TEKTRONIX®

TSG4

NTSC BLACK BURST TEST SIGNAL GENERATOR MODULE

INSTRUCTION MANUAL

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

Serial Number _____

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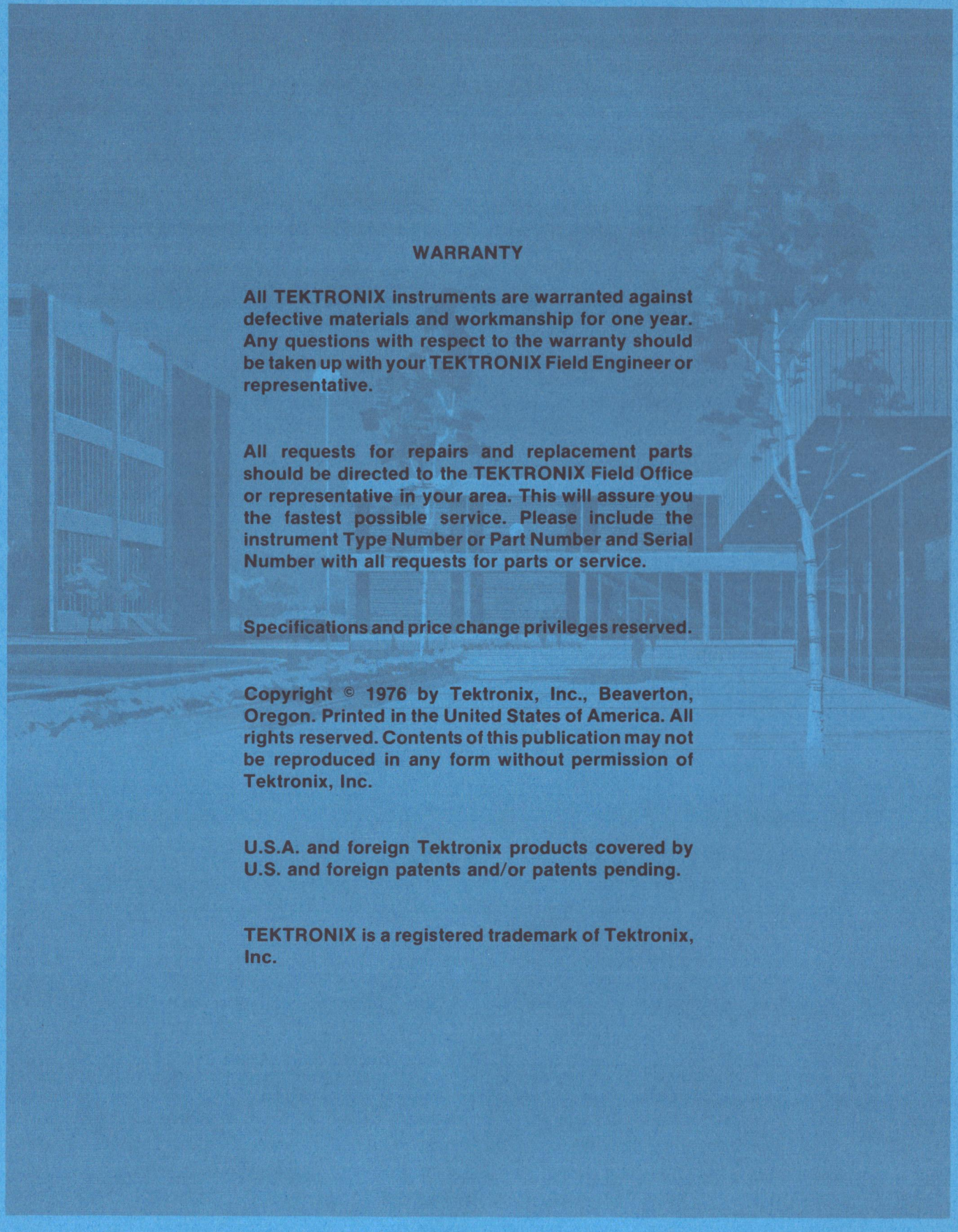

WARRANTY

All TEKTRONIX instruments are warranted against defective materials and workmanship for one year. Any questions with respect to the warranty should be taken up with your TEKTRONIX Field Engineer or representative.

All requests for repairs and replacement parts should be directed to the TEKTRONIX Field Office or representative in your area. This will assure you the fastest possible service. Please include the instrument Type Number or Part Number and Serial Number with all requests for parts or service.

Specifications and price change privileges reserved.

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TABLE OF CONTENTS

This manual is divided into two parts for safety purposes. Part I should be used by both operating and service personnel; the Safety Summary should be reviewed before operating or servicing the instrument. Part II contains service instructions that can lead to exposure of personnel to hazardous voltages; these instructions are for qualified service personnel only.

PART I—OPERATORS INFORMATION

PART II—SERVICE INFORMATION

WARNING

The remaining portion of this Table of Contents lists servicing instructions that expose personnel to hazardous voltages. These instructions are for qualified service personnel only.

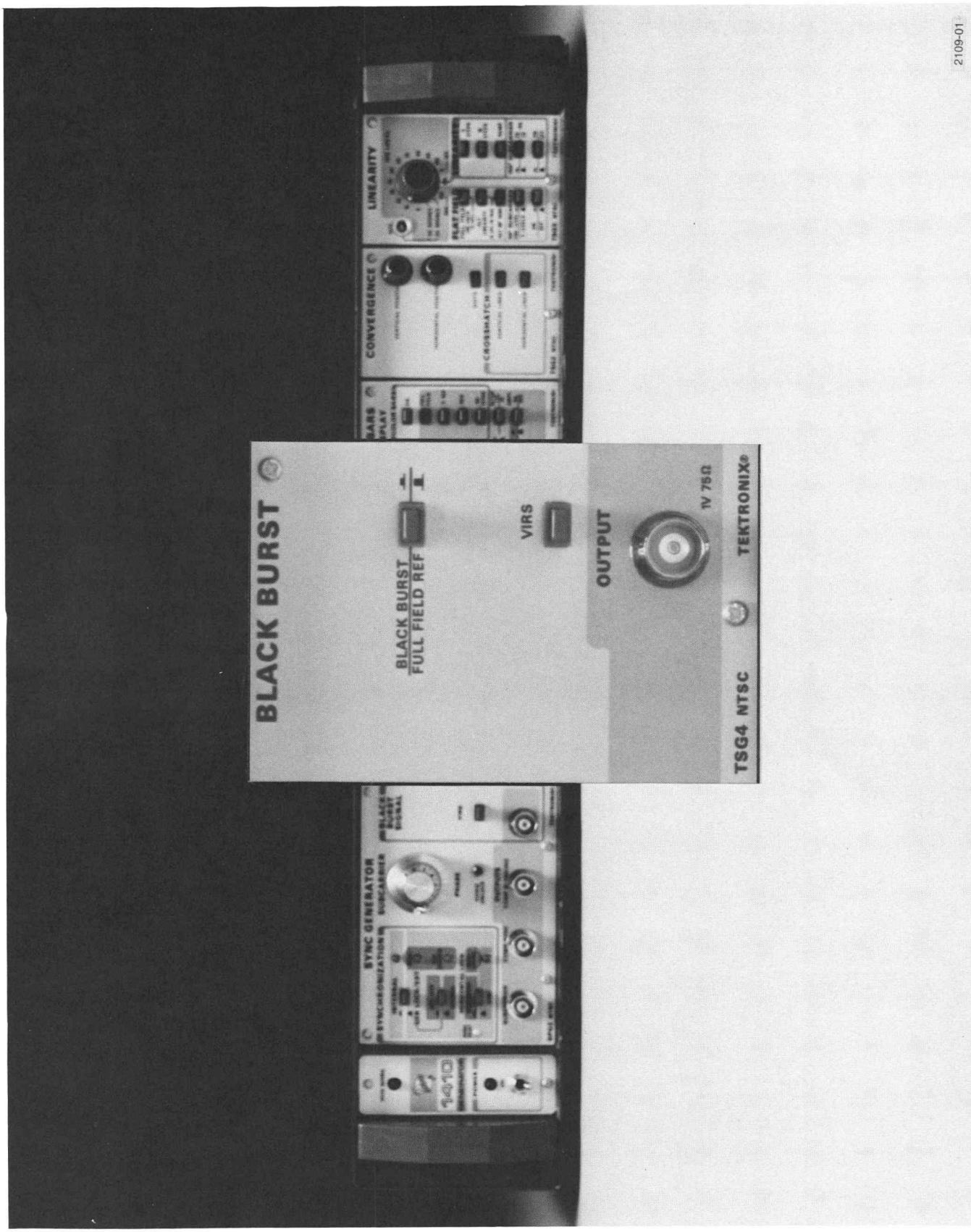


Fig. 1-1. The TSG4 NTSC Black Burst Test Signal Generator.

PART I
OPERATORS INFORMATION

OPERATING INSTRUCTIONS

SAFETY SUMMARY

This manual contains safety information which the operator and service technician must follow to avoid personal injury and to ensure safe operation of the instrument.

WARNING information is intended to protect the operator from personal injury.

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 instruction manual for more information.

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

DESCRIPTION

The TSG4 NTSC Black Burst Test Signal Generator Module circuitry is contained on one etched circuit board which plugs into the 1410 Mainframe Interface board. Pin connectors on the bottom edge of the circuit board mate with vertical pins on the Interface board.

The TSG4 provides black burst or a full field of the Vertical Interval Reference Signal. The VIR Signal is available for insertion on Fields 1, 2, or both and Line 18 or Line 19.

FRONT PANEL CONTROLS AND CONNECTORS

(1) BLACK BURST/FULL FIELD REF Pushbutton—Selects black burst when pushed in or a full field of reference signal in the 'out' position.

(2) VIRS Pushbutton—Inserts the Vertical Interval Reference Signal on selected fields and lines (Fields 1, 2, or both; line 18 or 19) when pushed in.

(3) OUTPUT Connector—Provides 1 V of output signal into 75 Ω.

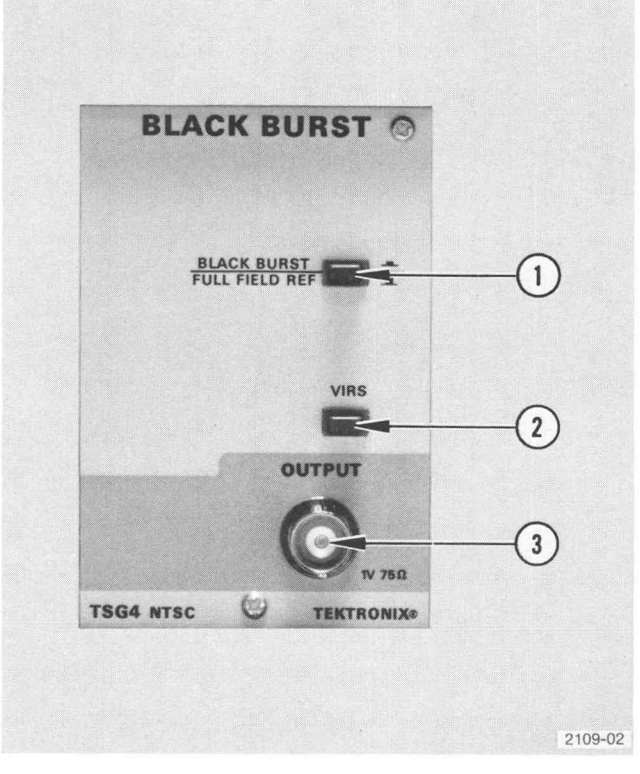


Fig. 1-2. Front panel controls and connectors.

GENERAL INFORMATION

VIRS

The Vertical Interval Reference Signal consists of a 7.5 IRE pedestal, a 50 IRE pedestal, and a 70 IRE pedestal with 40 IRE of chrominance modulation whose phase is the same as burst. The 70 IRE luminance level with modulation approximates the average program chrominance at typical skin tone luminance levels. The 50 IRE luminance pedestal represents average scene brightness and is useful for overall signal level measurements. It matches the bottom of the chrominance reference level, facilitating comparison of the two levels. The 7.5 IRE luminance pedestal provides a reference level for the setup or black level. See Fig. 1-3.

BLACK BURST

The Black Burst signal consists of a 7.5 IRE pedestal above blanking level with sync and burst. It is useful for genlocking other signal sources and for providing black level at switcher inputs. See Fig. 1-4.

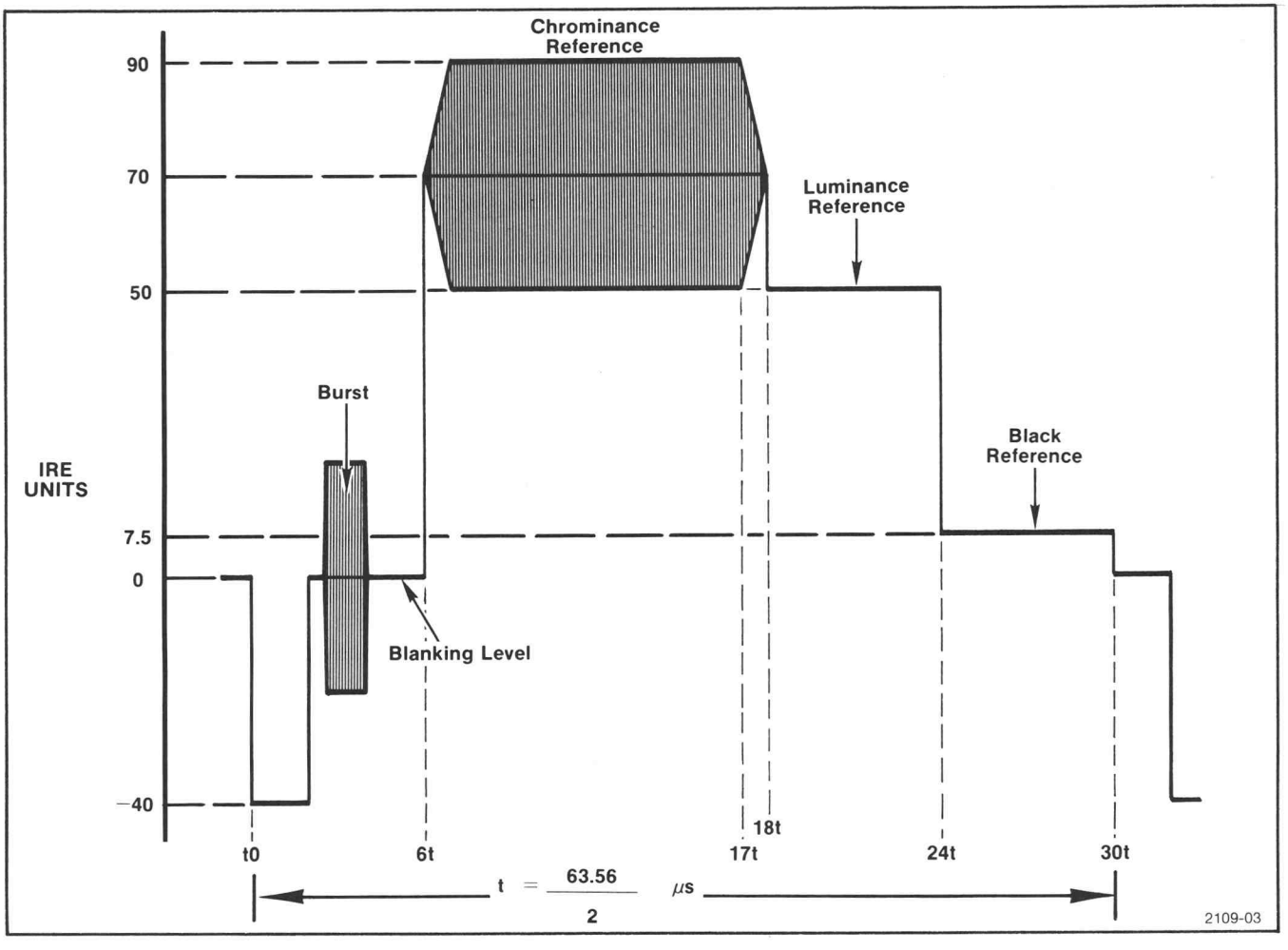


Fig. 1-3. The Vertical Interval Reference Signal.

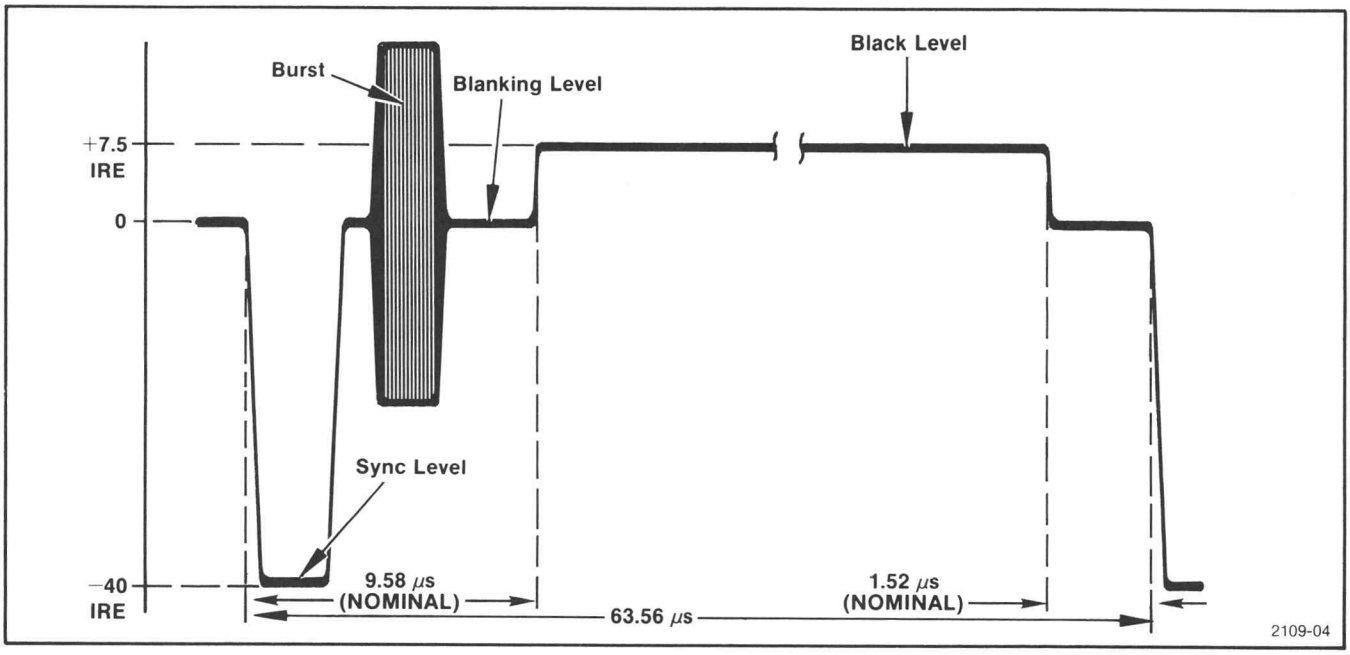


Fig. 1-4. The Black Burst Signal.

SPECIFICATIONS

ELECTRICAL CHARACTERISTICS

The electrical performance requirements for this instrument module are valid over the environmental limits listed at the end of this section. Calibration at 20°C to 30°C ambient with a 20-minute warm-up period is required to maintain stated accuracies.

Characteristics	Performance Requirements
VIR Signal	
Chrominance	
Amplitude	285.7 mV ±2.86 mV (40 IRE ±0.4 IRE).
Phase	Within 0.5° of burst.
Envelope Risetime	Sin^2 shaped, 1 μs ±150 ns.
Luminance	
Risetime	250 ns ±37.5 ns.
Setup Level	53.57 mV ±3.57 mV (7.5 IRE ±0.5 IRE).
Gray Level	357 mV ±3.57 mV (50 IRE ±0.5 IRE).
Chroma Pedestal	500 mV ±5 mV (70 IRE ±0.7 IRE).
Timing	See Fig. 1-3.
Black Burst	
Amplitude	
Sync	285.7 mV ±3.57 mV (40 IRE ±0.5 IRE) negative-going.
Setup Level	53.57 mV ±3.57 mV (7.5 IRE ±0.5 IRE).
Blanking DC Level	0 V ±50 mV
Sync and Set-up Risetime	130 ns, +20 ns, −10 ns.
Burst	285.7 mV ±2.86 mV (40 IRE ±0.4 IRE).
Timing	See Fig. 1-4.
Line Sync	4.77 μs ±50 ns.
Rise and Fall Time	Sin^2 shaped, 130 ns +20 ns −10 ns.
Front Porch Duration	1.59 μs ±50 ns at 50% point, 1.52 μs ±50 ns at 10% point.
Breezeway	475 ns ±50 ns at 10% point.
Period	63.56 μs (digitally determined from 3.579545 MHz).
Burst	
Risetime	400 ns ±60 ns.
Delay from Line Sync	5.309 μs (19 cycles of subcarrier) ±35 ns.
H.A.D. of Envelope	2.51 μs (9 cycles of subcarrier) ±70 ns.
Amplitude	285.7 mV ±3.57 mV.
Residual Sub-carrier	At least 52 dB below 1 V.
Return Loss	At least 30 dB to 5 MHz.
Isolation	
Passive	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.
Active (non-Coherent Cross-talk)	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 sub-carrier frequency.

ENVIRONMENTAL CHARACTERISTICS

Characteristics	Performance Requirements
Temperature	
Storage	−40°C to +65°C.
Operating	0°C to +50°C.
Altitude	
Storage	To 50,000 feet.
Operating	To 15,000 feet.

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.

PART II
SERVICE INFORMATION

INSTALLATION

INSTALLING IN THE MAINFRAME

Use the following steps to install the TSG4 Module in the 1410 Mainframe. Turn the Mainframe POWER switch off before attempting installation.

1. Select one of the available 1410 Mainframe module locations for installation of the TSG4 module: Locations 2 through 6 with the SPG1 or SPG2 installed or locations 1 through 6 with the SPG3 installed (see Fig. 3-1).

2. Position the TSG4 board over the Mainframe Interconnect pins using the plastic guides for proper pin alignment. Seat the board firmly on the Interconnect board.

3. Install the plastic pushbutton extenders on the board pushbutton shafts.

4. Position the TSG4 front panel over the pushbutton control extenders and secure to the 1410 Mainframe front casting with the screws provided.

5. Connect the coaxial cable from the front-panel OUTPUT connector to the board output connector. Connect the coaxial cable from the appropriate rear-panel MODULE OUTPUT connector to the other pair of board output connectors.

Reverse the installation steps to remove the module.

OPERATING MODE SELECTION

Located near the front of the circuit board (see Adjustment and Jumper Locations pullout) are three separate jumper connectors which provide selection of optional operating modes. The following describes the jumper functions.

VIRS Line, P857

This jumper provides selection of either Line 18 or Line 19 of the vertical interval for VIR signal insertion. Placing the jumper on pins 1 and 2 selects Line 18 and on pins 2 and 3, Line 19.

VIRS Field, P858

This jumper provides selection of either Field 1, Field 2, or both fields in which the VIR signal will appear. Pins 1 and 2 select Field 1, pins 1 and 3 select Field 2, and pins 3 and 4 select Both Fields 1 and 2.

Sync In Video Disable, P855

Composite sync drive to the module may be controlled by this jumper. Placing the jumper on pins 2 and 3 allows the Video Disable Line to control sync drive. The jumper at pins 1 and 2 disconnects the disable function.

PACKAGING

At installation time, save the shipping carton and packing materials for packaging in case shipment becomes necessary.

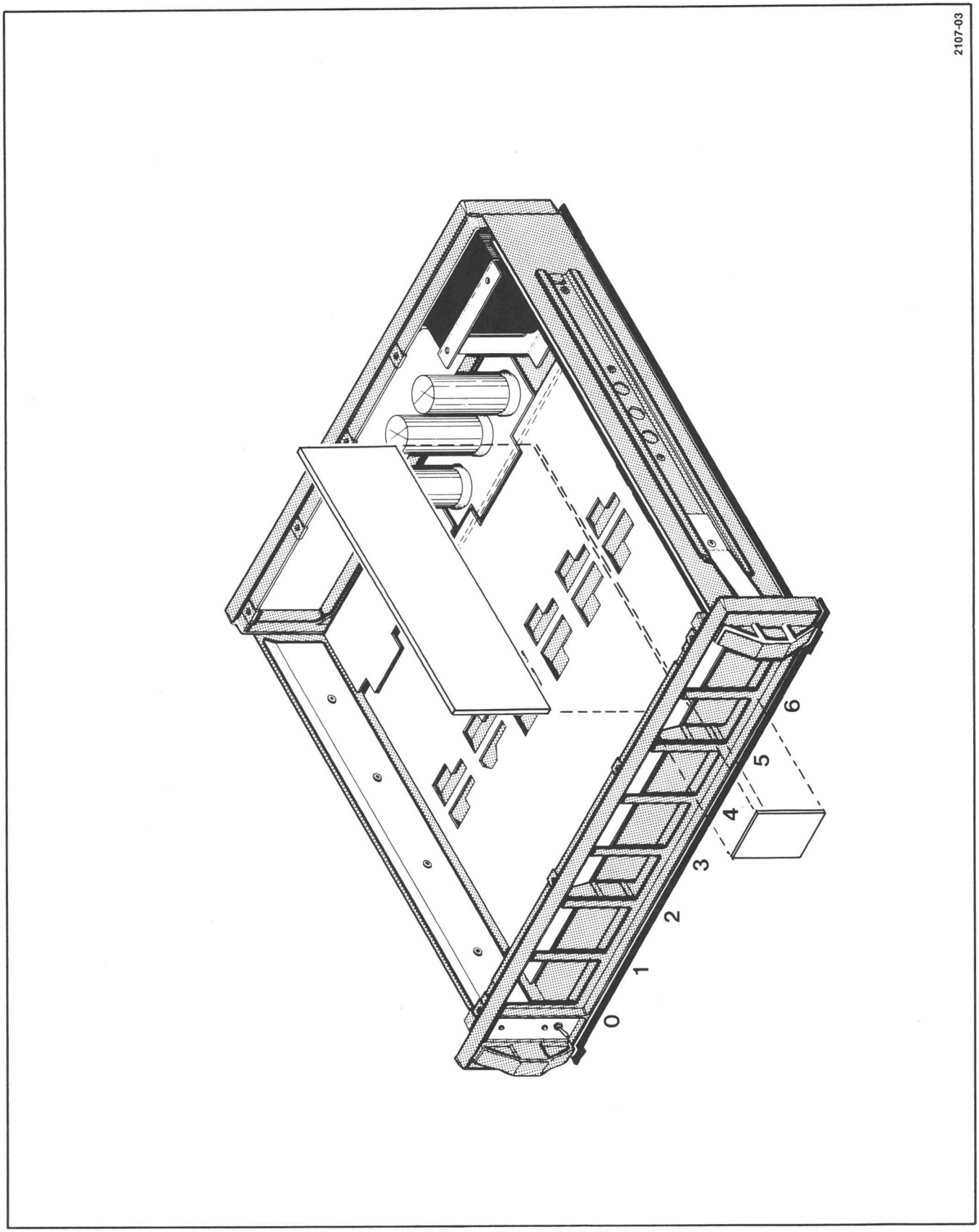


Fig. 3-1. Installing the module circuit board in the mainframe.

PERFORMANCE CHECK/CALIBRATION PROCEDURE

INTRODUCTION

Procedures in this section serve as guides to perform calibration steps and performance checks. Limits, tolerances, and waveforms appearing in these procedures are not instrument specifications except as listed in the Specifications section.

Performance checks are identified by the word "Check" in the step heading. These steps may be performed to verify instrument performance. Steps that include the word "Adjust" must be performed during calibration.

The TSG4 front-panel control and connector names in the text are capitalized; for example, VIRS and OUTPUT. Control and connector names on test equipment and internal controls in the TSG4 module under test have only the first letter capitalized; for example, Test Oscilloscope Time/Div., or 1480 Mag control.

TEST EQUIPMENT

Test equipment capabilities described herein are the minimum required to calibrate the instrument. Examples represent test equipment used in developing these procedures.

1. Waveform Monitor. Capable of viewing line rate and field rate signals, with a magnifier risetime and pulse duration. For example, a Tektronix 1480 Waveform Monitor.

2. Test Oscilloscope. Bandwidth, DC to 30 MHz; minimum deflection, 1 V/div; two input channels with provisions for independent or differential operation. For example, a Tektronix 7603 Oscilloscope with 7A13, 7A18, and 7B53A plug-in units.

3. Sine-wave Signal Generator. Minimum output, 500 mV; frequency range, 50 kHz and variable from 1 MHz to 5 MHz. For example, a Tektronix SG 503 in a Tektronix TM 500 Series Mainframe.

4. Spectrum Analyzer (Optional). A Tektronix 7L5 and L2 or 7L12 is compatible with the 7603 Oscilloscope.

5. Return Loss Bridge. Tektronix Part No. 015-1049-00.

6. Minimum Loss Attenuator. Tektronix Part No. 011-0057-00.

7. Vectorscope. Capable of viewing two signals simultaneously. For example, a Tektronix 520A.

8. Calibration Fixture (see Fig. 4-1).

9. Cable. Tektronix Part No. 012-0074-00.

10. 75 Ω End-Line Termination. Tektronix Part No. 011-0102-00.

11. 75 Ω In-Line Termination. Tektronix Part No. 011-0103-00.

12. Extender Circuit Board. Tektronix Part No. 670-4441-00.

13. 75 Ω 10X Attenuator. Tektronix Part No. 011-0061-00.

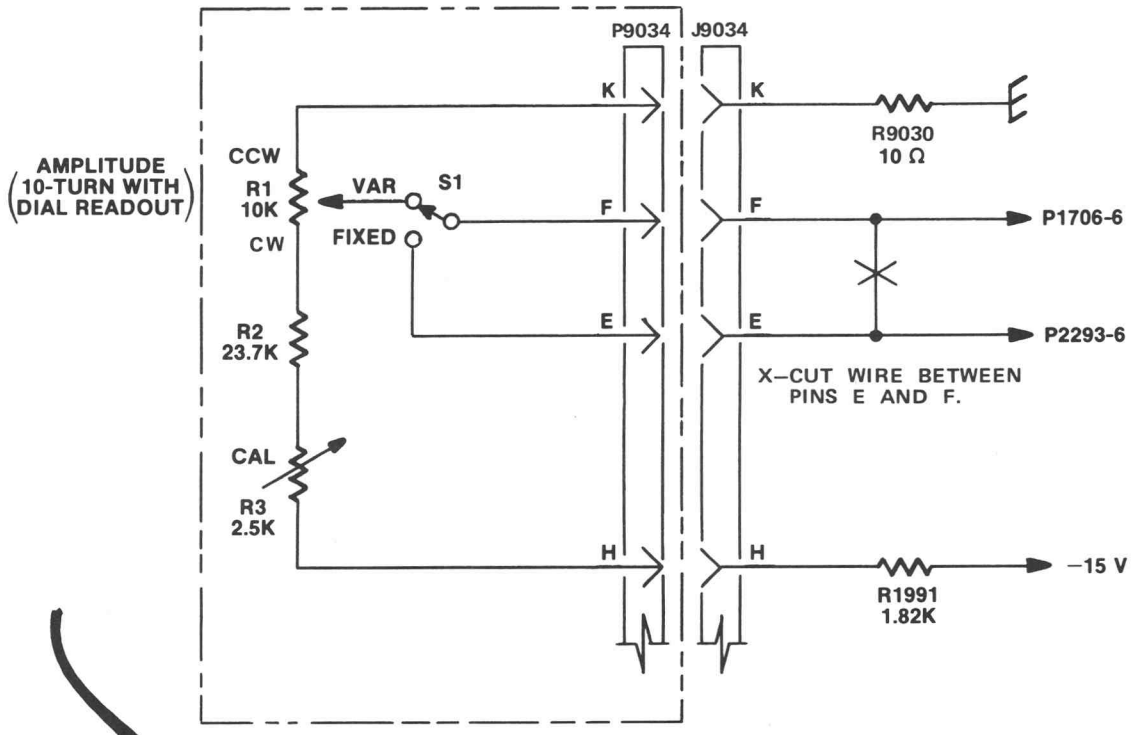
14. 10X Probe P6008. Tektronix Part No. 010-0129-00.

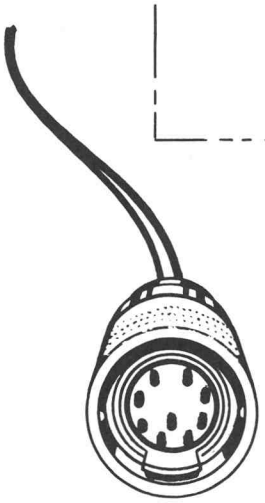
Calibration Fixture

This fixture and the 1480 Waveform Monitor provides 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.

CALIBRATION FIXTURE

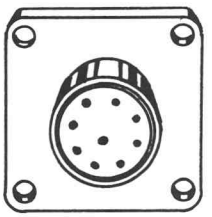
1480 REAR PANEL





P9034
REAR VIEW

J9034
REAR VIEW



PARTS LIST

Ckt No.	Description	TEKTRONIX p/n
P9034	9-pin Amphenol #165-13	134-0049-00
R1	10kΩ ± 5%, Ind. Lin. ±0.1%, 10-turn, prec. var.	311-1729-00
R2	23.7kΩ ± 1%, 1/8 W, metal film	321-0325-00
R3	2.5kΩ ± 20%	311-0086-00
S1	SPDT	260-0613-00
	10-turn dial for R1, Kilo-dial Mod. 461-S-41	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.

2107-04

Fig. 4-1. Calibration Fixture illustration.

@

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.

PROCEDURE

Remove the TSG4 module circuit board to the extender board to access all of the adjustments in the following procedure. Carefully align the board pin connectors to ensure good electrical contact.

1. Check/Adjust Full Field Reference Signal Amplitude

a. Connect the Black Burst rear panel MODULE OUTPUT connector to the 1480 CH A input and terminate in 75 Ω. Set the BLACK BURST/FULL FIELD REF pushbutton in the FULL FIELD REF position.

b. Set the 1480 Display to 10 μs/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 ±3.6 mV.

d. Adjust—R978 (Gain) for 286 mV of sync amplitude.

2. Check/Adjust DC Level

a. Set the 1480 Volts Full Scale to 1.0, Display to 10 μs/div, push in the Oper switch, and set the DC Restorer Off and Response switch to Aux Video In.

Position the trace to the 0 IRE graticule line and change the TSG4 module output cable to the Aux Video In connector.

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

c. Adjust—R969 (DC Level) for 0 volt blanking level. Recheck Step 1 signal amplitude after making this adjustment. Return the TSG4 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 ±3.57 mV.
Gray Level—357 mV ±3.57 mV.
Chrominance Pedestal—500 mV ±5 mV.

4. Check/Adjust VIRS Luminance Risetime

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

b. Check—Luminance risetime should be 260 ns ±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 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 nsec/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

a. Check—Sync risetime should be 130 ns +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

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 ±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.

7. Check/Adjust VIRS Chrominance Risetime

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

b. Check—Chrominance risetime should be 1 μs ±150 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.

8A. Adjust Chrominance Bandpass Filter

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 TSG4 output to the vectorscope and display the chrominance vector.

b. Mid-range R958 (Chrominance Gain).

c. Adjust—L938 and L948 (Chrominance Bandpass Filter) for best overlay; see Fig. 4-2.

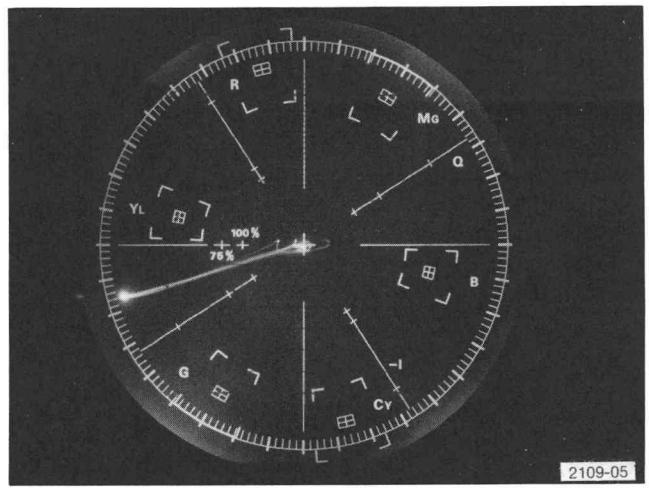


Fig. 4-2. Chrominance Bandpass Filter adjusted for best vector overlay.

8B. Adjust Chrominance Bandpass Filter (Optional Method)

a. Connect the TSG4 output to the spectrum analyzer and display the chrominance signal.

b. Adjust—L938 and L948 (Chrominance Bandpass Filter) for best compromise between Step 8A(b) and third order harmonics of −30 dB or more.

9. Check/Adjust 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.

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

10. Check/Adjust 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 mV ±2.86 mV and the bottom of the chrominance packet should be even with the gray level.

c. Adjust—R958 (Chrominance Gain) for 285.7 mV ±2.86 mV.

NOTE

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

11. Check Black Burst Setup Level

a. Push in the BLACK BURST/FULL FIELD REF pushbutton and display the Black Burst signal on the 1480.

b. Check—Setup level should be 53.57 mV ±3.57 mV.

12. Check Black Burst Timing

a. Check—Refer to Fig. 1-4 (Operating Instructions) for timing details.

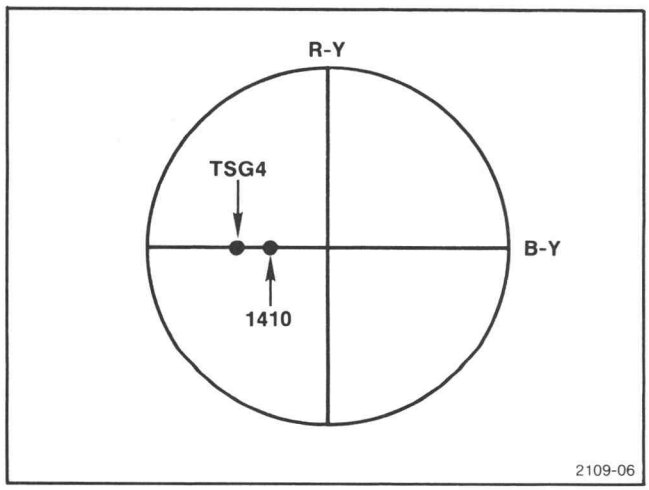


Fig. 4-3. Subcarrier phase adjustment illustration.

13. Check/Adjust Subcarrier Phase

a. Connect the 1410 Mainframe subcarrier output to the vectorscope CW Ext Ø Ref input. Connect the other Ext Ø Ref input to CH B through the 10X attenuator pad. Connect the TSG4 output to CH A. Display CH A and CH B. See Fig. 4-3.

b. Check—TSG4 subcarrier phase is within 10° (factory setting) of the 1410 subcarrier phase.

c. Adjust—C865 and L863 (Subcarrier Phase) to within 10° of the 1410 subcarrier phase, or to compensate for cable delay in the installation.

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. 1-3, in the Operating Instructions section 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. Move cable to opposite set of pins and repeat a and b.

d. Connect the Test Oscilloscope to one pair of output connectors through a 75 Ω in-line terminator.

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

f. Check—Subcarrier added to the output signal should be −40 dB or more 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 differental measurement.

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. Balance the bridge.

c. Set the Test Oscilloscope for alternate channel viewing.

d. Set the Sine-wave Generator frequency controls for 50 kHz 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 TSG4 module 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.

THEORY OF OPERATION

BLOCK DIAGRAM DESCRIPTION

VIRS Generation

The required timing signals for the VIR signal elements are generated by the PROM Timing Generator. The output controls the Modulator during chrominance timing and also provides the three step levels of the VIR signal.

The PROM is enabled during unblanking time by the VIRS Drive circuitry. This circuitry also provides selection of Line 18 or Line 19 and Fields 1, 2, or both.

Composite sync and setup are provided by the Sync and Setup Drive circuitry.

Modulator

Generation of the chrominance portion of the VIR signal takes place in this block. Subcarrier and burst gate signals are processed before being applied to the Modulator.

Output Amplifier

The Output Amplifier combines the chrominance, luminance, sync and setup signals to produce the composite VIR or black burst signal at the output.

CIRCUIT DESCRIPTION

DIAGRAM 1
VIRS/BLACK BURST

PROM Timing Generator

U921 is a Programmable Read Only Memory (PROM) which 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, 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 Q941 which turns off current drive through the transistor. When the PROM's output goes low, current drive resumes causing 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 U851. Line 18 or Line 19 may be selected by grounding pin 15 or pin 1 with the jumper connector.

Sync and Setup Drive

Gate U851D 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 and 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.

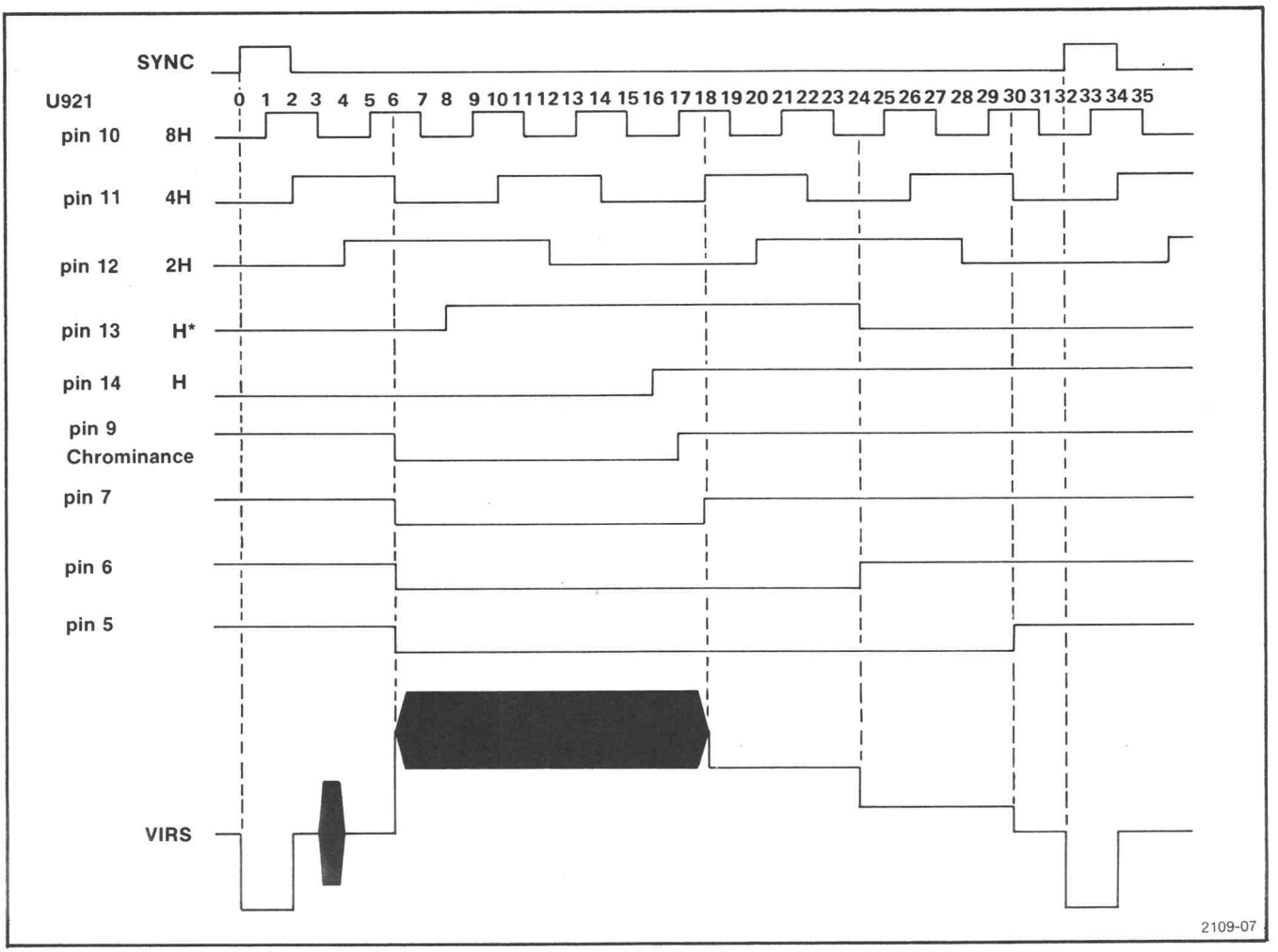


Fig. 5-1. Chart illustrating PROM timing relationships.

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

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 boards acts as an insulating blanket, preventing efficient heat dissipation, and possibly causing overheating and component breakdown. A layer of dust can also produce 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 accumulation of dust is to blow it off with a 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.

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 board is properly seated on the 1410 Mainframe Interface jacks. Board 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.

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.

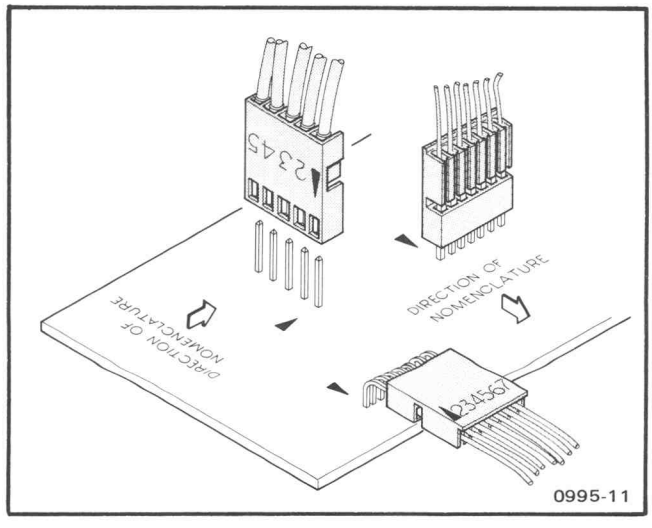


Fig. 6-1. Multiple pin connector holders.

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 1,000 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.

Diagram

The circuit diagram is shown on the foldout page in Section 9. The circuit number and electrical value of each component are shown on the diagram. Important waveforms are also shown.

Circuit Board

The circuit board is outlined in blue on the schematic diagram. The circuit board illustration is provided on the back of the foldout page that precedes the relevant diagram. The assembly number assigned to the circuit board is an abbreviated method for identifying the board.

When troubleshooting the circuit board in the instrument, the use of an extender board facilitates access to the board connections and components. Removing the 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.

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.

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.

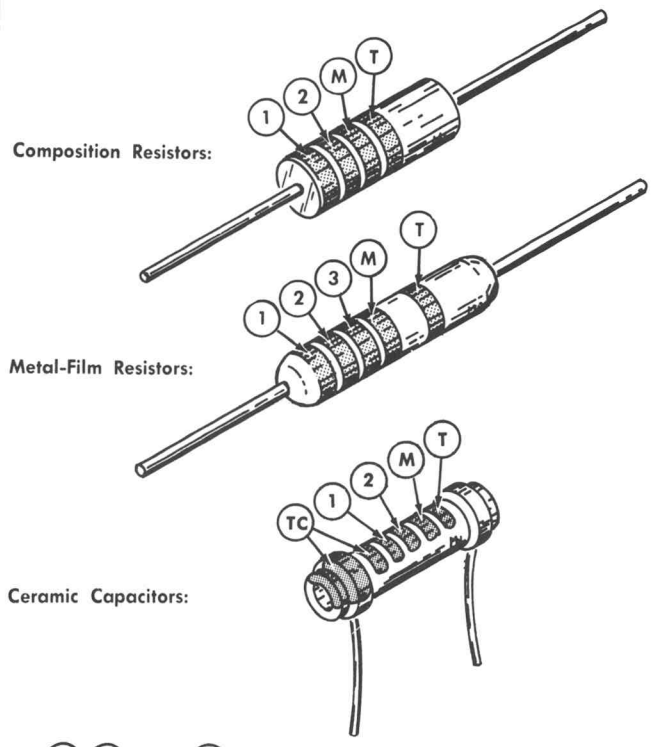
Troubleshooting Equipment

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 576 will give the most complete information.



1 2 and 3 —1st, 2nd and 3rd significant figures;
M —multiplier; T —tolerance;
TC —temperature coefficient.

Resistor and Capacitor Color Code

Color	Significant Figures	Multiplier		Tolerance	
		Resistors	Capacitors	Resistors	Capacitors
Silver	---	10^{-2}	---	±10%	---
Gold	---	10^{-1}	---	±5%	---
Black	0	1	1	---	±20% or 2 pF*
Brown	1	10	10	±1%	±1% or 0.1 pF*
Red	2	10^{2}	10^{2}	±2%	±2%
Orange	3	10^{3}	10^{3}	±3%	±3%
Yellow	4	10^{4}	10^{4}	±4%	+100% —0%
Green	5	10^{5}	10^{5}	±0.5%	±5% or 0.5 pF*
Blue	6	10^{6}	10^{6}	---	---
Violet	7	---	---	---	---
Gray	8	---	10^{-2}	---	+80% —20% or 0.25 pF*
White	9	---	10^{-1}	---	±10% or 1 pF*
(none)	---	---	---	±20%	±10% or 1 pF*

*For capacitance of 10 pF or less.

NOTE: T and/or TC color code for capacitors depends upon manufacturer and capacitor type. May not be present in some cases.

Fig. 6-2. Standard EIA color coding for resistors and capacitors.

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 Interface board. Make sure that other boards on the Interface 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.

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 transisitors, 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 diagrams. 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.

Rated Voltage VDC 25°C	Color	CODE FOR CAPACITANCE IN PICOFARADS		
		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	

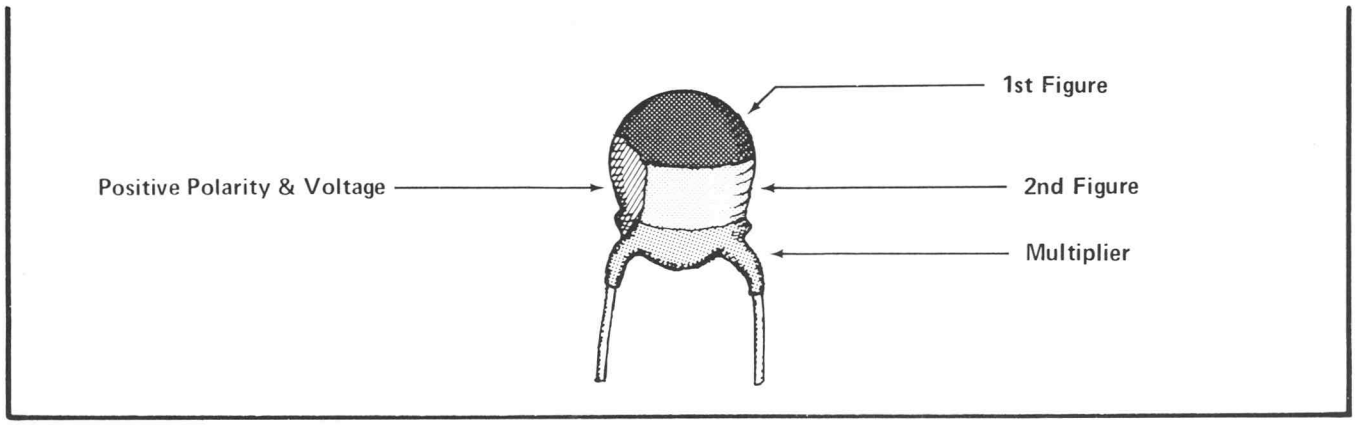


Fig. 6-3. Color coding for dipped tantalum capacitors.

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 diconnecting 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 576) 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 Electrical Parts List for the tolerance

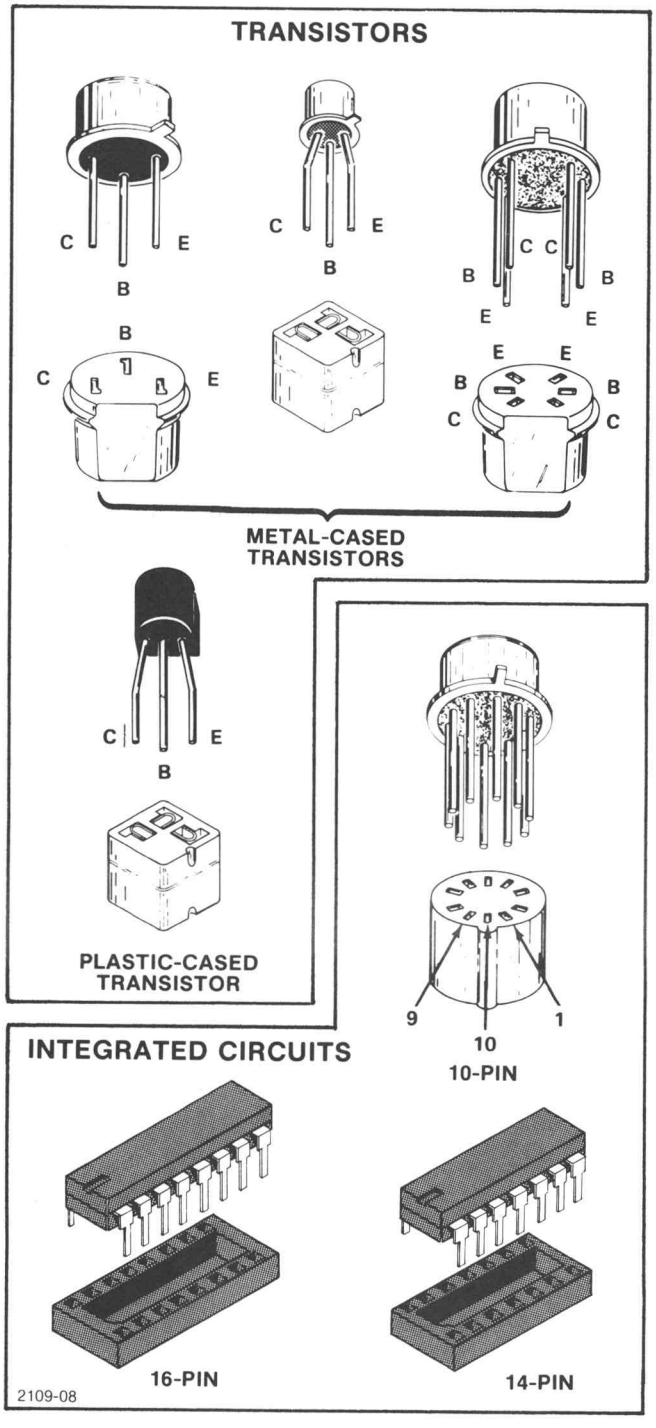


Fig. 6-4. Transistor and integrated circuit basing illustration.

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 & 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

Repair 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 repair 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.

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 foldout pages in the diagram 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.

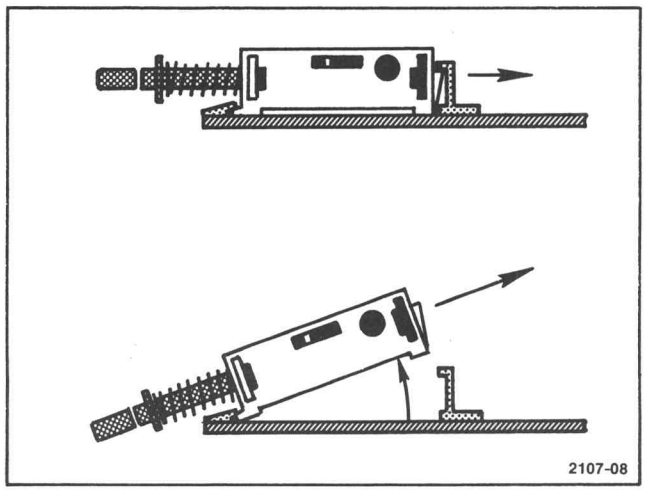


Fig. 6-5. Pushbutton switch replacement.

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 control extenders 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.

Transistors and IC's

Transistors and IC's should not be replaced unless they are actually defective. If removed from their sockets during routine maintenance, return them to their original sockets. Unnecessary replacement or transposing of semiconductors may affect the calibration of the board.

CAUTION

Disconnect the instrument power before removing or replacing semiconductors.

Any replacement component should be of the original type or 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.

Interconnecting Pins. To replace a pin which 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.

An extracting tool should be used to remove the 14- and 16-inch 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.

@

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
000AK	DAU CO., GES, M.B.H. & CO., KG.	A-8563	LIGIST, AUSTRIA
0000L	MATSUHITA ELECTRIC	200 PARK AVENUE, 54TH FLOOR	NEW YORK, NY 10017
00213	NYTRONICS, COMPONENTS GROUP, INC.	ORANGE STREET	DARLINGTON, SC 29532
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
04713	Motorola, Inc., Semiconductor Products Div.	5005 E. McDowell Rd.	Phoenix, AZ 85008
07263	Fairchild Semiconductor, A Div. of Fairchild Camera and Instrument Corp.	464 Ellis St.	Mountain View, CA 94040
07910	Teledyne Semiconductor	12515 Chadron Ave.	Hawthorne, CA 90250
27014	National Semi-Conductor Corp.	2900 San Ysidro Way	Santa Clara, CA 95051
56289	Sprague Electric Co.		North Adams, MA 01247
72136	Electro Motive Mfg. Co., Inc., The	South Park and John Streets	Willimantic, CT 06226
72982	Erie Technological Products, Inc.	644 W. 12th St.	Erie, PA 16512
73138	Beckman Instruments, Inc., Helipot Div.	2500 Harbor Blvd.	Fullerton, CA 92634
80009	Tektronix, Inc.	P. O. Box 500	Beaverton, OR 97005
81483	International Rectifier Corp.	9220 Sunset Blvd.	Los Angeles, CA 90069
91637	Dale Electronics, Inc.	P. O. Box 609	Columbus, NB 68601

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A25	670-4451-00			CKT CARD ASSY:VIRS/BLACK BURST	80009	670-4451-00
C852	290-0745-00			CAP.,FXD,ELCTLT:22UF,+50-10%,25V	0000L	ECE-A25V22L
C861	283-0648-00			CAP.,FXD,MICA D:10PF,5%,100V	00853	D151C100DC
C865	281-0226-00			CAP.,VAR,PLASTIC:5.5-65PF,100V	000AK	009-3801-065
C867	283-0047-00			CAP.,FXD,CER DI:270PF,5%,500V	72982	861-518B271J
C871	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C875	283-0047-00			CAP.,FXD,CER DI:270PF,5%,500V	72982	861-518B271J
C877	283-0047-00			CAP.,FXD,CER DI:270PF,5%,500V	72982	861-518B271J
C878	283-0047-00			CAP.,FXD,CER DI:270PF,5%,500V	72982	861-518B271J
C883	281-0773-00			CAP.,FXD,CER DI:0.01UF,10%,100V	72982	8005H9AADW5R103K
C884	283-0047-00			CAP.,FXD,CER DI:270PF,5%,500V	72982	861-518B271J
C886	283-0047-00			CAP.,FXD,CER DI:270PF,5%,500V	72982	861-518B271J
C892	281-0773-00			CAP.,FXD,CER DI:0.01UF,10%,100V	72982	8005H9AADW5R103K
C894	281-0773-00			CAP.,FXD,CER DI:0.01UF,10%,100V	72982	8005H9AADW5R103K
C896	283-0187-00			CAP.,FXD,CER DI:0.047UF,10%,400V	72982	8131N401X5R473K
C897	281-0773-00			CAP.,FXD,CER DI:0.01UF,10%,100V	72982	8005H9AADW5R103K
C898	283-0081-00			CAP.,FXD,CER DI:0.1UF,+80-20%,25V	56289	36C600
C899	290-0523-00			CAP.,FXD,ELCTLT:2.2UF,20%,20V	56289	196D225X0025HA1
C901	281-0773-00			CAP.,FXD,CER DI:0.01UF,10%,100V	72982	8005H9AADW5R103K
C902	283-0728-00			CAP.,FXD,MICA D:120PF,1%,500V	00853	D15-5F121F0
C903	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C904	283-0081-00			CAP.,FXD,CER DI:0.1UF,+80-20%,25V	56289	36C600
C911	283-0648-00			CAP.,FXD,MICA D:10PF,5%,100V	00853	D151C100DC
C916	283-0649-00			CAP.,FXD,MICA D:105PF,1%,300V	00853	D153F1050F0
C923	283-0649-00			CAP.,FXD,MICA D:105PF,1%,300V	00853	D153F1050F0
C925	290-0778-00			CAP.,FXD,ELCTLT:1UF,+50-10%,50V NPLZD	0000L	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	72982	8005H9AADW5R103K
C928	281-0064-00			CAP.,VAR,PLSTC:(0.25-1.5PF),600V	72982	530-002
C929	281-0661-00			CAP.,FXD,CER DI:0.8PF,+/-0.1PF,500V	72982	301-000C0K0808B
C933	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C936	283-0730-00			CAP.,FXD,MICA D:274PF,1%,500V	00853	D155E2740F0
C945	283-0639-00			CAP.,FXD,MICA D:56PF,1%,100V	00853	D151E560F0
C946	283-0687-00			CAP.,FXD,MICA D:560PF,2%,300V	72136	DM15E561G0300
C947	283-0643-00			CAP.,FXD,MICA D:22PF,+/-0.5PF,300V	00853	D103C220D0
C948	283-0638-00			CAP.,FXD,MICA D:130PF,1%,100V	00853	D151E131F0
C956	283-0081-00			CAP.,FXD,CER DI:0.1UF,+80-20%,25V	56289	36C600
C961	283-0660-00			CAP.,FXD,MICA D:510PF,2%,500V	00853	D155F511G0
C967	283-0081-00			CAP.,FXD,CER DI:0.1UF,+80-20%,25V	56289	36C600
C971	283-0602-00			CAP.,FXD,MICA D:53PF,5%,300V	00853	D153E530J0
C973	283-0632-00			CAP.,FXD,MICA D:87PF,1%,100V	00853	D151E870F0
C974	283-0625-00			CAP.,FXD,MICA D:220PF,1%,500V	00853	D105F221F0
C977	281-0526-00			CAP.,FXD,CER DI:1.5PF,+/-0.5PF,500V	72982	301-000S2K0159D
C981	283-0634-00			CAP.,FXD,MICA D:65PF,1%,100V	00853	D151E650F0
C982	283-0666-00			CAP.,FXD,MICA D:890PF,2%,100V	00853	D151F891G0
C983	283-0628-00			CAP.,FXD,MICA D:410PF,1%,500V	00853	D155F411F0
C984	283-0644-00			CAP.,FXD,MICA D:150PF,1%,500V	00853	D151E151F0
C985	283-0081-00			CAP.,FXD,CER DI:0.1UF,+80-20%,25V	56289	36C600
C986	283-0081-00			CAP.,FXD,CER DI:0.1UF,+80-20%,25V	56289	36C600
C991	290-0745-00			CAP.,FXD,ELCTLT:22UF,+50-10%,25V	0000L	ECE-A25V22L
C992	290-0745-00			CAP.,FXD,ELCTLT:22UF,+50-10%,25V	0000L	ECE-A25V22L
C993	290-0745-00			CAP.,FXD,ELCTLT:22UF,+50-10%,25V	0000L	ECE-A25V22L

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
C994	281-0577-00			CAP.,FXD,CER DI:14PF,5%,500V	72982	301-050C0G0140J
C995	281-0577-00			CAP.,FXD,CER DI:14PF,5%,500V	72982	301-050C0G0140J
C996	283-0177-00			CAP.,FXD,CER DI:1UF,+80-20%,25V	72982	8131N039 E 105Z
CR861	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR862	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR871	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR883	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR901	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR933	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR941	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR943	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR952	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR955	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR956	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
L863	114-0280-00			COIL,RF:12-43UH,CORE 276-0568-00	80009	114-0280-00
L911	114-0218-00			COIL,RF:70-120UH	80009	114-0218-00
L923	114-0343-00			COIL,RF:200-400UH,CORE 276-0096-00	80009	114-0343-00
L933	114-0343-00			COIL,RF:200-400UH,CORE 276-0096-00	80009	114-0343-00
L938	114-0281-00			COIL,RF:35-70UH,CORE 276-0540-00	80009	114-0281-00
L948	114-0281-00			COIL,RF:35-70UH,CORE 276-0540-00	80009	114-0281-00
L971	114-0257-00			COIL,RF:6-11UF	80009	114-0257-00
L974	114-0308-00			COIL,RF:2.9-6.5UH	80009	114-0308-00
L981	114-0278-00			COIL,RF:4.6-16.7UH,CORE 276-0568-00	80009	114-0278-00
L984	114-0278-00			COIL,RF:4.6-16.7UH,CORE 276-0568-00	80009	114-0278-00
Q875	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q876	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q878	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q880	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q897	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q898	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q903	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q915	151-0232-00			TRANSISTOR:SILICON,NPN,DUAL	80009	151-0232-00
Q941	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q942	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q944	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q951	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q954	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q955	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q962	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q963	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q966	151-0459-00			TRANSISTOR:SILICON,PNP	04713	2N3251
Q976	151-0460-00			TRANSISTOR:SILICON,NPN	07263	2N3947
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	04713	2N2219A
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

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
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
R867	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R868	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
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:2.00K 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			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
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	311-1562-00			RES.,VAR,NONWIR:2K OHM,20%,0.50W	73138	91A-20000M
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			RES.,FXD,FILM:392 OHM,1%,0.125W	91637	MFF1816G392R0F
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	321-1705-04			RES.,FXD,FILM:13.05K OHM,0.1%,0.125W	91637	MFF1816D13051B
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	321-0327-03			RES.,FXD,FILM:24.9K OHM,0.25%,0.125W	91637	MFF1816D24901C
R948	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	91637	MFF1816G10000F
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
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

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Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
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	311-1563-00			RES.,VAR,NONWIR:1K OHM,20%,0.50W	73138	91A-10000M
R960	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R961	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R962	321-0335-00			RES.,FXD,FILM:30.1K OHM,1%,0.125W	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			RES.,FXD,FILM:2.74K OHM,1%,0.125W	91637	MFF1816G27400F
R968	321-0181-00			RES.,FXD,FILM:750 OHM,1%,0.125W	91637	MFF1816G750R0F
R969	311-1571-00			RES.,VAR,NONWIR:500 OHM,0.50W	73138	91W-500R0M
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			RES.,FXD,FILM:887 OHM,1%,0.125W	91637	MFF1816G887R0F
R978	311-1565-00			RES.,VAR,NONWIR:250 OHM,20%,0.50W	73138	91A-250R0M
R984	321-0117-00			RES.,FXD,FILM:162 OHM,1%,0.125W	91637	MFF1816G162R0F
R985	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R986	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
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
R997	321-0085-00			RES.,FXD,FILM:75 OHM,1%,0.125W	91637	MFF1816G75R00F
R996	321-0085-00			RES.,FXD,FILM:75 OHM,1%,0.125W	91637	MFF1816G75R00F
R999	308-0426-00			RES.,FXD,WW:470 OHM,5%,3W	00213	1240S-470ROJ
S854	260-1132-00			SWITCH,PUSH:1 BUTTON,DOUBLE POLE	80009	260-1132-00
S858	260-1132-00			SWITCH,PUSH:1 BUTTON,DOUBLE POLE	80009	260-1132-00
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
U851	156-0383-00			MICROCIRCUIT,DI:QUAD 2-INPUT NOR GATE	01295	SN74LS02N
U853	156-0406-00			MICROCIRCUIT,DI:2-INPUT NAND,QUAD INVERTER	27014	DM8090N
U855	156-0386-00			MICROCIRCUIT,DI:TRIPLE 3-INPUT NAND GATE	01295	SN74LS10N
U859	156-0422-00			MICROCIRCUIT,DI:UP/DOWN SYNC BINARY COUNTER	01295	SN74LS191N
U918	156-0130-00			MICROCIRCUIT,LI:BALANCED MODEM	04713	MC1496G
U921	156-0785-00			MICROCIRCUIT,DI:256 BIT PROM	01295	SN745288N
VR906	152-0226-00			SEMICOND DEVICE:ZENER,0.4W,5.1V,5%	81483	69-6584

SERVICING ILLUSTRATION

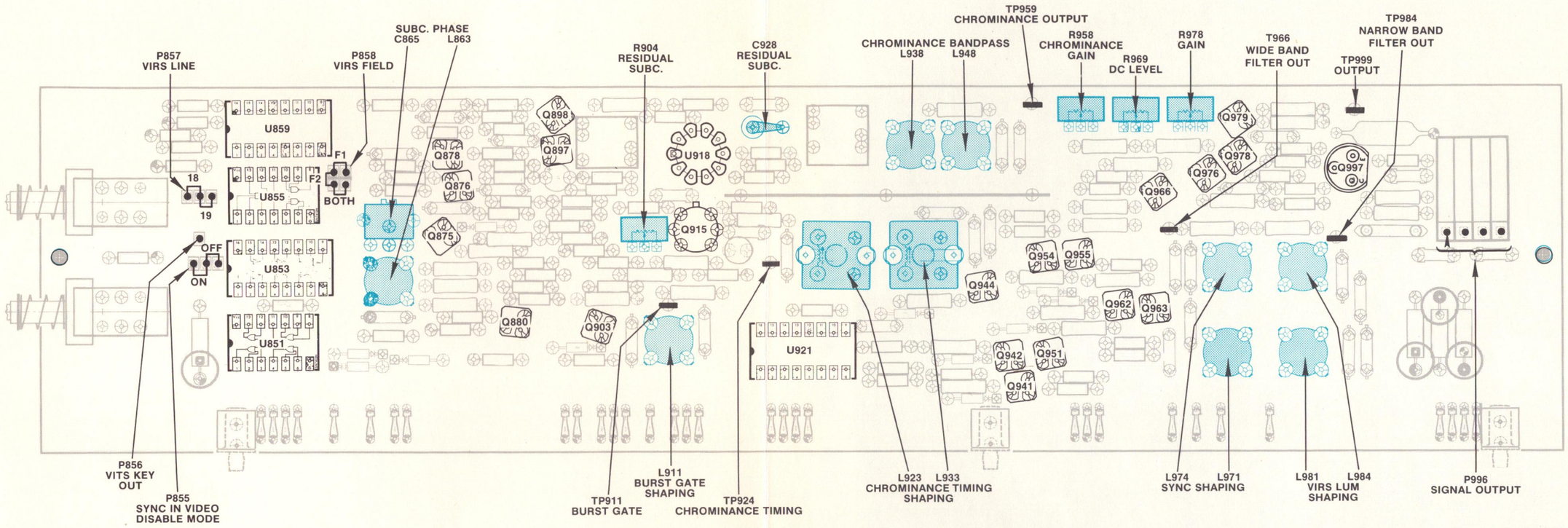

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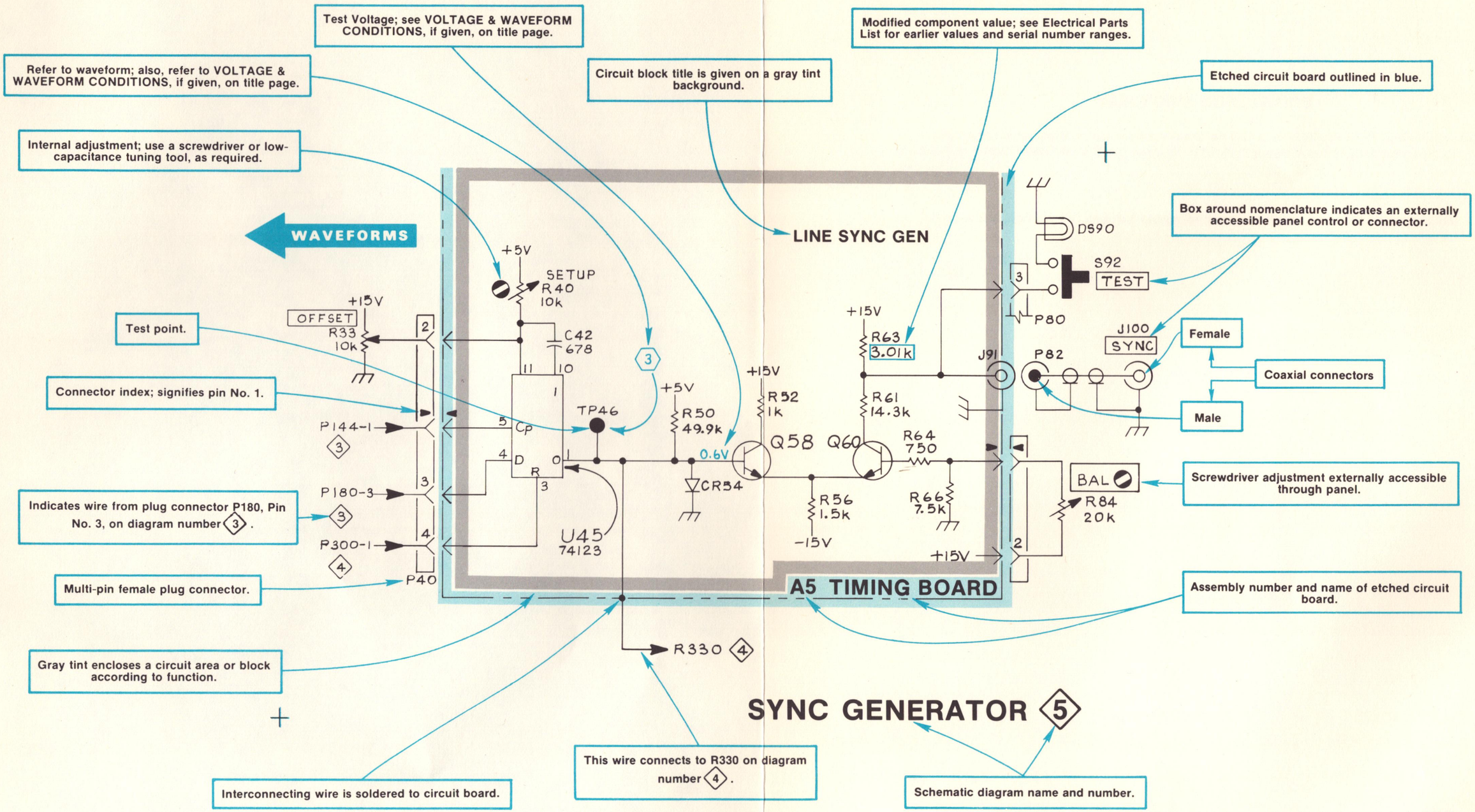
FIG. 8-1. A25 VIRS/BLACK BURST ADJUSTMENT LOCATIONS AND JUMPERS



2029-32

SCHEMATIC EXAMPLE

DIAGRAM AND CIRCUIT BOARD ILLUSTRATION

This section of the manual contains the block and schematic diagram with waveforms and etched circuit board illustration.

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 (μF).

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.)
AT	Attenuator, fixed or variable
B	Motor
BT	Battery
C	Capacitor, fixed or variable
CR	Diode, signal or rectifier
DH	Decoupling Hybrid
DL	Delay Line
DS	Indicating device (lamp)
E, SG	Spark Gap
F	Fuse
FL	Filter
H	Heat dissipating device (heat sink, heat radiator, etc.)
HR	Heater
J	Connector, stationary portion
K	Relay
L	Inductor, fixed or variable
LR	Inductor/resistor combination
M	Meter
P	Connector, movable portion
Q	Transistor, silicon-controlled rectifier, or programmable unijunction transistor
R	Resistor, fixed or variable
RT	Thermistors
S	Switch
T	Transformer
TC	Thermocouple
TP	Test Point
U	Assembly, inseparable or non-repairable (integrated circuit, etc.)
V	Electron tube
VR	Voltage regulator (zener diode, etc.)
Y	Crystal

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
Br	Brown
Rd	Red
Or	Orange
Yl	Yellow
G	Green
Bl	Blue
Vi	Violet
Gy	Gray
W	White

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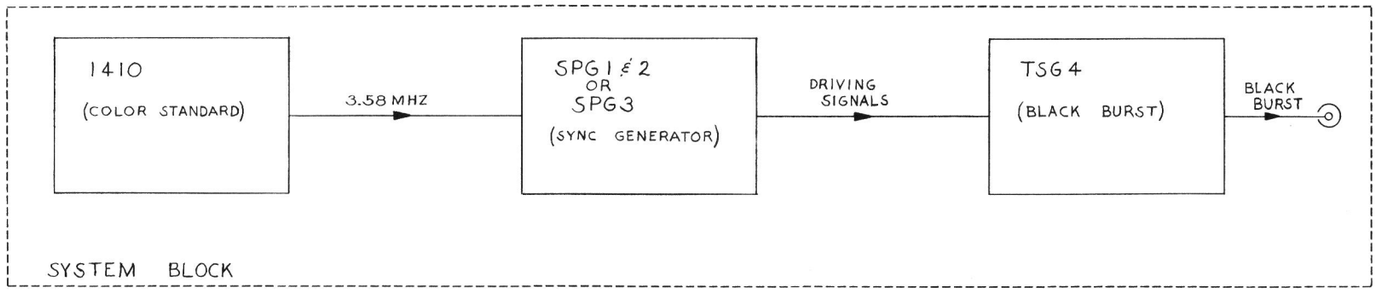
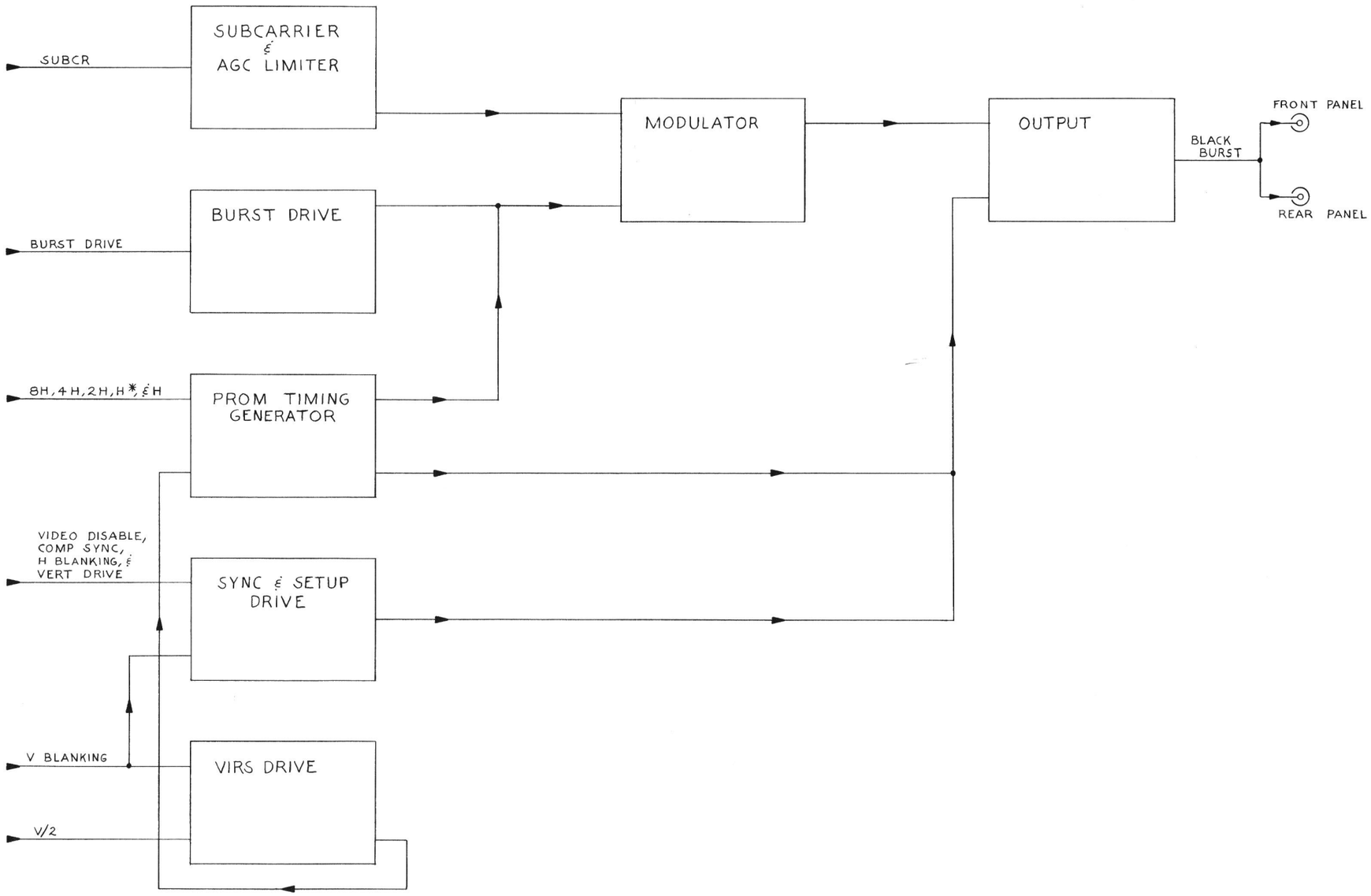
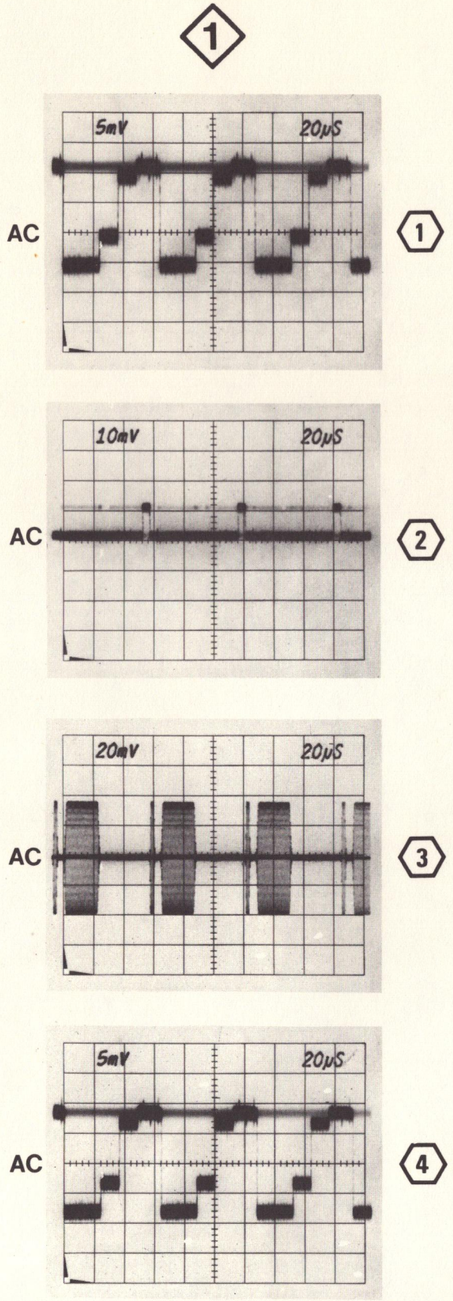
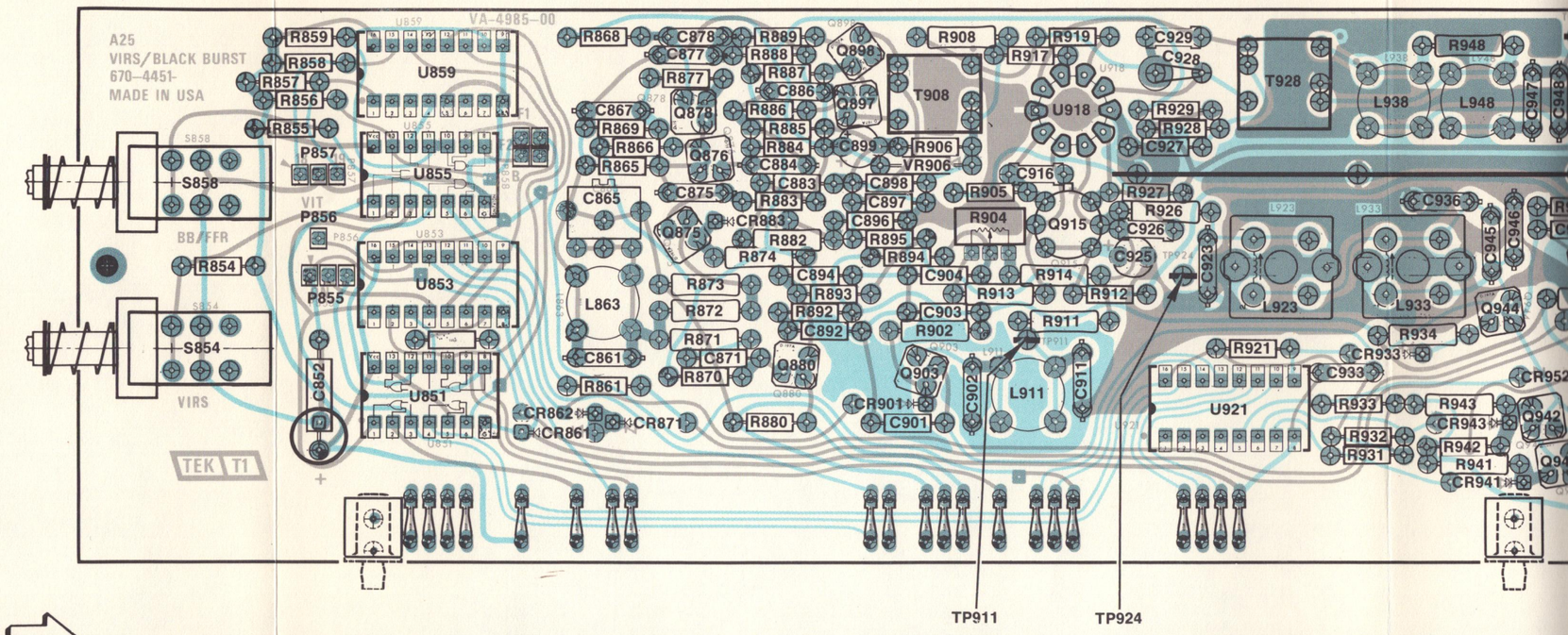

1410
(COLOR STANDARD)
3.58 MHZ
SPG 1 & 2
OR
SPG 3
(SYNC GENERATOR)
DRIVING
SIGNALS
TSG 4
(BLACK BURST)
BLACK
BURST
SYSTEM BLOCK

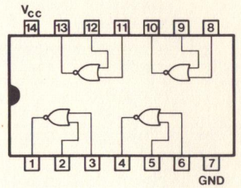

SUBCR
SUBCARRIER
&
AGC LIMITER
MODULATOR
OUTPUT
FRONT PANEL
BLACK
BURST
REAR PANEL
BURST DRIVE
BURST DRIVE
8H, 4H, 2H, H * & H
PROM TIMING
GENERATOR
VIDEO DISABLE,
COMP SYNC,
H BLANKING, &
VERT DRIVE
SYNC & SETUP
DRIVE
V BLANKING
VIRS DRIVE
V/2



CIRCUIT NUMBERING SEQUENCE



A25 VIRS/BLACK BURST CIRCUIT BOARD



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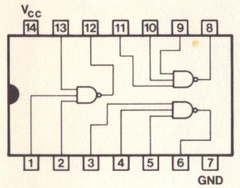

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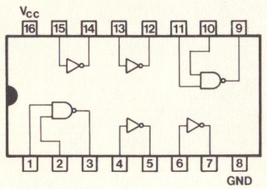

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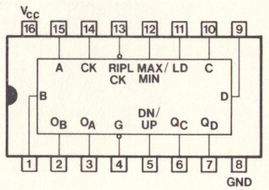

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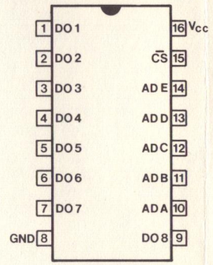

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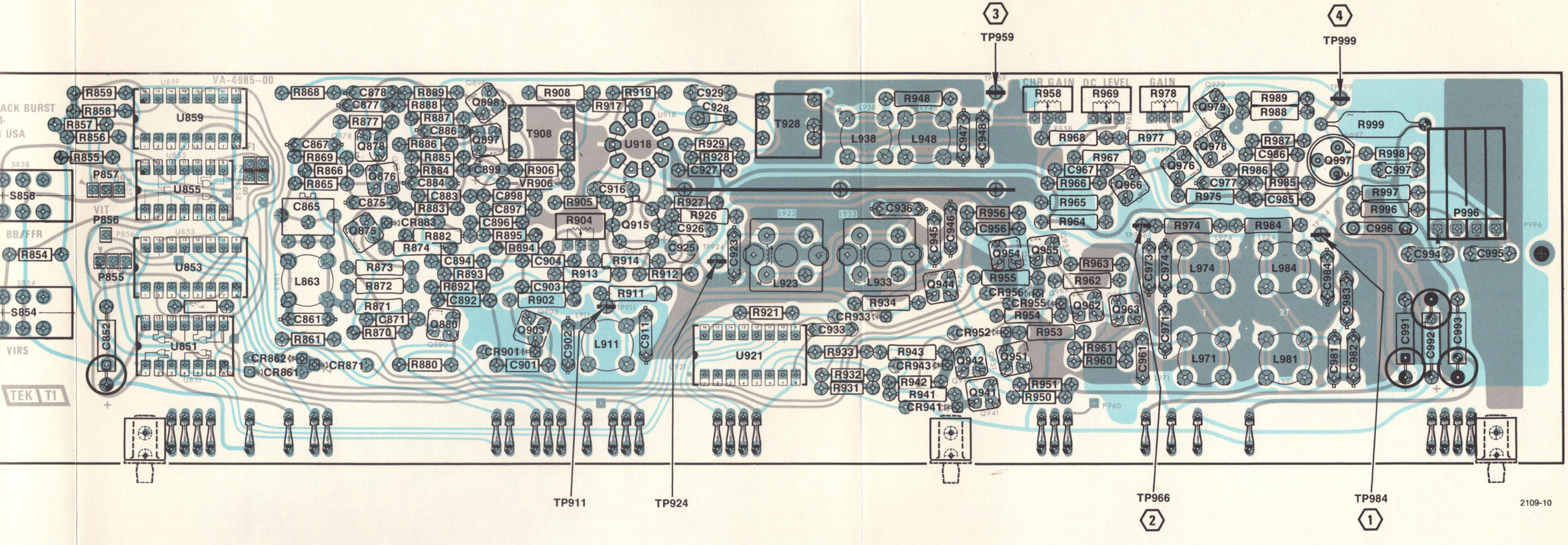
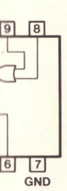
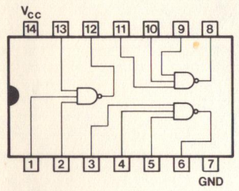


/BLACK BURST CIRCUIT BOARD





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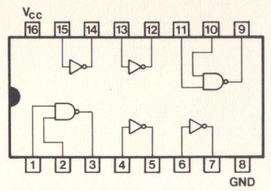

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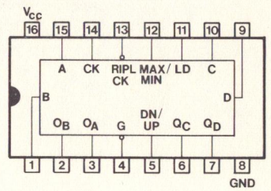

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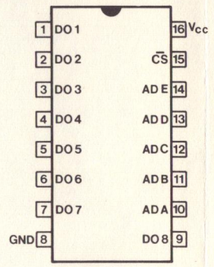

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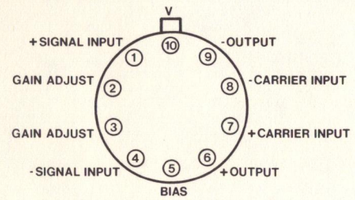
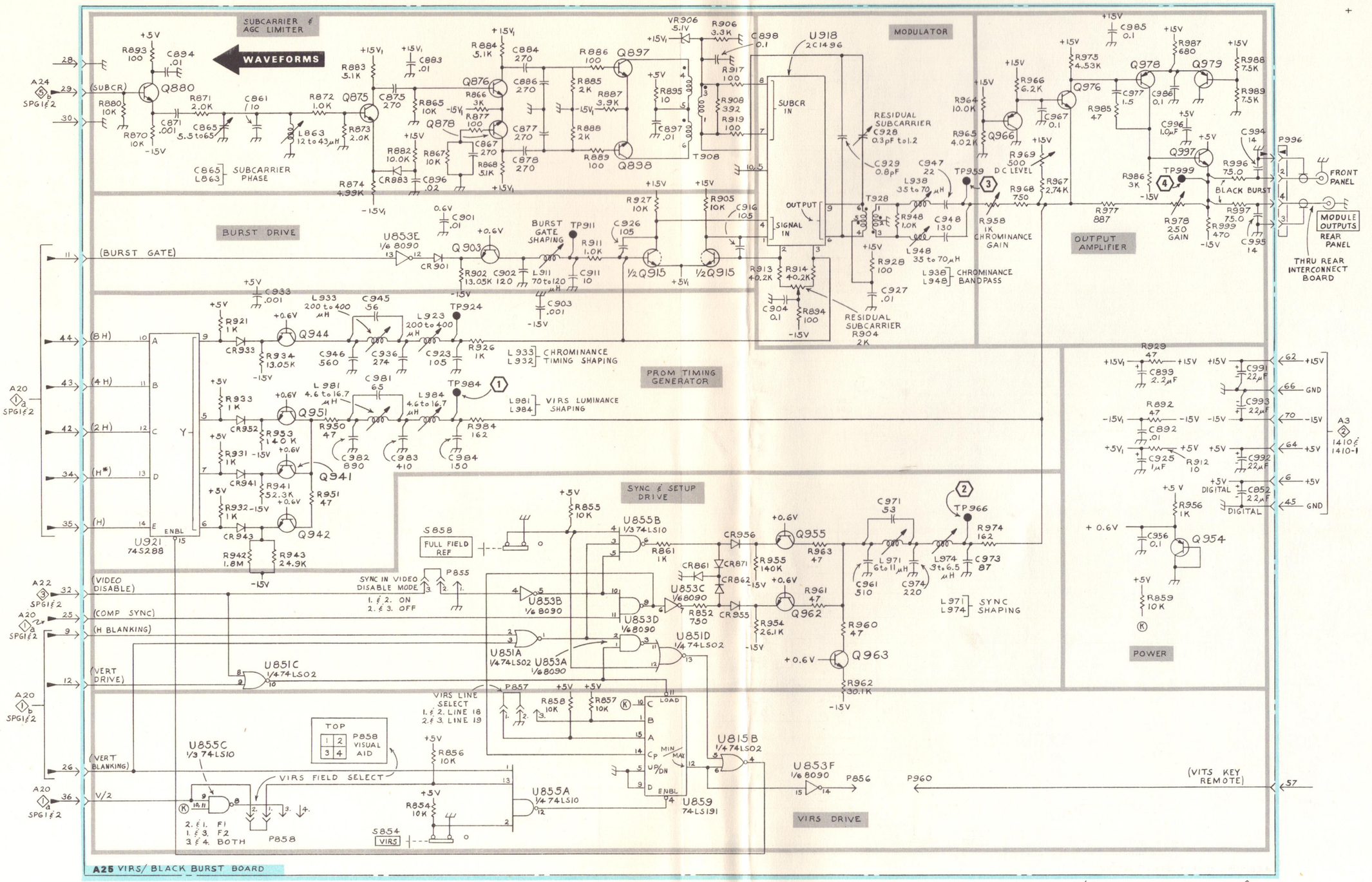


MC1496G

VIRS/BLACK BURST PARTS LOCATING CHART

C852	C5	CR861	C3	R852	C3	R950	B2	U851A	C3
C861	A2	CR862	C3	R854	D2	R951	C2	U851B	D3
C865	A1	CR871	C3	R855	C3	R953	B2	U851C	D2
C867	A2	CR883	A2	R856	D2	R954	C3	U851D	C3
C871	A1	CR901	B2	R857	D3	R955	C3	U853A	C3
C875	A2	CR933	B2	R858	D3	R956	C5	U853B	C3
C877	A3	CR941	C2	R859	C5	R958	A4	U853C	C3
C878	A3	CR943	C2	R861	C3	R960	C4	U853D	C3
C883	A2	CR952	B2	R865	A2	R961	C4	U853E	B2
C884	A3	CR955	C3	R866	A2	R962	D4	U853F	D4
C886	A3	CR956	C3	R867	A2	R963	C4	U855A	D3
C892	B5			R868	A2	R964	A4	U855B	C3
C894	A1	L863	A2	R870	A1	R965	A4	U855C	D1
C896	A2	L911	B3	R871	A1	R966	A4	U859	D3
C897	A3	L923	B2	R872	A2	R967	A4	U918	A4
C898	A3	L933	B2	R873	A2	R968	A4	U921	C1
C899	B5	L938	A4	R874	A2	R969	A4		
C901	A2	L948	A4	R877	A2	R974	C4	VR906	A3
C902	B3	L971	C4	R880	A1	R975	A5		
C903	B3	L974	C4	R882	A2	R977	A5		
C904	B4	L981	B2	R883	A2	R978	A5		
C911	B3	L984	B2	R884	A2	R984	B2		
C916	B3			R885	A3	R985	A5		
C923	B2	P856	D4	R886	A3	R986	A5		
C925	C5	P857	D3	R887	A3	R987	A5		
C926	B3	P858	D2	R888	A3	R988	A5		
C927	B4	P885	C2	R889	A3	R989	A5		
C928	A4	P960	D4	R892	B5	R996	A5		
C929	A4	P996	A5	R893	A1	R997	A5		
C933	B2			R894	B4	R999	A5		
C936	B2	Q875	A2	R895	A3				
C945	B2	Q876	A2	R902	B2	S854	C2		
C946	B2	Q878	A2	R904	B4	S858	D2		
C947	A4	Q880	A1	R905	A3				
C948	A4	Q897	A3	R906	A3	T908	A3		
C956	C5	Q898	A3	R908	A3	T928	A4		
C961	A4	Q903	B2	R911	B3				
C967	A4	Q915	B3	R912	C5	TP911	A3		
C971	C4	Q941	C2	R913	B3	TP924	B2		
C973	C4	Q942	C2	R914	B3	TP959	A4		
C974	C4	Q944	B2	R917	A3	TP966	C4		
C977	A5	Q951	B2	R919	A3	TP984	B2		
C981	B2	Q954	C5	R921	B1	TP999	A5		
C982	B2	Q955	C4	R926	B2				
C983	B2	Q962	C4	R927	A3				
C984	B2	Q963	D4	R928	B4				
C985	A5	Q966	A4	R929	B5				
C986	A5	Q976	A5	R931	C1				
C991	B5	Q978	A5	R932	C1				
C992	C5	Q979	A5	R933	B1				
C993	B5	Q997	A5	R934	B2				
C994	A5			R941	C2				
C995	A5			R942	C2				
C996	A5			R943	C2				
				R948	A4				

Component Value changes.



TSG 4 @ GEM 5/76 VIRS/BLACK BURST ⟨1⟩

NTSC VIRS/BLACK BURST GENERATOR ⟨1⟩

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.

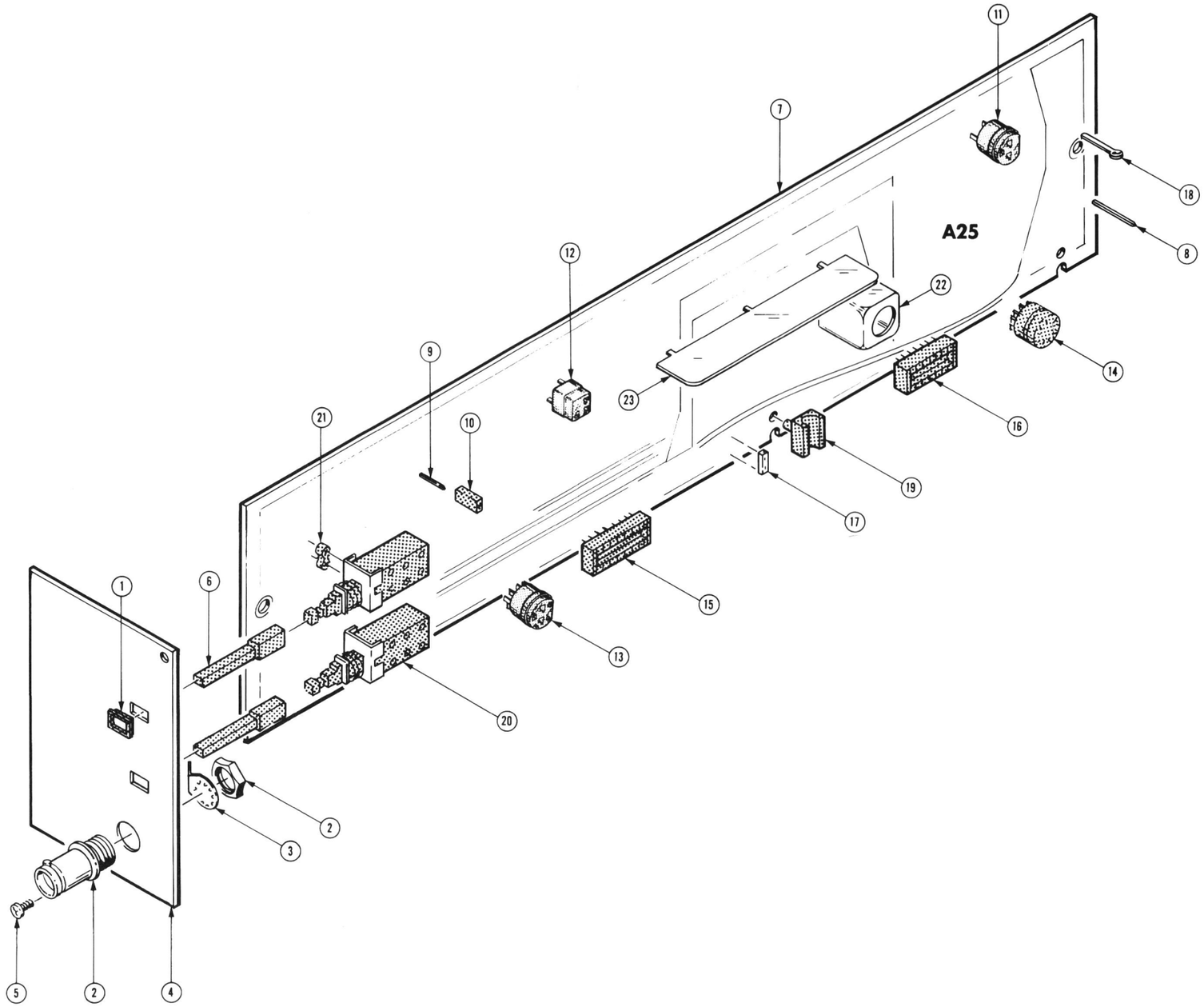
ABBREVIATIONS

"	INCH
#	NUMBER SIZE
ACTR	ACTUATOR
ADPTR	ADAPTER
ALIGN	ALIGNMENT
AL	ALUMINUM
ASSEM	ASSEMBLED
ASSY	ASSEMBLY
ATTEN	ATTENUATOR
AWG	AMERICAN WIRE GAGE
BD	BOARD
BRKT	BRACKET
BRS	BRASS
BRZ	BRONZE
BSHG	BUSHING
CAB	CABINET
CAP	CAPACITOR
CER	CERAMIC
CHAS	CHASSIS
CKT	CIRCUIT
COMP	COMPOSITION
CONN	CONNECTOR
COV	COVER
CPLG	COUPLING
CRT	CATHODE RAY TUBE
DEG	DEGREE
DWR	DRAWER
ELCTRN	ELECTRON
ELEC	ELECTRICAL
ELCTLT	ELECTROLYTIC
ELEM	ELEMENT
EPL	ELECTRICAL PARTS LIST
EQPT	EQUIPMENT
EXT	EXTERNAL
FIL	FILLISTER HEAD
FLEX	FLEXIBLE
FLH	FLAT HEAD
FLTR	FILTER
FR	FRAME or FRONT
FSTNR	FASTENER
FT	FOOT
FXD	FIXED
GSKT	GASKET
HDL	HANDLE
HEX	HEXAGON
HEX HD	HEXAGONAL HEAD
HEX SOC	HEXAGONAL SOCKET
HLCPS	HELICAL COMPRESSION
HLEXT	HELICAL EXTENSION
HV	HIGH VOLTAGE
IC	INTEGRATED CIRCUIT
ID	INSIDE DIAMETER
IDENT	IDENTIFICATION
IMPLR	IMPELLER
IN	INCH
INCAND	INCANDESCENT
INSUL	INSULATOR
INTL	INTERNAL
LPHLDR	LAMPHOLDER
MACH	MACHINE
MECH	MECHANICAL
MTG	MOUNTING
NIP	NIPPLE
NON WIRE	NOT WIRE WOUND
OBD	ORDER BY DESCRIPTION
OD	OUTSIDE DIAMETER
OVH	OVAL HEAD
PH BRZ	PHOSPHOR BRONZE
PL	PLAIN or PLATE
PLSTC	PLASTIC
PN	PART NUMBER
PNH	PAN HEAD
PWR	POWER
RCPT	RECEPTACLE
RES	RESISTOR
RGD	RIGID
RLF	RELIEF
RTNR	RETAINER
SCH	SOCKET HEAD
SCOPE	OSCILLOSCOPE
SCR	SCREW
SE	SINGLE END
SECT	SECTION
SEMICOND	SEMICONDUCTOR
SHLD	SHIELD
SHLDR	SHOULDERED
SKT	SOCKET
SL	SLIDE
SLFLKG	SELF-LOCKING
SLVG	SLEEVING
SPR	SPRING
SQ	SQUARE
SST	STAINLESS STEEL
STL	STEEL
SW	SWITCH
T	TUBE
TERM	TERMINAL
THD	THREAD
THK	THICK
TNSN	TENSION
TPG	TAPPING
TRH	TRUSS HEAD
V	VOLTAGE
VAR	VARIABLE
W/	WITH
WSHR	WASHER
XFMR	TRANSFORMER
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
01295	Texas Instruments, Inc., Components Group	P. O. Box 5012	Dallas, TX 75222
22526	Berg Electronics, Inc.	Youk Expressway	New Cumberland, PA 17070
24931	Specialty Connector Co., Inc.	3560 Madison Ave.	Indianapolis, IN 46227
71590	Centralab Electronics, Div. of Globe-Union, Inc.	5757 N. Green Bay Ave.	Milwaukee, WI 53201
71785	TRW Electronic Components, Cinch Connector Operations	1501 Morse Ave.	Elk Grove Village, IL 60007
80009	Tektronix, Inc.	P. O. Box 500	Beaverton, OR 97005
83385	Central Screw Co.	2530 Crescent Dr.	Broadview, IL 60153

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	426-1206-00			2		FRAME,PUSH BTN:MOMENTARY,GRAY PLASTIC	80009	426-1206-00
-2	131-0955-00			1		CONNECTOR,RCPT,:BNC,FEMALE	24931	28JR200-1
-3	210-0255-00			1		TERMINAL,LUG:0.391" ID INT TOOTH	80009	210-0255-00
-4	333-2172-00			1		PANEL,FRONT:TSG4	80009	333-2172-00
						(ATTACHING PARTS)		
-5	213-0120-00			2		SCR,TPG,THD FOR:2-32 X 0.250 INCH,PNH STL	83385	OBD
						- - - * - - -		
-6	366-1691-00			2		PUSH BUTTON:GY,1.2 INCH LONG	80009	366-1691-00
-7	----- -----			1		CKT CARD ASSY:VIRS/BLACK BURST(SEE A25 EPL)		
-8	131-0589-00			6		. CONTACT,ELEC:0.46 INCH LONG	22526	47350
-9	131-0608-00			10		. CONTACT,ELEC:0.365 INCH LONG	22526	47357
-10	131-0993-00			3		. LINK,TERM.CONNE:2 WIRE BLACK	00779	530153-2
-11	136-0183-00			1		. SOCKET,PLUG-IN:3 PIN,ROUND	80009	136-0183-00
-12	136-0220-00			19		. SOCKET,PLUG-IN:3 PIN,SQUARE	71785	133-23-11-034
-13	136-0235-00			1		. SOCKET,PLUG-IN:6 CONTACT,ROUND	71785	133-96-12-062
-14	136-0241-00			1		. SOCKET,PLUG-IN:10 CONTACT,ROUND	71785	133-99-12-064
-15	136-0260-02			3		. SOCKET,PLUG-IN:16 CONTACT,LOW CLEARANCE	01295	C931602
-16	136-0269-02			2		. SOCKET,PLUG-IN:14 CONTACT,LOW CLEARANCE	01295	C931402
-17	136-0328-03			34		. SOCKET,PIN TERM:FOR 0.025 DIA PIN	22526	47710
-18	214-0579-00			6		. TERM.,TEST PT:0.40 INCH LONG	80009	214-0579-00
-19	214-2440-00			3		. RECEPTACLE,PIN:	80009	214-2440-00
-20	260-1132-00			2		. SWITCH,PUSH:1 BUTTON,DOUBLE POLE	80009	260-1132-00
-21	361-0542-00			4		. SPACER,SWITCH:PLASTIC	71590	J-64281
-22	337-1417-00			2		. SHLD,ELECTRICAL:0.55 SQ X 0.685 INCH HIGH	80009	337-1417-00
-23	337-1456-00			1		. SHLD,ELECTRICAL:CKT BOARD MOUNT	80009	337-1456-00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MANUAL CHANGE INFORMATION

At Tektronix, we continually strive to keep up with latest electronic developments by adding circuit and component improvements to our instruments as soon as they are developed and tested.

Sometimes, due to printing and shipping requirements, we can't get these changes immediately into printed manuals. Hence, your manual may contain new change information on following pages.

A single change may affect several sections. Since the change information sheets are carried in the manual until all changes are permanently entered, some duplication may occur. If no such change pages appear following this page, your manual is correct as printed.

SERVICE NOTE

Because of the universal parts procurement problem, some electrical parts in your instrument may be different from those described in the Replaceable Electrical Parts List. The parts used will in no way alter or compromise the performance or reliability of this instrument. They are installed when necessary to ensure prompt delivery to the customer. Order replacement parts from the Replaceable Electrical Parts List.

CALIBRATION TEST EQUIPMENT REPLACEMENT

Calibration Test Equipment Chart

This chart compares TM 500 product performance to that of older Tektronix equipment. Only those characteristics where significant specification differences occur, are listed. In some cases the new instrument may not be a total functional replacement. Additional support instrumentation may be needed or a change in calibration procedure may be necessary.

Comparison of Main Characteristics

DM 501 replaces 7D13		
PG 501 replaces 107	PG 501 - Risetime less than 3.5 ns into 50 Ω.	107 - Risetime less than 3.0 ns into 50 Ω.
108	PG 501 - 5 V output pulse; 3.5 ns Risetime.	108 - 10 V output pulse; 1 ns Risetime.
111	PG 501 - Risetime less than 3.5 ns; 8 ns Pretrigger pulse delay.	111 - Risetime 0.5 ns; 30 to 250 ns Pretrigger Pulse delay.
114	PG 501 - ±5 V output.	114 - ±10 V output. Short proof output.
115	PG 501 - Does not have Paired, Burst, Gated, or Delayed pulse mode; ±5 V dc Offset. Has ±5 V output.	115 - Paired, Burst, Gated, and Delayed pulse mode; ±10 V output. Short-proof output.
PG 502 replaces 107		
108	PG 502 - 5 V output	108 - 10 V output.
111	PG 502 - Risetime less than 1 ns; 10 ns Pretrigger pulse delay.	111 - Risetime 0.5 ns; 30 to 250 ns Pretrigger pulse delay.
114	PG 502 - ±5 V output	114 - ±10 V output. Short proof output.
115	PG 502 - Does not have Paired, Burst, Gated, Delayed & Undelayed pulse mode; Has ±5 V output.	115 - Paired, Burst, Gated, Delayed & Undelayed pulse mode; ±10 V output. Short-proof output.
2101	PG 502 - Does not have Paired or Delayed pulse. Has ±5 V output.	2101 - Paired and Delayed pulse; 10 V output.
PG 506 replaces 106	PG 506 - Positive-going trigger output signal at least 1 V; High Amplitude output, 60 V.	106 - Positive and Negative-going trigger output signal, 50 ns and 1 V; High Amplitude output, 100 V.
067-0502-01	PG 506 - Does not have chopped feature.	0502-01 - Comparator output can be alternately chopped to a reference voltage.
SG 503 replaces 190, 190A, 190B	SG 503 - Amplitude range 5 mV to 5.5 V p-p.	190B - Amplitude range 40 mV to 10 V p-p.
191	SG 503 - Frequency range 250 kHz to 250 MHz.	191 - Frequency range 350 kHz to 100 MHz.
067-0532-01	SG 503 - Frequency range 250 kHz to 250 MHz.	0532-01 - Frequency range 65 MHz to 500 MHz.
TG 501 replaces 180, 180A	TG 501 - Marker outputs, 5 sec to 1 ns. Sinewave available at 5, 2, and 1 ns. Trigger output - slaved to marker output from 5 sec through 100 ns. One time-mark can be generated at a time.	180A - Marker outputs, 5 sec to 1 μs. Sinewave available at 20, 10, and 2 ns. Trigger pulses 1, 10, 100 Hz; 1, 10, and 100 kHz. Multiple time-marks can be generated simultaneously.
181	TG 501 - Marker outputs, 5 sec to 1 ns. Sinewave available at 5, 2, and 1 ns.	181 - Marker outputs, 1, 10, 100, 1000, and 10,000 μs, plus 10 ns sinewave.
184	TG 501 - Marker outputs, 5 sec to 1 ns. Sinewave available at 5, 2, and 1 ns. Trigger output - slaved to marker output from 5 sec through 100 ns. One time-mark can be generated at a time.	184 - Marker outputs, 5 sec to 2 ns. Sinewave available at 50, 20, 10, 5, and 2 ns. Separate trigger pulses of 1 and .1 sec; 10, 1, and .1 ms; 10 and 1 μs. Marker amplifier provides positive or negative time marks of 25 V min. Marker intervals of 1 and .1 sec; 10, 1, and .1 ms; 10 and 1 μs.
2901	TG 501 - Marker outputs, 5 sec to 1 ns. Sinewave available at 5, 2, and 1 ns. Trigger output - slaved to marker output from 5 sec through 100 ns. One time-mark can be generated at a time.	2901 - Marker outputs, 5 sec to 0.1 μs. Sinewave available to 50, 10, and 5 ns. Separate trigger pulses, from 5 sec to 0.1 μs. Multiple time-marks can be generated simultaneously.

NOTE: All TM 500 generator outputs are short-proof. All TM 500 plug-in instruments require TM 500-Series Power Module.

REV. A, OCT 1975

TEKTRONIX®
committed to technical excellence

MANUAL CHANGE INFORMATION

PRODUCT TSG4
070-2109-00

CHANGE REFERENCE C1/1276
DATE Dec. 15, 1976

CHANGE:	DESCRIPTION

TEXT CHANGES

Section 1, OPERATORS INFORMATION, Page 1-2, Fig. 1-3 and Page 1-3, Fig. 1-4

CHANGE TO FIGURES BELOW:

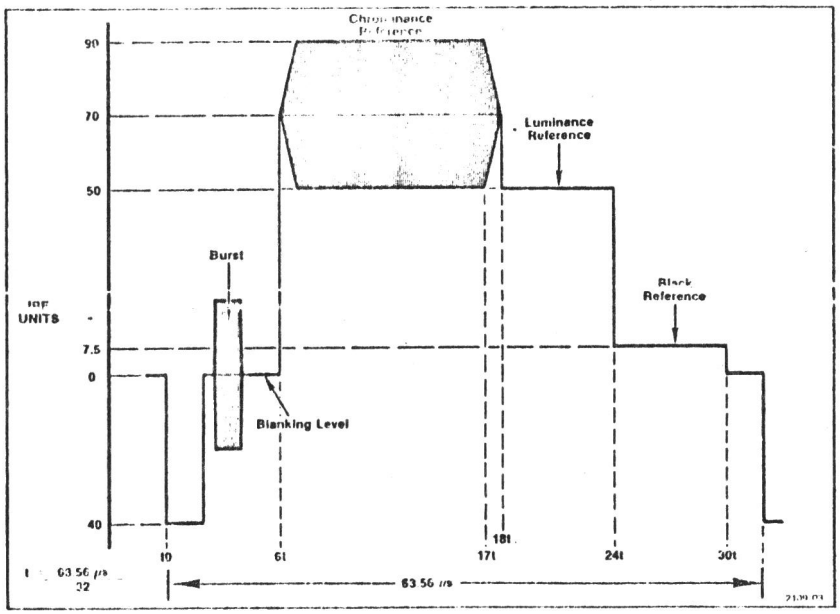

Fig. 1-3. The Vertical Interval Reference Signal.

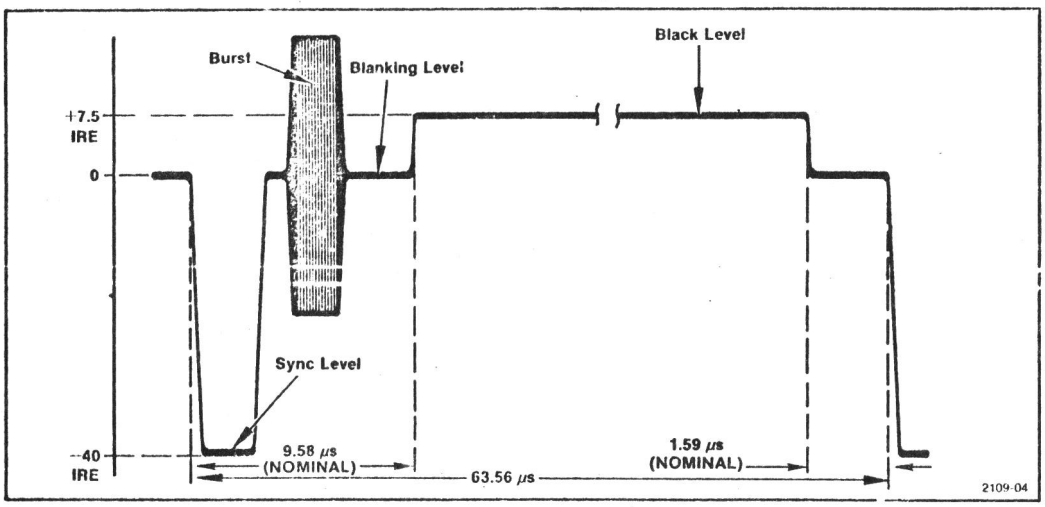

Fig. 1-4. The Black Burst Signal.

PRODUCT TSG4 CHANGE REFERENCE C1/1276 DATE Dec. 15, 1976

CHANGE:	DESCRIPTION

TEXT CHANGES

Section 4, PERFORMANCE CHECK/CALIBRATION PROCEDURE, Procedure, Page 4-3, Step 1 and part a., CHANGE TO READ:

1. Check/Adjust Output Amplifier Gain

a. Connect the Black Burst rear-panel MODULE OUTPUT connector to the 1480 CH A input and terminate in 75 Ω.

Page 4-3, Step 4, parts b., and c., CHANGE TO READ:

b. Check - Luminance risetime should be 250 ns, ±37.5 ns.

c. Adjust - L981 and L984 (VIRS Lum Shape) for correct risetime and minimum aberrations.

Page 4-5, Step 13, part a., first sentence, CHANGE TO READ:

a. Connect the 1410 Mainframe rear-panel subcarrier output to the vectorscope CW ExtØ Ref input.

Section 7, REPLACEABLE ELECTRICAL PARTS, Page 7-3, DELETE:

C985	283-0081-00	CAP.,FXD,CER DI: 0.1UF, +80-20%, 25V	56289	36C600

Section 9, DIAGRAM AND CIRCUIT BOARD ILLUSTRATION, Diagram 1, MAKE THE FOLLOWING CHANGES:

ADD: on C993, positive polarity at ground, negative polarity at -15V.

CHANGE: U815B TO READ: U851B

Chrominance Timing Shaping (in PROM TIMING GENERATOR)
TO READ: L923 & L933

CHANGE: Connections on P857 and P858 as indicated below: