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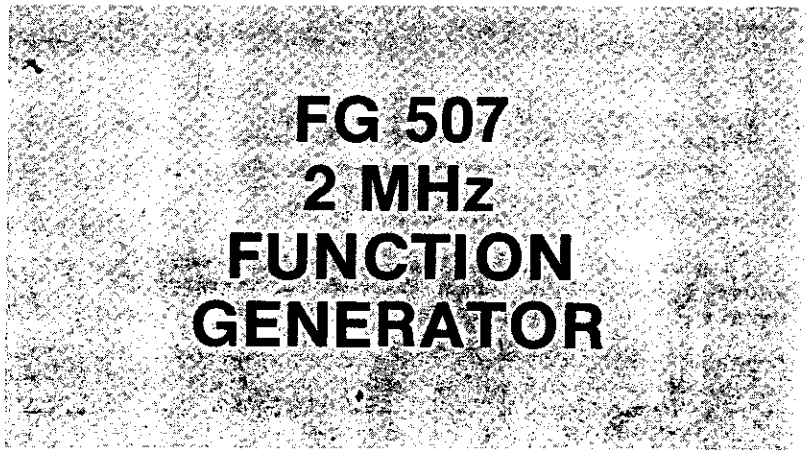

INSTRUCTION MANUAL

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

Serial Number _____

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WARNING

THE FOLLOWING SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID PERSONAL INJURY, DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO.

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LIST OF TABLES

NOTE

The following tables appear in the Diagrams and Illustrations foldout section.

LIST OF ILLUSTRATIONS

NOTE

The following illustrations appear in the Diagrams and Illustrations foldout section.

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OPERATORS SAFETY SUMMARY

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

TERMS

In This Manual

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

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

As Marked on Equipment

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

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

SYMBOLS

In This Manual

This symbol indicates where applicable cautionary or other information is to be found.

As Marked on Equipment

DANGER — High voltage.

Protective ground (earth) terminal.

ATTENTION — refer to manual.

Power Source

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

Grounding the Product

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

Danger Arising From Loss of Ground

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

Use the Proper Fuse

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

Refer fuse replacement to qualified service personnel.

Do Not Operate in Explosive Atmospheres

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

Do Not Operate Without Covers

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

SERVICE SAFETY SUMMARY

FOR QUALIFIED SERVICE PERSONNEL ONLY

Refer also to the preceding Operators Safety Summary.

Do Not Service Alone

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

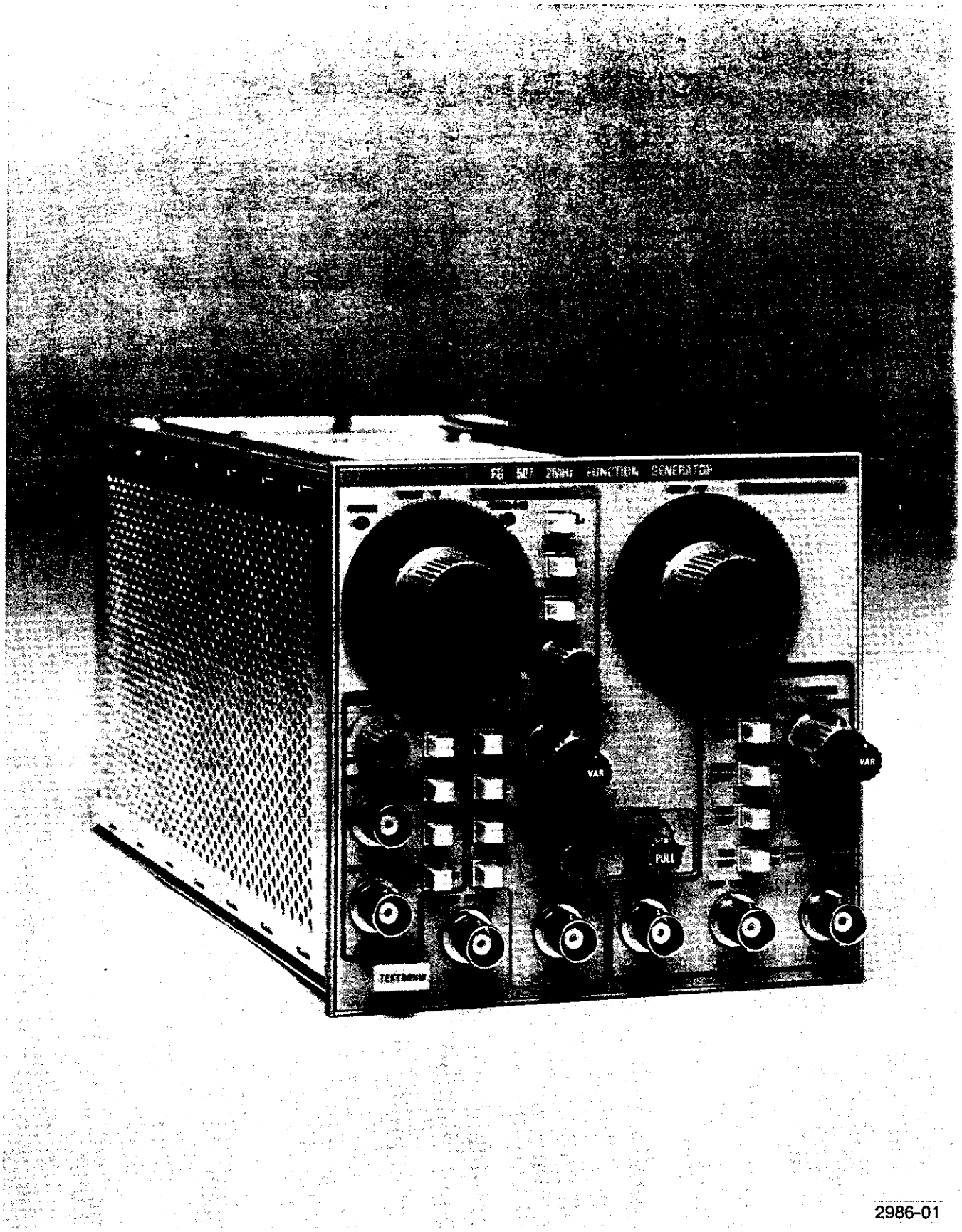
Use Care When Servicing With Power On

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

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

Power Source

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



FG 507 2 MHz SWEEPING FUNCTION GENERATOR

SPECIFICATION

INTRODUCTION

This section of the manual contains a general description of the FG 507 and complete electrical, environmental, and physical specifications. Standard accessories are also listed. Instrument option information is located in the back of this manual in a separate section.

INSTRUMENT DESCRIPTION

The FG 507 Function Generator provides low distortion sine, square, triangle, ramp, and pulse waveforms over a frequency range from 0.002 Hz to 2 MHz. Dc offset up to ±13 V is available. Waveform triggering and gating functions, in addition to being slope (+ or −) selectable, are provided with variable phase control capable of up to ±90° phase shift. The symmetry of the output waveform may also be varied from 5 to 95%. Step attenuators provide up to 60 dB of attenuation in 20 dB steps. A variable amplitude control provides an additional 20 dB attenuation.

A voltage-controlled frequency (VCF) input is provided to control the output frequency from an external voltage source. The output frequency can be swept above and below the selected frequency to a maximum of 1000:1 depending on the polarity and amplitude of the VCF input and the selected output frequency.

The FG 507 has the capability of self-sweeping up to three decades of frequency, either linearily or logarithmically.

The sweep can be switched between linear and logarithmic without readjusting the frequency controls. The sweep can be free running or manually or externally triggered. The linear sweep ramp is available at a front panel connector, as is an internally generated gating pulse equal in duration to the sweep ramp. The FG 507 features a manual sweep function whereby the operator can, via a front panel control, manually sweep between the start and stop frequencies.

ACCESSORIES

The only accessory shipped with the FG 507 is the Instruction Manual.

PERFORMANCE CONDITIONS

The electrical characteristics are valid with the following conditions:

1. The instrument must have been adjusted at an ambient temperature between +20° C and +30° C and operating at an ambient temperature between 0° C and +50° C.

2. The instrument must be in a noncondensing environment whose limits are described under Environmental.

3. Allow 20 minutes warm-up time for operation to specified accuracy; 60 minutes after exposure to or storage in a high humidity (condensing) environment.

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 may not be verified in this manual; they are either explanatory notes or performance characteristics for which no limits are specified.

Table 1-1

ELECTRICAL CHARACTERISTICS

Characteristics	Performance Requirements	Supplemental Information
Frequency Range		Provided in eight decade steps plus variable, with overlap on all ranges.
Sinewave, squarewave, and triangle	0.002 Hz to 2 MHz calibrated portion of dial.	Calibrated portion of dial extends from 20 to 2. Portion of dial from 2 to 0.2 is uncalibrated. 0.0002 Hz to 0.002 Hz uncalibrated portion of dial.
Ramp and Pulse	0.002 Hz to 200 kHz ±5% calibrated portion of dial.	Measured at 50% duty cycle. 0.0002 Hz to 0.002 Hz uncalibrated portion of dial.
Variable Symmetry Duty Cycle	⩽ 5% to ⩾ 95%.	Activation of symmetry control divides output frequency by ≈ 10.
Output Amplitude	At least 30 V p-p into an open circuit, at least 15 V p-p into 50 Ω (front panel only).	Offset control off.
Output Impedance		Front panel z_o = 50 Ω ±10%. ATTEN in 0 dB position. Rear interface z_o = 600 Ω ±10%.
Offset Range	At least ±13 V into open circuit, at least ±6.5 V into 50 Ω. Maximum peak signal plus offset cannot exceed ±15 V into an open circuit, or ±7.5 into 50 Ω (front panel only). Offset reduced by attenuators.	
Frequency Resolution		1 part in 10^4 of full scale with frequency vernier control.
Stability (Frequency) Time		⩽ 0.1% for 1 hour, ⩽ 0.5% for 24 hours.
Temperature		Within 2% from 0.2 Hz to 2 MHz, and within 10% from 0.002 Hz to 0.2 Hz. The FREQUENCY Hz dial must be on the calibrated portion. The instrument must be in a temperature between 0° C and +50° C and checked after a 1 hour warmup. VAR SYMM control disabled.

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Table 1-1 (cont)

Characteristics	Performance Requirements	Supplemental Information
Amplitude Flatness	Measured with 0 dB ATTEN button pressed and output driving 50 Ω load. (front panel only)	
Sinewave (10 kHz Sinewave Reference)	±0.1 dB 20 Hz to 20 kHz ±0.5 dB 20 kHz to 1 MHz ±1 dB 1 MHz to 2 MHz	Typically ±0.5 dB 0.002 Hz to 20 Hz.
Squarewave (10 kHz Squarewave Reference)	Peak to peak amplitude within ±0.5 dB of squarewave reference amplitude 20 Hz to 2 MHz.	Typically within ±0.5 dB 0.002 Hz to 20 Hz.
Triangle (10 kHz Triangle Reference)	Peak to peak amplitude within ±0.5 dB of triangle wave reference amplitude 20 Hz to 200 kHz. Within 2 dB 200 kHz to 2 MHz.	Typically within ±0.5 dB 0.002 Hz to 20 Hz.
Sinewave Distortion	⩽ 0.25% 20 Hz to 20 kHz on 10^3 range and below.	20° to 30° C. Measured with average responding THD meter.
	⩽ 0.5% 20 kHz to 100 kHz.	Measurement bandwidth limited to approximately 300 kHz.
	All harmonics at least 30 dB below fundamental from 100 kHz to 2 MHz.	Verified at 15 V p-p into 50 Ω load. Must be on calibrated portion of dial. VAR SYMM control off. Offset control off. Trigger output driving open circuit.
Squarewave Output Risetime and Falltime Aberrations (p-p)	Step ATTEN in 0 dB position. ⩽ 25 ns at 15 V p-p into 50 Ω. ⩽ 3% (front panel only).	
Pulse Output Risetime and Falltime Aberrations (p-p)	Step ATTEN in 0 dB position. ⩽ 25 ns at 15 V p-p into 50 Ω. ⩽ 3% (front panel only).	
VCF Input	10 V ⩾ 1000:1	Positive going voltage increases frequency. Maximum slew rate = 0.5 V/μs. VCF must not exceed range limits. Maximum input ⩽ 15 Vpk.
Ext Trig/Gate Input Impedance Threshold Level	 +1 V ± 20%.	 ⩽ 10 kΩ. Maximum input ⩽ 15 Vpk.

Table 1-1 (cont)

Characteristics	Performance Requirements	Supplemental Information
Trigger Output	⩾ +4 V into open circuit. ⩾ +2 V into 50 Ω.	
Variable Phase Range	At least ±90°.	Sine and triangle only.
Attenuators		60 dB in 20 dB steps. > 20 dB additional attenuation with amplitude control.
Accuracy	±1 dB.	Verified at 20 kHz.
Dial Accuracy	Within 3% of full scale 20 to 2.	2 to 0.2 uncalibrated.
Triangle		
Linearity		Greater than or equal to 99% 20 Hz to 200 kHz, 97% 200 kHz to 2 MHz (calibrated). Measured from 10% to 90% of waveform.
Time Symmetry	Better than 1% from 20 Hz to 200 kHz. 5% from 200 kHz to 2 MHz (calibrated).	
Internal Sweep		
Sweep Duration	1 mS to 10 s > 10 sec with variable.	In five decades plus variable with overlap on all ranges.
Sweep Trigger Input		
Threshold Level	+1 V (fixed) ±20%.	Maximum input ⩽ 15 Vpk.
Impedance		≈ 2 kΩ
Sweep Output	Ramp less than +300V to 10 V ±5%.	Output impedance typically 1 kΩ ±5%.
Gate Output	⩾ +4 V into open circuit. ⩾ +2 V into 50 Ω.	
Dial Accuracy		
Nonswept Mode		
Start Frequency	Within 3% of full scale 20 to 2.	SWEEP DURATION knob in "off" position. 2 to 0.2 uncalibrated.
Swept Mode	Temperature = 25°C ±5°C	
Start Frequency	Within 5% of full scale 20 to 2.	Stop frequency knob set at 20 in TRIG SWEEP mode with no EXT TRIG. 0.2 to 2 uncalibrated.
Stop Frequency	Within 5% of full scale 20 to 2.	Start frequency knob set at .2 VAR full clockwise. Sweep hold button pressed. 0.2 to 2 uncalibrated.

Table 1-2

MISCELLANEOUS

Characteristics	Description
Power Consumption	17 W or less (plug-in only)
Recommended Adjustment Interval	1000 hours or 6 months, whichever occurs first.
Warm-up time	30 minutes.

Table 1-3

ENVIRONMENTAL[a]

Characteristics	Description	
Temperature		Meets MIL-T-28800B, class 5.
Operating	0°C to +50°C	
Nonoperating	−55°C to +75°C	
Humidity	95% RH, 0°C to 30°C 75% RH to 40°C 45% RH to 50°C	Exceeds MIL-T-28800B, class 5.
Altitude		Exceeds MIL-T-28800B, class 5.
Operating	4.6 Km (15,000 ft)	
Nonoperating	15 Km (50,000 ft)	
Vibration	0.38 mm (0.015") peak to peak, 5 Hz to 55 Hz, 75 minutes.	Exceeds MIL-T-28800B, class 5, when installed in qualified power modules.[b]
Shock	30 g's (1/2 sine), 11 ms duration, 3 shocks in each direction along 3 major axes, 18 total shocks.	Meets MIL-T-28800B, class 5, when installed in qualified power modules.[b]
Bench Handling[c]	12 drops from 45°, 4" or equilibrium, whichever occurs first.	Meets MIL-T-28800B, class 5.
Transportation[c]	Qualified under National Safe Transit Association Preshipment Test Procedures 1A-B-1 and 1A-B-2.	
EMC	Within limits of MIL-461A, and F.C.C. Regulations, Part 15, Subpart J, Class A.	
Electrical Discharge	20 kV maximum charge applied to instrument case.	

[a] With power module.

[b] Refer to TM 500 power module specifications.

[c] Without power module.

Table 1-4

PHYSICAL CHARACTERISTICS

Characteristics	Description
Finish	Plastic/aluminum laminate front panel. Anodized aluminum chassis.
Net Weight	3.25 lbs (1.47 kg)
Overall Dimensions	Height 5.0 in. (12.7 cm) Width 5.3 in. (13.5 cm) Length 12.2 in. (31 cm)

OPERATING INSTRUCTIONS

INTRODUCTION

This section of the manual provides operating information required to obtain the most effective performance from the FG 507. Also included are installation and removal instructions and a functional description of front panel controls and connectors. Operating modes and basic applications are also discussed.

INSTALLATION AND REMOVAL

The FG 507 is calibrated and ready to use when received. It operates in two compartments of any TM 500-series power module except the TM 501. Refer to the power module instruction manual for line voltage requirements and power module operation.

CAUTION

To prevent damage to the FG 507, turn the power module off before installation or removal of the instrument from the mainframe. Do not use excessive force to install or remove.

Check to see that the plastic barriers on the interconnecting jacks of the selected power module compartments match the cutouts in the FG 507 circuit board edge connectors. If they do not match, do not insert the instrument until the reason for the barrier is checked. When the units are properly matched, align the FG 507 chassis with the upper and lower guides of the selected compartments (see Fig. 2-1). Insert the FG 507 into the mainframe and press firmly to seat the circuit board edge

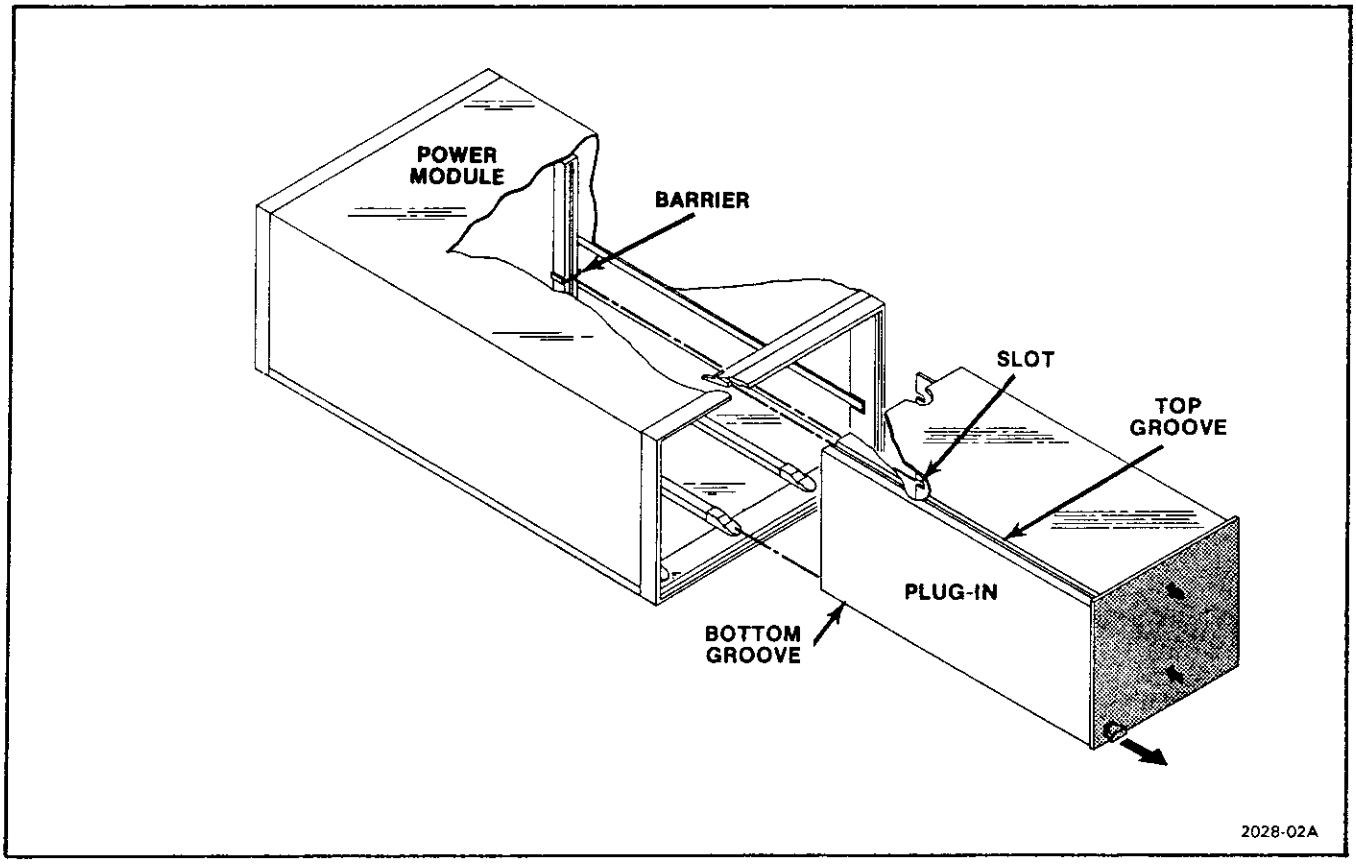

Fig. 2-1. Installation and Removal.

connectors in the power module interconnecting jacks. Apply power to the FG 507 by operating the power switch on the power module.

To remove the FG 507 from the power module, pull the release latch (located in the lower left corner) until the interconnecting jack disengages. The FG 507 will now slide straight out.

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.

If the original package is not fit for use or not available, repackage the instrument as follows:

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

The carton test strength for your instrument is 200 pounds.

CONTROLS AND CONNECTORS

Although the FG 507 is calibrated and ready to use, the function and actions of the controls and connectors should be reviewed before attempting to use it. All controls necessary for operation of the instrument are located on the front panel. A brief description of these controls follows. Refer to Fig. 2-2.

(1) **RELEASE LATCH**—pull to disengage the FG 507 from the power module.

(2) **POWER**—illuminated when power is applied to the FG 507.

FREQUENCY/FUNCTION

(3) **FREQUENCY Hz (START)**—selects frequency of operation or start frequency in sweep mode.

(4) **FREQUENCY Hz (STOP)**—selects ending frequency in sweep mode.

(5) **MULTIPLIER**—in conjunction with the FREQUENCY Hz controls, selects the output frequency in eight decade steps.

(6) **FREQUENCY VERNIER**—control for fine adjustment of output frequency to at least 1 part in 10^4 of full scale.

(7) **FUNCTION BUTTONS**—select output waveform; square, triangle, and sine.

(8) **VAR SYMM**—(push to enable) readjusts time-based symmetry of output waveform. Reduces the frequency of the output waveform by a factor of approximately ten and illuminates the FREQ ÷ 10 indicator.

(9) **FREQ ÷ 10**—illuminated when the variable symmetry function is activated.

TRIGGER/GATE

(10) **FREE RUN**—button when pushed causes continuous waveform output.

(11) **TRIG**—button when pushed causes output of one cycle of selected waveform for each trigger pulse applied to the TRIG/GATE IN Connector.

(12) **GATE**—button when pushed causes continuous output of the selected waveform for the duration of the gating pulse.

(13) **SLOPE**—button selects, in Trig mode, the slope of the input signal which will trigger the selected output waveform, and, in GATE mode, whether

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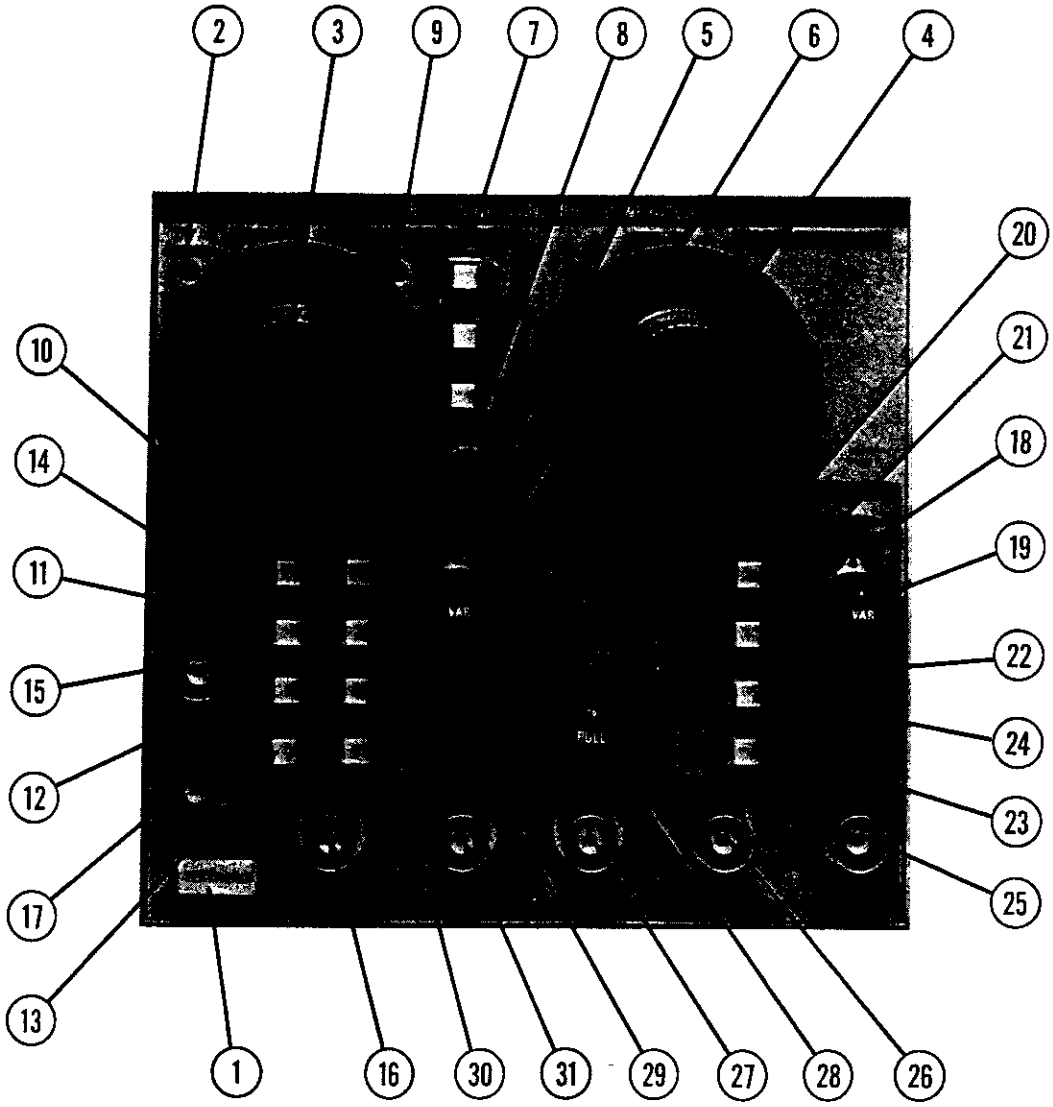

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Fig. 2-2. Controls and Connectors.

output gating will occur when the level of the input signal is above or below the threshold level of +1 V.

(14) **VAR Ø**—control to adjust phase lead or lag, up to ±90°, relative to input trigger or gate waveform.

(15) **TRIG/GATE IN**—BNC connector used to apply the external trigger or gating signal.

(16) **VCF INPUT**—BNC connector for applying an external voltage for controlling the output frequency of the generator. Positive voltage increases frequency.

(17) **TRIG OUTPUT**—BNC connector which outputs one positive pulse for each cycle of the selected output waveform.

SWEEP

(18) **SWEEP DURATION**—selects total duration time of frequency sweeping ramp. Also selects manual (MAN) sweep and disables (OFF) the sweep function.

(19) **VAR**—varies total sweep time between steps of the SWEEP DURATION control.

(20) **MAN TRIG**—button manually triggers one sweep each time it is pushed when Triggered Sweep is selected.

(21) **HOLD SWP**—button in causes the sweep to hold when it reaches the STOP frequency. Sweep will reset to START frequency when button is released.

(22) **LOG SWP/LIN SWP**—button in sweeps frequency (start to stop) at a logarithmic rate; button out sweeps frequency (start to stop) at a linear rate.

(23) **TRIG SWP/FREE RUN**—button in causes frequency sweeping to commence with positive pulse at the SWP TRIG IN connector; button out allows the sweep to free run.

(24) **MAN SWP**—with the SWEEP DURATION control in the "MAN" position this control permits manual adjustment of the frequency from start to stop.

(25) **LIN SWP OUTPUT**—BNC connector outputs a 0 to 10 V linear ramp, irrespective of sweep mode used, any time sweep is running.

(26) **SWP TRIG IN**—waveform applied to this connector triggers frequency sweeping ramp when in TRIG SWP mode.

(27) **GATE OUTPUT**—available at this connector is a positive squarewave gating pulse equal in duration to the sweep ramp.

OUTPUT

(28) **OFFSET**—pull and turn control provides up to ±13 V DC offset of the output waveform.

(29) **AMPLITUDE**—varies the amplitude of the selected output waveform between steps of the attenuator buttons.

(30) **ATTENUATOR BUTTONS**—when pushed in attenuate the amplitude of the selected output waveform in 20 dB steps to a maximum of 60 dB.

(31) **OUTPUT**—BNC connector for output of the selected waveform.

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OPERATING CONSIDERATIONS

OUTPUT CONNECTIONS

The output of the FG 507 is designed to operate as a 50 Ω voltage source working into a 50 Ω load. At higher frequencies, an unterminated or improperly terminated output will cause aberrations on the output waveform. Loads less than 50 Ω will reduce the waveform amplitude.

Excessive distortion or aberrations, due to improper termination, are less noticeable at the lower frequencies (expecially with sine and square waveforms). To ensure waveform purity, observe the following precautions:

1. Use good quality 50 Ω coaxial cables and connectors.

2. Make all connections tight and as short as possible.

3. Use good quality attenuators if it is necessary to reduce waveform amplitude applied to sensitive circuits.

4. Use terminations or impedance-matching devices to avoid reflections when using long cables (6 feet or more).

5. Ensure that attenuators, terminations, etc., have adequate power handling capabilities for the output waveform.

If there is a dc voltage across the output load, use a coupling capacitor in series with the load. The time constant of the coupling capacitor and load must be long enough to maintain pulse flatness.

RISETIME AND FALLTIME

If the FG 507 is used to measure the rise or falltime of a device, the risetime characteristics of associated equipment should be considered. If the risetime of the device under test is at least 10 times greater than the combined risetimes of the FG 507 and associated equipment, the error introduced will not exceed 1%, and generally can be ignored. When the rise or falltime of the test device is less than 10 times as long as the combined risetimes of the testing system, the actual risetime of the system must be calculated. Once the risetime of the system is known, the risetime of the device under test can be determined.

IMPEDANCE MATCHING

If the FG 507 is driving a high impedance such as the 1 MΩ input impedance (paralleled by a stated capacitance) of the vertical input of an oscilloscope, connect the transmission line to a 50 Ω attenuator, 50 Ω termination, and then the oscilloscope input. The attenuator isolates the input capacitance of the device, and the FG 507 is properly terminated.

FIRST TIME OPERATION

The Controls and Connectors pages give a description of the front panel controls. The waveform selection and frequency determining controls are outlined in blue, the trigger function controls and inputs are outlined in green, the sweep controls are outlined in orange, and the output controls are outlined in black.

The following exercise will familiarize the operator with most functions of the FG 507.

NOTE

If any discrepancies are encountered during the exercise, refer the condition to qualifed service personnel.

For first time operation, preset the controls as follows:

Blue Section

FREQUENCY Hz (start)	10
FREQUENCY Hz (stop)	20
MULTIPLIER	10^2
FREQUENCY VERNIER	Fully Clockwise
VAR SYMM	Off (in)
Sine Wave	in
All Others	Out

Green Section

VAR Ø	Centered
FREE RUN	In
All Others	Out

Black Section

0 dB	In
AMPLITUDE	Centered
OFFSET	Off (in)
All Others	Out

Orange Section

SWEEP DURATION	OFF
MAN SWP	Fully Counterclockwise
All Others	Out

Connect a 50 Ω bnc coaxial cable terminated in 50 Ω to the vertical input of an oscilloscope. Set the oscilloscope controls to:

Vertical	2 V/DIV DC Coupled
Horizontal (Time Base)	1 ms/Div

The oscilloscope should display one complete cycle per division of the sine waveform (approximately ten cycles across the graticule).

1. Alternately press the square, triangle, and sine buttons and observe the different waveshapes. Return to the preset condition.

2. Alternately press the four attenuator buttons and rotate the AMPLITUDE (variable) control to verify that the waveform amplitude changes. Return these controls to the preset condition.

3. Pull out and rotate the OFFSET knob. Notice the change in dc level of the displayed waveform. Return the OFFSET knob to the "IN" position.

4. Push the VAR SYMM button to release it to the out position. Observe that the FREQ ÷ 10 indicator is illuminated and only one cycle of the output waveform is displayed. Rotate the VAR SYMM control through its range and notice the change in shape of the square, triangle, and sine waveforms (with the appropriate buttons pushed in). Return the controls to the preset condition.

5. Rotate the FREQUENCY control and the MULTIPLIER switch and observe the change in frequency of the displayed waveform. Return these controls to the preset condition.

6. Set the FREQUENCY Hz (start) dial to 2 and check that the FREQUENCY Hz (stop) dial is at 20. Two complete cycles of the sine wave should be displayed on the oscilloscope.

7. Set the SWEEP DURATION control to the MAN position.

8. Rotate the MAN SWP control fully clockwise and back. Observe the frequency change of the displayed waveform.

9. Set the SWEEP DURATION control to the 10 s position. Note that the displayed waveform changes from the start frequency to the stop frequency, at a linear rate, in 10 seconds.

10. Push the HOLD SWP button to the in position. The displayed waveform will sweep to the stop frequency and remain there until the HOLD SWP button is released. Release the HOLD SWP button.

11. Push the LOG SWP button to the in position. The FG 507 will now sweep at a logarithmic rate. Observe that the displayed waveform changes frequency slowly at the beginning and more rapdily toward the end of the sweep.

12. Push the TRIG SWP button to the in position. Each time the MAN TRIG button is pushed, the displayed waveform will sweep to the stop frequency, then return and hold at the start frequency.

13. Release the TRIG SWP button to the FREE RUN position and turn the SWEEP DURATION control to the OFF position.

This completes the operators front panel familiarization exercise.

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OPERATING MODES

FREE-RUNNING OUTPUT

The following procedure will provide a free-running output with variable frequency and amplitude.

1. Select the desired waveform.

2. Set the AMPL control fully counterclockwise. Check that the VAR SYMM and OFFSET controls are in the off (in) position.

3. Select the desired frequency with the FREQUENCY Hz dial and MULTIPLIER switch. Frequency equals dial setting times multipler setting.

4. Connect the load to the FG 507 output connector and adjust the AMPL control for the desired output amplitude.

TRIGGERED OR GATED (BURST) OPERATION

With the FG 507 set for free-running operation as described in previous paragraphs, apply the triggering or gating signal to the TRIG/GATE IN connector.

If only one cycle of the output waveform per trigger is desired, push the TRIG button and select + or − slope. One output cycle will now be generated for each input trigger cycle.

If more than one cycle of the output waveform is desired, push the GATE button. The output will now be continuous for the duration of the gating waveform. The number of cycles per burst can be approximated by dividing the gating signal duration by the period of FG 507 output frequency.

In triggered or gated operation the PHASE control varies the start of the output waveform by ±90°. This phase change is measured from the 0 V, 0° point on the output waveform.

VOLTAGE CONTROLLED FREQUENCY (VCF) OPERATION

The output frequency of any selected waveform can be swept within a range of 1000:1 by applying an external voltage to the VCF INPUT connector. The polarity of the VCF input signal determines which direction the output frequency sweeps from the selected frequency. A positive (+) going signal increases the frequency, while a negative (−) going signal decreases the frequency (see Fig. 2-3). The amplitude and polarity of the input voltage can be selected within a range of ±10 V depending on the FREQUENCY Hz dial setting.

The maximum swept frequency range of 1000:1 encompasses the uncalibrated portion of the FREQUENCY Hz dial (<.2 to 2). To ensure that the frequency does sweep at least a range of 1000:1, it is recommended that the FREQUENCY Hz dial be set at 20 and a 0 to −10 V signal be applied to the VCF INPUT connector. It may, however, be necessary to vary the FREQUENCY VERNIER control to obtain the full 1000:1 swept range or the lowest swept frequency desired.

Since the VCF input amplitude is a linear relationship, the frequency output range can be determined from the VCF input amplitude.

INTERNAL SWEEP OPERATION

The internal sweep function allows a rapid overview of the frequency sensitive characteristics of a device under test. The following paragraphs discuss the various sweep modes of the FG 507.

Manual Sweep

Select the desired waveform and set the start and stop frequencies. Adjust the amplitude, symmetry and offset as desired. Set the SWEEP DURATION control to MAN and the MAN SWP control fully counterclockwise (START FREQ). Check that the HOLD SWP button is in the SWP (out) position. Select LOG SWP or LIN SWP as desired. Set the TRIG SWP-FREE RUN button to the FREE RUN (out) position. Connect the FG 507 OUTPUT to the device under test.

In this mode, the frequency of the selected waveform can be swept from start to stop with the MAN SWP control. The frequency of the output signal can be increased, decreased, or stopped as desired along the sweep. This mode is useful if it is desirable to stop the sweep at some point between the start and stop settings. The operator may want to examine a portion of the output frequency more closely than would be allowed using one of the calibrated sweep speeds.

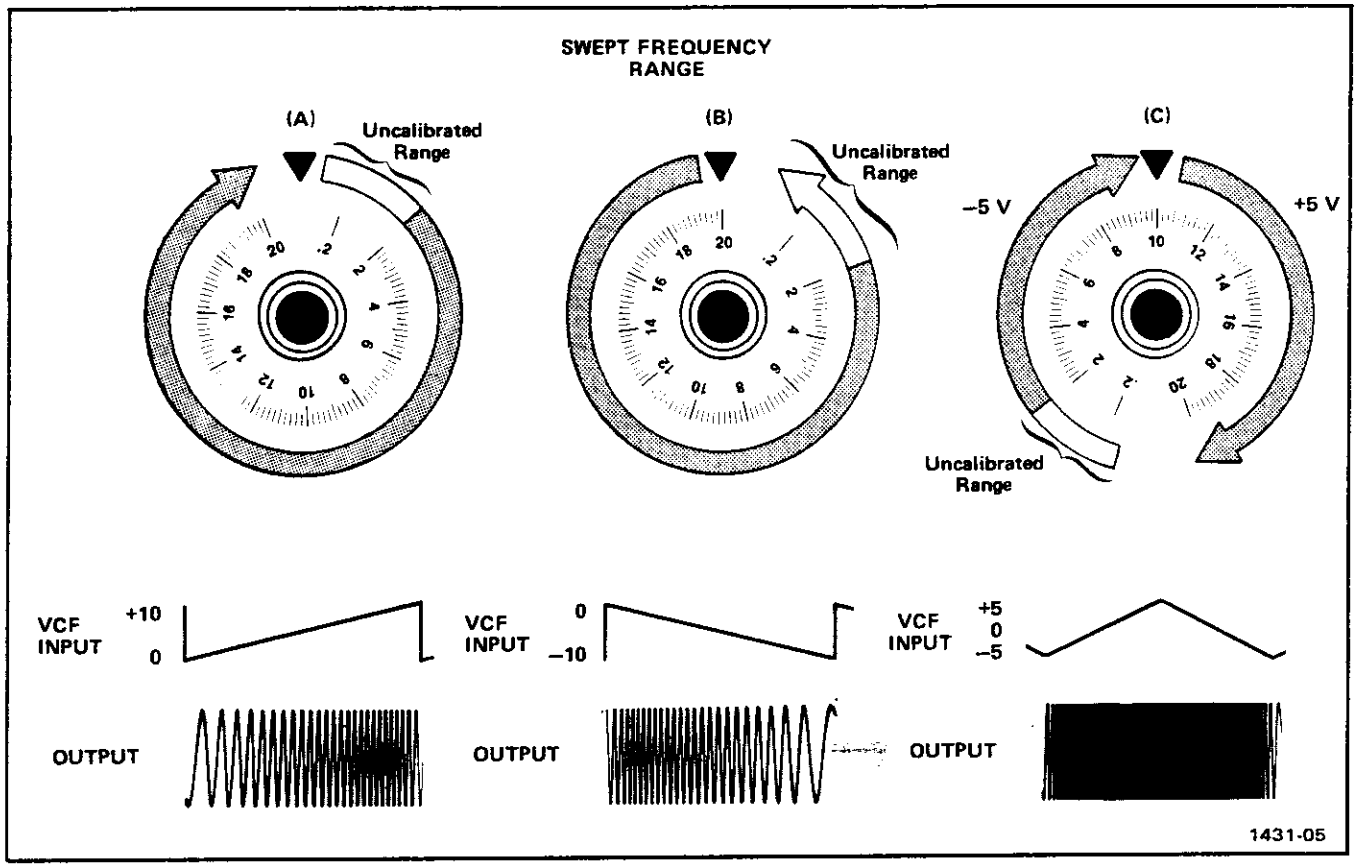

Fig. 2-3. Swept frequency range with 10 V signal applied to VCF IN connector.

Free Running Sweep

With the sweep controls set as previously described under Manual Sweep, switch the SWEEP DURATION control to one of the five calibrated sweep time positions. Connect the FG 507 OUTPUT to the device under test.

In this mode, the frequency of the selected waveform is automatically swept from the selected start frequency to the selected stop frequency. When the stop frequency is reached, the FG 507 resets to the start frequency and repeats. When the HOLD SWP function is activated, the sweep will continue on to the stop frequency and remain there until the hold button is released to the out position.

Triggered Sweep

With the sweep controls set as previously described under Manual Sweep, switch the SWEEP DURATION control to one of the five calibrated sweep time positions. Press the TRIG SWP-FREE RUN button to the TRIG SWP (in) position. Connect the FG 507 OUTPUT to the device under test.

In this mode the sweep of the output signal can be triggered manually or with an external signal. Each time the MAN TRIG button is pressed the output signal will sweep to the stop frequency, reset to the start frequency, and hold there until the next trigger pulse.

With an external trigger signal applied to the SWP TRIG IN connector, the repetition rate of the sweep is determined by the frequency of that signal and the setting of the SWEEP DURATION control. A trigger pulse applied after the sweep cycle has started is ignored. The first trigger pulse after the sweep has reset to start will repeat the cycle.

TRIGGER OUTPUT

A +4 V square wave is available from the TRIG OUTPUT connector. The frequency of the trigger output is determined by the frequency of the selected output waveform. One trigger pulse is generated for each positive cycle of the output signal except when square wave is selected. When generating square waves, one trigger pulse is generated for each negative cycle of the output signal. Trigger output impedance is 50 Ω.

BASIC WAVEFORM CAPABILITIES

The following photographs illustrate the basic waveform capabilities of the FG 507.

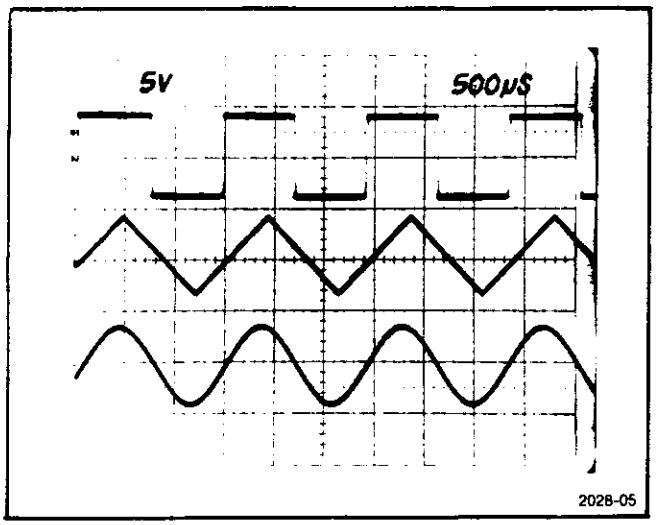

Fig. 2-4. BASIC FUNCTIONS. Square, triangle, and sine waveforms selected by front panel pushbuttons.

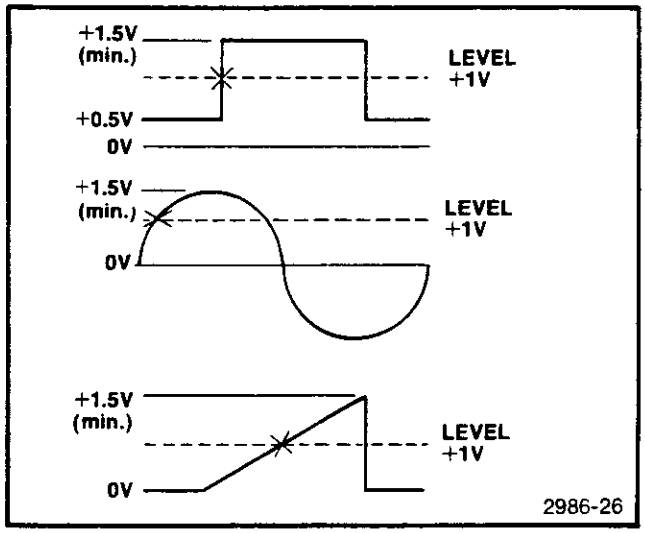

Fig. 2-6. Trigger Signal amplitude requirements and triggering points.

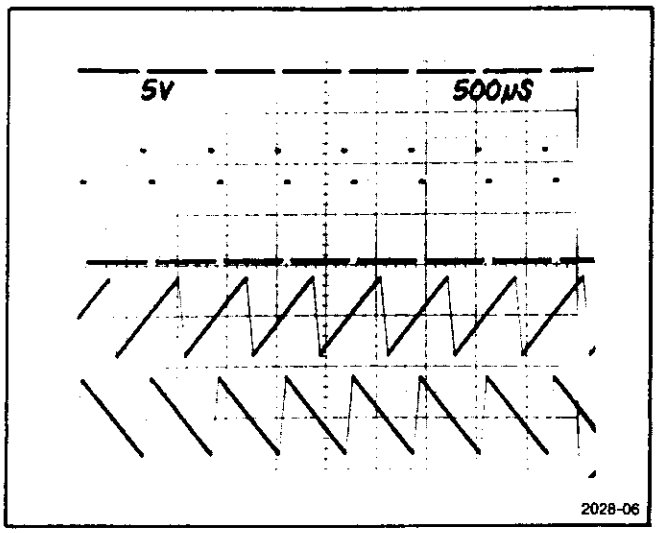

Fig. 2-5. RAMPS AND PULSES. These are obtained from the basic waveforms by using the SYMMETRY control.

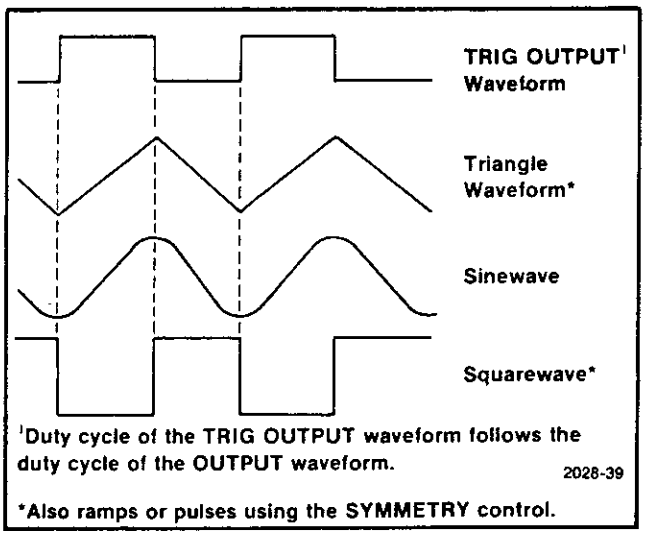

Fig. 2-7. Phase relationships between OUTPUT waveforms and the TRIG OUT waveform.

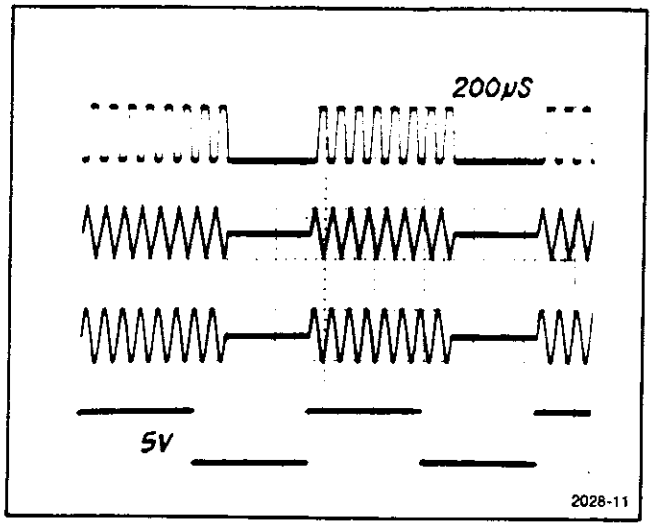

Fig. 2-8. GATED OPERATION. The top three traces are various output waveforms and the bottom trace is the gating waveform applied to the trigger INPUT connector with the GATE pushbutton pressed in. Note the additional cycle completed after the waveforms are gated off.

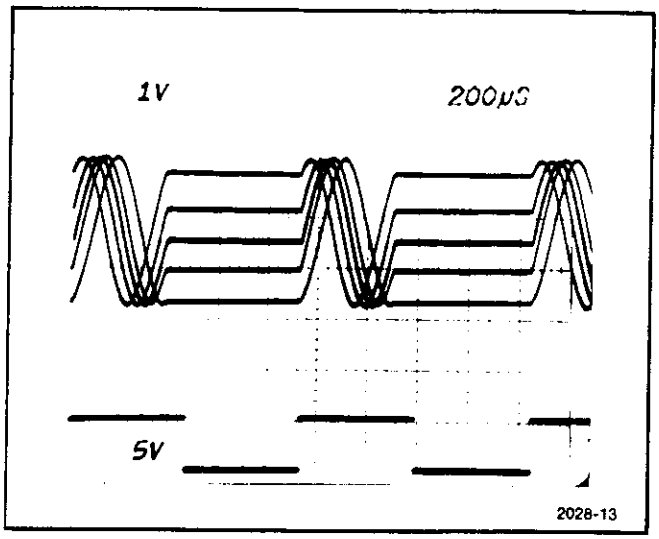

Fig. 2-10. PHASE CONTROL OPERATION. This photograph illustrates PHASE control usage in the triggered mode. The five super-imposed traces illustrate the effect of the phase control. This control provides approximately ±90° of shift. The bottom trace is the triggering waveform.

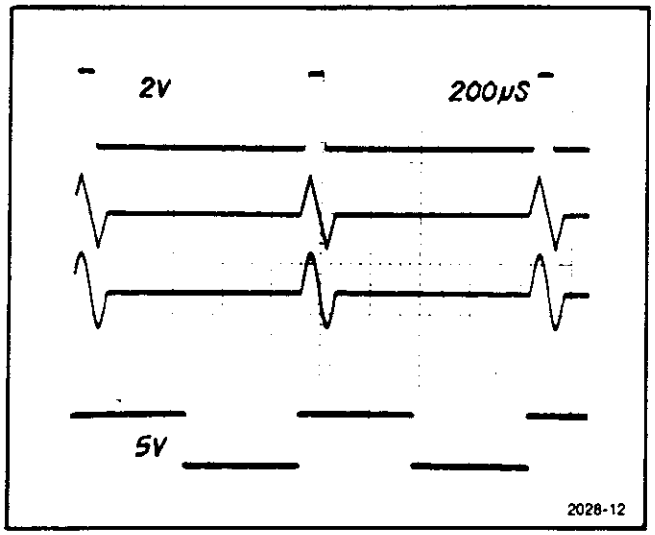

Fig. 2-9. TRIGGERED OPERATION. The top three traces are the various output traces selected. The bottom trace is the triggering waveform applied to the trigger INPUT connector with the TRIG mode selected. Note that only one cycle of the output waveforms is completed.

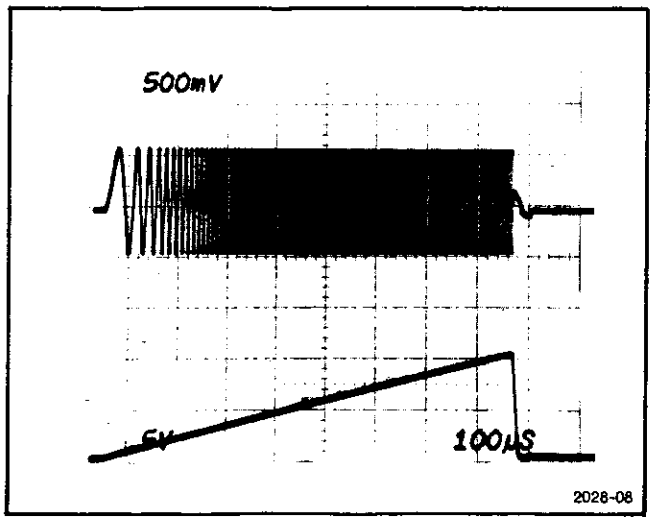

Fig. 2-11. LINEAR SWEEP. Select the start and stop frequencies and the internal linear ramp for a swept output from the start to stop frequencies in the selected time.

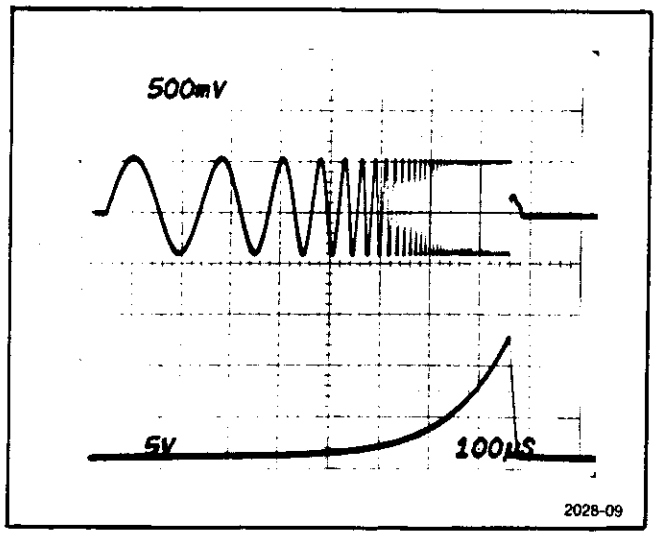

Fig. 2-12. LOGARITHMIC SWEEP. Use the same setup as in Fig. 2-11. Select the logarithmic ramp. The frequency is swept at a logarithmic rate. The logarithmic ramp voltage is not externally available.

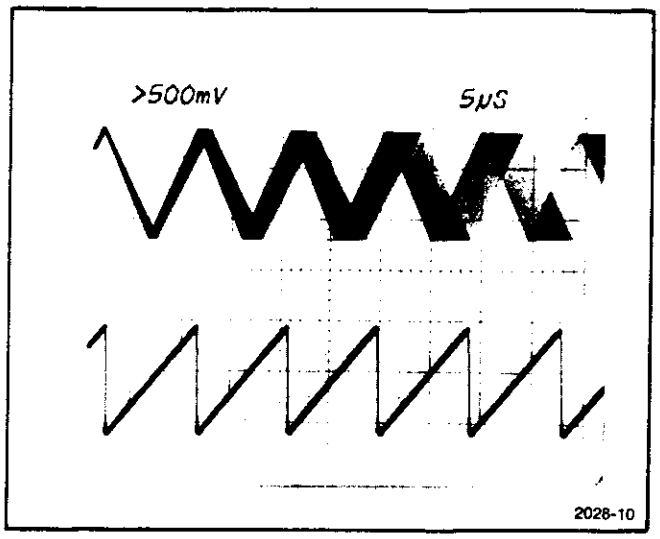

Fig. 2-13. NARROW BAND SWEEP. The top trace shows the triangle waveform swept by a linear ramp. The start frequency is 9.52 kHz and the stop frequency is 10.52 kHz. This function is useful for narrow band sweep testing. The bottom trace is the sweeping ramp.

APPLICATIONS

RESPONSE ANALYSIS

The FG 507 is particularly suited for determining response characteristics of circuits or systems. This application utilizes the internal sweep feature of the FG 507 to sweep over a range of frequencies. Refer to the Internal Sweep Operation discussion under Operating Modes for additional information.

1. Connect the FG 507 output to the device under test and connect the device under test to a monitoring device.

2. Set the MULTIPLIER switch and FREQUENCY Hz dials for the desired upper and lower frequency limits.

3. Select the desired sweep duration and set the FG 507 for a free running mode.

4. Observe the response characteristics on the monitoring device.

The frequency at which an observed response characteristic occurs can be determined by first pressing the HOLD SWP button. This stops the sweep at the selected upper limit. Then adjust the FREQUENCY Hz (STOP) dial toward the start frequency to again obtain the observed characteristic. The frequency is the FREQUENCY Hz (STOP) dial reading times the MULTIPLIER setting.

If a frequency counter is available, the frequency of the observed characteristic can be determined without disturbing the FG 507 frequency control settings. Connect the FG 507 output to the device under test and the frequency counter using a 50 Ω tee adapter. Switch the SWEEP DURATION control to the MAN position. Rotate the MAN SWP control to again obtain the observed characteristic. The frequency can now be read directly from the counter.

TONE-BURST GENERATION

The FG 507 can be used as a tone-burst generator or frequency multiplier for checking tone controlled devices. This application utilizes the internal sweep feature of the FG 507 and a pulse generator, such as the TEKTRONIX PG 501, as a gating signal source.

The following procedure describes a technique for obtaining a tone-burst or frequency mutliplied output from the FG 507. Refer to the Triggered or Gated (Burst)

Output discussion under Operating Modes for additional information.

1. Select the desired upper and lower frequency limits with the FREQUENCY Hz controls and MULTIPLIER switch.

2. Select the desired sweep duration and set the FG 507 for a free running mode.

3. Push the GATE button and connect the pulse generator to the TRIG/GATE IN connector.

4. Adjust the pulse generator period for the desired number of bursts within the selected sweep duration.

5. Adjust the pulse generator duration for the desired burst width.

6. Connect the FG 507 output to the device under test and adjust the AMPLITUDE control for the desired output level.

FILTER TESTING

The swept frequency capabilities of the FG 507 make it quite suitable for sweep testing filters. When using the FG 507 in this application, it is best to use the LOG SWP mode. Figures 2-14 and 2-15 illustrate the advantages of using logarithmic sweeps.

CHART RECORDER CONTROL

Two signals available at the front panel of the FG 507 make it a useful device in chart recording systems. The linear sweep ramp is used to drive the recorder and the gate pulse to control the recording pen.

Because the duration of the gate pulse is equal to the length of the sweep ramp, the recording pen will be picked up precisely at the end of each sweep. When the next sweep starts, the recording pen will return to the paper.

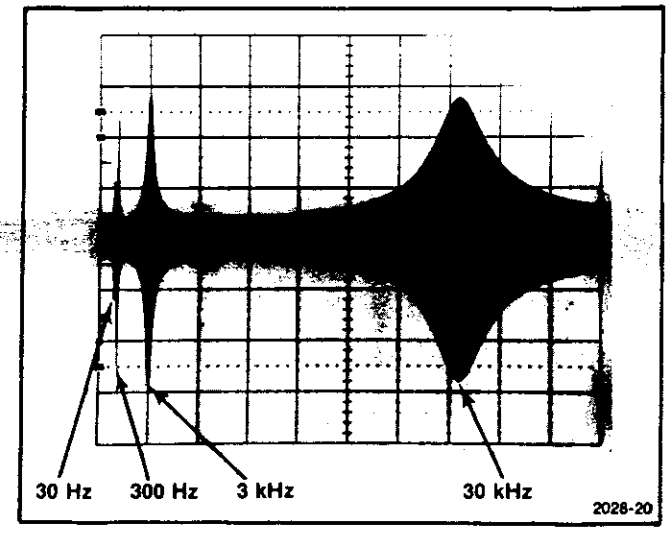

Fig. 2-14. Linear sweep showing skewed spacing of filter output frequencies.

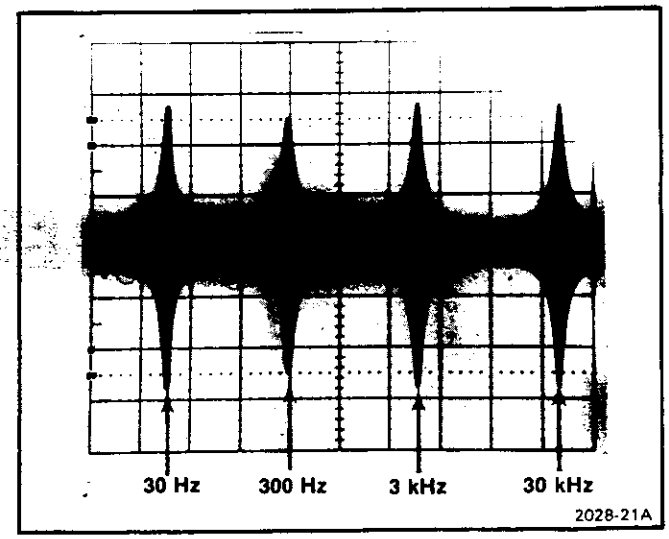

Fig. 2-15. Logarithmic sweep showing even spacings of filter output frequencies.

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THEORY OF OPERATION

INTRODUCTION

This section of the manual contains a description of the electrical circuits in the FG 507. Refer to the block diagram and schematic diagrams on the fold out pages in the back of the manual to aid in understanding this description. Diamond enclosed numbers appearing throughout this section refer to the schematic diagram on which the circuit being discussed is located.

LOOP ①

SUMMING AMPLIFIER

Refer to the discussion under FREQUENCY CONTROL AND LOG AMPLIFIERS toward the back of this section.

The start frequency voltage is applied to pin 2 of summing amplifier U1540A where it is summed with any currents developed by a voltage applied to the VCF inputs. The VCF inputs are J510 (front panel) through R1553, and pin 21B (rear interface) through R1103. These summed currents are buffered by Q1445 and flow through R1543. The voltage developed across R1543 is proportional to the frequency.

CURRENT SOURCES AND SWITCH

The voltage developed across R1543 is buffered by U1440 and Q1541 which form the negative current source for the main loop timing circuitry. This same voltage is also buffered by U1540C and Q1543 which form a current source identical to U1440 and Q1541. The output current from Q1543 flows through Q1527, Q1525, and Q1421, which form a current mirror that inverts this current to provide the positive current source for the main loop timing circuitry. The current through R1521 is the timing capacitor charging current; the current through R1536 is the discharging current. The Top Dial Symmetry Cal, R1421, adjusts the balance between these two currents so they are equal in magnitude.

In the normal mode of operation (fixed symmetry) R520 and R540 are in the emitter circuit of Q1541 and Q1543. In this condition, equal amounts of current will flow in both the positive and negative current sources. When S500, VAR SYMM, is activated, R530 is switched into the current source emitter circuits. As R530 is varied from one end to the other, unequal amounts of current flow through the positive and negative current sources. In this manner the symmetry of the waveform generated by the loop is varied.

These currents are switched into the junction of CR1531 and CR1533 where they alternately charge and discharge the timing capacitor, producing a triangle waveform. The current switch is formed by Q1531, CR1531, Q1433 and CR1533.

TIMING CAPACITORS AND CAPACITANCE MULTIPLIER ②

The timing capacitors provide for triangle generation in the five fastest MULTIPLIER ranges. They are switched into and out of the circuit in decade steps from 10^5 (C1631) down to 10^1 (C1741).

For the four lower MULTIPLIER ranges, 10^0 down to 10^{-3}, C1741 is switched into the feedback loop of U1930 forming an integrator. Current from the current switch is applied to operational amplifier U1940. A voltage is developed at the output of this amplifier that is proportional to the applied current times the value of R1941 (1 kΩ). This voltage is applied, across one of four resistors, to the input of U1930. These resistors, R1831, R1841, R1842, and R1843, are switched into and out of the circuit in decade steps with the MULTIPLIER switch S1731. This arrangement provides very large values of effective capacitance. The output of U1930 is now the triangle that is applied to the buffer stage.

TRIANGLE BUFFER ①

The voltage developed by the timing capacitor or multiplier (U1930) is applied to the triangle buffer. Q1725 and Q1723 form the differential input stage of this circuit. Q1821 serves as a constant current source for the input differential pair. Q1721 and Q1712 complete the feedback for the amplifier such that the voltage at the emitter of Q1712 is equal to the voltage at the Gate of Q1725.

Loop delay compensation is provided by a network comprised of R1712, R1812, C1712, and C1714. The buffered timing capacitor voltage is applied through this network to the level comparators.

LEVEL COMPARATORS

The level comparators detect upper and lower threshold levels. U1700A is the upper level detector and U1700B the lower. The reference level for these comparators is supplied by U1400B and C. As the threshold levels are detected, the respective comparator triggers U1600B.

REFERENCE VOLTAGES

The reference voltage supplies are composed of U1400B (−) and U1400C (+) and associated components. The upper (positive) level threshold voltage is established by adjusting R1412. This resistor is in a voltage divider string from zener diode VR1413. The voltage developed across R1412 is buffered by U1400C and set to approximately +400 mV at the output. This voltage is applied to pin 5 of U1700A as the upper threshold level reference. This same voltage is also applied to pin 9 of inverter U1400B. R1511 is used to adjust the gain of this stage so that the output is nominally −400 mV. This voltage is applied to pin 13 of U1700B as the lower threshold level reference.

LOOP LOGIC

When a rising voltage at pin 6 of U1700A passes through the threshold level set at pin 5, the output (pin 8) goes low pulling pin 10 of U1600B low. This action sets the flip-flop causing pin 9 (Q) to go high and pin 8 (Q) to go low. Pin 8 of U1600B is tied back, through R1403, to the junction of CR1431 and VR1532. VR1532 serves as a level shifter to change the TTL output gate to the correct level to drive the current switch (Q1531, CR1531, Q1433, CR1533).

As the voltage at the junction of R1532 and R1534 drops, it pulls the bases of Q1531 and Q1433 low. Q1531 is turned on and Q1433 is turned off. Any current from the positive current source, through R1521, now flows through Q1531 and is shunted to the −15 V supply. With Q1433 turned off, any current flow through the negative current source must come from the positively charged timing capacitor through CR1533.

The falling voltage on the timing capacitor is buffered through the triangle buffer and applied to the level comparators U1700A and U1700B. As the voltage at pin 12 of U1700B falls through the threshold level set at pin 13, the output (pin 1) goes low pulling pin 13 of U1600B low. This action resets the flip-flop causing pin 9 (Q) to now go low and pin 8 (Q) to go high. Taking this high at pin 8 back to the current switch, Q1531 will be turned off and Q1433 turned on. This allows the timing capacitor to charge in the positive direction.

The action just described generates one entire cycle of a triangle wave.

TRIGGER GENERATOR

The square wave output at pin 8 (Q) of U1600B also drives the trigger output amplifier. This circuit is composed of emitter follower Q1431 and associated components. Q1440, in conjunction with R1440, serves as output short circuit protection. The output of this circuit (at J2043) is a square wave 180° out of phase with the main loop signal. The output amplitude is greater than +4 V into an open circuit, and at least +2 V into a 50 Ω load.

SQUARE WAVE GENERATOR

The output at pin 9 (Q) of U1600B is a square wave, but 180° out of phase with that at pin 8. This signal is used to drive the square wave generator composed of differential pair Q1801, Q1901, and associated components. The base of Q1901 is held at a constant voltage by divider network R1815 and R1818. R1728 and R1816 form a constant current source for the differential pair. The square wave from U1600B alternately switches this constant current to ground through Q1801 or through R1819 and Q1901. In this manner, a square wave voltage is developed with dc levels sufficient to drive the output amplifier for the square wave function.

PHASE CLAMP THRESHOLD DETECTOR

The output of the triangle buffer, in addition to possibly being fed to the Output Amplifier through S1901B, is connected to the base of Q1711. Q1711 and Q1611 form a differential amplifier. Q1621 and associated components provide a constant current source for the differential pair. This amplifier senses the level of the triangle waveform and compares it to the output voltage of U1400A. The output voltage of U1400A is determined by the setting of the VAR Ø control, R550. The voltage range of R550 is established by reference voltage supplies U1400B (−) and U1400C (+). These are the same reference voltages supplied to the Level Comparators. This arrangement permits comparison of the triangle voltage with the maximum possible positive and negative levels, and all levels between.

When the triangle voltage exceeds the reference voltage set by the VAR Ø control, Q1711 turns off. Any current flowing through Q1621 now flows through Q1611.

CURRENT AMPLIFIER

Current flowing through Q1611 also flows through R1622 and is amplified by Q1521. Temperature compensation for this amplifier is provided by CR1621. Differential pair Q1511 and Q1523 serve as a current switch. With Q1511 turned off, any current amplified by Q1521 passes through Q1523 to the junction of CR1531 and CR1533.

When the timing capacitor voltage rises to the threshold level set by the VAR Ø control, R550, it is clamped. Q1523 now draws exactly the amount of current that the positive current source supplies. Because the square wave at pin 5 (Q) of U1600A drives the base of Q1511, the clamping action only happens during the positive edge of the triangle wave. On the negative transition, Q1523 is shut off, and Q1511 is on. In this manner, the timing capacitor voltage can be clamped at any desired positive level.

TRIG/GATE AMP AND SINE SHAPER ③

TRIG/GATE AMP AND LOGIC

The input trigger amplifier consists of an emitter coupled differential pair (Q1320 and Q1322), current amplifier Q1324, and the required logic circuitry to control the operation of the main loop phase clamp. Input circuit protection is provided by R1203, R1204, CR1220 and CR1221. Triggering signals are applied either through front panel connector J520 or interface connections on the rear edge of the Main circuit board.

The differential pair, Q1320-Q1322, responds to the input signal when the voltage rises above (+ SLOPE) the reference voltage at the base of Q1320. This reference voltage is established by divider network R1312 and R1314. The position of S1400D, SLOPE switch, determines whether a positive or negative going input will cause the amplifier Q1324 to conduct. When the threshold level is exceeded and conduction starts, current flow through the circuit causes a voltage to be developed across R1322. This voltage is applied to the base of Q1324. The output at the collector of Q1324 is a TTL compatible waveform to drive the logic circuit, U1310. CR1320 provides temperature compensation for Q1324.

Three modes of operation are selectable with S1400; Triggered, Gated, and Free Running.

In the TRIG mode, S1400A and S1400C are positioned such that the output, pin 6, of U1310B is connected to pin 4, set input, of U1600A. In this mode, a very narrow, negative going voltage pulse is developed by U1310B each time the input waveform passes through the trigger threshold. This low sets U1600A, which deactivates the phase clamp until the triangle generator again starts in the positive direction, and allows the generator to complete one full cycle.

In the GATE mode, S1400A and S1400C are positioned such that the output, pin 3, of U1310A is connected to pin 4, set input, of U1600A. In this mode, a low level is produced whenever the input waveform exceeds the threshold if + SLOPE is selected. The generator free runs as long as this condition exists. As soon as the level at the input connector drops below the threshold, the output voltage of U1310A rises. This high level causes the generator to again stop running when the phase clamp reaches its threshold level at the end of the last complete cycle.

In the FREE RUN mode, S1400A is positioned such that pin 4 of U1600A is held low. The generator now outputs continuous waveforms.

SINE SHAPER

The Sine Shaper is composed of three separate circuit functions: a Transconductance Amplifier, the Shaper Circuitry, and an Output Buffer.

Transconductance Amplifier. Emitter coupled transistors Q1210 and Q1212 along with current source Q1200 form the Transconductance Amplifier. The amplifier converts the triangle voltage at the base of Q1212 to a differential current. This current flows through two sets of diode wired transistors, U1120C, U1120D, U1220C, and U1220D, to the input of the shaper.

Shaper. The active portion of the Shaper is formed by two sets of emitter coupled transistors U1220A, U1220B, U1120A and U1120B. These devices have their inputs wired in series and their outputs cross coupled. U1120E and U1220E are current sources for these devices. The circuit operates by generating a power series approximation to the sine function. The devices in U1120 generate the first order term while those in U1220 generate the second order term in the approximation.

Output Buffer. The Output Buffer is an operational amplifier that converts the differential current from Q1010 and U1020D to a single ended voltage that is applied, through the function switch, to the output amplifier. U1020E is a current source for the emitter coupled differential input pair U1020A and U1020B. Q1012 serves as a current mirror for U1020A and as an active load for U1020B. U1020C is the output emitter follower and R1020 is the feedback resistor.

OUTPUT AMPLIFIER & ATTENUATORS ④

The output amplifier is basically a noninverting operational amplifier whose plus input is the base of Q2101 and minus input is the base of Q2113.

The three basic waveforms are selected by S1901 and applied across R570 and R580 to the input stage of the amplifier. R570 varies the amplitude of the selected waveform. The feedback network consists of R2011 and R2012, connected from the output to the minus input of the amplifier. C2011 provides high frequency compensation for the feedback, and is used to adjust the squarewave front corner. The input pair, Q2101 and Q2113, amplify the difference between the input waveform and the fedback waveform.

An offset current is also summed with the feedback signal at the base of Q2113 when S510A is closed. This allows R560 to control the dc offset of the output signal.

The output of Q2101 is applied directly to Q2111 which is cascoded with Q2011. The output of Q2113 passes through an inverting amplifier, Q2211, before passing to Q2213 cascoded with Q2311. CR2111 provides temperature compensation for Q2211. The two cascodes form drivers for the amplifier output stage.

The output stage consists of Q2013 and Q2123 in parallel with Q2121 for amplification of positive going signals. Q2321 and Q2323 in parallel with Q2325 form the amplifier for negative going signals. The output is taken at the junction of R2026 and R2228. The 50 Ω output impedance is determined by parallel 100 Ω resistors R2033 and R2131. C2121 in this network provides high frequency compensation for the output impedance. The attenuator circuit is a constant impedance resistive divider network, switch selectable in 20 dB steps.

POWER SUPPLY ⑤

The FG 507 receives its power from the power module via interface connections on the rear edge of the Main circuit board. The power module supplies plus (+) and minus (−) 33.5 Vdc (unregulated) from which the following regulated voltages are generated.

+20 V SUPPLY

The +33.5 V from the power module is filtered and applied to voltage regulator U1210 (pins 11 and 12). This regulator contains its own reference, operational amplifier, and current limiting elements. The output of the regulator is applied to Q1231 which serves as a driver the the series pass transistor located in the power module. The +20 V output is applied across voltage divider R1201, R1301, and R1315. The output level of the supply is set by R1301 (+15 V Adj) which compares the supply output to the internal reference level of the regulator. This supply is current limited through the action of R1121 and the current limiting element in the regulator. When excessive amounts of current are drawn from the supply, the voltage developed across R1121 turns on the current limiting element in the regulator (U1210). This action reduces the base drive, through Q1231, to the series pass transistor causing the supply to reduce output. This supply is the reference for other supplies in the FG 507.

+15 V SUPPLY

The +15 V supply consists of U1230D and Q1221. U1230D serves as an error amplifier which compares the +15 V output of the supply to a +15 V reference developed by divider network R1231, R1232 and R1233 from the +20 V supply. Since this supply is sourced from the +20 V, it is inherently current limited by the +20 V supply.

+5 V SUPPLY

The +5 V supply consists of U1230C and Q1331. U1230C serves as an error amplifier which compares the +5 V output to a + V reference developed by divider network R1231, R1232 and R1233 from the +20 V supply. Since this supply is sourced from the +15 V and referenced to the +20 V supply, it is inherently current limited under the same conditions that limit those supplies.

−20 V SUPPLY

The −20 V supply is derived from −33.5 V supplied by the power module. The output of operational amplifier U1230A is applied, through Q1245, to the base of Q1241, which serves as a driver for the series pass transistor located in the power module. This supply is also referenced to the +20 V. The supply is current limited through the action of R1141 and Q1243. When excessive amounts of current are drawn through R1141, a voltage sufficient to turn Q1243 on develops across R1141. This action reduces the base drive to the series pass transistor causing the supply to reduce output.

−15 V SUPPLY

The −15 V supply consists of operational amplifier (U1230B) and a series pass feedback regulator (Q1345). The output of the supply is fed back through divider network R1247, R1341, and R1245. The output level is adjusted by R1341. Because this supply is sourced from the −20 V supply, it is current limited by the −20 V supply.

SWEEP GENERATOR ⑥

SWEEP DURATION SELECT

U1240A and Q1240 form a positive current source to charge timing capacitor C1132. Sweep duration is selected by switching into the emitter circuit of Q1240, one of the resistors R1340, R1341, or R1342. Each of these resistors is ten times larger in value than the previous one. The sweep duration is variable between decade steps by adjusting R1520. This current source charges C1132 to approximately +2 V.

CAPACITANCE MULTIPLIER

In the three fastest sweep ranges U1240B serves as a non-inverting unity gain buffer for the timing capacitor (C1132) voltage. For the two slower sweep ranges (1 s and 10 s) this circuit is re-configured to act as a X100 capacitance multiplier. Opening contact 5 and closing contact 4 of S1320, SWEEP DURATION, inserts R1240 and R1241 into the input circuit of U1240B. The 100 to 1 value ratio of these resistors permits C1132 to receive only 1/100th the charging current it does in the slower sweep speeds. This makes the capacitor effectively 100 times larger in value. The output of U1240B is applied to, and amplified by, U1140B. This stage has a gain of five, which raises the timing capacitor voltage from +2 V to +10 V.

LEVEL DETECTOR AND 10 VOLT REFERENCE

The +10 V reference for the sweep ramp is established by U1340B. The differential amplifier formed by Q1132 and Q1136 serves as an upper level threshold detector. When the voltage at the output of U1140B, which drives the base of Q1136, reaches the +10 V reference level, the differential amplifier will switch turning Q1136 off and Q1132 on. With S1020B in the FREE RUN position, current flows through R1130, Q1132, and R1123.

SWEEP MULTIVIBRATOR

The voltage developed across R1123 drives the base of Q1120 high causing that differential amplifier (Q1120, Q1122) to change state. Q1120 turns on and Q1122 turns off. Current now flows through divider string R1124, R1125, R1129. The voltage developed across this divider drives the base of Q1116 high causing its collector voltage to drop. This low on the collector of Q1116 causes the flip-flop, Q1112 and Q1118 to change state. The collector of Q1112 is now high, which drives the base of Q1124 high.

CLAMP DRIVE

With the base of Q1124 driven high, its emitter will pull up, through R1134 and R1137, on the base of Q1130 and Q1134. Timing capacitor current flow is now through Q1134 to ground allowing U1140B output to start falling. Q1134 is used in its reverse active mode in this circuit. This arrangement provides for collector to emitter saturation at very low voltages resulting in very accurate clamping of the timing capacitor. Q1130 provides increased drive capability for Q1134.

TRIGGER GENERATOR

The drop in U1140B output drives the base of Q1040B low. When the voltage at the base of Q1040B drops below the lower threshold level set at the base of Q1040A, Q1040B will turn off. This causes Q1040B collector to go high which drives the base of Q1220 high. The emitter of Q1220 goes high driving the base of Q1114 high. The collector of Q1114 goes low causing the flip-flop to change state and drives the base of Q1124 low. Q1124 turns off and its emitter goes low. This action drives the base of Q1130 and Q1134 low turning them off. This releases the clamp to ground from the timing capacitor C1132. The capacitor recharges and starts the next sweep ramp. Diode CR1040 on the base of Q1040B prevents this device going into reverse breakdown when the output of U1140B is at +10 V.

Manual Sweep Mode. In this mode S1320 contact 6 is opened and contact 7 is closed. R1530 is between the +10 V reference and ground. The voltage developed across R1530 is buffered by U1340A and applied to pin 9 of U1730. With this arrangement, the +10 V reference is variable from 0 to +10 and the generator can be manually swept over its entire sweep range.

Hold Sweep Mode. This mode allows the sweep generator to be stopped at the top of the ramp (+10 V) and held for an indefinite period. In this mode, S1020B is positioned such that the output of the upper level threshold detector is disconnected from the multivibrator. The rising voltage at the output of U1140B drives the base of Q1136 high turning it off. Conduction through Q1132 causes a voltage to develop across R1134 and R1135 driving the base of Q1130 and Q1134 high. These two transistors now serve as a linear clamp that will draw off any current that would otherwise flow into C1132.

Any increase in voltage above established limits at C1132 is buffered and amplified by U1240B and U1140B. This action turns Q1136 off harder, increasing conduction through Q1132. The resulting increase in voltage across R1134 drives the base of Q1130 and Q1134 higher. More current is drawn from C1132 and the voltage drops to the established level. This feedback action assures that the output of U1140B will remain at +10 V until S1020B (HOLD SWP) is released.

TRIGGER AMPLIFIER

In the triggered mode of operation, S1020D is positioned such that the generator is in its quiescent state. The collectors of Q1112 and Q1114 will be high. The base of Q1124 is being held high and its emitter is pulling up on the base of Q1130 and Q1134. The timing capacitor, C1132, is clamped to ground. The generator is waiting for a trigger to change the state of the flip-flop (Q1112, Q1118). The trigger signal can be applied to the trigger amplifier through front panel connector J540 or rear interface connector 22A.

The sweep trigger amplifier consists of Q1004 and Q1006 which form a Schmitt Trigger. Q1000 and Q1002 serve as a temperature compensated current source used to establish the width of the hysteresis window. Input circuit protection is provided by R1104, CR1100, and CR1102. Q1110 acts as a trigger lockout ot block any recurring trigger pulses during the period that the ramp is resetting.

An input signal larger than +1 V applied to the base of Q1006 will cause the Schmitt trigger to change state. This causes a trigger pulse to be applied, through C1014 and S1020D, to the base of Q1220 driving it high. The emitter of Q1220 goes high pulling the base of Q1114 high. The collector of Q1114 goes low resetting the flip-flop (Q1112, Q1118) and pulling the base of Q1124 low. Q1124 emitter goes low driving (through R1137 and R1134) the base of Q1130 and Q1134 low. This lifts the clamp from the timing capacitor allowing it to charge and start the ramp. In this mode, since the lower level threshold detector is disconnected from the multivibrator, the sweep will not free run. When the ramp voltage reaches zero the generator will remain quiescent until the next trigger pulse.

The sweep can also be triggered manually by pressing the MAN SWP button on the front panel. This pushbutton activates S1020A. When this switch is closed, the base of Q1220 is pulled up to +15 V through a very short time constant (R1110, C1016). Pulling the base of Q1220 up starts the action just described and generates one complete ramp.

GATE AMPLIFIER

The gate amplifier consists of an emitter coupled comparator, Q1440 and Q1442, and an emitter follower buffer, Q1444. This circuit is driven by the same signal that drives the timing capacitor clamp circuit (Q1130, Q1134). This arrangement assures that the gate output will always go low while the ramp is resetting (free run and triggered modes) or being held high (hold sweep mode).

The threshold level is set by R1443 and R1444 at the base of Q1442. While the generator is sweeping (the clamp circuit is off) there is +Ø V on the base of Q1440 and it is shut off. The collector of Q1440 is high, driving the base of Q1444 high. The emitter of Q1444 is high resulting in a high output at front panel connector J560. When the

sweep ramp reaches +10 V, conduction through Q1132 drives the base of Q1440 high. When this voltage exceeds the level set at the base of Q1442 (approximately 0.25 V) Q1440 will turn on. This pulls the collector of Q1440 low, driving the base of Q1444 low. The emitter of Q1444 goes low resulting in a low output at J560. This action produces a positive square wave gate output equal in duration to the sweep ramp.

RAMP BUFFER

The +Ø to 10 V ramp output of U1140B is applied to the + input of U1140A which serves as a unity gain buffer. The ramp output of this stage is available at front panel connector J550. This buffered ramp voltage is also available at rear interface connector 25A.

FREQUENCY CONTROL AND LOG AMPLIFIERS ⑦

NONSWEEPING MODE

In the nonsweeping mode, the frequency of the generated waveforms is determined by the setting of the FREQUENCY Hz START control. The voltage developed across R500 is buffered by U1310C. This buffered voltage is applied directly to the Voltage Controlled Oscillator (VCO) U1540A on diagram ①. From this point on, the action of generating the various waveforms has been discussed.

LINEAR SWEEP MODE

In this mode, the buffered start frequency voltage is applied to the plus (+) input of summing amplifier U1710A. This same voltage is also applied to the minus (−) input of U1310A. Simultaneously, the stop frequency voltage, which is set by R520 and buffered by U1310D, is applied to the plus (+) input of U1310A. The difference voltage at the output of U1310A is applied to the +Y input (pin 4) of multiplier U1730. This dc level is used to scale the 0 to 10 V sweep ramp. The sweep ramp is applied to the +X input (pin 9) of the multiplier from the sweep generator. The differential output currents (pins 2 and 14) from U1730 are applied to the input of U1830. Buffer amplifier U1830 converts these currents to a single ended voltage which is applied to the minus (−) input of the summing amplifier U1710A. The summed output at pin 1 of U1710A is applied to, and sweeps the VCO. Since the transfer function of the VCO is linear, the generator output is a linear sweep from the start frequency to the stop frequency.

LOG SWEEP MODE

The basic difference between linear and logarithmic sweeping is that the sweep ramp must be scaled differently to maintain a given set of sweep limits. The FG 507 utilizes a unique network of log and anti-log amplifiers to accomplish this. Since each of the circuits function identically, only the operation of one will be discussed.

ANTI-LOG AMPLIFIER

The anti-log amplifier that will be discussed is comprised of U1810B, Q1910, Q1912, U1810A, U1820, and associated components.

In bipolar transistors, the relationship of the collector current to the base-to-emitter voltage is logarithmic over a wide current range.

The collector current of grounded base amplifier Q1912 is used to develop a voltage at the output of U1810A. This voltage is proportional to the product of Q1912 collector current times the value of R1815. At a constant temperature, a linearily decreasing voltage applied to the emitter of Q1912 will cause an exponentially increasing current in the collector circuit. This results in an exponentially increasing voltage at the output of U1810A. Q1910 provides the required temperature compensation to assure stable base-to-emitter voltage in Q1912. Operational amplifier U1820 serves as a current source to maintain a constant current flow through Q1910. With this arrangement, a linear voltage applied to the base of Q1910 results in a temperature compensated exponential current in the collector circuit of Q1912, and the desired exponential voltage at the output of U1810A.

LOG AMPLIFIER

There are two log amplifiers used in the FG 507; one each for the start frequency and the stop frequency. The log amplifiers consist of a simple operational amplifier with an anti-log amplifier in the feed-back loop. The operation of this anti-log amplifier is exactly as previously described. The start frequency circuit consists of operational amplifier U1510 with anti-log amplifier components U1600B, U1610, Q1600, Q1602, and U1600A. The stop frequency circuit consists of operational amplifier U1300 with anti-log amplifier components U1400B, U1410, Q1400, Q1402, and U1400A.

LOG SWEEPING

The start frequency voltage, set by R500, is buffered through U1310C and applied to the input of log amplifier U1510. The output of U1510 is applied to pin 5 of the log mode summing amplifier U1710B. This dc level sets the initial condition for the sweep. This same voltage is also applied to the minus (−) input of summing amplifier U1310B. The stop frequency voltage, set by R520, is buffered through U1310D and applied to the input of log amplifier U1300. The output of this log amplifier is applied to the plus (+) input of summing amplifier U1310B.

The output of U1310B is the difference between the start and stop log amplifiers. This dc level is applied to the +Y input (pin 4) of the multiplier U1730. The multiplier now automatically scales the 0 to 10 V sweep ramp, which is applied to the +X input (pin 9), for a logarithmic sweep.

The multiplier output currents are converted to a single ended voltage through U1830 and applied to the minus (−) input (pin 6) of the summing amplifier U1710B. The summing amplifier inverts the ramp voltage at pin 6 and adds it to the dc level set at pin 5. The output of U1710B is scaled through U1810B to the correct dc level to drive Q1910. The output of this anti-log amplifier is applied directly to the VCO through J1800.

SWEEP POWER SUPPLY ⑧

The sweep circuitry receives its power from the power module via interface connections on the rear edge of the sweep board. The power module supplies plus (+) and minus (−) 33.5 Vdc (unregulated) from which the following regulated voltages are generated.

+15 V SUPPLY

The +33.5 V from the power module is applied to U1744 which provides a precision reference voltage for comparator U1742. The voltage developed by the supply output across divider network R1638, R1639, and R1640 is compared to this reference. The difference voltage at the output of U1742 is applied to the base of Q1846. Q1846 serves as a driver for the Series Pass Transistor located in the power module. Overload protection is provided by R1845 and Q1844. If an excessive amount of current is drawn from the supply, current flow through R1845 develops a voltage across the base-emitter junction of Q1844. This turns Q1844 on, which in turn reduces the base drive to Q1846. This action results in a reduced output from the supply.

−15 V SUPPLY

The −15 V supply is derived from the −33.5 V furnished by the power module. The entire circuit, except the reference voltage, functions exactly as the +15 V supply. In this supply, the output of the +15 V supply is used as the reference voltage. The +15 V is applied to the input of U1740B, inverted, and applied to comparator U1740A. This arrangement permits precise adjustment of both supplies with one control (R1640).

CALIBRATION

PERFORMANCE CHECK

INTRODUCTION

This procedure checks the Electrical Performance Requirements as listed in the Specification section in this manual. Perform the internal adjustment procedure if the instrument fails to meet these checks. If recalibration does not correct the discrepancy, circuit troubleshooting is indicated. Also, use this procedure to determine acceptability of performance in an incoming inspection facility. For convenience, many steps in this procedure check the performance of this instrument at only one value in the specified performance range. Any value within the specified range, within appropriate limits, may be substituted.

TEST EQUIPMENT REQUIRED

The test equipment, or equivalent, listed in Table 4-1 is suggested to perform the performance check and the adjustment procedure.

Table 4-1

TEST EQUIPMENT REQUIRED

Item	Description	Minimum Specifications	Application		Example
			Perf Check	Adj Proc	
1	Power Module	Five compartments or more	X	X	TEKTRONIX TM 515 or TM 506
2	Oscilloscope System	Minimum Vertical deflection factor .5 V/div. Fastest Calibrated Sweep Rate .5μs.	X	X	TEKTRONIX 7704A/7A16A/7B50
3	Differential Comparator Amplifier	Minimum Vertical deflection factor .1 V/div	X	X	TEKTRONIX 7A13
4	Sampling System			X	TEKTRONIX 7704A/7S11/7T11/S-1
5	Spectrum Analyzer		X		TEKTRONIX 7L12
6	Distortion Analyzer	Frequency range from 20 Hz to at least 300 kHz. Distortion resolution <0.25%	X	X	TEKTRONIX AA 501
7	Frequency Counter	Frequency range 0.002 Hz to above 2 MHz. Accuracy within one part in 10^4 ±1 count	X	X	TEKTRONIX DC 504
8	Digital Multimeter	Range to ±30 V Accuracy 0.1%	X	X	TEKTRONIX DM 501
9	Function Generator	100 Hz Square Wave		X	TEKTRONIX FG 503
10	Pulse Generator	0 to 2 V square wave output into 50 Ω load. Period 2 μs; Duration .1 μs	X		TEKTRONIX PG 501

Table 4-1 (cont)

Item	Description	Minimum Specifications	Application		Example
			Perf Check	Adj Proc	
11	Power Supply	0 to 10 V range Accuracy ±10%	X		TEKTRONIX PS 501-1
12	Flexible Extender Cable	Compatible with TM 500-Series Power Modules		X	Tektronix Part No. 067-0645-02
13	Meter Lead	Black	X	X	Tektronix Part No. 012-0462-00
14	Meter Lead	Red	X	X	Tektronix Part No. 012-0462-01
15	Oscilloscope Probe	X10 10 MΩ	X	X	Tektronix Part No. 010-6053-13
16	Coaxial Cable	50 Ω BNC Connectors	X	X	Tektronix Part No. 012-0057-01
17	Termination	50 Ω BNC Connectors	X	X	Tektronix Part No. 011-0049-01
18	X10 Attenuator	50 Ω (20 dB) BNC		X	Tektronix Part No. 011-0059-02
19	X5 Attenuator	50 Ω (14 dB) BNC		X	Tektronix Part No. 011-0060-02
20	Adapter	BNC Female to Dual Banana	X	X	Tektronix Part No. 103-0090-00
21	Coaxial Cable	50 Ω BNC Connectors		X	Tektronix Part No. 012-0076-00
22	Adapter	BNC Female to EZ Ball		X	Tektronix Part No. 013-0076-01

1. Check Frequency Range

a. Connect the OUTPUT connector of the FG 507 to the counter input.

b. Press the FREE RUN and 0 dB pushbuttons.

c. Press either the ∿, ⊓ or ⩘ pushbuttons.

d. Make certain the VAR SYMM, OFFSET and SWEEP DURATION controls are off.

e. Set the START dial to 20 and the MULTIPLIER control to the 10^5 position.

f. Adjust the AMPLITUDE control for a stable counter display.

g. CHECK—that the counter reads ≥2 MHz.

h. Activate the VAR SYMM control.

i. Adjust the VAR SYMM control for a 50% duty cycle pulse waveform.

j. CHECK—that the counter reads from 180 kHz to 220 kHz.

k. Change the MULTIPLIER to 10^{-3}.

l. CHECK—for an output frequency of ≤0.002 Hz. For counters set to measure period this corresponds to ≥500 s.

m. Disable the VAR SYMM control.

n. Change the START dial to 2.

o. CHECK—that the counter reads ≤0.002 Hz. For counters set to measure periods this corresponds to 500 s.

p. Disconnect the counter for the next step.

2. Check Variable Symmetry Duty Cycle

a. Press the FREE RUN, 0 dB, and ⊓⌊ pushbuttons.

b. Release the VAR SYMM pushbutton.

c. Connect the OUTPUT connector through a 50 Ω coaxial cable to the oscilloscope vertical input.

d. Adjust the START, MULTIPLIER, AMPLITUDE, and oscilloscope controls to display a squarewave that occupys exactly 10 major divisions for one cycle.

e. Rotate the VAR SYMM control from fully cw to fully ccw.

f. CHECK—that the oscilloscope display varies each squarewave half cycle from ≤1/2 major division to ≥9.5 major divisions.

g. Leave these connections for the next step.

3. Check Output Amplitude

a. Using the same setup as in the previous step, turn the AMPLITUDE control fully cw.

b. CHECK—that the waveform on the oscilloscope display is ≥30 V peak to peak.

c. Remove the coaxial cable from the oscilloscope vertical input and connect a 50 Ω termination in series with the cable.

d. CHECK—that the oscilloscope display is ≥15 V peak to peak.

e. Disconnect the 50 Ω cable and remove the 50 Ω termination to the oscilloscope for the next step.

4. Check Offset Range

a. Press the TRIG, 0 dB, and ∿ pushbuttons.

b. Make certain the VAR SYMM pushbutton is in.

c. Connect a dmm set to read ±15 V to the output connector.

d. Adjust the VAR Ø control for a 0 V reading on the dmm.

e. Pull and turn the OFFSET control fully cw to fully ccw.

f. CHECK—that the dmm reads ≥±13 V at the appropriate stops for the OFFSET control.

g. Remove the coaxial cable from the dmm and insert a 50 Ω termination.

h. CHECK—that the dmm reads at least ±6.5 V at the appropriate stops of the OFFSET control.

i. Remove the connection to the dmm for the next step.

5. Check Amplitude Flatness

a. Press the FREE RUN, 0 dB and ∿ pushbuttons.

b. Make certain the OFFSET is off.

c. Set the START dial to 10 and the MULTIPLIER to 10^3.

d. Connect the OUTPUT connector through a 50 Ω cable and 50 Ω termination to the vertical input of the differential oscilloscope plug-in.

e. Adjust the AMPLTIUDE control and the gain of the vertical amplifier for an 8 major division peak-to-peak display.

f. Increase the vertical amplifier gain by a factor of 10.

g. Adjust the vertical amplifier plug-in offset voltage so that the waveform peaks are on the oscilloscope graticule center line.

h. Change the output to any frequency from 20 Hz to 20 kHz.

i. CHECK—that the display is within 0.46 major divisions from graticule center.

j. Change the output to any freuqncy from 20 kHz to 1 MHz.

k. CHECK—that the display is within 2.37 major divisions from graticule center.

l. Decrease the vertical gain of the oscilloscope by a factor of 10 and adjust the offset voltage to 0.

m. Adjust the output frequency to 10 kHz.

n. Adjust the oscilloscope vertical gain and the AMPLITUDE control for a 6 major division peak to peak display.

o. Change the output to any frequency from 1 MHz to 2 MHz.

p. CHECK—that the peak to peak display amplitude is from 5.36 to 6.73 major divisions.

q. Press the ⌜⌞ pushbutton.

r. Set the output frequency to 10 kHz.

s. Adjust the AMPLITUDE control and the vertical comparator oscilloscope plug-in for an 8 major division peak to peak display.

t. Increase the oscilloscope vertical plug-in gain by a factor of 10.

u. Adjust the vertical plug-in offset voltage so that the positive peaks of the squarewaves are at graticule center.

v. Change the output to any frequency from 20 Hz to 2 MHz.

w. CHECK—that the positive squarewave peaks are within ±2.37 major divisions from graticule center.

x. Press the ∿ pushbutton.

y. Change the output frequency to 10 kHz.

z. Decrease the oscilloscope vertical plug-in gain by a factor of 10.

aa. Adjust the vertical plug-in offset voltage to 0.

bb. Adjust the AMPLITUDE control and the vertical plug-in gain for an 8 major division oscilloscope display of the triangle waveform.

cc. Increase the plug-in gain by a factor of 10.

dd. Adjust the offset voltage so that the positive peak of the triangle waveform is at graticule center.

ee. Change the output to any frequency from 20 Hz to 200 kHz.

ff. CHECK—that the positive peak of the triangle waveform is within 2.37 major divisions from graticule center.

gg. Decrease the vertical amplifier gain by a factor of 10.

hh. Remove the comparison voltage from the vertical plug-in.

ii. Adjust the AMPLITUDE control and the vertical plug-in gain for a peak to peak triangle waveform display of 6 major divisions.

jj. Change the output to any frequency from 200 kHz to 2 MHz.

kk. CHECK—that the peak to peak display reads from 4.4 major divisions to 7.6 major divisions in amplitude.

ll. Disconnect the oscilloscope for the next step.

6. Check Sinewave Distortion

a. Press the FREE RUN, 0 dB, and ∿ pushbuttons. The VAR SYMM, and OFFSET controls must be off (in).

b. Connect the OUTPUT connector through a 50 Ω coaxial cable and 50 Ω termination to the distortion analyzer.

c. Set the distortion analyzer to measure total harmonic distortion plus noise with average response.

d. Make certain the function generator is in an ambient temperature from 20°C to 30°C.

e. Select any frequency from 20 Hz to 20 kHz with the START and MULTIPLIER controls. The START dial must be on the calibrated portion of the dial and the MULTIPLIER control must be on the 10^3 range or below.

f. Adjust the AMPLITUDE control for a 15 V peak to peak signal at the input of the distortion analyzer.

g. CHECK—that the distortion is ≤0.25%.

h. Select any frequency from 20 kHz to 100 kHz. The START control must be on the calibrated portion of the dial.

i. CHECK—that the distortion is ≤0.5%.

j. Disconnect the distortion analyzer and the 50 Ω termination from the coaxial cable.

k. Connect the coaxial cable to the input of the spectrum analyzer.

l. Set the START dial at 10 and the MULTIPLIER at 10^4.

m. Adjust the AMPLITUDE control and the spectrum analyzer controls so that amplitudes 30 dB or greater below the fundamental amplitude are easily viewed on the spectrum analyzer.

n. Rotate the START dial to 20, change the MULTIPLIER to 10^5, and rotate the START dial from 2 to 20.

o. CHECK—that all harmonics from 100 kHz to 2 MHz are at least 30 dB below the fundamental amplitude.

p. Remove the connections to the spectrum analyzer for the next step.

7. Check Squarewave and Pulse Output

a. Press the FREE RUN, 0 dB and ⊓⊔ pushbuttons. All other pushbuttons out.

b. Set the START dial and the MULTIPLIER control for any calibrated frequency. (For ease, the START dial at 20 and the MULTIPLIER at 10^5 are recommended.)

c. Turn the AMPLITUDE control fully cw.

d. Connect the OUTPUT connector through a 50 Ω coaxial cable and the necessary attenuators to obtain a 5 division display to the 50 Ω vertical input of the sampling oscilloscope.

e. Connect the TRIG OUTPUT connector through a 50 Ω coaxial cable and the necessary attenuators to the external trigger input on the sampling oscilloscope.

f. Obtain a stable rise and fall time display on the oscilloscope.

g. CHECK—that the rise time and fall time is ≤25 ns from the 10% to the 90% amplitude points.

h. CHECK—that the peak to peak amplitude of the front corner ringing does not exceed 3% of the total squarewave amplitude. (If the squarewave amplitude is 8 major divisions maximum aberrations allowed are 0.24 major divisions.)

i. Release the VAR SYMM pushbutton.

j. Adjust the VAR SYMM control for a pulse waveform.

k. Repeat steps f and g.

l. Remove all connections for the next step.

8. Check VCF Input

a. Press the FREE RUN, 0 dB and ∿ pushbuttons. The VAR SYMM and OFFSET pushbuttons should be in. Set the FREQUENCY Hz START dial to 20 and the MULTIPLIER to 10^5.

b. Connect the OUTPUT connector through a 50 Ω coaxial cable to the input of the frequency counter.

c. Obtain a stable counter display.

d. Apply −10 Vdc to the VCF INPUT connector.

e. CHECK—that the frequency decreases by a factor of ≥1000.

f. Remove all connections for the next step.

9. Check External Trigger/Gate Input

a. Press the TRIG, 0 dB, and ∿ pushbuttons.

b. Connect the OUTPUT connector to the vertical input of the oscilloscope.

c. Connect the pulse generator through a 50 Ω coaxial cable and 50 Ω termination to the TRIG/GATE IN connector.

d. Set the pulse generator for a 0 to 1.2 V positive going 50% duty cycle pulse at 1/2 the frequency of the FG 507.

e. CHECK—for one cycle of a sine waveform for each trigger pulse.

f. Press the GATE pushbutton.

g. CHECK—for an output waveform that lasts for the duration of the gating waveform.

h. Remove all connections for the next step.

10. Check Trigger Output

a. Press the FREE RUN pushbutton.

b. Connect the TRIG OUTPUT connector through a 50 Ω coaxial cable to the vertical input of the oscilloscope.

c. CHECK—for a ≥+4 V waveform on the oscilloscope display.

d. Insert a 50 Ω termination from the coaxial cable to the oscilloscope vertical input.

e. CHECK—for a ≥+2 V waveform on the oscilloscope display.

f. Remove all connections for the next step.

11. Check Variable Phase Range

a. Press the FREE RUN, 0 dB, and ∿ pushbuttons.

b. Connect the Output connector to the vertical input of the oscilloscope. Set the oscilloscope for automatic triggering.

c. Obtain a sine waveform on the oscilloscope centered around 0 V. Determine the peak to peak amplitude of the waveform.

d. Press the TRIG pushbutton.

e. Rotate the VAR Ø from stop to stop and observe the position of the free running trace on the oscilloscope display.

f. CHECK—that the straight line can be positioned to the peak amplitudes of the sine waveform.

g. Remove all connections for the next step.

12. Check Attenuator Accuracy

a. Press the FREE RUN, 0 dB and ∿ pushbuttons.

b. Set the START dial to 20.

c. Set the MULTIPLIER to the 10^3 position.

d. Set the AMPLITUDE control fully cw.

e. Connect the OUTPUT connector through a 50 Ω coaxial cable and 50 Ω termination to the input of the dB ratio meter (AA 501).

f. Set the AA 501 for automatic level ranging.

g. Push the 0 dB REF button on the AA 501.

h. Push the −20 dB pushbutton.

i. CHECK—that the ratio meter reads from −19 dB to −21 dB.

j. Push the −40 dB pushbutton.

k. CHECK—that the display reads from −39 dB to −41 dB.

l. Push the −60 dB pushbutton.

m. CHECK—that the display reads from −59 dB to −61 dB.

n. Remove all connections for the next step.

12A. Alternate Procedure for Checking Attenuator Accuracy

a. Press the FREE RUN, 0 dB, and ∿ pushbuttons.

b. Set the START dial to 20.

c. Set the MULTIPLIER to 10^3 position. Connect the output through a coaxial cable to the oscilloscope vertical input.

d. Adjust the AMPLITUDE control for exactly a 30 V peak to peak sinewave.

e. Push the −20 dB pushbutton.

f. CHECK—for a waveform amplitude from 2.67 V to 3.37 V.

g. Press the −40 dB pushbutton.

h. CHECK—for a waveform amplitude of 0.267 V to 0.337 V.

i. Press the −60 dB pushbutton.

j. CHECK—for a waveform amplitude from 0.0267 V to 0.0337 V.

k. Remove all connections for the next step.

13. Check Triangle Time Symmetry

a. Press the FREE RUN pushbutton.

b. Set the START dial and MULTIPLIER control for any frequency from 20 Hz to 200 kHz in the calibrated portion of the START dial. Connect the counter through a coaxial cable to the TRIG OUTPUT connector.

c. Trigger the counter to read the time of the positive-going half cycle of the trigger waveform (+ slope).

d. Record this reading.

e. Trigger the counter to read the negative-going half cycle of the triggering waveform (− slope).

f. Record this reading.

g. CHECK—that the time difference of both readings is ≤1%.

h. Set the START and MULTIPLIER controls for a frequency from 200 kHz to 2 MHz in the calibrated portion of the START dial.

i. Repeat steps c through f.

j. CHECK—that the time difference is ≤5%.

k. Remove all connections for the next step.

14. Check Internal Sweep

a. Set the SWEEP DURATION control to the 1 ms position.

b. Connect the GATE OUTPUT connector through a 50 Ω coaxial cable to the counter input.

c. Set the counter to read time duration.

d. Make certain the SWEEP VAR control is fully ccw.

e. CHECK—that the counter reads a pulse duration of 1 ms.

f. Change the SWEEP DURATION control to the 10 s position.

g. CHECK—that the counter reads a pulse duration of 10 s.

h. Turn the SWEEP VAR control fully cw.

i. CHECK—that the pulse duration time is >10 s.

j. Press the TRIG SWP pushbutton.

k. Remove the counter from the GATE OUTPUT connection and connect the coaxial cable to the vertical input of the oscilloscope.

l. Connect a pulse generator to the SWP TRIG IN connector.

m. Increase the amplitude of the pulse generator output from 0 V.

n. CHECK—that the sweep generator outputs a gate waveform when the pulse generator waveform is between 0.8 V to 1.2 V.

o. CHECK—that the GATE OUTPUT is ≥+4 V.

p. Insert a 50 Ω termination from the coaxial cable to the oscilloscope vertical input.

q. CHECK—that the output reads ≥+2 V.

r. Connect the oscilloscope vertical input to the RAMP OUTPUT connector.

s. Remove the pulse generator from the SWP TRIG IN connector.

t. Release the TRIG SWP pushbutton.

u. CHECK—that the ramp starts at ≤+300 mV from ground and rises to 9.5 V to 10.5 V.

v. Remove all connections for the next step.

15. Check Dial Accuracy in the Nonswept Mode

a. Connect the OUTPUT through a coaxial cable to the counter input.

b. Press the FREE RUN, 0 dB and ∿ pushbuttons. All other pushbuttons out.

c. Make certain the SWEEP DURATION switch is off.

d. Determine the full scale tolerance for the MUTLIPLER switch position selected from Table 4-2

e. Set the START control to any position from 2 to 20.

f. CHECK—that any frequency is within the tolerance for the multiplier setting as listed in the table.

Table 4-2

MULTIPLIER TOLERANCE

Multiplier	Tolerance
10^5	±6 kHz
10^4	±600 Hz
10^3	±6 Hz
10^2	±0.6 Hz
10^1	±0.06 Hz
10^{-1}	±0.006 Hz
10^{-2}	±0.0006 Hz
10^{-3}	

g. Leave these connections for the next step.

16. Check Dial Accuracy in the Swept Mode

a. Make certain the ambient temperature is from +20°C to +30°C.

b. Place the STOP dial in the 20 position.

c. Set the SWEEP DURATION control to the 10 ms position.

d. Press the TRIG SWEEP pushbutton.

@

e. Press the FREE RUN, 0 dB, and ∿ pushbuttons.

f. Set the MULTIPLIER to any desired multiplier.

g. Set the START dial to any position from 2 to 20.

h. Connect the counter through a 50 Ω coaxial cable to the OUTPUT connector.

i. Obtain a stable counter display.

j. Determine the indicated output frequency from the settings of the MULTIPLIER and START dials.

k. Determine 5% of the full dial scale reading for the multiplier range selected (for example, 100 kHz on the 10^5 MULTIPLIER position).

l. Apply this tolerance to the output frequency indicated by the START dial and the MULTIPLIER switch setting.

m. CHECK—that the counter reads within the tolerance determined in the previous step.

n. Set the START dial to .2.

o. Make certain the MULTIPLIER VAR control is fully cw.

p. Set the STOP dial to any position from 2 to 20.

q. Determine 5% of the full scale frequency determined by the STOP dial and MULTIPLIER switch positions (for example, 1 kHz for 10^3 MULTIPLIER setting.).

r. Determine the actual output frequency from the STOP dial setting and the MULTIPLIER switch position.

s. Apply this frequency tolerance to the actual output frequency determined by the STOP dial setting and the MULTIPLIER switch position.

t. Press the HOLD SWP pushbutton.

u. Press and release the MAN TRIG pushbutton.

v. CHECK—that the counter reads within the frequency tolerance determined in step s.

w. Remove all connections.

x. This completes the Performance Check procedure.

ADJUSTMENT PROCEDURE

INTRODUCTION

Use this Adjustment Procedure to restore the FG 507 to original performance requirements. This Adjustment Procedure need not be performed unless the instrument fails to meet the Performance Requirements of the Electrical Characteristics listed in the Specification section, or if the Performance Check procedure cannot be completed satisfactorily. If the instrument has undergone repairs, the Adjustment Procedure is recommended.

Satisfactory completion of all adjustment steps in this procedure assures that the instrument will meet the performance requirements.

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.

RECALIBRATION INTERVAL

Recommended recalibration interval is 2000 hours of operation or six months, whichever occurs first.

TEST EQUIPMENT REQUIRED

The test equipment (or equivalent) listed in Table 4-1 is required for adjustment of the FG 507. Specifications given for the test equipment are the minimum necessary for accurate adjustment. All test equipment is assumed to be correctly calibrated and operating within specifications.

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

PREPARATION

Access to the internal adjustments is achieved most easily when the FG 507 is connected to the power module with flexible extenders (see equipment list). Removal of the left side cover provides access to adjustments located on the Main Board and Auxiliary Board. Removal of the right side cover provides access to adjustments located on the Sweep Board. Refer to the Adjustment Locations in the pullout pages at the rear of the manual.

Make adjustments at an ambient temperature between +20°C and +25°C.

PRELIMINARY CONTROL SETTINGS

Power Module

LINE SELECTOR	HI

Digital Multimeter

RANGE/FUNCTION	20 DC Volts
INPUT (pushbutton)	out

FG 507

⌐ (pushbutton)	in
FREE RUN (pushbutton)	in
0 dB (pushbutton)	in
FREQUENCY Hz—START	20
FREQUENCY Hz—STOP	20
VAR SYMM	midrange, in
VAR Ø	midrange
MULTIPLIER	10^3
FREQUENCY—VAR	cw
OFFSET	midrange, in
AMPLITUDE	cw
DURATION	10 ms
TRIG SWP/FREE RUN	FREE RUN

POWER SUPPLIES

1. Adjust the +15 V ADJ (R1301), ±0.1%

a. Insert the FG 507 and digital multimeter into the power module.

b. Connect the power module power cord to 117 Vac source and turn on the power module.

c. Connect the test leads to the digital multimeter HI and LO INPUTS.

d. Connect the digital multimeter LO test lead to the FG 507 chassis ground. Connect the HI test lead to the FG 507 test point, TP1323 located on the Main board.

e. ADJUST—potentiometer R1301 located on the Main board until the digital multimeter readout indicates between +14.985 and +15.015.

2. Adjust the −15 V ADJ (R1341), ±0.1%

a. Remove the digital multimeter HI test lead from TP1323 and connect to test point, TP1451 (also located on the Main board).

b. ADJUST—potentiometer R1341 located on the Main board until the digital multimeter readout indicates between −14.985 and −15.015.

3. Check the +15 V Supply Accuracy, ±0.5%

a. Remove the digital multimeter HI test lead from TP1451 and connect to test point, TP1331 located on the Main board.

b. The digital multimeter must indicate a readout between +4.975 and +5.025.

4. Check the +20 V Supply Accuracy, ±0.5%

a. Change the digital multimeter RANGE/FUNCTION switch to 200 DC VOLTS.

b. Remove the digital multimeter HI test lead from TP1331 and connect to test point, TP1321 located on the Main board.

c. The digital multimeter must indicate a readout between +19.90 and +20.10.

5. Check the −20 V Supply Accuracy, ±0.5%

a. Remove the digital multimeter HI test lead from TP1321 and connect to test point, TP1241 located on the Main board.

b. The digital multimeter must indicate a readout between −19.90 and −20.10.

6. Adjust the +15 V ADJ (R1640, ±0.1%; Check −15 V Supply Accuracy

a. Remove the digital multimeter HI test lead from TP1241 and connect to the positive polarity side of capacitor C1642, located on the Sweep board.

b. Change the digital multimeter RANGE/FUNCTION switch to 20 DC VOLTS.

c. ADJUST—potentiometer R1640 located on the sweep board until the digital multimeter readout indicates between +14.985 and +15.015.

d. Remove the digital multimeter HI test lead from the positive side of capacitor C1642 and connect to the negative side of C1640.

e. The digital multimeter must indicate a readout between −14.700 and −15.300.

f. Remove all connections.

DIAL ALIGNMENT

Refer to Fig. 4-1 test setup and preliminary control settings with the following exceptions.

FG 507

DURATION	off
MAN SWP	cw

7000 Series Oscilloscope

POWER	on
FOCUS, INTENSITY	as desired for a well-defined display
VERTICAL MODE	LEFT
HORIZONTAL MODE	B
B TRIGGER SOURCE	VERT MODE

Vertical Plug-in

VOLTS/DIV	5
VARIABLE	in
BANDWIDTH	FULL
POLARITY	+ UP
AC-GND-DC	DC
POSITION	centered display

Horizontal Plug-in

DISPLAY MODE	TIME BASE
TIME/DIV	50 μs
VARIABLE	in
LEVEL/SLOPE	⊣
MODE	AUTO
COUPLING	AC
SOURCE	INT
MAGNIFIER	10X

7. START Frequency Dial Alignment

a. Connect the coaxial cable from the FG 507 OUTPUT to the vertical plug-in INPUT.

b. Adjust the horizontal plug-in LEVEL control for a stable squarewave display on the crt.

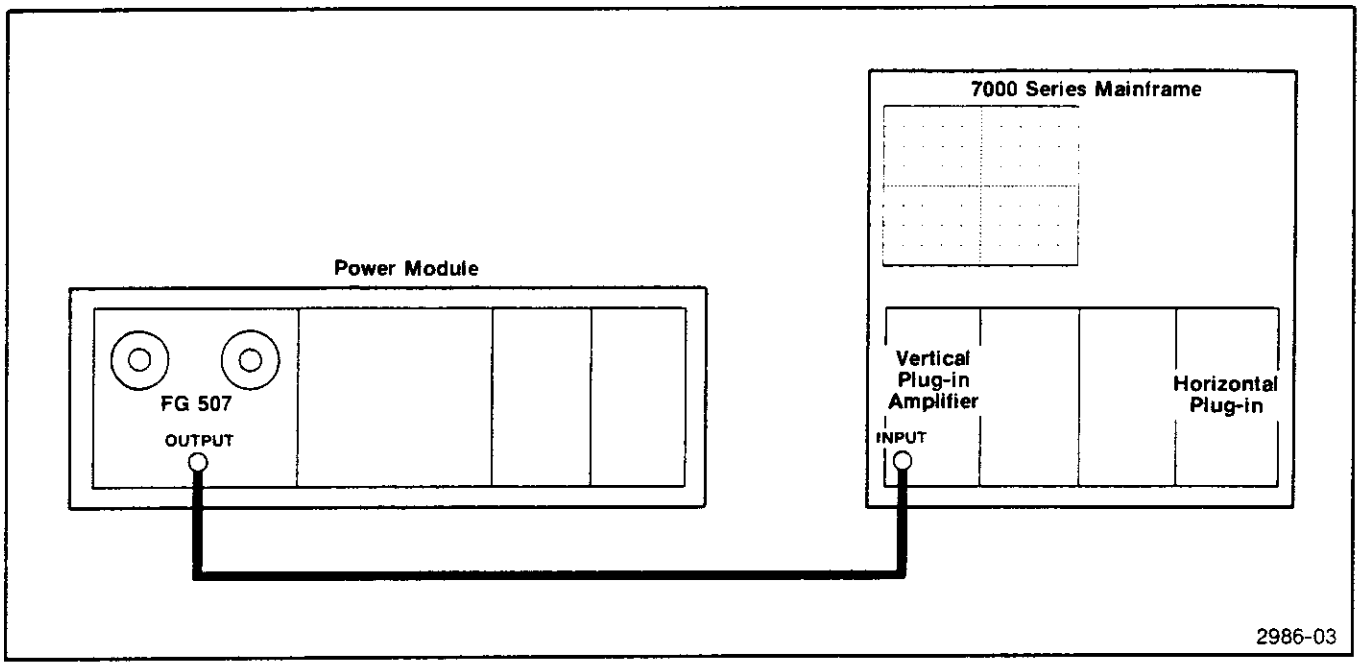


Fig. 4-1. Test setup for DIAL ALIGNMENT and OFFSET adjustment.

c. Locate the coupler holding the START frequency potentiometer extension shaft and loosen the coupler set screw.

d. ADJUST—the START frequency potentiometer counterclockwise until the displayed waveform just stops moving.

e. While holding the potentiometer (coupler), adjust the START frequency dial to 20 (exact).

f. Tighten the coupler set screw (snug only).

g. Adjust the FG 507 START frequency dial to 18. Then rotate dial slowly counterclockwise until the displayed crt waveform just stops moving.

h. Check that the START frequency dial is on 20 (±.5 minor graticule division).

i. Tighten the START frequency coupler set screw.

8. STOP Frequency Dial Alignment

a. Change the FG 507 DURATION to MAN, and press HOLD SWP pushbutton (in).

b. The oscilloscope crt display is a squarewave.

c. Locate the coupler holding the STOP frequency potentiometer extension shaft and loosen the coupler set screw.

d. ADJUST—the STOP frequency potentiometer counterclockwise until the displayed waveform just stops moving.

e. While holding the potentiometer (coupler) adjust the STOP frequency dial to 20 (exact).

f. Tighten the coupler set screw (snug only).

g. Adjust the FG 507 STOP frequency dial to 18. Then rotate dial slowly counterclockwise until the displayed crt waveform just stops moving.

h. Check that the STOP frequency dial is on 20 (±.5 minor graticule division).

i. Tighten the STOP frequency coupler set screw.

j. Remove all cables and set DURATION to OFF.

ADJUST OFFSET

Refer to Fig. 4-1 test setup and preliminary control settings with the following exceptions.

FG 507

AMPLITUDE	ccw
∿ (pushbutton)	in
FREQUENCY Hz—START	20
MULTIPLIER	10^2

Vertical Plug-in

VOLTS/DIV	2

9. Adjust the OUTPUT OFFSET (R2201) and SINE OFFSET (R1104)

a. The oscilloscope crt display is a triangle.

b. ADJUST—potentiometer R2201 located on the Main board until the displayed waveform is centered on the vertical graticule line.

c. Press the ∿ (pushbutton) in.

d. The oscilloscope crt display is a sinewave.

e. ADJUST—potentiometer R1104 located on the Aux board until the displayed waveform is centered on the vertical graticule line.

ADJUST SINE DISTORTION

10. Adjust the TRIANGLE AMPL ADJ (R1412), TRIANGLE OFFSET (R1511), and TOP DIAL SYMM CAL (R1421)

Refer to the preliminary control settings with the following exceptions.

FG 507

AMPLITUDE	cw

Audio Analyzer

INPUT LEVEL RANGE	20 V
FUNCTION	THD+N
PERCENT DISTORTION	AUTO
FILTERS	OUT
RESPONSE	AVE

a. Remove the vertical plug-in INPUT connection and re-connect to the audio analyzer using a bnc to banana plug adapter. Refer to Fig. 4-2 check setup.

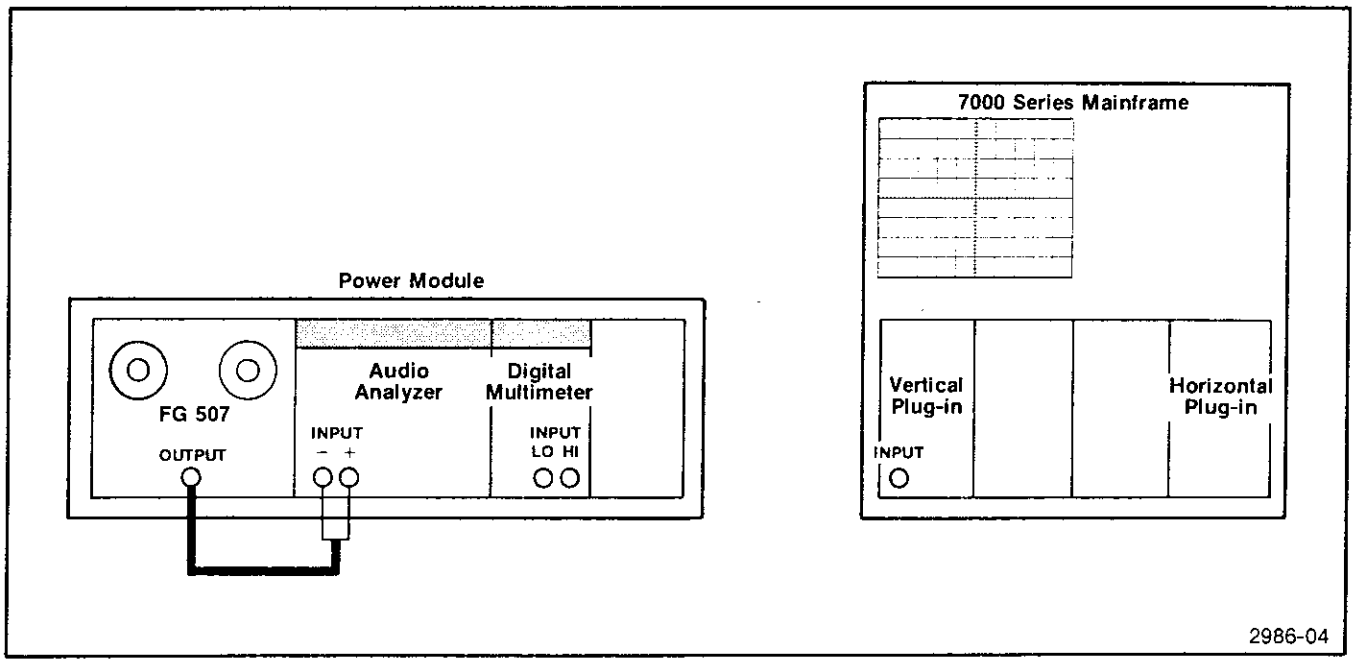


Fig. 4-2. Test setup for SINE DISTORTION adjustment.

b. ADJUST—potentiometers R1412, R1511, and R1421 all located on the Main board for a minimum reading on the audio analyzer. Repeat these adjustments until no further improvement is noted.

11. Adjust the "C" MULT ADJ (R1951)

Refer to Fig. 4-2 test setup and preliminary control settings with the following exceptions.

Digital Multimeter

RANGE/FUNCTION	2 DC VOLTS

FG 507

MULTIPLIER	1

a. Connect the digital multimeter LO INPUT test lead to pin 2 of IC, U1930 located on the Main board.

b. Connect the HI INPUT test lead to pin 2 of IC, U1940 also located on the Main board.

c. ADJUST—potentiometer R1951 located on the Main board for a .0000 digital multimeter readout.

d. Remove digital mutlimeter test leads.

12. Adjust the BOTTOM DIAL SYMM CAL (R1441)

Refer to Fig. 4-2 test setup.

a. Adjust the FG 507 START frequency dial to 1 and change the MULTIPLIER to 10^2.

b. ADJUST—potentiometer R1441 for a minimum reading on the audio analyzer.

SWEEP WIDTH

Refer to Fig. 4-3 test setup and preliminary control settings with following exceptions.

Digital Counter

FUNCTION	PERIOD/10 μs

Horizontal Plug-in

TIME/DIV	2 ms
MAGNIFIER	X1

Vertical Plug-in

INPUT	
+	GND
–	GND
VOLTS/DIV	.2

FG 507

HOLD SWP	in
DURATION	10 ms

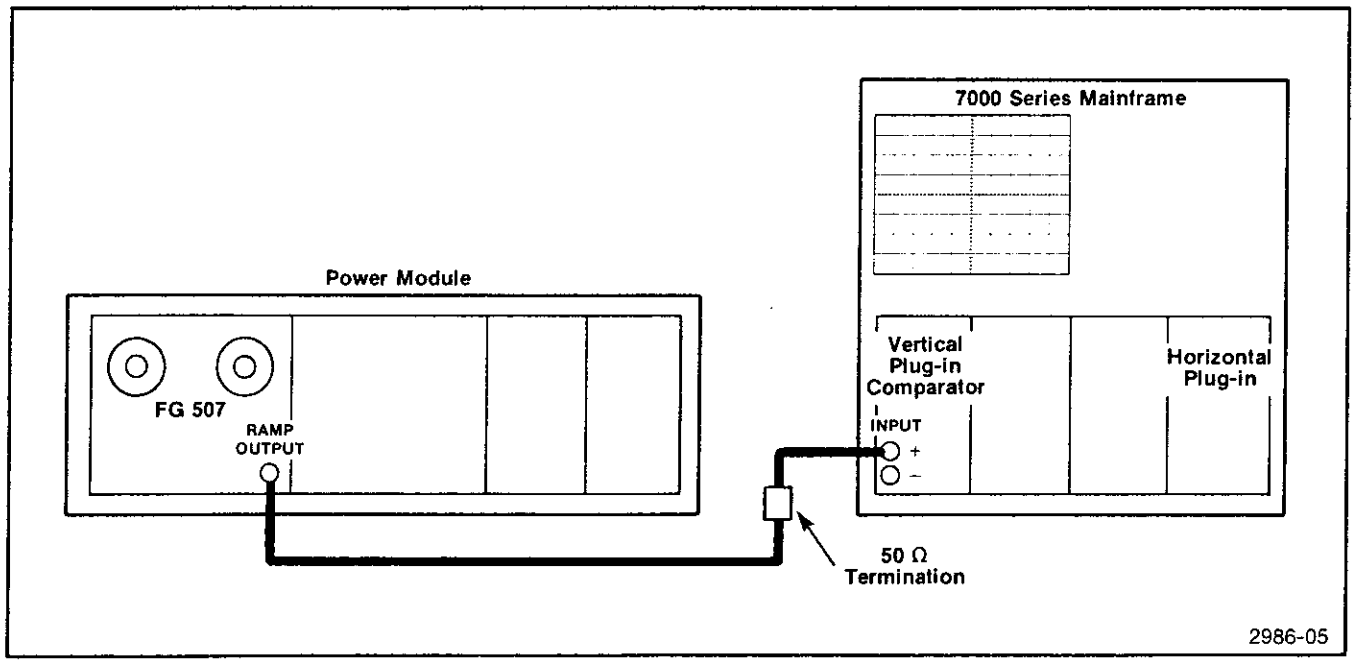


Fig. 4-3. Test setup for SWEEP WIDTH adjustments.

13. Adjust SWP WIDTH CAL (R1210)

a. Rotate the vertical plug-in POSITION control until the trace is on the center graticule line.

b. Set the vertical plug-in + INPUT to DC and the – INPUT to VC.

c. Connect the coaxial cable from the FG 507 RAMP OUTPUT to the vertical plug-in + INPUT.

d. Adjust the vertical plug-in comparison voltage to position the display on the center graticule line.

e. Set the HOLD SWP pushbutton switch to the out position.

f. ADJUST—potentiometer R1210 located on the Sweep board to position the positive peaks of the displayed waveform on the center graticule line.

14. Adjust the SWP CAL (R1546)

a. Connect a coaxial cable with 50 Ω termination from the FG 507 GATE OUTPUT to the Digital Counter INPUT.

b. ADJUST—potentiometer R1546 located on the Sweep board for a digital counter readout of 10.00.

START/STOP FREQUENCY

Refer to Fig. 4-4 test setup and preliminary control settings with the following exceptions.

FG 507

DURATION	OFF
FREQUENCY Hz—START	20
FREQUENCY Hz—STOP	20
MULTIPLIER	10^3

Digital Counter

FUNCTION	FREQUENCY/10 Hz

Digital Multimeter

RANGE/FUNCION	2 DC VOLTS

15. Adjust START FREQ CAL (R1205)

a. Connect a coaxial cable with 50 Ω termination from the FG 507 OUTPUT to the digital counter INPUT.

b. ADJUST—potentiometer R1205 located on the Sweep board for a digital counter readout of 20.00.

16. Adjust LOOP DELAY (C1714)

a. Change the FG 507 MULTIPLIER to 10^5 and the digital counter FUNCTION to FREQUENCY/1 kHz.

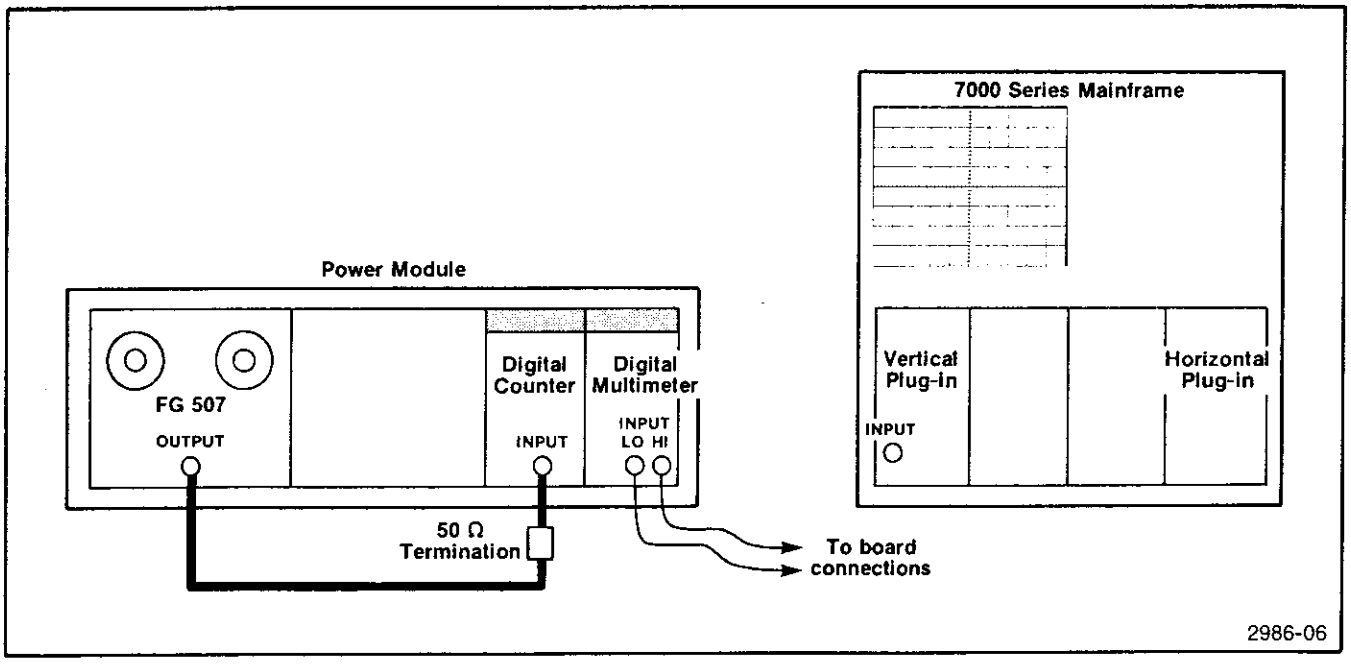


Fig. 4-4. Test setup for START/STOP FREQUENCY and LOG PEAK adjustments.

b. ADJUST—variable capacitor C1714 located on Main board for a digital counter readout of 2.000.

17. Adjust STOP FREQ CAL (R1200)

a. Change FG 507 MULTIPLIER to 10^3 and the digital counter FUNCTION switch to FREQUENCY/10 Hz.

b. Connect the digital multimeter LO INPUT test lead to pin 14 of IC, U1310 located on the Sweep board.

c. Connect the HI INPUT test lead to pin 8 of IC, U1310.

d. ADJUST—potentiometer R1200 located on the Sweep board until the digital multimeter readout indicates between +0.0010 and −0.0010.

LOG PEAK ADJUST

Refer to Fig. 4-4 test setup.

18. Adjust LP1 (R1700)

a. Remove the digital multimeter LO INPUT test lead from pin 14 and attach to pin 6 of IC, U1510 located on the Sweep board.

b. Connect the multimeter HI INPUT test lead to pin 8 of IC, U1310 located on the Sweep board.

c. ADJUST—potentiometer R1700 located on the Sweep board until the digital multimeter readout indicates between +0.0010 and −0.0010.

19. Adjust LP2 (R1503)

a. Remove the digital multimeter LO INPUT test lead from pin 6 of U1510 and attach to pin 6 of IC, U1300 located on the Sweep board. Leave the HI INPUT test lead connected to pin 8 of U1310.

b. ADJUST—potentiometer R1503 located on the Sweep board until the digital multimeter readout indicates between +0.0010 and −0.0010.

c. Remove test leads.

X/Y OFFSET ADJUST

Refer to Fig. 4-5 test setup and preliminary control settings with the following exceptions.

FG 507

DURATION	10 ms
FREQUENCY Hz—STOP	2

Vertical Plug-in

VOLTS/DIV	1V
AC-GNC-DC	AC

Function Generator

FREQUENCY (dial)	10
MULTIPLIER	10
FUNCTION	⎍
OFFSET	OFF

20. Adjust Y OFFSET (R1820)

a. Adjust the vertical plug-in POSITION control until the displayed trace is positioned on the center graticule line.

b. Connect the coaxial cable with 50 Ω termination from the function generator OUTPUT to the vertical plug-in INPUT.

c. The oscilloscope crt display is a squarewave.

d. Adjust the function generator AMPLITUDE control for a displayed waveform of 5 divisions peak-to-peak. Adjust function generator OFFSET control to center the display.

e. Remove the coaxial cable and termination from the vertical plug-in INPUT connector and attach the 10X probe to this connector.

f. Connect the probe tip to pin 6 of IC U1830 located on the Sweep board. Connect the probe ground lead to the FG 507 chassis.

g. Connect the digital multimeter HI INPUT test lead to pin 4 of IC U1730 located on the Sweep board.

h. Connect the LO INPUT test lead to the FG 507 chassis ground.

i. Adjust the FG 507 START frequency dial and the VAR frequency control for a digital multimeter readout between +0.0010 and −0.0010.

j. Change vertical plug-in VOLTS/DIV switch to 5 mV and set BW switch to 20 MHz.

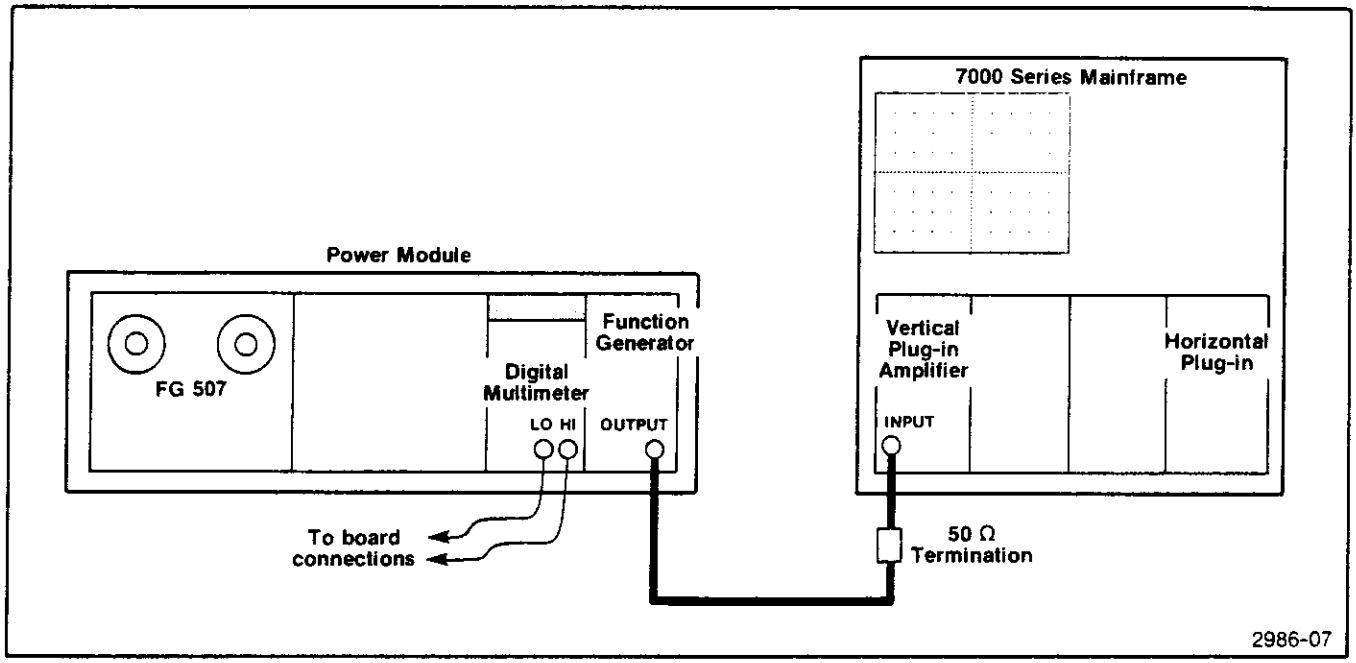


Fig. 4-5. Test setup for X/Y OFFSET.

k. ADJUST—potentiometer R1820 located on the Sweep board for a minimum peak-to-peak signal display on the crt.

l. Remove the digital multimeter HI test lead.

21. Adjust X OFFSET (R1726)

a. Change the FG 507 DURATION control to MAN position.

b. Locate the connector (P1205) on the Sweep board that attaches to the STOP frequency potentiometer. Remove this connector.

c. Connect a 50 Ω coaxial cable to the function generator OUTPUT. Connect a bnc to clip lead adapter to the coaxial cable. Connect the center conductor to pin 8 of J1205 and the outer conductor (ground) clip to pin 9 of J1205.

d. Connect the digital multimeter HI INPUT test lead to pin 9 of IC U1730 located on the Sweep board.

e. Adjust the FG 507 MAN SWP control for a digital multimeter readout of 0 V.

f. Remove the digital multimeter test leads.

g. ADJUST—potentiometer R1726 for a minimum peak-to-peak signal display on the crt.

h. Remove all test leads and cables and re-attach connector P1205 to J1205 on the Sweep board.

OUTPUT OFFSET AND SCALE FACTOR ADJUST

Refer to Fig. 4-6 test setup and preliminary control settings with the following exceptions.

FG 507

MULTIPLIER	10^2
FREQUENCY Hz—START	.2
FREQUENCY Hz—STOP	20
VAR frequency	cw
DURATION	10 ms

Digital Counter

FUNCTION	FREQUENCY/1 Hz

22. Adjust the OUTPUT OFFSET (R1622)

a. Connect the coaxial cable with 50 Ω termination from the FG 507 TRIG OUTPUT to the digital counter INPUT.

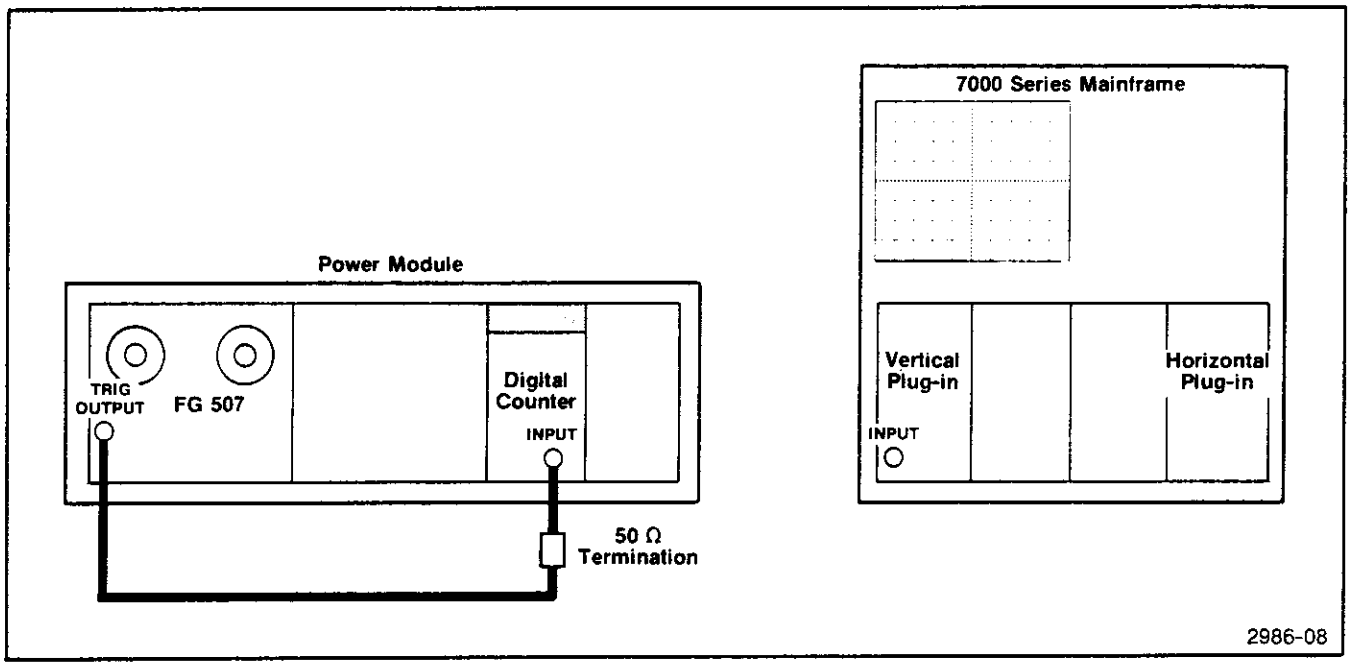


Fig. 4-6. Test setup for OUTPUT OFFSET, SCALE FACTOR, and ANTI-LOG PEAK/GAIN MATCH adjustments.

b. Press the FG 507 TRIG SWP pushbutton (in) and the HOLD SWP pushbutton (in).

c. ADJUST—potentiometer R1622 located on the Sweep board for a digital counter readout of .200.

23. Adjust the SCALE FACTOR (R1620)

a. Press and release the FG 507 MAN TRIG pushbutton.

b. ADJUST—potentiometer R1620 located on the Sweep board for a digital counter readout of 2.000.

c. Press HOLD SWP pushbutton (out). Press HOLD SWP pushbutton (in).

d. Repeat steps 22b, 22c, and 23a, 23b, 23c as necessary until no further adjustments are required.

ANTI-LOG PEAK/GAIN MATCH ADJUSTS

Refer to Fig. 4-6 test setup.

24. Adjust ANTI-LOG PEAK (R1804)

a. Press the FG 507 LOG SWP pushbutton (in).

b. ADJUST—potentiometer R1804 located on the Sweep board for a digital counter readout of 2.000.

25. Adjust GAIN MATCH (R1702)

a. Change the FG 507 START frequency dial to 20.

b. ADJUST—potentiometer R1702 located on the Sweep board for a digital counter readout of 2.000.

c. Change the FG 507 START frequency dial to .2.

d. Repeat steps 24a, 24b, and 25a, 25b, 25c as necessary until no further adjustments are required.

OFFSET ADJUSTS

Refer to Fig. 4-7 test setup and preliminary control settings with the following exceptions.

FG 507

∿ (pushbutton)	in
MULTIPLIER	10^2
OUTPUT	ccw
DURATION	OFF

Vertical Plug-in

VOLTS Polarity	+
+ INPUT Coupling	GND
− INPUT Coupling	GND
VOLTS/DIV	.1

26. Adjust OUTPUT OFFSET (R2201)

a. Connect a coaxial cable with 50 Ω termination from the FG 507 OUTPUT to the vertical plug-in + INPUT.

b. Adjust the vertical plug-in POSITION control until the trace lines up on the center horizontal graticule line.

c. Change the vertical plug-in + INPUT coupling to DC.

d. Adjust the vertical plug-in COMPARISON VOLTAGE control until the positive peak of the displayed waveform appears at graticule center.

e. Change the vertical plug-in VOLTS polarity to −.

f. Adjust the vertical plug-in COMPARISON VOLTAGE control until the negative peak of the displayed waveform moves half-way between its present position and the center horizontal graticule line.

g. ADJUST—potentiometer R2201 located on the Main board until the negative peak of the displayed waveform is on the center horizontal graticule line.

27. Adjust the SINE OFFSET (R1104)

a. Change the vertical plug-in VOLTS polarity to + and press the ∿ pushbutton (in).

b. Adjust the vertical plug-in COMPARISON VOLTAGE control until the positive peak of the displayed waveform appears at graticule center.

c. Change the vertical plug-in VOLTS polarity to −

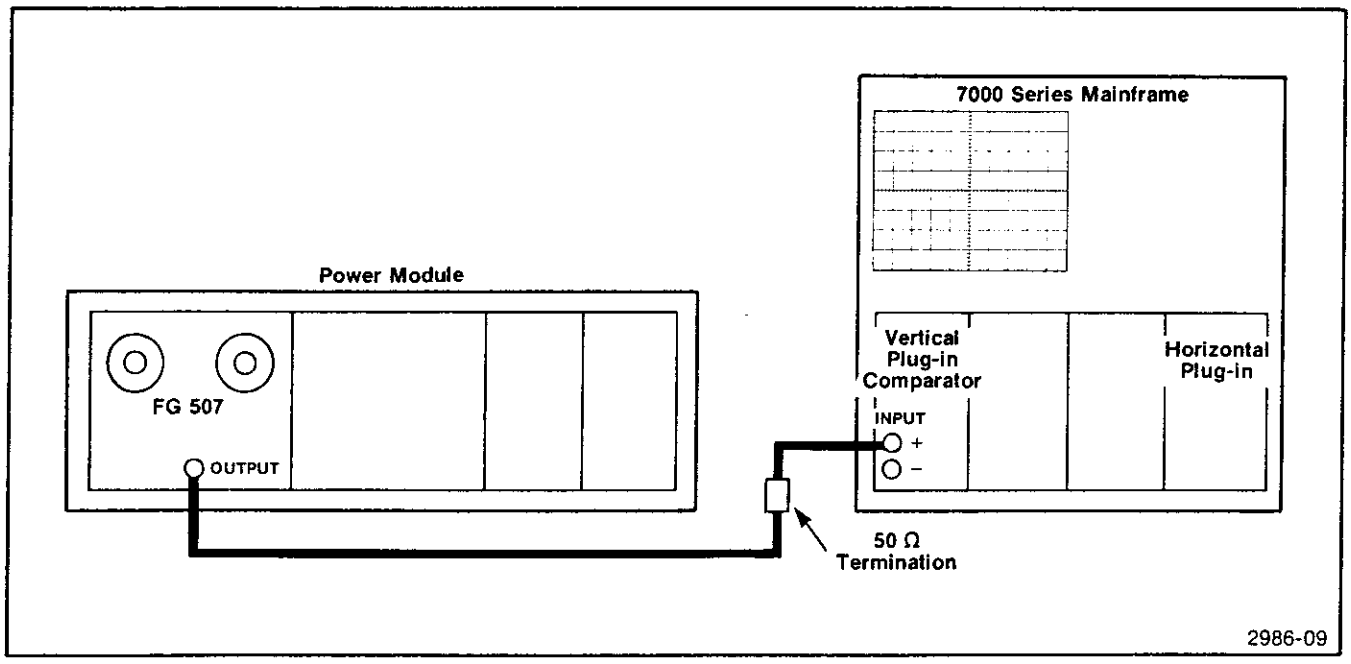


Fig. 4-7. Test setup for OFFSET AND SINE/SQUARE AMPLITUDE adjustments.

d. Adjust the vertical plug-in COMPARISON VOLTAGE control until the negative peak of the displayed waveform moves half-way between its present position and the center horizontal graticule line.

e. ADJUST—potentiometer R1104 located on the Aux board until the negative peak of the displayed waveform is on the center horizontal graticule line.

SINE/SQUARE AMPLITUDE ADJUSTS

Refer to Fig. 4-7 test setup and the preliminary control settings with the following exceptions.

FG 507

∿ (pushbutton)	in
AMPLITUDE	cw

Vertical Plug-in

VOLTS/DIV	.2
+ INPUT Coupling	GND
− INPUT Coupling	GND

28. Adjust the SINE AMPL (R1106)

a. Adjust the vertical plug-in POSITION control until the trace lines up on the center horizontal graticule line.

b. Change the vertical plug-in VOLTS polarity to −.

c. Change the vertical plug-in + INPUT coupling to DC and the − INPUT coupling to VC.

d. Adjust the vertical plug-in COMPARISON VOLTAGE control until the negative peak of the displayed waveform appears at graticule center.

e. Press the FG 507 ∿ pushbutton (in).

f. ADJUST—potentiometer R1106 located on the Aux board until the negative peak of the displayed waveform is on the center horizontal graticule line.

29. Adjust the SQ WAVE AMPL (R1728)

a. Press the FG 507 ⊓⊔ pushbutton (in).

b. Note the position of the negative level of the displayed squarewave.

c. Press the FG 507 ∿ pushbutton (in).

d. Change the vertical plug-in VOLTS polarity to +.

e. Adjust the vertical plug-in COMPARISON VOLTAGE control until the positive peak of the displayed waveform is on the center horizontal graticule line.

f. Press the FG 507 ⊓⊔ pushbutton (in).

g. ADJUST—potentiometer R1728 located on the Main board until the positive level of the displayed squarewave is off of the center graticule line in the same direction and same amount as the negative level squarewave noted in step 29b.

SQUAREWAVE COMP/RISE AND FALLTIME ADJUSTS

Refer to Fig. 4-8 test setup and the preliminary control settings with the following exceptions.

FG 507

FREQUENCY Hz—START	20
MULTIPLIER	10^5
AMPLITUDE	ccw

Sampling Vertical Plug-in

mVOLTS/DIV	200

Sampling Horizontal Plug-in

SWEEP RANGE	5 μs
TIME/DIV	.1 μs

30. Adjust the SQ WV COMP (C2011)

a. Connect a coaxial cable with a 10X attenuator from the FG 507 OUTPUT to the vertical plug-in sampling head input.

b. Connect a coaxial cable with a 5X attenuator from the FG 507 TRIG OUTPUT to the sampling horizontal plug-in TRIG INPUT.

c. Set the sampling vertical plug-in VARIABLE out and adjust for a displayed waveform amplitude of five major graticule divisions.

d. Change the sampling vertical plug-in mVOLTS/DIV switch to 20.

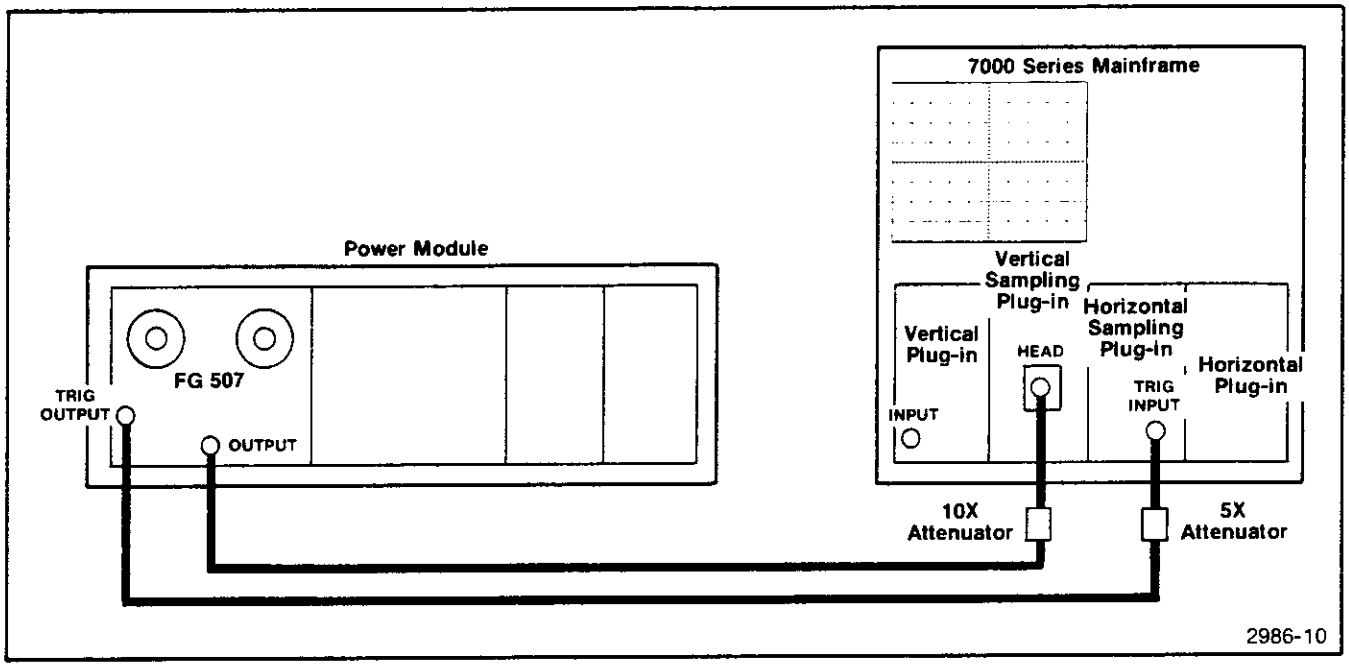


Fig. 4-8. Test setup for SQUAREWAVE COMP/RISE AND FALL TIME adjustment.

e. ADJUST—variable capacitor C2011 located on the Main board for a peak-to-peak aberration of 1 major graticule division on the displayed waveform. This aberration will appear at both the top and bottom of the waveform.

f. Remove all cables and connections.

This completes the Adjustment Procedure.

MAINTENANCE

GENERAL MAINTENANCE INFORMATION

STATIC-SENSITIVE COMPONENTS

CAUTION

Static discharge can damage any semiconductor component in this instrument.

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

Observe the following precautions to avoid damage:

1. Minimize handling of static sensitive components.

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

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

4. Nothing capable of generating or holding a static charge should be allowed on the work station surface.

5. Keep the component leads shorted together whenever possible.

6. Pick up components by the body, never by the leads.

7. Do not slide the components over any surface.

8. Avoid handling components in areas that have a floor or work surface covering capable of generating a static charge.

9. Use a soldering iron that is connected to earth ground.

10. Use only special antistatic suction type or wick type desoldering tools.

Table 5-1

RELATIVE SUSCEPTIBILITY TO STATIC DISCHARGE DAMAGE

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

*** Voltage equivalent for levels:**

1 = 100 to 500 V 4 = 500 V 7 = 400 to 1000 V (est.)
2 = 200 to 500 V 5 = 400 to 600 V 8 = 900 V
3 = 250 V 6 = 600 to 800 V 9 = 1200 V

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

CLEANING

This instrument should be cleaned as often as operating conditions require. Loose dust accumulated on the outside of the instrument can be removed with a soft cloth or small brush. Remove dirt that remains with a soft cloth dampened in a mild detergent and water solution. Do not use abrasive cleaners.

CAUTION

To clean the front panel use freon, isopropyl alcohol, or totally denatured ethyl alcohol. Do not use petroleum based cleansing agents. Before using any other type of cleaner, consult your Tektronix Service Center or representative.

The best way to clean the interior is to blow off the accumulated dust with dry, low-velocity air (approximately 5 lb/in^2) or use a soft brush or cloth dampened with a mild detergent and water solution.

Hold the board so the cleaning residue runs away from the connectors. Do not scrape or use an eraser to clean the edge connector contacts. Abrasive cleaning can remove the gold plating.

CAUTION

Circuit board and components must be dry before applying power.

OBTAINING REPLACEMENT PARTS

Electrical and mechanical parts can be obtained through your local Tektronix Field Office or representative. However, it may be possible to obtain many of the standard electronic components from a local commercial source. Before purchasing or ordering a part from a source other than Tektronix, Inc., check the Replaceable Electrical Parts list for the proper value, rating, tolerance, and description.

NOTE

When selecting replacement parts, remember that the physical size and shape of a component may affect its performance in the instrument.

Some parts are manufactured or selected by Tektronix, Inc., to satisfy particular requirements or are manufactured for Tektronix, Inc., to our specifications. Most of the mechanical parts used in this instrument have been manufactured by Tektronix, Inc. To determine the manufacturer, refer to the Replaceable Parts list and the Cross Reference Index, Mfr. Code Number to Manufacturer.

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

1. Instrument type and option number.
2. Instrument serial number.
3. A description of the part (if electrical, include complete circuit number)
4. Tektronix part number.

SOLDERING TECHNIQUES

WARNING

To avoid electric-shock hazard, disconnect the instrument from the power source before soldering.

The reliability and accuracy of this instrument can be maintained only if proper soldering techniques are used when repairing or replacing parts. General soldering techniques which apply to maintenance of any precision electronic equipment should be used when working on this instrument. Use only 60/40 rosin-core, electronic grade solder. The choice of soldering iron is determined by the repair to be made.

When soldering on circuit boards or small wiring, use only a 15 watt, pencil type soldering iron. A higher wattage soldering iron can cause the etched circuit wiring to separate from the board base material and melt the insulation from small wiring. Always keep the soldering iron tip properly tinned to ensure the best heat transfer to the solder joint. Apply only enough heat to remove the component or to make a good solder joint. To protect heat sensitive components, hold the component lead with a pair of long-nose pliers between the component body and the solder joint. Use a solder removing wick to remove excess solder from connections or to clean circuit board pads.

SEMICONDUCTORS

To remove in-line integrated circuits use an extracting tool. This tool is available from Tektronix, Inc.; order Tektronix Part Number 003-0619-00. If an extracting tool is not available, use care to avoid damaging the pins. Pull slowly and evenly on both ends of the integrated circuit. Try to avoid disengaging one end before the other end.

INTERCONNECTING PINS

Several methods of interconnection including multipin and coaxial cable, are used to electrically connect the circuit boards with other boards and components.

COAXIAL CABLES

Replacement of coaxial end lead connectors requires special tools. Damaged cables should be replaced as a unit. For cable part numbers see the Replaceable Mechanical Parts list. Fig. 5-1 shows a coaxial connector assembly.

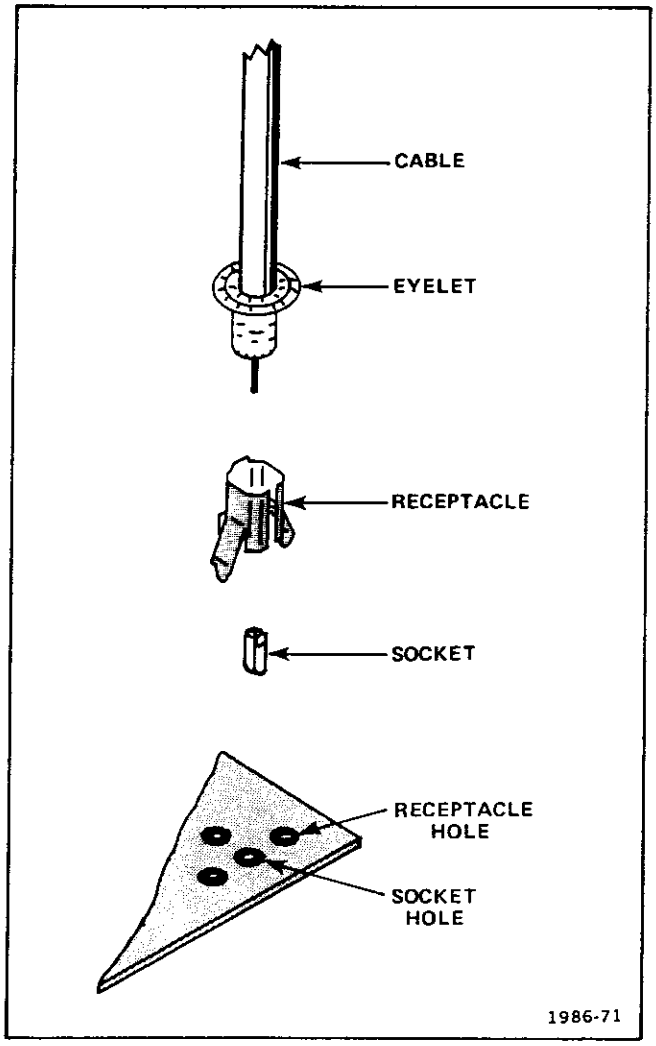


Fig. 5-1. Coaxial end lead connector assembly.

MULTIPIN CONNECTORS

The pin connectors used to connect the wires to the interconnecting pins are clamped to the ends of the wires. To replace damaged multipin connectors, remove the old pin connector from the holder. Do this by inserting a scribe between the connector and the holder and prying the connector from the holder. Clamp the replacement connector to the wire. Reinstall the connector in the holder.

If the individual end lead pin connectors are removed from the plastic holder, note the order of the individual wires for correct replacement in the holder. For proper replacement see Fig. 5-2.

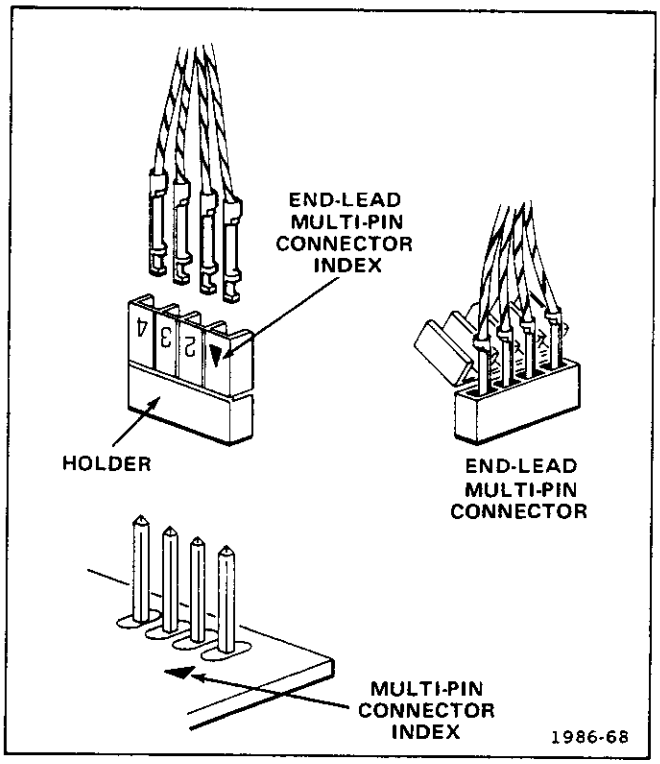


Fig. 5-2. Orientation and disassembly of multipin connectors.

CAM SWITCHES

Use care when cleaning or repairing cam switches. Shaft alignment and spring tension of the contacts must be carefully maintained for proper operation of the switch. For assistance, contact your local Tektronix Field Office or representative.

NOTE

A cam-type switch repair kit including necessary tools, instructions, and replacement contacts is available from Tektronix, Inc. Order Tektronix Part No. 040-0541-00.

The cam switches consist of rotating cam drums which are turned by front-panel knobs, and sets of spring-leaf contacts mounted on adjacent circuit boards. The contacts are actuated by lobes on the cams. These switches can be disassembled for inspection, cleaning, repair, or replacement as follows:

1. Pull the metal cover off the switch. The switch is now open for inspection or cleaning.

2. To completely remove a switch from the circuit board, first remove any knobs or shaft extensions. Loosen the coupling at the potentiometer at the rear of the switch, and pull the long shaft out of the switch assembly.

3. Remove the screws (from the opposite side of the circuit board) that hold the cam drum to the board.

4. To remove the cam drum from the front support block, remove the retaining ring from the shaft on the front of the switch and slide the cam drum out of the support block. Be careful not to lose the small detent roller.

5. To replace defective switch contacts, follow the instructions given in the switch repair kit.

6. To reinstall the switch assembly, reverse the above procedure.

PUSHBUTTON SWITCHES

See Fig. 5-3 for pushbutton switch disassembly instructions.

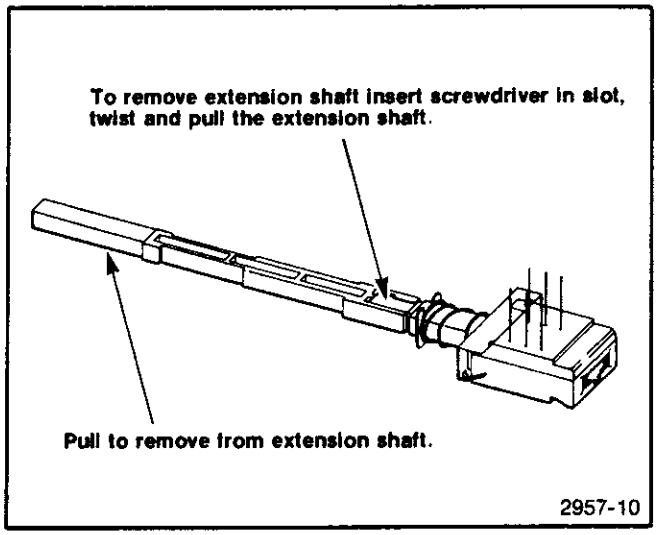


Fig. 5-3. Extension shaft and pushbutton removal.

FRONT PANEL LATCH REMOVAL

To disassemble the latch, pry up on the pull tab bar attached to the latch assembly. The latch components can now be removed from the instrument.

REAR INTERFACE INFORMATION

FUNCTIONS AVAILABLE AT REAR CONNECTOR

A slot exists between pins 23 and 24 on the rear connector of the Main and Sweep boards. Insert a barrier in the corresponding position of the power module jack to prevent noncompatible plug-ins from being used in these compartments. Consult the power module manual for further information. Signals for other specialized connections may be made to the rear interface connectors as shown in Fig. 5-4 and 5-5.

Main Board:

Output (From 600 Ω) 28A

This terminal is connected via an internal jumper to the front panel output connector. See the Adjustment Location illustration for the location of this jumper. A 560 Ω resistor is in series with this terminal.

Output Common 27A

This is the return connection for the output and sweep out.

Trigger Output (50 Ω) 27B

This terminal is connected via an internal jumper to the front panel trigger output connector. See the Adjustment Location illustration for the location of this jumper.

Trigger Out Common 28B

This is the return connection for the trigger output.

Trig/Gate In 24B

This terminal is connected to the trigger amplifier through a 1 KΩ resistor. The output signal is 1 V with an impedance of $\leq$ 10 KΩ.

Trig/Gate In Common 25B

This is the return connection for the trig/gate in.

VCF In 21B

This terminal is connected through a 10 KΩ resistor via an internal jumper to the virtual ground summing node of operational amplifier U1540A (pin 2). See the Adjustment Location illustration for the location of this jumper.

VCF Input Common 22B

This connection is the ground return for the VCF In.

Sweep Board:

Sweep Out 28A

This terminal connects through 100 Ω to the output of the sweep generator. Sufficient current is available to drive the input of an operational amplifier or similar device.

Sweep Out Common 27A

This is the return connection for the sweep out.

Sweep Gate Out 26A

This connection provides a 0 to +4 V waveform. The output impedance is 1 KΩ. This waveform is similar to the front panel GATE OUTPUT waveform. The common terminal is any convenient connection from contacts 22B through 28B.

Ramp Out 25A

This connection provides a 0 to +10 V ramp waveform. It is functionally identical to the front panel RAMP OUTPUT. This contact is isolated from the front panel connector by 1 KΩ. The common terminal is any convenient connection 22B through 28B.

Sweep Trigger Input 22A

This contact is functionally equivalent to the front panel SWP TRIG IN connection. A waveform of approximately +1 V into 2 KΩ is required. The common connector is any convenient terminal 22B through 28B.

Commons 22B through 28B

These are the common ground terminals for the sweep gate out, ramp out, and sweep trigger input.

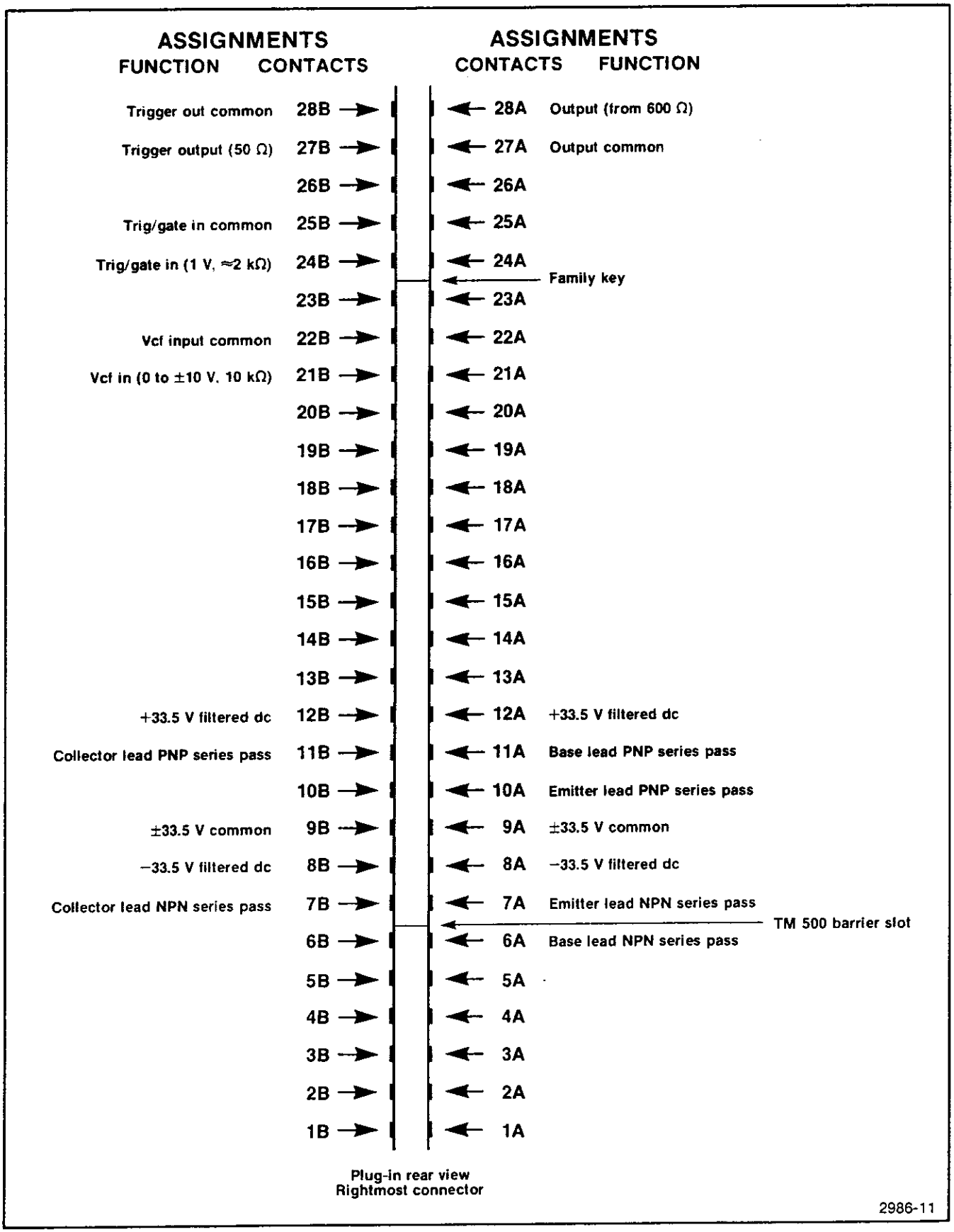


Fig. 5-4. Rear interface connector assignments for the Main board.

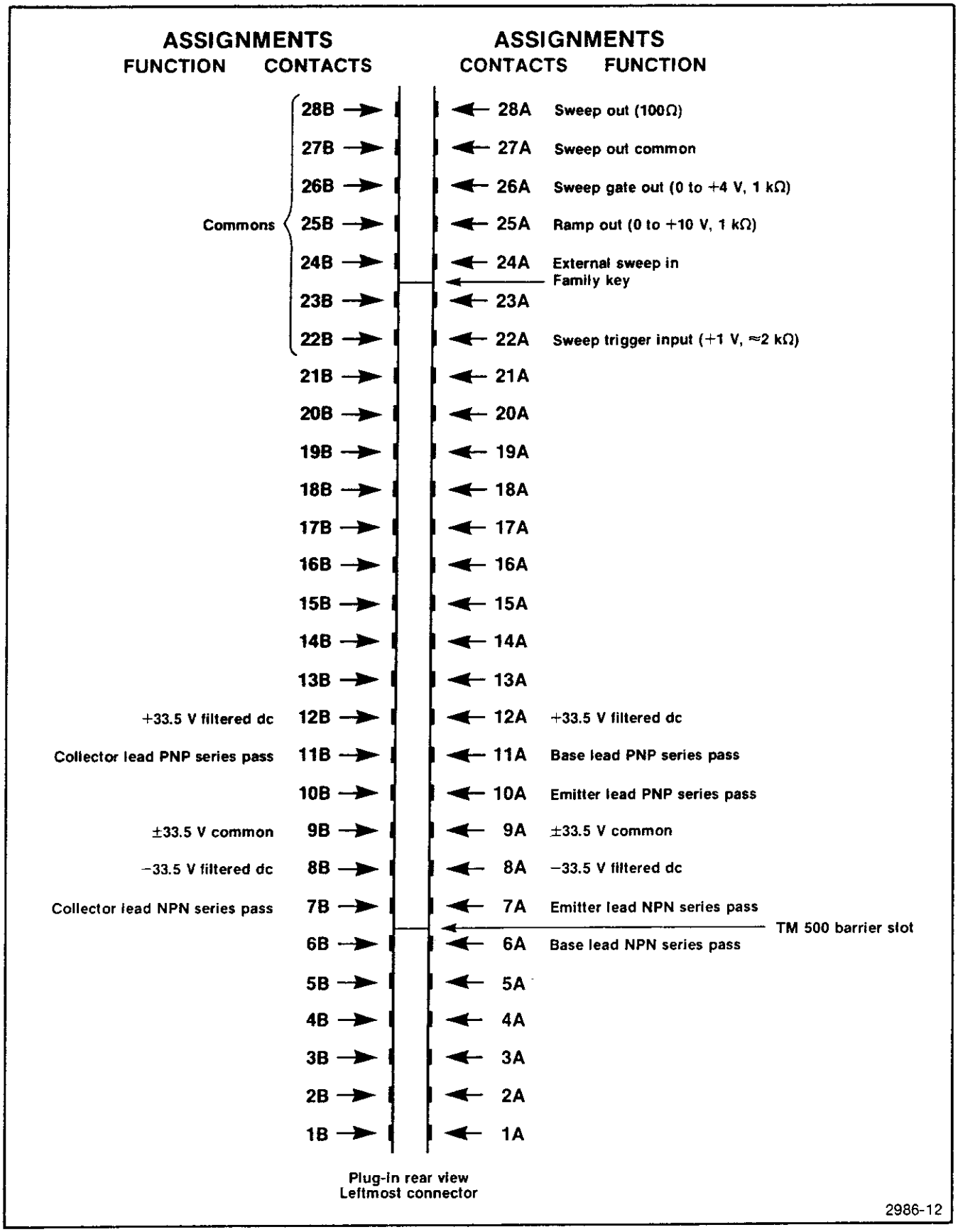


Fig. 5-5. Rear interface connector assignments for the Sweep board.

OPTIONS

There are no options for the FG 507 at the time of this printing.

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.

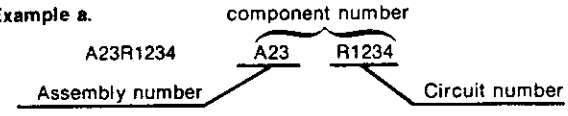
ABBREVIATIONS

Abbreviations conform to American National Standard Y1.1.

COMPONENT NUMBER (column one of the Electrical Parts List)

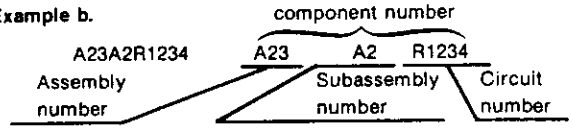
A numbering method has been used to identify assemblies, subassemblies and parts. Examples of this numbering method and typical expansions are illustrated by the following:

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 NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
01121	ALLEN-BRADLEY COMPANY	1201 2ND STREET SOUTH	MILWAUKEE, WI 53204
01295	TEXAS INSTRUMENTS, INC., SEMICONDUCTOR GROUP	P O BOX 5012, 13500 N CENTRAL EXPRESSWAY	DALLAS, TX 75222
02111	SPECTROL ELECTRONICS CORPORATION	17070 EAST GALE AVENUE	CITY OF INDUSTRY, CA 91745
02735	RCA CORPORATION, SOLID STATE DIVISION	ROUTE 202	SOMERVILLE, NY 08876
03508	GENERAL ELECTRIC COMPANY, SEMI-CONDUCTOR PRODUCTS DEPARTMENT	ELECTRONICS PARK	SYRACUSE, NY 13201
03888	KDI PYROFILM CORPORATION	60 S JEFFERSON ROAD	WHIPPANY, NJ 07981
04713	MOTOROLA, INC., SEMICONDUCTOR PROD. DIV.	5005 E MCDOWELL RD,PO BOX 20923	PHOENIX, AZ 85036
07263	FAIRCHILD SEMICONDUCTOR, A DIV. OF FAIRCHILD CAMERA AND INSTRUMENT CORP.	464 ELLIS STREET	MOUNTAIN VIEW, CA 94042
12697	CLAROSTAT MFG. CO., INC.	LOWER WASHINGTON STREET	DOVER, NH 03820
12969	UNITRODE CORPORATION	580 PLEASANT STREET	WATERTOWN, MA 02172
13511	AMPHENOL CARDRE DIV., BUNKER RAMO CORP.		LOS GATOS, CA 95030
14752	ELECTRO CUBE INC.	1710 S. DEL MAR AVE.	SAN GABRIEL, CA 91776
18324	SIGNETICS CORP.	811 E. ARQUES	SUNNYVALE, CA 94086
19701	ELECTRA-MIDLAND CORP., MEPCO ELECTRA INC.	P O BOX 760	MINERAL WELLS, TX 76067
22526	BERG ELECTRONICS, INC.	YOUK EXPRESSWAY	NEW CUMBERLAND, PA 17070
24546	CORNING GLASS WORKS, ELECTRONIC COMPONENTS DIVISION	550 HIGH STREET	BRADFORD, PA 16701
27014	NATIONAL SEMICONDUCTOR CORP.	2900 SEMICONDUCTOR DR.	SANTA CLARA, CA 95051
32997	BOURNS, INC., TRIMPOT PRODUCTS DIV.	1200 COLUMBIA AVE.	RIVERSIDE, CA 92507
50434	HEWLETT-PACKARD COMPANY	640 PAGE MILL ROAD	PALO ALTO, CA 94304
53184	XCITON CORPORATION	5 HEMLOCK STREET	LATHAM, NY 12110
55210	GETTIG ENG. AND MFG. COMPANY	PO BOX 85, OFF ROUTE 45	SPRING MILLS, PA 16875
56289	SPRAGUE ELECTRIC CO.		NORTH ADAMS, MA 01247
71400	BUSSMAN MFG., DIVISION OF MCGRAW-EDISON CO.	2536 W. UNIVERSITY ST.	ST. LOUIS, MO 63107
71590	CENTRALAB ELECTRONICS, DIV. OF GLOBE-UNION, INC.	P O BOX 858	FORT DODGE, IA 50501
72982	ERIE TECHNOLOGICAL PRODUCTS, INC.	644 W. 12TH ST.	ERIE, PA 16512
73138	BECKMAN INSTRUMENTS, INC., HELIPOT DIV.	2500 HARBOR BLVD.	FULLERTON, CA 92634
73899	JFD ELECTRONICS COMPONENTS CORP.	PINETREE ROAD	OXFORD, NC 27565
75042	TRW ELECTRONIC COMPONENTS, IRC FIXED RESISTORS, PHILADELPHIA DIVISION	401 N. BROAD ST.	PHILADELPHIA, PA 19108
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
81483	INTERNATIONAL RECTIFIER CORP.	9220 SUNSET BLVD.	LOS ANGELES, CA 90069
91637	DALE ELECTRONICS, INC.	P. O. BOX 609	COLUMBUS, NE 68601

Component No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A10	----- -----			CKT BOARD ASSY:FUNCTION GEN		
	----- -----			(NOT REPLACEABLE ORDER 672-0897-00)		
A12	670-6694-00			CKT BOARD ASSY:AUXILIARY	80009	670-6694-00
A14	----- -----			CKT BOARD ASSY:SWEEP		
	----- -----			(NOT REPLACEABLE ORDER 672-0898-00)		
A10	----- -----			CKT BOARD ASSY:FUNCTION GEN		
A10C1115	290-0779-00			CAP.,FXD,ELCTLT:10UF,+50-10%,50VDC	56289	502D237
A10C1201	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A10C1203	281-0773-00			CAP.,FXD,CER DI:0.01UF,10%,100V	72982	8005H9AADW5R103K
A10C1224	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A10C1235	281-0812-00			CAP.,FXD,CER DI:1000PF,10%,100V	72982	8035D9AADX7R102K
A10C1251	290-0779-00			CAP.,FXD,ELCTLT:10UF,+50-10%,50VDC	56289	502D237
A10C1253	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A10C1313	281-0820-00			CAP.,FXD,CER DI:680PF,10%,50V	12969	CGB681KDX
A10C1321	290-0745-00			CAP.,FXD,ELCTLT:22UF,+50-10%,25V	56289	502D225
A10C1323	290-0745-00			CAP.,FXD,ELCTLT:22UF,+50-10%,25V	56289	502D225
A10C1325	290-0745-00			CAP.,FXD,ELCTLT:22UF,+50-10%,25V	56289	502D225
A10C1341	290-0745-00			CAP.,FXD,ELCTLT:22UF,+50-10%,25V	56289	502D225
A10C1431	283-0203-00			CAP.,FXD,CER DI:0.47UF,20%,50V	72982	8131N075E474M
A10C1434	283-0203-00			CAP.,FXD,CER DI:0.47UF,20%,50V	72982	8131N075E474M
A10C1451	290-0745-00			CAP.,FXD,ELCTLT:22UF,+50-10%,25V	56289	502D225
A10C1516	281-0773-00			CAP.,FXD,CER DI:0.01UF,10%,100V	72982	8005H9AADW5R103K
A10C1532	281-0762-00			CAP.,FXD,CER DI:27PF,20%,100V	72982	8035D9AADC0G270M
A10C1601	281-0773-00			CAP.,FXD,CER DI:0.01UF,10%,100V	72982	8005H9AADW5R103K
A10C1603	281-0773-00			CAP.,FXD,CER DI:0.01UF,10%,100V	72982	8005H9AADW5R103K
A10C1611	281-0759-00			CAP.,FXD,CER DI:22PF,10%,100V	72982	8035D9AADC1G220K
A10C1613	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A10C1631 A10C1633 A10C1641	295-0164-00			CAP.SET,MTCHD:10,1,0.1,0.01UF,950PF	80009	295-0164-00
A10C1711	281-0773-00			CAP.,FXD,CER DI:0.01UF,10%,100V	72982	8005H9AADW5R103K
A10C1712	281-0763-00			CAP.,FXD,CER DI:47PF,10%,100V	72982	8035D9AADC1G470K
A10C1714	281-0158-00			CAP.,VAR,CER DI:7-45PF,50V	73899	DVJ-5006
A10C1723	281-0773-00			CAP.,FXD,CER DI:0.01UF,10%,100V	72982	8005H9AADW5R103K
A10C1724	281-0773-00			CAP.,FXD,CER DI:0.01UF,10%,100V	72982	8005H9AADW5R103K
A10C1725	281-0810-00			CAP.,FXD,CER DI:5.6PF,0.5%,100V	72982	1035D2ADC0G569D
A10C1726	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A10C1741 A10C1751	----- -----			(PART OF A10C1631)		
A10C1811	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A10C1812	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A10C1813	281-0773-00			CAP.,FXD,CER DI:0.01UF,10%,100V	72982	8005H9AADW5R103K
A10C1814	281-0773-00			CAP.,FXD,CER DI:0.01UF,10%,100V	72982	8005H9AADW5R103K
A10C2006	281-0812-00			CAP.,FXD,CER DI:1000PF,10%,100V	72982	8035D9AADX7R102K
A10C2007	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A10C2011	281-0064-00			CAP.,VAR,PLSTC:0.25-1.5PF,600V	72982	530-002
A10C2013	290-0517-00			CAP.,FXD,ELCTLT:6.8UF,20%,35V	56289	196D685X0035KA1
A10C2020	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A10C2031	281-0773-00			CAP.,FXD,CER DI:0.01UF,10%,100V	72982	8005H9AADW5R103K
A10C2121	281-0764-00			CAP.,FXD,CER DI:82PF,5%,100V	72982	8035D9AADC1G802J
A10C2204	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A10C2217	290-0517-00			CAP.,FXD,ELCTLT:6.8UF,20%,35V	56289	196D685X0035KA1
A10C2221	281-0812-00			CAP.,FXD,CER DI:1000PF,10%,100V	72982	8035D9AADX7R102K
A10C2224	290-0517-00			CAP.,FXD,ELCTLT:6.8UF,20%,35V	56289	196D685X0035KA1

Component No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A10C2228	281-0773-00			CAP.,FXD,CER DI:0.01UF,10%,100V	72982	8005H9AADW5R103K
A10C2229	290-0517-00			CAP.,FXD,ELCTLT:6.8UF,20%,35V	56289	196D685X0035KA1
A10C2301	281-0773-00			CAP.,FXD,CER DI:0.01UF,10%,100V	72982	8005H9AADW5R103K
A10C2302	281-0812-00			CAP.,FXD,CER DI:1000PF,10%,100V	72982	8035D9AADX7R102K
A10CR1411	152-0141-02			SEMICOND DEVICE:SILICON,30V,50NA	01295	1N4152R
A10CR1431	152-0141-02			SEMICOND DEVICE:SILICON,30V,50NA	01295	1N4152R
A10CR1531	152-0322-00			SEMICOND DEVICE:SILICON,15V,HOT CARRIER	50434	5082-2672
A10CR1533	152-0322-00			SEMICOND DEVICE:SILICON,15V,HOT CARRIER	50434	5082-2672
A10CR1621	152-0141-02			SEMICOND DEVICE:SILICON,30V,50NA	01295	1N4152R
A10CR2111	152-0141-02			SEMICOND DEVICE:SILICON,30V,50NA	01295	1N4152R
A10CR2113	152-0141-02			SEMICOND DEVICE:SILICON,30V,50NA	01295	1N4152R
A10CR2213	152-0141-02			SEMICOND DEVICE:SILICON,30V,50NA	01295	1N4152R
A10CR2221	152-0141-02			SEMICOND DEVICE:SILICON,30V,50NA	01295	1N4152R
A10CR2222	152-0141-02			SEMICOND DEVICE:SILICON,30V,50NA	01295	1N4152R
A10F1111	159-0019-00			FUSE,CARTRIDGE:3AG,1A,250V,SLOW BLOW	71400	MDL1
A10F1131	159-0019-00			FUSE,CARTRIDGE:3AG,1A,250V,SLOW BLOW	71400	MDL1
A10J1100	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	47357
	----- -----			(QTY OF 2)		
A10J1110	131-1003-00			CONN,RCPT,ELEC:CKT BD MT,3 PRONG	80009	131-1003-00
A10J1202	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	47357
	----- -----			(QTY OF 3)		
A10J1203	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	47357
	----- -----			(QTY OF 3)		
A10J1301	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	47357
	----- -----			(QTY OF 3)		
A10J1541	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	47357
	----- -----			(QTY OF 4)		
A10J1611	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	47357
	----- -----			(QTY OF 3)		
A10J1641	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	47357
	----- -----			(QTY OF 2)		
A10J1651	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	47357
	----- -----			(QTY OF 4)		
A10J1801	131-1003-00			CONN,RCPT,ELEC:CKT BD MT,3 PRONG	80009	131-1003-00
A10J1921	131-1003-00			CONN,RCPT,ELEC:CKT BD MT,3 PRONG	80009	131-1003-00
A10J1923	131-1003-00			CONN,RCPT,ELEC:CKT BD MT,3 PRONG	80009	131-1003-00
A10J2011	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	47357
	----- -----			(QTY OF 4)		
A10J2021	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	47357
A10J2041	131-1003-00			CONN,RCPT,ELEC:CKT BD MT,3 PRONG	80009	131-1003-00
A10J2043	131-1003-00			CONN,RCPT,ELEC:CKT BD MT,3 PRONG	80009	131-1003-00
A10L1111	108-0020-00			COIL,RF:7.1UH	80009	108-0020-00
A10L1251	108-0020-00			COIL,RF:7.1UH	80009	108-0020-00
A10Q1221	151-0606-00			TRANSISTOR:SILICON,NPN	01295	EP8010
A10Q1231	151-0464-00			TRANSISTOR:SILICON,NPN	80009	151-0464-00
A10Q1241	151-0464-00			TRANSISTOR:SILICON,NPN	80009	151-0464-00
A10Q1243	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A10Q1245	151-0350-00			TRANSISTOR:SILICON,PNP	04713	SPS6700
A10Q1331	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A10Q1335	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
A10Q1345	151-0607-00			TRANSISTOR:SILICON,PNP	01295	EP8106
A10Q1421	153-0586-00			SEMICOND DVC SE:2N3906,MATCHED PAIR	80009	153-0586-00
	----- -----			(FURNISHED AS A MATCHED PAIR WITH A10Q1527)		
A10Q1431	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A10Q1433	151-0367-00			TRANSISTOR:SILICON,NPN,SEL FROM 3571TP	01295	SKA6516
A10Q1440	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A10Q1445	151-0435-00			TRANSISTOR:SILICON,PNP	07263	S43187

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Component No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A10Q1511	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A10Q1521	151-0427-00			TRANSISTOR:SILICON,NPN	80009	151-0427-00
A10Q1523	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A10Q1525	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
A10Q1527	----- -----			(PART OF A10Q1421)		
A10Q1531	151-0438-00			TRANSISTOR:SILICON,PNP,SEL FROM SPS6927	80009	151-0438-00
A10Q1541	151-0341-00			TRANSISTOR:SILICON,NPN	07263	S040065
A10Q1543	151-0341-00			TRANSISTOR:SILICON,NPN	07263	S040065
A10Q1611	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
A10Q1621	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
A10Q1711	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
A10Q1712	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A10Q1721	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
A10Q1723| A10Q1725|	151-1042-00			SEMICOND DVC SE:MATCHED PAIR FET	27014	SF50031
A10Q1801	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
A10Q1821	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A10Q1901	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
A10Q2011	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
A10Q2013	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A10Q2101	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A10Q2111	151-0221-00			TRANSISTOR:SILICON,PNP	04713	SPS246
A10Q2113	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A10Q2121	151-0440-00			TRANSISTOR:SILICON,PNP	03508	X41E603
A10Q2123	151-0440-00			TRANSISTOR:SILICON,PNP	03508	X41E603
A10Q2211	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
A10Q2213	151-0427-00			TRANSISTOR:SILICON,NPN	80009	151-0427-00
A10Q2311	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A10Q2321	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
A10Q2323	151-0439-00			TRANSISTOR:SILICON,NPN	80009	151-0439-00
A10Q2325	151-0439-00			TRANSISTOR:SILICON,NPN	80009	151-0439-00
A10R510	311-1392-00			RES.,VAR,WW:PNL,10K OHM,2W	02111	140-9504
A10R1101	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A10R1103	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A10R1113	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
A10R1121	307-0093-00			RES.,FXD,CMPSN:1.2 OHM,5%,0.50W	01121	EB12G5
A10R1131	315-0203-00			RES.,FXD,CMPSN:20K OHM,5%,0.25W	01121	CB2035
A10R1133	321-0318-00			RES.,FXD,FILM:20K OHM,1%,0.125W	91637	MFF1816G20001F
A10R1135	321-0318-00			RES.,FXD,FILM:20K OHM,1%,0.125W	91637	MFF1816G20001F
A10R1141	307-0093-00			RES.,FXD,CMPSN:1.2 OHM,5%,0.50W	01121	EB12G5
A10R1143	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
A10R1201	321-0337-00			RES.,FXD,FILM:31.6K OHM,1%,0.125W	91637	MFF1816G31601F
A10R1203	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
A10R1225	315-0151-00			RES.,FXD,CMPSN:150 OHM,5%,0.25W	01121	CB1515
A10R1226	315-0682-00			RES.,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
A10R1227	307-0051-00			RES.,FXD,CMPSN:2.7 OHM,5%,0.50W	01121	EB27G5
A10R1228	301-0201-00			RES.,FXD,CMPSN:200 OHM,5%,0.50W	01121	EB2015
A10R1229	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A10R1231	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A10R1232	321-0318-00			RES.,FXD,FILM:20K OHM,1%,0.125W	91637	MFF1816G20001F
A10R1233	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A10R1235	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A10R1241	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A10R1242	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A10R1243	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
A10R1245	321-0347-00			RES.,FXD,FILM:40.2K OHM,1%,0.125W	91637	MFF1816G40201F
A10R1247	321-0335-00			RES.,FXD,FILM:30.1K OHM,1%,0.125W	91637	MFF1816G30101F

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A10R1301	311-1562-00			RES.,VAR,NONWIR:2K OHM,20%,0.50W	73138	91-84-0
A10R1311	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A10R1315	321-0311-00			RES.,FXD,FILM:16.9K OHM,1%,0.125W	91637	MFF1816G16901F
A10R1331	315-0682-00			RES.,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
A10R1333	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A10R1341	311-1563-00			RES.,VAR,NONWIR:1K OHM,20%,0.50W	73138	91-85-0
A10R1346	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
A10R1401	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A10R1403	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A10R1411	315-0622-00			RES.,FXD,CMPSN:6.2K OHM,5%,0.25W	01121	CB6225
A10R1412	311-1567-00			RES.,VAR,NONWIR:TRMR,100 OHM,0.50W	73138	91-89-0
A10R1413	315-0331-00			RES.,FXD,CMPSN:330 OHM,5%,0.25W	01121	CB3315
A10R1421	311-0605-01			RES.,VAR,NONWIR:200 OHM,10%,0.50W	73138	82P-3-0-201
A10R1423	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	91637	MFF1816G10000F
A10R1425	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	91637	MFF1816G10000F
A10R1431	315-0242-00			RES.,FXD,CMPSN:2.4K OHM,5%,0.25W	01121	CB2425
A10R1432	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A10R1433	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
A10R1434	315-0750-00			RES.,FXD,CMPSN:75 OHM,5%,0.25W	01121	CB7505
A10R1435	315-0300-00			RES.,FXD,CMPSN:30 OHM,5%,0.25W	01121	CB3005
A10R1436	315-0241-00			RES.,FXD,CMPSN:240 OHM,5%,0.25W	01121	CB2415
A10R1440	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
A10R1441	311-1559-00			RES.,VAR,NONWIR:10K OHM,20%,0.50W	73138	91-81-0
A10R1451	307-0051-00			RES.,FXD,CMPSN:2.7 OHM,5%,0.50W	01121	EB27G5
A10R1501	315-0911-00			RES.,FXD,CMPSN:910 OHM,5%,0.25W	01121	CB9115
A10R1511	311-1565-00			RES.,VAR,NONWIR:250 OHM,20%,0.50W	73138	91-87-0
A10R1512	321-0222-00			RES.,FXD,FILM:2K OHM,1%,0.125W	91637	MFF1816G20000F
A10R1513	321-0245-00			RES.,FXD,FILM:3.48K OHM,1%,0.125W	91637	MFF1816G34800F
A10R1514	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
A10R1515	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
A10R1517	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A10R1518	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A10R1521	315-0201-00			RES.,FXD,CMPSN:200 OHM,5%,0.25W	01121	CB2015
A10R1532	315-0511-00			RES.,FXD,CMPSN:510 OHM,5%,0.25W	01121	CB5115
A10R1533	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
A10R1534	315-0511-00			RES.,FXD,CMPSN:510 OHM,5%,0.25W	01121	CB5115
A10R1536	315-0201-00			RES.,FXD,CMPSN:200 OHM,5%,0.25W	01121	CB2015
A10R1541	321-0181-00			RES.,FXD,FILM:750 OHM,1%,0.125W	91637	MFF1816G750R0F
A10R1543	321-0272-00			RES.,FXD,FILM:6.65K OHM,1%,0.125W	91637	MFF1816G66500F
A10R1545	321-0181-00			RES.,FXD,FILM:750 OHM,1%,0.125W	91637	MFF1816G750R0F
A10R1553	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A10R1603	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A10R1611	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
A10R1613	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A10R1615	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A10R1621	315-0332-00			RES.,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
A10R1622	315-0221-00			RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
A10R1623	315-0510-00			RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
A10R1624	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A10R1625	315-0332-00			RES.,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
A10R1641	321-0222-00			RES.,FXD,FILM:2K OHM,1%,0.125W	91637	MFF1816G20000F
A10R1711	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A10R1712	321-0172-00			RES.,FXD,FILM:604 OHM,1%,0.125W	91637	MFF1816G604R0F
A10R1713	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A10R1721	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
A10R1723	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A10R1724	315-0751-00			RES.,FXD,CMPSN:750 OHM,5%,0.25W	01121	CB7515

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Component No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A10R1725	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
A10R1727	315-0752-00			RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
A10R1728	311-1566-00			RES.,VAR,NONWIR:200 OHM,20%,0.50W	73138	91-88-0
A10R1801	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A10R1812	321-0155-00			RES.,FXD,FILM:402 OHM,1%,0.125W	91637	MFF1816G402R0F
A10R1814	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
A10R1815	321-0222-00			RES.,FXD,FILM:2K OHM,1%,0.125W	91637	MFF1816G20000F
A10R1816	321-0196-00			RES.,FXD,FILM:1.07K OHM,1%,0.125W	91637	MFF1816G10700F
A10R1817	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A10R1818	321-0313-00			RES.,FXD,FILM:17.8K OHM,1%,0.125W	91637	MFF1816G17801F
A10R1819	321-0236-00			RES.,FXD,FILM:2.8K OHM,1%,0.125W	91637	MFF1816G28000F
A10R1831	321-0289-03			RES.,FXD,FILM:10K OHM,0.25%,0.125W	91637	MFF1816D10001C
A10R1841	321-0645-00			RES.,FXD,FILM:100K OHM,0.5%,0.125W	91637	MFF1816D10002D
A10R1842	307-0465-00			RES.,FXD,FILM:10M OHM,1%,0.5W	03888	FL1/2-105F
A10R1843	321-0481-01			RES.,FXD,FILM:1M OHM,0.5%,0.125W	91637	MFF1816G10003D
A10R1941	321-0193-03			RES.,FXD,FILM:1K OHM,0.25%,0.125W	91637	MFF1816D10000C
A10R1950	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A10R1951	311-1559-00			RES.,VAR,NONWIR:10K OHM,20%,0.50W	73138	91-81-0
A10R2001	315-0201-00			RES.,FXD,CMPSN:200 OHM,5%,0.25W	01121	CB2015
A10R2003	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A10R2004	315-0183-00			RES.,FXD,CMPSN:18K OHM,5%,0.25W	01121	CB1835
A10R2005	315-0330-00			RES.,FXD,CMPSN:33 OHM,5%,0.25W	01121	CB3305
A10R2006	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
A10R2011	321-0253-00			RES.,FXD,FILM:4.22K OHM,1%,0.125W	91637	MFF1816G42200F
A10R2012	321-0143-00			RES.,FXD,FILM:301 OHM,1%,0.125W	91637	MFF1816G301R0F
A10R2013	321-0269-00			RES.,FXD,FILM:6.19K OHM,1%,0.125W	91637	MFF1816G61900F
A10R2024	321-0134-00			RES.,FXD,FILM:243 OHM,1%,0.125W	91637	MFF1816G243R0F
A10R2025	315-0201-00			RES.,FXD,CMPSN:200 OHM,5%,0.25W	01121	CB2015
A10R2026	307-0055-00			RES.,FXD,CMPSN:3.9 OHM,5%,0.50W	01121	EB39G5
A10R2031	315-0105-00			RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB1055
A10R2033	305-0101-00			RES.,FXD,CMPSN:100 OHM,5%,2W	01121	HB1015
A10R2041	315-0125-00			RES.,FXD,CMPSN:1.2M OHM,5%,0.25W	01121	CB1255
A10R2043	315-0332-00			RES.,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
A10R2045	315-0332-00			RES.,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
A10R2047	315-0125-00			RES.,FXD,CMPSN:1.2M OHM,5%,0.25W	01121	CB1255
A10R2101	321-0112-00			RES.,FXD,FILM:143 OHM,1%,0.125W	91637	MFF1816G143R0F
A10R2111	321-0151-00			RES.,FXD,FILM:365 OHM,1%,0.125W	91637	MFF1816G365R0F
A10R2113	321-0122-00			RES.,FXD,FILM:182 OHM,1%,0.125W	91637	MFF1816G182R0F
A10R2121	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
A10R2122	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
A10R2123	315-0270-00			RES.,FXD,CMPSN:27 OHM,5%,0.25W	01121	CB2705
A10R2124	321-0049-00			RES.,FXD,FILM:31.6 OHM,1%,0.125W	91637	MFF1816G31R60F
A10R2131	305-0101-00			RES.,FXD,CMPSN:100 OHM,5%,2W	01121	HB1015
A10R2141	321-0002-00			RES.,FXD,FILM:10.2 OHM,1%,0.125W	91637	MFF1816G10R20F
A10R2143	321-0059-00			RES.,FXD,FILM:40.2 OHM,1%,0.125W	91637	MFF1816G40R20F
A10R2201	311-1560-00			RES.,VAR,NONWIR:5K OHM,20%,0.50W	73138	91-82-0
A10R2202	321-0238-00			RES.,FXD,FILM:2.94K OHM,1%,0.125W	91637	MFF1816G29400F
A10R2203	321-0271-00			RES.,FXD,FILM:6.49K OHM,1%,0.125W	91637	MFF1816G64900F
A10R2204	321-0238-00			RES.,FXD,FILM:2.94K OHM,1%,0.125W	91637	MFF1816G29400F
A10R2211	321-0122-00			RES.,FXD,FILM:182 OHM,1%,0.125W	91637	MFF1816G182R0F
A10R2213	321-0112-00			RES.,FXD,FILM:143 OHM,1%,0.125W	91637	MFF1816G143R0F
A10R2223	315-0270-00			RES.,FXD,CMPSN:27 OHM,5%,0.25W	01121	CB2705
A10R2225	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
A10R2226	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
A10R2227	321-0049-00			RES.,FXD,FILM:31.6 OHM,1%,0.125W	91637	MFF1816G31R60F
A10R2228	307-0055-00			RES.,FXD,CMPSN:3.9 OHM,5%,0.50W	01121	EB39G5
A10R2231	323-0088-00			RES.,FXD,FILM:80.6 OHM,1%,0.50W	75042	CECTO-80R60F

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A10R2233	323-0089-00			RES.,FXD,FILM:82.5 OHM,1%,0.50W	19701	MF7CD82R50F
A10R2251	321-0059-00			RES.,FXD,FILM:40.2 OHM,1%,0.125W	91637	MFF1816G40R20F
A10R2253	321-0002-00			RES.,FXD,FILM:10.2 OHM,1%,0.125W	91637	MFF1816G10R20F
A10R2255	321-0089-00			RES.,FXD,FILM:82.5 OHM,1%,0.125W	91637	MFF1816G82R50F
A10R2257	321-0002-00			RES.,FXD,FILM:10.2 OHM,1%,0.125W	91637	MFF1816G10R20F
A10R2301	315-0183-00			RES.,FXD,CMPSN:18K OHM,5%,0.25W	01121	CB1835
A10R2303	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
A10R2304	315-0330-00			RES.,FXD,CMPSN:33 OHM,5%,0.25W	01121	CB3305
A10R2351	315-0561-00			RES.,FXD,CMPSN:560 OHM,5%,0.25W	01121	CB5615
A10R2353	323-0089-00			RES.,FXD,FILM:82.5 OHM,1%,0.50W	19701	MF7CD82R50F
A10R2355	323-0088-00			RES.,FXD,FILM:80.6 OHM,1%,0.50W	75042	CECT0-80R60F
A10S1901	260-1268-01			SWITCH,PUSH:3 BUTTON,2 POLE,FUNCTION	80009	260-1268-01
A10S2331	260-2020-00			SWITCH,PUSH:4 BUTTON ATTENUATOR	80009	260-2020-00
A10TP1241	214-0579-00			TERM,TEST POINT:BRS CD PL	80009	214-0579-00
A10TP1321	214-0579-00			TERM,TEST POINT:BRS CD PL	80009	214-0579-00
A10TP1323	214-0579-00			TERM,TEST POINT:BRS CD PL	80009	214-0579-00
A10TP1331	214-0579-00			TERM,TEST POINT:BRS CD PL	80009	214-0579-00
A10TP1451	214-0579-00			TERM,TEST POINT:BRS CD PL	80009	214-0579-00
A10U1210	156-0071-00			MICROCIRCUIT,LI:VOLTAGE REGULATOR	04713	MC1723CL
A10U1230	156-0495-00			MICROCIRCUIT,LI:OPNL AMPL	27014	LM324N
A10U1400	156-0495-00			MICROCIRCUIT,LI:OPNL AMPL	27014	LM324N
A10U1440	156-0067-00			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER	02735	85145
A10U1501	156-0991-00			MICROCIRCUIT,LI:VOLTAGE REGULATOR	80009	156-0991-00
A10U1540	156-0495-00			MICROCIRCUIT,LI:OPNL AMPL	27014	LM324N
A10U1600	156-0331-00			MICROCIRCUIT,DI:DUAL D-TYPE,FLIP-FLOP	80009	156-0331-00
A10U1700	156-1056-00			MICROCIRCUIT,LI:DIFFERENTIAL COMPARATOR	04713	MC1514L
A10U1930	156-1156-00			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER	80009	156-1156-00
A10U1940	156-1156-00			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER	80009	156-1156-00
A10VR1241	152-0149-00			SEMICOND DEVICE:ZENER,0.4W,10V,5%	80009	152-0149-00
A10VR1413	152-0227-00			SEMICOND DEVICE:ZENER,0.4W,6.2V,5%	04713	SZ13903
A10VR1532	152-0667-00			SEMICOND DEVICE:ZENER,0.4W,3.0V,2%	80009	152-0667-00
A10VR1811	152-0278-00			SEMICOND DEVICE:ZENER,0.4W,3V,5%	04713	SZG35009K20
A10VR1813	152-0212-00			SEMICOND DEVICE:ZENER,0.5W,9V,5%	81483	69-9062
A10VR2213	152-0590-00			SEMICOND DEVICE:ZENER,18V,5% AT 7MA	80009	152-0590-00
A10W1503	131-0566-00			BUS CONDUCTOR:DUMMY RES,2.375,22 AWG	55210	L-2007-1
A10W1531	131-0566-00			BUS CONDUCTOR:DUMMY RES,2.375,22 AWG	55210	L-2007-1
A10W1535	131-0566-00			BUS CONDUCTOR:DUMMY RES,2.375,22 AWG	55210	L-2007-1

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A12	----- -----			CKT BOARD ASSY:AUXILIARY		
A12C1000	290-0301-00			CAP.,FXD,ELCTLT:10UF,10%,20V	56289	150D106X9020B2
A12C1002	281-0810-00			CAP.,FXD,CER DI:5.6PF,0.5%,100V	72982	1035D2ADC0G569D
A12C1020	281-0810-00			CAP.,FXD,CER DI:5.6PF,0.5%,100V	72982	1035D2ADC0G569D
A12C1022	281-0810-00			CAP.,FXD,CER DI:5.6PF,0.5%,100V	72982	1035D2ADC0G569D
A12C1100	290-0301-00			CAP.,FXD,ELCTLT:10UF,10%,20V	56289	150D106X9020B2
A12C1110	281-0773-00			CAP.,FXD,CER DI:0.01UF,10%,100V	72982	8005H9AADW5R103K
A12C1112	281-0773-00			CAP.,FXD,CER DI:0.01UF,10%,100V	72982	8005H9AADW5R103K
A12C1120	281-0773-00			CAP.,FXD,CER DI:0.01UF,10%,100V	72982	8005H9AADW5R103K
A12C1200	281-0773-00			CAP.,FXD,CER DI:0.01UF,10%,100V	72982	8005H9AADW5R103K
A12C1202	290-0301-00			CAP.,FXD,ELCTLT:10UF,10%,20V	56289	150D106X9020B2
A12C1220	281-0764-00			CAP.,FXD,CER DI:82PF,5%,100V	72982	8035D9AADC1G802J
A12C1300	283-0177-00			CAP.,FXD,CER DI:1UF,+80-20%,25V	56289	273C5
A12C1310	281-0773-00			CAP.,FXD,CER DI:0.01UF,10%,100V	72982	8005H9AADW5R103K
A12C1320	283-0177-00			CAP.,FXD,CER DI:1UF,+80-20%,25V	56289	273C5
A12CR1000	152-0141-02			SEMICOND DEVICE:SILICON,30V,50NA	01295	1N4152R
A12CR1110	152-0141-02			SEMICOND DEVICE:SILICON,30V,50NA	01295	1N4152R
A12CR1120	152-0141-02			SEMICOND DEVICE:SILICON,30V,50NA	01295	1N4152R
A12CR1200	152-0141-02			SEMICOND DEVICE:SILICON,30V,50NA	01295	1N4152R
A12CR1220	152-0141-02			SEMICOND DEVICE:SILICON,30V,50NA	01295	1N4152R
A12CR1221	152-0141-02			SEMICOND DEVICE:SILICON,30V,50NA	01295	1N4152R
A12CR1320	152-0141-02			SEMICOND DEVICE:SILICON,30V,50NA	01295	1N4152R
A12J1000	131-1003-00			CONN,RCPT,ELEC:CKT BD MT,3 PRONG	80009	131-1003-00
A12J1020	131-1425-00			CONTACT SET,ELE:R ANGLE,0.150" L,STR OF 36	22526	65521-136
A12J1220	131-1003-00			CONN,RCPT,ELEC:CKT BD MT,3 PRONG	80009	131-1003-00
A12J1300	131-1003-00			CONN,RCPT,ELEC:CKT BD MT,3 PRONG	80009	131-1003-00
A12J1302	131-1003-00			CONN,RCPT,ELEC:CKT BD MT,3 PRONG	80009	131-1003-00
A12J1400	131-1425-00			CONTACT SET,ELE:R ANGLE,0.150" L,STR OF 36	22526	65521-136
A12L1010	108-0419-00			COIL,RF:FIXED,1.1UH	80009	108-0419-00
A12Q1010	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A12Q1012	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
A12Q1200	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
A12Q1210	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
A12Q1212	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
A12Q1320	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
A12Q1322	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
A12Q1324	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A12R1000	321-0256-00			RES.,FXD,FILM:4.53K OHM,1%,0.125W	91637	MFF1816G45300F
A12R1010	321-0181-00			RES.,FXD,FILM:750 OHM,1%,0.125W	91637	MFF1816G750R0F
A12R1012	321-0181-00			RES.,FXD,FILM:750 OHM,1%,0.125W	91637	MFF1816G750R0F
A12R1014	315-0242-00			RES.,FXD,CMPSN:2.4K OHM,5%,0.25W	01121	CB2425
A12R1015	315-0622-00			RES.,FXD,CMPSN:6.2K OHM,5%,0.25W	01121	CB6225
A12R1016	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
A12R1020	321-0256-00			RES.,FXD,FILM:4.53K OHM,1%,0.125W	91637	MFF1816G45300F
A12R1022	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
A12R1100	321-0269-00			RES.,FXD,FILM:6.19K OHM,1%,0.125W	91637	MFF1816G61900F
A12R1102	321-0269-00			RES.,FXD,FILM:6.19K OHM,1%,0.125W	91637	MFF1816G61900F
A12R1104	311-0634-00			RES.,VAR,NONWIR:TRMR,500 OHM,0.5W	32997	3326H-G48-501
A12R1106	311-0643-00			RES.,VAR,NONWIR:50 OHM,10%,0.50W	73138	82-33-2
A12R1108	321-0216-00			RES.,FXD,FILM:1.74K OHM,1%,0.125W	91637	MFF1816G17400F
A12R1110	315-0133-00			RES.,FXD,CMPSN:13K OHM,5%,0.25W	01121	CB1335
A12R1111	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
A12R1113	315-0301-00			RES.,FXD,CMPSN:300 OHM,5%,0.25W	01121	CB3015
A12R1115	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A12R1116	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A12R1120	315-0221-00			RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
A12R1121	315-0510-00			RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105

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A12R1122	315-0510-00			RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
A12R1123	315-0510-00			RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
A12R1125	315-0301-00			RES.,FXD,CMPSN:300 OHM,5%,0.25W	01121	CB3015
A12R1200	321-0229-00			RES.,FXD,FILM:2.37K OHM,1%,0.125W	91637	MFF1816G23700F
A12R1202	315-0432-00			RES.,FXD,CMPSN:4.3K OHM,5%,0.25W	01121	CB4325
A12R1203	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A12R1204	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A12R1210	321-0224-00			RES.,FXD,FILM:2.1K OHM,1%,0.125W	91637	MFF1816G21000F
A12R1212	321-0242-00			RES.,FXD,FILM:3.24K OHM,1%,0.125W	91637	MFF1816G32400F
A12R1216	321-0183-00			RES.,FXD,FILM:787 OHM,1%,0.125W	91637	MFF1816G787R0F
A12R1217	321-0183-00			RES.,FXD,FILM:787 OHM,1%,0.125W	91637	MFF1816G787R0F
A12R1220	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A12R1221	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A12R1300	315-0361-00			RES.,FXD,CMPSN:360 OHM,5%,0.25W	01121	CB3615
A12R1310	315-0162-00			RES.,FXD,CMPSN:1.6K OHM,5%,0.25W	01121	CB1625
A12R1312	321-0222-00			RES.,FXD,FILM:2K OHM,1%,0.125W	91637	MFF1816G20000F
A12R1313	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A12R1314	321-0285-00			RES.,FXD,FILM:9.09K OHM,1%,0.125W	91637	MFF1816G90900F
A12R1320	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A12R1322	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	91637	MFF1816G10000F
A12R1324	315-0221-00			RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
A12R1325	315-0621-00			RES.,FXD,CMPSN:620 OHM,5%,0.25W	01121	CB6215
A12S1400	260-2040-00			SWITCH,PUSH:4 BTN,2 POLE,MODE	80009	260-2040-00
A12U1020	156-0048-00			MICROCIRCUIT,LI:FIVE NPN TRANSISTOR ARRAY	02735	CA3046
A12U1120	156-0048-00			MICROCIRCUIT,LI:FIVE NPN TRANSISTOR ARRAY	02735	CA3046
A12U1220	156-0048-00			MICROCIRCUIT,LI:FIVE NPN TRANSISTOR ARRAY	02735	CA3046
A12U1310	156-0721-00			MICROCIRCUIT,DI:QUAD 2-INP ST NAND GATE	80009	156-0721-00

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A14	----- -----			CKT BOARD ASSY:SWEEP		
A14C1014	281-0771-00			CAP.,FXD,CER DI:0.0022UF,20%,200V	72982	314-0222Z5U0222M
A14C1016	281-0771-00			CAP.,FXD,CER DI:0.0022UF,20%,200V	72982	314-0222Z5U0222M
A14C1020	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A14C1040	281-0771-00			CAP.,FXD,CER DI:0.0022UF,20%,200V	72982	314-0222Z5U0222M
A14C1130	281-0773-00			CAP.,FXD,CER DI:0.01UF,10%,100V	72982	8005H9AADW5R103K
A14C1132	285-1056-00			CAP.,FXD,PLSTC:1UF,2%,50V	14752	650B1A105G
A14C1300	281-0791-00			CAP.,FXD,CER DI:270PF,10%,100V	72982	8035D2AADX5R271K
A14C1410	281-0786-00			CAP.,FXD,CER DI:150PF,10%,100V	72982	8035D2AADX5P151K
A14C1412	281-0791-00			CAP.,FXD,CER DI:270PF,10%,100V	72982	8035D2AADX5R271K
A14C1510	281-0791-00			CAP.,FXD,CER DI:270PF,10%,100V	72982	8035D2AADX5R271K
A14C1610	281-0786-00			CAP.,FXD,CER DI:150PF,10%,100V	72982	8035D2AADX5P151K
A14C1612	281-0791-00			CAP.,FXD,CER DI:270PF,10%,100V	72982	8035D2AADX5R271K
A14C1630	281-0773-00			CAP.,FXD,CER DI:0.01UF,10%,100V	72982	8005H9AADW5R103K
A14C1632	290-0188-00			CAP.,FXD,ELCTLT:0.1UF,10%,35V	56289	162D104X9035BC2
A14C1634	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A14C1640	290-0301-00			CAP.,FXD,ELCTLT:10UF,10%,20V	56289	150D106X9020B2
A14C1642	290-0301-00			CAP.,FXD,ELCTLT:10UF,10%,20V	56289	150D106X9020B2
A14C1740	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A14C1800	281-0773-00			CAP.,FXD,CER DI:0.01UF,10%,100V	72982	8005H9AADW5R103K
A14C1820	281-0810-00			CAP.,FXD,CER DI:5.6PF,0.5%,100V	72982	1035D2ADC0G569D
A14C1920	281-0758-00			CAP.,FXD,CER DI:15PF,20%,100V	72982	314022C0G0150M
A14C1922	281-0791-00			CAP.,FXD,CER DI:270PF,10%,100V	72982	8035D2AADX5R271K
A14CR1040	152-0141-02			SEMICOND DEVICE:SILICON,30V,50NA	01295	1N4152R
A14CR1100	152-0141-02			SEMICOND DEVICE:SILICON,30V,50NA	01295	1N4152R
A14CR1102	152-0141-02			SEMICOND DEVICE:SILICON,30V,50NA	01295	1N4152R
A14CR1220	152-0141-02			SEMICOND DEVICE:SILICON,30V,50NA	01295	1N4152R
A14CR1412	152-0141-02			SEMICOND DEVICE:SILICON,30V,50NA	01295	1N4152R
A14CR1440	152-0141-02			SEMICOND DEVICE:SILICON,30V,50NA	01295	1N4152R
A14CR1610	152-0141-02			SEMICOND DEVICE:SILICON,30V,50NA	01295	1N4152R
A14CR1740	152-0141-02			SEMICOND DEVICE:SILICON,30V,50NA	01295	1N4152R
A14CR1742	152-0141-02			SEMICOND DEVICE:SILICON,30V,50NA	01295	1N4152R
A14CR1920	152-0141-02			SEMICOND DEVICE:SILICON,30V,50NA	01295	1N4152R
A14F1840	159-0030-00			FUSE,CARTRIDGE:3AG,0.3A,250V,0.25 SEC	71400	AGC 3/10
A14F1940	159-0030-00			FUSE,CARTRIDGE:3AG,0.3A,250V,0.25 SEC	71400	AGC 3/10
A14J1100	131-1003-00			CONN,RCPT,ELEC:CKT BD MT,3 PRONG	80009	131-1003-00
A14J1205	131-0608-00 ----- -----			TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD (QTY OF 3)	22526	47357
A14J1206	131-0608-00 ----- -----			TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD (QTY OF 3)	22526	47357
A14J1207	131-0608-00 ----- -----			TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD (QTY OF 3)	22526	47357
A14J1240	131-1003-00			CONN,RCPT,ELEC:CKT BD MT,3 PRONG	80009	131-1003-00
A14J1540	131-1003-00			CONN,RCPT,ELEC:CKT BD MT,3 PRONG	80009	131-1003-00
A14J1800	131-1003-00			CONN,RCPT,ELEC:CKT BD MT,3 PRONG	80009	131-1003-00
A14Q1000	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A14Q1002	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A14Q1004	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A14Q1006	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A14Q1040	151-0232-00			TRANSISTOR:SILICON,NPN,DUAL	80009	151-0232-00
A14Q1110	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A14Q1112	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A14Q1114	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A14Q1116	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A14Q1118	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A14Q1120	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A14Q1122	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677

Component No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A14Q1124	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A14Q1130	151-0347-00			TRANSISTOR:SILICON,NPN	04713	SPS7951
A14Q1132	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
A14Q1134	151-0273-00			TRANSISTOR:SILICON,NPN	80009	151-0273-00
A14Q1136	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
A14Q1220	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A14Q1240	151-0219-00			TRANSISTOR:SILICON,PNP	07263	S022650
A14Q1400 A14Q1402	153-0547-00			SEMICOND DVC SE:SILICON,NPN,MATCHED	80009	153-0547-00
A14Q1440	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A14Q1442	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A14Q1444	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A14Q1600 A14Q1602	153-0547-00			SEMICOND DVC SE:SILICON,NPN,MATCHED	80009	153-0547-00
A14Q1840	151-0350-00			TRANSISTOR:SILICON,PNP	04713	SPS6700
A14Q1842	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
A14Q1844	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A14Q1846	151-0347-00			TRANSISTOR:SILICON,NPN	04713	SPS7951
A14Q1910 A14Q1912	153-0547-00			SEMICOND DVC SE:SILICON,NPN,MATCHED	80009	153-0547-00
A14R520	311-1392-00			RES.,VAR,WW:PNL,10K OHM,2W	02111	140-9504
A14R1001	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
A14R1002	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
A14R1004	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
A14R1005	321-0226-00			RES.,FXD,FILM:2.21K OHM,1%,0.125W	91637	MFF1816G22100F
A14R1010	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
A14R1011	315-0912-00			RES.,FXD,CMPSN:9.1K OHM,5%,0.25W	01121	CB9125
A14R1012	315-0473-00			RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
A14R1040	315-0623-00			RES.,FXD,CMPSN:62K OHM,5%,0.25W	01121	CB6235
A14R1041	315-0393-00			RES.,FXD,CMPSN:39K OHM,5%,0.25W	01121	CB3935
A14R1043	315-0333-00			RES.,FXD,CMPSN:33K OHM,5%,0.25W	01121	CB3335
A14R1044	315-0221-00			RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
A14R1100	321-0328-00			RES.,FXD,FILM:25.5K OHM,1%,0.125W	91637	MFF1816G25501F
A14R1101	321-0254-00			RES.,FXD,FILM:4.32K OHM,1%,0.125W	91637	MFF1816G43200F
A14R1104	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A14R1105	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A14R1106	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A14R1110	315-0105-00			RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB1055
A14R1111	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
A14R1112	315-0333-00			RES.,FXD,CMPSN:33K OHM,5%,0.25W	01121	CB3335
A14R1114	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
A14R1116	315-0303-00			RES.,FXD,CMPSN:30K OHM,5%,0.25W	01121	CB3035
A14R1118	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
A14R1119	315-0303-00			RES.,FXD,CMPSN:30K OHM,5%,0.25W	01121	CB3035
A14R1120	315-0752-00			RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
A14R1121	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A14R1122	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
A14R1123	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A14R1124	315-0752-00			RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
A14R1125	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A14R1126	315-0273-00			RES.,FXD,CMPSN:27K OHM,5%,0.25W	01121	CB2735
A14R1127	315-0391-00			RES.,FXD,CMPSN:390 OHM,5%,0.25W	01121	CB3915
A14R1128	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
A14R1129	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
A14R1130	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
A14R1132	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A14R1133	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025

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A14R1134	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A14R1135	315-0391-00			RES.,FXD,CMPSN:390 OHM,5%,0.25W	01121	CB3915
A14R1136	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
A14R1137	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A14R1140	315-0623-00			RES.,FXD,CMPSN:62K OHM,5%,0.25W	01121	CB6235
A14R1141	315-0333-00			RES.,FXD,CMPSN:33K OHM,5%,0.25W	01121	CB3335
A14R1142	321-0318-00			RES.,FXD,FILM:20K OHM,1%,0.125W	91637	MFF1816G20001F
A14R1143	321-0816-00			RES.,FXD,FILM:5K OHM,1%,0.125W	24546	NA55D5001F
A14R1146	315-0242-00			RES.,FXD,CMPSN:2.4K OHM,5%,0.25W	01121	CB2425
A14R1200	311-1561-00			RES.,VAR,NONWIR:2.5K OHM,20%,0.50W	73138	91-83-0
A14R1203	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
A14R1205	311-1561-00			RES.,VAR,NONWIR:2.5K OHM,20%,0.50W	73138	91-83-0
A14R1210	311-1561-00			RES.,VAR,NONWIR:2.5K OHM,20%,0.50W	73138	91-83-0
A14R1212	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A14R1213	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A14R1214	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A14R1215	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A14R1220	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
A14R1221	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A14R1230	315-0331-00			RES.,FXD,CMPSN:330 OHM,5%,0.25W	01121	CB3315
A14R1240	321-0481-00			RES.,FXD,FILM:1M OHM,1%,0.125W	24546	NA4D1004F
A14R1241	321-0290-00			RES.,FXD,FILM:10.2K OHM,1%,0.125W	91637	MFF1816G10201F
A14R1242	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
A14R1246	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A14R1247	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A14R1300	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
A14R1302	321-0269-00			RES.,FXD,FILM:6.19K OHM,1%,0.125W	91637	MFF1816G61900F
A14R1303	321-0101-00			RES.,FXD,FILM:110 OHM,1%,0.125W	91637	MFF1816G110R0F
A14R1310	315-0106-00			RES.,FXD,CMPSN:10M OHM,5%,0.25W	01121	CB1065
A14R1311	315-0106-00			RES.,FXD,CMPSN:10M OHM,5%,0.25W	01121	CB1065
A14R1314	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A14R1330	315-0911-00			RES.,FXD,CMPSN:910 OHM,5%,0.25W	01121	CB9115
A14R1340	321-0816-00			RES.,FXD,FILM:5K OHM,1%,0.125W	24546	NA55D5001F
A14R1341	321-0756-00			RES.,FXD,FILM:50K OHM,1%,0.125W	24546	NA55D5002F
A14R1342	321-0648-02			RES.,FXD,FILM:500K OHM,0.5%,0.125W	24546	NC55C5003D
A14R1344	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A14R1345	321-0260-00			RES.,FXD,FILM:4.99K OHM,1%,0.125W	91637	MFF1816G49900F
A14R1400	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A14R1402	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A14R1404	321-0402-00			RES.,FXD,FILM:150K OHM,1%,0.125W	24546	NA55D1503F
A14R1410	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A14R1411	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A14R1412	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
A14R1440	315-0362-00			RES.,FXD,CMPSN:3.6K OHM,5%,0.25W	01121	CB3625
A14R1442	315-0752-00			RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
A14R1443	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
A14R1444	315-0273-00			RES.,FXD,CMPSN:27K OHM,5%,0.25W	01121	CB2735
A14R1445	315-0752-00			RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
A14R1447	315-0201-00			RES.,FXD,CMPSN:200 OHM,5%,0.25W	01121	CB2015
A14R1500	321-0344-00			RES.,FXD,FILM:37.4K OHM,1%,0.125W	91637	MFF1816G37401F
A14R1501	321-0135-00			RES.,FXD,FILM:249 OHM,1%,0.125W	91637	MFF1816G249R0F
A14R1503	311-1567-00			RES.,VAR,NONWIR:TRMR,100 OHM,0.50W	73138	91-89-0
A14R1505	321-0269-00			RES.,FXD,FILM:6.19K OHM,1%,0.125W	91637	MFF1816G61900F
A14R1506	321-0101-00			RES.,FXD,FILM:110 OHM,1%,0.125W	91637	MFF1816G110R0F
A14R1507	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A14R1510	321-0402-00			RES.,FXD,FILM:150K OHM,1%,0.125W	24546	NA55D1503F
A14R1512	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F

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A14R1530	311-1298-00			RES.,VAR,NONWIR:10K OHM,20%,0.50W	01121	W-7909
A14R1540	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
A14R1541	315-0270-00			RES.,FXD,CMPSN:27 OHM,5%,0.25W	01121	CB2705
A14R1542	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A14R1544	315-0432-00			RES.,FXD,CMPSN:4.3K OHM,5%,0.25W	01121	CB4325
A14R1546	311-1562-00			RES.,VAR,NONWIR:2K OHM,20%,0.50W	73138	91-84-0
A14R1600	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A14R1602	321-0402-00			RES.,FXD,FILM:150K OHM,1%,0.125W	24546	NA55D1503F
A14R1603	321-0344-00			RES.,FXD,FILM:37.4K OHM,1%,0.125W	91637	MFF1816G37401F
A14R1604	321-0135-00			RES.,FXD,FILM:249 OHM,1%,0.125W	91637	MFF1816G249R0F
A14R1610	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
A14R1612	321-0402-00			RES.,FXD,FILM:150K OHM,1%,0.125W	24546	NA55D1503F
A14R1620	311-1560-00			RES.,VAR,NONWIR:5K OHM,20%,0.50W	73138	91-82-0
A14R1622	311-1558-00			RES.,VAR,NONWIR:20K OHM,20%,0.50W	73138	91-80-0
A14R1630	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A14R1631	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A14R1632	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A14R1633	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A14R1634	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A14R1636	315-0123-00			RES.,FXD,CMPSN:12K OHM,5%,0.25W	01121	CB1235
A14R1637	315-0133-00			RES.,FXD,CMPSN:13K OHM,5%,0.25W	01121	CB1335
A14R1638	321-0394-00			RES.,FXD,FILM:124K OHM,1%,0.125W	91637	MFF1816G12402F
A14R1639	321-0326-00			RES.,FXD,FILM:24.3K OHM,1%,0.125W	91637	MFF1816G24301F
A14R1640	311-1562-00			RES.,VAR,NONWIR:2K OHM,20%,0.50W	73138	91-84-0
A14R1700	311-1567-00			RES.,VAR,NONWIR:TRMR,100 OHM,0.50W	73138	91-89-0
A14R1702	311-1562-00			RES.,VAR,NONWIR:2K OHM,20%,0.50W	73138	91-84-0
A14R1710	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A14R1712	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A14R1714	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A14R1715	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A14R1720	315-0333-00			RES.,FXD,CMPSN:33K OHM,5%,0.25W	01121	CB3335
A14R1721	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
A14R1722	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
A14R1723	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
A14R1724	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
A14R1725	315-0752-00			RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
A14R1726	311-1558-00			RES.,VAR,NONWIR:20K OHM,20%,0.50W	73138	91-80-0
A14R1730	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
A14R1731	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
A14R1740	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A14R1741	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A14R1743	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
A14R1800	315-0912-00			RES.,FXD,CMPSN:9.1K OHM,5%,0.25W	01121	CB9125
A14R1802	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A14R1804	311-1567-00			RES.,VAR,NONWIR:TRMR,100 OHM,0.50W	73138	91-89-0
A14R1810	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A14R1812	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A14R1813	321-0269-00			RES.,FXD,FILM:6.19K OHM,1%,0.125W	91637	MFF1816G61900F
A14R1814	321-0101-00			RES.,FXD,FILM:110 OHM,1%,0.125W	91637	MFF1816G110R0F
A14R1815	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A14R1816	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A14R1820	311-1558-00			RES.,VAR,NONWIR:20K OHM,20%,0.50W	73138	91-80-0
A14R1830	315-0273-00			RES.,FXD,CMPSN:27K OHM,5%,0.25W	01121	CB2735
A14R1831	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
A14R1832	321-0347-00			RES.,FXD,FILM:40.2K OHM,1%,0.125W	91637	MFF1816G40201F
A14R1840	307-0103-00			RES.,FXD,CMPSN:2.7 OHM,5%,0.25W	01121	CB27G5
A14R1841	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025

Component No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A14R1842	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
A14R1844	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A14R1845	307-0103-00			RES.,FXD,CMPSN:2.7 OHM,5%,0.25W	01121	CB27G5
A14R1900	315-0303-00			RES.,FXD,CMPSN:30K OHM,5%,0.25W	01121	CB3035
A14R1902	321-0135-00			RES.,FXD,FILM:249 OHM,1%,0.125W	91637	MFF1816G249R0F
A14R1903	321-0344-00			RES.,FXD,FILM:37.4K OHM,1%,0.125W	91637	MFF1816G37401F
A14R1910	321-0402-00			RES.,FXD,FILM:150K OHM,1%,0.125W	24546	NA55D1503F
A14R1920	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A14R1922	315-0154-00			RES.,FXD,CMPSN:150K OHM,5%,0.25W	01121	CB1545
A14S1020	260-1618-00			SWITCH,PUSH:4 STA,2 POLE,PUSH-PUSH & MOM	71590	2KBM040000-XXX
A14U1140	156-0158-00			MICROCIRCUIT,LI:DUAL OPERATIONAL AMPLIFIER	18324	MC1458V
A14U1240	156-1191-00			MICROCIRCUIT,LI:DUAL BI-FET OP-AMPL,8 DIP	01295	TL072CP
A14U1300	156-0105-00			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER	27014	LM301AN
A14U1310	156-0495-00			MICROCIRCUIT,LI:OPNL AMPL	27014	LM324N
A14U1340	156-0158-00			MICROCIRCUIT,LI:DUAL OPERATIONAL AMPLIFIER	18324	MC1458V
A14U1400	156-0158-00			MICROCIRCUIT,LI:DUAL OPERATIONAL AMPLIFIER	18324	MC1458V
A14U1410	156-0105-00			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER	27014	LM301AN
A14U1510	156-0105-00			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER	27014	LM301AN
A14U1600	156-0158-00			MICROCIRCUIT,LI:DUAL OPERATIONAL AMPLIFIER	18324	MC1458V
A14U1610	156-0105-00			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER	27014	LM301AN
A14U1710	156-0158-00			MICROCIRCUIT,LI:DUAL OPERATIONAL AMPLIFIER	18324	MC1458V
A14U1730	156-0407-00			MICROCIRCUIT,LI:4-QUAD,ANALOG MULT	04713	MC1495L
A14U1740	156-0158-00			MICROCIRCUIT,LI:DUAL OPERATIONAL AMPLIFIER	18324	MC1458V
A14U1742	156-0067-00			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER	02735	85145
A14U1744	156-1173-00			MICROCIRCUIT,LI:VOLTAGE REFERENCE	04713	MC1403UDS
A14U1810	156-0158-00			MICROCIRCUIT,LI:DUAL OPERATIONAL AMPLIFIER	18324	MC1458V
A14U1820	156-0105-00			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER	27014	LM301AN
A14U1830	156-0067-00			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER	02735	85145
A14VR1840	152-0166-00			SEMICOND DEVICE:ZENER,0.4W,6.2V,5%	04713	SZ11738
A14VR1842	152-0166-00			SEMICOND DEVICE:ZENER,0.4W,6.2V,5%	04713	SZ11738
A14W1240	131-0566-00			BUS CONDUCTOR:DUMMY RES,2.375,22 AWG	55210	L-2007-1
A14W1400	131-0566-00			BUS CONDUCTOR:DUMMY RES,2.375,22 AWG	55210	L-2007-1
A14W1600	131-0566-00			BUS CONDUCTOR:DUMMY RES,2.375,22 AWG	55210	L-2007-1
A14W1910	131-0566-00			BUS CONDUCTOR:DUMMY RES,2.375,22 AWG	55210	L-2007-1

Component No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
				CHASSIS PARTS		
CR500	150-1033-00			LT EMITTING DIO:YELLOW,585NM,40MA MAX	50434	5082-4584
CR510	150-1029-00			LT EMITTING DIO:GREEN,565NM,35A	53184	XC209G
J500	131-0955-00			CONNECTOR,RCPT,:CKT BD,28/56 CONTACT	13511	31-279
J510	131-0955-00			CONNECTOR,RCPT,:CKT BD,28/56 CONTACT	13511	31-279
J520	131-0955-00			CONNECTOR,RCPT,:CKT BD,28/56 CONTACT	13511	31-279
J530	131-0955-00			CONNECTOR,RCPT,:CKT BD,28/56 CONTACT	13511	31-279
J540	131-0955-00			CONNECTOR,RCPT,:CKT BD,28/56 CONTACT	13511	31-279
J550	131-0955-00			CONNECTOR,RCPT,:CKT BD,28/56 CONTACT	13511	31-279
J560	131-0955-00			CONNECTOR,RCPT,:CKT BD,28/56 CONTACT	13511	31-279
R500	311-0169-00			RES.,VAR,NONWIR:100 OHM,20%,0.50W	01121	W-7564B
R520	321-0085-00			RES.,FXD,FILM:75 OHM,1%,0.125W	91637	MFF1816G75R00F
R530	311-2104-00			RES.,VAR,NONWIR:PNL,15K OHM,10%,0.25W	12697	CM41780
	----- -----			(FURNISHED AS A UNIT WITH S500)		
R540	321-0085-00			RES.,FXD,FILM:75 OHM,1%,0.125W	91637	MFF1816G75R00F
R550	311-1298-00			RES.,VAR,NONWIR:10K OHM,20%,0.50W	01121	W-7909
R560	311-1310-00			RES.,VAR,NONWIR:20K OHM,20%,1W	01121	10M654
R570	311-0091-00			RES.,VAR,NONWIR:1K OHM,10%,0.50W	01121	W-3083E
R580	315-0750-00			RES.,FXD,CMPSN:75 OHM,5%,0.25W	01121	CB7505
R1520	311-1298-00			RES.,VAR,NONWIR:10K OHM,20%,0.50W	01121	W-7909
S500	----- -----			(PART OF R530)		
S1320	263-1190-00			SW CAM ACTR AS:SWEEP RANGE	80009	263-1190-00
S1731	263-1189-00			SW CAM ACTR AS:FREQUENCY MULTIPLIER	80009	263-1189-00