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

# INSTRUCTION MANUAL

## TG 501A Time Mark Generator


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

COMMITTED TO EXCELLENCE

# Tektronix<sup>®</sup>

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### INSTRUMENT SERIAL NUMBERS

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

B010000 — Tektronix, Inc. Beaverton, Oregon, USA  
G100000 — Tektronix Guernsey, Ltd., Channel Islands  
E200000 — Tektronix United Kingdom, Ltd., London  
J300000 — Sony/Tektronix, Japan  
H700000 — Tektronix Holland, NV, Heerenveen,  
The Netherlands

Instruments manufactured for Tektronix by external  
vendors outside the United States are assigned a two digit  
alpha code to identify the country of manufacture (e.g., JP  
for Japan, HK for Hong Kong, IL for Israel, etc.).

# OPERATORS SAFETY SUMMARY

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

## Terms in This Manual

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

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

## Terms as Marked on Equipment

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

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

## Symbols as Marked on Equipment



DANGER – High voltage.



Protective ground (earth) terminal.



ATTENTION – Refer to manual.

## Power Source

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

## Grounding the Product

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

## Danger Arising From Loss of Ground

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

## Use the Proper Power Cord

Use only the power cord and connector specified for your product.  
Use only a power cord that is in good condition.  
Refer cord and connector changes to qualified service personnel.

## Use the Proper Fuse

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

## Do Not Operate in Explosive Atmospheres

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

## Do Not Operate Plug-In Unit Without Covers

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



# SERVICING SAFETY SUMMARY

FOR QUALIFIED SERVICE PERSONNEL ONLY

*Refer also to the preceding Operators Safety Summary*

## Do Not Service Alone

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

## Use Care When Servicing With Power On

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

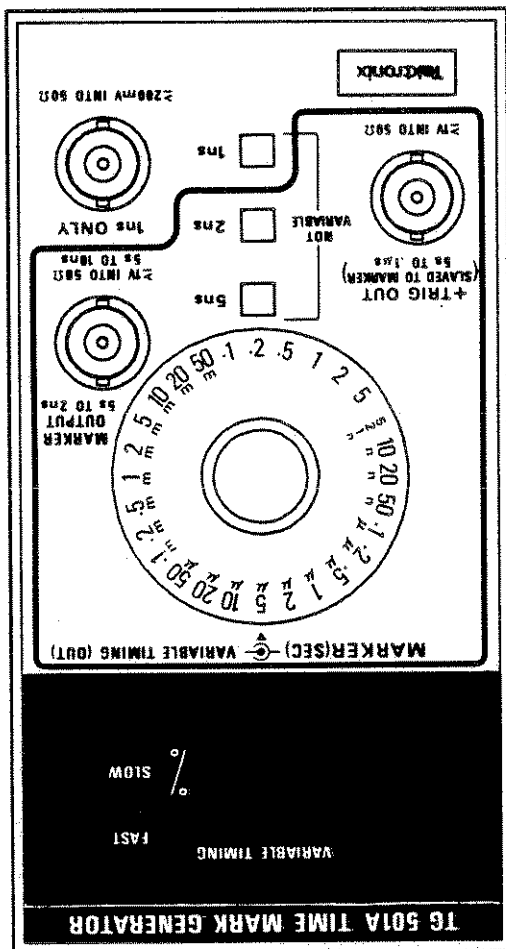
## Power Source

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

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

TG 501A Time Mark Generator

7373-1



# SPECIFICATION

## INTRODUCTION

selected by a rotary switch, 5, 2, and 1 ns modified sine waves are selected by self-cancelling push buttons when the rotary switch is in the 52 in position.

All outputs are available at the front-panel connectors, or by modification at the interface connector, located at the back of the plug-in, and the TM 500 or TM 5000 Series Power Module.

Power supplies are current limited. The 5 volt supply is over-voltage protected to avoid damage to the integrated circuits.

## Description

The TG 501A is a general purpose Time Mark Generator plug-in designed to operate in a TM 500 or TM 5000 Series Power Module. A Variable Timing Readout provides a simple but accurate means of measuring timing errors over +7.5% minimum range. Since many specifications are given in percentages, the error readout eliminates the need for computations and, additionally, lessens parallax discrepancies.

Marker section from 5 s through 1 ns in a 1, 2, 5 sequence is available. 5 s through 10 ns markers are

Table 1-1  
ELECTRICAL CHARACTERISTICS

Characteristics	Performance Requirements	Supplemental Information
Markers	5 s through 1 ns in a 1, 2, 5 sequence.	5 s through 10 ns are selected by a rotary switch, 5 ns, 2 ns, and 1 ns are push button selected modified sine waves.
Marker Amplitude	$\geq 1$ V peak into 50 $\Omega$ on 5 s through 10 ns markers, $\geq 750$ mV peak-to-peak into 50 $\Omega$ on 5 ns and 2 ns markers, $\geq 200$ mV peak-to-peak into 50 $\Omega$ on 1 ns markers.	
Trigger Output Signal	Slaved to marker output from 5 s through 100 ns. Remains at 100 ns for all faster markers.	Amplitude $\geq 1$ V peak into 50 $\Omega$ .
Internal Reference	Crystal Frequency	5 MHz.
Stability (0°C to +50°C) after 1/2 hour warm-up	Within 5 parts in 10 <sup>7</sup> .	
Long-Term Drift	1 part or less in 10 <sup>7</sup> per month.	
Setability	Adjustable to within 5 parts in 10 <sup>9</sup> .	

Table 1-1 (cont)

Characteristics	Performance Requirements	Supplemental Information
External Reference Input		Remove INTERNAL SELECT jumper W3051 and install EXTERNAL SELECT jumper W1061. Install one of the following jumpers: 1 MHz W1060 5 MHz W3050 10 MHz W3052
Acceptable Frequencies		
Input Amplitude		Must be TTL compatible.
Error Readout Range	To $\pm 7.5\%$ .	
Timing Error Measurement Accuracy	Device under test error is indicated to within one least significant digit (i.e., to within one displayed count).	Example: If DUT Timing error reads 3.0% slow, the absolute will be between 2.9% and 3.1% slow.

Table 1-2 ENVIRONMENTAL CHARACTERISTICS

Characteristics	Description
Temperature	Operating 0°C to +50°C. Non-Operating -40°C to +75°C.
Altitude	Operating To 15,000 ft. Storage To 50,000 ft.
Vibration	Operating and Non-Operating With the instrument complete and operating, vibration frequency swept from 10 to 50 to 10 Hz at 1 minute per sweep. Vibrate 15 minutes in each of the three major axes at 0.015" total displacement. Hold 3 minutes at any major resonance, or if none, at 50 Hz. Total time, 54 minutes.
Shock	30 g's, 1/2 sine, 11 ms duration, 2 shocks in each direction along 3 major axes, 12 total shocks.
Transportation	Qualified under National Safe Transit Committee Test Procedure 1A, Category II.



Table 1-3  
 PHYSICAL CHARACTERISTICS

Characteristics	Description
Finish	Polycarbonate front panel; chromate conversion coated aluminum chassis.
Net Weight	2 lbs., 4 oz. (1 kg).
Dimensions	2.6 in. (66 mm) w x 12.2 in. (310 mm) d x 4.7 in. (119 mm) h



# OPERATING INSTRUCTIONS

Refer to the Controls and Adjustments page for front-panel controls, connections and indicator descriptions.

**CAUTION**

Turn the Power Module off before inserting the plug-in; otherwise, damage may occur to the plug-in circuitry.

## Installation

The TG 501A is calibrated and ready for use when received. Referring to Figure 2-1, install the Generator and turn on the Power Module. Check the front-panel of the Generator to see that the knob skirt is lighted. The TG 501A is designed to operate in any compartment of a Power Module Instruction Manual for line voltage requirements and Power Module operation.

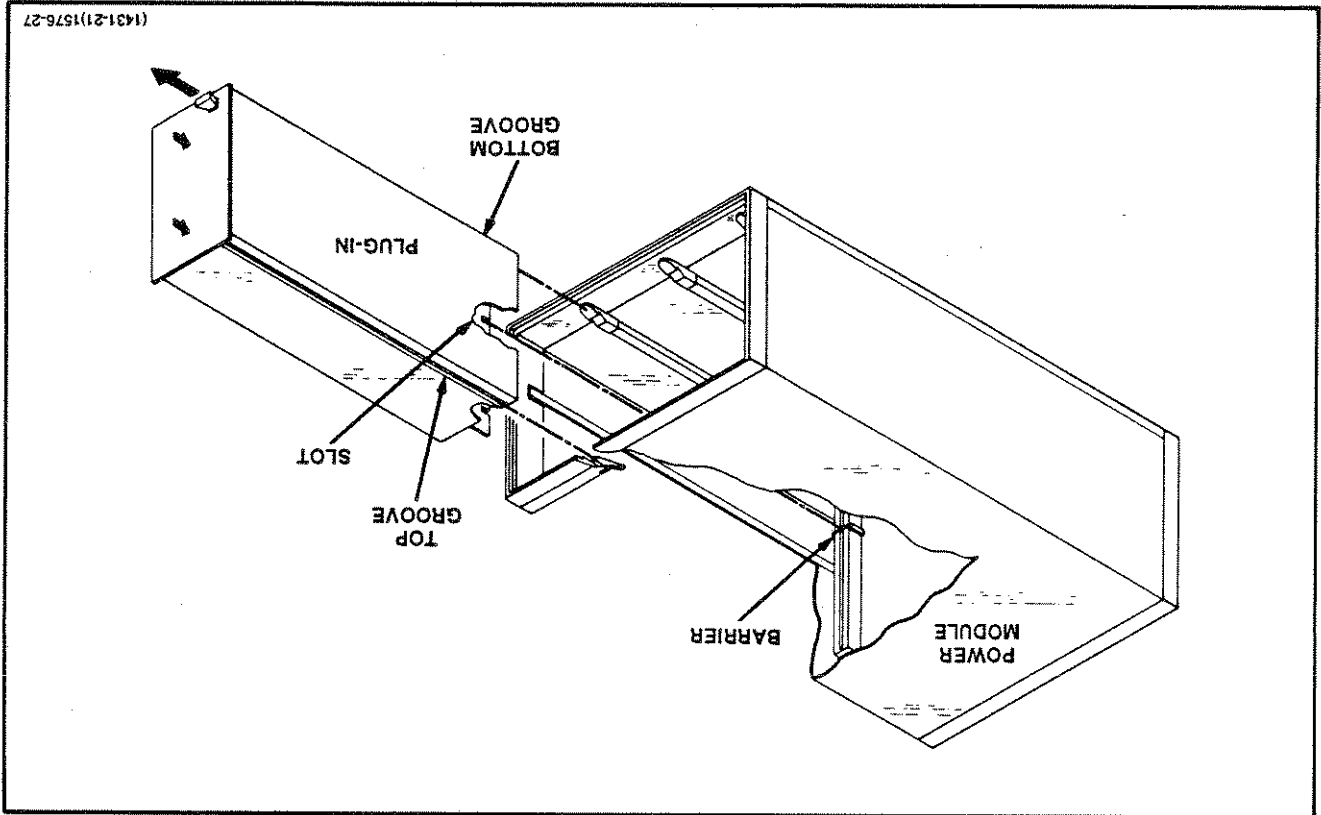


Fig. 2-1. Plug-in installation and removal.

## CONTROLS AND CONNECTORS

(Refer to Figure 2-2)

### MARKER CONTROL

- ① Rotary switch selects individual marker intervals from 5 s to 10 ns. Set to 521n position when using push buttons for 5 ns, 2 ns and 1 ns. Readout Display is turned off in 521n position.
- ② Self-cancelling push buttons select modified sine waves for 5, 2, and 1 ns when MARKER control is in 521n position. 1 ns marker has a separate output connector. These are not variable.

### 5 ns, 2 ns and 1 ns PUSH BUTTON

- ③ Provides positive markers of  $\geq 1$  V peak amplitude into 50  $\Omega$  for 5 s through 10 ns selected by MARKER Control rotary switch. Provides markers of  $\geq 1$  V peak-to-peak amplitude into 50  $\Omega$  for 5 ns and 2 ns modified sine waves, selected by self-cancelling push buttons when MARKER Control is in 521n position.

### MARKER OUT Connector

- ④ Provides  $\geq 0.5$  V peak-to-peak amplitude into 50  $\Omega$  or 1 ns modified sine wave selected by the 1 ns push button when MARKER Control is in 521n position.

### 1 ns ONLY Connector

- ③ Provides trigger pulses slaved to Marker Output from 5 s through 100 ns. Remains at 100 ns for all faster markers. Pulse amplitude is  $\geq 1$  V into 50  $\Omega$ .

### TRIGGER OUT Connector

- ⑥ Concentric with MARKER Control switch. Markers are calibrated when center button is pushed in allowing selection as indicated by the lighted knob skirt. When center button is out, output timing is fast or slow by the percentage indicated on the Readout Display.

### VARIABLE TIMING Control

- ⑦ Light when variable timing control is used. "Fast" lights when timing is faster than the standard indicated by lighted knob skirt. "Slow" lights when timing is slower. Percentage of faster or slower is read from VARIABLE TIMING Readout.

### FAST-SLOW Indicators

- ⑧ Indicates timing variation from standard timing. First digit is in percent units, second indicates one-tenth percent units.

### VARIABLE TIMING Readout

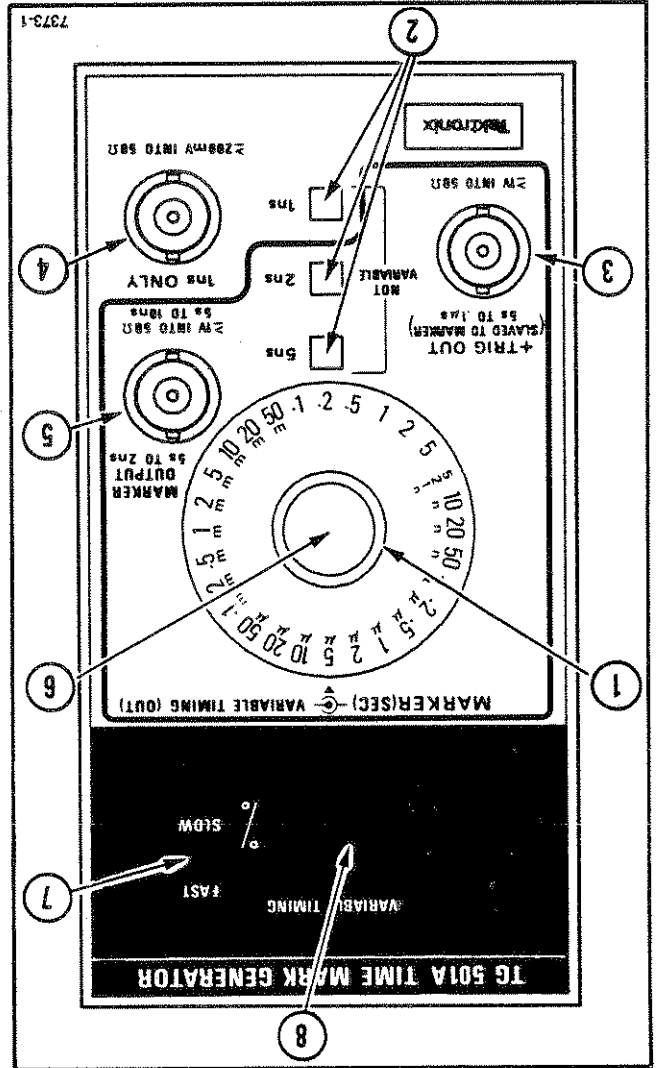


Fig. 2-2. Controls and Connectors.

## OPERATING MODES

### Calibrated Mode

When the center button of the VARIABLE TIMING Control is pushed in, the MARKER Control selects calibrated marker intervals from 5 s to 10 ns, indicated by the lighted knob skirt. To select 5, 2, or 1 ns modified sine wave markers, set the MARKER Control to 521n position and press the desired push button.

### Variable Timing Mode

When the center button of the VARIABLE TIMING Control is out, output timing is faster or slower than the calibrated marker to the percentage indicated by the VARIABLE TIMING READOUT Display and the FAST-SLOW indicator lights. 5, 2, and 1 ns push-button controlled modified sine waves are not variable and the Readout Display is turned off when the MARKER Control is in the 521n position.

## TYPICAL APPLICATIONS

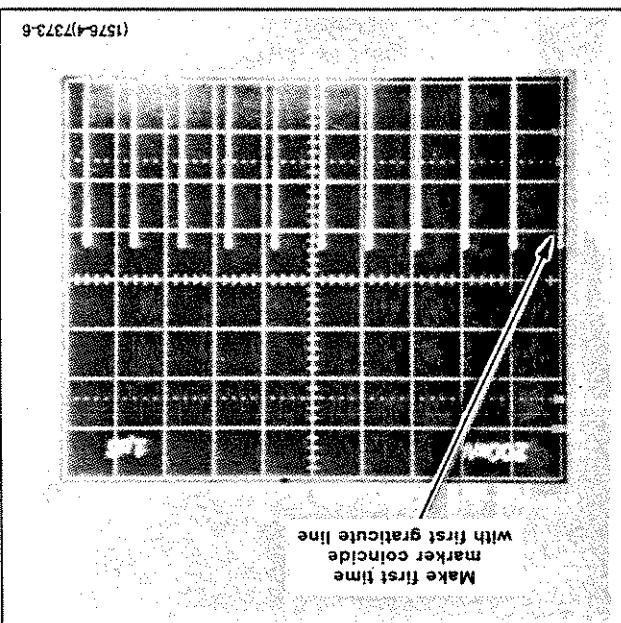
The TG 501A can be used for many applications not described in the manual. Use the following examples to become familiar with the TG 501A's VARIABLE TIMING READOUT. Contact your Tektronix Field Office or representative for making specific measurements with this instrument.

### Time Base Measurements

To accurately determine the timing error of a time base:

1. Connect the MARKER OUT of the TG 501A to the vertical input of the oscilloscope. Use a 50  $\Omega$  coaxial cable terminated into 50  $\Omega$ .
2. Connect the TRIGGER OUT of the TG 501A to the External Trigger input of the time base. Use a 50  $\Omega$  coaxial cable terminated into 50  $\Omega$ .
3. Select external trigger source on the time base.

Fig. 2-3. Timing error of time base.



4. Select, for example, the 1  $\mu$ s sweep rate of the time base.

5. Set the MARKER Control rotary switch of the TG 501A to 1  $\mu$ s.

6. Make sure the center button of VARIABLE TIMING Control, concentric with the MARKER Control, is out (Variable Timing Mode).

7. Use the Horizontal Position control of the time base to make the first time mark coincide with the first graticule line on the oscilloscope. See Figure 2-3.

8. Rotate the VARIABLE TIMING knob until all time markers coincide with graticule lines on the oscilloscope, as shown in Figure 2-4.

9. Either the FAST or SLOW indicator will light showing whether the time base is faster or slower than the calibrated markers of the TG 501A. Read the percentage of error from the VARIABLE TIMING READOUT Display.

**Pulse Generator Measurements**

To accurately determine pulse duration or period of a Pulse Generator:

1. A dual-trace oscilloscope is required. Select alternate mode.

2. Connect the MARKER OUT of the TG 501A to one channel of the dual-trace oscilloscope. Use a 50  $\Omega$  coaxial cable terminated in 50  $\Omega$ .

3. Connect the Output of the pulse generator to the other channel of the dual-trace, using a 50  $\Omega$  coaxial cable terminated in 50  $\Omega$ .

4. Set the time/div switch to display 1 cycle of a pulse in 10 divisions of the graticule on the oscilloscope, as indicated in Figure 2-5.

5. Use the MARKER Control switch of the TG 501A to display one time marker approximately at pulse duration and one at pulse period. Align the first time marker with the beginning of pulse wave-form. See Figure 2-5.

6. Select Variable Timing Mode on the TG 501A (VARIABLE TIMING Control button out).

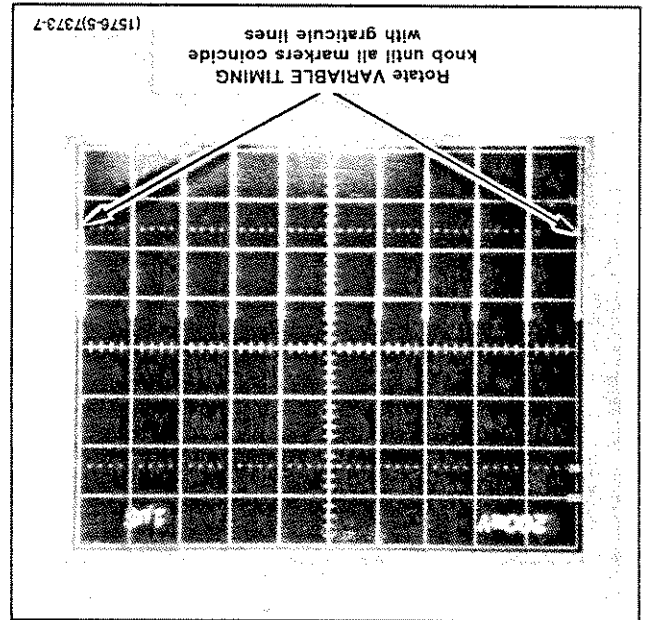


Fig. 2-4. Measuring timing error of time base.

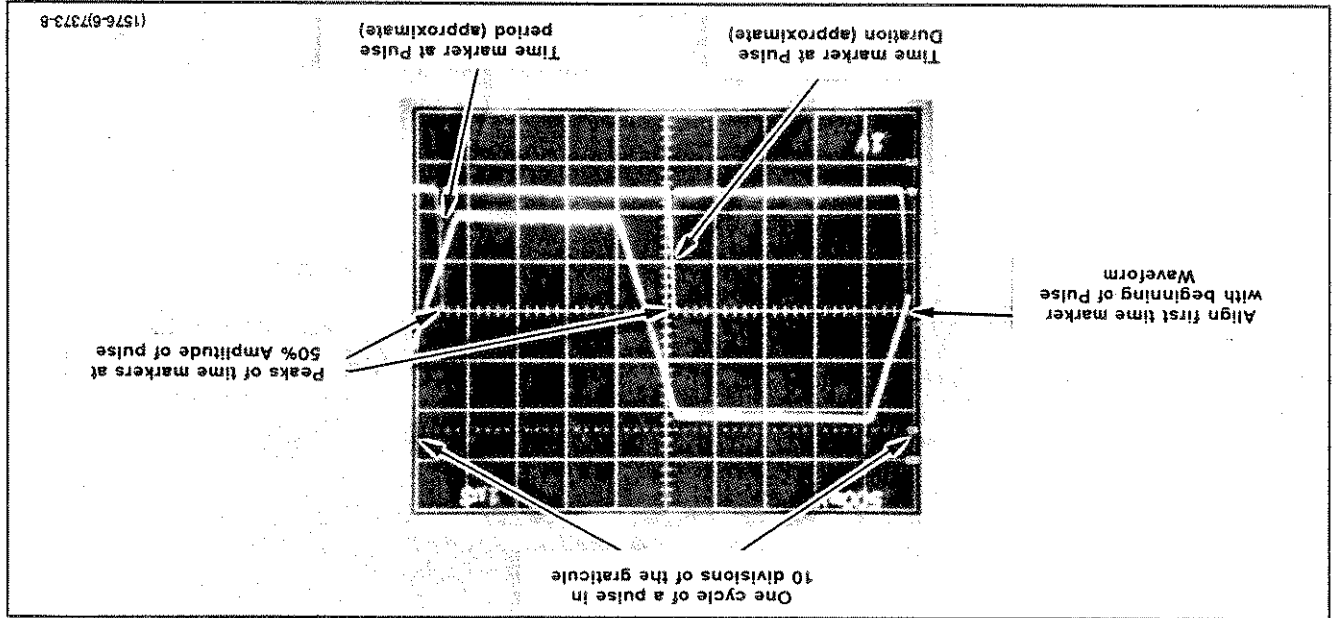


Fig. 2-5. Markers approximately at pulse duration and period.

2. Surround the instrument with polyethylene sheeting to protect the finish of the instrument.

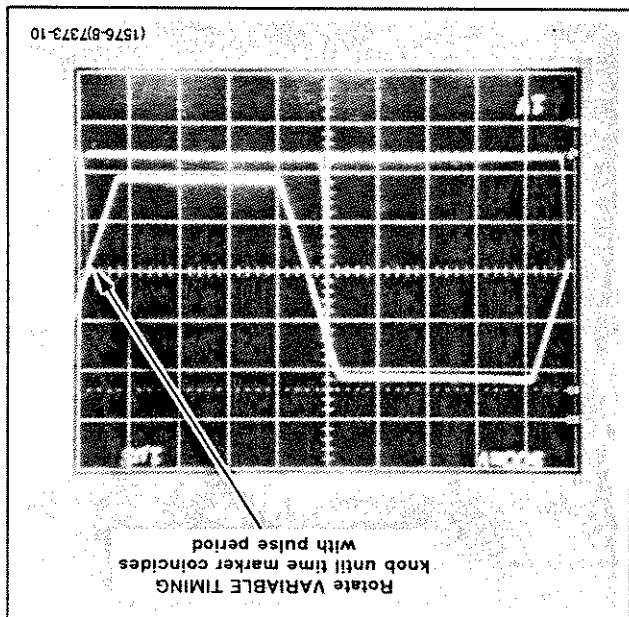
1. Obtain a carton of corrugated cardboard having inside dimensions of no less than six inches more than the instrument dimensions; this will allow for cushioning. Refer to the following table for carton test strength requirements.

Save and re-use the packaging in which your instrument was shipped. If the original package is unfit for use or not available, repack the instrument as follows:

If the Tektronix instrument is to be shipped to a Tektronix Service Center for service or repair, attach a tag showing: owner (with address) and the name of an individual at your firm that can be contacted, complete instrument serial number and a description of the service required.

## REPACKING FOR SHIPMENT

Fig. 2-7. Measuring pulse period.



7. Use the Vertical Position control of the oscilloscope to set the peaks of the time markers at 50% amplitude of the pulse shown in Figure 2-5.

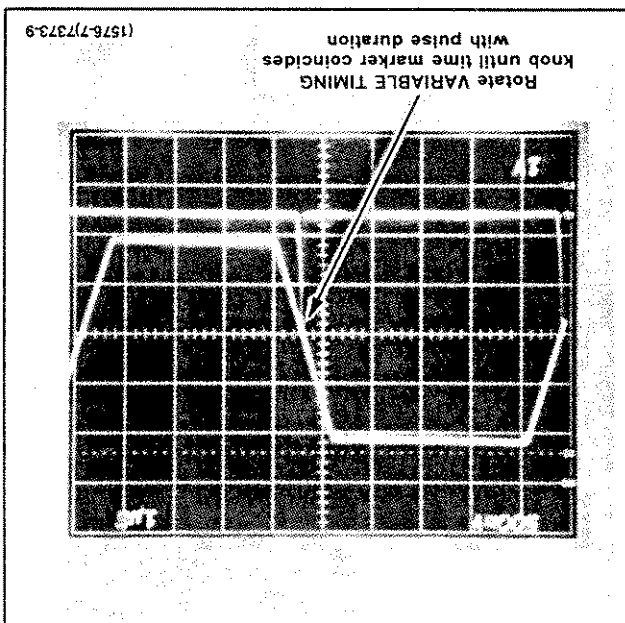
8. To check pulse duration, rotate the VARIABLE TIMING knob until time marks coincide with pulse duration, as shown in Figure 2-6.

9. Either the FAST or SLOW Indicator will light, showing whether the pulse duration of the pulse generator is faster or slower than the calibrated time mark of the TG 501A. Read the percentage of error from the VARIABLE TIMING READOUT Display.

10. To check pulse period, rotate the VARIABLE TIMING knob until time marks coincide with pulse period. See Figure 2-7.

11. Read the VARIABLE TIMING READOUT Display and check the FAST-SLOW indicators as described in step 9 to find the percentage of error from standard timing.

Fig. 2-6. Measuring pulse duration.




3. Cushion the instrument on all sides by tightly packing dunnage or urethane foam between cartons and instrument, allowing three inches on all sides.

4. Seal carton with shipping tape or industrial stapler.

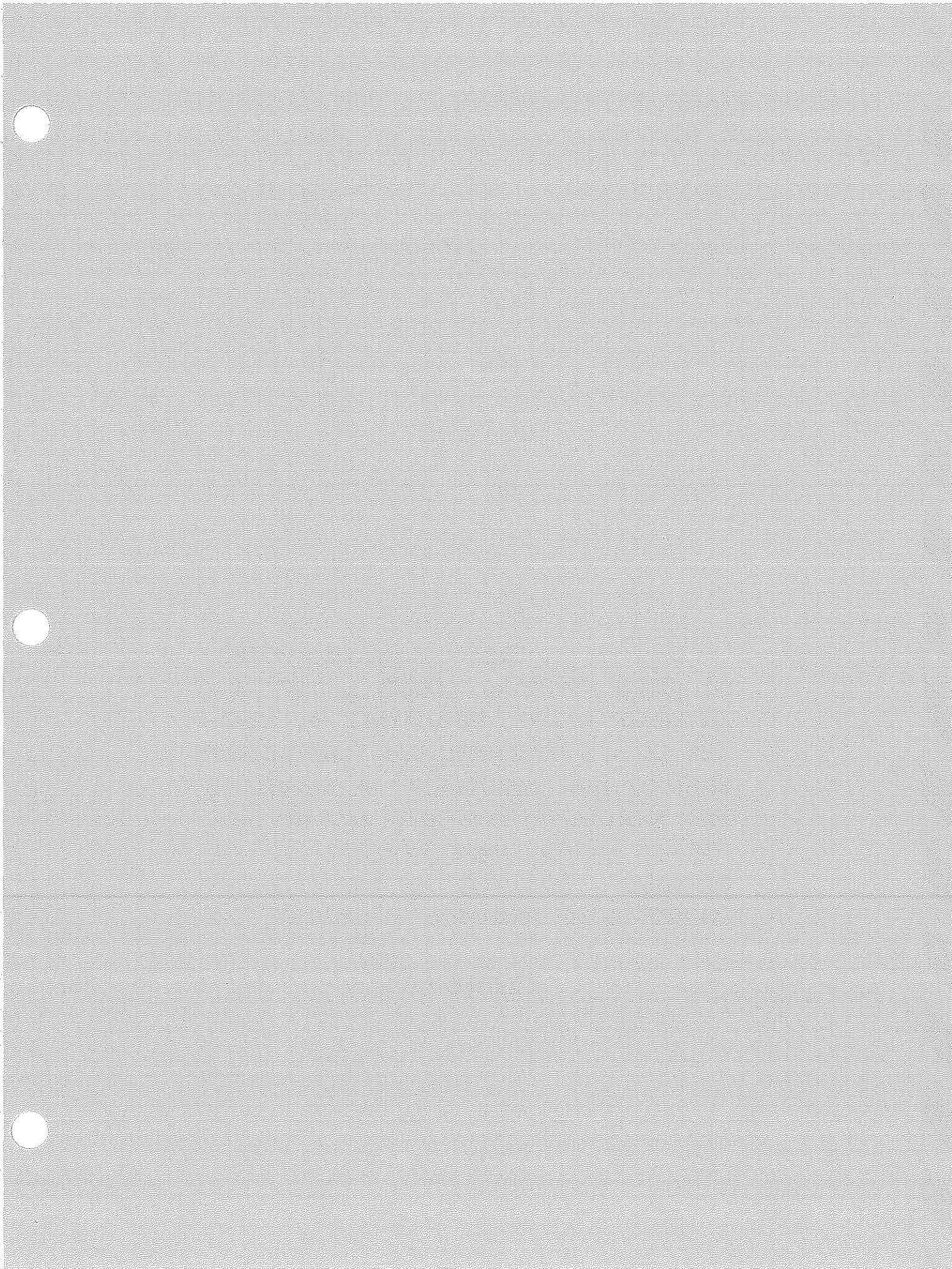
SHIPPING CARTON TEST STRENGTH	
Gross Weight (lb)	Carton Test Strength (lb)
1 - 10	200
10 - 30	275
20 - 120	375
120 - 140	500
140 - 160	600





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

**WARNING**



# THEORY OF OPERATION

## 1 MHz Crystal Reference

The reference frequency is supplied by a 5 MHz compensated crystal oscillator (TCXO) U460. Frequency adjustment of U460 is on the front side of the TCXO. The output of U460 is divided to 1 MHz by U3050B.

An external reference frequency may also be provided through the rear interface, as a TTL compatible, 1 MHz, 5 MHz, or 10 MHz signal.

5 dummy resistors are provided to select between internal or external reference, and 1, 5, or 10 MHz. The following table summarizes the jumper selections for each configuration.

	W1060	W1061	W3050	W3051	W3052
Internal 5 MHz			X	X	
External 1 MHz	X		X		
External 5 MHz			X		
External 10 MHz				X	X

Equivalently:

- W1061: Insert for External Reference.
- W3051: Insert for Internal Reference.
- (factory configured).
- W1060: Insert for 1 MHz Reference.
- W3050: Insert for 5 MHz Reference.
- (factory configured).
- W3052: Insert for 10 MHz Reference.

## 1 MHz Variable Clock and Multiplexer

The 1 MHz Variable Clock is generated by U2061, a voltage controlled multivibrator (VCM), with center frequency set by R2060 and C3061. The VARIABLE TIMING (OUT) knob controls R2074, which sets the frequency control voltage at pin 13 of U2061. The upper and lower voltage limits are set by R3070 and R3071, respectively, through voltage followers U3060B and U3060A.

The 1 MHz Variable clock and the 1 MHz Crystal Reference are multiplexed by U2060, with the Variable

Clock selected when R2074SW is open, and the Reference selected when R2074SW is closed. R2074SW is opened by pulling out the VARIABLE TIMING (OUT) knob, and closed by pushing it in.

## 100 MHz Voltage Controlled Oscillator and Dividers

The voltage controlled oscillator (VCO) is U1041, with control voltage at pin 2, and timing capacitor C1044. The output of the VCO at pin 4 is applied to a ÷2 counter in U2040, and a ÷5 counter in U1040. The outputs of these two counters are applied to a ÷5 counter in U2040, and a ÷2 counter in U1040, respectively, to yield a 10 MHz signal. The outputs of these two counters are connected to an "ECL to TTL" transistor, composed of Q1030 and associated components. The TTL signal is then buffered by U1030C. The 10 MHz TTL signal is applied to a ÷5 counter U2030B pin 12, and the 2 MHz output at pin 10 is applied to ÷2 counter U2050A. The output of U2050A, at 1 MHz, is compared to the 1 MHz Reference, or the Variable Clock, by the phase detector circuitry.

## Frequency Control of the 100 MHz Oscillator

Frequency control of the 100 MHz VCO is accomplished through a phase detector and low pass filter.

The phase detector consists of two D flip-flops, U1070A and B, and a third flip-flop consisting of U1051A, B, C, and D. The 1 MHz reference is input to the clock input of U1070A, and the VCO output, divided to 1 MHz, is input to the clock input of U1070B. The inverted outputs of these two gates are converted to low duty cycle pulses, by feeding them back to the Set inputs of U1070A and B, pins 4 and 10 respectively. A rising edge on the reference signal, U1070A pin 3, causes the phase detector output, U1051B pin 6, to switch low, and a rising edge on the VCO signal, U1070B pin 11, causes the phase detector output to switch high.

If the reference and VCO signals are locked, the phase detector output will be a pulse train, the duty cycle of which is proportional to the phase difference between the two signals. This pulse train is inverted and integrated by the low pass filter, consisting of U1050, R1053, C1051, and associated components. A longer or shorter duty cycle results in a lower or higher low pass filter output, respectively, and after level shifting, a slower or faster VCO signal, respectively. VR1050 provides overvoltage protection of the VCO IC.



- f. Remove 1 MHz Frequency input and TG 501A cables from test oscilloscope.
- e. CHECK - Test oscilloscope display for a rate of  $\leq 6 \text{ div}/10 \text{ s}$ . This establishes the clock accuracy to  $\pm 12 \times 10^{-7}$ .

Volts/Div	0.5
Time/Div	2 $\mu$
Triggering Source	External

**Test Oscilloscope**

- d. Set:
  - c. Connect TG 501A 1  $\mu$  time marker (via a 50  $\Omega$  cable and 50  $\Omega$  terminator) from MARKER OUT to oscilloscope vert input.
  - b. Connect 1 MHz Frequency from the WWVB receiver output to the ext trig input of the test oscilloscope.

MARKER (SEC)	1 $\mu$
VARIABLE TIMING	In
	Push buttons
	as they are

**TG 501A**

- a. Set
- 3. Check Clock Accuracy**

- d. Remove cable from TG 501A and DC 503.

TG 501A	ERROR	DC 503A
0.0%	$\pm 0.1\%$	9.990 to 10.010 KHZ
5.0% FAST	$\pm 0.1\%$	10.490 to 10.510 KHZ
5.0% SLOW	$\pm 0.1\%$	9.490 to 9.510 KHZ

**Timing Error Measurement Accuracy**

**Table 4-2**

- c. Check to within one displayed count as per Table 4-2.

- f. Connect 50  $\Omega$  cable from vertical amplifier input to the TG 501A + TRIG OUT.
- i. Connect 50  $\Omega$  cable from time base Ext Trig In to the TG 501A MARKER OUTPUT.
- h. Remove 50  $\Omega$  cables from vertical amplifier input and time base Ext Trig In.
- g. Set Time Base Time/Div to 0.1  $\mu$ s.
- f. Set TG 501A MARKER (SEC) dial to .1  $\mu$ s.
- e. CHECK - Each setting has marker amplitude of  $\geq 1 \text{ V}$  and 1 marker per div.

- d. Set Time base Time/Div to the same time (SEC) division that the TG 501A MARKER is set to.
- c. Set TG 501A MARKER (SEC) control to each position on the dial (.1  $\mu$  through 5 s).
- b. Connect 50  $\Omega$  cable and 50  $\Omega$  terminator from TG 501A + TRIG OUT to the oscilloscope time base Ext Trig In. Connect a second 50  $\Omega$  cable and 50  $\Omega$  terminator from the TG 501A MARKER OUTPUT to the oscilloscope vertical amplifier input. The terminators should be placed at the oscilloscope end of the cables.

Display Mode	Time/Div	Variable	Level/Slope	Mode	Coupling	Source	Magnifier
Time Base	.1 $\mu$ s	Cal	+	Auto	AC	Ext	X1

**Oscilloscope Time Base**

Polarity	Volts/Div
+ up	.5 V

**Oscilloscope Vertical Amplifier**

MARKER (SEC)	5.2, and 1 ns
VARIABLE TIMING	In
	Push buttons
	as they are

**TG 501A**

- a. Set:

**4. Check Timing Accuracy and Marker Amplitude**

k. CHECK—TRIG OUT amplitude  $\geq 1.0$  V display.

l. Note TRIG OUT amplitude.

m. Set TG 501A MARKER dial to 50 ns.

n. CHECK—Approximately the same trigger amplitude as noted at 1  $\mu$ s,  $\geq 1.0$  V.

o. Remove TG 501A MARKER OUTPUT and + TRIG OUT from vertical amplifier input and time base Ext Trig

in.

**5. Check 50-20-10-5-2-1 ns Marker Amplitude**

a. Set:

**TG 501A**

MARKER (SEC)

VARIABLE TIMING

50 ns

In

Push button in

2 and 1 ns

Push button

**Sampling Unit**

mVolts/Div

200 mV

CH 1

**Sample Sweep Unit**

Delaying Sweep

50 ns

Delayed Sweep

50 ns

Delay Time Multi (2nd Dot)

0.0

Delay Zero (1st Dot)

ccw

Swp push button

Out

Int CH 1 push button

Out

HF Sync push button

Out

Auto Trig push button

In

+ Slope push button

In

Rep push button

In

b. Connect 50  $\Omega$  cable from TG 501A MARKER OUTPUT to sampling unit CH 1 vertical input.

c. Connect 50  $\Omega$  cable from TG 501A + TRIG OUT to sample sweep unit Ext Input.

d. Set Sampling unit Triggering Level, Triggering Hold Off, and scan controls for a suitable stable display.

e. CHECK—Test oscilloscope display for a marker amplitude of  $\geq 1$  V and a display of 1 marker per div.

f. Set TG 501A MARKER (SEC) control and the sampling sweep unit Delayed Sweep control to 20 ns and then to 10 ns, each time repeating part e of this step.

g. Set TG 501A MARKER (SEC) control to 5-2-1 ns and sampling sweep unit Delayed Sweep to 5 ns.

h. CHECK—Amplitude of display is  $\geq 750$  mV peak-to-peak.

i. Set Sampling unit Volts/Div to 200mV.

j. Set TG 501A 2 ns push button in.

k. Set Sampling sweep unit Time/Div to 2 ns.

l. CHECK—Amplitude of display is  $\geq 750$  mV peak-to-peak.

m. Remove 50  $\Omega$  cable from TG 501A MARKER OUTPUT and reconnect it to TG 501A 1 ns only connector.

n. Set TG 501A 1 ns button in.

o. Set Sampling unit Volts/Div to 100mV.

p. CHECK—Amplitude of display is  $\geq 200$ mV peak-to-peak.

q. Remove TG 501A MARKER OUTPUT and + TRIG OUT output cables from sampling unit vertical input and sampling sweep unit Trigger Input respectively.

r. This completes the performance check.

# ADJUSTMENT PROCEDURE

## Introduction

Use the Adjustment Procedure to restore the TG 501A to original performance requirements. This Adjustment Procedure need not be performed unless the instrument fails to meet the Performance Requirements of the electrical characteristics listed in the Specification section, or if the Performance Check procedure cannot be completed satisfactorily. If the instrument has undergone repairs, the Adjustment Procedure is recommended. Satisfactory completion of all adjustment steps in this procedure ensures that the instrument will meet the Performance Requirements.

## Test Equipment Required

The test equipment (or equivalent) listed in Table 4-1 is required for adjustment of the TG 501A. Specifications given for the test equipment are the minimum necessary for accurate adjustment. All test equipment is assumed to be correctly calibrated and operating within specifications. If other test equipment is substituted, calibration setup may need to be altered to meet the requirements of the equipment used.

## Preparation

Access to the internal adjustments is achieved most easily when the TG 501A is connected to the power module with a flexible plug-in extender. Make adjustments at an ambient temperature between 21°C and 25°C (70°F and 77°F). Allow at least 30 minutes of warm-up time.

## 1. Check Power Supplies

a. Set the TG 501A controls as follows:

MARKER (SEC) 1  $\mu$ s  
 VARIABLE TIMING (OUT) Pushed in

b. Refer to the Adjustment page and connect a digital voltmeter between the +15V test point and ground.

c. Check for a voltage between +14.3 and +15.7V.

a. Set the controls of the TG 501A as follows:

MARKER (SEC) 1  $\mu$ s  
 VARIABLE TIMING (OUT) Out

b. Rotate the VARIABLE TIMING (OUT) control fully clockwise.

c. Adjust R3071, Var Range Low, until readout is  $\geq 7.5\%$  slow.

d. Rotate the VARIABLE TIMING (OUT) control fully clockwise.

## 3. Adjust VARIABLE TIMING range

f. If the frequency is not within these limits, remove the screw in the TXCO and adjust the internal screw for minimum horizontal drift.

g. Check all markers from 10 ns to 5 s for an amplitude of at least one volt and correct timing.

e. Check the test oscilloscope display for a drift rate  $\leq 5$  div/10 ( $\pm 5 \times 10^7$ ).

Volts/Div 0.5  
 Time/Div 1  $\mu$ s  
 Trigger Source External

d. Set the oscilloscope as follows:

b. Connect a 50  $\Omega$  coaxial cable through a 50  $\Omega$  terminator to the input of the oscilloscope vertical amplifier.

c. Connect the 1 MHz signal from the WWVB receiver to the external trigger input on the oscilloscope.

## 2. Adjust Time Reference Set

a. Set the TG 501A controls as follows:

MARKER (SEC) 1  $\mu$ s  
 VARIABLE TIMING (OUT) Pushed in

e. Check for a voltage between +4.94 V and 5.64 V.

d. Connect the digital voltmeter between the +5 V test point and ground.

e. Adjust R3070, Var Range High, until readout is  $\geq 7.5\%$  fast.

f. Repeat steps b through e to remove interaction.

**4. Adjust 5 ns Marker out**

a. Set the controls of the TG 501A as follows:

MARKER (SEC)	521n
VARIABLE TIMING (OUT)	In
5 ns Button	In

b. Connect a 50  $\Omega$  coaxial cable (the sampling scope input is 50  $\Omega$ ) from the TG 501A MARKER OUT to the input of the sampling oscilloscope.

c. Set the oscilloscope controls as follows:

Vertical sensitivity	0.2 V/Div
Time/Div	5 ns/Div
Triggering Source	Internal

d. Adjust C450, C465, and C467 for maximum marker amplitude.

**5. Adjust 2 ns Marker out**

a. Set the TG 501A controls as follows:

MARKER (SEC)	521n
VARIABLE TIMING (OUT)	In
2 ns Button	In

b. Set the oscilloscope as follows:

Vertical Sensitivity	0.2 V/Div
Time/Div	2 ns/Div
Trigger Source	Internal

c. Adjust C498 and R482 for maximum amplitude on the oscilloscope.

d. Adjust C505, C504 and R500 for maximum amplitude on the oscilloscope.

e. Adjust C510, C511, C512, and C513, in the Locations page, for maximum amplitude on the test oscilloscope.

**6. Adjust 1 ns Marker out**

a. Set the TG 501A controls as follows:

MARKER (SEC)	521n
VARIABLE TIMING (OUT)	In
1 ns Button	In

b. Set the oscilloscope as follows:

Vertical Sensitivity	0.1 V/Div
Time/Div	1 ns/Div
Triggering Source	Internal

c. Remove the coaxial output cable from the TG 501A MARKER OUTPUT connector and connect it to the TNS ONLY connector.

d. Adjust C517, C518, C519, and C520 in the sequence indicated by the arrow on the Adjustment Location page. Adjust for maximum amplitude.

e. Adjust C515 so the amplitude of the 1 ns marker is over 200 mV peak-to-peak and the amplitude of the 2 ns marker is over 750 mV peak-to-peak.

f. Recheck step 5 because step 6 interacts with its adjustments.

g. This completes the adjustment procedure.



# ADJUSTMENT PROCEDURE

## Introduction

Use the Adjustment Procedure to restore the TG 501A to original performance requirements. This Adjustment Procedure need not be performed unless the instrument fails to meet the Performance Requirements of the electrical characteristics listed in the Specification section, or if the Performance Check procedure cannot be completed satisfactorily. If the instrument has undergone repairs, the Adjustment Procedure is recommended. Satisfactory completion of all adjustment steps in this procedure ensures that the instrument will meet the Performance Requirements.

## Test Equipment Required

The test equipment (or equivalent) listed in Table 4-1 is required for adjustment of the TG 501A. Specifications for accurate adjustment. All test equipment is assumed to be correctly calibrated and operating, within specifications.

If other test equipment is substituted, calibration setup may need to be altered to meet the requirements of the equipment used.

## Preparation

Access to the internal adjustments is achieved most easily when the TG 501A is connected to the power module with a flexible plug-in extender. Make adjustments at an ambient temperature between 21°C and 25°C (70°F and 77°F). Allow at least 30 minutes of warm-up time.

## 1. Check Power Supplies

a. Set the TG 501A controls as follows:

MARKER (SEC) 1  $\mu$ s  
 VARIABLE TIMING (OUT) Pushed in

b. Refer to the Adjustment page and connect a digital voltmeter between the +15V test point and ground.

c. Check for a voltage between +14.3 and +15.7V.

a. Set the controls of the TG 501A as follows:

MARKER (SEC) 1  $\mu$ s  
 VARIABLE TIMING (OUT) Out

b. Rotate the VARIABLE TIMING (OUT) control fully clockwise.

c. Adjust R3071, Var Range Low, until readout is  $\geq 7.5\%$  slow.

d. Rotate the VARIABLE TIMING (OUT) control fully clockwise.

## 3. Adjust VARIABLE TIMING range

g. Check all markers from 10 ns to 5 s for an amplitude of at least one volt and correct timing.

f. If the frequency is not within these limits, remove the screw in the TXCO and adjust the internal screw for minimum horizontal drift.

e. Check the test oscilloscope display for a drift rate  $\leq 5 \text{ div}/10 (\pm 5 \times 10^7)$ .

Volts/Div	0.5
Time/Div	1 $\mu$ s
Trigger Source	External

d. Set the oscilloscope as follows:

c. Connect the 1 MHz signal from the WWVB receiver to the external trigger input on the oscilloscope.

b. Connect a 50  $\Omega$  coaxial cable through a 50  $\Omega$  terminator to the input of the oscilloscope vertical amplifier.

MARKER (SEC) 1  $\mu$ s  
 VARIABLE TIMING (OUT) Pushed in

a. Set the TG 501A controls as follows:

## 2. Adjust Time Reference Set

e. Check for a voltage between +4.94 V and 5.64 V.

d. Connect the digital voltmeter between the +5 V test point and ground.

- e. Adjust R3070, Var Range High, until readout is  $\geq 7.5\%$  fast.
- f. Repeat steps b through e to remove interaction.

**4. Adjust 5 ns Marker out**

- a. Set the controls of the TG 501A as follows:

MARKER (SEC)	521n
VARIABLE TIMING (OUT)	In
5 ns Button	In

- b. Connect a 50  $\Omega$  coaxial cable (the sampling scope input is 50  $\Omega$ ) from the TG 501A MARKER OUT to the input of the sampling oscilloscope.

- c. Set the oscilloscope controls as follows:

Vertical sensitivity	0.2 V/Div
Time/Div	5 ns/Div
Triggering Source	Internal

- d. Adjust C450, C465, and C467 for maximum marker amplitude.

**5. Adjust 2 ns Marker out**

- a. Set the TG 501A controls as follows:

MARKER (SEC)	521n
VARIABLE TIMING (OUT)	In
2 ns Button	In

- b. Set the oscilloscope as follows:

Vertical Sensitivity	0.2 V/Div
Time/Div	2 ns/Div
Trigger Source	Internal

- c. Adjust C498 and R482 for maximum amplitude on the oscilloscope.

- d. Adjust C505, C504 and R500 for maximum amplitude on the oscilloscope.

- e. Adjust C510, C511, C512, and C513, in the Locations page, for maximum amplitude on the test oscilloscope.

**6. Adjust 1 ns Marker out**

- a. Set the TG 501A controls as follows:

MARKER (SEC)	521n
VARIABLE TIMING (OUT)	In
1 ns Button	In

- b. Set the oscilloscope as follows:

Vertical Sensitivity	0.1 V/Div
Time/Div	1 ns/Div
Triggering Source	Internal

- c. Remove the coaxial output cable from the TG 501A MARKER OUTPUT connector and connect it to the 1ns ONLY connector.

- d. Adjust C517, C518, C519, and C520 in the sequence indicated by the arrow on the Adjustment Location page. Adjust for maximum amplitude.

- e. Adjust C515 so the amplitude of the 1 ns marker is over 200 mV peak-to-peak and the amplitude of the 2 ns marker is over 750 mV peak-to-peak.

- f. Recheck step 5 because step 6 interacts with its adjustments.

- g. This completes the adjustment procedure.

# MAINTENANCE

## GENERAL

### Introduction

This section of the manual provides information on preventive maintenance, troubleshooting, ordering parts, and replacing components and sub-assemblies for the TG 501A.

### Cabinet Removal

**Dangerous potentials exist at several points throughout the system. When the system must be operated with the cabinet removed, do not touch exposed connections or components. Some transistors have voltage present on their cases. Disconnect power before cleaning the system or replacing parts.**

**WARNING**

### Cleaning

*Avoid using chemical cleaning agents which might damage plastic parts. Avoid chemicals containing benzene, toluene, xylene, acetone, or similar solvents.*

**Exterior.** Loose dust may be removed with a soft cloth or a dry brush.

**Interior.** Cleaning the interior of a unit should precede calibration since the cleaning process could alter the settings or calibration adjustments. Use low-velocity compressed air to blow off accumulated dust. Hardened dirt can be removed with a soft brush, cotton tipped swab, or a cloth dampened in a solution of water and mild detergent.

### Preventive Maintenance

Preventive maintenance steps performed on a regular basis will increase the reliability of the instrument

## TROUBLESHOOTING AIDS

### Circuit Description

The Theory of Operation section explains circuit operation theory. Used with the schematics, this can be a powerful analytic tool.

### Diagrams

Block diagram and detailed circuit schematics are located on pages in the Diagram and Circuit Board Illustrations section. The schematic diagrams show the component values and assigned circuit reference numbers on each part necessary to the circuit design. The first page of the section defines the circuit symbols and reference designators used. Major circuits are usually identifiable by a series of component numbers. Those portions of the circuits located on circuit boards are enclosed with a dark outline.

### Cam Switch Charts

The Cam switch shown on the schematics is coded on a chart. To locate the cam number of the switch contact in the complete switch assembly, count from the front, or knob end, toward the rear of the switch. The chart indicates with a solid dot when each contact is closed.

### Calibration

To ensure accurate signal generation and measurement, the performance of the TG 501A should be checked periodically. Refer to the Adjustment and Performance Check procedures.

However, period checks of the semi-conductors in the absence of a malfunction are not recommended as preventive maintenance measures. See the semiconductor checking information under Troubleshooting Techniques which follow. A convenient time to perform preventive maintenance is just before instrument adjustment.

## Circuit Board Illustrations

Illustrations showing component locations, keyed with a grid scheme for each circuit board and schematic, allow the component to be located on both the circuit board and schematic by use of a lookup table.

## Component Color Codes

Color strips or dots on electrical components signify electrical values, tolerances, etc., according to EIA standards. Components not color-coded usually have information printed on the body.

## Testing Equipment

Generally, a wide-band oscilloscope, a probe, and a multimeter are all that is needed to perform basic waveform and voltage checks for diagnostic purposes. The procedure adjustment lists specific test equipment and the features necessary.

## TROUBLESHOOTING TECHNIQUES

### Introduction

This troubleshooting procedure is arranged in an order that checks the simple trouble possibilities before proceeding to extensive troubleshooting.

### Control Settings

Incorrect control settings can seem like a trouble that does not actually exist. If there is any question about the correct function or operation of any control, see the Operating Instructions section.

### System and Associated Equipment

Before troubleshooting the TG 501A, check for proper interconnection between the power module and the plug-in. Check the line voltage at the power source. Verify that the signal is properly connected and that the interconnecting cables are not defective.

### Visual Check

Many troubles can be located by visual clues such as unsoldered connections, broken wires, damaged circuit board, damaged components, etc.

## Instrument Adjustment

Check the Adjustment of the suspected circuit if the trouble is obviously in a certain circuit. The trouble may only be a result of misadjustment and may be corrected by readjustment.

## Circuit Isolation

Note the trouble symptoms. These often identify the circuit in which the trouble is located. When trouble symptoms appear in more than one circuit, check the affected circuits by making waveform and voltage measurements.

## Component Checking

Incorrect operation of all circuits often means trouble in the power supplies. Using a multimeter, check first for correct voltages of the individual regulated supplies according to the plug-in schematics and adjustment procedures. Then check the unregulated supplies of the power modules. Defective components elsewhere in the instrument can appear as power supply problems. In these instances, suspected circuits should be disconnected from apparently bad power supplies one at a time to narrow the search.

If a component cannot be disconnected from its circuit, then the effects of the associated circuitry must be considered when evaluating the measurement. Except for soldered-in transistors and integrated circuits, most components can be lifted at one end from the circuit board.

**Transistors and IC's.** Turn the power switch off before removing or replacing any semiconductor.

A good check of transistor operation is actual performance under operating conditions. A transistor can most effectively be checked by substituting a new component for it (or one which has been checked previously). However, be sure that circuit conditions are not such that a replacement transistor might also be damaged. If substitute transistors are not available, use a dynamic tester. Static-type testers are not recommended, since they do not check operation under simulated operating conditions. An approved anti-static suction-type desoldering tool must be used to remove soldered-in transistors; see component replacement procedure for details.

Integrated circuits can be checked with a voltmeter, test oscilloscope, or by direct substitution. A good understanding of the theory of operation is essential to

system have been manufactured by Tektronix, Inc. Order all special parts directly from the local Tektronix Field Office or representative.

**Ordering Procedure.** When ordering replacement parts from Tektronix, Inc., please include the following minimum information:

1. Instrument Type (TG 501A)
  2. Instrument Serial Number (For example, B010251)
  3. A description of the part (if electrical include the circuit number)
  4. Tektronix part number
- Please do not return any instruments or parts before receiving directions from Tektronix, Inc.

A listing of Tektronix Field Offices, Service Centers and Representatives can be found in the Tektronix Product Catalog and Supplements.

### Replacing

The exploded view drawings with the Mechanical Parts List, located to the rear of this manual, may be especially helpful when disassembling or reassembling individual components or sub-assemblies.

**Circuit Boards.** If a circuit board is damaged beyond repair, the entire assembly including all soldered-on components can be replaced. To remove or replace a board, proceed as follows:

1. Disconnect all leads connected to the board (both soldered lead connections and solderless pin connections).

2. Remove all mounting screws holding the board in the instrument. Remove any knobs, etc., that would prevent the board from being lifted out of the instrument.
3. Lift the circuit board out of the unit. Do not force or bend the board.
4. To replace the board, reverse the order of removal. Use care when replacing pin connectors. If forced into place incorrectly positioned, the pin connectors may be damaged.

**Transistors and IC's.** Transistors and IC's should not be replaced unless they are actually defective. If removed from their sockets during routine maintenance, return them to their original sockets. Unnecessarily

troubleshooting circuits using IC's. Operating wave-forms, logic levels, and other operating information for the IC's are given in the theory of operation. Use care when checking voltages and waveforms around the IC's so that adjacent leads are not shorted together. A convenient means of clipping a test probe to the 14- and 16-pin in-line IC's is with an integrated circuit test clip. This device also doubles as an extraction tool.

**Diodes.** Do not use an ohmmeter that has a high internal current. High currents may damage a diode.

A diode may be checked for an open or shorted condition by measuring the resistance. With an ohmmeter scale having an internal source of between 800 mV, and 1.5 V, the resistance should be very high in one direction and very low when the leads are reversed.

**Resistors.** Check the resistors with an ohmmeter. Resistor tolerances are given in the Electrical Parts List in every manual. Resistors do not normally need to be replaced unless the measured value varies widely from the specified value.

**Capacitors.** A leaky or shorted capacitor can be detected by checking resistance with an ohmmeter on the highest scale. Use an ohmmeter that will not exceed the voltage rating of the capacitor. The resistance reading should be high after initial charge of the capacitor. An open capacitor can best be detected with a capacity meter, or by checking whether it passes ac signals.

## PARTS ORDERING AND REPLACING

### Ordering

**Obtaining Replacement Parts.** Most electrical and mechanical parts can be obtained through your local Tektronix field office or representative. However, you should be able to obtain many of the standard components from a local commercial source in your area. Before you purchase or order a part from a source other than Tektronix, Inc., check the electrical parts list for the proper value rating, tolerance and description.

**Special parts.** Some parts are manufactured or selected by Tektronix, Inc., to satisfy particular requirements, or are manufactured for Tektronix, Inc., to our specifications. Most of the mechanical parts used in this

replacement or switching of semiconductor devices may affect the calibration of the instruments. When a transistor is replaced, check the operation of the part of the instrument that may be affected.

Replacement semiconductor should be of the original type or a direct replacement. When removing soldered-in transistors, use an approved anti-static suction-type desoldering tool to remove the solder from the holes in the circuit board.

An extracting tool should be used to remove the 14- and 16-pin integrated circuits to prevent damage to the pins. This tool is available from Tektronix, Inc. Order Tektronix Part No. 003-0619-00. If an extracting tool is not available, use care to avoid damaging the pins. Pull slowly and evenly on both ends of the IC. Avoid having one end of the IC disengage from the socket before the other end.



*Static discharge can damage any semiconductor component in this instrument.*

This instrument contains electrical components that are susceptible to damage from static discharge. See Table 5-1 for relative susceptibility of various classes of semiconductor. Static voltages of 1 kV to 30 kV are common in unprotected environments.

Observe the following precautions to avoid damage:

1. Minimize handling of static-sensitive components.

2. Transport and store static-sensitive components or assemblies in their original containers, on a metal rail, or on conductive foam. Label any packages that contain static-sensitive assemblies or components.

3. Discharge the static voltages from your body by wearing a wrist strap while handling these components. Servicing static-sensitive assemblies or components should be performed only at a static-free workstation by qualified service personnel.

4. Nothing capable of generating or holding a static charge should be allowed on the work station surface.
5. Keep the component leads shorted together whenever possible.

Relative Susceptibility to Static-Discharge Damage

Table 5-1

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

<sup>a</sup> Voltage equivalent for levels:  
 1 = 100 to 500 V  
 2 = 200 to 500 V  
 3 = 250 V  
 4 = 500 V  
 5 = 400 to 600 V  
 6 = 600 to 800 V  
 7 = 400 to 1000 V (est.)  
 8 = 900 V  
 9 = 1200 V

(Voltage discharged from a 100-pF capacitor through a resistance of 100 ohms):

# REAR CONNECTOR PIN ASSIGNMENTS

Table 5-2

	A	B	
** Marker Output	28	28	** Trig Out Common
** Marker Output Common	27	27	** + Trig Out
Buffered Internal Clock Output common	26	26	Not Used
***Buffered Internal Clock Output	25	25	External Clock Input Common
Not Used	24	24	External Clock Input
Not Used	23	23	Not Used
Not Used	22	22	Not Used
Not Used	21	21	Not Used
Not used	20	20	Not Used
Not Used	19	19	Not Used
Not Used	18	18	Not Used
Not Used	17	17	Not Used
Not Used	16	16	Not Used
Not Used	15	15	Not Used
Not Used	14	14	Not Used
25 VAC Winding	13	13	25 VAC Winding
* + 33.5 Filtered DC	12	12	* + 33.5 V Filtered DC
* Base of Series Pass Transistor	11	11	* Collector of Series Pass Transistor
* Base of Series Pass Transistor	10	10	Transformer
* Emitter of Series Pass Transistor	9	9	* 33.5 V Common
* 33.5 V Common	8	8	-33.5 V Filtered DC
-33.5 V Filtered DC	7	7	* Collector of Series Pass Transistor
* Emitter of Series Pass Transistor	6	6	Not Used
* Base of Series Transistor	5	5	17.5 VAC Winding
17.5 VAC Winding	4	4	* + 11.5 V Common
* + 11.5 V Common	3	3	* + 11.5 V Common
* + 11.5 V Common	2	2	* + 11.5 V Filtered DC
25 VAC Winding	1	1	25 VAC Winding

## Rear-view of plug-in

Assignments listed for pins 1A-13A and 1B-13B are available in all power modules; however only those pins marked with an asterisk (\*) are used by the TG 501A.

\*\* Customer configured  
\*\*\* Will drive 5 TTL loads

# OPERATING CONSIDERATIONS

## INTERFACE NOTES

### Marker Output (Customer Configured)

Marker output pulses (5 s to 2 ns) can be supplied to contact 28A (contact 27A is associated ground) by disconnecting the coaxial cable going to the MARKER OUTPUT front-panel connector (the cable, connector pulls out of the back of the BNC connector). It will be necessary to purchase an Electrical Connector Receptacle, Tektronix Part Number 131-1003-00 and solder it to the circuit board pads going to contacts 28A and 27A. Now connect the cable to the newly added connector near the rear of the plug-in which is connected to contact 28A. Coil the excessive cable length so that the coil loop is near the rear of the TG 501A. The output of contact 28A must be terminated into 50 Ω.

The internal reference of the TG 501A is a 5 MHz crystal. Provisions are made for buffered output of the 1 MHz internal clock through interface connector pin 25A with associated ground on pin 26A.

### External Clock Input

A 1 MHz, 5 MHz, or 10 MHz external clock can be substituted for the internal clock. Interface contact 24B is used for the external clock input with the associated ground on contact 25B.

To use an external 1, 5, or 10 MHz clock, the clock jumpers on the Main Circuit Board must be correctly configured, see Fig. 5-1.

### Standard Clock

Reconfigure the clock jumpers on the Main Circuit Board (see Fig. 5-1) before using an external clock.

	W1060	W1061	W3050	W3051	W3052
STANDARD				•	
EXTERNAL 5MHZ			•		
EXTERNAL 1MHZ	•				
EXTERNAL 5MHZ		•			
EXTERNAL 10MHZ			•		
USER CONF					•

NOTE:  
FIVE DUMMY RESISTOR (0 OHM) LOCATIONS ARE ON EACH CIRCUIT BOARD. ONLY TWO ARE USED PER BOARD ACCORDING TO THE FOLLOWING CHART

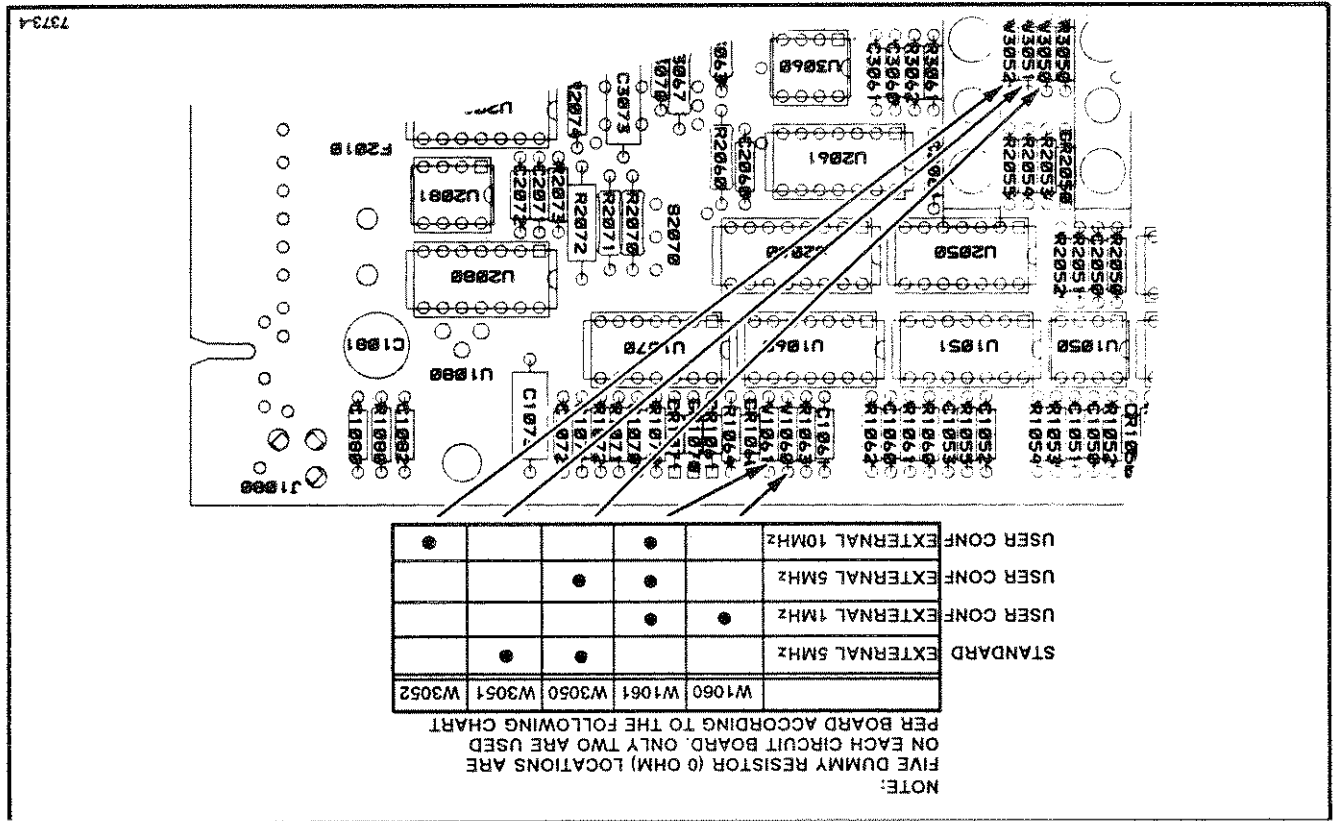


Fig. 5-1. Location of jumpers for clock.



**+ Trig Out (Customer Configured)**

Trigger output pulses can be supplied to contact 27B by disconnecting the coaxial cable going from the circuit board to the + TRIG OUT front-panel connector. Connect another 50 Ω coaxial cable (having characteristics similar to RG174U) from the circuit board trigger output and shield solder pads (from which coaxial cable was just removed) to contacts 27B (center conductor) and 28B (shield). The output of contact 27B must be terminated into 50 Ω.

**NOTE**

*The output signal may not meet specifications due to variables introduced by using the rear interface.*

**Buffered Internal Clock Output**

Interface contact 25A supplies the internal 1 MHz clock pulses of the TG 501A for external use. This output will drive 5 TTL loads (8 mA).





There are no options available for the TG 501A at this time.

# OPTIONS



# Replaceable Electrical Parts

Only the circuit number will appear on the diagrams and circuit board illustrations. Each diagram and circuit board illustration is clearly marked with the assembly exploded views located in the Mechanical Parts List. The component number is obtained by adding the assembly number prefix to the circuit number.

The Electrical Parts List is divided and arranged by assemblies in numerical sequence (e.g., assembly A1 with its subassemblies and parts, precedes assembly A2 with its subassemblies and parts).

Chassis-mounted parts have no assembly number prefix and are located at the end of the Electrical Parts List.

## TEKTRONIX PART NO. (column two of the Electrical Parts List)

Indicates part number to be used when ordering replacement part from Tektronix.

## SERIAL/MODEL NO. (columns three and four of the Electrical Parts List)

Column three (3) indicates the serial number at which the part was first used. Column four (4) indicates the serial number at which the part was removed. No serial number entered indicates part is good for all serial numbers.

## NAME & DESCRIPTION (column five of the Electrical Parts List)

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

## MFR. CODE (column six of the Electrical Parts List)

Indicates the code number of the actual manufacturer of the part. (Code to name and address cross reference can be found immediately after this page.)

## MFR. PART NUMBER (column seven of the Electrical Parts List)

Indicates actual manufacturer's part number.

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

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

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

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

## LIST OF ASSEMBLIES

A list of assemblies can be found at the beginning of the Electrical Parts List. The assemblies are listed in numerical order. When the complete component number of a part is known, this list will identify the assembly in which the part is located.

## CROSS INDEX-MFR. CODE NUMBER TO MANUFACTURER

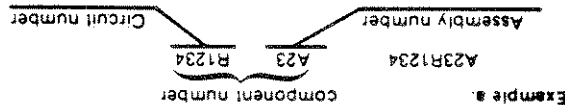
The Mfr. Code Number to Manufacturer index for the Electrical Parts List is located immediately after this page. The Cross Index provides codes, names and addresses of manufacturers of components listed in the Electrical Parts List.

## ABBREVIATIONS

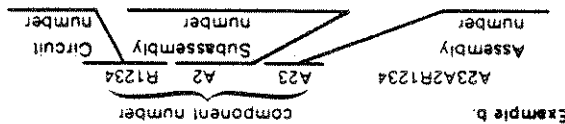
Abbreviations conform to American National Standard Y1.1.

## COMPONENT NUMBER (column one of the Electrical Parts List)

A numbering method has been used to identify assemblies, subassemblies and parts. Examples of this numbering method and typical expansions are illustrated by the following.



Read: Resistor 1234 of Assembly 23



Read: Resistor 1234 of Subassembly 2 of Assembly 23

CROSS INDEX - MFR CODE NUMBER TO MANUFACTURER

Mfr Code	Manufacturer	Address	City, State, Zip Code
00779	AMP INC	2800 FULLING MILL	HARRISBURG PA 17105
01121	ALLEN-BRADLEY CO	1201 S 2ND ST	MILWAUKEE WI 53204-2410
01295	TEXAS INSTRUMENTS INC	13500 N CENTRAL EXPY	DALLAS TX 75265
04222	AVX CERAMICS	197H AVE SOUTH	MYRTLE BEACH SC 29577
04713	MOTOROLA INC	P O BOX 867	
08261	SPECTRA-STRIP	5005 E MCDOWELL RD	PHOENIX AZ 85008-4229
09982	HARRISON ELECTRIC CO LTD	7100 LAMPSON AVE	GARDEN GROVE CA 92642
09403	ZMAN AND ASSOCIATES	ASAHIMACHI 5-CHOME IMABARI	EHIME JAPAN
12617	HAMLIN INC	7633 S 180th	KENT WA 98032
12697	CLAROSTAT MFG CO INC	612 EAST LAKE STREET	LAKE MILLS WI 53551
18324	SIGNETICS CORP	4130 S MARKET COURT	DOVER NH 03820
19701	PHILLIPS COMPONENTS DISCRETE PRODUCTS	PO BOX 760	SACRAMENTO CA 95834-1222
1M344	UNITED CHEMI-CON INC	9801 W HIGGINS	MINERAL WELLS TX 76067-0760
22526	DU PONT E I DE NEMOURS AND CO INC	515 FISHING CREEK RD	ROSEMONT IL 60018-4704
24546	CORNING GLASS WORKS	550 HIGH ST	BRADFORD PA 16701-3737
27014	NATIONAL SEMICONDUCTOR CORP	2900 SEMICONDUCTOR DR	SANTA CLARA CA 95051-0606
28480	HEWLETT-PACKARD CO	3000 HANOVER ST	PALO ALTO CA 94304-1112
31433	KEMET ELECTRONICS CORP	PO BOX 5928	GREENVILLE SC 29606
32997	BOURNS INC	1200 COLUMBIA AVE	RIVERSIDE CA 92507-2114
34371	HARRIS CORP	200 PALM BAY BLVD	MELBOURNE FL 32919
50088	SGS-THOMSON MICROELECTRONICS INC	HARRIS SEMICONDUCTOR PRODUCTS GROUP	CARROLLTON TX 75006-6906
50434	HEWLETT-PACKARD CO	1310 ELECTRONICS DR	SAN JOSE CA 95131
52763	STETCO INC	370 W TRIMBLE RD	FRANKLIN PARK IL 60131
55680	NICHICON /AMERICA/ CORP	3344 SCHEERHORN	SCHAUMBURG IL 60195-4526
57668	ROHM CORP	927 E STATE PKY	IRVINE CA 92713
61857	SAN-O INDUSTRIAL CORP	8 WHATNEY	BOHEMIA LONG ISLAND NY 11716-2501
71400	BUSSMANN	114 OLD STATE RD	ST LOUIS MO 63178
71950	CRL COMPONENTS INC	PO BOX 14460	FORT DODGE IA 50501
74970	JOHNSON E F CO	HWY 20 W	MASECA MN 56093-2539
75378	CTS KNIGHTS INC	299 10TH AVE S W	SANDWICH IL 60548-1846
75498	MULTICOMP INC	400 REIMANN AVE	BEAVERTON OR 97006
80009	TEKTRONIX INC	3005 SW 154TH TERRACE #3	BEAVERTON OR 97077-0001
91637	DALE ELECTRONICS INC	14150 SW KARL BRAUN DR	COLUMBUS NE 68601-3632
96733	SFE TECHNOLOGIES	2064 12TH AVE	SAN FERNANDO CA 91340-2707
		1501 FIRST ST	

Component No.	Tektronix Part Number	Serial Number	Effect	Part Name & Description	Mfr Code	Mfr Part Number
A1	671-0289-00			CIRCUIT BD ASSY:MAIN	80009	671-0289-00
A2	671-1486-00			CIRCUIT BD ASSY:MULTIPLIER	80009	671-1486-00
A3	671-1485-00			CIRCUIT BD ASSY:DISPLAY	80009	671-1485-00
A1010	281-0775-00			CAP,FXD,CER D1:0.1UF,20%,50V	04222	S A105E104M A
A1C1011	281-0862-00			CAP,FXD,CER D1:0.001UF,+80-20%,100VTUBULAR	04222	S A101C102M A
A1C1012	281-0775-00			CAP,FXD,CER D1:0.1UF,20%,50V	04222	S A105E104M A
A1C1013	281-0775-00			CAP,FXD,CER D1:0.1UF,20%,50V	04222	S A105E104M A
A1C1020	281-0775-00			CAP,FXD,CER D1:0.1UF,20%,50V	04222	S A105E104M A
A1C1021	281-0775-00			CAP,FXD,CER D1:0.1UF,20%,50V	04222	S A105E104M A
A1C1022	281-0775-00			CAP,FXD,CER D1:0.1UF,20%,50V	04222	S A105E104M A
A1C1023	281-0862-00			CAP,FXD,CER D1:0.001UF,+80-20%,100VTUBULAR	04222	S A101C102M A
A1C1030	281-0775-00			CAP,FXD,CER D1:0.1UF,20%,50V	04222	S A105E104M A
A1C1031	281-0775-00			CAP,FXD,CER D1:0.1UF,20%,50V	04222	S A105E104M A
A1C1040	281-0773-00			CAP,FXD,CER D1:0.01UF,10%,100V	04222	S A201C103K A
A1C1041	281-0775-00			CAP,FXD,CER D1:0.1UF,20%,50V	04222	S A105E104M A
A1C1042	281-0862-00			CAP,FXD,CER D1:0.001UF,+80-20%,100VTUBULAR	04222	S A101C102M A
A1C1043	281-0773-00			CAP,FXD,CER D1:0.01UF,10%,100V	04222	S A201C103K A
A1C1044	281-0893-00			CAP,FXD,CER D1:4.7PF,+/-0.5PF,100VTUBULAR	04222	S A102A4R7D A
A1C1050	281-0775-00			CAP,FXD,CER D1:0.1UF,20%,50V	04222	S A105E104M A
A1C1051	281-0925-00			CAP,FXD,CER D1:0.22UF,20%,50V,AXIAL	96733	TW5138Z224MT
A1C1052	281-0775-00			CAP,FXD,CER D1:0.1UF,20%,50V	04222	S A105E104M A
A1C1053	281-0862-00			CAP,FXD,CER D1:0.001UF,+80-20%,100VTUBULAR	04222	S A101C102M A
A1C1060	281-0775-00			CAP,FXD,CER D1:0.1UF,20%,50V	04222	S A105E104M A
A1C1061	281-0775-00			CAP,FXD,CER D1:0.1UF,20%,50V	04222	S A105E104M A
A1C1070	281-0775-00			CAP,FXD,CER D1:0.1UF,20%,50V	04222	S A105E104M A
A1C1071	281-0820-00			CAP,FXD,CER D1:680 PF,10%,50V	04222	S A101C681K A
A1C1072	281-0773-00			CAP,FXD,CER D1:0.01UF,10%,100V	04222	S A201C103K A
A1C1080	281-0862-00			CAP,FXD,CER D1:0.001UF,+80-20%,100VTUBULAR	04222	S A101C102M A
A1C1081	290-0973-00			CAP,FXD,ELECTLT:100UF,20%,25VDC	1W344	SM25VB10RMBX11LL
A1C2010	281-0775-00			CAP,FXD,CER D1:0.1UF,20%,50V	04222	S A105E104M A
A1C2020	281-0775-00			CAP,FXD,CER D1:0.1UF,20%,50V	04222	S A105E104M A
A1C2030	281-0775-00			CAP,FXD,CER D1:0.1UF,20%,50V	04222	S A105E104M A
A1C2031	281-0775-00			CAP,FXD,CER D1:0.1UF,20%,50V	04222	S A105E104M A
A1C2040	281-0775-00			CAP,FXD,CER D1:0.1UF,20%,50V	04222	S A105E104M A
A1C2050	281-0862-00			CAP,FXD,CER D1:0.001UF,+80-20%,100VTUBULAR	04222	S A101C102M A
A1C2060	281-0773-00			CAP,FXD,CER D1:0.01UF,10%,100V	04222	S A201C103K A
A1C2061	281-0862-00			CAP,FXD,CER D1:0.001UF,+80-20%,100VTUBULAR	04222	S A101C102M A
A1C2071	281-0773-00			CAP,FXD,CER D1:0.01UF,10%,100V	04222	S A201C103K A
A1C2072	281-0773-00			CAP,FXD,CER D1:0.01UF,10%,100V	04222	S A201C103K A
A1C2073	281-0563-00			CAP,FXD,CER D1:0.47UF,20%,50V	04222	S A305E474M A
A1C2075	281-0820-00			CAP,FXD,CER D1:680 PF,10%,50V	04222	S A101C681K A
A1C2010	281-0759-00			CAP,FXD,CER D1:22PF,10%,100V	04222	S A101A220K A
A1C2020	281-0862-00			CAP,FXD,CER D1:0.001UF,+80-20%,100VTUBULAR	04222	S A101C102M A
A1C2021	281-0775-00			CAP,FXD,CER D1:0.1UF,20%,50V	04222	S A105E104M A
A1C2030	281-0862-00			CAP,FXD,CER D1:0.001UF,+80-20%,100VTUBULAR	04222	S A101C102M A
A1C2031	281-0811-00			CAP,FXD,CER D1:10PF,10%,100V	04222	S A102A100K A
A1C2032	281-0813-00			CAP,FXD,CER D1:10PF,10%,100V	04222	S A102A100K A
A1C2033	281-0862-00			CAP,FXD,CER D1:0.001UF,+80-20%,100VTUBULAR	04222	S A101C102M A
A1C2050	281-0775-00			CAP,FXD,CER D1:0.1UF,20%,50V	04222	S A105E104M A
A1C2060	281-0773-00			CAP,FXD,CER D1:0.01UF,10%,100V	04222	S A201C103K A
A1C2061	281-0773-00			CAP,FXD,CER D1:0.01UF,10%,100V	04222	S A201C103K A
A1C3061	281-0851-00			CAP,FXD,CER D1:180PF,5%,100VDC	04222	S A101A181J A

Component No.	Tektronix Part Number	Effect Serial Number	Part Name & Description	Mfr Code	Mfr Part Number
A1C3070	281-0775-00		CAP,FXD,CER D1:0.1UF,20%,50V	04222	S105E104MA
A1C3071	290-0973-00		CAP,FXD,ELECTL:100UF,20%,25VDC	1W344	S25VB10M8X1LL
A1C3072	281-0862-00		CAP,FXD,CER D1:0.001UF,+80-20%,100VTTBULAR	04222	S101C102MA
A1C4010	281-0775-00		CAP,FXD,CER D1:0.1UF,20%,50V	04222	S105E104MA
A1C4011	281-0862-00		CAP,FXD,CER D1:0.001UF,+80-20%,100VTTBULAR	04222	S101C102MA
A1C4012	281-0777-00		CAP,FXD,CER D1:51PF,5%,100V	04222	S101A510MA
A1C4013	281-0775-00		CAP,FXD,CER D1:0.1UF,20%,50V	04222	S105E104MA
A1C4021	281-0775-00		CAP,FXD,CER D1:0.1UF,20%,50V	04222	S105E104MA
A1C4022	290-0973-00		CAP,FXD,ELECTL:100UF,20%,25VDC	1W344	S25VB10M8X1LL
A1C4023	281-0773-00		CAP,FXD,CER D1:0.01UF,10%,100V	04222	S201C103KAA
A1C4024	281-0775-00		CAP,FXD,CER D1:0.1UF,20%,50V	04222	S105E104MA
A1C4030	281-0862-00		CAP,FXD,CER D1:0.001UF,+80-20%,100VTTBULAR	04222	S101C102MA
A1C4031	281-0775-00		CAP,FXD,CER D1:0.1UF,20%,50V	04222	S105E104MA
A1C4032	281-0773-00		CAP,FXD,CER D1:0.01UF,10%,100V	04222	S201C103KAA
A1C4040	281-0775-00		CAP,FXD,CER D1:0.1UF,20%,50V	04222	S105E104MA
A1C4041	281-0775-00		CAP,FXD,CER D1:0.1UF,20%,50V	04222	S105E104MA
A1C4042	283-0059-00		CAP,FXD,CER D1:1UF,+80-20%,50V	04222	S105E105MA
A1C4043	281-0773-00		CAP,FXD,CER D1:0.01UF,10%,100V	04222	S201C103KAA
A1C4050	290-0974-00		CAP,FXD,ELECTL:10UF,20%,50VDC	55680	UVX1H100MA
A1C4051	281-0775-00		CAP,FXD,CER D1:0.1UF,20%,50V	04222	S105E104MA
A1C4052	281-0773-00		CAP,FXD,CER D1:0.01UF,10%,100V	04222	S201C103KAA
A1C4053	290-0973-00		CAP,FXD,ELECTL:100UF,20%,25VDC	1W344	S25VB10M8X1LL
A1C4070	281-0773-00		CAP,FXD,CER D1:0.01UF,10%,100V	04222	S201C103KAA
A1C1060	152-0581-00		D10DE,RECT,SCHTRY,;20V,1A,.450VF,25A,1FSM	04713	1N5817
A1C1061	152-0141-02		D10DE,SIG,;ULTRA FAST:40V,150MA,4NS,2PF	27014	FDH9427
A1C1070	152-0141-02		D10DE,SIG,;ULTRA FAST:40V,150MA,4NS,2PF	27014	FDH9427
A1C1071	152-0141-02		D10DE,SIG,;ULTRA FAST:40V,150MA,4NS,2PF	27014	FDH9427
A1C1076	152-0141-02		D10DE,SIG,;ULTRA FAST:40V,150MA,4NS,2PF	27014	FDH9427
A1C1021	152-0141-02		D10DE,SIG,;ULTRA FAST:40V,150MA,4NS,2PF	27014	FDH9427
A1C1022	152-0141-02		D10DE,SIG,;ULTRA FAST:40V,150MA,4NS,2PF	27014	FDH9427
A1C1030	152-0141-02		D10DE,SIG,;ULTRA FAST:40V,150MA,4NS,2PF	27014	FDH9427
A1C1031	152-0141-02		D10DE,SIG,;ULTRA FAST:40V,150MA,4NS,2PF	27014	FDH9427
A1C1032	152-0141-02		D10DE,SIG,;ULTRA FAST:40V,150MA,4NS,2PF	27014	FDH9427
A1C1020	152-0951-00		D10DE,SIG,SCHTRY,;50V,2.25PF;1N6263,DO-35	50088	1N6263
A1C1021	152-0141-02		D10DE,SIG,;ULTRA FAST:40V,150MA,4NS,2PF	27014	FDH9427
A1C1033	152-0141-02		D10DE,SIG,;ULTRA FAST:40V,150MA,4NS,2PF	27014	FDH9427
A1C1034	152-0141-02		D10DE,SIG,;ULTRA FAST:40V,150MA,4NS,2PF	27014	FDH9427
A1C1035	152-0141-02		D10DE,SIG,;ULTRA FAST:40V,150MA,4NS,2PF	27014	FDH9427
A1C1041	152-0141-02		D10DE,SIG,;ULTRA FAST:40V,150MA,4NS,2PF	27014	FDH9427
A1C1042	152-0141-02		D10DE,SIG,;ULTRA FAST:40V,150MA,4NS,2PF	27014	FDH9427
A1C1044	152-0141-02		D10DE,SIG,;ULTRA FAST:40V,150MA,4NS,2PF	27014	FDH9427
A1C1050	152-0141-02		D10DE,SIG,;ULTRA FAST:40V,150MA,4NS,2PF	27014	FDH9427
A1C1051	152-0141-02		D10DE,SIG,;ULTRA FAST:40V,150MA,4NS,2PF	27014	FDH9427
A1F2080	159-0028-00		FUSE,CARTRIDGE:0.25A,250V,FAST BLOW	61857	SS2-0.25
A1F4080	159-0160-00		FUSE,CARTRIDGE:3AG,1.5 A,250 V,18 SEC	71400	MDL-1 1/2
A1J1040	131-0589-00		TERMINAL,PIN,PRESSFIT/PCB,;MALE,STR,0.025	22526	48283-029
A1J2010	136-0630-00		CONN,BOX,;PCB,;FEMALE,RTANG,1 X 4,0,0.1 CTR	00779	1-380949-4
A1J2011	136-0548-00		CONN,BOX,;PCB,;FEMALE,RTANG,1 X 10,0,1 CTR	00779	2-380949-0
A1J3010	131-1003-00		CONN,RF JACK:PCB,PELTOLA;FEMALE,STR,0.141	80009	131-1003-00
A1J3011	131-1003-00		CONN,RF JACK:PCB,PELTOLA;FEMALE,STR,0.141	80009	131-1003-00



Component No.	Tektronix Part Number	Serial Number	Effect	Discont	Part Name & Description	Code	Mtr Part Number
A1J040	131-2919-00				CONN,HDR:PCB,MALE,RTANG,1 X 4,0.1 CTR	0079	87232-4
A1J040	131-1003-00				CONN,RF JACK:PCB,PELLTOLA:FEMALE,STR,0.141	9009	131-1003-00
A1P1040	131-0993-00				BUS,CONDUCTOR:SHUNT/SHORTING,;FEMALE,STR,1	22526	65474-006
A101030	151-0188-00				TRANSISTOR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ	04713	2N3906
A103010	151-0271-00				TRANSISTOR,SIG:BIPOLAR,PNP;15V,30MA,2.0GHZ	04713	MP5H69
A103010	151-0271-00				TRANSISTOR,SIG:BIPOLAR,PNP;15V,30MA,2.0GHZ	04713	MP5H69
A103040	151-0424-00				TRANSISTOR:PNP,SI,10-92	04713	MP52369A
A104010	151-0221-00				TRANSISTOR,SIG:BIPOLAR,PNP;12V,80MA	04713	MP54258(EL8345)
A104011	151-0221-00				TRANSISTOR,SIG:BIPOLAR,PNP;12V,80MA	04713	MP54258(EL8345)
A104012	151-0325-00				TRANSISTOR,SIG:BIPOLAR,PNP;15V,50MA	04713	MP55771
A104013	151-0424-00				TRANSISTOR:PNP,SI,10-92	04713	MP52369A
A104021	151-0221-00				TRANSISTOR,SIG:BIPOLAR,PNP;12V,80MA	04713	MP54258(EL8345)
A104021	151-0271-00				TRANSISTOR,SIG:BIPOLAR,PNP;15V,30MA,2.0GHZ	04713	MP5H69
A104070	151-0521-00				SCR,SI,MU-27	04713	C12281
A1R1010	315-0391-00				RES,FXD,FILM:390 OHM,5%,0.25W	57668	NTR25J-E390E
A1R1011	315-0510-00				RES,FXD,FILM:51 OHM,5%,0.25W	19701	5043CX51R00J
A1R1012	315-0102-00				RES,FXD,FILM:1K OHM,5%,0.25W	19701	5043CX51E01K0
A1R1013	315-0332-00				RES,FXD,FILM:3.3K OHM,5%,0.25W	57668	NTR25J-E03K3
A1R1014	315-0751-00				RES,FXD,FILM:750 OHM,5%,0.25W	57668	NTR25J-E750E
A1R1015	315-0273-00				RES,FXD,FILM:27K OHM,5%,0.25W	57668	NTR25J-E27K0
A1R1016	315-0273-00				RES,FXD,FILM:27K OHM,5%,0.25W	57668	NTR25J-E27K0
A1R1017	315-0751-00				RES,FXD,FILM:750 OHM,5%,0.25W	57668	NTR25J-E750E
A1R1020	315-0103-00				RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
A1R1021	315-0103-00				RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
A1R1022	315-0131-00				RES,FXD,FILM:130 OHM,5%,0.25W	19701	5043CX130R0J
A1R1030	315-0150-00				RES,FXD,FILM:15 OHM,5%,0.25W	19701	5043CX15R00J
A1R1031	315-0101-00				RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A1R1032	315-0241-00				RES,FXD,FILM:240 OHM,5%,0.25W	19701	5043CX240R0J
A1R1040	315-0241-00				RES,FXD,FILM:240 OHM,5%,0.25W	19701	5043CX240R0J
A1R1041	315-0241-00				RES,FXD,FILM:240 OHM,5%,0.25W	19701	5043CX240R0J
A1R1042	315-0241-00				RES,FXD,FILM:240 OHM,5%,0.25W	19701	5043CX240R0J
A1R1043	315-0241-00				RES,FXD,FILM:240 OHM,5%,0.25W	19701	5043CX240R0J
A1R1044	315-0222-00				RES,FXD,FILM:2.2K OHM,5%,0.25W	57668	NTR25J-E02K2
A1R1050	315-0391-00				RES,FXD,FILM:390 OHM,5%,0.25W	57668	NTR25J-E390E
A1R1051	315-0121-00				RES,FXD,FILM:120 OHM,5%,0.25W	19701	5043CX120R0J
A1R1052	315-0121-00				RES,FXD,FILM:120 OHM,5%,0.25W	19701	5043CX120R0J
A1R1053	315-0242-00				RES,FXD,FILM:2.4K OHM,5%,0.25W	57668	NTR25J-E02K4
A1R1054	315-0274-00				RES,FXD,FILM:270K OHM,5%,0.25W	57668	NTR25J-E270K
A1R1055	315-0103-00				RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
A1R1060	315-0103-00				RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
A1R1061	315-0751-00				RES,FXD,FILM:750 OHM,5%,0.25W	57668	NTR25J-E750E
A1R1062	315-0472-00				RES,FXD,FILM:4.7K OHM,5%,0.25W	57668	NTR25J-E04K7
A1R1063	315-0274-00				RES,FXD,FILM:270K OHM,5%,0.25W	57668	NTR25J-E270K
A1R1064	315-0202-00				RES,FXD,FILM:2K OHM,5%,0.25W	57668	NTR25J-E 2K
A1R1070	315-0242-00				RES,FXD,FILM:2.4K OHM,5%,0.25W	57668	NTR25J-E02K4
A1R1071	315-0510-00				RES,FXD,FILM:51 OHM,5%,0.25W	19701	5043CX51R00J
A1R1072	315-0510-00				RES,FXD,FILM:51 OHM,5%,0.25W	19701	5043CX51R00J
A1R1080	315-0750-00				RES,FXD,FILM:75 OHM,5%,0.25W	57668	NTR25J-E750E
A1R2030	315-0561-00				RES,FXD,FILM:560 OHM,5%,0.25W	19701	5043CX560R0J
A1R2031	315-0561-00				RES,FXD,FILM:560 OHM,5%,0.25W	19701	5043CX560R0J
A1R2032	315-0561-00				RES,FXD,FILM:560 OHM,5%,0.25W	19701	5043CX560R0J
A1R2033	315-0241-00				RES,FXD,FILM:240 OHM,5%,0.25W	19701	5043CX240R0J
A1R2034	315-0750-00				RES,FXD,FILM:75 OHM,5%,0.25W	57668	NTR25J-E750E
A1R2040	315-0750-00				RES,FXD,FILM:75 OHM,5%,0.25W	57668	NTR25J-E750E

Component No.	Tektronix Part Number	Serial Number	Effect	Part Name & Description	Mfr Code	Mfr Part Number
AIR2041	315-0241-00			RES,FXD,FILM:240 OHM,5%,0.25W	19701	5043CX240ROU
AIR2050	315-0241-00			RES,FXD,FILM:240 OHM,5%,0.25W	19701	5043CX240ROU
AIR2051	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10KOU
AIR2052	315-0153-00			RES,FXD,FILM:15K OHM,5%,0.25W	19701	5043CX15KOU
AIR2053	315-0472-00			RES,FXD,FILM:4.7K OHM,5%,0.25W	57668	NTR25J-E04K7
AIR2054	315-0472-00			RES,FXD,FILM:4.7K OHM,5%,0.25W	57668	NTR25J-E04K7
AIR2055	315-0472-00			RES,FXD,FILM:4.7K OHM,5%,0.25W	57668	NTR25J-E04K7
AIR2060	321-0168-00			RES,FXD,FILM:549 OHM,1%,0.125W,TC=T0	91637	CMF551166549ROF
AIR2070	321-0932-03			RES,FXD,FILM:2.5K OHM,0.25%,0.125W,TC=T2	19701	5033RC2K500C
AIR2071	321-0631-03			RES,FXD,FILM:12.5K OHM,0.25%,0.125W,TC=T2	19701	5033RC12K500C
AIR2072	307-0052-00			RES,FXD,CMPNS:3 OHM,5%,0.5W	01121	EB3065
AIR2073	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JDE10K0
AIR2074	311-2351-00			RES,VAR,NONMM:PNL,100 OHM,0.25W	12697	CM45237
AIR3010	301-0221-00			RES,FXD,FILM:220 OHM,5%,0.5W	19701	5053CX220ROU
AIR3011	315-0270-00			RES,FXD,FILM:27 OHM,5%,0.25W	19701	5043CX27ROU
AIR3012	315-0111-00			RES,FXD,FILM:110 OHM,5%,0.25W	57668	NTR25J-E110E
AIR3013	315-0182-00			RES,FXD,FILM:1.8K OHM,5%,0.25W	57668	NTR25J-E1K8
AIR3014	315-0271-00			RES,FXD,FILM:270 OHM,5%,0.25W	57668	NTR25J-E270E
AIR3015	315-0512-00			RES,FXD,FILM:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
AIR3016	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
AIR3017	315-0271-00			RES,FXD,FILM:270 OHM,5%,0.25W	57668	NTR25J-E270E
AIR3018	315-0221-00			RES,FXD,FILM:220 OHM,5%,0.25W	57668	NTR25J-E220E
AIR3020	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
AIR3021	315-0151-00			RES,FXD,FILM:150 OHM,5%,0.25W	57668	NTR25J-E150E
AIR3022	315-0471-00			RES,FXD,FILM:470 OHM,5%,0.25W	57668	NTR25J-E470E
AIR3023	315-0561-00			RES,FXD,FILM:560 OHM,5%,0.25W	19701	5043CX560ROU
AIR3024	315-0561-00			RES,FXD,FILM:560 OHM,5%,0.25W	19701	5043CX560ROU
AIR3025	315-0180-00			RES,FXD,FILM:18 OHM,5%,0.25W	19701	5043CX18ROU
AIR3026	315-0180-00			RES,FXD,FILM:18 OHM,5%,0.25W	19701	5043CX18ROU
AIR3030	315-0822-00			RES,FXD,FILM:8.2K OHM,5%,0.25W	19701	5043CX8K200J
AIR3031	315-0751-00			RES,FXD,FILM:750 OHM,5%,0.25W	57668	NTR25J-E750E
AIR3032	315-0751-00			RES,FXD,FILM:750 OHM,5%,0.25W	57668	NTR25J-E750E
AIR3033	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
AIR3034	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
AIR3035	313-1103-00			RES,FXD,FILM:10K OHM,5%,0.2W	91637	CCF50-2-10001J
AIR3040	315-0153-00			RES,FXD,FILM:15K OHM,5%,0.25W	19701	5043CX15KOU
AIR3041	315-0512-00			RES,FXD,FILM:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
AIR3050	315-0472-00			RES,FXD,FILM:4.7K OHM,5%,0.25W	57668	NTR25J-E04K7
AIR3062	315-0511-00			RES,FXD,FILM:510 OHM,5%,0.25W	19701	5043CX510ROU
AIR3069	321-0225-00			RES,FXD,FILM:2.15K OHM,1%,0.125W	91637	CMF5511664900F
AIR3067	321-0271-00			RES,FXD,FILM:6.49K OHM,1%,0.125W,TC=T0M1	91637	CMF5511664900F
AIR3069	321-0225-00			RES,FXD,FILM:2.15K OHM,1%,0.125W	91637	CMF55116621500F
AIR3070	308-0679-00			RES,FXD,MM:0.51 OHM,5%,2M	91637	CPF-2-0R51J11
AIR3071	321-0233-00			RES,FXD,FILM:2.61K OHM,1%,0.125W,TC=T0M1	91637	CMF55116626100F
AIR3072	321-0225-00			RES,FXD,FILM:2.15K OHM,1%,0.125W	91637	CMF55116621500F
AIR3073	311-1141-00			RES,VAR,NONMM:TRMR,2.5K OHM,0.5W	32997	3386M-1-252
AIR3074	311-1141-00			RES,VAR,NONMM:TRMR,2.5K OHM,0.5W	32997	3386M-1-252
AIR3080	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JDE10K0
AIR3081	315-0750-00			RES,FXD,FILM:75 OHM,5%,0.25W	57668	NTR25J-E75E0
AIR3082	321-0230-00			RES,FXD,FILM:2.43K OHM,1%,0.125W,TC=T0M1	91637	CMF55116624300F
AIR4010	315-0200-00			RES,FXD,FILM:20 OHM,5%,0.25W	19701	5043CX20ROU
AIR4012	315-0471-00			RES,FXD,FILM:470 OHM,5%,0.25W	57668	NTR25J-E470E
AIR4013	315-0302-00			RES,FXD,FILM:3K OHM,5%,0.25W	57668	NTR25J-E03K0
AIR4014	315-0122-00			RES,FXD,FILM:1.2K OHM,5%,0.25W	57668	NTR25J-E01K2

Component No.	Tektronix Part Number	Effect Serial Number	Part Name & Description	Mtr Code	Mtr Part Number
A1R4015	315-0751-00		RES,FXD,FILM:750 OHM,5%,0.25W	57668	NTR25J-E750E
A1R4016	315-0152-00		RES,FXD,FILM:1.5K OHM,5%,0.25W	57668	NTR25J-E01K5
A1R4017	315-0681-00		RES,FXD,FILM:680 OHM,5%,0.25W	57668	NTR25J-E680E
A1R4018	315-0202-00		RES,FXD,FILM:2K OHM,5%,0.25W	57668	NTR25J-E 2K
A1R4019	315-0202-00		RES,FXD,FILM:2K OHM,5%,0.25W	57668	NTR25J-E 2K
A1R4020	315-0102-00		RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25J-E01K0
A1R4021	315-0102-00		RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25J-E01K0
A1R4022	317-0056-00		RES,FXD,COMP5M:5.6 OHM,5%,0.125W	01121	BB5655
A1R4023	315-0101-00		RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A1R4024	315-0101-00		RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A1R4025	315-0131-00		RES,FXD,FILM:130 OHM,5%,0.25W	19701	5043CX130R0J
A1R4030	315-0111-00		RES,FXD,FILM:110 OHM,5%,0.25W	57668	NTR25J-E110E
A1R4031	315-0751-00		RES,FXD,FILM:750 OHM,5%,0.25W	57668	NTR25J-E750E
A1R4032	315-0751-00		RES,FXD,FILM:750 OHM,5%,0.25W	57668	NTR25J-E750E
A1R4040	315-0751-00		RES,FXD,FILM:750 OHM,5%,0.25W	57668	NTR25J-E750E
A1R4041	315-0751-00		RES,FXD,FILM:750 OHM,5%,0.25W	57668	NTR25J-E750E
A1R4050	315-0751-00		RES,FXD,FILM:750 OHM,5%,0.25W	57668	NTR25J-E750E
A1R4051	315-0751-00		RES,FXD,FILM:750 OHM,5%,0.25W	57668	NTR25J-E750E
A1R4052	313-1102-00		RES,FXD,FILM:1K OHM,5%,0.2W	91637	CCF50-2-10000J
A1R4053	313-1102-00		RES,FXD,FILM:1K OHM,5%,0.2W	91637	CCF50-2-10000J
A1R4080	315-0100-00		RES,FXD,FILM:10 OHM,5%,0.25W	19701	5043CX10R00J
A1R4081	315-0101-00		RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A1R13064	307-0751-00		RES,THERMAL:20K OHM,5%	91637	C1-298
A1S2040	263-1049-00		SM CAM ACTR AS:TIMING	80009	263-1049-00
A1S2074	311-2351-00		RES,VAR,NONMM:PNL,100 OHM,0.25W (COMBINE WITH R2074)	12697	CM45237
A1U1010	156-0387-00		IC,DIGITAL:LS TTL,FLIP FLOP:DUAL J-K, PRESET	01295	SN74LS73AM
A1U1020	156-0067-00		IC,LINEAR:BI POLAR,OP-AMP	04713	MC1741CP1
A1U1030	156-0383-00		IC,DIGITAL:LS TTL,GATES:QUAD 2-INPUT NOR	01295	SN74LS02N
A1U1040	156-0642-00		IC,DIGITAL:ECL,COUNTER:BI-QUINARY:10138	04713	MC10138P
A1U1041	156-0224-01		MICROCKT,DGTL:TTL,VOLTAGE CONT MULTIVIBRATOR	04713	MC1658LD
A1U1050	156-0067-00		IC,LINEAR:BI POLAR,OP-AMP	04713	MC1741CP1
A1U1051	156-0382-00		IC,DIGITAL:LS TTL,GATE:QUAD 2-INPUT NAND	01295	SN74ALS00N
A1U1060	156-0721-00		IC,DIGITAL:LS TTL,GATES:QUAD 2-INPUT NAND	01295	SN74ALS132N
A1U1070	156-0388-00		IC,DIGITAL:LS TTL,FLIP FLOP:DUAL D W/SET &	01295	SN74ALS74AN
A1U2010	156-0466-00		IC,DIGITAL:LS TTL,GATES:QUAD 2-INPUT NAND	01295	SN74ALS27N
A1U2011	156-0910-00		IC,DIGITAL:LS TTL,COUNTER:DUAL 4-BIT DECADE	01295	SN74ALS90N
A1U2012	156-0910-00		IC,DIGITAL:LS TTL,COUNTER:DUAL 4-BIT DECADE	01295	SN74ALS90N
A1U2020	156-0388-00		IC,DIGITAL:LS TTL,FLIP FLOP:DUAL D W/SET &	01295	SN74ALS74AN
A1U2021	156-1743-00		IC,DIGITAL:F TTL,GATE:QUAD 2-INPUT NOR:74F02	04713	MC74F02N
A1U2022	156-0910-00		IC,DIGITAL:LS TTL,COUNTER:DUAL 4-BIT DECADE	01295	SN74ALS90N
A1U2030	156-0910-00		IC,DIGITAL:LS TTL,COUNTER:DUAL 4-BIT DECADE	01295	SN74ALS90N
A1U2031	156-0205-00		IC,DIGITAL:ECL,GATE:QUAD 2-INPUT OR:10102	04713	MC10102(P OR L)
A1U2032	156-2324-00		IC,DIGITAL:AS TTL,GATE:TRIPLE 3-INPUT NOR	01295	SN74AS27N
A1U2033	156-2540-00		IC,DIGITAL:F TTL,GATE:QUAD 2-INPUT NAND	18324	N74F38 N OR F
A1U2040	156-1126-01		IC,LINEAR:BI POLAR,COMPARTOR:DUPLICATE OF	01295	LM311P
A1U2050	156-0642-00		IC,DIGITAL:ECL,COUNTER:BI-QUINARY:10138	04713	MC10138P
A1U2060	156-1395-00		IC,DIGITAL:LS TTL,MUX/ENCODER:QUAD 2-TO-1	27014	DM74LS158N
A1U2080	156-0071-00		IC,LINEAR:BI POLAR,VOLTAGE REGULATOR	27014	LM723CN
A1U2081	156-1173-00		IC,LINEAR:BI POLAR,VOLTAGE REFERENCE	04713	MC1403N
A1U2082	156-0071-00		IC,LINEAR:BI POLAR,VOLTAGE REGULATOR	27014	LM723CN
A1U2020	156-0205-00		IC,DIGITAL:ECL,GATE:QUAD 2-INPUT OR:10102	04713	MC10102(P OR L)

Component No.	Taktronix Part Number	Serial Number	Effect	Part Name & Description	Mtr Code	Mtr Part Number
A1U3021	156-2257-00			IC,DIGITAL:FCTL,MUX:8-TO-1 DATA SELECTOR.	04713	MC74F251ND/JD
A1U3030	156-1743-00			IC,DIGITAL:FCTL,GATE:QUAD 2-INPUT NOR:74F02	04713	MC74F02N
A1U3040	156-0736-00			IC,DIGITAL:LSTTL,DEMUX/DECODER:BCD TO	04713	SN74LS42N
A1U3050	156-0910-00			IC,DIGITAL:LSTTL,COUNTER:DUAL 4-BIT DECADE	01295	SN74LS390N
A1U3060	156-0853-00			IC,LINEAR:BIPOLAR,OP-AMP:DUAL,SINGLE SUPPLY	04713	LM358N
A1U3070	156-0991-00			MICROCKT,LINEAR:VOLTAGE REGULATOPQUA78L05AWC	27014	UA78L05AWC
A1U4030	156-0910-00			IC,DIGITAL:LSTTL,COUNTER:DUAL 4-BIT DECADE	01295	SN74LS390N
A1U4031	156-0910-00			IC,DIGITAL:LSTTL,COUNTER:DUAL 4-BIT DECADE	01295	SN74LS390N
A1U4040	156-0383-00			IC,DIGITAL:LSTTL,GATES:QUAD 2-INPUT NOR	01295	SN74LS02N
A1U4050	156-0910-00			IC,DIGITAL:LSTTL,COUNTER:DUAL 4-BIT DECADE	01295	SN74LS390N
A1U4060	119-2470-00			OSC,XTAL CLOCK:5.00 MHZ, ADJUSTABLE,TTL	75378	JKX0-12C
A1V1050	152-0175-00			DIODE,ZENER:.,5.6V,5%,0.4W:1N752A,DO-7 OR	04713	SZG35008 (1N752ARL)
A1V13081	152-0175-00			DIODE,ZENER:.,5.6V,5%,0.4W:1N752A,DO-7 OR	04713	SZG35008 (1N752ARL)
A1W3050	131-0566-00			BUS,CONDUCTOR:DUMMY RES:0.094 OD X 0.225L	24546	OMA 07
A1W3051	131-0566-00			BUS,CONDUCTOR:DUMMY RES:0.094 OD X 0.225L	24546	OMA 07

Component No.	Tektronix Part Number	Serial Number	Effect	Part Name & Description	Mtr Code	Mtr Part Number
AZ	671-1486-00			CIRCUIT BD ASSY:MULTIPLIER	80009	671-1486-00
AZC450	281-0153-00			CAP,VAR,AIR DI:1.7-10PF,250V	74970	187-0106-055
AZC452	283-0156-00			CAP,FXD,CER DI:1000PF,+80-20%,200VSQUARE	04222	SRI52E102ZAA
AZC454	283-0156-00			CAP,FXD,CER DI:1000PF,+80-20%,200VSQUARE	04222	SRI52E102ZAA
AZC455	283-0156-00			CAP,FXD,CER DI:1000PF,+80-20%,200VSQUARE	04222	SRI52E102ZAA
AZC457	283-0156-00			CAP,FXD,CER DI:1000PF,+80-20%,200VSQUARE	04222	SRI52E102ZAA
AZC458	283-0156-00			CAP,FXD,CER DI:1000PF,+80-20%,200VSQUARE	04222	SRI52E102ZAA
AZC462	283-0156-00			CAP,FXD,CER DI:1000PF,+80-20%,200VSQUARE	04222	SRI52E102ZAA
AZC465	281-0153-00			CAP,VAR,AIR DI:1.7-10PF,250V	74970	187-0106-055
AZC467	281-0153-00			CAP,VAR,AIR DI:1.7-10PF,250V	74970	187-0106-055
AZC481	283-0177-00			CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SF305E105ZAA
AZC489	283-0156-00			CAP,FXD,CER DI:1000PF,+80-20%,200VSQUARE	04222	SRI52E102ZAA
AZC490	283-0156-00			CAP,FXD,CER DI:1000PF,+80-20%,200VSQUARE	04222	SRI52E102ZAA
AZC492	283-0156-00			CAP,FXD,CER DI:1000PF,+80-20%,200VSQUARE	04222	SRI52E102ZAA
AZC494	283-0156-00			CAP,FXD,CER DI:1000PF,+80-20%,200VSQUARE	04222	SRI52E102ZAA
AZC495	290-0519-00			CAP,FXD,ELECTLT:100UF,20%,20V	31433	T354J107M010AS
AZC497	283-0359-00			CAP,FXD,CER DI:1000PF,10%,200V	04222	SF212A102KAA
AZC498	281-0153-00			CAP,VAR,AIR DI:1.7-10PF,250V	74970	187-0106-055
AZC499	281-0578-00			CAP,FXD,CER DI:18PF,5%,500V	52763	ZRDPZ2007 18PJ0C
AZC500	281-0511-00			CAP,FXD,CER DI:22PF,+/-2.2PF,500V	52763	ZRDPZ2007 22PJ0KC
AZC504	281-0153-00			CAP,VAR,AIR DI:1.7-10PF,250V	74970	187-0106-055
AZC510	281-0168-00			CAP,VAR,AIR DI:1.3-5.4PF,250V	74970	187-0103-005
AZC511	281-0168-00			CAP,VAR,AIR DI:1.3-5.4PF,250V	74970	187-0103-005
AZC512	281-0168-00			CAP,VAR,AIR DI:1.3-5.4PF,250V	74970	187-0103-005
AZC513	281-0168-00			CAP,VAR,AIR DI:1.3-5.4PF,250V	74970	187-0103-005
AZC515	281-0168-00			CAP,VAR,AIR DI:1.3-5.4PF,250V	74970	187-0103-005
AZC517	281-0168-00			CAP,VAR,AIR DI:1.3-5.4PF,250V	74970	187-0103-005
AZC518	281-0168-00			CAP,VAR,AIR DI:1.3-5.4PF,250V	74970	187-0103-005
AZC519	281-0168-00			CAP,VAR,AIR DI:1.3-5.4PF,250V	74970	187-0103-005
AZC520	281-0168-00			CAP,VAR,AIR DI:1.3-5.4PF,250V	74970	187-0103-005
AZCR450	152-0141-02			DIODE,SIG;ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
AZCR468	152-0153-00			SEMICOND DVC,DI:SM,SI,10V,50MA,DO-7FD7003	27014	FD7003
AZCR470	152-0153-00			SEMICOND DVC,DI:SM,SI,10V,50MA,DO-7FD7003	27014	FD7003
AZCR482	152-0141-02			DIODE,SIG;ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
AZCR500	152-0503-00			DIODE,SIG;SRD;35V,500PS,7S,250NS,TL,4.65PF	28480	5082-8872
AZCR515	152-0536-00			DIODE,SIG;SCHTRKY;4V,0.6VF,1.0PF;MBD101	04713	MBD101
AZJ450	131-1003-00			CONN,RF JACK;PCB,PELTOLA;FEMALE,STR,0.141	80009	131-1003-00
AZJ455	131-1003-00			CONN,RF JACK;PCB,PELTOLA;FEMALE,STR,0.141	80009	131-1003-00
AZJ468	131-1003-00			CONN,RF JACK;PCB,PELTOLA;FEMALE,STR,0.141	80009	131-1003-00
AZK450	108-0357-00			COIL,REED SW;6VDC,37MA,SINGLE REED	75498	108-0357-00
AZL458	108-0371-00			COIL,RF:FIXED,200NH	0JMR3	108-0371-00
AZL460	108-0371-00			COIL,RF:FIXED,200NH	0JMR3	108-0371-00
AZL462	108-0371-00			(ETCHED ON CIRCUIT BOARD)		
AZL465	108-0509-00			COIL,RF:FIXED,2.45UH +/-10%,AXIAL LEAD,CORE	0JMR3	108-0371-00
AZL486	108-0371-00			COIL,RF:FIXED,200NH	0JMR3	108-0371-00
AZL490	108-0347-00			COIL,RF:FIXED,120NH	0JMR3	108-0347-00
AZL492	108-0371-00			COIL,RF:FIXED,200NH	0JMR3	108-0371-00
AZL494	108-0371-00			COIL,RF:FIXED,200NH	0JMR3	108-0371-00
AZL500	108-0371-00			(ETCHED ON CIRCUIT BOARD)		
AZL502	108-0371-00			(ETCHED ON CIRCUIT BOARD)		

Component No.	Tektronix Part Number	Serial Number	Effect	Part Name & Description	Mfr Code	Mfr Part Number
A2L510				(ETCHED ON CIRCUIT BOARD)		
A2L511				(ETCHED ON CIRCUIT BOARD)		
A2L512				(ETCHED ON CIRCUIT BOARD)		
A2L513				(ETCHED ON CIRCUIT BOARD)		
A2L517				(ETCHED ON CIRCUIT BOARD)		
A2L518				(ETCHED ON CIRCUIT BOARD)		
A2L519				(ETCHED ON CIRCUIT BOARD)		
A2L520				(ETCHED ON CIRCUIT BOARD)		
A20460	151-0221-00			TRANSISTOR,SIG:BIPOLAR,PNP:12V,80MA	04713	MP54258(EL8345)
A20484	151-0221-00			TRANSISTOR,SIG:BIPOLAR,PNP:12V,80MA	04713	MP54258(EL8345)
A20486	151-0411-00			TRANSISTOR:PNP,SI,10-39	04713	SRF709
A2R451	315-0391-00			RES,FXD,FILM:390 OHM,5%,0.25W	57668	NTR25J-E390E
A2R452	315-0181-00			RES,FXD,FILM:180 OHM,5%,0.25W	57668	NTR25J-E180E
A2R460	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JED1K0
A2R461	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
A2R463	315-0471-00			RES,FXD,FILM:470 OHM,5%,0.25W	57668	NTR25J-E470E
A2R465	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
A2R478	315-0391-00			RES,FXD,FILM:390 OHM,5%,0.25W	57668	NTR25J-E390E
A2R480	315-0391-00			RES,FXD,FILM:390 OHM,5%,0.25W	57668	NTR25J-E390E
A2R481	315-0391-00			RES,FXD,FILM:390 OHM,5%,0.25W	57668	NTR25J-E390E
A2R482	311-1225-00			RES,VAR,NONMMW:TRMR,1K OHM,0.5M	32997	3386F-1-102
A2R484	315-0152-00			RES,FXD,FILM:1.5K OHM,5%,0.25W	57668	NTR25J-E01K5
A2R486	315-0151-00			RES,FXD,FILM:150 OHM,5%,0.25W	57668	NTR25J-E150E
A2R487	317-0220-00			RES,FXD,COMP:22 OHM,5%,0.125W	01121	BB2205
A2R488	317-0200-00			RES,FXD,COMP:20 OHM,5%,0.125W	01121	BB2005
A2R489	315-0241-00			RES,FXD,FILM:240 OHM,5%,0.25W	19701	5043CX240R0J
A2R500	311-1559-00			RES,VAR,NONMMW:TRMR,10K OHM,0.5M	32997	3352T-1-103
A2S1	260-0817-00			SWTGH,REED:SPDT,0.25A,100V (USED WITH K450)	12617	1152234160
A2S450	260-1571-00			SWTGH,PUSH:3 BTN,2 POLE,SINE WAVE SEL	71590	2K8C030000-746
A21450	120-0870-00			XMR,TOROID:	0JR03	120-0870-00
A2U450	156-0252-00			IC,DIGITAL:ECL,GATE:TRIPLE 4-3-3 INPUT NOR	18324	101068
A2U455	156-0033-00			MICROCKT,LINEAR:RF-IF AMPLIFIER	34371	CA3028A

Component No.	Tektronix Part Number	Serial Number	Effect	Discont	Part Name & Description	Mtr Code	Mtr Part Number
A3	671-1485-00				CIRCUIT BD ASSY:DISPLAY	80009	671-1485-00
A3C550	283-0156-00				CAP,FXD,CER DI:1000PF,+80-20%,200VSQUARE	04222	SRI5E21022AA
A3CR167	152-0141-02				DIODE,SIG:,ULTRA FAST:40V,150MA,4NS,2PF	27014	FDH9427
A3CR168	152-0141-02				DIODE,SIG:,ULTRA FAST:40V,150MA,4NS,2PF	27014	FDH9427
A3DS170	150-1001-01				DIODE,OPTO:,LED:RED,655NM,.8 MCD @ IF=20MA	50434	HLMF-3200
A3DS172	150-1001-01				DIODE,OPTO:,LED:RED,655NM,.8 MCD @ IF=20MA	50434	HLMF-3200
A3DS550	150-1162-00				DIODE,OPTO:,LED:RED,635NM,7 SEG W/DEC	50434	HOSP-7501
A3DS570	150-1162-00				DIODE,OPTO:,LED:RED,635NM,7 SEG W/DEC	50434	HOSP-7501
A3DS630	150-0048-01				LAMP,INCAND:5V,0.06A,#683,AGED & SEL	0J9R2	683
A3P2010	131-1614-00				CONN,HDR:PCB,;MALE,STR,1 X 36,0.1 CTR,0.230 (USES 4 EACH)	08261	800-380-000
A3P2011	131-1614-00				CONN,HDR:PCB,;MALE,STR,1 X 36,0.1 CTR,0.230 (USES 10 EACH)	08261	800-380-000
A3R167	315-0161-00				RES,FXD,FILM:160 OHM,5%,0.25M	19701	5043CX160R0J
A3R553	315-0561-00				RES,FXD,FILM:560 OHM,5%,0.25M	19701	5043CX560R0J
A3R554	315-0561-00				RES,FXD,FILM:560 OHM,5%,0.25M	19701	5043CX560R0J
A3R555	315-0561-00				RES,FXD,FILM:560 OHM,5%,0.25M	19701	5043CX560R0J
A3R556	315-0561-00				RES,FXD,FILM:560 OHM,5%,0.25M	19701	5043CX560R0J
A3R557	315-0561-00				RES,FXD,FILM:560 OHM,5%,0.25M	19701	5043CX560R0J
A3R558	315-0561-00				RES,FXD,FILM:560 OHM,5%,0.25M	19701	5043CX560R0J
A3R559	315-0561-00				RES,FXD,FILM:560 OHM,5%,0.25M	19701	5043CX560R0J
A3R570	315-0561-00				RES,FXD,FILM:560 OHM,5%,0.25M	19701	5043CX560R0J
A3R573	315-0561-00				RES,FXD,FILM:560 OHM,5%,0.25M	19701	5043CX560R0J
A3R574	315-0561-00				RES,FXD,FILM:560 OHM,5%,0.25M	19701	5043CX560R0J
A3R575	315-0561-00				RES,FXD,FILM:560 OHM,5%,0.25M	19701	5043CX560R0J
A3R576	315-0561-00				RES,FXD,FILM:560 OHM,5%,0.25M	19701	5043CX560R0J
A3R577	315-0561-00				RES,FXD,FILM:560 OHM,5%,0.25M	19701	5043CX560R0J
A3R578	315-0561-00				RES,FXD,FILM:560 OHM,5%,0.25M	19701	5043CX560R0J
A3R579	315-0561-00				RES,FXD,FILM:560 OHM,5%,0.25M	19701	5043CX560R0J
A3R629	315-0100-00				RES,FXD,FILM:10 OHM,5%,0.25M	19701	5043CX10R0R0J
A3U550	156-1243-00				IC,DIGITAL:LSTTL,DEMUX/DECODER;BCD-T0-7	01295	SN74LS47N
A3U570	156-1243-00				IC,DIGITAL:LSTTL,DEMUX/DECODER;BCD-T0-7	01295	SN74LS47N
A3U575	156-0724-00				IC,DIGITAL:LSTTL,GATES;HEX INV, OC:7ALS05	01295	SN74LS05N





# DIAGRAMS AND CIRCUIT BOARD ILLUSTRATIONS

## Symbols

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

Logic symbology is based on ANSI Y32.14-1973 in terms of positive logic. Logic symbols depict the logic function performed and may differ from the manufacturer's data.

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

Abbreviations are based on ANSI Y1.1-1972.

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

- Y14.15, 1966 Drafting Practices.  
 Y14.2, 1973 Line Conventions and Lettering.  
 Y10.5, 1968 Letter Symbols for Quantities Used in Electrical Science and Electrical Engineering.  
 American National Standard Institute  
 1430 Broadway  
 New York, New York 10018
- Component Values**  
 Electrical components shown on the diagrams are in the following units unless noted otherwise:  
 Capacitors = Values one or greater are in picofarads (pF). Values less than one are in microfarads ( $\mu$ F).  
 Resistors = Ohms ( $\Omega$ ).

## Assembly Numbers and Grid Coordinates

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

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

