turn on the instrument power and allow 10 minutes for warmup.

c. Set the TEST FUNCTION switch to LOW LOAD.

d. Connect the voltmeter between ground and the +225 V front-panel jack.

e. Press the +225 V pushbutton and check for +225 volts; then check for zero volts with the pushbutton released.

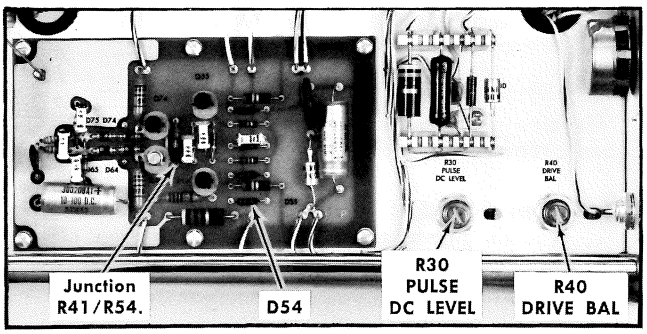


Fig. 6-2. Left side of 067-0521-00 showing calibration adjustments and test points.

4. Check VARIABLE Control

a. Reset the 067-0521-00 controls to the positions given under "Preliminary Instructions".

b. Set the Time Base A triggering control to free-run the sweep.

c. Adjust the Focus and Intensity controls for a proper display.

d. Connect a 50-ohm coaxial cable from the Calibrator to the 067-0521-00 EXT INPUT connector.

e. Set the Calibrator for an output amplitude of 0.5 volt.

f. Turn the 067-0521-00 VARIABLE control fully clockwise and check for approximately a 1-cm free-running Calibrator signal on the crt.

g. Turn the VARIABLE control fully counterclockwise and check that no signal is visible on the trace.

5. Check Internal Plug-In Trigger

a. Set the indicator oscilloscope Trigger Source switch to the External position.

b. Set the Calibrator amplitude for 5 volts.

c. Adjust the 067-0521-00 VARIABLE control for 4 cm of vertical deflection on the crt.

d. Connect the test oscilloscope probe to pin 5 of the interconnecting plug and check for at least 65 mv of Calibrator signal. (This signal simulates the internal trigger from a dual-trace plug-in unit with single-channel pickoff.)

e. Remove the probe.

6. Check Gain Set Function

a. Set the TEST FUNCTION switch to GAIN SET.

b. Set the Calibrator for 100 volts and check the display for 4 cm of vertical deflection (±1%).

7. Check Common Mode Function

a. Set the TEST FUNCTION switch to COMMON MODE.

b. Set the Calibrator for 2 volts.

c. Connect the test probe to terminal 1, then terminal 3 of the interconnecting plug and check for 2 volts of Calibrator signal at each pin.

d. Remove the probe.

8. Check Alternate Operation

a. Set the TEST FUNCTION switch to ALTERNATE.

b. Set the Calibrator for 100 volts.

c. Set the indicator oscilloscope Trigger Source switch to External and adjust the triggering control for a free-running sweep.

d. Turn the indicator oscilloscope Time/Cm switch through-out its range and check for a display of two traces on all sweep rates. The lower trace should display about 0.5 cm of Calibrator signal which will identify the lower trace at slow sweep rates. Due to the ac coupling in the 067-0521-00, both traces will tend to curve toward the electrical center of the vertical system.

9. Check Alternate-Sweep Slaving

NOTE

This check can be made only on an oscilloscope (such as the Type 547) that can switch alternately between two time bases.

a. Set the indicator oscilloscope Time Base A Time/Cm switch to 1 msec and the Time Base B Time/Cm switch to .5 mSec.

b. Set the Triggering Source switches to Plug-In and adjust the triggering controls of both time bases to trigger the two displays.

c. Turn the Time Base A Time/Cm switch through a few positions while watching the display.

d. Check that the lower trace is locked to Time Base A.

e. Turn the Time Base B Time/Cm switch through a few positions.

f. Check that the upper trace is locked to Time Base B.

10. Check Chopped Operation

a. Remove the Calibrator signal.

b. Set the TEST FUNCTION switch to CHOPPED.

c. Set the indicator oscilloscope Horizontal Display switch to Time Base A, Time/Cm switch to 10 μSec, and the Triggering Source switch to +Internal.

d. Trigger the display and check the chopped waveform for 1 cycle/cm (100 kc) ±20%.

11. Check Chopped Blanking

a. Set the indicator oscilloscope Crt Cathode Selector switch to Chopped Blanking and check the crt display for blanking of the vertical portions of the chopped waveform (see Fig. 2-3).

b. Return the Crt Cathode Selector switch to the Crt Cathode position.

12. Adjust DRIVE BAL R40

a. Set the TEST FUNCTION switch to +PULSE.

b. Trigger the pulse display and adjust the AMPLITUDE control for 4 cm of vertical deflection.

c. With the test oscilloscope, check the pulse amplitude at pins 1 and 3 of the interconnecting plug.

d. Adjust DRIVE BAL R40 (see Fig. 6-2) if the amplitudes are not equal.

e. Disconnect the probe.

13. Adjust PULSE DC LEVEL R30

a. Connect the dc voltmeter between chassis ground and pin 10 of the interconnecting plug.

b. Record the actual voltage of the +100 volt supply.

c. Do the two mathematical calculations indicated below.

1. (66.25%) (Voltage recorded in part b) = Lower limit.
2. (68.86%) (Voltage recorded in part b) = Upper limit.

d. Disconnect the dc voltmeter.

e. Connect the dc voltmeter between chassis ground and the junction of R54 and R41 (see Fig. 6-2).

f. Check that the dc voltmeter falls between the upper and lower limits calculated in part c of this step.

g. Adjust PULSE DC LEVEL R30 if the voltage does not fall between the upper and lower limits calculated in part c.

14. Check Pulse Repetition Rate

a. Check the Pulse Generator display for the following output repetition rates, with the REPETITION RATE switch set as follows:

LOW—5 kc ±25% (1 cycle/cm at 0.2 msec/cm)

MED—100 kc ±25% (1.2 cycles/cm at 10 μsec/cm)

HIGH—600 kc ±20% (1.2 cycles/cm at 2 μsec/cm)

b. Set the TEST FUNCTION switch to —PULSE and check for an inverted display.

c. Return the switch to +PULSE.

15. Check AMPLITUDE Control

a. Turn the AMPLITUDE control fully clockwise.

b. Check for approximately 6 cm of vertical deflection (5.6 cm minimum).

c. Turn the AMPLITUDE control fully counterclockwise and check for approximately 2 cm of deflection (2.8 cm maximum).

16. Check Pulse Risetime

NOTE

The pulse risetime is not adjustable and is therefore determined by the circuit parameters and the switching characteristics of gallium arsenide diodes D64, D65, D74 and D75.

a. Set the REPETITION RATE switch to MED.

b. Adjust the AMPLITUDE control for 4 cm of vertical deflection.

c. Turn off the indicator oscilloscope power and remove the 067-0521-00.

d. Insert the special plug-in extension (item 10 under "Equipment Required") in the plug-in jack.

e. Plug the 067-0521-00 into the extender.

f. Turn on the indicator oscilloscope power. (If the indicator oscilloscope has a plug-in sensing switch in the plug-in compartment, pull forward on the switch plunger.)

g. Place the coupling capacitors (item 9 under "Equipment Required") on the Input connectors of the sampling oscilloscope.

h. Connect the coaxial cable from pin 1 of the interconnecting jack to the capacitor on the Channel A Input.

i. Connect the cable from pin 3 to the capacitor on the Channel B Input.

j. Display the Channel A signal on the sampling oscilloscope.

k. Set the Channel A Mv/Cm switch and Variable control for 2.5 cm of vertical deflection.

l. Switch to Channel B and adjust for 2.5 cm of vertical deflection.

m. Set the sampling oscilloscope for a differential display (A+B, B inverted).

n. Center the display and readjust the Variable Mv/Cm controls slightly to produce 5 cm of vertical deflection.

o. Check for a 10% to 90% risetime of 3 nsec or less (see Fig. 6-3).

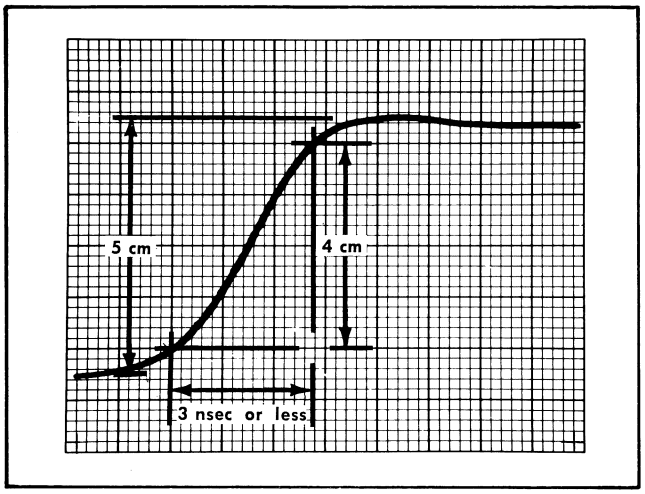


Fig. 6-3. Pulse Generator risetime check.

ABBREVIATIONS AND SYMBOLS

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

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.

SECTION 7
ELECTRICAL PARTS

Values are fixed unless marked Variable.

Ckt. No.	Tektronix Part No.	Description				S/N Range
		Capacitors				
Tolerance ±20% unless otherwise indicated.						
C10	281-0534-00	3.3 pF	Cer	500 V	±0.25 pF	
C19	281-0551-00	390 pF	Cer	500 V	10%	
C22	285-0572-00	0.1 μF	PTM	200 V		
C33	283-0000-00	0.001 μF	Cer	500 V		
C35	290-0194-00	10 μF	EMT	100 V		
C39	Use 283-0057-00	0.1 μF	Cer	200 V		
C41	290-0194-00	10 μF	EMT	100 V		
C42	290-0226-00	20 μF	EMT	100 V		
C43	283-0001-00	0.005 μF	Cer	500 V		
C45	281-0518-00	47 pF	Cer	500 V		
C47	283-0051-00	0.0033 μF	Cer	100 V	5%	100-1409
C47	285-0627-00	0.0033 μF	PTM	100 V	5%	1410-up
C48	283-0004-00	0.02 μF	Cer	150 V		100-1409
C48	285-0683-00	0.022 μF	PTM	100 V	5%	1410-up
C49	283-0026-00	0.2 μF	Cer	25 V		100-1409
C49	285-0623-00	0.47 μF	PTM	100 V		1410-up
C50	283-0026-00	0.2 μF	Cer	25 V		100-1409X
C52	281-0525-00	470 pF	Cer	500 V		
C55	281-0518-00	47 pF	Cer	500 V		
C65	281-0505-00	12 pF	Cer	500 V	10%	
C66	281-0547-00	2.7 pF	Cer	500 V	10%	
C67	281-0601-00	7.5 pF	Cer	500 V	5%	
C68	283-0059-00	1 μF	Cer	25 V		
C69	283-0001-00	0.005 μF	Cer	500 V		
C78	283-0059-00	1 μF	Cer	25 V		
C79	283-0001-00	0.005 μF	Cer	500 V		
C83	285-0572-00	0.1 μF	PTM	200 V		
C91	281-0519-00	47 pF	Cer	500 V	10%	
C97	281-0519-00	47 pF	Cer	500 V	10%	
C100	281-0505-00	12 pF	Cer	500 V	10%	
C101	281-0519-00	47 pF	Cer	500 V	10%	
C102	281-0505-00	12 pF	Cer	500 V	10%	
C105	283-0000-00	0.001 μF	Cer	500 V		
C120	283-0001-00	0.005 μF	Cer	500 V		
C121	283-0001-00	0.005 μF	Cer	500 V		
C122	283-0001-00	0.005 μF	Cer	500 V		
C125	283-0001-00	0.005 μF	Cer	500 V		

Diodes

Ckt. No.	Tektronix Part No.	Description				S/N Range
D30	152-0024-00	Zener 1N3024B		15 V		
D35	152-0024-00	Zener 1N3024B		15 V		
D46	*152-0107-00	Silicon, Replaceable by 1N647				
D54	*152-0061-00	Silicon, Tek Spec				
D56	*152-0107-00	Silicon, Replaceable by 1N647				
D64, D65	Use *152-0193-00	GaAs Tek Spec				
D74, D75	Use *152-0193-00	GaAs Tek Spec				
D80	152-0142-00	Zener 1N972A	0.4 W, 30 V, 10%			X1720-up
D89	152-0008-00	Germanium				
D90	152-0008-00	Germanium				
D102	*152-0061-00	Silicon, Tek Spec				

Fuse

F120	159-0024-00	1/16 Amp 3AG Fast Blo				

Transistors

Q33	*151-0103-00	Replaceable by 2N2219				
Q45	*151-0108-00	Replaceable by 2N2501				
Q55	*151-0108-00	Replaceable by 2N2501				
Q64	151-0097-00	2N955				100-1859
Q64	151-0120-00	Selected from 2N2475				1860-up
Q74	*151-0083-00	Selected from 2N964				

Resistors

Resistors are fixed, composition, ±10% unless otherwise indicated.

R10	302-0103-00	10 kΩ	1/2 W			
R11	311-0395-00	2.5 kΩ		Var		
R12	316-0105-00	1 MΩ	1/4 W			
R13	302-0564-00	560 kΩ	1/2 W			
R14	316-0104-00	100 kΩ	1/4 W			
R15	316-0223-00	22 kΩ	1/4 W			
R16	301-0335-00	3.3 MΩ	1/2 W		5%	
R17	323-0668-00	1.442 MΩ	1/2 W	Prec	1/4 %	
R18	323-0670-00	8.570 kΩ	1/2 W	Prec	1/4 %	
R19	323-0669-00	18.05 kΩ	1/2 W	Prec	1/4 %	
R20	301-0151-00	150 Ω	1/2 W		5%	
R21	321-0613-00	5.03 kΩ	1/8 W	Prec	1%	X1410-up
R22	302-0104-00	100 kΩ	1/2 W			
R25	316-0151-00	150 Ω	1/4 W			
R26	316-0151-00	150 Ω	1/4 W			
R30	311-0052-00	300 Ω		Var		
R32	302-0222-00	2.2 kΩ	1/2 W			X1410-up
R33	308-0062-00	3 kΩ	5 W	WW	5%	
R34	301-0821-00	820 Ω	1/2 W		5%	
R39	305-0432-00	4.3 kΩ	2 W		5%	
R40	311-0006-00	1 kΩ		Var		
R41	304-0471-00	470 Ω	1 W			

Resistors (Cont)

Ckt. No.	Tektronix Part No.	Description				S/N Range
R43	Use 301-0153-00	15 kΩ	½ W		5%	
R44	322-0097-00	100 Ω	¼ W	Prec	1%	
R45	316-0102-00	1 kΩ	¼ W			
R46	316-0273-00	27 kΩ	¼ W			
R52	315-0220-00	22 Ω	¼ W		5%	
R53	Use 301-0153-00	15 kΩ	½ W		5%	
R54	321-0122-00	182 Ω	⅛ W	Prec	1%	
R55	316-0102-00	1 kΩ	¼ W			
R56	316-0273-00	27 kΩ	¼ W			
R62†	Use 311-0007-00	1 kΩ		Var		
R61	316-0105-00	1 MΩ	¼ W			X1860-up
R63	302-0332-00	3.3 kΩ	½ W			
R64	323-0633-00	801 Ω	½ W	Prec	1%	
R65	321-0289-00	10 kΩ	⅛ W	Prec	1%	
R66	321-0068-00	49.9 Ω	⅛ W	Prec	1%	
R67	321-0189-00	909 Ω	⅛ W	Prec	1%	
R68	321-0289-00	10 kΩ	⅛ W	Prec	1%	
R69	302-0225-00	2.2 MΩ	½ W			
R72[1]	Use 311-0007-00	1 kΩ		Var		
R74	323-0633-00	801 Ω	½ W	Prec	1%	
R76	321-0068-00	49.9 Ω	⅛ W	Prec	1%	
R78	321-0289-00	10 kΩ	⅛ W	Prec	1%	
R79	302-0225-00	2.2 MΩ	½ W			
R80A	Use 315-0104-00	100 kΩ	¼ W		5%	
R80B	Use 315-0104-00	100 kΩ	¼ W		5%	
R80C	Use 315-0104-00	100 kΩ	¼ W		5%	
R80D	Use 315-0104-00	100 kΩ	¼ W		5%	
R81	Use 301-0433-00	43 kΩ	½ W		5%	100-1719
R81	324-0306-00	15 kΩ	1 W	Prec	1%	1720-up
R82	311-0152-00	2 x 500 kΩ		Var		
R83	302-0225-00	2.2 MΩ	½ W			
R84	302-0105-00	1 MΩ	½ W			
R85	323-0368-00	66.5 kΩ	½ W	Prec	1%	
R86	323-0396-00	130 kΩ	½ W	Prec	1%	
R87	301-0151-00	150 Ω	½ W		5%	
R88	302-0221-00	220 Ω	½ W			
R89	301-0202-00	2 kΩ	½ W		5%	
R90	302-0154-00	150 kΩ	½ W			
R91	301-0164-00	160 kΩ	½ W		5%	
R92	301-0224-00	220 kΩ	½ W		5%	
R93	301-0204-00	200 kΩ	½ W		5%	
R94	306-0333-00	33 kΩ	2 W			

[1]R62 and R72 furnished as a unit.

Resistors *(Cont)*

Ckt. No.	Tektronix Part No.		Description			S/N Range
R95	301-0204-00	200 kΩ	½ W		5%	
R96	301-0224-00	200 kΩ	½ W		5%	
R97	301-0164-00	160 kΩ	½ W		5%	
R98	306-0333-00	33 kΩ	2 W			
R99	301-0471-00	470 Ω	½ W		5%	
R100	303-0333-00	33 kΩ	1 W		5%	
R101	301-0184-00	180 kΩ	½ W		5%	
R102	302-0564-00	560 kΩ	½ W			
R104	301-0155-00	1.5 MΩ	½ W		5%	
R106	304-0224-00	220 kΩ	1 W			
R107	308-0024-00	15 kΩ	10 W	WW	5%	
R109	308-0108-00	15 kΩ	5 W	WW	5%	100-199
R109	Use 308-0093-00	12 kΩ	8 W	WW	5%	200-up
R110	308-0044-00	3.8 kΩ	25 W	WW	5%	
R111	306-0822-00	8.2 kΩ	2 W		5%	
R112	308-0059-00	2.25 kΩ	10 W	WW	5%	
R116	308-0018-00	2.5 kΩ	10 W	WW	5%	
R121	324-0603-00	27.8 kΩ	1 W	Prec	1%	100-1719X
R122	308-0025-00	20 kΩ	10 W	WW	5%	100-199
R122	308-0027-00	30 kΩ	10 W	WW	5%	200-up
R123	*312-0642-00	500 Ω	20 W	WW	1%	
R124	301-0623-00	62 kΩ	½ W		5%	
R125	303-0433-00	43 kΩ	1 W		5%	

Switches

	Unwired	Wired		
SW10A	260-0610-00	*262-0644-00	Rotary	TEST FUNCTION
SW10B	260-0598-00	*262-0639-00	Rotary	TEST FUNCTION
SW50	260-0599-00	Use *262-0638-01	Rotary	REPETITION RATE
SW120	260-0247-00		Push-Button	+225 V

Transformer

T110	*120-0286-00	Toroid	2 turns, Bifilar

Electron Tubes

V95	154-0039-00	12AT7
V102	154-0016-00	6AL5

SECTION 8
MECHANICAL PARTS LIST

FIG. 1 EXPLODED VIEW

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty 1 2 3 4 5	Description
1-1	352-0002-00			1	ASSEMBLY, fuse holder
	- - - - - -			-	assembly includes:
	352-0010-00			1	HOLDER, fuse
-2	200-0582-00			1	CAP, fuse, black
-3	210-0873-00			1	WASHER, rubber, 1/2 ID x 11/16 inch OD
-4	- - - - - -			1	NUT
-5	260-0247-00			1	SWITCH, pushbutton—+225 V
	- - - - - -			-	mounting hardware: (not included w/switch)
-6	210-0940-00			1	WASHER, flat, 1/4 ID x 3/8 inch OD
-7	210-0583-00			1	NUT, hex., 1/4-32 x 5/16 inch
-8	136-0140-00			1	SOCKET, banana jack
	- - - - - -			-	mounting hardware: (not included w/socket)
	210-0895-00			1	WASHER, insulating, charcoal (not shown)
-9	210-0223-00			1	LUG, solder, 1/4 ID x 7/16 inch OD, SE
-10	210-0465-00			1	NUT, hex., 1/4-32 x 3/8 x 3/32 inch
-11	366-0220-00			1	KNOB, charcoal—VERTICAL POSITION
	- - - - - -			-	knob includes:
	213-0020-00			1	SCREW, set, 6-32 x 1/8 inch, HSS
-12	- - - - - -			2	RESISTOR, variable
	- - - - - -			-	mounting hardware for each: (not included w/resistor)
-13	210-0207-00			1	LUG, solder, 3/8 ID x 5/8 inch OD, SE
-14	210-0013-00			1	LOCKWASHER, internal, 3/8 ID x 11/16 inch OD
-15	210-0840-00			1	WASHER, flat, 0.390 ID x 9/16 inch OD
-16	210-0590-00			1	NUT, hex., 3/8-32 x 7/16 inch
-17	333-0791-00	100	499	1	PANEL, front, TU7
	333-0875-00	500	1386	1	PANEL, front, 1M1
	333-0875-01	1387		1	PANEL, front, 067-0521-00
-18	366-0220-00			1	KNOB, charcoal—VARIABLE
	- - - - - -			-	knob includes:
	213-0020-00			1	SCREW, set, 6-32 x 1/8 inch, HSS
-19	366-0220-00			1	KNOB, charcoal—REPETITION RATE
	- - - - - -			-	knob includes:
	213-0020-00			1	SCREW, set, 6-32 x 1/8 inch, HSS
-20	262-0638-00	100	1409	1	SWITCH, wired—REPETITION RATE
	262-0638-01	1410		1	SWITCH, wired—REPETITION RATE
	- - - - - -			-	switch includes:
	260-0599-00			1	SWITCH, unwired—REPETITION RATE
	- - - - - -			-	mounting hardware: (not included w/switch)
-21	210-0840-00			1	WASHER, flat, 0.390 ID x 9/16 inch OD
-22	210-0590-00			1	NUT, hex., 3/8-32 x 7/16 inch
-23	366-0117-00			1	KNOB, charcoal—TEST FUNCTION
	- - - - - -			-	knob includes:
	213-0004-00			1	SCREW, set, 6-32 x 3/16 inch, HSS

FIG. 1 EXPLODED VIEW *(Cont)*

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	Description
				1 2 3 4 5	
1-24	262-0644-00			1	SWITCH, wired—TEST FUNCTION
	- - - - - -			-	switch, includes:
	260-0610-00			1	SWITCH, unwired—TEST FUNCTION
	- - - - - -			-	mounting hardware: (not included w/switch)
-25	210-0840-00			1	WASHER, flat, 0.390 ID x 9/16 inch OD
-26	210-0413-00			1	NUT, hex., 3/8-32 x 1/2 inch
-27	262-0639-00			1	SWITCH, wired—FUNCTION
	- - - - - -			-	switch includes:
	260-0598-00			1	SWITCH, unwired—FUNCTION
	- - - - - -			-	mounting hardware: (not included w/switch)
-28	210-0012-00			1	LOCKWASHER, internal, 3/8 ID x 1/2 inch OD
-29	210-0840-00			1	WASHER, flat, 0.390 ID x 9/16 inch OD
-30	210-0413-00			1	NUT, hex., 3/8-32 x 1/2 inch
-31	210-0586-00			1	NUT, keps, 4-40 x 1/4 inch
-32	406-0998-00			1	BRACKET, switch mounting
	- - - - - -			-	mounting hardware: (not included w/switch)
-33	210-0457-00			2	NUT, keps, 6-32 x 5/16 inch
-34	376-0007-00			1	COUPLING
	- - - - - -			-	coupling includes:
	213-0005-00			2	SCREW, set, 8-32 x 1/8 inch, HSS
-35	131-0106-00			1	CONNECTOR, coaxial, 1 contact, BNC, w/hardware
-36	366-0220-00			1	KNOB, charcoal—AMPLITUDE
	- - - - - -			-	knob includes:
	213-0020-00			1	SCREW, set, 6-32 x 1/8 inch, HSS
-37	- - - - - -			3	RESISTOR, variable
	- - - - - -			-	mounting hardware for each: (not included w/resistor)
-38	210-0840-00			1	WASHER, flat, 0.390 ID x 9/16 inch OD
-39	210-0413-00			1	NUT, hex., 3/8-32 x 1/2 inch
-40	366-0125-00			1	KNOB, securing
	- - - - - -			-	knob includes:
	213-0004-00			1	SCREW, set, 6-32 x 3/16 inch, HSS
-41	210-0894-00			1	WASHER, plastic, 0.190 ID x 7/16 inch OD
-42	384-0510-00			1	ROD, securing
	- - - - - -			-	rod includes:
-43	354-0025-00			1	RING, retaining
-44	- - - - - -			1	RESISTOR
	- - - - - -			-	mounting hardware: (not included w/resistor)
-45	212-0037-00			1	SCREW, 8-32 x 1 3/4 inch, Fil HS
-46	210-0809-00			1	WASHER, centering
-47	210-0462-00			1	NUT, hex., 8-32 x 1/2 inch
-48	212-0004-00			1	SCREW, 8-32 x 5/16 inch, PHS
-49	- - - - - -			4	RESISTOR
	- - - - - -			-	mounting hardware for each: (not included w/resistor)
-50	211-0553-00			1	SCREW, 6-32 x 1 1/2 inch, RHS
-51	210-0601-00			1	EYELET
-52	210-0478-00			1	NUT, hex., 5/16 x 21/32 inch long
-53	211-0507-00			1	SCREW, 6-32 x 5/16 inch, PHS

FIG. 1 EXPLODED VIEW *(Cont)*

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	Description
					1 2 3 4 5
1-54	- - - - - -			1	RESISTOR
	- - - - - -			-	mounting hardware: (not included w/resistor)
-55	212-0037-00			1	SCREW, 8-32 x 1¾ inch, Fil HS
-56	210-0808-00			1	WASHER, centering
-57	210-0462-00			1	NUT, hex., 8-32 x ½ inch
	210-0228-00			1	LUG, solder, SE #8, long (not shown)
-58	212-0004-00			1	SCREW, 8-32 x 5/16 inch, PHS
-59	136-0008-00			1	SOCKET, tube, 7 pin, w/ground lugs
	- - - - - -			-	mounting hardware: (not included w/socket)
-60	213-0044-00			2	SCREW, thread forming, 5-32 x 3/16 inch, PHS
-61	136-0015-00			1	SOCKET, tube, 9 pin, w/ground lugs
	- - - - - -			-	mounting hardware: (not included w/socket)
-62	213-0044-00			2	SCREW, thread forming, 5-32 x 3/16 inch, PHS
-63	136-0181-00			1	SOCKET, transistor, 4 pin
	- - - - - -			-	mounting hardware: (not included w/socket)
-64	354-0234-00			1	RING, socket mounting
-65	348-0006-00			1	GROMMET, rubber, ¾ inch
-66	210-0201-00			3	LUG, solder, SE #4
	- - - - - -			-	mounting hardware for each: (not included w/lug)
-67	213-0044-00			1	SCREW, thread forming, 5-32 x 3/16 inch, PHS
-68	131-0017-00			1	CONNECTOR, 16 contact
	- - - - - -			-	mounting hardware: (not included w/connector)
-69	211-0008-00			2	SCREW, 4-40 x ¼ inch, PHS
-70	210-0201-00			2	LUG, solder, SE #4
-71	210-0406-00			2	NUT, hex., 4-40 x 3/16 inch
-72	384-0508-00	100	319	4	ROD, frame, ⅜ x 8⅞ inches
	384-0631-00	320		4	ROD, spacer, 0.375 diameter x 8⅞ inches
	- - - - - -			-	mounting hardware: (not included w/rod)
-73	212-0044-00			1	SCREW, 8-32 x ½ inch, RHS
-74	670-0202-00			1	ASSEMBLY, circuit board
	- - - - - -			-	assembly includes:
	388-0592-00			1	BOARD, circuit
-75	344-0064-00	100	499	8	CLIP, diode
	344-0108-00	500		8	CLIP, diode
-76	136-0150-00	100	559	4	SOCKET, transistor, 3 pin
	136-0183-00	560		4	SOCKET, transistor, 3 pin
	- - - - - -			-	mounting hardware: (not included w/assembly)
-77	211-0008-00	100	1369	6	SCREW, 4-40 x ¼ inch, PHS
	211-0116-00	1370		6	SCREW, sems, 4-40 x 5/16 inch, PHS
-78	210-0586-00			6	NUT, keps, 4-40 x ¼ inch

FIG. 1 EXPLODED VIEW *(Cont)*

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	Description 1 2 3 4 5
1-79	387-0901-00			1	PLATE, rear
-80	441-0542-00			1	CHASSIS
	- - - - - -			-	mounting hardware: (not included w/chassis)
	211-0538-00			3	SCREW, 6-32 x 5/16 inch, 100° csk, FHS (not shown)
-81	211-0504-00			3	SCREW, 6-32 x 1/4 inch, PHS
-82	387-0900-00			1	PLATE, sub-panel, front
-83	179-0850-00			1	CABLE HARNESS, chassis
-84	179-0851-00			1	CABLE HARNESS, switch
-85	124-0148-00			2	STRIP, ceramic, 7/16 inch h, w/20 notches
	- - - - - -			-	each strip includes:
	355-0046-00			2	STUD, plastic
	- - - - - -			-	mounting hardware for each: (not included w/strip)
	361-0009-00			2	SPACER, plastic, 0.406 inch long
-86	124-0145-00			4	STRIP, ceramic, 7/16 inch h, w/9 notches
	- - - - - -			-	each strip includes:
	355-0046-00			2	STUD, plastic
	- - - - - -			-	mounting hardware for each: (not included w/strip)
	361-0009-00			2	SPACER, plastic, 0.406 inch long

STANDARD ACCESSORIES

	070-0407-01			2	MANUAL, instruction (not shown)

WAVEFORMS and VOLTAGE READINGS were obtained under following conditions:		
CONTROLS	SETTINGS	
VARIABLE	centered	
VERTICAL POSITION	centered	
AMPLITUDE	centered	
REPETITION RATE	MED	
Input Signal	none	
	Pulse Gen. ckt.	All other ckts.
TEST FUNCTION	+PULSE	CHOPPED
Test Oscilloscope		
Bandpass	30 Mc	
Triggering	+Internal	
DC Voltmeter		
Impedance	20,000Ω/volt	

Q64 CHANGED TO 151-0120-00
AND R61 ADDED

SW10A TEST FUNCTION SW10B
GANGED
1R 5R 2R 2F 3F 4R 4F 6R 3F 3R 5F 6R 1F 6R 1F 3R 1F 2R 1R

INTERNAL TRIGGER
VERTICAL SIGNAL
T110
+225V +350V +225V +100V -150V
R106 220K R107 15K
R109 12K R110 3.8K
R111 8.2K R112 2.25K
R116 2.5K

EXT INPUT
J10
LOW LOAD
HIGH LOAD
GAIN SET
COMMON MODE
ALTERNATE
CHOPPED
+ PULSE
– PULSE
R10 10K
C10 3.3
R11 2.5K VARIABLE
C22 0.1
R22 100K
R25 150
R26 150
R12 1M
R14 100K
R15 22K
R17 1.442M
R81 5.03K
C19 390
R20 150
R18 8.57K
R19 18.05K
R13 560K
R16 3.3M
-150V
+100V
+67.5

PULSE DC LEVEL
+95
D30 15V
R34 820
R30 300
R32 2.2K
R33 3K
C33 .001
Q33
+100V
0.2V/CM
2μSEC/CM

PULSE GENERATOR CIRCUIT
+75
DRIVE BAL
R40 1K
R41 470
+67.5
C42 20μf
C41 10μf
C43 .005
R62 1K cw
R64 801
D64 D65
R68 10K
C68 1μf
Q64
R66 49.9
C65 12
R67 909
C67 7.5
C66 2.7
R61 1M
+75V
R63 3.3K
Q74
R76 49.9
R65 10K
R44 100
R54 182
C45 47
C55 47
+67 +67
R45 1K
R55 1K
C35 10μf
Q45 Q55
D54
R72 1K cw
R74 801
D74 D75
AMPLITUDE
0.5V/CM
2μSEC/CM
+65.5
D35 15V
R46 27K
R56 27K
D46 D56
+60
R39 4.3K
C39 0.1
+66 +66
R52 22
C52 470
R43 15K
R53 15K
0.5V/CM
2μSEC/CM
+65.5
C49 .47
C50 0.2
C48 .022
C47 .0033
LOW
MED
HIGH
SW50 REPETITION RATE
ETCHED WIRING BOARD

SEE PARTS LIST FOR SEMICONDUCTOR TYPES

SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS MARKED WITH BLUE OUTLINE.

C78 1μf
R78 10K
R79 2.2M
R69 2.2M
C69 .005
C79 .005
R87 150
R84 1M
R85 66.5K
R83 2.2M
C83 0.1
+67.5
R86 130K
+100V
+225V
R81 15K
R80A 100K
R80C 100K
R80B 100K
R80D 100K
R82 2.X500K
VERTICAL POSITION
D80 30V
+100V

DUAL-TRACE SWITCHING CIRCUIT
R89 2K
R90 150K
R88 220
R94 33K
R98 33K
C100 12
R101 180K
R100 33K
C101 47
SLAVE PULSE IN
+80
50V/CM
+150
2μSEC/CM
+80
V102 6AL5
+167
D102
C105 .001
SYNC PULSE IN
+202
CHOPPED BLANKING PULSE OUT
R102 560K
R104 1.5M
C102 12
C91 47
C97 47
-11 -11
R91 160K
R97 160K
V 95A ½12AT7
V 95B ½12AT7
D90
R92 220K
R96 220K
R99 470
+2.1
+0.25
R93 200K
R95 200K
D89
-150V -150V
20V/CM
+150
2μSEC/CM
0.5V/CM
0V
2μSEC/CM
V102 3 4,5 V95 9 6.3VAC
+225V
F120 1/16A
SW120
J120 +225V

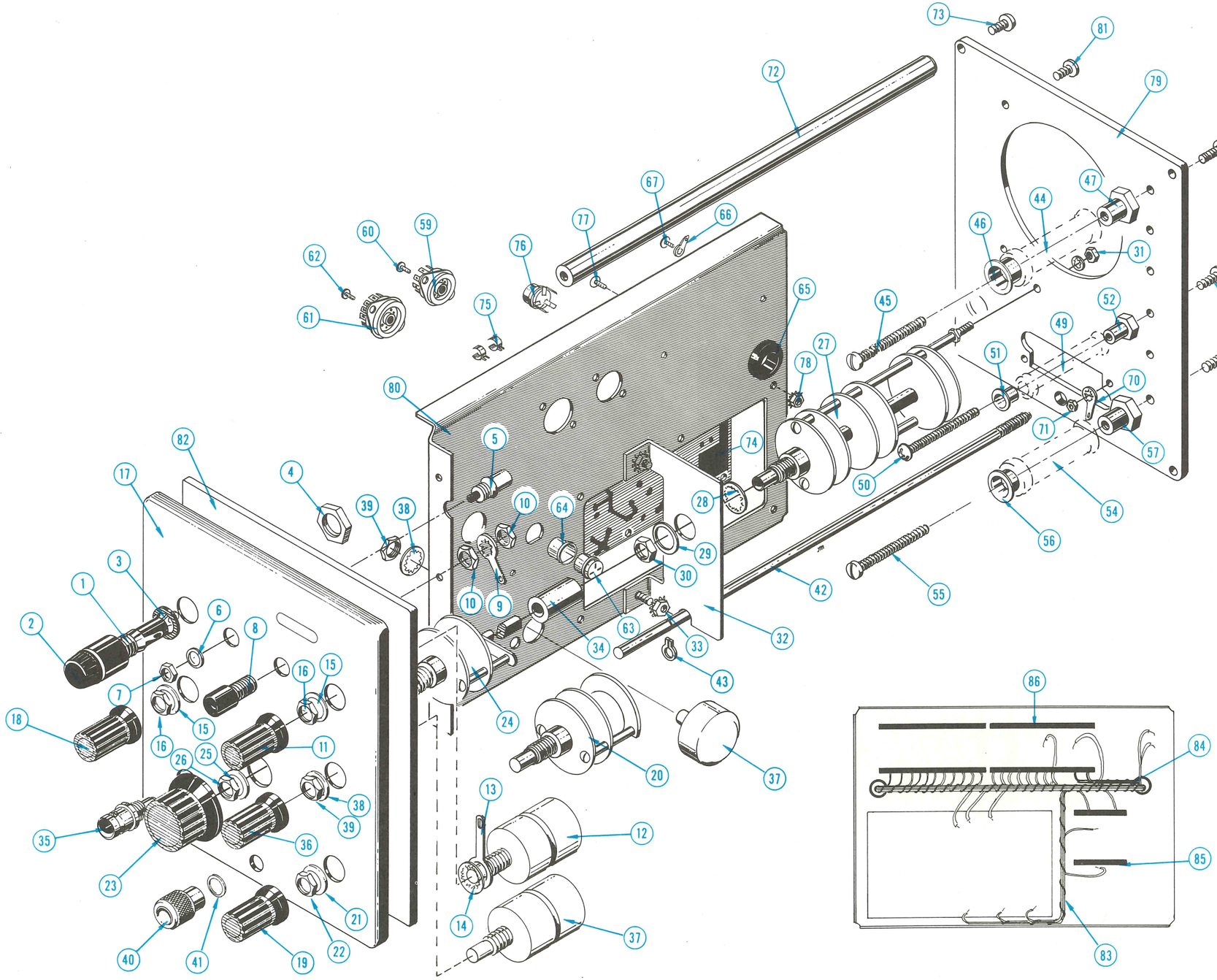
+350V
+225V
+100V
-150V
C120 .005
R122 30K
R121 27.5K
C121 .005
R124 62K
C122 .005
R123 500
R125 43K
C125 .005
P11
1 2 3 4 5 6 8 9 10 11 12 13 14 15 16

CMD 4-67

TYPE 067-0521-00

CALIBRATION FIXTURE

FIG. 1 FRONT



B

067-0521-00 CALIBRATION FIXTURE

FIG. 1

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. If it does not, your manual is correct as printed.

TYPE 067-0521-00 TENT SN 2600

PARTS LIST CORRECTION

CHANGE TO:

D80	152-0282-00	1N972B	0.4 w, 30 V, ±5%

M11,191/1167

TYPE 067-0521-00

PARTS LIST CORRECTION

CHANGE:

R54	321-0152-00	374 Ω	1/8 W	1%

M12,536/967