



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

**SPG1/SPG2
NTSC SYNC GENERATOR
MODULES**

INSTRUCTION MANUAL

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


070-2104-00
Product Group 20

Serial Number _____

First Printing NOV 1976
Revised JUL 1983

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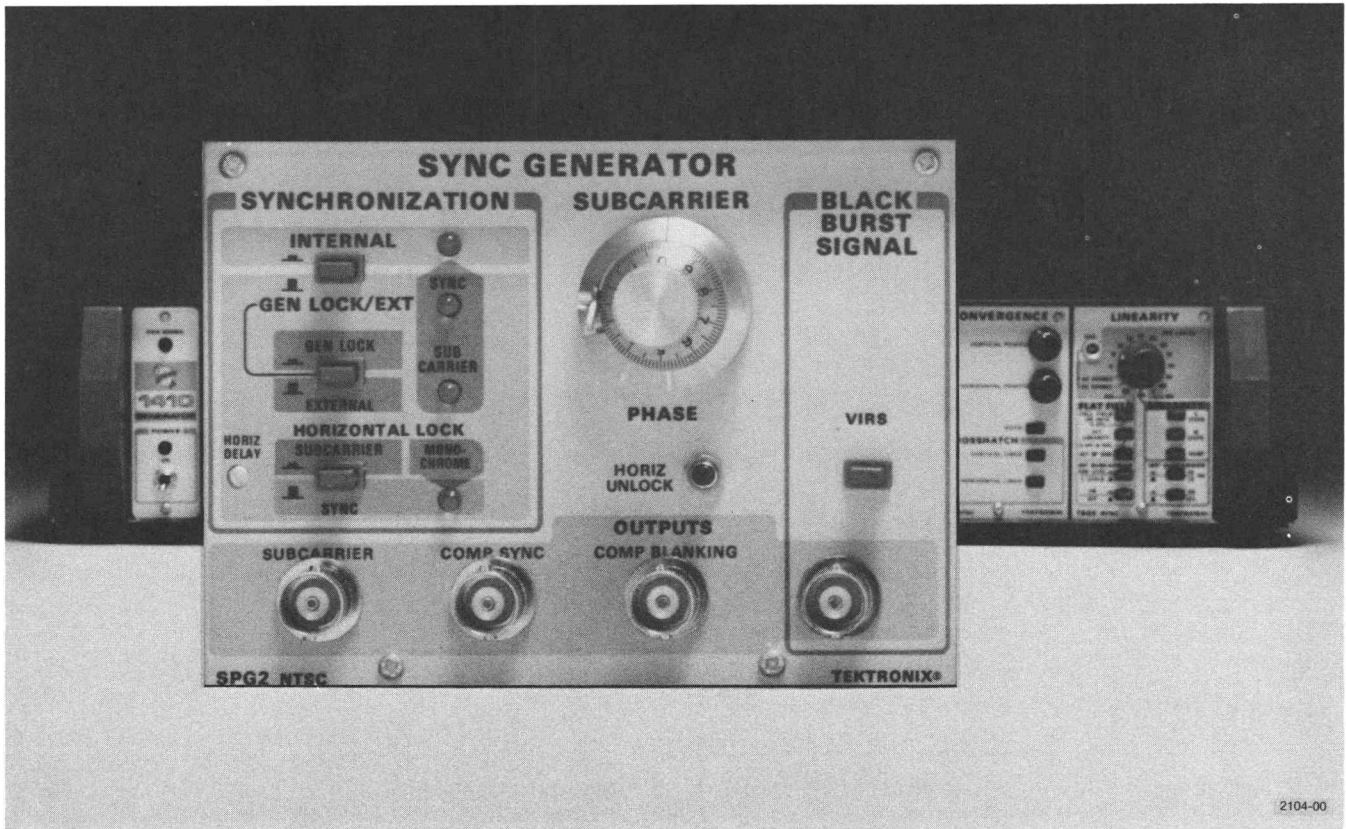
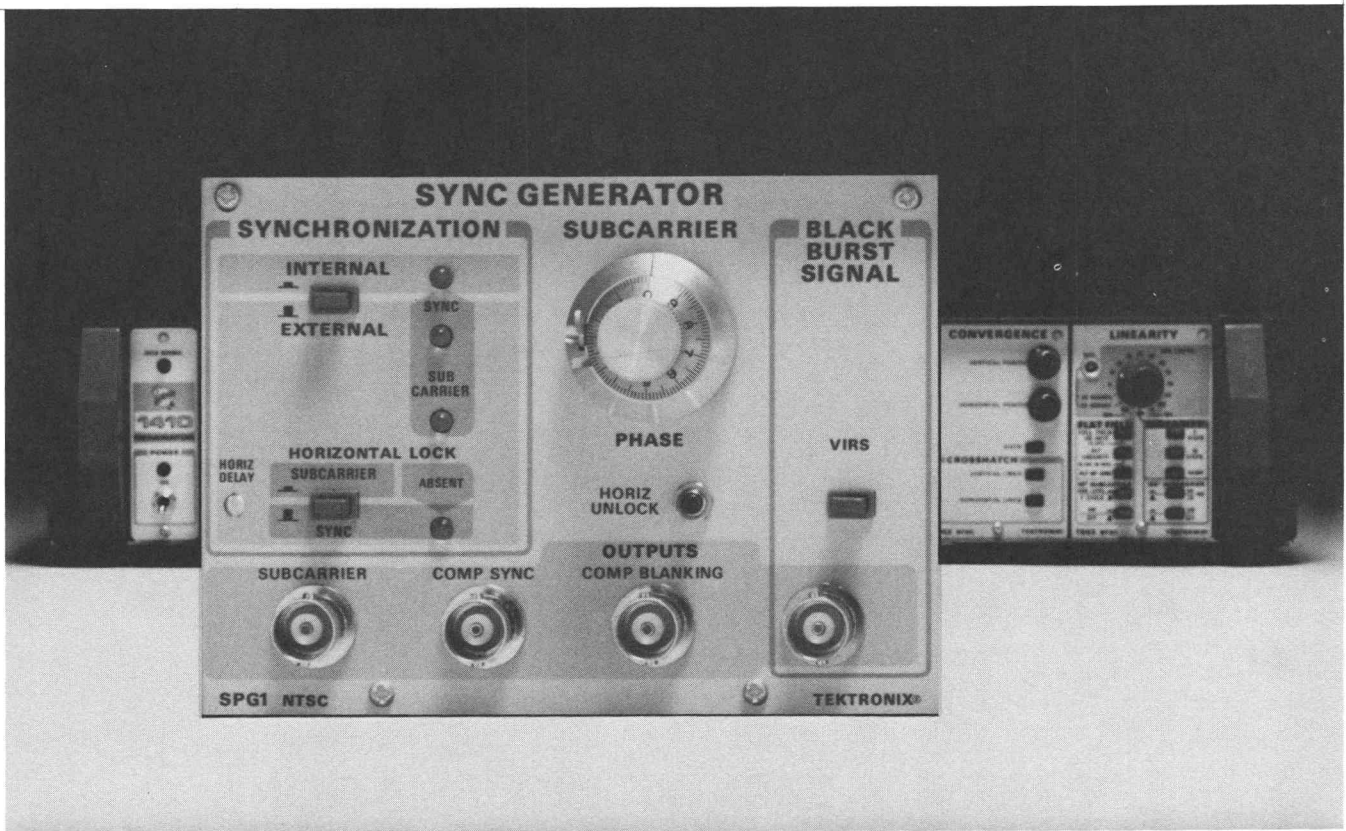
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PART I

OPERATORS INFORMATION

OPERATING INSTRUCTIONS

SAFETY SUMMARY

This manual contains safety information that the operator and service technician must follow to avoid hazardous voltages and to ensure safe operation of the instrument.

WARNING information is intended to protect the operator from hazardous voltages.

CAUTION information is intended to protect the instrument from damage.

The following are general safety precautions that must be observed during all phases of operation and maintenance.

WARNING

To reduce electrical shock hazard, the instrument must be properly grounded. Refer to the 1410 Mainframe manual for more information.

Electrical shock hazards are present inside the instrument. Only qualified service personnel should remove the instrument covers.

DESCRIPTION

The SPG1 and SPG2 NTSC Sync Generators are two-location wide generators of sync and timing signals for the 1410 and 1410 Option 1 NTSC Generator system. All the timing signals required for operation of any of the test signal generator modules in the 1410 system are available from the SPG1 and SPG2.

Parallel outputs of sync and blanking pulses are available at the SPG1 and SPG2 front panels and the 1410 rear panel. The generators also provide Black Burst outputs with the provision of the Vertical Interval Reference Signal (VIRS) on line 18 or 19, or full field.

The SPG1 and SPG2 can both be referenced to an external source of composite sync and subcarrier. The SPG2 can be Gen-Locked to an external composite video signal.

REMOTE OPERATION

Via the Remote connector on the rear panel of the host 1410 Mainframe, the SPG1 and SPG2 can be remotely commanded to change operating modes. Also, status of operating modes and external reference signals are provided as outputs capable of driving LED indicators.

Logic 'low' levels are required for the input switching functions.

Connect LED's between any of the output circuits and chassis ground as status indicators. See Table 1-1.

TABLE 1-1

1410 Remote Connector J41	SPG1 or SPG2 Function
Pin 25	Subcarrier Absent Output
Pin 26	In Internal Mode Output
Pin 27	Sync Absent Output
Pin 29	Internal Mode Input
Pin 30	External Mode Input
Pin 31	Genlock Mode Input
Pin 36	Chassis Ground

FRONT-PANEL CONTROLS (Refer to Figs. 1-1 and 1-2)

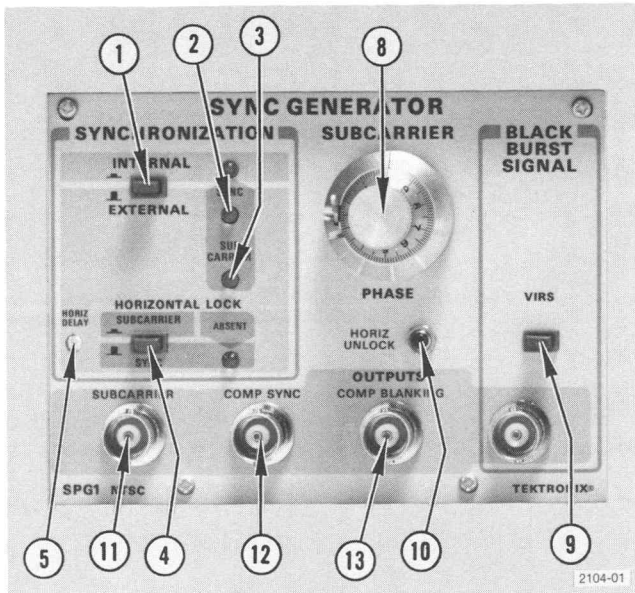


Fig. 1-1. SPG1 front-panel controls.

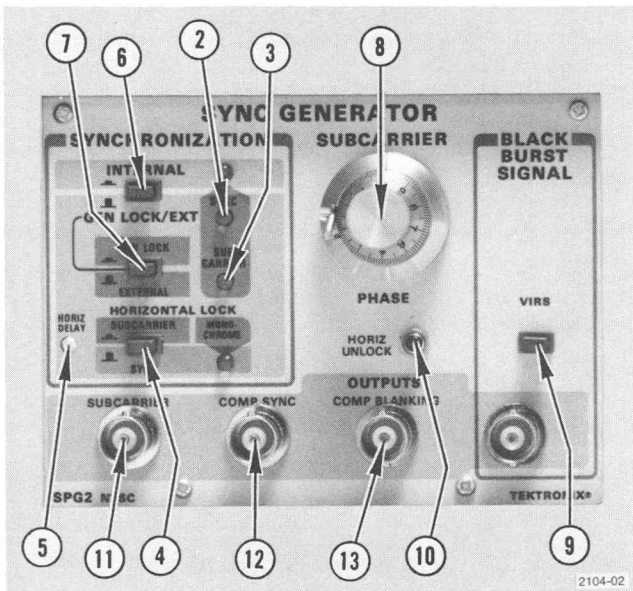


Fig. 1-2. SPG2 front-panel controls.

SYNCHRONIZATION

- ① **INTERNAL-EXTERNAL**—Selects INTERNAL reference (button pressed in), or external source of composite sync and subcarrier (button out). INTERNAL LED lights when INTERNAL reference is selected.

- ② **SYNC**—LED indicates absence of composite sync in EXTERNAL mode. Loss of incoming composite sync automatically causes the SPG1 to switch to internal sync reference or to full internal gen (determined by internal plug-jumper). If HORIZONTAL LOCK is in the SYNC mode, full internal gen is always selected when incoming sync is lost. The user can select (via internal plug-jumper) to cause loss of incoming sync to inhibit all signals. The SYNC LED may be lit or out at the user's discretion.

- ③ **SUBCARRIER**—LED indicates absence of subcarrier in external mode. Loss of incoming subcarrier causes the SPG1 to automatically switch to full internal gen or lock to sync. The user can elect (via internal plug-jumper) to cause loss of incoming subcarrier to inhibit subcarrier on all signals. The SUBCARRIER LED may be lit or out at the user's discretion.

HORIZONTAL LOCK

- ④ **SUBCARRIER-SYNC**—Selects either incoming subcarrier or composite sync to phase-lock the timing generator clock oscillator on sync timing board A20. The SPG1 automatically switches reference to incoming composite sync if subcarrier is absent and the SPG1 is not programmed to switch to full internal on loss of subcarrier, causing the SYNC LOCK LED to light. The SYNC LOCK indicator is lit if locked to sync.

- ⑤ **HORIZ DELAY**—Delays the output sync $\pm 1/2 \mu s$ with respect to external input sync. A wider range ($+4 \mu s, -10 \mu s$) can be selected via internal switch.
- ⑥ **INTERNAL-GEN LOCK/EXT**—Selects INTERNAL reference (button pressed in) or external signal source (button out). The INTERNAL indicator is lit in the INTERNAL mode.

- ⑦ **GEN LOCK-EXTERNAL**—In the GEN LOCK-EXTERNAL mode, the GEN LOCK-EXTERNAL switch selects either an external source of composite sync and subcarrier (EXTERNAL, button out) or an external source of composite video (GEN LOCK, button in). SYNC and SUBCARRIER indicators respond to loss of the corresponding signal or portion of the signal in both modes. The LED indicator may be lit or out for loss indication at the user's discretion. With signal loss, the SPG2 switches to internal sync reference or to full internal gen. If HORIZONTAL LOCK is in the SYNC mode, full internal gen is always selected when sync is lost. Loss of subcarrier switches the SPG2 to full internal gen or to sync lock.

TEST EQUIPMENT

The test equipment listed here was used in preparing this procedure. The measurement capabilities described are the minimum required to verify instrument performance. Each piece of test equipment is assumed to be operating within its stated specifications. If alternative equipment is used, it must meet or exceed these requirements.

1. Test Oscilloscope

Dual Time Base. Range from 50 ns/Div to 5 s/Div with provisions for a delaying sweep and television triggering.

Differential Comparator. Bandwidth, dc to 30 MHz; minimum deflection factor, 1 mV/Div; two channels capable of differential operation.

Dual Trace Amplifier. Vertical amplifier independent of the Differential Comparator. Bandwidth, dc to 30 MHz; minimum deflection factor, 5 mV/Div) e.g., a Tektronix 7603 with 7B53A Option 5 Dual Time Base, 7A13 Differential Comparator, and 7A18 Dual Trace Amplifier.

2. Leveled Sine Wave Generator

Capable of amplitudes from 0.2 to 5 volts peak-to-peak; frequency range, from 50 kHz to 5 MHz (e.g., a Tektronix SG 503 in a TM 500-series Power Unit).

3. Return Loss Bridge

Tektronix Part No. 015-0149-00.

4. 50 Ω to 75 Ω Minimum Loss Attenuator

Tektronix Part No. 011-0057-00.

5. 75 Ω Feed-through Termination

Two, matched within 0.2%, supplied as accessories with the Return Loss Bridge (Item 3). Tektronix Part No. 011-0103-00 (red), and 011-0103-01 (green).

6. 75 Ω Feed-through Termination (2)

Tektronix Part No. 011-0103-02.

7. 75 Ω Cable (5)

42 inches long. Tektronix Part No. 012-0074-00.

8 PHASE—Varies the phase of the subcarrier portion of the output signals, and the subcarrier signal at the rear-panel SUBCARRIER connector, 360° with respect to incoming subcarrier and subcarrier at the front-panel connector.

9 VIRS On-Off (pressed in—VIRS on, released—VIRS off)—Selects the Vertical Interval Reference Signal (VIRS) on line 18 or 19 of either or both fields at the BLACK BURST SIG output connector.

10 HORIZ UNLOCK—Momentary-closure pushbutton unlocks H sync from subcarrier. For testing subcarrier packet risetimes, etc.

CONNECTORS

11 SUBCARRIER—2 V p-p of 3.579545 MHz subcarrier from the selected source (internal or external).

12 COMP SYNC—4 V of negative-going composite sync.

13 COMP BLANKING—4 V of negative-going composite blanking.

PERFORMANCE CHECK

This procedure is to be used to verify that the SPG1 or SPG2 is performing to specifications. None of the checks in this procedure involve any internal adjustments or operating changes. Do not remove the protective covers.

This procedure assumes no changes to factory-set operating modes.

Control and connector titles on the SPG1 or SPG2 are capitalized in this procedure, for example: HORIZ UNLOCK. Controls and connectors on test equipment or the 1410 Mainframe and any modules installed in the Mainframe have only their first letter capitalized, for example: Test Oscilloscope Time/Div, or 1410 rear-panel Gen Lock loop-through connector.

Operating Instructions—SPG1/SPG2

8. A test signal generator module (TSG1, TSG2, TSG3, TSG4) mounted in the 1410 along with the SPG1 or SPG2. The test signal generator signal must contain a subcarrier portion at 0 APL with more than 19 cycles of subcarrier.

9. Video Signal Source

Capable of generating composite video, composite sync, and a 2 volt peak-to-peak subcarrier signal (e.g., a Tektronix 1410 with SPG1 or SPG2; or a Tektronix 146).

10. Waveform Monitor

Capable of overlaying one portion of a line sweep display on another portion and having sweep magnification to at least $0.1 \mu\text{s}/\text{div}$ (e.g., a Tektronix 1480-series).

11. Vectorscope

Capable of measuring phase differences between two signals of less than 0.5° (e.g., a Tektronix 520A).

12. Spectrum Analyzer

Capable of measuring the third harmonic of the color subcarrier to below -30 dB (e.g., a Tektronix 7L12 or 7L5/L2, 7000-series plug-in unit).

13. Frequency Counter

Capable of resolving 0.25 Hz out of 3 MHz, (e.g., a Hewlett-Packard 5326A Option 011).

14. Calibration Fixture

For use with the waveform Monitor. See Fig. 1-3.

EQUIPMENT SETUP

1. Test Oscilloscope

(7603 with the 7B53A Option 5 in the right compartment, the 7A18 in the left compartment, and the 7A13 in the center compartment.

7603	
Power	On
Readout	
Intensity	Best Display
Grat Illum	
Focus	
Vert Mode	Left
Trig Source	Left

7A13

+ Input	DC
- Input	DC
Volts/Div	.1
Variable	Cal
BW	Full

7A18

Ch 1 and Ch 2	
Volts/Div	1
Variable	Cal
Coupling	DC
Trigger Source	Ch 1
Display Mode	Alt
Ch 2 Polarity	+ Up

7B53A

Main Triggering	
Mode	Auto
Coupling	AC
Source	Int
Time/Div	$10 \mu\text{s}$
Variable	Cal
Mag	X1

2. 1410 with SPG1 or SPG2 and Test Signal Module

1410

Power	On
Test Signal Module	Set for signal containing subcarrier at 0 APL

SPG1

INTERNAL-EXTERNAL	EXTERNAL
HORIZONTAL LOCK	SUBCARRIER
BLACK BURST SIG VIRS	ON

SPG2

INTERNAL-GEN	
LOCK/EXT	GEN LOCK/EXT
GEN LOCK-EXTERNAL	EXTERNAL
HORIZONTAL LOCK	SUBCARRIER
BLACK BURST SIG VIRS	ON

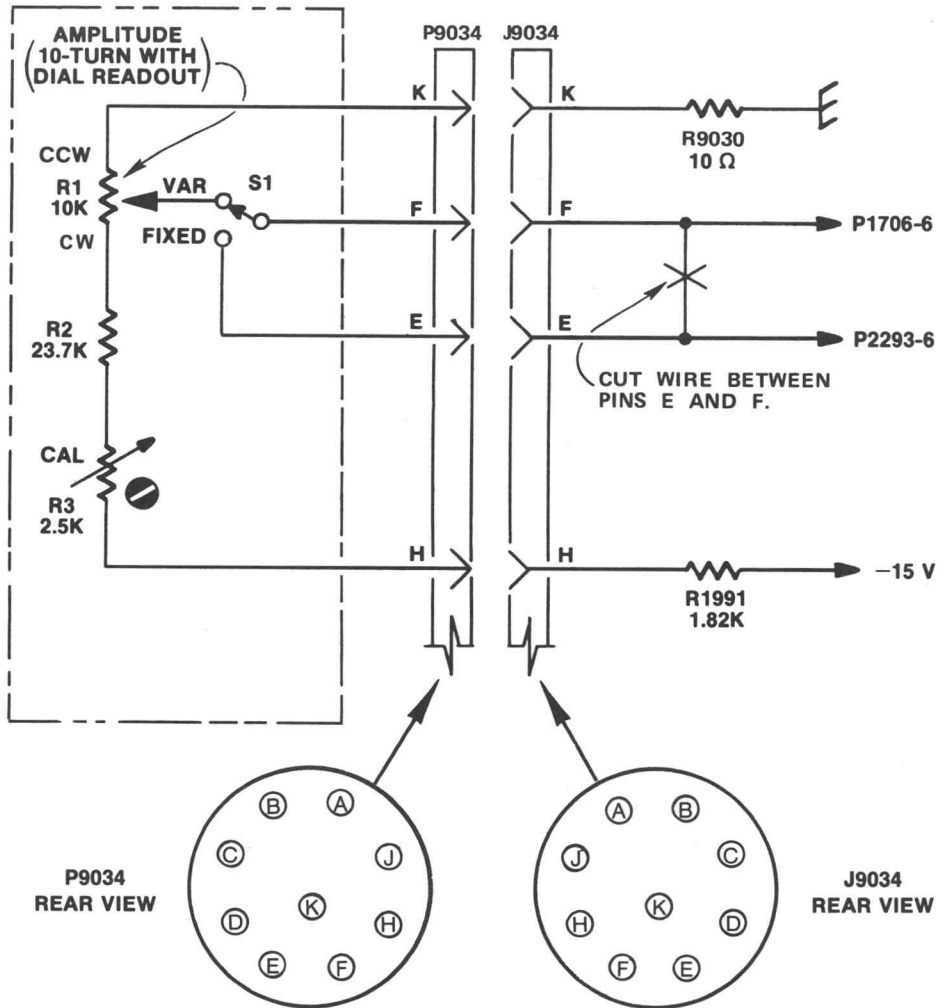
PROCEDURE

1. Check HORIZ DELAY Range

a. Display composite video from the Video Signal Source and from the 1410 Test Signal Module simultaneously on the Test Oscilloscope. Externally trigger the Test Oscilloscope with the composite from the Video Signal Source.

CALIBRATION FIXTURE

1480-SERIES REAR PANEL



Parts List

Ckt No.	Description	Tektronix Part No.
P9034	9-pin Amphenol #165-13	134-0049-00
R1	10kΩ ±5%, Ind. Lin. ±0.1%, 10-turn, prec. var.	311-1729-00
R2	23.7 kΩ ±1%, 1/8 W, metal film	321-0325-00
R3	2.5 kΩ ±20%, variable	311-0086-00
S1	SPDT toggle switch 10-turn dial for R1, Kilo-dial Mod. 461-S-41	260-0613-00 331-0139-00
Misc.	Approx. 3 ft. of 4-conductor cable and a small metal or plastic enclosure or case.	

Set R1 fully counterclockwise (ccw) and the dial at 0 when installing the dial.

2329-04

Fig. 1-3. Waveform Monitor Calibration Fixture.

Operating Instructions—SPG1/SPG2

b. Check—The leading edges of the two displayed line sync pulses should coincide.

c. Adjust—HORIZ DELAY (R175) until the sync pulses leading edges coincide.

2. Check Vertical Phasing

a. Set the Test Oscilloscope Dual Time Base Time/Div to 2 ms. Use the delaying sweep to view the vertical intervals of the two signals.

b. Check—The two displayed signals should coincide.

3. Check Field Blanking Duration (Variable)

a. Display the SPG1 or SPG2 COMP BLANKING output and composite video from the Video Signal Source simultaneously on the Test Oscilloscope.

b. Set the Test Oscilloscope Time/Div and Delayed Sweep Time/Div to view the vertical interval.

c. Check—The duration of the field blanking pulse should be 20 lines.

4. Check Line Blanking Duration (Variable)

a. Display signals from the SPG1 or SPG2 front-panel COMP BLANKING connector and the 1410 rear-panel H Drive connector simultaneously on the Test Oscilloscope.

b. Set the Test Oscilloscope Time/Div to display a horizontal line.

c. Check—Fixed line blanking duration should be $10.7 \mu\text{s}$ as measured at the 50% amplitude point on the signal.

5. Check Burst Delay and Burst Width

a. Display the SPG1 or SPG2 BLACK BURST and SUBCARRIER signals simultaneously on the Test Oscilloscope.

b. Using the Test Oscilloscope delayed sweep function, view the line sync area with the main sweep at a field rate and the delayed sweep at about $2 \mu\text{s}$.

c. Check—The time between the leading edge of line sync and the start of burst (50% points from the blanking level) should be equal to the duration of 19 cycles of subcarrier.

d. Check—Burst width should be 9 cycles of subcarrier.

e. Check—The breezeway should be 425 ns to 525 ns in width as measured from the 10% amplitude point on sync to the 50% amplitude point of burst.

f. Check—The front porch should be $1.4 \mu\text{s}$ in width as measured at the 50% amplitude points on sync and setup with respect to blanking.

6. Check Sync Timing

a. Display the SPG1 or SPG2 COMP SYNC signal on the Test Oscilloscope.

b. Using the Test Oscilloscope delayed sweep function, view the vertical interval area of the signal.

c. Check—Sync timing as follows:

Line sync duration	$4.70 \mu\text{s}$ $\pm 100 \text{ ns}$	measured at 50% points
Equalizing pulse duration	$2.3 \mu\text{s}$ $\pm 100 \text{ ns}$	measured at 50% points
Interval between sync pulses	$4.77 \mu\text{s}$ $\pm 100 \text{ ns}$	measured at 50% points
Field sync pulse	6 equalizing pulses—6 sync pulses— 6 equalizing pulses	

7. Check SCH ϕ Center

a. Display a composite video signal from the Video Signal Source on the Waveform Monitor. The displayed signal must contain at least 19 cycles of subcarrier on the 0 APL level.

b. Set the Waveform Monitor Field switch to 1, Display to $10 \mu\text{s}/\text{Div}$, Line Selector to Digital and Line 17, and Sync to External and Direct.

c. Externally trigger the Waveform Monitor with comp sync from the Video Signal Source.

d. Using the Waveform Monitor Waveform Comparison controls, overlay the second line sync pulse on the first line subcarrier.

e. Using the Waveform Monitor Vertical Position control, place the 50% amplitude point of the sync pulse on a reference line.

f. Rotate the Video Signal Source Subcarrier Phase control to place the zero crossing point of the positive-going slope of a cycle of subcarrier on the reference line.

g. Display the Waveform Monitor Line Strobe Out and the Field Ref signal from the 1410 rear panel simultaneously on the Test Oscilloscope.

h. Check—The two pulses displayed on the Test Oscilloscope should be field coincident.

i. Check—The Field Ref signal from the 1410 rear panel should shift one frame in time with each rotation of the Video Signal Source Subcarrier Phase control.

8. Check Subcarrier To Sync Lock Timing

a. Display the SPG1 or SPG2 BLACK BURST signal on the Test Oscilloscope. The SPG1 or SPG2 should still be in an external lock mode.

b. Externally trigger the Test Oscilloscope from the Video Signal Source.

c. Check—The display shift should be less than 100 ns as the HORIZONTAL LOCK is switched between SUBCARRIER and SYNC.

d. Set the SPG1 or SPG2 to INTERNAL.

e. Trigger the Test Oscilloscope internally.

f. Press the SPG1 or SPG2 front-panel HORIZONTAL UNLOCK button.

g. Check—The subcarrier portion of the displayed signal should free run.

9. Check INTERNAL Mode Operation

a. Connect composite sync, subcarrier, and composite video from the Video Signal Source to the appropriate 1410 rear-panel loop-through connectors.

b. Set the SPG1 or SPG2 for INTERNAL operation.

c. Display the SPG1 or SPG2 BLACK BURST signal and a signal from the Video Signal Source simultaneously on the Test Oscilloscope. Trigger the Test Oscilloscope externally from the Video Signal Source.

d. Check—The front-panel INTERNAL LED should be lit and the two signals displayed on the Test Oscilloscope should not be locked.

10. Check SYNC Lock EXTERNAL Mode Operation

a. Set the SPG1 or SPG2 for EXTERNAL operation. Set the HORIZONTAL LOCK Switch to SUBCARRIER.

b. Check—The SYNC and SUBCARRIER LED's indicate the presence of external sync and subcarrier.

c. Check—The two signals displayed on the Test Oscilloscope should be locked.

d. Remove composite sync from the 1410 rear-panel loop-through connector.

e. Check—The SYNC LED should change states and the two signals displayed on the Test Oscilloscope should remain locked.

f. Release HORIZONTAL LOCK switch.

g. Check—SYNC LOCK and INTERNAL LED's should light and the two signals displayed on the Test Oscilloscope should not be locked.

h. Connect composite sync to the appropriate 1410 rear-panel loop-through connector.

11. Check—SUBCARRIER Lock EXTERNAL Mode Operation

a. Set the SPG1 or SPG2 HORIZONTAL LOCK to SUBCARRIER.

b. Remove the subcarrier signal from the 1410 rear-panel loop-through connector.

c. Check—The SUBCARRIER LED should indicate the absence of external subcarrier, the SYNC LOCK LED should be lit, and the two signals displayed on the Test Oscilloscope should remain locked.

d. Connect subcarrier to the 1410 rear-panel loop-through connector.

12. Check GEN LOCK Mode (SPG2 only)

a. Set the SPG2 for GEN LOCK operation.

Operating Instructions—SPG1/SPG2

b. Remove composite sync from the Video Signal Source composite video signal.

c. Check—The SYNC and SUBCARRIER LED's should change states and the INTERNAL LED should be lit.

d. Restore composite sync to the Video Signal Source composite video signal.

e. Remove burst from the Video Signal Source composite video signal.

f. Check—The SUBCARRIER LED should change states and the SYNC LOCK LED should be lit.

g. Restore burst to the Video Signal Source composite video.

13. Check Subcarrier Phase

a. Connect the SPG2 BLACK BURST signal to the Vectorscope.

b. Lock the Vectorscope to the Video Signal Source subcarrier.

c. Check—The burst phase displayed on the Vectorscope should not vary more than $\pm 3^\circ$ as the input signal amplitude is varied from one-half to two times nominal (1 V).

14. Check Phase Stability with Dynamic APL

a. Apply a composite video signal that is variable in Average Picture Level from the Video Signal Source to the 1410 rear-panel Gen Lock loop-through input.

b. Check—The phase of the signal displayed on the Vectorscope should change by 0.1° or less as the input APL is varied from 10% to 90%.

15. Check SUBCARRIER PHASE Range

a. Rotate the SPG2 SUBCARRIER PHASE control.

b. Check—The phase of the signal displayed on the Vectorscope should change 360° for each 360° rotation of the SUBCARRIER phase control.

16. Check Horizontal Jitter

a. Display the SPG2 BLACK BURST signal on the Test Oscilloscope.

b. Externally trigger the Test Oscilloscope with composite sync from the Video Signal Source.

c. Using the Test Oscilloscope delayed sweep function and magnifier, view the leading edge of a line sync pulse at 20 ns/div ($.2 \mu\text{s}/\text{div} \times 10 \text{ mag}$).

d. Check—With the SPG2 HORIZONTAL LOCK in SYNC, jitter on the sync pulse leading edge should be 10 ns or less. With HORIZONTAL LOCK in SUBCARRIER, jitter should not exceed 4 ns.

17. Check Oscillator Frequency

NOTE

After initial shipment or long storage, allow approximately 2-hour warm-up period to re-age the crystal. Thereafter, 10 to 20 minutes warm-up is sufficient.

a. Remove the composite video signal from the 1410 rear-panel Gen Lock loop-through connector.

b. Connect the SPG2 SUBCARRIER output to the Frequency Counter.

c. Check—Subcarrier frequency should be within 10 Hz of 3.579545 MHz if the SPG2 is installed in a 1410, or within 1 Hz of 3.579545 MHz if the SPG2 is installed in a 1410 Option 1.

18. Check Subcarrier Amplitude

a. Connect one of the 1410 rear-panel Subcarrier outputs through 75Ω termination to the Test Oscilloscope input.

b. Check—The Subcarrier signal should be 1.8 volts peak-to-peak to 2.2 volts peak-to-peak in amplitude.

c. Check—The other 1410 rear-panel Subcarrier output should be as in step b.

d. Connect the SPG1 or SPG2 SUBCARRIER output through 75Ω termination to the Test Oscilloscope input.

NOTE

The SPG1 or SPG2 SUBCARRIER output is driven directly from the Subcarrier Output Amplifier on the 1410 Subcarrier Input board, A13. This output is provided as a subcarrier phase reference. The subcarrier signal phase at the SPG1 or SPG2 front panel cannot be varied with the SUBCARRIER PHASE control, but is always the same as the reference subcarrier (either from the 1410 Subcarrier Oscillator or from an external source).

e. Check—The SUBCARRIER signal amplitude should be 1.8 volts peak-to-peak to 2.2 volts peak-to-peak.

19. Check Comp Blanking Compensation

a. Connect the SPG1 or SPG2 COMP BLANKING output through 75 Ω termination to the Test Oscilloscope input.

b. Check—The signal amplitude should be 3.8 volts to 4.2 volts.

c. Check—Risetime and falltime should each be 120 ns to 160 ns.

d. Repeat this step for each of the two 1410 rear-panel Comp Blanking outputs.

20. Check Comp Sync Compensation

a. Connect the SPG1 or SPG2 COMP SYNC output through 75 Ω termination to the Test Oscilloscope input.

b. Check—The signal amplitude should be 3.8 volts to 4.2 volts.

c. Check—Risetime and falltime should each be 120 ns to 160 ns.

d. Repeat this step for each of the two 1410 rear-panel Comp Sync outputs.

21. Check Burst Flag Compensation, Burst Flag Delay, and Burst Flag Width

a. Connect the 1410 rear-panel Burst Flag output through 75 Ω termination to the Test Oscilloscope input.

b. Check—The signal amplitude should be 3.8 volts to 4.2 volts.

c. Check—Risetime and falltime should each be 120 ns to 160 ns.

d. Externally trigger the Test Oscilloscope with the SPG1 or SPG2 COMP SYNC signal.

e. Connect one of the 1410 rear-panel Comp Sync outputs through 75 Ω termination to the Test Oscilloscope so that comp sync and burst flag are displayed simultaneously.

f. Note the position of the leading edge of line sync.

g. Check—The leading edge of the Burst Flag pulse should be 5.3 μ s \pm 35 ns from the leading edge of line sync.

h. Check—The half-amplitude width of the Burst Flag pulse should be 2.5 μ s \pm 70 ns.

22. Check H Drive Compensation

a. Connect 1410 rear-panel H Drive output J16 through 75 Ω termination to the Test Oscilloscope input.

b. Check—The signal amplitude should be 3.8 volts to 4.2 volts.

c. Check—Risetime and falltime should each be 120 ns to 160 ns.

d. Repeat this step for H Drive output J15 on the 1410 rear panel.

23. Check V Drive Compensation

a. Connect 1410 rear-panel V Drive output J18 through 75 Ω termination to the Test Oscilloscope input.

b. Check—The signal amplitude should be 3.8 volts to 4.2 volts.

c. Check—Risetime and falltime should be 120 ns to 160 ns.

d. Repeat this step for V Drive output J19 on the 1410 rear panel.

Operating Instructions—SPG1/SPG2

24. Check Field Reference Compensation

a. Connect the 1410 rear-panel Field Ref output J14 through 75 Ω termination to the Test Oscilloscope input.

b. Connect the SPG1 or SPG2 BLACK BURST signal through 75 Ω termination to the other Test Oscilloscope input.

c. Externally trigger the Test Oscilloscope with V Drive from the 1410 rear panel.

d. Check—The Field Reference signal amplitude should be 3.8 volts to 4.2 volts.

NOTE

The Field Reference pulse is on either Field 1, line 11, or Field 3, line 10.

e. Check—Risetime and falltime should each be 120 ns to 160 ns.

25. Check VIRS Amplitude

a. Connect the Black Burst output connector to the 1480 Ch A input and terminate in 75 Ω . Set the VIRS pushbutton in the on position.

NOTE

If the SPG1 or SPG2 is internally set for full field reference, do not use the 1480 Line Selector function. If the VIRS is not set for full field, use the 1480 Line Selector to find the VIRS on line 18 or line 19.

b. Set the 1480 display to 10 μ s/div, Volts Full Scale to 0.5, and push in the Cal and Oper switches.

c. Check—Using the Amplitude dial of the Calibration Fixture to match the sync tip with blanking, read 286 mV \pm 3.6 mV.

26. Check DC Level

a. Set the 1480 Volts Full Scale to 1.0, Display to 10 μ s/div, push in the Oper switch, set the DC Restorer Off and Response switch to Aux Video In. Position the trace to the 0 IRE graticule line and change the Black Burst output cable to the Aux Video In connector.

b. Check—The waveform blanking level should be 0 V \pm 50 mV (\pm 7 IRE).

c. Return the Black Burst output cable to the 1480 Ch A input connector.

27. Check VIRS Luminance Levels

a. Check—Use the Calibration Fixture to read the following:

Setup Level—53.57 mV \pm 3.57 mV

Gray Level—357 mV \pm 3.57 mV

Chrominance Pedestal—500 mV \pm 5 mV

28. Check VIRS Luminance Risetime

a. Set the 1480 to measure risetime—Mag at .1 μ s/div.

b. Check—Luminance risetime should be 250 ns \pm 37.5 ns.

Graticule A has built-in risetime and falltime measurement capability. Point R at 80 IRE Units aligns with T on the 0 IRE Unit reference line.

To measure risetime or falltime, set the transition amplitude to 100 IRE Units (use the VARIable Volts Full Scale). Vertically position the display so that the transition is from the -10 IRE Units line to the +90 IRE Units line. Use the 100 ns/div time base and horizontally position the rise (or fall) of the transition through point R on the short 2 IRE Unit/div scale. Measure the distance from point T on the 0 IRE Unit reference line to where the transition crosses the reference line.

29. Check Sync Risetime

a. Check—Sync risetime should be 130 ns \pm 20 ns \pm 10 ns.

30. Check Burst Risetime

a. Push in the HORIZ UNLOCK pushbutton on the SPG front panel. Push in the INTERNAL/EXTERNAL pushbutton.

b. Check—Burst risetime should be 400 ns \pm 60 ns.

31. Check VIRS Chrominance Risetime

- a. Push in the HORIZ UNLOCK pushbutton on the SPG front panel.
- b. Check—Chrominance risetime should be $1 \mu\text{s} \pm 150 \text{ ns}$.
- c. Release the SPG HORIZ UNLOCK button.

32. Check Chrominance Bandpass Filter

- a. Connect the Black Burst output to the Spectrum Analyzer and display the chrominance signal.
- b. Check—Third order harmonics should be -30 dB .

33. Check Residual Subcarrier

- a. Set the 1480 VFS to 0.2 and position the blanking level at the 0 IRE graticule line.
- b. Check—Residual subcarrier should be 2.5 mV or less.

34. Check Chrominance Amplitude

- a. Set the 1480 to Cal mode. Use the Calibration Fixture Amplitude control to position the top and bottom of the chrominance packet to the blanking level. Subtract the two readings to obtain the actual amplitude.
- b. Check—Chrominance amplitude should be $285.7 \text{ mV} \pm 2.86 \text{ mV}$ and the bottom of the chrominance packet should be even with the gray level.

35. Check Black Burst Setup Level

- a. Display the Black Burst signal on the 1480.
- b. Check—Setup level should be $53.57 \text{ mV} \pm 3.57 \text{ mV}$.

36. Check Black Burst Timing

- a. Check—Refer to Fig. 1-4 for timing details.

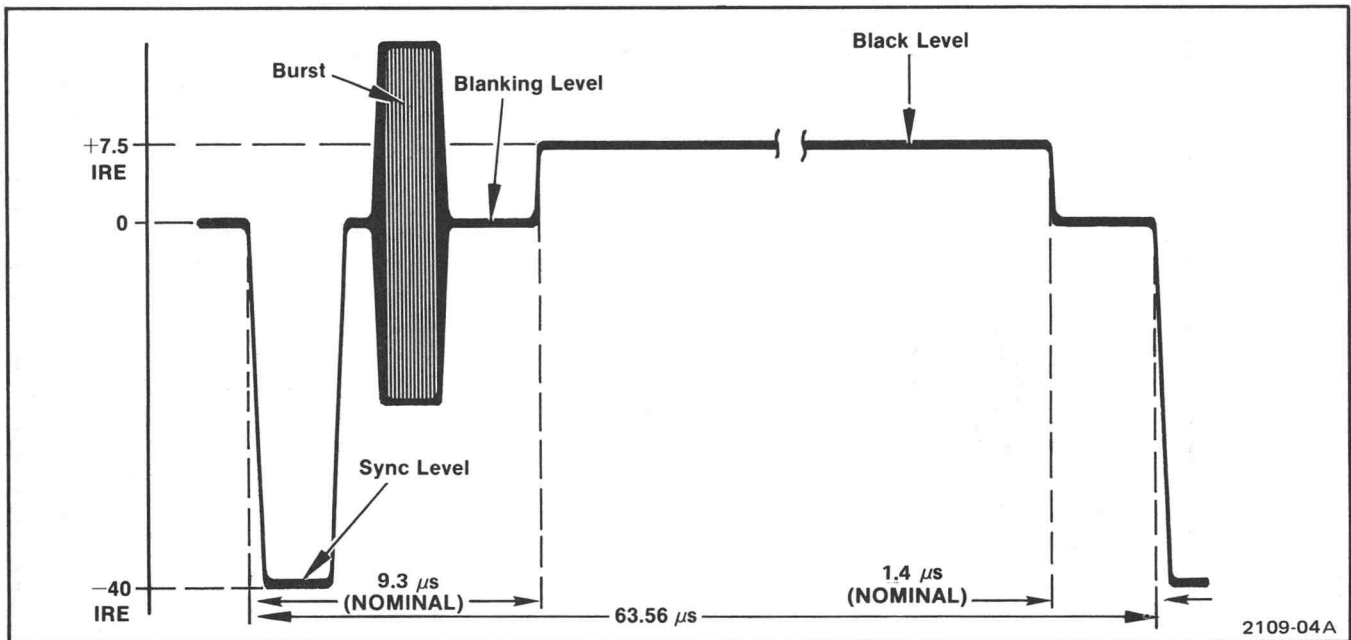


Fig. 1-4. Black Burst timing details.

37. Check Subcarrier Phase

a. Connect the 1410 Mainframe subcarrier output to the vectorscope CW Ext ϕ Ref input. Connect the other Ext ϕ Ref input to Ch B through the 10X attenuator pad. Connect the BLACK BURST output to Ch A. Display Ch A and Ch B.

b. Use the Vectorscope Line Selector to display the VIRS if not in full field mode.

c. Check—VIRS subcarrier phase is within 0.5° of the SPG1 or SPG2 burst phase.

38. Check VIRS Timing

a. Display the VIRS on the 1480.

b. Check—Refer to Fig. 1-5 (in the Operating Instructions section) for timing details.

39. Check Return Loss

a. Remove all connections from the SPG1 or SPG2, the 1410, and the Test Oscilloscope.

b. Set the SPG1 or SPG2 for INTERNAL operation.

c. Trigger the Test Oscilloscope internally.

d. Connect the Return Loss Bridge to the Test Oscilloscope Differential Comparator.

e. Connect the Leveled Sine Wave Generator through 50Ω to 75Ω Minimum Loss Attenuator to the Return Loss Bridge input.

f. Set the Leveled Sine Wave Generator Frequency Range to Ref (5 MHz), and the Test Oscilloscope Volts/Div to .1 V. Set the Differential Comparator for differential operation.

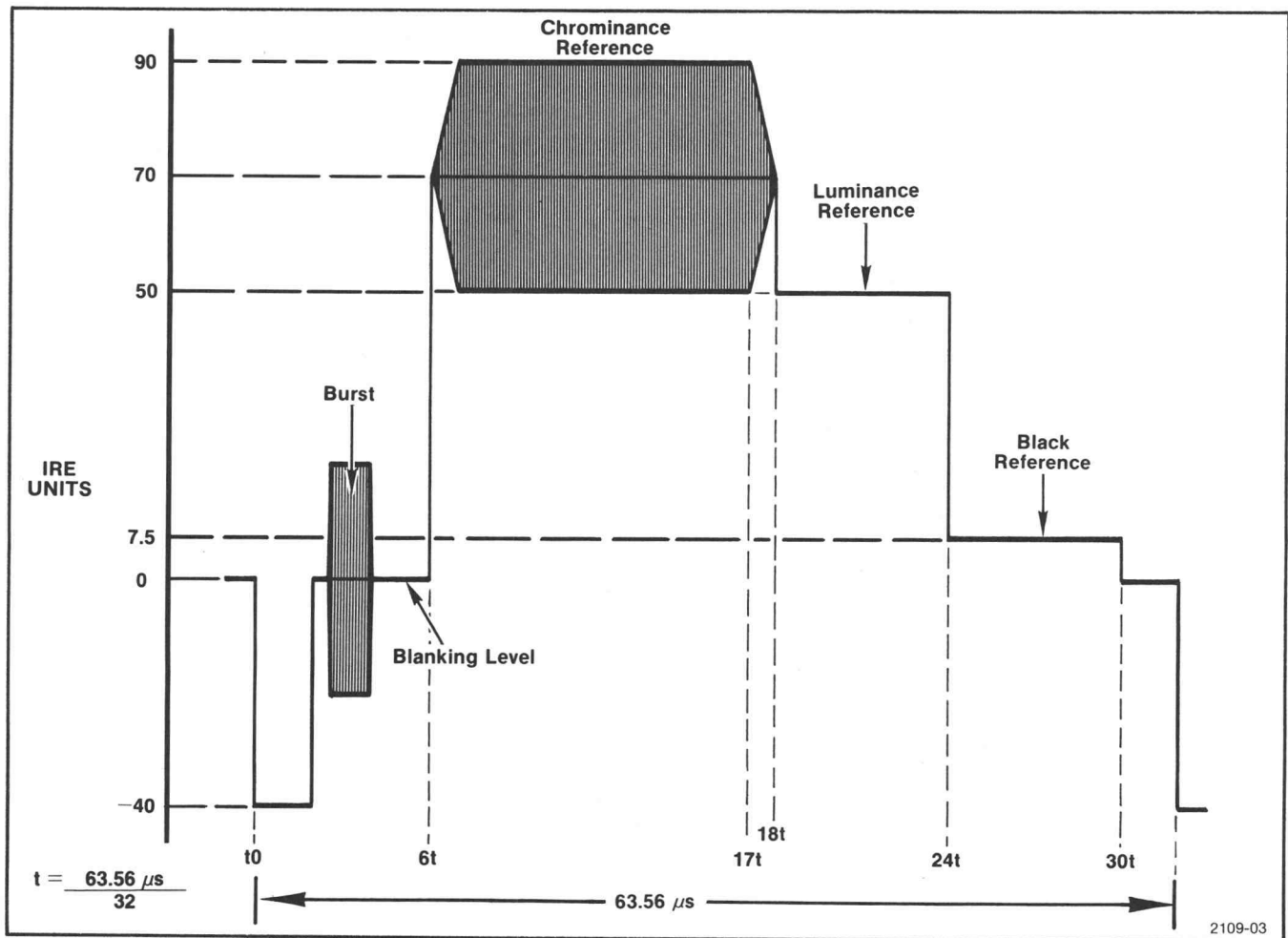


Fig. 1-5. VIRS timing details.

g. Remove the 75 Ω termination from the Return Loss Bridge Unknown arm and adjust the Leveled Sine Wave Generator Output Amplitude control for 500 mV display amplitude.

h. Replace the 75 Ω termination on the Return Loss Bridge Unknown arm.

i. Set the Test Oscilloscope Volts/Div to 10 mV.

j. Adjust the Return Loss Bridge Balance control for minimum display amplitude.

k. Remove the 75 Ω termination from the Return Loss Bridge Unknown arm.

l. Check return loss of all outputs on the SPG1 or SPG2 front panel and the 1410 rear panel (except SUB-CARRIER) by connecting the unterminated Unknown arm to each connector and checking the Test Oscilloscope display amplitude for 16 mV or less.

m. Check return loss of the loop-through inputs on the 1410 rear panel by connecting the Unknown arm to one side of the loop-through connector and the 75 Ω termination to the other side. Check for 3 mV display amplitude.

n. Remove the Return Loss Bridge.

40. Check Isolation

a. Check all double and triple outputs for active and passive isolation in the following manner:

Passive Isolation. Connect the output of interest through 75 Ω termination to the Test Oscilloscope input. Observe the signal amplitude at that output while shorting another output of the same signal to ground. The observed signal amplitude should change by no more than 1%.

Active Isolation. Observe the output of interest on the Test Oscilloscope while introducing a subcarrier signal into another output of the same signal. The subcarrier signal should be attenuated at the observed output by at least 40 dB. The introduced subcarrier signal amplitude should be varied from 0.5 to 4.0 volts.



SPECIFICATIONS

ELECTRICAL CHARACTERISTICS

The performance requirements listed here apply over an ambient temperature range of 0°C to +50°C. The rated accuracies are valid when the instrument is calibrated at +20°C to +30°C with ten minutes warm-up time. A twenty minute warm-up is required for rated accuracies 0°C ambient temperature.

Characteristics	Performance Requirements	
	SPG1	SPG2 Only
GEN LOCK	Does Not Apply	
Input Configuration		75 Ω loop-through
Input Requirements		
Sync Source		1 V nominal composite video or black burst, sync negative.
Sync Amplitude		286 mV \pm 6 dB.
Burst Amplitude		286 mV \pm 12 dB.
Burst/Sync Ratio		Within 6 dB.
Return Loss		\geq -46 dB to 5 MHz.
Loss of Lock		Indicated by front-panel LED's (automatic switching to full or partial internal).
Gen-Locked Subcarrier		
Phase error with Frequency Change		Within 0.5° with input burst frequency change of \pm 10 Hz.
Phase Error with Temperature Change (input burst within 10 Hz of nominal, oven temperature in normal range).		Within 5° with ambient temperature change from 0°C to 50°C, within 1° for any 10°C increment from 0°C to 50°C.
Phase Error with Burst Amplitude Change (input burst frequency within 10 Hz of nominal, oven temperature in normal range, ambient temperature +20°C).		\pm 1° with amplitude change from 210 mV to 420 mV, \pm 3° with amplitude range from 75 mV to 1.2 V.
Phase Stability (Breezeway Effect)		0.2° for burst timing errors including burst width variance (8 to 10 cycles) and breezeway variance (+0.28 μ s).
Phase Stability with Dynamic APL		0.1° or less with APL change from 10% to 90%.
Phase Stability with Noise		Within 1° with rms white noise at 24 dB below nominal p-p picture signal (nominal 714 mV).
Chroma Phase Range		360° via front-panel goniometer.
Line Sync Delay Range		Internal switch sets delay range to +10 μ s, -4 μ s. Front panel range \pm 1/2 μ s.

Specifications—SPG1/SPG2

Characteristics	Performance Requirements	
	SPG1 EXT—SPG2 GEN LOCK & EXT	
Stability (over ambient temperature range 0° C to 50° C).		
Subcarrier to Sync Lock Timing		Adjustable, range: +2 lines, -3 lines. Adjusted for 0 lines error.
Line Lock		Within 70 ns.
Subcarrier Lock		Within 35 ns.
Horiz Jitter		
Line Lock		10 ns or less.
Subcarrier Lock		4 ns or less.
Field/Frame Sync		Fast Lock: Direct-acting in 1 field. 1 line time offset provided. Slow Lock: 1 line/field slew.

(Remainder of specifications common to SPG1 and SPG2)

EXTERNAL Reference	
Input Configuration	75 Ω loop-through.
Input Requirements	
SUBCARRIER INPUT	
Amplitude	1.0 V to 4.0 V p-p.
Frequency	3.579545 MHz ±10 Hz.
Return Loss	≥-46 dB to 3.579545 MHz.
COMP SYNC INPUT	
Amplitude	2.0 V to 8.0 V p-p.
Polarity	Negative-going.
Return Loss	≥-46 dB to 5 MHz.
Loss of Lock	Indicated by front-panel LED indicators. Automatic switching to partial or full internal reference.
Subcarrier Stability	Output follows input.
Line Sync Delay Range	Internal switch sets delay range to +10 μs, -4 μs. Front Panel Range ±1/2 μs.
Chroma Phase Range	360° via front-panel goniometer.
SYNC GENERATOR	
COMP SYNC	
Timing	
Equalizing Pulse	2.3 μs ±100 ns.
Duration	Measured at 50% points.
Equalizing Pulse	3 lines
Sequence Duration	
Field Sync Duration	27.0 μs ±200 ns. Measured at 50% points.

Characteristics	Performance Requirements
<p>SYNC GENERATOR (cont)</p> <p>Field Sync Pulse</p> <p> Sequence</p> <p> Duration</p> <p>Interval Between Field Sync Pulses</p> <p>Jitter</p> <p>Line Sync Period</p> <p>Line Sync Duration</p>	<p>6-6-6</p> <p>3 lines.</p> <p>4.77 μs \pm100 ns. Measured at 50% points.</p> <p>4 ns or less.</p> <p>$\frac{1}{\text{subcarrier X2}}$ 455</p> <p>4.70 μs \pm100 ns at 50% point. 4.8 μs at 10% point.</p>
<p>COMP BLANKING</p> <p>Line Blanking Duration</p> <p>Field Blanking Duration</p>	<p>10.7 μs nominal, adjustable 9 to 12 μs. Measured at 50% points.</p> <p>20 lines nominal, adjustable 16 to 21 lines.</p>
<p>BURST FLAG</p> <p>Delay From Line Sync</p> <p>Duration</p>	<p>Adjustable.</p> <p>2.51 μs \pm50 ns (9 cycles of subcarrier, adjustable).</p>
<p>LINE DRIVE</p> <p>Duration</p>	<p>Start of line blanking to end of line sync \pm100 ns.</p>
<p>FIELD DRIVE</p> <p>Duration</p>	<p>9 lines.</p>
<p>FIELD REFERENCE</p> <p>Position</p>	<p>Field 1, line 11 or Field 3, line 10.</p>
<p>VIRS</p> <p>Chrominance</p> <p> Amplitude</p> <p> Phase</p> <p> Envelope Risetime</p>	<p>285.7 mV \pm2.86 mV (40 IRE \pm0.4 IRE).</p> <p>Within 0.5° of burst.</p> <p>Sin² shaped, 1 μs \pm150 ns.</p>
<p>Luminance</p> <p>Setup Level</p> <p>Gray Level</p> <p>Chroma Pedestal</p> <p>Rise and Fall Time</p>	<p>53.57 mV \pm3.57 mV (7.5 IRE \pm0.5 IRE).</p> <p>357 mV \pm3.57 mV (50 IRE \pm0.5 IRE).</p> <p>500 mV \pm5 mV (70 IRE \pm0.7 IRE).</p> <p>Sin² Shaped, 250 ns \pm37.5 ns (\pm15%).</p>
<p>Timing</p>	<p>See Fig. 2-1.</p>

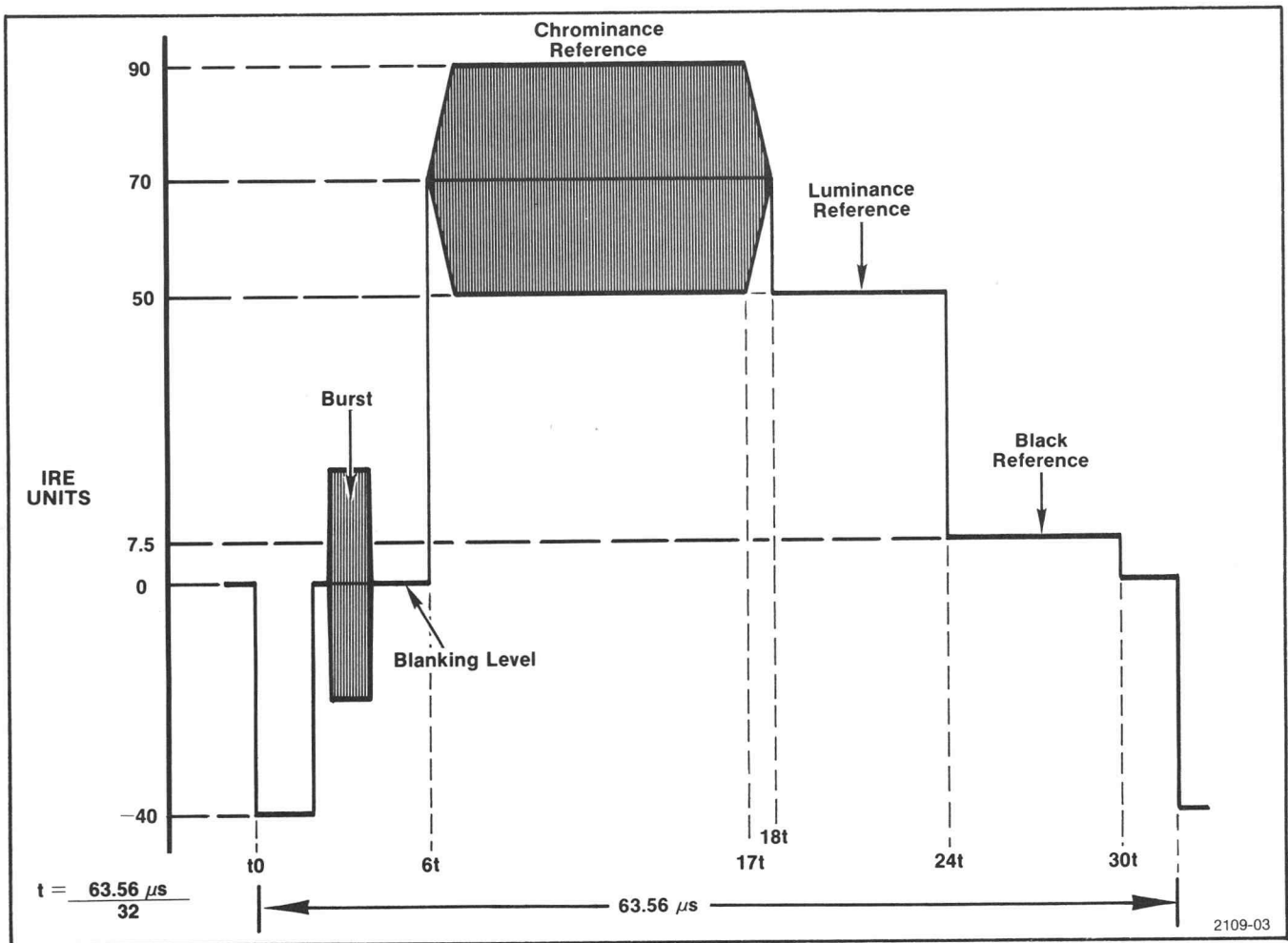


Fig. 2-1. VIR signal details.

Characteristics	Performance Requirements
VIRS (cont) Black Burst Amplitude Sync Setup Sync & Setup Risetime Burst	 286 mV ±3.57 mV (40 IRE ±0.5 IRE) negative-going. 53.57 mV ±3.57 mV (7.5 IRE ±0.5 IRE). Sin ² Shaped, 130 ns +20 ns, -10 ns. 286 mV ±2.86 mV (40 IRE ±0.4 IRE).
Timing Line Sync Period	 4.70 μs ±100 ns at 50% point, 4.8 μs ±100 ns at 10%. 63.56 μs (digitally determined from 3.579545 MHz).
Return Loss	At least 30 dB to 5 MHz.

Characteristics	Performance Requirements
<p>VIRS (cont)</p> <p>Isolation</p> <p>Passive</p> <p>Active (Non-Coherent Crosstalk)</p>	<p>Either open or short of one output shall cause an output level change at the other connector of 1% or less (40 dB) for all components of the signal.</p> <p>A signal introduced to one output connector shall be attenuated by at least 40 dB at the other connector for signals between 0.5 and 4.0 volts in amplitude at or below color subcarrier frequency.</p>
<p>Field Sync</p> <p>Sequence</p> <p>Interval between Field Sync Pulses</p> <p>Period</p>	<p>3 lines (digitally determined from 3.579545 MHz).</p> <p>4.77 μs \pm100 ns. Measured at 50% points.</p> <p>262.5 lines (digitally determined from 3.579545 MHz).</p>
<p>Equalizing Pulses</p> <p>Duration</p> <p>Sequence</p>	<p>2.33 μs \pm50 ns at 50% points.</p> <p>3 lines (digitally determined from 3.579545 MHz).</p>
<p>Burst</p> <p>Delay from Line Sync</p> <p>H.A.D. of Envelope</p> <p>Rise and Fall Time</p>	<p>5.309 μs (19 cycles of subcarrier) \pm35 ns.</p> <p>2.51 μs (9 cycles of subcarrier) \pm70 ns.</p> <p>400 ns \pm60 ns.</p>
<p>Breezeway</p>	<p>475 ns \pm50 ns from 10% point on burst.</p>
<p>Setup</p>	<p>Start 9.58 μs after leading edge of line sync, stop 1.59 μs before line sync leading edge.</p>
<p>PULSE OUTPUTS</p> <p>COMP SYNC</p> <p>Output Level into 75 Ω</p> <p>Return Loss</p> <p>Isolation</p> <p>Passive</p> <p>Active (Non-Coherent Crosstalk)</p> <p>Rise and Fall Time</p>	<p>4 V \pm5%.</p> <p>At least 30 dB to 5 MHz.</p> <p>Either open or short of one output shall cause an output level change at the other connector of 1% or less (40 dB) for all components of the signal.</p> <p>A signal introduced to one output connector shall be attenuated by at least 30 dB at the other connector for signals between 0.5 and 4.0 volts in amplitude at or below color subcarrier frequency.</p> <p>Linear ramp, 10% to 90% time 140 ns \pm20 ns.</p>
<p>COMP BLANKING</p> <p>Output Level into 75 Ω</p> <p>Return Loss</p>	<p>4 V \pm5%.</p> <p>At least 30 dB to 5 MHz.</p>

Specifications—SPG1/SPG2

Characteristics	Performance Requirements
<p>COMP BLANKING (cont)</p> <p>Isolation</p> <p> Passive</p> <p> Active (Non-Coherent Crosstalk)</p> <p>Rise and Fall Time</p>	<p>Either open or short of one output shall cause an output level change at the other connector of 1% or less (40 dB) for all components of the signal.</p> <p>A signal introduced to one output connector shall be attenuated by at least 30 dB at the other connector for signals between 0.5 and 4.0 volts in amplitude at or below color subcarrier frequency.</p> <p>Linear ramp, 10% to 90% time 140 ns \pm20 ns.</p>
<p>BURST FLAG</p> <p>Output Level into 75 Ω</p> <p>Return Loss</p> <p>Isolation</p> <p> Passive</p> <p> Active (Non-Coherent Crosstalk)</p> <p>Rise and Fall Time</p>	<p>4 V \pm5%</p> <p>At least 30 dB to 5 MHz.</p> <p>Either open or short of one output shall cause an output level change at the other connector of 1% or less (40 dB) for all components of the signal.</p> <p>A signal introduced to one output connector shall be attenuated by at least 30 dB at the other connector for signals between 0.5 and 4.0 volts in amplitude at or below color subcarrier frequency.</p> <p>Linear ramp, 10% to 90% time 140 ns \pm20 ns.</p>
<p>LINE DRIVE</p> <p>Output Level into 75 Ω</p> <p>Return Loss</p> <p>Isolation</p> <p> Passive</p> <p> Active (Non-Coherent Crosstalk)</p> <p>Rise and Fall Time</p>	<p>4 V \pm5%.</p> <p>At least 30 dB to 5 MHz.</p> <p>Either open or short of one output shall cause an output level change at the other connector of 1% or less (40 dB) for all components of the signal.</p> <p>A signal introduced to one output connector shall be attenuated by at least 30 dB at the other connector for signals between 0.5 and 4.0 volts in amplitude at or below color subcarrier frequency.</p> <p>Linear ramp, 10% to 90% time 140 ns \pm20 ns.</p>
<p>FIELD DRIVE</p> <p>Output Level into 75 Ω</p> <p>Return Loss</p> <p>Isolation</p> <p> Passive</p> <p> Active (Non-Coherent Crosstalk)</p> <p>Rise and Fall Time</p>	<p>4 V \pm5%.</p> <p>At least 30 dB to 5 MHz.</p> <p>Either open or short of one output shall cause an output level change at the other connector of 1% or less (40 dB) for all components of the signal.</p> <p>A signal introduced to one output connector shall be attenuated by at least 30 dB at the other connector for signals between 0.5 and 4.0 volts in amplitude at or below color subcarrier frequency.</p> <p>Linear ramp, 10% to 90% time 140 ns \pm20 ns.</p>

Characteristics	Performance Requirements
<p>FIELD REFERENCE</p> <p>Output Level into 75 Ω</p> <p>Return Loss</p> <p>Isolation</p> <p> Passive</p> <p> Active (Non-Coherent Crosstalk)</p> <p>Rise and Fall Time</p>	<p>4 V ±5%.</p> <p>At least 30 dB to 5 MHz.</p> <p>Either open or short of one output shall cause an output level change at the other connector of 1% or less (40 dB) for all components of the signal.</p> <p>A signal introduced to one output connector shall be attenuated by at least 30 dB at the other connector for signals between 0.5 and 4.0 volts in amplitude at or below color subcarrier frequency.</p> <p>Linear ramp, 10% to 90% time 140 ns ±20 ns.</p>
<p>SUBCARRIER</p> <p>Amplitude into 75 Ω</p> <p>Return Loss</p> <p>Isolation</p> <p> Passive</p> <p> Active (Non-Coherent Crosstalk)</p>	<p>2 V p-p ±10%.</p> <p>At least 30 dB to 5 MHz.</p> <p>Either open or short of one output shall cause an output level change at the other connector of 1% or less (40 dB) for all components of the signal.</p> <p>A signal introduced to one output connector shall be attenuated by at least 30 dB at the other connector for signals between 0.5 and 4.0 volts in amplitude at or below color subcarrier frequency.</p>

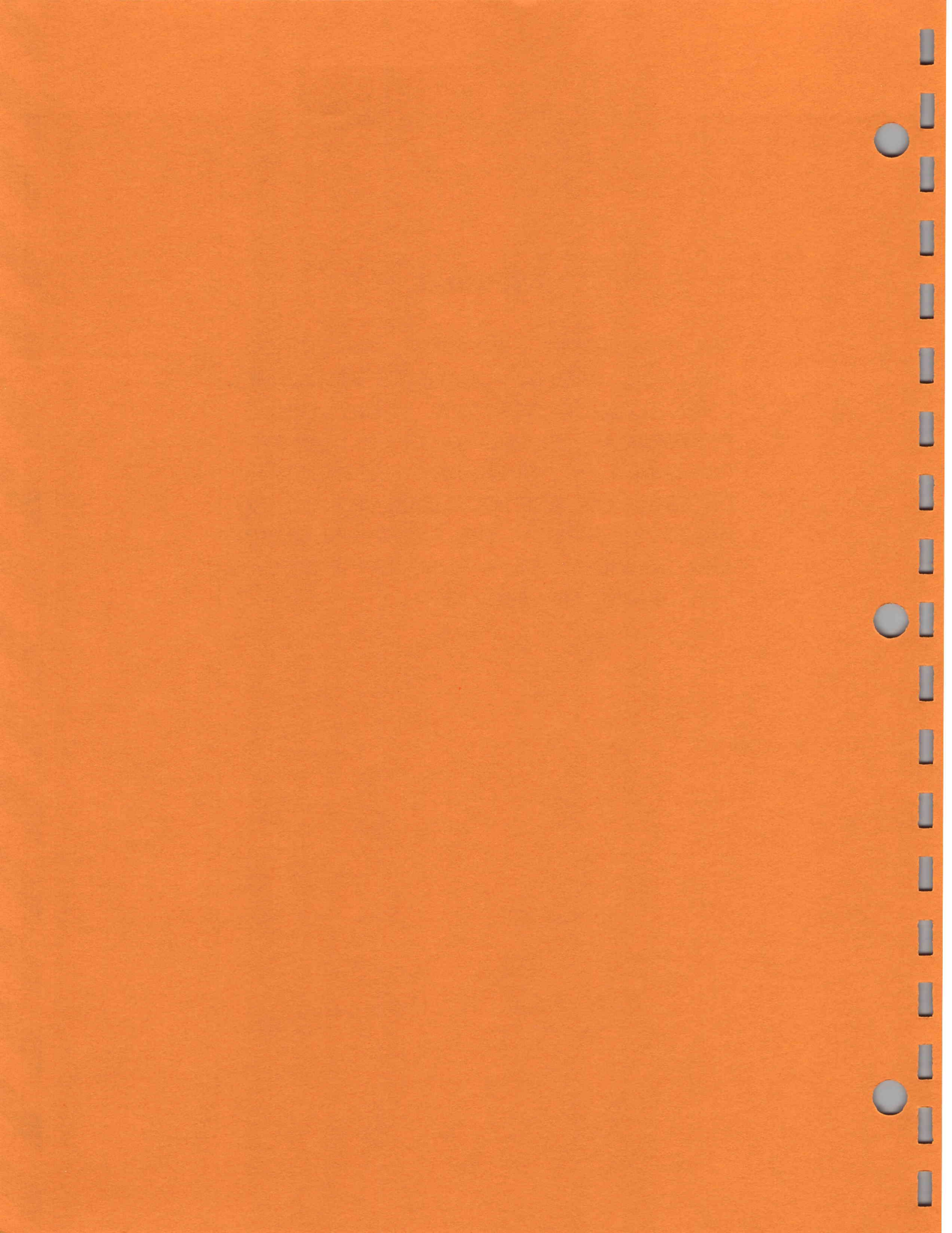
ENVIRONMENTAL CHARACTERISTICS

Characteristics	Performance Requirements
<p>Temperature</p> <p> Operating</p> <p> Storage</p> <p>Altitude</p> <p> Operating</p> <p> Storage</p>	<p>0°C to 50°C.</p> <p>-40°C to +65°C.</p> <p>To 15,000 feet.</p> <p>To 50,000 feet.</p>



WARNING

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



PART II

SERVICE INFORMATION

INSTALLATION

INSTALLATION IN MAINFRAME

Use the following steps to install the SPG1 or SPG2 in the 1410 Generator mainframe. Turn the 1410 Power switch off and remove the power cord before installation. Refer to Fig. 3-1 as installation is performed.

1. The rows of pins on the 1410 Interface board are labeled beginning with P51 on the front left of the board. Note that, unlike the test signal modules, which can be placed in any location, the SPG1 or SPG2 must be installed in the two locations immediately to the right of the 1410 front panel.

Starting with row P51, install the boards in the following order:

P51 Pulse Output Amplifier A24
 P52 Sync Lock A21
 P53 Generator Logic A22
 P54 Sync Timing A20
 P56 Subcarrier Lock A23 (SPG2 only)
 P57 VIRS/Black Burst A25

Position each board over the Interconnect pins using the plastic guides for pin alignment. Seat the board firmly on the Interconnect board.

2. Install shields (A100) as follows: Between rows P54 and P55 (separating Sync Timing A20 and Subcarrier Lock A23 in the SPG2 or VIRS/Black Burst A25 in the SPG1); between rows P56 and P57 in the SPG2 (separating Subcarrier Lock A23 from VIRS/Black Burst A25); and to the right of VIRS/Black Burst A25 (separating the SPG1 or SPG2 from the other modules).

3. Install plastic pushbutton extenders on pushbutton shafts.

4. Position the front panel over the pushbutton extenders and secure to the 1410 front casting with the screws provided.

5. Connect cables to the various boards as follows:

To	From
P816 A24	P76 1410 Rear Interconnect A5 and P75 1410 Rear Interconnect A5
P846 A24	P66 1410 Rear Interconnect A5 and P65 1410 Rear Interconnect A5
P759 A24	P339 A21 and Front Output Connectors
P755 A24	Front-Panel Goniometer
P339 A21	P759 A24 and P413 1410 Subcarrier Input A13
P743 A23	P98 1410 Rear Interconnect A5
P642 A23	P415 1410 Subcarrier Input A13
P996 A25	P58 1410 Rear Interconnect A5 and Front-Panel Output Connectors
P445 A22	P98 1410 Rear Interconnect A5
P449 A22	J41 1410 Remote Connector
P161, Pin 2, A20	P170, Pin 1, A21

Reverse the installation steps to remove the module.

OPERATING MODE SELECTION

A20 Sync Timing

P103 H Drive Start	Selects either fixed H Drive Start or variable H DRIVE Start. Variable Start varies with adjustment of H Blanking Start, R116.
S109 Horiz Phasing	Provides 4 μ s delay to 10 μ s advance with respect to external sync.
P110 Horiz Blanking	Selects either fixed or variable H Blanking width. R115 and R116 adjust starting and ending time.

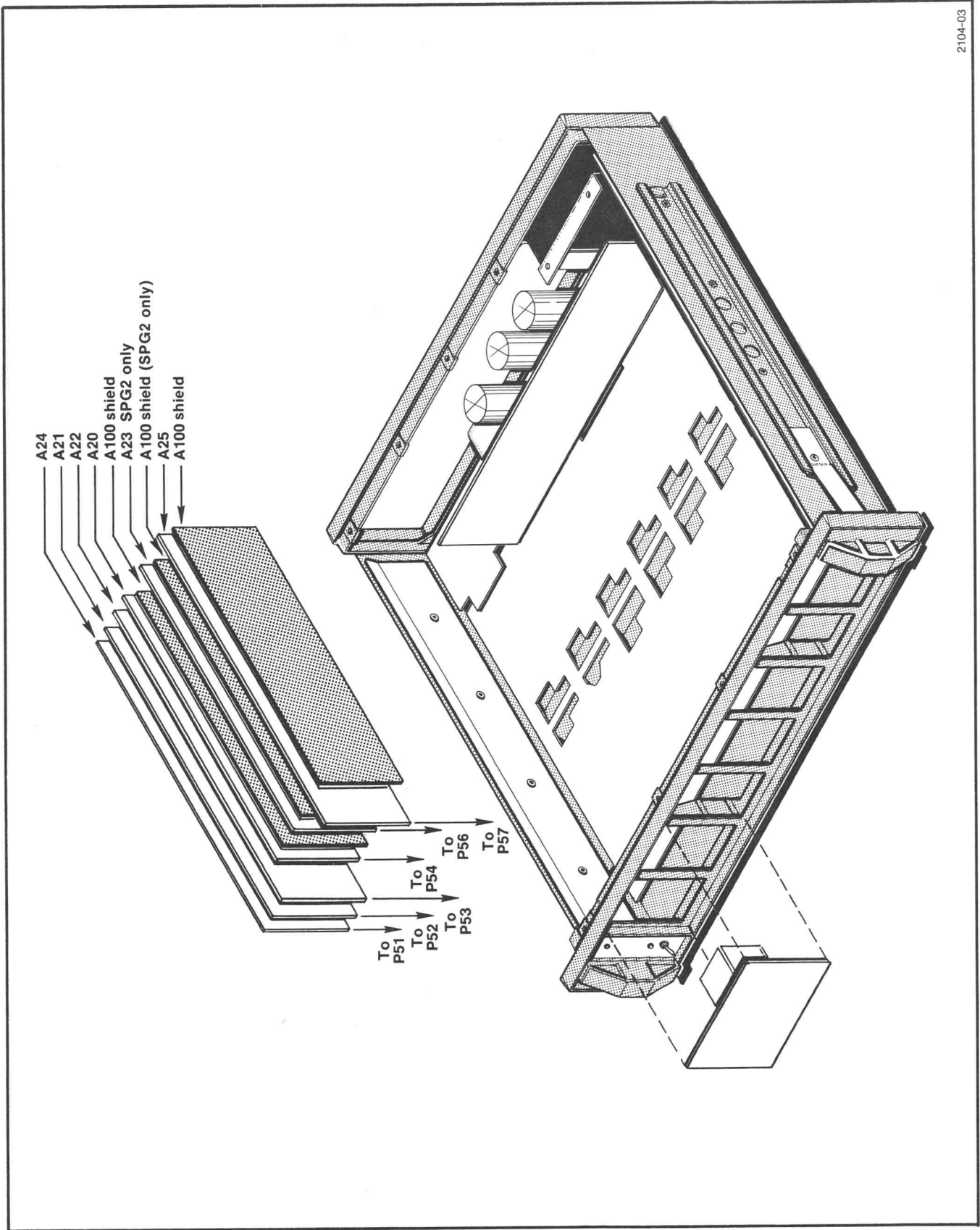


Fig. 3-1. Installation.

P111 Vert Blanking Selects either fixed or variable Vert Blanking width. Start of Vert Blanking is triggered by command from U129. End of variable Vert Blanking is controlled by R148.

P112 PAL Pulse P113 PAL Pulse Phase P112 and P113 provide functions not presently used in NTSC systems. P112 selects either a pulse occurring at sync time on alternate lines, or a square-wave that is high for one line, and low for the next. P113 selects either (a) which set of alternate lines the pulse will appear on, or (b) for which set of alternate lines the square-wave is high.

P126 V Blanking Width Selects either Short V Blanking (20 lines) or Normal blanking width (21 lines).

P129 Drive Start Selects either Blanking or Sync as the drive start for the Sync Generator.

P169 V Lock Selects either Fast lock, in which the counter in U129 is immediately reset to incoming vertical sync, or Slow lock, in which the counter is slewed at a rate of one line per field until lock occurs.

A21 Sync Lock

P228 Norm/Slow-Slow Selects speed of lock between H sync and subcarrier. Normal is a "crash" lock condition, Slow-Slow allows the counter to slew line-by-line to the correct phase.

P224 Sync/Subc Unlock; P324 Timing Jitter With a jumper installed on P224, incoming signals that do not have sync and subcarrier locked will cause a switch to sync lock. With the jumper installed on P324, switch to internal will occur under conditions of persistent noise on the incoming signal, or sync-subcarrier unlock.

P294 Osc Lock Selects either "crash" lock or slow lock of the horizontal oscillator on the SPG1 or SPG2 Sync Timing board.

A22 Generator Logic

P365 Ext Sync The Needed position requires that external sync be present to operate in the subcarrier lock mode. Not Needed does not require external sync to operate in the subcarrier lock mode.

P366, P374 SPG1/SPG2 P374 enables the Gen Lock mode of operation in SPG2's. If the Subcarrier Lock board is not installed (SPG1), this jumper must be on P366.

P382 Chrominance Disable The On position disables subcarrier portions of signals when the SPG1 or SPG2 loses either subcarrier or lock.

The Off position causes internal subcarrier to be substituted for external subcarrier on loss of subcarrier or lock.

P383 Subcarrier LED Polarity Selects mode of indication for the front-panel LED. The SUBCARRIER LED can be lit or off when subcarrier is lost.

P386 Video Disable The On position disables all video outputs upon loss of sync or lock.

The Off position substitutes internally-generated sync and subcarrier upon loss of sync or lock.

P387 Sync LED Polarity Selects mode of indication for the front-panel LED. The SYNC LED can be lit or off to indicate the loss of external sync.

P398 Ext Subcarrier The Needed position requires that external subcarrier be present to operate in the sync lock mode. Not Needed does not require external subcarrier for sync lock operation.

P399 Gen Lock Subcarrier The Needed position requires that burst be present to gen lock the SPG2. Not Needed does not require burst on the external video signal for gen lock mode.

Installation—SPG1/SPG2

A23 Subcarrier Lock

P459 Fast/Slow Lock Selects speed of subcarrier lock, either "crash" or a slower mode. Controls the subcarrier oscillator on the Subcarrier Input board in the 1410.

P685 Residual Phase Component Cancel phase cancels residual subcarrier present on the incoming signal, restoring original burst phase.

In the Ignore position, subcarrier phase is the sum of burst phase and residual subcarrier phase on the incoming signal, allowing lock to cw subcarrier.

P690 SIS Delete On deletes any sound-in-syncs (SIS) from the incoming signal after it passes through the sync stripper.

Off does not delete SIS.

A24 Pulse Output Amplifier

P836 Field Ref Timing Selects either field 3 line 10, or field 1 line 11 for generating the Field Reference pulse.

A25 VIRS/Black Burst

P855 Sync in Video Disable Mode If video is disabled under loss of lock conditions by P386 on A22, P855 selects either no output (Off) or sync output (On).

P857 VIRS Line Selects either line 18 or line 19 for the VIR Signal in Black Burst output mode.

P858 VIRS Field Selects either or both fields for the VIR Signal in Black Burst output mode.

P851 VIT Key Source Selects either internal or external sources for VIT Key.

P853 Blanking Selects either fixed and variable blanking width for the VIRS/Black Burst Signal.

RECALIBRATION PROCEDURE

Introduction

This procedure can be used to either verify that the instrument is performing to its rated specifications, or to recalibrate it after repairs or long periods of operation. A short form procedure precedes the Recalibration Procedure and can be used as a calibration record or as an index to the complete procedure.

In the complete procedure, steps or parts of steps that relate to performance check only are identified by the word "Check" in the step heading. Those steps that pertain to both the performance checks and calibration steps are headed "Check/Adjust".

Front-panel control and connector names on the SPG1 or SPG2 are capitalized, for example: SUBCARRIER PHASE. Control and connector names on test equipment or the 1410 mainframe and internal controls in the SPG1 or SPG2 have only the first letter capitalized, for example. Test Oscilloscope Time/Div, 1410 rear-panel Subcarrier input, or SPG1, SPG2 Line Frequency control.

See the circuit board illustrations in Section 8, Servicing Illustrations, of this manual for adjustment locations.

TEST EQUIPMENT

The test equipment listed here was used in preparing this procedure. The measurement capabilities described are the minimum required to recalibrate the instrument. Each piece of test equipment is assumed to be operating within its stated specifications. If alternative equipment is used, it must meet or exceed these requirements.

1. Test Oscilloscope

Dual Time Base. Range from 50 ns/Div to 5 s/Div with provisions for a delaying sweep and television triggering.

Differential Comparator. Bandwidth, dc to 30 MHz; minimum deflection factor, 1 mV/div; two channels capable of differential operation.

Dual Trace Amplifier. Vertical amplifier independent of the Differential Comparator. Bandwidth, dc to 30 MHz, minimum deflection factor, 5 mV/Div.

For example, a Tektronix 7603 with 7B53A Option 5 Dual Time Base, 7A13 Differential Comparator, and 7A18 Dual Trace Amplifier.

2. Leveled Sine Wave Generator

Capable of amplitudes from 0.2 volt peak-to-peak, frequency range from 50 kHz to 5 MHz, for example: a Tektronix SG 503 in a TM 500-series Power Unit.

3. Return Loss Bridge

Tektronix Part Number 015-0149-00.

4. 50 Ω to 75 Ω Minimum Loss Attenuator

Tektronix Part Number 011-0057-00.

5. 75 Ω Feed-Through Termination

Two, matched within 0.2% supplied as accessories with the Return Loss Bridge (item 3). Tektronix Part Numbers 011-0103-00 (red), and 011-0103-01 (green).

6. 75 Ω Feed-Through Termination (20)

Tektronix Part Number 011-0103-02.

7. 75 Ω Cable (5)

42 inches long. Tektronix Part Number 012-0074-00.

8. P6053B 10X Probe

Tektronix Part Number 010-6053-11.

9. A test signal generator module (TSG1, TSG2, TSG3, TSG4) mounted in the 1410 along with the SPG1 or SPG2. The test signal generator signal must contain a subcarrier portion at 0 APL with more than 19 cycles of subcarrier.

10. Video Signal Source

Capable of generating composite video, composite sync, and a 2 volt peak-to-peak subcarrier signal, for example: a Tektronix 1410 with SPG1 or SPG2; or a Tektronix 146.

Recalibration Procedure—SPG1/SPG2

11. Waveform Monitor

Capable of overlaying one portion of a line sweep display on another portion and having sweep magnification to at least $.1 \mu\text{s}/\text{Div}$, for example: a Tektronix 1480-series.

12. Vectorscope

Capable of measuring phase differences between two signals of less than 0.5° , for example: a Tektronix 520A.

13. Spectrum Analyzer

Capable of measuring the third harmonic of the color subcarrier to below -30 dB , for example: a Tektronix 7L12 or 7L5/L2 (7000-Series plug-in units).

14. Frequency Counter

Capable of resolving 0.25 Hz out of 3 MHz , for example: a Hewlett-Packard 5326A Option 011.

15. Calibration Fixture

For use with the Waveform Monitor. See Fig. 4-1.

Calibration Fixture

This fixture and the 1480 Waveform Monitor provide a variable calibration voltage level which can be read directly from a 10-turn dial. The schematic diagram and parts list for the fixture appear in Fig. 4-1. When S1 is in the Fixed position, the 1480 calibrator voltage is determined by the circuit in the fixture.

With P9034 connected to J9034 on the 1480, and S1 in the Fixed position, calibrate the graticule for 140 IRE (1 V). Set the Amplitude dial to 1000 and S1 to Variable. Adjust R3 (CAL), to exactly match the internal 1 V calibrator level. The dial is now calibrated so that each turn of the dial represents 100 mV.

Measurements

The signal to be measured must be fed to the 1480 CH A input, and both the OPER and CAL buttons pushed in. To check amplitude within a given tolerance, adjust the Amplitude dial while watching the waveform monitor display. When the level being measured overlays the blanking level, read the amplitude directly from the dial.

To adjust a signal level, use the Calibration Fixture as a reference. First, set the Amplitude dial to the desired level. Then, adjust the proper control so that the signal level overlays the blanking level. The signal level now matches the Amplitude level.

EQUIPMENT SETUP

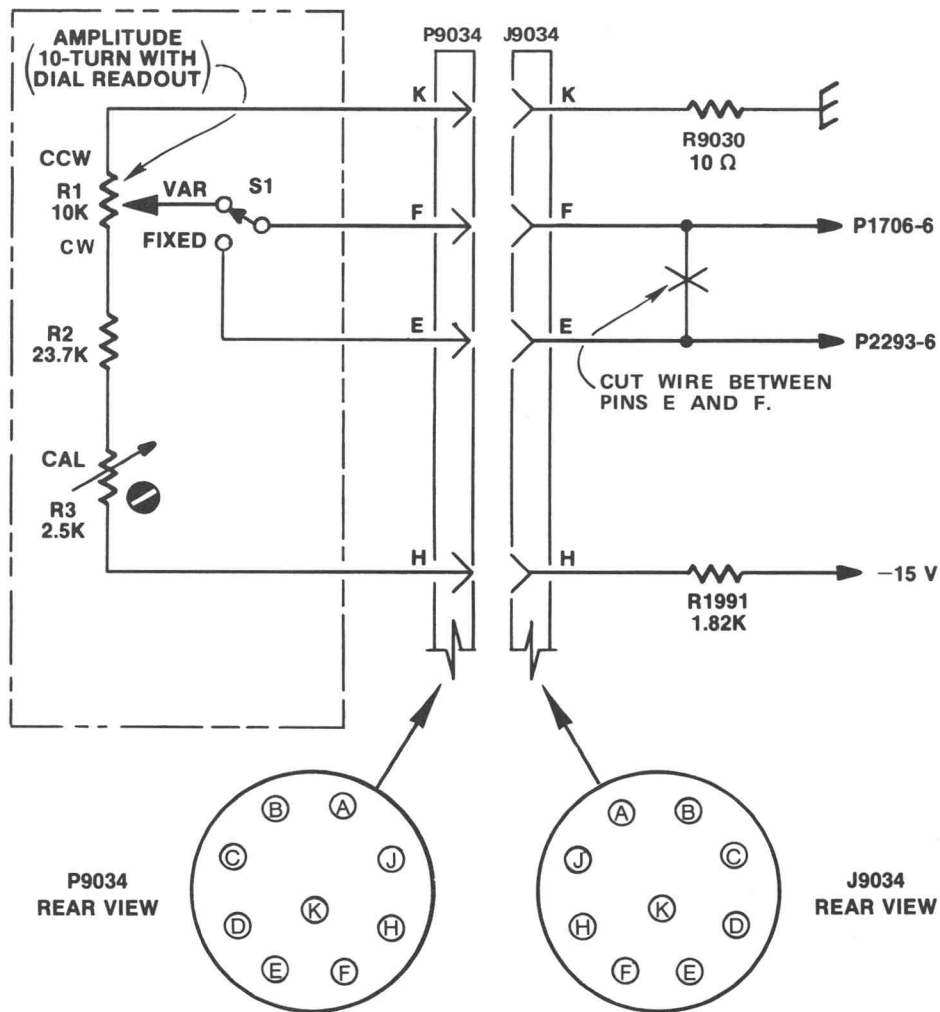
1. Test Oscilloscope

(A 7603 with the 7B53A Option 5 in the right compartment, the 7A18 in the left compartment, and the 7A13 in the center compartment.)

	7603
Power	On
Readout	
Intensity	Best Display
Grat Illum	
Focus	
Vert Mode	Left
Trig Source	Left
	7A13
+Input	DC
-Input	DC
Volts/Div	.1
Variable	Cal
BW	Full
	7A18
Ch 1 and Ch 2	
Volts/Div	1
Variable	Cal
Coupling	DC
Trigger Source	Ch 1
Display Mode	Ch 1
Ch 2 Polarity	+Up
	7B53A
Main Triggering	
Mode	Auto
Coupling	AC
Source	Int
Time/Div	$10 \mu\text{s}$
Variable	Cal
Mag	X1

CALIBRATION FIXTURE

1480-SERIES REAR PANEL



Parts List

Ckt No.	Description	Tektronix Part No.
P9034	9-pin Amphenol #165-13	134-0049-00
R1	10kΩ ±5%, Ind. Lin. ±0.1%, 10-turn, prec. var.	311-1729-00
R2	23.7 kΩ ±1%, 1/8 W, metal film	321-0325-00
R3	2.5 kΩ ±20%, variable	311-0086-00
S1	SPDT toggle switch 10-turn dial for R1, Kilo-dial Mod. 461-S-41	260-0613-00 331-0139-00
Misc.	Approx. 3 ft. of 4-conductor cable and a small metal or plastic enclosure or case.	

Set R1 fully counterclockwise (ccw) and the dial at 0 when installing the dial.

2329-04

Fig. 4-1. Waveform Monitor Calibration Fixture.

Recalibration Procedure—SPG1/SPG2

2. 1410 with SPG1 or SPG2 and test signal module

1410

Power	On
Test Signal Module	Set for signal containing sub-carrier at 0 APL

SPG1

INTERNAL-EXTERNAL	INTERNAL
HORIZONTAL LOCK	SUBCARRIER
BLACK BURST SIG VIRS	ON

SPG2

INTERNAL-GEN LOCK/EXT	INTERNAL
GEN LOCK-EXTERNAL	EXTERNAL
HORIZONTAL LOCK	SUBCARRIER
BLACK BURST SIG VIRS	ON

When performing the Recalibration Procedure, mount each circuit board in turn on the 1410 Extender board A2. The Extender board allows easy access to the controls on the SPG1 or SPG2 board.

SHORT FORM PROCEDURE

A20 Sync Timing Board

1. Check/Adjust Line Frequency (C159). Page 4-5
2. Check Line Sync Delay Range (S109). Page 4-5
3. Check/Adjust Vertical Phasing (R169). Page 4-6
4. Check Field Blanking Duration (Variable). Page 4-6
5. Check/Adjust Variable V Blanking Stop (R148). Page 4-6
6. Check Line Blanking Duration (Variable). Page 4-6
7. Check/Adjust Variable H Blanking Start and Variable H Blanking Stop (R116, R115). Page 4-6
8. Check/Adjust Color Bars Horiz Shift (R149). Page 4-6
9. Check/Adjust Burst Delay and Burst Width (R119, R128). Page 4-7

10. Check Comp Sync Timing. Page 4-7
11. Check PAL Pulse. Page 4-7
12. Check Split Field Timing. Page 4-7
13. Check V Lock. Page 4-8
14. Check Timing Outputs. Page 4-8

A21 Sync Lock Board

1. Check Sync Lock Loop. Page 4-8⁹
2. Check/Adjust HORIZ DELAY (R175). Page 4-9
3. Check Slow-Fast Lock. Page 4-9
4. Check ÷455 Counter Operation. Page 4-9
5. Check/Adjust Lower Phase Reset, Lower Phase Advance, Upper Phase Retard, Upper Phase Reset, and Preset Center (R209, R198, R199, R189, R276). Page 4-9
6. Check/Adjust SHC Phase Center (R219). Page 4-11
7. Check SCH Phasing. Page 4-11
8. Check/Adjust Subcarrier to Sync Lock Timing (R208). Page 4-11
9. Check Normal/Slow-Slow Lock. Page 4-11
10. Check Timing Jitter and Sync-Subcarrier Unlock. Page 4-12

A22 Generator Logic Board

1. Check INTERNAL Mode Operation. Page 4-12
2. Check SYNC Lock EXTERNAL Mode Operation. Page 4-12
3. Check SUBCARRIER Lock External Mode Operation. Page 4-13
4. Check LED Polarity and Chroma and Video Disable. Page 4-13
5. Check GEN LOCK Mode Operation (SPG2 Only). Page 4-14

*Correction
DOT*

A23 Subcarrier Lock Board (SPG2 Only).

- 1. Check Sync Stripper. Page 4-14
- 2. Check AGC. Page 4-14
- 3. Check/Adjust Subcarrier Phase (L679). Page 4-14
- 4. Check Phase Stability with Dynamic APL. Page 4-15
- 5. Check Phase Response to Residual Subcarrier. Page 4-15
- 6. Check Subcarrier Phase Range. Page 4-15
- 7. Check Fast-Slow Lock. Page 4-15
- 8. Check Horizontal Jitter. Page 4-16
- 9. Check/Adjust Oscillator Frequency (R456). Page 4-16

A24 Pulse Output Amplifier Board

- 1. Check/Adjust Subcarrier Amplitude (C779). Page 4-16
- 2. Check/Adjust Comp Blanking Compensation (C798, C808, C809). Page 4-16
- 3. Check/Adjust Comp Sync Compensation (C799, C838, C839). Page 4-17
- 4. Check/Adjust Burst Flag Compensation (C818), Burst Flag Delay (R800), and Burst Flag Width (R821). Page 4-17
- 5. Check/Adjust H Drive Compensation (C819, C848). Page 4-17
- 6. Check/Adjust V Drive Compensation (C828, C849). Page 4-17
- 7. Check/Adjust Field Reference Compensation (C829). Page 4-17
- 8. Check Return Loss. Page 4-18
- 9. Check Isolation. Page 4-18

A25 VIRS/Black Burst Board

- 1. Check/Adjust Full Field Reference Signal Amplitude (R978). Page 4-19
- 2. Check/Adjust DC Level (R969). Page 4-19
- 3. Check VIRS Luminance Levels. Page 4-19

- 4. Check/Adjust VIRS Luminance Risetime (L981, L984). Page 4-19
- 5. Check/Adjust Sync Risetime (L971, L974). Page 4-19
- 6. Check/Adjust Burst Risetime (L911). Page 4-19
- 7. Check/Adjust VIRS Chrominance Risetime (L923, L933). Page 4-20
- 8. Adjust Chrominance Bandpass Filter (L938, L948). Page 4-20
- 9. Check/Adjust Residual Subcarrier (C928, R904). Page 4-20
- 10. Check/Adjust Chrominance Amplitude (R958). Page 4-20
- 11. Check Black Burst Setup Level. Page 4-20
- 12. Check Black Burst Timing. Page 4-20
- 13. Check/Adjust Subcarrier Phase (C865, L863). Page 4-20
- 14. Check VIRS Line & Field Timing. Page 4-21
- 15. Check VIRS Timing. Page 4-21
- 16. Check Isolation. Page 4-21
- 17. Check Return Loss. Page 4-22

PROCEDURE

A20 Sync Timing Board

- 1. Check/Adjust Line Frequency (C159)**
 - a. Connect the 10X probe from the Test Oscilloscope Dual Trace Amplifier to 1410 Interface line 55.
 - b. Connect the subcarrier signal from the Video Signal Source to the 1410 rear-panel Subcarrier loop-through input. Terminate the loop-through input in 75 Ω.
 - c. Check—The level at Interface line 55 should be approximately +5 volts.
 - d. Adjust—C159 (Line Frequency) for approximately +5 volts at Interface line 55.
- 2. Check Line Sync Delay Range**
 - a. Display composite video from the Video Signal Source and from the 1410 test signal module simultaneously on the Test Oscilloscope. Externally trigger the Test Oscilloscope with composite sync from the Video Signal Source.

Recalibration Procedure—SPG1/SPG2

b. Check—Line sync from the two sources (e.g., the Video Signal Source and the 1410 test signal module), should be approximately coincident. Select combinations of switch sections of S109 on Sync Timing Board A20 for approximate line sync coincidence if necessary.

c. Check—With all S109 switch sections closed, the 1410 test signal module line sync should lead the Video Signal Source line sync by at least 10 μ s.

d. With all S109 switch sections except section 4 open, the 1410 test signal module line sync should lag the Video Signal Source line sync by at least 4 μ s.

e. Reset S109 for approximate coincidence of the two line sync signals.

3. Check/Adjust Vertical Phasing (R169)

a. Set the Test Oscilloscope Dual Time Base Time/Div to 2 ms. Use the delaying sweep to view the vertical intervals of the two signals.

b. Check—The two displayed signals should coincide.

c. Adjust—R169 (Vertical Phasing) until the two displayed signals coincide. As R169 is adjusted, the display jumps in one-half line increments. The final setting of R169 should be between jumps.

4. Check Field Blanking Duration (Variable)

a. Place jumper P111 in the Fixed position (pins 1 and 2 connected).

b. Display the SPG1 or SPG2 COMP BLANKING output and composite video from the Video Signal Source simultaneously on the Test Oscilloscope.

c. Set the Test Oscilloscope Time/Div and Delayed Sweep Time/Div to view the vertical interval.

d. Check—The duration of the field blanking pulse should be 20 lines.

5. Check/Adjust Variable V Blanking Stop (R148)

a. Place jumper P111 in the Variable position (pins 2 and 3 connected).

b. Check—The field blanking pulses should end at the beginning of line 21 in field 1, and at the center of line 20 in field 2 (20 lines vertical blanking).

c. Adjust—R148 (Var V Blanking Stop) for the correct position of the end of field blanking. As R148 is adjusted, the display jumps in one-half line increments. The final setting of R148 should be between jumps.

d. Return P111 to the Fixed position.

6. Check Line Blanking Duration (Variable)

a. Place jumper P103 in the Fixed position (pins 2 and 3 connected); and P110 jumper in the Fixed position (pins 1 and 2 connected).

b. Display signals from the SPG1 or SPG2 front-panel COMP BLANKING connector and the 1410 rear-panel H Drive connector simultaneously on the Test Oscilloscope.

c. Set the Test Oscilloscope Time/Div to display a horizontal line.

d. Check—Fixed line blanking duration should be 10.7 μ s as measured at the 50% amplitude point on the signal.

7. Check/Adjust Variable H Blanking Start (R116) and Variable H Blanking Stop (R115)

a. Place P103 (H Drive) in the Variable position (pins 1 and 2 connected). Place P110 (H Blanking) in the Variable position (pins 2 and 3 connected).

b. Check—The leading edges of both signals should move as R116 is rotated.

c. Remove the H Drive Signal from the Test Oscilloscope and replace it with COMP SYNC from the SPG1 or SPG2.

d. Adjust—R116 so the leading edge of the line blanking starts 1.4 μ s before line sync starts.

e. Adjust—R115 for 10.7 μ s duration of line blanking.

f. Return P103 to the fixed position (pins 2 and 3 connected). Return P110 to the fixed position (pins 1 and 2 connected).

8. Check/Adjust Color Bars Horizontal Shift (R149).

a. Connect a 10X probe between the Test Oscilloscope and interface line 8 (Color Bars Timing).

b. Set the Test Oscilloscope Time/Div to view the line blanking portion of the waveform (about 2 $\mu\text{s}/\text{div}$).

c. Rotate R149 (Color Bars Horiz Shift) throughout its range. Note that at one end of the range a spike appears just following the falling edge of the waveform, and at the other end of the range the timing pulse jumps.

d. Adjust—R149 (Color Bars Horiz Shift) so that the spike is not present and the timing pulse does not jump.

9. Check/Adjust Burst Delay (R119) and Burst Width (R128).

a. Display the SPG1 or SPG2 BLACK BURST and SUBCARRIER signals simultaneously on the Test Oscilloscope.

b. Using the Test Oscilloscope delayed sweep function, view the line sync area with the main sweep at a field rate and the delayed sweep at about 2 μs .

c. Check—The time between the leading edge of line sync and the start of burst (50% point from the blanking level) should be equal to the duration of 19 cycles of subcarrier.

d. Check—Burst width should be 9 cycles of subcarrier.

e. Adjust—R119 (Burst Delay) for a time between the leading edge of line sync and the start of burst equal to the duration of 19 cycles of subcarrier.

f. Adjust—R128 (Burst Width) for 9 cycles of subcarrier burst width.

g. Check—The breezeway should be 425 ns to 525 ns in width as measured at the 10% amplitude point on sync to 50% point on burst.

h. Check—The front porch should be 1.49 μs to 1.69 μs in width as measured at the 50% amplitude points on sync and setup with respect to blanking.

10. Check Sync Timing

a. Display the SPG1 or SPG2 COMP SYNC signal on the Test Oscilloscope.

b. Using the Test Oscilloscope delayed sweep function, view the vertical interval area of the signal.

c. Check—Sync timing as follows:

Line sync duration	4.70 μs ± 100 ns	measured at 50% points
Equalizing pulse duration	2.3 μs ± 100 ns	measured at 50% points
Interval between field sync pulses	4.77 μs ± 100 ns	measured at 50% points
Field sync Pulse sequence		6 equalizing pulses— 6 sync pulses— 6 equalizing pulses

11. Check PAL Pulse

a. Connect a 10X probe between the Test Oscilloscope vertical input and Interface line 20.

b. Place P112 in the Square position (pins 1 and 2 connected).

c. Check—A square-wave should be present on Interface line 20.

d. Move P112 to the Pulse position (pins 2 and 3 connected).

e. Check—A pulse should be present on Interface line 20.

f. Display the SPG1 or SPG2 BLACK BURST signal on the Test Oscilloscope along with the PAL pulse.

g. Check—The PAL pulse should appear on different alternate pairs of video lines as P113 is moved from the 90° position (pins 2 and 3 connected) to the 270° position (pins 1 and 2 connected).

12. Check Split Field Timing

a. Display the SPG1 or SPG2 BLACK BURST signal and the signal on Interface line 27 simultaneously at a fixed rate on the Test Oscilloscope.

b. Place jumper P144 in the 1/2 Field Split position (pins 2 and 3 connected).

Recalibration Procedure—SPG1/SPG2

c. Check—The signal on Interface line 27 should be low for half the field and high for half the field.

d. Place jumper P144 in the 3/4, 1/4 Field Split position (pins 1 and 2 connected).

e. Check—The signal on Interface line 27 should be low for three-fourths of the field and high for one-fourth of the field.

f. Return jumper P144 to the 1/2 Field Split position.

13. Check V Lock

a. Set the 1410 Power switch Off.

b. Connect comp sync and subcarrier from the Video Signal Source to the proper 1410 rear-panel loop-through inputs.

c. Set the SPG1 or SPG2 INTERNAL/EXTERNAL switch to EXTERNAL.

d. Connect the SPG1 or SPG2 BLACK BURST SIG output and comp video from the Video Signal Source to the Test Oscilloscope.

e. Trigger the Test Oscilloscope externally with comp sync from the Video Signal Source.

f. Place jumper P169 in the Fast position (pins 1 and 2 connected).

g. Set the 1410 Power switch On.

h. Check—The SPG1 or SPG2 should immediately lock to the external signal.

i. Set the 1410 Power switch Off.

j. Move jumper P169 to the Slow position (pins 2 and 3 connected).

k. Set the 1410 Power switch On.

l. Check—The lock to the external signal should be slower than that in part h.

14. Check Timing Outputs

a. Check—Using the 10X probe from the Test Oscilloscope, check for proper outputs at the following Interface lines.

Interface line	Signal	Interface line	Signal
2	PAL Pulse	25	Comp Sync
3	Delayed H	26	Vert Blanking
7	H Drive	27	1/2-3/4 V
8	CB Timing	33	Field Sq. Wave
9	H Blanking	34	H*
10	Comp Blanking	35	H
11	Burst Gate	36	V/2
12	Vert Drive	37	V/4
13	Burst Gate Start	38	16H
		39	Window
		40	5 MHz
21	H/4	41	1 MHz
22	H/2	42	2H
23	H Crosshatch	43	4H
24	V Crosshatch	44	8H

NOTE

If U129 (40-pin MOS/LSI package) is replaced, check for TTL-switching spikes in the timing outputs H, H*, 2H, 4H, 8H, and 16H (use Extender board A2). If spikes are present and greater than +0.4 V on any of the outputs, add capacitors or resistors, or both, to the appropriate signal lines, at the locations designated on Diagram 1a, according to the following guidelines:

Signal	Circuit Numbers	Suggested Values and Ratings
H	U128A, C123	Use axial lead, tubular ceramic caps of 100 V, 10% ratings. Start with small values. Nominal value should be 47 pF. Maximum value should not exceed 150 pF. Mount caps on backside of board.
H*	U128B, C124	
2H	U145A, C142	
4H	U145B, C143	
8H	U145C, C144	
16H	U145D, C145	
4H	U129, R142	Use 5%, 0.25 W rated resistors. Nominal value should be 39 kΩ but can be smaller. Retain some resistance for pull-down on these outputs of the MOS device.
8H	U129, R143	
16H	U129, R124	

Retain any factory installed parts for the replaced device.

A21 Sync Lock Board

1. Check Sync Lock Loop

a. Connect comp sync and subcarrier from the Video Signal Source to the correct 1410 rear-panel loop-through inputs. If the instrument being calibrated is an SPG2, connect comp video from the Video Signal Source to the correct 1410 rear-panel loop-through input.

b. Set the SPG1 INTERNAL-EXTERNAL switch to EXTERNAL. Set the SPG2 to EXTERNAL/GEN LOCK, and set the EXTERNAL-GEN LOCK switch to GEN LOCK.

c. Set the HORIZONTAL LOCK switch to SUB-CARRIER.

d. Connect the 10X probe from the Test Oscilloscope to U284 pin 7.

e. Check—A locked indication is a dc level at U284 pin 7; unlocked is a trapezoidal wave.

2. Check/Adjust HORIZ DELAY (R175)

a. Display the SPG1 or SPG2 BLACK BURST signal and comp video from the Video Signal Source simultaneously on the Test Oscilloscope. Externally trigger the Test Oscilloscope from the Video Signal Source.

b. Check—The leading edges of the two displayed line sync pulses should coincide.

c. Adjust—HORIZ DELAY (R175) until the sync pulses leading edges coincide.

NOTE

If the HORIZ DELAY control does not match the leading edges of the two line sync pulses, set S109 on the Sync Timing board A20 to bring the SPG1, SPG2 sync pulse within the range of the HORIZ DELAY control.

d. Check—The total range of the HORIZ DELAY control should be at least 1 μ s.

3. Check Slow-Fast Lock

a. Connect a 10X probe from the Test Oscilloscope to U284 pin 1.

b. Place jumper P294 in the Fast position (pins 2 and 3 connected).

c. Press the front-panel HORIZ UNLOCK button.

d. Check—The signal at U284 pin 1 should be approximately 3 volts in amplitude.

e. Move jumper P294 to the Slow position (pins 1 and 2 connected).

f. Press the front-panel HORIZ UNLOCK button.

g. Check—The signal of U284 pin 1 should be much larger than 3 volts in amplitude.

h. Release the HORIZ UNLOCK button.

4. Check \div 455 Counter Operation

a. Connect a 10X probe from the Test Oscilloscope to TP239.

b. Check—The signal at TP239 should be a square-wave with a period equal to one horizontal line.

5. Check/Adjust Lower Phase Reset (R209), Lower Phase Advance (R198), Upper Phase Retard (R199), Upper Phase Reset (R189), and Preset Center (R276)

a. Display composite video from the Video Signal Source on the Waveform Monitor and the Test Oscilloscope. (The composite video signal must contain at least 19 cycles of subcarrier at 0 APL, and must be displayed on VITS line 18. For example: a linearity test signal with steps removed).

b. Display the Field Reference pulse from the 1410 rear panel on the Test Oscilloscope simultaneously with the composite video from the Video Signal Source.

c. Display VIRS from the SPG1 or SPG2 on the Vectorscope.

d. Externally trigger the Test Oscilloscope and externally sync the Waveform Monitor with composite sync from the Video Signal Source.

e. Externally reference the Vectorscope to the Video Signal Source subcarrier.

f. Set the Test Oscilloscope Time/Div to view four fields of composite video.

g. Set the Waveform Monitor Field switch to 1, Line Selector to Digital and line 17, and Time/Div to 10 μ s/Div.

h. Using the Waveform Monitor Waveform Comparison controls, overlay the 0 APL subcarrier on line 18 over line 18 sync and burst.

i. Set the Waveform Monitor Magnifier to .2 μ s/Div and view the sync and burst area of line 18.

j. Adjust the Waveform Monitor Waveform Comparison Overlay control until subcarrier and burst are exactly in phase.

Recalibration Procedure—SPG1/SPG2

k. Using the Waveform Monitor Position controls, set the 50% amplitude point of the leading edge of sync on a reference point somewhere along the graticule 0 IRE line.

l. Using the Waveform Monitor Vertical Position control only, set the zero crossing of the overlaid subcarrier on the graticule 0 IRE line.

m. Rotate the SPG1 or SPG2 SUBCARRIER PHASE control so that the zero crossing of a positive slope of one cycle of subcarrier falls on the same reference point used in part k of this step.

n. Set SPG1 for External mode, SPG2 for Gen Lock mode.

o. Rotate the SPG1 or SPG2 SUBCARRIER PHASE control to 0 on the dial and rotate the Vectorscope Phase control to set the VIRS vector to 180° on the Vectorscope.

p. Rotate the SPG1 or SPG2 SUBCARRIER PHASE control in the direction that causes the Vectorscope display to move clockwise until the Field Reference pulse displayed on the Test Oscilloscope shifts one television frame in time.

q. Check—The VIRS vector displayed on the Vectorscope should fall at approximately 45°.

r. Rotate the SPG1 or SPG2 SUBCARRIER PHASE control in the direction that moves the Vectorscope display counter-clockwise until the Field Reference pulse displayed on the Test Oscilloscope shifts back to the original television frame.

s. Check—The VIRS vector displayed on the Vectorscope should fall at approximately 135°.

t. Rotate the SPG1 or SPG2 SUBCARRIER PHASE control to move the VIRS vector in a counter-clockwise direction until the Field Reference pulse again shifts one television frame.

u. Check—The VIRS vector should fall at approximately 315°.

v. Rotate the SPG1 or SPG2 SUBCARRIER PHASE control to move the VIRS vector in the clockwise direction until the Field Reference pulse shifts back to its original television frame.

w. Check—The VIRS vector should fall at approximately 225°.

NOTE

If the limits above have not been met, continue through the remaining portion of Step 5.

aa. Set R198 (Lower Phase Advance) and R199 (Upper Phase Retard) so that U205 pins 7 and 4 are at the maximum voltage apart (at the stops of the controls).

ab. Center R209 (Lower Phase Reset) and R189 (Upper Phase Reset).

ac. Ground TP229 and place jumper P228 in the Normal position (pins 1 and 2 connected).

ad. Connect the 10X probe from the Test Oscilloscope to the junction of R198 and R199. Note the voltage level.

ae. Move the 10X probe to TP244.

af. Check—The voltage level at TP244 should be the same as that noted in part ad.

ag. Adjust—R276 (Preset Center) for the same voltage level as that noted in part ad.

ah. Remove the ground from TP229.

ai. Rotate the SPG1 or SPG2 SUBCARRIER PHASE control to place the VIRS vector at 45° on the Vectorscope.

aj. Adjust—R199 (Upper Phase Retard) until the Field Reference pulse displayed on the Test Oscilloscope shifts one television frame in time.

ak. Rotate the SPG1 or SPG2 SUBCARRIER PHASE control to move the VIRS vector counter-clockwise to 315°.

al. Adjust—R198 (Lower Phase Advance) until the Field Reference pulse shifts one frame.

am. Rotate the SPG1 or SPG2 SUBCARRIER PHASE control to move the VIRS vector clockwise to 225°.

an. Check—The Field Reference pulse should shift back to its original position.

6. Check/Adjust SCH ϕ Center (R219)

a. Without disturbing the equipment setup of Step 5, connect the Waveform Monitor Line Strobe Out to the Test Oscilloscope. (Use the + Input of the Differential Comparator, set the 7603 Vert Mode to Chop.)

b. Check—The Line Strobe from the Waveform Monitor and the Field Reference pulse from the 1410 should fall in the same television frame.

c. Adjust—R219 (SCH ϕ Center) until the Line Strobe from the Waveform Monitor and the Field Reference pulse from the 1410 fall in the same frame.

7. Check SCH Phasing

a. Check—The Field Ref signal from the 1410 rear panel should shift one frame in time with each 180° of rotation of the Video Signal Source Subcarrier Phase control.

8. Check/Adjust Subcarrier to Sync Lock Timing (R208)

NOTE

Make certain that the SPG1 or SPG2 SUBCARRIER PHASE control is still set to 0 on the dial, and that the equipment setup done in Step 5 is not disturbed.

a. Display the SPG1 or SPG2 BLACK BURST signal on the Test Oscilloscope. The SPG1 or SPG2 should still be in an external lock mode.

b. Externally trigger the Test Oscilloscope from the Video Signal Source.

c. Check—The display should not shift as the HORIZONTAL LOCK is switched between SUBCARRIER and SYNC.

d. Adjust—R208 (Subcarrier to Sync Lock Timing) for no display shift as HORIZONTAL LOCK is switched between SUBCARRIER and SYNC.

e. Set the SPG1 or SPG2 to INTERNAL.

f. Trigger the Test Oscilloscope internally.

g. Press the SPG1 or SPG2 front-panel HORIZ UNLOCK button.

h. Check—The subcarrier portion of the displayed signal should free run.

9. Check Normal/Slow-Slow Lock

a. Display signals from the Video Signal Source and the SPG1 or SPG2 simultaneously on the Test Oscilloscope.

b. Trigger the Test Oscilloscope externally from the Video Signal Source.

c. Set the SPG1 or SPG2 to INTERNAL.

d. Place P228 in the Normal position (pins 1 and 2 connected).

e. When the two displayed signals are one-half line apart, set the SPG1 or SPG2 to EXTERNAL.

f. Check—The SPG1 or SPG2 should immediately lock to the external source.

g. Move P228 to the Slow-Slow position (pins 2 and 3 connected).

h. Set the SPG1 or SPG2 to INTERNAL, press the HORIZ UNLOCK button wait until the two displayed signals are one-half line apart, then release the HORIZ UNLOCK button and set the SPG1 or SPG2 to EXTERNAL.

i. Check—The SPG1 or SPG2 should slowly lock to the external source.

j. Monitor the level at the emitter of Q217 (at TP217) with the 10X probe from the Test Oscilloscope.

k. Check—The level at the emitter of Q217 should go high when the displayed signal is moving to the right during Slow-Slow lock.

l. Move P228 to the Normal position.

Recalibration Procedure—SPG1/SPG2

m. Check—The level at the emitter of Q217 should be 0 volt at all times in Normal lock.

10. Check Sync/Subcarrier Unlock Switch to Sync Lock and Timing Jitter Switch to Internal

NOTE

P244 and P324 route different commands to the Generator Logic board A22 depending on which pair of the two pairs of pins are connected together. A jumper is installed on P324 at the factory, leaving P224 open. When P224 is to be used, remove the jumper from P324 and place it on P224.

- a. Place the jumper on P324.
- b. Press the SPG1 or SPG2 front-panel HORIZ UNLOCK button.
- c. Check—The HORIZONTAL LOCK LED should be lit.
- d. Move the jumper to P224.
- e. Press the HORIZ UNLOCK button.
- f. Check—The HORIZONTAL LOCK LED should not be lit.
- g. Return the jumper to P324.

A22 Generator Logic Board

1. Check INTERNAL Mode Operation

- a. Connect composite sync, subcarrier, and composite video from the Video Signal Source to the appropriate 1410 rear-panel loop-through connectors.
- b. Set the SPG1 or SPG2 for INTERNAL operation.
- c. Display the SPG1 or SPG2 BLACK BURST signal and a signal from the Video Signal Source simultaneously on the Test Oscilloscope. Trigger the Test Oscilloscope externally from the Video Signal Source.

d. Place P383 and P387 jumpers for the desired SYNC and SUBCARRIER LED indication. (P387 SYNC, pins 1 and 2 connected, lit when external sync is absent; pins 2 and 3 connected, lit when external sync is present. P383 SUBCARRIER, pins 1 and 2 connected, lit when external subcarrier is absent, pins 2 and 3 connected, lit when external subcarrier is present.)

e. Check—The front-panel INTERNAL LED should be lit and the two signals displayed on the Test Oscilloscope should not be locked.

2. Check SYNC Lock EXTERNAL Mode Operation

- a. Set the SPG1 or SPG2 for EXTERNAL operation. Set HORIZONTAL LOCK to SYNC.
- b. Place P386 jumper in the "Can" position (pins 2 and 1 connected). Place P855 in "on" position (pins 1 and 2).
- c. Check—The SYNC and SUBCARRIER LED's indicate the presence of external sync and subcarrier.
- d. Check—The two signals displayed on the Test Oscilloscope should be locked.
- e. Remove composite sync from the 1410 rear-panel loop-through connector.
- f. Check—The SYNC LED should change states, the INTERNAL LED should be lit, and BLACK BURST displayed on the Test Oscilloscope will go to zero.
- g. Connect composite sync to the appropriate 1410 rear-panel loop-through connector.
- h. Re-position all jumpers.
- i. Remove subcarrier from the 1410 rear-panel loop-through connector.
- j. Check—The SUBCARRIER LED should change states, and the two signals displayed on the Test Oscilloscope should remain sync-locked, but subcarrier will go to zero.
- k. Move P398 jumper to the Ext Subc Needed position (pins 2 and 3 connected).

l. Check—The SUBCARRIER LED should continue to indicate absence of external subcarrier, the INTERNAL LED should be lit, and the two signals displayed on the Test Oscilloscope should not be locked.

m. Re-position P398.

3. Check SUBCARRIER Lock EXTERNAL Mode Operation

a. Set the SPG1 or SPG2 HORIZONTAL LOCK to SUBCARRIER.

b. Check—The SUBCARRIER LED should indicate the absence of external subcarrier, the INTERNAL LED should be lit, and the two signals displayed on the Test Oscilloscope should not be locked.

c. Move P398 jumper to the Ext Subc Not Needed position (pins 1 and 2 connected).

d. Check—The SYNC and SUBCARRIER LED's should not change, the SYNC LOCK LED should be on, and the two signals displayed on the Test Oscilloscope should be sync-locked.

e. Remove composite sync from the 1410 rear-panel loop-through connector. Connect subcarrier to the 1410 rear-panel Subcarrier loop-through connector.

f. Check—The SYNC and SUBCARRIER LED's should change states, the SYNC LOCK LED should be off, and the two signals displayed on the Test Oscilloscope should be locked.

g. Move P365 to the Ext Sync Needed position (pins 1 and 2 connected).

h. Check—The SYNC and SUBCARRIER LED's should not change, the INTERNAL LED should be on, and the two signals displayed on the Test Oscilloscope should not be locked.

i. Re-position P365 to pins 2 and 3.

4. Check LED Polarity and Chroma and Video Disable

a. Connect composite sync to the 1410 rear-panel Sync loop-through connector.

b. Check—The SYNC and SUBCARRIER LED's should not be lit.

c. Remove external sync and subcarrier from the 1410 rear-panel loop-through connectors.

d. Check—The SYNC and SUBCARRIER LED's should be lit.

e. Move P383 and P387 jumpers to the Sync Present and Subc Present positions (pins 2 and 3 connected).

f. Check—The SYNC and SUBCARRIER LED's should not be lit.

g. Connect external sync and subcarrier to the appropriate 1410 rear-panel loop-through connectors.

h. Check—The SYNC and SUBCARRIER LED's should be lit.

i. Re-position P383 and P387 to pins 1 and 2.

j. Connect the 10X probe from the Test Oscilloscope to Interface line 31.

k. Check—Interface line 31 should be low under all conditions.

l. Move P382 to the Can position (pins 1 and 2 connected).

m. Remove external sync and subcarrier from the 1410 rear-panel loop-through connectors.

Recalibration Procedure—SPG1/SPG2

- n. Check—Interface line 31 should be high.
- o. Place P386 in the Can position (pins 1 and 2 connected).
- p. Move the 10X probe to Interface line 32.
- q. Check—Interface line 32 should be high.
- r. Connect external sync and subcarrier to the appropriate 1410 rear-panel loop-through connectors.
- s. Move P386 to the Can't position (pins 2 and 3 connected).
- t. Check—Interface line 32 should be low under all conditions.

5. Check GEN LOCK Mode (SPG2 Only)

- a. Set the SPG2 for GEN LOCK operation.
- b. Remove composite sync from the Video Signal Source composite video signal.
- c. Check—The SYNC and SUBCARRIER LED's should change states and the INTERNAL LED should be lit.
- d. Restore composite sync to the Video Signal Source composite video signal. Move P399 to "Needed" position (pins 2 and 3).
- e. Remove burst from the Video Signal Source composite video signal.
- f. Check—The SUBCARRIER LED should change states and the INTERNAL LED should be lit.
- g. Move P399 to the Not Needed position (pins 1 and 2 connected).
- h. Check—The INTERNAL LED is not lit.
- i. Restore burst to the Video Signal Source composite video signal.

A23 Subcarrier Lock Board (SPG2 Only)

1. Check/Adjust Sync Stripper (R707, R749)

- a. Connect composite video from the Video Signal Source to the 1410 rear-panel Gen Lock loop-through input connector.
- b. Terminate the loop-through connector into 75 ohms.
- c. Set the SPG2 for GEN LOCK mode of operation.
- d. Connect the 10X probe from the Test Oscilloscope to Interface line 53.
- e. Check—The sync pulse present on Interface line 53 should have no step at the trailing edge.
- f. Set R707 (SIS Lockout) so that the voltage at R707 wiper arm is maximum positive (+14.6 V to +15 V).
- g. Adjust—Preset R749 (noise Lockout) to maximum positive voltage (+7 V or higher) at R749 wiper arm. Then, readjust R749 to just eliminate the step at the sync pulse trailing edge.

2. Check AGC

- a. Connect the 10X probe from the Test Oscilloscope to TP714.
- b. Check—The signal amplitude at TP714 should remain constant as the input signal amplitude is varied from one-half to two times nominal (1 volt).

NOTE

Three 75 Ω terminations in series with the input signal reduces the amplitude to one-half. An unterminated input signal is two times nominal (1 volt).

- c. Check—The SUBCARRIER LED should not be lit within the AGC range.

3. Check/Adjust Subcarrier Phase (L679)

- a. Connect the 10X probe from the Test Oscilloscope to TP668.
- b. Adjust—L679 (Subcarrier Phase) for maximum dc level at TP668.

c. Connect the SPG2 BLACK BURST signal on the Vectorscope.

d. Lock the Vectorscope to the Video Signal Source subcarrier.

e. Check—The burst phase displayed on the Vectorscope should not vary more than $\pm 3^\circ$ as the input signal amplitude is varied from one-half to two times nominal.

4. Check Phase Stability with Dynamic APL

a. Apply a composite video signal that is variable in Average Picture Level from the Video Signal Source to the 1410 rear-panel Gen Lock loop-through input.

b. Check—The phase of the signal displayed on the Vectorscope should change by 0.1° or less as the input APL is varied from 10% to 90%.

5. Check Phase Response to Residual Subcarrier

a. Display the Video Signal Source subcarrier and composite video signal simultaneously on the Vectorscope.

b. Lock the Vectorscope to the Video Signal Source subcarrier.

c. Rotate the Video Signal Source Subcarrier Phase control to set the burst phase 90° from the subcarrier phase. Do not move the Video Signal Source subcarrier Phase control for the remainder of this step.

d. Remove the Video Signal Source composite video and subcarrier from the Vectorscope signal inputs. Leave the Vectorscope locked to the Video Signal Source subcarrier.

e. Display the SPG2 SUBCARRIER and BLACK BURST signals simultaneously on the Vectorscope.

f. Rotate the SPG2 SUBCARRIER PHASE control to set the BLACK BURST phase 90° from the SUBCARRIER phase.

g. Remove the $75\ \Omega$ termination from the 1410 rear-panel Gen Lock loop-through connector.

h. Connect subcarrier from the Video Signal Source through the $10X\ 75\ \Omega$ attenuator to the 1410 rear-panel Gen Lock loop-through connector. Composite video Signal Source should still be connected to the other side of the Gen Lock connector.

i. Set P685 to the Ignore position (pins 2 and 3 connected).

j. Check—The phase of the BLACK BURST signal displayed on the Vectorscope should change 15° or more when the subcarrier signal is removed from the 1410 rear-panel Gen Lock loop-through connector.

k. Reconnect Video Signal Source subcarrier through the $10X\ 75\ \Omega$ attenuator to the 1410 rear-panel Gen Lock loop-through connector.

l. Move P685 jumper to the Cancel position (pins 1 and 2 connected).

m. Check—The phase of the BLACK BURST signal displayed on the Vectorscope should change 10° or less when the subcarrier signal is removed from the 1410 rear-panel Gen Lock loop-through connector.

n. Terminate the 1410 rear-panel Gen Lock loop-through connector in $75\ \Omega$.

6. Check SUBCARRIER PHASE Range

a. Rotate the SPG2 SUBCARRIER PHASE control.

b. Check—The phase of the signal displayed on the Vectorscope should change 360° for each 360° rotation of the SUBCARRIER PHASE control.

7. Check Fast/Slow Lock

a. Connect the $10X$ probe from the Test Oscilloscope to TP456.

b. Move P459 jumper to the Slow position (pins 2 and 3 connected).

c. Check—The dc voltage at TP456 should move only slightly as the Video Signal Source burst is turned off and then restored.

Recalibration Procedure—SPG1/SPG2

d. Place P459 jumper in the Fast position (pins 1 and 2 connected).

e. Check—The dc voltage at TP456 should near 0 volt briefly as the Video Signal Source burst is turned off and then restored.

8. Check Horizontal Jitter

a. Display the SPG2 BLACK BURST signal on the Test Oscilloscope.

b. Externally trigger the Test Oscilloscope with composite sync from the Video Signal Source.

c. Using the Test Oscilloscope delayed sweep function and magnifier, view the leading edge of a line sync pulse at 20 ns/div (.2 μ s/div X10 mag).

d. Check—With the SPG2 HORIZONTAL LOCK in SYNC, jitter on the sync pulse leading edge should be 10 ns or less. With HORIZONTAL LOCK in SUBCARRIER, jitter should not exceed 4 ns.

9. Check/Adjust Oscillator Frequency (R456)

a. Remove the composite video signal from the 1410 rear-panel Gen Lock loop-through connector.

b. Connect the SPG2 SUBCARRIER output to the Frequency Counter.

c. Check—Subcarrier frequency should be within 10 Hz of 3.579545 MHz if the SPG2 is installed in a 1410, or within 1 Hz of 3.579545 MHz if the SPG2 is installed in a 1410 Option 1.

d. Adjust—R456 (Oscillator Frequency) for 3.579545 MHz.

A24 Pulse Output Amplifier Board

1. Check/Adjust Subcarrier Amplitude (C779, 1410 C496)

a. Connect one of the 1410 rear-panel Subcarrier outputs through 75 Ω termination to the Test Oscilloscope.

b. Check—The Subcarrier signal should be 1.8 volts peak-to-peak to 2.2 volts peak-to-peak in amplitude.

c. Adjust—C779 (Subcarrier Amplitude) for 2.0 volts peak-to-peak Subcarrier signal amplitude.

d. Check—The other 1410 rear-panel Subcarrier output should be identical to the first.

e. Connect the SPG1 or SPG2 SUBCARRIER output through 75 Ω termination to the Test Oscilloscope input.

NOTE

The SPG1 or SPG2 SUBCARRIER output is driven directly from the Subcarrier Output Amplifier on the 1410 Subcarrier Input board, A13. This output is provided as a subcarrier phase reference. The subcarrier signal phase at the SPG1 or SPG2 front panel cannot be varied with the SUBCARRIER PHASE control, but is always the same as the reference subcarrier (either from the 1410 Subcarrier Oscillator or from an external source). The Subcarrier Amplitude control on the 1410 Subcarrier Input board, A13 (C496), must be adjusted to set the amplitude of the SUBCARRIER output signal. See the 1410 manual for adjustment location.

f. Check—The SUBCARRIER signal should be 1.8 volts peak-to-peak to 2.2 volts peak-to-peak.

g. Adjust—C496 (Subcarrier Amplitude) on the 1410 Subcarrier Input board, A13, for 2.0 volts peak-to-peak SUBCARRIER signal amplitude.

2. Check/Adjust Comp Blanking Compensation (C798, C808, C809)

a. Connect the SPG1 or SPG2 COMP BLANKING output through 75 Ω termination to the Test Oscilloscope input.

b. Check—The signal amplitude should be 3.8 volts to 4.2 volts.

c. Check—Rise and fall time should be 120 ns to 160 ns.

d. Adjust—C798 (Rate) for 120 ns to 160 ns rise and fall times.

e. Repeat this step for each of the two 1410 rear-panel Comp Blanking outputs. Adjust C808 for the signal at J12 and C809 for the signal at J13.

3. Check/Adjust Comp Sync Compensation (C799, C838, C839)

- a. Connect the SPG1 or SPG2 COMP SYNC output through 75 Ω termination to the Test Oscilloscope input.
- b. Check—The signal amplitude should be 3.8 volts to 4.2 volts.
- c. Check—Rise and fall times should be 120 ns to 160 ns.
- d. Adjust—C799 (Rate) for 120 ns to 160 ns rise and fall times.
- e. Repeat this step for each of the two 1410 rear-panel Comp Sync outputs. Adjust C838 for the signal at J10 and C839 for the signal at J11.

4. Check/Adjust Burst Flag Compensation (C818), Burst Flag Delay (R800), and Burst Flag Width (R820)

- a. Connect the 1410 rear-panel Burst Flag output through 75 Ω termination to the Test Oscilloscope input.
- b. Check—The signal amplitude should be 3.8 volts to 4.2 volts.
- c. Check—Rise and fall times should be 120 ns to 160 ns.
- d. Adjust—C818 (Rate) for 120 ns to 160 ns rise and fall times.
- e. Externally trigger the Test Oscilloscope with the SPG1 or SPG2 COMP SYNC signal.
- f. Connect one of the 1410 rear-panel Comp Sync outputs through 75 Ω termination to the Test Oscilloscope so that comp sync and burst flag are displayed simultaneously.
- g. Note the position of the leading edge of line sync.
- h. Check—The leading edge of the Burst Flag pulse should be 5.3 μ s \pm 35 ns from the leading edge of line sync.
- i. Adjust—R800 (Burst Flag Delay) so that the leading edge of the Burst Flag pulse is 5.265 μ s to 5.335 ns from the leading edge of line sync.

- j. Check—The half-amplitude width of the Burst Flag pulse should be 2.5 μ s \pm 70 ns.

- k. Adjust—R820 (Burst Flag Width) for 2.43 μ s to 2.57 μ s half-amplitude width of the Burst Flag pulse.

5. Check/Adjust H Drive Compensation (C819, C848)

- a. Connect 1410 rear-panel H Drive output J16 through 75 Ω termination to the Test Oscilloscope input.
- b. Check—The signal amplitude should be 3.8 volts to 4.2 volts.
- c. Check—Rise and fall times should be 120 ns to 160 ns.
- d. Adjust—C819 (Rate) for 120 ns to 160 ns rise and fall times.
- e. Repeat this step for H Drive output J15 on the 1410 rear panel. (Adjust C848 for correct 120 ns to 160 ns rise and fall times.)

6. Check/Adjust V Drive Compensation (C828, C849)

- a. Connect 1410 rear-panel V Drive output J18 through 75 Ω termination to the Test Oscilloscope input.
- b. Check—The signal amplitude should be 3.8 volts to 4.2 volts.
- c. Check—Rise and fall times should be 120 ns to 160 ns.
- d. Adjust—C828 (Rate) for 120 ns to 160 ns rise and fall times.
- e. Repeat this step for V Drive output J19 on the 1410 rear panel. (Adjust C849 for 120 ns to 160 ns rise and fall times.)

7. Check/Adjust Field Reference Compensation (C829)

- a. Connect the 1410 rear-panel Field Ref output J14 through 75 Ω termination to the Test Oscilloscope input.
- b. Connect the SPG1 or SPG2 BLACK BURST signal through 75 Ω termination to the other Test Oscilloscope input.

Recalibration Procedure—SPG1/SPG2

c. Externally trigger the Test Oscilloscope with V Drive from the 1410 rear panel.

d. Check—The Field Ref signal amplitude should be 3.8 volts to 4.2 volts.

e. Check—Rise and fall times should be 120 ns to 160 ns.

f. Adjust—C829 (Rate) for 120 ns to 160 ns rise and fall times.

g. Place P836 in the Field 1, line 11 position.

h. Check—The Field Ref pulse should be at line 11 of Field 1.

i. Move P836 to the Field 3, line 10 position.

j. Check—The Field Ref pulse should be at line 10 of Field 3.

8. Check Return Loss

a. Remove all connections from the SPG1 or SPG2, the 1410, and the Test Oscilloscope.

b. Set the SPG1 or SPG2 for INTERNAL operation.

c. Trigger the Test Oscilloscope internally.

d. Connect the Return Loss Bridge to the Test Oscilloscope Differential Comparator.

e. Connect the Leveled Sine Wave Generator through 50 Ω cable and the 50 Ω to 75 Ω Minimum Loss Attenuator to the Return Loss Bridge input.

f. Set the Leveled Sine Wave Generator Frequency Range to Ref \approx .05 (50 kHz), and the Test Oscilloscope Volts/Div to .1 V. Set the Differential Comparator for differential operation.

g. Remove the 75 Ω termination from the Return Loss Bridge Unknown arm and adjust the Leveled Sine Wave Generator Output Amplitude control for 500 mV display amplitude.

h. Replace the 75 Ω termination on the Return Loss Bridge Unknown arm.

i. Set the Test Oscilloscope Volts/Div to 10 mV.

j. Adjust the Return Loss Bridge Balance control for minimum display amplitude.

k. Remove the 75 Ω termination from the Return Loss Bridge unknown arm.

l. Check return loss of all outputs on the SPG1 or SPG2 front panel and the 1410 rear panel by connecting the unterminated Unknown arm to each connector and checking the Test Oscilloscope display amplitude for 16 mV or less.

NOTE

When checking SPG1 or SPG2 SUBCARRIER return loss, remove Q464 on the 1410 Subcarrier Input board, A13. When checking the return loss of the Subcarrier outputs on the 1410 rear panel, remove Q767 on the SPG1 or SPG2 Pulse Output Amplifier board, A24.

m. Check return loss of the loop-through inputs on the 1410 rear panel by connecting the Unknown arm to one side of the of the loop-through connector and the 75 Ω termination to the other side. Check for 3 mV display amplitude.

n. Remove the Return Loss Bridge.

9. Check Isolation

a. Check all double and triple outputs for active and passive isolation in the following manner:

Passive Isolation. Connect the output of interest through 75 Ω termination to the Test Oscilloscope input. Observe the signal amplitude at that output while shorting another output of the same signal to ground. The observed signal amplitude should change by no more than 1%.

Active Isolation. Observe the output of interest on the Test Oscilloscope while introducing a subcarrier signal into another output of the same signal. The subcarrier signal should be attenuated at the observed output by at least 30 dB. The introduced subcarrier signal amplitude should be varied from 0.5 volt to 4.0 volts.

A25 VIRS/Black Burst Board**NOTE**

The adjustments in this step affect the harmonic content of the output signal. Only slight adjustment from the original calibration should be attempted without using a spectrum analyzer.

1. Check/Adjust Full Field Reference Signal Amplitude (R978)

- a. Connect the SPG1 or SPG2 BLACK BURST signal output to the 1480 CH A input and terminate in 75 Ω . Set the Full Field Reference switch S838 to the on position.
- b. Set the 1480 Display to 10 μ s/div, Volts Full Scale to 0.5, and push in the Cal and Oper switches.
- c. Check—Using the Amplitude dial for the Calibration Fixture to match the sync with blanking, read 286 mV \pm 3.6 mV.
- d. Adjust—R978 (Gain) for 286 mV of sync amplitude.

2. Check/Adjust DC Level (R969)

- a. Set the 1480 Volts Full Scale to 1.0, Display to 10 μ s/div, push in the Oper switch, and set the DC Restorer Off and the Response switch to Aux Video In. Position the trace to the 0 IRE graticule line and move the BLACK BURST signal output cable to the 1480 Aux Video In connector.
- b. Check—The waveform blanking level should be 0 V \pm 50 mV (\pm 7 IRE).
- c. Adjust—R969 (DC Level) for a 0 volt blanking level. Recheck Step 1 signal amplitude after making this adjustment. Return the BLACK BURST signal output cable to the 1480 CH A input connector.

3. Check VIRS Luminance Levels

- a. Remove Q944 to disable VIRS chrominance.
- b. Check—Use the Calibration Fixture to read the following:
 Setup Level—53.57 mV \pm 3.57 mV
 Gray Level—357 mV \pm 3.57 mV
 Chrominance Pedestal—500 mV \pm 5 mV

4. Check/Adjust VIRS Luminance Risetime (L981, L984)

- a. Set the 1480 to measure risetime—Mag at .1 μ s/div.

- b. Check—Luminance risetime should be 260 ns \pm 37.5 ns.

- c. Adjust—L981 and L984 (Virs Lum Shape) for correct risetime and minimum aberrations. Graticule A of the 1480 Waveform Monitor has built-in rise and fall time measurement capability. Point R at 80 IRE Units aligns with T on the 0 IRE Unit reference line.

To measure rise or fall time, set the transition amplitude to 100 IRE Units (use the VARIABLE Volts Full Scale). Vertically position the display so that the transition is from the -10 IRE Unit line to the +90 IRE Unit line. Use the 100 ns/div time base and horizontally position the rise (or fall) of the transition through point R on the short 2 IRE Unit/div scale. Measure the distance from point T on the 0 IRE Unit reference line to where the transition crosses the reference line.

5. Check/Adjust Sync Risetime (L971, L974)

- a. Check—Sync risetime should be 130 ns \pm 20 ns -10 ns.
- b. Adjust—L971 and L974 (Sync Shape) for correct risetime and minimum aberrations.
- c. Replace Q944.

6. Check/Adjust Burst Risetime (L911)**NOTE**

Adjustments in Steps 6, 7, and 8 should not be performed unless absolutely necessary.

- a. Push in the HORIZ UNLOCK pushbutton on the SPG front panel.
- b. Check—Burst risetime should be 400 ns \pm 60 ns.
- c. Place the Test Oscilloscope 10X probe on TP911.
- d. Check—For square burst gate corners and minimum aberrations.
- e. Adjust—L911 (Burst Gate Shape) for square burst gate corners and minimum aberrations.

Recalibration Procedure—SPG1/SPG2

7. Check/Adjust VIRS Chrominance Risetime (L923, L933)

a. Push in the HORIZ UNLOCK pushbutton on the SPG front panel.

b. Check—Chrominance risetime should be $1\ \mu\text{s} \pm 150\ \text{ns}$.

c. Place the Test Oscilloscope 10X probe on TP924.

d. Check—For best shape and minimum aberrations.

e. Adjust—L923 and L933 (Chrom. Timing Shape) for best shape and minimum aberrations.

8. Adjust Chrominance Bandpass Filter (L938, L948)

NOTE

The adjustments in this step affect the harmonic content of the output signal. Only slight adjustment from the original calibration should be attempted without using a spectrum analyzer.

a. Connect the BLACK BURST signal output to the Spectrum Analyzer and display the chrominance signal.

b. Adjust—L938 and L948 (Chrominance Bandpass Filter) for best compromise between Step 8b and third order harmonics of $-30\ \text{dB}$ or more.

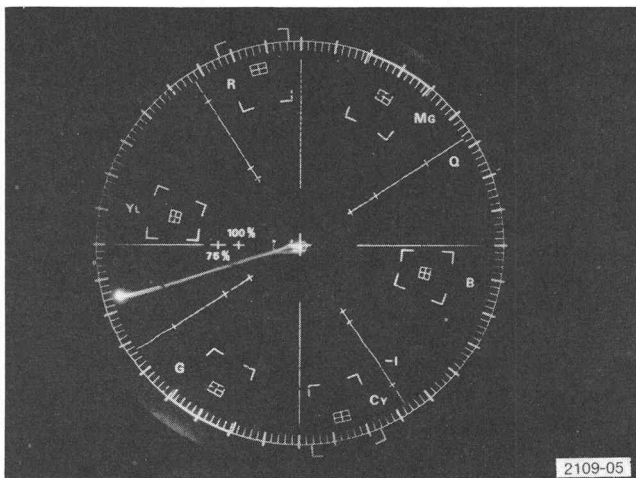


Fig. 4-2. Chrominance Bandpass Filter adjusted for best vector overlay.

9. Check/Adjust Residual Subcarrier (C928, R904)

a. Set the 1480 VFS to 0.2 and position the blanking level at the 0 IRE graticule line.

b. Check—Residual subcarrier should be 2.5 mV or less.

c. Adjust—C928 and R904 (Residual Subcarrier) for 2.5 mV or less residual subcarrier.

10. Check/Adjust Chrominance Amplitude (R958)

a. Set the 1480 to Cal mode. Use the Calibration Fixture Amplitude control to position the top and bottom of chrominance packet to the blanking level. Subtract the two readings to obtain the actual amplitude.

b. Check—Chrominance amplitude should be $285.7\ \text{mV} \pm 2.86\ \text{mV}$ and the bottom of the chrominance packet should be even with the gray level.

c. Adjust—R958 (Chrominance Gain) for $285.7\ \text{mV} \pm 2.86\ \text{mV}$.

NOTE

Adjustments performed in Steps 7 through 10 interact. Repeat if necessary.

11. Check Black Burst Setup Level

a. Push in the Full Field Ref pushbutton and display the BLACK BURST signal on the 1480.

b. Check—Setup level should be $53.57\ \text{mV} \pm 3.57\ \text{mV}$.

12. Check Black Burst Timing

a. Check—Refer to Fig. 4-3 for timing details.

13. Check/Adjust Subcarrier Phase (C865, L863)

a. Connect the 1410 Mainframe Subcarrier output to the vectorscope CW Ext ϕ Ref input. Connect the other Ext ϕ Ref input to CH B through the 10X attenuator pad. Connect the SPG1 or SPG2 BLACK BURST signal output to CH A. Display CH A and CH B. See Fig. 4-4.

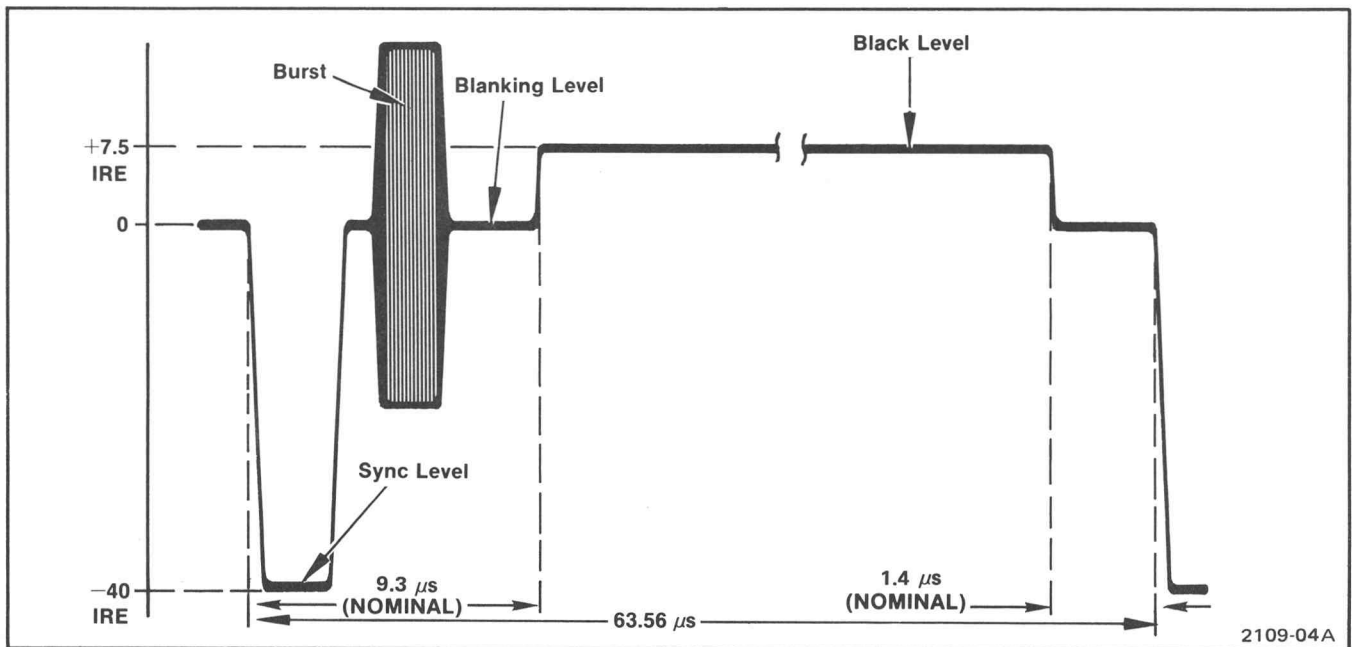


Fig. 4-3. The Black Burst Signal.

b. Check—VIRS subcarrier phase is within 0.5° of the SPG1 or SPG2 burst phase.

c. Adjust—C865 and L863 (Subcarrier Phase) to match SPG1 or SPG2 burst phase with the 1410 subcarrier phase.

14. Check VIRS Line and Field Timing

- a. Push in the VIRS pushbutton and set the 1480 for dig line selection.
- b. Check—P858 selects proper fields: 1, 2, or both.
- c. Check—P857 selects Line 18 or Line 19.

15. Check VIRS Timing

- a. Display the FULL FIELD REF signal on the 1480.
- b. Check—Refer to Fig. 4-5 for timing details.

16. Check Isolation

- a. Note the VIRS amplitude on the 1480 display and short the opposite output pins together.
- b. Check—Change in output should not exceed 1%.
- c. Reverse connections in step a and repeat step b.
- d. Connect the Test Oscilloscope to one pair of output connectors through a 75Ω in-line terminator.

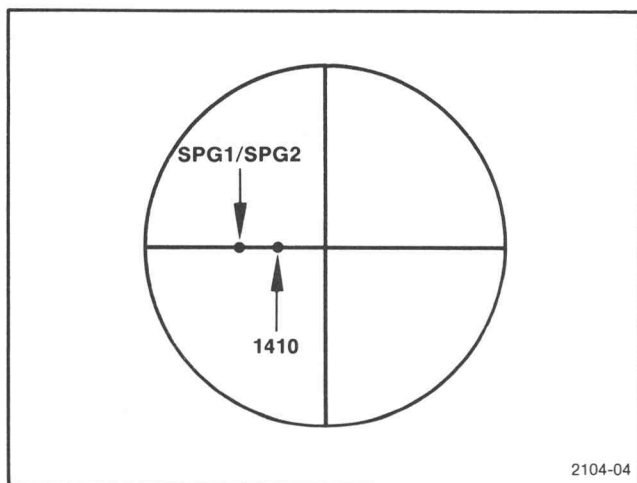


Fig. 4-4. Subcarrier phase adjustment illustration.

Recalibration Procedure—SPG1/SPG2

e. Connect the Sine-wave Generator to the other pair of output connectors through a 75 Ω in-line terminator. Set the Sine-wave Generator frequency to 3.58 MHz.

f. Check—The observed output should be -40 dB as the generator amplitude is varied from 0.5 V to 4 V (5 mV to 40 mV). Reverse output connections and repeat check.

17. Check Return Loss

a. Connect the Return Loss Bridge to the Test Oscilloscope Differential Comparator. Set the Differential Comparator for differential measurements.

b. Connect the Sine-wave Generator output through a "T" connector to the Return Loss Bridge input (see the Return Loss Bridge instruction manual) and to the Test Oscilloscope Vertical Amplifier plug-in.

c. Set the Test Oscilloscope for alternate channel viewing.

d. Set the Sine-wave Generator frequency controls for 5 MHz output.

e. Remove the 75 Ω terminator from the Return Loss Bridge Unknown arm.

f. Set the Sine-wave Generator Amplitude control for 500 mV output as monitored on the Test Oscilloscope.

g. Connect the Return Loss Bridge Unknown arm to the SPG1 or SPG2 VIRS output connector.

h. Check—Amplitude should not exceed 16 mV (30 dB return loss) as frequency is varied from 50 kHz to 5 MHz. Maintain constant sine-wave amplitude as monitored on the Test Oscilloscope Vertical Amplifier channel.

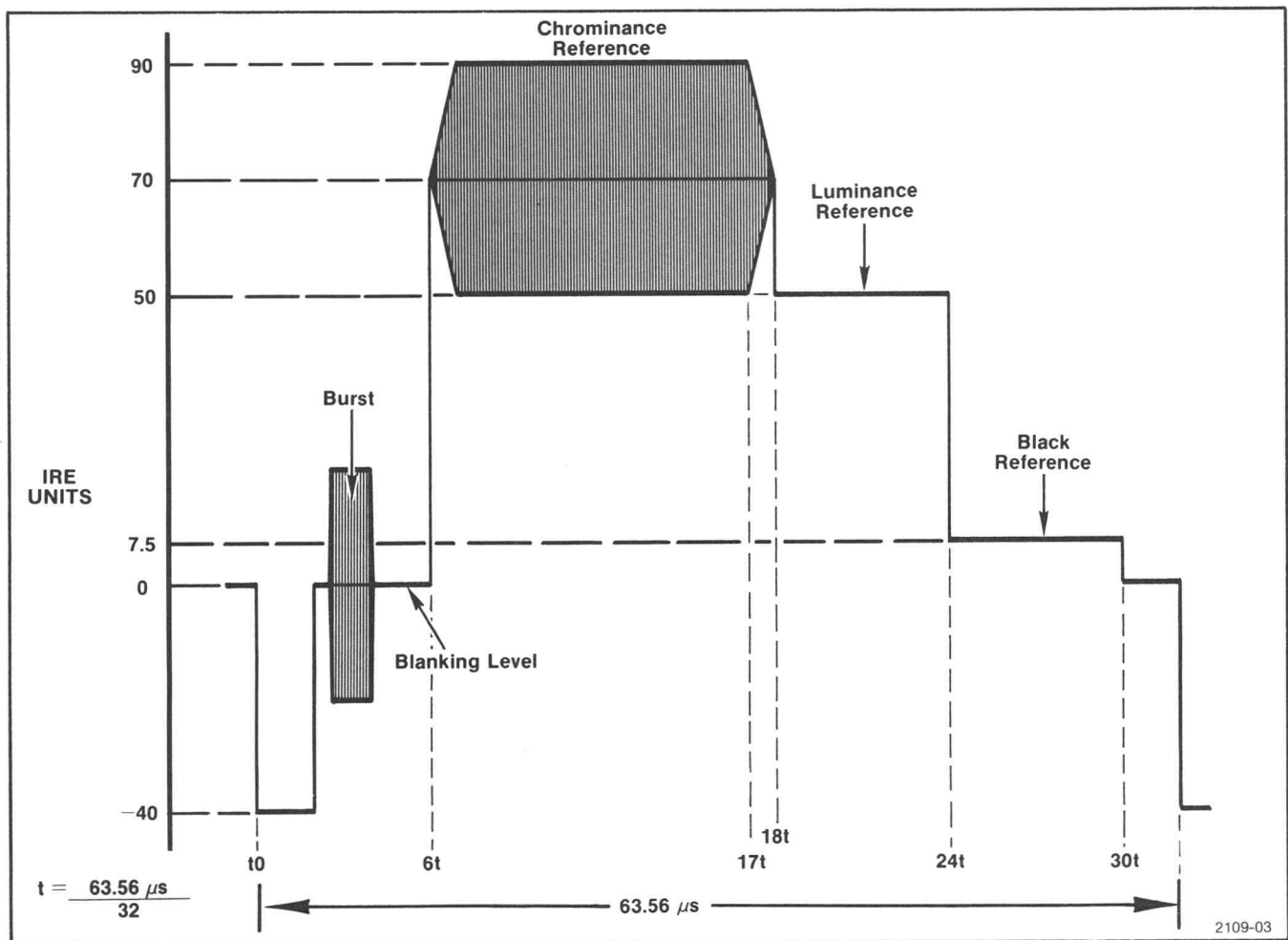


Fig. 4-5. The Vertical Interval Reference Signal.

THEORY OF OPERATION

This section is divided into two parts. First is a basic overview of instrument operation that describes circuit relationships and signal flow as illustrated by the Block Diagram. Second is a more detailed discussion of each of the circuit diagrams.

The circuit diagrams are blocked off according to circuit function. These circuit block titles are used as indices to the circuit diagram discussion.

The Block Diagram and circuit diagrams are located on fold-out pages at the rear of the manual. Refer to the appropriate diagram when reading this discussion.

Block Diagram Description

The heart of the SPG1 or SPG2 NTSC SYNC GENERATOR module is a 40-pin MOSLSI integrated circuit sync generator. This IC (found on the Sync Timing board A20, Diagrams 1a and 1b) is driven by a 640H (10.0699 MHz) oscillator and counts out sync and timing signals of the proper time and duration for operation of the rest of the 1410 system.

Oscillator frequency accuracy is maintained by comparing the leading edge of horizontal sync as generated by the sync generator IC to subcarrier phase. The subcarrier used can be either that generated in the 1410 Subcarrier Oscillator, an external subcarrier source, or an external source of composite video (in the SPG2 GEN LOCK mode). The phase comparison takes place on the Sync Lock board (A21) (see Diagrams 2a and 2b.)

Circuits on the Sync Lock (A21) board maintain the subcarrier to horizontal phase relationship and route reset information to the Sync Timing board (A20). In addition,

noisy signals, or signals with sync and subcarrier not locked, or conditions where horizontal lock has not taken place are detected and the proper command routed to the Generator Logic board (A22) to switch the SPG1 or SPG2 to INTERNAL mode.

The Generator Logic board (A22) contains the logic circuits that enable the SPG1 and SPG2 to react to the various front-panel switching commands. Outputs from A22 include drives for the front-panel LED indicators as well as enable/disable commands that cause the SPG1 or SPG2 to conform to existing conditions of front-panel switch positions and the presence or absence of external signals.

The Subcarrier Lock board (A23) is present only in the SPG2 module. Circuits on this board accept composite video from an external source and generate a control voltage for the 1410 subcarrier oscillator, a control level for the Sync Lock board that indicates a locked or unlocked subcarrier condition, and composite sync stripped from the incoming composite video signal.

The Pulse Output board (A24) accepts the sync and blanking signals from the Sync Timing board (A20) and shapes them for output. Each signal passes through one-half of a Tektronix-manufactured integrated circuit amplifier. Each amplifier provides the necessary drive for the output connectors.

The VIRS/Black Burst board (A25) uses the timing signals generated on the Sync Timing board (A20) to address a Programmable Read Only Memory which then produces the timing signals for the VIR Signal.

Subcarrier is modulated by timing signals generated on A25 then combined with luminance signals to form the VIR Signal at the output amplifier.

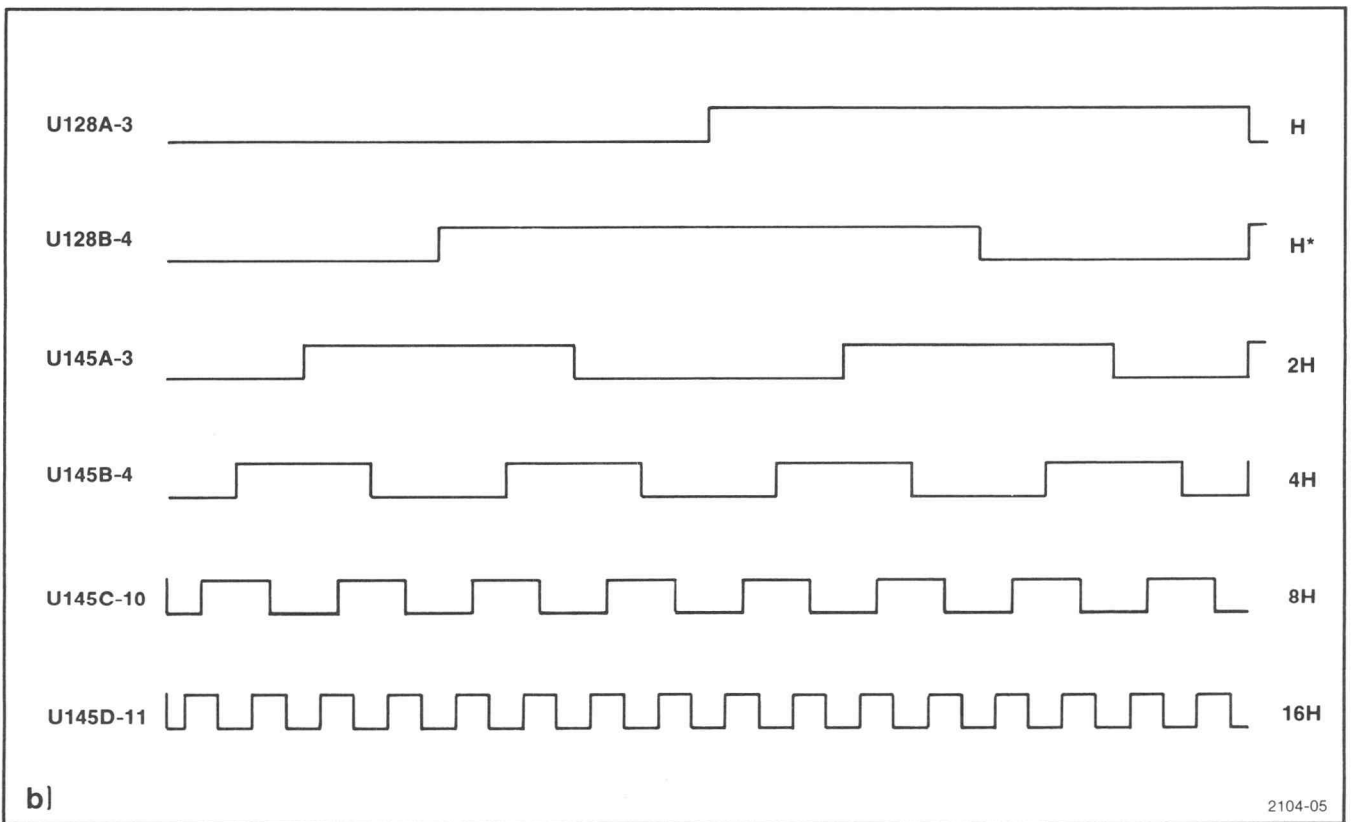
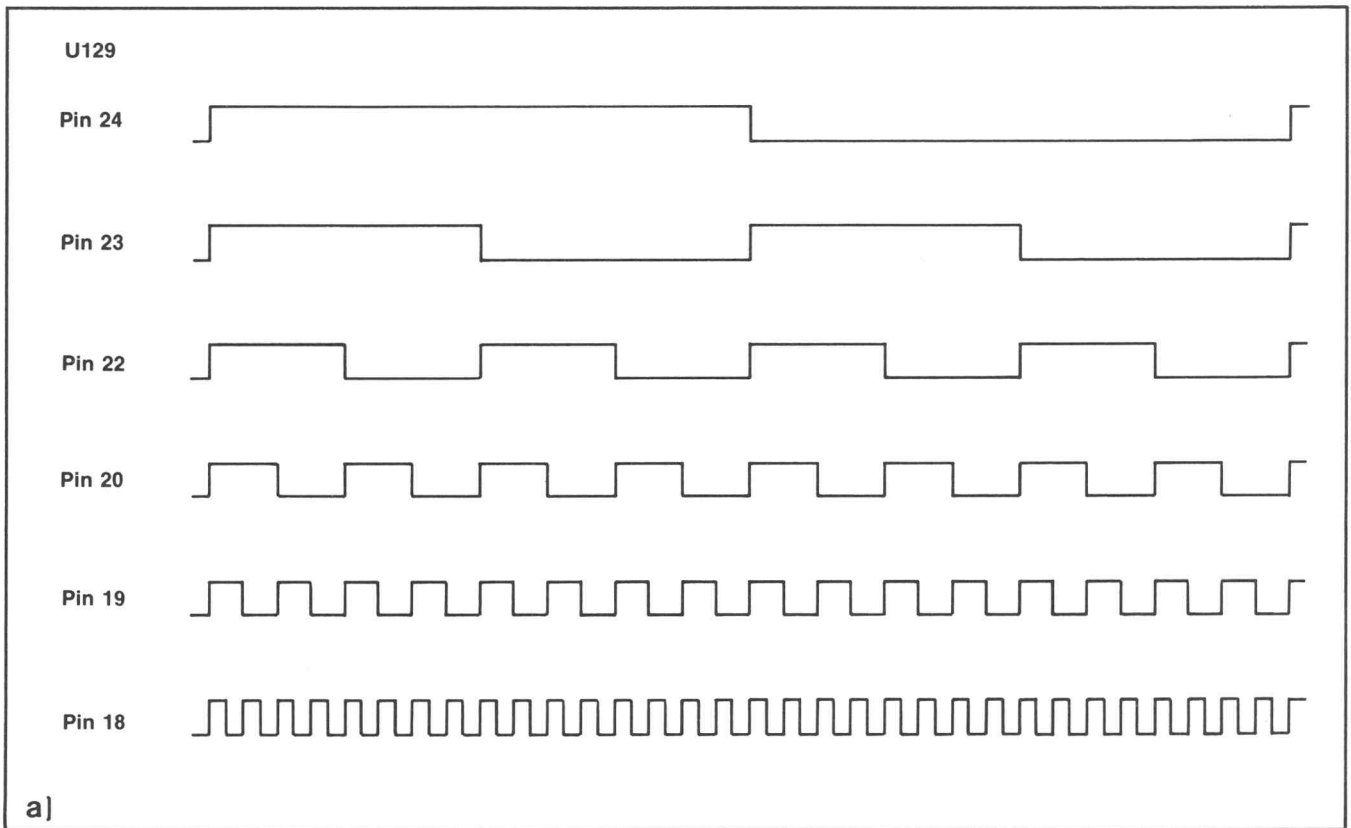


Fig. 5-1. H Timing diagram.

CIRCUIT DESCRIPTION

DIAGRAM a & b SYNC TIMING

Circuits on Diagrams 1a and 1b form the heart of the generator system. U129, a MOS/LSI circuit, generates the timing signals required for performance of the total system. U129 is clocked by a 5 MHz (320H), 2 phase pulse, which is derived from a 10 MHz (640H) oscillator. The outputs from U129 are either routed directly to the Interface board, or processed in one manner or another to produce necessary pulses.

DIAGRAM a

10 MHz Oscillator

Q157 is the active component of a Pierce Oscillator operating at 10 MHz. The frequency is determined by C159, C152, and L159, with frequency tuning controlled by C159. CR154 provides fine tuning of the oscillator frequency. The setting of C159 determines pull-in range of the oscillator.

Clock Drivers

The 10 MHz clock is divided by 2 and split into two phases by U152B and applied to two cascaded push-pull amplifiers. They amplify the two-phase 320H clock pulse required by U129. The TTL-amplitude signals at the outputs of U152B are stepped up to nearly 30 volts at the clock inputs (pins 13 and 14) of U129.

Sync Generator and Output Buffers

U129 is a MOS/LSI circuit that accepts the 320H clock pulses and generates timing pulses as required for operation of the rest of the system.

The 320H clock is counted down to 64H in U129. The 64H signal is then synchronously counted down (in U129) to H. Each interval of the countdown from 64H to H is an individual output of U129 (pins 17, 18, 19, 20, 22, 23, 24). The 64H derivatives from 32H to H are applied to a series of exclusive-or gates prior to the buffer amplifiers. The exclusive-or gates modify the sync generator outputs into a Gray Code reflection of the original signals. See H Timing Diagram, Fig. 5-1.

Each of the timing signals from U129 is applied to a buffer amplifier that reduces the signal amplitude, making it compatible with the TTL logic that follows.

The outputs of the Output Buffers are applied to the Interface board for routing to the rest of the system.

Burst Timing

The positive-going leading edge of the burst gate start pulse from U129 pin 32 clocks U126A. U126A is one-half of a dual monostable multivibrator with variable output pulse width as controlled by the external timing components C126, R117, and R119. Burst Delay control R119 is adjusted for breezeway width.

The trailing edge of the pulse from U126A pin 4 clocks U126B, the second half of the dual monostable multivibrator package, C127, R127, and R128 (the Burst Width control) are the external timing components for this device. R128 is adjusted for burst width. The output from U126B pin 12 is applied to the Interface board through U112A, which is an on-off gate controlled by the burst gate disable command from the Generator Logic board A22 (Diagram 3).

H Drive Timing

The H Drive signal on Interface board pin 7 is derived from one of two selectable sources. First, with P103 pins 2 and 3 shorted together, directly from sync generator circuit U129. Second, with P102 pins 2 and 3 shorted together, from D flipflop U102A. U102A receives its clock from the Variable H Blanking Start multivibrator U110B on Diagram 16. The time that pulse is generated depends on the setting of the H Blanking Start. The output of U102A goes high with the H Blanking Start clock pulse, beginning the variable H drive pulse. U102A's clear is set low at the end of H drive from U129, switching the output low again, ending the variable H drive pulse. See H Drive Timing Diagram Fig. 5-2.

Phasing Pulse Control

U115A generates a pulse of the type normally used in PAL television systems to regulate subcarrier phase on alternate horizontal lines. The output can be either a pulse or a square wave. H/2 is a square wave with its starting point at H Blanking start. This signal drives U115A D input, determining the output phase of U115A. U115A is clocked by a signal from U129 pin 24 that is coincident with line sync. If a square-wave is desired, P112 is open, leaving U115A's preset tied high. If a pulse output is desired, P112 connects U115A's preset to the H Drive pulse and U115A is reset at the end of H drive.

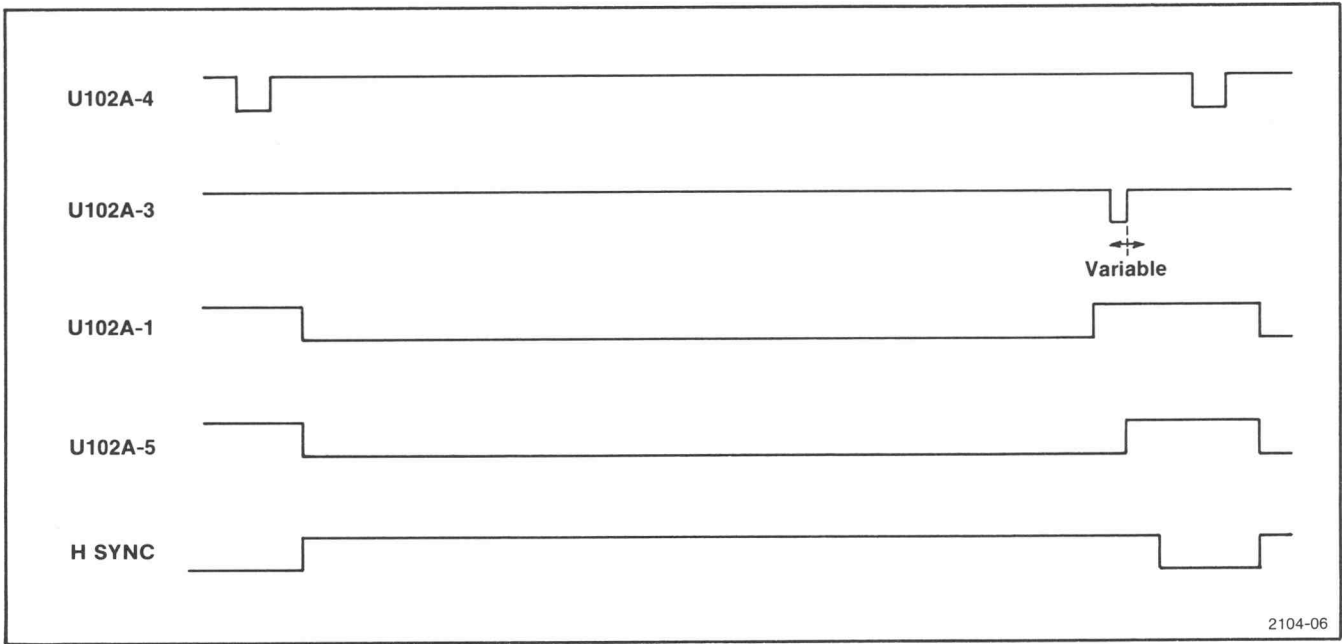


Fig. 5-2. H Drive Timing diagram.

DIAGRAM 1 b

Color Bar Timing

This circuit generates a series of pulses related to horizontal line timing used by the Color Bar Generator module TSG1 to time the individual bars sequence.

A two-stage 6-bit binary counter (U151 and U142) counts down from the 640H clock input to provide proper timing. The output timing is altered by command from the TSG1 when EIA color bars are desired.

U151 and U142 are data-loaded to counts determined by U141B and U141D, and U132A and U132B. In the full-field mode, the data load is a count of 63. The counter then divides by 65, resulting in a time between output pulses of 6.5 μ s.

In the EIA mode, interface line 47 is set to ground by the EIA switch in the TSG1 module. U141C and U146B alter the data load 3/4 of the way through the field. For the first 3/4 of the field, the counter is loaded to a count of 53. The counter divides by 75, resulting in 7.5 μ s bar widths. For the last 1/4 of the field the data load is changed to 34, the counter divides by 94, and the -I, W, and Q bars are generated. The Q output of U146B is also used by the TSG1 module to time the split-field displays. P144 determines the timing, either 1/2 field or 3/4, 1/4 field split.

The counter output is combined in U141A with a signal derived from horizontal blanking and routed to the TSG1 module via the Interface board. This output is also fed back to the counter load inputs to synchronize the count.

U148B and U146A form a timing circuit that determines the point on the line that the color bars begin. The time is controlled by R149, the Color Bars Horizontal Shift control.

Vertical Reset

This circuit locks the vertical counter in U129 to field 1 of the external reference signal in EXTERNAL and GEN LOCK modes.

Interface line 48 carries the field 1 identification pulse (field 1, line 6) from the Vertical Sync Detector on Generator Logic board A22 to the data input of U152A. In the fast Lock mode, U164A delays the pulse time by about 500 μ s as controlled by Vertical Phasing control R169. U164B sets a pulse width of about 40 μ s. The vertical reset pulse amplitude is increased to 15 V by U159B and is applied to U129 to reset the vertical counter. R169 advances or delays the vertical counter reset by one line.

Vertical Advance Delay

This circuit allows slower lock of the vertical counter in U129 to the external reference signal than the Vertical Reset circuit discussed previously.

The vertical reset pulse from U164B triggers the lock pulse in the slow lock mode. The vertical reset pulse is and'ed in U167C with a low output from U166B and gated through U167B to U159B and U129 under locked conditions. This ensures sustained lock of the U129 vertical counter to the external reference.

At the end of the V drive pulse, U162B generates a one-half-line timing pulse which passes down shift registers U161 and U160. Points along these shift registers are picked off to perform the desired timing functions.

U165C generates two clock pulses for U166B that cause U166B to generate an output between those two clock pulses. The output is of known polarity because of the V/2 preset. The output from U166B enables U167C to pass the vertical preset pulse from U164B during that output time. U166B Q output sets U166A D input high during that time so that if the vertical preset pulse is present, U166A Q output goes high indicating vertical lock.

U165B and D are used to generate a V/2 signal with edges coincident with normal vertical preset. U162A is clocked by incoming vertical preset so that if the vertical counter in U129 is not locked to incoming vertical preset, the output of U162A will enable U163 or U163D. Which gate is enabled, U163C or U163D, depends on relative position of the output of U165B and D compared with incoming vertical preset. This allows the vertical counter to be reset one line early (U163C or one line late (U163D) through gates U167A, U167D, and U167B, to bring the vertical counter into lock with the incoming signal.

When lock is acquired, U166A output is high and lock is maintained by the state of U166B providing a low input to U167C, allowing the vertical reset pulse to pass through to U159B.

Horizontal Phasing

U106 is loaded 16 μ s before horizontal sync and enabled 4 μ s before horizontal sync by commands from programmable read-only memory (PROM) U107. U129 supplies the 64H clock pulse. After a number of clock pulses, determined by the setting of S109, U106 generates a carry output pulse that is carried by interface line 3 to the Variable Delay circuit on Sync Lock board A21 (Diagram 2b). The timing of the load and enable commands permits delay of the carry output pulse for a time period extending from 4 μ s before horizontal sync to 10 μ s after horizontal sync.

Variable Horizontal Blanking

The two sections of U110, a dual monostable multivibrator, generate start and stop pulses for U102B, the Variable Horizontal Blanking generator. U110B initiates the blanking pulse, switching on the leading edge of the waveform from U107 pin 6. Duration of the start pulse is determined by the setting of U116 (H Blanking Start). U110A terminates the blanking pulse, switching on the trailing edge of the waveform from U107 pin 6. Duration of the stop pulse is determined by the setting of U115 (H Blanking Stop). The start pulse clocks U102B with its trailing edge, and the stop pulse trailing edge toggles U102B to terminate the blanking pulse. The time between

trailing edges of the start and stop pulses determines the duration of the Variable Horizontal Blanking pulse. The preset pulse at U102B pin 10 ensures the right polarity of U102B's Q output.

The blanking pulse is routed to P110, where it can be selected to become part of the composite blanking signal on interface line 10.

Variable Vertical Blanking

The leading edge of the V blanking waveform from U129 triggers U148A. U148A's output pulse duration is determined by R148, the Vertical Blanking Stop control. U148A's output sets U159B, and clears U159B at the end of its one-shot time constant. When U159B is cleared, its D input is high. If the H rate clock is present at the time, the variable vertical blanking pulse is generated. U159B output is applied to P111 where it can be selected to become part of the composite blanking signal on interface line 10.

DIAGRAMS 2 a & 2 b

SYNC LOCK

Circuits on Diagrams 2a and 2b accept sync and subcarrier from the selected sources, either internal or external, and generate the proper locking signals to phase-lock the Clock Oscillator on Sync Timing board A20 (Diagram 1a). The Clock Oscillator may be phase-locked to external line sync or subcarrier.

DIAGRAM 2 a

Subcarrier X2 Multiplier

Subcarrier to the other modules can be either locked to the 1410 3.58 MHz oscillator or is variable by turning the SUBCARRIER PHASE control. Refer to P339 on Diagram 2a. Note that the subcarrier applied to the Sync Lock board, A21, comes from either of two sources. With pin 1 of the connector connected to pin 1 of P339 on the circuit board, subcarrier reference comes from the SUBCARRIER PHASE control through the Pulse Output board, A24. With the connector reversed, subcarrier comes from the 1410 Subcarrier Input board, A13.

The outputs of U299A and U299D are at the subcarrier rate, but only one-fourth of a subcarrier cycle in duration. The in-phase output (U299A) is applied to U249B in Subcarrier/Horizontal Phasing circuit.

The outputs of the two pulse-narrowing networks are applied to U299C, which acts as a negative-input "or" gate. The output of U299C is twice the subcarrier rate with a 50% duty cycle and becomes the clock pulse for the divide-by-455 Horizontal Counter.

Horizontal Counter

The Horizontal Counter divides the twice-subcarrier-rate signal from the Subcarrier X2 Multiplier circuit by 455, generating an accurate H-rate signal at count 2048.

U289, U279, and U259 are loaded to a count of 1,592 by a command from U259's carry output. Following the load command, the counter is clocked by the 2X subcarrier signal from a count of 1,592 to 2048 dividing that clock by 455. In the internal mode of operation, the count to which the counters are loaded is never changed.

In the external mode of operation, the count can be altered by inputs from the Counter Reset Logic circuit. In the Slow-Slow Lock mode, the A and B inputs of U289 are loaded to add or subtract one count from the total if the Sync Phase Comparator circuit senses that the Counter H output is not in phase with input line sync. In the normal lock mode, horizontal sync from Generator Logic board A22 (Diagram 3) is used to reset the counter immediately through U200B, U249A and U255C.

Sync Phase Comparator

Horizontal sync, through U334A, switches diode switch CR270-CR271 (CR271 is normally conducting). Q260 generates a positive-going ramp that is clamped by Q262. At the falling edge of the signal on Interface line 87, the diode switch reverts to its normal condition, and the output of Q160 ramps back to ground.

The Q_A output of U259, which is an H-rate squarewave, is fed back to U285A. U285A and U285B time a sampling pulse (timing controlled by Preset Center control R276) to be in the center of the ramp that is generated by Q260. Q261 is turned off, turning Q252 on, allowing the ramp level at that time to be stored by memory capacitor C252. The memory level is applied through voltage follower U254A to quad comparator U205.

Each portion of U205 is preset by a section of a voltage divider to switch at some level of the sampled ramp voltage. When one of the comparators switches, the counter is reset as described earlier.

If the sample occurs on the falling portion of the ramp (after sync has ended), U240B and Q217 set the level on one input of U275C to ensure that the counter is shifted to allow the comparators to operate.

Counter Reset Logic

In the normal lock mode (P228 jumper connected to pins 2 and 3), a phase shift (sensed by the Sync Phase Comparator circuit) of sufficient amount to switch one of the reset portions of the comparator, feeds back to the clear input of U200B, enabling U200B to switch. U200B switches at the leading edge of the next horizontal sync pulse, presetting the Q output of U249A high. The high output from U249A loads the counter to the correct count (1,598). The Sync Phase Comparator output also disables the slow-slow lock loop with a low applied to U275B from U224A.

If the phase shift sensed by the Sync Phase Comparator is not sufficient to switch the reset portions of the comparator, either the retard or advance portion will act. The retard portion of the comparator operates when the Sync Phase Comparator senses that the counter output is leading the horizontal sync on interface line 87. In order to correct this lead, the counter must divide by 456. U255B pin 6 and U255A pin 3 are set low, resulting in a high level at U289 pin 4, and a low level at U289 pin 3.

At the next carry output from U259, the counter is loaded to a count of 1,591, allowing division by 456. U220B then triggers, switching the state of the counter back to divide by 455. If at the end of one-shot (U220B) time the phasing is still retarded, the same sequence is repeated.

If the Sync Phase Comparator senses that the counter is lagging horizontal sync, the count is similarly changed to 454 until the counter catches up.

In the slow-slow lock mode (P228 jumper connected to pins 1 and 2), U200B is always inhibited by the low clear command from U245D. The reset portions of comparator U205 now switch U275C, which in turn causes the count to be changed by one until an in-phase situation is regained. The retard and advance portions of the comparator operate as in the normal mode of operation. In the INTERNAL mode, the counter advance and retard functions are switched off through U255 pins 5 and 2, and the counter is preset through U255 pin 9.

Subcarrier/Horizontal Phasing

H/2 pulse from Sync Timing board A20 triggers U229B. U249B data input receives subcarrier-rate pulses from U299A and is clocked by the end of U229B one-shot time, timed by R219, the SCH Phase control. If U249B data input is low, at the time of the clock, the Q output goes low. When H/2 goes low, the Q output is preset high, triggering U220A, which in turn resets the horizontal counter in U129 on Sync Timing board A20.

Circuits on Diagram 2b sense the absence of burst and apply a low inhibit to U245C in monochrome conditions. This mode inhibits horizontal reset of the counter in U129 on Sync Timing board A20.

U220A is inhibited from generating a horizontal reset pulse when circuits on the Generator Logic board indicate absence of either horizontal or vertical lock and apply a low clear command via interface line 83.

Timing Jitter Detector

In the presence of an intermittently noisy signal or an unlocked sync-subcarrier condition, the subcarrier counter is continuously preset, causing U275A to pump current into memory cap C251 through Q284. If the noise persists, U254B's output becomes positive enough to gate a command through U224D that switches circuits on the Generator Logic board to switch to internal mode (if P224 is connected).

If sync and subcarrier are expected to be unlocked, P324 should be connected. This connection will cause the generator to lock to sync under sync-subcarrier unlocked conditions.

DIAGRAM 2 b

The circuits on Diagram 2b provide proper subcarrier to sync lock timing and inform Generator Logic board A22 when H lock is unsuccessful, allowing the SPG1 or SPG2 to switch to internal operation. The output from phase lock amplifier U284A keeps the 1410 subcarrier oscillator at the correct frequency.

Sync-Subcarrier Lock

The state of U334D's output determines whether the SPG1 or SPG2 locks to subcarrier or sync. With the instrument set for external operation and sync lock, the Q output of U240A is low, U334D pin 10 is high because of external operation, and U334D pin 11 is high because of the low output of U240A. The low output at U334D pin 9 inhibits U229A and enables U330D.

A horizontal-rate square-wave from U259 (Diagram 2a) is gated through U330D and clocks U325B. U325B enables ramp generator Q315 and a near-square ramp is applied to the emitter of Q304.

At the same time that the ramp is being started, H sync from Sync Timing board A20 clocks U200A. U200A output trailing edge clocks U325A. U325A generates a 500 ns sample pulse that occurs some time during the leading edge of Q315's ramp as determined by the HORIZ DELAY control. The sample pulse turns off Q312, which turns on Q304 and allows the ramp level at that time to be stored in memory capacitor C295.

Voltage follower U284B applies the level at C295 to phase-lock amplifier U284A, and to the H Unlock Detector circuit. U284A compares the output of U284B with its reference at pin 3 and applies correction voltage to the 640H oscillator via Interface line 55.

If the 640H oscillator is unlocked, the ramp and the sample pulse are no longer coincident. The output of U284B still follows whatever level appears at C295. A positive excursion by U284B output turns on Q294 via C298 and CR304. Q294 conduction turns on Q306, which switches the state of U324F output from high to low, signaling Generator Logic board A22 to indicate loss of sync and to switch to the internal mode.

At the same time, Q330 is turned off, turning on Q305. This places R296 (and R293 if slow-lock is selected) in parallel with R298, increasing the ac gain of U284A.

Q294 is held on by C307, holding Q306 on until the output of U284B settles down after re-acquiring lock. This ensures rapid phase-lock of the 640H oscillator.

With the instrument set for external operation and subcarrier lock, U240A pin 5 is high, causing U334D to enable U229A and disable U330D. U229A is clocked by H-rate signals counted down from subcarrier. The ramp is then referenced to subcarrier instead of sync.

Should the incoming subcarrier be lost, circuits on Generator Logic board A22 change the state of U240A data input. Another circuit on A22 applies a pulse via Interface line 57 that occurs at the sixth serration of the vertical pulse. That clock changes the state of U334D and switches back to sync lock. Remember that this action only takes place when the instrument is in subcarrier lock.

U330B, U334C, and U330C inhibit the sample pulse generator during the time that sync is missing.

With the instrument in internal mode, U334D selects subcarrier lock at all times.

DIAGRAM 3

VERTICAL SYNC AND GENERATOR LOGIC

Circuits on Diagram 3 provide the necessary synchronization switching functions and the logic required to alter the operation and front-panel indications of the SPG1 or SPG2 to conform to existing conditions.

Mode Switching

This circuit has four dc output lines (designated L, \bar{L} , K, and \bar{K}) that change logic levels as determined by the front-panel setting.

P374 and P366 enable or disable gen lock operation. The jumper should be on P374 if Subcarrier Lock board A23 is installed (SPG2), and on P366 if A23 is not installed (SPG1).

P365 connects the line K output to U386B when the HORIZONTAL LOCK switch is in the SUBCARRIER position. U386B pin 5 is low only in EXTERNAL mode and SUBCARRIER lock. This condition causes the SPG1 or SPG2 to lock internal sync to external subcarrier but not light the front-panel INTERNAL LED.

Sync Switching

The Sync Switching circuit selects sync from external, or in the case of SPG2, gen lock inputs and provides a starting pulse for the Sync Phase Comparator ramp generator on Sync Lock board A21 (see Diagram 2a).

U420B or U420D is enabled, depending on the Mode Switching circuit outputs. In the EXTERNAL mode, \bar{K} is high, enabling U420D and allowing external sync from the rear-panel COMP SYNC input to pass. U420C and U420A gate the sync through to the clock input of U426. U426 generates a positive-going pulse about 40 μ s in width, locking out the 24 pulses in the vertical interval.

In the GEN LOCK mode (SPG2 only), \bar{L} is high and \bar{K} is low, enabling U420B and passing sync from the Sync Separator circuit on Subcarrier Lock board A23. U426 operates in the same manner as in EXTERNAL.

A second output from U420A routes sync to Interface line 54 and to the Vertical Sync Detector.

Vertical Sync Detector

The negative-going sync pulses from U420A switch Q406 off as they arrive. During normal line sync, the line sync period is short enough that the change developed on C405 is not sufficient to turn Q405 on. During the vertical pulse time, however, the long vertical pulses do develop enough charge on C405 to turn Q408 on, generating a positive-going pulse for each of the six serrated vertical pulses. These pulses are applied to U400B as a clock, and to a pulse delay network, U406B, R402, C397, and U406F.

When U400B is clocked, a positive-going pulse longer than one-half line in duration is applied to U401A from U406F following the enable input and starts down the register.

Each of the following clock pulses has a similar effect on U400B and U401. U400B is not allowed to clear U401, and each time U401 is clocked the pulse is stepped one position along the register.

At the sixth clock pulse (corresponding to the sixth serrated vertical pulse), U401 output is picked off and routed to U406D and to sync present detector U400A. When U400A is clocked, its Q output goes high and Q low. The time constant is greater than one field in duration so the outputs remain in the same state as long as U401 generates a clock each field.

U401 output is also applied to U400B timing circuit via CR396, terminating U400B output and clearing U401.

Switching Logic

The outputs from the Switching Logic circuit are logic levels, with the exception of the vertical preset lines 48 and 57. The vertical preset pulses, however, are not present at lines 48 and 57 in INTERNAL mode since any external input is locked out in the Sync Switching circuit.

INTERNAL Operation. Line 52 (burst lock disable) is set low at all times in the INTERNAL mode because of output L from the Mode Switching circuit. This line goes to the Phase Lock Amplifier on Subcarrier Lock board A23, Diagram 4b.

External subcarrier line 56 is high at all times in the INTERNAL mode because of output K from the Mode Switching circuit disabling the four-input NAND gate formed by U389A, U389D, and U388A. This line goes to the Internal/External Subcarrier switch on Subcarrier Input board A13 in the 1410. See 1410 Diagram 3.

Connection
 P40
 16 Aug 83

Line 14 is the front-panel SYNC indicator drive. The mode of indication is selectable by positioning P387. In the sync absent position of P387, U385D is bypassed. The SYNC indicator is always off in the INTERNAL mode. P449 pin 3 routes a LED drive output, inverted from that on line 14, to the 1410 rear-panel REMOVE connector for use in remote indicators if desired.

Line 46 routes a command to the Sync Lock Logic circuit on Sync Lock board A21 (Diagram 2b) when burst is missing in the GEN LOCK mode. In the INTERNAL mode, line 46 is always high.

Line 1 drives the front-panel SUBCARRIER indicator. The mode of indication is reversible, depending upon the position of P383. In the subcarrier absent position of P383, U385A is bypassed. The SUBCARRIER LED is always off in the INTERNAL mode. P449 pin 1 routes a LED drive output, inverted from that on line 1, to the 1410 rear-panel REMOTE connector for use in remote indicators if desired.

Line 87 routes a signal from U426 in the Sync Switching circuit to the Sync Lock board A21 (Diagram 2a) for timing reference in EXTERNAL or GEN LOCK modes. In the INTERNAL mode, line 87 is always low.

Line 32 routes a video disable command, if desired, to all module locations. In the INTERNAL mode, line 32 is always low. In EXTERNAL or GEN LOCK modes, a high output on line 32 can disable video output upon loss of lock. With P380 in the "can" position, video is disabled upon loss of lock. With P380 in the "can't" position, line 32 is always low and can't disable video.

Line 4, burst gate disable, is always low in the INTERNAL mode, or when P380 is in the "can't" position. Line 4 goes to the Burst Gate Generator circuit on Sync Timing board A20, Diagram 1a. A high level on line 4 inhibits the burst gate.

Line 31 can disable the chrominance portions of composite video signals upon loss of lock, if P382 is positioned for it. In the INTERNAL mode, or with P382 in the "can't" position, line 31 is always low. A high on line 31 inhibits chrominance portions of signals in some modules.

Line 15 is the front-panel INTERNAL indicator drive. In the INTERNAL mode, or under some conditions of loss of lock, line 15 is low. P449 pin 2 is an external LED drive, inverted from that on line 15.

Line 85 routes a command level to the Sync Lock Logic circuit on Sync Lock board A21, Diagram 2a. In the INTERNAL mode, or under some loss of lock conditions, line 85 is low.

In the EXTERNAL mode, the Mode Switching outputs are altered to change the switching commands from the Sync Switching circuit.

With external sync present in the EXTERNAL mode, U400A pin 6 is high and pin 7 is low. U396A output is high if external subcarrier is not present, and low if external subcarrier is present. U406A output is low if U410A senses both H and V lock. U386D's output is high, and U388D's output is high, setting up the logic conditions for EXTERNAL operation.

The K output from the Mode Switching circuit is high in the EXTERNAL mode, allowing external sync from the 1410 rear-panel input to pass to the Vertical Sync Detector circuit. The high K level is also applied to U398B.

U398B also has high inputs from U386B and from Interface line 59 if external subcarrier is present or from R398 if P398 is in the Not Needed position. The Not Needed position of P398 eliminates the requirement for having external subcarrier present in the EXTERNAL mode.

U399D, seeing a low level at its input, applies a high level to the front-panel INTERNAL indicator, turning it off. U389C, sensing the high levels from U399D and U388D, applies a high level to line 85 to enable the Sync Phase Comparator on Sync Lock board A21, Diagram 2a. The high from U389C also enables U406D to pass vertical preset pulses to line 48. The rest of the logic outputs operate similarly to the INTERNAL mode until one of the external signals disappears.

If the external sync is lost, U410A, U426A, and U400A all switch states. U386A disables video outputs, if P380 is in the "can" position. U398A's output switches high, setting line 85 low and turning on the front-panel INTERNAL indicator. U389B senses two low inputs and turns on the front-panel SYNC indicator, assuming P387 is in the Sync Absent position.

If external subcarrier is lost, line 59 is low, causing U396A output to be low. That turns on the front-panel SUBCARRIER indicator, assuming P383 is in the Subc Absent position. The low on line 59 also causes U398B to turn on the front-panel INTERNAL indicator and switch line 85 low.

Theory of Operation—SPG1/SPG2

The HORIZONTAL LOCK switch does not affect circuits on this diagram as long as external sync is present and P365 is in the "needed" position.

If the HORIZONTAL LOCK switch is in the SUB-CARRIER position, and P365 is in the "not needed" position, the low K output causes U386B to maintain the Switching Logic circuit in the external mode.

In the SPG2 GEN LOCK mode, sync arrives via line 53 from Subcarrier Lock board A23, and the subcarrier lock signal arrives via line 51, again from A23. The Switching Logic circuit reacts to these inputs similarly to the EXTERNAL mode.

DIAGRAM a and b SUBCARRIER LOCK

Circuits on Diagrams 4a and 4b receive composite video from an external source, and generate a control voltage for the Subcarrier Oscillator in the 1410, a lock signal for Sync Lock board A22, and composite sync.

DIAGRAM a

Chroma Amplifier

The Chroma Amplifier consists of the Chroma Pickoff, and three operational amplifiers in series with an Automatic Gain Control (AGC) circuit.

Chroma Pickoff. C735 and L734 form a series resonant LC trap. The subcarrier components of the input signal are separated from the low-frequency components and applied to the Chroma Buffer Amplifier.

Chroma Buffer Amplifier. Q725 and Q715 form an operational amplifier with a gain of 5. The output is regulated by the AGC circuit and applied to the Limiting Amplifier.

AGC Operation. CR729 and CR736 form a gain control circuit. This circuit regulates the subcarrier signal current from the Chroma Buffer Amplifier by shunting a portion of that current through CR736 to ground.

The amount of signal current shunted to ground depends on the relative impedances of CR736 and CR729. If the input signal is large, the AGC control voltage from

Diagram 4b decreases the conduction (increases the impedance) of CR729. The signal current then has a lower impedance path through CR736 and less signal current reaches the Limiting Amplifier.

If the input signal is small, the AGC control voltage decreases CR729's impedance and the signal current has a lower impedance path to the Limiting Amplifier.

Limiting Amplifier. Q718 and Q719 form an operation amplifier with the feedback resistor shunted by two diodes (CR699 and CR708). The two diodes limit the peak-to-peak signal amplitude at the amplifier output at about 1.2 volts.

Output Amplifier. Q665 and Q666 form an operational amplifier that provides adequate drive current for the demodulators. L679 (Subcarrier Phase) is adjusted to compensate for phase changes caused by the amplifiers.

Sync Stripper

U700 is a Tektronix manufactured sync stripper circuit. Composite video, from an external source, arrives at the input and composite sync is the output. If the input signal contains sound-in-syncs, the position of P690 can be selected to delete that signal.

R707 is adjusted for proper timing of the sound-in-syncs deletion. R749 is adjusted for proper sampling point on a ramp generated in U700. The proper timing of the sample ensures that noise during video time will not cause U700 to change its timing. The Sync Stripper output is routed via the 1410 Interface board to Generator Logic board A22, and through R680 to the Clamp Timing Circuit.

Clamp Timing

Negative-going composite sync from Generator Logic board A22 turns off CR680, turning off Q670 after a time set by R673 and C650. When Q670 turns off, Q686 also turns off. This all happens during back porch time so that the incoming signal burst is allowed to pass to the demodulators. Subsequent circuitry matches the 1410 subcarrier phase to the incoming burst phase. The clamp pulse from Q670 is also applied to the Burst Detector and AGC circuit on Diagram 4b.

With P685 in the Cancel position (pins 1 and 2 connected), Q686 is also off during sync time. This means that the demodulators see residual subcarrier on sync tip as well as burst. The effect on the 1410 subcarrier is to cancel the phase error due to residual subcarrier.

Demodulators

The output of the Chroma Amplifier is applied to three integrated circuit demodulators (U639, U626, and U630). U639, the In-Phase Demodulator, and U626, the Quadrature Demodulator, compare the chroma signal at their + and - signal inputs to the 1410 subcarrier signal at their + carrier inputs. The output is proportional to the phase difference between the input signals. Both operate in the same manner, but U626 receives subcarrier shifted 90° in phase by L645 and C653.

U630 receives the signal from the Chroma Amplifier at its signal inputs and + subcarrier input, and operates as a self-synchronous detector. The output is proportional to the input chrominance amplitude and is not affected by phase.

All three outputs pass through shaping filters that remove any subcarrier component and through buffer amplifiers. The buffer amplifier outputs are applied to the Phase Control, Lock Detector, Burst Detector and AGC circuits on Diagram 4b.

The clamp pulse from Q565 causes Q578 to sample the level at the output of the In-Phase Demodulator buffer amplifier during burst time. This level is fed through U619 to U639 to ensure that the buffer amplifier output is at zero volts during burst time.

DIAGRAM 4 b

The three demodulators outputs plus the output of the Clamp Timing circuit are applied to the inputs of the three major circuits on Diagram 4b. The Clamp Timing output and the Amplitude Detector output enable a two-transistor gate (Q550 and Q560). When Clamp Timing and Amplitude Detector outputs coincide (burst time), the gate enables the memory circuits at the inputs of the Phase Control circuit, the Lock Detector circuit, and the Burst Detector and AGC circuit.

The instantaneous voltage levels at the inputs of the three circuits are stored in memory capacitors and applied through voltage followers to the rest of the circuits.

Phase Control

The output of the In-Phase Demodulator is applied to the memory portion of the Phase Control circuit. The instantaneous level during burst time is stored in C528 by Q539 and routed through voltage follower U489B to error amplifier U489A. The level at the input of the error amplifier is inverted and amplified and applied to the Control Voltage Switching circuit. The error signal is picked off at the wiper of R456 and routed to the 1410 Subcarrier Oscillator to control the oscillator varicap.

The error amplifier output is fed back through Darlington transistor Q465 to the error amplifier input. The Darlington configuration is used so that the current demand by the feedback loop does not affect the frequency control with temperature changes. C456 rate-limits the level changes the amplifier can make.

Q469 is a band switch circuit used to change the slew-rate of the amplifier by changing the input impedance. If fast lock is desired, P459 is connected around R459. The input impedance is then R469 in parallel with R479. For slow lock, P459 is open and the amplifier input impedance is R459 and R469 in parallel with R479.

Q469 is on only when the Lock Detector circuit detects a "no-lock" condition. When the circuit is locked, the junction of R467 and R468 is at +0.6 volt and the band switch is off.

Lock Detector

The output of the Quadrature Demodulator is stored in memory capacitor C552 during burst time. The memory level passes through voltage follower U510D to Q470, the Lock Detector delay circuit.

Before lock acquisition, Q470 is on, Q472 is not charged, Q462 is on, and Q463 is off. The junction of R467 and R468 is referenced to -15 V and the band switch (Q469) is on. During lock acquisition, the output of U510D goes far enough positive to turn Q470 off, allowing C472 to charge towards +15 V. After about 200 ms, Q462 turns off and the multivibrator switches states. When Q463 turns on, the band switch is turned off, and Q460 turns off, removing the 0 volt unlock level from Interface line 51.

Burst Detector and AGC

The output of the Amplitude Detector is stored in memory capacitor C563 and applied through voltage follower U510A to two circuits. U510C is connected as a Schmitt circuit, with a positive output when burst is present. U510B is a rate-limited amplifier with an output that is less negative the larger the input burst. U510B's output is applied to the Chroma Amplifier gain cell on Diagram 4a. U510A's output is applied to the Control Voltage Switching circuit.

Q545 inhibits the clamp timing pulse if Interface line 52 goes to 0 volt. This condition is present when the SPG2 is in the INTERNAL mode, or when the gen-lock signal is lost.

Theory of Operation—SPG1/SPG2

Control Voltage Switching

With the circuit locked, the positive output from U510C turns off Q474, Q464, and Q475. The 1410 Subcarrier Oscillator control is directly from U489A in this condition.

When unlocked, U510A's output is negative, turning Q474, Q464, and Q475 on. The 1410 Subcarrier Oscillator is then controlled by the setting of R456 as a voltage divider between -15 volts and ground.

DIAGRAM 5

Diagram 5a Pulse Output Amplifiers

The circuits on Diagram 5a accept signals from Sync Timing board A20 (see Diagrams 1a and 1b), and drive loads connected to the 1410 rear-panel output connectors. Each integrated circuit contains two completely independent amplifiers with rise and fall times matched and controlled by external timing capacitors (designated "Rate" on the diagram).

The output level excursion for each amplifier is from 0 to -8 volts open circuit, and 0 to -4 volts when terminated in 75 Ω at the 1410 rear panel connectors.

In most cases, the signal received from the Sync Timing board is processed through its amplifier and applied to the 1410 Rear Interconnect board. Two signals, however, get some prior processing before being applied to the amplifier.

The BURST FLAG output is developed from the Burst Flag Start pulse from the Sync Timing board. U810A delays the pulse for a period of time controlled by R800. U820B sets the duration of the pulse (adjustable by R821). When the two controls are properly adjusted, the BURST FLAG pulse is the width of burst and centered on burst time. If the SPG1 or SPG2 is in an external lock mode and set for chroma disable, the level at Interface line 31 inhibits the BURST FLAG output (via U790C) upon loss of lock.

The FIELD REF output is a one-line pulse that can be generated on Field 1, line 11 or Field 3, line 10. If P836 is set for Field 1, line 11, the signal on Interface line 37 is applied via U835A directly to the pulse amplifier, U829B. If P836 is set for Field 3, line 10, however, U825, a dual D-type flipflop, divides the V/2 clock by two, generating a V/4 pulse. The V/4 pulse clocks U826, the next toggle flipflop. U826's preset input prevents U826 from toggling until U825A's Q output is high. Conditions are correct at Field 3.

At Field 3, line 9, U826 is cleared to toggle, and a low level is applied to U825A's D input. The next horizontal sync pulse clocks U825A and the Field 3, line 10 FIELD REF pulse is passed to the output amplifier, U829B.

Diagram 5b Subcarrier Output

The circuit on Diagram 5b receives subcarrier from the Subcarrier Oscillator in the 1410, passes it through the phase shifter (goniometer), and applies it to the 1410 Interface board and the 1410 Rear Interconnect board.

Subcarrier from the 1410 Subcarrier Input board A13 passes through the front-panel SUBCARRIER PHASE control to an amplifier formed by Q755, Q767, and Q768. The output load for this amplifier is the tank circuit at the collector of Q768. The tank circuit is tuned for subcarrier frequency, with C779 providing amplitude control.

The output of the tank circuit is applied to the subcarrier output amplifier consisting of Q776, Q775, and Q784. This unity-gain amplifier provides the necessary low-impedance drive for signal distribution.

DIAGRAM 6

A25 VIRS/BLACK BURST

PROM Timing Generator

U921 is a Programmable Read Only Memory (PROM) that derives the VIRS timing signals. The PROM is addressed by drive signals from the SPG module causing its outputs to produce the timing signals shown in Fig. 5-1.

CR933, CR941, and CR943, and CR952 are negative-logic current steering diodes driven by the outputs of U921. If pin 7 is high, CR941 will turn on, steering emitter current away from Q841, which turns off current drive through the transistor. When the PROM's output goes low, current drive resumes and causes a current corresponding to 70 IRE to appear at the Luminance Filter output. The 50 IRE, 7.5 IRE, and chrominance levels are similarly generated.

VIRS Drive

U859 is a synchronous binary counter connected to produce a VIRS pulse for use at U921. U855A controls the VIRS pulse output depending on the position of the VIRS pushbutton switch. The counter is clocked by composite sync from U853D. The load input is driven by vertical drive from U851C. Line 18 or Line 19 may be selected by grounding pin 15 or pin 1 with the jumper connector.

Sync and Setup Drive

Gate U815D passes composite blanking and vertical drive when the Black Burst/Full Field Ref pushbutton is in the Full Field Ref position thus enabling U921 to generate the full field VIR signal. U851B passes the VIRS pulse which enables U921 during Line 18 or Line 19. Q955 and Q962 provide current during composite sync time and setup time.

Modulator

U918 is a double-balanced modulator that produces at its output (pins 6 and 9) sidebands proportional to the product of the input signal voltages (pins 1 and 4) and the carrier signal (pins 7 and 8). The modulated chrominance output signal is coupled by T928 to the Chrominance Bandpass Filter. This filter provides a bandpass response whose center frequency is tunable by L938 and L948 to 3.58 MHz. The signal then passes through the Chrominance Gain control to the Output Amplifier.

Burst Drive

Q903 is turned on during burst time to provide burst drive current to the Modulator. The burst gate signal is filtered and shaped in the collector circuit.

Subcarrier AGC and Limiter

This circuit ensures that the Modulator is always driven with a constant subcarrier signal amplitude. The circuit also maintains correct input waveform symmetry to provide balanced drive to the Modulator.

Q880 provides isolation from the subcarrier source. C865 and L863 provide adjustment of TSG4 subcarrier phase to 1410 subcarrier phase. The subcarrier signal is limited to a 50% duty cycle at the collector of Q875. Paraphase amplifier Q876 and Q878 provides AGC and drives push-pull output stages Q897 and Q898. Thus, the subcarrier signal at T908's secondary is of constant amplitude and shape.

Output Amplifier

This circuit is a non-inverting operational amplifier that combines chrominance and luminance at its summing input, provides dc level and gain adjustments, and presents a low impedance at its output. There is sufficient output to drive two 75 Ω external loads.



MAINTENANCE

INTRODUCTION

This section is divided into three parts: Maintenance, Troubleshooting, and Repair.

Maintenance includes inspection, cleaning, and recalibration. Troubleshooting contains information for isolating a trouble to a component. Repair includes procedures for removing and replacing components.

MAINTENANCE

A regular schedule of maintenance can improve instrument reliability. How often the maintenance is performed should be determined by the severity of the operating environment. Turn off the instrument power and remove the power cord before cleaning the module.

Cleaning

Dust accumulating on the circuit board acts as an insulating blanket, preventing efficient heat dissipation, and possibly causing overheating and component breakdown. A layer of dust can also provide an electrical conduction path, especially under high humidity conditions.

CAUTION

Avoid the use of chemical cleaning agents that might damage the plastics used in this instrument. Avoid chemicals that contain benzene, toluene, xylene, or similar solvents.

The best way to remove heavy accumulations of dust is to blow it off with dry, low-velocity air jet. Remaining dust can be removed with a small brush followed by a soft cloth dampened in a mild detergent and water solution. A cotton-tipped applicator is useful in tight places.

WARNING

THE FOLLOWING SHOULD BE PERFORMED BY QUALIFIED SERVICE PERSONNEL ONLY.

Visual Inspection

Visually inspect the circuit board or boards during the maintenance routine for such defects as broken connectors, loose or disconnected pin connectors, improperly seated transistors and integrated circuits, and damaged components. Make sure that the boards are properly seated on the 1410 Mainframe Interface jacks. Boards with shields should be parallel to each other and held firmly by the plastic clips provided for this purpose.

The corrective procedure for most visible defects is obvious; however, care must be taken to determine and correct the cause of heat-damaged components. Heat damage is sometimes an indication of trouble elsewhere in the instrument.

Multi-Pin Connectors

Board output signals are fed to the rear-panel connectors through coaxial cable and multi-pin connectors. The connector holder has identification numbers that identify terminal connectors No. 2 and up. A triangular key symbol is also located on the circuit board to identify pin No. 1 (see Fig. 6-1) so that the connector can be properly oriented.

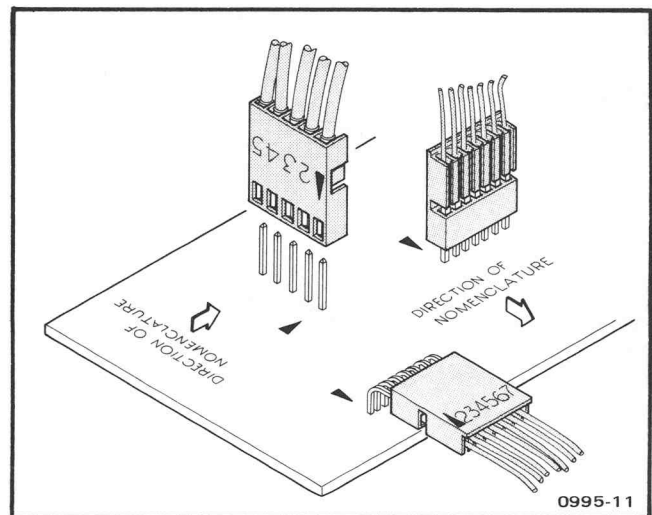


Fig. 6-1. Multi-pin circuit board connector.

Transistor and Integrated Circuit Checks

Periodic transistor and integrated circuit checks are not recommended. The best performance check for these devices is actual operation of the instrument. Performance of the circuit is thoroughly checked during the performance check or calibration procedure. Any sub-standard transistors or integrated circuits will usually be detected at that time.

Recalibration

The length of time between recalibration depends on the amount of use the circuitry receives, the nature of the environment, and the change in performance when some components are replaced.

In general, a partial recalibration is necessary if the components replaced affect the board calibration. Complete recalibration is recommended if the board or boards are not operating to their full capability. To ensure correct and accurate operation, performance should be checked at regular intervals; for example, after 1000 hours of operation if used continuously, or every six months if used infrequently.

A Performance Check/Calibration Procedure is given in Section 4.

TROUBLESHOOTING

Information contained here may be used as a guide in locating circuit failures. The schematic diagrams, circuit description, and calibration sections should be referred to for fast, efficient location and repair of defects.

Diagrams

Circuit diagrams are shown on the foldout pages in Section 9. The circuit and electrical value of each component is shown on the diagrams. Important waveforms are also shown.

Circuit Boards

The circuit boards are outlined in blue on the schematic diagrams. Circuit board illustrations are provided on the back of the foldout pages that precede the relevant diagrams. The assembly number assigned to each circuit board is an abbreviated method for identifying the board.

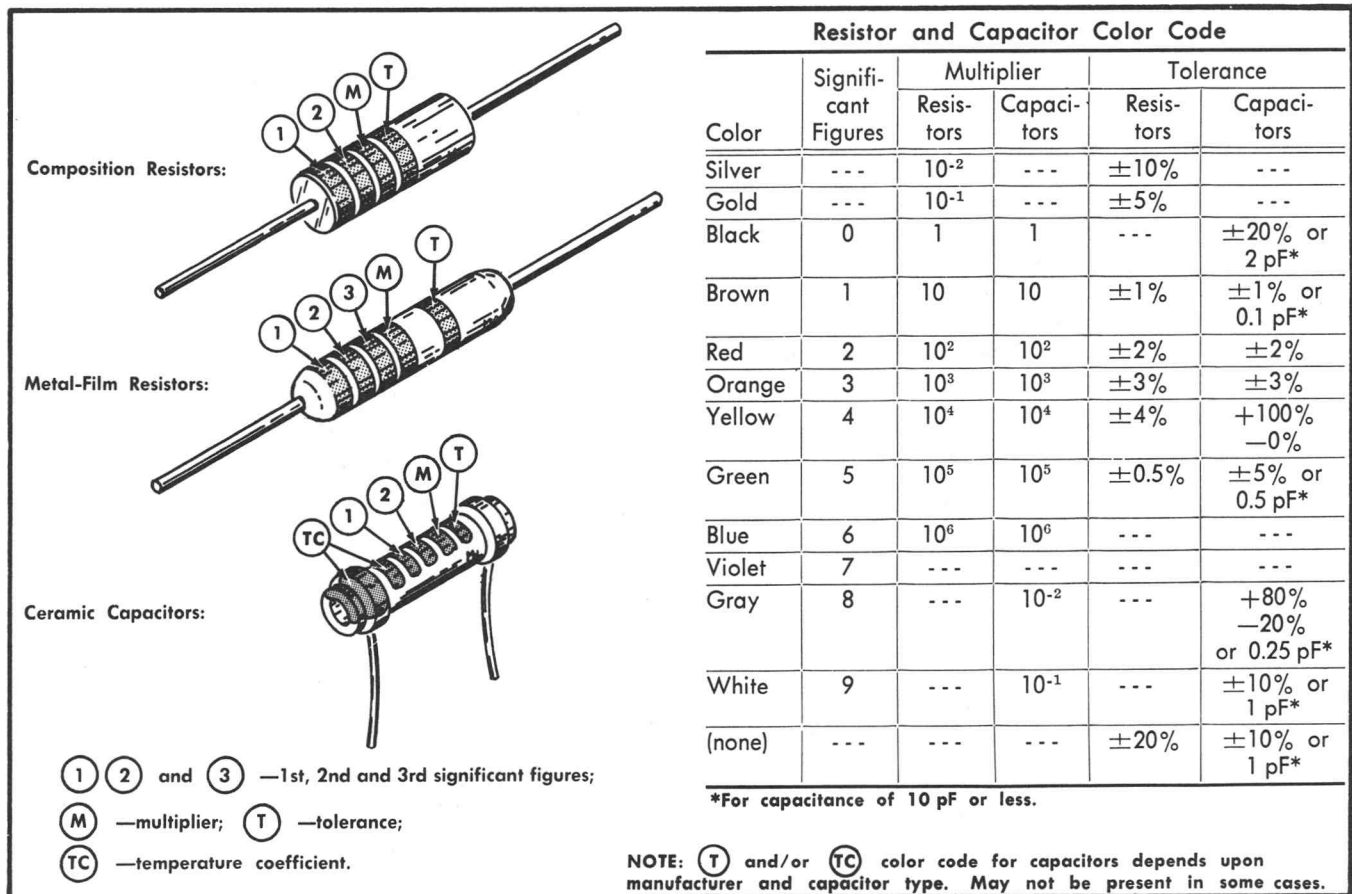


Fig. 6-2. Color Code for resistors and ceramic capacitors.

When troubleshooting the circuit boards in the instrument, the use of an extender board facilitates access to the board connections and components. Removing the suspected circuit board to the extender board will save time in looking for faults. Carefully align the board pin connectors to ensure good contact.

Circuit numbers are assigned on a grid system to facilitate component location. Low numbers start at the lower front corner of the board increasing to the rear and top.

Troubleshooting Charts

Troubleshooting charts are shown in "decision-tree" format in Section 8, Servicing Illustrations, of this manual. While the charts for an instrument as complex as the SPG1 or SPG2 cannot be inclusive, they will provide valuable assistance in troubleshooting procedures.

Wire Color Code

Insulated wires are color-coded to facilitate circuit tracing.

Resistor Color Code

Color stripes on resistors signify electrical values, tolerances, etc., according to the EIA standard color code (see Fig. 6-2). Resistors not color-coded usually have the value imprinted on the body.

Capacitor Markings

The capacitance value of a common disc capacitor or small electrolytic is marked in microfarads on the side of the component body. White ceramic capacitors are color coded in picofarads using a modified EIA code (see Fig. 6-2). The "tear drop" capacitors are color-coded in microfarads using a modified EIA code, with the dot indicating both temperature and positive (+) side. See Fig. 6-3.

Rated Voltage VDC 25°C	Color	CODE FOR CAPACITANCE IN PICO FARADS		
		1st Figure	2nd Figure	Multiplier—pF
4	Black	0	0	None
6	Brown	1	1	X 10
10	Red	2	2	X 10 ²
15	Orange	3	3	X 10 ³
20	Yellow	4	4	X 10 ⁴
25	Green	5	5	X 10 ⁵
35	Blue	6	6	X 10 ⁶
50	Violet	7	7	X 10 ⁷
	Gray	8	8	
3	White	9	9	

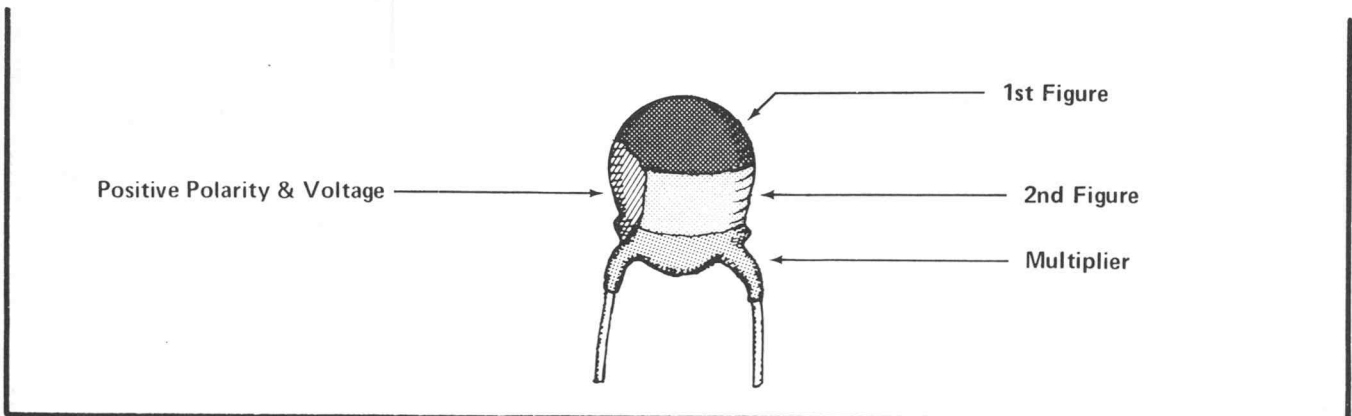


Fig. 6-3. Color coding for dipped tantalum "tear drop" capacitors.

Transistor and Integrated Circuit Lead Configurations.

Fig. 6-4 illustrates the lead configurations for the socket-mounted transistors and integrated circuits (IC) used on the circuit board.

IC Diagrams

Positive logic functions of the IC's are shown in Section 8 of this manual.

Troubleshooting Equipment

The following test equipment is useful for troubleshooting the generator circuit boards.

1. Test Oscilloscope. For viewing waveforms at various test points in the circuit. Frequency response: dc to at least 10 MHz. It should be equipped with a 10X probe.

2. DVM and Ohmmeter. For measuring dc voltages and resistances accurately. The ohmmeter is also required for checking continuity.

3. Semiconductor Tester. Some means of testing the transistors and diodes is helpful. A transistor-curve tracer such as the Tektronix Type 577 will give the most complete information.

Troubleshooting Procedure

This procedure starts with simple, but sometimes taken-for-granted problem areas and proceeds to detailed troubleshooting.

1. Check Control Settings. Incorrect control settings or wrong internal jumper positions can indicate a trouble that does not exist. If there is any question about the correct function or operation of any control or jumper, refer to the Operating Instructions or Installation sections.

2. Check Associated Boards. Before troubleshooting a board, check that the Sync Timing board is operating properly and supplying the correct signals to the Mainframe Interconnect board. Make sure that other boards on the Interconnect board are not defective. Check that the test oscilloscope probe, if used, is not defective.

3. Isolate Trouble to a Circuit. Symptoms will often identify the circuit in which the trouble is located. Incorrect operation of all circuits often means trouble in the power supply section of the Mainframe. Consider this possibility if voltages are incorrect. Make sure that all board pin connectors are making good contact before proceeding with trouble isolation.

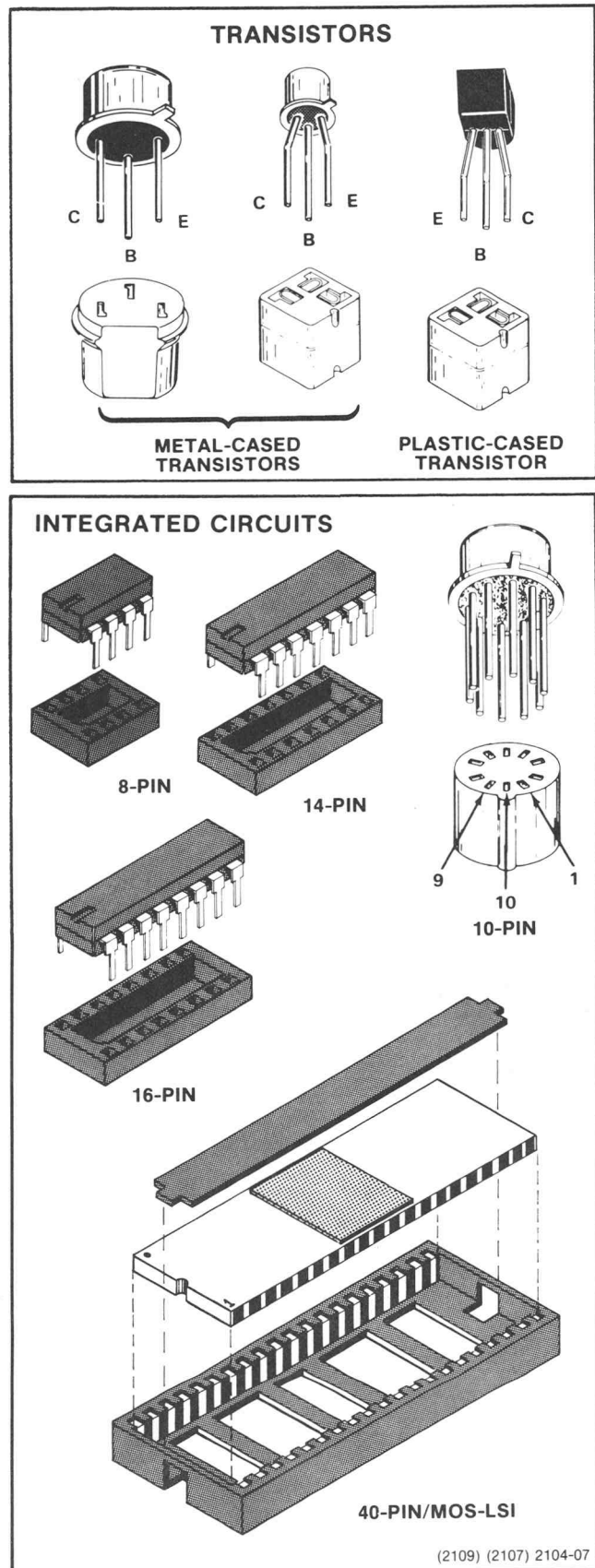


Fig. 6-4. Basing diagram for semiconductors.

4. **Visual Check.** Visually check the portion of the board in which the trouble is suspected. Some troubles can be located by checking for unsoldered connections, broken wires, loosely seated transistors, loose-fitting connectors, damaged components, or damaged circuit boards.

5. **Check Voltages and Waveforms.** Often the defective component or stage can be located by checking for the correct voltage or waveform in the circuit. Typical waveforms are given near the diagram. To obtain operating conditions similar to those used to take these waveforms, refer to the instructions at the start of the diagram section.

CAUTION

Due to component density on the circuit board, special care should be exercised when using meter leads and tips. Accidental shorts can cause abnormal voltages or transients that may destroy many components.

WARNING

"Ground lugs" are not always at ground potential. Check the diagram before using such connections as ground for meter prods or oscilloscope probes. Some transistor cases may be elevated from ground potential.

6. **Check Individual Components.** After the trouble has been isolated to one circuit or stage, the next step is to isolate the trouble to one component or part. Components that are soldered in place are best checked by disconnecting one end to isolate the measurement from the effects of surrounding circuitry. The following methods are provided for checking individual electrical components in the module.

a. **Transistors.** The best check of transistor operation is actual performance under operating conditions. If a transistor is suspected of being defective, it can be checked by substituting a new component or one which has been checked previously. However, be sure that the circuit conditions are not such that a replacement transistor might also be damaged. If substitute transistors are not available, use a dynamic tester (such as the Tektronix Type 577) to check the transistor.

b. **Integrated Circuits.** Integrated circuits should not be replaced unless they are actually defective. The best method for checking these devices is by direct substitution with a new component or one which is known to be good. Be sure that circuit conditions are not such that a replacement component might be damaged.

c. **Diodes.** A diode can be checked for an open or shorted condition by measuring the resistance between terminals. Use an ohmmeter, set to the 1k scale to keep from damaging the diode, for measuring the diode resistance. The resistance should be very high in one direction and very low when the ohmmeter leads are reversed.

d. **Resistors.** Resistors can be checked with an ohmmeter: Check the Replaceable Electrical Parts list for the tolerance of the resistors used in the instrument. Resistors normally do not need to be replaced unless the measured value varies widely from the specified value.

e. **Inductors and Switch Contacts.** Check for an open circuit (that should normally be closed) by checking continuity with an ohmmeter.

f. **Capacitors.** A leaky or shorted capacitor can best be detected by checking the resistance with an ohmmeter on the highest scale. Do not exceed the voltage rating of the capacitor. An open capacitor can best be detected with a capacitance meter or by checking whether the capacitor passes ac signals.

REPAIR

Corrective maintenance consists of component replacement and circuit board repair. Special techniques required to replace components in this instrument are given here.

Soldering Techniques

WARNING

Disconnect the instrument power cord before soldering.

Reliability and optimum performance of circuit boards can be maintained only if proper soldering techniques are used when repairing or replacing parts. Soldering techniques that apply to maintenance of precision electronic equipment should be used when working on the boards. Use only 60/40 rosin-core, electronic grade solder. The choice of soldering iron is determined by the repair to be made. When soldering on circuit boards, use a 15- to 25-watt pencil-type soldering iron with a 1/8-inch wide, wedge-shaped tip. Keep the tip properly tinned for best heat transfer to the solder joint. A higher wattage soldering iron may separate the etched wiring from the base material. Avoid excessive heat; apply only enough heat to remove the component or to make a good solder joint. Also, apply only enough solder to make a firm solder joint; do not apply too much solder. Use a desoldering tool or other device when it is necessary to remove excess solder.

Maintenance—SPG1/SPG2

The pencil-type soldering iron used on the circuit boards can be used for soldering to switch terminals, potentiometers, or metal terminals mounted in plastic holders. For ground lugs that are connected to the chassis, or other metal terminals that are connected to a large heat-radiating surface, use a higher wattage rating soldering iron with a larger tip.

After soldering is completed, clean the area around the solder connection with a flux-remover solvent. Be careful not to remove any information printed in the area.

Location Guide for Replacing Parts

The exploded view drawings associated with the Replaceable Mechanical Parts list (located at the rear of the manual) are helpful in the removal or disassembly of individual components or subassemblies. Circuit board illustrations are provided on the backs of fold-out pages in the Diagrams section of this manual.

Pushbutton Switch Replacement

Before removing a pushbutton switch, disengage the pushbutton actuating arm so that it does not project beyond the rear of the switch. Next carefully pry back the plastic retainer clip at the rear of the switch with the tip of a small screwdriver (see Fig. 6-5). Remove by lifting the switch body up and back from the front retainer clip.

Reverse the removal procedure to install the replacement switch.

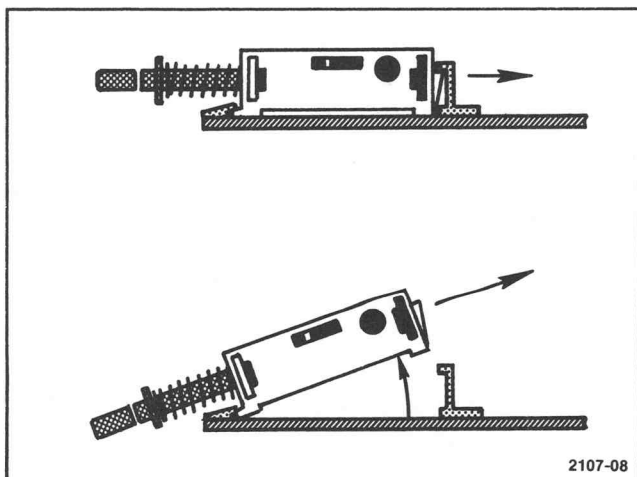


Fig. 6-5. Pushbutton switch replacement.

Circuit Board Replacement

If a circuit board is damaged beyond repair, the entire assembly, including all components, can be replaced. Tektronix part numbers are given in the Replaceable Electrical Parts list.

Circuit Board Removal.

1. Disconnect the multi-pin connectors from the board. Note the order of these connectors so they can be correctly replaced. Disconnect any other connectors that are used for interconnection with other circuits.
2. Disengage the front-panel knobs by pulling them straight out from the front panel until the board controls are free. Remove the plastic retaining clips from the top of the boards.
3. Grasp the board at both ends and pull straight up from the Interface board.
4. To replace the board, reverse the order of removal. Use the mating plastic guides to align the board pin connectors. Match the triangle key symbol on the multi-pin connectors to the same symbol on the board.
5. An extracting tool should be used to remove the 14- and 16-pin integrated circuits to prevent damage to the pins. This tool is available from Tektronix, Inc. Order Tektronix Part No. 003-0619-00. If an extracting tool is not available, use care to avoid damaging the pins. Pull slowly and evenly on both ends of the IC. Try to avoid having one end of the IC disengage from the socket before the other end.

Interconnecting pins. To replace a pin that is mounted on a circuit board, first disconnect any pin connectors. Then, unsolder the damaged pin and pull it out of the board with a pair of pliers. Be careful not to damage the wiring on the board with too much heat. Ream out the hole in the circuit board with a 0.031-inch drill. Remove the ferrule from the new interconnecting pin and press the new pin into the hole in the circuit board. Position the pin in the same manner as the old pin. If the old pin was bent at an angle to mate with a connector, bend the new pin to match the associated pins.

NOTE

A pin replacement kit including necessary tools, instructions, and replacement pins is available from Tektronix, Inc. Order Tektronix Part No. 040-0542-00.

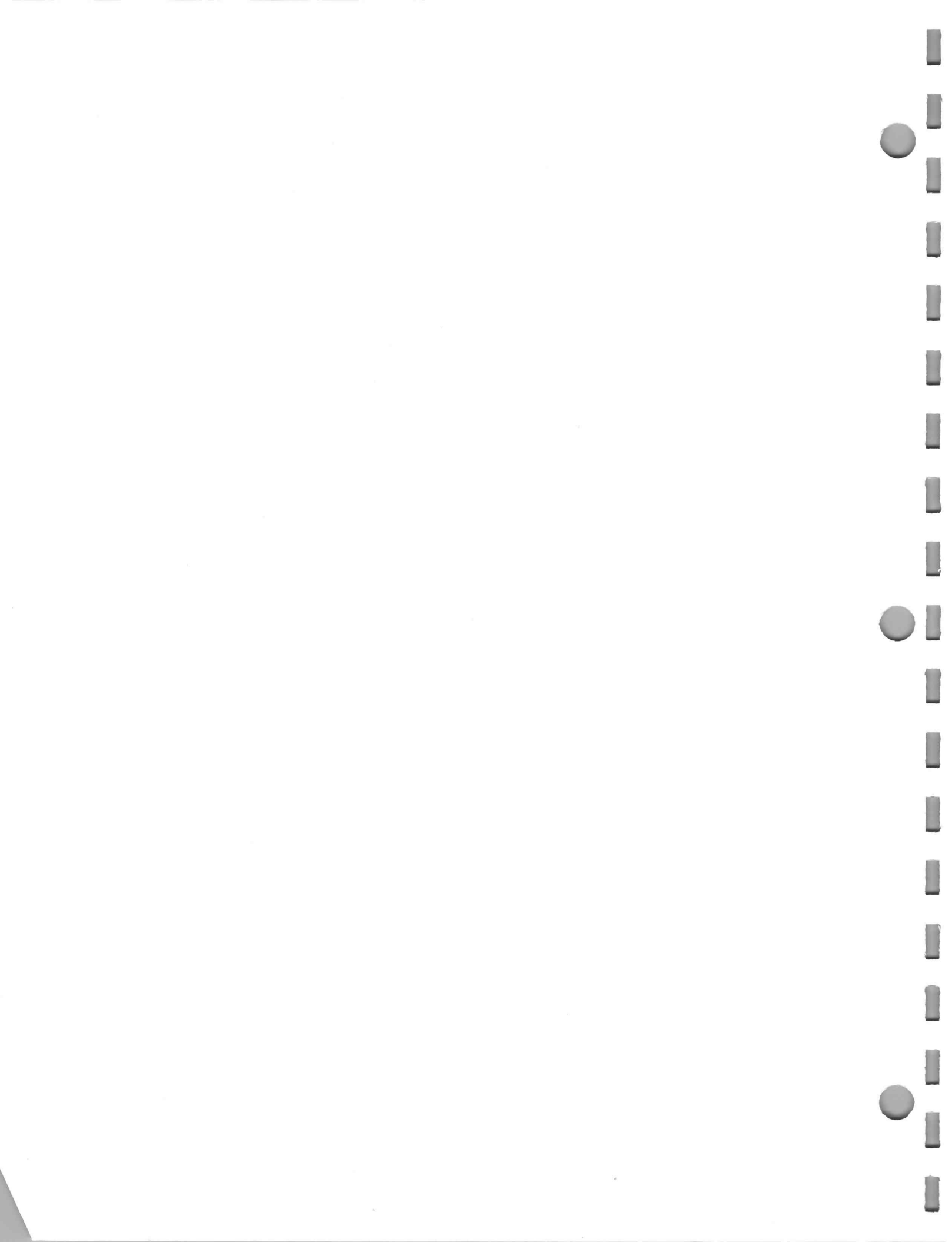
Transistors and ICs

Transistors and ICs should not be replaced unless they are actually defective. If removed from their sockets during routine maintenance, return them to their original sockets. Unnecessary replacement or transposing of semiconductors may affect the calibration of the board.



Disconnect the instrument power before removing or replacing semiconductors.

Any replacement component should be of the original type of a direct replacement. Cut and shape the leads to conform with the component being replaced. After a component is replaced, check the operation and calibration of associated circuits.



REPLACEABLE ELECTRICAL PARTS

PARTS ORDERING INFORMATION

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

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

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

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

SPECIAL NOTES AND SYMBOLS

X000 Part first added at this serial number
00X Part removed after this serial number

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

ACTR	ACTUATOR	PLSTC	PLASTIC
ASSY	ASSEMBLY	QTZ	QUARTZ
CAP	CAPACITOR	RECP	RECEPTACLE
CER	CERAMIC	RES	RESISTOR
CKT	CIRCUIT	RF	RADIO FREQUENCY
COMP	COMPOSITION	SEL	SELECTED
CONN	CONNECTOR	SEMICOND	SEMICONDUCTOR
ELCTLT	ELECTROLYTIC	SENS	SENSITIVE
ELEC	ELECTRICAL	VAR	VARIABLE
INCAND	INCANDESCENT	WW	WIREWOUND
LED	LIGHT EMITTING DIODE	XFMR	TRANSFORMER
NONWIR	NON WIREWOUND	XTAL	CRYSTAL

CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
00779	AMP, INC.	P O BOX 3608	HARRISBURG, PA 17105
00853	SANGAMO ELECTRIC CO., S. CAROLINA DIV.	P O BOX 128	PICKENS, SC 29671
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
01686	RCL ELECTRONICS, INC.	195 MCGREGOR ST.	MANCHESTER, NH 03102
02735	RCA CORPORATION, SOLID STATE DIVISION	ROUTE 202	SOMERVILLE, NY 08876
03508	GENERAL ELECTRIC COMPANY, SEMI-CONDUCTOR PRODUCTS DEPARTMENT	ELECTRONICS PARK	SYRACUSE, NY 13201
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
09023	CORNELL-DUBILIER ELECTRONIC DIVISION	FEDERAL PACIFIC ELECTRIC CO.	2652 DALRYMPLE ST.
14552	MICRO SEMICONDUCTOR CORP.	2830 E FAIRVIEW ST.	SANFORD, NC 27330
18324	SIGNETICS CORP.	811 E. ARQUES	SANTA ANA, CA 92704
19396	ILLINOIS TOOL WORKS, INC. PAKTRON DIV.	900 FOLLIN LANE, SE	SUNNYVALE, CA 94086
24546	CORNING GLASS WORKS, ELECTRONIC COMPONENTS DIVISION	550 HIGH STREET	VIENNA, VA 22180
27014	NATIONAL SEMICONDUCTOR CORP.	2900 SEMICONDUCTOR DR.	BRADFORD, PA 16701
32159	WEST-CAP ARIZONA	2201 E. ELVIRA ROAD	SANTA CLARA, CA 95051
32997	BOURNS, INC., TRIMPOT PRODUCTS DIV.	1200 COLUMBIA AVE.	TUCSON, AZ 85706
51642	CENTRE ENGINEERING INC.	2820 E COLLEGE AVENUE	RIVERSIDE, CA 92507
52769	SPRAGUE GOODMAN ELEC., INC.	134 FULTON AVENUE	STATE COLLEGE, PA 16801
54473	MATSUSHITA ELECTRIC, CORP. OF AMERICA	1 PANASONIC WAY	GARDEN CITY PARK, NY 11040
55680	NICHICON/AMERICA/CORP.	6435 N PROESEL AVENUE	SECAUCUS, NJ 07094
56289	SPRAGUE ELECTRIC CO.	87 MARSHALL ST.	CHICAGO, IL 60645
57668	R-OHM CORP.	16931 MILLIKEN AVE.	NORTH ADAMS, MA 01247
59660	TUSONIX INC.	2155 N FORBES BLVD	IRVINE, CA 92713
72982	ERIE TECHNOLOGICAL PRODUCTS, INC.	644 W. 12TH ST.	TUCSON, AZ 85705
73138	BECKMAN INSTRUMENTS, INC., HELIPOT DIV.	2500 HARBOR BLVD.	ERIE, PA 16512
74970	JOHNSON, E. F., CO.	299 10TH AVE. S. W.	FULLERTON, CA 92634
75042	TRW ELECTRONIC COMPONENTS, IRC FIXED RESISTORS, PHILADELPHIA DIVISION	401 N. BROAD ST.	WASECA, MN 56093
80009	TEKTRONIX, INC.	P O BOX 500	PHILADELPHIA, PA 19108
80031	ELECTRA-MIDLAND CORP., MEPCO DIV.	22 COLUMBIA ROAD	BEAVERTON, OR 97077
84411	TRW ELECTRONIC COMPONENTS, TRW CAPACITORS	112 W. FIRST ST.	MORRISTOWN, NJ 07960
90201	MALLORY CAPACITOR CO., DIV. OF P. R. MALLORY AND CO., INC.	3029 E. WASHINGTON STREET	OGALLALA, NE 69153
91418	RADIO MATERIALS COMPANY, DIV. OF P.R. MALLORY AND COMPANY, INC.	P. O. BOX 372	INDIANAPOLIS, IN 46206
91637	DALE ELECTRONICS, INC.	4242 W BRYN MAWR	CHICAGO, IL 60646
		P. O. BOX 609	COLUMBUS, NE 68601

Replaceable Electrical Parts—SPG1/SPG2

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A20	670-4446-00 -----	B010100	B010136	CKT BOARD ASSY:SYNC TIMING (SPG1 ONLY)	80009	670-4446-00
A20	670-4446-03 -----	B010137	B019999	CKT BOARD ASSY:SYNC TIMING (SPG1 ONLY)	80009	670-4446-03
A20	670-4446-04 -----	B020000	B020219	CKT BOARD ASSY:SYNC TIMING (SPG1 ONLY)	80009	670-4446-04
A20	670-4446-08 -----	B020220		CKT BOARD ASSY:SYNC TIMING (SPG1 ONLY)	80009	670-4446-08
A20	670-4446-00 -----	B010100	B010330	CKT BOARD ASSY:SYNC TIMING (SPG2 ONLY)	80009	670-4446-00
A20	670-4446-03 -----	B010331	B019999	CKT BOARD ASSY:SYNC TIMING (SPG2 ONLY)	80009	670-4446-03
A20	670-4446-04 -----	B020000	B021321	CKT BOARD ASSY:SYNC TIMING (SPG2 ONLY)	80009	670-4446-04
A20	670-4446-08 -----	B021322		CKT BOARD ASSY:SYNC TIMING (SPG2 ONLY)	80009	670-4446-08
A21	670-4447-00 -----	B010100	B010136	CKT BOARD ASSY:SYNC LOCK (SPG1 ONLY)	80009	670-4447-00
A21	670-4447-01 -----	B010137	B012485	CKT BOARD ASSY:SYNC LOCK (SPG1 ONLY)	80009	670-4447-01
A21	670-4447-02 -----	B012486		CKT BOARD ASSY:SYNC LOCK (SPG1,SPG2)	80009	670-4447-02
A21	670-4447-00 -----	B010100	B010559	CKT BOARD ASSY:SYNC LOCK (SPG2 ONLY)	80009	670-4447-00
A21	670-4447-01 -----	B010560	B012485	CKT BOARD ASSY:SYNC LOCK (SPG2 ONLY)	80009	670-4447-01
A21	670-4447-02 -----	B012486		CKT BOARD ASSY:SYNC LOCK (SPG1,SPG2)	80009	670-4447-02
A22	670-4448-00 -----	B010100	B010139	CKT BOARD ASSY:GENERATOR LOGIC (SPG1 ONLY)	80009	670-4448-00
A22	670-4448-03 -----	B010140	B020291	CKT BOARD ASSY:GENERATOR LOGIC (SPG1 ONLY)	80009	670-4448-03
A22	670-4448-05 -----	B020292		CKT BOARD ASSY:GENERATOR LOGIC (SPG1 ONLY)	80009	670-4448-05
A22	670-4448-00 -----	B010100	B010579	CKT BOARD ASSY:GENERATOR LOGIC (SPG2 ONLY)	80009	670-4448-00
A22	670-4448-03 -----	B010580	B021841	CKT BOARD ASSY:GENERATOR LOGIC (SPG2 ONLY)	80009	670-4448-03
A22	670-4448-05 -----	B021842		CKT BOARD ASSY:GENERATOR LOGIC (SPG2 ONLY)	80009	670-4448-05
A23	670-4449-00 -----	B010100	B021075	CKT BOARD ASSY:SUBCARRIER LOCK (SPG2 ONLY)	80009	670-4449-00
A23	670-4449-03 -----	B021076	B022219	CKT BOARD ASSY:SUBCARRIER LOCK (SPG2 ONLY)	80009	670-4449-03
A23	670-4449-05 -----	B022220		CKT BOARD ASSY:SUBCARRIER LOCK (SPG2 ONLY)	80009	670-4449-05
A24	670-4450-00 -----			CKT BOARD ASSY:PULSE OUTPUT AMPL (SPG1 ONLY)	80009	670-4450-00
A25	670-4451-00 -----	B010100	B010126	CKT BOARD ASSY:VIRS/BLACK BURST (SPG1 ONLY)	80009	670-4451-00
A25	670-4451-01 -----	B010127	B020210	CKT BOARD ASSY:VIRS/BLACK BURST (SPG1 ONLY)	80009	670-4451-01
A25	670-4451-02 -----	B020211		CKT BOARD ASSY:VIRS/BLACK BURST (SPG1 ONLY)	80009	670-4451-02
A25	670-4451-00 -----	B010100	B010437	CKT BOARD ASSY:VIRS/BLACK BURST (SPG2 ONLY)	80009	670-4451-00
A25	670-4451-01 -----	B010438	B021236	CKT BOARD ASSY:VIRS/BLACK BURST (SPG2 ONLY)	80009	670-4451-01
A25	670-4451-02 -----	B021237		CKT BOARD ASSY:VIRS/BLACK BURST (SPG2 ONLY)	80009	670-4451-02
A27	670-4453-00			CKT BOARD ASSY:LED	80009	670-4453-00

Replaceable Electrical Parts—SPG1/SPG2

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A100	670-4459-00			CKT BOARD ASSY:SHIELD (SPG1 ONLY)	80009	670-4459-00
A100	670-4459-00			CKT BOARD ASSY:SHIELD (SPG2 ONLY)	80009	670-4459-00
C100	283-0023-00	B010100	B019999	CAP., FXD, CER DI:0.1UF, +80-20%, 12V	91418	MX0104Z1205R5
C100	281-0775-00	B020000		CAP., FXD, CER DI:0.1UF, 20%, 50V	04222	SA205E104MAA
C103	281-0576-00			CAP., FXD, CER DI:11PF, 5%, 500V (SPG2 ONLY)	59660	301-000C0G0110J
C103	281-0576-00	XB010135		CAP., FXD, CER DI:11PF, 5%, 500V (SPG1 ONLY)	59660	301-000C0G0110J
C112	283-0649-00			CAP., FXD, MICA D:105PF, 1%, 300V	00853	D153F1050F0
C114	283-0672-00			CAP., FXD, MICA D:200PF, 1%, 500V	00853	D155F2010F0
C122	283-0023-00	B010100	B019999	CAP., FXD, CER DI:0.1UF, +80-20%, 12V	91418	MX0104Z1205R5
C123		XB010101		TEST SELECTABLE (SPG1 ONLY)		
C123		XB010176		TEST SELECTABLE (SPG2 ONLY)		
C124		XB010101	B020219	TEST SELECTABLE (SPG1 ONLY)		
C124	281-0763-00	B020220		CAP., FXD, CER DI:47PF, 10%, 100V (SPG1 ONLY)	04222	GC101A470K
C124		XB010176	B021321	TEST SELECTABLE (SPG2 ONLY)		
C124	281-0763-00	B021322		CAP., FXD, CER DI:47PF, 10%, 100V (SPG 2 ONLY)	04222	GC101A470K
C125	290-0782-00	B010100	B019999X	CAP., FXD, ELCTLT:4.7UF, +75-10%, 35V	55680	35ULA4R7V-T
C125	281-0763-00	XB020220		CAP., FXD, CER DI:47PF, 10%, 100V (SPG1 ONLY)	04222	GC101A470K
C125	281-0763-00	XB021322		CAP., FXD, CER DI:47PF, 10%, 100V (SPG2 ONLY)	04222	GC101A470K
C126	283-0649-00	B010100	B019999	CAP., FXD, MICA D:105PF, 1%, 300V	00853	D153F1050F0
C126	283-0647-00	B020000		CAP., FXD, MICA D:70PF, 1%, 100V	00853	D151E700F0
C127	283-0644-00			CAP., FXD, MICA D:150PF, 1%, 500V	00853	D155F151F0
C128	283-0024-00	B010100	B019999X	CAP., FXD, CER DI:0.1UF, +80-20%, 50V	72982	8121N083Z5U0104Z
C129	283-0024-00	B010100	B019999X	CAP., FXD, CER DI:0.1UF, +80-20%, 50V	72982	8121N083Z5U0104Z
C130	290-0782-00			CAP., FXD, ELCTLT:4.7UF, +75-10%, 35V	55680	35ULA4R7V-T
C135	283-0024-00	B010100	B019999X	CAP., FXD, CER DI:0.1UF, +80-20%, 50V	72982	8121N083Z5U0104Z
C136	283-0000-00			CAP., FXD, CER DI:0.001UF, +100-0%, 500V	59660	0831610Y5P0102D
C137	283-0000-00	B010100	B019999X	CAP., FXD, CER DI:0.001UF, +100-0%, 500V	59660	0831610Y5P0102D
C137	281-0763-00	XB020220		CAP., FXD, CER DI:47PF, 10%, 100V (SPG1 ONLY)	04222	GC101A470K
C137	281-0763-00	XB021322		CAP., FXD, CER DI:47PF, 10%, 100V (SPG2 ONLY)	04222	GC101A470K
C138	281-0791-00			CAP., FXD, CER DI:270PF, 10%, 100V	72982	8035D2AADX5R271K
C139	281-0791-00	B010100	B019999X	CAP., FXD, CER DI:270PF, 10%, 100V	72982	8035D2AADX5R271K
C139	281-0763-00	XB020220		CAP., FXD, CER DI:47PF, 10%, 100V (SPG1 ONLY)	04222	GC101A470K
C139	281-0763-00	XB021322		CAP., FXD, CER DI:47PF, 10%, 100V (SPG2 ONLY)	04222	GC101A470K
C140	283-0023-00	B010100	B019999X	CAP., FXD, CER DI:0.1UF, +80-20%, 12V	91418	MX0104Z1205R5
C141	281-0763-00	XB020220		CAP., FXD, CER DI:47PF, 10%, 100V (SPG1 ONLY)	04222	GC101A470K
C141	281-0763-00	XB021322		CAP., FXD, CER DI:47PF, 10%, 100V (SPG2 ONLY)	04222	GC101A470K
C142		XB010101	B020219	TEST SELECTABLE (SPG1 ONLY)		
C142	281-0763-00	B020220		CAP., FXD, CER DI:47PF, 10%, 100V (SPG1 ONLY)	04222	GC101A470K
C142		XB010176	B021321	TEST SELECTABLE (SPG2 ONLY)		

Replaceable Electrical Parts—SPG1/SPG2

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
C142	281-0763-00	B021322		CAP., FXD, CER DI:47PF, 10%, 100V (SPG2 ONLY)	04222	GC101A470K
C143	-----	XB010101		TEST SELECTABLE (SPG1 ONLY)		
C143	-----	XB010176		TEST SELECTABLE (SPG2 ONLY)		
C144	-----	XB010101		TEST SELECTABLE (SPG1 ONLY)		
C144	-----	XB010176		TEST SELECTABLE (SPG2 ONLY)		
C145	-----	XB010101		TEST SELECTABLE (SPG1 ONLY)		
C145	-----	XB010176		TEST SELECTABLE (SPG2 ONLY)		
C146	285-1101-00	B010100	B010136	CAP., FXD, PLSTC:0.022UF, 10%, 200V (SPG1 ONLY)	19396	223K02PT485
C146	285-0901-00	B010137		CAP., FXD, PLSTC:0.047UF, 5%, 50V (SPG1 ONLY)	56289	LP66A1AA73J
C146	285-1101-00	B010100	B010559	CAP., FXD, PLSTC:0.022UF, 10%, 200V (SPG2 ONLY)	19396	223K02PT485
C146	285-0901-00	B010560		CAP., FXD, PLSTC:0.047UF, 5%, 50V (SPG2 ONLY)	56289	LP66A1AA73J
C147	283-0649-00	B010100	B019999	CAP., FXD, MICA D:105PF, 1%, 300V	00853	D153F1050F0
C147	283-0638-00	B020000		CAP., FXD, MICA D:130PF, 1%, 100V	00853	D151F131F0
C150	283-0024-00			CAP., FXD, CER DI:0.1UF, +80-20%, 50V	72982	8121N083Z5U0104Z
C152	283-0633-00			CAP., FXD, MICA D:77PF, 1%, 100V	00853	D151E770F0
C154	283-0615-00			CAP., FXD, MICA D:33PF, 5%, 500V	00853	D155E330J0
C155	283-0645-00			CAP., FXD, MICA D:790PF, 1%, 100V	00853	D151E791F0
C157	283-0692-00			CAP., FXD, MICA D:670PF, 1%, 300V	00853	D15-3F671F0
C159	281-0204-00			CAP., VAR, PLSTC:2-22PF, 100V	80031	287C00222MJ02
C160	283-0024-00	B010100	B019999	CAP., FXD, CER DI:0.1UF, +80-20%, 50V	72982	8121N083Z5U0104Z
C160	281-0775-00	B020000		CAP., FXD, CER DI:0.1UF, 20%, 50V	04222	SA205E104MAA
C162	283-0023-00	B010100	B019999	CAP., FXD, CER DI:0.1UF, +80-20%, 12V	91418	MX0104Z1205R5
C162	281-0775-00	B020000		CAP., FXD, CER DI:0.1UF, 20%, 50V	04222	SA205E104MAA
C163	283-0024-00	B010100	B019999	CAP., FXD, CER DI:0.1UF, +80-20%, 50V	72982	8121N083Z5U0104Z
C163	281-0775-00	B020000		CAP., FXD, CER DI:0.1UF, 20%, 50V	04222	SA205E104MAA
C165	285-0916-00			CAP., FXD, PLSTC:0.01UF, 5%, 100V	84411	TEK35-10351
C166	283-0028-00			CAP., FXD, CER DI:0.0022UF, 20%, 50V	56289	55C144
C168	283-0023-00	B010100	B019999	CAP., FXD, CER DI:0.1UF, +80-20%, 12V	91418	MX0104Z1205R5
C168	281-0775-00	B020000		CAP., FXD, CER DI:0.1UF, 20%, 50V	04222	SA205E104MAA
C195	283-0023-00			CAP., FXD, CER DI:0.1UF, +80-20%, 12V	91418	MX0104Z1205R5
C202	283-0665-00			CAP., FXD, MICA D:190PF, 1%, 100V	00853	D151F19F0
C204	290-0534-00			CAP., FXD, ELCLTL:1UF, 20%, 35V	56289	196D105X0035HA1
C211	283-0597-00			CAP., FXD, MICA D:470PF, 10%, 300V	00853	D153E471K0
C212	283-0198-00	B010100	B010136	CAP., FXD, CER DI:0.22UF, 20%, 50V (SPG1 ONLY)	56289	1C10Z5U223M050B
C212	283-0111-00	B010137		CAP., FXD, CER DI:0.1UF, 20%, 50V (SPG1 ONLY)	72982	8121-N088Z5U104M
C212	283-0198-00	B010100	B010559	CAP., FXD, CER DI:0.22UF, 20%, 50V (SPG2 ONLY)	56289	1C10Z5U223M050B
C212	283-0111-00	B010560		CAP., FXD, CER DI:0.1UF, 20%, 50V (SPC2 ONLY)	72982	8121-N088Z5U104M
C218	283-0649-00			CAP., FXD, MICA D:105PF, 1%, 300V	00853	D153F1050F0
C219	283-0637-00			CAP., FXD, MICA D:20PF, 2.5%, 100V	00853	D151E200D0
C245	281-0786-00			CAP., FXD, CER DI:150PF, 10%, 100V	72982	8035D2AADX5P151K
C249	283-0023-00			CAP., FXD, CER DI:0.1UF, +80-20%, 12V	91418	MX0104Z1205R5
C252	283-0341-00			CAP., FXD, CER DI:0.047UF, 10%, 100V	72982	8121N153X7R0473K
C260	283-0622-00			CAP., FXD, MICA D:450PF, 1%, 300V	00853	D153F451F0
C265	281-0786-00			CAP., FXD, CER DI:150PF, 10%, 100V	72982	8035D2AADX5P151K
C275	283-0111-00			CAP., FXD, CER DI:0.1UF, 20%, 50V	72982	8121-N088Z5U104M
C279	283-0023-00			CAP., FXD, CER DI:0.1UF, +80-20%, 12V	91418	MX0104Z1205R5
C281	290-0534-00			CAP., FXD, ELCLTL:1UF, 20%, 35V	56289	196D105X0035HA1

Replaceable Electrical Parts—SPG1/SPG2

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
C282	290-0517-00			CAP., FXD, ELCTLT:6.8UF, 20%, 35V	56289	196D685X0035KA1
C283	290-0517-00			CAP., FXD, ELCTLT:6.8UF, 20%, 35V	56289	196D685X0035KA1
C284	283-0648-00			CAP., FXD, MICA D:10PF, 5%, 100V	00853	D151C100D0
C285	283-0644-00			CAP., FXD, MICA D:150PF, 1%, 500V	00853	D155F151F0
C295	283-0065-00			CAP., FXD, CER DI:0.001UF, 5%, 100V	59660	0835-591-Y5E0102
C298	283-0023-00			CAP., FXD, CER DI:0.1UF, +80-20%, 12V	91418	MX0104Z1205R5
C307	283-0023-00			CAP., FXD, CER DI:0.1UF, +80-20%, 12V	91418	MX0104Z1205R5
C314	283-0622-00			CAP., FXD, MICA D:450PF, 1%, 300V	00853	D153F451F0
C318	281-0788-00			CAP., FXD, CER DI:470PF, 10%, 100V	72982	8005H9AADW5R471K
C319	281-0788-00			CAP., FXD, CER DI:470PF, 10%, 100V	72982	8005H9AADW5R471K
C324	281-0773-00			CAP., FXD, CER DI:0.01UF, 10%, 100V	04222	SA201C103KAA
C335	283-0635-00			CAP., FXD, MICA D:51PF, 1%, 100V	00853	D151E510F0
C336	283-0666-00			CAP., FXD, MICA D:890PF, 2%, 100V	00853	D151F891G0
C338	283-0023-00			CAP., FXD, CER DI:0.1UF, +80-20%, 12V	91418	MX0104Z1205R5
C339	281-0773-00			CAP., FXD, CER DI:0.01UF, 10%, 100V	04222	SA201C103KAA
C374	283-0023-00			CAP., FXD, CER DI:0.1UF, +80-20%, 12V	91418	MX0104Z1205R5
C386	281-0775-00			CAP., FXD, CER DI:0.1UF, 20%, 50V	04222	SA205E104MAA
C397	281-0788-00			CAP., FXD, CER DI:470PF, 10%, 100V	72982	8005H9AADW5R471K
C400	290-0778-00			CAP., FXD, ELCTLT:1UF, +50-10%, 50V	54473	ECE-A50N1
C402	283-0065-00			CAP., FXD, CER DI:0.001UF, 5%, 100V	59660	0835-591-Y5E0102
C405	283-0238-00	B010100	B010139	CAP., FXD, CER DI:0.01UF, 10%, 50V (SPG1 ONLY)	72982	8121N075X7R0103K
C405	281-0773-00	B010140		CAP., FXD, CER DI:0.01UF, 10%, 100V (SPG1 ONLY)	04222	SA201C103KAA
C405	283-0238-00	B010100	B010579	CAP., FXD, CER DI:0.01UF, 10%, 50V (SPG2 ONLY)	72982	8121N075X7R0103K
C405	281-0773-00	B010580		CAP., FXD, CER DI:0.01UF, 10%, 100V (SPG2 ONLY)	04222	SA201C103KAA
C413	283-0058-00			CAP., FXD, CER DI:0.027UF, 10%, 100V	56289	273C17
C414	283-0210-00	XB020292		CAP., FXD, CER DI:0.0056UF, 20%, 50V (SPG1 ONLY)	72982	8131N145W5R562M
C414	283-0210-00	XB021842		CAP., FXD, CER DI:0.0056UF, 20%, 50V (SPG2 ONLY)	72982	8131N145W5R562M
C416	281-0791-00			CAP., FXD, CER DI:270PF, 10%, 100V	72982	8035D2AADX5R271K
C418	283-0023-00			CAP., FXD, CER DI:0.1UF, +80-20%, 12V	91418	MX0104Z1205R5
C419	281-0775-00			CAP., FXD, CER DI:0.1UF, 20%, 50V	04222	SA205E104MAA
C422	281-0772-00			CAP., FXD, CER DI:0.0047UF, 10%, 100V	04222	GC701C472K
C426	290-0534-00			CAP., FXD, ELCTLT:1UF, 20%, 35V	56289	196D105X0035HA1
C428	290-0530-00	XB010140		CAP., FXD, ELCTLT:68UF, 20%, 6V (SPG1 ONLY)	90201	TDC686M006NLF
C428	290-0530-00	XB010580		CAP., FXD, ELCTLT:68UF, 20%, 6V (SPG2 ONLY)	90201	TDC686M006NLF
C435	281-0775-00			CAP., FXD, CER DI:0.1UF, 20%, 50V	04222	SA205E104MAA
C436	283-0023-00			CAP., FXD, CER DI:0.1UF, +80-20%, 12V	91418	MX0104Z1205R5
C438	283-0618-00			CAP., FXD, MICA D:130PF, 2%, 400V	00853	D155F131G0
C447	290-0778-00			CAP., FXD, ELCTLT:1UF, +50-10%, 50V	54473	ECE-A50N1
C451	283-0641-00			CAP., FXD, MICA D:180PF, 1%, 100V (C451 SPG2 ONLY)	00853	D151E181F0
C466	290-0517-00			CAP., FXD, ELCTLT:6.8UF, 20%, 35V (C466 SPG2 ONLY)	56289	196D685X0035KA1
C472	290-0517-00			CAP., FXD, ELCTLT:6.8UF, 20%, 35V (C472 SPG2 ONLY)	56289	196D685X0035KA1
C490	283-0177-00			CAP., FXD, CER DI:1UF, +80-20%, 25V (C490 SPG2 ONLY)	56289	273C5
C493	281-0775-00	XB010135		CAP., FXD, CER DI:0.1UF, 20%, 50V (C493 SPG2 ONLY)	04222	SA205E104MAA
C520	283-0080-00			CAP., FXD, CER DI:0.022UF, +80-20%, 25V (C520 SPG2 ONLY)	91418	MX223Z2504R0
C522	283-0080-00			CAP., FXD, CER DI:0.022UF, +80-20%, 25V (C522 SPG2 ONLY)	91418	MX223Z2504R0

Replaceable Electrical Parts—SPG1/SPG2

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
C528	283-0080-00			CAP., FXD, CER DI:0.022UF, +80-20%, 25V (C528 SPG2 ONLY)	91418	MX223Z2504R0
C540	281-0773-00			CAP., FXD, CER DI:0.01UF, 10%, 100V (C540 SPG2 ONLY)	04222	SA201C103KAA
C549	281-0759-00			CAP., FXD, CER DI:22PF, 10%, 100V (C549 SPG2 ONLY)	72982	8035D9AADC1G220K
C552	283-0080-00			CAP., FXD, CER DI:0.022UF, +80-20%, 25V (C552 SPG2 ONLY)	91418	MX223Z2504R0
C556	281-0759-00			CAP., FXD, CER DI:22PF, 10%, 100V (C556 SPG2 ONLY)	72982	8035D9AADC1G220K
C557	281-0759-00			CAP., FXD, CER DI:22PF, 10%, 100V (C557 SPG2 ONLY)	72982	8035D9AADC1G220K
C561	281-0791-00			CAP., FXD, CER DI:270PF, 10%, 100V (C561 SPG2 ONLY)	72982	8035D2AADX5R271K
C562	283-0111-00	XB010135		CAP., FXD, CER DI:0.1UF, 20%, 50V (C562 SPG2 ONLY)	72982	8121-N088Z5U104M
C563	283-0080-00			CAP., FXD, CER DI:0.022UF, +80-20%, 25V (C563 SPG2 ONLY)	91418	MX223Z2504R0
C564	283-0081-00			CAP., FXD, CER DI:0.1UF, +80-20%, 25V (C564 SPG2 ONLY)	91418	MX104Z2504R0
C567	281-0773-00			CAP., FXD, CER DI:0.01UF, 10%, 100V (C567 SPG2 ONLY)	04222	SA201C103KAA
C573	283-0618-00			CAP., FXD, MICA D:130PF, 2%, 400V (C573 SPG2 ONLY)	00853	D155F131G0
C590	281-0773-00			CAP., FXD, CER DI:0.01UF, 10%, 100V (C590 SPG2 ONLY)	04222	SA201C103KAA
C598	283-0680-00			CAP., FXD, MICA D:330PF, 1%, 500V (C598 SPG2 ONLY)	00853	D155F331F0
C599	283-0641-00			CAP., FXD, MICA D:180PF, 1%, 100V (C599 SPG2 ONLY)	00853	D151E181F0
C605	283-0680-00			CAP., FXD, MICA D:330PF, 1%, 500V (C605 SPG2 ONLY)	00853	D155F331F0
C606	283-0641-00			CAP., FXD, MICA D:180PF, 1%, 100V (C606 SPG2 ONLY)	00853	D151E181F0
C610	283-0680-00			CAP., FXD, MICA D:330PF, 1%, 500V (C610 SPG2 ONLY)	00853	D155F331F0
C613	283-0641-00			CAP., FXD, MICA D:180PF, 1%, 100V (C613 SPG2 ONLY)	00853	D151E181F0
C614	281-0773-00			CAP., FXD, CER DI:0.01UF, 10%, 100V (C614 SPG2 ONLY)	04222	SA201C103KAA
C617	281-0773-00			CAP., FXD, CER DI:0.01UF, 10%, 100V (C617 SPG2 ONLY)	04222	SA201C103KAA
C628	283-0081-00			CAP., FXD, CER DI:0.1UF, +80-20%, 25V (C628 SPG2 ONLY)	91418	MX104Z2504R0
C629	281-0773-00			CAP., FXD, CER DI:0.01UF, 10%, 100V (C629 SPG2 ONLY)	04222	SA201C103KAA
C643	281-0773-00			CAP., FXD, CER DI:0.01UF, 10%, 100V (C643 SPG2 ONLY)	04222	SA201C103KAA
C650	281-0773-00			CAP., FXD, CER DI:0.01UF, 10%, 100V (C650 SPG2 ONLY)	04222	SA201C103KAA
C653	283-0660-00			CAP., FXD, MICA D:510PF, 2%, 500V (C653 SPG2 ONLY)	00853	D155F511G0
C654	281-0773-00			CAP., FXD, CER DI:0.01UF, 10%, 100V (C654 SPG2 ONLY)	04222	SA201C103KAA
C666	281-0773-00			CAP., FXD, CER DI:0.01UF, 10%, 100V (C666 SPG2 ONLY)	04222	SA201C103KAA
C667	281-0670-00	XB022220		CAP., FXD, CER DI:1.8PF, +/-0.1PF, 500V (C667 SPG2 ONLY. TEST SELECTED)	04222	7040-COK-1R8B
C669	283-0256-00			CAP., FXD, CER DI:130PF, 5%, 100V (C669 SPG2 ONLY)	51642	200-100N1500131J

Replaceable Electrical Parts—SPG1/SPG2

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
C680	283-0651-00			CAP., FXD, MICA D:430PF, 1%, 500V (C680 SPG2 ONLY)	00853	D155F431F0
C689	281-0773-00			CAP., FXD, CER DI:0.01UF, 10%, 100V (C689 SPG2 ONLY)	04222	SA201C103KAA
C690	283-0081-00			CAP., FXD, CER DI:0.1UF, +80-20%, 25V (C690 SPG2 ONLY)	91418	MX104Z2504R0
C693	283-0598-00			CAP., FXD, MICA D:253PF, 5%, 300V (C693 SPG2 ONLY)	09023	CD15EC(253)J03
C709	281-0773-00			CAP., FXD, CER DI:0.01UF, 10%, 100V (C709 SPG2 ONLY)	04222	SA201C103KAA
C710	290-0525-00			CAP., FXD, ELCTLT:4.7UF, 20%, 50V (C710 SPG2 ONLY)	56289	196D475X0050KA1
C714	290-0536-00			CAP., FXD, ELCTLT:10UF, 20%, 25V (C714 SPG2 ONLY)	90201	TDC106M025FL
C720	283-0637-00			CAP., FXD, MICA D:20PF, 2.5%, 100V (C720 SPG2 ONLY)	00853	D151E200D0
C721	283-0081-00			CAP., FXD, CER DI:0.1UF, +80-20%, 25V (C721 SPG2 ONLY)	91418	MX104Z2504R0
C726	281-0773-00			CAP., FXD, CER DI:0.01UF, 10%, 100V (C726 SPG2 ONLY)	04222	SA201C103KAA
C729	281-0772-00			CAP., FXD, CER DI:0.0047UF, 10%, 100V (C729 SPG2 ONLY)	04222	GC701C472K
C730	283-0004-00			CAP., FXD, CER DI:0.02UF, +80-20%, 150V (C730 SPG2 ONLY)	91418	SP203Z151-4R9
C734	283-0177-00			CAP., FXD, CER DI:1UF, +80-20%, 25V (C734 SPG2 ONLY)	56289	273C5
C735	283-0256-00			CAP., FXD, CER DI:130PF, 5%, 100V (C735 SPG2 ONLY)	51642	200-100N1500131J
C746	290-0745-00	B010100	B010134	CAP., FXD, ELCTLT:22UF, +50-10%, 25V (C746 SPG2 ONLY)	56289	502D225
C746	290-0779-00	B010135		CAP., FXD, ELCTLT:10UF, +50-10%, 50VDC (C746 SPG2 ONLY)	56289	502D237
C751	281-0773-00			CAP., FXD, CER DI:0.01UF, 10%, 100V	04222	SA201C103KAA
C758	281-0773-00			CAP., FXD, CER DI:0.01UF, 10%, 100V	04222	SA201C103KAA
C775	281-0773-00			CAP., FXD, CER DI:0.01UF, 10%, 100V	04222	SA201C103KAA
C776	281-0773-00			CAP., FXD, CER DI:0.01UF, 10%, 100V	04222	SA201C103KAA
C777	283-0640-00			CAP., FXD, MICA D:160PF, 1%, 100V	00853	D151E161F0
C778	283-0618-00			CAP., FXD, MICA D:130PF, 2%, 400V	00853	D155F131G0
C779	281-0226-00			CAP., VAR, PLSTC:5.5-65PF, 100V	52769	GXD38000
C785	283-0023-00			CAP., FXD, CER DI:0.1UF, +80-20%, 12V	91418	MX0104Z1205R5
C790	290-0745-00			CAP., FXD, ELCTLT:22UF, +50-10%, 25V	56289	502D225
C797	281-0592-00			CAP., FXD, CER DI:4.7PF, +/-0.5PF, 500V	59660	301-000-C0H0479D
C798	281-0205-00			CAP., VAR, PLSTC:5.5-65PF, 100V	80031	2810C5R565QJ02F0
C799	281-0205-00			CAP., VAR, PLSTC:5.5-65PF, 100V	80031	2810C5R565QJ02F0
C806	281-0592-00			CAP., FXD, CER DI:4.7PF, +/-0.5PF, 500V	59660	301-000-C0H0479D
C807	281-0592-00			CAP., FXD, CER DI:4.7PF, +/-0.5PF, 500V	59660	301-000-C0H0479D
C808	281-0205-00			CAP., VAR, PLSTC:5.5-65PF, 100V	80031	2810C5R565QJ02F0
C809	281-0205-00			CAP., VAR, PLSTC:5.5-65PF, 100V	80031	2810C5R565QJ02F0
C810	283-0649-00			CAP., FXD, MICA D:105PF, 1%, 300V	00853	D153F1050F0
C811	283-0644-00			CAP., FXD, MICA D:150PF, 1%, 500V	00853	D155F151F0
C812	281-0773-00			CAP., FXD, CER DI:0.01UF, 10%, 100V	04222	SA201C103KAA
C814	281-0773-00			CAP., FXD, CER DI:0.01UF, 10%, 100V	04222	SA201C103KAA
C815	290-0745-00			CAP., FXD, ELCTLT:22UF, +50-10%, 25V	56289	502D225
C816	281-0592-00			CAP., FXD, CER DI:4.7PF, +/-0.5PF, 500V	59660	301-000-C0H0479D
C817	281-0592-00			CAP., FXD, CER DI:4.7PF, +/-0.5PF, 500V	59660	301-000-C0H0479D
C818	281-0205-00			CAP., VAR, PLSTC:5.5-65PF, 100V	80031	2810C5R565QJ02F0
C819	281-0205-00			CAP., VAR, PLSTC:5.5-65PF, 100V	80031	2810C5R565QJ02F0

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
C826	281-0592-00			CAP., FXD, CER DI:4.7PF, +/-0.5PF, 500V	59660	301-000-COH0479D
C827	281-0592-00			CAP., FXD, CER DI:4.7PF, +/-0.5PF, 500V	59660	301-000-COH0479D
C828	281-0205-00			CAP., VAR, PLSTC:5.5-65PF, 100V	80031	2810C5R565QJ02F0
C829	281-0205-00			CAP., VAR, PLSTC:5.5-65PF, 100V	80031	2810C5R565QJ02F0
C830	283-0003-00			CAP., FXD, CER DI:0.01UF, +80-20%, 150V	91418	SP103Z151-4R9
C831	283-0003-00			CAP., FXD, CER DI:0.01UF, +80-20%, 150V	91418	SP103Z151-4R9
C832	283-0003-00			CAP., FXD, CER DI:0.01UF, +80-20%, 150V	91418	SP103Z151-4R9
C835	290-0745-00			CAP., FXD, ELCTLT:22UF, +50-10%, 25V	56289	502D225
C836	281-0592-00			CAP., FXD, CER DI:4.7PF, +/-0.5PF, 500V	59660	301-000-COH0479D
C837	281-0592-00			CAP., FXD, CER DI:4.7PF, +/-0.5PF, 500V	59660	301-000-COH0479D
C838	281-0205-00			CAP., VAR, PLSTC:5.5-65PF, 100V	80031	2810C5R565QJ02F0
C839	281-0205-00			CAP., VAR, PLSTC:5.5-65PF, 100V	80031	2810C5R565QJ02F0
C844	290-0745-00			CAP., FXD, ELCTLT:22UF, +50-10%, 25V	56289	502D225
C845	281-0773-00			CAP., FXD, CER DI:0.01UF, 10%, 100V	04222	SA201C103KAA
C846	281-0592-00			CAP., FXD, CER DI:4.7PF, +/-0.5PF, 500V	59660	301-000-COH0479D
C847	281-0592-00			CAP., FXD, CER DI:4.7PF, +/-0.5PF, 500V	59660	301-000-COH0479D
C848	281-0205-00			CAP., VAR, PLSTC:5.5-65PF, 100V	80031	2810C5R565QJ02F0
C849	281-0205-00			CAP., VAR, PLSTC:5.5-65PF, 100V	80031	2810C5R565QJ02F0
C852	290-0745-00			CAP., FXD, ELCTLT:22UF, +50-10%, 25V	56289	502D225
C861	283-0648-00	B010100	B010126	CAP., FXD, MICA D:10PF, 5%, 100V (SPG1 ONLY)	00853	D151C100D0
C861	283-0637-00	B010127		CAP., FXD, MICA D:20PF, 2.5%, 100V (SPG1 ONLY)	00853	D151E200D0
C861	283-0648-00	B010100	B010437	CAP., FXD, MICA D:10PF, 5%, 100V (SPG2 ONLY)	00853	D151C100D0
C861	283-0637-00	B010438		CAP., FXD, MICA D:20PF, 2.5%, 100V (SPG2 ONLY)	00853	D151E200D0
C865	281-0226-00			CAP., VAR, PLSTC:5.5-65PF, 100V	52769	GXD38000
C867	283-0047-00	B010100	B010126	CAP., FXD, CER DI:270PF, 5%, 500V (SPG1 ONLY)	72982	0831522Z5D00271J
C867	281-0791-00	B010127		CAP., FXD, CER DI:270PF, 10%, 100V (SPG1 ONLY)	72982	8035D2AADX5R271K
C867	283-0047-00	B010100	B010437	CAP., FXD, CER DI:270PF, 5%, 500V (SPG2 ONLY)	72982	0831522Z5D00271J
C867	281-0791-00	B010438		CAP., FXD, CER DI:270PF, 10%, 100V (SPG2 ONLY)	72982	8035D2AADX5R271K
C871	283-0000-00	B010100	B010126	CAP., FXD, CER DI:0.001UF, +100-0%, 500V (SPG1 ONLY)	59660	0831610Y5P0102D
C871	283-0639-00	B010127		CAP., FXD, MICA D:56PF, 1%, 100V (SPG1 ONLY)	00853	D151E560F0
C871	283-0000-00	B010100	B010437	CAP., FXD, CER DI:0.001UF, +100-0%, 500V (SPG2 ONLY)	59660	0831610Y5P0102D
C871	283-0639-00	B010438		CAP., FXD, MICA D:56PF, 1%, 100V (SPG2 ONLY)	00853	D151E560F0
C875	283-0047-00	B010100	B010126	CAP., FXD, CER DI:270PF, 5%, 500V (SPG1 ONLY)	72982	0831522Z5D00271J
C875	281-0791-00	B010127		CAP., FXD, CER DI:270PF, 10%, 100V (SPG1 ONLY)	72982	8035D2AADX5R271K
C875	283-0047-00	B010100	B010437	CAP., FXD, CER DI:270PF, 5%, 500V (SPG2 ONLY)	72982	0831522Z5D00271J
C875	281-0791-00	B010438		CAP., FXD, CER DI:270PF, 10%, 100V (SPG2 ONLY)	72982	8035D2AADX5R271K
C877	283-0047-00	B010100	B010126	CAP., FXD, CER DI:270PF, 5%, 500V (SPG1 ONLY)	72982	0831522Z5D00271J
C877	281-0791-00	B010127		CAP., FXD, CER DI:270PF, 10%, 100V (SPG1 ONLY)	72982	8035D2AADX5R271K
C877	283-0047-00	B010100	B010437	CAP., FXD, CER DI:270PF, 5%, 500V (SPG2 ONLY)	72982	0831522Z5D00271J

Replaceable Electrical Parts—SPG1/SPG2

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
C877	281-0791-00 -----	B010438		CAP.,FXD,CER DI:270PF,10%,100V (SPG2 ONLY)	72982	8035D2AADX5R271K
C878	283-0047-00 -----	B010100	B010126	CAP.,FXD,CER DI:270PF,5%,500V (SPG1 ONLY)	72982	0831522Z5D00271J
C878	281-0791-00 -----	B010127		CAP.,FXD,CER DI:270PF,10%,100V (SPG1 ONLY)	72982	8035D2AADX5R271K
C878	283-0047-00 -----	B010100	B010437	CAP.,FXD,CER DI:270PF,5%,500V (SPG2 ONLY)	72982	0831522Z5D00271J
C878	281-0791-00 -----	B010438		CAP.,FXD,CER DI:270PF,10%,100V (SPG2 ONLY)	72982	8035D2AADX5R271K
C880	281-0812-00 -----	XB010127		CAP.,FXD,CER DI:1000PF,10%,100V (SPG1 ONLY)	72982	8035D9AADX7R102K
C880	281-0812-00 -----	XB010438		CAP.,FXD,CER DI:1000PF,10%,100V (SPG2 ONLY)	72982	8035D9AADX7R102K
C883	281-0773-00			CAP.,FXD,CER DI:0.01UF,10%,100V	04222	SA201C103KAA
C884	283-0047-00 -----	B010100	B010126	CAP.,FXD,CER DI:270PF,5%,500V (SPG1 ONLY)	72982	0831522Z5D00271J
C884	281-0791-00 -----	B010127		CAP.,FXD,CER DI:270PF,10%,100V (SPG1 ONLY)	72982	8035D2AADX5R271K
C884	283-0047-00 -----	B010100	B010437	CAP.,FXD,CER DI:270PF,5%,500V (SPG2 ONLY)	72982	0831522Z5D00271J
C884	281-0791-00 -----	B010438		CAP.,FXD,CER DI:270PF,10%,100V (SPG2 ONLY)	72982	8035D2AADX5R271K
C886	283-0047-00 -----	B010100	B010126	CAP.,FXD,CER DI:270PF,5%,500V (SPG1 ONLY)	72982	0831522Z5D00271J
C886	281-0791-00 -----	B010127		CAP.,FXD,CER DI:270PF,10%,100V (SPG1 ONLY)	72982	8035D2AADX5R271K
C886	283-0047-00 -----	B010100	B010437	CAP.,FXD,CER DI:270PF,5%,500V (SPG2 ONLY)	72982	0831522Z5D00271J
C886	281-0791-00 -----	B010438		CAP.,FXD,CER DI:270PF,10%,100V (SPG2 ONLY)	72982	8035D2AADX5R271K
C892	281-0773-00 -----	B010100	B010126	CAP.,FXD,CER DI:0.01UF,10%,100V (SPG1 ONLY)	04222	SA201C103KAA
C892	281-0775-00 -----	B010127		CAP.,FXD,CER DI:0.1UF,20%,50V (SPG1 ONLY)	04222	SA205E104MAA
C892	281-0773-00 -----	B010100	B010437	CAP.,FXD,CER DI:0.01UF,10%,100V (SPG2 ONLY)	04222	SA201C103KAA
C892	281-0775-00 -----	B010438		CAP.,FXD,CER DI:0.1UF,20%,50V (SPG2 ONLY)	04222	SA205E104MAA
C894	281-0773-00			CAP.,FXD,CER DI:0.01UF,10%,100V	04222	SA201C103KAA
C896	283-0187-00 -----	B010100	B010126	CAP.,FXD,CER DI:0.047UF,10%,400V (SPG1 ONLY)	72982	8131N401X5R0473K
C896	281-0775-00 -----	B010127		CAP.,FXD,CER DI:0.1UF,20%,50V (SPG1 ONLY)	04222	SA205E104MAA
C896	283-0187-00 -----	B010100	B010437	CAP.,FXD,CER DI:0.047UF,10%,400V (SPG2 ONLY)	72982	8131N401X5R0473K
C896	281-0775-00 -----	B010438		CAP.,FXD,CER DI:0.1UF,20%,50V (SPG2 ONLY)	04222	SA205E104MAA
C897	281-0773-00			CAP.,FXD,CER DI:0.01UF,10%,100V	04222	SA201C103KAA
C898	283-0081-00 -----	B010100	B010126	CAP.,FXD,CER DI:0.1UF,+80-20%,25V (SPG1 ONLY)	91418	MX104Z2504R0
C898	281-0775-00 -----	B010127		CAP.,FXD,CER DI:0.1UF,20%,50V (SPG1 ONLY)	04222	SA205E104MAA
C898	283-0081-00 -----	B010100	B010437	CAP.,FXD,CER DI:0.1UF,+80-20%,25V (SPG2 ONLY)	91418	MX104Z2504R0
C898	281-0775-00 -----	B010438		CAP.,FXD,CER DI:0.1UF,20%,50V (SPG2 ONLY)	04222	SA205E104MAA

Replaceable Electrical Parts—SPG1/SPG2

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
C899	290-0523-00			CAP., FXD, ELCTLT: 2.2UF, 20%, 20V	56289	196D225X0020HA1
C901	281-0773-00			CAP., FXD, CER DI: 0.01UF, 10%, 100V	04222	SA201C103KAA
C902	283-0728-00	B010100	B010126	CAP., FXD, MICA D: 120PF, 1%, 500V (SPG1 ONLY)	00853	D155F121F0
C902	283-0638-00	B010127		CAP., FXD, MICA D: 130PF, 1%, 100V (SPG1 ONLY)	00853	D151F131F0
C902	283-0728-00	B010100	B010437	CAP., FXD, MICA D: 120PF, 1%, 500V (SPG2 ONLY)	00853	D155F121F0
C902	283-0638-00	B010438		CAP., FXD, MICA D: 130PF, 1%, 100V (SPG2 ONLY)	00853	D151F131F0
C903	283-0000-00	B010100	B010126	CAP., FXD, CER DI: 0.001UF, +100-0%, 500V (SPG1 ONLY)	59660	0831610Y5P0102D
C903	281-0775-00	B010127		CAP., FXD, CER DI: 0.1UF, 20%, 50V (SPG1 ONLY)	04222	SA205E104MAA
C903	283-0000-00	B010100	B010437	CAP., FXD, CER DI: 0.001UF, +100-0%, 500V (SPG2 ONLY)	59660	0831610Y5P0102D
C903	281-0775-00	B010438		CAP., FXD, CER DI: 0.1UF, 20%, 50V (SPG2 ONLY)	04222	SA205E104MAA
C904	283-0081-00	B010100	B010126	CAP., FXD, CER DI: 0.1UF, +80-20%, 25V (SPG1 ONLY)	91418	MX104Z2504R0
C904	281-0775-00	B010127		CAP., FXD, CER DI: 0.1UF, 20%, 50V (SPG1 ONLY)	04222	SA205E104MAA
C904	283-0081-00	B010100	B010437	CAP., FXD, CER DI: 0.1UF, +80-20%, 25V (SPG2 ONLY)	91418	MX104Z2504R0
C904	281-0775-00	B010438		CAP., FXD, CER DI: 0.1UF, 20%, 50V (SPG2 ONLY)	04222	SA205E104MAA
C911	283-0648-00			CAP., FXD, MICA D: 10PF, 5%, 100V	00853	D151C100D0
C916	283-0649-00			CAP., FXD, MICA D: 105PF, 1%, 300V	00853	D153F1050F0
C923	283-0649-00	B010100	B010126	CAP., FXD, MICA D: 105PF, 1%, 300V (SPG1 ONLY)	00853	D153F1050F0
C923	283-0647-00	B010127		CAP., FXD, MICA D: 70PF, 1%, 100V (SPG1 ONLY)	00853	D151E700F0
C923	283-0649-00	B010100	B010437	CAP., FXD, MICA D: 105PF, 1%, 300V (SPG2 ONLY)	00853	D153F1050F0
C923	283-0647-00	B010438		CAP., FXD, MICA D: 70PF, 1%, 100V (SPG2 ONLY)	00853	D151E700F0
C925	290-0778-00			CAP., FXD, ELCTLT: 1UF, +50-10%, 50V (SPG2 ONLY)	54473	ECE-A50N1
C926	283-0649-00			CAP., FXD, MICA D: 105PF, 1%, 300V	00853	D153F1050F0
C927	281-0773-00			CAP., FXD, CER DI: 0.01UF, 10%, 100V	04222	SA201C103KAA
C928	281-0064-00			CAP., VAR, PLSTC: 0.25-1.5PF, 600V	74970	273-0001-101
C929	281-0661-00	B010100	B010126X	CAP., FXD, CER DI: 0.8PF, +/-0.1PF, 500V (SPG1 ONLY)	04222	7001-1268
C929	281-0661-00	B010100	B010437X	CAP., FXD, CER DI: 0.8PF, +/-0.1PF, 500V (SPG2 ONLY)	04222	7001-1268
C933	283-0000-00	B010100	B010126	CAP., FXD, CER DI: 0.001UF, +100-0%, 500V (SPG1 ONLY)	59660	0831610Y5P0102D
C933	281-0812-00	B010127	B020210	CAP., FXD, CER DI: 1000PF, 10%, 100V (SPG1 ONLY)	72982	8035D9AADX7R102K
C933	281-0773-00	B020211		CAP., FXD, CER DI: 0.01UF, 10%, 100V (SPG1 ONLY)	04222	SA201C103KAA
C933	283-0000-00	B010100	B010437	CAP., FXD, CER DI: 0.001UF, +100-0%, 500V (SPG2 ONLY)	59660	0831610Y5P0102D
C933	281-0812-00	B010438	B021236	CAP., FXD, CER DI: 1000PF, 10%, 100V (SPG2 ONLY)	72982	8035D9AADX7R102K
C933	281-0773-00	B021237		CAP., FXD, CER DI: 0.01UF, 10%, 100V (SPG2 ONLY)	04222	SA201C103KAA

Replaceable Electrical Parts—SPG1/SPG2

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
C936	283-0730-00 -----	B010100	B010126	CAP., FXD, MICA D: 274PF, 1%, 500V (SPG1 ONLY)	00853	D155F2740F0
C936	283-0725-00 -----	B010127		CAP., FXD, MICA D: 214PF, 1%, 500V (SPG1 ONLY)	00853	D155F2140F0
C936	283-0730-00 -----	B010100	B010437	CAP., FXD, MICA D: 274PF, 1%, 500V (SPG2 ONLY)	00853	D155F2740F0
C936	283-0725-00 -----	B010438		CAP., FXD, MICA D: 214PF, 1%, 500V (SPG2 ONLY)	00853	D155F2140F0
C945	283-0639-00			CAP., FXD, MICA D: 56PF, 1%, 100V	00853	D151E560F0
C946	283-0687-00 -----	B010100	B010126	CAP., FXD, MICA D: 560PF, 2%, 300V (SPG1 ONLY)	00853	D153F561G0
C946	283-0689-00 -----	B010127		CAP., FXD, MICA D: 550PF, 1%, 300V (SPG1 ONLY)	00853	D153F551F0
C946	283-0687-00 -----	B010100	B010439	CAP., FXD, MICA D: 560PF, 2%, 300V (SPG2 ONLY)	00853	D153F561G0
C946	283-0689-00 -----	B010438		CAP., FXD, MICA D: 550PF, 1%, 300V (SPG2 ONLY)	00853	D153F551F0
C947	283-0643-00 -----	B010100	B010104	CAP., FXD, MICA D: 22PF, +/-0.5PF, 300V (SPG1 ONLY)	00853	D105E220D0
C947	283-0677-00 -----	B010105		CAP., FXD, MICA D: 82PF, 1%, 500V (SPG1 ONLY)	00853	D155E820F0
C947	283-0643-00 -----	B010100	B010175	CAP., FXD, MICA D: 22PF, +/-0.5PF, 300V (SPG2 ONLY)	00853	D105E220D0
C947	283-0677-00 -----	B010176		CAP., FXD, MICA D: 82PF, 1%, 500V (SPG2 ONLY)	00853	D155E820F0
C948	283-0638-00 -----	B010100	B010104	CAP., FXD, MICA D: 130PF, 1%, 100V (SPG1 ONLY)	00853	D151F131F0
C948	283-0725-00 -----	B010105		CAP., FXD, MICA D: 214PF, 1%, 500V (SPG1 ONLY)	00853	D155F2140F0
C948	283-0638-00 -----	B010100	B010175	CAP., FXD, MICA D: 130PF, 1%, 100V (SPG2 ONLY)	00853	D151F131F0
C948	283-0725-00 -----	B010176		CAP., FXD, MICA D: 214PF, 1%, 500V (SPG2 ONLY)	00853	D155F2140F0
C956	283-0081-00 -----	B010100	B010126	CAP., FXD, CER DI: 0.1UF, +80-20%, 25V (SPG1 ONLY)	91418	MX104Z2504R0
C956	281-0775-00 -----	B010127		CAP., FXD, CER DI: 0.1UF, 20%, 50V (SPG1 ONLY)	04222	SA205E104MAA
C956	283-0081-00 -----	B010100	B010437	CAP., FXD, CER DI: 0.1UF, +80-20%, 25V (SPG2 ONLY)	91418	MX104Z2504R0
C956	281-0775-00 -----	B010438		CAP., FXD, CER DI: 0.1UF, 20%, 50V (SPG2 ONLY)	04222	SA205E104MAA
C961	283-0660-00			CAP., FXD, MICA D: 510PF, 2%, 500V	00853	D155F511G0
C967	283-0081-00 -----	B010100	B010126	CAP., FXD, CER DI: 0.1UF, +80-20%, 25V (SPG1 ONLY)	91418	MX104Z2504R0
C967	281-0775-00 -----	B010127		CAP., FXD, CER DI: 0.1UF, 20%, 50V (SPG1 ONLY)	04222	SA205E104MAA
C967	283-0081-00 -----	B010100	B010437	CAP., FXD, CER DI: 0.1UF, +80-20%, 25V (SPG2 ONLY)	91418	MX104Z2504R0
C967	281-0775-00 -----	B010438		CAP., FXD, CER DI: 0.1UF, 20%, 50V (SPG2 ONLY)	04222	SA205E104MAA
C971	283-0602-00 -----	B010100	B010126	CAP., FXD, MICA D: 53PF, 5%, 300V (SPG1 ONLY)	00853	D153E530J0
C971	283-0636-00 -----	B010127		CAP., FXD, MICA D: 36PF, 1.4%, 100V (SPG1 ONLY)	00853	D155E360G0
C971	283-0602-00 -----	B010100	B010437	CAP., FXD, MICA D: 53PF, 5%, 300V (SPG2 ONLY)	00853	D153E530J0
C971	283-0636-00 -----	B010438		CAP., FXD, MICA D: 36PF, 1.4%, 100V (SPG2 ONLY)	00853	D155E360G0

Replaceable Electrical Parts—SPG1/SPG2

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
C973	283-0632-00 -----	B010100	B010126	CAP., FXD, MICA D: 87PF, 1%, 100V (SPG1 ONLY)	00853	D151E870F0
C973	283-0647-00 -----	B010127		CAP., FXD, MICA D: 70PF, 1%, 100V (SPG1 ONLY)	00853	D151E700F0
C973	283-0632-00 -----	B010100	B010437	CAP., FXD, MICA D: 87PF, 1%, 100V (SPG2 ONLY)	00853	D151E870F0
C973	283-0647-00 -----	B010438		CAP., FXD, MICA D: 70PF, 1%, 100V (SPG2 ONLY)	00853	D151E700F0
C974	283-0625-00 -----	B010100	B010126	CAP., FXD, MICA D: 220PF, 1%, 500V (SPG1 ONLY)	00853	D105F221F0
C974	283-0672-00 -----	B010127		CAP., FXD, MICA D: 200PF, 1%, 500V (SPG1 ONLY)	00853	D155F2010F0
C974	283-0625-00 -----	B010100	B010437	CAP., FXD, MICA D: 220PF, 1%, 500V (SPG2 ONLY)	00853	D105F221F0
C974	283-0672-00 -----	B010438		CAP., FXD, MICA D: 200PF, 1%, 500V (SPG2 ONLY)	00853	D155F2010F0
C977	281-0526-00 -----	B010100	B010126	CAP., FXD, CER DI: 1.5PF, +/-0.5PF, 500V (SPG1 ONLY)	04222	7001-1313
C977	281-0534-00 -----	B010127		CAP., FXD, CER DI: 3.3PF, +/-0.25PF, 500V (SPG1 ONLY)	04222	7001-1316
C977	281-0526-00 -----	B010100	B010437	CAP., FXD, CER DI: 1.5PF, +/-0.5PF, 500V (SPG2 ONLY)	04222	7001-1313
C977	281-0534-00 -----	B010438		CAP., FXD, CER DI: 3.3PF, +/-0.25PF, 500V (SPG2 ONLY)	04222	7001-1316
C981	283-0634-00 -----	B010100	B010126	CAP., FXD, MICA D: 65PF, 1%, 100V (SPG1 ONLY)	00853	D151E650F0
C981	283-0677-00 -----	B010127		CAP., FXD, MICA D: 82PF, 1%, 500V (SPG1 ONLY)	00853	D155E820F0
C981	283-0634-00 -----	B010100	B010437	CAP., FXD, MICA D: 65PF, 1%, 100V (SPG2 ONLY)	00853	D151E650F0
C981	283-0677-00 -----	B010438		CAP., FXD, MICA D: 82PF, 1%, 500V (SPG2 ONLY)	00853	D155E820F0
C982	283-0666-00			CAP., FXD, MICA D: 890PF, 2%, 100V	00853	D151F891G0
C983	283-0628-00 -----	B010100	B010126	CAP., FXD, MICA D: 410PF, 1%, 500V (SPG1 ONLY)	00853	D155F411F0
C983	283-0698-00 -----	B010127		CAP., FXD, MICA D: 390PF, 1%, 500V (SPG1 ONLY)	09023	CD15FD391F03
C983	283-0628-00 -----	B010100	B010437	CAP., FXD, MICA D: 410PF, 1%, 500V (SPG2 ONLY)	00853	D155F411F0
C983	283-0698-00 -----	B010438		CAP., FXD, MICA D: 390PF, 1%, 500V (SPG2 ONLY)	09023	CD15FD391F03
C984	283-0644-00			CAP., FXD, MICA D: 150PF, 1%, 500V	00853	D155F151F0
C985	283-0081-00 -----	B010100	B010126	CAP., FXD, CER DI: 0.1UF, +80-20%, 25V (SPG1 ONLY)	91418	MX104Z2504R0
C985	281-0775-00 -----	B010127		CAP., FXD, CER DI: 0.1UF, 20%, 50V (SPG1 ONLY)	04222	SA205E104MAA
C985	283-0081-00 -----	B010100	B010437	CAP., FXD, CER DI: 0.1UF, +80-20%, 25V (SPG2 ONLY)	91418	MX104Z2504R0
C985	281-0775-00 -----	B010438		CAP., FXD, CER DI: 0.1UF, 20%, 50V (SPG2 ONLY)	04222	SA205E104MAA
C986	283-0081-00 -----	B010100	B010126	CAP., FXD, CER DI: 0.1UF, +80-20%, 25V (SPG1 ONLY)	91418	MX104Z2504R0
C986	281-0775-00 -----	B010127		CAP., FXD, CER DI: 0.1UF, 20%, 50V (SPG1 ONLY)	04222	SA205E104MAA
C986	283-0081-00 -----	B010100	B010437	CAP., FXD, CER DI: 0.1UF, +80-20%, 25V (SPG2 ONLY)	91418	MX104Z2504R0

Replaceable Electrical Parts—SPG1/SPG2

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
C986	281-0775-00	B010438		CAP., FXD, CER DI: 0.1UF, 20%, 50V (SPG2 ONLY)	04222	SA205E104MAA
C990	283-0636-00	XB010127		CAP., FXD, MICA D: 36PF, 1.4%, 100V (SPG1 ONLY)	00853	D155E360G0
C990	283-0636-00	XB010438		CAP., FXD, MICA D: 36PF, 1.4%, 100V (SPG2 ONLY)	00853	D155E360G0
C991	290-0745-00			CAP., FXD, ELCTLT: 22UF, +50-10%, 25V	56289	502D225
C992	290-0745-00			CAP., FXD, ELCTLT: 22UF, +50-10%, 25V	56289	502D225
C993	290-0745-00			CAP., FXD, ELCTLT: 22UF, +50-10%, 25V	56289	502D225
C994	281-0577-00	B010100	B010126	CAP., FXD, CER DI: 14PF, 5%, 500V (SPG1 ONLY)	59660	301-050C0G0140J
C994	283-0648-00	B010127		CAP., FXD, MICA D: 10PF, 5%, 100V (SPG1 ONLY)	00853	D151C100D0
C994	281-0577-00	B010100	B010437	CAP., FXD, CER DI: 14PF, 5%, 500V (SPG2 ONLY)	59660	301-050C0G0140J
C994	283-0648-00	B010438		CAP., FXD, MICA D: 10PF, 5%, 100V (SPG2 ONLY)	00853	D151C100D0
C995	281-0577-00	B010100	B010126	CAP., FXD, CER DI: 14PF, 5%, 500V (SPG1 ONLY)	59660	301-050C0G0140J
C995	283-0648-00	B010127		CAP., FXD, MICA D: 10PF, 5%, 100V (SPG1 ONLY)	00853	D151C100D0
C995	281-0577-00	B010100	B010437	CAP., FXD, CER DI: 14PF, 5%, 500V (SPG2 ONLY)	59660	301-050C0G0140J
C995	283-0648-00	B010438		CAP., FXD, MICA D: 10PF, 5%, 100V (SPG2 ONLY)	00853	D151C100D0
C996	283-0177-00	B010100	B010126	CAP., FXD, CER DI: 1UF, +80-20%, 25V (SPG1 ONLY)	56289	273C5
C996	281-0775-00	B010127		CAP., FXD, CER DI: 0.1UF, 20%, 50V (SPG1 ONLY)	04222	SA205E104MAA
C996	283-0177-00	B010100	B010437	CAP., FXD, CER DI: 1UF, +80-20%, 25V (SPG2 ONLY)	56289	273C5
C996	283-0775-00	B010438		CAP., FXD, MICA D: 1764 PF, 1%, 500V (SPG2 ONLY)	00853	D19-5F17640F0
CR135	152-0141-02	XB020000		SEMICONV DEVICE: SILICON, 30V, 150MA	01295	1N4152R
CR154	152-0269-00	B010100	B010162	SEMICONV DEVICE: SILICON, VAR VCAP., 4V, 33PF (SPG1 ONLY)	04713	SMV1263
CR154	152-0269-01	B010163		SEMICONV DEVICE: VVC, SI, 33PF, 5%, 35V (SPG1 ONLY)	80009	152-0269-01
CR154	152-0269-00	B010100	B010632	SEMICONV DEVICE: SILICON, VAR VCAP., 4V, 33PF (SPG2 ONLY)	04713	SMV1263
CR154	152-0269-01	B010633		SEMICONV DEVICE: VVC, SI, 33PF, 5%, 35V (SPG2 ONLY)	80009	152-0269-01
CR224	152-0141-02			SEMICONV DEVICE: SILICON, 30V, 150MA	01295	1N4152R
CR241	152-0141-02			SEMICONV DEVICE: SILICON, 30V, 150MA	01295	1N4152R
CR270	152-0141-02			SEMICONV DEVICE: SILICON, 30V, 150MA	01295	1N4152R
CR271	152-0141-02			SEMICONV DEVICE: SILICON, 30V, 150MA	01295	1N4152R
CR280	152-0141-02			SEMICONV DEVICE: SILICON, 30V, 150MA	01295	1N4152R
CR300	152-0141-02			SEMICONV DEVICE: SILICON, 30V, 150MA	01295	1N4152R
CR304	152-0141-02			SEMICONV DEVICE: SILICON, 30V, 150MA	01295	1N4152R
CR308	152-0141-02			SEMICONV DEVICE: SILICON, 30V, 150MA	01295	1N4152R
CR317	152-0141-02			SEMICONV DEVICE: SILICON, 30V, 150MA	01295	1N4152R
CR324	152-0141-02			SEMICONV DEVICE: SILICON, 30V, 150MA	01295	1N4152R
CR364	152-0141-02			SEMICONV DEVICE: SILICON, 30V, 150MA	01295	1N4152R
CR365	152-0141-02			SEMICONV DEVICE: SILICON, 30V, 150MA	01295	1N4152R
CR375	152-0141-02			SEMICONV DEVICE: SILICON, 30V, 150MA	01295	1N4152R
CR379	152-0141-02			SEMICONV DEVICE: SILICON, 30V, 150MA	01295	1N4152R
CR389	152-0141-02			SEMICONV DEVICE: SILICON, 30V, 150MA	01295	1N4152R

Replaceable Electrical Parts—SPG1/SPG2

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
CR396	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	01295	1N4152R
CR406	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	01295	1N4152R
CR410	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	01295	1N4152R
CR426	152-0141-02	XB010580		SEMICON D DEVICE:SILICON,30V,150MA (SPG2 ONLY)	01295	1N4152R
CR426	152-0141-02	XB010140		SEMICON D DEVICE:SILICON,30V,150MA (SPG1 ONLY)	01295	1N4152R
CR429	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	01295	1N4152R
CR453	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA (CR453, SPG2 ONLY)	01295	1N4152R
CR476	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA (CR476, SPG2 ONLY)	01295	1N4152R
CR480	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA (CR480, SPG2 ONLY)	01295	1N4152R
CR483	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA (CR483, SPG2 ONLY)	01295	1N4152R
CR546	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA (CR546, SPG2 ONLY)	01295	1N4152R
CR563	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA (CR563, SPG2 ONLY)	01295	1N4152R
CR571	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA (CR571, SPG2 ONLY)	01295	1N4152R
CR573	152-0141-02	XB010135		SEMICON D DEVICE:SILICON,30V,150MA (CR573, SPG2 ONLY)	01295	1N4152R
CR660	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA (CR660, SPG2 ONLY)	01295	1N4152R
CR661	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA (CR661, SPG2 ONLY)	01295	1N4152R
CR680	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA (CR680, SPG2 ONLY)	01295	1N4152R
CR685	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA (CR685, SPG2 ONLY)	01295	1N4152R
CR699	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA (CR699, SPG2 ONLY)	01295	1N4152R
CR708	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA (CR708, SPG2 ONLY)	01295	1N4152R
CR729	152-0153-00			SEMICON D DEVICE:SILICON,15V,50MA (CR729, SPG2 ONLY)	07263	FD7003
CR736	152-0153-00			SEMICON D DEVICE:SILICON,15V,50MA (CR736, SPG2 ONLY)	07263	FD7003
CR861	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	01295	1N4152R
CR862	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	01295	1N4152R
CR871	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	01295	1N4152R
CR883	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	01295	1N4152R
CR901	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	01295	1N4152R
CR933	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	01295	1N4152R
CR941	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	01295	1N4152R
CR943	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	01295	1N4152R
CR952	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	01295	1N4152R
CR953	152-0141-02	XB010127		SEMICON D DEVICE:SILICON,30V,150MA (SPG1 ONLY)	01295	1N4152R
CR953	152-0141-02	XB010438		SEMICON D DEVICE:SILICON,30V,150MA (SPG2 ONLY)	01295	1N4152R
CR955	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	01295	1N4152R
CR956	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	01295	1N4152R
L159	108-0088-00			COIL,RF:FIXED,3.35UH	80009	108-0088-00
L448	108-0317-00			COIL,RF:FIXED,15UH	32159	71501M

Replaceable Electrical Parts—SPG1/SPG2

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
L589	108-0472-00			COIL, RF: 160UH (L589 SPG2 ONLY)	80009	108-0472-00
L600	108-0472-00			COIL, RF: 160UH (L600 SPG2 ONLY)	80009	108-0472-00
L606	108-0472-00			COIL, RF: 160UH (L606 SPG2 ONLY)	80009	108-0472-00
L645	108-0231-00			COIL, RF: 4.5UH (L645 SPG2 ONLY)	80009	108-0231-00
L656	108-0395-00			COIL, RF: 64UH (L656 SPG2 ONLY)	80009	108-0395-00
L679	114-0332-00			COIL, RF: VARIABLE, 12-20UH (L679 SPG2 ONLY)	80009	114-0332-00
L734	108-0317-00			COIL, RF: FIXED, 15UH (L734 SPG2 ONLY)	32159	71501M
L777	108-0443-00			COIL, RF: 25UH	80009	108-0443-00
L863	114-0280-00			COIL, RF: 12-43UH, CORE 276-0568-00	80009	114-0280-00
L911	114-0218-00	B010100	B010126	COIL, RF: 70-120UH (SPG1 ONLY)	80009	114-0218-00
L911	114-0219-00	B010127		COIL, RF: VARIABLE, 43-130UH (SPG1 ONLY)	80009	114-0219-00
L911	114-0218-00	B010100	B010437	COIL, RF: 70-120UH (SPG2 ONLY)	80009	114-0218-00
L911	114-0219-00	B010438		COIL, RF: VARIABLE, 43-130UH (SPG2 ONLY)	80009	114-0219-00
L923	114-0343-00			COIL, RF: 200-400UH, CORE 276-0568-00	80009	114-0343-00
L933	114-0343-00			COIL, RF: 200-400UH, CORE 276-0568-00	80009	114-0343-00
L938	114-0281-00	B010100	B010104	COIL, RF: 35-70UH, CORE 276-0540-00 (SPG1 ONLY)	80009	114-0281-00
L938	114-0280-00	B010105		COIL, RF: 12-43UH, CORE 276-0568-00 (SPG1 ONLY)	80009	114-0280-00
L938	114-0281-00	B010100	B010175	COIL, RF: 35-70UH, CORE 276-0540-00 (SPG2 ONLY)	80009	114-0281-00
L938	114-0280-00	B010176		COIL, RF: 12-43UH, CORE 276-0568-00 (SPG2 ONLY)	80009	114-0280-00
L948	114-0281-00	B010100	B010104	COIL, RF: 35-70UH, CORE 276-0540-00 (SPG1 ONLY)	80009	114-0281-00
L948	114-0280-00	B010105		COIL, RF: 12-43UH, CORE 276-0568-00 (SPG1 ONLY)	80009	114-0280-00
L948	114-0281-00	B010100	B010175	COIL, RF: 35-70UH, CORE 276-0540-00 (SPG2 ONLY)	80009	114-0281-00
L948	114-0280-00	B010176		COIL, RF: 12-43UH, CORE 276-0568-00 (SPG2 ONLY)	80009	114-0280-00
L971	114-0257-00			COIL, RF: VARIABLE, 6-11UH	80009	114-0257-00
L974	114-0308-00			COIL, RF: 2.9-6.5UH	80009	114-0308-00
L981	114-0278-00	B010100	B010126	COIL, RF: 4.6-16.7UH, CORE 276-0568-00 (SPG1 ONLY)	80009	114-0278-00
L981	114-0303-00	B010127		COIL, RF: 6.5-23UH, CORE 276-0506-00 (SPG1 ONLY)	80009	114-0303-00
L981	114-0278-00	B010100	B010437	COIL, RF: 4.6-16.7UH, CORE 276-0568-00 (SPG2 ONLY)	80009	114-0278-00
L981	114-0303-00	B010438		COIL, RF: 6.5-23UH, CORE 276-0506-00 (SPG2 ONLY)	80009	114-0303-00
L984	114-0278-00			COIL, RF: 4.6-16.7UH, CORE 276-0568-00	80009	114-0278-00
Q131	151-0402-00			TRANSISTOR: SILICON, NPN, SEL FROM 3571TP	80009	151-0402-00
Q132	151-0220-00			TRANSISTOR: SILICON, PNP	07263	S036228
Q133	151-0402-00	B010100	B019999X	TRANSISTOR: SILICON, NPN, SEL FROM 3571TP	80009	151-0402-00
Q134	151-0220-00	B010100	B019999X	TRANSISTOR: SILICON, PNP	07263	S036228

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
Q135	151-0220-00			TRANSISTOR: SILICON, PNP	07263	S036228
Q136	151-0402-00			TRANSISTOR: SILICON, NPN, SEL FROM 3571TP	80009	151-0402-00
Q137	151-0220-00	B010100	B019999X	TRANSISTOR: SILICON, PNP	07263	S036228
Q138	151-0402-00	B010100	B019999X	TRANSISTOR: SILICON, NPN, SEL FROM 3571TP	80009	151-0402-00
Q157	151-0188-00			TRANSISTOR: SILICON, PNP	04713	SPS6868K
Q217	151-0192-00			TRANSISTOR: SILICON, NPN, SEL FROM MPS6521	04713	SPS8801
Q252	151-0223-00			TRANSISTOR: SILICON, NPN	04713	SPS8026
Q260	151-0192-00	B010100	B020167	TRANSISTOR: SILICON, NPN, SEL FROM MPS6521 (SPG1 ONLY)	04713	SPS8801
Q260	151-0223-00	B020168		TRANSISTOR: SILICON, NPN (SPG1 ONLY)	04713	SPS8026
Q260	151-0192-00	B010100	B020904	TRANSISTOR: SILICON, NPN, SEL FROM MPS6521 (SPG2 ONLY)	04713	SPS8801
Q260	151-0223-00	B020905		TRANSISTOR: SILICON, NPN (SPG2 ONLY)	04713	SPS8026
Q261	151-0223-00			TRANSISTOR: SILICON, NPN	04713	SPS8026
Q262	151-0188-00			TRANSISTOR: SILICON, PNP	04713	SPS6868K
Q284	151-0190-00			TRANSISTOR: SILICON, NPN	07263	S032677
Q294	151-0254-00			TRANSISTOR: SILICON, NPN	03508	X38L3118
Q300	151-0188-00			TRANSISTOR: SILICON, PNP	04713	SPS6868K
Q301	151-0207-00			TRANSISTOR: SILICON, NPN	03508	X32D6191
Q304	151-0223-00			TRANSISTOR: SILICON, NPN	04713	SPS8026
Q305	151-0223-00			TRANSISTOR: SILICON, NPN	04713	SPS8026
Q312	151-0223-00			TRANSISTOR: SILICON, NPN	04713	SPS8026
Q314	151-0188-00			TRANSISTOR: SILICON, PNP	04713	SPS6868K
Q315	151-0192-00	B010100	B020167	TRANSISTOR: SILICON, NPN, SEL FROM MPS6521 (SPG1 ONLY)	04713	SPS8801
Q315	151-0223-00	B020168		TRANSISTOR: SILICON, NPN (SPG1 ONLY)	04713	SPS8026
Q315	151-0192-00	B010100	B020904	TRANSISTOR: SILICON, NPN, SEL FROM MPS6521 (SPG2 ONLY)	04713	SPS8801
Q315	151-0223-00	B020905		TRANSISTOR: SILICON, NPN (SPG2 ONLY)	04713	SPS8026
Q405	151-0221-00			TRANSISTOR: SILICON, PNP	04713	SPS246
Q406	151-0190-00			TRANSISTOR: SILICON, NPN	07263	S032677
Q407	151-0410-00			TRANSISTOR: SILICON, PNP	80009	151-0410-00
Q408	151-0221-00			TRANSISTOR: SILICON, PNP	04713	SPS246
Q427	151-0221-00			TRANSISTOR: SILICON, PNP	04713	SPS246
Q436	151-0216-00			TRANSISTOR: SILICON, PNP	04713	SPS8803
Q460	151-0207-00			TRANSISTOR: SILICON, NPN (Q460 SPG2 ONLY)	03508	X32D6191
Q462	151-0410-00			TRANSISTOR: SILICON, PNP (Q462 SPG2 ONLY)	80009	151-0410-00
Q463	151-0410-00			TRANSISTOR: SILICON, PNP (Q463 SPG2 ONLY)	80009	151-0410-00
Q464	151-0207-00			TRANSISTOR: SILICON, NPN (Q464 SPG2 ONLY)	03508	X32D6191
Q465	151-0435-00			TRANSISTOR: SILICON, PNP (Q465 SPG2 ONLY)	04713	SPS8335
Q469	151-0410-00			TRANSISTOR: SILICON, PNP (Q469 SPG2 ONLY)	80009	151-0410-00
Q470	151-0410-00			TRANSISTOR: SILICON, PNP (Q470 SPG2 ONLY)	80009	151-0410-00
Q474	151-0188-00			TRANSISTOR: SILICON, PNP (Q474 SPG2 ONLY)	04713	SPS6868K
Q475	151-0164-00			TRANSISTOR: SILICON, PNP (Q475 SPG2 ONLY)	01295	SKB3334

Replaceable Electrical Parts—SPG1/SPG2

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
Q489	151-0216-00 -----			TRANSISTOR: SILICON, PNP (Q489 SPG2 ONLY)	04713	SPS8803
Q538	151-1025-00 -----			TRANSISTOR: SILICON, JFE, N-CHANNEL (Q538 SPG2 ONLY)	01295	SFB8129
Q545	151-0325-00 -----	B010100	B021295	TRANSISTOR: SILICON, PNP, SEL FROM 2N4258 (SPG2 ONLY)	80009	151-0325-00
Q545	151-0325-01 -----	B021296		TRANSISTOR: PN4258, SELECTED (SPG2 ONLY)	80009	151-0325-01
Q550	151-0325-00 -----	B010100	B021295	TRANSISTOR: SILICON, PNP, SEL FROM 2N4258 (SPG2 ONLY)	80009	151-0325-00
Q550	151-0325-01 -----	B021296		TRANSISTOR: PN4258, SELECTED (SPG2 ONLY)	80009	151-0325-01
Q554	151-1025-00 -----			TRANSISTOR: SILICON, JFE, N-CHANNEL (Q554 SPG2 ONLY)	01295	SFB8129
Q555	151-1025-00 -----			TRANSISTOR: SILICON, JFE, N-CHANNEL (Q555 SPG2 ONLY)	01295	SFB8129
Q560	151-0325-00 -----	B010100	B021295	TRANSISTOR: SILICON, PNP, SEL FROM 2N4258 (SPG2 ONLY)	80009	151-0325-00
Q560	151-0325:01 -----	B021296		TRANSISTOR: PN4258, SELECTED (SPG2 ONLY)	80009	151-0325-01
Q565	151-0223-00 -----			TRANSISTOR: SILICON, NPN (Q565 SPG2 ONLY)	04713	SPS8026
Q569	151-0302-00 -----			TRANSISTOR: SILICON, NPN (Q569 SPG2 ONLY)	07263	S038487
Q570	151-0325-00 -----	B010100	B021295	TRANSISTOR: SILICON, PNP, SEL FROM 2N4258 (SPG2 ONLY)	80009	151-0325-00
Q570	151-0325-01 -----	B021296		TRANSISTOR: PN4258, SELECTED (SPG2 ONLY)	80009	151-0325-01
Q578	151-1005-00 -----	B010100	B021295	TRANSISTOR: SILICON, JFE, N-CHANNEL (SPG2 ONLY)	80009	151-1005-00
Q578	151-1005-01 -----	B021296		TRANSISTOR: FRT, N-CHAN, SI, 2N4303 FAM, CHK (SPG2 ONLY)	80009	151-1005-01
Q590	151-0302-00 -----			TRANSISTOR: SILICON, NPN (Q590 SPG2 ONLY)	07263	S038487
Q592	151-0216-00 -----			TRANSISTOR: SILICON, PNP (Q592 SPG2 ONLY)	04713	SPS8803
Q594	151-0302-00 -----			TRANSISTOR: SILICON, NPN (Q594 SPG2 ONLY)	07263	S038487
Q595	151-0216-00 -----			TRANSISTOR: SILICON, PNP (Q595 SPG2 ONLY)	04713	SPS8803
Q665	151-0190-00 -----			TRANSISTOR: SILICON, NPN (Q665 SPG2 ONLY)	07263	S032677
Q666	151-0190-00 -----			TRANSISTOR: SILICON, NPN (Q666 SPG2 ONLY)	07263	S032677
Q686	151-0441-00 -----			TRANSISTOR: SILICON, NPN (Q686 SPG2 ONLY)	04713	SRF501
Q715	151-0190-00 -----			TRANSISTOR: SILICON, NPN (Q715 SPG2 ONLY)	07263	S032677
Q718	151-0190-00 -----			TRANSISTOR: SILICON, NPN (Q718 SPG2 ONLY)	07263	S032677
Q719	151-0190-00 -----			TRANSISTOR: SILICON, NPN (Q719 SPG2 ONLY)	07263	S032677
Q725	151-0367-00 -----	B010100	B021295	TRANSISTOR: SILICON, NPN, SEL FROM 3571TP (SPG2 ONLY)	01295	SKA6516
Q725	151-0367-01 -----	B021296		TRANSISTOR: SKA6516, SELECTED (SPG2 ONLY)	01295	SKC0536
Q755	151-0221-00 -----			TRANSISTOR: SILICON, PNP	04713	SPS246

Replaceable Electrical Parts—SPG1/SPG2

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
Q767	151-0190-00			TRANSISTOR: SILICON, NPN	07263	S032677
Q768	151-0190-00			TRANSISTOR: SILICON, NPN	07263	S032677
Q775	151-0190-00			TRANSISTOR: SILICON, NPN	07263	S032677
Q776	151-0190-00			TRANSISTOR: SILICON, NPN	07263	S032677
Q784	151-0103-00			TRANSISTOR: SILICON, NPN	80009	151-0103-00
Q875	151-0190-00			TRANSISTOR: SILICON, NPN	07263	S032677
Q876	151-0190-00			TRANSISTOR: SILICON, NPN	07263	S032677
Q878	151-0190-00			TRANSISTOR: SILICON, NPN	07263	S032677
Q880	151-0190-00			TRANSISTOR: SILICON, NPN	07263	S032677
Q897	151-0190-00			TRANSISTOR: SILICON, NPN	07263	S032677
Q898	151-0190-00			TRANSISTOR: SILICON, NPN	07263	S032677
Q903	151-0192-00			TRANSISTOR: SILICON, NPN, SEL FROM MPS6521	04713	SPS8801
Q915A, B	151-0232-00			TRANSISTOR: SILICON, NPN, DUAL	07263	SP12141
Q941	151-0291-00			TRANSISTOR: SILICON, NPN	02735	60156
Q942	151-0192-00			TRANSISTOR: SILICON, NPN, SEL FROM MPS6521	04713	SPS8801
Q942	151-0192-00			TRANSISTOR: SILICON, NPN, SEL FROM MPS6521	04713	SPS8801
Q944	151-0192-00			TRANSISTOR: SILICON, NPN, SEL FROM MPS6521	04713	SPS8801
Q951	151-0192-00			TRANSISTOR: SILICON, NPN, SEL FROM MPS6521	04713	SPS8801
Q954	151-0220-00			TRANSISTOR: SILICON, PNP	07263	S036228
Q955	151-0192-00			TRANSISTOR: SILICON, NPN, SEL FROM MPS6521	04713	SPS8801
Q962	151-0192-00			TRANSISTOR: SILICON, NPN, SEL FROM MPS6521	04713	SPS8801
Q963	151-0192-00	B010100	B010126X	TRANSISTOR: SILICON, NPN, SEL FROM MPS6521 (SPG1 ONLY)	04713	SPS8801
Q963	151-0192-00	B010100	B010437X	TRANSISTOR: SILICON, NPN, SEL FROM MPS6521 (SPG2 ONLY)	04713	SPS8801
Q966	151-0459-00	B010100	B010126	TRANSISTOR: SILICON, PNP (SPG1 ONLY)	80009	151-0459-00
Q966	151-0220-00	B010127		TRANSISTOR: SILICON, PNP (SPG1 ONLY)	07263	S036228
Q966	151-0459-00	B010100	B010437	TRANSISTOR: SILICON, PNP (SPG2 ONLY)	80009	151-0459-00
Q966	151-0220-00	B010438		TRANSISTOR: SILICON, PNP (SPG2 ONLY)	07263	S036228
Q976	151-0460-00	B010100	B010126	TRANSISTOR: SILICON, NPN (SPG1 ONLY)	07263	S039652
Q976	151-0190-00	B010127		TRANSISTOR: SILICON, NPN (SPG1 ONLY)	07263	S032677
Q976	151-0460-00	B010100	B010437	TRANSISTOR: SILICON, NPN (SPG2 ONLY)	07263	S039652
Q976	151-0190-00	B010438		TRANSISTOR: SILICON, NPN (SPG2 ONLY)	07263	S032677
Q978	151-0220-00			TRANSISTOR: SILICON, PNP	07263	S036228
Q979	151-0220-00			TRANSISTOR: SILICON, PNP	07263	S036228
Q997	151-0103-00			TRANSISTOR: SILICON, NPN	80009	151-0103-00
R101	315-0472-00	XB020220		RES., FXD, CMPSN: 4.7K OHM, 5%, 0.25W (SPG1 ONLY)	01121	CB4725
R101	315-0472-00	XB021322		RES., FXD, CMPSN: 4.7K OHM, 5%, 0.25W (SPG2 ONLY)	01121	CB4725
R102	315-0332-00			RES., FXD, CMPSN: 3.3K OHM, 5%, 0.25W (SPG1 ONLY)	01121	CB3325
R102	315-0332-00	XB010135		RES., FXD, CMPSN: 3.3K OHM, 5%, 0.25W (SPG2 ONLY)	01121	CB3325
R103	315-0472-00			RES., FXD, CMPSN: 4.7K OHM, 5%, 0.25W	01121	CB4725
R104	315-0472-00			RES., FXD, CMPSN: 4.7K OHM, 5%, 0.25W	01121	CB4725
R105	315-0472-00			RES., FXD, CMPSN: 4.7K OHM, 5%, 0.25W	01121	CB4725
R106	315-0472-00			RES., FXD, CMPSN: 4.7K OHM, 5%, 0.25W	01121	CB4725

Replaceable Electrical Parts—SPG1/SPG2

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R107	315-0472-00			RES., FXD, CMPSN: 4.7K OHM, 5%, 0.25W	01121	CB4725
R108	315-0472-00	XB020220		RES., FXD, CMPSN: 4.7K OHM, 5%, 0.25W (SPG1 ONLY)	01121	CB4725
R108	315-0472-00	XB021322		RES., FXD, CMPSN: 4.7K OHM, 5%, 0.25W (SPG2 ONLY)	01121	CB4725
R112	321-0222-00			RES., FXD, FILM: 2K OHM, 1%, 0.125W	91637	MFF1816G20000F
R114	321-0222-00			RES., FXD, FILM: 2K OHM, 1%, 0.125W	91637	MFF1816G20000F
R115	311-1915-00			RES., VAR, NONWIR: 20K OHM, 10%, 0.50W	73138	72-196-0
R116	311-1915-00			RES., VAR, NONWIR: 20K OHM, 10%, 0.50W	73138	72-196-0
R117	321-0222-00			RES., FXD, FILM: 2K OHM, 1%, 0.125W	91637	MFF1816G20000F
R118	315-0472-00			RES., FXD, CMPSN: 4.7K OHM, 5%, 0.25W	01121	CB4725
R119	311-1916-00			RES., VAR, NONWIR: 10K OHM, 10%, 0.50W	73138	72-197-0
R120	315-0202-00	XB020190		RES., FXD, CMPSN: 2K OHM, 5%, 0.25W (SPG1 ONLY)	01121	CB2025
R120	315-0202-00	XB021070		RES., FXD, CMPSN: 2K OHM, 5%, 0.25W (SPG2 ONLY)	01121	CB2025
R124	315-0393-00	B010100	B019999X	RES., FXD, CMPSN: 39K OHM, 5%, 0.25W (NOMINAL VALUE, SELECTED)	01121	CB3935
R127	321-0318-00			RES., FXD, FILM: 20K OHM, 1%, 0.125W	91637	MFF1816G20001F
R128	311-1916-00			RES., VAR, NONWIR: 10K OHM, 10%, 0.50W	73138	72-197-0
R130	315-0202-00	XB020190		RES., FXD, CMPSN: 2K OHM, 5%, 0.25W (SPG1 ONLY)	01121	CB2025
R130	315-0202-00	XB021070		RES., FXD, CMPSN: 2K OHM, 5%, 0.25W (SPG2 ONLY)	01121	CB2025
R131	315-0472-00	XB010137	B019999X	RES., FXD, CMPSN: 4.7K OHM, 5%, 0.25W (SPG1 ONLY)	01121	CB4725
R131	315-0472-00	XB010331	B019999X	RES., FXD, CMPSN: 4.7K OHM, 5%, 0.25W (SPG2 ONLY)	01121	CB4725
R132	315-0150-00			RES., FXD, CMPSN: 15 OHM, 5%, 0.25W	01121	CB1505
R133	315-0150-00	B010100	B019999X	RES., FXD, CMPSN: 15 OHM, 5%, 0.25W	01121	CB1505
R134	315-0181-00			RES., FXD, CMPSN: 180 OHM, 5%, 0.25W	01121	CB1815
R135	315-0181-00	B010100	B019999	RES., FXD, CMPSN: 180 OHM, 5%, 0.25W	01121	CB1815
R135	315-0102-00	B020000		RES., FXD, CMPSN: 1K OHM, 5%, 0.25W	01121	CB1025
R136	315-0150-00			RES., FXD, CMPSN: 15 OHM, 5%, 0.25W	01121	CB1505
R137	315-0150-00	B010100	B019999X	RES., FXD, CMPSN: 15 OHM, 5%, 0.25W	01121	CB1505
R138	315-0181-00	B010100	B019999X	RES., FXD, CMPSN: 180 OHM, 5%, 0.25W	01121	CB1815
R139	315-0181-00	B010100	B029999X	RES., FXD, CMPSN: 180 OHM, 5%, 0.25W	01121	CB1815
R140	315-0102-00			RES., FXD, CMPSN: 1K OHM, 5%, 0.25W	01121	CB1025
R141	315-0102-00	XB010137	B019999	RES., FXD, CMPSN: 1K OHM, 5%, 0.25W (SPG1 ONLY)	01121	CB1025
R141	315-0102-00	XB010331	B019999	RES., FXD, CMPSN: 1K OHM, 5%, 0.25W (SPG2 ONLY)	01121	CB1025
R141	315-0472-00	B020000		RES., FXD, CMPSN: 4.7K OHM, 5%, 0.25W	01121	CB4725
R142	315-0393-00	B010100	B019999X	RES., FXD, CMPSN: 39K OHM, 5%, 0.25W (NOMINAL VALUE, SELECTED)	01121	CB3935
R143	315-0393-00	B010100	B019999X	RES., FXD, CMPSN: 39K OHM, 5%, 0.25W (NOMINAL VALUE, SELECTED)	01121	CB3935
R144	315-0470-00			RES., FXD, CMPSN: 47 OHM, 5%, 0.25W	01121	CB4705
R145	315-0470-00	B010100	B019999X	RES., FXD, CMPSN: 47 OHM, 5%, 0.25W	01121	CB4705
R146	321-0360-00	B010100	B010136	RES., FXD, FILM: 54.9K OHM, 1%, 0.125W (SPG1 ONLY)	91637	MFF1816G54901F
R146	321-0335-00	B010137	B019999	RES., FXD, FILM: 30.1K OHM, 1%, 0.125W (SPG1 ONLY)	91637	MFF1816G30101F
R146	321-0360-00	B010100	B010330	RES., FXD, FILM: 54.9K OHM, 1%, 0.125W (SPG2 ONLY)	91637	MFF1816G54901F
R146	321-0335-00	B010331	B019999	RES., FXD, FILM: 30.1K OHM, 1%, 0.125W (SPG2 ONLY)	91637	MFF1816G30101F

Replaceable Electrical Parts—SPG1/SPG2

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R146	321-0327-00	B020000		RES., FXD, FILM: 24.9K OHM, 1%, 0.125W	91637	MFF1816G24901F
R147	321-0289-00			RES., FXD, FILM: 10K OHM, 1%, 0.125W	91637	MFF1816G10001F
R148	311-1914-00			RES., VAR, NONWIR: TRMR, 50K OHM, 10%, 0.50W	73138	72-202-0
R149	311-1916-00	B010100	B019999	RES., VAR, NONWIR: 10K OHM, 10%, 0.50W	73138	72-197-0
R149	311-1917-00	B020000		RES., VAR, NONWIR: TRMR, 5K OHM, 10%, 0.5W	73138	72-198-0
R150	315-0100-00	B010100	B019999X	RES., FXD, CMPSN: 10 OHM, 5%, 0.25W	01121	CB1005
R151	315-0104-00			RES., FXD, CMPSN: 100K OHM, 5%, 0.25W	01121	CB1045
R152	315-0151-00			RES., FXD, CMPSN: 150 OHM, 5%, 0.25W	01121	CB1515
R153	315-0473-00			RES., FXD, CMPSN: 47K OHM, 5%, 0.25W	01121	CB4735
R154	315-0100-00			RES., FXD, CMPSN: 10 OHM, 5%, 0.25W	01121	CB1005
R155	315-0472-00			RES., FXD, CMPSN: 4.7K OHM, 5%, 0.25W	01121	CB4725
R156	315-0272-00	B010100	B010136	RES., FXD, CMPSN: 2.7K OHM, 5%, 0.25W (SPG1 ONLY)	01121	CB2725
R156	315-0202-00	B010137	B019999	RES., FXD, CMPSN: 2K OHM, 5%, 0.25W (SPG1 ONLY)	01121	CB2025
R156	315-0272-00	B010100	B010330	RES., FXD, CMPSN: 2.7K OHM, 5%, 0.25W (SPG2 ONLY)	01121	CB2725
R156	315-0202-00	B010331	B019999	RES., FXD, CMPSN: 2K OHM, 5%, 0.25W (SPG2 ONLY)	01121	CB2025
R156	315-0472-00	B020000		RES., FXD, CMPSN: 4.7K OHM, 5%, 0.25W	01121	CB4725
R157	315-0621-00			RES., FXD, CMPSN: 620 OHM, 5%, 0.25W	01121	CB6215
R158	315-0104-00			RES., FXD, CMPSN: 100K OHM, 5%, 0.25W	01121	CB1045
R159	315-0472-00			RES., FXD, CMPSN: 4.7K OHM, 5%, 0.25W	01121	CB4725
R160	315-0272-00	XB010137	B019999	RES., FXD, CMPSN: 2.7K OHM, 5%, 0.25W (SPG1 ONLY)	01121	CB2725
R160	315-0272-00	XB010331	B019999	RES., FXD, CMPSN: 2.7K OHM, 5%, 0.25W (SPG2 ONLY)	01121	CB2725
R160	315-0472-00	B020000		RES., FXD, CMPSN: 4.7K OHM, 5%, 0.25W	01121	CB4725
R161	315-0102-00	XB010137		RES., FXD, CMPSN: 1K OHM, 5%, 0.25W (SPG1 ONLY)	01121	CB1025
R161	315-0102-00	XB010331		RES., FXD, CMPSN: 1K OHM, 5%, 0.25W (SPG2 ONLY)	01121	CB1025
R162	315-0472-00	XB020000		RES., FXD, CMPSN: 4.7K OHM, 5%, 0.25W	01121	CB4725
R163	315-0102-00	XB020220		RES., FXD, CMPSN: 1K OHM, 5%, 0.25W (SPG1 ONLY)	01121	CB1025
R163	315-0102-00	XB021322		RES., FXD, CMPSN: 1K OHM, 5%, 0.25W (SPG2 ONLY)	01121	CB1025
R165	321-0335-00			RES., FXD, FILM: 30.1K OHM, 1%, 0.125W	91637	MFF1816G30101F
R166	315-0303-00			RES., FXD, CMPSN: 30K OHM, 5%, 0.25W	01121	CB3035
R167	315-0100-00	B010100	B010136	RES., FXD, CMPSN: 10 OHM, 5%, 0.25W (SPG1 ONLY)	01121	CB1005
R167	315-0272-00	B010137		RES., FXD, CMPSN: 2.7K OHM, 5%, 0.25W (SPG1 ONLY)	01121	CB2725
R167	315-0100-00	B010100	B010330	RES., FXD, CMPSN: 10 OHM, 5%, 0.25W (SPG2 ONLY)	01121	CB1005
R167	315-0272-00	B010331		RES., FXD, CMPSN: 2.7K OHM, 5%, 0.25W (SPG2 ONLY)	01121	CB2725
R169	311-1914-00			RES., VAR, NONWIR: TRMR, 50K OHM, 10%, 0.50W	73138	72-202-0
R175	311-1750-00			RES., VAR, NONWIR: 10K OHM, 10%, 0.75W	32997	3009P-T29-103
R180	315-0102-00			RES., FXD, CMPSN: 1K OHM, 5%, 0.25W	01121	CB1025
R188	321-0193-00			RES., FXD, FILM: 1K OHM, 1%, 0.125W	91637	MFF1816G10000F
R189	311-1918-00			RES., VAR, NONWIR: 2K OHM, 10%, 0.50W	73138	72-199-0
R190	315-0512-00			RES., FXD, CMPSN: 5.1K OHM, 5%, 0.25W	01121	CB5125
R196	321-0164-00			RES., FXD, FILM: 499 OHM, 1%, 0.125W	91637	MFF1816G499R0F
R197	315-0104-00			RES., FXD, CMPSN: 100K OHM, 5%, 0.25W	01121	CB1045
R198	311-1919-00			RES., VAR, NONWIR: TRMR, 1K OHM, 10%, 0.50W	32997	3386C-T07-102
R199	311-1919-00			RES., VAR, NONWIR: TRMR, 1K OHM, 10%, 0.50W	32997	3386C-T07-102

Replaceable Electrical Parts—SPG1/SPG2

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R202	321-0222-00			RES.,FXD,FILM:2K OHM,1%,0.125W	91637	MFF1816G20000F
R204	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R207	321-0251-00			RES.,FXD,FILM:4.02K OHM,1%,0.125W	91637	MFF1816G40200F
R208	311-1916-00			RES.,VAR,NONWIR:10K OHM,10%,0.50W	73138	72-197-0
R209	311-1918-00			RES.,VAR,NONWIR:2K OHM,10%,0.50W	73138	72-199-0
R210	315-0473-00			RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
R211	315-0224-00			RES.,FXD,CMPSN:220K OHM,5%,0.25W	01121	CB2245
R214	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R215	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R216	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R217	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R218	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R219	311-1915-00			RES.,VAR,NONWIR:20K OHM,10%,0.50W	73138	72-196-0
R225	315-0622-00			RES.,FXD,CMPSN:6.2K OHM,5%,0.25W	01121	CB6225
R226	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R227	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R244	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R250	315-0473-00			RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
R251	315-0473-00			RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
R252	315-0226-00			RES.,FXD,CMPSN:22M OHM,5%,0.25W	01121	CB2265
R253	315-0332-00			RES.,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R254	315-0105-00			RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB1055
R260	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R261	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R262	315-0242-00			RES.,FXD,CMPSN:2.4K OHM,5%,0.25W	01121	CB2425
R263	315-0123-00			RES.,FXD,CMPSN:12K OHM,5%,0.25W	01121	CB1235
R264	315-0432-00			RES.,FXD,CMPSN:4.3K OHM,5%,0.25W	01121	CB4325
R265	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R269	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R270	321-0298-00			RES.,FXD,FILM:12.4K OHM,1%,0.125W	91637	MFF1816G12401F
R271	315-0242-00			RES.,FXD,CMPSN:2.4K OHM,5%,0.25W	01121	CB2425
R272	315-0221-00			RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
R273	321-0270-00			RES.,FXD,FILM:6.34K OHM,1%,0.125W	91637	MFF1816G63400F
R274	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R275	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R276	311-1915-00			RES.,VAR,NONWIR:20K OHM,10%,0.50W	73138	72-196-0
R277	315-0472-00	B010100	B010136X	RES.,FXD,CMPSN:4.7K OHM,5%,0.25W (SPG1 ONLY)	01121	CB4725
R277	315-0472-00	B010100	B010559X	RES.,FXD,CMPSN:4.7K OHM,5%,0.25W (SPG2 ONLY)	01121	CB4725
R280	315-0221-00			RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
R281	315-0105-00			RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB1055
R282	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R283	315-0332-00			RES.,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R284	321-0222-00			RES.,FXD,FILM:2K OHM,1%,0.125W	91637	MFF1816G20000F
R285	321-0335-00			RES.,FXD,FILM:30.1K OHM,1%,0.125W	91637	MFF1816G30101F
R290	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R291	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R293	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R294	315-0224-00			RES.,FXD,CMPSN:220K OHM,5%,0.25W	01121	CB2245
R295	315-0226-00			RES.,FXD,CMPSN:22M OHM,5%,0.25W	01121	CB2265
R296	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R298	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R300	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R304	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R305	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R306	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025

Replaceable Electrical Parts—SPG1/SPG2

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R307	315-0105-00			RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB1055
R308	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R310	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R312	321-0298-00			RES.,FXD,FILM:12.4K OHM,1%,0.125W	91637	MFF1816G12401F
R313	321-0222-00			RES.,FXD,FILM:2K OHM,1%,0.125W	91637	MFF1816G20000F
R314	315-0242-00			RES.,FXD,CMPSN:2.4K OHM,5%,0.25W	01121	CB2425
R315	321-0231-00			RES.,FXD,FILM:2.49K OHM,1%,0.125W	91637	MFF1816G24900F
R316	321-0298-00			RES.,FXD,FILM:12.4K OHM,1%,0.125W	91637	MFF1816G12401F
R317	321-0270-00			RES.,FXD,FILM:6.34K OHM,1%,0.125W	91637	MFF1816G63400F
R324	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R326	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R327	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R328	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R329	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R334	315-0301-00			RES.,FXD,CMPSN:300 OHM,5%,0.25W	01121	CB3015
R335	321-0318-00			RES.,FXD,FILM:20K OHM,1%,0.125W	91637	MFF1816G20001F
R336	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R338	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R339	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R362	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R364	315-0270-00			RES.,FXD,CMPSN:27 OHM,5%,0.25W	01121	CB2705
R365	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R366	315-0270-00			RES.,FXD,CMPSN:27 OHM,5%,0.25W	01121	CB2705
R372	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R373	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R374	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R375	315-0301-00			RES.,FXD,CMPSN:300 OHM,5%,0.25W	01121	CB3015
R376	315-0270-00			RES.,FXD,CMPSN:27 OHM,5%,0.25W	01121	CB2705
R377	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R378	315-0301-00			RES.,FXD,CMPSN:300 OHM,5%,0.25W	01121	CB3015
R379	315-0270-00			RES.,FXD,CMPSN:27 OHM,5%,0.25W	01121	CB2705
R382	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R384	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R387	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R388	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R389	315-0301-00			RES.,FXD,CMPSN:300 OHM,5%,0.25W	01121	CB3015
R390	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R391	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R392	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R395	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R396	321-0393-00			RES.,FXD,FILM:121K OHM,1%,0.125W	91637	MFF1816G12102F
R397	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R398	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R400	315-0224-00			RES.,FXD,CMPSN:220K OHM,5%,0.25W	01121	CB2245
R401	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R402	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R403	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R404	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R405	321-0259-00			RES.,FXD,FILM:4.87K OHM,1%,0.125W	91637	MFF1816G48700F
R406	315-0753-00			RES.,FXD,CMPSN:75K OHM,5%,0.25W	01121	CB7535
R407	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R408	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R409	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R410	321-0338-00			RES.,FXD,FILM:32.4K OHM,1%,0.125W	91637	MFF1816G32401F
R411	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R412	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R413	321-0331-00			RES.,FXD,FILM:27.4K OHM,1%,0.125W	91637	MFF1816G27401F

Replaceable Electrical Parts—SPG1/SPG2

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R414	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R416	321-0426-00			RES.,FXD,FILM:267K OHM,1%,0.125W	91637	MFF1816G26702F
R420	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R425	315-0104-00	B010100	B010139	RES.,FXD,CMPSN:100K OHM,5%,0.25W (SPG1 ONLY)	01121	CB1045
R425	315-0204-00	B010140		RES.,FXD,CMPSN:200K OHM,5%,0.25W (SPG1 ONLY)	01121	CB2045
R425	315-0104-00	B010100	B010579	RES.,FXD,CMPSN:100K OHM,5%,0.25W (SPG2 ONLY)	01121	CB1045
R425	315-0204-00	B010580		RES.,FXD,CMPSN:200K OHM,5%,0.25W (SPG2 ONLY)	01121	CB2045
R426	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R427	315-0102-00	B010100	B010139	RES.,FXD,CMPSN:1K OHM,5%,0.25W (SPG1 ONLY)	01121	CB1025
R427	315-0202-00	B010140		RES.,FXD,CMPSN:2K OHM,5%,0.25W (SPG1 ONLY)	01121	CB2025
R427	315-0102-00	B010100	B010579	RES.,FXD,CMPSN:1K OHM,5%,0.25W (SPG2 ONLY)	01121	CB1025
R427	315-0202-00	B010580		RES.,FXD,CMPSN:2K OHM,5%,0.25W (SPG2 ONLY)	01121	CB2025
R428	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R429	315-0473-00	XB010140		RES.,FXD,CMPSN:47K OHM,5%,0.25W (SPG1 ONLY)	01121	CB4735
R429	315-0473-00	XB010580		RES.,FXD,CMPSN:47K OHM,5%,0.25W (SPG2 ONLY)	01121	CB4735
R437	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R438	315-0270-00			RES.,FXD,CMPSN:27 OHM,5%,0.25W	01121	CB2705
R439	315-0270-00			RES.,FXD,CMPSN:27 OHM,5%,0.25W	01121	CB2705
R446	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R447	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R450	315-0622-00			RES.,FXD,CMPSN:6.2K OHM,5%,0.25W (R450 SPG2 ONLY)	01121	CB6225
R451	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W (R451 SPG2 ONLY)	01121	CB1525
R453	315-0753-00			RES.,FXD,CMPSN:75K OHM,5%,0.25W (R453 SPG2 ONLY)	01121	CB7535
R456	311-1338-00			RES.,VAR,NONWIR:20K OHM,10%,0.50W (R456 SPG2 ONLY)	73138	89-130-1
R459	315-0243-00			RES.,FXD,CMPSN:24K OHM,5%,0.25W (R459 SPG2 ONLY)	01121	CB2435
R465	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W (R465 SPG2 ONLY)	01121	CB1535
R467	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W (R467 SPG2 ONLY)	01121	CB1025
R468	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W (R468 SPG2 ONLY)	01121	CB1035
R469	315-0751-00			RES.,FXD,CMPSN:750 OHM,5%,0.25W (R469 SPG2 ONLY)	01121	CB7515
R471	315-0474-00			RES.,FXD,CMPSN:470K OHM,5%,0.25W (R471 SPG2 ONLY)	01121	CB4745
R472	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W (R472 SPG2 ONLY)	01121	CB2725
R474	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W (R474 SPG2 ONLY)	01121	CB2025
R476	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W (R476 SPG2 ONLY)	01121	CB1025
R477	315-0473-00			RES.,FXD,CMPSN:47K OHM,5%,0.25W (R477 SPG2 ONLY)	01121	CB4735

Replaceable Electrical Parts—SPG1/SPG2

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R478	315-0123-00 ----- -----			RES., FXD, CMPSN: 12K OHM, 5%, 0.25W (R478 SPG2 ONLY)	01121	CB1235
R479	315-0243-00 ----- -----			RES., FXD, CMPSN: 24K OHM, 5%, 0.25W (R479 SPG2 ONLY)	01121	CB2435
R480	315-0103-00 ----- -----			RES., FXD, CMPSN: 10K OHM, 5%, 0.25W (R480 SPG2 ONLY)	01121	CB1035
R481	315-0104-00 ----- -----			RES., FXD, CMPSN: 100K OHM, 5%, 0.25W (R481 SPG2 ONLY)	01121	CB1045
R483	315-0472-00 ----- -----			RES., FXD, CMPSN: 4.7K OHM, 5%, 0.25W (R483 SPG2 ONLY)	01121	CB4725
R484	315-0103-00 ----- -----			RES., FXD, CMPSN: 10K OHM, 5%, 0.25W (R484 SPG2 ONLY)	01121	CB1035
R486	315-0103-00 ----- -----			RES., FXD, CMPSN: 10K OHM, 5%, 0.25W (R486 SPG2 ONLY)	01121	CB1035
R487	315-0104-00 ----- -----			RES., FXD, CMPSN: 100K OHM, 5%, 0.25W (R487 SPG2 ONLY)	01121	CB1045
R488	315-0105-00 ----- -----			RES., FXD, CMPSN: 1M OHM, 5%, 0.25W (R488 SPG2 ONLY)	01121	CB1055
R490	315-0513-00 ----- -----			RES., FXD, CMPSN: 51K OHM, 5%, 0.25W (R490 SPG2 ONLY)	01121	CB5135
R491	315-0474-00 ----- -----			RES., FXD, CMPSN: 470K OHM, 5%, 0.25W (R491 SPG2 ONLY)	01121	CB4745
R492	315-0101-00 ----- -----	XB010135		RES., FXD, CMPSN: 100 OHM, 5%, 0.25W (R492 SPG2 ONLY)	01121	CB1015
R493	315-0103-00 ----- -----			RES., FXD, CMPSN: 10K OHM, 5%, 0.25W (R493 SPG2 ONLY)	01121	CB1035
R520	315-0103-00 ----- -----			RES., FXD, CMPSN: 10K OHM, 5%, 0.25W (R520 SPG2 ONLY)	01121	CB1035
R521	315-0473-00 ----- -----			RES., FXD, CMPSN: 47K OHM, 5%, 0.25W (R521 SPG2 ONLY)	01121	CB4735
R532	315-0473-00 ----- -----			RES., FXD, CMPSN: 47K OHM, 5%, 0.25W (R532 SPG2 ONLY)	01121	CB4735
R537	315-0101-00 ----- -----			RES., FXD, CMPSN: 100 OHM, 5%, 0.25W (R537 SPG2 ONLY)	01121	CB1015
R539	315-0181-00 ----- -----			RES., FXD, CMPSN: 180 OHM, 5%, 0.25W (R539 SPG2 ONLY)	01121	CB1815
R543	315-0471-00 ----- -----			RES., FXD, CMPSN: 470 OHM, 5%, 0.25W (R543 SPG2 ONLY)	01121	CB4715
R544	315-0102-00 ----- -----			RES., FXD, CMPSN: 1K OHM, 5%, 0.25W (R544 SPG2 ONLY)	01121	CB1025
R545	315-0102-00 ----- -----			RES., FXD, CMPSN: 1K OHM, 5%, 0.25W (R545 SPG2 ONLY)	01121	CB1025
R546	315-0104-00 ----- -----			RES., FXD, CMPSN: 100K OHM, 5%, 0.25W (R546 SPG2 ONLY)	01121	CB1045
R549	315-0104-00 ----- -----			RES., FXD, CMPSN: 100K OHM, 5%, 0.25W (R549 SPG2 ONLY)	01121	CB1045
R550	315-0333-00 ----- -----			RES., FXD, CMPSN: 33K OHM, 5%, 0.25W (R550 SPG2 ONLY)	01121	CB3335
R552	315-0474-00 ----- -----			RES., FXD, CMPSN: 470K OHM, 5%, 0.25W (R552 SPG2 ONLY)	01121	CB4745
R554	315-0102-00 ----- -----			RES., FXD, CMPSN: 1K OHM, 5%, 0.25W (R554 SPG2 ONLY)	01121	CB1025
R556	315-0104-00 ----- -----			RES., FXD, CMPSN: 100K OHM, 5%, 0.25W (R556 SPG2 ONLY)	01121	CB1045
R560	315-0153-00 ----- -----			RES., FXD, CMPSN: 15K OHM, 5%, 0.25W (R560 SPG2 ONLY)	01121	CB1535

Replaceable Electrical Parts—SPG1/SPG2

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R562	315-0512-00			RES., FXD, CMPSN: 5.1K OHM, 5%, 0.25W (R562 SPG2 ONLY)	01121	CB5125
R564	315-0153-00			RES., FXD, CMPSN: 15K OHM, 5%, 0.25W (R564 SPG2 ONLY)	01121	CB1535
R565	315-0474-00			RES., FXD, CMPSN: 470K OHM, 5%, 0.25W (R565 SPG2 ONLY)	01121	CB4745
R566	315-0105-00			RES., FXD, CMPSN: 1M OHM, 5%, 0.25W (R566 SPG2 ONLY)	01121	CB1055
R567	315-0103-00			RES., FXD, CMPSN: 10K OHM, 5%, 0.25W (R567 SPG2 ONLY)	01121	CB1035
R568	315-0332-00			RES., FXD, CMPSN: 3.3K OHM, 5%, 0.25W (R568 SPG2 ONLY)	01121	CB3325
R569	315-0822-00			RES., FXD, CMPSN: 8.2K OHM, 5%, 0.25W (R569 SPG2 ONLY)	01121	CB8225
R570	315-0102-00			RES., FXD, CMPSN: 1K OHM, 5%, 0.25W (R570 SPG2 ONLY)	01121	CB1025
R571	315-0104-00			RES., FXD, CMPSN: 100K OHM, 5%, 0.25W (R571 SPG2 ONLY)	01121	CB1045
R573	315-0472-00			RES., FXD, CMPSN: 4.7K OHM, 5%, 0.25W (R573 SPG2 ONLY)	01121	CB4725
R574	315-0822-00			RES., FXD, CMPSN: 8.2K OHM, 5%, 0.25W (R574 SPG2 ONLY)	01121	CB8225
R575	315-0104-00			RES., FXD, CMPSN: 100K OHM, 5%, 0.25W (R575 SPG2 ONLY)	01121	CB1045
R576	315-0472-00			RES., FXD, CMPSN: 4.7K OHM, 5%, 0.25W (R576 SPG2 ONLY)	01121	CB4725
R577	315-0822-00			RES., FXD, CMPSN: 8.2K OHM, 5%, 0.25W (R577 SPG2 ONLY)	01121	CB8225
R578	315-0362-00			RES., FXD, CMPSN: 3.6K OHM, 5%, 0.25W (R578 SPG2 ONLY)	01121	CB3625
R579	315-0153-00			RES., FXD, CMPSN: 15K OHM, 5%, 0.25W (R579 SPG2 ONLY)	01121	CB1535
R582	315-0332-00			RES., FXD, CMPSN: 3.3K OHM, 5%, 0.25W (R582 SPG2 ONLY)	01121	CB3325
R583	315-0362-00			RES., FXD, CMPSN: 3.6K OHM, 5%, 0.25W (R583 SPG2 ONLY)	01121	CB3625
R584	315-0153-00			RES., FXD, CMPSN: 15K OHM, 5%, 0.25W (R584 SPG2 ONLY)	01121	CB1535
R585	315-0332-00			RES., FXD, CMPSN: 3.3K OHM, 5%, 0.25W (R585 SPG2 ONLY)	01121	CB3325
R586	315-0362-00			RES., FXD, CMPSN: 3.6K OHM, 5%, 0.25W (R586 SPG2 ONLY)	01121	CB3625
R587	315-0153-00			RES., FXD, CMPSN: 15K OHM, 5%, 0.25W (R587 SPG2 ONLY)	01121	CB1535
R588	315-0361-00			RES., FXD, CMPSN: 360 OHM, 5%, 0.25W (R588 SPG2 ONLY)	01121	CB3615
R594	315-0202-00			RES., FXD, CMPSN: 2K OHM, 5%, 0.25W (R594 SPG2 ONLY)	01121	CB2025
R595	315-0361-00			RES., FXD, CMPSN: 360 OHM, 5%, 0.25W (R595 SPG2 ONLY)	01121	CB3615
R602	315-0102-00			RES., FXD, CMPSN: 1K OHM, 5%, 0.25W (R602 SPG2 ONLY)	01121	CB1025
R603	315-0361-00			RES., FXD, CMPSN: 360 OHM, 5%, 0.25W (R603 SPG2 ONLY)	01121	CB3615
R607	315-0182-00			RES., FXD, CMPSN: 1.8K OHM, 5%, 0.25W (R607 SPG2 ONLY)	01121	CB1825
R608	315-0101-00			RES., FXD, CMPSN: 100 OHM, 5%, 0.25W (R608 SPG2 ONLY)	01121	CB1015

Replaceable Electrical Parts—SPG1/SPG2

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R609	315-0102-00			RES., FXD, CMPSN: 1K OHM, 5%, 0.25W (R609 SPG2 ONLY)	01121	CB1025
R610	315-0102-00			RES., FXD, CMPSN: 1K OHM, 5%, 0.25W (R610 SPG2 ONLY)	01121	CB1025
R615	315-0182-00			RES., FXD, CMPSN: 1.8K OHM, 5%, 0.25W (R615 SPG2 ONLY)	01121	CB1825
R616	315-0182-00			RES., FXD, CMPSN: 1.8K OHM, 5%, 0.25W (R616 SPG2 ONLY)	01121	CB1825
R617	315-0101-00			RES., FXD, CMPSN: 100 OHM, 5%, 0.25W (R617 SPG2 ONLY)	01121	CB1015
R621	315-0822-00			RES., FXD, CMPSN: 8.2K OHM, 5%, 0.25W (R621 SPG2 ONLY)	01121	CB8225
R622	315-0101-00			RES., FXD, CMPSN: 100 OHM, 5%, 0.25W (R622 SPG2 ONLY)	01121	CB1015
R623	315-0682-00			RES., FXD, CMPSN: 6.8K OHM, 5%, 0.25W (R623 SPG2 ONLY)	01121	CB6825
R624	315-0103-00			RES., FXD, CMPSN: 10K OHM, 5%, 0.25W (R624 SPG2 ONLY)	01121	CB1035
R625	315-0103-00			RES., FXD, CMPSN: 10K OHM, 5%, 0.25W (R625 SPG2 ONLY)	01121	CB1035
R629	315-0101-00			RES., FXD, CMPSN: 100 OHM, 5%, 0.25W (R629 SPG2 ONLY)	01121	CB1015
R633	315-0470-00			RES., FXD, CMPSN: 47 OHM, 5%, 0.25W (R633 SPG2 ONLY)	01121	CB4705
R634	315-0471-00			RES., FXD, CMPSN: 470 OHM, 5%, 0.25W (R634 SPG2 ONLY)	01121	CB4715
R635	315-0101-00			RES., FXD, CMPSN: 100 OHM, 5%, 0.25W (R635 SPG2 ONLY)	01121	CB1015
R636	315-0102-00			RES., FXD, CMPSN: 1K OHM, 5%, 0.25W (R636 SPG2 ONLY)	01121	CB1025
R637	315-0101-00			RES., FXD, CMPSN: 100 OHM, 5%, 0.25W (R637 SPG2 ONLY)	01121	CB1015
R639	315-0103-00			RES., FXD, CMPSN: 10K OHM, 5%, 0.25W (R639 SPG2 ONLY)	01121	CB1035
R641	315-0102-00			RES., FXD, CMPSN: 1K OHM, 5%, 0.25W (R641 SPG2 ONLY)	01121	CB1025
R642	315-0470-00			RES., FXD, CMPSN: 47 OHM, 5%, 0.25W (R642 SPG2 ONLY)	01121	CB4705
R643	315-0101-00			RES., FXD, CMPSN: 100 OHM, 5%, 0.25W (R643 SPG2 ONLY)	01121	CB1015
R646	315-0101-00			RES., FXD, CMPSN: 100 OHM, 5%, 0.25W (R646 SPG2 ONLY)	01121	CB1015
R649	315-0102-00			RES., FXD, CMPSN: 1K OHM, 5%, 0.25W (R649 SPG2 ONLY)	01121	CB1025
R654	315-0102-00			RES., FXD, CMPSN: 1K OHM, 5%, 0.25W (R654 SPG2 ONLY)	01121	CB1025
R655	315-0471-00			RES., FXD, CMPSN: 470 OHM, 5%, 0.25W (R655 SPG2 ONLY)	01121	CB4715
R656	315-0470-00			RES., FXD, CMPSN: 47 OHM, 5%, 0.25W (R656 SPG2 ONLY)	01121	CB4705
R657	315-0471-00			RES., FXD, CMPSN: 470 OHM, 5%, 0.25W (R657 SPG2 ONLY)	01121	CB4715
R658	315-0470-00			RES., FXD, CMPSN: 47 OHM, 5%, 0.25W (R658 SPG2 ONLY)	01121	CB4705
R659	315-0471-00			RES., FXD, CMPSN: 470 OHM, 5%, 0.25W (R659 SPG2 ONLY)	01121	CB4715

Replaceable Electrical Parts—SPG1/SPG2

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R660	315-0333-00 -----			RES., FXD, CMPSN: 33K OHM, 5%, 0.25W (R660 SPG2 ONLY)	01121	CB3335
R663	315-0102-00 -----			RES., FXD, CMPSN: 1K OHM, 5%, 0.25W (R663 SPG2 ONLY)	01121	CB1025
R665	315-0153-00 -----			RES., FXD, CMPSN: 15K OHM, 5%, 0.25W (R665 SPG2 ONLY)	01121	CB1535
R666	315-0472-00 -----	B010100	B010134	RES., FXD, CMPSN: 4.7K OHM, 5%, 0.25W (R666 SPG2 ONLY)	01121	CB4725
R666	315-0472-00 -----	B010135		RES., FXD, CMPSN: 4.7K OHM, 5%, 0.25W (SPG2 ONLY. NOMINAL VALUE, SELECTED)	01121	CB4725
R668	315-0471-00 -----			RES., FXD, CMPSN: 470 OHM, 5%, 0.25W (R668 SPG2 ONLY)	01121	CB4715
R672	315-0153-00 -----			RES., FXD, CMPSN: 15K OHM, 5%, 0.25W (R672 SPG2 ONLY)	01121	CB1535
R673	315-0333-00 -----			RES., FXD, CMPSN: 33K OHM, 5%, 0.25W (R673 SPG2 ONLY)	01121	CB3335
R674	321-0349-00 -----			RES., FXD, FILM: 4.2.2K OHM, 1%, 0.125W (R674 SPG2 ONLY)	91637	MFF1816G42201F
R675	315-0752-00 -----			RES., FXD, CMPSN: 7.5K OHM, 5%, 0.25W (R675 SPG2 ONLY)	01121	CB7525
R676	315-0105-00 -----			RES., FXD, CMPSN: 1M OHM, 5%, 0.25W (R676 SPG2 ONLY)	01121	CB1055
R680	315-0472-00 -----			RES., FXD, CMPSN: 4.7K OHM, 5%, 0.25W (R680 SPG2 ONLY)	01121	CB4725
R683	315-0432-00 -----			RES., FXD, CMPSN: 4.3K OHM, 5%, 0.25W (R683 SPG2 ONLY)	01121	CB4325
R684	315-0103-00 -----	B010100	B010199	RES., FXD, CMPSN: 10K OHM, 5%, 0.25W (R684 SPG2 ONLY)	01121	CB1035
R684	315-0822-00 -----	B010200		RES., FXD, CMPSN: 8.2K OHM, 5%, 0.25W (R684 SPG2 ONLY)	01121	CB8225
R689	315-0471-00 -----			RES., FXD, CMPSN: 470 OHM, 5%, 0.25W (R689 SPG2 ONLY)	01121	CB4715
R693	315-0473-00 -----			RES., FXD, CMPSN: 47K OHM, 5%, 0.25W (R693 SPG2 ONLY)	01121	CB4735
R698	315-0332-00 -----			RES., FXD, CMPSN: 3.3K OHM, 5%, 0.25W (R698 SPG2 ONLY)	01121	CB3325
R699	315-0153-00 -----			RES., FXD, CMPSN: 15K OHM, 5%, 0.25W (R699 SPG2 ONLY)	01121	CB1535
R703	321-0327-00 -----			RES., FXD, FILM: 24.9K OHM, 1%, 0.125W (R703 SPG2 ONLY)	91637	MFF1816G24901F
R704	321-0452-00 -----			RES., FXD, FILM: 499K OHM, 1%, 0.125W (R704 SPG2 ONLY)	91637	MFF1816G49902F
R707	311-1916-00 -----			RES., VAR, NONWIR: 10K OHM, 10%, 0.50W (R707 SPG2 ONLY)	73138	72-197-0
R709	315-0752-00 -----			RES., FXD, CMPSN: 7.5K OHM, 5%, 0.25W (R709 SPG2 ONLY)	01121	CB7525
R715	315-0153-00 -----			RES., FXD, CMPSN: 15K OHM, 5%, 0.25W (R715 SPG2 ONLY)	01121	CB1535
R716	315-0332-00 -----			RES., FXD, CMPSN: 3.3K OHM, 5%, 0.25W (R716 SPG2 ONLY)	01121	CB3325
R718	315-0472-00 -----	B010100	B010134	RES., FXD, CMPSN: 4.7K OHM, 5%, 0.25W (R718 SPG2 ONLY)	01121	CB4725
R718	315-0472-00 -----	B010135		RES., FXD, CMPSN: 4.7K OHM, 5%, 0.25W (SPG2 ONLY. NOMINAL VALUE, SELECTED)	01121	CB4725
R723	315-0391-00 -----			RES., FXD, CMPSN: 390 OHM, 5%, 0.25W (R723 SPG2 ONLY)	01121	CB3915
R724	315-0752-00 -----			RES., FXD, CMPSN: 7.5K OHM, 5%, 0.25W (R724 SPG2 ONLY)	01121	CB7525

Replaceable Electrical Parts—SPG1/SPG2

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R725	315-0752-00 -----			RES., FXD, CMPSN: 7.5K OHM, 5%, 0.25W (R725 SPG2 ONLY)	01121	CB7525
R726	315-0471-00 -----			RES., FXD, CMPSN: 470 OHM, 5%, 0.25W (R726 SPG2 ONLY)	01121	CB4715
R733	315-0430-00 -----			RES., FXD, CMPSN: 43 OHM, 5%, 0.25W (R733 SPG2 ONLY)	01121	CB4305
R736	315-0752-00 -----			RES., FXD, CMPSN: 7.5K OHM, 5%, 0.25W (R736 SPG2 ONLY)	01121	CB7525
R738	315-0153-00 -----			RES., FXD, CMPSN: 15K OHM, 5%, 0.25W (R738 SPG2 ONLY)	01121	CB1535
R739	315-0103-00 -----			RES., FXD, CMPSN: 10K OHM, 5%, 0.25W (R739 SPG2 ONLY)	01121	CB1035
R749	311-1916-00 -----			RES., VAR, NONWIR: 10K OHM, 10%, 0.50W (R749 SPG2 ONLY)	73138	72-197-0
R755	315-0103-00			RES., FXD, CMPSN: 10K OHM, 5%, 0.25W	01121	CB1035
R756	315-0331-00			RES., FXD, CMPSN: 330 OHM, 5%, 0.25W	01121	CB3315
R757	315-0472-00			RES., FXD, CMPSN: 4.7K OHM, 5%, 0.25W	01121	CB4725
R758	315-0102-00			RES., FXD, CMPSN: 1K OHM, 5%, 0.25W	01121	CB1025
R765	315-0470-00			RES., FXD, CMPSN: 47 OHM, 5%, 0.25W	01121	CB4705
R767	321-0301-00			RES., FXD, FILM: 13.3K OHM, 1%, 0.125W	91637	MFF1816G13301F
R768	315-0470-00			RES., FXD, CMPSN: 47 OHM, 5%, 0.25W	01121	CB4705
R775	321-0293-00			RES., FXD, FILM: 11K OHM, 1%, 0.125W	91637	MFF1816G11001F
R776	315-0182-00			RES., FXD, CMPSN: 1.8K OHM, 5%, 0.25W	01121	CB1825
R777	321-0251-00			RES., FXD, FILM: 4.02K OHM, 1%, 0.125W	91637	MFF1816G40200F
R784	315-0472-00			RES., FXD, CMPSN: 4.7K OHM, 5%, 0.25W	01121	CB4725
R785	321-0235-00			RES., FXD, FILM: 2.74K OHM, 1%, 0.125W	91637	MFF1816G27400F
R786	308-0243-00 -----			RES., FXD, WW: 240 OHM, 5%, 3W (SPG1 ONLY)	91637	CW2BB240R0J
R786	308-0299-00 -----	B010100	B010134	RES., FXD, WW: 300 OHM, 1%, 3W (SPG2 ONLY)	01686	T2A-300R-F-10
R786	308-0243-00 -----	B010135		RES., FXD, WW: 240 OHM, 5%, 3W (SPG2 ONLY)	91637	CW2BB240R0J
R787	321-0235-00			RES., FXD, FILM: 2.74K OHM, 1%, 0.125W	91637	MFF1816G27400F
R788	321-0277-00			RES., FXD, FILM: 7.5K OHM, 1%, 0.125W	91637	MFF1816G75000F
R789	322-0085-00			RES., FXD, FILM: 75 OHM, 1%, 0.25W	75042	CEBT0-75R00F
R791	315-0100-00			RES., FXD, CMPSN: 10 OHM, 5%, 0.25W	01121	CB1005
R796	315-0472-00			RES., FXD, CMPSN: 4.7K OHM, 5%, 0.25W	01121	CB4725
R797	321-0085-00			RES., FXD, FILM: 75 OHM, 1%, 0.125W	91637	MFF1816G75R00F
R798	322-0085-00			RES., FXD, FILM: 75 OHM, 1%, 0.25W	75042	CEBT0-75R00F
R800	311-1916-00			RES., VAR, NONWIR: 10K OHM, 10%, 0.50W	73138	72-197-0
R801	321-0085-00			RES., FXD, FILM: 75 OHM, 1%, 0.125W	91637	MFF1816G75R00F
R802	322-0085-00			RES., FXD, FILM: 75 OHM, 1%, 0.25W	75042	CEBT0-75R00F
R803	322-0085-00			RES., FXD, FILM: 75 OHM, 1%, 0.25W	75042	CEBT0-75R00F
R804	322-0085-00			RES., FXD, FILM: 75 OHM, 1%, 0.25W	75042	CEBT0-75R00F
R805	322-0085-00			RES., FXD, FILM: 75 OHM, 1%, 0.25W	75042	CEBT0-75R00F
R806	322-0085-00			RES., FXD, FILM: 75 OHM, 1%, 0.25W	75042	CEBT0-75R00F
R807	322-0085-00			RES., FXD, FILM: 75 OHM, 1%, 0.25W	75042	CEBT0-75R00F
R810	321-0222-00			RES., FXD, FILM: 2K OHM, 1%, 0.125W	91637	MFF1816G20000F
R812	315-0472-00			RES., FXD, CMPSN: 4.7K OHM, 5%, 0.25W	01121	CB4725
R816	321-0274-00			RES., FXD, FILM: 6.98K OHM, 1%, 0.125W	91637	MFF1816G69800F
R818	321-0280-00			RES., FXD, FILM: 8.06K OHM, 1%, 0.125W	91637	MFF1816G80600F
R820	321-0318-00			RES., FXD, FILM: 20K OHM, 1%, 0.125W	91637	MFF1816G20001F
R821	311-1916-00			RES., VAR, NONWIR: 10K OHM, 10%, 0.50W	73138	72-197-0
R823	321-0280-00			RES., FXD, FILM: 8.06K OHM, 1%, 0.125W	91637	MFF1816G80600F
R824	321-0274-00			RES., FXD, FILM: 6.98K OHM, 1%, 0.125W	91637	MFF1816G69800F
R825	315-0100-00			RES., FXD, CMPSN: 10 OHM, 5%, 0.25W	01121	CB1005

Replaceable Electrical Parts—SPG1/SPG2

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R833	315-0100-00			RES., FXD, CMPSN: 10 OHM, 5%, 0.25W	01121	CB1005
R834	322-0085-00			RES., FXD, FILM: 75 OHM, 1%, 0.25W	75042	CEBTO-75R00F
R835	322-0085-00			RES., FXD, FILM: 75 OHM, 1%, 0.25W	75042	CEBTO-75R00F
R838	315-0100-00			RES., FXD, CMPSN: 10 OHM, 5%, 0.25W	01121	CB1005
R839	315-0100-00			RES., FXD, CMPSN: 10 OHM, 5%, 0.25W	01121	CB1005
R842	322-0085-00			RES., FXD, FILM: 75 OHM, 1%, 0.25W	75042	CEBTO-75R00F
R843	322-0085-00			RES., FXD, FILM: 75 OHM, 1%, 0.25W	75042	CEBTO-75R00F
R844	322-0085-00			RES., FXD, FILM: 75 OHM, 1%, 0.25W	75042	CEBTO-75R00F
R845	322-0085-00			RES., FXD, FILM: 75 OHM, 1%, 0.25W	75042	CEBTO-75R00F
R850	315-0103-00	XB020211		RES., FXD, CMPSN: 10K OHM, 5%, 0.25W (SPG1 ONLY)	01121	CB1035
R850	315-0103-00	XB021237		RES., FXD, CMPSN: 10K OHM, 5%, 0.25W (SPG2 ONLY)	01121	CB1035
R852	315-0751-00			RES., FXD, CMPSN: 750 OHM, 5%, 0.25W	01121	CB7515
R854	315-0103-00			RES., FXD, CMPSN: 10K OHM, 5%, 0.25W	01121	CB1035
R855	315-0103-00			RES., FXD, CMPSN: 10K OHM, 5%, 0.25W	01121	CB1035
R856	315-0103-00			RES., FXD, CMPSN: 10K OHM, 5%, 0.25W	01121	CB1035
R857	315-0103-00			RES., FXD, CMPSN: 10K OHM, 5%, 0.25W	01121	CB1035
R858	315-0103-00			RES., FXD, CMPSN: 10K OHM, 5%, 0.25W	01121	CB1035
R859	315-0103-00			RES., FXD, CMPSN: 10K OHM, 5%, 0.25W	01121	CB1035
R861	315-0102-00			RES., FXD, CMPSN: 1K OHM, 5%, 0.25W	01121	CB1025
R865	315-0103-00			RES., FXD, CMPSN: 10K OHM, 5%, 0.25W	01121	CB1035
R866	315-0302-00			RES., FXD, CMPSN: 3K OHM, 5%, 0.25W	01121	CB3025
R868	315-0512-00			RES., FXD, CMPSN: 5.1K OHM, 5%, 0.25W	01121	CB5125
R869	315-0103-00			RES., FXD, CMPSN: 10K OHM, 5%, 0.25W	01121	CB1035
R870	315-0103-00			RES., FXD, CMPSN: 10K OHM, 5%, 0.25W	01121	CB1035
R871	321-0222-00			RES., FXD, FILM: 2K OHM, 1%, 0.125W	91637	MFF1816G20000F
R872	321-0193-00			RES., FXD, FILM: 1K OHM, 1%, 0.125W	91637	MFF1816G10000F
R873	321-0222-00			RES., FXD, FILM: 2K OHM, 1%, 0.125W	91637	MFF1816G20000F
R874	321-0260-00			RES., FXD, FILM: 4.99K OHM, 1%, 0.125W	91637	MFF1816G49900F
R877	315-0101-00			RES., FXD, CMPSN: 100 OHM, 5%, 0.25W	01121	CB1015
R880	315-0103-00			RES., FXD, CMPSN: 10K OHM, 5%, 0.25W	01121	CB1035
R882	321-0289-00			RES., FXD, FILM: 10K OHM, 1%, 0.125W	91637	MFF1816G10001F
R883	315-0512-00	B010100	B010126	RES., FXD, CMPSN: 5.1K OHM, 5%, 0.25W (SPG1 ONLY)	01121	CB5125
R883	315-0751-00	B010127		RES., FXD, CMPSN: 750 OHM, 5%, 0.25W (SPG1 ONLY)	01121	CB7515
R883	315-0512-00	B010100	B010437	RES., FXD, CMPSN: 5.1K OHM, 5%, 0.25W (SPG2 ONLY)	01121	CB5125
R883	315-0751-00	B010438		RES., FXD, CMPSN: 750 OHM, 5%, 0.25W (SPG2 ONLY)	01121	CB7515
R884	315-0512-00			RES., FXD, CMPSN: 5.1K OHM, 5%, 0.25W	01121	CB5125
R885	315-0202-00			RES., FXD, CMPSN: 2K OHM, 5%, 0.25W	01121	CB2025
R886	315-0101-00			RES., FXD, CMPSN: 100 OHM, 5%, 0.25W	01121	CB1015
R887	315-0392-00			RES., FXD, CMPSN: 3.9K OHM, 5%, 0.25W	01121	CB3925
R888	315-0202-00			RES., FXD, CMPSN: 2K OHM, 5%, 0.25W	01121	CB2025
R889	315-0101-00			RES., FXD, CMPSN: 100 OHM, 5%, 0.25W	01121	CB1015
R892	315-0470-00			RES., FXD, CMPSN: 47 OHM, 5%, 0.25W	01121	CB4705
R893	315-0101-00			RES., FXD, CMPSN: 100 OHM, 5%, 0.25W	01121	CB1015
R894	315-0101-00			RES., FXD, CMPSN: 100 OHM, 5%, 0.25W	01121	CB1015
R895	315-0101-00			RES., FXD, CMPSN: 100 OHM, 5%, 0.25W	01121	CB1015
R902	321-1705-04			RES., FXD, FILM: 13.05K OHM, 0.1%, 0.125W	91637	MFF1816D13051B
R904	311-1918-00			RES., VAR, NONWIR: 2K OHM, 10%, 0.50W	73138	72-199-0
R905	315-0103-00			RES., FXD, CMPSN: 10K OHM, 5%, 0.25W	01121	CB1035
R906	315-0332-00			RES., FXD, CMPSN: 3.3K OHM, 5%, 0.25W	01121	CB3325
R908	321-0154-00	B010100	B010126	RES., FXD, FILM: 392 OHM, 1%, 0.125W (SPG1 ONLY)	91637	MFF1816G392ROF

Replaceable Electrical Parts—SPG1/SPG2

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R908	321-0126-00 -----	B010127		RES.,FXD,FILM:200 OHM,1%,0.125W (SPG1 ONLY)	91637	MFF1816G200R0F
R908	321-0154-00 -----	B010100	B010437	RES.,FXD,FILM:392 OHM,1%,0.125W (SPG2 ONLY)	91637	MFF1816G392R0F
R908	321-0126-00 -----	B010438		RES.,FXD,FILM:200 OHM,1%,0.125W (SPG2 ONLY)	91637	MFF1816G200R0F
R911	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	91637	MFF1816G10000F
R912	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R913	321-0696-00			RES.,FXD,FILM:40.2K OHM,0.5%,0.125W	91637	MFF1816D40201D
R914	321-0696-00			RES.,FXD,FILM:40.2K OHM,0.5%,0.125W	91637	MFF1816D40201D
R917	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R919	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R921	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R926	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	91637	MFF1816G10000F
R927	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R928	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R929	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R931	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R932	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R933	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R934	321-0991-03			RES.,FXD,FILM:18K OHM,0.25%,0.125W	24546	NC55C1802C
R941	321-0358-00			RES.,FXD,FILM:52.3K OHM,1%,0.125W	91637	MFF1816G52301F
R942	315-0185-00			RES.,FXD,CMPSN:1.8M OHM,5%,0.25W	01121	CB1855
R943	321-0327-02			RES.,FXD,FILM:24.9K OHM,0.5%,0.125W	91637	MFF1816D24901D
R948	321-0193-00 -----	B010100	B010104	RES.,FXD,FILM:1K OHM,1%,0.125W (SPG1 ONLY)	91637	MFF1816G10000F
R948	321-0126-00 -----	B010105		RES.,FXD,FILM:200 OHM,1%,0.125W (SPG1 ONLY)	91637	MFF1816G200R0F
R948	321-0193-00 -----	B010100	B010175	RES.,FXD,FILM:1K OHM,1%,0.125W (SPG2 ONLY)	91637	MFF1816G10000F
R948	321-0126-00 -----	B010176		RES.,FXD,FILM:200 OHM,1%,0.125W (SPG2 ONLY)	91637	MFF1816G200R0F
R950	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R951	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R952	315-0102-00 -----	XB010127		RES.,FXD,CMPSN:1K OHM,5%,0.25W (SPG1 ONLY)	01121	CB1025
R952	315-0102-00 -----	XB010438		RES.,FXD,CMPSN:1K OHM,5%,0.25W (SPG2 ONLY)	01121	CB1025
R953	321-0399-00			RES.,FXD,FILM:140K OHM,1%,0.125W	91637	MFF1816G14002F
R954	321-0329-02			RES.,FXD,FILM:26.1K OHM,0.5%,0.125W	91637	MFF1816D26101D
R955	321-0399-00			RES.,FXD,FILM:140K OHM,1%,0.125W	91637	MFF1816G14002F
R956	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R958	311-1919-00 -----	B010100	B010104	RES.,VAR,NONWIR:TRMR,1K OHM,10%,0.50W (SPG1 ONLY)	32997	3386C-T07-102
R958	311-1244-00 -----	B010105		RES.,VAR,NONWIR:100 OHM,10%,0.50W (SPG1 ONLY)	32997	3386X-T07-101
R958	311-1919-00 -----	B010100	B010175	RES.,VAR,NONWIR:TRMR,1K OHM,10%,0.50W (SPG2 ONLY)	32997	3386C-T07-102
R958	311-1244-00 -----	B010176		RES.,VAR,NONWIR:100 OHM,10%,0.50W (SPG2 ONLY)	32997	3386X-T07-101
R960	315-0470-00 -----	B010100	B010126X	RES.,FXD,CMPSN:47 OHM,5%,0.25W (SPG1 ONLY)	01121	CB4705
R960	315-0470-00 -----	B010100	B010437X	RES.,FXD,CMPSN:47 OHM,5%,0.25W (SPG2 ONLY)	01121	CB4705
R961	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R962	321-0335-00 -----	B010100	B010126X	RES.,FXD,FILM:30.1K OHM,1%,0.125W (SPG1 ONLY)	91637	MFF1816G30101F

Replaceable Electrical Parts—SPG1/SPG2

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R962	321-0335-00 -----	B010100	B010437X	RES.,FXD,FILM:30.1K OHM,1%,0.125W (SPG2 ONLY)	91637	MFF1816G30101F
R963	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R964	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
R965	321-0251-00			RES.,FXD,FILM:4.02K OHM,1%,0.125W	91637	MFF1816G40200F
R966	315-0622-00			RES.,FXD,CMPSN:6.2K OHM,5%,0.25W	01121	CB6225
R967	321-0235-00 -----	B010100	B010126	RES.,FXD,FILM:2.74K OHM,1%,0.125W (SPG1 ONLY)	91637	MFF1816G27400F
R967	321-0240-00 -----	B010127		RES.,FXD,FILM:3.09K OHM,1%,0.125W (SPG1 ONLY)	91637	MFF1816G30900F
R967	321-0235-00 -----	B010100	B010437	RES.,FXD,FILM:2.74K OHM,1%,0.125W (SPG2 ONLY)	91637	MFF1816G27400F
R967	321-0240-00 -----	B010438		RES.,FXD,FILM:3.09K OHM,1%,0.125W (SPG2 ONLY)	91637	MFF1816G30900F
R968	321-0181-00 -----	B010100	B010104	RES.,FXD,FILM:750 OHM,1%,0.125W (SPG1 ONLY)	91637	MFF1816G750R0F
R968	321-0118-00 -----	B010105		RES.,FXD,FILM:165 OHM,1%,0.125W (SPG1 ONLY)	91637	MFF1816G165R0F
R968	321-0181-00 -----	B010100	B010175	RES.,FXD,FILM:750 OHM,1%,0.125W (SPG2 ONLY)	91637	MFF1816G750R0F
R968	321-0118-00 -----	B010176		RES.,FXD,FILM:165 OHM,1%,0.125W (SPG2 ONLY)	91637	MFF1816G165R0F
R969	311-1920-00 -----	B010100	B010126	RES.,VAR, NONWIR:500 OHM,10%,0.50W (SPG1 ONLY)	73138	72-190-0
R969	311-1248-00 -----	B010127		RES.,VAR, NONWIR:500 OHM,10%,0.50W (SPG1 ONLY)	73138	72X-23-0-501K
R969	311-1920-00 -----	B010100	B010437	RES.,VAR, NONWIR:500 OHM,10%,0.50W (SPG2 ONLY)	73138	72-190-0
R969	311-1248-00 -----	B010438		RES.,VAR, NONWIR:500 OHM,10%,0.50W (SPG2 ONLY)	73138	72X-23-0-501K
R974	321-0117-00			RES.,FXD,FILM:162 OHM,1%,0.125W	91637	MFF1816G162R0F
R975	321-0256-00			RES.,FXD,FILM:4.53K OHM,1%,0.125W	91637	MFF1816G45300F
R977	321-0188-00 -----	B010100	B010126	RES.,FXD,FILM:887 OHM,1%,0.125W (SPG1 ONLY)	91637	MFF1816G887R0F
R977	321-0191-00 -----	B010127		RES.,FXD,FILM:953 OHM,1%,0.125W (SPG1 ONLY)	91637	MFF1816G953R0F
R977	321-0188-00 -----	B010100	B010437	RES.,FXD,FILM:887 OHM,1%,0.125W (SPG2 ONLY)	91637	MFF1816G887R0F
R977	321-0191-00 -----	B010438		RES.,FXD,FILM:953 OHM,1%,0.125W (SPG2 ONLY)	91637	MFF1816G953R0F
R978	311-1921-00 -----	B010100	B010126	RES.,VAR, NONWIR:250 OHM,10%,0.50W (SPG1 ONLY)	73138	72-191-0
R978	311-1244-00 -----	B010127		RES.,VAR, NONWIR:100 OHM,10%,0.50W (SPG1 ONLY)	32997	3386X-T07-101
R978	311-1921-00 -----	B010100	B010437	RES.,VAR, NONWIR:250 OHM,10%,0.50W (SPG2 ONLY)	73138	72-191-0
R978	311-1244-00 -----	B010438		RES.,VAR, NONWIR:100 OHM,10%,0.50W (SPG2 ONLY)	32997	3386X-T07-101
R984	321-0117-00			RES.,FXD,FILM:162 OHM,1%,0.125W	91637	MFF1816G162R0F
R985	315-0470-00 -----	B010100	B010126X	RES.,FXD,CMPSN:47 OHM,5%,0.25W (SPG1 ONLY)	01121	CB4705
R985	315-0470-00 -----	B010100	B010437X	RES.,FXD,CMPSN:47 OHM,5%,0.25W (SPG2 ONLY)	01121	CB4705
R985	315-0470-00 -----			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R986	315-0302-00					
R987	315-0681-00			RES.,FXD,CMPSN:680 OHM,5%,0.25W	01121	CB6815
R988	321-0277-00			RES.,FXD,FILM:7.5K OHM,1%,0.125W	91637	MFF1816G75000F
R989	321-0277-00			RES.,FXD,FILM:7.5K OHM,1%,0.125W	91637	MFF1816G75000F

Replaceable Electrical Parts—SPG1/SPG2

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R996	321-0085-00	B010100	B020210	RES., FXD, FILM: 75 OHM, 1%, 0.125W (SPG1 ONLY)	91637	MFF1816G75R00F
R996	321-0085-03	B020211		RES., FXD, FILM: 75 OHM, 0.25%, 0.125W (SPG1 ONLY)	24546	NC55C75R0C
R996	321-0085-00	B010100	B021236	RES., FXD, FILM: 75 OHM, 1%, 0.125W (SPG2 ONLY)	91637	MFF1816G75R00F
R996	321-0085-03	B021237		RES., FXD, FILM: 75 OHM, 0.25%, 0.125W (SPG2 ONLY)	24546	NC55C75R0C
R997	321-0085-00	B010100	B020210	RES., FXD, FILM: 75 OHM, 1%, 0.125W (SPG1 ONLY)	91637	MFF1816G75R00F
R997	321-0085-03	B020211		RES., FXD, FILM: 75 OHM, 0.25%, 0.125W (SPG1 ONLY)	24546	NC55C75R0C
R997	321-0085-00	B010100	B021236	RES., FXD, FILM: 75 OHM, 1%, 0.125W (SPG2 ONLY)	91637	MFF1816G75R00F
R997	321-0085-03	B021237		RES., FXD, FILM: 75 OHM, 0.25%, 0.125W (SPG2 ONLY)	24546	NC55C75R0C
R998	321-0085-00	XB010127	B020210	RES., FXD, FILM: 75 OHM, 1%, 0.125W (SPG1 ONLY)	91637	MFF1816G75R00F
R998	321-0085-03	B020211		RES., FXD, FILM: 75 OHM, 0.25%, 0.125W (SPG1 ONLY)	24546	NC55C75R0C
R998	321-0085-00	XB010438	B021236	RES., FXD, FILM: 75 OHM, 1%, 0.125W (SPG2 ONLY)	91637	MFF1816G75R00F
R998	321-0085-03	B021237		RES., FXD, FILM: 75 OHM, 0.25%, 0.125W (SPG2 ONLY)	24546	NC55C75R0C
R999	308-0426-00			RES., FXD, WW: 470 OHM, 5%, 3W	91637	CW2B-470R0J
S109	260-1589-00			SWITCH, PUSH: (6) SPST, 0.1A, 5V	00779	435166-4
S362	263-0010-00			SWITCH PB ASSY: 1 PUSH, 7.5MM, W/2 CONTACTS	80009	263-0010-00
S366	263-0010-00			SWITCH PB ASSY: 1 PUSH, 7.5MM, W/2 CONTACTS	80009	263-0010-00
S368	263-0010-00			SWITCH PB ASSY: 1 PUSH, 7.5MM, W/2 CONTACTS	80009	263-0010-00
S854	260-1132-00	B010100	B010126	SWITCH, PUSH: DPDT, 1A, 28VDC1 BUTTON (SPG1 ONLY)	80009	260-1132-00
S854	260-1224-00	B010127		SWITCH, PUSH: 2PDT, PUSH-PUSH (SPG1 ONLY)	80009	260-1224-00
S854	260-1132-00	B010100	B010424	SWITCH, PUSH: DPDT, 1A, 28VDC1 BUTTON (SPG2 ONLY)	80009	260-1132-00
S854	260-1224-00	B010425		SWITCH, PUSH: 2PDT, PUSH-PUSH (SPG2 ONLY)	80009	260-1224-00
S858	260-1132-00	B010100	B010126	SWITCH, PUSH: DPDT, 1A, 28VDC1 BUTTON (SPG1 ONLY)	80009	260-1132-00
S858	260-1224-00	B010127		SWITCH, PUSH: 2PDT, PUSH-PUSH (SPG1 ONLY)	80009	260-1224-00
S858	260-1132-00	B010100	B010424	SWITCH, PUSH: DPDT, 1A, 28VDC1 BUTTON (SPG2 ONLY)	80009	260-1132-00
S858	260-1224-00	B010425		SWITCH, PUSH: 2PDT, PUSH-PUSH (SPG2 ONLY)	80009	260-1224-00
T908	120-1071-00			TRANSFORMER, RF: TOROID, 10 TURNS TRIFILAR	80009	120-1071-00
T928	120-1070-00			TRANSFORMER, RF: TOROID, 12 TURNS QUADFILAR	80009	120-1070-00
U101	156-0784-00	XB020220	B020291	MICROCIRCUIT, DI: SYNC 4 BIT BINARY COUNTER (SPG1 ONLY)	01295	SN74LS163AN
U101	156-0784-02	B020292		MICROCIRCUIT, DI: SYNC 4 BIT BINARY COUNTER (SPG1 ONLY)	27014	DM74LS163ANA+
U101	156-0784-00	XB021322	B021841	MICROCIRCUIT, DI: SYNC 4 BIT BINARY COUNTER (SPG2 ONLY)	01295	SN74LS163AN
U101	156-0784-02	B021842		MICROCIRCUIT, DI: SYNC 4 BIT BINARY COUNTER (SPG2 ONLY)	27014	DM74LS163ANA+
U102	156-0388-00			MICROCIRCUIT, DI: DUAL D-TYPE FLIP-FLOP	80009	156-0388-00

Replaceable Electrical Parts—SPG1/SPG2

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
U106	156-0784-00 -----	B010100	B020291	MICROCIRCUIT,DI:SYNC 4 BIT BINARY COUNTER (SPG1 ONLY)	01295	SN74LS163AN
U106	156-0784-02 -----	B020292		MICROCIRCUIT,DI:SYNC 4 BIT BINARY COUNTER (SPG1 ONLY)	27014	DM74LS163ANA+
U106	156-0784-00 -----	B010100	B021841	MICROCIRCUIT,DI:SYNC 4 BIT BINARY COUNTER (SPG2 ONLY)	01295	SN74LS163AN
U106	156-0784-02 -----	B021842		MICROCIRCUIT,DI:SYNC 4 BIT BINARY COUNTER (SPG2 ONLY)	27014	DM74LS163ANA+
U107	156-0785-04 -----	B010100	B020219	MICROCIRCUIT,DI:PROM,PROGRAMMED (SPG1 ONLY)	80009	156-0785-04
U107	156-0785-19 -----	B020220		MICROCIRCUIT,DI:256 BIT PROM,PROGRAMMED (SPG1 ONLY)	80009	156-0785-19
U107	156-0785-04 -----	B010100	B021321	MICROCIRCUIT,DI:PROM,PROGRAMMED (SPG2 ONLY)	80009	156-0785-04
U107	156-0785-19 -----	B021322		MICROCIRCUIT,DI:256 BIT PROM,PROGRAMMED (SPG2 ONLY)	80009	156-0785-19
U110	156-0733-00			MICROCIRCUIT,DI:DUAL MONOSTABLE MV	80009	156-0733-00
U112	156-0043-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NOR GATE	80009	156-0043-00
U113	156-0385-00			MICROCIRCUIT,DI:HEX.INVERTER	80009	156-0385-00
U115	156-0388-00			MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP	80009	156-0388-00
U121	156-0504-00			MICROCIRCUIT,DI:HEX BUFFER	27014	MM5610AJ
U122	156-0504-00			MICROCIRCUIT,DI:HEX BUFFER	27014	MM5610AJ
U126	156-0733-00			MICROCIRCUIT,DI:DUAL MONOSTABLE MV	80009	156-0733-00
U128	156-0786-00	B010100	B019999X	MICROCIRCUIT,DI:QUAD,EXCLUSIVE OR GATE	80009	156-0786-00
U129	155-0147-00 -----	B010100	B010132	MICROCIRCUIT,DI:CIRCUIT TV GEN MOS,40 LEAD (SPG1 ONLY)	80009	155-0147-00
U129	155-0147-02 -----	B010133	B019999	MICROCIRCUIT,DI:CIRCUIT TV GEN,MOS,40 LEAD (SPG1 ONLY)	80009	155-0147-02
U129	155-0147-00 -----	B010100	B010519	MICROCIRCUIT,DI:CIRCUIT TV GEN MOS,40 LEAD (SPG2 ONLY)	80009	155-0147-00
U129	155-0147-02 -----	B010520	B019999	MICROCIRCUIT,DI:CIRCUIT TV GEN,MOS,40 LEAD (SPG2 ONLY)	80009	155-0147-02
U129	155-0188-00	B020000		MICROCIRCUIT,DI:SYNC GENERATOR	80009	155-0188-00
U131	156-0504-00			MICROCIRCUIT,DI:HEX BUFFER	27014	MM5610AJ
U132	156-0385-00			MICROCIRCUIT,DI:HEX.INVERTER	80009	156-0385-00
U140	156-0504-00			MICROCIRCUIT,DI:HEX BUFFER	27014	MM5610AJ
U141	156-0043-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NOR GATE	80009	156-0043-00
U142	156-0784-00 -----	B010100	B020291	MICROCIRCUIT,DI:SYNC 4 BIT BINARY COUNTER (SPG1 ONLY)	01295	SN74LS163AN
U142	156-0784-02 -----	B020292		MICROCIRCUIT,DI:SYNC 4 BIT BINARY COUNTER (SPG1 ONLY)	27014	DM74LS163ANA+
U142	156-0784-00 -----	B010100	B021841	MICROCIRCUIT,DI:SYNC 4 BIT BINARY COUNTER (SPG2 ONLY)	01295	SN74LS163AN
U142	156-0784-02 -----	B021842		MICROCIRCUIT,DI:SYNC 4 BIT BINARY COUNTER (SPG2 ONLY)	27014	DM74LS163ANA+
U145	156-0786-00	B010100	B019999X	MICROCIRCUIT,DI:QUAD,EXCLUSIVE OR GATE	80009	156-0786-00
U146	156-0388-00			MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP	80009	156-0388-00
U148	156-0733-00			MICROCIRCUIT,DI:DUAL MONOSTABLE MV	80009	156-0733-00
U151	156-0784-00 -----	B010100	B020291	MICROCIRCUIT,DI:SYNC 4 BIT BINARY COUNTER (SPG1 ONLY)	01295	SN74LS163AN
U151	156-0784-02 -----	B020292		MICROCIRCUIT,DI:SYNC 4 BIT BINARY COUNTER (SPG1 ONLY)	27014	DM74LS163ANA+
U151	156-0784-00 -----	B010100	B021841	MICROCIRCUIT,DI:SYNC 4 BIT BINARY COUNTER (SPG2 ONLY)	01295	SN74LS163AN
U151	156-0784-02 -----	B021842		MICROCIRCUIT,DI:SYNC 4 BIT BINARY COUNTER (SPG2 ONLY)	27014	DM74LS163ANA+

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
U152	156-0041-00	B010100	B019999	MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP	27014	DM7474N
U152	156-0331-03	B020000		MICROCIRCUIT,DI:DUAL D TYPE POS EDGE TRIG	80009	156-0331-03
U159	156-0112-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	80009	156-0112-00
U160	156-0651-00			MICROCIRCUIT,DI:8-BIT PRL-OUT,SER SHF RGTR	01295	SN74LS164N
U161	156-0651-00			MICROCIRCUIT,DI:8-BIT PRL-OUT,SER SHF RGTR	01295	SN74LS164N
U162	156-0388-00			MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP	80009	156-0388-00
U163	156-0043-00	B010100	B019999	MICROCIRCUIT,DI:QUAD 2-INPUT POS NOR GATE	80009	156-0043-00
U163	156-0030-00	B020000		MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U164	156-0733-00			MICROCIRCUIT,DI:DUAL MONOSTABLE MV	80009	156-0733-00
U165	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U166	156-0388-00			MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP	80009	156-0388-00
U167	156-0043-00	B010100	B019999X	MICROCIRCUIT,DI:QUAD 2-INPUT POS NOR GATE	80009	156-0043-00
U167	156-0382-00	XB020220		MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE (SPG1 ONLY)	01295	SN74LS00(N OR J)
U167	156-0382-00	XB021322		MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE (SPG2 ONLY)	01295	SN74LS00(N OR J)
U200	156-0733-00			MICROCIRCUIT,DI:DUAL MONOSTABLE MV	80009	156-0733-00
U205	156-0411-00			MICROCIRCUIT,LI:QUAD-COMP,SGL SUPPLY	27014	LM339N
U220	156-0487-00			MICROCIRCUIT,DI:DUAL RETRIG,ONE SHOT	80009	156-0487-00
U224	156-0043-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NOR GATE	80009	156-0043-00
U229	156-0733-00			MICROCIRCUIT,DI:DUAL MONOSTABLE MV	80009	156-0733-00
U240	156-0388-00			MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP	80009	156-0388-00
U244	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U245	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U249	156-0388-00	B010100	B010139	MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP (SPG1 ONLY)	80009	156-0388-00
U249	156-0041-00	B010140		MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP (SPG1 ONLY)	27014	DM7474N
U249	156-0388-00	B010100	B010559	MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP (SPG2 ONLY)	80009	156-0388-00
U249	156-0041-00	B010560		MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP (SPG2 ONLY)	27014	DM7474N
U254	156-0158-00			MICROCIRCUIT,LI:DUAL OPERATIONAL AMPLIFIER	18324	MC1458N
U255	156-0043-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NOR GATE	80009	156-0043-00
U259	156-0784-00	B010100	B020291	MICROCIRCUIT,DI:SYNC 4 BIT BINARY COUNTER (SPG1 ONLY)	01295	SN74LS163AN
U259	156-0784-02	B020292		MICROCIRCUIT,DI:SYNC 4 BIT BINARY COUNTER (SPG1 ONLY)	27014	DM74LS163ANA+
U259	156-0784-00	B010100	B021841	MICROCIRCUIT,DI:SYNC 4 BIT BINARY COUNTER (SPG2 ONLY)	01295	SN74LS163AN
U259	156-0784-02	B021842		MICROCIRCUIT,DI:SYNC 4 BIT BINARY COUNTER (SPG2 ONLY)	27014	DM74LS163ANA+
U275	156-0186-00	B010100	B010136	MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE (SPG1 ONLY)	01295	SN7403N
U275	156-0144-00	B010137		MICROCIRCUIT,DI:3-INPUT POS NAND GATE (SPG1 ONLY)	80009	156-0144-00
U275	156-0186-00	B010100	B010559	MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE (SPG2 ONLY)	01295	SN7403N
U275	156-0144-00	B010560		MICROCIRCUIT,DI:3-INPUT POS NAND GATE (SPG2 ONLY)	80009	156-0144-00
U279	156-0784-00	B010100	B020291	MICROCIRCUIT,DI:SYNC 4 BIT BINARY COUNTER (SPG1 ONLY)	01295	SN74LS163AN
U279	156-0784-02	B020292		MICROCIRCUIT,DI:SYNC 4 BIT BINARY COUNTER (SPG1 ONLY)	27014	DM74LS163ANA+
U279	156-0784-00	B010100	B021841	MICROCIRCUIT,DI:SYNC 4 BIT BINARY COUNTER (SPG2 ONLY)	01295	SN74LS163AN
U279	156-0784-02	B021842		MICROCIRCUIT,DI:SYNC 4 BIT BINARY COUNTER (SPG2 ONLY)	27014	DM74LS163ANA+
U284	156-0158-00			MICROCIRCUIT,LI:DUAL OPERATIONAL AMPLIFIER	18324	MC1458N
U285	156-0733-00			MICROCIRCUIT,DI:DUAL MONOSTABLE MV	80009	156-0733-00

Replaceable Electrical Parts—SPG1/SPG2

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
U289	156-0784-00 -----	B010100	B020291	MICROCIRCUIT,DI:SYNC 4 BIT BINARY COUNTER (SPG1 ONLY)	01295	SN74LS163AN
U289	156-0784-02 -----	B020292		MICROCIRCUIT,DI:SYNC 4 BIT BINARY COUNTER (SPG1 ONLY)	27014	DM74LS163ANA+
U289	156-0784-00 -----	B010100	B021841	MICROCIRCUIT,DI:SYNC 4 BIT BINARY COUNTER (SPG2 ONLY)	01295	SN74LS163AN
U289	156-0784-02 -----	B028142		MICROCIRCUIT,DI:SYNC 4 BIT BINARY COUNTER (SPG2 ONLY)	27014	DM74LS163ANA+
U299	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U309	156-0385-00			MICROCIRCUIT,DI:HEX. INVERTER	80009	156-0385-00
U325	156-0487-00			MICROCIRCUIT,DI:DUAL RETRIG,ONE SHOT	80009	156-0487-00
U329	156-0251-00			MICROCIRCUIT,DI:VOLTAGE COMPENSATOR	27014	LM361H
U330	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U334	156-0406-00			MICROCIRCUIT,DI:2-INPUT NAND,QUAD INVERTER	80009	156-0406-00
U385	156-0112-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	80009	156-0112-00
U386	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U388	156-0406-00			MICROCIRCUIT,DI:2-INPUT NAND,QUAD INVERTER	80009	156-0406-00
U389	156-0129-00			MICROCIRCUIT,DI:QUAD 2-INPUT GATE	80009	156-0129-00
U396	156-0043-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NOR GATE	80009	156-0043-00
U398	156-0034-00			MICROCIRCUIT,DI:DUAL 4-INPUT NAND GATE	80009	156-0034-00
U399	156-0406-00			MICROCIRCUIT,DI:2-INPUT NAND,QUAD INVERTER	80009	156-0406-00
U400	156-0487-00			MICROCIRCUIT,DI:DUAL RETRIG,ONE SHOT	80009	156-0487-00
U401	156-0651-00			MICROCIRCUIT,DI:8-BIT PRL-OUT,SER SHF RGTR	01295	SN74LS164N
U406	156-0406-00			MICROCIRCUIT,DI:2-INPUT NAND,QUAD INVERTER	80009	156-0406-00
U410	156-0129-00			MICROCIRCUIT,DI:QUAD 2-INPUT GATE	80009	156-0129-00
U420	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U426	156-0405-00			MICROCIRCUIT,DI:DUAL RETRIG MONOSTABLE MV	07263	9602 (PC OR DC)
U489	156-0158-00 -----			MICROCIRCUIT,LI:DUAL OPERATIONAL AMPLIFIER (SPG2 ONLY)	18324	MC1458N
U510	156-0495-00 -----			MICROCIRCUIT,LI:OPNL AMPL (SPG2 ONLY)	27014	LM324N
U619	156-0067-00 -----			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER (SPG2 ONLY)	01295	MICROA741CP
U626	156-0130-00 -----	B010100	B021841	MICROCIRCUIT,LI:MODULATOR/DEMODULATOR (SPG2 ONLY)	80009	156-0130-00
U626	156-0130-02 -----	B021842		MICROCIRCUIT,LI:MODULATOR/DEMODULATOR,SCRN (SPG2 ONLY)	04713	SC77162GH
U630	156-0130-00 -----	B010100	B021841	MICROCIRCUIT,LI:MODULATOR/DEMODULATOR (SPG2 ONLY)	80009	156-0130-00
U630	156-0130-02 -----	B021842		MICROCIRCUIT,LI:MODULATOR/DEMODULATOR,SCRN (SPG2 ONLY)	04713	SC77162GH
U639	156-0130-00 -----	B010100	B021841	MICROCIRCUIT,LI:MODULATOR/DEMODULATOR (SPG2 ONLY)	80009	156-0130-00
U639	156-0130-02 -----	B021842		MICROCIRCUIT,LI:MODULATOR/DEMODULATOR,SCRN (SPG2 ONLY)	04713	SC77162GH
U700	155-0144-00 -----			MICROCIRCUIT,LI:DUAL IN-LINE,16 LEAD (SPG2 ONLY)	80009	155-0144-00
U790	156-0385-00			MICROCIRCUIT,DI:HEX. INVERTER	80009	156-0385-00
U798	155-0145-00			MICROCIRCUIT,LI:DUAL IN-LINE,16 LEAD	80009	155-0145-00
U808	155-0145-00			MICROCIRCUIT,LI:DUAL IN-LINE,16 LEAD	80009	155-0145-00
U810	156-0733-00			MICROCIRCUIT,DI:DUAL MONOSTABLE MV	80009	156-0733-00
U815	156-0158-00			MICROCIRCUIT,LI:DUAL OPERATIONAL AMPLIFIER	18324	MC1458N

Replaceable Electrical Parts—SPG1/SPG2

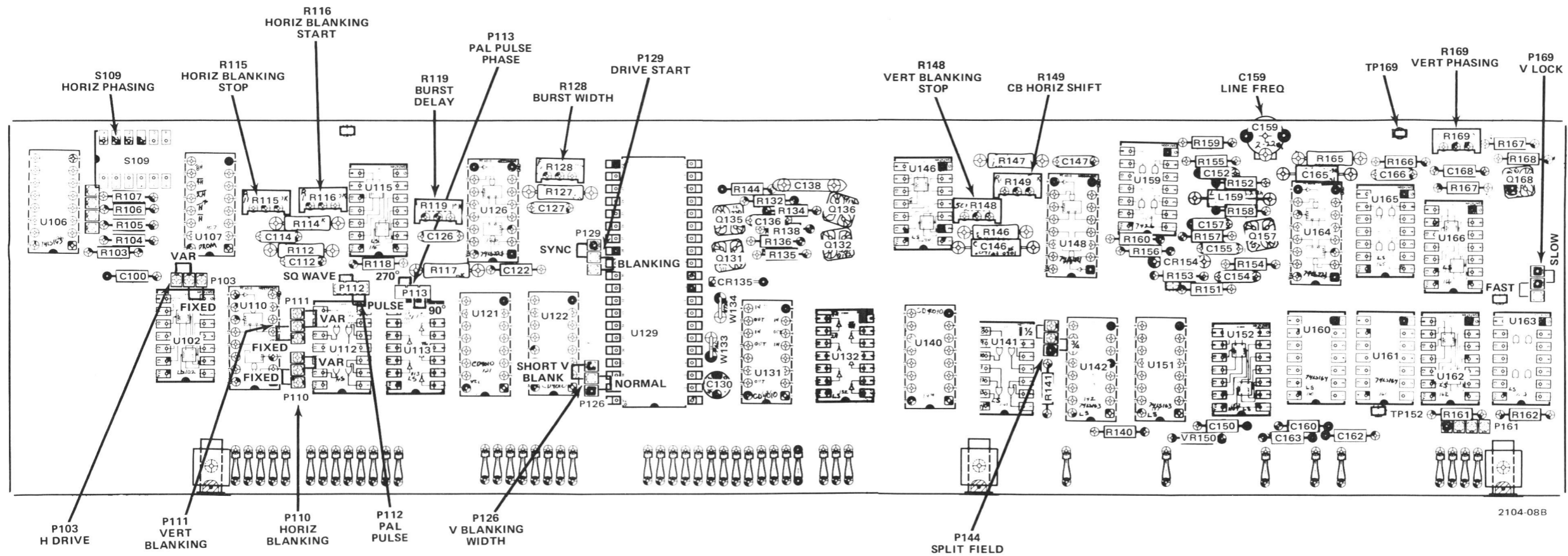
Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
U818	155-0145-00			MICROCIRCUIT,LI:DUAL IN-LINE,16 LEAD	80009	155-0145-00
U825	156-0388-00			MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP	80009	156-0388-00
U828	155-0145-00			MICROCIRCUIT,LI:DUAL IN-LINE,16 LEAD	80009	155-0145-00
U835	156-0381-00			MICROCIRCUIT,DI:QUAD 2-INPUT EXCL OR GATES	80009	156-0381-00
U838	155-0145-00			MICROCIRCUIT,LI:DUAL IN-LINE,16 LEAD	80009	155-0145-00
U848	155-0145-00			MICROCIRCUIT,LI:DUAL IN-LINE,16 LEAD	80009	155-0145-00
U851	156-0383-00			MICROCIRCUIT,DI:QUAD 2-INPUT NOR GATE	80009	156-0383-00
U853	156-0406-00	B010100	B020210	MICROCIRCUIT,DI:2-INPUT NAND,QUAD INVERTER (SPG1 ONLY)	80009	156-0406-00
U853	156-0383-00	B020211		MICROCIRCUIT,DI:QUAD 2-INPUT NOR GATE (SPG1 ONLY)	80009	156-0383-00
U853	156-0406-00	B010100	B021236	MICROCIRCUIT,DI:2-INPUT NAND,QUAD INVERTER (SPG2 ONLY)	80009	156-0406-00
U853	156-0383-00	B021237		MICROCIRCUIT,DI:QUAD 2-INPUT NOR GATE (SPG2 ONLY)	80009	156-0383-00
U854	156-0382-00	XB020211		MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE (SPG1 ONLY)	01295	SN74LS00(N OR J)
U854	156-0382-00	XB021237		MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE (SPG2 ONLY)	01295	SN74LS00(N OR J)
U855	156-0386-02			MICROCIRCUIT,DI:TRIPLE 3-INPUT NAND GATE	01295	SN74LS10
U859	156-0422-00			MICROCIRCUIT,DI:UP/DOWN SYNC BINARY COUNTER	07263	74LS191PC OR DC
U918	156-0130-00	B010100	B020291	MICROCIRCUIT,LI:MODULATOR/DEMODULATOR (SPG1 ONLY)	80009	156-0130-00
U918	156-0130-02	B020292		MICROCIRCUIT,LI:MODULATOR/DEMODULATOR,SCRN (SPG1 ONLY)	04713	SC77162GH
U918	156-0130-00	B010100	B021841	MICROCIRCUIT,LI:MODULATOR/DEMODULATOR (SPG2 ONLY)	80009	156-0130-00
U918	156-0130-02	B021842		MICROCIRCUIT,LI:MODULATOR/DEMODULATOR,SCRN (SPG2 ONLY)	04713	SC77162GH
U921	156-0785-05			MICROCIRCUIT,DI:PROM U921 PROGRAMMED	80009	156-0785-05
VR129	152-0278-00	XB010200	B019999X	SEMICONV DEVICE:ZENER,0.4W,3V,5%	04713	SZG35009K20
VR150	152-0226-00	XB020000		SEMICONV DEVICE:ZENER,0.4W,5.1V,5%	14552	TD3810980
VR559	152-0127-00			SEMICONV DEVICE:ZENER,0.4W,7.5V,5%	04713	SZG35009K2
VR650	152-0127-00			SEMICONV DEVICE:ZENER,0.4W,7.5V,5%	04713	SZG35009K2
VR686	152-0395-00			SEMICONV DEVICE:ZENER,0.4W,4.3V,5%	14552	TD332317
VR906	152-0226-00			SEMICONV DEVICE:ZENER,0.4W,5.1V,5%	14552	TD3810980
W794	131-0566-00			BUS CONDUCTOR:DUMMY RES,2.375,22 AWG	57668	JWW-0200E0



SERVICING ILLUSTRATIONS

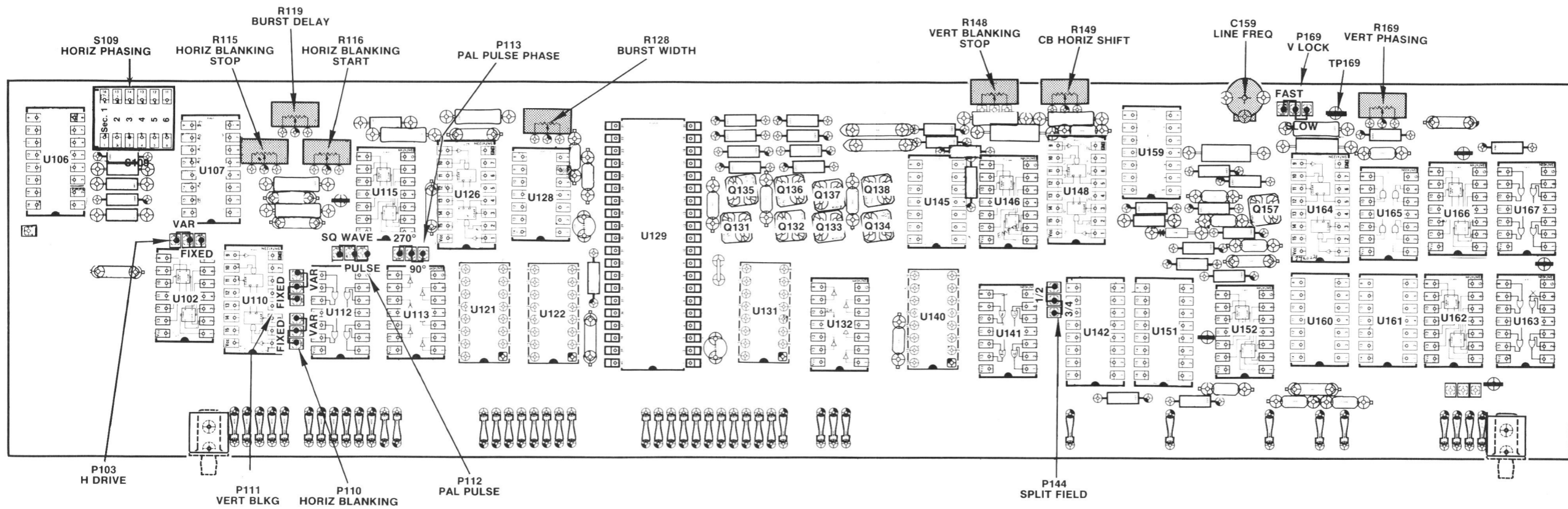
Information contained in this section serves as an aid to the service technician who performs the calibration, maintenance, and troubleshooting procedures. Included are illustrations showing the adjustment and jumper locations for each circuit board, and troubleshooting charts.





2104-08B

FIG. 8-1A. A20 SYNC TIMING BOARD ADJUSTMENT LOCATIONS & JUMPERS (SN B020000 & UP).



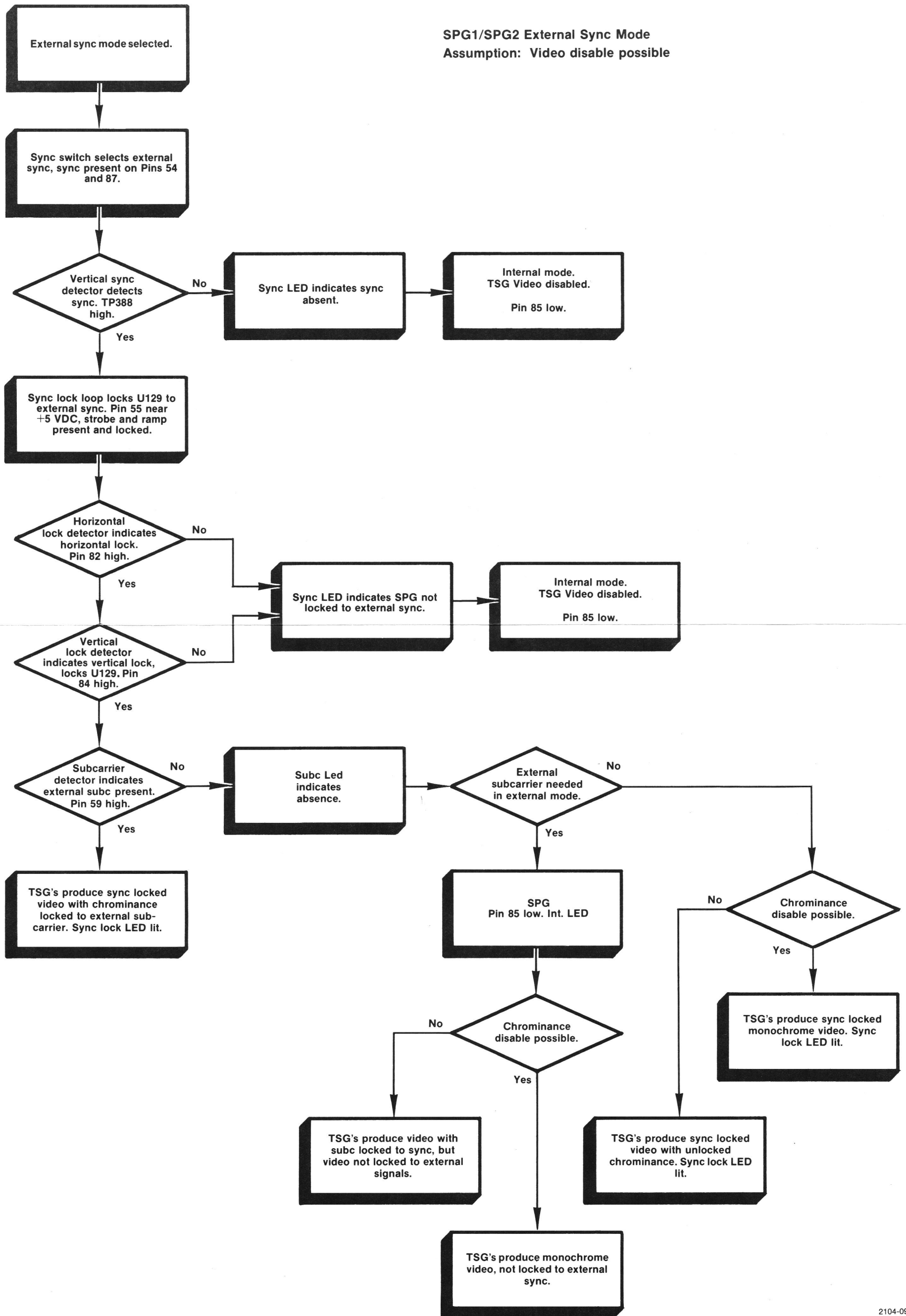
2104-49

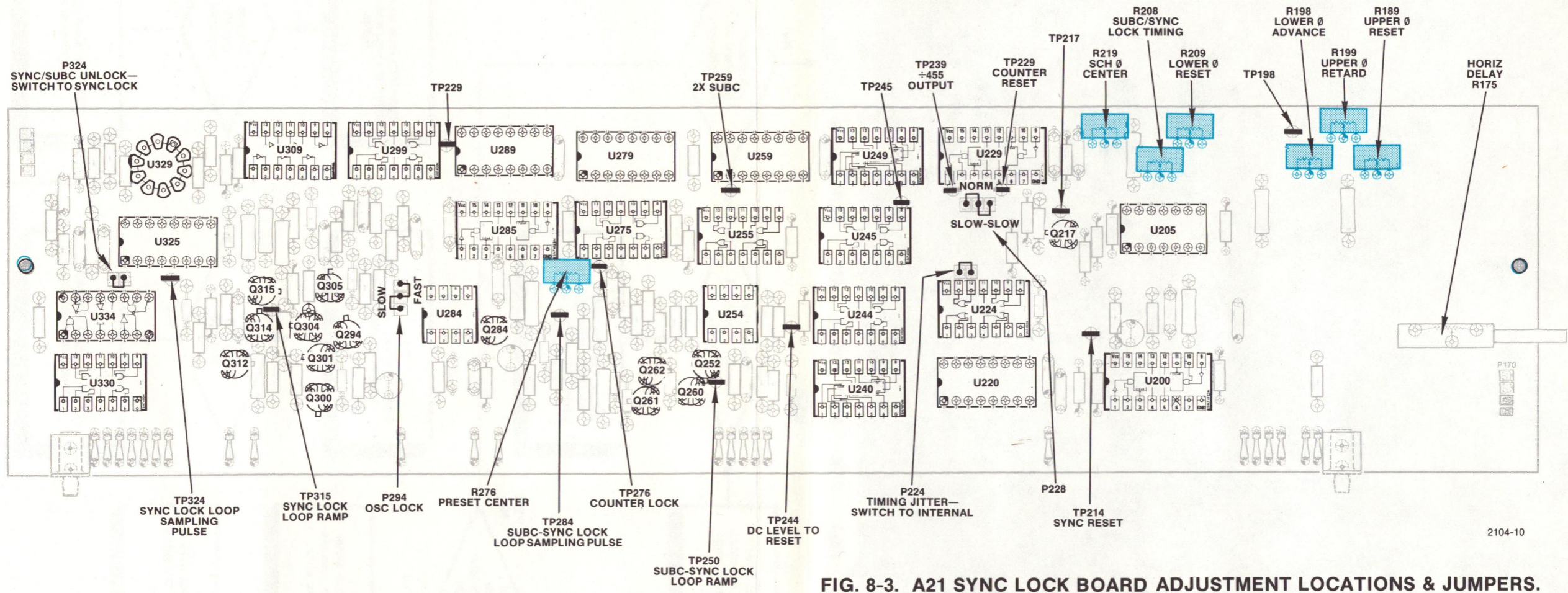
FIG. 8-1B. A20 SYNC TIMING BOARD ADJUSTMENT LOCATIONS & JUMPERS (SN B019999 & BELOW).

REV JUL 1983

A20 SYNC TIMING ADJ. LOC.

FIG. 8-2. TROUBLESHOOTING CHART 1.





2104-10

FIG. 8-3. A21 SYNC LOCK BOARD ADJUSTMENT LOCATIONS & JUMPERS.

A21 SYNC LOCK ADJ. LOC.

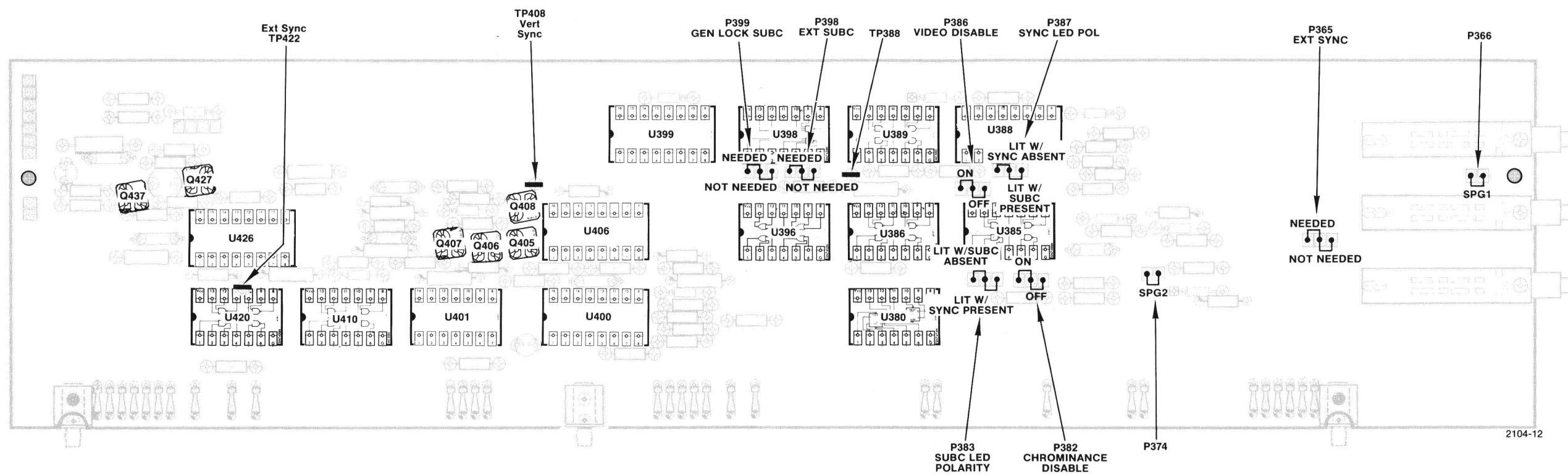
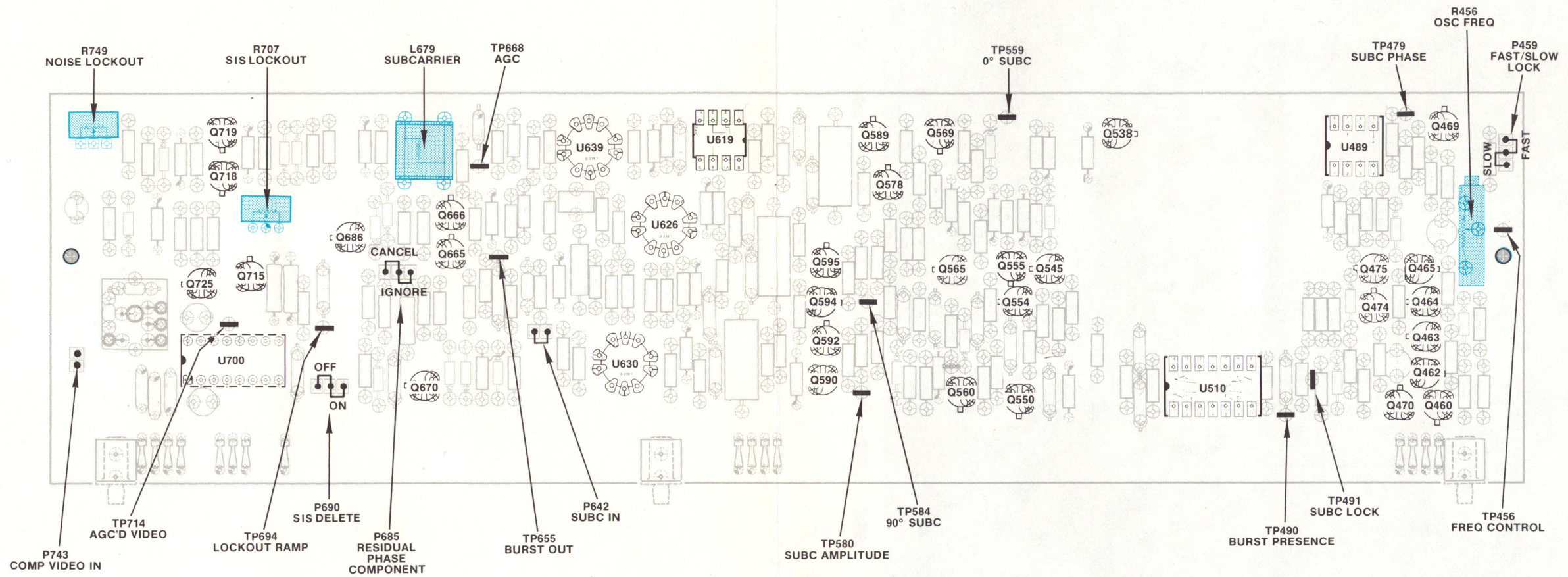


FIG. 8-5. A22 GENERATOR LOGIC BOARD JUMPERS LOCATIONS.

FIG. 8-6. TROUBLESHOOTING CHART 3.





2104-14A

FIG. 8-7. A23 SUBCARRIER LOCK BOARD ADJUSTMENT LOCATIONS & JUMPERS.

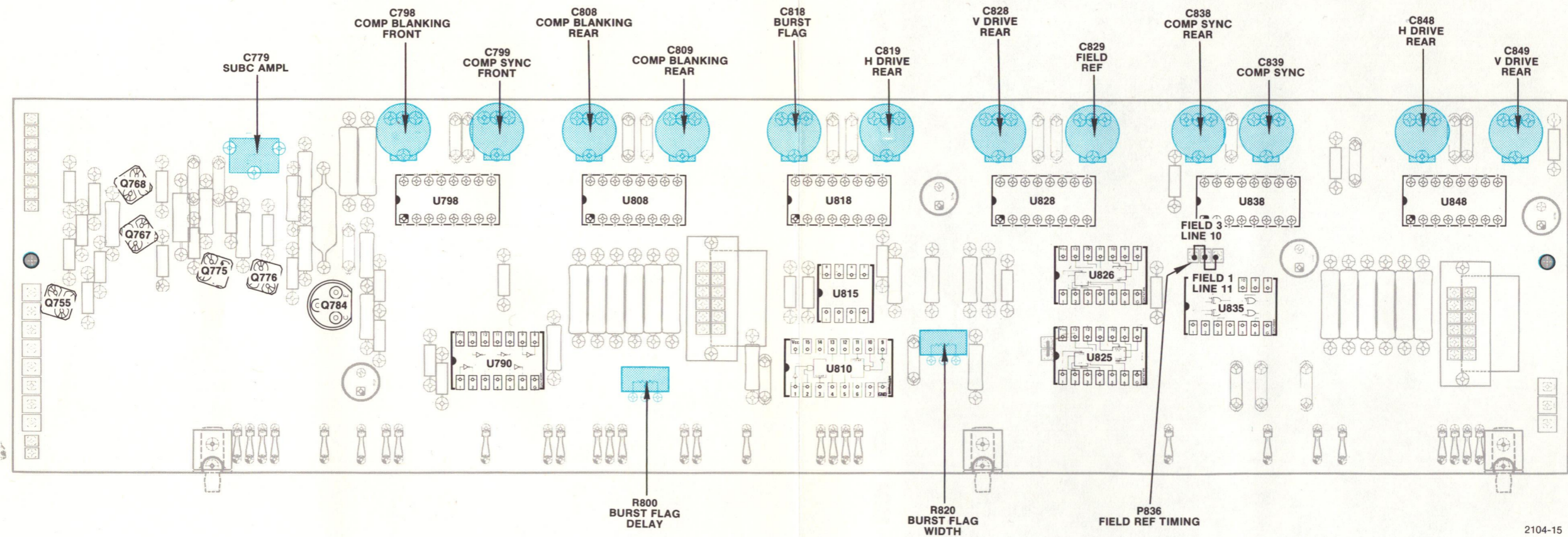
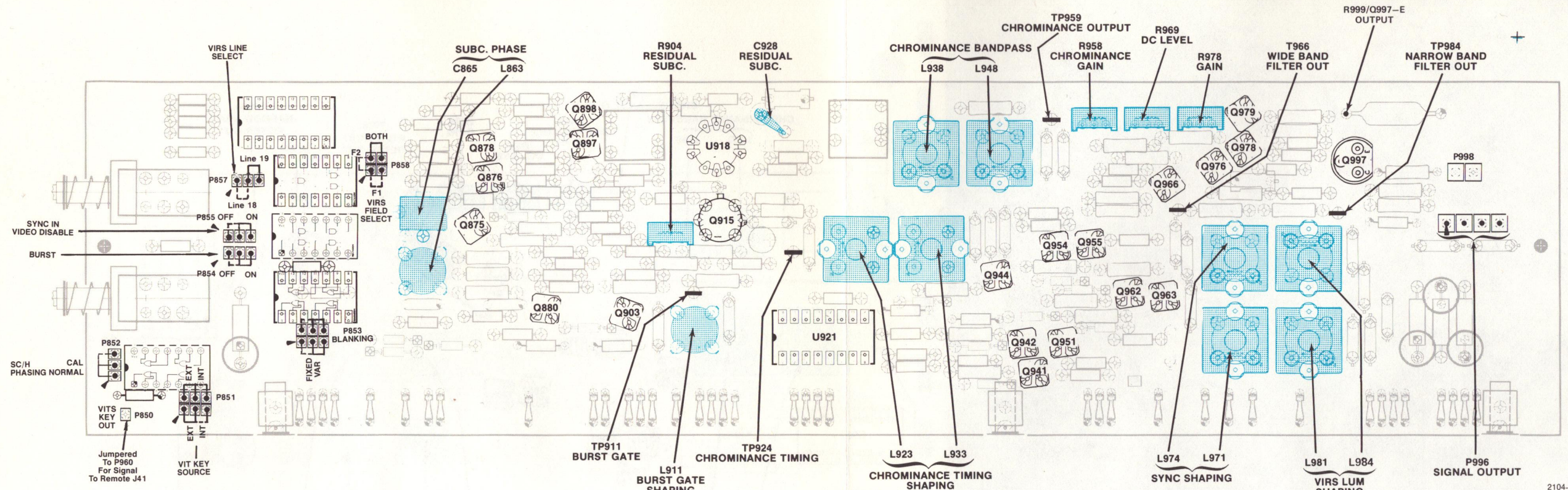


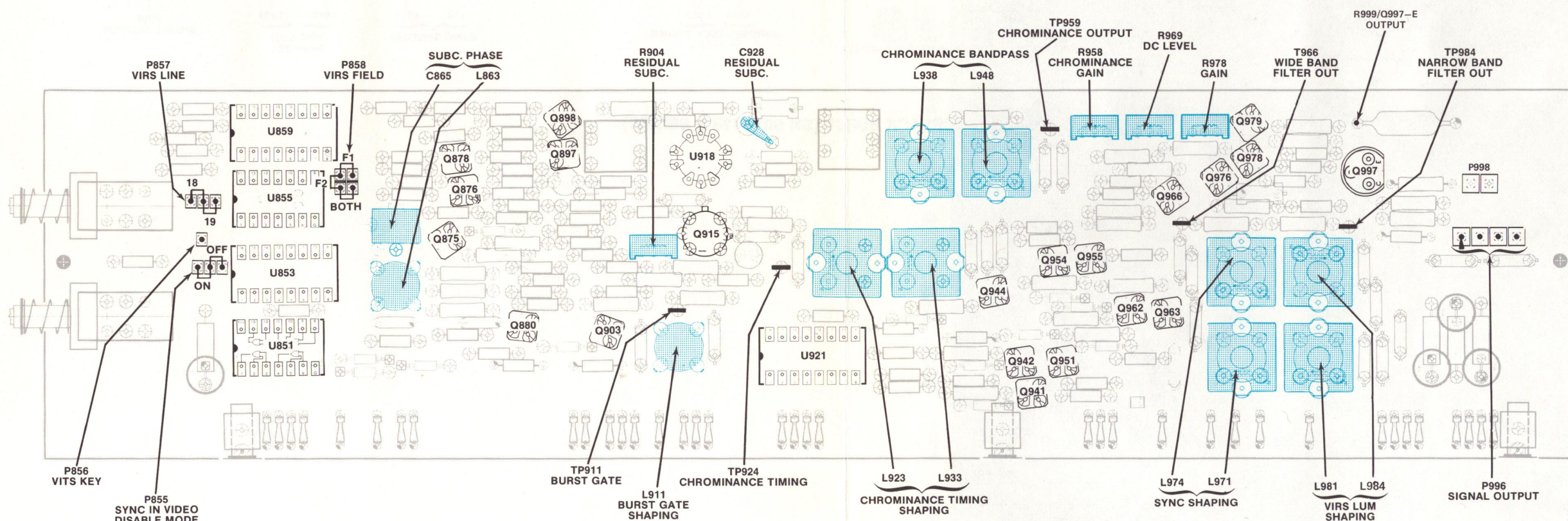
FIG. 8-8. A24 PULSE OUTPUT AMP BOARD ADJUSTMENT LOCATIONS & JUMPER.

A24 PULSE OUTPUT AMP
ADJUSTMENT LOCATIONS



SN B020211 & UP-SPG1 & SN B021237 & UP-SPG2

2104-43



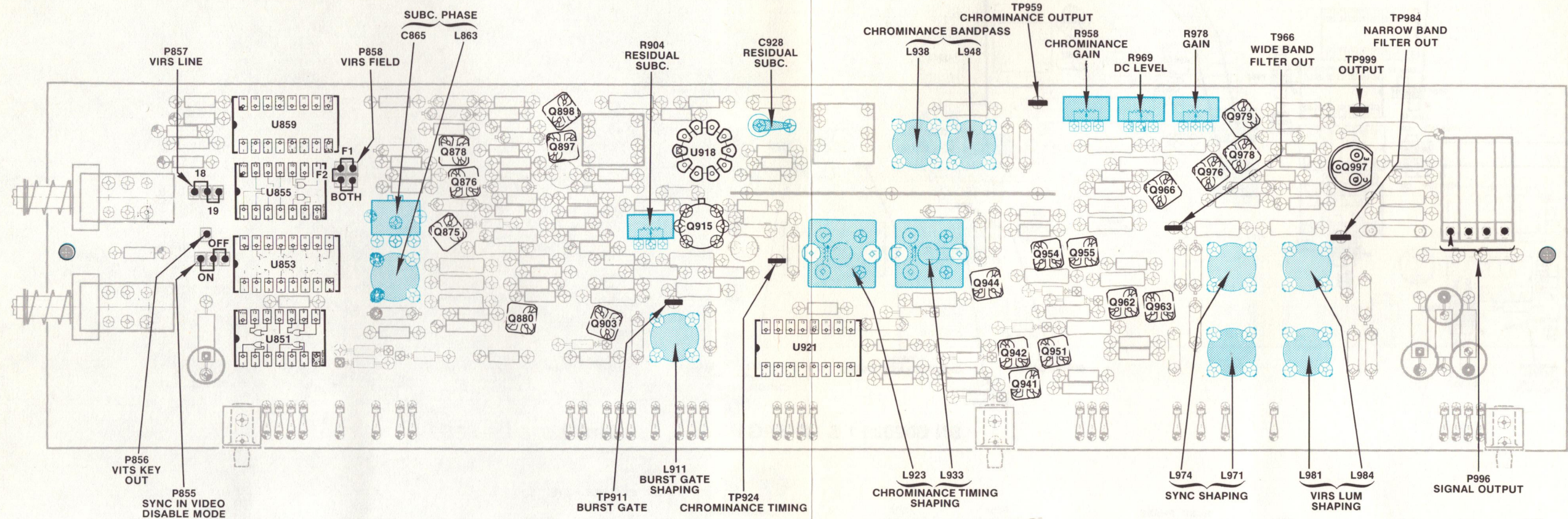
SN B010127-SN B021236

2104-40

A25 (SN B010126 - BELOW) BACK OF PAGE

Fig. 8-9. A25 VIRS/BLACK BURST ADJUSTMENT LOCATIONS AND JUMPERS

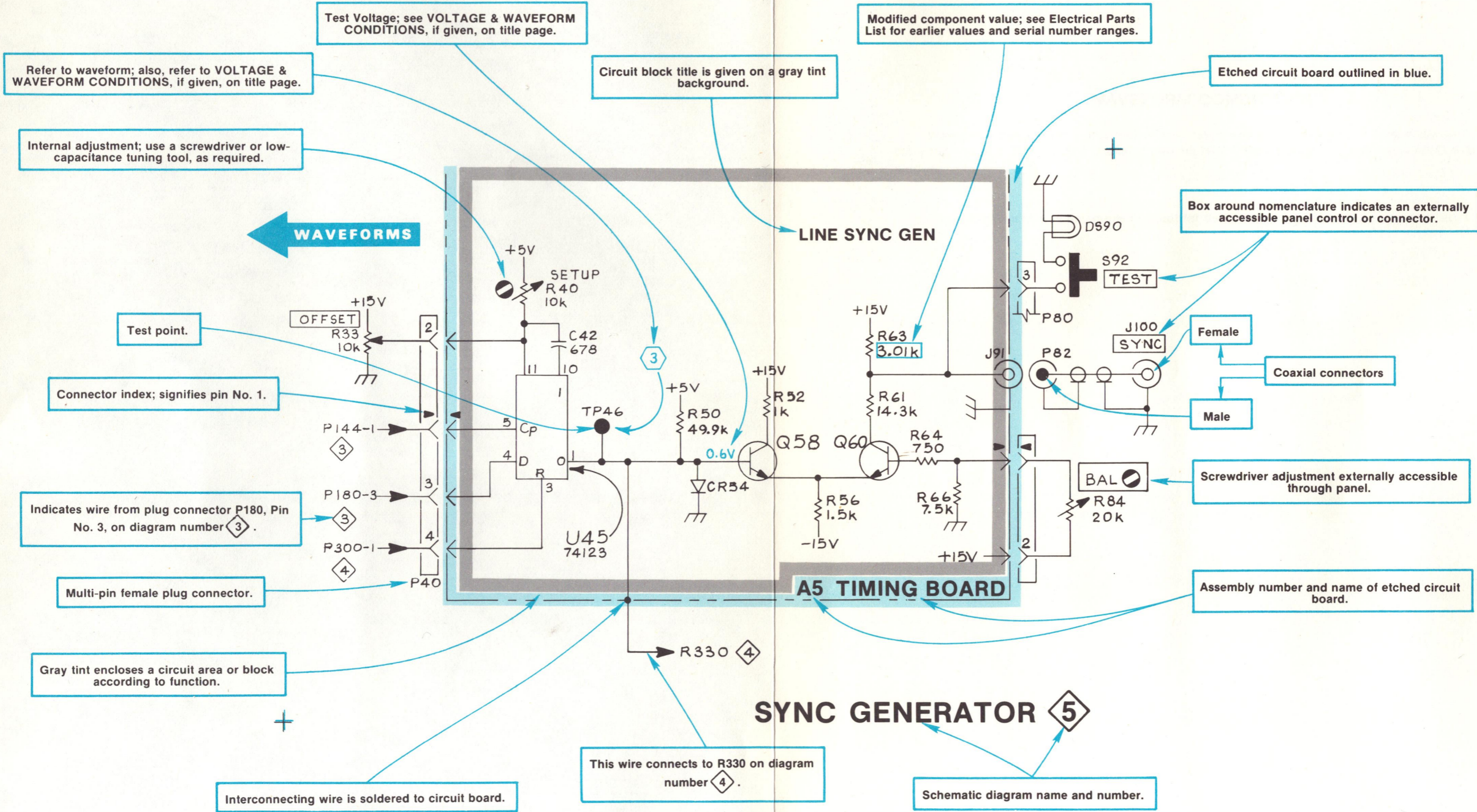
A25 VIRS/BLACK BURST ADJUSTMENT LOCATIONS



2104-09

Fig. 8-10. A25 VIRS/BLACK BURST (SN B010126 & BELOW).

A25 VIRS/BLACK BURST ADJUSTMENT LOCATIONS



SCHEMATIC EXAMPLE

DIAGRAMS AND CIRCUIT BOARD ILLUSTRATIONS

This section of the manual contains block and schematic diagrams with waveforms and etched circuit board illustrations.

Symbols

Symbols used on the diagrams are based on ANSI Y32.2-1970 and IEEE No. 315 March 1971. Logic symbology is based on ANSI Y32.14-1973 (IEEE Std. 91-1973). Logic symbols depict the logic function performed and may differ from the manufacturer's data.

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 micofarads (μ F).

Resistors Ohms (Ω).

Semiconductor Types

Refer to the Electrical Parts List.

Reference Designators

The following letters are used as reference designators to identify components or assemblies on Tektronix, Inc. schematic diagrams.

A	Assembly, separable or repairable (circuit board, etc.)	LR	Inductor/resistor combination
AT	Attenuator, fixed or variable	M	Meter
B	Motor	P	Connector, movable portion
BT	Battery	Q	Transistor, silicon-controlled rectifier, or programmable unijunction transistor
C	Capacitor, fixed or variable	R	Resistor, fixed or variable
CR	Diode, signal or rectifier	RT	Thermistors
DH	Decoupling Hybrid	S	Switch
DL	Delay Line	T	Transformer
DS	Indicating device (lamp)	TC	Thermocouple
E, SG	Spark Gap	TP	Test Point
F	Fuse	U	Assembly, inseparable or non-repairable (integrated circuit, etc.)
FL	Filter	V	Electron tube
H	Heat dissipating device (heat sink, heat radiator, etc.)	VR	Voltage regulator (zener diode, etc.)
HR	Heater	Y	Crystal
J	Connector, stationary portion		
K	Relay		
L	Inductor, fixed or variable		

Partial Schematic Diagram With Explanations

The partial diagram at the left is an example of the various symbols and other information provided on Tektronix, Inc. diagrams.

Transformer Wiring

A two-letter abbreviation color code is used to identify wires without terminal connection labels.

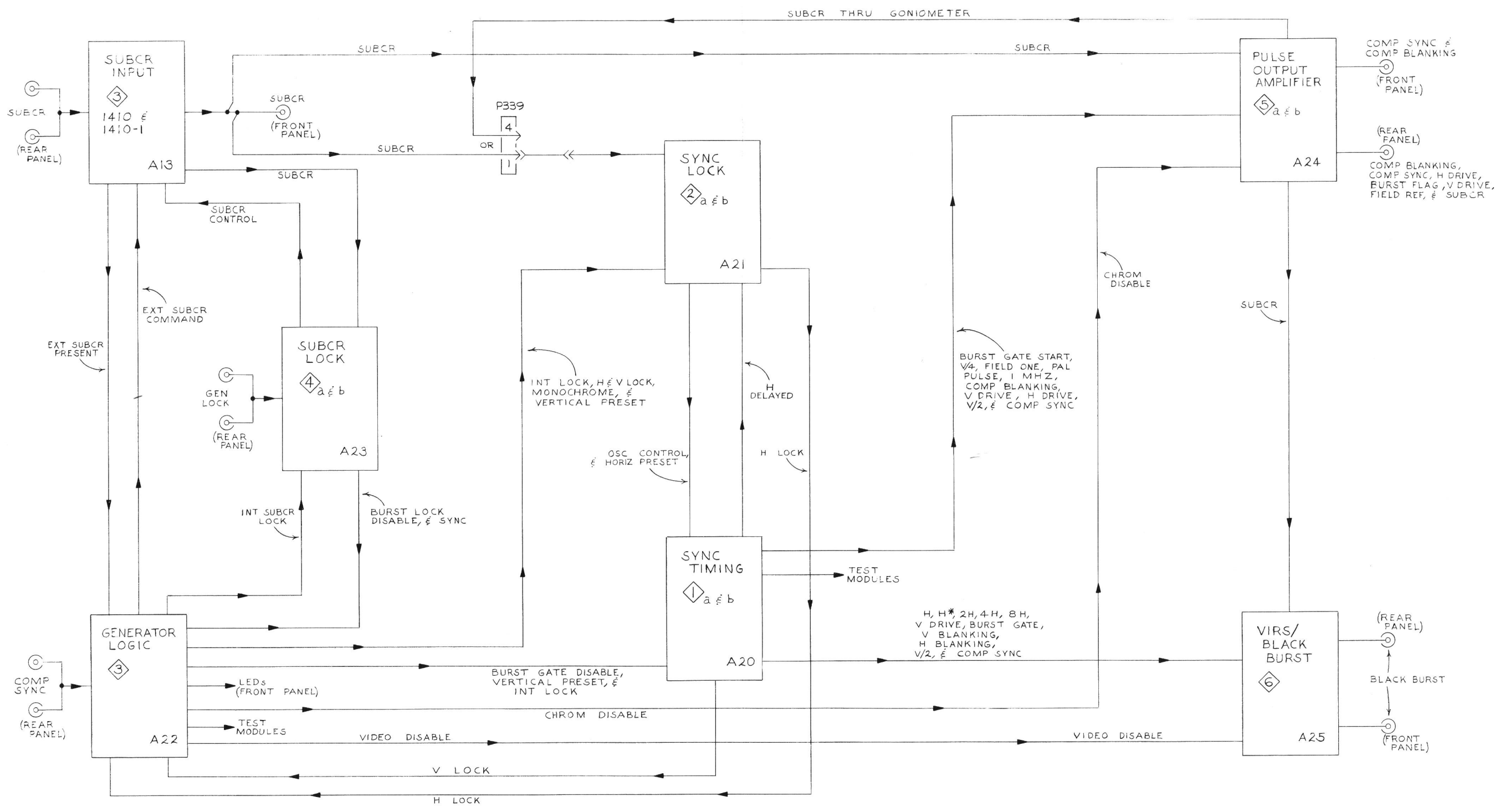
Bk	Black	G	Green
Br	Brown	Bl	Blue
Rd	Red	Vi	Violet
Or	Orange	Gy	Gray
Yl	Yellow	W	White

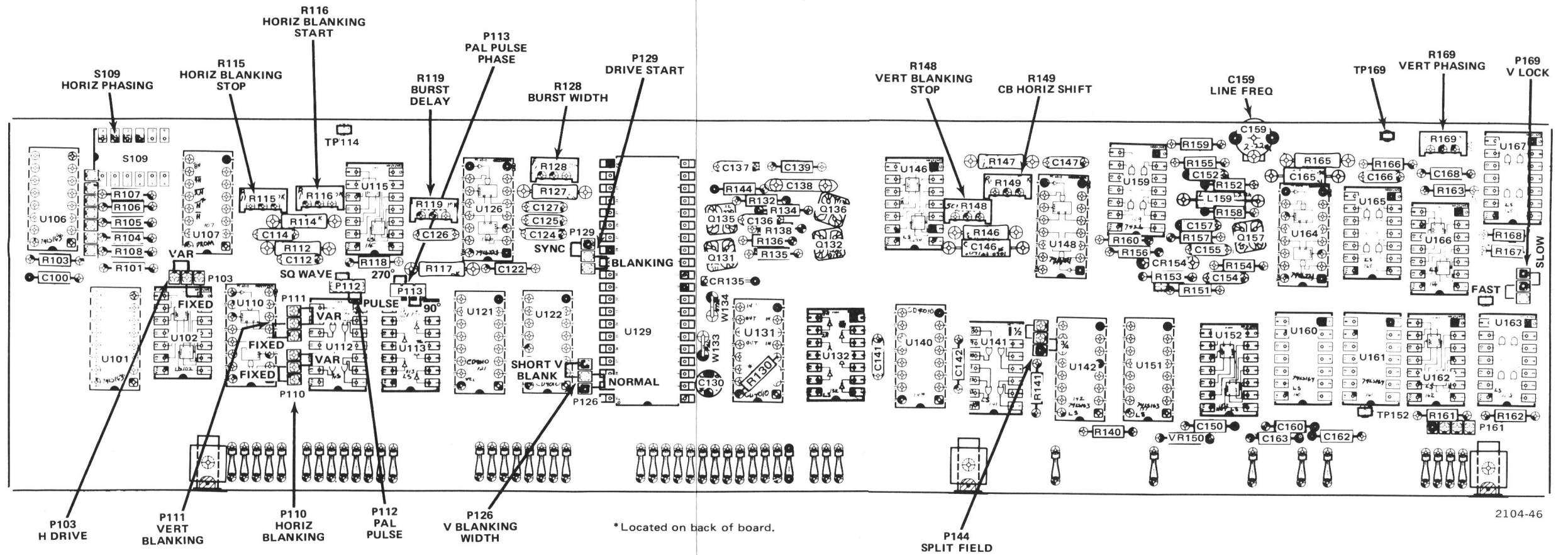
WAVEFORM CONDITIONS

Waveform photographs in this section were taken with a TEKTRONIX C-59 Oscilloscope Camera mounted on a TEKTRONIX 7603 Oscilloscope with 7B53A Time Base and 7A13 Differential Comparator plug-ins.

The vertical input was dc coupled except for those waveforms identified as ac coupled.

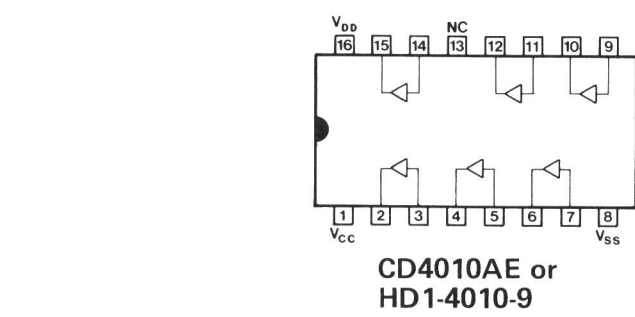
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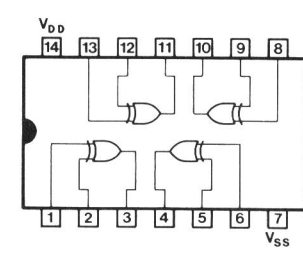


2104-46

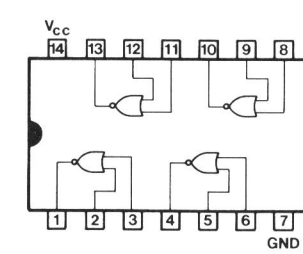
A20 SYNC TIMING CIRCUIT BOARD (SN B020000 & UP).



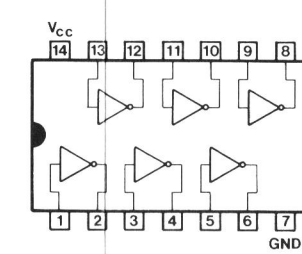
CD4010AE or HD1-4010-9



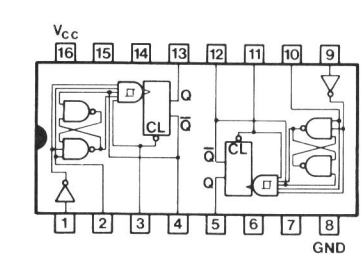
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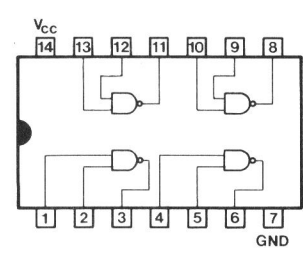
7402 or 74LS02



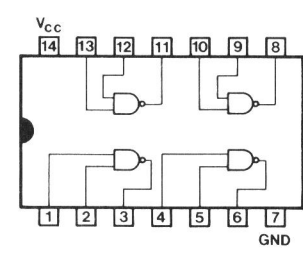
74LS04



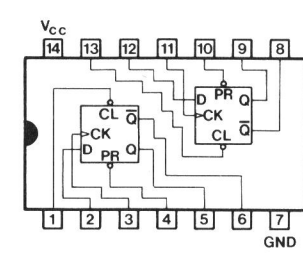
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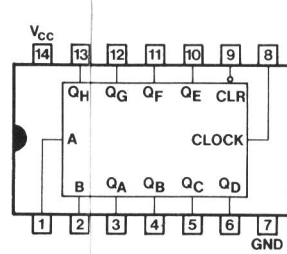
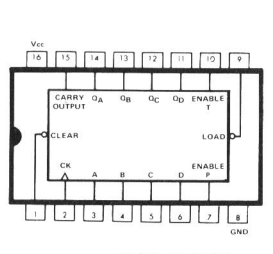
74LS26 or 7426



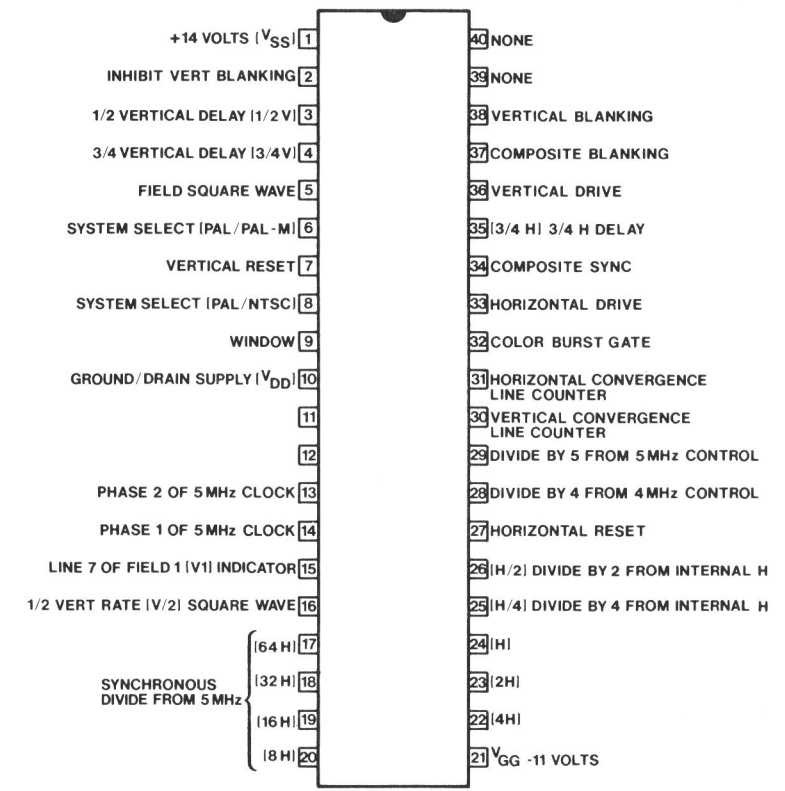
74LS74 or 7474



74LS163

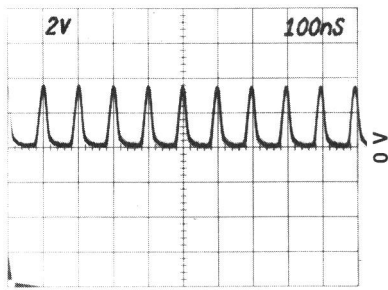


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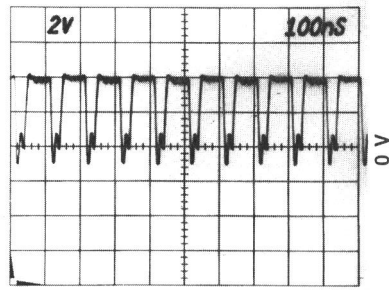


155-0188-00

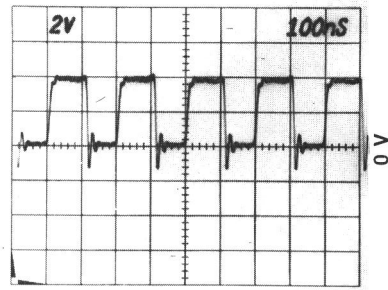
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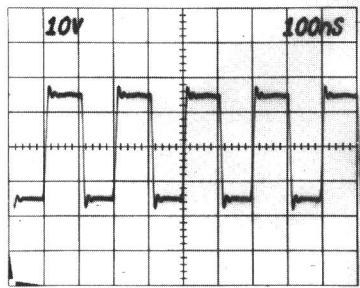
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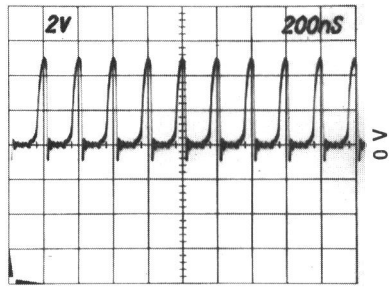
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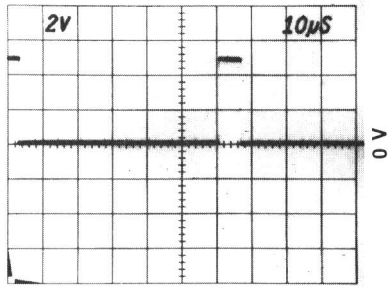
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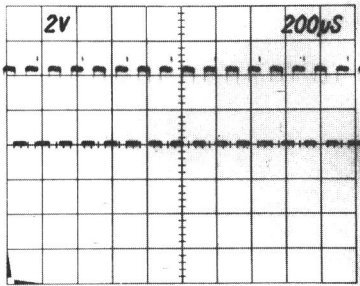
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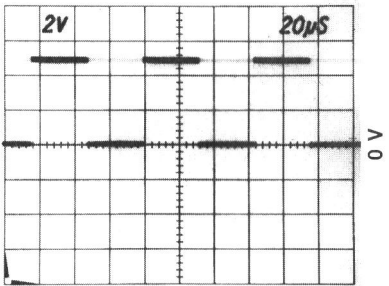
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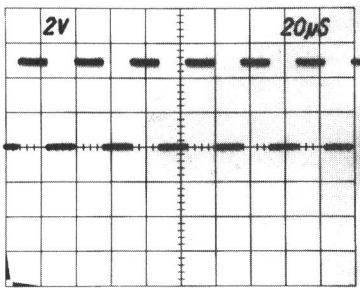
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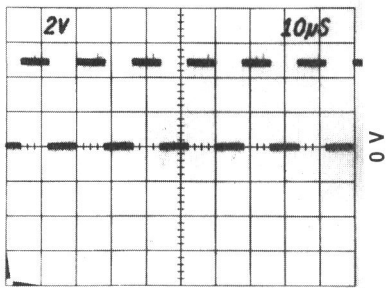
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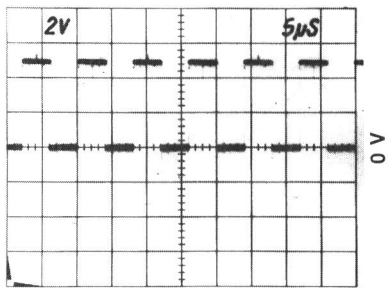
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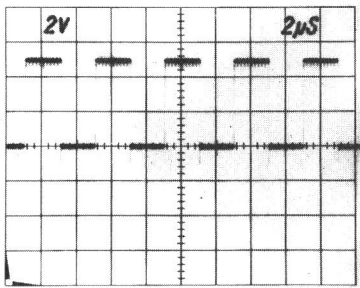
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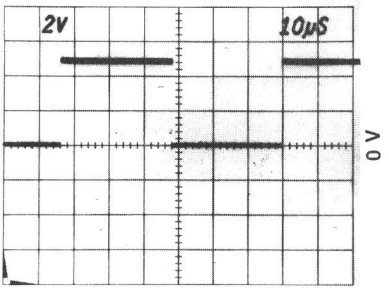
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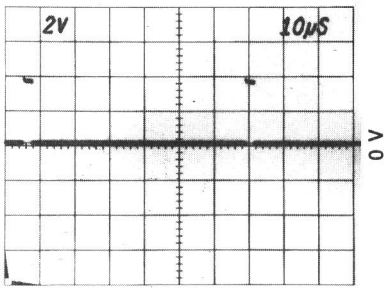
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12



13
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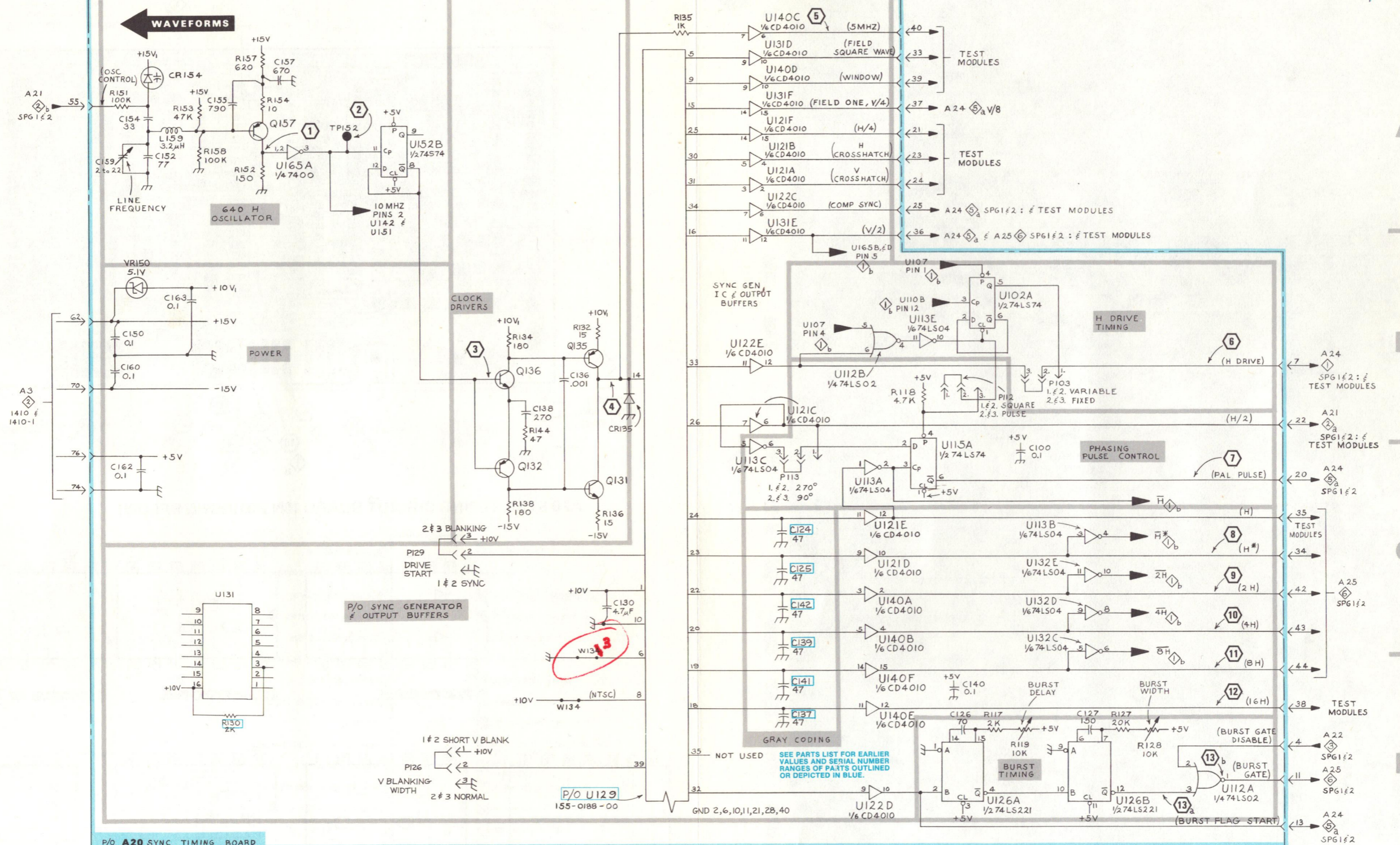
13
b



SYNC TIMING PARTS LOCATING CHART

C100	C4	R117	D4	U122E	B3
C123	C4	R118	B4	U126A	D4
C124	C4	R119	D4	U126B	D5
C125	C4	R124	D3	U128A	C4
C126	D4	R127	D5	U128B	C4
C127	D5	R128	D5	U129	D3
C128	B1	R132	B3	U131D	A3
C129	B1	R133	A3	U131E	A3
C130	C3	R134	B3	U131F	A3
C135	B3	R135	A3	U132C	C5
C136	B3	R136	C3	U132D	C5
C137	D4	R137	B3	U132E	C5
C138	B3	R138	C3	U140A	C4
C139	C4	R139	B3	U140B	C4
C140	D4	R141	A2	U140C	A3
C141	D4	R142	C3	U140D	A3
C142	C4	R143	D3	U140E	D4
C143	C4	R144	B3	U140F	D4
C144	D4	R145	A3	U145A	C4
C145	D4	R150	B1	U145B	D4
C150	B1	R151	A1	U145C	D4
C152	A1	R152	A2	U145D	D4
C154	A1	R153	A1	U152B	A2
C155	A2	R154	A2	U159D	A2
C157	A2	R156	A2	U165A	A2
C159	A1	R157	A2		
C160	B1	R158	A1	VR129	B1
C162	C1				
C163	B1	TP152	A2	W133	D3
				W134	D3
CR154	A1	U102A	B4		
		U112A	D5		
L159	A1	U112B	B4		
		U113A	C4		
P103	B4	U113B	C5		
P112	B4	U113C	C3		
P113	C4	U113E	B4		
		U115A	C4		
Q131	C3	U121A	A3		
Q132	C3	U121B	A3		
Q133	B3	U121C	B3		
Q134	A3	U121D	C4		
Q135	B3	U121E	C4		
Q136	B3	U121F	A3		
Q137	A3	U122C	A3		
Q138	A3	U122D	D4		
Q157	A2				





SPG 1 ε 2

2104-23
REV JUL 1983

GEM 5/76

SYNC TIMING 1a

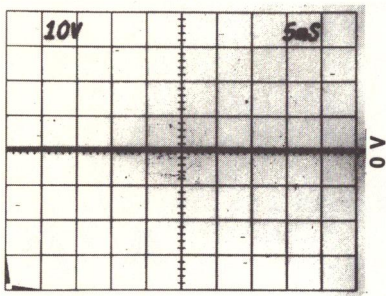
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Det
12 Aug 83*

SYNC TIMING

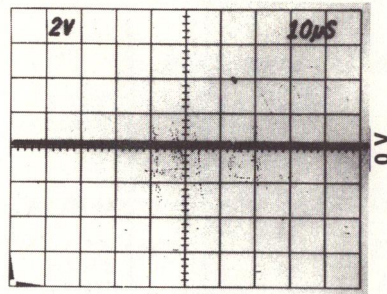
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1a

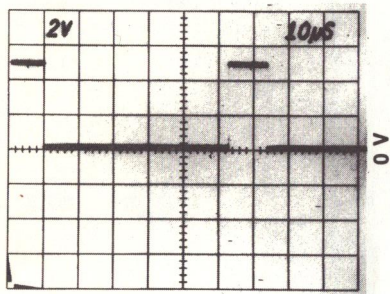
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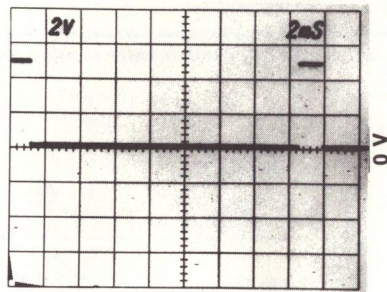
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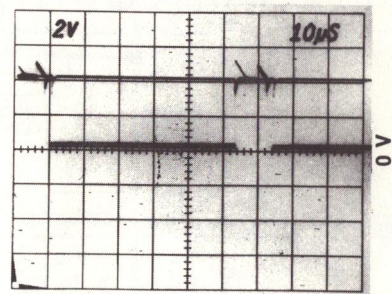
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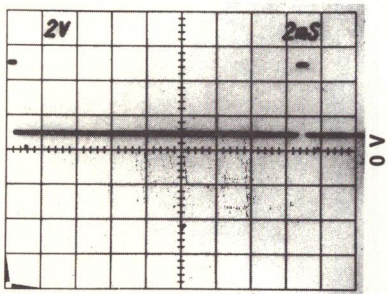
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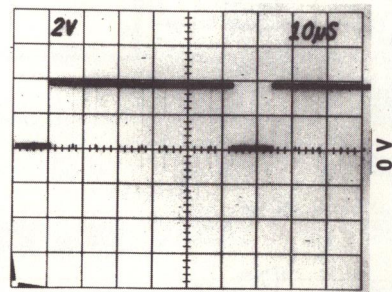
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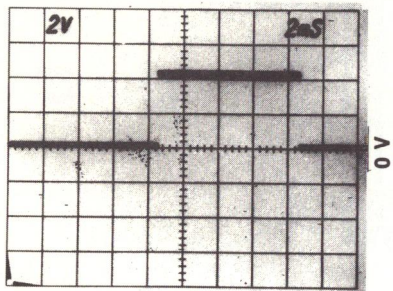
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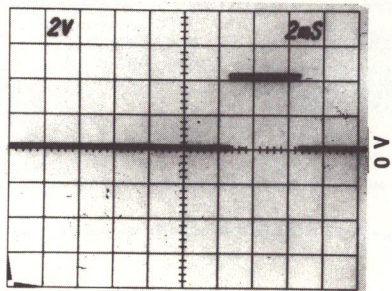
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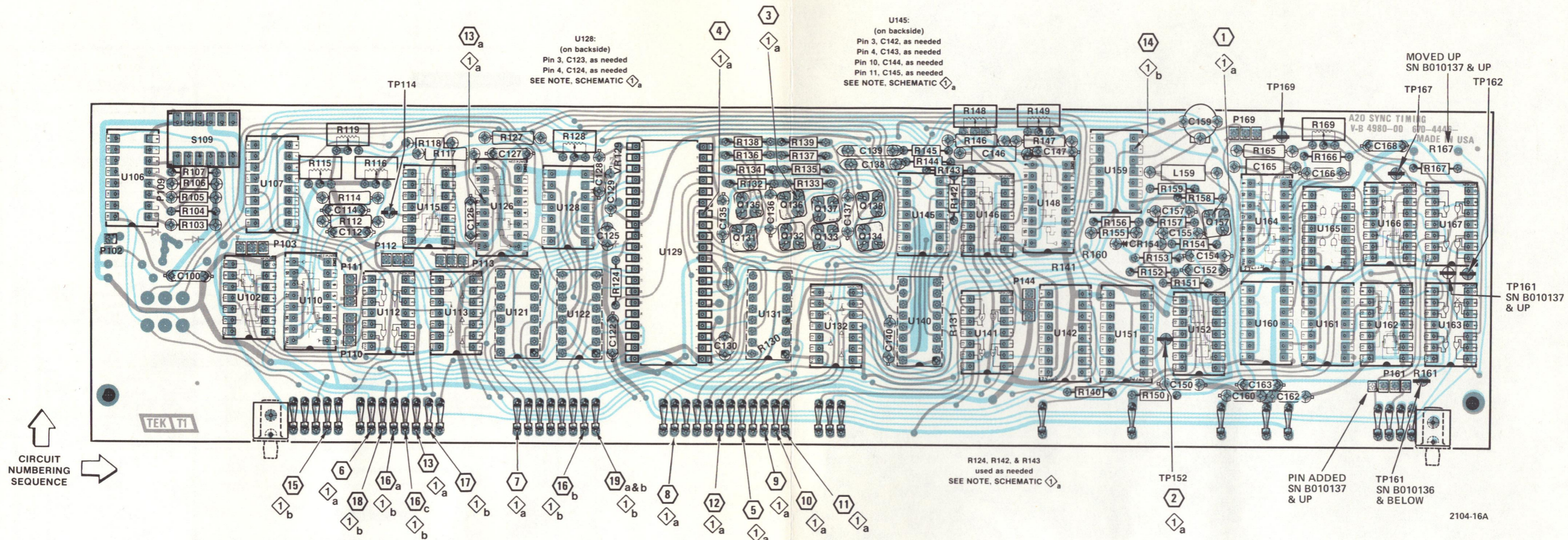
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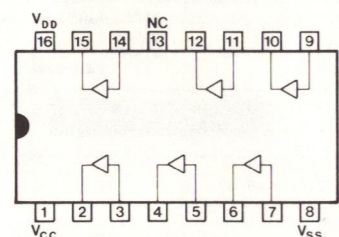
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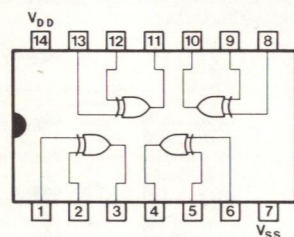
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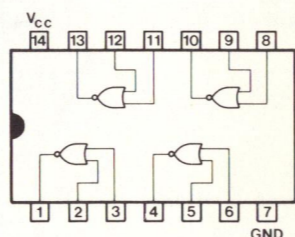
A20 SYNC TIMING CIRCUIT BOARD (SN B01999 & BELOW)



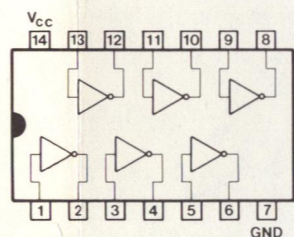
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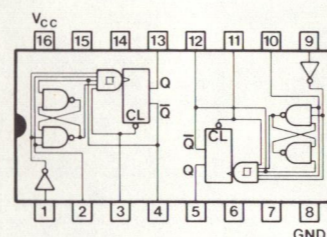
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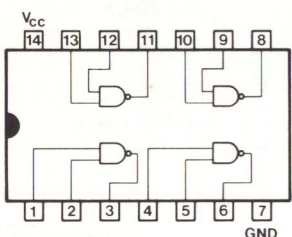
7402 or 74LS02



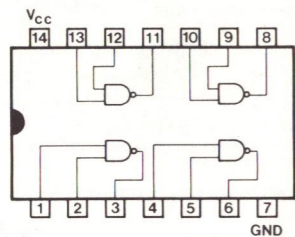
74LS04 or 7404



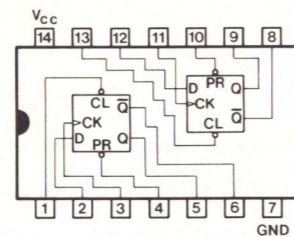
74LS221



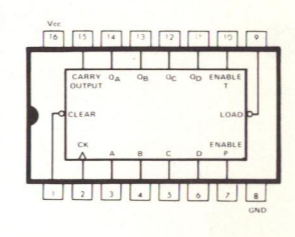
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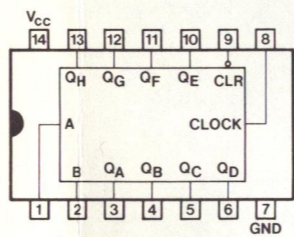
7426



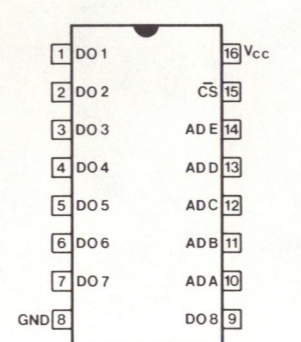
74LS74 or 7474



74163 or 74LS163



74164 or 74LS164



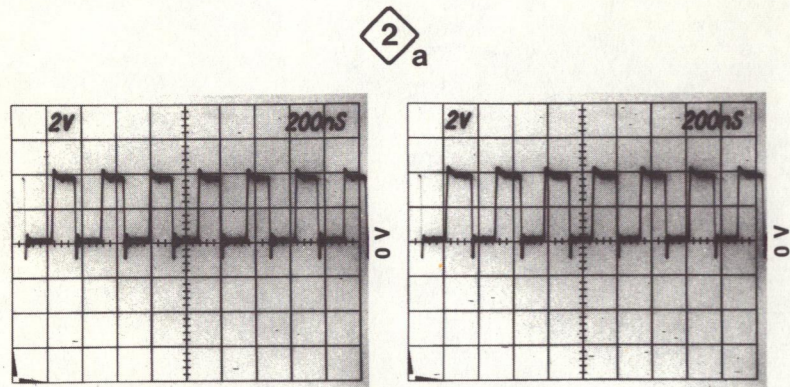
74288

+14 VOLTS (V _{SS})	1	40	NONE
INHIBIT VERT BLANKING	2	39	NONE
1/2 VERTICAL DELAY (1/2 V)	3	38	VERTICAL BLANKING
3/4 VERTICAL DELAY (3/4 V)	4	37	COMPOSITE BLANKING
FIELD SQUARE WAVE	5	36	VERTICAL DRIVE
SYSTEM SELECT (PAL/PAL-M)	6	35	3/4 HI 3/4 H DELAY
VERTICAL RESET	7	34	COMPOSITE SYNC
SYSTEM SELECT (PAL/NTSC)	8	33	HORIZONTAL DRIVE
WINDOW	9	32	COLOR BURST GATE
GROUND/DRAIN SUPPLY (V _{DD})	10	31	HORIZONTAL CONVERGENCE LINE COUNTER
PHASE 2 OF 1.25 MHz CLOCK	11	30	VERTICAL CONVERGENCE LINE COUNTER
PHASE 1 OF 1.25 MHz CLOCK	12	29	DIVIDE BY 5 FROM 5 MHz CONTROL
PHASE 2 OF 5 MHz CLOCK	13	28	DIVIDE BY 4 FROM 4 MHz CONTROL
PHASE 1 OF 5 MHz CLOCK	14	27	HORIZONTAL RESET
LINE 7 OF FIELD 1 (V _I) INDICATOR	15	26	(H/2) DIVIDE BY 2 FROM INTERNAL H
1/2 VERT RATE (V/2) SQUARE WAVE	16	25	(H/4) DIVIDE BY 4 FROM INTERNAL H
SYNCHRONOUS DIVIDE FROM 5 MHz	{ 164 HI | 17 { 32 HI | 18 { 16 HI | 19 { 8 HI | 20	24	1HI
		23	2HI
		22	4HI
		21	V _{GG} -11 VOLTS

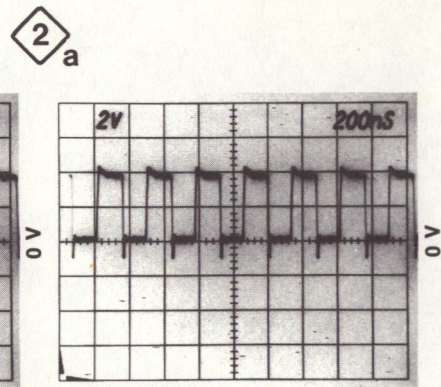


SYNC TIMING PARTS LOCATING CHART

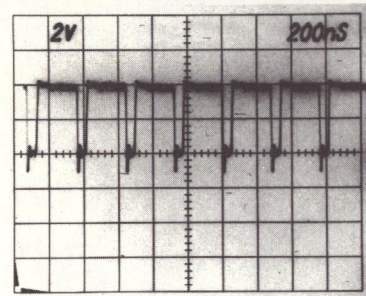
C112	B4	R165	B1	U146A	C3
C114	C4	R166	B2	U146B	D1
C122	D3	R167	A1	U148A	C4
C146	C4	R168	A1	U148B	C3
C147	C3	R169	B1	U151	D2
C165	C1			U152A	C1
C166	C2	S109	A4	U159A	C3
C168	B2			U159B	B2
		TP114	D4	U159C	C3
P110	C5	TP161	A2	U160	B2
P111	D5	TP162	A3	U161	A1
P144	D1	TP167	A3	U162A	A2
P161	A1	TP169	C2	U162B	A1
P161	B1			U163A	B2
P169	C2	U102B	B5	U163B	D2
		U106	A5	U163C	A2
Q168	A1	U107	B4	U163D	A2
		U110A	C4	U164A	C1
R103	A5	U110B	C4	U164B	C2
R104	A4	U112C	D5	U165B,D	A2
R105	A4	U112D	B5	U165C	A3
R106	A4	U113F	D5	U166A	A3
R107	A5	U115B	D4	U166B	A3
R112	B4	U122A	D3	U167A	A3
R114	C4	U122B	D3	U167B	B2
R115	C4	U122F	C3	U167C	B2
R116	B4	U129	B3	U167D	A3
R131	C1	U131A	B3		
R140	C1	U131B	D2		
R146	C4	U131C	D2		
R147	B3	U132A	D2		
R148	C4	U132B	D2		
R149	B3	U141A	D4		
R155	C3	U141B	D2		
R159	C3	U141C	D1		
R160	B2	U141D	D2		
R161	B1	U142	D3		



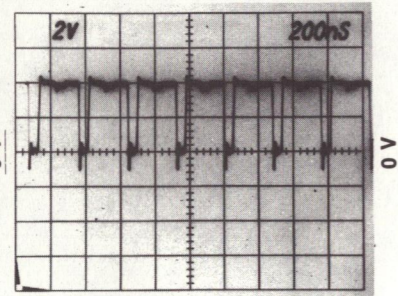
1 INT TRIG



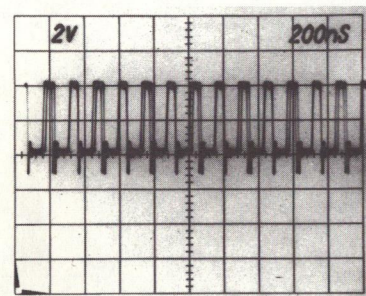
2 INT TRIG



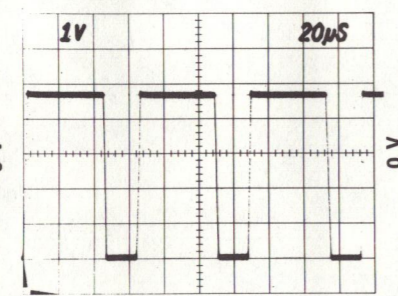
3 INT TRIG



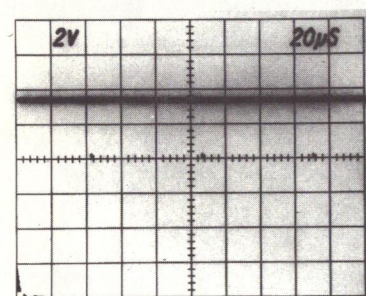
4 INT TRIG



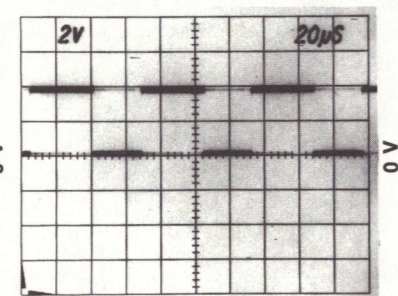
5 INT TRIG



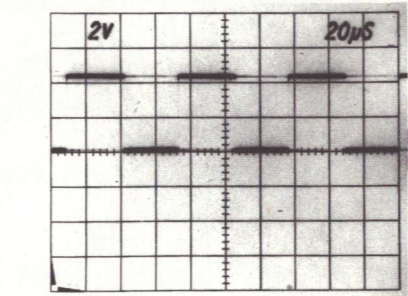
6 EXT MODE



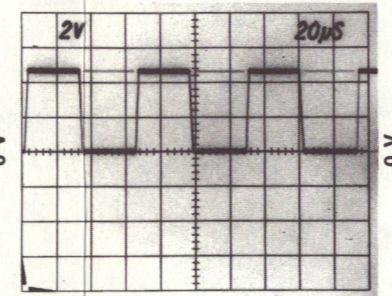
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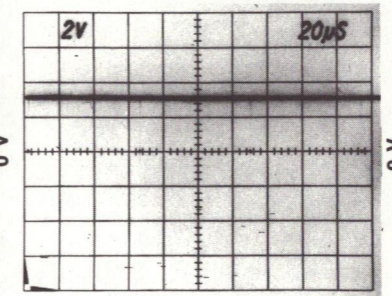
8



9

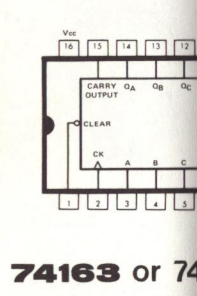
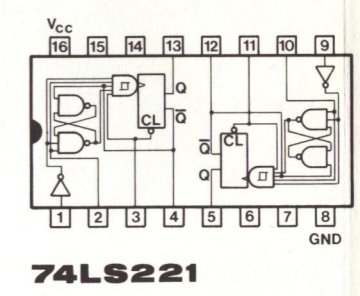
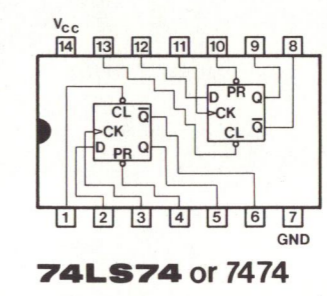
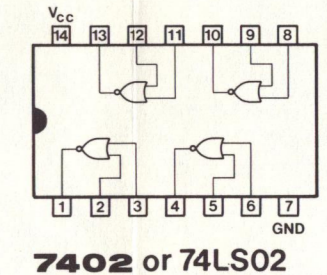
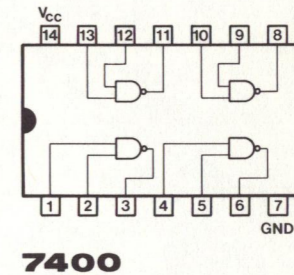
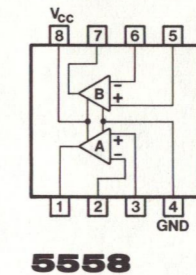
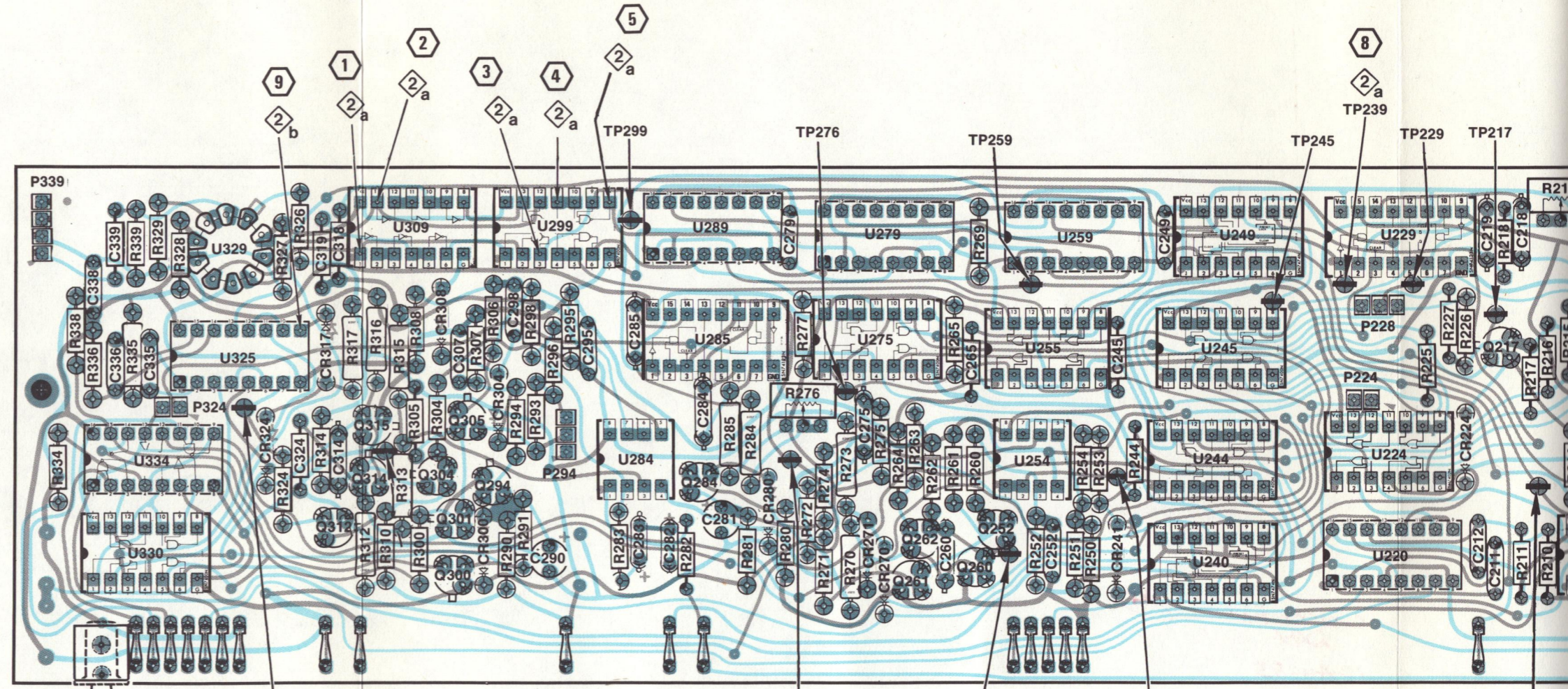


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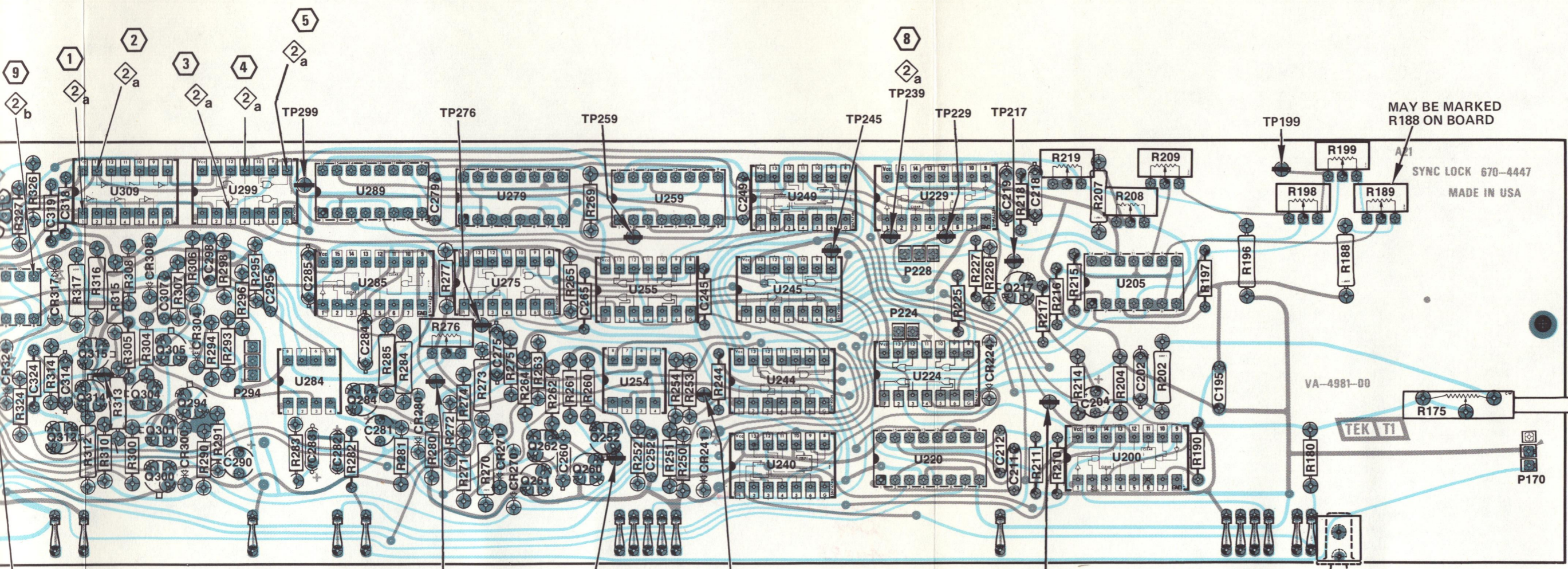


11

A21 SYNC LOCK CIRCUIT BOARD

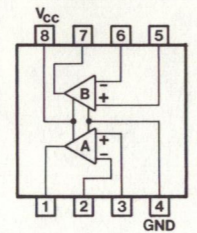
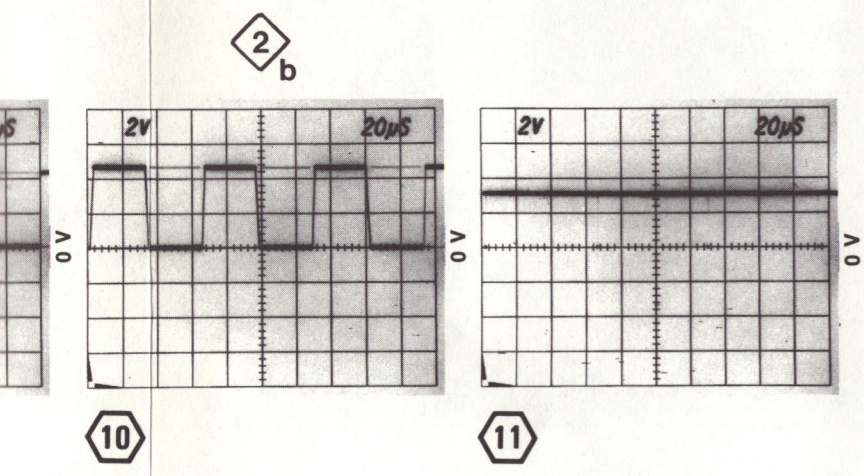


A21 SYNC LOCK AND WAVEFORMS FOR

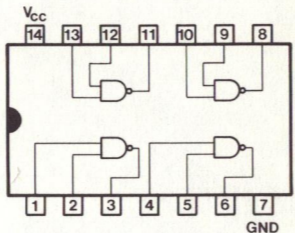


↑
CIRCUIT
NUMBERING
SEQUENCE

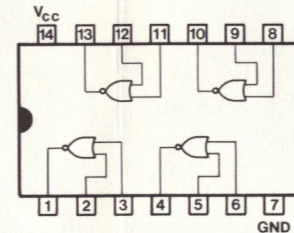
CIRCUIT BOARD



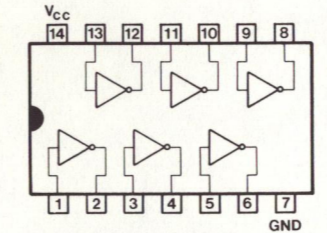
5558



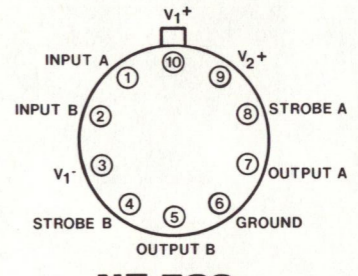
7400



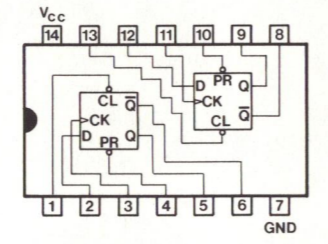
7402 or 74LS02



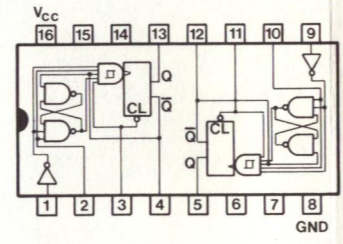
74LS04 or 7404



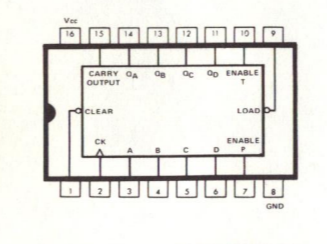
NE 529



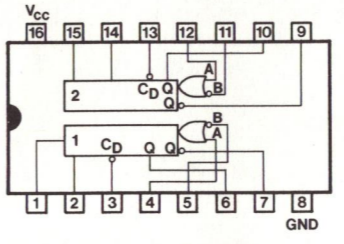
74LS74 or 7474



74LS221



74163 or 74LS163



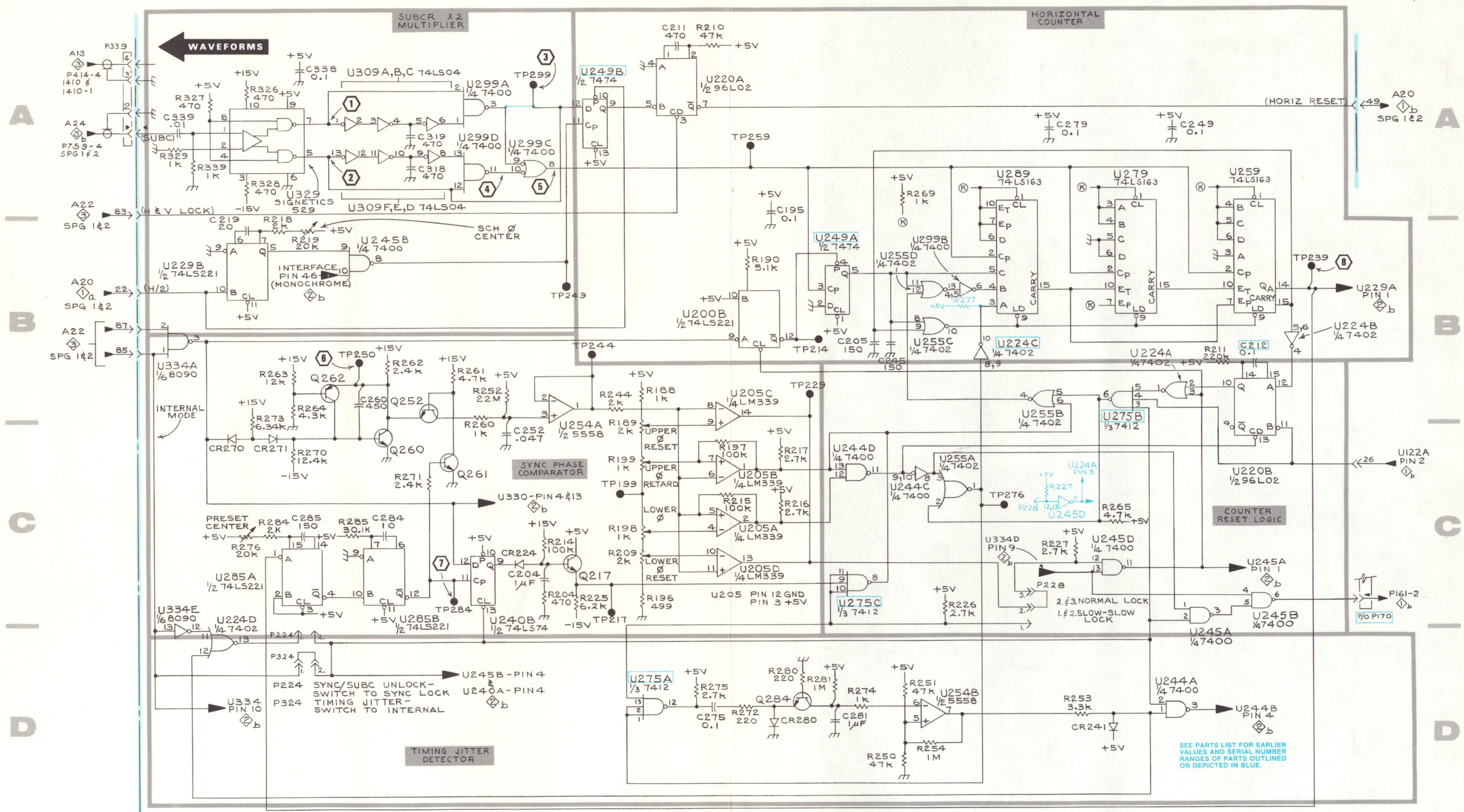
96L02 or 9602

2 a

SYNC LOCK PARTS LOCATING CHART

C195	3A	R199	3C	R285	2C	U229B	1B
C204	2C	R204	2C	R326	1A	U240B	2C
C205	4B	R209	3C	R327	1A	U244A	5D
C211	3A	R210	3A	R328	1A	U244C	4C
C212	5B	R211	5B	R329	1A	U244D	3C
C219	1B	R214	2C	R339	1A	U245A	5C
C245	4B	R215	3C			U245B	5C
C249	5A	R216	3C	TP199	3C	U245C	2B
C251	3D	R217	3C	TP214	3B	U245D	4C
C252	2C	R218	1B	TP217	3C	U249A	3B
C260	2B	R225	2C	TP229	3B	U249B	3A
C275	3D	R226	4C	TP239	5B	U254A	3B
C279	4A	R227	4C	TP244	3B	U254B	4D
C284	2C	R244	3B	TP250	2B	U255A	4C
C285	1C	R250	4D	TP259	3A	U255B	4B
C318	2A	R251	4D	TP276	4C	U255C	4B
C319	2A	R252	2B	TP284	2C	U255D	4B
C338	1A	R253	4D	TP299	2A	U259	4A
C339	1A	R254	4D			U275A	3D
		R260	2B	Q217	2C	U275B	4B
CR224	2C	R261	2B	Q252	2B	U275C	3C
CR241	4D	R262	2B	Q260	2C	U279	4A
CR270	1C	R263	1B	Q261	2C	U285A	1C
CR271	1C	R264	1B	Q262	2B	U285B	2C
CR280	3D	R265	4C	Q284	3D	U289	4A
		R269	4A			U299A	2A
P170	5C	R270	1C	U200B	3B	U299B	4B
P224	1D	R271	2C	U205A	3C	U299C	2A
P228	4C	R272	3D	U205B	3C	U299D	2A
P324	1D	R273	1B	U205C	3B	U309A	2A
		R274	4D	U205D	3C	U209B	2A
R188	3B	R275	3D	U220A	3A	U309C	2A
R189	3C	R276	1C	U220B	5C	U309D	2A
R190	3B	R277*	4B	U224A	5B	U309E	2A
R196	3C	R280	3D	U224B	5B	U309F	2A
R197	3C	R281	3D	U224C	4B	U329	1A
R198	3C	R284	1C	U224D	1D	U334A	1B
						U334E	1D

*See Parts List for
serial number ranges.



P/O A21 SYNC LOCK BOARD
SPG 1 & 2

2104-27
REV JUL 1983

GEM 8/76

SYNC LOCK 2a

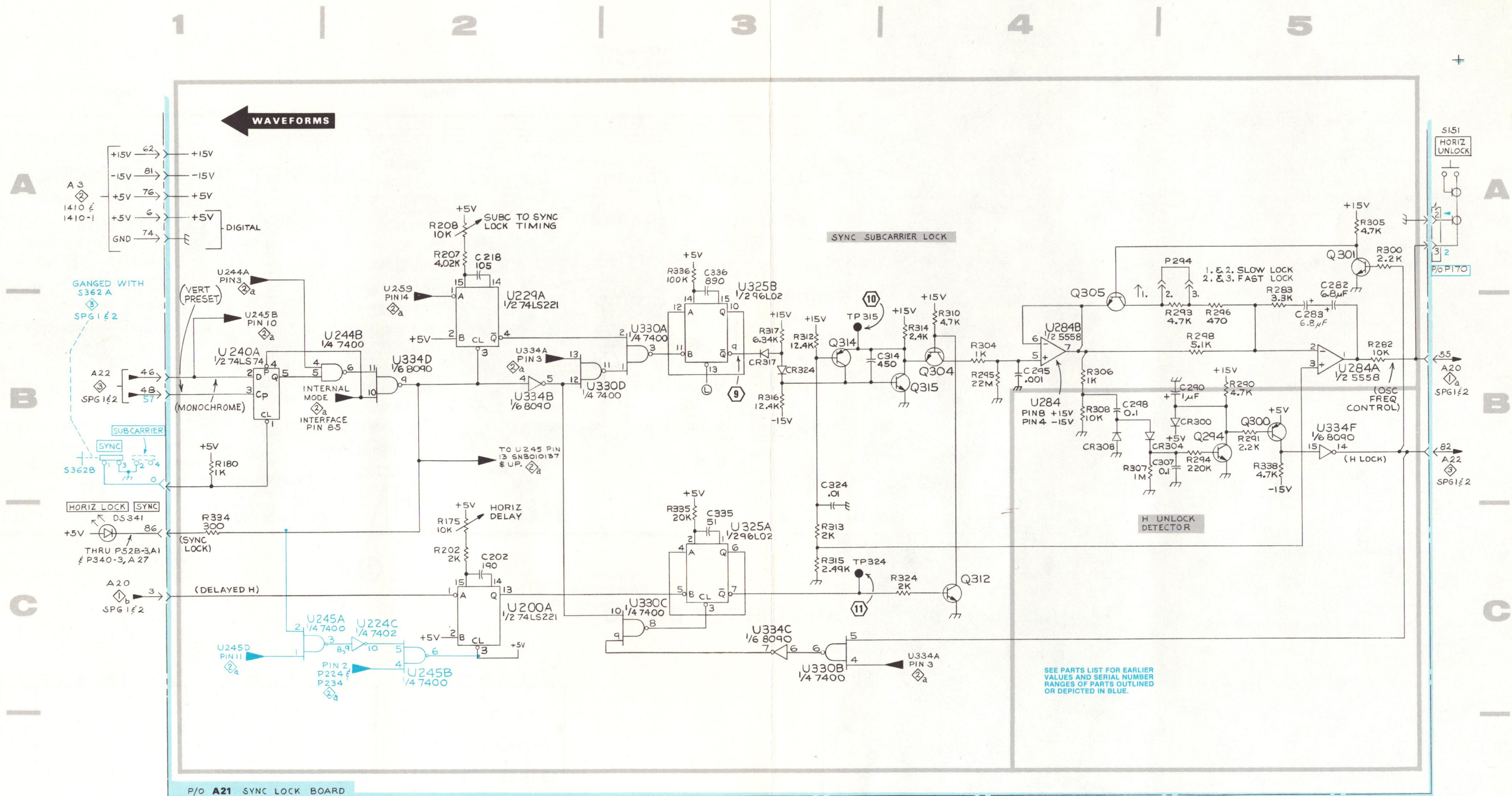
SEE PARTS LIST FOR EARLIER
VALUES AND SERIAL NUMBER
RANGES OF PARTS OUTLINED
OR DEPICTED IN BLUE.

SYNC LOCK

2 b

SYNC LOCK PARTS LOCATING CHART

C202	C2	R296	B5
C218	A2	R298	B5
C282	B5	R300	A5
C283	B5	R304	B4
C290	B5	R305	A5
C295	B4	R306	B4
C298	B4	R307	B4
C307	B5	R308	B4
C314	B3	R310	B4
C324	B3	R312	B3
C335	C3	R313	C3
C336	A3	R314	B4
		R315	C3
CR300	B5	R316	B3
CR304	B5	R317	B3
CR308	B4	R324	C4
CR317	B3	R334	C1
CR324	B3	R335	B3
		R336	A3
DS341	C1	R338	B5
P170	A5	S151	A5
P294	A5	S362B	B1
Q294	B5	TP315	B3
Q300	B5	TP324	C3
Q301	A5		
Q304	B4	U200A	C2
Q305	A4	U224C	C2
Q312	C4	U229A	A2
Q314	B3	U240A	B1
Q315	B4	U244B	B2
		U245A	C1
R175	C2	U245B	C2
R180	B1	U284A	B5
R202	C2	U284B	B4
R207	A2	U325A	C3
R208	A2	U325B	A3
R282	B5	U330A	B3
R283	B5	U330B	C3
R290	B5	U330C	C3
R291	B5	U330D	B2
R293	B5	U334B	B2
R294	B5	U334C	C3
R295	B4	U334D	B2
		U334F	B5



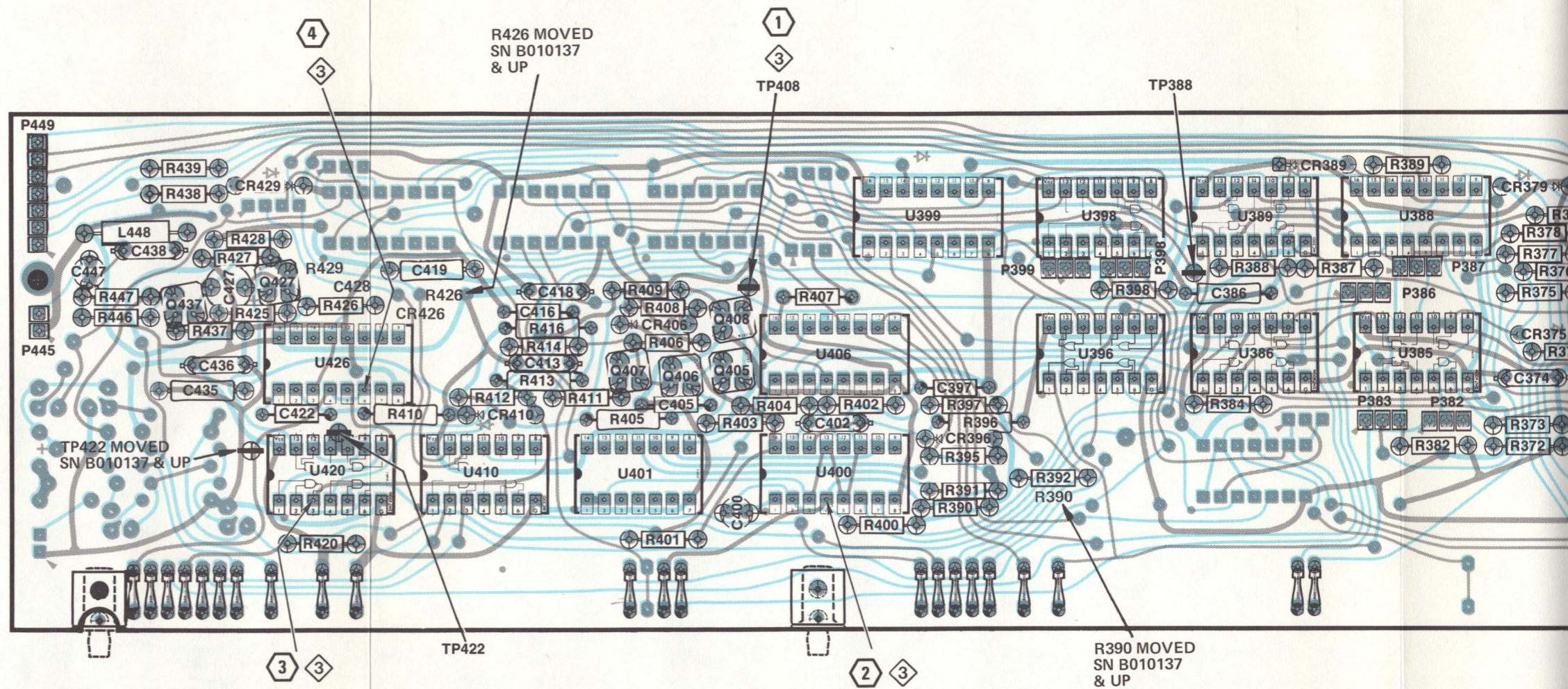
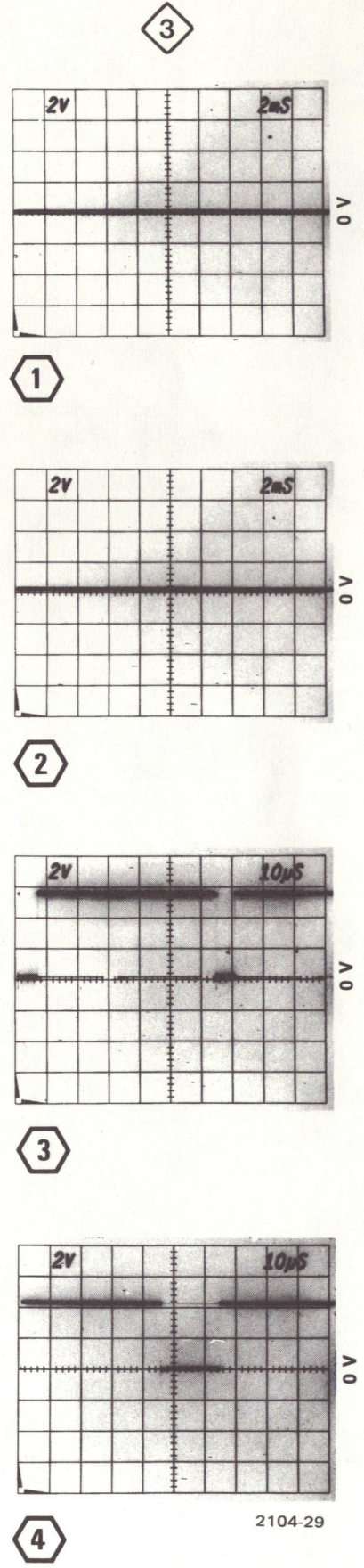
P/O A21 SYNC LOCK BOARD

SPG 1 & 2

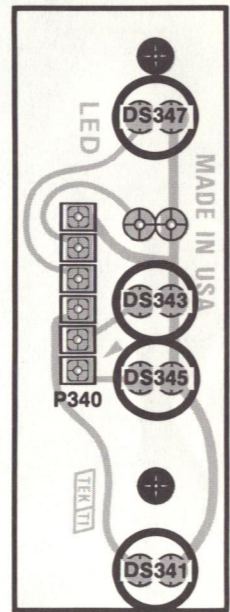
2104-28 REV APR 1981

GEM 7/76

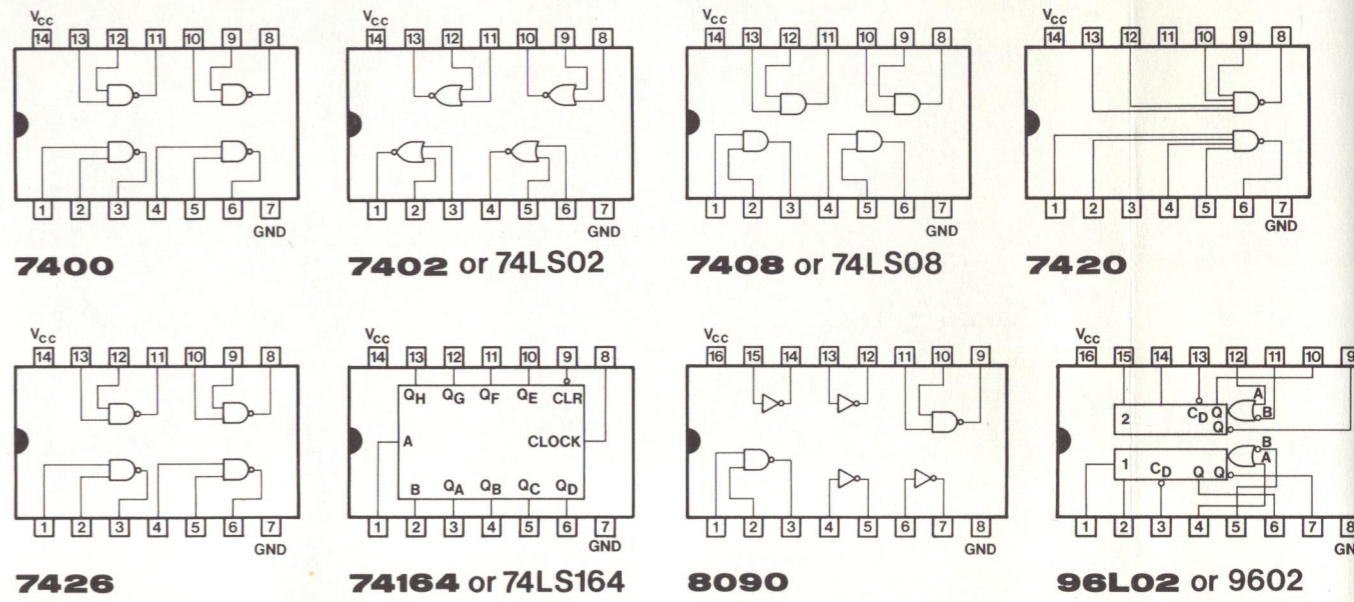
SYNC LOCK



A22 GENERATOR LOGIC CIRCUIT BOARD



A27 LED CIRCUIT BOARD



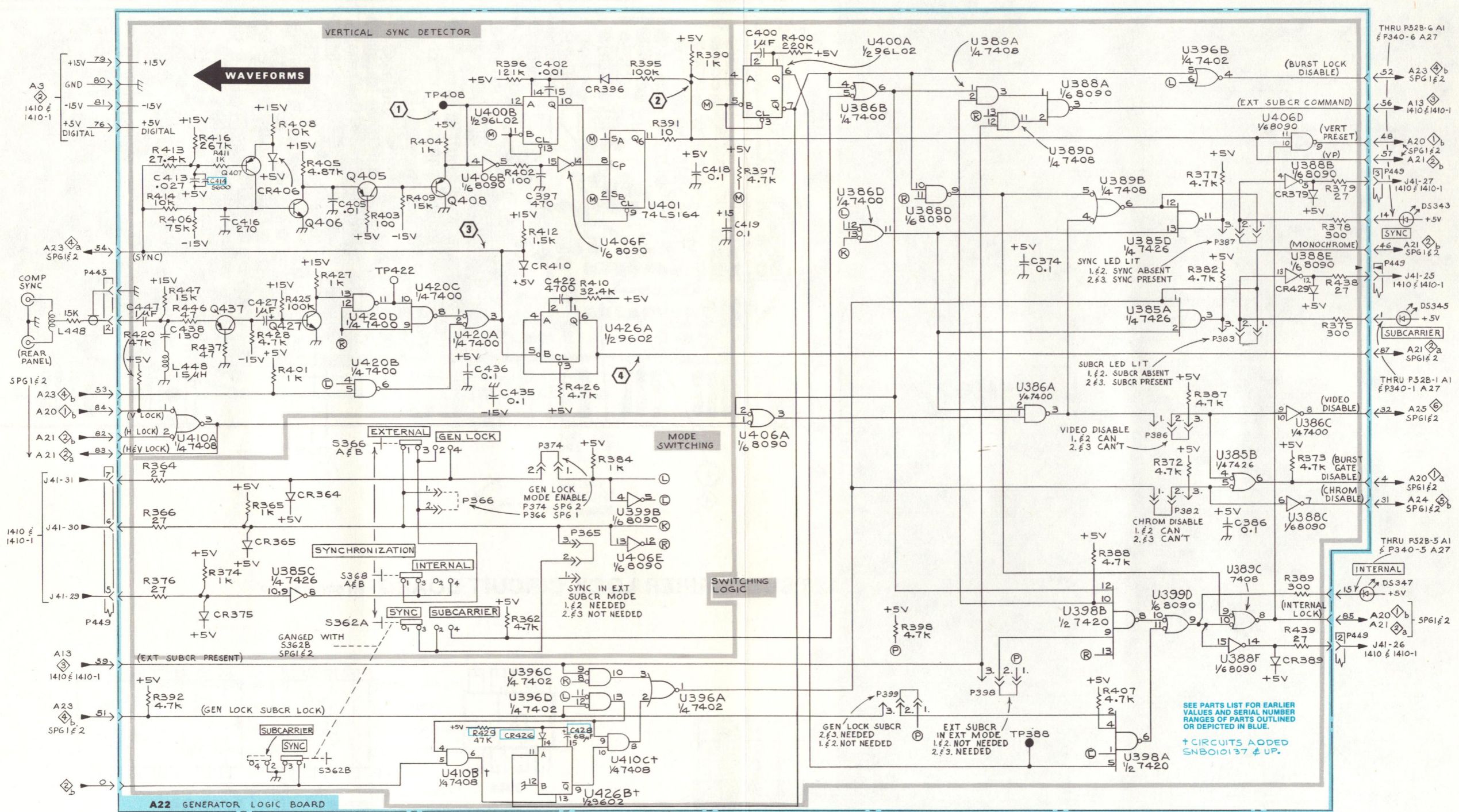
GENERATOR LOGIC PARTS LOCATING CHART

C374	4B	R362	2C	S362A	2C
C386	5C	R364	1C	S362B	2D
C397	2A	R365	1C	S366	2C
C400	3A	R366	1C	S368A	2C
C402	2A	R372	5C		
C405	2A	R373	5C	TP388	4D
C413	1A	R374	1C	TP408	2A
C414*	1A	R375	5B	TP422	2B
C418	3A	R376	1C		
C419	3B	R377	5A	U385A	5B
C422	2B	R378	5B	U385B	5C
C427	1B	R379	5A	U385C	2C
C428	2D	R382	5B	U385D	5B
C435	2B	R384	4C	U386A	4B
C436	2B	R387	5B	U386B	4A
C438	1B	R388	4C	U386C	5B
C447	1B	R389	5B	U386D	4B
		R390	3A	U388A	4A
CR364	2C	R391	3A	U388C	5C
CR365	1C	R392	1D	U388D	4A
CR375	1C	R395	3A	U388E	5B
CR379	5A	R396	2A	U388F	5D
CR389	5D	R397	3A	U389A	4A
CR396	3A	R398	4C	U389B	4A
CR406	1A	R400	3A	U389C	5C
CR410	2B	R401	1B	U389D	4A
CR426*	2D	R402	2A	U396A	3D
CR429	5B	R404	2A	U396B	5A
		R405	2A	U396C	3D
L448	1B	R407	4D	U396D	3D
		R408	1A	U398A	4D
P365	3C	R409	2A	U398B	4C
P366	2C	R410	3B	U399B	3C
P374	2C	R411	1A	U399D	5C
P382	5C	R412	2B	U400A	3A
P383	5B	R413	1A	U400B	2A
P386	5C	R414	1A	U401A	3A
P387	5B	R416	1A	U406A	3B
P398	4D	R420	1B	U406B	2A
P399	4D	R425	2B	U406D	5A
		R426	2B	U406E	3C
Q405	2A	R427	2B	U410A	1C
Q406	2A	R428	1B	U410B	2D
Q407	1A	R429*	2D	U410C	3D
Q408	2A	R437	1B	U420A	2B
Q427	2B	R438	5B	U420B	2B
Q433	1B	R439	5D	U420C	2B
		R446	1B	U420D	2B
		R447	1B	U426A	2B
				U426B	3D

*See Parts List for
serial number ranges.

A
B
C
D

A
B
C
D



SPG1E2

2104-30
REV AUG 1982

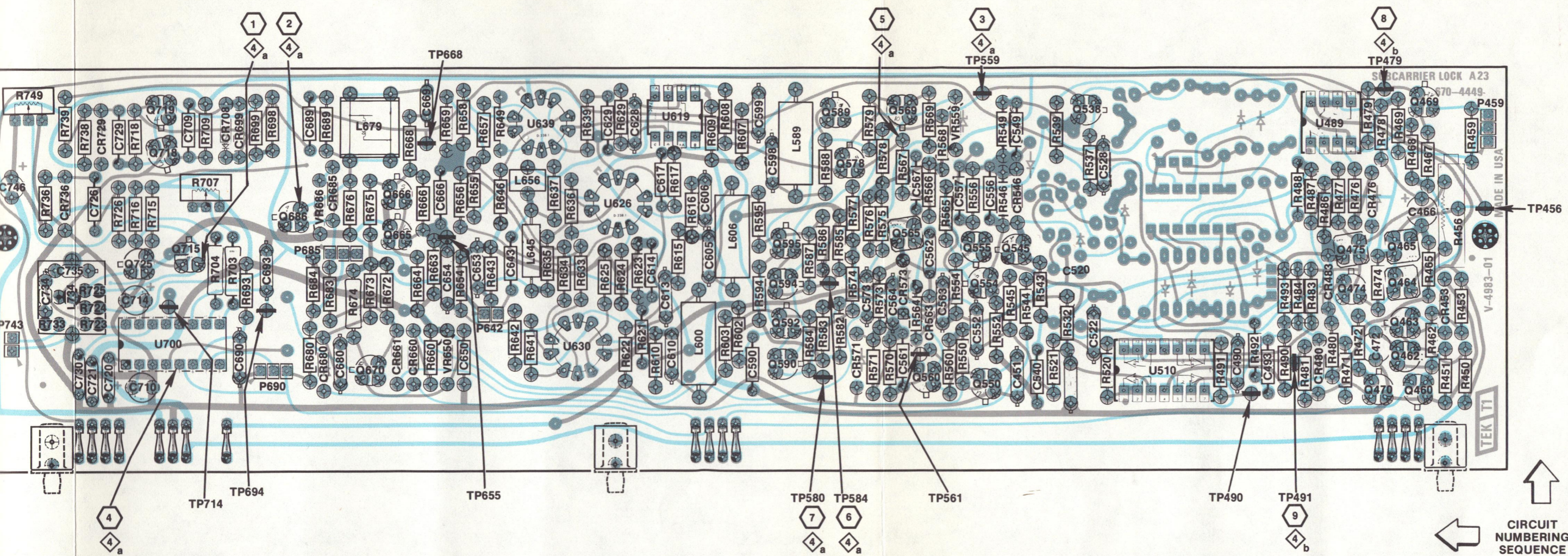
GEM 9/76

VERTICAL SYNC & GENERATOR LOGIC

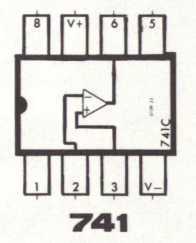
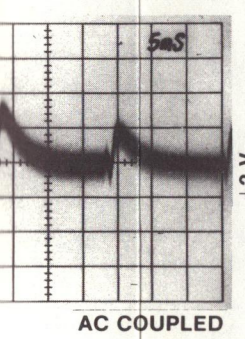
SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS OUTLINED OR DEPICTED IN BLUE.

† CIRCUITS ADDED SNB010137 & UP.

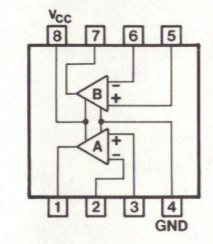
VERTICAL SYNC AND GENERATOR LOGIC 3



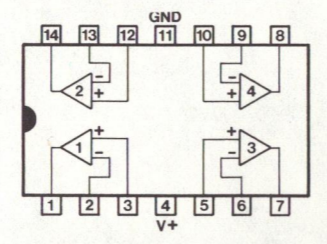
23 SUBCARRIER LOCK CIRCUIT BOARD SN B021076 & UP



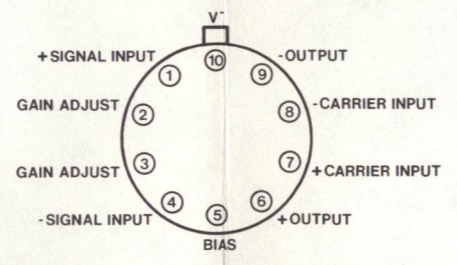
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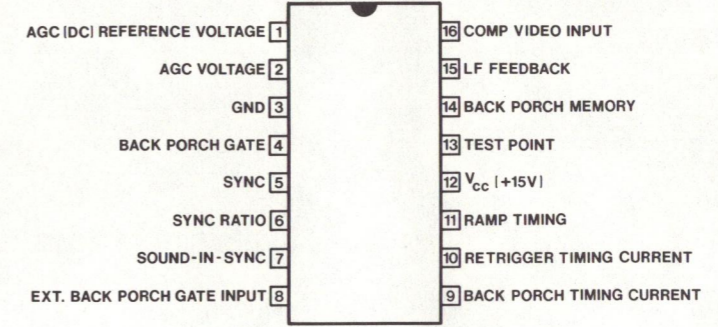
5558



LM324



MC1496G



155-0144-00

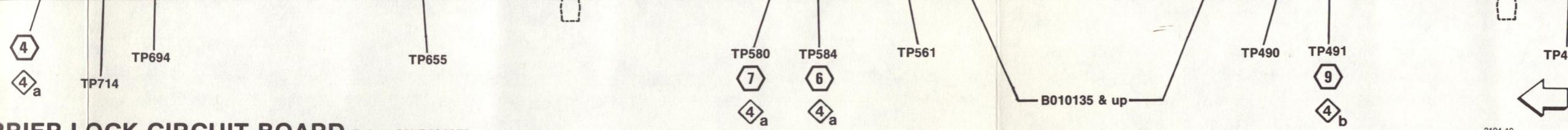
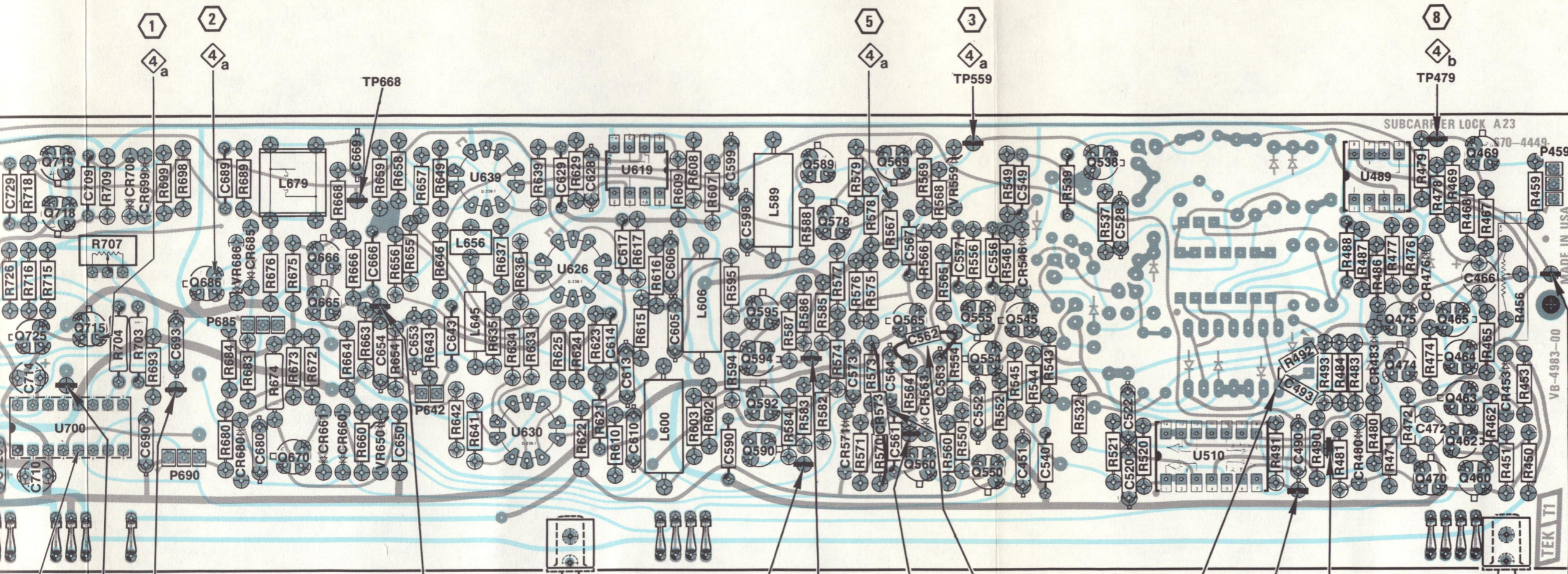


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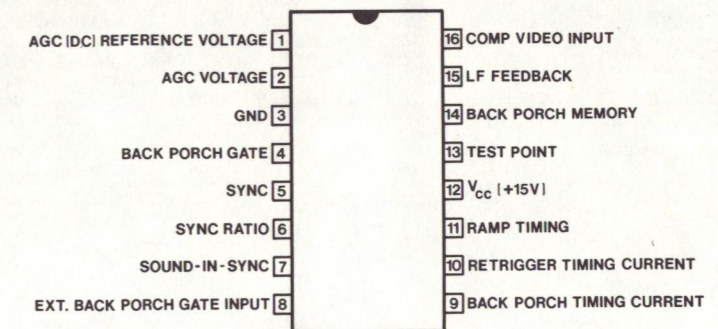
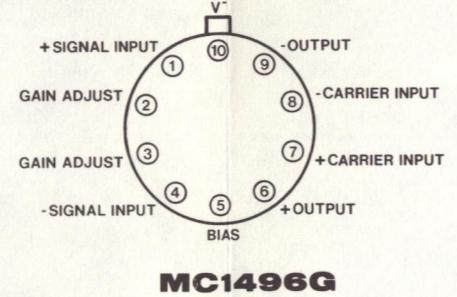
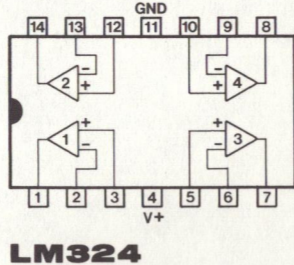
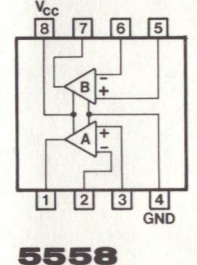
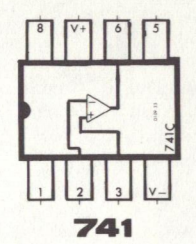
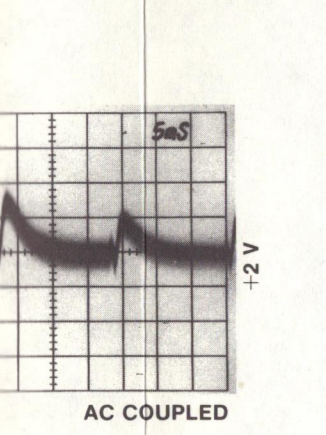
SUBCARRIER LOCK PARTS LOCATING CHART

C567	3C	L589	4A	R602	5B	R676	3B
C573	3C	L600	4C	R603	5C	R680	3C
C590	5C	L606	4B	R607	4A	R683	3B
C598	5A	L645	4B	R608	5A	R684	3B
C599	4A	L656	4A	R609	5A	R689	3A
C605	5B	L679	3A	R610	4C	R693	2C
C606	4B	L734	1B	R615	4C	R698	3A
C610	5C			R616	4B	R699	2A
C613	4C	P685	3B	R617	4B	R703	2C
C614	4C	P690	3D	R621	4C	R704	2C
C617	4B			R622	4B	R707	2C
C628	4A	Q565	3C	R623	4C	R709	2B
C629	4A	Q569	5A	R624	4B	R715	2B
C643	4A	Q578	5A	R625	4C	R716	2B
C650	3C	Q589	5A	R629	4A	R718	3B
C653	4B	Q590	5C	R633	4C	R723	1C
C654	4C	Q592	5C	R634	4C	R724	2B
C666	4A	Q594	5B	R635	4B	R725	2B
C667*	3A	Q595	5B	R636	4B	R726	2B
C669	3A	Q670	3C	R637	4A	R733	1B
C680	3C	Q665	3A	R639	4A	R736	2B
C689	3A	Q666	3A	R641	4C	R738	2B
C690	2D	Q686	3B	R642	4C	R739	2B
C693	2D	Q715	2B	R643	4B	R749	2C
C709	3B	Q718	2B	R646	4A		
C710	2D	Q719	3A	R649	4A	TP559	5A
C714	1D	Q725	1B	R654	4C	TP558	5C
C720	2D			R655	4B	TP584	5B
C721	2C	R566	3C	R656	4B	TP655	4B
C726	2B	R567	4C	R657	4A	TP694	2D
C729	2B	R568	5A	R658	4A	TP714	2D
C730	2D	R569	5A	R659	4A		
C734	1B	R574	3C	R660	3C	U619	4A
C735	1B	R575	3C	R663	3A	U626	4B
C746	2D	R576	3C	R665	3A	U630	4C
		R577	5B	R666	3A	U639	4A
CR660	3C	R578	5A	R668	3A	U700	2D
CR680	3C	R579	5A	R672	3C		
CR685	3B	R582	5C	R673	3C	VR559	5B
CR699	3B	R583	5C	R674	3C	VR650	3C
CR708	3B	R584	5C	R675	3A	VR686	3B
CR729	2B	R585	5B				
CR736	2B	R586	5B				
		R587	5B				
		R588	5A				
		R594	5B				
		R595	5B				

*See Parts List for serial number ranges.



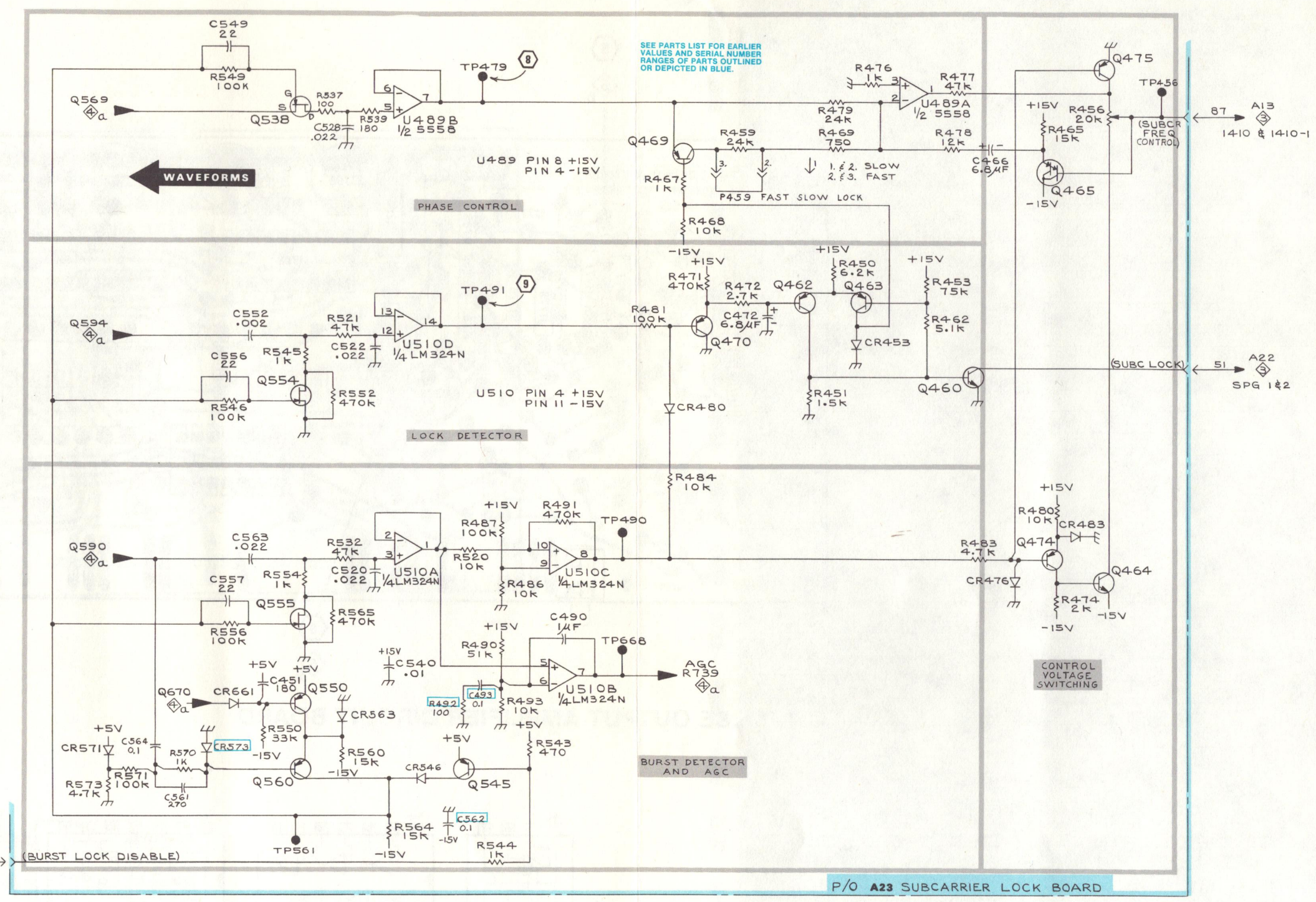
CARRIER LOCK CIRCUIT BOARD Below SN B021076



4 b

SUBCARRIER LOCK PARTS LOCATING CHART

C451	C2	R469	A3
C466	A4	R471	B3
C472	B3	R472	B3
C490	C3	R474	C4
C493	C2	R476	A4
C520	C2	R477	A4
C522	B2	R478	A4
C528	A2	R479	A3
C540	C2	R480	C4
C549	A1	R481	B3
C552	B2	R483	C4
C556	B1	R484	B3
C557	C1	R486	C2
C561	D1	R487	C2
C562	D2	R490	C2
C563	C2	R491	C3
C564	D1	R492	C2
CR453	B4	R493	C2
CR476	C4	R520	C2
CR480	B3	R521	B2
CR563	C2	R532	C2
CR571	D1	R537	A2
CR573	D1	R539	A2
CR661	C2	R543	D2
P459	A3	R544	D2
Q460	B4	R545	D2
Q462	B3	R546	B1
Q463	B4	R549	A1
Q464	C4	R550	D2
Q465	A4	R552	B2
Q469	A3	R554	C2
Q470	B3	R556	C1
Q474	C4	R560	D2
Q475	A4	R564	D2
Q538	A2	R565	C2
Q545	D2	R570	D1
Q550	C2	R571	D1
Q554	B2	R573	D1
Q555	C2	TP456	A5
Q560	D2	TP479	A2
R450	B3	TP490	C3
R451	B3	TP491	B2
R453	B4	TP561	D2
R456	A4	TP668	C3
R459	A3	U489A	A4
R462	B4	U489B	A2
R465	A4	U510A	C2
R467	A3	U510B	C3
R468	A3	U510C	C3
		U510D	B2



SPG 2

2104-33
 REV. A, MAR. 1978

GEM

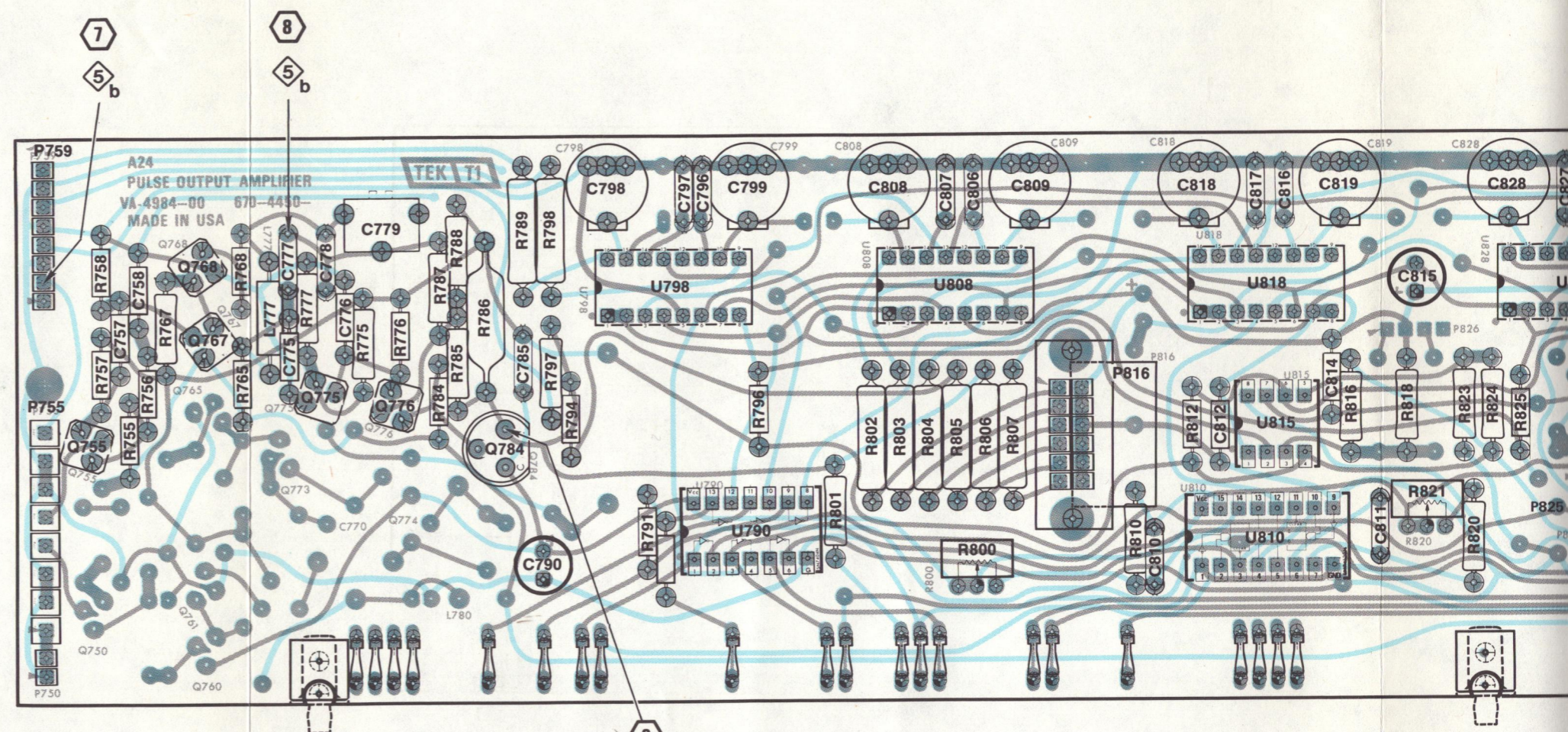
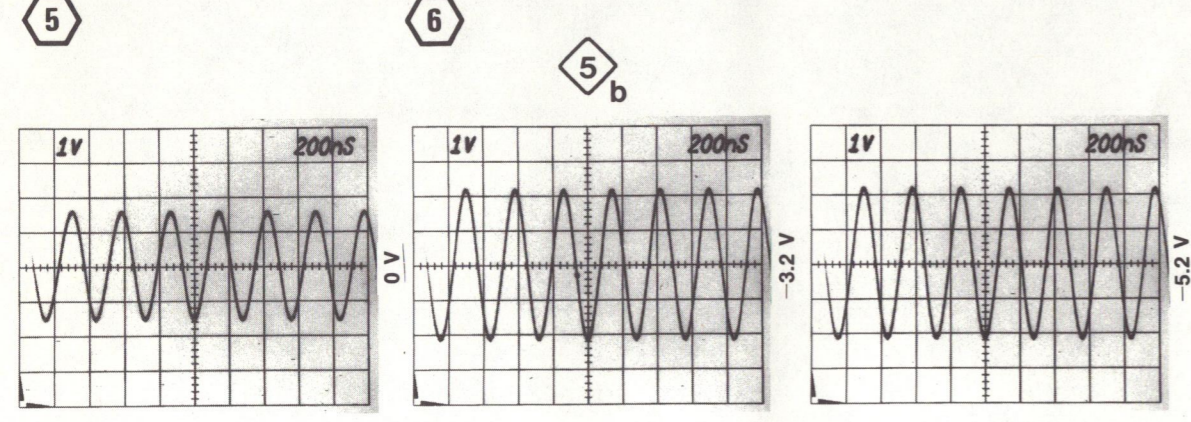
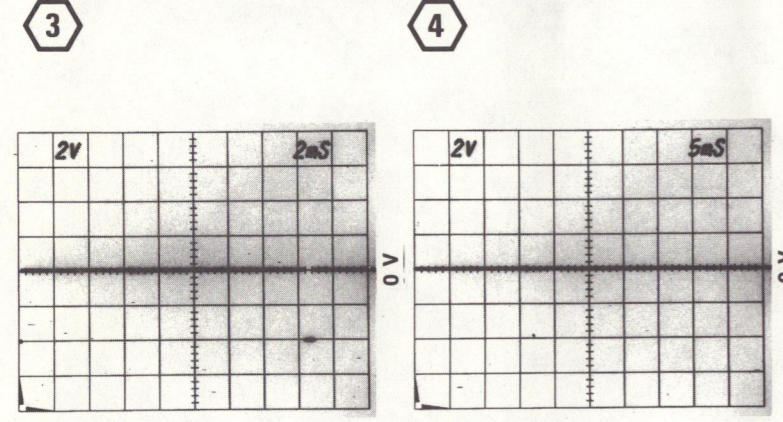
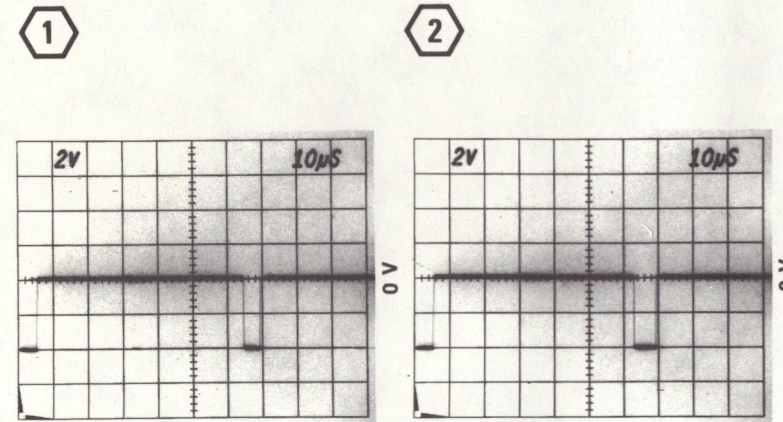
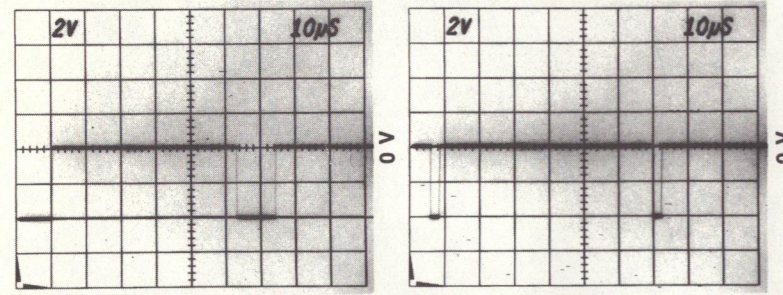
10/76

SUBCARRIER LOCK 4_b

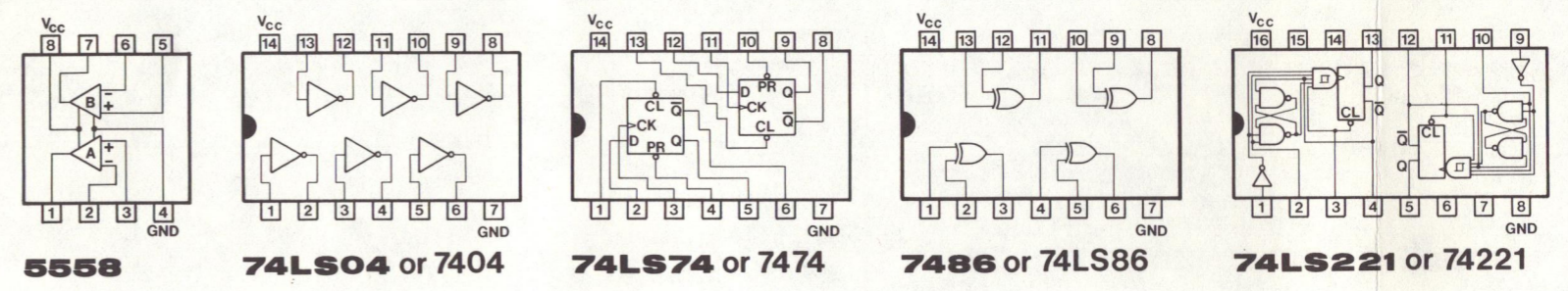
SUBCARRIER LOCK

4_b

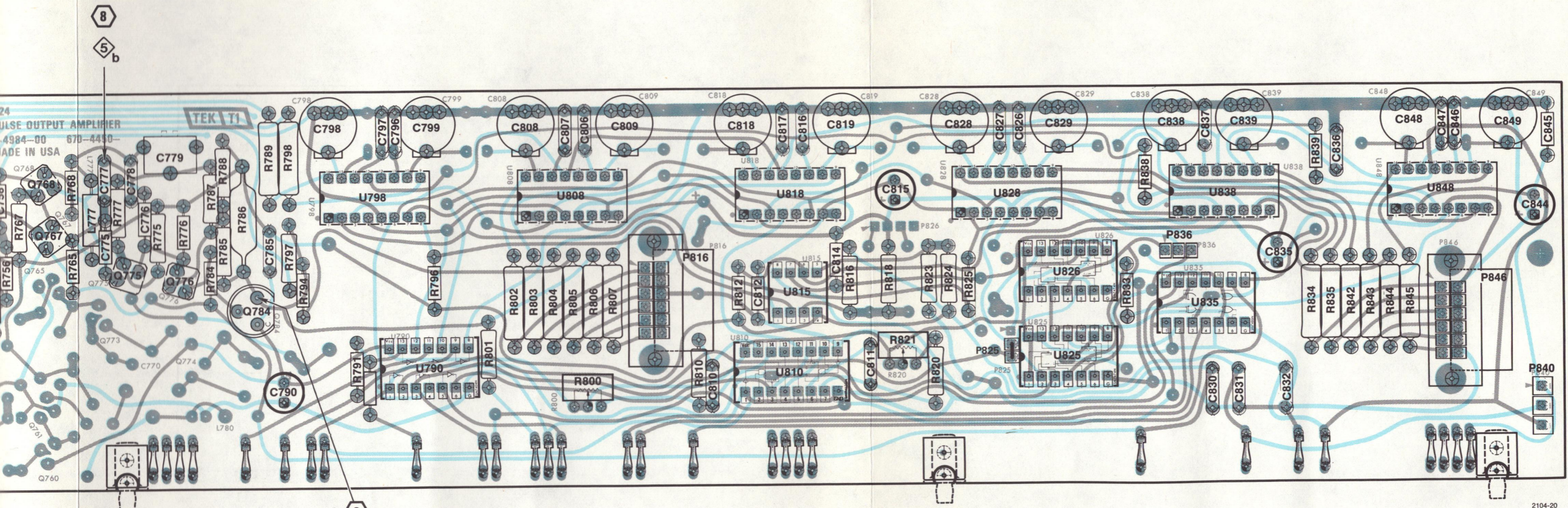
WAVEFORMS 1 THROUGH 6 TAKEN AT FRONT AND REAR PANEL CONNECTORS



A24 PULSE OUTPUT AMPLIFIER CIRCUIT BOARD

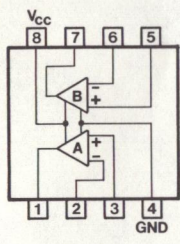


A24 PULSE OUTPUT AMP AND WAVEFORMS FOR

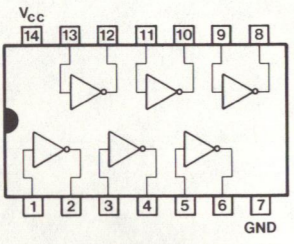


2104-20

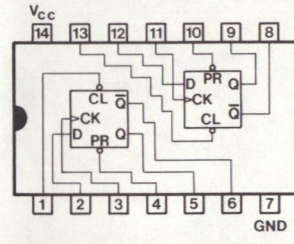
PULSE OUTPUT AMPLIFIER CIRCUIT BOARD



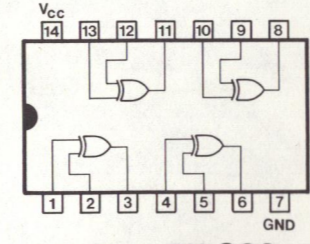
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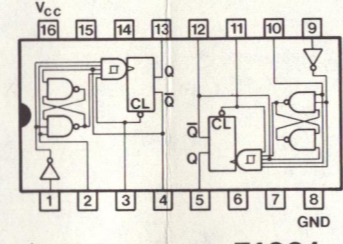
74LS04 or 7404



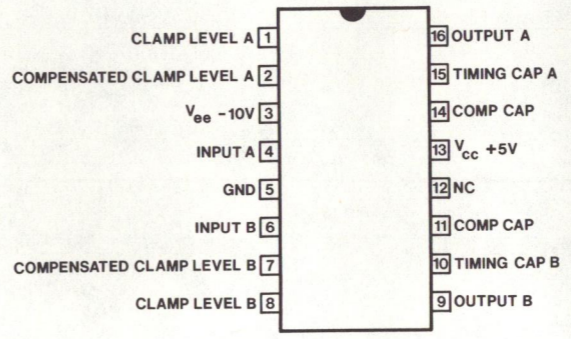
74LS74 or 7474



7486 or 74LS86



74LS221 or 74221



155-0145-00

5 a

PULSE OUTPUT AMPLIFIER PARTS LOCATING CHART

C796	2C	P816	2A	U838A	2D
C797	2A	P825	4B	U838B	4D
C798	2A	P836	4C	U848A	4A
C799	2C	P846	5C	U848B	4C
C806	2B	P846	5B		
C807	2B	P846	5A		
C808	2A	P846	5D		
C809	2B	P846	2D		
C810	1D	P846	5C		
C811	1D				
C812	1D	R789	2A		
C814	5D	R791	1A		
C815	5D	R796	2D		
C816	5B	R798	2C		
C817	2C	R800	1B		
C818	2C	R802	2A		
C819	5A	R803	2B		
C826	5C	R804	2C		
C827	5B	R807	5A		
C828	5B	R810	1B		
C829	5C	R812	5D		
C830	1C	R816	1D		
C831	1C	R818	1D		
C832	1C	R820	1B		
C835	5D	R821	1B		
C836	5D	R823	5D		
C837	2D	R824	5D		
C838	2D	R825	2B		
C839	5D	R833	4B		
C844	4B	R834	4C		
C845	4B	R835	2D		
C846	5A	R838	4D		
C847	5C	R839	4A		
C848	5A	R842	5D		
C849	5B	R843	5A		
		R844	4B		
		R845	4C		
P65	5C	U790A	3B		
P65	5B	U790B	1C		
P65	5A	U790C	1C		
P65	5D	U790D	1B		
P65	5C	U790E	3A		
P66	D2	U790F	1A		
P66	5C	U798A	2A		
P66	5B	U798B	2C		
P66	5A	U808A	2B		
P66	5D	U808B	2B		
P66	5C	U810A	1C		
P75	5A	U810B	1C		
P75	2C	U815A	1D		
P75	2B	U815B	5D		
P75	2A	U818A	2C		
P76	5A	U818B	4B		
P76	2C	U825A	4C		
P76	2B	U825B	4C		
P76	2A	U826A	4C		
P759	2C	U828A	4B		
P759	2A	U828B	4C		
P759	2A	U835A	3D		
P816	5A	U835B	3C		
P816	2C	U835C	3A		
P816	2B				

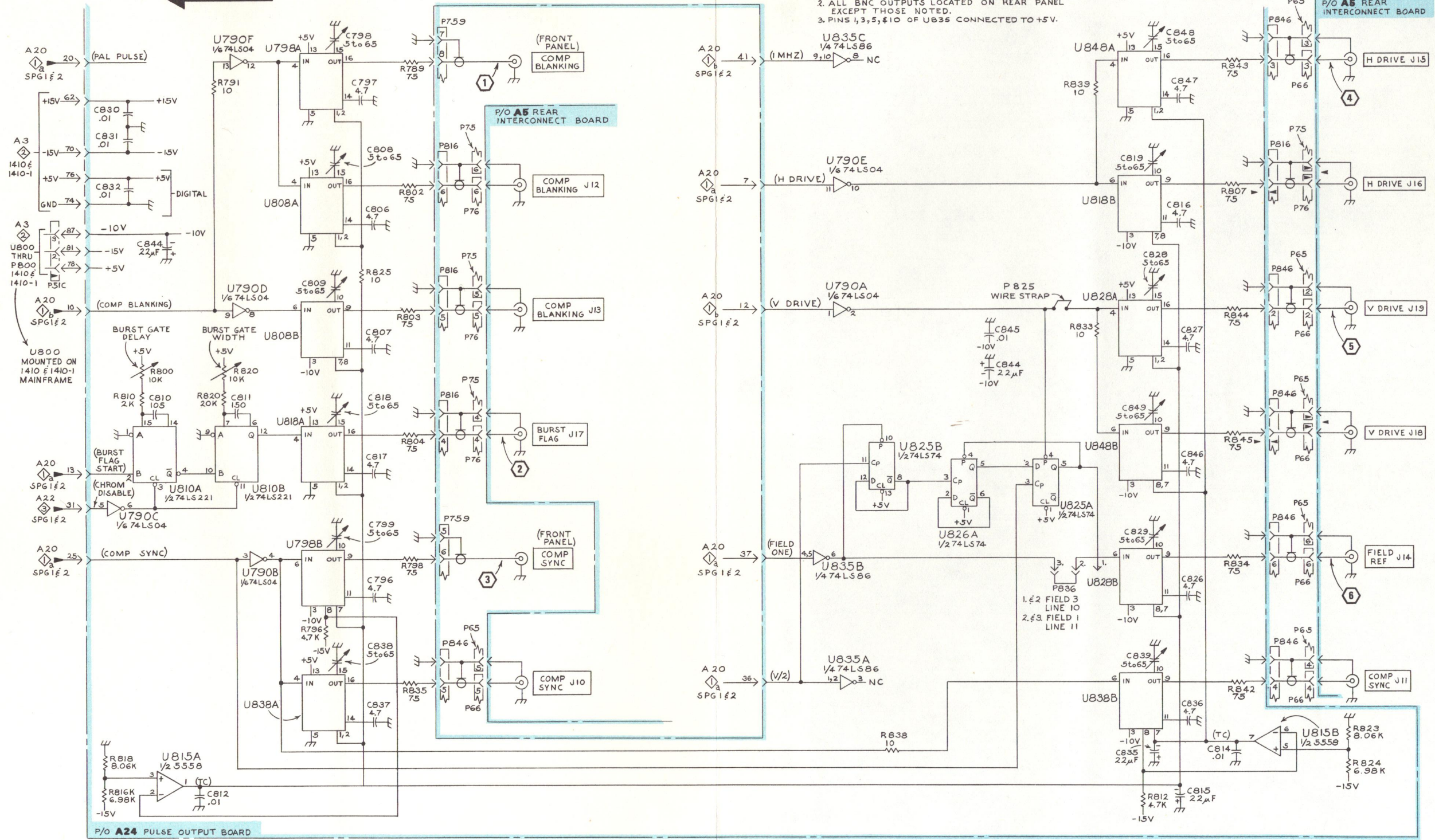
PULSE OUTPUT
AMPLIFIERS

5 a

1 | 2 | 3 | 4 | 5

← WAVEFORMS

NOTES:
 1. U798, U808, U818, U828, U838, & U848 ARE TYPE 155-0145-00 (TEK MADE) AND PINS 10 & 15 ARE TIED TO A TIMING CAP TITLED RATE.
 2. ALL BNC OUTPUTS LOCATED ON REAR PANEL EXCEPT THOSE NOTED.
 3. PINS 1, 3, 5, & 10 OF U836 CONNECTED TO +5V.



P/O A24 PULSE OUTPUT BOARD

P/O A5 REAR INTERCONNECT BOARD

SPG1E2

2104-35 REV APR 1981

GEM 10/76

PULSE OUTPUT AMPLIFIERS

5a

5 b

PULSE OUTPUT AMPLIFIER PARTS LOCATING CHART

C757	3C
C758	3C
C775	3B
C776	4B
C777	3B
C778	3B
C779	3B
C785	5B
C790	5B

L777	3B
------	----

Q755	2C
Q767	3C
Q768	3C
Q775	4B
Q776	4B
Q784	4B

R755	2B
R756	3C
R757	2C
R758	3C
R765	3B
R767	3C
R768	3C
R775	4B
R776	4B
R777	4B
R784	4B
R785	4C
R786	4C
R787	3B
R788	3B
R797	5C
R801	4B
R805	5C
R806	4B

W794	4C
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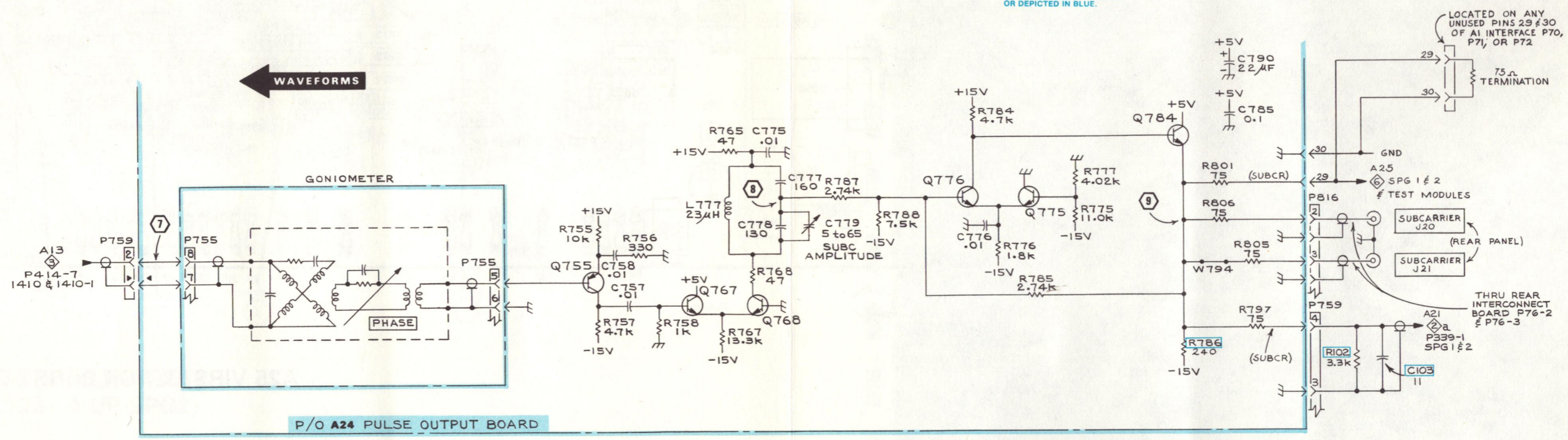
1 | 2 | 3 | 4 | 5

A — | — | — | — | — A

B — | — | — | — | — B

C — | — | — | — | — C

D — | — | — | — | — D



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

← WAVEFORMS

P/O A24 PULSE OUTPUT BOARD

LOCATED ON ANY UNUSED PINS 29 & 30 OF AI INTERFACE P70, P71, OR P72

75 Ω TERMINATION

A25 SPG 1 & 2 TEST MODULES

SUBCARRIER J20 (REAR PANEL)
SUBCARRIER J21

THRU REAR INTERCONNECT BOARD P76-2 & P76-3

A21 P339-1 SPG 1 & 2

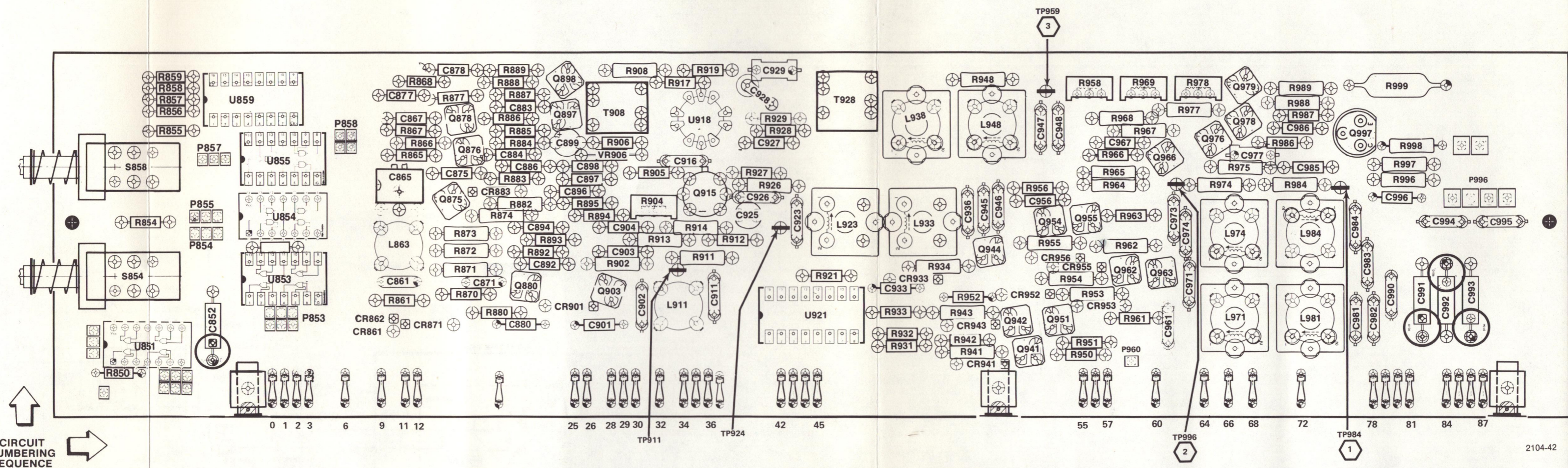
SPG 1 & 2

REV APR 1981

GEM 10/76

SUBCARRIER OUTPUT 5_b

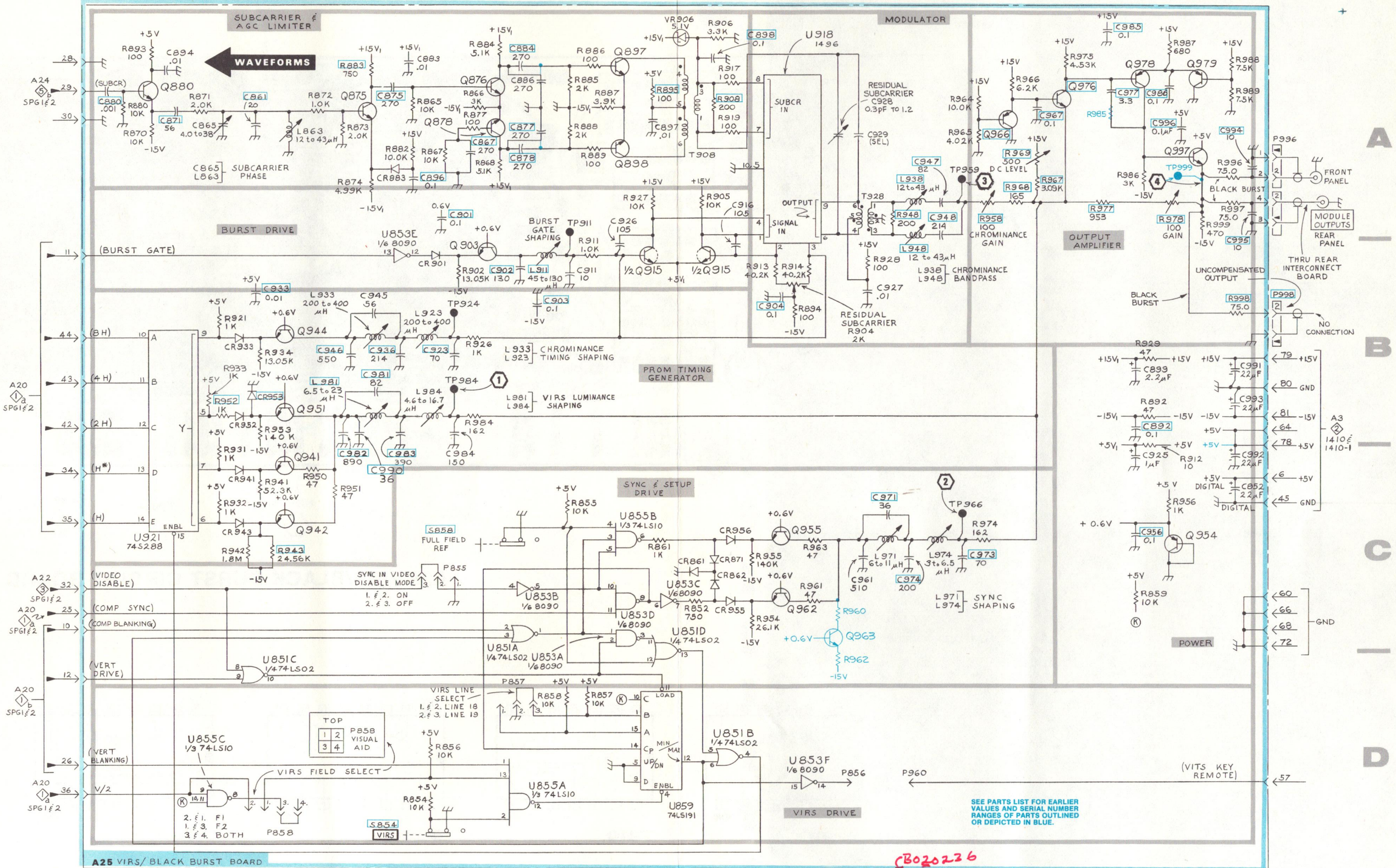
SUBCARRIER OUTPUT 5_b



**A25 VIRS/BLACK BURST CIRCUIT BOARD (SN B020211 & UP-SPG1)
(SN B021237 & UP-SPG2)**

VIRS / BLACK BURST PARTS LOCATING CHART

C852	C5	CR861	C3	R852	C3	R954	C3
C861	A2	CR862	C3	R854	D2	R955	C3
C865	A1	CR871	C3	R855	C3	R956	C5
C867	A2	CR883	A2	R856	D2	R958	A4
C871	A1	CR901	B2	R587	D3	R960	C4
C875	A2	CR933	B2	R858	D3	R961	C4
C877	A3	CR941	C2	R859	C5	R962	D4
C878	A3	CR943	C2	R861	C3	R963	C4
C880	A1	CR952	B2	R865	A2	R964	A4
C883	A2	CR955	C3	R866	A2	R965	A4
C884	A3	CR956	C3	R867	A2	R966	A4
C886	A3	CR953	B2	R868	A2	R967	A4
C892	B5			R870	A1	R968	A4
C894	A1	L863	A2	R871	A1	R969	A4
C896	A2	L911	B3	R872	A2	R974	C4
C897	A3	L923	B2	R873	A2	R975	A5
C898	A3	L933	B2	R874	A2	R977	A5
C899	B5	L938	A4	R877	A2	R978	A5
C901	A2	L948	A4	R880	A1	R984	B2
C902	B3	L971	C4	R882	A2	R985	A5
C903	B3	L974	C4	R883	A2	R986	A5
C904	B4	L981	B2	R884	A2	R987	A5
C911	B3	L984	B2	R885	A3	R988	A5
C916	B3			R886	A3	R989	A5
C923	B2	P856	D4	R887	A3	R996	A5
C925	C5	P857	D3	R888	A3	R997	A5
C926	B3	P858	D2	R889	A3	R998	B5
C927	B4	P885	C2	R892	B2	R999	A5
C928	A4	P960	D4	R893	A1		
C929	A4	P996	A5	R894	B4	S854	C2
C933	B2			R895	A3	S858	D2
C936	B2	Q875	A2	R902	B2		
C945	B2	Q876	A2	R904	B4	T908	A3
C946	B2	Q878	A2	R905	A3	T928	A4
C947	A4	Q880	A1	R906	A3		
C948	A4	Q897	A3	R908	A3	TP911	A3
C956	C5	Q898	A3	R911	B3	TP924	B2
C961	A4	Q903	B2	R912	C5	TP959	A4
C967	A4	Q915	B3	R913	B3	TP966	C4
C971	C4	Q941	C2	R914	B3	TP984	B2
C973	C4	Q942	C2	R917	A3	TP999	A5
C974	C4	Q944	B2	R919	A3		
C977	A5	Q951	B2	R921	B1	U851A	C3
C981	B2	Q954	C5	R926	B2	U851B	D3
C982	B2	Q955	C4	R927	A3	U851C	D2
C983	B2	Q962	C4	R928	B4	U851D	C3
C984	B2	Q963	D4	R929	B5	U853A	C3
C985	A5	Q966	A4	R931	C1	U853B	C3
C986	A5	Q976	A5	R932	C1	U853C	C3
C990	B2	Q978	A5	R933	B1	U853D	C3
C991	B5	Q979	A5	R934	B2	U853E	B2
C992	C5	Q997	A5	R941	C2	U853F	D4
C993	B5			R942	C2	U855A	D3
C994	A5			R943	C2	U855B	C3
C995	A5			R948	A4	U855C	D1
C996	A5			R950	B2	U859	D3
				R951	C2	U918	A4
				R952	B2	U921	C1
				R953	B2		
						VR906	A3



A25 VIRS/BLACK BURST BOARD

SPG1 & 2

2104-37 REVAUG 1982

SPG2 - SN B020236 & BELOW
SN B020210-3PG1 & BELOW

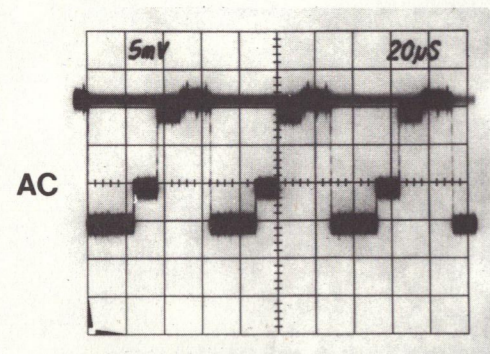
VIRS/BLACK BURST

B020236

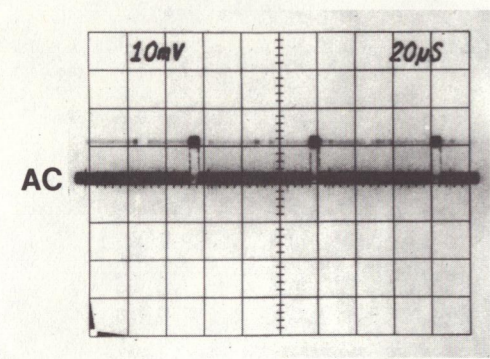
SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS OUTLINED OR DEPICTED IN BLUE.

VIRS/BLACK BURST (SN B020210 & Below) SPG 1 (SN B020236 & Below) SPG 2

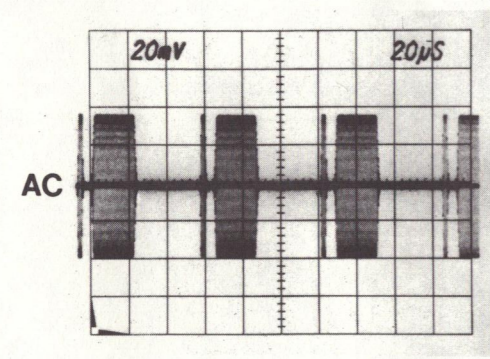
6



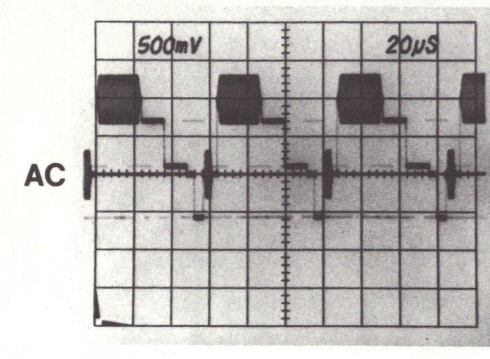
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2

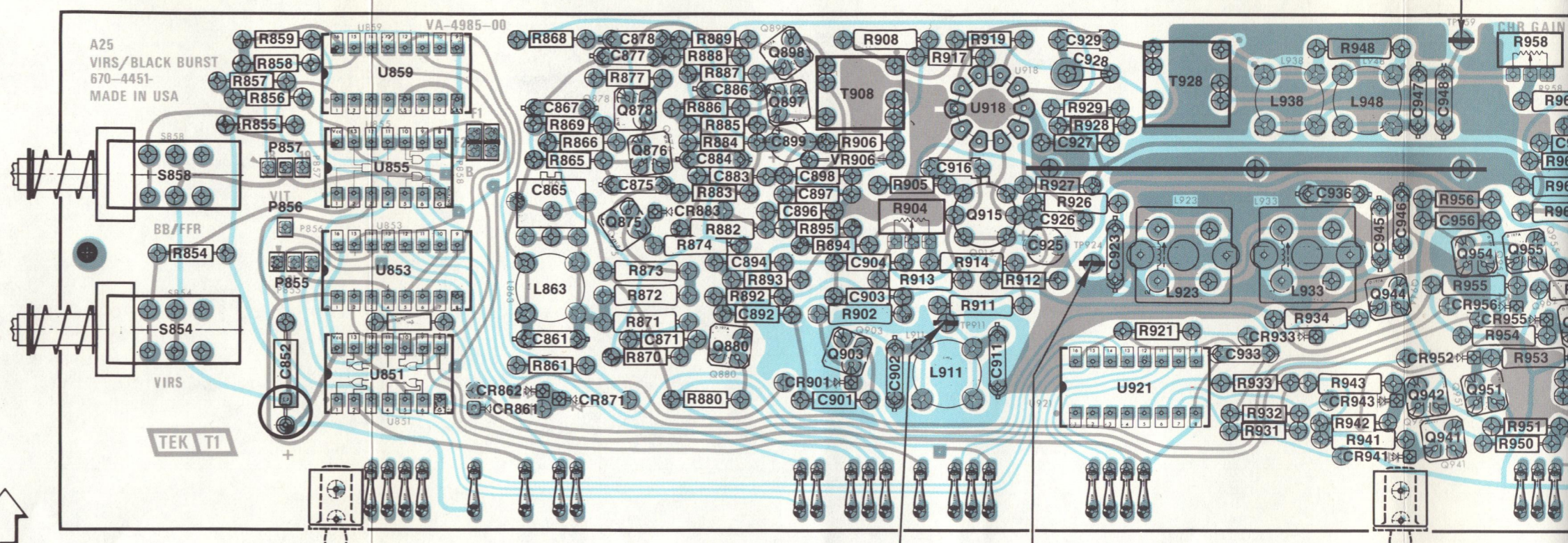


3



4

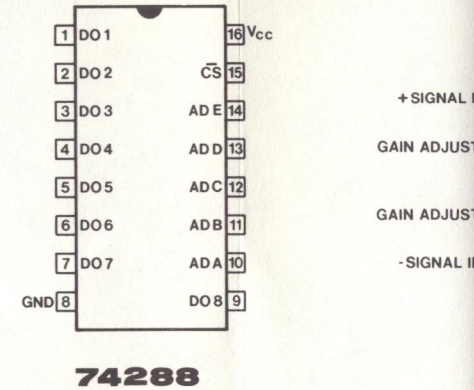
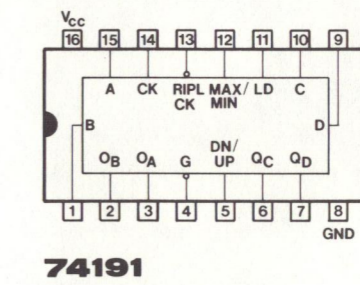
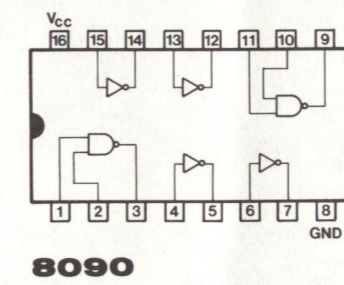
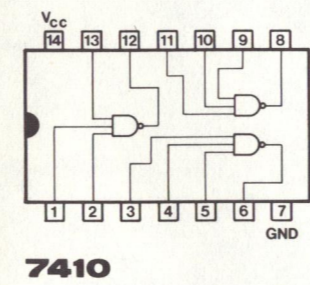
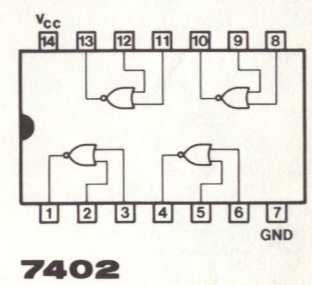
CIRCUIT NUMBERING SEQUENCE



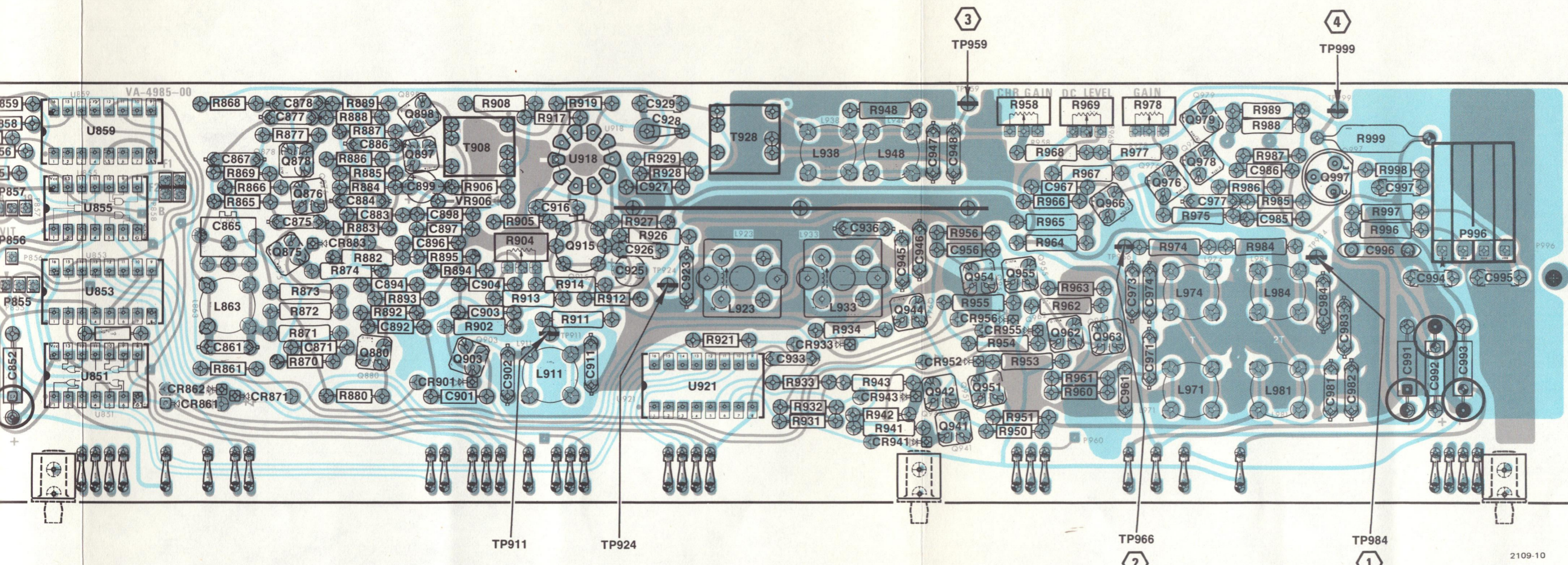
3 TP959

TP911 TP924

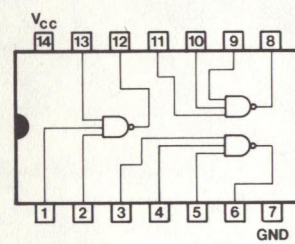
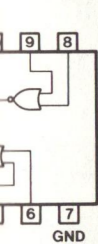
A25 VIRS/BLACK BURST CIRCUIT BOARD (SNB010100 TO B010126)



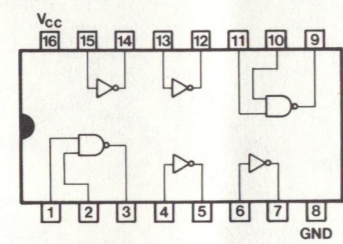
A25 VIRS/BLACK BURST AND WAVEFORMS FOR SN B010100 - B010126



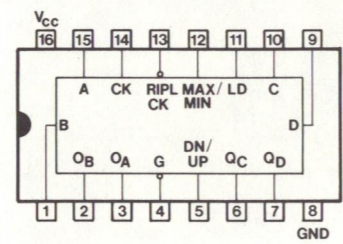
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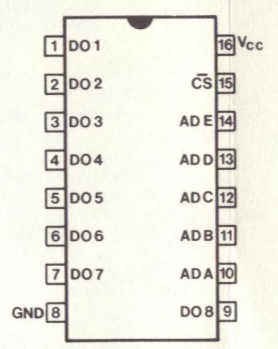
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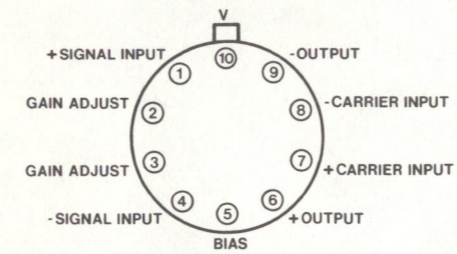
8090



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MC1496G

VIRS / BLACK BURST PARTS LOCATING CHART

C852	C5	CR861	C3	R852	C3	R954	C3
C861	A1	CR862	C3	R854	D2	R955	C3
C865	A1	CR871	C3	R855	C2	R956	C5
C867	A2	CR883	A2	R856	D2	R958	A4
C871	A1	CR901	B2	R587	D3	R960	C3
C875	A2	CR933	B1	R858	D2	R961	C3
C877	A2	CR941	C1	R859	D1	R962	C3
C878	A2	CR943	C1	R861	C3	R963	C3
C880	A1	CR952	B1	R865	A2	R964	A4
C883	A2	CR955	C3	R866	A2	R965	A4
C884	A2	CR956	C3	R867	A2	R966	A4
C886	A2	CR953	B1	R868	A2	R967	A4
C892	B5			R870	A1	R968	A4
C894	A1	L863	A2	R871	A1	R969	A4
C896	A2	L911	B2	R872	A2	R974	C4
C897	A3	L923	B2	R873	A2	R975	A4
C898	A3	L933	B2	R874	A2	R977	A4
C899	B5	L938	A4	R877	A2	R978	A5
C901	A2	L948	B4	R880	A1	R984	B2
C902	B2	L971	C4	R882	A2	R985	A5
C903	B2	L974	C4	R883	A2	R986	A5
C904	B3	L981	B2	R884	A2	R987	A5
C911	B3	L984	B2	R885	A2	R988	A5
C916	B3			R886	A2	R989	A5
C923	B2	P856	D4	R887	A2	R996	A5
C925	C5	P857	D1	R888	A2	R997	A5
C926	B3	P858	D2	R889	A3	R998	B5
C927	B4	P885	C2	R892	B3	R999	B5
C928	A3	P960	D4	R893	A1		
C929	A4	P996	A5	R894	B4	S854	D2
C933	B1			R895	A3	S858	C2
C936	B2	Q875	A2	R902	B2		
C945	B2	Q876	A2	R904	B4	T908	A3
C946	B2	Q878	A2	R905	A3	T928	A4
C947	A4	Q880	A1	R906	A3		
C948	B4	Q897	A3	R908	A3	TP911	A3
C956	C4	Q898	A3	R911	B3	TP924	B2
C961	C4	Q903	B2	R912	C5	TP959	A4
C967	A4	Q915	B3	R913	B3	TP966	C4
C971	C4	Q941	C1	R914	B3	TP984	B2
C973	C4	Q942	C2	R917	A3	TP999	A5
C974	C4	Q944	B2	R919	A3		
C977	A4	Q951	B2	R921	B1	U851A	B3
C981	B2	Q954	C5	R926	B2	U851B	D4
C982	B2	Q955	C3	R927	A3	U851C	B1
C983	B2	Q962	C3	R928	B4	U851D	B2
C984	B2	Q963	C3	R929	B5	U853A	C2
C985	A4	Q966	A4	R931	C1	U853B	D3
C986	A5	Q976	A4	R932	C1	U853C	D1
C990	B2	Q978	A4	R933	B1	U853D	C3
C991	B5	Q979	A5	R934	B1	U853E	B2
C992	C5	Q997	A5	R941	C1	U853F	D4
C993	B5			R942	C1	U855A	D3
C994	A5			R943	C1	U855B	C3
C995	B5			R948	A4	U855C	D1
C996	A5			R950	C1	U859	D3
				R951	C2	U918	A3
				R952	B1	U921	C1
				R953	B1	VR906	A3

1 | 2 | 3 | 4 | 5

A

B

C

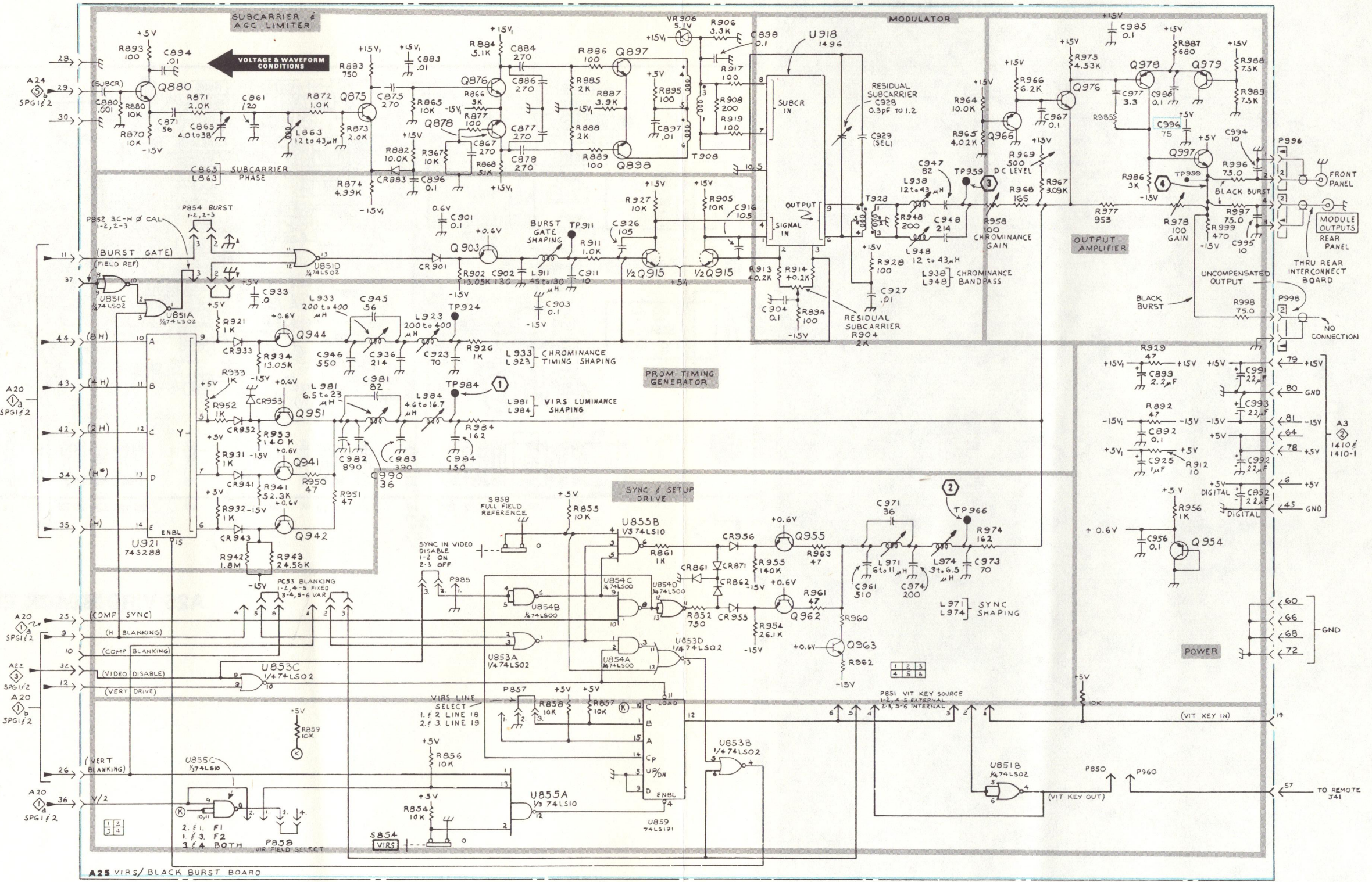
D

A

B

C

D



SPG1/SPG2

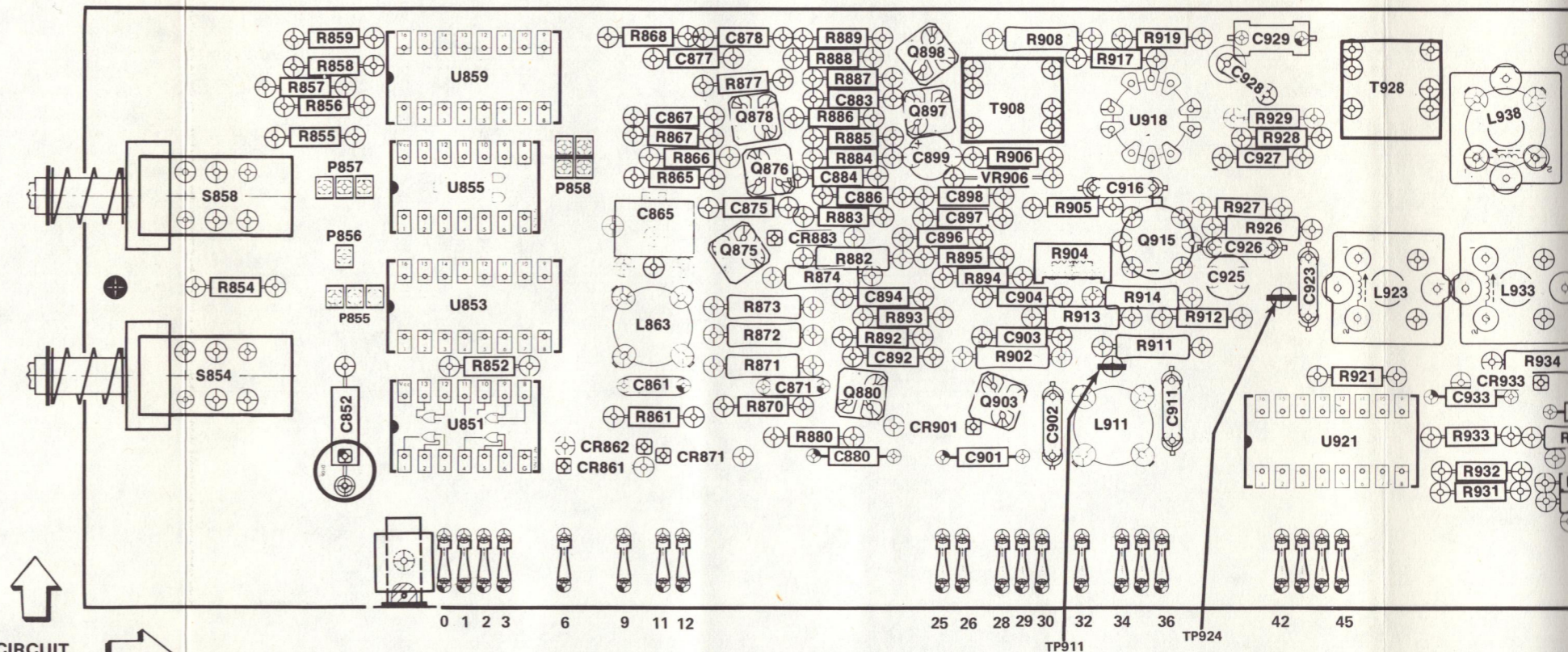
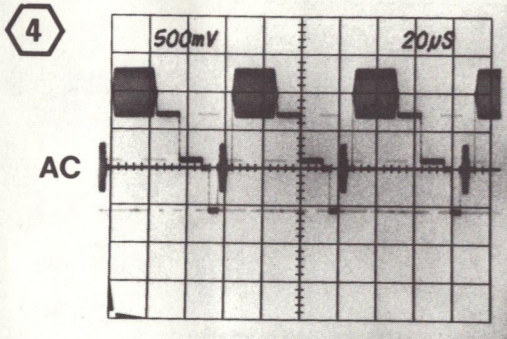
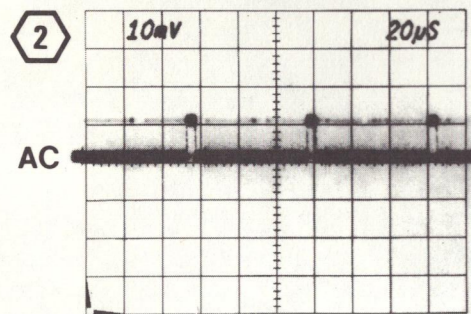
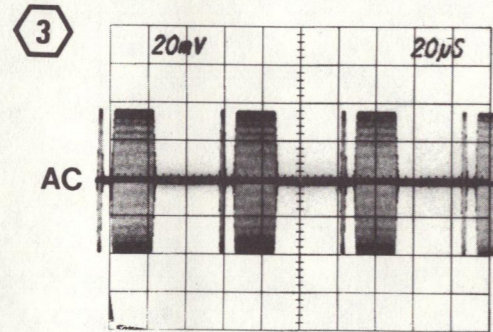
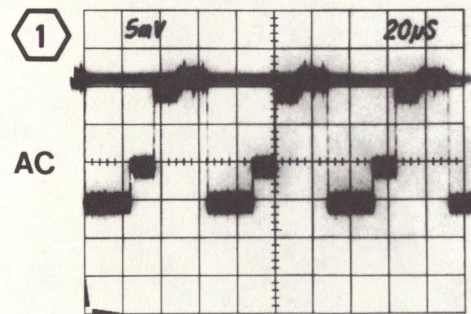
REV AUG 1982
2104-44

VIRS/BLACK BURST
(SN B020211 + UP SPG1)
(SN B020237 + UP SPG2)

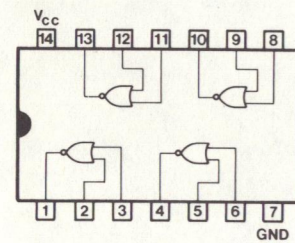
VIRS/BLACK BURST
(SN B020211 + UP SPG1)
(SN B020237 + UP SPG2)

6

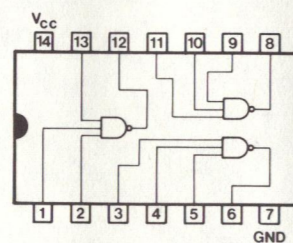
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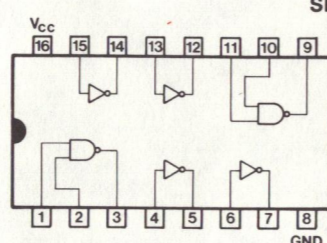
CIRCUIT NUMBERING SEQUENCE



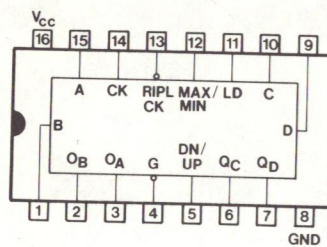
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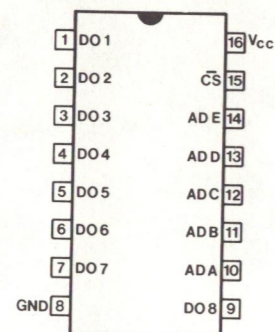
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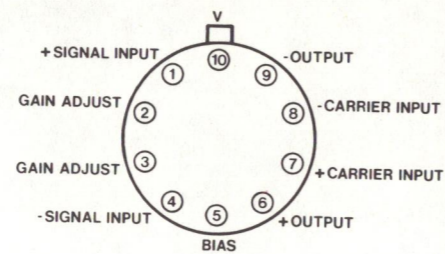
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A25 VIRS/BLACK BURST CIRCUIT BOARD (SN B010127-B010210)

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	ELECTRN	ELECTRON	IN	INCH	SE	SINGLE END
#	NUMBER SIZE	ELEC	ELECTRICAL	INCAND	INCANDESCENT	SECT	SECTION
ACTR	ACTUATOR	ELECTLT	ELECTROLYTIC	INSUL	INSULATOR	SEMICOND	SEMICONDUCTOR
ADPTR	ADAPTER	ELEM	ELEMENT	INTL	INTERNAL	SHLD	SHIELD
ALIGN	ALIGNMENT	EPL	ELECTRICAL PARTS LIST	LPHLDR	LAMPHOLDER	SHLDR	SHOULDERED
AL	ALUMINUM	EQPT	EQUIPMENT	MACH	MACHINE	SKT	SOCKET
ASSEM	ASSEMBLED	EXT	EXTERNAL	MECH	MECHANICAL	SL	SLIDE
ASSY	ASSEMBLY	FIL	FILLISTER HEAD	MTG	MOUNTING	SFLKLG	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	OB	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	HANDLE	PN	PART NUMBER	THD	THREAD
CER	CERAMIC	HEX	HEXAGON	PNH	PAN HEAD	THK	THICK
CHASS	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	IDNT	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
00779	AMP, INC.	P O BOX 3608	HARRISBURG, PA 17105
05129	KILO ENGINEERING COMPANY	2015 D	LA VERNE, CA 91750
06383	PANDUIT CORPORATION	17301 RIDGELAND	TINLEY PARK, IL 60477
07707	USM CORP., USM FASTENER DIV.	510 RIVER RD.	SHELTON, CT 06484
08261	SPECTRA-STRIP CORP.	7100 LAMPSON AVE.	GARDEN GROVE, CA 92642
12703	JUDD WIRE DIV. ELECTRONIZED CHEMICALS CORP.	250 TURNPIKE RD P.O. BOX 390	TURNERS FALLS, MA 01376
13511	AMPHENOL CARDRE DIV., BUNKER RAMO CORP.		LOS GATOS, CA 95030
22526	BERG ELECTRONICS, INC.	YOUK EXPRESSWAY	NEW CUMBERLAND, PA 17070
50434	HEWLETT-PACKARD COMPANY	640 PAGE MILL ROAD	PALO ALTO, CA 94304
53184	XCITON CORPORATION	5 HEMLOCK STREET	LATHAM, NY 12110
56375	WESCORP, DIV OF DAL INDUSTRIES, INC.	1155 TERRA BELLA AVE.	MT VIEW, CA 94043
71590	CENTRALAB ELECTRONICS, DIV. OF GLOBE-UNION, INC.	P O BOX 858	FORT DODGE, IA 50501
71785	TRW, CINCH CONNECTORS	1501 MORSE AVENUE	ELK GROVE VILLAGE, IL 60007
73743	FISCHER SPECIAL MFG. CO.	446 MORGAN ST.	CINCINNATI, OH 45206
73803	TEXAS INSTRUMENTS, INC., METALLURGICAL MATERIALS DIV.	34 FOREST STREET	ATTLEBORO, MA 02703
74932	INDUSTRIAL SPECIALTIES, INC.		WARREN, MI 48091
76854	OAK INDUSTRIES, INC., SWITCH DIV.	S. MAIN ST.	CRYSTAL LAKE, IL 60014
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
81073	GRAYHILL, INC.	561 HILLGROVE AVE., PO BOX 373	LA GRANGE, IL 60525
83385	CENTRAL SCREW CO.	2530 CRESCENT DR.	BROADVIEW, IL 60153

Replaceable Mechanical Parts—SPG1/SPG2

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	131-0955-00		4		CONN, RCPT, ELEC: BNC, FEMALE (ATTACHING PARTS)	13511	31-279
-2	210-0255-00		4		TERMINAL, LUG: 0.391 ID, LOCKING, BRS CD PL - - - * - - -	80009	210-0255-00
-3	119-0846-00		1		GONIOMETER, ELEC: 3.58MHZ (ATTACHING PARTS)	80009	119-0846-00
-4	331-0361-01		1		. DIAL, CONTROL: SINGLE TURN, UNCALIBRATED - - - * - - -	05129	572 SI
-5	260-0735-00		1		SWITCH, PUSH: T, NO CONTACT, RED BUTTON	81073	39-1
-6	366-1691-00		4		PUSH BUTTON: GY, 1.2 L	80009	366-1691-00
-7	426-1206-00		4		FRAME, PUSH BTN: MOMENTARY, GRAY PLASTIC	80009	426-1206-00
-8	333-2174-00		1		PANEL, FRONT: (SPG1 ONLY)	80009	333-2174-00
	333-2159-00		1		PANEL, FRONT: (SPG2 ONLY)	80009	333-2159-00
					(ATTACHING PARTS)		
-9	213-0120-00	B010100 B010283	4		SCR, TPG, THD FOR: 2-32 X 0.250 INCH, PNH STL	83385	OBD
	213-0277-00	B010284	2		SCR, TPG, THD FOR: 2-56 X 0.312 INCH, PNH STL - - - * - - -	83385	OBD
-10	-----		1		CKT BOARD ASSY: LED(SEE A27 REPL) (ATTACHING PARTS)		
-11	210-0406-00		2		NUT, PLAIN, HEX.: 4-40 X 0.188 INCH, BRS	73743	12161-50
-12	361-0552-00		2		SPACER, SLEEVE: 0.093 L X 0.126 ID BRS ID - - - * - - -	76854	3-5116-322
	-----		-		CKT BOARD ASSY INCLUDES:		
-13	150-1029-00		2		. LT EMITTING DIO: GREEN, 565NM, 35MA	53184	XC209G
-14	150-1033-00		2		. LT EMITTING DIO: YELLOW, 585NM, 40MA MAX	50434	HLMF 1401
-15	131-0608-00		6		. TERMINAL, PIN: 0.365 L X 0.025 PH BRZ GOLD	22526	47357
-16	-----		1		CKT BOARD ASSY: VIRS/BLACK BURST(SEE A25 REPL)		
-17	131-0589-00	B010100 B020210	6		. TERMINAL, PIN: 0.46 L X 0.025 SQ (SPG1 ONLY)	22526	48283-029
	131-0589-00	B020211	5		. TERMINAL, PIN: 0.46 L X 0.025 SQ (SPG1 ONLY)	22526	48283-029
	131-0589-00	B010100 B021236	6		. TERMINAL, PIN: 0.46 L X 0.025 SQ (SPG2 ONLY)	22526	48283-029
	131-0589-00	B021237	5		. TERMINAL, PIN: 0.46 L X 0.025 SQ (SPG2 ONLY)	22526	48283-029
-18	131-0608-00	B010100 B020210	10		. TERMINAL, PIN: 0.365 L X 0.025 PH BRZ GOLD (SPG1 ONLY)	22526	47357
	131-0608-00	B020211	29		. TERMINAL, PIN: 0.365 L X 0.025 PH BRZ GOLD (SPG1 ONLY)	22526	47357
	131-0608-00	B010100 B021236	10		. TERMINAL, PIN: 0.365 L X 0.025 PH BRZ GOLD (SPG2 ONLY)	22526	47357
	131-0608-00	B021237	29		. TERMINAL, PIN: 0.365 L X 0.025 PH BRZ GOLD (SPG2 ONLY)	22526	47357
-19	131-0993-00	B010100 B020210	3		. BUS, CONDUCTOR: 2 WIRE BLACK (SPG1 ONLY)	00779	850100-01
	131-0993-00	B020211	5		. BUS, CONDUCTOR: 2 WIRE BLACK (SPG1 ONLY)	00779	850100-01
	131-0993-00	B010100 B021236	3		. BUS, CONDUCTOR: 2 WIRE BLACK (SPG2 ONLY)	00779	850100-01
	131-0993-00	B021237	5		. BUS, CONDUCTOR: 2 WIRE BLACK (SPG2 ONLY)	00779	850100-01
-20	136-0183-00	B010100 B020192X	1		. SOCKET, PLUG-IN: 3 PIN, ROUND (SPG1 ONLY)	80009	136-0183-00
	136-0183-00	B010100 B020991X	1		. SOCKET, PLUG-IN: 3 PIN, ROUND (SPG2 ONLY)	80009	136-0183-00
-21	136-0220-00	B010100 B020192	19		. SKT, PL-IN ELEK: TRANSISTOR 3 CONTACT, PCB MT (SPG1 ONLY)	71785	133-23-11-034
	136-0220-00	B020193	1		. SKT, PL-IN ELEK: TRANSISTOR 3 CONTACT, PCB MT (SPG1 ONLY)	71785	133-23-11-034
	136-0220-00	B010100 B020991	19		. SKT, PL-IN ELEK: TRANSISTOR 3 CONTACT, PCB MT (SPG2 ONLY)	71785	133-23-11-034
	136-0220-00	B020992	1		. SKT, PL-IN ELEK: TRANSISTOR 3 CONTACT, PCB MT (SPG2 ONLY)	71785	133-23-11-034

Replaceable Mechanical Parts—SPG1/SPG2

Fig. & Index No.	Tektronix Part No.	Serial/Model No.		Qty	1	2	3	4	5	Name & Description	Mfr Code	Mfr Part Number
		Eff	Dscont									
1-22	136-0235-00			1						. SOCKET, PLUG-IN: 6 CONTACT, ROUND	71785	133-96-12-062
-23	136-0241-00	B010100	B020291X	1						. SKT, PL-IN ELEK: MICROCIRCUIT, 10 CONT, PCB MT	71785	133-99-12-064
	-----			-						. (SPG1 ONLY)		
	136-0241-00	B010100	B021841X	1						. SKT, PL-IN ELEK: MICROCIRCUIT, 10 CONT, PCB MT	71785	133-99-12-064
	-----			-						. (SPG2 ONLY)		
-24	136-0260-02	B010100	B020210	3						. SKT, PL-IN ELEK: MICROCIRCUIT, 16 DIP, LOW CLE	71785	133-51-92-008
	-----			-						. (SPG1 ONLY)		
	136-0260-02	B020211		2						. SKT, PL-IN ELEK: MICROCIRCUIT, 16 DIP, LOW CLE	71785	133-51-92-008
	-----			-						. (SPG1 ONLY)		
	136-0260-02	B010100	B021236	3						. SKT, PL-IN ELEK: MICROCIRCUIT, 16 DIP, LOW CLE	71785	133-51-92-008
	-----			-						. (SPG2 ONLY)		
	136-0260-02	B021237		2						. SKT, PL-IN ELEK: MICROCIRCUIT, 16 DIP, LOW CLE	71785	133-51-92-008
	-----			-						. (SPG2 ONLY)		
-25	136-0269-02	B010100	B020210	2						. SKT, PL-IN ELEK: MICROCIRCUIT, 14 DIP, LOW CLE	73803	CS9002-14
	-----			-						. (SPG1 ONLY)		
	136-0269-02	B020211		4						. SKT, PL-IN ELEK: MICROCIRCUIT, 14 DIP, LOW CLE	73803	CS9002-14
	-----			-						. (SPG1 ONLY)		
	136-0269-02	B010100	B021236	2						. SKT, PL-IN ELEK: MICROCIRCUIT, 14 DIP, LOW CLE	73803	CS9002-14
	-----			-						. (SPG2 ONLY)		
	136-0269-02	B021237		4						. SKT, PL-IN ELEK: MICROCIRCUIT, 14 DIP, LOW CLE	73803	CS9002-14
	-----			-						. (SPG2 ONLY)		
-26	136-0328-03	B010100	B020210	32						. SOCKET, PIN TERM: HORIZ, SQ PIN RCPT	22526	47710
	-----			-						. (SPG1 ONLY)		
	136-0328-03	B020211		35						. SOCKET, PIN TERM: HORIZ, SQ PIN RCPT	22526	47710
	-----			-						. (SPG1 ONLY)		
	136-0328-03	B010100	B021236	32						. SOCKET, PIN TERM: HORIZ, SQ PIN RCPT	22526	47710
	-----			-						. (SPG2 ONLY)		
	136-0328-03	B021237		35						. SOCKET, PIN TERM: HORIZ, SQ PIN RCPT	22526	47710
	-----			-						. (SPG2 ONLY)		
-27	214-0579-00			6						. TERM, TEST POINT: BRS CD PL	80009	214-0579-00
-28	214-2440-00			3						. RECEPTACLE, PIN: CIRCUIT CARD	80009	214-2440-00
-29	-----			2						. SWITCH, PUSH: (SEE S854, S858 REPL)		
-30	361-0542-00			4						. SPACER, SWITCH: PLASTIC	71590	J-64281
-31	337-1456-00	B010100	B010482X	1						. SHLD, ELECTRICAL: CKT CARD MOUNT	80009	337-1456-00
	-----			-						. (SPG1 ONLY)		
	337-1456-00	B010100	B010126X	1						. SHLD, ELECTRICAL: CKT CARD MOUNT	80009	337-1456-00
	-----			-						. (SPG2 ONLY)		
-32	337-1417-00			2						. SHIELD, ELEC: 0.55 SQ X 0.685 INCH HIGH	80009	337-1417-00
-33	-----	B010100	B010164	3						. CKT BOARD ASSY: SHIELD (SEE A100 REPL)		
	-----			-						. (SPG1 ONLY)		
	-----	B010165		2						. CKT BOARD ASSY: SHIELD (SEE A100 REPL)		
	-----			-						. (SPG1 ONLY)		
	-----	B010100	B010849	3						. CKT BOARD ASSY: SHIELD (SEE A100 REPL)		
	-----			-						. (SPG2 ONLY)		
	-----	B010850		2						. CKT BOARD ASSY: SHIELD (SEE A100 REPL)		
	-----			-						. (SPG2 ONLY)		
-34	136-0328-03	B010100	B010164	12						. SOCKET, PIN TERM: HORIZ, SQ PIN RCPT	22526	47710
	-----			-						. (SPG1 ONLY)		
	136-0328-03	B010165		8						. SOCKET, PIN TERM: HORIZ, SQ PIN RCPT	22526	47710
	-----			-						. (SPG1 ONLY)		
	136-0328-03	B010100	B010849	12						. SOCKET, PIN TERM: HORIZ, SQ PIN RCPT	22526	47710
	-----			-						. (SPG2 ONLY)		
	136-0328-03	B010850		8						. SOCKET, PIN TERM: HORIZ, SQ PIN RCPT	22526	47710
	-----			-						. (SPG2 ONLY)		
	198-2868-00	XB020211		2						. WIRE SET, ELEC:	80009	198-2868-00
	-----			-						. (SPG1 ONLY)		
	198-2868-00	XB021237		2						. WIRE SET, ELEC:	80009	198-2868-00
	-----			-						. (SPG2 ONLY)		
	131-0707-00	XB020211		4						. . CONNECTOR, TERM: 22-26 AWG, BRS& CU BE GOLD	22526	47439
	-----			-						. . (SPG1 ONLY)		
	131-0707-00	XB021237		4						. . CONNECTOR, TERM: 22-26 AWG, BRS& CU BE GOLD	22526	47439
	-----			-						. . (SPG2 ONLY)		
	175-0733-00	XB020211		AR						. . WIRE, ELECTRICAL: STRD, 26 AWG, 150 RMS, BLACK	12703	OBD
	-----			-						. . (SPG1 ONLY)		
	175-0733-00	XB021237		AR						. . WIRE, ELECTRICAL: STRD, 26 AWG, 150 RMS, BLACK	12703	OBD
	-----			-						. . (SPG2 ONLY)		

Replaceable Mechanical Parts—SPG1/SPG2

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
	352-0177-00	XB020211	1	.	CONN BODY,PL,EL:6 WIRE,DBL ROW BLACK	80009	352-0177-00
	-----	-----	-	.	(SPG1 ONLY)		
	352-0177-00	XB021237	1	.	CONN BODY,PL,EL:6 WIRE,DBL ROW BLACK	80009	352-0177-00
	-----	-----	-	.	(SPG2 ONLY)		
1-35	-----	-----	1		CKT BOARD ASSY:SUBCARRIER LOCK(SEE A23 REPL)		
	-----	-----	-		(SPG2 ONLY)		
-36	131-0608-00		13	.	TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	47357
-37	131-0993-00		3	.	BUS,CONDUCTOR:2 WIRE BLACK	00779	850100-01
-38	136-0220-00	B010100 B020991	31	.	SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT,PCB MT	71785	133-23-11-034
	-----	B020992	5	.	SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT,PCB MT	71785	133-23-11-034
-39	136-0241-00	B010100 B021841X	3	.	SKT,PL-IN ELEK:MICROCIRCUIT,10 CONT,PCB MT	71785	133-99-12-064
-40	136-0260-02		1	.	SKT,PL-IN ELEK:MICROCIRCUIT,16 DIP,LOW CLE	71785	133-51-92-008
-41	136-0269-02		1	.	SKT,PL-IN ELEK:MICROCIRCUIT,14 DIP,LOW CLE	73803	CS9002-14
-42	136-0328-03		16	.	SOCKET,PIN TERM:HORIZ,SQ PIN RCPT	22526	47710
-43	136-0514-00		2	.	SKT,PL-IN ELEK:MICROCIRCUIT,8 DIP	73803	CS9002-8
-44	214-0579-00		12	.	TERM,TEST POINT:BRS CD PL	80009	214-0579-00
-45	214-2440-00		2	.	RECEPTACLE,PIN:CIRCUIT CARD	80009	214-2440-00
-46	337-1417-00		1	.	SHIELD,ELEC:0.55 SQ X 0.685 INCH HIGH	80009	337-1417-00
-47	-----	-----	1		CKT BOARD ASSY:SYNC TIMING(SEE A20 REPL)		
-48	006-2358-00	B010100 B020220X	1	.	FOAM,CONDUCTIVE:0.75 X 2 X 2.25	56375	OBD
	-----	-----	-	.	(SPG1 ONLY)		
	006-2358-00	B010100 B021321X	1	.	FOAM,CONDUCTIVE:0.75 X 2 X 2.25	56375	OBD
	-----	-----	-	.	(SPG2 ONLY)		
-49	131-0608-00	B010100 B010136	24	.	TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	47357
	-----	-----	-	.	(SPG1 ONLY)		
	131-0608-00	B010137 B020219	29	.	TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	47357
	-----	-----	-	.	(SPG1 ONLY)		
	131-0608-00	B020220	30	.	TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	47357
	-----	-----	-	.	(SPG1 ONLY)		
-50	131-0993-00	B010100 B010137X	8	.	BUS,CONDUCTOR:2 WIRE BLACK	00779	850100-01
-51	136-0220-00	B010100 B020192	9	.	SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT,PCB MT	71785	133-23-11-034
	-----	-----	-	.	(SPG1 ONLY)		
	136-0220-00	B020193	4	.	SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT,PCB MT	71785	133-23-11-034
	-----	-----	-	.	(SPG1 ONLY)		
	136-0220-00	B010100 B020991	9	.	SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT,PCB MT	71785	133-23-11-034
	-----	-----	-	.	(SPG2 ONLY)		
	136-0220-00	B020992	4	.	SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT,PCB MT	71785	133-23-11-034
	-----	-----	-	.	(SPG2 ONLY)		
-52	136-0260-02	B010100 B020219	12	.	SKT,PL-IN ELEK:MICROCIRCUIT,16 DIP,LOW CLE	71785	133-51-92-008
	-----	-----	-	.	(SPG1 ONLY)		
	136-0260-02	B020200	13	.	SKT,PL-IN ELEK:MICROCIRCUIT,16 DIP,LOW CLE	71785	133-51-92-008
	-----	-----	-	.	(SPG1 ONLY)		
	136-0260-02	B010100 B021321	12	.	SKT,PL-IN ELEK:MICROCIRCUIT,16 DIP,LOW CLE	71785	133-51-92-008
	-----	-----	-	.	(SPG2 ONLY)		
	136-0260-02	B021322	13	.	SKT,PL-IN ELEK:MICROCIRCUIT,16 DIP,LOW CLE	71785	133-51-92-008
	-----	-----	-	.	(SPG2 ONLY)		
-53	136-0269-02	B010100 B020219	18	.	SKT,PL-IN ELEK:MICROCIRCUIT,14 DIP,LOW CLE	73803	CS9002-14
	-----	-----	-	.	(SPG1 ONLY)		
	136-0269-02	B020220 B020291	19	.	SKT,PL-IN ELEK:MICROCIRCUIT,14 DIP,LOW CLE	73803	CS9002-14
	-----	-----	-	.	(SPG1 ONLY)		
	136-0269-02	B020292	15	.	SKT,PL-IN ELEK:MICROCIRCUIT,14 DIP,LOW CLE	73803	CS9002-14
	-----	-----	-	.	(SPG1 ONLY)		
	136-0269-02	B010100 B021321	18	.	SKT,PL-IN ELEK:MICROCIRCUIT,14 DIP,LOW CLE	73803	CS9002-14
	-----	-----	-	.	(SPG2 ONLY)		
	136-0269-02	B021322 B021841	19	.	SKT,PL-IN ELEK:MICROCIRCUIT,14 DIP,LOW CLE	73803	CS9002-14
	-----	-----	-	.	(SPG2 ONLY)		
	136-0269-02	B021842	15	.	SKT,PL-IN ELEK:MICROCIRCUIT,14 DIP,LOW CLE	73803	CS9002-14
	-----	-----	-	.	(SPG2 ONLY)		
-54	136-0328-03		45	.	SOCKET,PIN TERM:HORIZ,SQ PIN RCPT	22526	47710
-55	136-0641-00	B010100 B010132	1	.	SOCKET,PLUG-IN:40 CONTACT	00779	1-485169-2
	-----	-----	-	.	(SPG1 ONLY)		
	136-0623-00	B010133	1	.	SOCKET,PLUG-IN:40 DIP,LOW PROFILE	73803	CS9002-40
	-----	-----	-	.	(SPG1 ONLY)		
	136-0641-00	B010100 B010519	1	.	SOCKET,PLUG-IN:40 CONTACT	00779	1-485169-2
	-----	-----	-	.	(SPG2 ONLY)		

Replaceable Mechanical Parts—SPG1/SPG2

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Qty	1	2	3	4	5	Name & Description	Mfr Code	Mfr Part Number
	136-0623-00	B010520	1	.	.	.	.	.	SOCKET, PLUG-IN: 40 DIP, LOW PROFILE	73803	CS9002-40
	-----	-----	-	.	.	.	.	.	(SPG2 ONLY)		
1-56	214-0579-00	B010100 B020219	1	.	.	.	.	.	TERM, TEST POINT: BRS CD PL	80009	214-0579-00
	-----	-----	-	.	.	.	.	.	(SPG1 ONLY)		
	214-0579-02	B020220	3	.	.	.	.	.	TERM, TEST POINT: BRASS	80009	214-0579-02
	-----	-----	-	.	.	.	.	.	(SPG1 ONLY)		
	214-0579-00	B010100 B021321	1	.	.	.	.	.	TERM, TEST POINT: BRS CD PL	80009	214-0579-00
	-----	-----	-	.	.	.	.	.	(SPG2 ONLY)		
	214-0579-02	B021322	3	.	.	.	.	.	TERM, TEST POINT: BRASS	80009	214-0579-02
	-----	-----	-	.	.	.	.	.	(SPG2 ONLY)		
-57	214-2440-00		2	.	.	.	.	.	RECEPTACLE, PIN: CIRCUIT CARD	80009	214-2440-00
-58	-----		1	.	.	.	.	.	SWITCH, PUSH: (SEE S109 REPL)		
-59	346-0130-00		1	.	.	.	.	.	STRAP, RETAINING: FOR 40 CONTACT SBSTR SKT	00779	350894-1
-60	-----		1	.	.	.	.	.	CKT BOARD ASSY: GENERATOR LOGIC (SEE A22 REPL)		
-61	131-0589-00	B010100 B010136	9	.	.	.	.	.	TERMINAL, PIN: 0.46 L X 0.025 SQ	22526	48283-029
	-----	-----	-	.	.	.	.	.	(SPG1 ONLY)		
	131-0608-00	B010137	10	.	.	.	.	.	TERMINAL, PIN: 0.365 L X 0.025 PH BRZ GOLD	22526	47357
-62	131-0608-00	B010100 B010136	25	.	.	.	.	.	TERMINAL, PIN: 0.365 L X 0.025 PH BRZ GOLD	22526	47357
	-----	-----	-	.	.	.	.	.	(SPG1 ONLY)		
	131-0608-00	B010137	26	.	.	.	.	.	TERMINAL, PIN: 0.365 L X 0.025 PH BRZ GOLD	22526	47357
-63	131-0993-00		8	.	.	.	.	.	BUS, CONDUCTOR: 2 WIRE BLACK	00779	850100-01
-64	136-0252-07		18	.	.	.	.	.	SOCKET, PIN CONN: W/O DIMPLE	22526	75060-012
-65	136-0260-02		5	.	.	.	.	.	SKT, PL-IN ELEK: MICROCIRCUIT, 16 DIP, LOW CLE	71785	133-51-92-008
-66	136-0269-02		8	.	.	.	.	.	SKT, PL-IN ELEK: MICROCIRCUIT, 14 DIP, LOW CLE	73803	CS9002-14
-67	136-0328-03		28	.	.	.	.	.	SOCKET, PIN TERM: HORIZ, SQ PIN RCPT	22526	47710
-68	214-2440-00		3	.	.	.	.	.	RECEPTACLE, PIN: CIRCUIT CARD	80009	214-2440-00
-69	214-0579-00		3	.	.	.	.	.	TERM, TEST POINT: BRS CD PL	80009	214-0579-00
-70	263-0010-00		3	.	.	.	.	.	SWITCH PB ASSY: 1 PUSH, 7.5MM, W/2 CONTACTS	80009	263-0010-00
-71	343-0495-05		1	.	.	.	.	.	CLIP, SWITCH: FRONT, 7.5MM X5 UNIT	80009	343-0495-05
	-----	-----	-	.	.	.	.	.	(SPG1 ONLY)		
	348-0430-00	XB010103	2	.	.	.	.	.	FOOT, PLASTIC: 0.625 OD X 0.32 W/ADH BACK	74932	SJ5027
	-----	-----	-	.	.	.	.	.	(SPG1 ONLY)		
	348-0430-00	XB010139	2	.	.	.	.	.	FOOT, PLASTIC: 0.625 OD X 0.32 W/ADH BACK	74932	SJ5027
	-----	-----	-	.	.	.	.	.	(SPG2 ONLY)		
									(ATTACHING PARTS)		
-72	210-3033-00		3	.	.	.	.	.	EYELET, METALLIC: 0.59 OD X 0.156 INCH LONG	07707	SE-25
	-----	-----	-	.	.	.	.	.	(SPG1 ONLY)		
-73	343-0499-05	B010100 B012137	1	.	.	.	.	.	CLIP, SWITCH: REAR, 7.5MM X 5 UNIT	80009	343-0499-05
	-----	-----	-	.	.	.	.	.	(SPG1 ONLY)		
	343-0499-14	B012138	1	.	.	.	.	.	CLIP, SWITCH: 7.5MM X 5 UNIT	80009	343-0499-14
	-----	-----	-	.	.	.	.	.	(SPG1 ONLY)		
	343-0499-05	B010100 B012140	1	.	.	.	.	.	CLIP, SWITCH: REAR, 7.5MM X 5 UNIT	80009	343-0499-05
	-----	-----	-	.	.	.	.	.	(SPG2 ONLY)		
	343-0499-14	B012141	1	.	.	.	.	.	CLIP, SWITCH: 7.5MM X 5 UNIT	80009	343-0499-14
	-----	-----	-	.	.	.	.	.	(SPG2 ONLY)		
									(ATTACHING PARTS)		
-74	210-3033-00		3	.	.	.	.	.	EYELET, METALLIC: 0.59 OD X 0.156 INCH LONG	07707	SE-25
	-----	-----	-	.	.	.	.	.	(SPG1 ONLY)		
-75	-----		1	.	.	.	.	.	CKT BOARD ASSY: SYNC LOCK (SEE A21 REPL)		
-76	131-0608-00	B010100 B010100	16	.	.	.	.	.	TERMINAL, PIN: 0.365 L X 0.025 PH BRZ GOLD	22526	47357
	-----	-----	-	.	.	.	.	.	(SPG1 ONLY)		
	131-0608-00	B010101	10	.	.	.	.	.	TERMINAL, PIN: 0.365 L X 0.025 PH BRZ GOLD	22526	47357
	-----	-----	-	.	.	.	.	.	(SPG1 ONLY)		
	131-0589-00	B010101	6	.	.	.	.	.	TERMINAL, PIN: 0.46 L X 0.025 SQ	22526	48283-029
	-----	-----	-	.	.	.	.	.	(SPG1 ONLY)		
	131-0608-00	B010100 B010175	8	.	.	.	.	.	TERMINAL, PIN: 0.365 L X 0.025 PH BRZ GOLD	22526	47357
	-----	-----	-	.	.	.	.	.	(SPG2 ONLY)		
	131-0608-00	B010176	2	.	.	.	.	.	TERMINAL, PIN: 0.365 L X 0.025 PH BRZ GOLD	22526	47357
	-----	-----	-	.	.	.	.	.	(SPG2 ONLY)		
	131-0589-00	B010176	6	.	.	.	.	.	TERMINAL, PIN: 0.46 L X 0.025 SQ	22526	48283-029
	-----	-----	-	.	.	.	.	.	(SPG2 ONLY)		
-77	131-0993-00	B010100 B010136	2	.	.	.	.	.	BUS, CONDUCTOR: 2 WIRE BLACK	00779	850100-01
	-----	-----	-	.	.	.	.	.	(SPG1 ONLY)		
	131-0993-00	B010137	3	.	.	.	.	.	BUS, CONDUCTOR: 2 WIRE BLACK	00779	850100-01
-78	136-0241-00	B010100 B012485X	1	.	.	.	.	.	SKT, PL-IN ELEK: MICROCIRCUIT, 10 CONT, PCB MT	71785	133-99-12-064
-79	136-0252-07		42	.	.	.	.	.	SOCKET, PIN CONN: W/O DIMPLE	22526	75060-012
-80	136-0260-02	B010100 B020291	9	.	.	.	.	.	SKT, PL-IN ELEK: MICROCIRCUIT, 16 DIP, LOW CLE	71785	133-51-92-008
	-----	-----	-	.	.	.	.	.	(SPG1 ONLY)		
	136-0260-02	B020292	6	.	.	.	.	.	SKT, PL-IN ELEK: MICROCIRCUIT, 16 DIP, LOW CLE	71785	133-51-92-008
	-----	-----	-	.	.	.	.	.	(SPG1 ONLY)		

Fig. & Index No.	Tektronix Part No.	Serial/Model No.		Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
		Eff	Dscont					
	136-0260-02	B010100	B021841	9	.	SKT, PL-IN ELEK:MICROCIRCUIT, 16 DIP, LOW CLE	71785	133-51-92-008
	-----			-	.	(SPG2 ONLY)		
	136-0260-02	B021842		6	.	SKT, PL-IN ELEK:MICROCIRCUIT, 16 DIP, LOW CLE	71785	133-51-92-008
	-----			-	.	(SPG2 ONLY)		
1-81	136-0269-02			11	.	SKT, PL-IN ELEK:MICROCIRCUIT, 14 DIP, LOW CLE	73803	CS9002-14
-82	136-0328-03			24	.	SOCKET, PIN TERM:HORIZ, SQ PIN RCPT	22526	47710
-83	136-0514-00			2	.	SKT, PL-IN ELEK:MICROCIRCUIT, 8 DIP	73803	CS9002-8
-84	214-0579-00			14	.	TERM, TEST POINT: BRS CD PL	80009	214-0579-00
-85	214-2440-00			3	.	RECEPTACLE, PIN: CIRCUIT CARD	80009	214-2440-00
-86	-----			1	.	CKT BOARD ASSY: PULSE OUTPUT AMPL(SEE A24 REPL)		
-87	376-0029-00	B010100	B010132	1	.	CPLG, SHAFT, RGD: 0.128 ID X 0.312 OD X 0.5"L	80009	376-0029-00
	-----			-	.	(SPG1 ONLY)		
	376-0051-00	B010133		1	.	CPLG, SHAFT, FLEX: 0.127 ID X 0.375 ID DELRIN	80009	376-0051-00
	-----			-	.	(SPG1 ONLY)		
	376-0029-00	B010100	B010849	1	.	CPLG, SHAFT, RGD: 0.128 ID X 0.312 OD X 0.5"L	80009	376-0029-00
	-----			-	.	(SPG2 ONLY)		
	376-0051-00	B010850		1	.	CPLG, SHAFT, FLEX: 0.127 ID X 0.375 ID DELRIN	80009	376-0051-00
	-----			-	.	(SPG2 ONLY)		
-88	384-1171-00			1	.	EXTENSION SHAFT: 1.05 L X 0.125 OD AL	80009	384-1171-00
-89	131-0589-00			11	.	TERMINAL, PIN: 0.46 L X 0.025 SQ	22526	48283-029
-90	131-0608-00	B010100	B012529	13	.	TERMINAL, PIN: 0.365 L X 0.025 PH BRZ GOLD	22526	47357
	-----			11	.	TERMINAL, PIN: 0.365 L X 0.025 PH BRZ GOLD	22526	47357
	131-0589-00	XB012530		4	.	TERMINAL, PIN: 0.46 L X 0.025 SQ	22526	48283-029
-91	131-0787-00			24	.	CONTACT, ELEC: 0.64 INCH LONG	22526	47359
-92	131-0993-00			1	.	BUS, CONDUCTOR: 2 WIRE BLACK	00779	850100-01
-93	136-0183-00	B010100	B020192X	1	.	SOCKET, PLUG-IN: 3 PIN, ROUND	80009	136-0183-00
	-----			-	.	(SPG1 ONLY)		
	136-0183-00	B010100	B020991X	1	.	SOCKET, PLUG-IN: 3 PIN, ROUND	80009	136-0183-00
	-----			-	.	(SPG2 ONLY)		
-94	136-0220-00	B010100	B020192X	5	.	SKT, PL-IN ELEK: TRANSISTOR 3 CONTACT, PCB MT	71785	133-23-11-034
	-----			-	.	(SPG1 ONLY)		
	136-0220-00	B010100	B020991X	5	.	SKT, PL-IN ELEK: TRANSISTOR 3 CONTACT, PCB MT	71785	133-23-11-034
	-----			-	.	(SPG2 ONLY)		
-95	136-0260-02			7	.	SKT, PL-IN ELEK:MICROCIRCUIT, 16 DIP, LOW CLE	71785	133-51-92-008
-96	136-0269-02			4	.	SKT, PL-IN ELEK:MICROCIRCUIT, 14 DIP, LOW CLE	73803	CS9002-14
-97	136-0328-03			28	.	SOCKET, PIN TERM:HORIZ, SQ PIN RCPT	22526	47710
-98	136-0514-00			1	.	SKT, PL-IN ELEK:MICROCIRCUIT, 8 DIP	73803	CS9002-8
-99	214-2440-00			3	.	RECEPTACLE, PIN: CIRCUIT CARD	80009	214-2440-00
	198-3291-00	B010100	B010146X	1	.	WIRE SET, ELEC:	80009	198-3291-00
	-----			-	.	(SPG1 ONLY)		
	-----	B010100	B010146X	1	.	WIRE ASSY: 6 WIRE RIBBON, 6.50 INCHES LONG		
	-----			-	.	(SPG1 ONLY)		
	198-3291-00	B010100	B010699X	1	.	WIRE SET, ELEC:	80009	198-3291-00
	-----			-	.	(SPG2 ONLY)		
	-----	B010100	B010699X	1	.	WIRE ASSY: 6 WIRE RIBBON, 6.50 INCHES LONG		
	-----			-	.	(SPG2 ONLY)		
-100	175-0829-00	B010100	B010146X	FT	.	WIRE, ELECTRICAL: 6 WIRE RIBBON	08261	SS-0626-710610C
	-----			-	.	(SPG1 ONLY)		
	175-0829-00	B010100	B010699X	FT	.	WIRE, ELECTRICAL: 6 WIRE RIBBON	08261	SS-0626-710610C
	-----			-	.	(SPG2 ONLY)		
-101	352-0164-00	B010100	B010146X	2	.	CONN BODY, PL, EL: 6 WIRE BLACK	80009	352-0164-00
	-----			-	.	(SPG1 ONLY)		
	352-0164-00	B010100	B010699X	2	.	CONN BODY, PL, EL: 6 WIRE BLACK	80009	352-0164-00
	-----			-	.	(SPG2 ONLY)		
-102	131-0707-00	B010100	B010146X	12	.	CONNECTOR, TERM: 22-26 AWG, BRS& CU BE GOLD	22526	47439
	-----			-	.	(SPG1 ONLY)		
	-----	B010100	B010146X	1	.	WIRE ASSY: CABLE COAXIAL, 15.50 INCHES LONG		
	-----			-	.	(SPG1 ONLY)		
	131-0707-00	B010100	B010699X	1	.	CONNECTOR, TERM: 22-26 AWG, BRS& CU BE GOLD	22526	47439
	-----			-	.	(SPG2 ONLY)		
	-----	B010100	B010699X	1	.	WIRE ASSY: CABLE COAXIAL, 15.50 INCHES LONG		
	-----			-	.	(SPG2 ONLY)		
-103	352-0198-01	B010100	B010146X	1	.	HLDR, TERM CONN: 2 WIRE BROWN	80009	352-0198-01
	-----			-	.	(SPG1 ONLY)		
	352-0198-01	B010100	B010699X	1	.	HLDR, TERM CONN: 2 WIRE BROWN	80009	352-0198-01
	-----			-	.	(SPG2 ONLY)		
	131-0622-00	B010100	B010146X	1	.	CONTACT, ELEC: 0.577"L, 28-32 AWG WIRE	22526	46241
	-----			-	.	(SPG1 ONLY)		

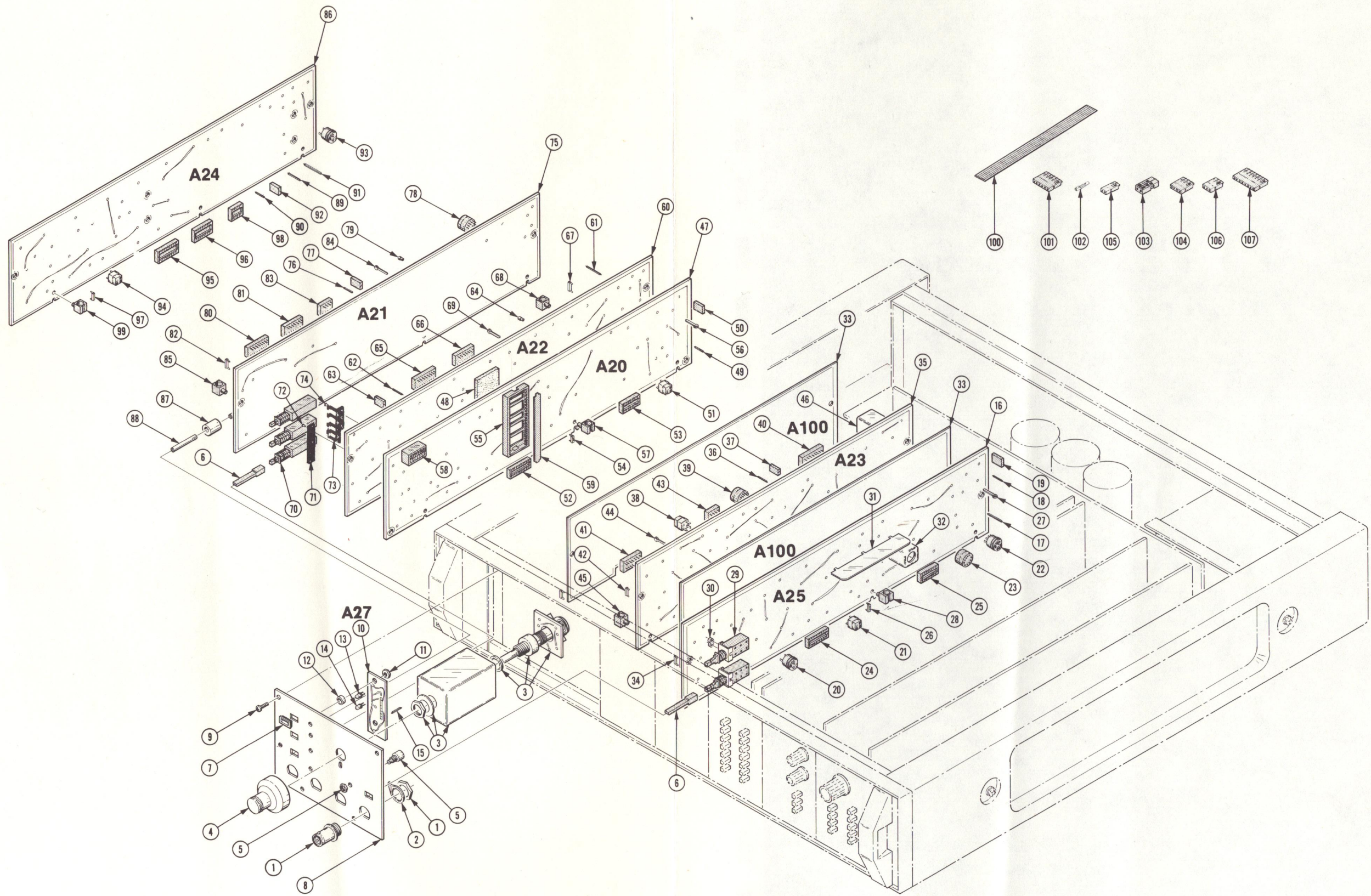
Replaceable Mechanical Parts—SPG1/SPG2

Fig. & Index No.	Tektronix Part No.	Serial/Model No.		Qty	1	2	3	4	5	Name & Description	Mfr Code	Mfr Part Number
		Eff	Dscont									
1-	131-0622-00	B010100	B010699X	1	.	.	.	.	.	CONTACT, ELEC:0.577"L, 28-32 AWG WIRE	22526	46241
	-----	-----	-----	-	.	.	.	.	.	(SPG2 ONLY)		
	131-0621-00	B010100	B010146X	1	.	.	.	.	.	CONNECTOR, TERM:22-26 AWG, BRS& CU BE GOLD	22526	46231
	-----	-----	-----	-	.	.	.	.	.	(SPG1 ONLY)		
	-----	B010100	B010146X	1	.	.	.	.	.	WIRE ASSY: CABLE COAXIAL, 6 INCHES LONG		
	-----	-----	-----	-	.	.	.	.	.	(SPG1 ONLY)		
	131-0621-00	B010100	B010699X	1	.	.	.	.	.	CONNECTOR, TERM:22-26 AWG, BRS& CU BE GOLD	22526	46231
	-----	-----	-----	-	.	.	.	.	.	(SPG2 ONLY)		
	-----	B010100	B010699X	1	.	.	.	.	.	WIRE ASSY: CABLE COAXIAL, 6 INCHES LONG		
	-----	-----	-----	-	.	.	.	.	.	(SPG2 ONLY)		
-104	352-0162-01	B010100	B010146X	1	.	.	.	.	.	CONN BODY, PL, EL: 4 WIRE BROWN	80009	352-0162-01
	-----	-----	-----	-	.	.	.	.	.	(SPG1 ONLY)		
	352-0162-01	B010100	B010699X	1	.	.	.	.	.	CONN BODY, PL, EL: 4 WIRE BROWN	80009	352-0162-01
	-----	-----	-----	-	.	.	.	.	.	(SPG2 ONLY)		
	131-0708-00	B010100	B010146X	2	.	.	.	.	.	CONTACT, ELEC:0.48"L, 28-32 AWG WIRE	22526	47437
	-----	-----	-----	-	.	.	.	.	.	(SPG1 ONLY)		
	131-0708-00	B010100	B010699X	2	.	.	.	.	.	CONTACT, ELEC:0.48"L, 28-32 AWG WIRE	22526	47437
	-----	-----	-----	-	.	.	.	.	.	(SPG2 ONLY)		
	131-0707-00	B010100	B010146X	2	.	.	.	.	.	CONNECTOR, TERM:22-26 AWG, BRS& CU BE GOLD	22526	47439
	-----	-----	-----	-	.	.	.	.	.	(SPG1 ONLY)		
	131-0707-00	B010100	B010699X	2	.	.	.	.	.	CONNECTOR, TERM:22-26 AWG, BRS& CU BE GOLD	22526	47439
	-----	-----	-----	-	.	.	.	.	.	(SPG2 ONLY)		
	175-3026-00	XB010147			1	.	.	.	.	CA ASSY, SP, ELEC:6, 26 AWG, 6.25L	80009	175-3026-00
	-----	-----	-----	-----	-	.	.	.	.	(SPG1 ONLY)		
	175-3026-00	XB010700			1	.	.	.	.	CA ASSY, SP, ELEC:6, 26 AWG, 6.25L	80009	175-3026-00
	-----	-----	-----	-----	-	.	.	.	.	(SPG2 ONLY)		
	352-0164-05	XB010147			2	.	.	.	.	CONN BODY, PL, EL: 6 WIRE GREEN	80009	352-0164-05
	-----	-----	-----	-----	-	.	.	.	.	(SPG1 ONLY)		
	352-0164-05	XB010700			2	.	.	.	.	CONN BODY, PL, EL: 6 WIRE GREEN	80009	352-0164-05
	-----	-----	-----	-----	-	.	.	.	.	(SPG2 ONLY)		
	175-3027-00	XB010147			1	.	.	.	.	CABLE ASSY, RF: 50 OHM COAX, 6.0 L, 9-8	80009	175-3027-00
	-----	-----	-----	-----	-	.	.	.	.	(SPG1 ONLY)		
	175-3027-00	XB010700			1	.	.	.	.	CABLE ASSY, RF: 50 OHM COAX, 6.0 L, 9-8	80009	175-3027-00
	-----	-----	-----	-----	-	.	.	.	.	(SPG2 ONLY)		
	352-0169-01	XB010147			1	.	.	.	.	HLDR, TERM CONN: 2 WIRE, BROWN	80009	352-0169-01
	-----	-----	-----	-----	-	.	.	.	.	(SPG1 ONLY)		
	352-0169-01	XB010700			1	.	.	.	.	HLDR, TERM CONN: 2 WIRE, BROWN	80009	352-0169-01
	-----	-----	-----	-----	-	.	.	.	.	(SPG2 ONLY)		
	352-0169-04	XB010147			1	.	.	.	.	CONN BODY, PL, EL: 2 WIRE YELLOW	80009	352-0169-04
	-----	-----	-----	-----	-	.	.	.	.	(SPG1 ONLY)		
352-0169-04	XB010700			1	.	.	.	.	CONN BODY, PL, EL: 2 WIRE YELLOW	80009	352-0169-04	
-----	-----	-----	-----	-	.	.	.	.	(SPG2 ONLY)			
175-3029-00	XB010147			1	.	.	.	.	CABLE ASSY, RF: 75 OHM COAX, 15.5 L, 9-0	80009	175-3029-00	
-----	-----	-----	-----	-	.	.	.	.	(SPG1 ONLY)			
175-3029-00	XB010700			1	.	.	.	.	CABLE ASSY, RF: 75 OHM COAX, 15.5 L, 9-0	80009	175-3029-00	
-----	-----	-----	-----	-	.	.	.	.	(SPG2 ONLY)			
352-0198-01	XB010147			1	.	.	.	.	HLDR, TERM CONN: 2 WIRE BROWN	80009	352-0198-01	
-----	-----	-----	-----	-	.	.	.	.	(SPG1 ONLY)			
352-0198-01	XB010700			1	.	.	.	.	HLDR, TERM CONN: 2 WIRE BROWN	80009	352-0198-01	
-----	-----	-----	-----	-	.	.	.	.	(SPG2 ONLY)			
198-3290-00				1	.	.	.	.	WIRE SET, ELEC:	80009	198-3290-00	
-----	-----	-----	-----	-	.	.	.	.	(SPG2 ONLY)			
-----	-----	-----	-----	-	.	.	.	.	WIRE ASSY: CABLE COAX, 8 INCHES LONG			
-105	352-0169-00			1	.	.	.	.	.	HLDR, TERM CONN: 2 WIRE BLACK	80009	352-0169-00
	352-0169-05			1	.	.	.	.	.	CONN BODY, PL, EL: 2 WIRE GREEN	80009	352-0169-05
	131-0708-00			2	.	.	.	.	.	CONTACT, ELEC:0.48"L, 28-32 AWG WIRE	22526	47437
	131-0707-00			2	.	.	.	.	.	CONNECTOR, TERM:22-26 AWG, BRS& CU BE GOLD	22526	47439
	179-2469-00			1	.	.	.	.	.	WIRING HARNESS: PULSE OUTPUT COAX	80009	179-2469-00
	343-0549-00			6	.	.	.	.	.	STRAP, TIEDOWN: 0.091 W X 3.62 INCH LONG	06383	PLTIM
	131-0707-00			30	.	.	.	.	.	CONNECTOR, TERM:22-26 AWG, BRS& CU BE GOLD	22526	47439
	131-0708-00			24	.	.	.	.	.	CONTACT, ELEC:0.48"L, 28-32 AWG WIRE	22526	47437
	131-2428-00			24	.	.	.	.	.	CONN PLUG, ELEC: 18-20 AWG, BRS& CU BE GOLD	22526	47441
	-----	-----	-----	-----	-	.	.	.	.	(SPG2 ONLY)		
-106	352-0161-01			2	.	.	.	.	.	CONN BODY, PL, EL: 3 WIRE BROWN	80009	352-0161-01
	352-0164-00			8	.	.	.	.	.	CONN BODY, PL, EL: 6 WIRE BLACK	80009	352-0164-00
	179-2471-01			1	.	.	.	.	.	WIRING HARNESS:	80009	179-2471-01

Replaceable Mechanical Parts—SPG1/SPG2

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-	343-0549-00		9						. STRAP, TIEDOWN: 0.091 W X 3.62 INCH LONG	06383	PLT1M
	131-0707-00		9						. CONNECTOR, TERM: 22-26 AWG, BRS& CU BE GOLD	22526	47439
	131-0708-00		9						. CONTACT, ELEC: 0.48"L, 28-32 AWG WIRE	22526	47437
	131-2428-00		9						. CONN PLUG, ELEC: 18-20 AWG, BRS& CU BE GOLD	22526	47441
-107	352-0166-00		1						. CONN BODY, PL, EL: 8 WIRE BLACK	80009	352-0166-00
	352-0166-07		1						. CONN BODY, PL, EL: 8 WIRE VIOLET	80009	352-0166-07
	352-0162-07		1						. CONN BODY, PL, EL: 4 WIRE VIOLET	80009	352-0162-07





SPG1/2 NTSC SYNC GENERATOR MODULE

Fig. & Index No.	Tektronix Part No.	Serial/Model No.		Qty						Name & Description	Mfr Code	Mfr Part Number	
		Eff	Dscont		1	2	3	4	5				
	070-2104-00			1							MANUAL, TECH: INSTRUCTION	80009	070-2104-00

ACCESSORIES

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SPG1/2 NTSC SYNC GENERATOR MODULE