Instruction Manual

Tektronix

SG 503
Leveled Sine Wave Generator

070-6770-00 B090000 - up

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Leveled Sine Wave Generator

070-6770-00

This document supports product serial numbers B090000 and above.

Warning
The servicing instructions are for use by qualified personnel only. To avoid personal injury, do not perform any servicing unless you are qualified to do so. Refer to the Safety Summary prior to performing service.

Please check for change information at the rear of this manual.

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Tektronix, Inc., P.O. Box 1000, Wilsonville, OR 97070–1000

WARRANTY

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In order to obtain service under this warranty, Customer must notify Tektronix of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. Customer shall be responsible for packaging and shipping the defective product to the service center designated by Tektronix, with shipping charges prepaid. Tektronix shall pay for the return of the product to Customer if the shipment is to a location within the country in which the Tektronix service center is located. Customer shall be responsible for paying all shipping charges, duties, taxes, and any other charges for products returned to any other locations.

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WARNING

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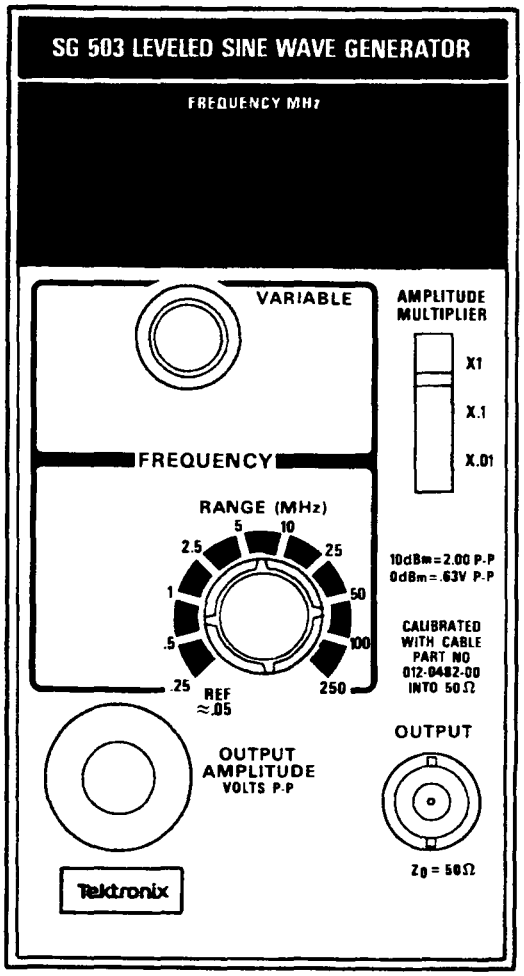


Fig. 1-1. SG 503 Leveled Sine Wave Generator plug-in module.

OPERATING INSTRUCTIONS

INTRODUCTION

Description

The SG 503 Leveled Sine-Wave Generator provides a regulated, constant-amplitude versus frequency output into a 50-ohm load. The SG 503 is primarily intended to be used as an oscilloscope calibration device for measuring bandwidths up to 250 megahertz. The SG 503 can also be used as a signal source for general electronics design and development.

Nine overlapping ranges cover the frequency band from 250 kilohertz to 250 megahertz, with an additional range reserved for a 50 kilohertz reference frequency.

A digital counter with automatic ranging and a front panel LED readout is used for frequency indication.

Installation and Removal

CAUTION

Turn the power module off before inserting the plug-in; otherwise, damage may occur to the plug-in circuitry. Because of the high current drawn by the SG 503, it is also recommended that the power module be turned off before removing the SG 503. Refer to Fig. 1-2. Check to see that the plastic barriers on the interconnecting jack of the selected power module compartment match the cut-outs in the SG 503 circuit board edge connector.

Align the SG 503 chassis with the upper and lower guides of the selected compartment. Push the module in and press firmly to seat the circuit board in the interconnecting jack.

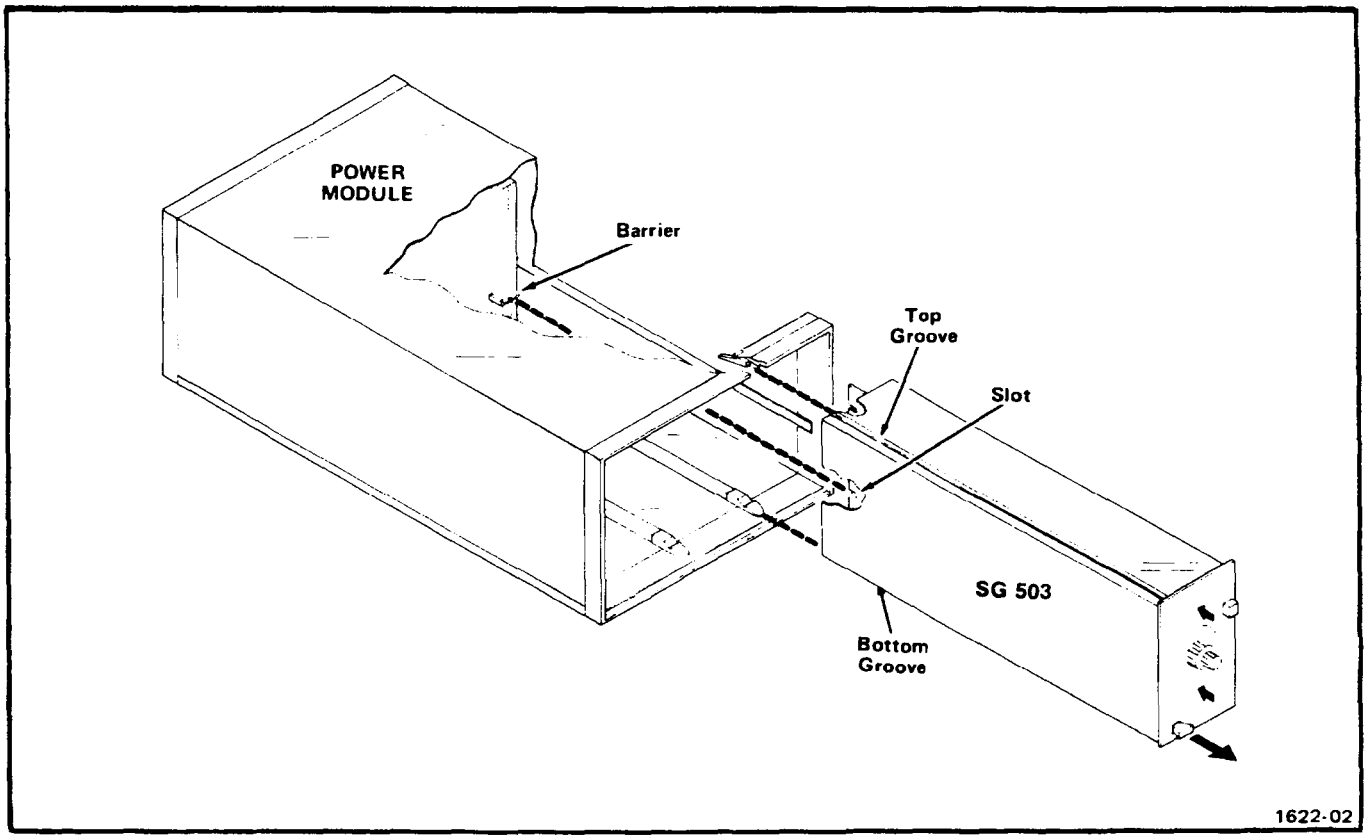
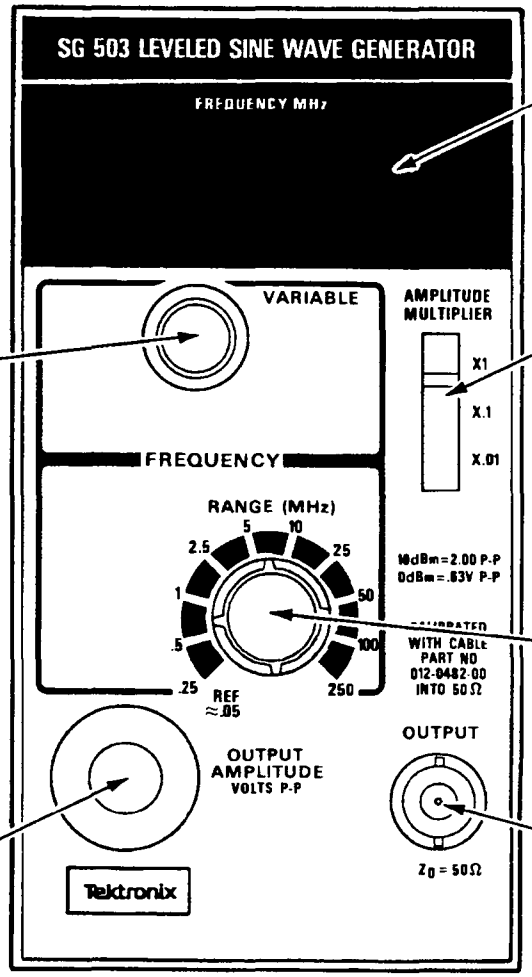


Fig. 1-2. Plug-in installation and removal.



LED Display
Three-digit readout indicates output frequency.

AMPLITUDE MULTIPLIER
Three-position lever switch to allow choice of unattenuated or attenuated output amplitude. Output amplitude is OUTPUT AMPLITUDE VOLTS P-P control setting times the factor indicated by the AMPLITUDE MULTIPLIER switch position.

FREQUENCY VARIABLE
Selects output frequency within the desired frequency range.

FREQUENCY RANGE (MHz)
Selects the desired frequency range as indicated.

OUTPUT
BNC connector output terminal. Use proper coaxial cable as indicated on front panel.

OUTPUT AMPLITUDE VOLTS P-P
Determines the peak-to-peak amplitude into the attenuator (AMPLITUDE MULTIPLIER).

Fig. 1-3. SG 503 controls and connectors.

To remove the SG 503, pull on the release latch located in the lower left corner, until the interconnecting jack disengages and the SG 503 will slide out.

Power application to the SG 503 is indicated by the three-digit LED (Light-Emitting Diode) display being lighted. Turn the FREQUENCY RANGE (MHz) control between the detent positions to test the LED's (888 display). Reset the FREQUENCY RANGE (MHz) control to the desired range. Allow 15 to 20 minutes warmup time for all equipment before using the SG 503.

Overheating

The SG 503 is designed to operate at an ambient temperature from 0°C to +50°C. However, when operating several power supplies in a multi-plug-in power module, especially at low output voltages, or when operating close to other heat-producing equipment, internal temperature may exceed safe limits and actuate a thermal cutout in the power module. Refer to the power module instruction manual for more complete information.

Controls and Connectors

Refer to Fig. 1-3. Even though the SG 503 is fully calibrated and ready to use, the functions and actions of the controls and connectors should be reviewed before attempting to use it.

CAUTION

If the instrument is operated at the extreme limit of, or beyond a band range, the front-panel display may flash a blinking indication, alerting the user to an unleveled output amplitude condition.

OPERATING CONSIDERATIONS

Introduction

The SG 503 has been designed and calibrated with a high quality coaxial cable (Part Number 012-0482-00) to operate as a closely matched system when terminated into a 50-ohm load. See Fig. 1-4A. The absolute amplitude across the load is directly related to its impedance. Part Number 012-0482-00 should be connected directly to the equipment under test if the input impedance of the equipment is 50 ohms. For equipment with an input impedance much greater than 50 ohms, an accurate 50-ohm termination should be connected between the coaxial cable and the equipment. Tee connectors or wire of any type between the 50-ohm termination and the equipment being tested will produce some variation in the calibrated output amplitude at higher frequencies.

Coaxial cables of lesser quality or cables that are longer or shorter than Part Number 012-0482-00 can be used, but the output amplitude flatness specifications are no longer applicable. Cables that are 2 feet longer or 2 feet shorter than Part Number 012-0482-00 can cause amplitude variations that are as much as 4% low or 2% high (respectively) when compared to the calibrated amplitudes at 250 megahertz.

Optimum performance is obtained when the setting of the OUTPUT AMPLITUDE control is in the 1.0 to 5.0 range. For example; when an output amplitude of 0.5 volt peak-to-peak is desired, set OUTPUT AMPLITUDE control to 5.0 and AMPLITUDE MULTIPLIER switch to X.1 instead of 0.5 and X1.

The sine-wave output from the SG 503 may be applied to an external dc level that does not exceed ±1 volt. At higher dc offset levels, couple the output through a dc blocking capacitor. When operating the SG 503 always consider the total load impedance and its effect on the output amplitude.

Open-Circuit Operation

When the SG 503 is operating into an impedance much greater than 50 ohms, up to twice the maximum terminated output amplitude can be obtained. Under open-circuit conditions, the actual output amplitude will be two times the amplitude indicated by the front panel controls.

NOTE

The frequency value shown on the display may not be valid unless a 50 Ω cable is attached (terminated or not) to the OUTPUT connector.

Open-circuit amplitude flatness is not specified, but is adequate for many applications in the lower frequency bands because the steady state 50-ohm output impedance of the SG 503 reverse-terminates the characteristic impedance of a 50-ohm coaxial cable. The reverse termination keeps the output amplitude constant at the unterminated end of the cable even though standing waves may exist in the coaxial cable.

Capacitive Loads

The input capacitance of the equipment under test will affect the bandwidth. The equivalent circuits shown in Fig. 1-4B and Fig. 1-4C are useful in estimating the amplitude changes caused by reactive loads. Note that as system input capacitance increases, bandwidth decreases. The bandwidth of an oscilloscope with a high input impedance is usually specified using an equivalent 25-ohm source.

When operating the SG 503 on the higher frequency bands with no output attenuation, the front-panel display may flash, indicating an unleveled output amplitude. Switch the AMPLITUDE MULTIPLIER control to the X.1 position and if the display flashing ceases, the problem may be related to an extreme mismatch between the SG 503 and the load. If the SG 503 is operating into a high SWR, a 3-decibel attenuator inserted between the output and the load may improve the operation at full output amplitude (X1 position of the AMPLITUDE MULTIPLIER switch).

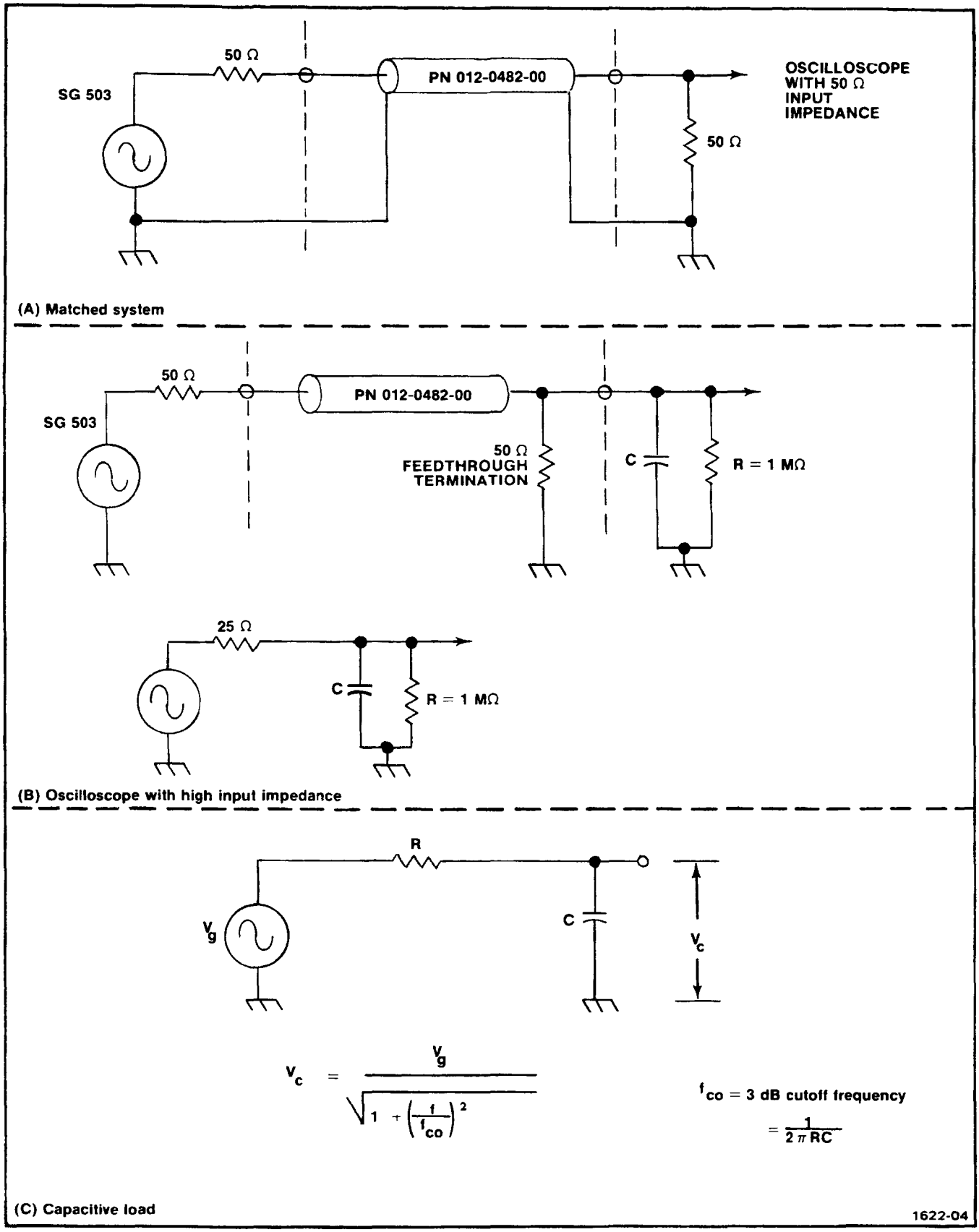


Fig. 1-4. Equivalent circuits for SG 503, 50 ohm coaxial cable and various terminations.

SPECIFICATION AND PERFORMANCE CHECK

SPECIFICATION

Performance Conditions

The electrical characteristics are valid only if the SG 503 has been calibrated at an ambient temperature between +20° C and +30° C and is operating at an ambient temperature between 0° C and +50° C unless otherwise noted.

The SG 503 is calibrated for use with a furnished coaxial cable accessory (See Standard Accessories in Replaceable Mechanical Parts list section) terminated into a 50-ohm load.

Items listed in the Performance Requirements column of the Electrical Characteristics are verified by completing the Performance Check in this manual. Items listed in the Supplemental Information column are not verified in this manual; they are either explanatory notes or performance characteristics for which no limits are specified.

Table 2-1

ELECTRICAL CHARACTERISTICS

Characteristics	Performance Requirements	Supplemental Information
Frequency Range	250 kHz to 250 MHz, plus 50 kHz reference frequency.	
Output Accuracy	Within ±0.7 of the least significant displayed digit.	
Amplitude Range	5 mV to 5.5 V peak-to-peak over three decade ranges and terminated into a 50-Ω load.	
Accuracy	At 50 kHz reference frequency; within 3% of indicated amplitude on X1 range, 4% on X.1 range, and 5% on X.01 range.	Accuracy must be set to within 0.3% on X1 range and checked to be within 2.0% on X.1 and X.01 ranges.

NOTE

Flatness (Peak-to-Peak) valid only when precision coaxial cable is used. Flatness referenced to NBS corrections of Tektronix standards. NBS uncertainties not included.

Table 2-1 (cont)
ELECTRICAL CHARACTERISTICS

Characteristics	Performance Requirements	Supplemental Information
Flatness (Peak-to-Peak)		
Amplitude Multiplier Setting: X1, X.1, X.01	From 250 kHz output ampltiude will not vary more than 1% of the value at 50 kHz. From 100 MHz to 250 MHz amplitude variation is within 3% of the value at 50kHz.	
Amplitude Multiplier Setting: X1	50 MHz to 100 MHz range; output amplitude will not vary more than 1% of the value at 50 kHz.	
Amplitude Multiplier Setting: X.1 and X.01	50 MHz to 100 MHz range; output amplitude will not vary more than +1.5% and −1.0% of the value at 50 kHz.	
Harmonic Content (relative to fundamental)		Multiplier setting X.01:
Multiplier setting: X1	2nd harmonic at least 35 db down. 3rd harmonic and all higher order harmonics at least 40 db down.	Harmonics typically 20 db down or more.
Multiplier setting: X.1	2nd harmonic at least 33 db down. 3rd harmonic and all higher order harmonics at least 38 db down.	

Table 2-2
ENVIRONMENTAL CHARACTERISTICS

Characteristics	Performance Requirements	Supplemental Information
Temperature		
Operating	0°C to +50°C	
Storage	−40°C to +75°C.	
Altitude		
Operating	To 15,000 feet maximum operating temperature decreased by 1°C/1,000 feet from 5,000 to 15,000 feet.	
Storage	To 50,000 feet.	
Vibration		
Operating and Non-operating	With the instrument complete and operating, vibration frequency swept from 10 to 55 to 10 Hz at 1 minute per sweep. Vibrate 15 minutes in each of the three major axes at 0.015 inch total displacement. Hold 10 minutes at any major resonance, or in none, at 55 Hz. Total time, 75 minutes.	
Shock		
Operating and Non-operating	30 g's 1/2 sine, 11 ms duration, 3 shocks in each direction along 3 major axes, for a total of 18 shocks.	

Table 2-3

PHYSICAL CHARACTERISTICS

Characteristics	Information
Overall Dimensions (measured at maximum points) Height	5.0 inches 12.7 centimeter
Width	2.6 inches 6.6 centimeter
Length	12.2 inches 31.0 centimeter
Net Weight (Instrument Only)	2.25 lbs. 1.02 kilograms

PERFORMANCE CHECK

Introduction

This procedure checks the electrical characteristics of the SG 503 that appear in the Specification section of this manual. If the instrument fails to meet the requirements given in this performance check, the calibration procedure should be performed. This procedure can also be used by an incoming inspection facility to determine acceptability of performance.

The electrical characteristics in Section 2 are valid only if the SG 503 is calibrated at an ambient temperature of +20° C to +30° C and operated at an ambient temperature of 0° C to +50° C. Forced air circulation is required for ambient temperature above +40° C.

Tolerances that are specified in this performance check procedure apply to the instrument under test and do not include test equipment error.

Test Equipment Required

The test equipment listed in Table 2-4, or equivalent, is required to perform the performance check. Test equipment characteristics listed are the minimum required to verify the performance of the equipment under test. Substitute equipment must meet or exceed the stated requirements. All test equipment is assumed to be operating within tolerance.

Special test devices are used where necessary to facilitate the procedure. Most of these are available from Tektronix, Inc. and can be ordered through your local Tektronix Field Office or representative.

Table 2-4

LIST OF TEST EQUIPMENT REQUIREMENTS

Description	Performance Requirements	Application	Example
Oscilloscope	Bandwidth, dc to 100 MHz; minimum deflection factor, 1 mV/div with differential comparator; sweep rate, 10 ms/div to 1 μs/div; accuracy, within 3%.	Used throughout procedure to provide display.	TEKTRONIX 7603, 7A13, 7B70 Oscilloscope System.
Digital Voltmeter	Range, 0 to 50 V; accuracy, within 0.1%.	Output voltage flatness check.	TEKTRONIX DM 501 Digital Multimeter.*
Digital Counter	Range, 50 kHz to 250 MHz.	Output accuracy	TEKTRONIX DC508 Digital Counter.*
Power Module	Three compartments or more.	All tests.	TEKTRONIX TM 503 or TM 504.
Calibration Generator	Amplitude calibration, 5 mV to 5 V; accuracy, ±0.25% into 1 MΩ; output, square wave at approximately 1 kHz.	Amplitude Set check.	TEKTRONIX PG 506 Calibration Generator.*
Spectrum Analyzer	Range, 100 kHz to 300 MHz; calibrated levels in decade steps from −45 dB to −35 dB; impedance, 50 Ω; accuracy, linear display, within 10%.	Buffer Distortion, Harmon-Suppression check.	TEKTRONIX 7L12 Spectrum Analyzer.
Peak-to-Peak Detector	Frequency range, 50 Hz to 500 MHz; requires 1.2 V p-p input voltage.	Output voltage flatness check.	Tektronix 067-0625-00 Calibration Fixture.
Coaxial cable	Impedance, 50 Ω; length, 36 inches; connectors, bnc; (precision coaxial cable).	Provides signal interconnection.	Tektronix Part No. 012-0482-00 (supplied with SG 503).
Patch cord (2 required)	Bnc to banana plug-jack, 18 inch.	Provides signal interconnection.	Tektronix Part No. 012-0090-00 (black) 012-0091-00 (red)
Coaxial cable (2 required)	Impedance, 50 Ω; length, 42 inches; connectors, bnc.	Provides signal interconnection.	Tektronix Part No. 012-0057-01.
Attenuator, 2X (2 required).	Impedance, 50 Ω; connectors, bnc.	Output voltage flatness check.	Tektronix Part No. 011-0069-02.
Tee connector	Connectors, bnc.	Reference amplitude check.	Tektronix Part No. 103-0030-00.
Adapter	GR to bnc female.	Output voltage flatness check.	Tektronix Part No. 017-0063-00.
Termination	Impedance, 50 Ω; connectors, bnc.	Output termination for signal generator.	Tektronix Part No. 011-0049-01.
Resistor	Fixed, 2.4 M Ω, 1/2 W, 5%.	Output voltage flatness check.	Tektronix Part No. 301-0245-00.

*Requires TM 500-Series Power Module.

Preliminary Procedure

1. Ensure that all power switches are off.

2. Ensure that all test equipment and the SG 503 under test are suitably adapted to the line voltage to be applied.

3. Install the SG 503 into the power module, and if applicable, install all other TM 500-series test equipment into the power module.

4. Connect the equipment under test and the test equipment to a suitable line voltage source. Turn all equipment on and allow at least 20 minutes for the equipment to warm up and stabilize.

Initial Control Settings

Set the following controls during warm-up time:

SG 503

AMPLITUDE MULTIPLIER	X1
FREQUENCY VARIABLE	Midrange
FREQUENCY RANGE (MHz)	REF ≈ .05
OUTPUT AMPLITUDE	5.0

Oscilloscope

Intensity, Focus	Set for well-defined trace and normal brightness.

Differential Comparator

Volts/Div	.1 V
Variable	fully clockwise (cal)
+Input	ac
−Input	ac
Bandwidth Limit	5 MHz

Time Base Plug-In

Time/Div	.2 ms
Variable	(cal in)
Triggering	
+Slope	selected
Mode	P-P Auto
Coupling	ac hf rej
Source	Ext
Position	Set so trace starts at left side of graticule.
Magnifier	X1

PERFORMANCE CHECK PROCEDURE

NOTE

The SG 503 must be terminated into an accurate 50-ohm load for all checks. Measure the 50-ohm termination to determine percent of error. A 2% error in the termination (1 ohm) will cause amplitude errors of 1%. For example, a 51-ohm termination causes an amplitude error that is 1% high at 50 kilohertz.

1. Check Reference Amplitude Accuracy at 0.05 megahertz.

a. Connect a 1 kilohertz, 5 volt square-wave signal from the calibration generator, through a bnc tee connector, to the + input of the differential comparator, using a 42-inch cable. Connect a 42-inch cable from the tee connector to the time-base unit external trigger input.

b. Connect the precision 50-ohm cable (supplied with SG 503) to the SG 503 OUTPUT connector.

c. Connect a 50-ohm termination to the remaining end of the precision 50-ohm cable; connect the other end of the 50-ohm termination to the − input of the differential comparator.

d. Set the time-base triggering controls for a stable display; a crt display similar to Fig. 2-1 is obtained.

e. Check—that the corners of the idealized waveform are aligned as illustrated in Fig. 2-1, within 1.5 vertical divisions. Disregard waveform tilt.

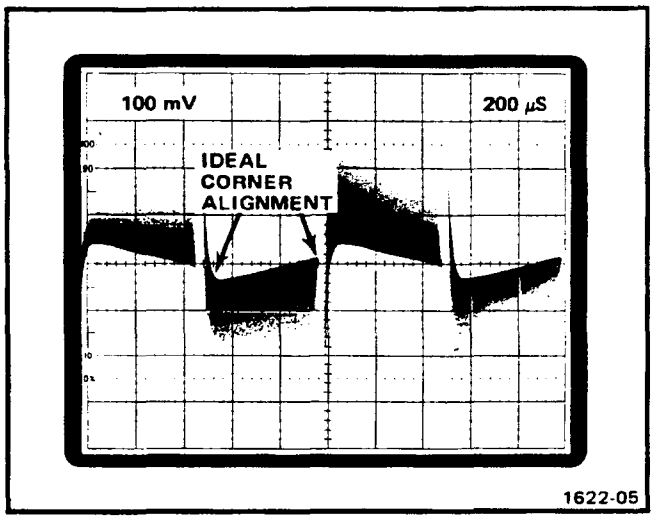


Fig. 2-1. Representation of complex waveform (idealized) with 5 volt reference amplitude at 0.05 MHz, properly set.

f. Set the SG 503 OUTPUT AMPLITUDE control to 0.5; set the calibration generator for a 0.5 volt, 1 kilohertz square-wave signal.

g. Set the differential-comparator deflection factor for 10 mV/div.

h. Check—that the waveform is similar as illustrated in Fig. 2-2, (within 1.5 vertical divisions).

i. Disconnect all cables.

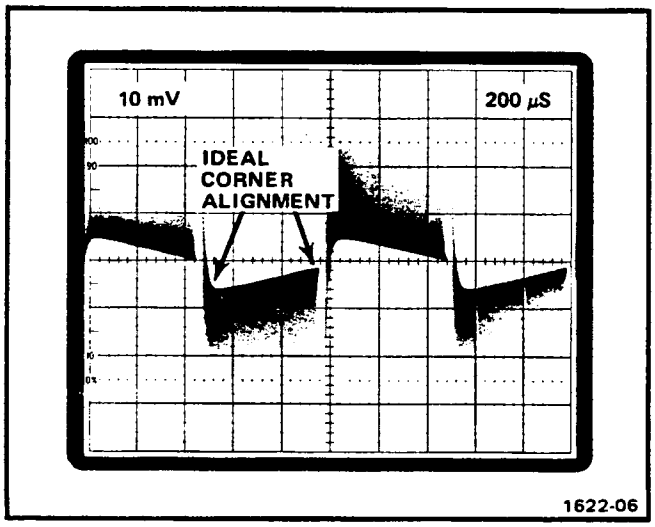


Fig. 2-2. Display of complex waveform (idealized) with 0.5 volt reference amplitude of 0.05 MHz, properly set.

2. Check Harmonic Suppression and Leveling

a. Connect the SG 503 output to the spectrum analyzer input, using the precision 50-ohm cable (supplied with SG 503).

b. Set the SG 503 OUTPUT AMPLITUDE control to 5.5 and the AMPLITUDE MULTIPLIER switch to the X1 position.

c. Set the SG 503 FREQUENCY RANGE (MHz) switch to the 100-250 range.

d. Position the fundamental display to the top graticule line with the spectrum analyzer position control. See Fig. 2-3 for reference.

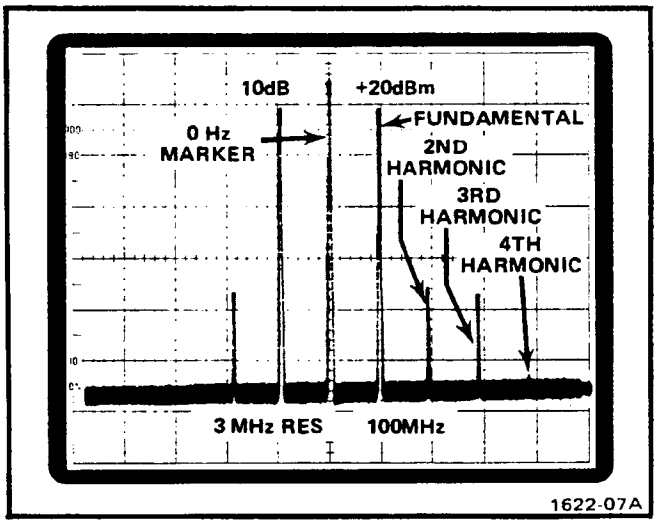


Fig. 2-3. Display of 100 MHz signal and harmonics.

NOTE

It will be necessary to change the spectrum analyzer input attenuation (sensitivity) to maintain a reasonable display on screen, with harmonics above the baseline noise level and within the graticule area.

e. Slowly adjust the SG 503 FREQUENCY VARIABLE control over its entire range and check that the vertical distance (suppression) between the top of the fundamental and second harmonic display is at least 3.5 divisions; the tops of the remaining harmonics are separated at least 4.0 divisions. (Adjust the spectrum analyzer Frequency Span/Div control as necessary to maintain the harmonic display on screen.) See Fig. 2-3.

f. Set the SG 503 FREQUENCY RANGE (MHz) switch to the 50-100 range.

g. Repeat part e of this step for the remaining frequency ranges. (Suppression limit of 35 decibels down corresponds to 3.5 divisions on the display.)

NOTE

All coil adjustments have been adjusted for minimum harmonic amplitude at the high end of the associated range (worst case harmonic conditions). Check that the output remains leveled (display will blink if unleveled condition occurs) as the SG 503 FREQUENCY VARIABLE control is slowly rotated over its associated frequency range.

h. Set the SG 503 AMPLITUDE MULTIPLIER to X.1.

i. Increase the spectrum analyzer input sensitivity by a factor of 10.

j. Repeat parts c through g of this step, checking that the vertical distance (suppression) between the top of the fundamental and second harmonic display is at least 3.3 divisions (33 db); the tops of the remaining harmonics are separated at least 3.8 divisions.

k. Return the SG 503 AMPLITUDE MULTIPLIER to X1 and disconnect the cable from the spectrum analyzer.

3. Readout Accuracy

a. Connect the SG 503 output to the frequency counter using the 50 Ω coax. (Set the counter to 50 Ω.)

b. Set the SG 503 OUTPUT AMPLITUDE to a level that stabilizes the frequency counter display.

c. Slowly adjust the SG 503 FREQUENCY VARIABLE control over its entire range at each of the frequency range positions of the FREQUENCY RANGE (MHz) switch.

d. Check that the frequency counter display is within ±0.7 of the least significant displayed digit on the SG 503.

4. Check Flatness (Peak-to-Peak Amplitude Regulation)

a. Set the SG 503 controls as follows: FREQUENCY RANGE (MHz) switch to REF ≈ .05 position, and the AMPLITUDE MULTIPLIER switch to X1.

b. Connect a 2.4 megohm, 5% resistor across the digital voltmeter floating input terminals. Connect the SG 503 via the precision cable (012-0482-00) and the bnc female-to-GR adapter to the input of the peak-to-peak detector. Use two bnc to banana-plug-jack patch cords to connect the output of the peak-to-peak detector to the floating input terminals on the digital voltmeter; maintain correct polarity, HI to + and LO to −. Set the digital voltmeter to the 20 volts dc range.

c. Slowly adjust the SG 503 OUTPUT AMPLITUDE VOLTS P-P control until the digital voltmeter display indicates ±.000. Output amplitude from the SG 503 should be about 1.1 to 1.2 volts; this establishes a 0.0% reference setting at .050 megahertz.

d. Slowly adjust the SG 503 FREQUENCY VARIABLE control over its entire range at each of the frequency range positions of the FREQUENCY RANGE (MHz) switch.

e. Check—the flatness deviation from 0.25 megahertz to 50 megahertz, must be within 1% of the value at .050 megahertz. The total percentage deviation calculation must include the digital voltmeter reading and the calibration factor of the peak-to-peak detector. For example, a reading of +.008 volt on the digital voltmeter is equivalent to +0.8% deviation. Applying a correction factor of −0.3% results in a total percentage deviation of +0.5%.

f. Check—the flatness deviation from 50 megahertz to 100 megahertz, must be within 1% of the value at .050 megahertz. The same calculation must be considered for this deviation reading as described in part e of this step.

NOTE

A 1% total percentage deviation ensures flatness specification when the SG 503 is operating at the X.1 and X.01 AMPLITUDE MULTIPLIER switch positions.

g. Check—the flatness deviation from 100 megahertz to 250 megahertz, must be within 3% of the value at .050 megahertz. The same calculation must be considered for this deviation reading as described in part e and f of this step.

h. To check the flatness deviation at a higher voltage output from the SG 503, insert two 2X attenuators between the SG 503 cable and the peak-to-peak detector. Repeat part c of this step to obtain another 0.0% reference reading of about 4.7 volts output from the SG 503.

i. After obtaining the new 0.0% reference indication on the digital voltmeter, repeat parts e and f of this step to check flatness deviation for about 4.7 volts output from the SG 503. Tolerance limits are the same as in parts e and f of this step.

j. Disconnect all cables from the SG 503.

This completes the Performance Check procedure of the SG 503 Leveled Sine Wave Generator.

Warning

The following servicing instructions are for use only by qualified personnel. To avoid personnel injury, do not perform any servicing other than that contained in the operating instructions unless you are qualified to do so. Refer to General Safety Summary and Service Safety Summary prior to performing any service.

ADJUSTMENT

Introduction

This adjustment procedure is to be used to restore the SG 503 to original performance specifications. Adjustment need not be performed unless the instrument fails to meet the Performance Requirements of the Electrical Characteristics listed in the Specification section, or the Performance Check cannot be completed satisfactorily.

Completion of all adjustment steps in this procedure ensures that the instrument will meet the performance requirements listed in the Specification section. However, to fully ensure satisfactory performance, it is recommended that the Performance Check be performed after any adjustment is made.

Services Available

Tektronix, Inc. provides complete instrument repair and adjustment at local Field Service Centers and at the Factory Service Center. Contact your local Tektronix Field Office or representative for further information.

Test Equipment Required

The test equipment listed in Table 3-1, or equivalent, is required for adjustment of the SG 503. Specifications given for the test equipment are the minimum necessary for accurate adjustment and measurement. All test equipment is assumed to be correctly calibrated and operating within specification.

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

A flexible plug-in extender, Tektronix Part No. 067-0645-02, is useful for troubleshooting or adjusting the SG 503; however, the complete Adjustment Procedure can be performed without use of the extender.

Table 3-1

LIST OF TEST EQUIPMENT REQUIREMENTS

Description	Performance Requirements	Application	Example
Oscilloscope	Bandwidth, dc to 100 MHz; minimum deflection factor, 1 mV/div; sweep rate, 10 ms/div to 1 μs/div; accuracy, within 3%.	Used throughout procedure to provide display.	TEKTRONIX 7603, 7A13, 7B70 Oscilloscope System.
Digital Voltmeter	Range, 0 to 50 V; accuracy, within 0.1%.	Voltage measurements. Output voltage flatness check.	TEKTRONIX DM 501 Digital Multimeter.*
Power Module	Three compartments or more.	All tests.	TEKTRONIX TM 503 or TM 504.
Calibration Generator	Amplitude calibration, 50 mV to 5 V; accuracy, ±0.25% into 1 MΩ; output, square wave at approximately 1 kHz.	Amplitude Set check and adjustment.	TEKTRONIX PG 506 Calibration Generator.*
Spectrum Analyzer	Range, 100 kHz to 300 MHz; calibrated levels in decade steps from −45 db to −35 db; impedance, 50 Ω; accuracy, linear display, within 10%.	Buffer Distortion, Harmonic Suppression check.	TEKTRONIX 7L12 Spectrum Analyzer.

*Requires TM 500-Series Power Module.

Table 3-1 (cont)

LIST OF TEST EQUIPMENT REQUIREMENTS

Description	Performance Requirements	Application	Example
Peak-to-Peak Detector	Frequency range, 50 Hz to 500 MHz; requires 1.2 V p-p input voltage.	Output voltage flatness check.	Tektronix 067-0625-00 Calibration Fixture.
Autotransformer with ac voltmeter	Capable of supplying an output voltage from 90 to 132 V, ac; 120 watts of power at the upper limit.	Power supply check.	General Radio W10MTR3W Variac Autotransformer.
Coaxial cable	Impedance, 50 Ω; length, 36 inches; connectors, bnc; (precision coaxial cable).	Provides signal interconnection.	Tektronix Part No. 012-0482-00 (supplied with SG 503).
Patch cord (2 required)	Bnc to banana-plug-jack, 18 inch.	Provides signal interconnection.	Tektronix Part No. 012-0090-00 (black) 012-0091-00 (red)
Coaxial cable (2 required)	Impedance, 50 Ω; length, 42 inches; connectors, bnc.	Provides signal interconnection.	Tektronix Part No. 012-0057-01.
Attenuator, 2X (2 required)	Impedance, 50 Ω; connectors, bnc.	Output voltage flatness check.	Tektronix Part No. 011-0069-02.
Tee connector	Connectors, bnc.	Reference amplitude check.	Tektronix Part No. 103-0030-00.
Adapter	GR to bnc female.	Output voltage flatness	Tektronix Part No. 017-0063-00.
Termination	Impedance, 50 Ω connectors, bnc.	Output termination for signal generator.	Tektronix Part No. 011-0049-01.
Resistor	Fixed, 2.4 MΩ, 1/2 W, 5%.	Output voltage flatness	Tektronix Part No. 301-0245-00.
Screwdriver	Three-inch shaft, 3/32 inch bit.	Used to adjust variable resistors.	Xcelite R-3323.
Alignment tool	Fits 5/64-inch (ID) hex cores.	Used to adjust coils in harmonic suppression check.	Tektronix Part No. 003-0307-00 (handle) 003-0310-00 (insert)
Alignment tool	Five-inch, for slotted cores.	Used to adjust coils in harmonic suppression check.	Tektronix Part No. 003-0301-00.

Preparation

a. Remove the left and right side covers of the SG 503 to gain access to the component side of the circuit boards.

b. Install the SG 503 into the left power module compartment, or if appropriate, connect the SG 503 to the power module by means of the flexible plug-in extender.

c. Set the power module for the line voltage to be applied (see power module manual) and connect it to the variable autotransformer; connect the autotransformer to the line voltage source. Be sure that the power switch is off.

d. Install the TM 500-series equipment, including the SG 503 into the power module.

e. Connect all test equipment to a suitable line voltage source.

f. Turn on all test equipment and allow at least 20 minutes for the equipment to warm up and stabilize.

Initial Control Settings

Set the following controls during warm-up time:

SG 503

AMPLITUDE MULTIPLIER	X1
FREQUENCY VARIABLE	Midrange
FREQUENCY RANGE (MHz)	REF ≈ .05
OUTPUT AMPLITUDE	5.0

Oscilloscope

Intensity, Focus	Set for well-defined trace and normal brightness.

Differential Comparator

Volts/div	.1 V
Variable	fully clockwise (cal)
+Input	ac
−Input	ac
Bandwidth Limit	5 MHz

Time Base Plug-In

Time/Div	.2 ms
Variable	(cal in)
Triggering	
+Slope	selected
Mode	P-P Auto
Coupling	ac hf rej
Source	Ext
Position	Set so trace starts at left side of graticule.
Magnifier	X1

7L12 Spectrum Analyzer

Frequency	
Center	selected
Coarse	0000
Fine	midrange
10 dB/div	selected
Triggering	
P-P auto	selected
Free Run	selected
Level	midrange
Slope	+
RF dB	50 (on knob)
Reference level	20
Variable	CAL (ccw)
Time/Div	SPECTRUM
Variable	in
Base Line Clipper	ccw
Horiz Pos	midrange
Video Filters	30 kHz
Video Processor	not selected
Auto Phase Locked	on (up)
Freq Span/Div	100 MHz
Hz Resolution	3 MHz (3M)
Variable	Cal
Vert Pos	midrange

ADJUSTMENT PROCEDURE

NOTE

The SG 503 must be terminated into an accurate 50-ohm load for all checks and adjustments. Measure the 50-ohm termination to determine percent of error. A 2% error in termination (1 ohm) will cause amplitude errors of 1%. For example, a 51-ohm termination causes an amplitude error that is 1% high at 50 kilohertz.

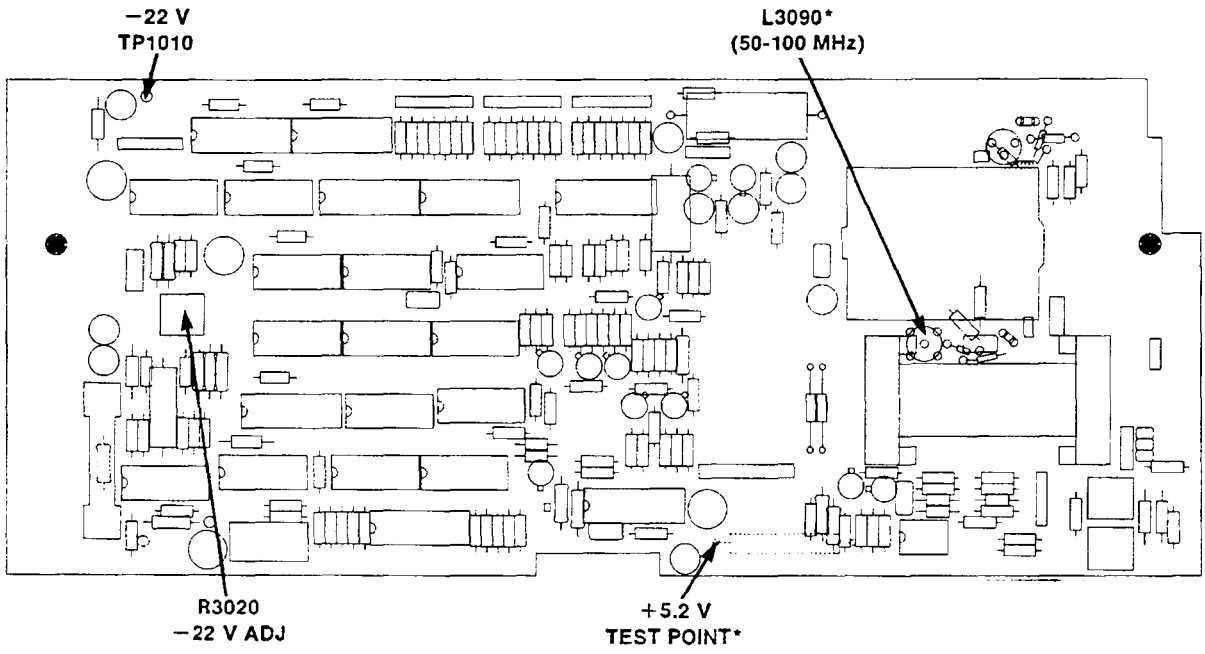


Fig. 3-1. Location of test points, L3090, and −22 volt adjustment.

1. Adjust −22 Volt Power Supply

a. Connect the digital voltmeter between the −22 V test point on the Main circuit board, and chassis ground. See Fig. 3-1 for voltage test point location.

b. Check—for a meter reading of −22 volts, ±50 millivolts.

c. Adjust−−22 V adj, R3020, for a meter reading of −22 volts. See Fig. 3-1 for adjustment location.

d. Adjust the autotransformer output voltage from the low limit to the high limit as indicated in Table 3-2. Meter reading should not vary more than ±50 millivolts. Return the autotransformer to the nominal line voltage setting.

e. Disconnect the digital voltmeter.

Table 3-2

POWER MODULE UNIVERSAL TRANSFORMER

Line Selector Block Position	Regulating Ranges	
	110-Volts Nominal	220-Volts Nominal
L	90 Vac to 110 Vac	180 Vac to 220 Vac
M	99 Vac to 121 Vac	198 Vac to 242 Vac
H	108 Vac to 132 Vac	216 Vac to 264 Vac
Line Fuse Data	1.6 A slow-blow	0.8 A slow-blow

2. Check +5.2 Volt Supply

a. Connect the digital voltmeter between the +5.2 V test point on the Main circuit board, and chassis ground. See Fig. 3-1 for voltage test point location.

b. Check—for meter reading of +5.0 to +5.4 volts.

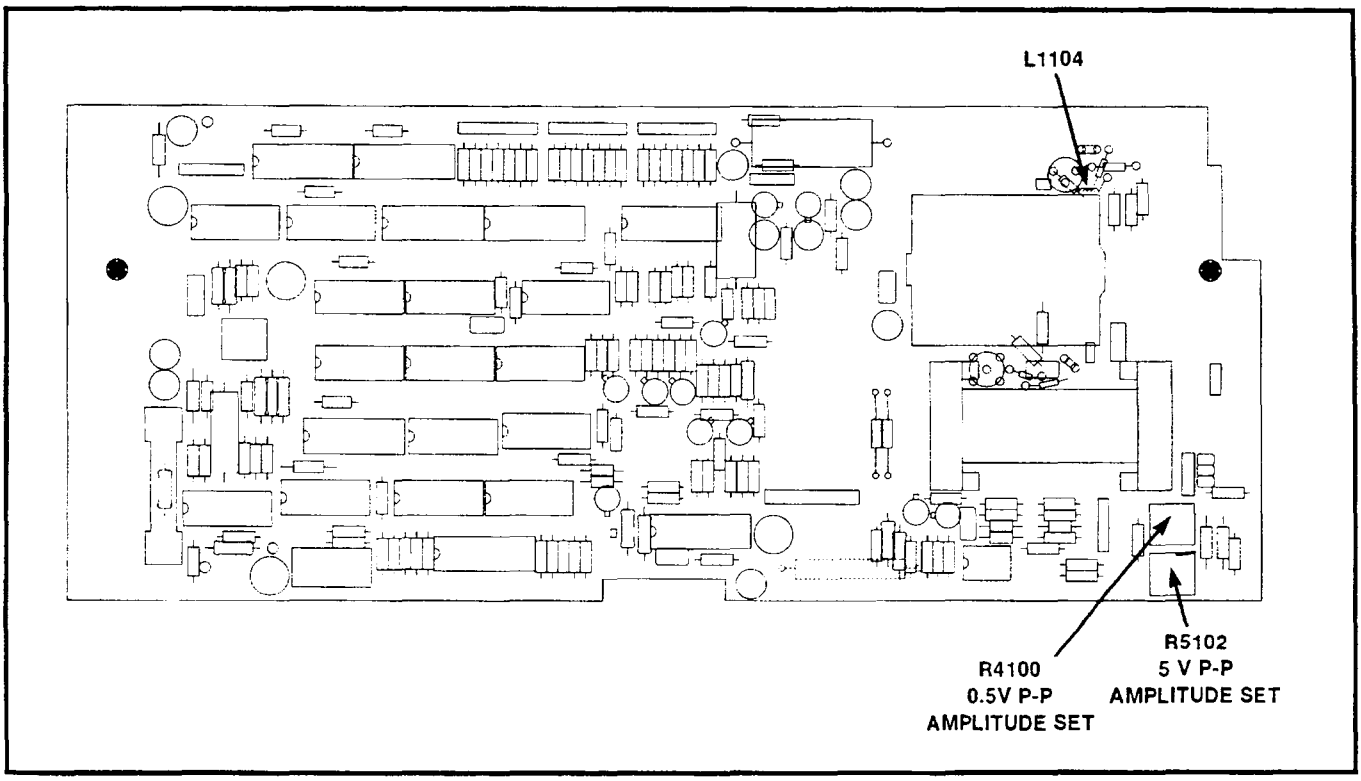


Fig. 3-2. Location of L1104, 0.5 V P-P, and 5 V P-P Amplitude Set.

c. Disconnect the digital voltmeter.

3. Adjust .5 V P-P and 5 V P-P Amplitude Set

a. Connect a 1 kilohertz, 5 volt square-wave signal from the Standard Ampl Output of the calibration generator, through a tee connector, to the + input of the differential comparator, using a 42-inch cable. Connect a 42-inch cable from the tee connector to the time-base external trigger input.

b. Connect the precision 50-ohm cable (supplied with SG 503) to the SG 503 OUTPUT connector.

c. Connect a 50-ohm termination to the remaining end of the precision 50-ohm cable; connect the other end of the 50-ohm termination to the − input of the differential comparator.

d. Set the time-base triggering controls for a stable display; a crt display similar to Fig. 3-3 is obtained.

e. Check—that the corners of the idealized waveform are aligned as illustrated in Fig. 3-3. Disregard waveform tilt.

f. Adjust-5.0 P-P Amplitude Set, R5102, so the corners of the idealized waveform are aligned as illustrated in Fig. 3-3. See Fig. 3-2 for adjustment location.

g. Set the SG 503 OUTPUT AMPLITUDE control to 0.5; reduce the calibration generator output for a 0.5 V, 1 kHz square-wave signal.

h. Set the differential comparator deflection factor for 10 mV/div.

i. Check—that the waveform is similar as illustrated in Fig. 3-3.

j. Adjust-0.5 V P-P Amplitude Set, R4100, so the corners of the idealized waveform are aligned as illustrated in Fig. 3-3. See Fig. 3-2 for adjustment location.

k. Interaction—repeat parts e through j of this step until corners of the idealized waveform are aligned at the 0.5 volt and 5.0 volt settings.

4. Check Amplitude Multiplier Accuracy at 0.05 MHz

a. Set the SG 503 OUTPUT AMPLITUDE control to 5.0 and the AMPLITUDE MULTIPLIER switch to the X.1 position. Note that the FREQUENCY MHz display reads .050.

b. Set the calibration generator for a 0.5 volt, 1 kilohertz square-wave output signal.

c. Check—that the corners of the idealized waveform are not separated by more than 1.5 vertical divisions. See Fig. 3-3 for waveform illustration.

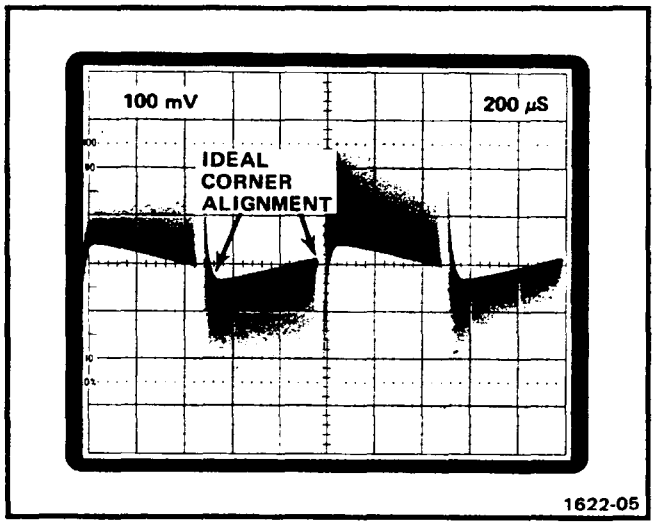


Fig. 3-3. Display of complex waveform (idealized) obtained when the amplitude set controls are properly adjusted at 0.05 MHz.

d. Set the SG 503 AMPLITUDE MULTIPLIER switch to the X.01 position. Do not disturb the SG 503 OUTPUT AMPLITUDE control setting.

e. Set the calibration generator for a 50 millivolt, 1 kilohertz square-wave output signal.

f. Set the differential comparator deflection factor for 1 millivolt/division.

g. Check—that the corners of the idealized waveform are not separated by more than 1.5 vertical divisions. See Fig. 3-3 for waveform illustration.

h. Disconnect all cables and termination.

5. Adjust Output Buffer Current

a. Connect the SG 503 output to the Spectrum Analyzer input, using the precision 50-ohm cable (supplied with the SG 503).

b. Set the SG 503 FREQUENCY RANGE (MHz) switch to the 100-250 range; adjust the FREQUENCY VARIABLE control for a display of 100 megahertz.

c. Position the 0 Hz marker display to the center graticule line with the spectrum analyzer position control. See Fig. 3-5 for reference.

d. Position the fundamental to the top graticule line with the spectrum analyzer vertical position control. See Fig. 3-5 for reference.

e. Slowly adjust the SG 503 OUTPUT AMPLITUDE control over the 0.5 volt to 5.5 volt range in both directions and check for at least 3.5 division vertical separation between the top of the fundamental and the top of the second harmonic display (35 decibels down). See Fig. 3-5 for harmonic reference.

NOTE

It will be necessary to change the spectrum analyzer input attenuation (sensitivity) to maintain a reasonable display on screen, with harmonics above the baseline noise level and within the graticule area.

f. Adjust—Current Adj, R175, for at least 3.5 division vertical separation between the top of the fundamental and the top of the second harmonic display. Repeat part e of this step. See Fig. 3-4 for adjustment location, and Fig. 3-5 for reference.

g. Repeat parts e and f of this step until final adjustment of R175 results in a crt display that shows the vertical separation between the top of the fundamental and second harmonic is at least 3.5 division, and the tops of the remaining harmonics are separated at least 4.0 division.

h. Set the FREQUENCY RANGE (MHz) switch to the 50-100 position; adjust the FREQUENCY VARIABLE control for a display of 100 megahertz.

i. Repeat parts d through g of this step.

6. Check/Adjust Harmonic Suppression

a. Set the SG 503 OUTPUT AMPLITUDE control to 5.5 and the AMPLITUDE MULTIPLIER switch to the X1 position.

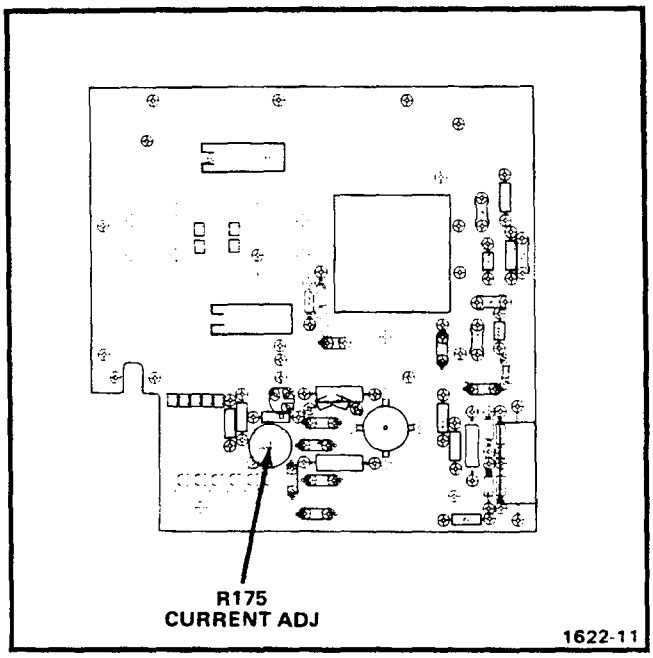


Fig. 3-4. Location of R175 Current Set adjustment.

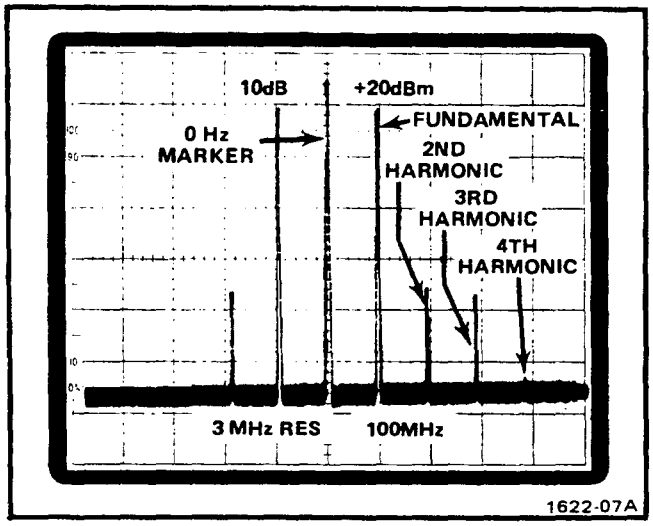


Fig. 3-5. Display of 100 MHz signal and harmonics.

b. Set the SG 503 FREQUENCY RANGE (MHz) switch to the 100-250 range.

NOTE

Adjustment of any coil associated with the oscillator sections is not recommended unless it is definitely proven that the SG 503 does not meet the typical frequency and harmonic suppression requirements as listed in Table 3-1. No coil should be adjusted for more than marginal deviations in frequency range or harmonic suppression. The generation of large harmonic amplitudes or large deviations from the typical frequency range listed in Table 3-1 indicate possible circuit faults, which must be corrected before proceeding further.

c. Position the fundamental to the top graticule line with the spectrum analyzer vertical position control. See Fig. 3-5 for reference.

NOTE

Interaction of the harmonic amplitude display will occur with adjustment of any coil. For example, decreasing the second harmonic amplitude will increase the amplitude of the third harmonic. No attempt should be made to adjust coils to obtain an ideal harmonic display (downward slope from the center frequency); instead, coil adjustments should achieve suppression requirements over the entire over-lapping range.

d. Slowly adjust the SG 503 FREQUENCY VARIABLE control over its entire range and check that the vertical distance (suppression) between the top of the fundamental and second harmonic display is at least 3.5 division, and the tops of the remaining harmonics are separated at least 4.0 division. (Adjust the spectrum analyzer frequency span/div control as necessary to maintain the harmonic display on screen.)

e. Adjust-L1104 (physically moving coil), to meet the suppression requirement as given in part d of this step. See Fig. 3-2 for adjustment location.

f. Set the SG 503 FREQUENCY RANGE (MHz) switch to the 50-100 range.

g. Repeat part d of this step for the remaining frequency ranges, using Table 3-3 as reference. (Suppression limit of 35 decibel down corresponds to 3.5 divisions on the display.) See Fig. 3-6 for adjustment location of coils.

NOTE

All coil adjustments should be adjusted for minimum harmonic amplitude at the high end of the associated range (worst case harmonic conditions). Check that the output remains leveled (display will blink if unleveled condition occurs) as the SG 503 FREQUENCY VARIABLE control is slowly rotated over its associated frequency range.

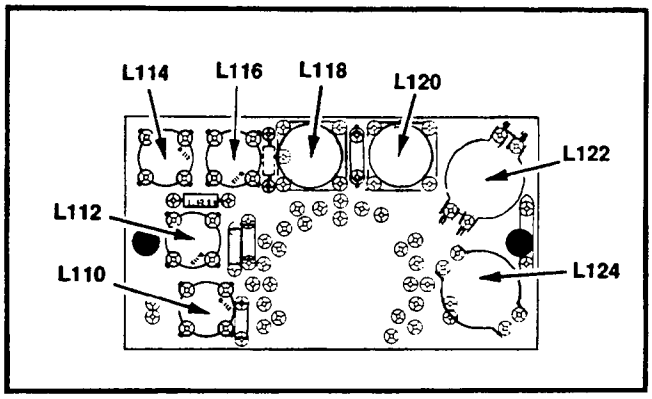


Fig. 3-6. Location of oscillator coils.

Table 3-3

SG 503 FREQUENCY RANGE (MHz)	SG 503 FREQUENCY VARIABLE Typical Displayed Count (Frequency Range)[a]	SG 503 Coil Adjustment
100 - 250	97.5 - 260	L1104, air core
50 - 100	41.0 - 109	L3090, slug tuned
25 - 50	23.7 - 52.5	L110, slug tuned
10 - 25	9.09 - 27.3	L112, slug tuned
5 - 10	4.70 - 11.1	L114, slug tuned
2.5 - 5	2.30 - 5.50	L116, slug tuned
1 - 2.5	.950 - 2.55	L118, pot core, fixed
.5 - 1	.480 - 1.05	L120, pot core, fixed
.25 - .5	.240 - .520	L122, pot core, fixed
REF ≈ .05	.049 - .051	L124, pot core, fixed

[a]The minimum and maximum displayed count on each range will vary slightly between instruments.

h. Set the SG 503 AMPLITUDE MULTIPLIER to X.1.

i. Increase the spectrum analyzer input sensitivity by a factor of 10.

j. Repeat parts b, c, d, f, and g of this step, checking that the vertical distance between the top of the fundamental and the second harmonic display is at least 3.3 divisions (33 db); the tops of the remaining harmonics are separated at least 3.8 divisions.

k. Disconnect the cable from the spectrum analyzer.

7. Check Flatness (Peak-to-Peak Amplitude Regulation)

a. Set the SG 503 controls as follows: FREQUENCY RANGE (MHz) switch to REF ≈ .05 position, and the AMPLITUDE MULTIPLIER switch to X1.

b. Connect a 2.4 megohm, 5% resistor across the digital voltmeter floating input terminals. Connect the SG 503 via the precision cable (012-0482-00) and the bnc female-to-GR adapter to the input of the peak-to-peak detector. Use two bnc to banana-plug-jack patch cords to connect the output of the peak-to-peak detector to the floating input terminals on the digital voltmeter; maintain correct polarity, HI to + and LO to −. Set the digital voltmeter to the 20 volts dc range.

c. Slowly adjust the SG 503 OUTPUT AMPLITUDE VOLTS P-P control until the digital voltmeter display indicates ±.000. Output amplitude from the SG 503 should be about 1.1 to 1.2 volts; this establishes a 0.0% reference setting at .050 megahertz.

d. Slowly adjust the SG 503 FREQUENCY VARIABLE control over its entire range at each of the frequency range positions of the FREQUENCY RANGE (MHz) switch.

e. Check—the flatness deviation from 0.25 megahertz to 50 megahertz, must be within 1% of the value at .050 megahertz. The total percentage deviation calcuation must include the digital voltmeter reading and the calibration factor of the peak-to-peak detector. For example, a

reading of +.008 volt on the digital voltmeter is equivalent to +0.8% deviation. Applying a correct factor of −0.3% results in a total percentage deviation of +0.5%.

f. Check—the flatness deviation from 50 megahertz to 100 megahertz, must be within 1% of the value at .050 megahertz. The same calculation must be considered for this deviation reading as described in part e of this step.

NOTE

A 1% total percentage deviation ensures flatness performance requirement when the SG 503 is operating at the X.1 and X.01 AMPLITUDE MULTIPLIER switch positions.

g. Check—the flatness deviation from 100 megahertz to 250 megahertz, must be within 3% of the value at .050 megahertz. The same calculation must be considered for this deviation reading as described in part e of this step.

h. To check the flatness deviation at a higher voltage output from the SG 503, insert two 2X attenuators between the SG 503 cable and the peak-to-peak detector. Repeat part c of this step to obtain another 0.0% reference reading for approximately 4.7 volts output from the SG 503.

i. After obtaining the new 0.0% reference indication on the digital voltmeter, repeat parts e and f of this step to check flatness deviation for approximately 4.7 volts output from the SG 503. Tolerance limits are the same as in parts e and f of this step.

j. Disconnect all cables from the SG 503.

This completes the Adjustment procedure of the SG 503 Leveled Sine Wave Generator.

MAINTENANCE AND INTERFACING INFORMATION

Preventive Maintenance

There are no special preventive maintenance procedures that apply to the SG 503. Refer to the power module instruction manual for general preventive maintenance procedures and instructions.

Corrective Maintenance

Refer to the power module instruction manual for general corrective maintenance procedures and instructions.

System Maintenance

System maintenance procedures are provided in the power module manual; i.e., preventive maintenance, troubleshooting aids, parts removal and replacement procedures, parts ordering information, etc.

In certain areas in this instrument, it is not recommended to use a suction type desoldering tool when repairing or replacing parts. Use a soldering wick when removing or replacing oscillator coils or the Output Buffer Amplifier (Q190).

Oscillator Maintenance

The oscillcator sections can be checked out independent of the leveling circuitry (feedback loop) by removing Q4081 and connecting a 500-ohm potentiometer between the socket pins for the collector and emitter.

When replacing components for the oscillator sections be certain that they are as close to the original mechanical layout as possible. Lead length for the transistor, Q3090 and Q1090 should be 0.2 inch. Replace the heat sinks as originally installed (flush with the top of the transistor case). Do not allow any heat sink to touch any other part or the chassis. Distributed capacity from Q1090 heat sinks to surroundings determines the upper frequency limit on the 100-250 megahertz range.

The air-core coil for the 100-250 megahertz range should not need adjustment or repair. If it becomes necessary to perform a repair in this area, use extreme caution and do not break or damage the 50 nanofarad disc capacitor that grounds one end of the coil to the variable capacitor.

Replacing Output Buffer Amplifier

WARNING

The ceramic portions of power transistor Q190 contain BERYLLIUM OXIDE as a major ingredient. Beryllium Oxide heat sinks are safe under most conditions. The only hazard is that a toxic effect may occur if fumes or fine particles are inhaled. Grinding, crushing, or heating above 1800° F can produce fumes or fine particles. Avoidance of such action and subsequent inhalation will assure the absence of any hazard. No hazard is present in normal instrument operation or maintenance.

The Output Buffer Amplifier power transistor (Q190) can be replaced without removing the Attenuator-Output Buffer Amplifier circuit board by unsoldering the leads and removing a 5/16 nut on the mounting stud. Cut the leads of the new transistor to the proper length, keeping note of the position of the collector lead. Apply Dow Corning 4 silicone compound on the under surface of the transistor and about two threads of the mounting stud. Use a very small amount and avoid placing silicone compound on the transistor leads or on the ceramic case. Orient the collector lead toward the rear of the instrument. Seat the transistor to its heat sink and tighten the 5/16 nut on the mounting stud. For efficient heat sinking, the maximum torque for first time replacement should be 6 and 1/2 inch-pounds and 5 inch-pounds for repeated installation of the same transistor. When resoldering the transistor leads to the circuit board, avoid large amounts of solder which may flow through the circuit board holes.

Removal and Replacement of Attenuator-Output Buffer Circuit Board

Remove metal shield cover for the attenuators. The circuit board is held in place by six screws. Four corner screws hold this circuit board to the main board and two counter-sunk screws hold the Output Buffer Amplifier heat sink bracket to the side rail of the chassis. For removal of this board, it may be necessary to loosen the screws holding the main circuit board to the same side rail so that the heat-sink bracket can be withdrawn.

NOTE

Do not loosen the three nuts that hold the heat sink bracket to the circuit board. If it becomes necessary to remove this heat sink from the circuit board it is important to reinstall the three 35-mil washers and plastic insulation between the heat sink and the under side of the board.

When replacing the Attenuator-Output Buffer circuit board, ensure that all pin connections from the main circuit board are aligned and seated properly. Install the six screws, but do not tighten. The two counter-sunk screws on the chassis side rail must be tightened first in order to ensure efficient heat transfer and minimum stress. Tighten the main circuit board screws, and then tighten the four Attenuator-Output Buffer Amplifier circuit board screws last. Replace metal shield.

Alignment of FREQUENCY RANGE (MHz) Control

If it becomes necessary to remove this knob from the front panel, or if it becomes loose on the shaft of the high frequency cam switch, alignment upon reinstallation is accomplished by setting the cam switch on the 50-100 megahertz range. This position can be noted by observing when the three switch contacts on the main circuit board first open when rotating the shaft clockwise.

Selected Component Criteria

If the 0.5-1.0 MHz frequency range is outside the specified range, C118 may be selected to raise or lower the frequency range. Optimum value is normally 33 pF, with 20 pF to 47 pF as upper and lower limits. An increase in capacitance will lower the frequency.

Resistor R118 is selected for oscillator stability (e.g., the oscillator may break in and out of oscillation). The nominal value is approximately 470 Ω, with a range of values from 300 Ω to 1 kΩ.

Resistor R116 is also selected for oscillator stability with the same range of values as R118.

Resistor R177 is selected for improved oscillator leveling at 250 MHz. If the oscillator at 250 MHz has an unleveled output, a 10 Ω resistor may be installed between the Main Board (A1) and the Attenuator-Output Buffer Board (A3). The only choice for R177 is either a 10 Ω resistor or no resistor at all.

Troubleshooting

Use the Performance Check, Adjustment Procedure, and Circuit Description as aids to locate trouble in the event of equipment failure. The test equipment listed in the Performance Check and Adjustment Procedure will prove useful in troubleshooting the SG 503.

REPACKAGING FOR SHIPMENT

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. Include complete instrument serial number and a description of the service required.

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

Surround the instrument with polyethylene sheeting to protect the finish of the instrument. Obtain a carton of corrugated cardboard of the correct carton strength and having inside dimensions of no less than six inches more than the instrument dimensions. Cushion the instrument by tightly packing three inches of dunnage or urethane foam between carton and instrument, on all sides. Seal carton with shipping tape or industrial stapler.

The carton test strength for your instrument is 200 pounds.

CIRCUIT DESCRIPTION

Introduction

This section of the manual contains a description of the circuitry used in the SG 503 Leveled Sine Wave Generator. Individual descriptions are separated into the following parts: Oscillator Circuits, Output Buffer Amplifier and Filter, Leveling Circuitry, Display Flash Multivibrator, 50 Ohm Wideband Attenuators, and Power Supplies. Diagrams 1 and 2 are segmented with gray-tint blocks according to circuit function. Circuit block titles correspond to those listed in the Block Diagram. Refer to appropriate diagrams in the Diagrams section of this manual while reading the circuit description.

Oscillator Circuits ◇1◇4

Both oscillator sections, Q3090 and Q1090 are common-base Hartley configurations with inductive feedback (tapped coils for each frequency range). Amplitude control is accomplished by varying the dc emitter currents. Q4081 operates as a variable current source, with its collector current controlled by the output of operational amplifier U5090.

The oscillators operate in a non-linear mode (Class C) and the collector current for Q3090 or Q1090 is a series of pulses at the operating frequency. This series of pulses contain a large number of harmonics and a high Q parallel resonant tank circuit is required to obtain a good sine wave output. The tapped coils allow the highest possible operating Q factor at a given supply voltage and collector-base breakdown rating for the transistors. Spurious oscillations are reduced by the L/R combinations in the collector lead for each transistor.

For those coils that have tuning slugs, the slug position determines the inductance, coupling between windings (leakage inductance) and the Q factor for the oscillating circuit. All of the above factors combine to determine the frequency range, harmonic suppression and maximum available output amplitude.

Output Buffer Amplifier and Filter ◇1

Signals from the oscillator sections are applied via a 100 ohm strip line to the base of Q190. The output of Q190 feeds a low-pass filter which has a cut-off frequency of about 300 megahertz.

Harmonic distortion is generated in the oscillator circuits and also in the Output Buffer Amplifier. At low frequencies, the Output Buffer Amplifier is practically ideal and contributes negligible distortion. However, at higher frequencies distortion increases and becomes more critically dependent on the collector current operating point for Q190. By choosing a frequency where the oscillator signal is fairly clean, most of the observed distortion will be due to the Output Buffer Amplifier. The collector current can then be set for minimum distortion by the adjustment of R175. Distortion is also somewhat dependent on the drive level to Q190. The final adjustment of R175 should result in minimum distortion over the full amplitude range from 0.5 volt to 5.5 volts, establishing a collector current operating point which falls in the 80 to 110 milliamp range.

Leveling Circuitry ◇1

The leveling circuitry is composed of a reference voltage divider, a hybrid peak-to-peak detector, temperature compensation diodes CR216-CR218, and error amplifier U5090 with its associated components.

The major components of the hybrid peak-to-peak detector (U225) are diodes CR225A and CR225B with their associated storage capacitors, C225A and C225B, coupling capacitor C225C and output resistor R225A. The peak-to-peak detector produces a dc output across C225A and C225B that is approximately equal to the peak-to-peak voltage at the leveling point (junction of C225C and R225A).

To aid in understanding operation of the peak-to-peak detector, assume perfect diodes, 10 volts peak-to-peak at the leveling point and the reference voltage (set by R260) disconnected. C225A would charge by normal rectifier action to −5 volts dc and C225B to +5 volts dc. If the reference voltage level set by R260 is −10 volts and now applied to C225A (series opposing) the dc levels on C225A, C225B and coupling capacitor C225C will shift by an amount equal to one half the peak-to-peak amplitude at the leveling point. There will now be zero volts dc across C225B, −10 volts dc across C225A, and coupling capacitor C225C will be charged to −5 volts dc. The sinewave at the junction of the two diodes is now centered at −5 volts dc. For an actual complete circuit with non-ideal diodes, the potential difference between C225A and C225B is about equal to the peak-to-peak amplitude at the leveling point.

Because the reference voltage and the dc output of the peak-to-peak detector are connected series opposing, any algebraic difference between these two voltages will be applied to the input of error amplifier U5090. When the generator output is leveled, equal dc potentials (about −.7 volt dc) exist at the − and + input terminals of U5090 and the system is stabilized.

If the peak-to-peak output amplitude from an oscillator section changes for any reason, a corresponding change in detetector output produces an error signal at the − input terminal of U5090 which is converted into a collector current change in Q3090 or Q1090 in such a direction to restore the original peak-to-peak amplitude at the leveling point.

The high-gain leveling system (closed loop) establishes a steady state impedance point at the junction of C225C and R225A which approaches zero ohms. R225A, therefore, sets the generators output impedance and reverse terminates a 50 ohm coaxial cable.

CR200, CR202, VR200 and VR202 reduce transients which can be caused by sudden load changes, while R5100, R5101, CR4090 and CR4092 reduce switching transients when changing frequency ranges.

Display Flash Multivibrator 

Q1071 and Q1070 with their associated components, is a multivibrator circuit that is held in a normally stable state as long as the sine-wave output amplitude is leveled. If the output is not leveled, pin 6 of U5090 swings positive with repect to ground and turns on CR4094. The multivibrator then operates as an astable circuit with a period of about 2 hertz. The waveform at the collector of Q1070 is applied to pins 6 and 7 of U3051 (State Generator). This signal causes binary zeros to be supplied to the Display Drivers, which turns off the display. The result is a visible flashing of the front panel LED display.

50 Ohm Wideband Attenuators 

In the X1 position of the AMPLITUDE MULTIPLIER switch, the output signal bypasses the hybrid chip attenuators.

The hybrid chip attenuators (R245 and R240) are labeled on the circuit board as 'X.1 & X.01' and 'FIRST ÷ 10, X.01'.

In the X.1 position of the AMPLITUDE MULTIPLIER switch, R245 divides the generators output by 10.

In the X.01 position of the AMPLITUDE MULTIPLIER switch, R240 divides the generators output by 10 and then R245 divides again by 10 for a total division of 100.

In the X.1 and X.01 positions of the AMPLITUDE MULTIPLIER switch, the 50 ohm attenuators provide additional isolation between the oscillators and a large mismatched load.

Auto-Ranging Counter 

The input circuit to the Auto-Ranging Counter is through emitter-follower Q3060, which provides a low impedance drive to Q3062. Transistors Q3062, Q3061 and Q3064, Q3063 form a dual-differential amplifier that provides high gain in two stages. R3062, R3060 and R3067, R3085 are the constant-current sources for the respective amplifier, while C3064 and C3063 serve to stabilize the operating points of the amplifiers. The output signal amplitudes on pins 6 and 7 are constant-amplitude square waves, regardless of the input amplitude to Q3060.

A 1-volt peak-to-peak square-wave signal from Q3063 is applied to a divide-by-8 prescaling circuit consisting of U4060, U5040A and U5040B (each IC divides by 2) and to the base of Q4050. The positive-going edge of the signal at pin 7 of U4060 and the negative-going edge of the signal at the base of Q4050 are significant to the counting operation. Signal prescaling does not occur for the 50 kilohertz reference frequency or for other frequencies up to and including .999 megahertz.

A self-biasing arrangement is provided for U4060 to ensure that the input bias level on pin 7 is always centered in the hysteresis window. The average of the complementary outputs on pins 2 and 3 is obtained from the junction of R4051 and R4050 and fed back to pin 7 through L4061 and R4063 to automatically compensate for any internal temperature drift.

Four counters, U1020, U1031A, U1031B and U1030A are used for the counting process, but only three decimal digits are displayed on the front panel after the bcd data has been decoded by the bcd-to-Seven Segment Decoder Drivers. U1020 frequency divides the input by 10 and its output is used to round off the count held in the remaining counters, allowing a more accurate three-digit display.

The 1 MHz reference clock circuit, U4030A and U4030B with inverter U4030D, drives U4040, which produces two functions. Frequency division by 16 and frequency division by 2 produces a clock signal with a period of 16 microseconds on pin 11 and a clock signal with a period of 2 microseconds on pin 12.

U4050B, U4050C, U4050D, and U4030C are positive NAND gates. The logic levels at pin 5 of U4050B and pin 10 of U4030C determine whether a clock signal with a period of 16 microseconds or 2 microseconds appears at the output of U4050D. These logic levels are determined by the output level of positive NAND gate U4050C and inverter U4050A.

When the FREQUENCY RANGE (MHz) control is in the REF approx .05 position, pin 1 of U3040A and pin 13 of U3040B are held LO (=0) by the closure of S3090-2. This clears U3040A and U3040B and sets both Q terminals (pin 6 of U3040A dn pin 8 of U3040B) to a HI (=1) level. A HI level is established on pins 9 and 10 of U4050C, setting its output to a LO level. A LO on pin 5 of U4050B locks out the clock signal with a 16 microsecond period, while the HI level on pin 10 of U4030C allows the 2 microsecond clock to be gated through to the output of U4050D.

The HI level on pin 10 of U4030C is also transmitted through VR4050 reverse biasing CR4050 and disabling the divide-by-8 signal prescaling circuitry. The 50 kilohertz signal is then processed by Q4050 and Q3050 with the posi--tive-going edge of the signal at pin 1 of U3050A significant to counting operation only during the time that pin 2 of U3050A is HI (gating signal).

For 50 kilohertz counting, the 10^{-1} decimal source point (anode of VR4050) is always HI and the 2 microsecond clock signal is frequency divided by 100 by Gate Time Clock Dividers U3031 and U1030B. Positive AND gates of U3041 are clocked out due to the LO levels set at the output of inverting input AND gates of U3030B, U3030C and U3030D. With pins 9 and 11 of U3041B set to a HI level by the Q terminals of U3040A and U3040B, a 2000 microsecond clock signal is gated through U3041 and U1032C to pin 1 of U3051.

(Refer to Fig. 5-1 for waveform time relationships involved with the State Generator circuits.) If the leveling circuitry is operating properly, a HI level is set on pins 6 and 7 of U3051, allowing it to count. U3051 frequency divides by 5 from pin 1 to pin 11 and frequency divides by 2 from pin 14 to pin 12. This frequency division produces a signal with a period of 20 milliseconds at pin 12. The square wave signal (50% duty cycle) on pin 12 is the reference waveform from the counting period, display time and counter reset time.

The square-wave signal on pin 12 of U3051 is applied through inverter U2050A to pin 2 of positive NAND gate U3050A with the positive half of the square wave acting as a gating signal that allows the counters to count for 50% of the total period (10 milliseconds for 50 kilohertz counting).

If the sign wave output amplitude from the SG 503 is not leveled, pins 6 and 7 of U3051 go negative at an approximately 2 hertz rate. The result is a blinking front panel display because U3051 is cleared to zero. Zeros supplied to pin 10 of the Display Drivers (U1040, U1050 and U1060) causes them to blank the display for about 0.25 second.

The Auto Ranging circuits operate when S3090-2 is open to change the output levels of U4050C, U3030B, U3030C, and U3030D at the proper time to set the decimal point in its proper location and to select the proper gate time intervals for the counting, display, and reset process.

Only one decimal point shift (from .999 megahertz to 1.00 megahertz) will be discussed as the operation is similar for other decimal point shifts. Overflow Detector U2030A detects when it is necessary to shift the decimal point as frequency is increased, while U2030B detects when it is necessary to shift the decimal point as frequency is decreased.

U3040A and U3040B operate as a 4-bit shift register (memory). Exclusive−OR gates U2040A and U2040B act as control devices to determine whether the register shifts right or left to produce the proper output data, thereby speeding up the Auto Ranging process.

Frequencies from .250 megahertz up to and including .999 megahertz do not cause the output data from U3040A and U3040B to change state. Consequently, the output level of U4050C remains LO for these frequencies and the gatin signal at pin 12 of U3051 is the same as for 50 kilohertz counting.

When U1031B and U1030A contain binary data equivalent to decimal 99, the next input count to U1031A causes pin 9 of U1031B to go negative and triggers U2030B to force pin 9 of U2030B to a HI (=1). When U1031A and U1030A contain binary data equivalent to decimal 999, the next input count to U1031A causes pin 7 of U1030A to go negative and triggers U2030A to force pin 13 of U2030A to a LO (=0). At the transition point from .999 megahertz to 1.00 megahertz, U2030B and U2030A have been triggered and set.

A HI on pin 9 of U2030B along with a HI on pin 6 of U3040A and a LO on pin 9 of U3040B results (through the action of U2040A and U2040B) in a HI (=1) being transferred to the D input terminal (pin 2) of U3040A and a LO (=0) to the D input terminal (pin 12) of U3040B. Pin 5 of U3050B (Auto Range Clock Enable) has also been set to a HI through the action of U3050D.

On the next Auto Range Clock signal from U3030A, pin 6 of U3050B goes LO and this negative transition triggers both U3040A and U3040B, transferring the data from the D terminals to the Q terminals. After data transfer, pin 6 of U3040D will be LO (=0) and pin 5 will be a HI (=1); pin 9 of U3040B will be a LO (=0) and pin 8 will be a HI (=1). These logic levels are decoded by U4050C, U3030B, U3030C and U303D to shift the decimal point one place to the right, select the proper gating signal from the Gate Time Clock Dividers, and enables the signal prescaling circuitry.

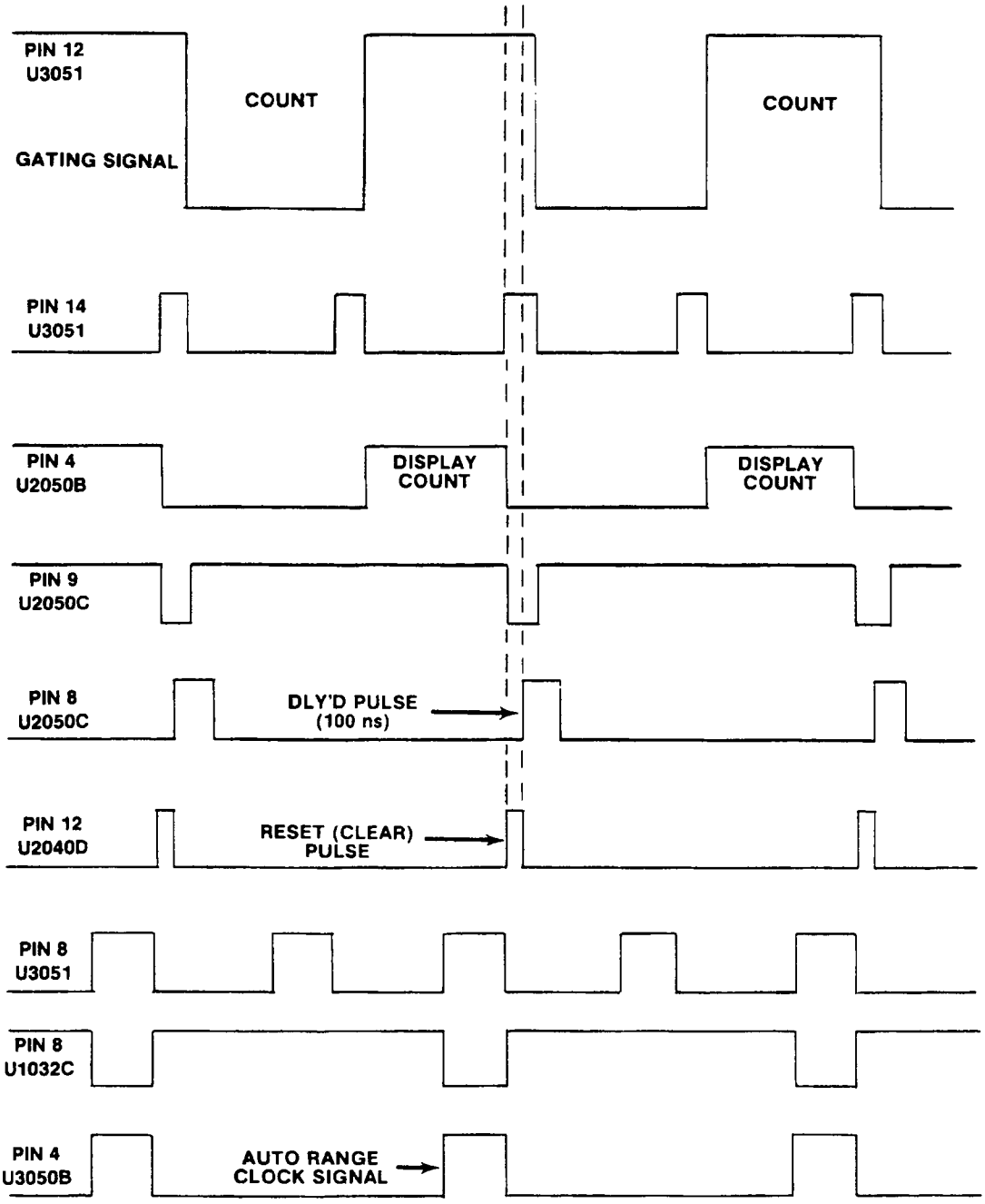


Fig. 5-1. State Generator waveform time relationship.

For the logic levels given, the 2 microsecond clock signal is locked out from U4030C and the 16 microsecond clock signal is gated through to the output of U4050D. After frequency division by 100, a 1600 microsecond signal is gated through U3041 to appear at pin 1 of U3051. The output of U450B is HI and all other decoding gate output levels are LO. Although new gate time intervals are selected for Auto Ranging, the waveform time relationships remain the same as illustrated in Fig. 5-1.

Due to the change from a HI to a LO on pin 6 of U3040A, the output level of U2040B goes HI during the count interval. The output of U2030A is now at a HI level because it was reset by the clear pulse and not triggered during count time. This results in a LO level at pin 5 of U3050B which locks out the Auto Ranging clock signal, preventing U3040A and U3040B from being triggered. U3040A and U3040B will not change their output data unless it again becomes necessary to change the decimal point location.

For the next decimal point shift (for example, from 9.99 megahertz to 10.0 megahertz), the same sequence of events occur with Exclusive-OR gates U2040A and U2040B sensing the previous output data of the 4-bit register. The proper binary code is then set at the outputs of U3040A and U3040B (when triggered by the Auto Ranging clock signal) to shift the decimal point one more place to the right. U3041 pin 3 is enabled by the output level of U3030C going HI and a 160 microsecond clock signal is gated through to pin 1 of U3051.

Power Supplies 

The −22V supply is provided by U2020, a three terminal regulator. Pin 1 is the feedback and adjustment, pin 2 the power supply source and pin 3 the output. With ground as a reference, R2020, R2021 and R3020 form a divider to supply feedback to pin 1.

The +5V supply is referenced to the −22V supply with the reference voltage point established at pin 4 of U4020 by voltage divider R3021, R3022 and R3023. This reference level is about +2.6 volts. In a quiescent state, the voltage on pin 5 of U4020 is also about +2.6 volts. If the +5 volt output level goes more positive, the voltage change appears at pin 4 of U4020. This change is inverted and reflected on pin 10, causing the series of pass transistor to conduct less, returning the output level to +5 volts. Pin 2 and pin 3 of U4020 provide current limiting. When the load draws enough current to drop approximately .6 V across R4022, the internal transistor in U4020 turns on which turns off the output at pin 10. CR4030 prevents the +5 volt supply from going more negative than about -0.7 volts if F4010 opens.

OPTIONS

(No options available at this time.)

REPLACEABLE ELECTRICAL PARTS

PARTS ORDERING INFORMATION

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

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

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

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

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.

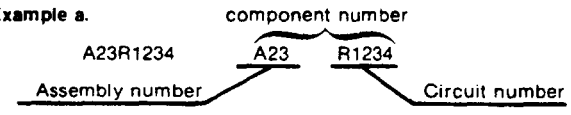
ABBREVIATIONS

Abbreviations conform to American National Standard Y1.1.

COMPONENT NUMBER (column one of the Electrical Parts List)

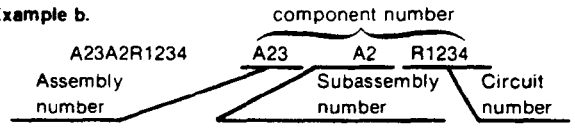
A numbering method has been used to identify assemblies, subassemblies and parts. Examples of this numbering method and typical expansions are illustrated by the following:

Example a.



Read: Resistor 1234 of Assembly 23

Example b.



Read: Resistor 1234 of Subassembly 2 of Assembly 23

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 number. Assembly numbers are also marked on the mechanical 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 manufacturers part number.

CROSS INDEX - MFR. CODE TO MANUFACTURER

Mfr Code	Manufacturer	Address	City, State, Zip Code
00779	AMP INC	2800 FULLING MILL PO BOX 3608	HARRISBURG PA 17105
00853	SANGAMO WESTON INC COMPONENTS DIV	SANGAMO RD PO BOX 128	PICKENS SC 29671-9716
01121	ALLEN-BRADLEY CO	1201 SOUTH 2ND ST	MILWAUKEE WI 53204-2410
01295	TEXAS INSTRUMENTS INC SEMICONDUCTOR GROUP	13500 N CENTRAL EXP PO BOX 655012	DALLAS TX 75265
03508	GENERAL ELECTRIC CO SEMI-CONDUCTOR PRODUCTS DEPT	W GENESEE ST	AUBURN NY 13021
04222	AVX CERAMICS DIV OF AVX CORP	19TH AVE SOUTH P O BOX 867	MYRTLE BEACH SC 29577
04713	MOTOROLA INC SEMICONDUCTOR PRODUCTS SECTOR	5005 E MCDOWELL RD	PHOENIX AZ 85008-4229
05397	UNION CARBIDE CORP MATERIALS SYSTEMS DIV	11901 MADISON AVE	CLEVELAND OH 44101
05828	GENERAL INSTRUMENT CORP GOVERNMENT SYSTEMS DIV	600 W JOHN ST	HICKSVILLE NY 11802
07263	FAIRCHILD SEMICONOUCTOR CORP NORTH AMERICAN SALES SUB OF SCHLUMBERGER LTD MS 118	10400 RIDGEVIEW CT	CUPERTINO CAW CA 95014
07716	TRW INC TRW IRC FIXED RESISTORS/BURLINGTON	2850 MT PLEASANT AVE	BURLINGTON IA 52601
09922	BURNDY CORP	RICHARDS AVE	NORWALK CT 06852
13454	SHITEHALL CORP CRYSTEK CRYSTALS CORP DIV	2371 CRYSTAL DR PO BOX 6135	FT MYERS FL 33906
14433	ITT SEMICONDUCTORS DIV		WEST PALM BEACH FL
19701	MEPCO/CENTRALAB A NORTH AMERICAN PHILIPS CO	P O BOX 760	MINERAL WELLS TX 76067-0760
22526	DU PONT E I DE NEMOURS AND CO INC DU PONT CONNECTOR SYSTEMS DIV MILITARY PRODUCTS GROUP	515 FISHING CREEK RD	NEW CUMBERLAND PA 17070-3007
24546	CORNING GLASS WORKS	550 HIGH ST	BRADFORD PA 16701-3737
27014	NATIONAL SEMICONDUCTDR CORP	2900 SEMICONDUCTOR DR	SANTA CLARA CA 95051-0606
32159	WEST-CAP ARIZONA	2201 E ELVIRA ROAD	TUCSON AZ 85706-7026
32997	BOURNS INC TRIMPOT DIV	1200 COLUMBIA AVE	RIVERSIDE CA 92507-2114
50434	HEWLETT-PACKARD CO OPTOELECTRONICS DIV	370 W TRIMBLE RD	SAN JOSE CA 95131
51642	CENTRE ENGINEERING INC	2820 E COLLEGE AVE	STATE COLLEGE PA 16801-7515
52648	PLESSEY TRADING CORP PLESSEY OPTOELECTRONICS AND MICROWAVE	1641 KAISER AVE	IRVINE CA 92714-5703
52763	STETTNER ELECTRONICS INC	6135 AIRWAYS BLVD PO BOX 21947	CHATTANOOGA TN 37421-2970
54473	MATSUSHITA ELECTRIC CORP OF AMERICA	ONE PANASONIC WAY PO BOX 1501	SECAUCUS NJ 07094-2917
54583	TDK ELECTRONICS CORP	12 HARBOR PARK DR	PORT WASHINGTON NY 11550
55680	NICHICON /AMERICA/ CORP	927 E STATE PKY	SCHAUMBURG IL 60195-4526
56289	SPRAGUE ELECTRIC CO WORLD HEADQUARTERS	92 HAYDEN AVE	LEXINGTON MA 02173-7929
57668	R-OHM CORP	16931 MILLIKEN AVE	IRVINE CA 92713
75042	TRW INC TRW ELECTRONIC COMPONENTS IRC FIXED RESISTORS PHILADELPHIA DIV	401 N BROAD ST	PHILADELPHIA PA 19108-1001
75915	LITTELFUSE TRACTOR INC SUB TRACTOR INC	800 E NORTHWEST HWY	DES PLAINES IL 60016-3049
76493	BELL INDUSTRIES INC JW MILLER DIV	19070 REYES AVE PO BOX 5825	COMPTON CA 90224-5825
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON OR 97077
K0099	JACKSON BROTHERS (LONDON) LTD	258 BROADWAY	NEW YORK NY 10007
TK1263	PERMAG SIERRA CORP	1159 SONORA CT	SUNNYVALE CA 94086
TK1345	ZMAN AND ASSOCIATES	7633 S 180TH	KENT WA 98032
TK2042	ZMAN AND ASSOCIATES	7633 S 180TH	KENT, WA 98032

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A1	672-0232-02			CIRCUIT BD ASSY:BAND SW	80009	672-0232-02
A1A1	671-0338-02			CIRCUIT BD ASSY:MAIN (AVAILABLE ONLY AS 672-0232-02(SEE A1 REPL)	80009	671-0338-02
A1A2	670-2983-02			CIRCUIT BD ASSY:COIL	80009	670-2983-02
A3	670-3073-04			CIRCUIT BD ASSY:ATTENUATOR	80009	670-3073-04
A4	671-0339-00			CIRCUIT BD ASSY:DISPLAY	80009	671-0339-00
A1	672-0232-00			CIRCUIT BD ASSY:BAND SW	80009	672-0232-00
A1A1	671-0338-00			CIRCUIT BD ASSY:MAIN (AVAILABLE ONLY AS 672-0232-02(SEE A1 REPL)	80009	671-0338-00
A1A1C1010	290-0920-00			CAP,FXD,ELCTLT:33UF,+50-20%,35WVDC	55680	UVX1H330MPA
A1A1C1011	290-0779-00			CAP,FXD,ELCTLT:10 UF +50% -10%,50VDC	56289	502D237
A1A1C1020	281-0775-00			CAP,FXD,CER DI:0.1UF,+/-1PF 50V	04222	MA205E104MAA
A1A1C1030	281-0775-00			CAP,FXD,CER DI:0.1UF,+/-1PF 5W	04222	MA205E104MAA
A1A1C1031	281-0775-00			CAP,FXD,CER DI:0.1UF,+/-1PF,5W	04222	MA205E104MAA
A1A1C1070	281-0773-00			CAP,FXD,CER DI:0.01UF,10%,100V	04222	MA201C103KAA
A1A1C1071	290-0891-00			CAP,FXD,ELCTLT:1UF,+75 -10%,50V	55680	U1A1H010TEA
A1A1C1072	281-0773-00			CAP,FXD,CER DI:0.011UF,10%,100V	04222	MA201C103KAA
A1A1C1080	290-0920-00			CAP,FXD,ELCTLT:33UF+50-20%,35WVDC	55680	UVX1H330MPA
A1A1C1081	290-0891-00			CAP,FXD,ELCTLT:1UF,+75 -10%,50V	55680	U1A1H010TEA
A1A1C1090	283-0353-00			CAP,FXD,CER DI:0,1UF,10%,50V	04222	12105C104KA2075
A1A1C1100	283-0299-00			CAP,FXD,CER DI:51PF,5%,500V	51642	200-500-NP0-510J
A1A1C1101	281-0798-00			CAP,FXD,CER DI:51PF,1%,10W	04222	MA101A510GAA
A1A1C2020	290-0755-00			CAP,FXD,ELCTLT:100UF,+50%-20%,10WVDC	54473	ECE-A10V1001
A1A1C2030	281-0775-00			CAP,FXD,CER D1:0.1UF,+/-1PF,50V	04222	MA205E104MAA
A1A1C2040	283-0177-00			CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR302E105ZAATR
A1A1C2050	281-0865-00			CAP.FXD,CER D1:1000PF,5%,100V	04222	MA101A102JAA
A1A1C2051	281-0775-00			CAP,FXD,CER DI:0.1UF,+/-1PF,50V	04222	MA205E104MAA
A1A1C2060	281-0775-00			CAP,FXD,CER DI:0.1UF,+/-1PF,50V	04222	MA205E104MAA
A1A1C2061	281-0773-00			CAP,FXD,CER DI:0.01UF.10%.100V	04222	MA201C103KAA
A1A1C2062	281-0775-00			CAP,FXD,CER D1:0,1UF,+/-1PF,50V	04222	MA205E104MAA
A1A1C2070	290-0920-00			CAP;FXD,ELCTLT:33UF,+50-20%,35WVDC	55680	UVX1H330MPA
A1A1C2071	290-0920-00			CAPFXD,ELCTLT:33UF,+50-20%,35WVDC	55680	UVX1H330MPA
A1A1C2072	281-0773-00			CAP,FXD,CER DI:0.01U,10%,100V	04222	MA201C103KAA
A1A1C2080	283-0177-00			CAP,FXD,CER DI:1UF+80-20%,25V	04222	SR302E105ZAATR
A1A1C2081	290-0920-00			CAP,FXD,E1CT1T 33UF,+50-20%,35WVDC	55680	UVX1H330MPA
A1A1C2090	281-0210-01			CAP,VM,AIR DI:3 SECT,5-60,6-80, 10-410PF	K0099	5318/3/1H/M0D
A1A1C3010	290-0891-00			CAP,FXD,ELCTLT:l1UF,+75 -10%,5W	55680	U1A1H010TEA
A1A1C3011	290-0891-00			CAP,FXD,ELCTLT:1UF,+75 -10%,50V	55680	U1A1H010TEA
A1A1C3020	281-0909-00			CAP,FXD,CER DI:0.022UF,20%,50V	54583	MA12X7R1H223M-T
A1A1C3021	281-0909-00			CAP,FXD,CER DI:0.022UF,20%,50V	54583	MA12X7R1H223M-T
A1A1C3030	281-0775-00			CAP,FXD,CER DI:0.1UF,+/-1PF,50V	04222	MA205E104MAA
A1A1C3050	281-0819-00			CAP,FXD,CER DI:33 PF,5% 50V	04222	GC105A330J
A1A1C3060	281-0775-00			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A1A1C3061	281-0775-00			CAP,FXD,CER DI:0.1UF,+/-1PF,50V	04222	MA205E104MAA
A1A1C3062	281-0775-00			CAP,FXD,CER DI:0.1UF,+/-1PF,50V	04222	MA205E104MAA
A1A1C3063	281-0775-00			CAPFXD,CER DI:0.1UF+/-1PF,50V	04222	MA205E104MAA
A1A1C3064	281-0775-00			CAP,FXD,CER D1 0.1UF+/-1PF,50V	04222	MA205E104MAA
A1A1C3070	281-0811-00			CAPFXD,CER DI:10PF,10%,100V	04222	MA101A100KAA
A1A1C3090	283-0177-00			CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR302E1057JATR
A1A1C3100	283-0353-00			CAP,FXD,CER DI:0.1UF,10%,50V	04222	12105C104KA2075
A1A1C3101	283-0639-00			CAP,FXD,MICA DI:56PF,1%,100V	00853	D155E560F0
A1A1C4020	281-0909-00			CAP,FXD,CER DI:0.022UF,20%,50V	54583	MA12X7R1H223M-T
A1A1C4021	281-0909-00			CAP,FXD,CER DI:0.022UF,20%,50V	54583	MA12X7R1H223M-T
A1A1C4022	281-0765-00			CAP,FX0,CER DI:100PF,5%,100V	04222	MA101A101JAA
A1A1C4030	281-0759-00			CAP,FXD,CER DI:22PF,10%,100V	04222	MA101A220KAA

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A1A1C4050	283-0353-00			CAP,FXD,CER DI 0.IUF,I0%,50V	04222	12105C104KA2075
A1A1C4060	281-0773-00			CAP,FXD,CER D1:0.0IUF,10%,100V	04222	MA201C103KAA
A1A1C4061	281-0811-00			CAP,FXD,CER DI:10PF,10%,100V	04222	MA101A100KAA
A1A1C4062	283-0177-00			CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR302E105ZAATR
A1A1C4070	290-0755-00			CAP,FXD,ELCTLT:100UF,+50%-20%.10WVDC	54473	ECE-A10V100L
A1A1C4090	283-0198-00			CAP,FXD,CER DI:0.22UF,20%,50V	05397	C330C224M5U1CA
A1A1C4100	281-0775-00			CAP,FXD,CER DI:0.IUF,+/-1PF,50V	04222	MA205E104MAA
A1A1C4110	283-0156-00			CAP,FXD.CER DI:1000PF,+80-20%,200V	05397	C315C102ZR5CA
A1A1C4111	283-0156-00			CAP,FXD,CER DI:1000PF,+80-20%,200V	05397	C315C102Z R5CA
A1A1C4112	283-0156-00			CAP,FXD,CER D1:1000PF+80-20%,200V	05397	C315C102Z2R5CA
A1A1C5020	281-0909-00			CAP,FXD,CER DI:0.022UF,20%,50V	54533	MA12X7RIH223M-T
A1A1C5021	290-0755-00			CAP,FXD,ELCTLT:100UF,+50%-20%,10WVDC	54473	ECE-A10V100L
A1A1C5030	281-0811-00			CAP,FXD,CER DI I0PF,I0%,100V	04222	MA101A100KAA
A1A1C5040	281-0775-00			CAP,FXD,CER DI:0.1UF,+/-1PF,50V	04222	MA205E104MAA
A1A1C5060	290-0920-00			CAP,FXD,ELCTLT:33UF,+50-20%,35WVDC	55680	UVX1H330MAA
A1A1C5080	281-0775-00			CAP,FXD,CER D1:0.1UF +/-1PF 5W	04222	MA205E104MAA
A1A1C5110	281-0775-00			CAP,FXD,CER D1:0.1UF +/-1PF 5W	04222	MA205E104MAA
A1A1CR1010	152-0066-00			SEMICOND DVC,DI:RECT,51,400V,1A,DO-41	05828	GP10G-020
A1A1CR3090	152-0141-02			SEMICOND DVC,DI:SW,51.30V.150MA,30V,W-35	03503	DA2527 (1N4152)
A1A1CR4030	152-0066-00			SEMICOND DVC,DI:RECT.51,400V,1A,DO-41	05828	GP10G-020
A1A1CR4050	152-0951-00			SEMICOND DVC DI:SI,SCHOTTKY,6W,2.2PF	50434	IN6263
A1A1CR4090	152-0246-00			SEMICOND DVC,DI:SW,S1,40V,200MA, W-7	14433	WG1537TK
A1A1CR4091	152-0141-02			SEMICON0 DVC,DI:SW,S1,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1A1CR4092	152-0141-02			SEMICOND DVC,DI:SW,S1,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1A1CR4094	152-0141-02			SEMICOND DVC,DI:SW,51,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1A1F4010	159-0015-00			FUSE.CARTRIDGE:3AG,3A,250V,0.65SEC	75915	312 003
A1A1J1020	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY OF 6)	22526	48283-036
A1A1J1040	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY DF 7)	22526	48283-036
A1A1J1050	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GL0 PL (QUANTITY OF 7)	22526	48283-036
A1A1J1060	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY OF 7)	22526	48283-036
A1A1J1070	131-0608-00			TERMINAL PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY OF 4)	22526	48283-036
A1A1J3110	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY OF 3)	22526	48283-036
A1A1J4070	131-0589-00			TERMINAL,PIN:0.46 L X 0.025 SQ PH BRZ (QUANTITY OF 6)	22526	48283-029
A1A1J4100	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLO PL (QUANTITY OF 4)	22526	48283-036
A1A1J4101	131-0589-00			TERMINAL,PIN:0.46 L X 0.025 SQ PH 8RZ (QUANTITY OF 4)	22526	48283-029
A1A1L1070	108-0205-00			COIL,RF:FIXED,1MH	76493	8209
A1A1L1100	108-0796-00			COIL,RF:FIXED,16NH	TK1345	108-0796-00
A1A1L1101	108-0794-00			COIL,RF:FIXED,44NH	TK1345	108-0794-00
A1A1L2040	120-0342-00			XFMR,TOROID:	TK1345	120-0342-00
A1A1L2060	108-0733-00			COIL,RF:FIXED,117NH	80009	108-0733-00
A1A1L2061	108-0472-00			COIL,RF:FIXED,162UH	80009	108-0472-00
A1A1L3090	120-0939-00			TRANSFORMER,RF:VARIABLE	80009	120-0939-00
A1A1L4060	108-0733-00			COIL,RF:FIXED,117NH	80009	108-0733-00
A1A1L4061	108-0509-00			COIL,RF:FIXED,2.45UH	TK2042	ORDER BY DESCR
A1A1L5070	108-0795-00			COIL,RF:FIXED,2MH	TK1345	108-0795-00
A1A1LR1102	108-0271-00			COIL,RF:FIXED,245NH	80009	108-0271-00
A1A1LR1103	108-0271-00			COIL,RF:FIXED,245NH	80009	108-0271-00
A1A1LR3091	108-0797-00			COIL,RF:FIXED,2.45UH	TK1345	108-0797-00

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A1A1LR3092	108-0595-00			COIL,RF:FIXED,49NH	TK1345	108-0595-00
A1A1Q1070	151-0347-00			TRANSISTOR:BIPOLAR,NPN;160V,600 MA,TO-92	04713	2N5551
A1A1Q1071	151-0347-00			TRANSISTOR:BIPOLAR,NPN;160V,600 MA,TO-92	04713	2N5551
A1A1Q1090	151-0451-00			TRANSISTOR:NPN,SI,TO-39	04713	SRF503
A1A1Q3050	151-0221-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0221-00
A1A1Q3060	151-0402-00			TRANSISTOR:SELECTED	01295	SKA6814
A1A1Q3061	151-0402-00			TRANSISTOR:SELECTED	01295	SKA6814
A1A1Q3062	151-0402-00			TRANSISTOR:SELECTED	01295	SKA6814
A1A1Q3063	151-0402-00			TRANSISTOR: SELECTED	01295	SKA6814
A1A1Q3064	151-0402-00			TRANSISTOR:SELECTED	01295	SKA6814
A1A1Q3090	151-0211-01			TRANSISTOR:NPN,SI,TO-39	04713	2N3866 (FAMILY)
A1A1Q4050	151-0367-00			TRANSISTOR,SIG:BIPOLAR,NPN;25V,30MA,TO-39	04713	SPS 8811
A1A1Q4080	151-0188-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0188-00
A1A1Q4081	151-0302-00			TRANSISTOR:NPN,SI,TO-18	04713	2N2222A
A1A1R1040	315-0751-00			RES,FXD,FILM:750 OHM.5%.0.25W	57668	NTR25J-E750E
A1A1R1041	315-0751-00			RES,FXD,FILM:750 OHM.5%.0.25W	57668	NTR25J-E750E
A1A1R1042	315-0751-00			RES,FXD,FILM:750 OHM,5%,0.25W	57668	NTR25J-E750E
A1A1R1043	315-0751-00			RES,FXD,FILM:750 OHM,5%,0.25W	57668	NTR25J-E750E
A1A1R1044	315-0751-00			RES,FXD,FILM:750 OHM,5%,0.25W	57668	NTR25J-E750E
A1A1R1050	315-0751-00			RES,FXD,FILM:750 OHM,5%,0.25W	57668	NTR25J-E750E
A1A1R1051	315-0751-00			RES,FXD,FILM:750 OHM,5%,0.25W	57668	NTR25J-E750E
A1A1R1052	315-0751-00			RES,FXD,FILM:750 OHM,5%,0.25W	57668	NTR25J-E750E
A1A1R1053	315-0751-00			RES,FXD,FILM:750 OHM,5%,0.25W	57668	NTR25J-E750E
A1A1R1054	315-0751-00			RES,FXD,FILM:750 OHM,5%,0.25W	57668	NTR25J-E750E
A1A1R1055	315-0751-00			RES,FXD,FILM:750 OHM,5%,0.25W	57668	NTR25J-E750E
A1A1R1056	315-0751-00			RES,FXD,FILM:750 OHM,5%,0.25W	57668	NTR25J-E750E
A1A1R1057	315-0751-00			RES,FXD,FILM:750 OHM,5%,0.25W	57668	NTR25J-E750E
A1A1R1058	315-0751-00			RES,FXD,FILM:750 OHM,5%,0.25W	57668	NTR25J-E750E
A1A1R1060	315-0751-00			RES,FXD,FILM:750 OHM,5%,0.25W	57668	NTR25J-E750E
A1A1R1061	315-0751-00			RES,FXD,FILM:750 OHM,5%,0.25W	57668	NTR25J-E750E
A1A1R1062	315-0751-00			RES,FXD,FILM:750 OHM,5%,0.25W	57668	NTR25J-E750E
A1A1R1063	315-0751-00			RES,FXD,FILM:750 OHM,5%,0.25W	57668	NTR25J-E750E
A1A1R1064	315-0751-00			RES,FXD,FILM:750 OHM,5%,0.25W	57668	NTR25J-E750E
A1A1R1065	315-0751-00			RES,FXD,FILM:750 OHM,5%,0.25W	57668	NTR25J-E750E
A1A1R1066	315-0751-00			RES,FXD,FILM:750 OHM,5%,0.25W	57668	NTR25J-E750E
A1A1R1070	315-0562-00			RES,FXD,FILM:5.6K OHM,5%,0.25W	57668	NTR25J-E05K6
A1A1R1100	317-0510-00			RES, FXD, CMPSN:51 OHM,5%,O.125W	01121	BB5105
A1A1R1101	317-0510-00			RES,FXD,CMPSN:51 OHM,5%,0.125W	01121	BB5105
A1A1R2020	321-0939-03			RES,FXD,FILM:122.2 OHM,0. 25%,0.125W,T=T2	19701	5033RC122R2C
A1A1R2021	321-0998-07			RES,FXD,FILM:1.915K OHM,0.1%,0.125W.TC=T9	19701	5033REIK915B
A1A1R2022	315-0561-00			RES,FXD,FILM:560 OHM.5%.0.25W	19701	5043CX560R0J
A1A1R2023	315-0511-00			RES,FXD,FILM:510 OHM.5%.0.25W	19701	5043CX510R0J
A1A1R2050	315-0161-00			RES,FXD,FILM:160 OHM.5%.0.25W	57668	NTR25J-E 160E
A1A1R2060	315-0102-00			RES,FXD,FILM:IK OHM,5%,0.25W	57668	NTR25JE01K0
A1A1R2061	315-0150-00			RES,FXD,FILM:15 OHM,5%,0.25W	19701	5043CX15R00J
A1A1R2062	315-0182-00			RES,FXD,FILM:1.8K OHM,5%,0.25W	57668	NTR25J-E1K8
A1A1R2063	315-0392-00			RES,FXD,FILM:3.9K OHM,5%,0.25W	57668	NTR25 1-E03K9
A1A1R2064	315-0181-00			RES,FXD,FILM:180 OHM,5%,0.25W	57668	NTR25J-E180E
A1A1R2065	315-0272-00			RES,FXD,FILM:2.7K OHM,5%,0.25W	57668	NTR25J-E02K7
A1A1R2070	315-0162-00			RES,FXD,FILM:1.6K OHM,5%,0.25W	19701	5043CX1K600J
A1A1R2071	315-0750-00			RES,FXD,FILM:75 OHM,5%,0.25W	57668	NTR25J-E75E0
A1A1R2072	315-0102-00			RES,FXD,FILM:IK OHM,5%,0.25W	57668	NTR25JE01K0
A1A1R2073	315-0512-00			RES,FXD,FILM:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
A1A1R3020	311-1223-00			RES,VAR,NONWW:TRMR,250 OHM,0.5W	32997	3386F-T04-251
A1A1R3021	321-0289-07			RES,FXD,FILM:I0.0K OHM.0.1%.0.125W,TC=T9	19701	5033RE10K00B
A1A1R3022	321-0410-07			RES, FXD, FI LM: 182K OHM,0.1%,0.125W,TC=T9	07716	CEAE18202B
A1A1R3023	321-0193-07			RES,FXD,FILM:IK OHM,0.1%,0.125W,TC=T9	19701	5033RE1K000B
A1A1R3050	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR251-E 100E
A1A1R3051	315-0131-00			RES,FXD,FILM:130 OHM,5%,0.25W	19701	5043CX130R0J
A1A1R3060	315-0821-00			RES,FXD,FILM:820 OHM,5%,0.25W	19701	5043CX820R0J

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A1A1R3061	315-0471 -00			RES,FXD,FILM:470 OHM5% 0.25W	57663	NTR25J-E470E
A1A1R3062	315-0821-00			RES,FXD,FILM:820 OHM 5%,0.25W	19701	5043CX820R0J
A1A1R3063	315-0471-00			RES,FXD,FILM:470 OHM 5% 0.25W	57668	NTR25J-E470E
A1A1R3064	315-0181-00			RES,FXD,FILM:180 OHM,5%,0.25W	57668	NTR25J-E180E
A1A1R3065	315-0821-00			RES,FXD,FILM:820 OHM,5%,0.25W	19701	5043CX820R0J
A1A1R3066	315-0181-00			RES,FXD,FILM:180 OHM,5%,0.25W	57668	NTR25J-E180E
A1A1R3067	315-0821-00			RES,FXD,FILM:820 OHM,5%,0.25W	19701	5043CX820ROJ
A1A1R3068	315-0271-00			RES,FXD,FILM:270 OHM,5%,0.25W	57668	NTR25J-E270E
A1A1R3070	315-0510-00			RES,FXD,FILM:51 OHM,5%,0.25W	19701	5043CX51R00J
A1A1R3071	321-0132-00			RES,FXD,FILM:232 OHM,1%,0.125W,TC=T0	19701	5043ED232R0F
A1A1R3080	301-0750-00			RES,FXD,FILM:75 OHM,5%,0.5W	19701	5053CX75R00J
A1A1R3090	317-0510-00			RES,FXD,CMPSN:51 OHM,5%.0.125W	01121	BB5105
A1A1R3091	317-0131-00			RES,FXD,CMPSN:130 OHM,5%,0.125W	01121	BB1315
A1A1R4010	321-0222-07			RES,FXD,FI LM:2.0K OHM,0.1%,0.125W,TC=T9	19701	5033RE2K000B
A1A1R4020	313-1361-00			RES,FXD,FILM:360 OHM,5%,0.2W	57668	TR20JE 360E
A1A1R4021	315-0102-00			RES,FXD,FILM:IK OHM,5%,0.25W	57668	NTR25JE01K0
A1A1R4022	308-0702-00			RES,FXD,WW:0.33 OHM,5%,2W	75042	BWH-R3300J
A1A1R4023	315-0430-00			RES,FXD,FILM:43 OHM,5%,0.25W	19701	5043CX43R00J
A1A1R4030	315-0222-00	B090100	B091003	RES,FXD,FILM:2.2K OHM,5%,0.25W	57668	NTR25J-E02K2
A1A1R4030	315-0152-00	B091004		RES,FXD,FILM:1.5K OHM,5%,0.25W	57668	NTR25J-E01K5
A1A1R4031	315-0301-00			RES,FXD,FILM:300 OHM,5%,0.25W	57668	NTR25J-E300E
A1A1R4050	321-0126-00			RES,FXD,FILM:200 OHM,1%.0.125W,TC=T0	19701	5033ED200R0F
A1A1R4051	321-0126-00			RES,FXO,FILM:200 OHM,1%,0.125W,TC=T0	19701	5033ED200R0F
A1A1R4060	315-0471-00			RES,FXD,FILM:470 OHM,5%,0.25W	57668	NTR25J-E470E
A1A1R4061	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E100E
A1A1R4062	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E100E
A1A1R4063	315-0181-00			RES,FXD,FILM:180 OHM,5%,0.25W	57668	NTR25J-E180E
A1A1R4064	315-0391-00			RES,FXD,FILM:390 OHM,5%,0.25W	57668	NTR25J-E390E
A1A1R4080	315-0392-00			RES,FXD,FILM:3.9K OHM,5%,0.25W	57668	NTR25J-E03K9
A1A1R4081	315-0181-00			RES,FXD,FILM:180 OHM,5%.0.25W	57668	NTR25J-E180E
A1A1R4082	321 -0319-00			RES,FXD,FILM:20.5K OHM,1%,0.125W,TC=T0	19701	5033ED20K50F
A1A1R4083	321-0207-00			RES,FXD,FILM:1.40K OHM,1%,0.125W,TC=T0	19701	5033EDIK400F
A1A1R4090	315-0103-00			RES, FXD, FI LM: IOK OHM,5%,0. 25W	19701	5043CX10K00J
A1A1R4091	315-0103-00			RES,FXD,FILM:IOK OHM,5%,0.25W	19701	5043CX10K001
A1A1R4092	315-0103-00			RES,FXD,FILM:IOK OHM,5%,0.25W	19701	5043CXI0K001
A1A1R4093	315-0275-00			RES,FXD,FILM:2.7M OHM,5%,0.25W	01121	CB2755
A1A1R4094	315-0204-00			RES,FXD,FILM:200K OHM,5%,0.25W	19701	5043CX200K0J
A1A1R4100	311-1222-00			RES,VAR,NONW:TRMR,100 OHM,0.5W	32997	3386F-T04-101
A1A1R4110	315-0102-00			RES,FXD,FILM:IK OHM,5%,0.25W	57668	NTR25JE01K0
A1A1R4111	321-0927-07			RE5,FXD,FILM:125 OHM,0.1%,0.125W,TC=T9	19701	5033RE125R0B
A1A1R4112	321-0222-07			RES,FXD,FI LM: 2.0K OHM,0.1%,0.125W,TC=T9	19701	5033RE2K000B
A1A1R5020	321-0222-07			RES, FXD,FILM:2.0K OHM,0.1%,0.125W,TC=T9	19701	5033RE2K000B
A1A1R5030	315-0222-00			RES,FXD.FILM:2.2K OHM,5%,0.25W	57668	NTR25J-E02K2
A1A1R5040	315-0271-00			RES,FXD,FILM:270 OHM,5%,0.25W	57668	NTR25J-E270E
A1A1R5041	315-0271-00			RES,FXD,FILM:270 OHM,5%,0.25W	57668	NTR25J-E270E
A1A1R5050	315-0271-00			RES,FXD,FILM:270 OHM,5%,0.25W	57668	NTR25J-E270E
A1A1R5051	315-0391-00			RES,FXD,FILM:390 OHM,5%,0.25W	57658	NTR25J-E390E
A1A1R5052	315-0391-00			RES,FXD,FILM:390 OHM,5%,0.25W	57668	NTR25J-E390E
A1A1R5053	315-0103-00			RES,FXD,FILM:10K 0HM,5%,0.25W	19701	5043CXI0K00J
A1A1R5054	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CXI0K00J
A1A1R5080	315-0471-00			RES,FXD,FILM:470 OHM,5%,0.25W	57668	NTR25J-E470E
A1A1R5081	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
A1A1R5032	315-0123-00			RES,FXD,FILM:12K OHM,5%,0.25W	57668	NTR25 I-E12K0
A1A1R5100	315-0513-00			RES,FXD,FILM:51K OHM,5%,0.25W	57668	NTR25J-E51K0
A1A1R5101	315-0103-00			RES,FXD,FILM:IOK OHM,5%,0.25W	19701	5043CXI0K00J
A1A1R5102	311-1223-00			RES,VAR,NONW:TRMR,250 OHM,0.5W,	32997	3386F-T04-251
A1A1S3090	131-1030-00			CONT ASSY,ELEC:CAM SWITCH,BOTTOM (QUANTITY OF 3)	80009	131-1030-00

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A1A1S3090	131-1031-00			CONT ASSY,ELEC:CAM SWITCH,TOP (QUANTITY OF 11)	80009	131-1031-00
A1A1TP1010	131-0608-00			TERMINAL,PIN:MALE,0.385 L X 0.025 SQ PH BRZ	22526	48283-036
A1A1TP5020	131-0608-00			TERMINAL,PIN:MALE,0.385 L X 0.025 SQ PH BRZ	22526	48283-036
A1A1TP5030	131-0608-00			TERMINAL,PIN:MALE,0.385 L X 0.025 SQ PH BRZ	22526	48283-036
A1A1U1020	156-0656-00			MICROCKT,DGTL:DECADE COUNTER	01295	SN74LS90 (N OR J)
A1A1U1030	156-0910-00			MICROCKT,DGTL:DUAL DECADE COUNTER	07263	SL68104
A1A1U1031	156-0910-00			MICROCKT,DGTL:DUAL DECADE COUNTER	07263	SL68104
A1A1U1032	156-0385-00			MICROCKT,DGTL:HEX INVERTER	01295	SN74LS04 (N OR J)
A1A1U1040	156-1243-00			MICROCKT,DGTL:BCD-TO-7 SEGMENT DECODER	01295	SN74LS47N
A1A1U1050	156-1243-00			MICROCKT,DGTL:BCD-TO-7 SEGMENT DECODER	01295	SN74LS47N
A1A1U1060	156-1243-00			MICROCKT,DGTL:BCD-TO-7 SEGMENT DECODER	01295	SN74LS47N
A1A1U2020	156-1451-00			MICROCKT,LINEAR:3-TERM – VOLTAGE RGLTR	27014	LM337T
A1A1U2030	156-0387-00			MICROCKT,DGTL:DUAL J-K FLIP-FLOP	01295	SN74LS73 (N OR J)
A1A1U2040	156-0381-00			MICROCKT,DGTL:QUAD 2-INP ECXL OR GATE	01295	SN74LS86 (N OR J)
A1A1U2050	156-0383-00			MICROCKT,DGTL:QUAD 2-1NP NOR GATE	01295	SN74LS02 (N OR J)
A1A1U3030	156-0383-00			MICROCKT,DGTL:QUAD 2-INP NOR GATE	01295	SN74LS02 (N OR J)
A1A1U3031	156-0910-00			MICROCKT,DGTL:DUAL DECADE COUNTER	07263	SL68104
A1A1U3040	156-0388-00			MICROCKT,DGTL:DUAL D FLIP-FLOP	01295	SN74LS74 (N OR J)
A1A1U3041	156-0452-00			MICROCKT,DGTL:4-WIDE,2-INP ADI	01295	SN74LS54 (N OR J)
A1A1U3050	156-0180-00			MICROCKT,DGTL:QUAD 2-INPUT NAND GATE	01295	SN74S00 (N OR J)
A1A1U3051	156-0656-00			MICROCKT,DGTL:DECADE COUNTER	01295	SN74LS90 (N OR J)
A1A1U4020	156-0071-00			MICROCKT,LINEAR:VOLTAGE REGULATOR,CHECKED	04713	MC1723CLDS
A1A1U4030	156-0382-00			MICROCKT,DGTL:Q W 2-INP NAND GATE	01295	SN74LS00 (N OR J)
A1A1U4040	156-0646-00			MICROCKT,DGTL:4-BIT BINARY COUNTER	01295	SN74LS93N
A1A1U4050	156-0382-00			MICROCKT,DGTL:Q W 2-INP NAND GATE	01295	SN74LS00 (N OR J)
A1A1U4060	156-0228-00			MICROCKT,DGTL:ECL,MA-SLAVE D FLIP-FLOP	52648	SP1670
A1A1U5040	156-0230-00			MICROCKT,DGTL:ECL,DUAL D MASTER-SLAVE FF	04713	MC10131 (L OR P)
A1A1U5090	156-0067-00			MICROCKT,LINEAR:OPNL AMPL,SEL	04713	MC1741CP1
A1A1VR3020	152-0171-00			SEMICOND DVC,DI:ZEN.SI,11.7V,5%.0.5W,DO-7	04713	SZ13464
A1A1VR4050	152-0278-00			SEMICDND DVC,DI:ZEN,SI,3V,5%,0.4W,DO-7	80009	152-0278-00
A1A1W3080	131-0566-00			BUS,CONOUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1A1XL3090	136-0261-00			SOCKET,PIN TERM:U/W 0.022 TO 0.025 PIN (OUANTITY OF 4)	00779	1-331677-6
A1A1XQ1090	136-0252-07			SOCKET,PIN CONN:W/O DIMPLE (QUANTITY OF 3)	22526	75060-012
A1A1XQ3090	136-0252-07			SOCKET,PIN CONN:W/O DIMPLE (QUANTITY OF 3)	22526	75060-012
A1A1X04081	136-0252-07			SOCKET,PIN CONN:W/O DIMPLE (QUANTITY OF 3)	22526	75060-012
A1A1XU4060	136-0252-07			SOCKET,PIN CONN:W/O DIMPLE (OUANTITY OF 16)	22526	75060-012
A1A1Y5030	158-0014-00			XTAL UNIT,QTZ:1MHZ,+/-0.005%	13454	153-0014-00
A1A2	670-2983-02			CIRCUIT BD ASSY:COIL	80009	670-2983-02
A1A2C112	283-0597-00			CAP,FXD,MICA DI:470PF,10%,300V	00853	D155F471K0
A1A2C118	283-0615-00			CAP,FXD,MICA DI:33PF,5%,500V	00853	D155B30J0
A1A2C124	283-0695-00			CAP,FXD,MICA DI:4440PF,1%,300V	00853	D195F4441F0
A1A2L110	120-0938-00			TRANSFORMER,RF:VARIABLE	80009	120-0938-00
A1A2L112	120-0937-00			TRANSFORMER,RF:VARIABLE	80009	120-0937-00
A1A2L114	120-0936-00			TRANSFORMER,RF:VARIABLE	80009	120-0936-00
A1A2L116	120-0935-00			TRANSFORMER,RF:VARIABLE	80009	120-0935-00
A1A2L118	120-0934-00			TRANSFORMER,RF:VARIABLE	80009	120-0934-00
A1A2L120	120-0933-00			TRANSFORMER,RF:VARIABLE	80009	120-0933-00
A1A2L122	120-0932-00			TRANSFORMER RF:OSCILLATOR	80009	120-0932-00
A1A2L124	120-0931-00			TRANSFORMER RF:	80009	120-0931-00
A1A21R110	108-0408-00			COIL,RF:FIXED,91NH	TK1345	108-0408-00
A1A21R112	108-0271-00			COIL,RF:FIXED,245NH	80009	108-0271-00
A1A21R114	108-0333-00			COIL,RF:FIXED,881NH	TK1345	108-0333-00

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A1A2R116	315-0471-00			RES,FXD,FILM:470 OHM,5%,0.25W	57668	NTR25J-E470E
A1A2R118	315-0471-00			RES,FXD,FILM:470 OHM,5%,0.25W	57668	NTR25J-E470E
A3	670-3073-03			CIRCUIT BD ASSY:ATTENUATOR	80009	670-3073-03
A3C170	283-0198-00			CAP,FXD,CER DI:0.22UF,20%, 50V	05397	C330C224M5U1CA
A3C172	290-0534-00			CAP,FXD,ELCTLT:1UF,20%,35V	05397	T368A105M035AZ
A3C180	290-0534-00			CAP,FXD,ELCTLT:1UF,20%,35V	05397	T368A105M035AZ
A3C184	283-0198-00			CAP,FXD,CER DI:0.22UF,20%, 50V	05397	C330C224M5U1CA
A3C190	283-0198-00			CAP,FXD,CER DI:0.22UF,20%, 50V	05397	C330C224M5U1CA
A3C192	281-0615-00			CAP,FXD,CER DI:3.9PF,+/-0.5PF,200V	52763	2RDPLZ007 3P90DC
A3C194	283-0204-00			CAP,FXD,CER DI:0.01UF,20%,50V	04222	SR155E103MAA
A3C200	283-0198-00			CAP,FXD,CER DI:0.22UF,20%,50V	05397	C330C224M5U1CA
A3C204	281-0730-00			CAP,FXD,CER DI:10.8PF,1%,500V	52763	2RDPLZ007 10P8LC
A3C208	281-0730-00			CAP.FXD.CER DI:10.8PF,1%,500V	52763	2RDPLZ007 10P8LC
A3C212	281-0604-00			CAP,FXD,CER D1:2.2PF,+/-0.25PF,500V	52763	2RDPLZ007 2P20CC
A3C214	283-0156-00			CAP, FXD,CER DI:1000PF+80-20%,200V	05397	C315C102Z2R5CA
A3C215	283-0156-00			CAP, FXD,CER DI:1000PF+80-20%,200V	05397	C315C102Z2R5CA
A3C216	281-0661-00			CAP,FXD,CER DI:0.8PF,+/-0.1PF,500V	52763	2RDPLZ007 0P80BC
A3C230	283-0111-00			CAP,FXD,CER DI:0.1UF,20%,50V	05397	C330C104M5U1CA
A3C232	283-0204-00			CAP,FXD,CER DI:0.01UF,20%,50V	04222	SR155E103MAA
A3CR200	152-0322-00			SEMICOND DVC,DI:SCHOTTKY,SI,15V,DO-35	50434	5082-2672
A3CR202	152-0322-00			SEMICOND DVC,DI:SCHOTTKY,SI,15V,DO-35	50434	5082-2672
A3CR216	152-0322-00			SEMICONO DVC,DI:SCHOTTKY,SI,15V,DO-35	50434	5082-2672
A3CR218	152-0322-00			SEMICONO DVC,DI:SCHOTTKY,SI,15V,DO-35	50434	5082-2672
A3E190	276-0569-00			CORE,EM:TOROID,FERRITE,0.12 OD X 0.07 ID	TK1263	M1019
A3E191	276-0569-00			CORE,EM:TOROID,FERRITE,0.12 OD X 0.07 ID	TK1263	M1019
A3J230	131-0589-00			TERMINAL,PIN:0.46 L X 0.025 SQ PH BRZ (QUANTITY OF 4)	22526	48283-029
A3J240	131-1003-00			CONN, RCPT,ELEC:CKT BD MT,3 PRONG	80009	131-1003-00
A3JX240	136-0252-01			SOCKET,PIN TERM:U/W 0.019 DIA PINS	00779	1-332095-2
A3L184	108-0606-00			COIL,RF:FIXED,31NH	80009	108-0606-00
A3L190	103-0797-00			COIL,RF:FIXED,2.45UH	TK1345	108-0797-00
A3L195	103-0317-00			COIL, RF:FIXED,15UH	32159	71501M+10PERCENT
A3L197	108-0795-00			COIL, RF:FIXED, 2MH	TK1345	108-0795-00
A3L200	108-0578-00			COIL, RF:FIXED, I9NH	TK1345	108-0578-00
A3L204	108-0578-00			COIL,RF:FIXED,19NH	TK1345	108-0578-00
A3L208	108-0552-00			COIL, RF:FIXED,80NH	TK1345	108-0552-00
A3L212	108-0552-00			COIL, RF:FIXED,80NH	TK1345	108-0552-00
A3P540	136-0263-07			SOCKET,PIN TERM:U/W 0.025 SQ PIN (QUANTITY OF 6)	22526	75377-001
A3Q180	151-0188-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0188-00
A3Q190	151-0614-00			TRANSISTOR:NPN,SI,4 LEAD POWER TOWER	80009	151-0614-00
A3R174	315-0182-00			RES,FXD,FILM:1.8K OHM,5%,0.25W	57668	NTR25J-E1K8
A3R175	311-1563-00			RES,VAR,NONWW:TRMR,IK OHM,0.5W	32997	3352T-DY7-102
A3R176	315-0123-00			RES,FXD,FILM:12K OHM,5%,0.25W	57668	NTR25J-E12K0
A3R180	315-0272-00			RES,FXD,FILM:2.7K OHM,5%,0.25W	57668	NTR25J-E02K7
A3R184	317-0151-00			RES,FXD,CMPSN:150 OHM,5%,0.125W	01121	BB1515
A3R190	301-0560-00			RES,FXD,FILM:56 OHM,5%,0.5W	19701	5053CX56R00J
A3R192	301-0560-00			RES,FXD,FILM:56 OHM,5%,0.5W	19701	5053CX56R00J
A3R195	315-0471-00			RES,FXD,FILM:470 OHM,5%,0.25W	57668	NTR25J-E470E
A3R197	315-0102-00			RES,FXD,FILM:IK OHM,5%,0.25W	57668	NTR25J-E01K0
A3R204	317-0181-00			RES,FXD,CMPSN:180 OHM,5%,0.125W	01121	BB1815
A3R212	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
A3R216	315-0911-00			RES,FXD,FILM:910 OHM,5%,0.25W	57668	NTR25J-E910E
A3R240	307-1024-00			ATTENUATOR,FXD:10X,50 OHM	80009	307-1024-00
A3R245	307-1024-00			ATTENUATOR,FXD:10X,50 OHM	80009	307-1024-00
A3S240	105-0588-00			ACTR ASSY,SL SW:OUTPUT ATTEN	80009	105-0588-00

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A3U225	155-0107-00			MICROCKT,LINEAR:DIODE LEVELER,HYBRID	80009	155-0107-00
A3VR200	152-0337-00			SEMICOND DVC,DI:ZEN,SI,6.3V,3.2%,0.4W	04713	SZG210K
A3VR202	152-0337-00			SEMICOND DVC,DI:ZEN,SI,6.3V,3.2%,0.4W	04713	SZG210K
A4	671-0339-00			CIRCUIT BD ASSY:DISPLAY	80009	671-0339-00
A4DS500	150-1162-00			LT EMITTING DIO:RED	50434	HDSP-7501
A4DS510	150-1162-00			LT EMITTING DIO:RED	50434	HDSP-7501
A4DS520	150-1162-00			LT EMITTING DIO:RED	50434	HDSP-7501
A4DS530	150-1162-00			LT EMITTING DIO:RED	50434	HDSP-7501
A4R510	315-0821-00			RES,FXD,FILM:820 OHM,5%,0.25W	19701	5043CX820R0J
A4R520	315-0821-00			RES,FXD,FILM:820 OHM,5%,0.25W	19701	5043CX820R0J
A4R530	315-0821-00			RES,FXD,FILM:820 OHM,5%,0.25W	19701	5043CX820R0J
A4W10	175-0100-00			CA8LE ASSY,RF:144.0 L	80009	175-0100-00
A4W12	175-0103-00			CABLE ASSY,RF:144.0 L	80009	175-0103-00
A4W14	175-0102-00			CABLE ASSY,RF:108.0 L	80009	175-0102-00
A4W16	175-0101-00			CABLE ASSY,RF:144.0 L	80009	175-0101-00
				CHASSIS PARTS		
J245	131-1315-01			CONN,RCPT,ELEC: BNC,FEMALE	80009	131-1315-01
R260	311-2204-00			RES,VAR,WW:PANEL,2.5K OHMS,5%,0.5W	32997	84N1D-E26-CA0021
R260	198-2210-00			WIRE SET,ELEC: (WIRE SET FOR:W18,W20,W24 AND J3110 TO R260)	80009	198-2210-00

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:

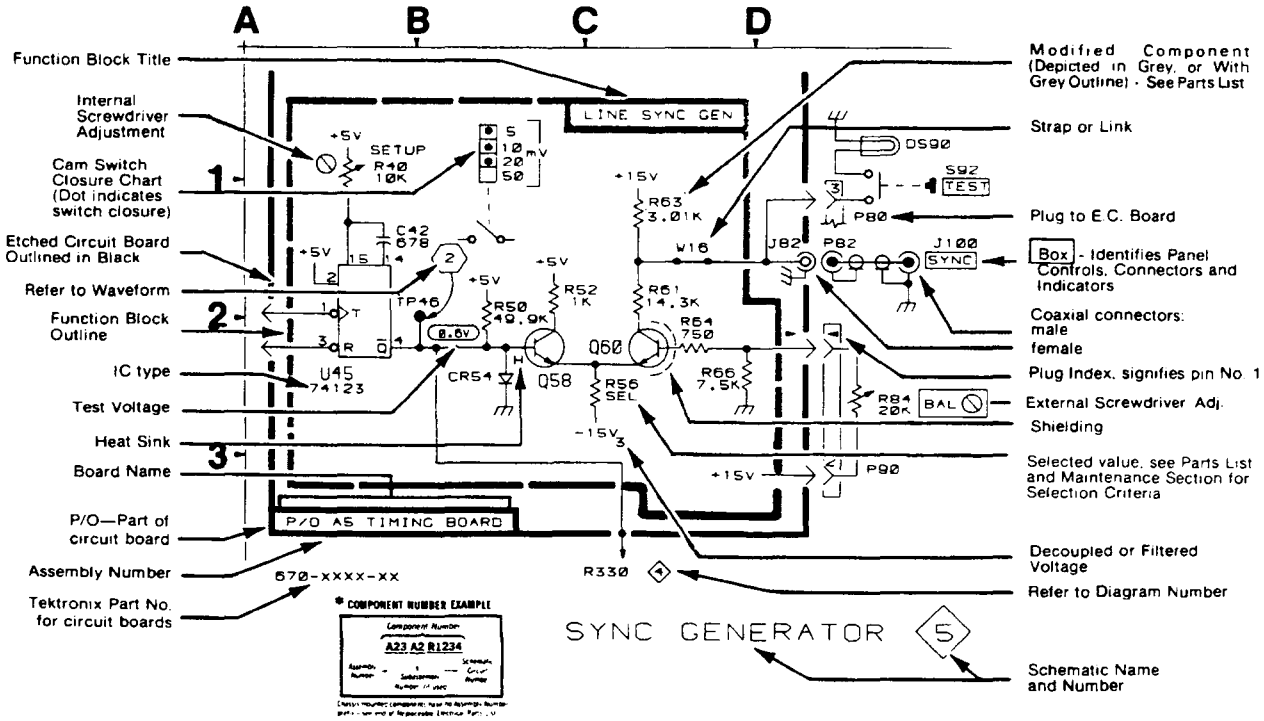
Capacitors = Values one or greater are in picofarads (pF). Values less than one are in microfarads (μF).
Resistors = Ohms (Ω).

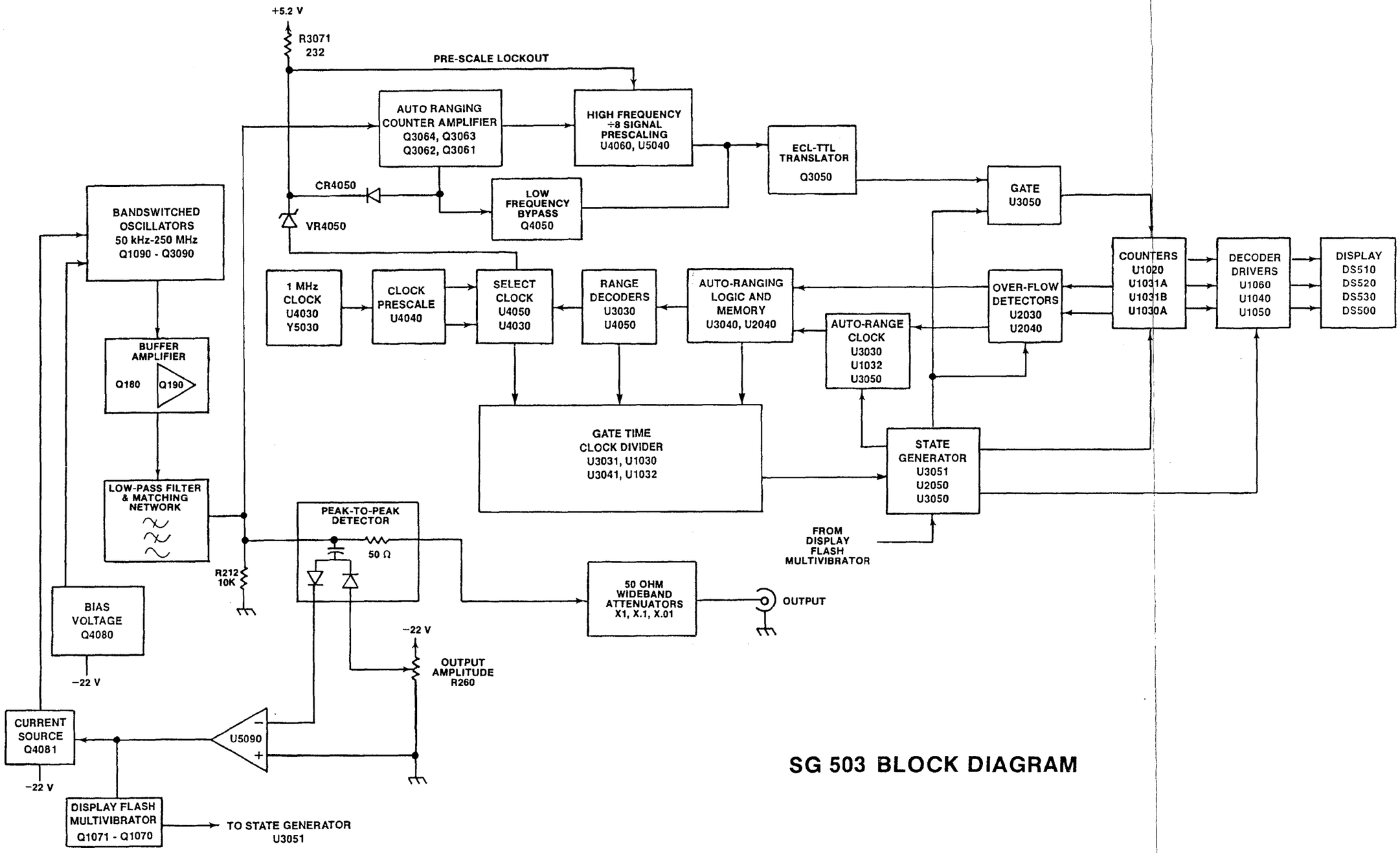
The information and special symbols below may appear in this manual.

Assembly Numbers and Grid Coordinates

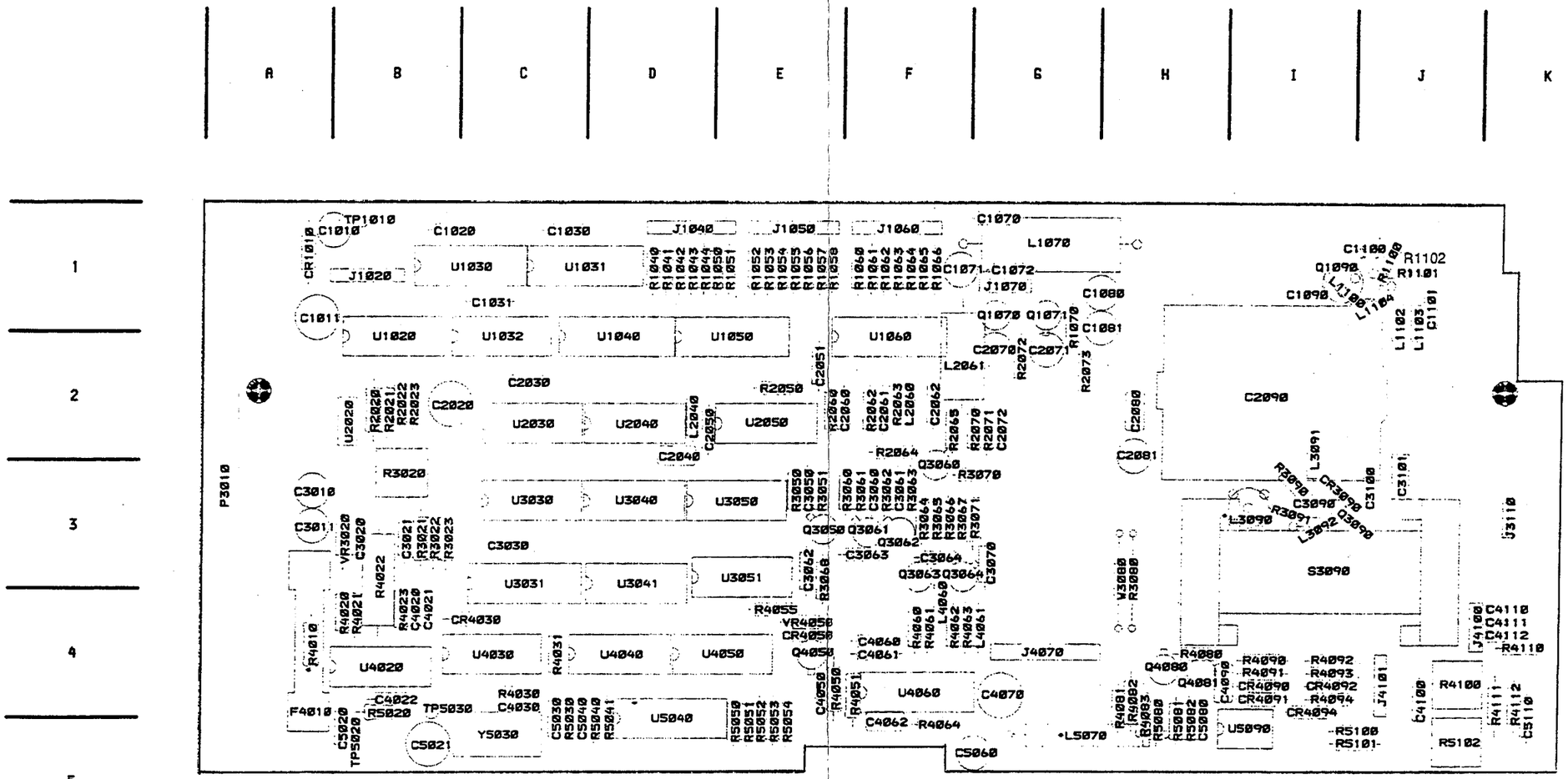
Each assembly in the instrument is assigned an assembly number (e.g., A20). The assembly number appears on the circuit board outline on the diagram, in the title for the circuit board component location illustration, and in the lookup table for the schematic diagram and corresponding component locator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

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





SG 503 BLOCK DIAGRAM



*Parts are on back side of board.

Fig. 8-1. A1-Main circuit board assembly.

A1

Locator Table for Diagram 1

A3 ASSY — OSCILLATOR, BUFFER, OUTPUT 1

Circuit Number	Schematic Location	Board Location	Circuit Number	Schematic Location	Board Location	Circuit Number	Schematic Location	Board Location
C170	F2	D5	J230	H4	B4	R180	F3	C4
C172	F2	D5	J240	M3	B3	R184	G3	D4
C180	G3	D4	J245	N3	CHASSIS	R190	G4	D4
C184	F4	C4				R192	H4	D5
C190	H4	C5	L184	G3	D4	R195	G2	E4
C192	G3	E5	L190	G3	E4	R197	G2	E5
C194	H5	D4	L195	G2	E4	R204	I3	F4
C200	H3	E4	L197	G2	F5	R212	J3	F2
C204	I3	E3	L200	H3	E4	R216	J2	F3
C208	I3	E3	L204	I3	F4	R240	K3	C3
C212	J3	E2	L208	I3	E3	R245	L3	C2
C214	H4	C3	L212	I3	E3			
C215	I4	D3				S240	L2	C2
C216	J2	F3	P230	K5	B4			
C218	I4	D3	P240	M3	B3	U225	K3	D3
C230	J4	E3	P245	N3	CHASSIS			
C232	K4	D3	P540	F1	C5	VR200	H4	E5
			P540	F4	C5	VR202	H4	E5
CR200	H3	E4	P540	M1	C5			
CR202	H3	E4				W20	N3	CHASSIS
CR216	I4	C3	Q180	G3	C4			
CR218	I4	D3						
			R174	F3	C4			
E190	G4		R175	F3	C5			
E191	G3		R176	F3	C4			
E245	N3							

P/O A1 ASSY

Circuit Number	Schematic Location	Board Location	Circuit Number	Schematic Location	Board Location	Circuit Number	Schematic Location	Board Location
C1090	C4	I1	J4101	I6	J4	R4083	E5	H4
C1100	B5	J1	L1100	B4	I1	R4090	G7	I4
C1101	C5	J1	L1102	C4	J1	R4091	G6	I4
C2070	F8	G2	L1103	C5	J1	R4092	G6	I4
C2071	F8	G2	L1104	A4	J1	R4093	K8	I4
C2080	A1	H2	L3090	A2	I3	R4094	I6	I4
C2090A	B4	I2	L3091	D3	I2	R4100	J6	J4
C2090B	B3	I2	L3092	D2	I3	R4110	H5	K4
C2090C	B3	I2	P4101	K5	J4	R4111	J6	K4
C3090	D2	I3	Q1070	G8	G1	R4112	J8	K4
C3100	E2	J3	Q1071	E8	G1	R5080	E6	H4
C3101	B3	J3	Q1090	C4	I1	R5081	E6	H4
C4090	F7	I4	Q3090	D2	I3	R5082	F6	H4
C4100	H6	J4	Q4080	D5	H4	R5100	G5	I5
C4110	F7	K4	Q4081	D6	H4	R5101	G5	I5
C5080	L7	H4	R177	E2	CHASSIS	R5102	J8	J5
C5110	J7	K4	R1070	F8	G2	S3090	B6	I3
CR3090	D3	I3	R1100	B5	J1	S3090-1	D5	I3
CR4090	G6	I4	R1101	C5	J1	S3090-10	C2	I3
CR4091	F6	I4	R1102	B5	J1	S3090-11	D3	I3
CR4092	H6	I4	R2060	G8	E2	S3090-4	C3	I3
CR4094	F6	I4	R2072	E8	G2	S3090-5	C3	I3
E265	I5	CHASSIS	R2073	F8	G2	S3090-6	C2	I3
E270	I5	CHASSIS	R260	I7	CHASSIS	S3090-7	B2	I3
J1070	F8	G1	R3080	D4	H3	S3090-8	C2	I3
J3110	J6	K3	R3090	C3	I3	S3090-9	B2	I3
J3110	J7	K3	R3091	C2	I3	U5090	F6	I5
J4070	E2	G4	R4080	E4	H4	U5090	K7	I5
J4070	E4	G4	R4081	D5	H4	W18	K5	CHASSIS
J4100	F7	G4	R4082	E4	H4	W24	G7	CHASSIS

A1 ASSY also shown on diagrams 2 and 3.

VOLTAGE AND WAVEFORM CONDITIONS

WARNING

Dangerous potentials exist at several points throughout this instrument. When the instrument is operated with the covers removed, do not touch exposed connections or components. Some transistors have voltages present on their cases. Disconnect the power source before replacing parts.

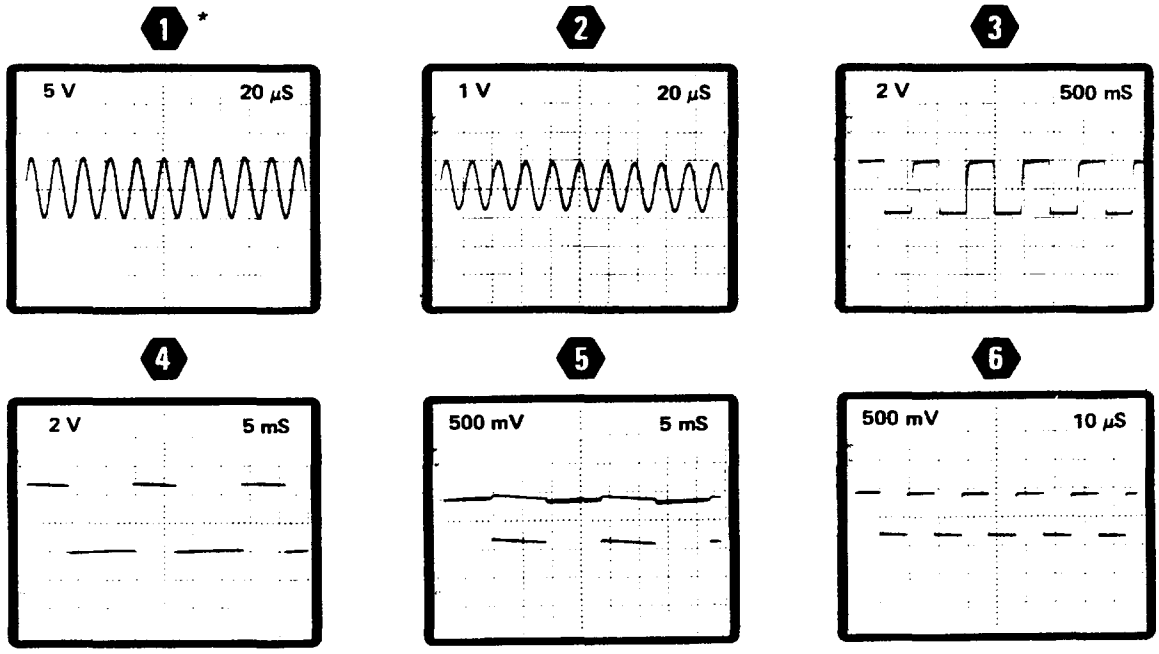
The voltages and waveforms shown on the diagrams were taken with no input signal and the SG 503 front panel controls set as follows:

VOLTAGES		*WAVEFORMS	
AMPLITUDE MULTIPLIER	X1	AMPLITUDE MULTIPLIER	X1
FREQUENCY VARIABLE	Midrange	FREQUENCY VARIABLE	Midrange
FREQUENCY RANGE (MHz)	REF ≈ .05	FREQUENCY RANGE (MHz)	REF ≈ .05
OUTPUT AMPLITUDE	5.5	OUTPUT AMPLITUDE	5.5

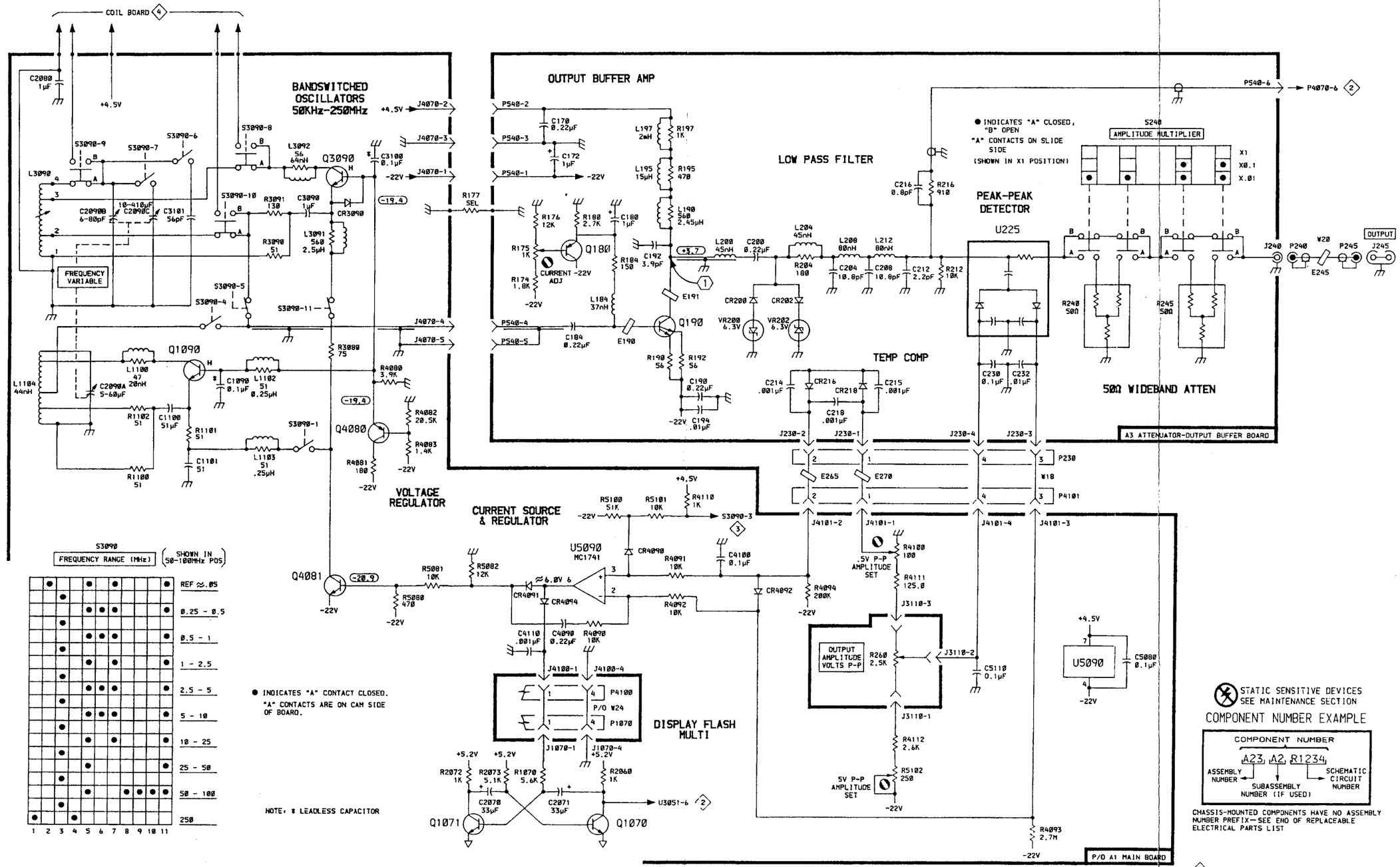
***gnd reference: center horizontal graticule line**

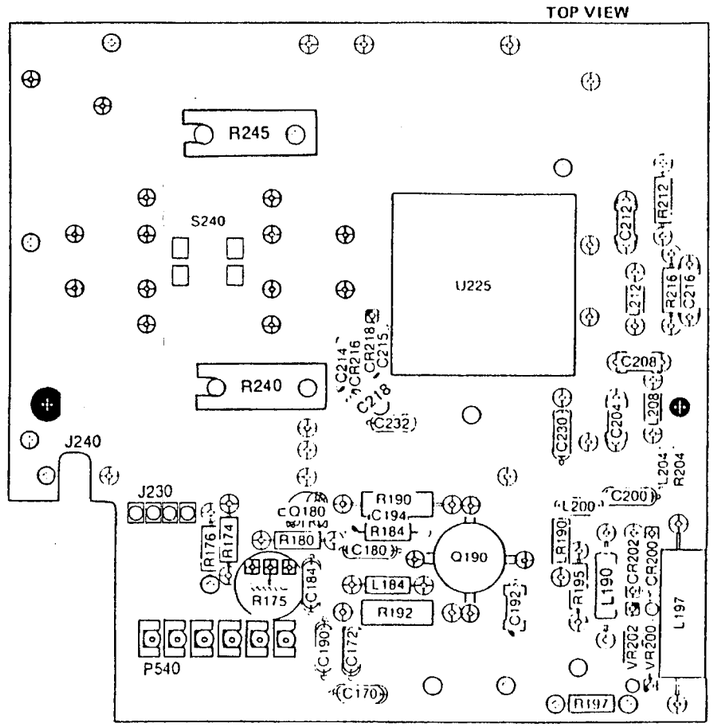
Voltage Conditions. The voltages shown on the diagram were obtained using a digital multimeter with a 10 MΩ input impedance (Tektronix DM 501 Digital Multimeter or Tektronix 7D13 Digital Multimeter used with readout equipped, 7000-series oscilloscope).

Waveform Conditions. The waveforms shown are actual waveform photographs taken with a Tektronix Oscilloscope Camera System and Projected Graticule. Vertical deflection factor shown on the waveform is the actual deflection factor from the probe tip. Voltages and waveforms on the diagrams are not absolute and may vary between instruments because of component tolerances, internal calibration, or front-panel settings. Readouts are simulated in larger-than-normal type.



***Note: Waveform 1 is located on diagram 1. Waveforms 2 thru 6 are on diagram 2.**





A3

Fig. 8-2. A3-Attenuator circuit board assembly.

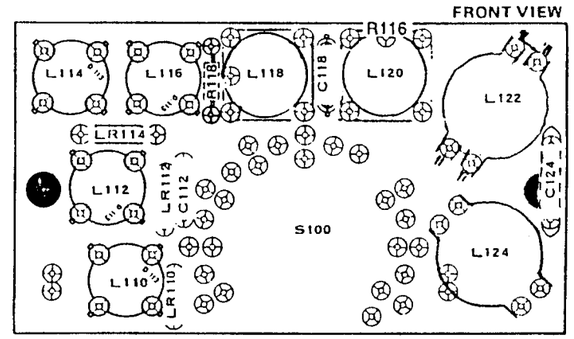
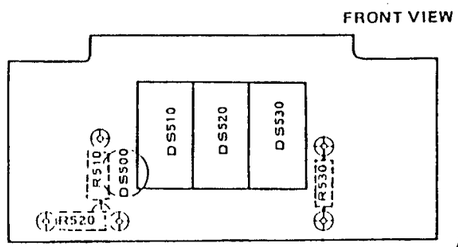


Fig. 8-4. A2-Coil circuit board assembly.

A2



A4

Fig. 8-3. A4-Display circuit board assembly.

Locator Table for Diagram 2

P/O A1 ASSY — AUTO-RANGING COUNTER 2

Circuit Number	Schematic Location	Board Location	Circuit Number	Schematic Location	Board Location
C1031	J1	C1	R4051	F2	F4
C1081	G4	G2	R4055	I2	E4
C2030	J1	C2	R4060	D2	F4
C2040	G1	D2	R4061	D1	F4
C2050	L8	D2	R4062	D1	F4
C2061	C4	F2	R4063	E2	F4
C2072	B2	G2	R4064	F3	F5
C3030	K1	C3	R5030	A8	C5
C3050	I2	E3	R5040	H2	D5
C3060	B3	F3	R5041	G3	D5
C3061	B3	F3	R5050	H3	E5
C3062	M1	E3	R5051	C3	E5
C3063	D4	F3	R5052	G2	E5
C3064	D2	F3	R5053	H3	E5
C3070	C1	G3	R5054	G3	E5
C4030	A7	C4			
C4050	G2		S3090-2	J5	I3
C4060	E3	F4			
C4061	C1	F4	U1020	L2	B2
C4062	M1	F5	U1030A	L5	C1
C4111	J5	K4	U1030B	F9	C1
C5030	A8	C5	U1031A	L3	C1
C5040	M1	C5	U1031B	L4	C1
			U1032A	G6	C2
CR4050	G1	E4	U1032B	G6	C2
			U1032C	H8	C2
J1070	H5	G1	U1032D	J7	C2
J4100	I5	K4	U1032E	J7	C2
			U1032F	G6	C2
L2040	H1	D2	U2030A	J6	C2
L2060	B3	F2	U2030B	J4	C2
L4060	D1	F4	U2040A	G4	D2
L4061	E2	G4	U2040B	I5	D2
			U2040C	K8	D2
P1070	I5	G1	U2040D	K7	D2
P4100	I5	K4	U2050A	J7	E2
			U2050B	K7	E2
Q3050	I2	E3	U2050B	L2	E2
Q3060	B3	F3	U2050C	L8	E2
Q3061	D3	F3	U3030A	I7	C3
Q3062	C3	F3	U3030B	F6	C3
Q3063	D2	F3	U3030C	E5	C3
Q3064	C2	F3	U3030D	E5	C3
Q4050	H3	E4	U3031	E7	C3
			U3040A	F4	D3
R2022	D6	B2	U3040B	H4	D3
R2023	D7	B2	U3041	G7	D3
R2050	K8	E2	U3050	G1	E3
R2062	D4	F2	U3050A	K2	E3
R2063	H4	F2	U3050B	H5	E3
R2064	B3	F2	U3050C	J8	E3
R2065	B3	F2	U3050D	I5	E3
R2070	D3	G2	U3051	J7	E3
R2071	B2	G2	U4030A	A7	C4
R3050	I2	E3	U4030B	A8	C4
R3051	I2	E3	U4030C	D8	C4
R3060	D4	F3	U4030D	B7	C4
R3061	D3	F3	U4040	C7	D4
R3062	C4	F3	U4050A	D8	E4
R3063	C3	F3	U4050B	D7	E4
R3064	D2	F3	U4050C	D5	E4
R3065	D2	F3	U4050D	E7	E4
R3066	C2	F3	U4060	F2	F4
R3067	C2	F3	U5040A	G2	D5
R3068	I3	E3	U5040B	H2	D5
R3070	B3	G3	VR4050	C5	E4
R3071	C1	G3			
R4030	A6	C4	W24	I5	CHASSIS
R4031	B8	C4			
R4050	F2	E4	Y5030	B7	C5

A1 ASSY also shown on diagrams 1 and 3.

CKT#	TYPE	C# CKT#	PIN A +5.2V	PIN B GND
U1020	74LS90		3,5	6,7,18
U1030	74LS390		16	8,14
U1031	74LS390		16	8
U1032	74LS04	C1031	14	7
U2030	74LS73	C2030	4	11
U2040	74LS86		10,13,14	7

CKT#	TYPE	C# CKT#	PIN A +5.2V	PIN B GND
U2050	74LS02		14	3,7
U3030	74LS02		14	7
U3031	74LS390	C3030	5,16	2,8, 10,14
U3040	74LS74		14	7
U3050	74LS74		14	7
U3041	74LS54		14	7

CKT#	TYPE	C# CKT#	PIN A +5.2V	PIN B GND
U3051	74LS90	C3062	5	2,3,10
U4030	74LS90		14	7
U4040	74LS93		5	2,3,10
U4050	74LS08		14	7
U5040	74LS93	C4062	1,16	8
U5050	74LS90	C5040	1,16	8

NOTE: * LEADLESS CAP

AUTO RANGING COUNTER AMPLIFIER

C3060 LOCATION FOR SERIAL NUMBERS BELOW B091100

C3060 LOCATION FOR SERIAL NUMBERS B091100 - UP

÷8 SIGNAL PRESCALING

COUNTERS

GATE

RANGE DECODER

SELECT CLOCK

AUTO RANGE CLOCK ENABLE

OVERFLOW DETECTOR

REFERENCE CLOCK

CLOCK PRESCALE

AUTO RANGE CLOCK

STATE GEN

GATE TIME CLOCK DIVIDER

STATIC SENSITIVE DEVICES SEE MAINTENANCE SECTION

COMPONENT NUMBER EXAMPLE

COMPONENT NUMBER: A23, A2, R1234 — ASSEMBLY NUMBER; SUBASSEMBLY NUMBER (IF USED); SCHEMATIC CIRCUIT NUMBER

CHASSIS-MOUNTED COMPONENTS HAVE NO ASSEMBLY NUMBER PREFIX—SEE END OF REPLACEABLE ELECTRICAL PARTS LIST

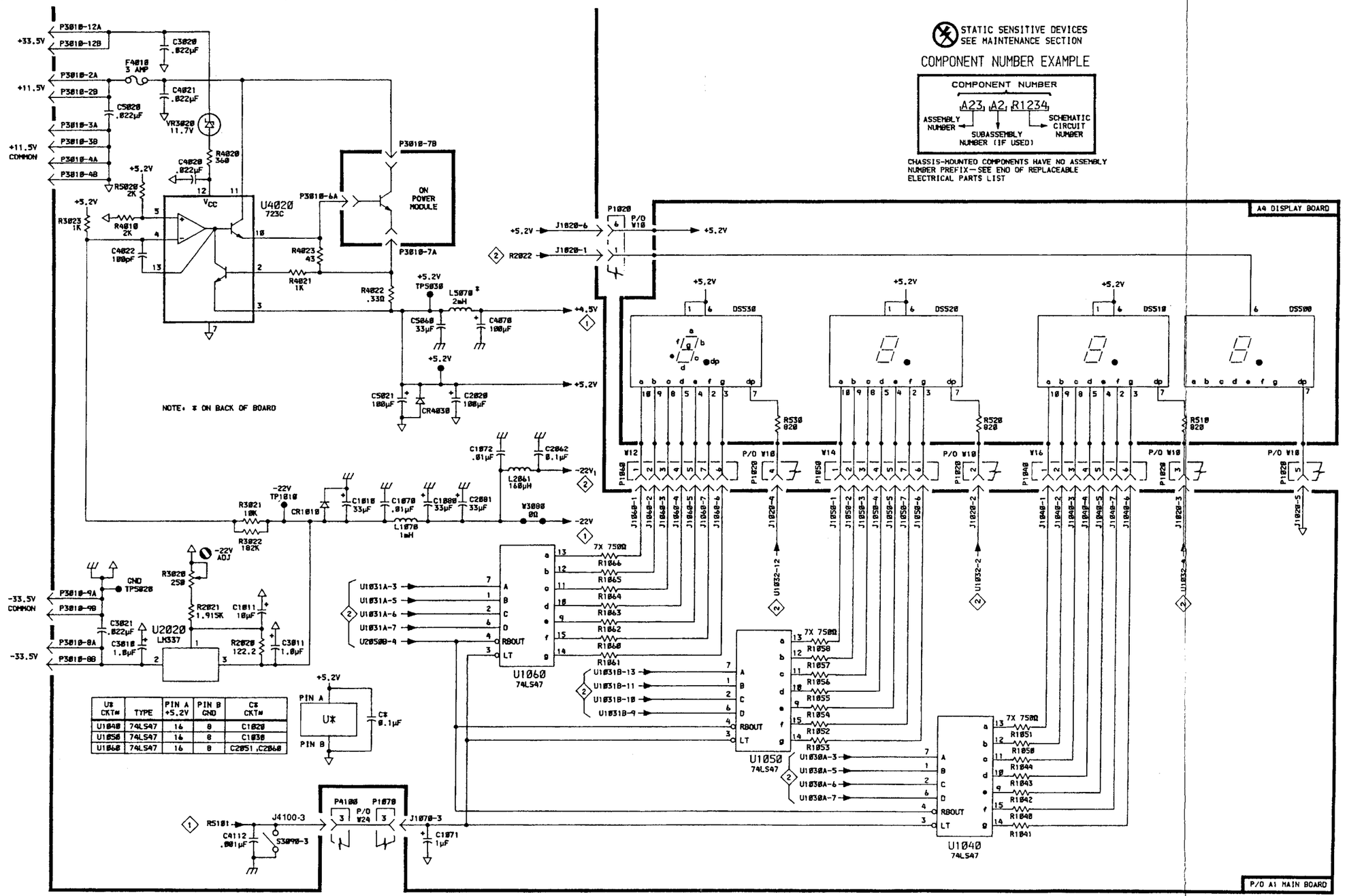
P/O A1 MAIN BOARD

Locator Table for Diagram ◇3

A4 ASSY		
Circuit Number	Schematic Location	Board Location
DS500	M3	H5
DS510	K3	I5
DS520	I3	I5
DS530	H3	I5
R510	L4	H5
R520	J4	H5
R530	H4	J5

P/O A1 ASSY			POWER SUPPLY AND DISPLAY ◇3		
Circuit Number	Schematic Location	Board Location	Circuit Number	Schematic Location	Board Location
C1010	D5	A1	P4100	D8	K4
C1011	C6	A1	R1040	J8	D1
C1020	C7	B1	R1041	J8	D1
C1030	C7	C1	R1042	J8	D1
C1070	E5	G1	R1043	J8	D1
C1071	E8	F1	R1044	J8	D1
C1072	E5	G1	R1050	J7	E1
C1080	E5	G1	R1051	J7	E1
C2020	E4	B2	R1052	H7	E1
C2051	C7	E2	R1053	H7	E1
C2060	C7	F2	R1054	H7	E1
C2062	F5	F2	R1055	H7	E1
C2081	E5	H2	R1056	H7	E1
C3010	B6	A3	R1057	H7	E1
C3011	D6	A3	R1058	H6	E1
C3020	C1	B3	R1060	F6	F1
C3021	B6	B3	R1061	F7	F1
C4020	C2	B4	R1062	F6	F1
C4021	C1	B4	R1063	F6	F1
C4022	B3	B4	R1064	F6	F1
C4070	E3	G4	R1065	F6	F1
C4112	C8	K4	R1066	F6	F1
C5020	B1	B5	R2020	C6	B2
C5021	D4	B5	R2021	C6	B2
C5060	E3	G5	R3020	B6	B3
CR1010	D5	A1	R3021	C5	B3
CR4030	E4	C4	R3022	C5	B3
			R3023	B3	B3
F4010	B1	A4	R4010	B3	A4
			R4020	C2	B4
J1020	F3	B1	R4021	D3	B4
J1020	H5	B1	R4022	D3	B3
J1020	J5	B1	R4023	D3	B4
J1020	L5	B1	R5020	B2	B4
J1020	M5	B1	S3090-3	D8	I3
J1040	J5	D1			
J1050	H5	E1	TP1010	D5	B1
J1060	G5	F1	TP5020	B6	B5
J1070	E8	G1	TP5030	E3	B4
J4100	D8	K4			
			U1040	J8	D2
L1070	E5	G1	U1050	H7	E2
L2061	F5	F2	U1060	F7	F2
L5070	E3	G5	U2020	B6	B2
			U4020	C2	B4
P1020	G2	B1			
P1020	H5	B1	VR3020	C2	B3
P1020	J5	B1			
P1020	L5	B1	W10	G3	CHASSIS
P1020	M5	B1	W10	H5	CHASSIS
P1040	J5	D1	W10	J5	CHASSIS
P1050	H5	E1	W10	L5	CHASSIS
P1060	G5	F1	W10	M5	CHASSIS
P1070	D8	G1	W12	G5	CHASSIS
P3010	B1	A3	W14	H5	CHASSIS
P3010	B6	A3	W16	J5	CHASSIS
P3010	D2	A3	W24	D8	CHASSIS
P3010	E2	A3	W3080	F5	C5
P3010	E3	A3			

A1 ASSY also shown on diagrams 1 and 2.

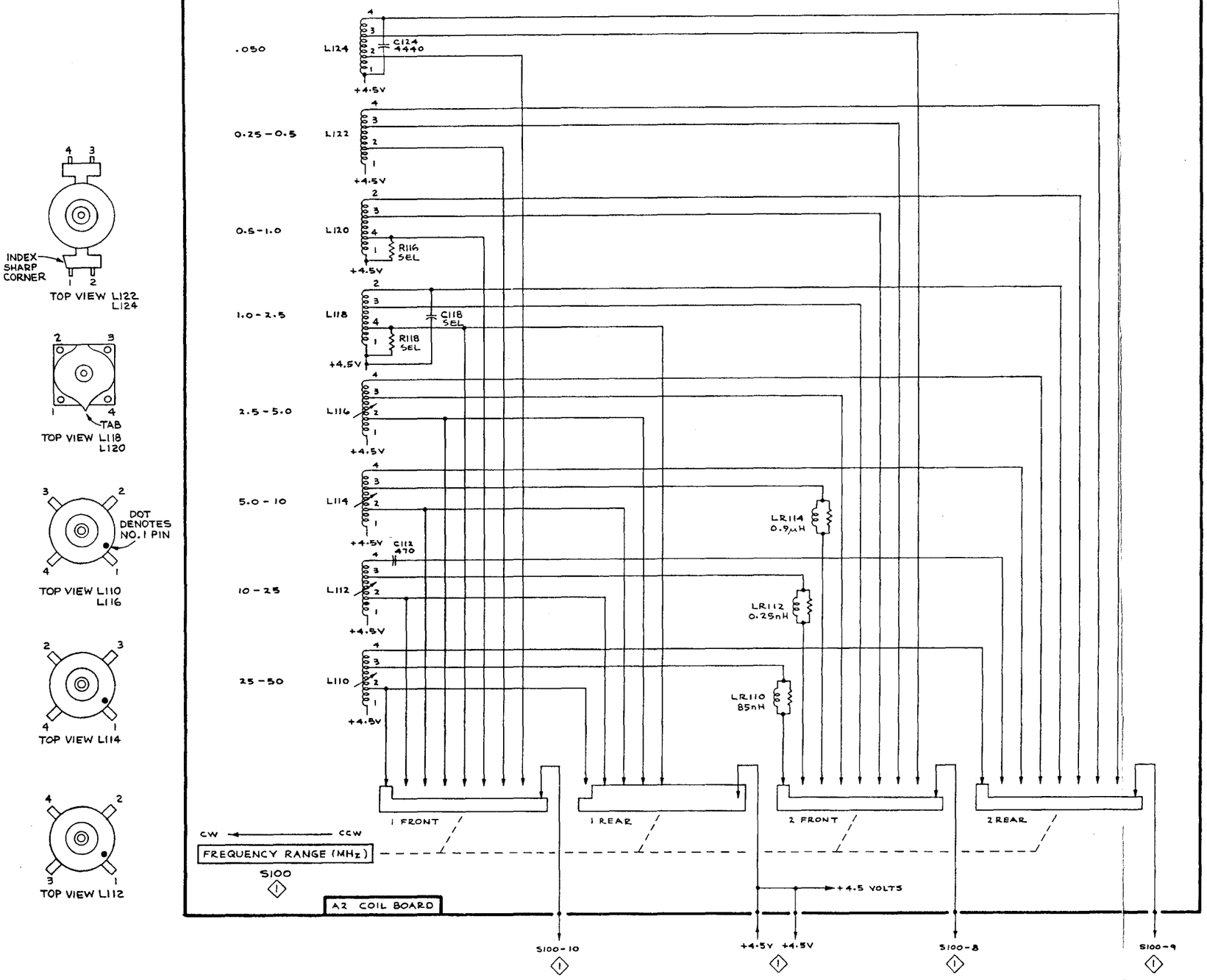


SG 503

POWER SUPPLY AND DISPLAY ◇3 DJD

Locator Table for Diagram 4

A2 ASSY			SWITCH DETAILS 4		
Circuit Number	**Schematic Location**	**Board Location**	**Circuit Number**	**Schematic Location**	**Board Location**
C112	C4	K2	LR110	D4	K3
C118	C2	L1	LR112	E4	K2
C124	C1	M2	LR114	E4	J2
L110	B4	J3	R116	C2	L1
L112	B4	J2	R118	C3	K1
L114	B3	J1			
L116	B3	K1	S100	B5	L2
L118	B2	K1			
L120	B2	L1			
L122	B1	M1			
L124	B1	M2			



SG 503

Switch Details ◇4

DBM
0874

REPLACEABLE MECHANICAL PARTS

PARTS ORDERING INFORMATION

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

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

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

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

ITEM NAME

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

FIGURE AND INDEX NUMBERS

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

INDENTATION SYSTEM

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

1 2 3 4 5 Name & Description

Assembly and/or Component
Attaching parts for Assembly and/or Component

END ATTACHING PARTS

Detail Part of Assembly and/or Component
Attaching parts for Detail Part

END ATTACHING PARTS

Parts of Detail Part
Attaching parts for Parts of Detail Part

END ATTACHING PARTS

Attaching Parts always appear in the same indentation as the item it mounts, while the detail parts are indented to the right. Indented items are part of, and included with, the next higher indentation.

Attaching parts must be purchased separately, unless otherwise specified.

ABBREVIATIONS

Abbreviations conform to American National Standards Institute Y1.1

CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
05129	KILO ENGINEERING CO	2118 D ST	LA VERNE CA 91750-5422
05820	EG AND G WAKEFIELD ENGINEERING	60 AUDUBON RD	WAKEFIELD MA 01880-1203
12327	FREEWAY CORP	9301 ALLEN DR	CLEVELAND OH 44125-4632
22526	DU PONT E I DE NEMOURS AND CO INC DU PONT CONNECTOR SYSTEMS DIV MILITARY PRODUCTS GROUP	515 FISHING CREEK RD	NEW CUMBERLAND PA 17070-3007
61957	USM CORP SUB OF EMHART INDUSTRIES INC	140 FEDERAL ST	BOSTON MA 02107
73743	FISCHER SPECIAL MFG CO	111 INDUSTRIAL RD	COLD SPRING KY 41076-9749
75915	LITTELFUSE TRACTOR INC SUB TRACTOR INC	800 E NORTHWEST HWY	DES PLAINES IL 60016-3049
77900	SHAKEPROOF DIV OF ILLINOIS TOOL WORKS	SAINT CHARLES RD	ELGIN IL 60120
78189	ILLINOIS TOOL WORKS INC SHAKEPROOF DIV	ST CHARLES ROAD	ELGIN IL 60120
79136	WALDES KOHINOR IN	47-16 AUSTEL PLACE	LONG ISLAND CITY NY 11101-4402
79807	WROUGHT WASHER MFG INC	2100 S BAY ST	MILWAUKEE WI 53207-1208
80009	TEKTRONIX INC	14150 SW KARL BRAUM DR PO BOX 500 MS 53-111	BEAVERTON OR 97077
83385	MICRODOT MFG INC GREER-CENTRAL DIV	3221 W BIG BEAVER RD	TROY MI 48098
83486	ELCO INDUSTRIES INC	1101 SAMUELSON RD	ROCKFORD IL 61101
86113	MICRODOT MFG INC CENTRAL SCREW-KEENE DIV	149 EMERALD ST	KEENE NH 03431-3628
86928	SEASTROM MFG CO INC	701 SONORA AVE	GLENDALE CA 91201-2431
93907	TEXTRON INC CAMCAR DIV	600 18TH AVE	ROCKFORD IL 61101
97464	INDUSTRIAL RETAINING RING CO	57 CORDIER ST	IRVINGTON NJ 07111-4035
98978	INTERNATIONAL ELECTRONIC RESEARCH CORP	135 W MAGNOLIA BLVD PO BOX 7704	BURBANK CA 91502
K0099	JACKSON BROTHERS (LONDON) LTD	258 BROADWAY	NEW YORK NY 10007
TK0433	PORTLAND SCREW CO	6520 N BASIN	PORTLAND OR 97217-3920
TK0435	LEWIS SCREW CO	4300 S RACINE AVE	CHICAGO IL 60609-3320
TK0507	O HARA METAL PRODUCTS CO	542 BRANNAN ST	SAN FRANCISCO CA 94107
TK0845	PARKER PRECISION PRODUCTS INC	1897 RIVER ROAD	CASTLETON NY 12033
TK1319	MORELLIS Q & D PLASTICS	1812 16-TH AVE	FOREST GROVE OR 97116
TK1326	NORTHWEST FOURSLIDE INC	18224 SW 100TH CT	TUALATIN OR 97062
TK1452	SHELLY-RAGON INC	8219 SW CIRRUS	BEAVERTON OR 97005
TK1569	GERHART TOOL AND DIE	1116 W ISABEL ST	BURBANK CA 91506

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-1	337-3211-00			2	SHIELD,ELEC:	80009	337-3211-00
-2	105-0932-00			2	LATCH,PANEL:SIDE	80009	105-0932-00
-3	214-3364-00			2	FASTENER,LATCH:ACETAL,SIL GRAY	80009	214-3364-00
-4	366-1861-00			1	KNOB:GY,0.252 ID X 0.706 OD X 0.612 H	80009	366-1861-00
-5	366-1190-02			1	KNOB:GY,0.252 ID X 0.706 OD X 0.6 H	80009	366-1190-02
-6	366-1851-01			1	KNOB,LATCH:IVORY GY,0.625 X 0.25 X 1.09	80009	366-1851-01
					ATTACHING PARTS		
-7	105-0865-00			1	BAR,LATCH RLSE:	80009	105-0865-00
-8	105-0866-00			1	LATCH,RETAINING:SAFETY	80009	105-0866-00
-9	214-3143-00			1	SPRING,HLEXT:0.125 OD X 0.545 L,XLOOP	80009	214-3143-00
					END ATTACHING PARTS		
-10	331-0360-00			1	DIAL,CONTROL:5 TURN,0 THRU 5.0	05129	771-S5
-11	210-0940-00			1	WASHER,FLAT:0.25 ID X 0.375 OD X 0.02,STL	12327	ORDER BY DESCR
-12	----- -----			1	CONN,RCPT,ELEC:BNC,FEMALE(SEE J245 REPL)		
-13	401-0270-00			1	GR ASSY,SP RDCN:5 TO 1	K0099	4112/P/MOD
-14	333-3051-00			1	PANEL,FRONT:	80009	333-3051-00
					ATTACHING PARTS		
-15	211-0101-00			3	SCREW,MACHINE:4-40 X 0.25,FLH,100 DEG,STL	TK0435	ORDER BY DESCR
-16	211-0025-00			1	SCREW,MACHINE:4-40 X 0.375,FLH,100 DEG,STL	TK0435	ORDER BY DESCR
					END ATTACHING PARTS		
-17	378-2030-08			1	LENS,LED DSPL:RED,PRINTED	80009	378-2030-08
-18	334-4925-00			1	MARKER,IDENT:MKD LEVELED SINE WAVE GEN	80009	334-4925-00
-19	337-3065-00			1	SHIELD,ELEC:FRONT SUBPANEL	80009	337-3065-00
-20	337-2171-00			1	SHIELD,ELEC:CAPACITOR	80009	337-2171-00
					ATTACHING PARTS		
-21	211-0292-00			1	SCR,ASSEM WSHR:4-40 X 0.29,PNH,BRS NI PL	78189	51-040445-01
-22	210-0406-00			1	NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL	73743	12161-50
-23	211-0030-00			1	SCREW,MACHINE:2-56 X 0.25,FLH,82 DEG,STL	TK0435	ORDER BY DESCR
-24	210-0406-00			1	NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL	73743	12161-50
-25	210-0001-00			1	WASHER,LOCK:#2 INTL,0.013 THK,STL	77900	1202-00-00-0541C
-26	213-0206-00			1	SCREW,TPG,TF:6-32 X 1.25,SPCL TYPE,PNH,STL	86113	ORDER BY DESCR
					END ATTACHING PARTS		
-27	361-0516-00			1	SPACER,SLEEVE:0.986 L X 0.157 ID,BRS	80009	361-0516-00
-28	214-1989-01			1	LEVER,SLIDE SW:	TK1319	N/A
					ATTACHING PARTS		
-29	354-0165-00			1	RING,RETAINING:TYPE E EXT,U/O 0.156 OD SFT	97464	1000-15-ZD
					END ATTACHING PARTS		
-30	343-0470-00			1	RTNR,PIVOT PIN:STAINLESS STEEL	80009	343-0470-00
					ATTACHING PARTS		
-31	211-0292-00			1	SCR,ASSEM WSHR:4-40 X 0.29,PNH,BRS NI PL	78189	51-040445-01
					END ATTACHING PARTS		
-32	214-3026-00			1	SPRING,GROUND:CU BE	TK1569	ORDER BY DESCR
-33	376-0154-00			1	ADAPTER,SW ACTR:OUTPUT ATTEN	80009	376-0154-00
-34	384-1223-00			1	EXTENSION SHAFT:LEVER SWITCH	80009	384-1223-00
-35	----- -----			1	CKT BD ASSY:DISPLAY(SEE A4 REPL)		
					ATTACHING PARTS		
-36	211-0101-00			2	SCREW,MACHINE:4-40 X 0.25,FLH,100 DEG,STL	TK0435	ORDER BY DESCR
					END ATTACHING PARTS		
-37	----- -----			1	CKT BD ASSY:ATTENUATOR(SEE A3 REPL)		
					ATTACHING PARTS		
-38	211-0101-00			2	SCREW,MACHINE:4-40 X 0.25,FLH,100 DEG,STL	TK0435	ORDER BY DESCR
-39	211-0292-00			4	SCR,ASSEM WSHR:4-40 X 0.29,PNH,BRS NI PL	78189	51-040445-01
					END ATTACHING PARTS		
					.CKT BD ASSY INCLUDES:		
-40	337-2016-00			1	.SHIELD,ELEC:HIGH FREQUENCY OSCILLATOR	80009	337-2016-00
					ATTACHING PARTS		
-41	213-0055-00			10	.SCREW,TPG,TF:2-32 X 0.188,TYPE B,PNH,STL	93907	ORDER BY DESCR
					END ATTACHING PARTS		
-42	210-0259-00			1	.TERMINAL,LUG:0.099 ID,LOCKING,BRS CD PL	80009	210-0259-00
	----- -----			1	.ACTUATOR ASSY:(SEE A3S240 REPL)		
					.ACTUATOR ASSEMBLY INCLUDES;		
-43	214-1126-01			2	..SPRING,FLAT:0.7 X 0.125,CU BE GRN CLR	80009	214-1126-01
-44	214-1127-00			2	..ROLLER,DETENT:0.125 DIA X 0.125,SST	80009	214-1127-00
-45	351-0355-00			1	..GUIDE,SLIDE SW:GRAY POLYCARBONATE	80009	351-0355-00
-46	105-0511-00			1	..ACTUATOR,SWITCH:OUTPUT ATTEN	80009	105-0511-00
-47	----- -----			1	.TRANSISTOR:(SEE A3Q190 REPL)		
					ATTACHING PARTS		
-48	220-0555-00			1	.NUT,PLAIN,HEX:8-32 X 0.25 HEX,STL CD PL	TK0433	ORDER BY DESCR

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-49	210-0804-00			1	.WASHER,FLAT:0.17 ID X 0.375 OD X 0.032	86928	76430-000
-50	342-0265-00			1	.INSULATOR,WSHR:0.322 ID X 0.75 OD X 0.17	TK0845	140A362H09
					END ATTACHING PARTS		
-51	----- -----			4	.CONT ASSY,ELEC:CAM SWITCH,BOTTOM		
					.(SEE A3S240 REPL)		
-52	131-1031-00			4	.CONT ASSY,ELEC:CAM SWITCH,TOP	80009	131-1031-00
					.(SEE A3S240 REPL)		
-53	210-3082-00			4	.EYELET,METALLIC:0.047 OD X 0.133 L,BRS NP	61957	S6494 (MODIFIED)
-54	----- -----			2	.ATTENUATOR,FXD:(SEE A3U240,U245 REPL)		
					ATTACHING PARTS		
-55	344-0248-00			2	.CLIP,ATTENUATOR:0.866 L,CU BE	80009	344-0248-00
-56	214-1797-00			4	.PIN,ATTEN CLIP:	80009	214-1797-00
					END ATTACHING PARTS		
-57	----- -----			1	.MICROCKT,DI(SEE A3U225 REPL)		
					ATTACHING PARTS		
-58	210-0405-00			2	.NUT,PLAIN,HEX:2-56 X 0.188,BRS CD PL	73743	12157-50
-59	211-0180-00			2	.SCR,ASSEM WSHR:2-56 X 0.25,PNH,BRS,NP,POZ	TK0435	ORDER BY DESCR
					END ATTACHING PARTS		
-60	214-2132-00			1	.HEAT SINK,XSTR:(2)NUTS,(2)STUDS	80009	214-2132-00
					ATTACHING PARTS		
-61	210-0406-00			3	.NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL	73743	12161-50
-62	210-0054-00			3	.WASHER,LOCK:#4 SPLIT,0.025 THK STL	78189	ORDER BY DESCR
-63	210-0956-00			3	.WASHER,FLAT:0.12 ID X 0.25 OD X 0.034,SST	79807	ORDER BY DESCR
					END ATTACHING PARTS		
-64	136-0263-04			6	.SOCKET,PIN TERM:U/W 0.025 SQ PIN	22526	75377-001
-65	337-2017-00			1	.SHIELD,ELEC:HIGH FREQUENCY OSCILLATOR	80009	337-2017-00
	----- -----			1	CKT BD ASSY:BAND SW(SEE A1 REPL)		
					ATTACHING PARTS		
-66	213-0146-00			3	SCREW,TPG,TF:6-20 X 0.312,TYPE B,PNH,STL	83385	ORDER BY DESCR
					END ATTACHING PARTS		
					.BAND SW ASSY INCLUDES;		
-67	131-0963-00			1	..CONTACT,ELEC:GROUNDING,PH BRZ,W/BRACKET	TK0507	ORDER BY DESCR
-68	----- -----			1	.CKT BD ASSY:COIL(SEE A1A2 REPL)		
					ATTACHING PARTS		
-69	211-0292-00			4	.SCR,ASSEM WSHR:4-40 X 0.29,PNH,BRS NI PL	78189	51-040445-01
					END ATTACHING PARTS		
					.CKT BD ASSY INCLUDES;		
	----- -----			1	..SW CAM ACTR AS:FREQUENCY RANGE(SEE A1A2		
					..S3090 REPL)		
					..ACTUATOR ASSY INCLUDES;		
-70	200-1647-00			1	...COVER,CAM SW:11 ELEMENTS	80009	200-1647-00
					ATTACHING PARTS		
-71	211-0008-00			3	...SCREW,MACHINE:4-40 X 0.25,PNH,STL	93907	ORDER BY DESCR
-72	210-0004-00			3	...WASHER,LOCK:#4 INTL,0.015 THK,STL	77900	1204-00-00-0541C
-73	211-0097-00			1	...SCREW,MACHINE:4-40 X 0.312,PNH,STL	TK0435	ORDER BY DESCR
-74	210-0994-00			1	...WASHER,FLAT:0.125 ID X 0.25 OD X 0.022,STL	86928	A371-283-20
-75	343-0144-00			1	...CLAMP,LOOP:0.125 ID,NYLON	TK1452	ORDER BY DESCR
-76	131-0963-00			1	...CONTACT,ELEC:GROUNDING,PH BRZ,W/BRACKET	TK0507	ORDER BY DESCR
-77	210-0406-00			2	...NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL	73743	12161-50
-78	354-0391-00			1	...RING,RETAINING:BASIC EXT,U/O 0.438 DIA SFT	79136	5100-43 MD
-79	214-1139-03			2	...SPRING,FLAT:0.885 X 0.156 CU BE RED CLR	80009	214-1139-03
-80	214-1127-00			2	...ROLLER,DETENT:0.125 DIA X 0.125,SST	80009	214-1127-00
-81	401-0081-02			1	...BEARING,CAM SW:FRONT W/O MOUNTING BOSSES	80009	401-0081-02
-82	386-3069-00			1	...PLATE,SW MTG:BAND	80009	386-3069-00
					ATTACHING PARTS		
-83	211-0022-00			2	...SCREW,MACHINE:2-56 X 0.188,PNH,STL	TK0435	ORDER BY DESCR
-84	210-0001-00			2	...WASHER,LOCK:#2 INTL,0.013 THK,STL	77900	1202-00-00-0541C
					END ATTACHING PARTS		
-85	105-0599-00			1	...ACTUATOR,CAM SW:BAND SWITCH	80009	105-0599-00
-86	210-0406-00			4	...NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL	73743	12161-50
-87	401-0113-01			1	...BEARING,CAM SW:W/INSERT	80009	401-0113-01
-88	----- -----			1	.CKT BD ASSY:MAIN(SEE A1A1 REPL)		
					.CKT BD ASSY INCLUDES;		
-89	----- -----			1	..TRANSISTOR:(SEE A1A1U2020 REPL)		
-90	214-3036-00			1	..HEAT SINK,XSTR:TO-220,ALUMINUM	98978	7363-BA
					ATTACHING PARTS		
-91	211-0008-00			1	..SCREW,MACHINE:4-40 X 0.25,PNH,STL	93907	ORDER BY DESCR
-92	210-0586-00			1	..NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL	78189	211-041800-00

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-					END ATTACHING PARTS		
-93	344-0326-00			2	..CLIP,ELECTRICAL:FUSE,BRASS	75915	102071
-94	337-2264-00			1	..SHIELD,ELEC:CIRCUIT BOARD	80009	337-2264-00
-95	----- -----			3	..CONT ASSY,ELEC:CAM SWITCH,BOTTOM ..(SEE A1A1S3090 REPL)		
-96	----- -----			11	..CONT ASSY,ELEC:CAM SWITCH,TOP ..(SEE A1A1S3090 REPL)		
-97	210-3082-00			11	..EYELET,METALLIC:0.047 OD X 0.133 L,BRS NP	61957	S6494 (MODIFIED)
-98	214-1292-00			2	..HEAT SINK,XSTR:TO-5,SIL BRZ PTD BLACK	05820	205SB
-99	----- -----			1	..CAP,VAR,AIR:(SEE A1A1C2090 REPL) ATTACHING PARTS		
-100	211-0503-00			2	..SCREW,MACHINE:6-32 X 0.188,PNH,STL	TK0435	ORDER BY DESCR
-101	210-0801-00			2	..WASHER,FLAT:0.14 ID X 0.281 OD X 0.25,BRS END ATTACHING PARTS	12327	31724-000
-102	376-0172-00			1	..CPLG,SHAFT,RGD:0.25 ID X 0.75 OD,DELRIN	K0099	5610/4-40
-103	426-0724-24			1	FR SECT,PLUG-IN:BOTTOM W/SPRING & EYELET	80009	426-0724-24
-104	214-3406-00			1	SPRING,FLAT:1.48 L X 0.125 W,CU BE	TK1326	ORDER BY DESCR
-105	426-0724-25			1	FR SECT,PLUG-IN:BOTTOM	80009	426-0724-25
-106	386-4866-00			1	SUPPORT,FRAME:REAR,AL ATTACHING PARTS	80009	386-4866-00
-107	386-3657-01			1	SUPPORT,PLUG-IN:	93907	ORDER BY DESCR
-108	213-0793-00			2	SCREW,TPG,TF:6-32 X 0.4375,TAPTITE,FILH END ATTACHING PARTS	83486	239-006-406043
					STANDARD ACCESSORIES		
	012-0482-00			1	CABLE ASSY,RF:50 OHM COAX,36.0 L	80009	012-0482-00
	070-6770-00			1	MANUAL,TECH:INSTR,SG503	80009	070-6770-00

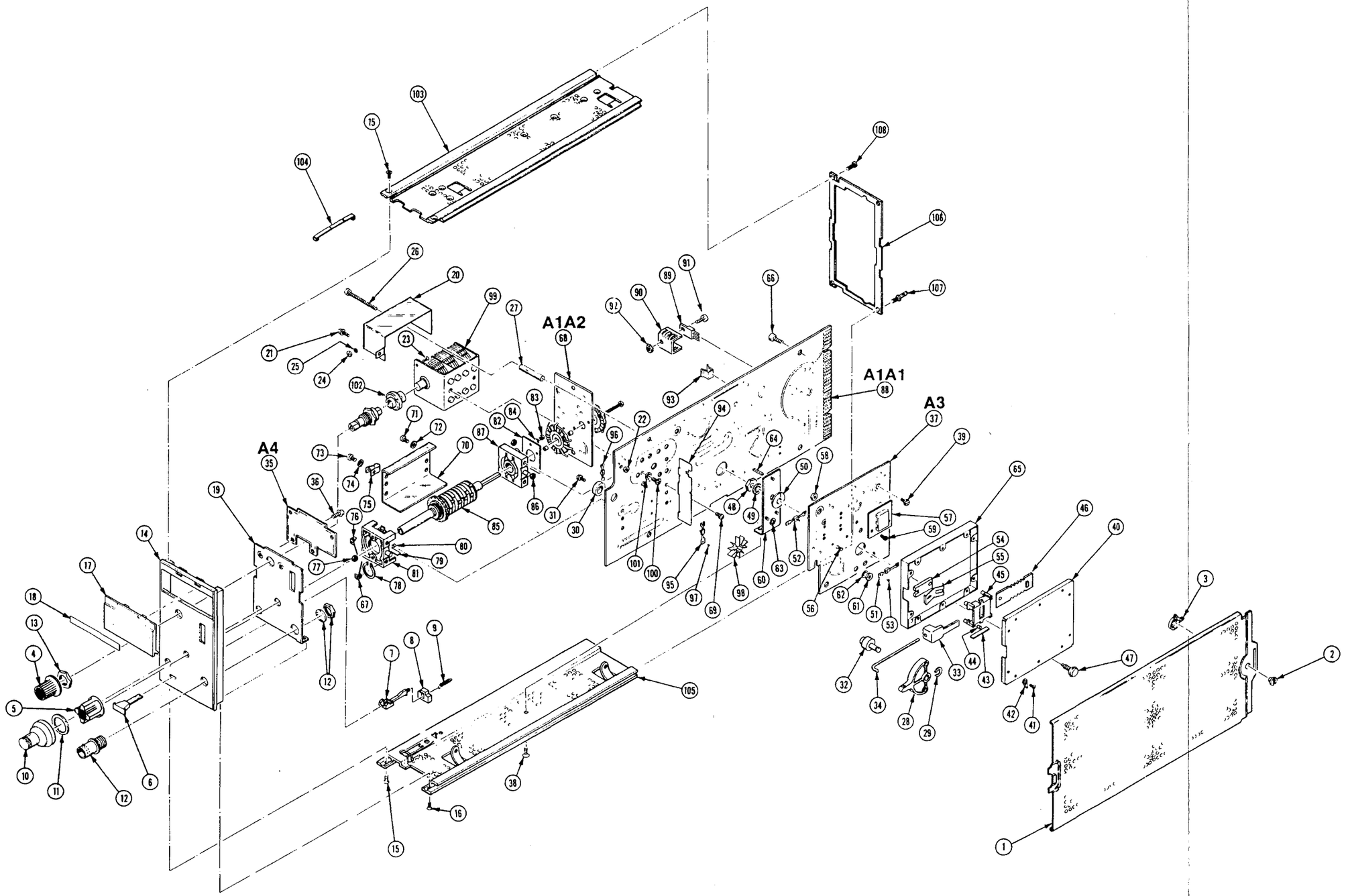


FIG.1 EXPLODED

SG 503 (SN B090000 & UP)

Tektronix®

REVISION INFORMATION

Manual Part No. 070-6770-00 **First Printing** September 1987

Product: SG 503 Leveled Sine Wave Generator **Revised** January 1991

Manual Insert Status

DATE	CHANGE REFERENCE	STATUS
OCT 87	M58343	Effective
FEB 88	M65669	Effective
APR 89	M69518	Effective

Tektronix
COMMITTED TO EXCELLENCE

MANUAL CHANGE INFORMATION

Date: October 2, 1987 Change Reference: M58343

Product: SG503 Manual Part No.: 070-6770-00

DESCRIPTION Product Group 75

Effective Serial Number B090100 and up:

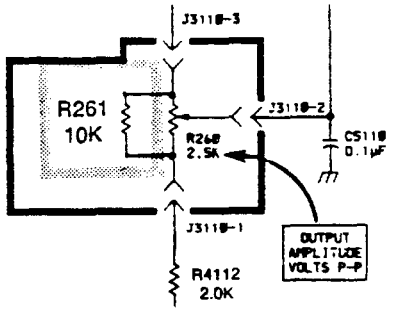
Electrical Parts List and Schematic Changes

Change to:

R4112	321-0222-07	Res,Fxd,Film:2.0K Ohm,0.1%,0.125W

Add:

R261	321-0289-00	Res,Fxd,Film:10.0K Ohm,1.0%,0.125W



Partial Oscillator, Buffer, Output ①

Tektronix
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MANUAL CHANGE INFORMATION

Date: FEB 11 1988 Change Reference: M65669

Product: SG 503 Leveled Sine-Wave Generator Manual Part No.: 070-6770-00

DESCRIPTION Product Group 75

EFFECTIVE SERIAL NUMBER B090465 AND ABOVE, PLEASE MAKE THE FOLLOWING CHANGE:

Remove:

A3	1	670-3073-03	CIRCUIT BD ASSY: ATTENUATOR
L204	1	108-0578-00	COIL,RF,FIXED,19NH AIRWOUND

Add:

A3	1	670-3073-04	CIRCUIT BD ASSY: ATTENUATOR
L204	1	108-0420-00	COIL,RF,FIXED,35NH,15%,AIRWOUND

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MANUAL CHANGE INFORMATION

Date: Apr 14, 1989 Change Reference: M69518

Product: SG 503 Leveled Sine-Wave Generator Manual Part No: 070-6770-00

DESCRIPTION

For Serial Numbers B091004 and above, please make the following changes:

Section 7

REPLACEABLE ELECTRICAL PARTS

Change:

Page 7-3

A1	672-0232-01	CIRCUIT BD ASSY:BAND SW
A1A1	671-0338-01	CIRCUIT BD ASSY:MAIN
		[AVAILABLE ONLY AS 672-0232-01 (SEE A1 REPL)]

Page 7-6

A1A1R4030	315-0152-00	RES,FXD,FILM:1.5K OHM,5%,0.25W
A1A1R5030	315-0152-00	RES,FXD,FILM:1.5K OHM,5%,0.25W