TM 9-6625-474-14&P-2

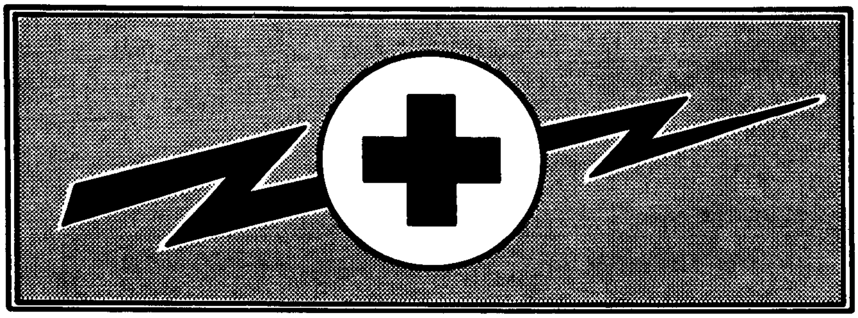
TECHNICAL MANUAL

OPERATOR, ORGANIZATIONAL,
DIRECT SUPPORT, AND GENERAL SUPPORT
MAINTENANCE MANUAL
(INCLUDING REPAIR PARTS)
FOR

FUNCTION GENERATOR
TEKTRONIX, MODEL FG 501A
(6625-01-106-9873)

DEPARTMENT OF THE ARMY 27 DECEMBER 1984

WARNING



RA PD 404264

DANGEROUS VOLTAGE

is used in the operation of this equipment

DEATH ON CONTACT

may result if personnel fail to observe safety precautions

Never work on electronic equipment unless there is another person nearby who is familiar with the operation and hazards of the equipment and who is competent in administering first aid. When the technician is aided by operators, he must warn them about dangerous areas.

Whenever possible, the power supply to the equipment must be shut off before beginning work on the equipment. Take particular care to ground every capacitor likely to hold a dangerous potential. When working inside the equipment, after the power has been turned off, always ground every part before touching it.

Be careful not to contact high-voltage connections when installing or operating this equipment.

Whenever the nature of the operation permits, keep one hand away from the equipment to reduce the hazard of current flowing through vital organs of the body.

WARNING

Do not be misled by the term “low voltage.” Potentials as low as 50 volts may cause death under adverse conditions.

COMMON and probe ground straps are electrically connected. Herefore, an elevated reference applied to any is present on each - as indicated by the yellow warning bands under the probe retractable hook tips.

For Artificial Respiration, refer to FM 21-11,

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.

TECHNICAL MANUAL
No. 9-6625-474-14&P-2

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D.C., *27 December 1984*

OPERATOR, ORGANIZATIONAL, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL (INCLUDING REPAIR PARTS)

FOR

FUNCTION GENERATOR TEKTRONIX, MODEL FG 501A (6625-01-106-9873)

REPORTING OF ERRORS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms), direct to: Commander, US Army Missile Command, ATTN: DRSMI-SNPM, Redstone Arsenal, AL 35898-5238. A reply will be furnished to you.

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This manual is, in part, authenticated manufacturer's commercial literature. Recommended Spare Parts List has been added to supplement the commercial literature, The format of this manual has not been structured to consider levels of maintenance.

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LIST OF ILLUSTRATIONS

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SECTION 0

GENERAL INFORMATION

0-1. Scope. This manual contains instructions for the operator, organizational, direct support, and general support maintenance of and calibration procedures for Tektronix Function Generator, Model FG 501A. Throughout this manual, Tektronix Function Generator, Model FG 501A is referred to as the FG 501A.

0-2. Indexes of publications. *a. DA Pam 310-4.* Refer to the latest issue of DA Pam 310-4 to determine whether there are new editions, changes, or additional publications pertaining to Tektronix Function Generator, Model FG 501A.

b. DA Pam 310-7. Refer to the latest issue of DA Pam 310-7 to determine whether there are modification work orders (MWO'S) pertaining to Tektronix Function Generator, Model FG 501A.

0-3. Forms, Records, and Reports. Department of Army forms and procedures used for equipment maintenance and calibration are those prescribed by TM 38-750, The Army Maintenance Management System. Accidents involving injury to personnel or damage to materiel will be reported on DA Form 285, Accident Report, in accordance with AR 385-40.

0-4. Reporting Equipment Improvement Recommendations (EIR). If your FG 501A needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design. Tell us why a procedure is hard to perform. Put it on an SF 368 (Quality Deficiency Report). Mail it to Commander, U.S. Army Missile Command, ATTN: DRSM1-CIMD, Redstone Arsenal, AL 35898-5290. We'll send you a reply.

0-5. Administrative Storage. To prepare the Tektronix Function Generator, Model FG 501A for placement into and removal from administrative storage, refer to Section 3, Chapter 4, AR 750-25-1, Maintenance of Equipment and Supplies. Temporary storage should be accomplished in accordance with TB 750-25-1, Section 2, Maintenance of Supplies and Equipment.

0-6. Destruction of Army Electronics Materiel. Destruction of Tektronix Function Generator, Model FG 501A to prevent enemy use shall be in accordance with TM 750-244-2.

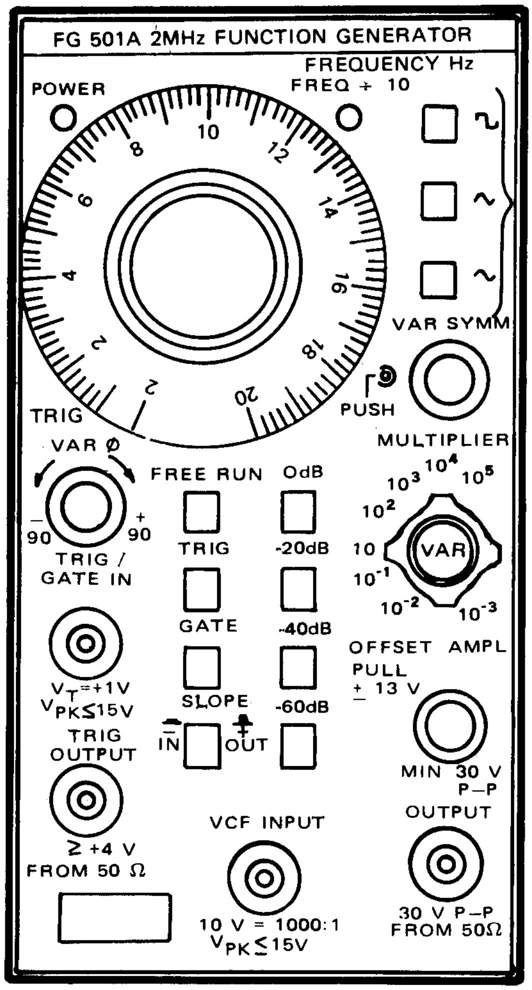


FIG.0-1. FG 501A 2MHz FUNCTION GENERATOR

SECTION 1

SPECIFICATION

INTRODUCTION

This section of the manual contains a general description of the FG 501A 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 501A Function Generator provides low distortion sine, square, triangle, ramp, and pulse waveforms over the frequency range 0.002 Hz to 2 MHz in eight decade steps. 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 signal and the selected output frequency.

ACCESSORIES

The only accessory shipped with the FG 501A 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 non-condensing environment whose limits are described under Environmental.

3. Allow twenty minutes warm-up time for operation to specified accuracy; sixty minutes after exposure to or storage in 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		Provided in eight decade steps plus variable, with overlap on all ranges.
Range		
Sine-wave, square-wave, and triangle	.002 Hz to 2 MHz	Calibrated portion of dial extends from 20 to 2. Portion of dial from 2 to .2 is uncalibrated .0002 Hz to .002 Hz uncalibrated portion of dial.
Ramp and Pulse	.002 Hz to 200 kHz ± 10% calibrated portion of dial.	Measured at 50% duty cycle. .0002 Hz to .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 .2 Hz to 2 MHz, and within 10% from .002 Hz to .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,

Table 1-1 (cont)

Characteristics	Performance Requirements	Supplemental Information
Amplitude Flatness	Measured with 0 dB ATTEN button "IN" and output driving 50 Ω load. (Front panel only.)	
Sinewave (10 kHz Sinewave Ref)	±0.1 dB 20 Hz to 20 kHz ±0.5 dB 20 kHz to 1 MHz ±1 dB 1 MHz to 2 MHz	Typically ±.5 dB .002 Hz to 20 Hz
Squarewave (10 kHz Squarewave Ref)	Peak to peak amplitude within ±0.5 dB of squarewave reference amplitude 20 Hz to 2 MHz.	Typically within ±.5 dB .002 Hz to 20 Hz.
Triangle (10 kHz Triangle Ref)	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 ±.5 dB .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 with average responding THD meter. Measurement bandwidth limited to approximately 300 kHz.
	⩽0.5% 20 kHz to 100 kHz.	Verified at 15 V p-p into 50 Ω load. Must be on calibrated portion of dial. VAR SYMM control off, Offset control off.
	All harmonics at least 30 dB below fundamental from 100 kHz to 2 MHz	Trig output driving open circuit.
Squarewave Output	Step ATTEN in 0 dB position.	
Risetime and Falltime	⩽25 ns at 15 V p-p into 50 Ω.	
Aberrations (p-p)	⩽3% (Front panel only.)	
Pulse Output	Step ATTEN in 0 dB position.	
Risetime and Falltime	⩽25 ns at 15 V p-p into 50 Ω.	
Aberrations (p-p)	⩽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 V pk.
Ext Trig/Gate Input		
Impedance		≈2 kΩ
Threshold Level	+1 V ±20%.	Maximum input ⩽ 15 V pk.
Trigger Output	⩾ +4 V into open circuit ⩾ +2 V into 50 Ω.	
Variable Phase Range	At least ±90°	Sine and Triangle only.

Table 1-1 (cont)

Characteristics	Performance Requirements	Supplemental Information
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 .2 Uncal.
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% 20 Hz to 200 kHz. 5% 200 kHz to 2 MHz (calibrated).	

Table 1-2

MISCELLANEOUS

Characteristics	Description
Power Consumption	12 W or less. (plug-in only)
Recommended Adjustment Interval	1000 hours or 6 months, whichever occurs first.
Warm-up Time	20 minutes.

Table 1-3

ENVIRONMENTAL’

Characteristics	Description	
Temperature		Meets MIL-T-28800B, class 5.
Operating	0° C to +50° C	
Non-operating	–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)	
Non-operating	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]

Table 1-3 (cont)

Characteristics	Description	
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	1.88 lbs (.85 kg)
Overall Dimensions	Height 5 in (126mm) Width 2.6 in (67mm) Length 11.9 in (303mm)

SECTION 2

OPERATING INSTRUCTIONS

INTRODUCTION

This section of the manual provides operating information required to obtain the most effective performance from the FG 501A. Included are installation and removal instructions, a functional description of the front panel controls, and a general description of the operating modes. Some basic applications of the instrument are also briefly discussed.

INSTALLATION AND REMOVAL

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

CAUTION

To prevent damage to the FG 501A, 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 jack of the selected power module compartment match the cutouts in the FG 501 A circuit board edge connector. If they do not match, do not insert the instrument until the reason is found. When the units are properly matched, align the FG 501A chassis with the upper and lower guides of the selected compartment (see Fig. 2-1). Insert the FG 501A into the compartment and press firmly to seat the circuit board edge connector in the power module interconnecting jack. Apply power to the FG 501A by operating the power switch on the power module.

To remove the FG 501A from the power module, pull the release latch (located in the lower left corner) until the interconnecting jack disengages. The FG 501A 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.

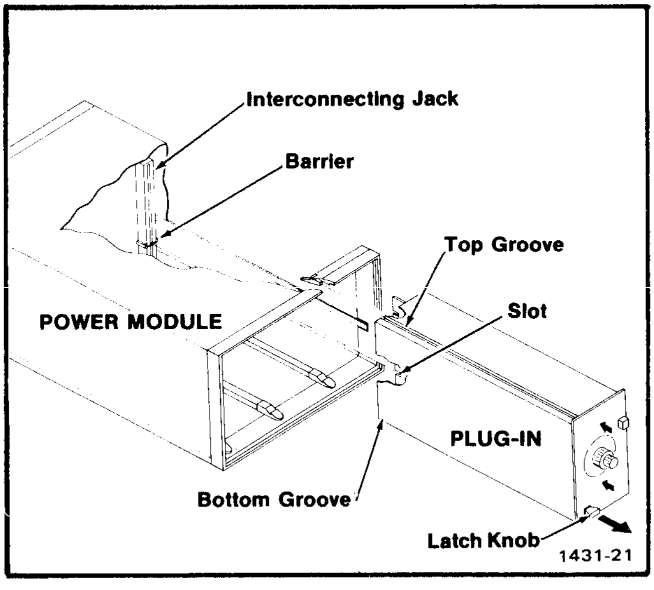


Fig. 2-1. Plug-in installation and removal.

CONTROLS AND CONNECTORS

Although the FG 501A is calibrated and ready to use, the functions 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.

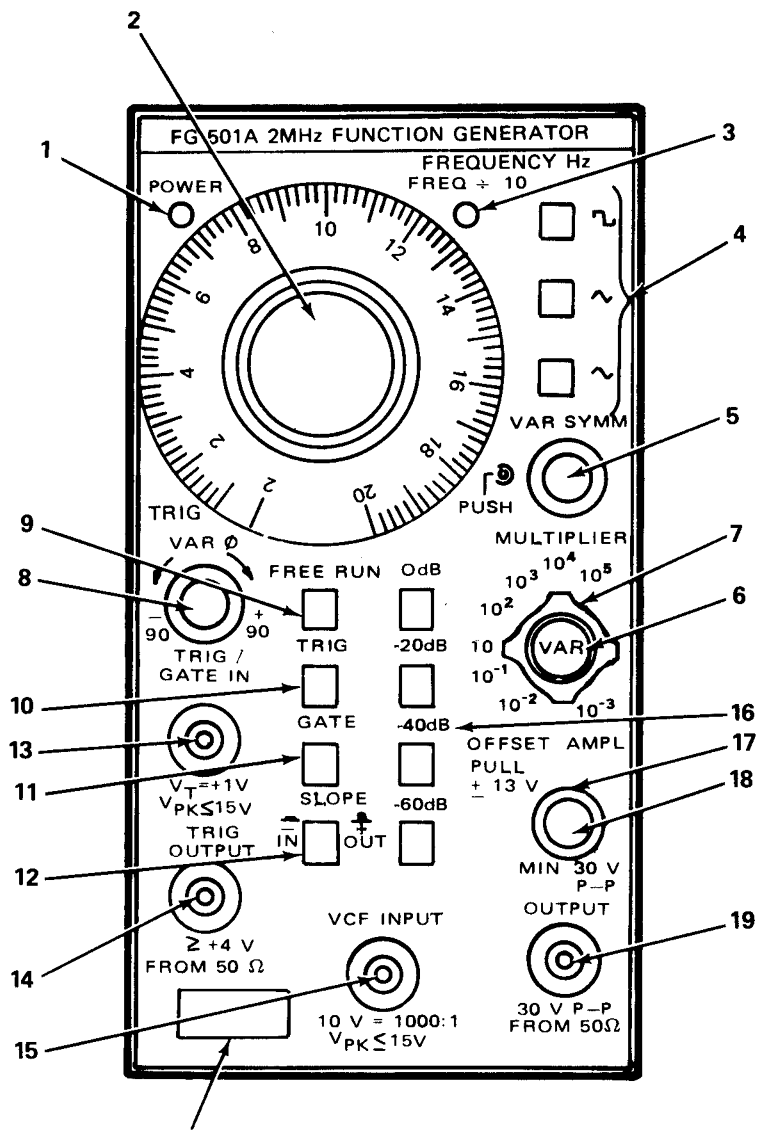


Fig. 2-2. Controls and connectors.

1 **POWER -** Illuminated when power is applied to the FG 501A.

FREQUENCY CONTROL AND FUNCTION SELECTION

2 **FREQUENCY Hz** - Selects the frequency of the output waveform in conjunction with the MULTIPLIER control.

3 **FREQ** + 10 - Illuminated when the variable symmetry function is activated.

4 **FUNCTION BUTTONS** - Select square, triangle, and sine waveforms.

5 **VAR SYMM** - (push to enable) adjusts time-based symmetry of the selected output waveform. Reduces the frequency of the output waveform by a factor = 10 and illuminates the FREQ + 10 indicator.

6 **FREQUENCY VERNIER** - For fine adjustment of output frequency to at least 1 part in 10^4 of full scale.

7 **MULTIPLIER** - Selects the output frequency in eight decade steps in conjunction with the FREQUENCY Hz control.

TRIGGER AND GATE CONTROLS

8 **VAR Ø—Selects** - Selects phase lead or lag, up to ±90°, relative to input trigger or gate waveform.

9 **FREE RUN** - When pressed causes continuous waveform output.

10 **TRIG** - When pressed causes output of one cycle of selected waveform for each trigger pulse applied to the TRIG/GATE IN connector.

11 **GATE** - When pressed causes continuous output of the selected waveform for the duration of the gating pulse.

12 **SLOPE** - Button selects, in TRIG mode, the slope of the input signal which will trigger the selected output waveform. In GATE mode, whether output gating will occur when the level of the input signal is above or below the threshold level of +1 V.

13 **TRIG/GATE IN** - Bnc connector used to apply the external trigger or gating signal.

14 **VCF INPUT** - Bnc connector for applying an external voltage for controlling the output frequency of the generator.

15 **TRIGGER OUTPUT** - Bnc connector which outputs one positive pulse for each cycle of the selected output waveform.

OUTPUT CONTROLS

16 **ATTENUATOR BUTTONS** - Attenuate the amplitude of the selected output waveform in 20 dB steps to a maximum of 60 dB when pressed.

17 **AMPL** - Varies the amplitude of the selected output waveform, between steps of the attenuator buttons.

18 **OFFSET** - Pull and turn control, concentric with the AMPL control, provides up to ±13 V dc offset of the output waveform.

19 **OUTPUT** - Bnc connector for output of the selected waveform.

20 **RELEASE LATCH** - Pull to disengage the FG 501A from the power module.

OPERATING CONSIDERATIONS

OUTPUT CONNECTIONS

The output of the FG 501A 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 (especially 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 orimpedance 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 501A is used to measure the rise or falltime of a device, the riestime 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 501A 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. The risetime of the device under test can be determined once the risetime of the system is known.

IMPEDANCE MATCHING

If the FG 501A 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 to the oscilloscope input. The attenuator isolates the input capacitance of the device, and the FG 501A is properly terminated.

FIRST TIME OPERATION

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

The following exercise will familiarize the operator with most functions of the FG 501A.

NOTE

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

Preset the controls as follows:

Blue section:

FREQUENCY Hz	10
MULTIPLIER	10
FREQUENCY VERNIER	Fully cw
WAVEFORM—SINE	in
VAR SYMM	off

Green section:

FREE RUN	in

Black section:

ATTENUATOR	-20 dB
AMPL (variable)	Centered
OFFSET	off

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

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

The oscilloscope should display 1 complete cycle per division of the sine waveform (approximately 10 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 AMPL (variable) control to verify that the waveform amplitude changes. Return these controls to the preset condition.

3. Pull the OFFSET knob out and rotate it. 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 while observing the change in frequency of the displayed waveform, Return these controls to the preset condition,

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 multiplier setting.

4. Connect the load to the FG 501A output connector and adjust the AMPL control for the desired output amplitude.

TRIGGERED OR GATED (BURST) OPERATION

With the FG 501A 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 501A 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. 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 .2 and a 0 to +10 V signal be applied to the VCF INPUT connector. It may 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.

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 waves are 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 501A.

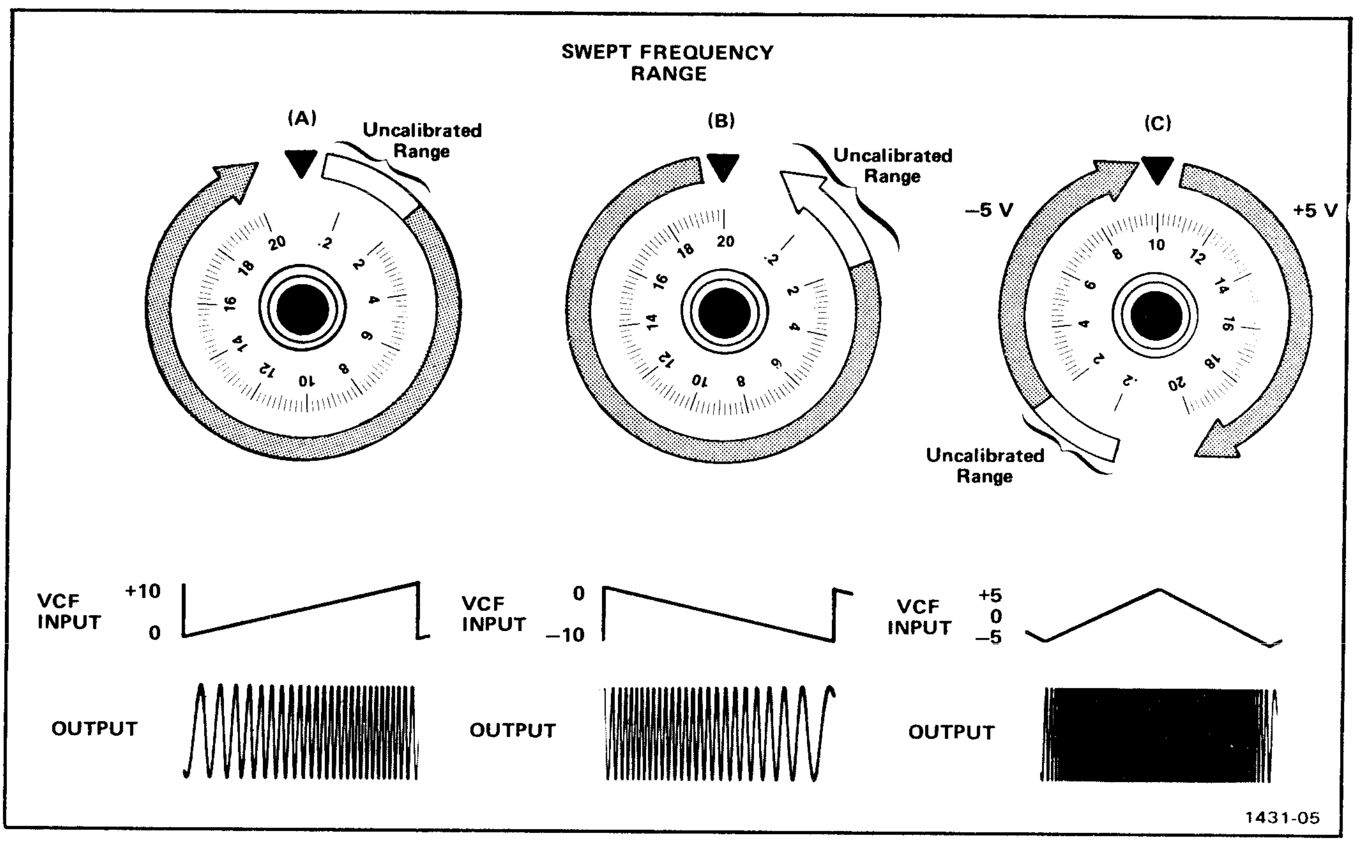


Fig. 2-3. Swept Frequency range with 10 V signals applied to VCF IN connector.

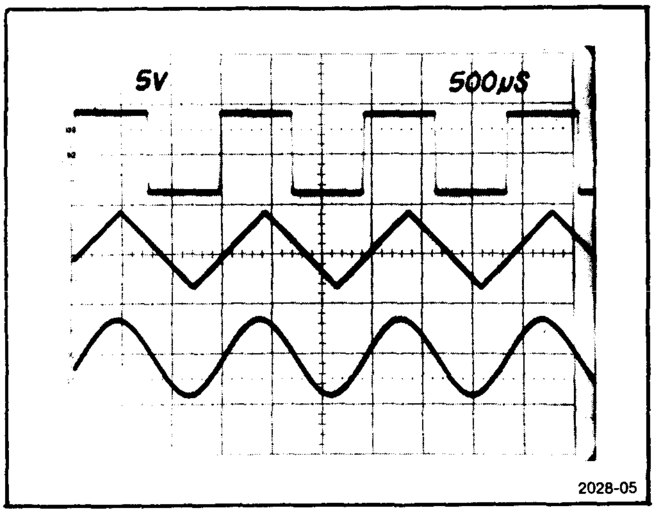


Fig. 2-4. BASIC FUNCTIONS. Square, triangle, and sine waveforms selected by front panel pushbuttons.

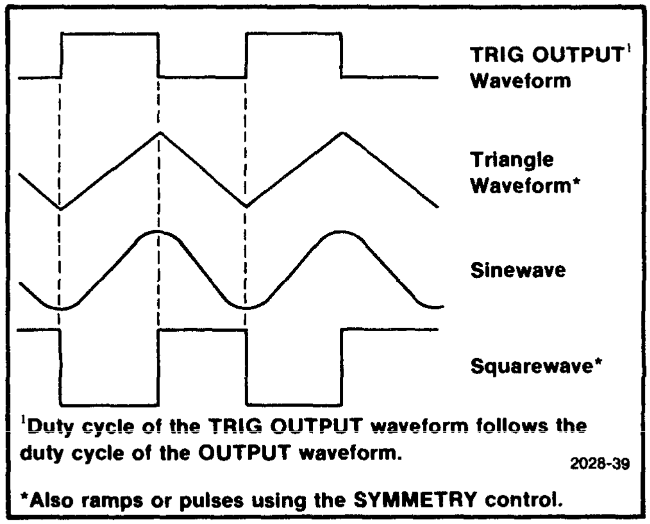


Fig. 2-6. Phase relationships between OUTPUT waveforms and the TRIG OUT waveform.

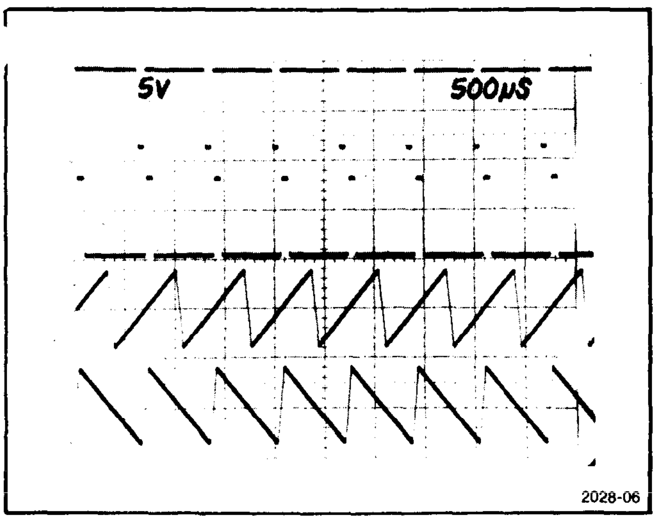


Fig. 2-5. RAMPS AND PULSES. These are obtained from the basic waveforms by using the SYMMETRY control.

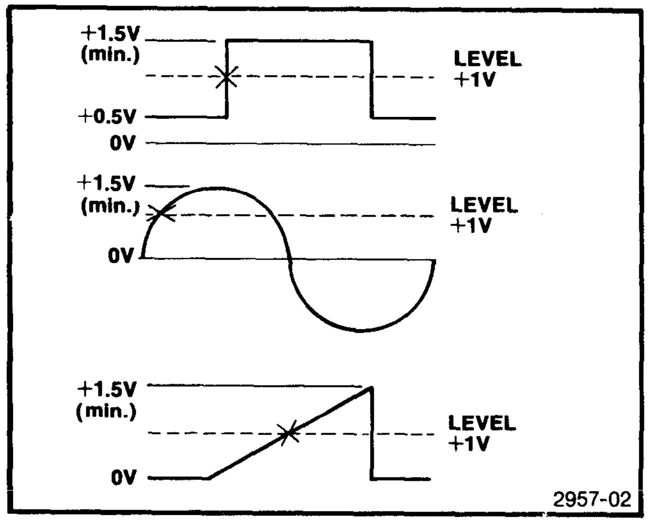


Fig. 2-7. Trigger Signal amplitude requirements and triggering points.

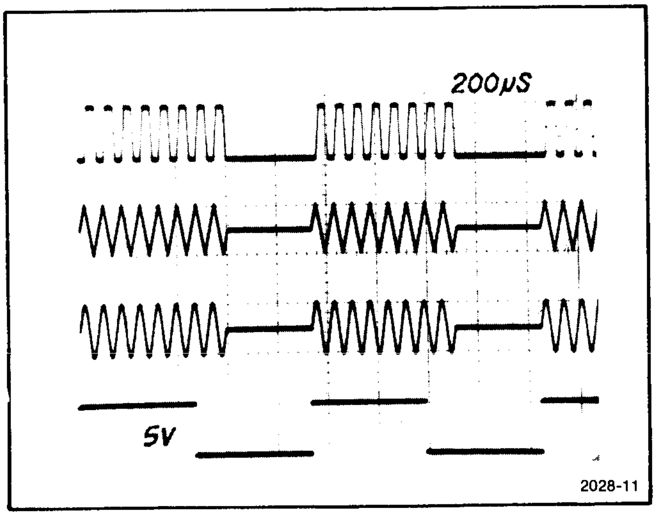


Fig. 2-8. GATED OPERATION. The top three traces are various output waveforms and the bottom trace is the gating waveform applied to the trigger INPUT connector with the GATE pushbutton pressed in. Note the additional cycle completed after the waveforms are gated off.

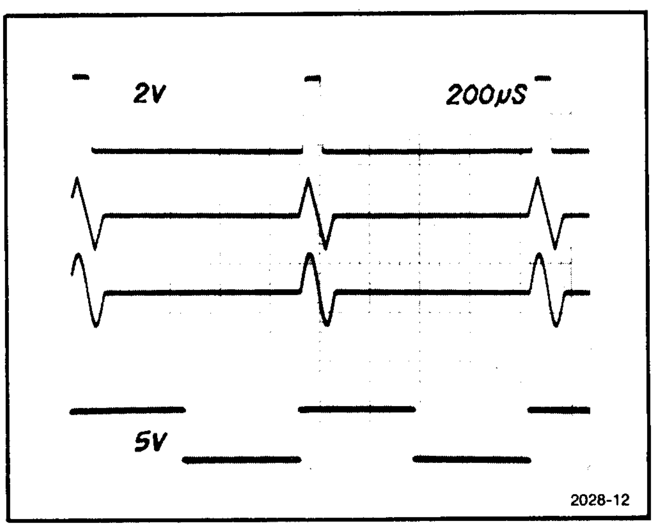


Fig. 2-9. TRIGGERED OPERATION. The top three traces are the various out put traces selected. The bottom trace is the triggering waveform applied to the trigger INPUT connector with the TRIG mode selected. Note that only one cycle of the output waveforms is completed.

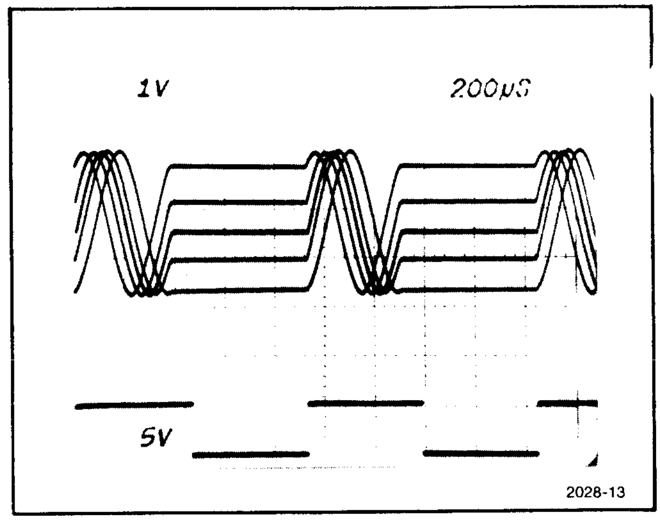


Fig. 2-10. PHASE CONTROL OPERATION. This photograph illustrates PHASE control usage in the triggered mode. The five super-imposed traces illustrate the effect of the phase control. This control provides ±90° of shift. The bottom trace is the triggering waveform.

APPLICATIONS

RESPONSE ANALYSIS

The FG 501A is particularly suited for determining reslponse characteristics of circuits or systems. This application utilizes the VCF input of the FG 501 Ato sweep the generator over a range of frequencies. Refer to the Voltage Controlled Frequency (VCF) Operation discussion under Operating Modes for additional information.

1. Connect the equipment as shown in Fig. 2-11.

2. Set the MULTIPLIER selector and FREQUENCY Hz dial for the desired upper or lower frequency limit (depending on the direction you wish to sweep).

3. Apply the desired waveform to the VCF INPUT connector. (A positive-going waveform will increase the frequency while a negative-going waveform will decrease it.)

4. Adjust the amplitude of the VCF input waveform for the desired output frequency range.

5. Observe the response characteristics on the monitoring oscilloscope.

The frequency at which a displayed response characteristic occurs can be determined by first removing the VCF input waveform, then manually adjusting the FREQUENCY Hz dial to again obtain the particular characteristic observed in the swept display and reading that frequency on the FREQUENCY Hz dial.

TONE-BURST GENERATION OR STEPPED FREQUENCY MULTIPLICATION

The FG 501A can be used as atone-burst generator or frequency multiplier for checking tone-controlled devices. This application utilizes a ramp generator, such as the TEKTRONIX RG 501, as a VCF signal source 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 multiplied output

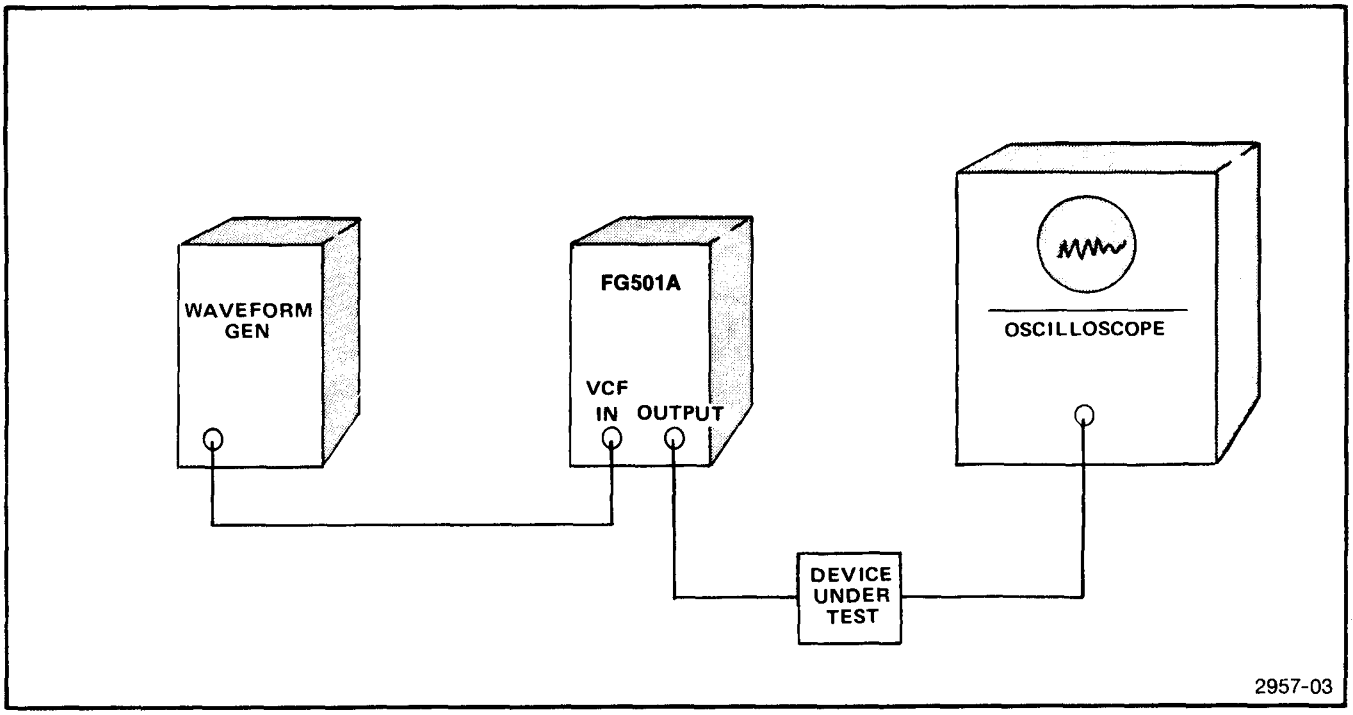


Fig. 2-11. Analyzing circuit or system response.

from the FG 501A. Refer to the Gated (burst) Output and Variable Phase and the Voltage-controlled Frequency (VCF) Output discussions under Operation for additional information.

1. Connect the equipment as shown in Fig. 2-12.

2. Push the GATE button in and set the PHASE control to the desired phase.

3. Set the ramp generator for the desired ramp duration and polarity.

4. Adjust the pulse generator period for the desired number of bursts within the selected ramp duration. Adjust the pulse generator duration for the desired burst width.

5. Select the sweep frequency range by adjusting the FREQUENCY Hz dial for one end of the sweep range (upper or lower limit depending on the polarity of the ramp). Then, adjust the ramp generator amplitude for the other swept frequency limit.

Various other tone-burst or frequency multiplied characteristics can be obtained by using different gating input waveforms, i.e., triangle, sine, square, etc.

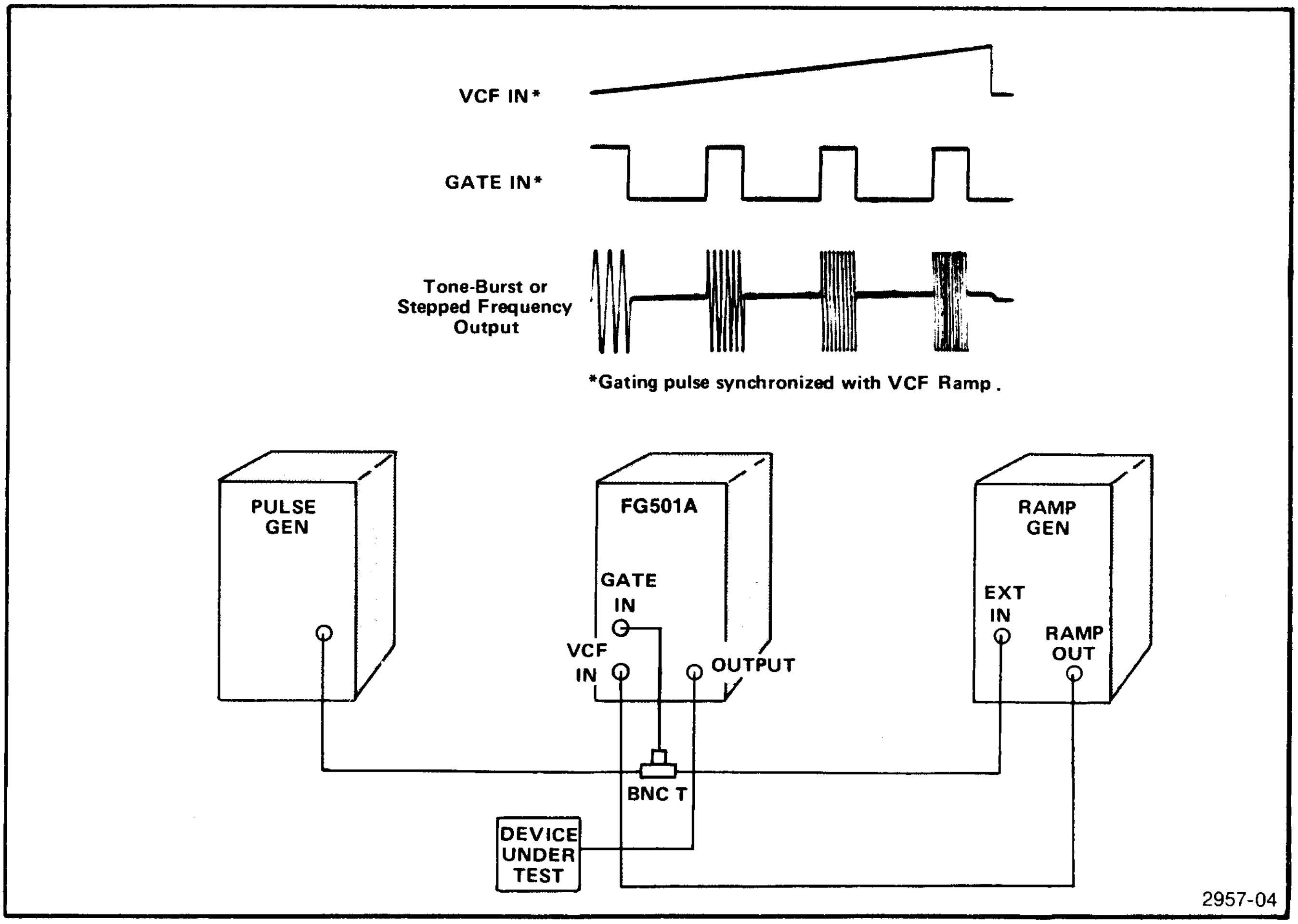


Fig. 2-12. Tone-burst generation or stepped frequency multiplication.

SECTION 3

THEORY OF OPERATION

INTRODUCTION

This section of the manual contains a description of the electrical circuits in the FG 501A. 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

FREQUENCY CONTROL AND SUMMING AMPLIFIER

The voltage developed across the frequency control divider string, R1429, R1321, R500 and R510, is applied to pin 5 of operational amplifier U1540B. This voltage is buffered by the amplifier and. a current is developed through R1551. This current is applied top in 2 of summing amplifier U1540A where it is summed with any currents developed by a voltage applied tothe 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 stepsfrom 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 ($\overline{Q}$) 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 ($\overline{Q}$) 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 0 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 0 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 0 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 R560B and R2335 to the input stage of the amplifier. R560B 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 R560A 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 501A 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 501A.

+15 V SUPPLY

The +15 V supply consists of U1230D and Q1221. U1230D serves as an error amplifier which compares the F15 Voutput of the supply to a +15 Preference 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 +5 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.

SECTION 4

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 adjust ment 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 Sweep Rate .5 μs.	X	X	TEKTRONIX 7704/4/ 7A16A/7B50
3	Differential Comparator Amplifier	Minimum Vertical deflection factor .1 V/div	X	X	TEKTRONIX 7A13
4	Sampling System			X	Tektronix 7704/7S11/ 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 Multi meter	Range to ±30 V 5 1/2 digits Accuracy 0.1%.	X	X	TEKTRONIX DM 501
9	Pulse Generator	0 to 2 V square wave output into 50 Ω load. Period 2 μs; Duration .1 μs	X		TEKTRONIX PG 501
10	Power Supply	0 to 10 V range Accuracy ±10%	X		TEKTRONIX PS 501-1

Table 4-1 (cont)

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

1. Check Frequency Range

a. Connect the OUTPUT connector of the FG 501 to the counter input.

b. Press the FEE RUN and 0 dB pushbuttons.

c. Press either the ∿, ⎍, or ⋀ pushbuttons.

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

e. Set the FREQUENCY Hz 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 MULTPLIER to 10^{-3}.

l. CHECK - for an output frequency of between 0.0019 Hz and 0.0021 Hz.

m Disable the VAR SYMM control.

n. Change the FREQUENCY Hz dial to 2.

o. CHECK - that the FREQUENCY Hz dial can be adjusted to obtain 0.0002 Hz.

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 from 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 connections from 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 FREQUENCY Hz 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 AMPLITUDE control and the gain of the vertial 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 frequency 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 2.37 major divisions or less from the 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 anal yzer.

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 FREQUENCY Hz and MULTIPLIER controls. The FREQUENCY Hz control 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 $\leqslant$0.25%.

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

i. CHECK - that the distortion is $\leqslant$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 FREQUENCY Hz 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 FREQUENCY Hz dial to 20, change the MULTIPLER to 10^5, and rotate the FREQUENCY Hz dial from 20 to 2.

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 FREQUENCY Hz dial and the MULTIPLIER control for any calibrated frequency. (For ease, the FREQUENCY Hz 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 $\leqslant$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 dial to 20 and the MULTPLIER 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.

CHECK - that the frequency decreases by a factor of $\geqslant$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 coaxial cable and 50 Ω termination 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 501A.

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 Out put

a. Press the FREE RUN pushbutton.

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

c. CHECK - for a $\geqslant$+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 $\geqslant$+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 0 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 at 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 FREQUENCY Hz dial to 20.

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

d. Set the AMPLITUDE control fully cw.

e. Connect the OUTPUT connector thorugh 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 FREQUENCY Hz 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 from 0.267 Vto 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 FREQUENCY Hz and MULTIPLIER control for any frequency from 20 Hz to 200 kHz in the calibrated portion of the 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 $\leqslant 1$

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

i. Repeat steps c through f.

j. CHECK-that the time difference is $\leqslant 5\%$.

k. Remove all connections.

ADJUSTMENT PROCEDURE

INTRODUCTION

Use this Adjustment Procedure to restore the FG 501A to original performance requirements. This Adjustment Procedure need not be performed unless the instrument fails to meet the Performance Requirements of the Electrical Characteristics listed in the Specification section, or if the Performance Check procedure cannot be completed satisfactorily. If the instrument has undegone 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 501A. Specifications given for the test equipment are the minimum necessary for accurate adjustment. All test equipment is assumed to be correctly calibrated and operating within specifications.

If other test equipment is 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 501A is connected to the power module with a flexible extender (see equipment list). Removal of the left side cover provides access to all internal adjustments. 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 SETTINGS

Preset the FG 501A and test equipment controls as follows:

CAUTION

To prevent damage to equipment, be sure the power module and oscilloscope mainframe power is off before inserting or removing plug-in units.

Power Module

LINE SELECTOR	HI

FG 501A

(pushbutton)	in
FREE RUN (pushbutton)	in
0 dB (pushbutton)	in
FREQUENCY Hz dial	20
VAR SYMM	Mid-range & in
VAR 0	Mid-range
MULTIPLIER	10^3
VAR (frequency)	cw
OFFSET	Mid-range & in
AMPL	cw

Digital Multimeter (DM 501)

RANGE/FUNCTION	20 DC VOLTS
INPUT	EXT

POWER SUPPLIES

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

a. Insert the FG 501A and digital multi meter 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 multi meter HI and LO INPUTS.

d. Connect the digital multi meter LO test lead to the FG 501A chassis ground. Connect the HI test lead to the FG 501A test point, TP1323 located on the Main board.

e. ADJUST-potentiometer R1301 located on the Main board until the digital multi meter readout indicates between +14.985 and +15.015.

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

a. Remove the digital multi meter 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 multi meter readout indicates between -14.985 and -15.015.

3. Check the +5 V Supply Accuracy, ±0.5%

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

b. The digital multi meter 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 TP 1331 and connect to test point, TP1321 located on the Main board.

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

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

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

b. The digital multi meter must indicate a readout between -19.90 and -20.10.

c. Remove all connections

DIAL ALIGNMENT

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

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

Vertial Plug-in

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

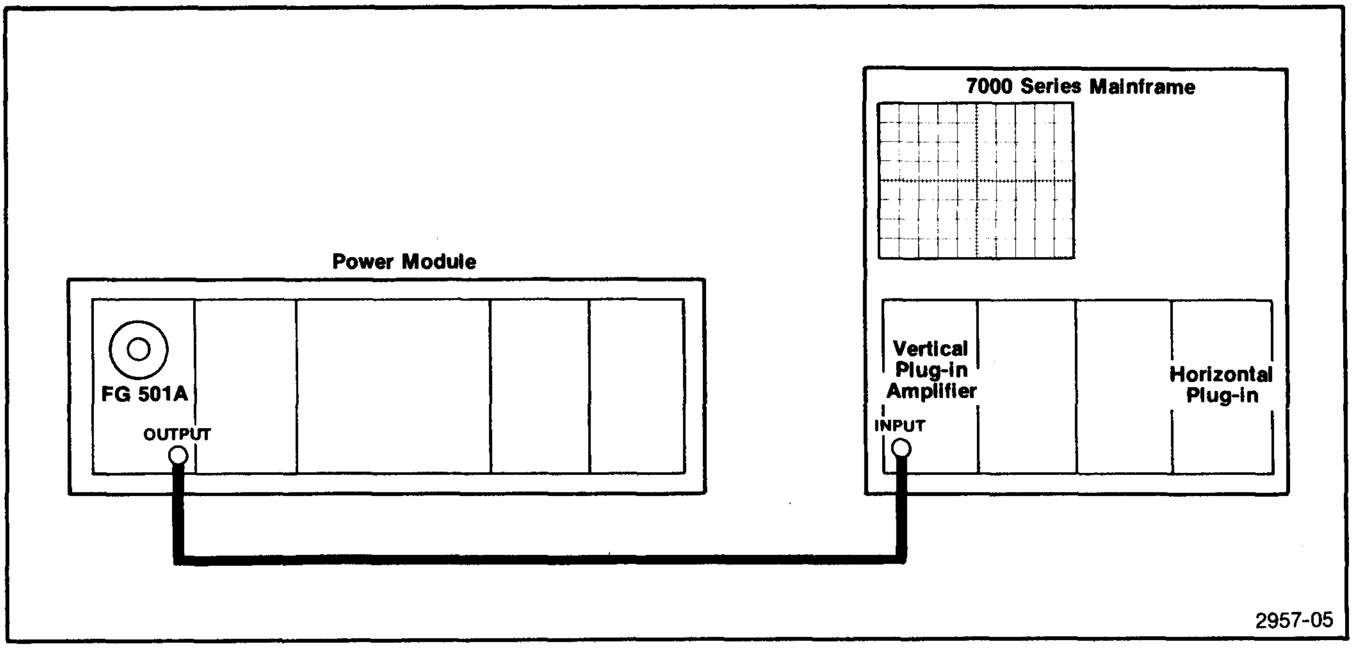


Fig. 4-1. Test setup for DIAL ALIGNMENT and OFFSET adjustment.

Horizontal Plug-in

DISPLAY MODE	TIME BASE
TIME/DIV	50 μs
VARIABLE	in
LEVEL/SLOPE	
MODE	AUTO
COUPLING	AC
SOURCE	INT
MAGNIFIER	X1

Vertical Plug-in

VOLTS/DIV	2

6. Frequency Hz Dial Alignment

a. Connect the coaxial cable from the FG 501A OUTPUT to the vertical plug-in INPUT.

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

c. Locate the coupler holding the FREQUENCY Hz potentiometer extension shaft and loosen the coupler set screw.

d. ADJUST-the FREQUENCY Hz potentiometer counterclockwise until the displayed waveform just stops moving.

e. While holding the potentiometer (coupler), adjust the FREQUENCY Hz dial to 20 (exact).

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

g. Adjust the FREQUENCY Hz dial to 18. Then rotate dial slowly counterclockwise until the display crt waveform just stops moving.

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

i. Tighten the coupler set screw.

ADJUST OFFSET

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

FG 501A

AMPLITUDE	Ccw
∿ (pushbutton)	in
FREQUENCY Hz	20
MULTIPLIER	102

7. 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

8. Adjust the TRIANGLE AM PLADJ (R1412), TRIANGLE OFFSET (R1511), and TOP DIAL SYMM CAL (R1421)

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

FG 501A

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.

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.

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

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

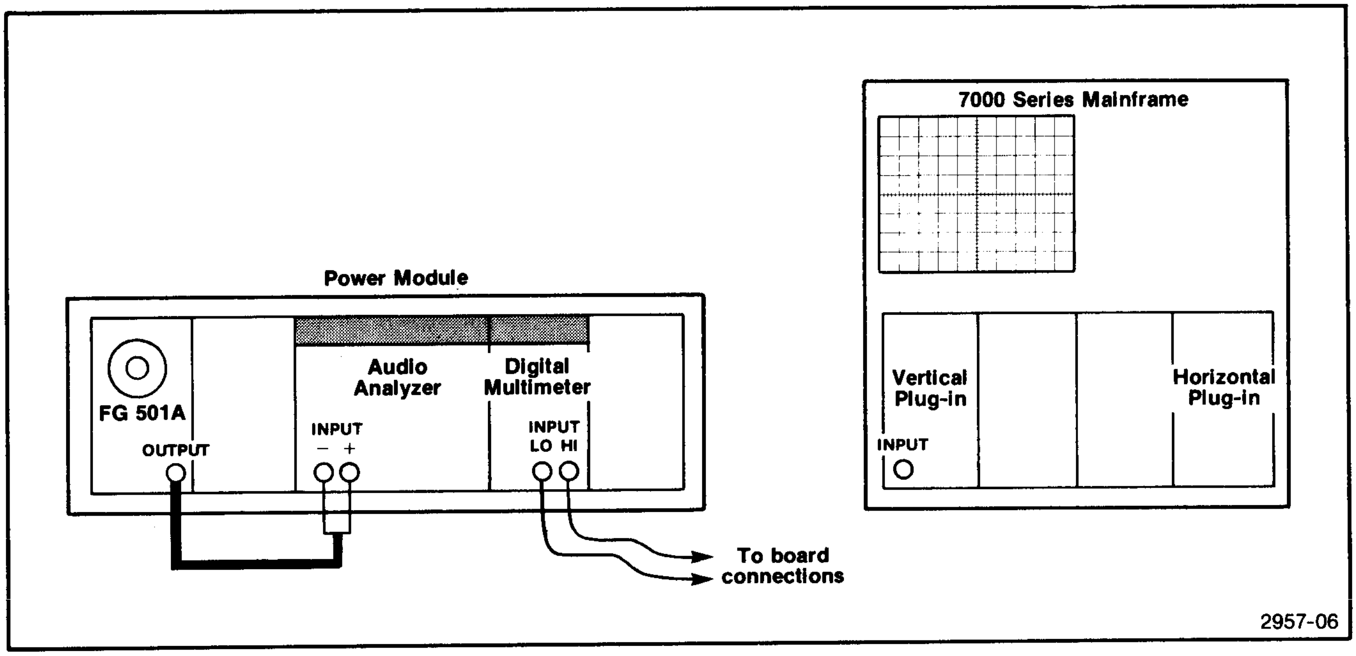


Fig. 4-2. Test setup for SINE DISTORTION adjustment.

Digital Multimeter

RANGE/FUNCTION	2 DC Volts

FG 501A

MULTIPLIER	1

a. Connect the digital mult meter 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 multimeter test leads.

10. Adjust the BOTTOM DIAL SYMM CAL (R1441)

Refer to Fig. 4-2 test setup.

a. Adjust the FG 501A FREQUENCY Hz dial to 1 and change the MULTIPLIER to 10^2.

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

OFFSET ADJUSTS

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

FG 501A

∿ (pushbutton)	in
MULTIPLIER	102
OUTPUT	ccw

Vertical Plug-in

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

11. Adjust OUTPUT OFFSET (R2201)

a. Connect a coaxial cable with 50 Ω termination from the FG 501A 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 as graticule center.

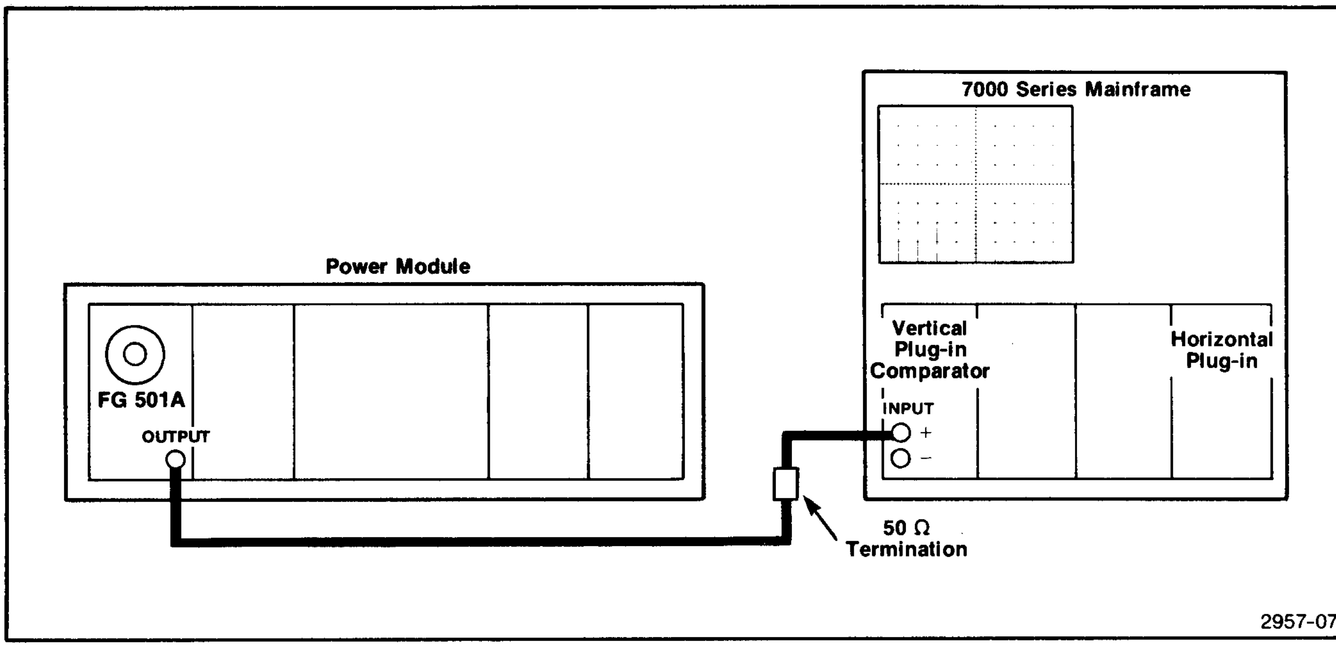


Fig. 4-3. Test setup for OFFSET and SINE/SQUARE AMPLITUDE adjustments.

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.

12. 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 -.

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. 4-3 test setup and the preliminary controls settings with the following exceptions:

FG 501A

∿ (pushbutton)	in
AMPLITUDE	cw

Vertical Plug-in

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

13. 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 501A ∿ 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.

14. Adjust the SQ WAVE AMPL (R1728)

a. Press the FG 501A ⊓⊔ pushbutton (in).

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

c. Press the FG 501A ⋁ 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 501A ⊓⊔ 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. 4-4 test setup and the preliminary control settings with the following exceptions.

FG 501A	
FREQUENCY Hz	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

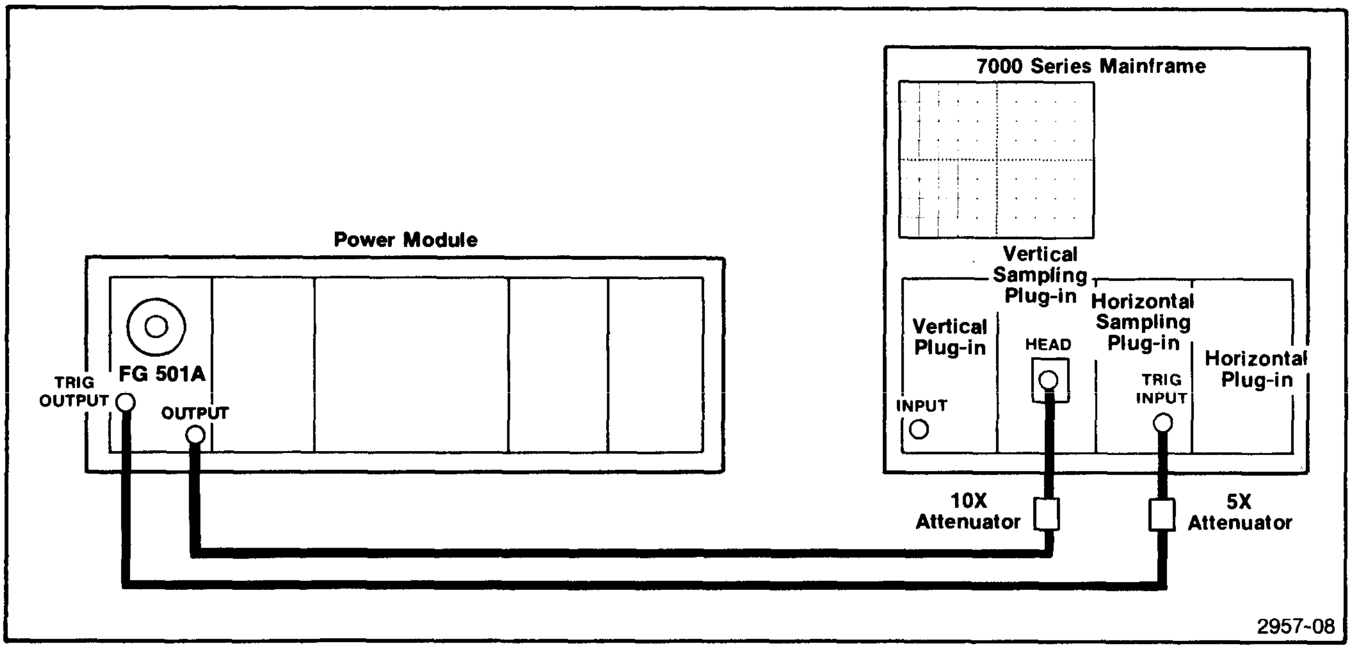


Fig. 4-4. Test setup for SQUAREWAVE COMP/RISE and FALL TIME adjustments.

15. Adjust the SQ WV COMP (C2011)

a. Connect a coaxial cable with a 10X attenuator from the FG 501A OUTPUT to the vertical plug-in sampling head input.

b. Connect a coaxial cable with a 5X attenuator from the FG 501A 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.

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 aberra-ion will appear at both the top and bottom of the waveform.

DIAL CAL/LOOP DELAY

Refer to Fig. 4-5 test setup and preliminary control setti rigs.

16. Adjust the DIAL CAL (R1321)

a. Connect a 50 Ω coaxial cable and terminator from the FG 501A output to the counter input.

b. ADJUST-potentiometer R1321 located on the main board for a counter display of 20.00.

17. Adjust LOOP DELAY (C1714)

a. Change the FG 501A MULTIPLIER to 10^5 and the digital counter FUNCTION to FREQUENCY/.1 kHz.

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

c. Remove all cables and connections.

This completes the Adjustment Procedure for the FG 501A.

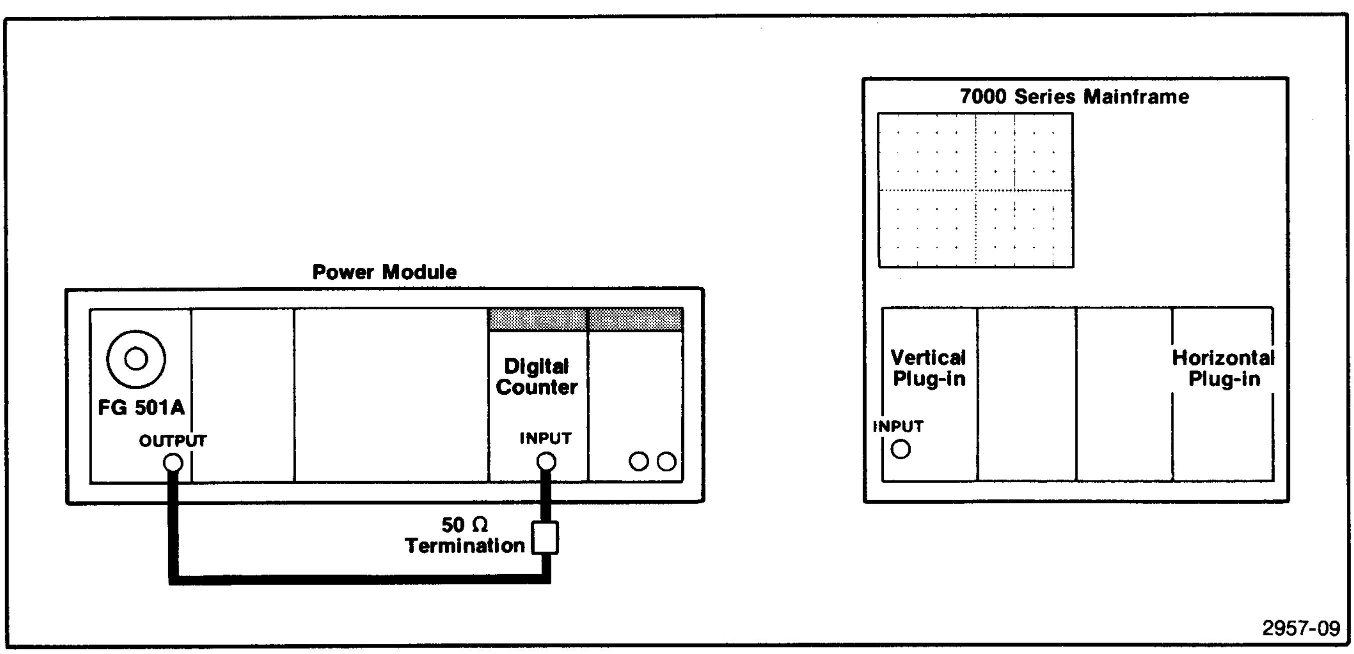


Fig. 4-5. Test setup for DIAL CAL and LOOP DELAY adjustments.

SECTION 5

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 resoldering tools.

Table 5-1

RELATIVE SUSCEPTIBILITY TO STATIC DISCHARGE DAMAGE

Semiconductor Classes	Relative Susceptibility Levels[a]
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

[a] **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 boards 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 reapir 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 multi pin 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.

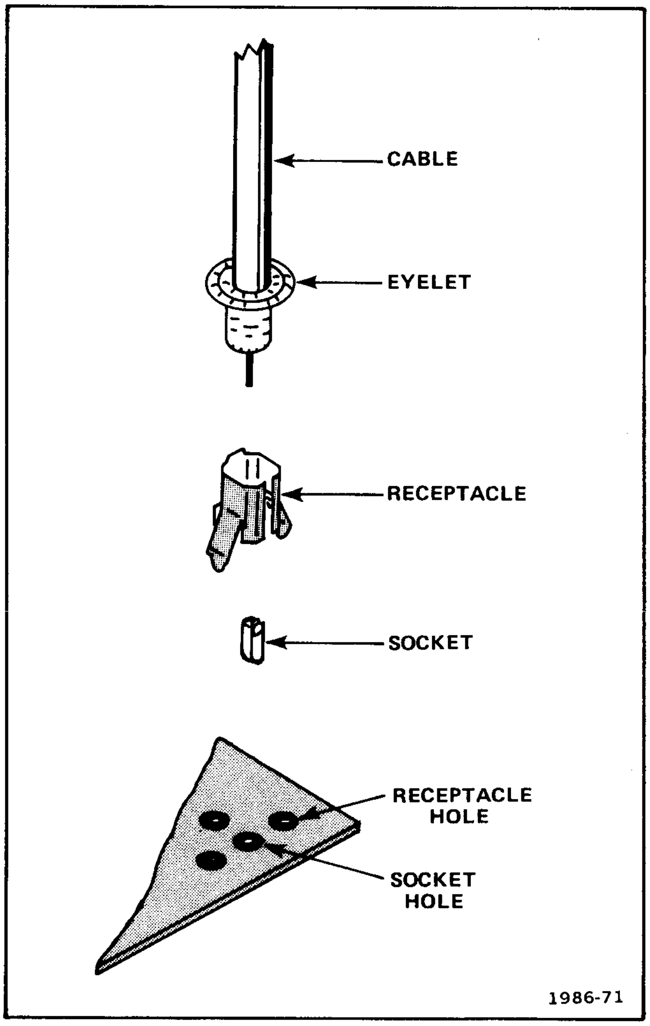


Fig. 5-1. Coaxial end lead connector assembly.

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 individaul 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.

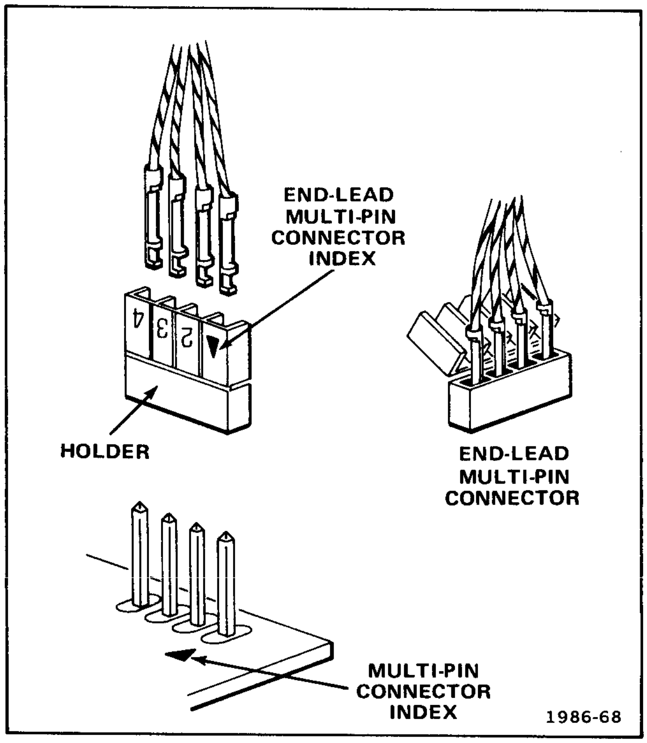


Fig. 5-2. Orientation and disassembly of multipin connectors.

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 spri rig-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.

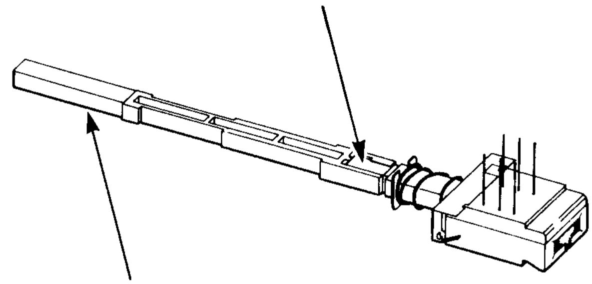


Fig. 5-3. Extension shaft and pushbutton removal.

PUSHBUTTON SWITCHES

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

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. Insert a barrier in the corresponding position of the power module jack to prevent noncompatible plug-ins from being using in that compartment. 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. A description of these connections follows.

Output (From 600 Ω) 28A

The output can be obtained at this terminal by connecting a coax cable from J2141 to J1204 on the A10 Main Board assembly. A 560 Ω resistor is in series with J2141.

Output Common 27A

This is the return connection for the output.

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 ≤10 KΩ.

Trig/Gate In Common 25B

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

ASSIGNMENTS FUNCTION	CONTACTS	ASSIGNMENTS CONTACTS	FUNCTION
Trigger out common	28B	28A	Output (from 600 Ω)
Trigger output (50 Ω)	27B	27A	Output common
	26B	26A	
Trig/gate in common	25B	25A	
Trig/gate in (1 V, ≈2 kΩ)	24B	24A	
			Family key
	23B	23A	
Vcf input common	22B	22A	
Vcf in (0 to ±10 V, 10 kΩ)	21B	21A	
	20B	20A	
	19B	19A	
	18B	18A	
	17B	17A	
	16B	16A	
	15B	15A	
	14B	14A	
	13B	13A	
+33.5 V filtered dc	12B	12A	+33.5 V filtered dc
Collector lead PNP series pass	11B	11A	Base lead PNP series pass
	10B	10A	Emitter lead PNP series pass
±33.5 V common	9B	9A	±33.5 V common
−33.5 V filtered dc	8B	8A	−33.5 V filtered dc
Collector lead NPN series pass	7B	7A	Emitter lead NPN series pass
			TM 500 barrier slot
	6B	6A	Base lead NPN series pass
	5B	5A	
	4B	4A	
	3B	3A	
	2B	2A	
	1B	1A	

2957-11

Fig. 5-4. Rear interface connector assignments.

VCF In 21B

This terminal is connected through a 10KΩ 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 In Common 22B

This connection is the ground return for the VCF In.

SECTION 6

OPTIONS

There are no options for the FG 501A 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, aerial 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 thecomplete 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.

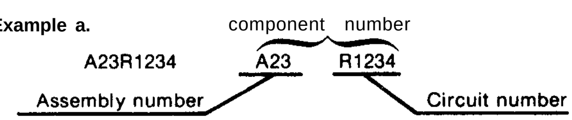
ABBREVIATIONS

Abbreviations conform to American National Standard Y1.1.

COMPONENT NUMBER (column one of the Electrical Parts List)

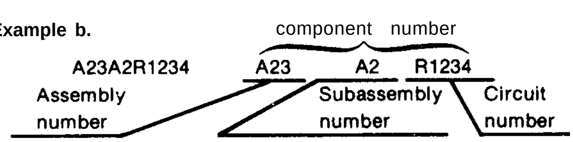
A numbering method has been used to identify assemblies, subassemblies and parts. Examples of this numbering method and typical expansions are illustrated by the following:

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 ita 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
04222	AVX CERAMICS, DIVISION OF AVX CORP.	P O BOX 867, 19TH AVE. SOUTH	MYRTLE BEACH, SC 29577
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
19701	ELECTRA-MIDLAND CORP., MEPCO ELECTRA INC.	P O BOX 760	MINERAL WELLS, TX 76067
22526	BERG ELECTRONICS, INC.	YOUR EXPRESSWAY	NEW CUMBERLAND, PA 17070
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.	87 MARSHALL ST.	NORTH ADAMS, MA 01247
71400	BUSSMAN MFG., DIVISION OF MCGRAW-EDISON CO.	2536 W. UNIVERSITY ST.	ST. LOUIS, MO 63107
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
74970	JOHNSON, E. F., CO.	299 10TH AVE. S. W.	WASECA, MN 56093
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
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	PART NUMBER
A10				CKT BOARD ASSY:FUNCTION GEN (NOT REPLACEABLE ORDER 672-0924-01)		
A12	670-6694-00	B010100	B020349	CKT BOARD ASSY:AUXILIARY	80009	670-6694-00
A12	670-6694-01	B020350		CKT BOARD ASSY:AUXILIARY	80009	670-6694-01
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:O.1UF,20%,50V	72982	8005D9AABZ5U104M
A10C1203	281-0773-00			CAP.,FXD,CER DI:0.01UF,10%,100V	04222	GC70-1C103K
A10C1224	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A10C1235	281-0763-00			CAP.,FXD,CER DI:47PF,10%,100V	72982	8035D9AADC1G470K
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:2UF,+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
A10C13434	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	04222	GC70-1C103K
A10C1532	281-0762-00			CAP.,FXD,CER DI:27PF,20%,100V	72982	8035D9AADC0G270M
A10C1543	281-0823-00	XB020350		CAP.,FXD,CER DI:470PF,10%,50V	12969	CGB471KDN
A10C1601	281-0773-00			CAP.,FXD,CER DI:O.O1UF,10%,100V	04222	GC70-1C103K
A10C1603	281-0773-00			CAP,FXD,CER DI:O.O1UF,10%,100V	04222	GC70-1C103K
A10C1611	281-0759-00			CAP.,FXD,CER DI:22PF,10%,100V	72982	8035D9AADC1G220K
A10C1613	281-0775-00			CAP.,FXD,CER DI:O.1UF,20%,50V	72982	8005D9AABZ5U104M
A10C1631	295-0164-00			CAP.SET,MTCHD:10,1,O.1,0.01UF,950PF	80009	295-0164-00
A10C1633						
A10C1641						
A10C1711	281-0773-00			CAP.,FXD,CER DI:O.O1UF,10%,100V	04222	GC70-1C103K
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:O.O1UF,10%,100V	04222	GC70-1C103K
A10C1724	281-0773-00			CAP.,FXD,CER DI:O.O1UF,10%,100V	04222	GC70-1C103K
A10C1725	281-0810-00			CAP.,FXD,CER DI:5.6PF,0.5%,100V	04222	GC10-1A5R6D
A10C1726	281-0775-00			CAP.,FXD,CER DI:O.1UF,20%,50V	72982	8005D9AABZ5U104M
A10C1741				(PART OF A10C1631)		
A10C1751						
A10C1811	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A10C1812	281-0775-00			CAP.,FXD,CER DI:O.1UF,20%,50V	72982	8005D9AABZ5U104M
A10C1813	281-0773-00			CAP.,FXD,CER DI:0.01UF,10%,100V	04222	GC70-1C103K
A10C1814	281-0773-00			CAP.,FXD,CER DI:O.O1UF,10%,100V	04222	GC70-1C103K
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:O.25-1.5PF,600V	74970	273-0001-301
A10C2013	290-0517-00			CAP.,FXD,ELCTLT:6.8UF,20%,35V	56289	196D685X0035KA1
A10C2020	281-0775-00			CAP.,FXD,CER DI:O.1UF,20%,50V	72982	8005D9AABZ5U104M
A10C2031	281-0773-00			CAP.,FXD,CER DI:O.O1UF,10%,100V	04222	GC70-1C103K
A10C2121	281-0764-00			CAP.,FXD,CER DI:82PF,5%,100V	72982	8035D9AADC1G802J
A10C2204	281-0775-00			CAP.,FXD,CER DI:O.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:O.O1UF,10%,100V	04222	GC70-1C103K
A10C2229	290-0517-00			CAP.,FXD,ELCTLT:6.8UF,20%,35V	56289	196D685X0035KA1
A10C2301	281-0773-00			CAP.,FXD,CER DI:O.O1UF,10%,100V	04222	GC70-1C103K
A10C2302	281-0812-00			CAP.,FXD,CER DI:1000PF,10%,100V	72982	8035D9AADX7R102K
A10CR1431	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	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,150MA	01295	1N4152R
A10CR2111	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A10CR2113	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A10CR2213	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A10CR2221	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A10CR2222	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	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:O.365 L X 0.025 PH BRZ GOLD (QTY OF 2)	22526	47357
A10J1121	131-0608-00			TERMINAL,PIN:O.365 L X O.O25 PH BRZ GOLD	22526	47357
A10J1202	131-0608-00			TERMINAL,PIN:O.365 L X O.O25 PH BRZ GOLD (QTY OF 3)	22526	47357
A10J1203	131-0608-00			TERMINAL,PIN:O.365 L X O.O25 PH BRZ GOLD (QTY OF 3)	22526	47357
A10J1301	131-0608-00			TERMINAL,PIN:O.365 L X O.O25 PH BRZ GOLD (QTY OF 3)	22526	47357
A10J1541	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD (QTY OF 4)	22526	47357
A10J1611	131-0608-00			TERMINAL,PIN:O.365 L X O.O25 PH BRZ GOLD (QTY OF 3)	22526	47357
A10J1641	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD (QTY OF 2)	22526	47357
A10J1651	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD (QTY OF 4)	22526	47357
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 (QTY OF 4)	22526	47357
A10J2021	131-0608-00			TERMINAL,PIN:0.365 LM X 0.025 PH BRZ GOLD (QTY OF 2)	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	04713	SJE375
A10Q1231	151-0464-00			TRANSISTOR:SILICON,NPN	04713	SJE412
A10Q1241	151-0464-00			TRANSISTOR:SILICON,NPN	04713	SJE412
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	04713	SJE376
A10Q1421	153-0586-00			SEMICOND DVD SE:2N3906,MATCHED PAIR (FURNISHED AS A MATCHED PAIR WITH A10Q1527)	80009	153-0586-00
A10Q1431	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A10Q1433	151-0367-00			TRANSISTOR:SILICON,NPN,SEL FROM 3471TP	01295	SKA6516
A10Q1440	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A10Q1445	151-0435-00			TRANSISTOR:SILICON,PNP	04713	SPS8335

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	151-1042-00			SEMICOND DVC SE:MATCHED PAIR FET	01295	SKA5390
A10Q1725						
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
A10R500	311-1392-00			RES.,VAR,WW:PNL,10K OHM,2W	02111	140-9504
A10R1103	321-0289-00			RES.,FXD,FILM:10K OHM,1%,O.125W	91637	MFF1816G10001F
A10R1113	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,O.25W	01121	CB2025
A10R1121	307-0093-00			RES.,FXD,CMPSN:1.2 OHM,5%,O.50W	01121	EB12G5
A10R1131	315-0203-00			RES.,FXD,CMPSN:20K OHM,5%,O.25W	01121	CB2035
A10R1133	321-0318-00			RES.,FXD,FILM:20K OHM,1%,O.125W	91637	MFF1816G20001F
A10R1135	321-0318-00			RES.,FXD,FILM:20K OHM,1%,O.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%,0.025W	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
A10R1301	311-1562-00			RES.,VAR,NONWIR:2K OHM,20%,0.50W	73138	91-84-0

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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
A10R1321	311-1561-00			RES.,VAR,NONWIR:2.5K OHM,20%,0.50W	73138	91-83-0
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	321-0193-03	B010100	B020339	RES.,FXD,FILM:1K OHM,0.25%,0.125W	91637	MFF1816D10000C
A10R1401	321-0222-00	B020340		RES.,FXD,FILM:2K OHM,1%,0.125W	91637	MFF1816G20000F
A10R1403	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A10R1411	321-0258-09			RES.,FXD,FILM:4.75K OHM,1%,0.125W	91637	MFF1816C47500F
A10R1412	311-1567-00	B010100	B020339	RES.,VAR,NONWIR:TRMR,100 OHM,0.50W	73138	91-89-0
A10R1412	311-1175-00	B020340		RES.,VAR,NONWIR:100 OHM,10%,0.50W	73138	68WR100
A10R1413	321-0916-03			RES.,FXD,FILM:289 OHM,0.25%,0.125W	91637	MFF1816D289R0C
A10R1421	311-0605-00			RES.,VAR,NONWIR:TRMR,200 OHM,0.5W	73138	82-23-2
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
A10R1429	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
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 OHOM,20%,0.50W	73138	91-81-0
A10R1451	307-0051-00			RES.,FXD,CMPSN:2.7 OHM,5%,0.50W	01121	EB27G5
A10R1501	321-0754-07	B010100	B020339	RES.,FXD,FILM:900 OHM,0.1%,0.125W	91637	MFF1816C900R0B
A10R1501	321-0641-00	B020340		RES.,FXD,FILM:1.8K OHM,1%,0.125W	91637	MFF1816G18000F
A10R1511	311-1565-00	B010100	B020339	RES.,VAR,NONWIR:250 OHM,20%,0.50W	73138	91-87-0
A10R1511	311-1307-00	B020340		RES.,VAR,NONWIR:500 OHM,0.50W	32997	3299W-R27-501
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
A10R1551	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A10R1553	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF181G10001F
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

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A10R1711	315-0101-00	B010100	B020349	RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A10R1711	315-0361-00	B020350		RES.,FXD,CMPSN:360 OHM,5%,0.25W	01121	CB3615
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
A10R1714	315-0472-00	XB020350		RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
A10R1715	315-0472-00	XB020350		RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
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
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.,CAR,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	321-0268-00			RES.,FXD,FILM:6.04K OHM,1%,0.125W	91637	MFF1816G60400F
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

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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
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
A10R2301	315-0330-00			RES.,FXD,CMPSN:33 OHM,5%,0.25W	01121	CB3305
A10R2335	315-0750-00	B010100	B020709	RES.,FXD,CMPSN:75 OHM,5%,0.25W	01121	CB7505
A10R2335	321-0046-00	B020710		RES.,FXD,FILM:29.4 OHM,1%,0.125W	91637	MFF1816G29R40F
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	CECTO-80R60F
A10S1901	260-1268-01			SWITCH,PUSH:3 BUTTON,2 POLE,FUNCTION	80009	260-1268-01
A10S2331	260-2020-00			SWITCH,PUSH:4 BUTTON,2 POLE,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	04713	MC78L05ACP
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%	04713	SZG35009K3
A10VR1413	152-0456-00			SEMICOND DEVICE:ZENER,0.4W,6.2V,5%	04713	1N827
A10VR1532	152-0667-00			SEMICOND DEVICE:ZENER,0.4W,3.0V,2%	04713	SZG30025RL
A10VR1811	152-0278-00			SEMICOND DEVICE:ZENER,0.4W,3V,5%	04713	SZG35009K20
A10VR1813	152-0212-00			SEMICOND DEVICE:ZENER,0.5W,9V,5%	04713	SZ50646RL
A10VR2213	152-0590-00			SEMICOND DEVICE:ZENER,18V,5% AT 7MA	80009	152-0590-00
A10W1411	131-0566-00			BUS CONDUCTOR:DUMMY RES,2.375,22 AWG	55210	L-2007-1
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

COMPONENT NO.	TEKTRONIX PART NO.	SERIAL/MODEL NO. EFF	DSCONT	NAME & DESCRIPTION	MFR CODE	MFR PART NUMBER
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	04222	GC10-1A5R6D
A12C1020	281-0810-00			CAP.,FXD,CER DI:5.6PF,0.5%,100V	04222	GC10-1A5R6D
A12C1022	281-0810-00			CAP.,FXD,CER DI:5.6PF,0.5%,100V	04222	GC10-1A5R6D
A12C1100	290-0301-00			CAP.,FXD,ELCTLT:10UF,10%,20V	56289	150D106X9020B2
A12C1110	281-0773-00			CAP.,FXD,CER DI:0.01UF,10%,100V	04222	GC70-1C103K
A12C1112	281-0773-00			CAP.,FXD,CER DI:0.01UF,10%,100V	04222	GC70-1C103K
A12C1120	281-0773-00			CAP.,FXD,CER DI:0.01UF,10%,100V	04222	GC70-1C103K
A12C1200	281-0773-00			CAP.,FXD,CER DI:0.01UF,10%,100V	04222	GC70-1C103K
A12C1202	290-0301-00			CAP.,FXD,ELCTLT:10UF,10%,20V	56289	150D106X9020B2
A12C1215	281-0630-00	XB020350		CAP.,FXD,CER DI:390PF,5%,500V	72982	630000Y5D391J
A12C1220	281-0764-00			CAP.,FXD,CER DI:82PF,5%,100V	72982	8035D9AADC1G802
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	04222	GC70-1C103K
A12C1320	283-0177-00			CAP.,FXD,CER DI:1UF,+80-20%,25V	56289	273C5
A12CR1000	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A12CR1110	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A12CR1200	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A12CR1220	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A12CR1221	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A12CR1225	152-0141-02	XB020350		SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A12CR1226	152-0141-02	XB020350		SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A12CR1320	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	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,O.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

COMPONENT NO.	TEKTRONIX PART NO.	SERIAL/MODEL NO. EFF	DSCONT	NAME & DESCRIPTION	MFR CODE	PART NUMBER
A12R1119	315-0181-00			RES.,FXD,CMPSN:180 OHM,5%,0.25W	01121	CB1815
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
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
A12R1215	315-0204-00	XB020350		RES.,FXD,CMPSN:200K OHM,5%,0.25W	01121	CB2045
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
A12R1225	315-0472-00	XB020350		RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
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	156-0382-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN74LS00(N OR J)

COMPONENT NO.	TEKTRONIX PART NO.	SERIAL/MODEL NO. EFF	DSCONT	NAME & DESCRIPTION	CODE	MFR PART NUMBER
CR500	150-1033-00			LT EMITTING DIO:YELLOW,585NM,40MA MAX	50434	HLMP 1401
CR510	150-1029-00			LT EMITTING DIO:GREEN,565NM,35MA	53184	XC209G
J500	131-0955-00			CONN,RCPT,ELECT:BNC,FEMALE	13511	31-279
J510	131-0955-00			CONN,RCPT,ELEC:BNC,FEMALE	13511	31-279
J520	131-0955-00			CONN,RCPT,ELEC:BNC,FEMALE	13511	31-279
J530	131-0955-00			CONN,RCPT,ELEC:BNC,FEMALE	13511	31-279
R510	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 (FURNISHED AS A UNIT WITH S500)	12697	CM41780
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	311-2107-00			RES.,VAR,NONWIR:DUAL,PNL,1K X 50K OHM (FURNISHED AS A UNIT WITH S510)	12697	CM41781
S500				(PART OF R530)		
S510				(PART OF R560)		
S1731	263-1189-00			SW CAM ACTR AS:FREQUENCY MULTIPLIER	80009	263-1189-00

DIAGRAMS AND CIRCUIT BOARD ILLUSTRATIONS

Symbols

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

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

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

Abbreviations are based on ANSI Y1.1-1972.

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

Y14.15, 1966	Drafting Practices.
Y14.2, 1973	Line Conventions and Lettering.
Y10.5, 1968	Letter Symbols for Quantities Used in Electrical Science and Electrical Engineering.

American National Standard Institute
1430 Broadway
New York, New York 10018

Component Values

Electrical components shown on the diagrams are in the following units unless noted otherwise:

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

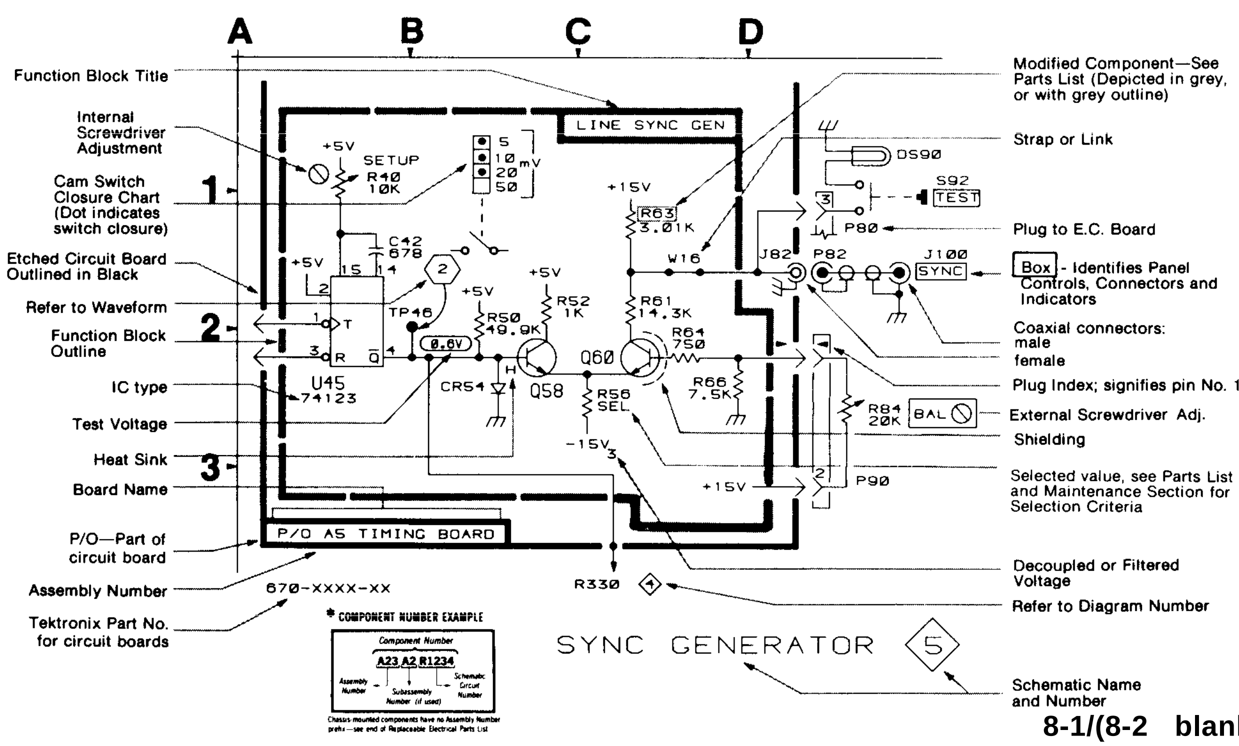
Resistors = Ohms (Ω).

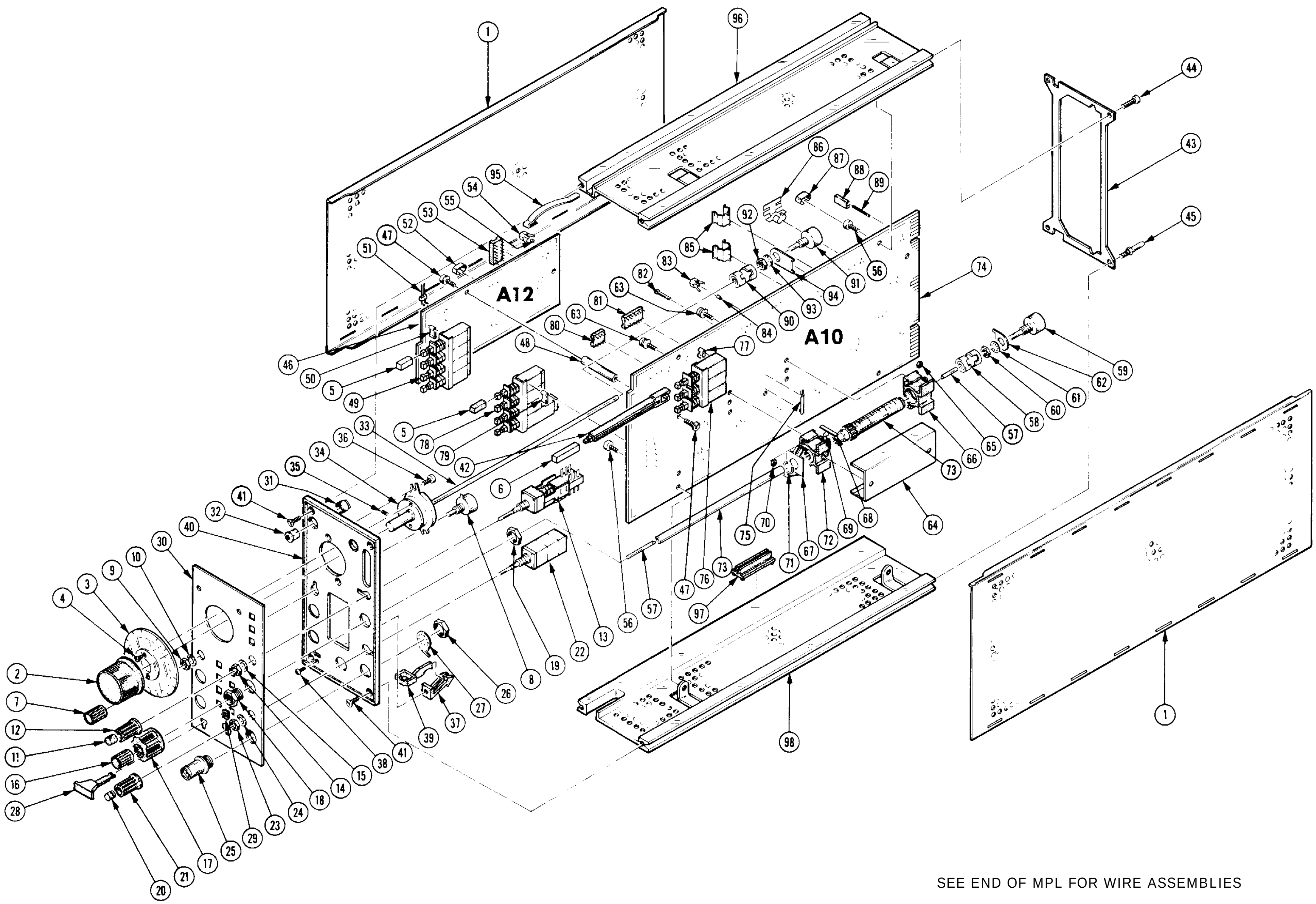
The information and special symbols below may appear in this manual.

Assembly Numbers and Grid Coordinates

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

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





SEE END OF MPL FOR WIRE ASSEMBLIES

FG 501A FUNCTION GENERATOR EXPLODED VIEW

ADJUSTMENT LOCATIONS

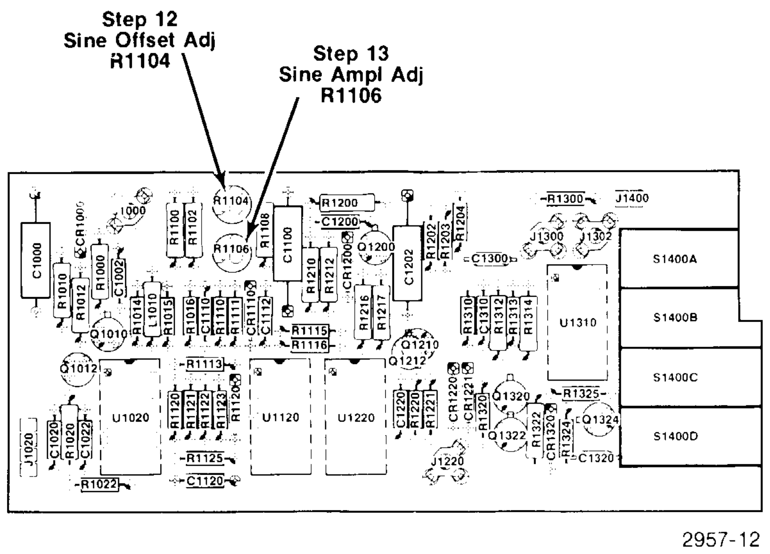


Fig. 8-1. Auxiliary Board.

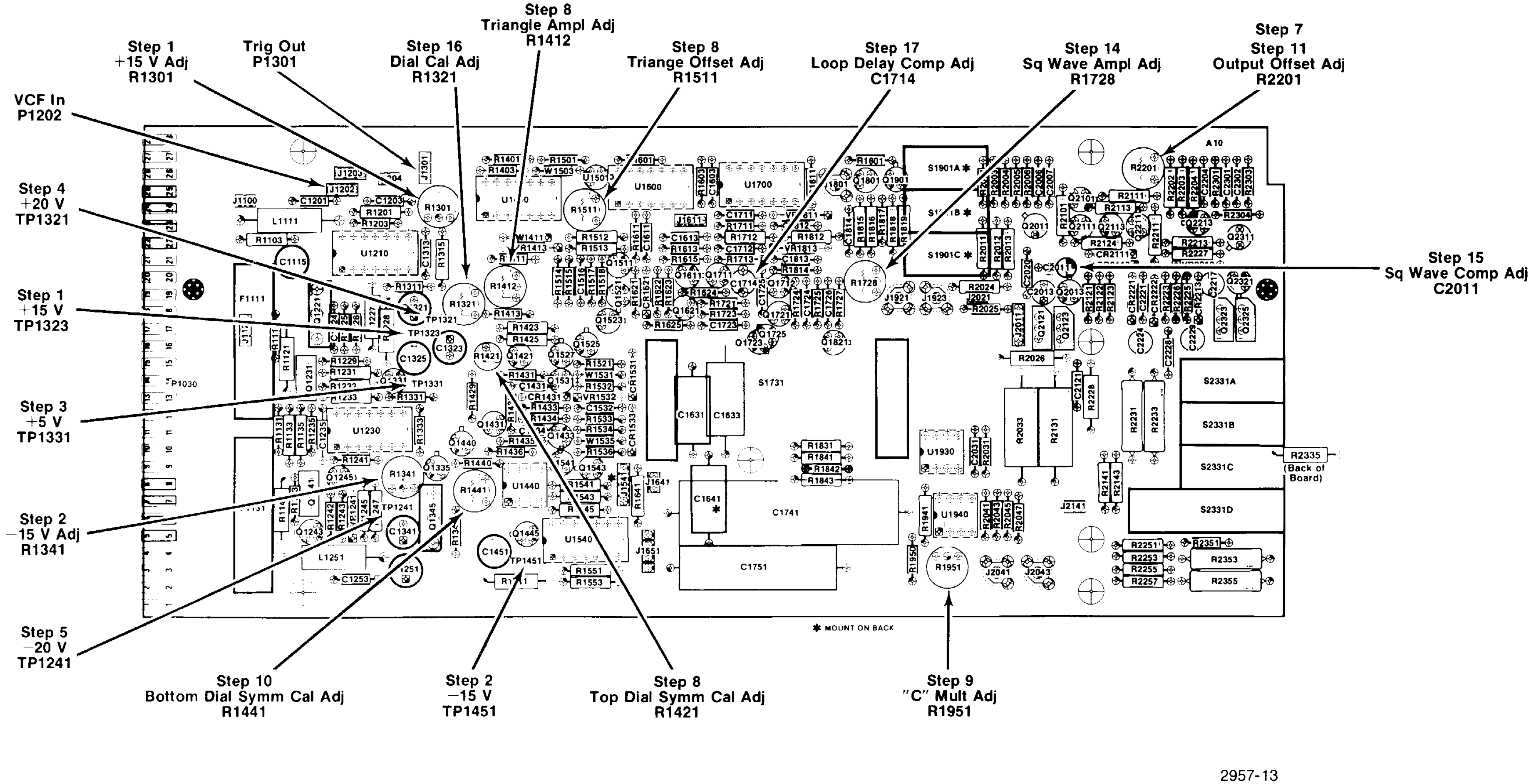
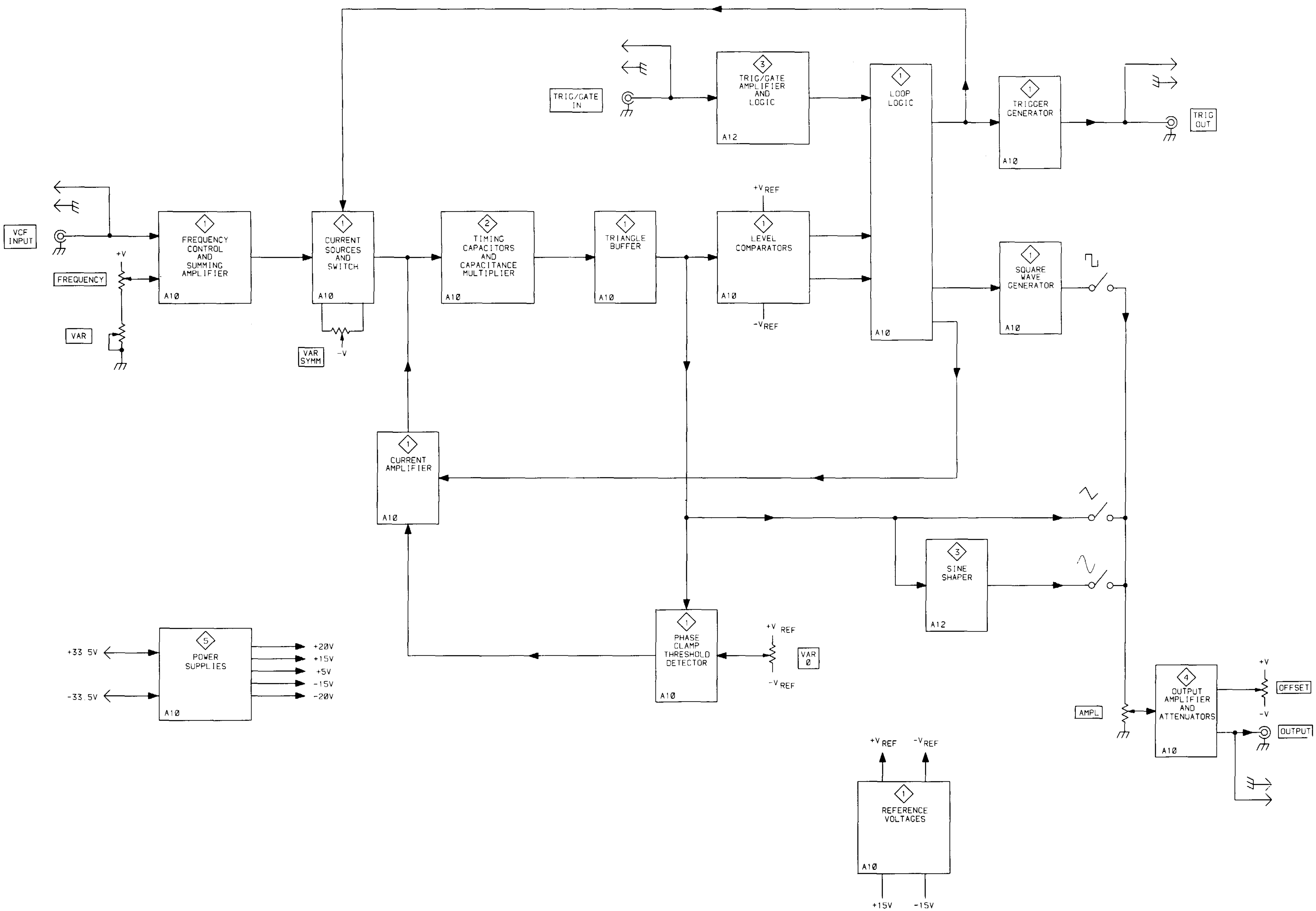


Fig. 8-2. Main Board.



FG 5Ø1A BLOCK DIAGRAM

Fig. 8-3.

2957-40

JS

PARTS LOCATION GRID

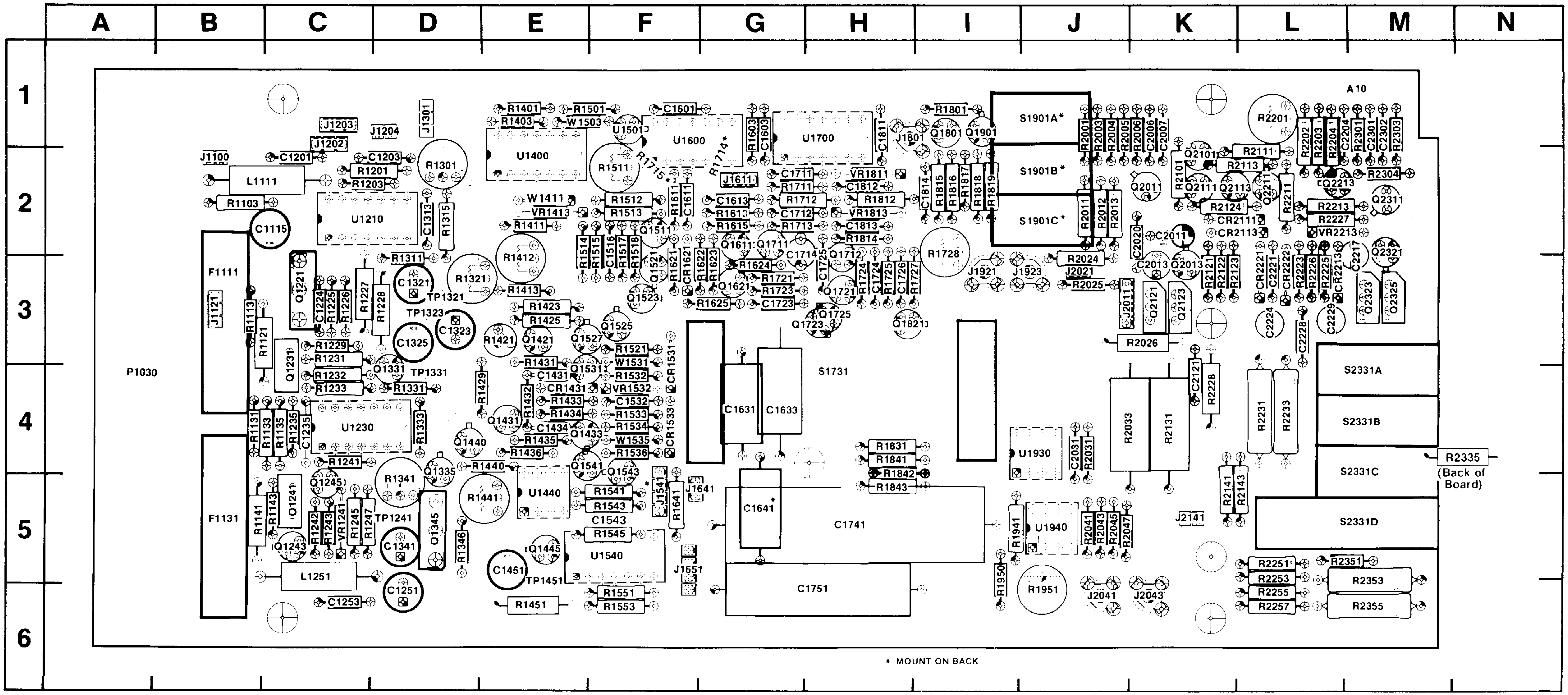


Fig. 8-4. Main Board (A10 Assy).

COMPONENT NUMBER EXAMPLE

Component Number

A23 A2 R1234

Assembly Number — Subassembly Number (if used) — Schematic Circuit Number

Chassis mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List

Static Sensitive Devices
See Maintenance Section

TABLE 8-1
COMPONENT REFERENCE CHART

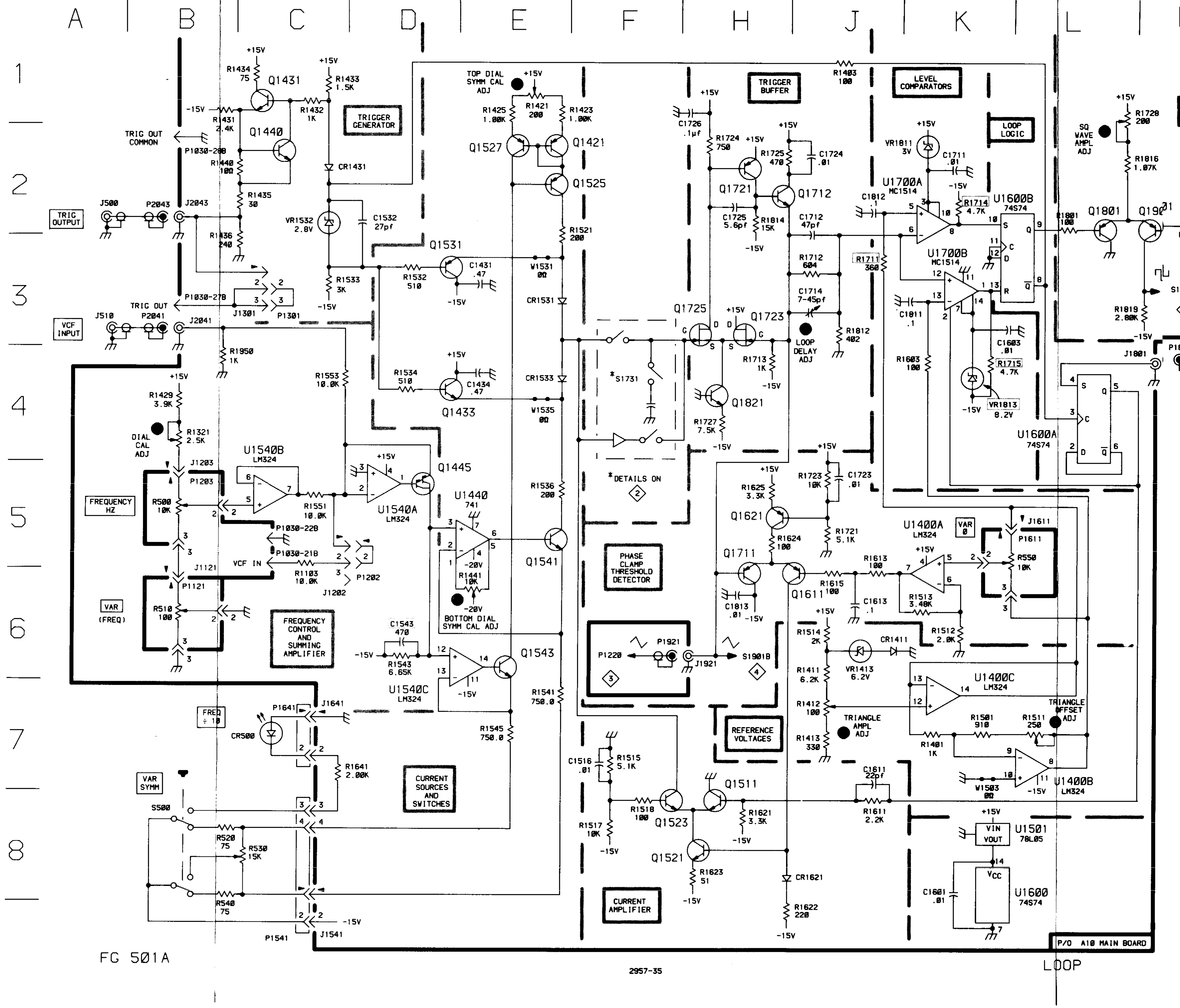
P/O A10 ASSY — MAIN BOARD ⟨1⟩

CIRCUIT NUMBER	SCHEMATIC LOCATION	BOARD LOCATION
C1431	E3	E4
C1434	E4	E4
C1516	F7	F2
C1532	D2	F4
C1543	D6	F5
C1601	K8	F1
Cl 603	K3	G1
C1611	J7	F2
C1613	J6	G2
C1711	K2	G2
C1712	J2	G2
C1714	J3	G2
C1723	J5	G3
C1724	J2	H3
C1725	H2	H3
C1726	H1	H3
C1811	K3	H1
C1812	J2	H2
C1813	H6	H2
C1814	M3	I2
CR1431	C2	E4
CR1531	E3	F3
CR1533	E4	F4
CR1621	H8	F3
J1121	B6	B3
J1202	D5	C1
J1203	B5	C1
J1301	C3	D2
J1541	C8	F5
J1611	K5	G2
J1641	C7	F5
J1801	M4	H1
J1921	H6	I3
J2041	93	J6
J2043	92	K6
P1030	B3	A4
P1121	B6	93
P1203	B5	C1
P1301	C3	D2
P1541	C8	F5
P1611	K5	G2
P1641	C7	F5
P1801	M4	H1
P1921	F6	I3
P2041	93	J6
Q1421	E2	E3
Q1431	cl	E4
Q1433	D4	E4
Q1440	C2	D4
Q1445	D5	E5
Q1511	H8	F2
Q1521	H8	F3
Q1523	F8	F3

CIRCUIT NUMBER	SCHEMATIC LOCATION	BOARD LOCATION
Q1525	E2	F3
Q1527	E2	E3
Q1531	D3	E4
Q1541	E5	E4
Q1543	E6	F4
Q1611	H5	G2
Q1621	H5	G3
Q1711	H5	G2
Q1712	H2	H2
Q1721	H2	H3
Q1723	H3	H3
Q1725	H3	H3
Q1801	L2	I1
Q1821	H4	H3
Q1901	M2	I1
R1103	C5	B2
R1321	94	D3
R1401	K7	E1
R1403	J1	E1
R1411	J6	E2
R1412	J7	E3
R1413	J7	E3
R1421	E1	E3
R1423	E1	E3
R1425	E1	E3
R1429	B4	E4
R1431	B1	E3
R1432	C1	E4
R1433	C1	E4
R1434	C1	E4
R1435	C2	E4
R1436	B3	E4
R1440	B2	E4
R1441	E6	E5
R1501	K7	F1
R1511	L7	F2
R1512	K6	F2
R1513	K6	F2
R1514	J6	E2
R1515	F7	F2
R1517	F8	F2
R1518	F8	F2
R1521	E2	F3
R1532	D3	F4
R1533	C3	F4
R1534	D4	F4
R1536	E5	F4
R1541	E7	F5
R1543	D6	F5
R1545	E7	F5
R1551	C5	F6
R1553	C4	F6
R1603	K4	G1
R1611	J8	F2
R1613	J5	G2
R1615	J6	G2
R1621	H8	F3
R1622	H8	G3

CIRCUIT NUMBER	SCHEMATIC LOCATION	BOARD LOCATION
R1623	H8	G3
R1624	H5	G3
R1625	H5	G3
R1641	C7	F5
R1711	J3	G2
R1712	J3	G2
R1713	H4	G2
R1714	K2	G2
R1715	K4	F2
R1721	J5	G3
R1723	J5	G3
R1724	H2	H3
R1725	H2	H3
R1727	H4	H3
R1728	L1	I2
R1801	L2	I1
R1812	J3	H2
R1814	H2	H2
R1815	M3	I2
R1816	L2	I2
R1817	M2	I2
R1818	M2	I2
R1819	M3	I2
R1950	B4	I5
R2043	B2	J5
U1400A	K5	E2
U1400B	L5	E2
U1400C	K7	E2
U1501	K8	F1
U1540A	D5	F5
U1540B	C5	F5
U1540C	D6	F5
U1600A	L4	F1
U1600B	K2	F1
U1700A	K2	H1
U1700B	K3	H1
VR1413	J6	E2
VR1532	C2	F4
VR1811	K2	H2
VR1813	K4	H2
W1411	J6	E2
w 1503	K7	El
W1531	E3	F3
W1535	E4	F4
CR500	C7	Chassis
J500	A2	Chassis
J510	A3	Chassis
R500	C8	Chassis
R510	B6	Chassis
R520	C8	Chassis
R530	C8	Chassis
R540	C8	Chassis
S500	98	Chassis

P/O **A10 ASSY also shown on** ⟨2⟩ ⟨3⟩ ⟨4⟩ ⟨5⟩



SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS OUTLINED OR DEPICTED IN GREY

Static Sensitive Devices
See Maintenance Section

COMPONENT NUMBER EXAMPLE

Component Number
A23 A2 R1234
Assembly Number — Subassembly Number (if used) — Schematic Circuit Number

Chassis-mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.

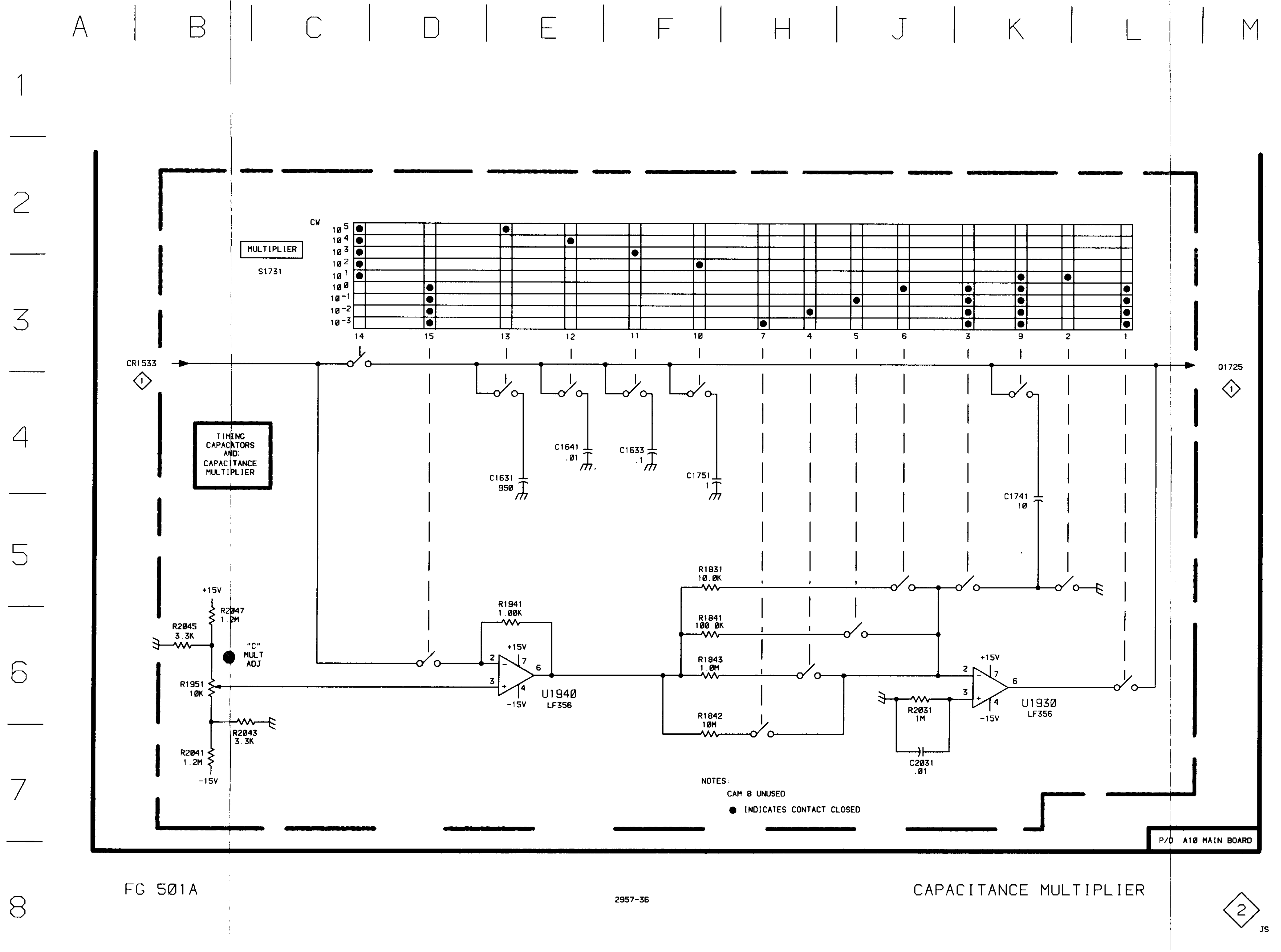
⟨1⟩

TABLE 8-2
COMPONENT REFERENCE CHART

P/O A10 ASSY MAIN BOARD 2

CIRCUIT NUMBER	SCHEMATIC LOCATION	BOARD LOCATION
C1631	**E4**	**G4**
C1633	**F4**	**G4**
C1641	**E4**	**G5**
C1741	**K4**	**H5**
C1751	**F4**	**H6**
C2031	**J7**	**J4**
R1831	F5	H4
R1841	F6	H4
R1842	F7	H4
R1843	F6	**H5**
R1941	E6	**I5**
R1951	**B6**	J6
R2031	**J6**	J4
R2041	**B7**	**J5**
R2043	**B7**	**J5**
R2045	**B6**	J5
R2047	**B6**	J5
S1731	C3	H4
U1930	K6	J4
U1940	E6	J5

P/O A10 ASSY also shown on 1 3 4 5



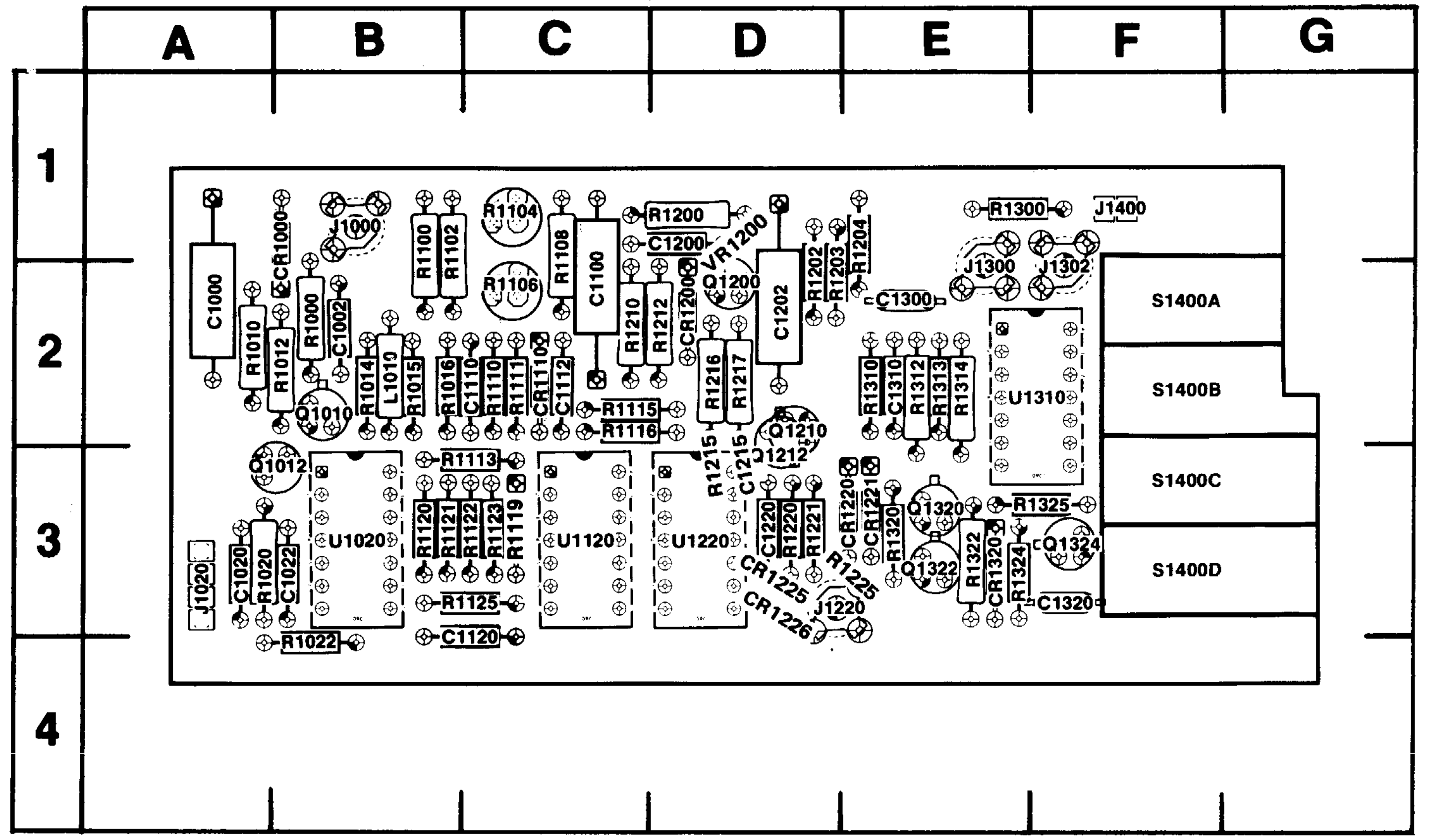
Static Sensitive Devices
See Maintenance Section

COMPONENT NUMBER EXAMPLE

Component Number
A23 A2 R1234
Assembly Number — Subassembly Number (if used) — Schematic Circuit Number

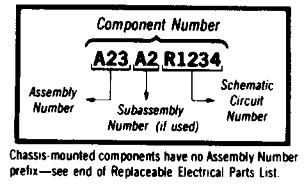
Chassis-mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.

PARTS LOCATION GRID



2957-17A

Fig. 8-5. Auxiliary Board (A12 Assy).



Static Sensitive Devices
See Maintenance Section

TABLE 8-3
COMPONENT REFERENCE CHART

A12 ASSY — AUXILIARY BOARD ◇3

CIRCUIT NUMBER	SCHEMATIC LOCATION	BOARD LOCATION
C1000	J5	A2
C1002	F5	B2
C1020	J6	A3
C1022	K6	B3
C1100	E8	C2
C1110	D5	C2
C1112	B8	C2
C1120	B7	C3
C1200	B4	D1
C1202	C4	D2
C1215	C4	D3
C1220	F4	D3
C1300	E1	E2
C1310	C2	E2
C1320	F4	F3
CR1000	J6	B1
CR1110	C8	C2
CR1120	C7	C3
CR1200	B4	D2
CR1220	C3	E3
CR1221	C2	E3
CR1225	H5	D3
CR1226	H5	D3
CR1320	E4	E3
J1000	M7	B1
J1020	B6	A3
J1100	B3	B2
J1220	K4	D3
J1300	B2	E2
J1302	M2	F2
J1400	B1	F1
L1010	L7	B2
P1000	M7	B1
P1020	B6	A3
P1030	A3	A4
P1220	K4	D3
P1300	B2	E2
P1302	M2	F2
P1400	B1	F1
Q1010	E5	B2

CIRCUIT NUMBER	SCHEMATIC LOCATION	BOARD LOCATION
Q1012	J6	A3
Q1200	C4	D2
Q1210	C5	D2
Q1212	F4	D3
Q1320	D1	E3
Q1322	E3	E3
Q1324	F3	F3
R1000	H7	B2
R1010	J6	A2
R1012	J6	B2
R1014	L7	B2
R1015	J8	B2
R1016	B7	B2
R1020	K7	A3
R1022	B6	B4
R1100	J5	B1
R1102	J5	B1
R1104	J5	C1
R1106	M7	C2
R1108	C8	C1
R1110	H8	C2
R1111	D6	C2
R1113	E6	B3
R1115	D8	C2
R1116	D8	C2
R1119	C7	C3
R1120	L6	B3
R1121	D5	B3
R1122	D5	C3
R1123	H7	C3
R1125	D6	C3
R1200	C4	D1
R1202	B4	D2
R1203	C3	C2
R1204	C2	E1
R1210	E8	C2
R1212	D8	D2
R1215	C5	D3
R1216	C5	D2
R1217	E4	D2
R1220	H4	D3

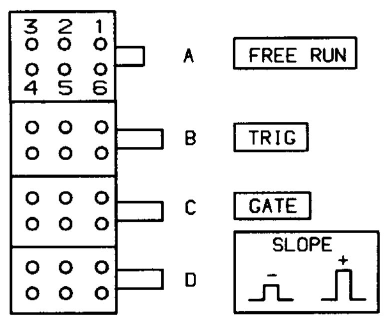
CIRCUIT NUMBER	SCHEMATIC LOCATION	BOARD LOCATION
R1221	B5	D3
R1225	H4	D3
R1300	C1	E1
R1310	E1	E2
R1312	D2	E2
R1313	D1	E2
R1314	D1	E2
R1320	D3	E3
R1322	E4	E3
R1324	F3	E3
R1325	F2	F3
S1400A	L2	F2
S1400B	L2	F2
S1400C	L2	F3
S1400D	E3	F3
U1020A	J7	B3
U1020B	J7	B3
U1020C	L6	B3
U1020D	D5	B3
U1020E	J7	B3
U1020	J7	B3
U1120A	E7	C3
U1120B	E7	C3
U1120C	C7	C3
U1120D	F7	C3
U1120E	E8	C3
U1220A	D6	D3
U1220B	E7	D3
U1220C	C6	D3
U1220D	F6	D3
U1220E	D8	D3
U1310A	J2	F2
U1310B	K3	F2
U1310C	J2	F2
U1310D	H2	F2
VR1200 *	B4	D1
CR510	B1	Chassis
J520	B2	Chassis

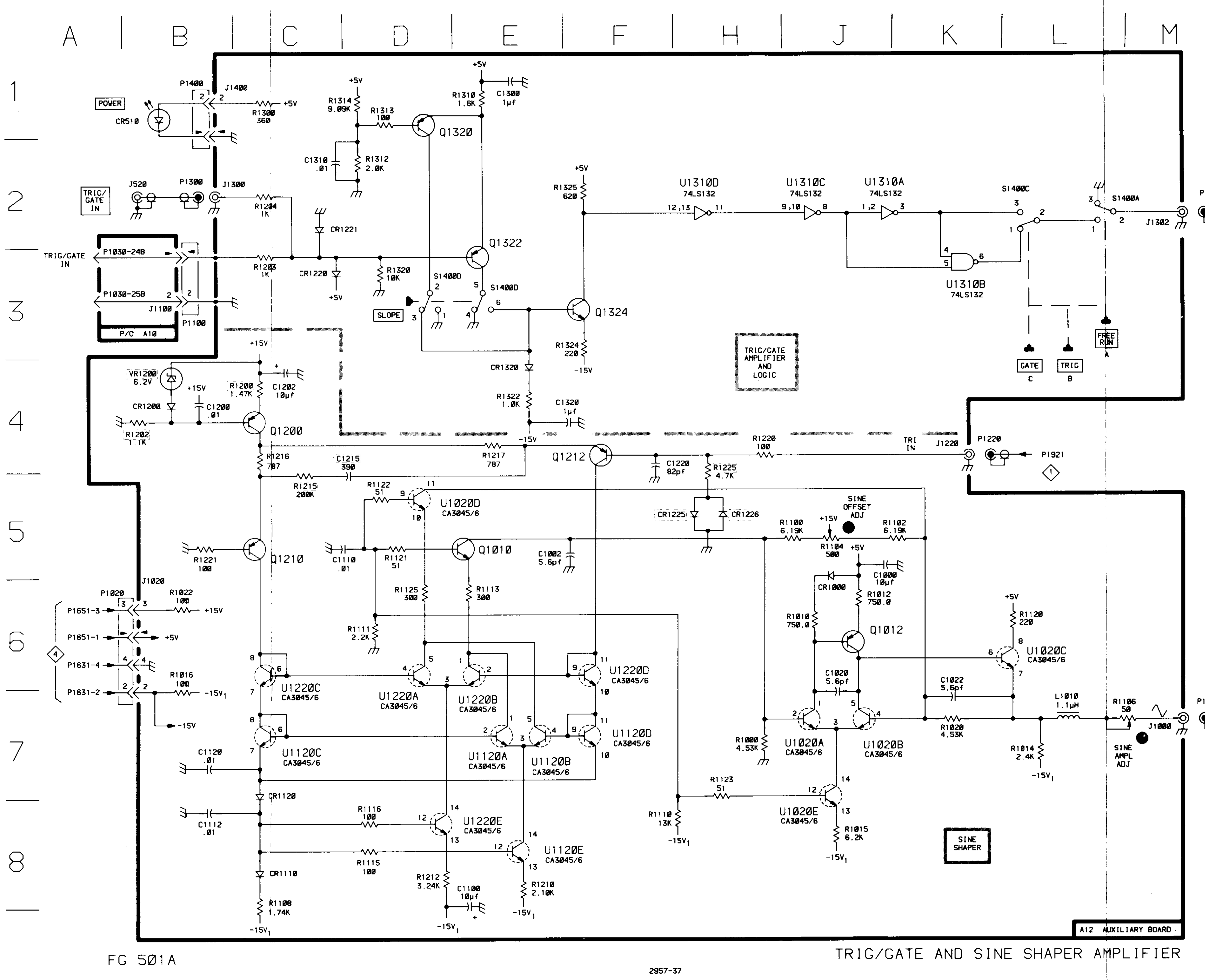
P/O A10 ASSY — MAIN BOARD ◇3

CIRCUIT NUMBER	SCHEMATIC LOCATION	BOARD LOCATION
J1100	B3	S2
P1100	B3	B2

P/O **A10 ASSY also shown on** ◇1 ◇2 ◇4 ◇5

S1400





FG 501A

TRIG/GATE AND SINE SHAPER AMPLIFIER

2957-37

SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS OUTLINED OR DEPICTED IN GREY

Static Sensitive Devices
See Maintenance Section

COMPONENT NUMBER EXAMPLE

Component Number

A23 A2 R1234

Assembly Number — *Subassembly Number (if used)* — *Schematic Circuit Number*

Chassis-mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.

3

JS

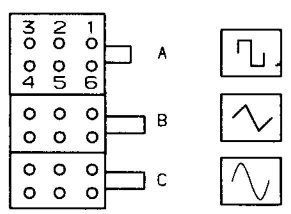
TABLE 8-4
COMPONENT REFERENCE CHART

P/O A10 ASSY — MAIN BOARD 4

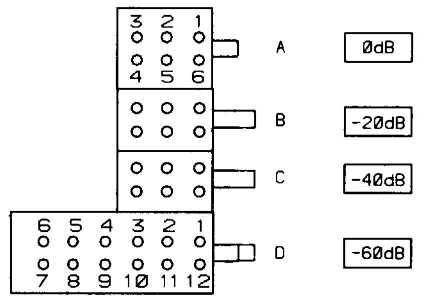
CIRCUIT NUMBER	SCHEMATIC LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEMATIC LOCATION	BOARD LOCATION
C2006	H2	K1	R2012	ES	J2
C2007	H2	K1	R2013	F2	J1
C2011	F4	**K2**	R2024	**D4**	J2
C2013	H1	**K3**	R2025	**C7**	J3
C2020	**H2**	K2	R2026	H4	**K3**
C2121	**H5**	K4	R2033	H5	**J4**
C2204	D6	**L1**	R2101	D2	K2
C2217	H7	**M2**	R2111	ES	L1
C2221	F5	L3	R2113	E4	L2
C2224	**F1**	**L3**	R2121	H3	K3
C2228	**F2**	**L3**	R2122	H3	K3
C2229	F8	L3	R2123	F3	K3
C2301	H8	M1	R2124	F2	K2
C2302	H8	M1	R2131	**H5**	K4
			R2141	**J5**	KS
CR2111	E4	L2	R2143	J4	L5
CR2113	F5	**L2**	R2201	E5	L1
CR2213	**F5**	**L3**	R2202	**D6**	L1
CR2221	**F4**	L3	R2203	**E6**	L1
CR2222	H6	L3	R2204	E6	L1
			R2211	F4	L2
J1204	M6	D1	R2213	F8	**L2**
J1651	M1	**F5**	R2223	H7	**L3**
J1923	**B6**	**J3**	R2225	**H6**	L3
J2011	**C1**	J3	R2226	**J6**	L3
J2021	C5	J3	R2227	F8	L2
J2141	M6	KS	R2228	**H5**	K4
			R2231	**J4**	L4
P1030	M6	**A4**	R2233	J5	**L4**
P1651	M1	**F5**	R2251	K4	**L5**
P1923	**B6**	**J3**	R2253	K4	**L5**
P2011	**C1**	**J3**	R2255	K4	**L6**
P2021	C5	J3	R2257	**K4**	L6
			R2301	**H7**	M1
02011	F3	K2	R2303	H8	**M1**
Q2013	F4	K3	R2304	H7	**M2**
Q2101	D5	K2	R2335	C5	N4
Q2111	F2	K2	R2351	M6	**L5**
02113	E5	K2	R2353	KS	**M5**
Q2121	H4	K3	R2355	K4	M6
02123	H4	K3			
02211	E4	L2	S1901A	C4	**J1**
02213	**F8**	**L2**	S1901B	C5	**J2**
Q2311	**F7**	**M2**	S1901C	**C6**	J2
Q2321	F6	M2	S2331B	**J4**	M4
Q2323	H6	M3	S2331C	**K3**	M4
Q2325	H6	M3	S2331D	K4	MS
R2001	C6	**J1**	VR2213	F7	L2
R2003	D5	**J1**			
R2004	**H3**	J1	J530	M5	Chassis
R2005	**H3**	J1	R560A	**B1**	Chassis
R2006	H2	**K1**	R560B	**C5**	Chassis
R2011	**F5**	**J2**		B1	Chassis
				B2	Chassis

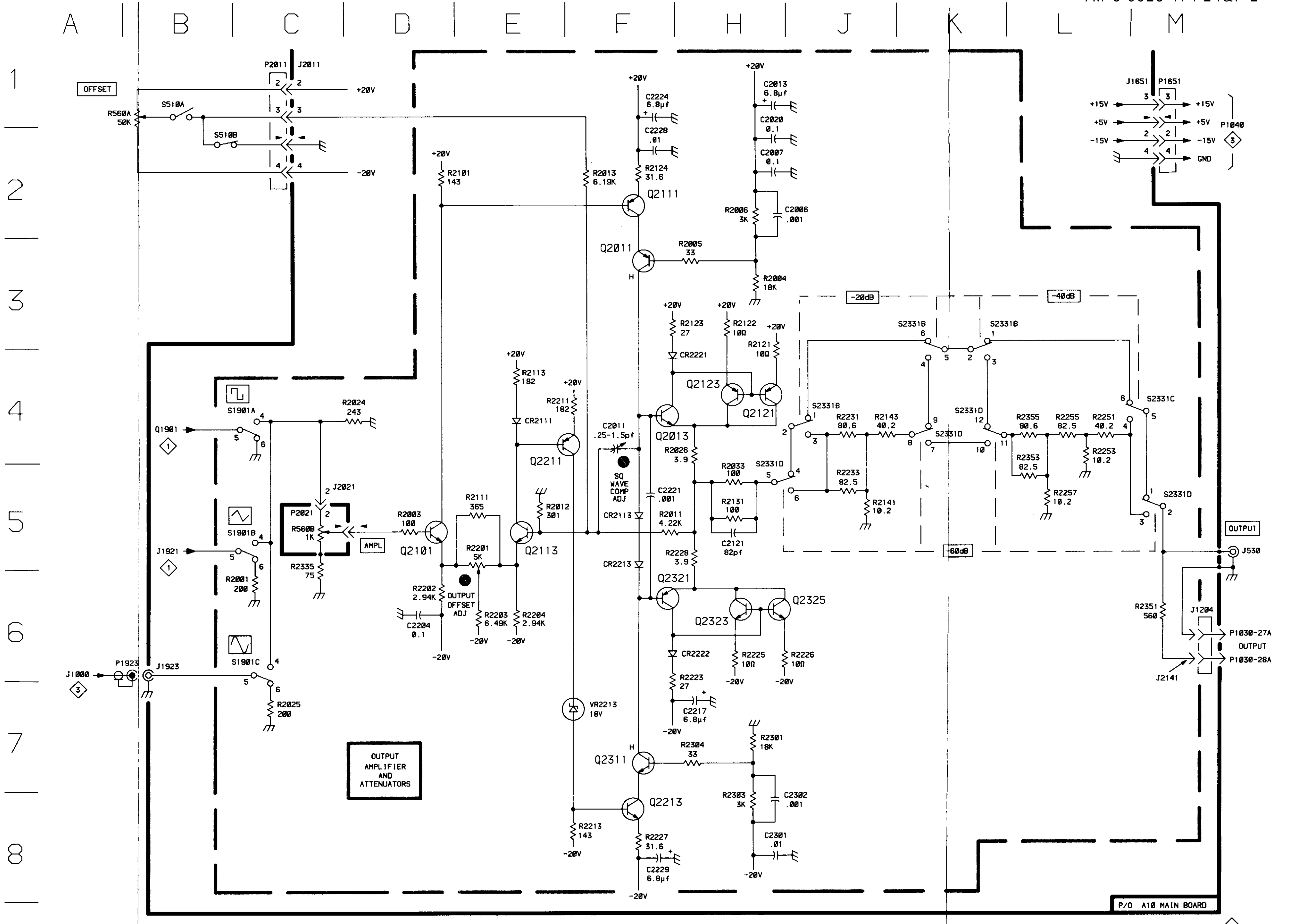
P/O **A10 ASSY also shown on** 1 2 3 5

S1901



S2331





FG 501A

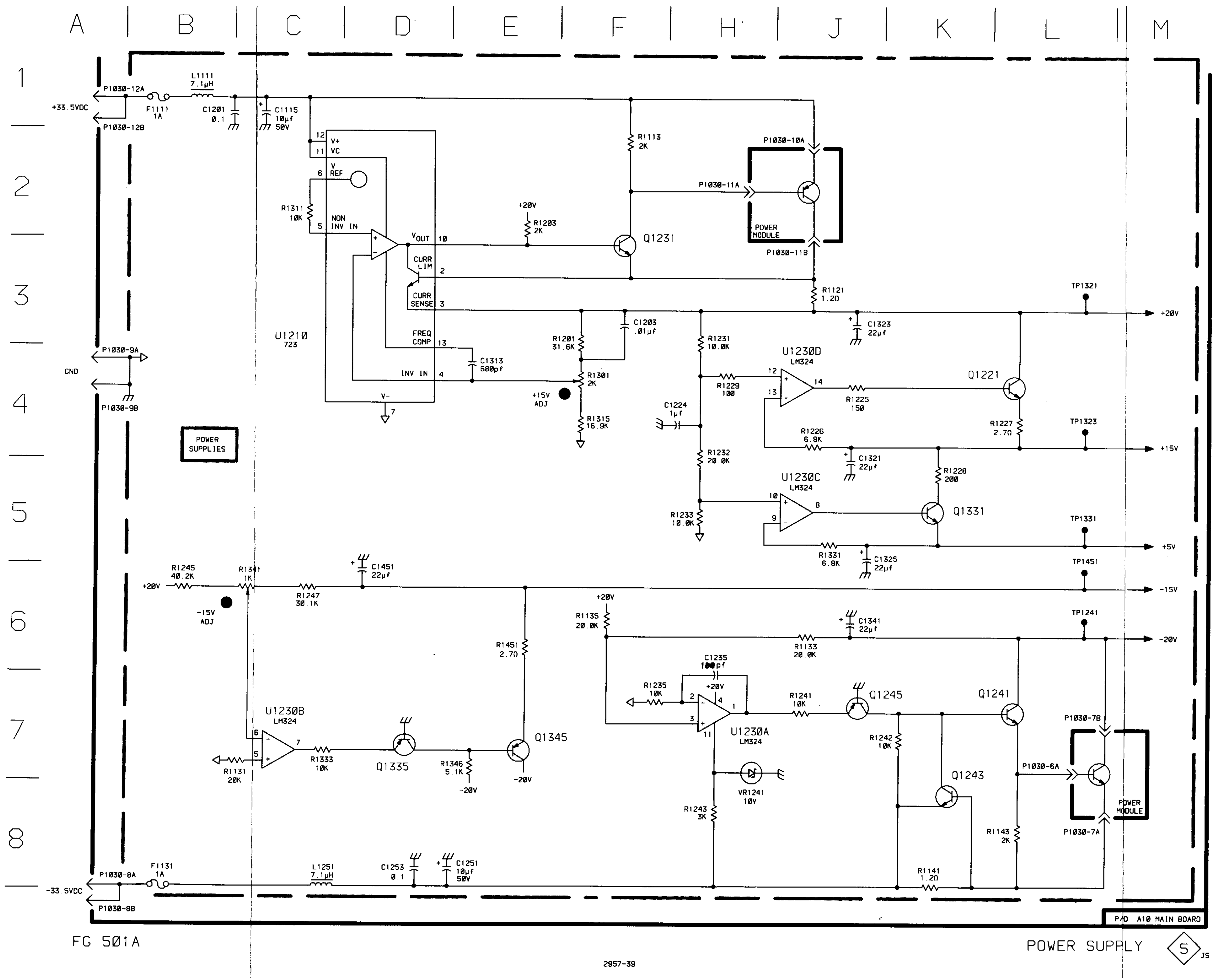
OUTPUT AMPLIFIER AND ATTENUATORS 4

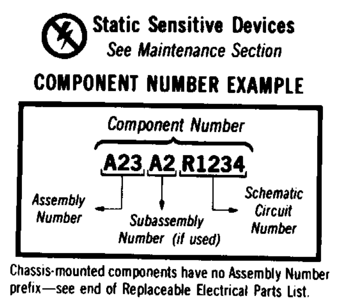
TABLE 8-5
COMPONENT REFERENCE CHART

P/O A10 ASSY — MAIN BOARD ⟨5⟩

CIRCUIT NUMBER	SCHEMATIC LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEMATIC LOCATION	BOARD LOCATION
C1115	**C1**	**C2**	**R1135**	**F6**	**C4**
C1201	**B1**	**C2**	**R1141**	**K8**	**B5**
C1203	**F3**	**D2**	**R1143**	**L8**	**C5**
C1224	**H4**	**C3**	**R1201**	**F3**	**C2**
C1235	**H6**	**C4**	**R1203**	**E2**	**C2**
C1251	**D8**	**D6**	**R1225**	**J4**	**C3**
C1253	**D8**	**C6**	**R1226**	**J4**	**C3**
C1313	**E4**	**D2**	**R1227**	**L4**	**C3**
C1321	**J5**	**D3**	**R1228**	**K5**	**D3**
C1323	**J3**	**D3**	**R1229**	**H4**	**C3**
C1325	**J5**	**D3**	**R1231**	**H3**	**C3**
C1341	**J6**	**D5**	**R1232**	**H4**	**C4**
C1451	**D6**	**E5**	**R1233**	**H5**	**C4**
			R1235	**F7**	**C4**
F1111	**B1**	B3	**R1241**	**J7**	**C4**
F1131	**B8**	B5	**R1242**	**K7**	**C5**
			R1243	**H8**	**C5**
L1111	**B1**	**B2**	**R1245**	**B6**	**C5**
L1251	**C8**	**C5**	**R1247**	**C6**	**C5**
P1030	**L8**	**A4**	**R1301**	**F4**	**D2**
P1030	**A1**	**A4**	**R1311**	**C2**	**D3**
P1030	**A8**	**A4**	**R1315**	**F4**	**D2**
P1030	**J2**	**A4**	**R1331**	**J5**	**D4**
P1030	**H2**	**A4**	**R1333**	**C7**	**D4**
P1030	**L7**	**A4**	**R1341**	**C6**	**D5**
P1030	**A4**	**A4**	**R1346**	**E7**	**D5**
			R1451	**E6**	**E6**
01221	**L4**	**C3**	TP1241	**L6**	**D5**
01231	**F3**	**C3**	TP1321	**L3**	**D3**
Q1241	**L7**	**C5**	TP1323	**L4**	**D3**
Q1243	**K8**	**C5**	TP1331	**L5**	**D4**
01245	**J7**	**C5**	TP1451	**L6**	**E5**
Q1331	**K5**	**D4**	U1210	**D3**	**C2**
01335	**D7**	**D4**	U1230A	**H7**	**C4**
01345	**E7**	**D5**	U1230B	**C7**	**C4**
R1113	**F2**	B3	U1230C	**J5**	**C4**
R1121	**J3**	B3	U1230D	**J4**	**C4**
R1131	**C7**	B4	VR1241	H7	C5
R1133	**J6**	C4			

P/O **A10 ASSY also shown on** ⟨1⟩ ⟨2⟩ ⟨3⟩ ⟨4⟩





SECTION 9

REPLACEABLE MECHANICAL PARTS

PARTS ORDERING INFORMATION

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

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

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

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

SPECIAL NOTES AND SYMBOLS

X000 Part first added at this serial number

00X Part removed after this serial number

FIGURE AND INDEX NUMBERS

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

INDENTATION SYSTEM

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

1 2 3 4 5 *Name & Description*

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

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

Parts of Detail Part
Attaching parts for Parts of Detail Part
---*---

Attaching Parts always appear in the same indentation as the item it mounts, while the detail parts are indented to the right. Indented items are part of, and included with, the next higher indentation. The separation symbol ---*--- indicates the end of attaching parts.

Attaching parts must be purchased separately, unless otherwise specified.

ITEM NAME

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

ABBREVIATIONS

"	INCH	ELCTRN	ELECTRON	IN	INCH	SE	SINGLE END
#	NUMBER SIZE	ELEC	ELECTRICAL	INCAND	INCANDESCENT	SECT	SECTION
ACTR	ACTUATOR	ELCTLT	ELECTROLYTIC	INSUL	INSULATOR	SEMICOND	SEMICONDUCTOR
ADPTR	ADAPTER	ELEM	ELEMENT	INTL	INTERNAL	SHLD	SHIELD
ALIGN	ALIGNMENT	EPL	ELECTRICAL PARTS LIST	LPHLDR	LAMPHOLDER	SHLOR	SHOULDERED
AL	ALUMINUM	EQPT	EQUIPMENT	MACH	MACHINE	SKT	SOCKET
ASSEM	ASSEMBLED	EXT	EXTERNAL	MECH	MECHANICAL	SL	SLIDE
ASSY	ASSEMBLY	FIL	FILLISTER HEAD	MTG	MOUNTING	SLFLKG	SELF-LOCKING
ATTEN	ATTENUATOR	FLEX	FLEXIBLE	NIP	NIPPLE	SLVG	SLEEVING
AWG	AMERICAN WIRE GAGE	FLH	FLAT HEAD	NON WIRE	NOT WIRE wOUND	SPR	SPRING
BD	BOARD	FLTR	FILTER	OBD	ORDER BY DESCRIPTION	SQ	SQUARE
BRKT	BRACKET	FR	FRAME or FRONT	OD	OUTSIDE DIAMETER	SST	STAINLESS STEEL
BRS	BRASS	FSTNR	FASTENER	OVH	OVAL HEAD	STL	STEEL
BRZ	BRONZE	FT	FOOT	PH BRZ	PHOSPHOR BRONZE	SW	SWITCH
BSHG	BUSHING	FXD	FIXED	PL	PLAIN or PLATE	T	TUBE
CAB	CABINET	GSKT	GASKET	PLSTC	PLASTIC	TERM	TERMINAL
CAP	CAPACITOR	HDL	HANOLE	PN	PART NUMBER	THD	THREAD
CER	CERAMIC	HEX	HEXAGON	PNH	PAN HEAD	THK	THICK
CHAS	CHASSIS	HEX HD	HEXAGONAL HEAD	PWR	POWER	TNSN	TENSION
CKT	CIRCUIT	HEX SOC	HEXAGONAL SOCKET	RCPT	RECEPTACLE	TPG	TAPPING
COMP	COMPOSITION	HLCPS	HELICAL COMPRESSION	RES	RESISTOR	TRH	TRUSS HEAD
CONN	CONNECTOR	HLEXT	HELICAL EXTENSION	RGD	RIGID	V	VOLTAGE
COV	COVER	HV	HIGH VOLTAGE	RLF	RELIEF	VAR	VARIABLE
CPLG	COUPLING	IC	INTEGRATED CIRCUIT	RTNR	RETAINER	W/	WITH
CRT	CATHODE RAY TUBE	ID	INSIDE DIAMETER	SCH	SOCKET HEAD	WSHR	WASHER
DEG	DEGREE	IDENT	IDENTIFICATION	SCOPE	OSCILLOSCOPE	XFMR	TRANSFORMER
DWR	DRAWER	IMPLR	IMPELLER	SCR	SCREW	XSTR	TRANSISTOR

CROSS INDEX-MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
K0099	JACKSON BROS (LONDON) LTD.	258 BROADWAY	NEW YORK, NEW YORK 10007
00779	AMP, INC.	P O BOX 3608	HARRISBURG. PA 17105
01536	CAMCAR DIV OF TEXTRON INC. SEMS PRODUCTS UNIT	1818 CHRISTINA ST.	ROCKFORD, IL 61108
13103	THERMALLOY COMPANY, INC.	2021 W VALLEY VIEW LANE P O BOX 34829	DALLAS, TX 75234
22526	BERG ELECTRONICS, INC.	YOUK EXPRESSWAY	NEW CUMBERLAND, PA 17070
73743	FISCHER SPECIAL MFG. CO.	446 MORGAN ST.	CINCINNATI, OH 45206
73803	TEXAS INSTRUMENTS, INC., METALLURGICAL MATERIALS DIV.	34 FOREST STREET	ATTLEBORO, MA 02703
74445	HOLO-KROME CO.	31 BROOK ST. WEST	HARTFORD, CT 06110
75915	LITTELFUSE, INC.	800 E. NORTHWEST HWY	DES PLAINES, IL 60016
77250	PHEOLL MANUFACTURING CO., DIVISION OF ALLIED PRODUCTS CORP.	5700 W. ROOSEVELT RD.	CHICAGO, IL 60650
78189	ILLINOIS TOOL WORKS, INC. SHAKEPROOF DIVISION	ST. CHARLES ROAD	ELGIN, IL 60120
79136	WALDES, KOHINOOR, INC.	47-16 AUSTEL PLACE	LONG ISLAND CITY, NY 11101
79807	WROUGHT WASHER MFG. CO.	2100 S. O BAY ST.	MILWAUKEE, WI 53207
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
83385	CENTRAL SCREW CO.	2530 CRESCENT DR.	BROADVIEW, IL 60153
93907	TEXTRON INC. CAMCAR DIV	600 18TH AVE	ROCKFORD, IL 61101

FIG. & INDEX NO.	TEKTRONIX PART NO.	SERIAL/MODEL NO. EFF	DSCONT	QTY	1 2 3 4 5 NAME & DESCRIPTION	MFR CODE	MFR PART NUMBER
1-1	337-1399-04			2	SHIELD,ELEC:SIDE	80009	337-1399-04
-2	366-1837-00			1	KNOB:GRAY,0.252 ID X 1.041 OD,0.7	80009	366-1837-00
-3	354-0557-05			1	RING,KNOB SKIRT:CLEAR,1.875 OD	80009	354-0557-05
					(ATTACHING PARTS)		
-4	211-0088-00			2	SCREW,MACHINE:2-56 X 0.281"82 DEG,FLH STL	77250	OBD
					-*-		
-5	366-1559-00			8	PUSH BUTTON:SIL GY,0.18 SQ X 0.43	80009	366-1559-00
-6	366-1512-00			3	PUSH BUTTON:GRAY,0.18 SQ X 0.83 INCH LG	80009	366-1512-00
-7	366-1023-07			1	KNOB:GRAY,0.127 ID,0.392 OD,0.466	80009	366-1023-07
-8				1	RES.,VAR,NONWIR:(SEE R550 REPL)		
					(ATTACHING PARTS)		
-9	210-0583-00			1	NUT,PLAIN,HEX:0.25-32 X 0.312 INCH,BRS	73743	2X20317-402
-10	210-0940-00			1	WASHER,FLAT:0.25 ID X 0.375 INCH OD,STL	79807	OBD
					-*-		
-11	366-1059-03			1	PUSH BUTTON:GY W/YEL BND,0.227	80009	366-1059-03
-12	366-1215-01			1	KNOB:GY,0.127 ID X 0.5 OD,0.531	80009	366-1215-01
-13				1	RES.,VAR,NONWIR:(SEE R530,S500 REPL)		
					(ATTACHING PARTS)		
-14	210-0583-00			1	NUT,PLAIN,HEX:0.25-32 X 0.312 INCH,BRS	73743	2X20317-402
-15	210-0940-00			1	WASHER,FLAT:0.25 ID X 0.375 INCH OD,STL	79807	OBD
					-*-		
-16	366-1031-06			1	KNOB:GRAY--VAR	80009	366-1031-06
-17	366-1170-03			1	KNOB:GRAY,0.25 ID X 0.706 OD,0.6H	80009	366-1170-03
-18	358-0029-00			1	BSHG,MACH.THD:HEX,0.375-32 X 0.438"LONG	80009	358-0029-00
					(ATTACHING PARTS)		
-19	210-0413-00			1	NUT,PLAIN,HEX.:0.375-32 X 0.50 INCH,STL	73743	3145-402
					-*-		
-20	366-1319-03			1	KNOB:GY,W/IDX,0.79 ID,0.28 OD,0.32 H	80009	366-1319-03
-21	366-1077-01			1	KNOB:GRAY,0.127 ID,0.5 OD,0.531H	80009	366-1077-01
-22				1	RES.,VAR,NONWIR:(SEE R560,S510 REPL)		
					(ATTACHING PARTS)		
-23	210-0583-00			1	NUT,PLAIN,HEX:0.25-32 X 0.312 INCH BRS	73743	2X20317-402
-24	210-0940-00			1	WASHER,FLAT:0.25 ID X 0.375 INCH OD,STL	79807	OBD
					-*-		
-25				4	CONNECTOR,RCPT:(SEE J500,J510,J520,J530 REPL)		
					(ATTACHING PARTS)		
-26	220-0495-00			1	NUT,PLAIN,HEX.:0.375-32 X 0.438 INCH BRS	73743	OBD
-27	210-0255-00			4	TERMINAL,LUG:0.391 ID,LOCKING,BRS CD PL	80009	210-0255-00
					-*-		
-28	366-1690-00			1	KNOB:SIL GY,0.53 X0.23 X 1.059	80009	366-1690-00
-29	426-1072-00			11	FRAME,PUSH BTN:PLASTIC	80009	426-1072-00
-30	333-2684-00			1	PANEL,FRONT:	80009	333-2684-00
-31	200-0935-00			2	BASE,LAMPHOLDER:0.29 OD X 0.19 CASE	80009	200-0935-00
-32	352-0157-00			2	LAMPHOLDER:WHITE PLASTIC	80009	352-0157-00
-33	384-1406-00			1	EXTENSION SHAFT:6.64 L X 0.125 OD,AL,CRM	80009	384-1406-00
-34	401-0206-00			1	GR ASSY,SP RDCN:6 TO 1	K0099	4511/DAF
					(ATTACHING PARTS)		
-35	213-0022-00			1	SETSCREW:4-40 X 0.188 INCH,HEX SOC STL	74445	OBD
-36	211-0008-00			2	SCREW,MACHINE:4-40 X 0.250,PNH,STL,CD PL	83385	OBD
					-*-		
-37	105-0719-00			1	LATCH,RETAINING:PLUG-IN	80009	105-0719-00
					(ATTACHING PARTS)		
-38	213-0113-00			1	SCR,TPG,THD FOR:2-32 X 0.312 INCH,PNH STL	93907	OBD
					-*-		
-39	105-0718-01			1	BAR,LATCH RLSE:	80009	105-0718-01
-40	386-4469-00			1	SUBPANEL,FRONT:	80009	386-4469-00
					(ATTACHING PARTS)		
-41	213-0229-00			4	SCR,TPG,THD FOR:6-20 X0.375"100 GED,FLH STL	93907	OBD
					-*-		
-42	384-1292-00			3	EXTENSION SHAFT:2.417 INCH LONG,PLASTIC	80009	384-1292-00
-43	386-4278-00			1	SUPPORT,FRAME:REAR,AL	80009	386-4278-00
					(ATTACHING PARTS)		
-44	213-0868-00			2	SCREW,TPG,TF:6-32 X 0.375 L,FILM,STEEL	93907	OBD
-45	386-3657-01			2	SUPPORT,PLUG IN:	93907	OBD
					-*-		

FIG. & INDEX NO.	TEKTRONIX PART NO.	SERIAL/MODEL NO. EFF	DSCONT	QTY	1 2 3 4 5 NAME & DESCRIPTION	MFR CODE	MFR PART NUMBER
1-46				1	CKT BOARD ASSY:AUXILIARY(SEE A12 REPL)		
					(ATTACHING PARTS)		
-47	211-0678-00			6	SCR,ASSEM WSHR:4-40 X 0.281 L,PNH STEEL	01536	OBD
-48	129-0251-00			3	INSULATOR,STDF:O.250 OD X 1.125" L,PLSTC	80009	129-0251-00
					-*-		
				-	CKT BOARD ASSY INCLUDES:		
-49				1	.SWITCH,PUSH:(SEE A14S1400 REPL)		
-50	361-0385-00			4	.SPACER,PB SW:0.164 INCH LONG	80009	361-0385-00
-51				1	.TERMINAL,SET PIN:(SEE A12J1020,J1400 REPL)		
-52	214-0973-00			1	.HEAT SINK,ELEC:0.28 X 0.18 OVAL X 0.187"H	80009	214-0973-00
-53	136-0269-02			4	.SKT,PL-IN ELEK:MICROCIRCUIT,14 DIP,LOW CLE	73803	CS9002-14
-54				4	.CONN,RCPT,ELEC:(SEE A14J1000,J1220,J1300,		
				-	.J1302 REPL)		
-55	136-0252-07			4	.SOCKET,PIN CONN:W/O DIMPLE	22526	75060-012
	672-0924-00	B010100	B020349	1	CKT BOARD ASSY:FUNCTION GEN 1 WIDE	80009	672-0924-00
	672-0924-01	B020350		1	CKT BOARD ASSY:FUNCTION GEN 1 WIDE	80009	672-0924-01
					(ATTACHING PARTS)		
-56	213-0124-00			4	SCR,TPG,THD FOR:6-20 X 0.250 INCH,PNH STL	83385	OBD
					-*-		
				-	CKT BOARD W/SW ASSY INCLUDES:		
-57	384-1007-00			1	.EXTENSION SHAFT:8.328 L X 0.123 OD	80009	384-1007-00
-58	376-0051-01			1	.CPLG,SHAFT,FLEX:0.127 ID X 0.375 OD	80009	376-0051-01
-59				1	.RES.,VAR,NONWIR:(SEE R510 REPL)		
					(ATTACHING PARTS)		
-60	210-0583-00			1	.NUT,PLAIN,HEX:0.25-32 X 0.312 INCH,BRS	73743	2X20317-402
-61	210-0046-00			1	.WASHER,LOCK:0.261 ID,INTL,0.018 THK,BRS	78189	1214-05-00-0541C
					-*-		
-62	407-0579-00			1	.BRACKET,VAR RES:BRASS CD,PL	80009	407-0579-00
				1	.SW,CAM ACTR AS:(SEE S1731 REPL)		
					(ATTACHING PARTS)		
-63	211-0678-00			4	.SCR,ASSEM WSHR:4-40 X 0.281 L,PNH STEEL	01536	OBD
					-*-		
					.ACTR ASSY INCLUDES:		
-64	200-2524-00			1	..COVER,CAM SW:15 ELEMENT,AL	80009	200-2524-00
-65	210-0406-00			2	..NUT,PLAIN,HEX.:4-40 X 0.188 INCH,BRS	73743	12161-50
-66	401-0156-00			1	..BEARING,CAM SW:REAR	80009	401-0156-00
-67	131-1248-00			1	..CONTACT,ELEC:SHAFT GND,NI BE	80009	131-1248-00
-68	214-1704-00			2	..SPRING,FLAT:CAM SW DETENT,0.006 INCH THK	80009	214-1704-00
-69	214-1127-00			2	..ROLLER,DETENT:0.125 DIA X 0.125,SST	80009	214-1127-00
-70	210-0406-00			2	..NUT,PLAIN,HEX.:4-40 X 0.188 INCH,BRS	73743	12161-50
-71	354-0219-00			1	..RING,RETAINING:FOR 0.25 INCH SHAFT	79136	5103-25-MD-R
-72	401-0155-00			1	..BEARING,CAM SW:FRONT	80009	401-0155-00
-73	105-0856-00			1	..ACTR,CAM SW:FREQUENCY MULTIPLIER	80009	105-0856-00
-74				1	.CKT BOARD ASSY:FUNCTION GEN(SEE A10 REPL)		
-75	131-0604-00			15	..CONTACT,ELEC:CKT BD SW,SPR,CU BE	80009	131-0604-00
-76				1	..SWITCH,PUSH:(SEE A10S1901 REPL)		
-77	361-0385-00			4	..SPACER,PB SW:0.164 INCH LONG	80009	361-0385-00
-78				1	..SWITCH,PUSH:(SEE A10S2331 REPL)		
-79	361-0385-00			4	..SPACER,PB SW:0.164 INCH LONG	80009	361-0385-00
-80	136-0514-00			3	..SKT,PL-IN ELEC:MICROCIRCUIT,8 DIP	73803	CS9002-8
-81	136-0269-02			6	..SKT,PL-IN ELEK:MICROCIRCUIT,14 DIP,LOW CLE	73803	CS9002-14
-82	214-0579-02			5	..TERM,TEST POINT:BRASS	80009	214-0579-02
-83				5	..CONN,RCP,ELEC:(A10J1801,J1921,J1923,		
				-	..J2041,J2043 REPL)		
-84	136-0252-07			5	..SOCKET,PIN CONN:W/O DIMPLE	22526	75060-012
-85	344-0326-00			4	..CLIP,ELECTRICAL:FUSE,BRASS	75915	102071
-86	214-3057-00			2	..HEAT SINK,XSTR:TO-5,SIL BRZ PTD,BLACK	13103	6024U SPECIAL
-87	214-0973-00			1	..HEAT SINK,ELEC:0.28 X 0.18 OVAL X 0.187"H	80009	214-0973-00
-88	131-0993-00			1	..BUS,CONDUCTOR:2 WIRE BLACK	00779	530153-2
-89				33	..TERMINAL,PIN:(SEE A10J1100,J1121,J1202,		
				-	..J1203,J1204,J1301,J1541,J1611,J1641,J1651,		
				-	..J2011,J2021,J2141 REPL)		
-90	376-0051-01			1	..CPLG,SHAFT,FLEX:0.127 ID X 0.375 OD	80009	376-0051-01
-91				1	..RES.,VAR,NONWIR:(SEE A10R500 REPL)		
					..(ATTACHING PARTS)		
-92	210-0583-00			1	..NUT,PLAIN,HEX:0.25-32 X 0.312 INCH,BRS	73743	2X20317-402
-93	210-0046-00			1	..WASHER,LOCK 0.261 ID,INTL,0.018 THK,BRS	78189	1214-05-00-0541C
					-*-		

FIG.& INDEX NO.	TEKTRONIX PART NO.	SERIAL/MODEL NO. EFF	DSCONT	QTY	1 2 3 4 5 NAME & DESCRIPTION	MFR CODE	MFR PART NUMBER
1-94	386-4470-00			1	..PLATE,RES MTG:BRASS	80009	386-4470-00
-95	214-1061-00			1	SPRING,GROUND:FLAT	80009	214-1061-00
-96	426-0724-19			1	FR SECT,PLUG-IN:BOTTOM	80009	426-0724-19
-97	351-0612-00			2	GUIDE,CKT BOARD:NYLON,1.0 L	80009	351-0612-00
-98	426-0725-05			1	FR SECT,PLUG-IN:TOP	80009	426-0725-05

FIG.& INDEX NO.	TEKTRONIX PART NO.	SERIAL/MODEL NO. EFF	DSCONT	QTY	1 2 3 4 5 NAME & DESCRIPTION	MFR CODE	MFR PART NUMBER
					WIRE ASSEMBLIES		
	175-2101-00			1	CA ASSY,SP,ELEC:3,26 AWG,3.5 L	80009	175-2101-00
				-	(FROM A10R500 TO A10J1203)		
	352-0161-03			1	.CONN BODY,PL,EL:3 WIRE ORANGE	80009	352-0161-03
	175-5119-00			1	CA ASSY,SP,ELEC:2,26AWS,8.5L,RIBBON	80009	175-5119-00
					(FROM A10J1100 TO A12J1210)		
	352-0169-02			1	.CONN BODY,PL,EL:2 WIRE RED	80009	352-0169-00
	175-2101-00			1	CA ASSY,SP,ELEC:3,26 AWG,3.5 L,RIBBON	80009	175-2101-00
				-	(FROM A10J1121 TO R510)		
	352-0161-03			1	.CONN BODY,PL,EL:3 WIRE ORANGE	80009	352-0161-03
	175-5124-00			1	CA ASSY,SP,ELEC:4,26 AWG,7.0 L,RIBBON	80009	175-5124-00
				-	(FROM A10J1541 TO R530,S500)		
	352-0162-04			1	.CONN BODY,PL,EL:4 WIRE YELLOW	80009	352-0162-04
	175-5120-00			1	CA ASSY,SP,ELEC:3,26 AWG,7.0 L,RIBBON	80009	175-5120-00
				-	(FROM A10J1611 TO R550)		
	352-0161-03			1	.CONN BODY,PL.EL:3 WIRE ORANGE	80009	352-0161-03
	175-3242-00			1	CA ASSY,SP,ELEC:2,26 AWG,8.0 L,RIBBON	80009	175-3242-00
				-	(FROM A10J1641 TO CR500)		
	352-0169-02			1	.CONN BODY,PL,EL:2 WIRE RED	80009	352-0169-00
	175-5117-00			1	CA ASSY,SP,ELEC:4,26 AWG,3.5 L,RIBBON	80009	175-5117-00
				-	(FROM A10J1651 TO A12J1020)		
	352-0162-04			2	.CONN BODY,PL,EL:4 WIRE YELLOW	80009	352-0162-04
	175-5113-00			1	CABLE ASSY,RF:50 OHM COAX,5.5 L	80009	175-5113-00
				-	(FROM A10J1801 TO A12J1302)		
	175-3073-00			1	CABLE ASSY,RF:50 OHM COAX,4L5 L,9-2	80009	175-3073-00
				-	(FROM A10J1921 TO A12J1220)		
	175-3074-00			1	CA ASSY,RF:50 OHM COAX,3L5 L,9-1	80009	175-3074-00
				-	(FROM A10J1923 TO A12J1000)		
	175-3432-00			1	CA ASSY,SP,ELEC:4,26 AWG,3L5 L,RIBBON	80009	175-3432-00
				-	(FROM A10J2011 TO R560,S510)		
	352-0162-04			1	.CONN BODY,PL,EL:4 WIRE YELLOW	80009	352-0162-04
	175-5122-00			1	CA ASSY,SP,ELEC:2,26 AWG,4.0 L,RIBBON	80009	175-5122-00
				-	(FROM A10J2021 TO R560,S510)		
	352-0169-02			1	.CONN BODY,PL,EL:2 WIRE RED	80009	352-0169-00
	175-3272-00			1	CABLE ASSY,RF:50 OHM COAX,4.0 L	80009	175-3272-00
				-	(FROM A10J2041 TO J510)		
	175-3255-00			1	CABLE ASSY,RF:50 OHM COAX,3.5 L	80009	175-3255-00
				-	(FROM A10J2043 TO J500)		
	175-5115-00			1	CABLE ASSY,RF:50 OHM COAX,3.0 L	80009	175-5115-00
				-	(FROM A12J1300 TO J520)		
	175-3062-00			1	CA ASSY,SP,ELEC:2,26 AWG,3.0 L,RIBBON	80009	175-3062-00
				-	(FROM A12J1400 TO CR510)		
	352-0169-02			1	.CONN BODY,PL,EL:2 WIRE RED	80009	352-0169-00

APPENDIX A

REFERENCES

DA PAM 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (Types 7, 8, and 9), Supply Bulletins, and Lubrication Orders
DA PAM 310-7	Index of US Army Equipment Modification Work Orders
FM 21-11	First Aid for Soldiers
AR 385-40	Accident Reporting and Records
AR 750-1	Army Materiel Maintenance Concept and Policies
TB 750-25-1	Maintenance Supplies and Equipment: Army Metrology and Calibration System
TM 38-750	The Army Maintenance Management System (TAMMS)
TM 750-244-2	Procedures for Destruction of Electronics Materiel to Prevent Enemy Use

APPENDIX B
MAINTENANCE ALLOCATION CHART

Section 1. INTRODUCTION

B-1. GENERAL.

a. This section provides a general explanation of all maintenance and repair functions authorized at various maintenance categories.

b. The Maintenance Allocation Chart (MAC) in Section II designates overall authority and responsibility for the performance of maintenance functions on the identified end items or component. The application of the maintenance functions to the end item or component will be consistent with the capacities and capabilities of the designated maintenance categories.

c. Section III lists the tools and test equipment (both special and common) required for each maintenance function as referenced from Section II.

d. Section IV contains supplemental instructions and explanatory notes for a particular maintenance function.

B-2. MAINTENANCE FUNCTIONS. Maintenance Functions will be limited to and defined as follows:

a. Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination (e.g., by sight, sound, or feel).

b. Test. To verify serviceability by measuring the mechanical, pneumatic, hydraulic, electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. Operations required periodically to keep an item in proper operating condition, i.e., to clean (includes decontaminate, when required), to preserve, to drain, to paint, or to replenish fuel, lubricants, chemical fluids, or gases.

d. Adjust. To maintain or regulate, within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to specified parameters.

e. *Aline.* To adjust specified variable elements of an item to bring about optimum or desired performance.

f. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments or test, measuring, and diagnostic equipment used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. Removal/Install. To remove and install the same item when required to perform service or other maintenance functions. Install may be the act of emplacing, seating, or fixing into position a spare, repair part, or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.

h. Replace. To remove an unserviceable item and install a serviceable counterpart in its place.

i. Repair. The application of maintenance services 1, including fault location/troubleshooting 2, removal/ installation, and disassembly/assembly 3, procedures, and maintenance actions 4, to identify troubles and restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item, or system.

j. Overhaul. That maintenance effort (service/action) prescribed to restore an item to a completely serviceable-operational condition as required by maintenance standard in appropriate technical publications. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like-new condition.

k. Rebuild. Consists of those services/actions necessary for the restoration of unserviceable equipment to a like-new condition in accordance with original manufacturing standards. Rebuild is the highest degree of material maintenance applied to army equipment and is normally reserved for the depot category of maintenance. The rebuild operation includes the act of returning to zero those age measurements (hours/mile, etc.) considered in classifying army equipment/components.

(1) Services - inspect, test, service, adjust, aline, calibrate, and/or replace.

(2) Fault locate/troubleshoot - the process of investigating and detecting the cause of equipment malfunctioning; the act of isolating a fault within a system or Unit Under Test (UUT).

(3) Disassembly/assembly - encompasses the step-by-step taking apart (or breakdown) of a repairable assembly (group numbered item) to the level of its least componency identified as maintenance significant (i.e., assigned an SMR code) for the category of maintenance under consideration.

(4) Actions - welding, griding, riveting, straightening, facing, remachinery, and/or resurfacing.

B-3. EXPLANATION OF COLUMNS IN THE MAC, SECTION II.

a. Column 1, Group Number. Column 1 lists group numbers, the purpose of which is to identify maintenance significant components, assemblies, subassemblies, and modules with the next higher assembly.

b. Column 2, Component/Assembly. Column 2 contains the names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. Column 3, Maintenance Function. Column 3 lists the functions to be performed on the item listed in Column 2 (for detailed explanation of these functions, see paragraph B-2).

d. Column 4, Maintenance Category. Column 4 specifies, by the listing of a work time figure in the appropriate subcolumn(s), the category of maintenance authorized to perform the function listed in Column 3. This figure represents the active time required to perform that maintenance function at the indicated category of maintenance. If the number of complexity of the tasks within the listed maintenance function vary at different maintenance categories, appropriate work time figures will be shown for each category. The work time figure represents the average time required to restore an item (assembly, subassembly, component, module, end item, or system) to a serviceable condition under typical field operating conditions. This time includes preparation time (including any necessary disassembly/assembly time), troubleshooting/fault location time, and quality assurance/ quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart. The symbol designations for the various maintenance categories are as follows:

C .... Operator or Crew
O .... Organizational Maintenance
F .... Direct Support Maintenance
H .... General Support Maintenance
L .... Specialized Repair Activity (SRA)[5]
D .... Depot Maintenance

5 This maintenance category is not included in Section II, column (4) of the Maintenance Allocation Chart. To identify functions to this category of maintenance, enter a work time figure in the "H" column of Section II, column (4), and use an associated reference code in the Remarks column (6). Key the code to Section IV, Remarks, and explain the SRA complete repair application there. The explanatory remark(s) shall reference the specific Repair Parts and Special Tools LIST (RPSTL) TM which contains additional SRA criteria and the authorized spare/repair parts.

e. Column 5, Tools and Test Equipment. Column 5 specifies, by code, those common tools sets (not individual tools) and special tools, TMDE, and support equipment required to perform the designated function,

f. Column 6, Remarks. This column shall, when applicable, contain a letter code, in alphabetic order, which shall be keyed to the remarks contained in Section IV.

B-4. EXPLANATION OF COLUMNS IN TOOL AND TEST EQUIPMENT REQUIREMENTS, SECTION III.

a. Colunm 1, Reference Code. The tool and test equipment reference code correlates with a code used in the MAC, Section III, Column 5.

b. Column 2, Maintenance Category. The lowest category of maintenance authorized to use the tool or test equipment.

c. Column 3, Nomenclature. Name or identification of the tool or test equipment.

d. Column 4, National Stock Number. The National Stock Number of the tool or test equipment.

e. Column 5, Tool Number. The manufacturer's part number

B-5. EXPLANATION OF COLUMNS IN REMARKS, SECTION IV.

a. Column 1, Reference Code. The code recorded in Column 6, Section II.

b. Column 2, Remarks. This column lists information pertinent to the maintenance function being performed as indicated in the MAC, Section II.

SECTION II. MAINTENANCE ALLOCATION CHART FOR TEKTRONIC 501A FUNCTION GENERATOR

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATETORY* C	O	F	H	D	(5) TOOLS AND EQUPT	(6) REMARKS
Fig 1	TEK 501A Function Generator	Insp	0.10						A
		Calibrate				1.00		1-20	B
		Repair				1.50		20	C D
	Circuit Card Assy A-12	Insp				.10			A
		Replace				.50		20	B
	Circuit Card Assy	Insp				.10			A
		Replace				.50		20	B
	Lt. Emitting Diode	Insp				.10			A
		Replace				.50		20	B

*C.operator/crew O.organizational F.direct support H.general support D.depot

SECTION III. TOOL AND TEST EQUIPMENT REQUIREMENTS FOR TEKTRONIC 501A FUNCTIONAL GENERATOR

TOOL OR TEST EQUIPMENT	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL/NATO STOCK NUMBER	TOOL NUMBER
1-14	H	Test Equipment		Ref Table 4-1
20	H	JTK 17LAL, 35H Tool Kit	4931-01-073-3845	

SECTION IV. REMARKS

REFERENCE CODE	REMARKS
A	Organizational maintenance will be accomplished by the organization owning and using the equipment.
B	All special tools and test equipment are called out in Table 4-1.
C	Supply of parts will be through normal supply channels.
D	A recommended repair parts list will be published as part of this manual. Parts that have NSN'S assigned will be requisitioned separately and will not be part of this kit.

APPENDIX C

RECOMMENDED SPARE PARTS LIST
FOR
TEKTRONIX 501A FUNCTIONAL GENERATOR

ITEM NO.	TEKTRONIX PART NO.	ITEM NAME	REC. QTY
1	150-1029-00	LT EMITTING DIO	1
2	150-1033-00	LT EMITTING DIO	1
3	670-6694-02	CIRCUIT BOARD ASSY	1
4	670-6697-05	CIRCUIT BOARD ASSY	1

APPENDIX D

MANUAL CHANGE INFORMATION

DESCRIPTION

EFF SN B022260 (FG 501A) 070-2957-00

EFF SN B020890 (FG 507) 070-2986-00

REPLACEABLE ELECTRICAL PARTS AND SCHEMATIC CHANGES

CHANGE TO:

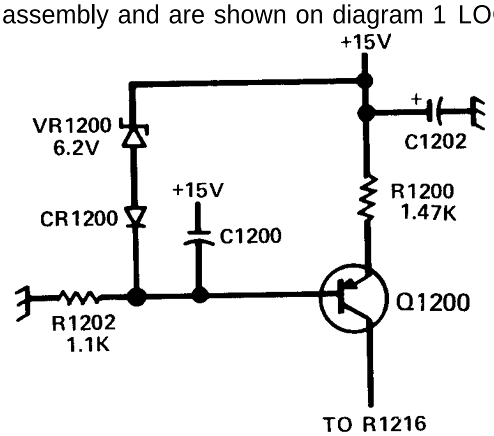
A10	---- ----	CKT BOARD ASSY: FUNCTION GEN
		(NOT REPLACEABLE ORDER 672-0924-03) (FG 501A)
A10	---- ----	CKT BOARD ASSY: FUNCTION GEN
		(NOT REPLACEABLE ORDER 672-0897-03) (FG 507
A12	670-6694-02	CKT BOARD ASSY: AUXILIARY (FG 501A & FG 507)
A10U1400	156-0495-01	MICROCIRCUIT, LI: OPNL AMPL, SEL
A10VR1813	152-0217-00	SEMICOND DEVICE: ZENER, 0.4W, 8.2V, 5%
A12R1200	321-0209-00	RES., FXD, FILM: 1.47K OHM, 1%, 0.125W
A12R1202	315-0112-00	RES., FXD, CMPSN: 1.1K OH, 5%, 0.25W

ADD:

A12VR1200	152-0486-00	SEMICOND DEVICE: ZENER, 0.25W, 6.2V, 2%

U1400 and VR1813 are located on the MAIN circuit board assembly and are shown on diagram 1 LOOP.

DIAGRAM 3 TRIG/GATE AND
SINE SHAPER AMPLIFIER - partial



By Order of the Secretary of the Army:

JOHN A. WICKHAM, JR.
General, United States Army
Chief of Staff

Official:

DONALD J. DELANDRO
Brigadier General, United States Army
The Adjutant General

Distribution:

To be distributed in accordance with DA Form 12-37, Operator, Organizational, DS and GS Maintenance requirements for Bradley Fighting Vehicle TOW Subsystem.

CUT ALONG THIS LINE

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

SOMETHING WRONG WITH THIS PUBLICATION?

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

DATE SENT

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE

BE EXACT . . . PIN-POINT WHERE IT IS

PAGE NO.	PARA-GRAPH	FIGURE NO.	TABLE NO.	IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER	SIGN HERE

DA FORM 1 JUL 79 2028-2

PREVIOUS EDITIONS ARE OBSOLETE.

PS - - IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS

THE METRIC SYSTEM AND EQUIVALENTS

NEAR MEASURE

. Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches
1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 Inches
1 Kilometer = 1000 Meters = 0.621 Miles

EIGHTS

Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces
1 Kilogram = 1000 Grams = 2.2 lb.
1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

SQUARE MEASURE

1 Sq. Centimeter = 100 Sq. Millimeters = 0.155 Sq. Inches
1 Sq. Meter = 10,000 Sq. Centimeters = 10.76 Sq. Feet
1 Sq. Kilometer = 1,000,000 Sq. Meters = 0.386 Sq. Miles

CUBIC MEASURE

1 Cu. Centimeter = 1000 Cu. Millimeters = 0.06 Cu. Inches
1 Cu. Meter = 1,000,000 Cu. Centimeters = 35.31 Cu. Feet

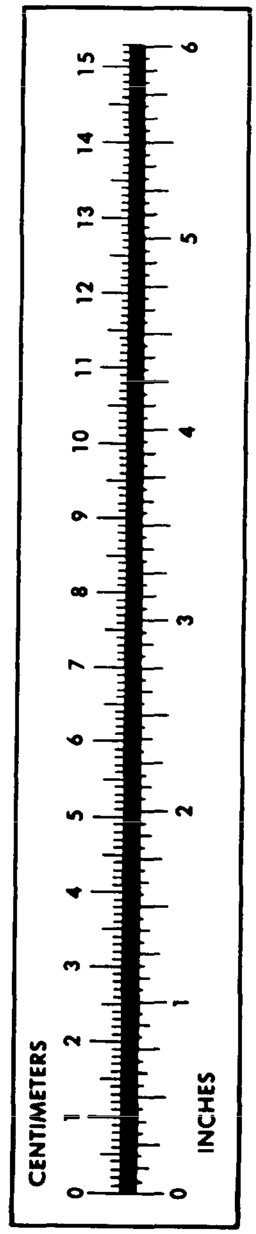
TEMPERATURE

5/9(°F - 32) = °C
212° Fahrenheit is evuivalent to 100° Celsius
90° Fahrenheit is equivalent to 32.2° Celsius
32° Fahrenheit is equivalent to 0° Celsius
9/5C° + 32 =°F

APPROXIMATE CONVERSION FACTORS

TO CHANGE	TO	MULTIPLY BY
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Square Inches	Square Centimeters	6.451
Square Feet	Square Meters	0.093
Square Yards	Square Meters	0.836
Square Miles	Square Kilometers	2.590
Acres	Square Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29.573
nts	Liters	0.473
arts	Liters	0.946
allons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds per Square Inch	Kilopascals	6.895
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609

TO CHANGE	TO	MULTIPLY BY
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
Square Kilometers	Square Miles	0.386
Square Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
ers	Gallons	0.264
ms	Ounces	0.035
ograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pounds-Feet	0.738
Kilopascals	Pounds per Square Inch	0.145
lometers per Liter	Miles per Gallon	2.354
meters per Hour	Miles per Hour	0.621



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